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Air Traffic Control Radiotelephony Safety: Investigating the English Second Language Users' Perspective

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ABSTRACT

Radiotelephony between air traffic controllers and pilots utilises standard phraseology as the medium of communications. Standard phraseology employs specific structure, terminology and pronunciation to ensure effectiveness and accuracy. On occasions when standard phraseology is found insufficient, plain language is used to efficiently relay vital information. By default, English is the designated language of communication between controllers and pilots of international flights. Deviations from the usage of standard phraseology and lack of language proficiency had been identified as one of the causal factors in safety occurrences. Language deficiencies, specifically of the non-native speakers of the English language, had raised much concern but there is limited information in the area.

This research attempted to fill a small segment of this knowledge gap. It was focussed on the usage of standard phraseology and English language in an air traffic control environment involving English Second Language users. Audio data was sourced from routine radiotelephony recordings of 'live' air traffic control facilities in Malaysia to capture realistic communications between controllers and pilots in the Terminal Approach Radar, Area Radar and Aerodrome Control environments. A detailed cross sectional investigation of the radiotelephony characteristics, deficiencies and errors of transmitted messages revealed the radiotelephony performances of controllers and pilots in the environments. The recurrence of deviations from standards and occurrence of errors implied the likelihood of such deficiencies taking place. Demographic groups' descriptions complemented the radiotelephony analyses as background information on language related training. The results were comparative to other similar studies and offered new information on English Second Language speakers in the Air Traffic Control environment.

Keywords: Air Traffic Control radiotelephony, standard phraseology, English language proficiency.

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ACRONYMS

ACC	Area Control Centre
ADREP	Accident / Incident Data Reporting
AIRPROX	Aircraft Proximity
AMS	Aeronautical Mobile Service
ARR	Area Radar Control
ASIAS	Aviation Safety Information Analysis and Sharing
ASRS	Aviation Safety Reporting System
ATC	Air Traffic Control
ATSAT	Aviation Topic and Speech Acts Taxonomy
ATWIT	Air Traffic Workload Input Technique
CA	Contrastive Analysis
CAA	Civil Aviation Authority
CAST	Commercial Aviation Safety Team
CFIT	Controlled Flight Into Terrain
CHIRP	Confidential Human Factors Incident Reporting Program
CTZ	Control Zone
DCA	Department of Civil Aviation (Malaysia)
DME	Distance Measuring Equipment
EA	Error Analysis
ECCAIRS	European Coordination Centre for Aviation Incident Reporting System
ESL	English Second Language
FAA	Federal Aviation Authority
FAIDS	FAA Aircraft Incident Data System
FIR	Flight Information Region
GAIN	Global Aviation Network
HF	High Frequency
HQ	Headquarters
ICAO	International Civil Aviation Organisation
IELTS	International English Language Testing System
IL	Inter-language
ILS	Instrument Landing System
JAAP	Joint Airprox Assessment Panel
JAWG	Joint Airprox Working Group
KLIA	Kuala Lumpur International Airport
LOSA	Line Operations Safety Audit
MATS	Manual of Air Traffic Services
MORS	Mandatory Occurrence Reporting Scheme
MT	Mother Tongue
MUET	Malaysian University English Test
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organisation
NOSS	Normal Operations Safety Survey
NDB	Non-directional Beacon
NMACS	Near Mid-Air Collision System
NTSB	National Transportation Safety Bureau

PELA	Proficiency in English Language
SATCO	Senior Air Traffic Control Officer
SID	Standard Instrument Departure
SRG	Safety Regulation Group
TA	Transfer Analysis
TAR	Terminal Approach Radar
TEM	Threat and Error Management
TL	Target Language
TMA	Terminal Control Area
TOEFL	Test of English as a Foreign Language
TWR	Tower / Aerodrome
UK	United Kingdom
UKAB	United Kingdom Airprox Board
US	United States
VHF	Very High Frequency
VOR	VHF Omni-directional Range

1 INTRODUCTION

This thesis examined the characteristics of routine radiotelephony in an air traffic control (ATC) environment where the controllers were English Second Language (ESL) users. The research had involved the transcription of 4,400 minutes of ATC radiotelephony audio into text, encoding and analysing over 20,500 messages containing more than 210,000 words as well as analysis of the Malaysian controllers' demographic data.

1.1 Motivational Factors

Non-native users of the English language had often been associated with poor usage of the language that led to misunderstandings and error in ATC operations. The lack of proficiency had been highlighted as a factor contributing to safety occurrences. A cross sectional analysis of routine radiotelephony was considered the most appropriate method to best identify and quantify these language related problems. The messages in routine radiotelephony are considered a valuable source of information about the real communicative practises and needs of pilots and controllers as it would show consistent language and terminology usage patterns, message structure formulation and how the dialogue is organised (Mell, 1991c). Monitoring of routine operations is also a practise recommended by ICAO for safety assessment (ICAO, 2005; Maurino, 2004; ICAO, 2006).

Research into ATC radiotelephony, language or communication problems and safety occurrences are not new. However, the previous researches had mostly been carried out in native English speaking countries. What this research has to offer are findings from primary data from an ESL user country in a region seldom visited by researchers. As no known data have been collected from the Asian region before, nor any ATC radiotelephony related research carried out there, this research could be a beginning to more data being collected and more information gathered on the communication characteristics of the aviation community in this region.

As Malaysia's air traffic controllers presumably fall into the ESL category, the Department of Civil Aviation (DCA) Malaysia, being an ATC service provider, was totally supportive of this research. The researcher being a licensed and qualified air traffic controller; with experience in training, personnel licensing and ATC examination had been an advantage to the undertaking of this task. ATC radiotelephony exchanges are not similar to daily conversation and an in depth knowledge of the subject matter had assisted in data processing and analyses.
The findings should motivate the ESL controllers and pilots to maintain and improve their commendable radiotelephony performance shown through this research. Deficiencies that were identified could be repaired through training and awareness programmes.

1.2 Limitations

Malaysia was chosen due to the ESL status of the controllers and data source accessibility, but using a real-time ATC environment had dismissed the possibility of getting participation only from ESL pilots. It was not practical and time consuming to determine the first languages of all the pilots flying in Malaysian airspace. To filter out the radiotelephony involving native English speaker pilots would also render the communications flow inaccurate and valuable data may be lost. As the controllers are all non-native English speakers, it could be established that the ATC radiotelephony does involve an ESL user at all times.

There were two types of data collected in this research; the recorded ATC radiotelephony and questionnaire responses. However, these two sources were independent of each other. No individual respondent could be linked to specific recording as the information was not disclosed for privacy reasons. The conclusion however, had been derived as grouped categories where applicable. It would have been ideal to analyse data from various countries in the region to represent a wider ESL population, but that may be something to look forward to in future.

The audio data transcribed and analysed do not include messages between ATC and other ground units. These were filtered out as the research focus was on controller-pilot communications. The taxonomy chosen for encoding the controllers' and pilots' transmission exchanges was not suited for ground communications. Those communications rightfully require a separate classification and analyses.

1.3 Research Objectives

The main objectives of this research were:

1. **To identify and quantify the ATC radiotelephony characteristics in an ESL environment.**

2. **To determine types and recurrence of, language and standard phraseology associated errors.**

In relations to the ESL status and usage of the English language among the controllers in the ATC system, sub-objectives relevant to the research focus were added as follows:

i. To summarise the demographics of the Malaysian controllers

ii. To determine if English is a dominant language among the controllers in daily communication

iii. To examine the attendees' perception of the Aviation English and ATC communication related training's value.

iv. To examine the controllers' perception of non-adherence to standard practises recurrences in routine ATC operations.

1.4 Hypothesis

The hypothesis of this research stemmed from the need to scientifically and factually establish how efficient the ESL controllers (and pilots) perform in their daily radiotelephony.

This research hypothesis is that the characteristics of ATC Radiotelephony involving ESL controllers will show frequent evidence of non-proficiency and language related errors that are commonly associated with safety occurrences.

1.5 Thesis Structure

The thesis is presented in 7 chapters. Chapter 2 briefly explains about ATC operations, radiotelephony and its related problems. Chapter 3 approaches the research area from the language perspective and also discuss ESL related problems. Research methodology is explained in Chapter 4, detailing the methods, the data collection program, data processing and encoding phase. As there were two data sources, data analyses results are presented in two separate chapters. Demographics and respondents' perception of language training and usage is presented in Chapter 5 while ATC radiotelephony analysis in Chapter 6. Chapter 7 presents the conclusion, summarising the knowledge contributed by this research, commenting on the overall undertaking of the task and possible areas for related researches to widen the knowledge map of this subject matter. For a detailed research work flowchart refer to Figure 4-2 on page 89.

2 AIR TRAFFIC CONTROL COMMUNICATIONS

This research is specifically focussed on verbal communications involving air traffic controllers and pilots within the ATC environment. The importance of ATC communications as a feature of the overall system is summed up by Linter and Buckles (1993) as,

"Regardless of the level of sophistication that the air traffic system achieves by the turn of the century, the effectiveness of our system will always come down to how successfully we communicate"

The definition of communication is constantly connected to keywords such as imparting, exchange, transmission, sharing, interchange, sending and conveying of information, ideas, feelings, thoughts, data, opinion or views by means of speech, writing or signs. Other than verbal, there are a number of mediums through which information is relayed, such as the auditory Morse Codes, Braille writing for the blind, visual signalling by hands, flags, or lights, writings, encryption and symbols or simply by signage.

In ATC, communications take place between controllers of the same and other stations, with pilots on the ground, pilots in the air, meteorology office, ground operators, airlines and other relevant organisations. Ground based stations such as ATC units and meteorology office communicate through telephone land-lines while controller-pilot communication utilises radio frequencies. Controller-pilot communication differs from our daily speech and is closely related to aircraft operations and safety.

It is therefore useful to understand the overall function of the ATC system, the rules that govern ATC communication, the role of International Civil Aviation Organisation (ICAO) as the advisory body and the airspace structure where flights operate. This chapter will introduce briefly these topics as well as explain in greater detail about ATC radiotelephony and problems related to this type of communication. It will additionally explore the records and information from various safety occurrences databases in terms of statistics, data availability and contents relevance to this research.

2.1 The Air Traffic Control System

An ATC system coordinates movement of aircraft operations at an airport and in the air to ensure that each and every aircraft is kept a safe distance apart from another. The system would require accurate delineation of routes and airspace segments, special rules and regulations, presence of qualified personnel to provide directives and advice, a reliable communication and information network and technical facilities for navigation (Field, 1980). Air traffic controllers are the people monitoring these movements and with pilots' cooperation and compliance, realises the objectives of the system (US Labor Department, 2006). An important feature of the ATC system is that movement of air traffic involves a four dimensional management of the situation. The position of an aircraft at any one time is three dimensional in nature, described in lateral, longitudinal and vertical displacement, but the projection of time need to be taken into account to ensure safety.

2.1.1 ATC Objectives

An aircraft provided with ATC services is ensured of its safety by issuance of necessary instructions, in line with the standards and recommended practices of the ICAO and in accordance with the Air Navigation Order and Rules of the Air. The ATC function is collectively defined by five objectives (ICAO, 2001b):

i. Preventing collisions between aircraft in flight,
ii. Preventing collisions between aircraft on the manoeuvring area of an airport and obstructions on that area,
iii. Expediting and maintaining an orderly flow of air traffic,
iv. Providing advice and information useful for the safe and efficient conduct of flights, and
v. Notifying appropriate organisations regarding aircraft in need of search and rescue aid, and assisting such organisations as required.

Air Traffic Service is a collective broad term and may include positive ATC, advisory, information and/or alerting service, depending on the classification of airspace. When positive ATC service is provided, the controller is primarily responsible for collision avoidance between aircraft. The advisory and information services partly delegates the maintaining of safety function to the pilots as they are kept well informed of possible traffic confliction and are expected to be visually alert. The alerting service is meant for rendering all possible assistance to aircraft in difficulties or emergencies. All these services are made available for most parts through ATC communications between controllers and pilots.

ATC plays an important role in ensuring the safety of an aircraft in flight. It is involved in the safety of flight operations from the time an aircraft is pushed-back from the parking gate while the engines are started-up until the aircraft reaches its destination and is parked safely at the arrival gate. The pilot does the actual flying of the aircraft, but the air traffic controller is responsible for ensuring the safe disposition of the aircraft in relation to other aircraft in the airspace system. The controller sits at the centre of an ATC system making safety-critical decisions based on information acquired from the system.

In the vicinity of an aerodrome, flights are provided with aerodrome control service where the controllers visually monitor aircraft movements from a control tower. Aerodrome controllers are primarily responsible for manoeuvring areas and runway safety (Field, 1980). These controllers ensure separation between departing and landing aircraft, manage surface movements of aircraft and vehicles, monitor local weather conditions and designate the most suitable runway-in-use (Nolan, 1998).

After takeoff or prior to landing, when flights are in the air within the terminal control area (TMA), approach control service is provided. Busy and congested TMAs near international and major airports are usually controlled under terminal approach radar (TAR) service. TAR controllers are responsible for sequencing arriving aircraft for landing, positioning departing aircraft to join designated airways and controlling other aircraft operating within the TMA. A concept known as Flow Control is sometimes utilised to avoid unnecessary congestion, fuel wastage and system overload (Field, 1980). These airspaces are the busiest and require highly trained controllers, efficient controlling techniques and effective communications.

Beyond the TMA, flights in en-route phase are provided with area radar control service as they travel towards their intended destinations. The area controllers deal with aircraft climbing to cruising phase, descending in preparation for arrival, standard holding patterns and en-route weather deviations that may disrupt aircraft routing. These controllers do not have visual contact with aircraft at all. Each aircraft is represented in the form of flight progress strips or radar responses and these displays are used for managing, controlling and co-ordinating aircraft movements. Controllers apply an extensive degree of projection and visualisation to understand the traffic scenario and use the information communicated by the display for conflict detection and resolution (Nunes and Mogford, 2003).

Area controllers' workload may be perceived as less hectic than approach radar's but each controller handles a larger chunk of airspace and planning for traffic confliction is projected over a longer period of time. An essential part of Area control is in prior planning and imposing restrictions, sometimes well before a flight actually takes off to avoid bottlenecks and confliction points along the intended flight route and cruising altitude. A continuous flow of verbal, electronic and computerised data assist real time adjustments to ensure aircraft safety (Field, 1980).

Outside controlled airspace the flight information service officers provide traffic information to participating pilots. Position reports, estimates of arrival and aircraft flight altitude are advised to those in potential conflict. It is up to the pilots to look out for traffic and keep clear of each other. However, the controllers are required to provide correct and complete information to assist the pilots.

An alerting service is provided in all airspace together with other ATC services. The controller monitors all aircraft operating within the controlling frequency and provides assistance to aircraft in difficulty. In the event that rescue services are required, assistance would be rendered to agencies involved in the operations. In emergency situations, the controller has to ensure that the situation is best managed in the interest of the distressed aircraft without putting into second place, the safety of other aircraft operating in the vicinity.

All the objectives of ATC as explained above involve communication, largely with pilots and other ATC units. Controllers communicate with pilots mainly through verbal radiotelephony from the departure point until destination. As more aircraft operates in the sky, further afield and at higher altitudes, there is a higher demand for ATC services. This also means ATC communications need to be more reliable and efficient in all aspects.

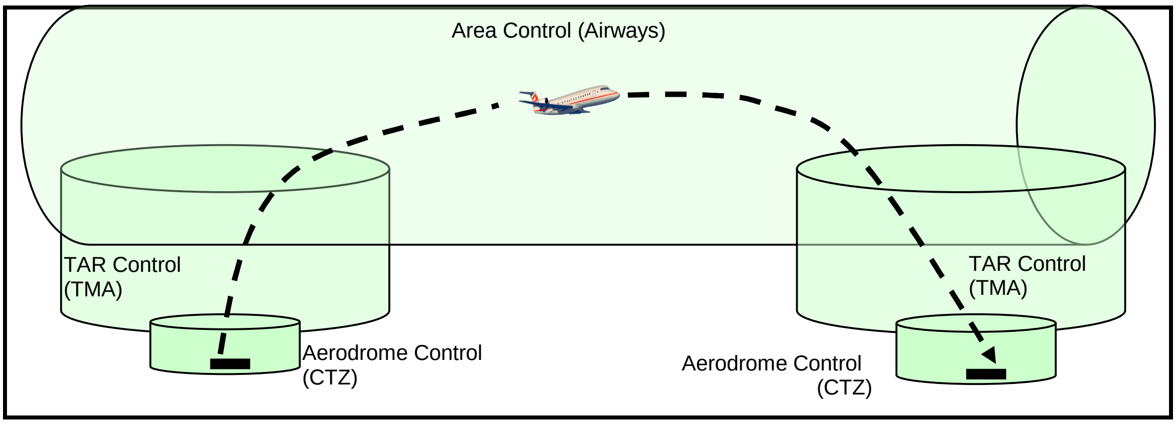
2.1.2 Airspace Structure

The establishment of airspace and corresponding ATC units and services are considered necessary to promote a safe, orderly and expeditious flow of air traffic. Annex 11 (ICAO, 2001b) to the Convention of International Civil Aviation describes standards and guidelines for establishing these features of the ATC and airspace system. The type of ATC service provided depends on airway configuration and classification as well as types of air traffic involved, traffic density and meteorological conditions.

A country's Flight Information Region (FIR) is the designated airspace within which the country provides flight information and alerting services. Malaysia for instance has 2 FIRs, the Kuala Lumpur and Kota Kinabalu FIR. The delineation of FIRs is based on the nature of route structure efficiency rather than national boundaries or any country's territory and territorial waters. Provision of ATC services will abide by ICAO-approved procedures (Nolan, 1998).

Figure 2-1 illustrates an aircraft passage through a simplified airspace structure with the relevant ATC units having jurisdiction of the airspace portions. The flight will begin and end at an aerodrome where the tower/ aerodrome controller is responsible for flight movements. In the TMA the approach radar control directs and positions a flight onto the en-route phase. Once joining the intended airways, the area control takes charge of an aircraft flight until descend phase in preparation for arrival. At this point, the flight once again enters the TAR control airspace. Landing and gate-in at the end of a flight will be under the responsibility of the aerodrome controller.

Figure 2-1: ATC Airspace Structure



Airways are similar to motorways, roads and railways in that it maps the intended and designated routes. Airways designated aerial routes for flight paths of an aircraft from one airport to another, in the form of a 3 dimensional corridor, delineated by navigational aids (ICAO, 2001e). These airways have an identification and classification system similar to the motorways network on the ground. However, motorways are two dimensional in nature while airways have an additional vertical dimension known as altitude or flight levels. As there are no landmarks or roads in the sky, the structure of airways are dependent on radio beacons and other electronic devices. Airways are connected between adjacent FIRs, allowing global air travel within controlled airspaces.

Terminal Control Area (TMA) which could be compared to city areas, are more congested as many airways confluence here for traffic movements into and out of an airport. The airspace surrounding an airport is known as the control zone (CTZ). These segments of control areas, control zones, airways, terminal areas and aerodrome traffic zones are structured for the efficient and smooth control of traffic flow.

The airspace segments are designated identity names in relations to the ATC service provider having jurisdiction over the airspace, for example Lumpur TMA or Melaka Control Zone. The ATC units having authority within classes of airspace are also assigned unique identification names which are used as addressees in communication. An aerodrome control tower unit is identified by the location of the aerodrome, for example Lumpur Tower, Changi Tower and Cranfield Tower. Designation of the approach control or terminal approach radar unit would be in the same manner. An area control unit is usually identified by the name of the town or geographical feature nearest to it, but the designation would use the word control, as in Lumpur Control, Kuching Control and Kinabalu Control.

2.1.3 The International Civil Aviation Organisation (ICAO)

The International Civil Aviation Organisation is a specialised agency of the United Nations and presently consists of 190 contracting states. ICAO was formed at the Chicago Convention in 1944, more than 30 years after the first attempt towards a globally represented civil aviation body.

Table 2-1 lists in chronological order, other conventions related to civil aviation from 1909 leading towards the Chicago Convention in 1944 (US centennial of flight commission, 2004b). Participation of interested countries was initially lacking as there were questions of airspace sovereignty and authority. Even United States, one of the major influences in the industry, chose to be excluded from the International Commission on Air Navigation (ICAN) agreement in 1919 that serves as a forum to discuss foreign aircraft operations in sovereign airspace. The US developed bilateral agreements with individual countries for landing rights.

Table 2-1: Convention related to civil aviation between 1909 and 1944

YEAR	CONVENTION	ACHIEVEMENTS
1909	Conference of Diplomats	• failed to reach an agreement on whether the air is free for the use of all
1919	International Commission on Air Navigation (ICAN)	• 26 countries signed agreement that each nation has "complete and exclusive sovereignty over the airspace above its territory". • United States and Russia excluded
1928	Havana Convention	• 21 Western Hemisphere countries agreed to guarantee innocent passage of aircraft • formulate rules for aircraft identification, landing facilities, pilot standards and setting of air routes through a country's territories.
1929	Warsaw Convention	• limits of passenger compensation for loss of property or bodily harm
1944	Chicago Convention (Convention on International Civil Aviation)	• signed on 7th December by 52 nations • basic principles that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically.

ICAO's function is more advisory than regulatory, through which member countries may work together towards a safe, secure and sustainable development of civil aviation. It's principal target would be a "commonality of operating rules, navigating procedures, language and phraseology" with safety being the paramount issue (Illman, 1993).

ICAO is made up of an Assembly, a Council and a Secretariat. The Assembly is the sovereign body of ICAO, made up of a representative from each state and 36 out of these are elected as The Council. Selection is based on states importance in air transport, contribution to the provision of facilities for air navigation and whose designation will ensure that major areas in the world are represented. The chief officers are the President of the Council and the Secretary General. Four Commissions assist the Council in its work. The Secretary General heads the secretariat, which is divided into 5 main Divisions; air navigation, air transport, technical cooperation, legal and administration and services (ICAO, 2004b). The members of the secretariat reflect an international approach by recruitment of professional personnel on a broad geographical basis.

The Council, as the governing body of ICAO, provides continuing direction to the development of civil aviation, adopts Standard and Recommended Practices and incorporates them as Annexes to the convention (ICAO, 2004b). It is responsible for the establishment of International standards, recommended practices and procedures; for personnel licensing, rules of the air, aeronautical meteorology, aeronautical charts, units of measurements, aircraft operations, aircraft markings, airworthiness, air traffic services, aeronautical telecommunications, search and rescue, aircraft accident investigation, aerodromes, aeronautical information services, noise and engine emissions, security and safe transport of dangerous goods.

2.1.4 Standards and Recommended Practices (SARPS)

A Standard is defined as,

> *"any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognised as necessary for the safety or regularity of international air navigation and to which Contracting States will conform in accordance with the Convention; in the event of impossibility of compliance, notification to the Council is compulsory under Article 38 of the Convention"* (ICAO, 2004c).

A Recommended Practice is,

"any specification for physical characteristics, configuration, material, performance, personnel or procedure, the uniform application of which is recognized as desirable in the interest of safety, regularity or efficiency of international air navigation, and to which Contracting States will endeavour to conform in accordance with the Convention." States are invited to inform the Council of non-compliance (ICAO, 2004c).

These specification or rules are formulated for the safety of aircraft operations, initially developed as the General Rules for Air Traffic at the International Commission for Air Navigation (ICAN), consisting of brief and basic rules applicable in most countries where aircraft operated. A recommended practice is similar to standards, recognised as desirable but not mandatory, in the interest of safety. ICAO's standards and recommended practices are organised into 18 annexes (listed in Table 2-2) which are subject specific and used as references by member states

Table 2-2 : ICAO Annexes

Annex 1	Personnel Licensing
Annex 2	Rules of the Air
Annex 3	Meteorological Service for International Air Navigation
Annex 4	Aeronautical Charts
Annex 5	Units of Measurement to be Used in Air and Ground Operations
Annex 6	Operation of Aircraft - Aeroplanes
Annex 7	Aircraft Nationality and Registration Marks
Annex 8	Airworthiness of Aircraft
Annex 9	Facilitation
Annex 10	Aeronautical Telecommunications
Annex 11	Air Traffic Services
Annex 12	Search and Rescue
Annex 13	Aircraft Accident and Incident Investigation
Annex 14	Aerodromes - Aerodrome Design and Operations, Heliports
Annex 15	Aeronautical Information Services
Annex 16	Environmental Protection - Aircraft Noise and Emissions
Annex 17	Security: Safeguarding International Civil Aviation Against Acts of Unlawful Interference
Annex 18	The Safe Transport of Dangerous Goods by Air

One of the earliest rules of air traffic control was about runway incursion and separation, explaining when it is considered safe for a pilot to begin his take-off roll. The rule takes into account the position of aircraft that had just landed and/or taken-off before so as to prevent a collision. The United States who did not sign the ICAN Convention has its own set of similar rules in the Air Commerce Act of 1926.

In view of ATC radiotelephony communications, selected parts of Annexes 2, 6, 10 and 11 are relevant. States with different practices to the SARPS are required to notify these differences in the interest of safe flight operations by submitting a “Note on the Notification of Differences” and a “Form of Notification”. These forms are dispatched to member states after Annex amendments are adopted. States are invited to notify their differences before the provisions become applicable (ICAO, 1999). All notified differences are listed as part of individual Annexes for easy reference. For example, there are 19 states who filed differences to various paragraphs in Annex 2.

In addition to the Annexes, other documents and manuals are also published by ICAO to assist member countries manage certain aspects of civil aviation. Documents directly relevant to ATC communications are:

- The Procedures for Air Navigation Services (DOC 4444),
- Manual of Radiotelephony (DOC 9432)
- Manual of Radiotelephony Regional Supplementary Procedures (DOC 7030),
- Manual on the Implementation of ICAO Language Proficiency Requirements (DOC 9835)

Of more localised nature is the Aeronautical Information Publication (AIP) which contains aeronautical information of a lasting character essential to air navigation within a state’s airspace. This document is published by individual contracting states for the benefit of those planning to operate within the states airspace. Local guidance materials for controllers are usually published in the Manual of Air Traffic Services (MATS).

The ICAO DOC 4444, Annexes 11 and 10 Volume II, Malaysia’s AIP and Manual of Air Traffic Services will be used as the main references for identifying discrepancies in radiotelephony data in this research.

2.2 ATC Radiotelephony

ATC radiotelephony (also known as Air-Ground communications) refers to pilot-controller messages exchange, inclusive of communications when the aircraft is on ground at an airport. Before auditory signals existed, controller and pilot communications were conducted using flags as visual signals. Archie League was arguably the first air traffic controller, then known as a flagman, providing services to flights at the St. Louis Airfield, Missouri in 1920s.

Air to ground communications began in 1926 using Morse Code, to assist pilots in navigating their airplanes and also in broadcasting weather information (US centennial of flight commission, 2004a). In this era, simple devices such as liquid bubble was used to keep wings level, the altimeter to indicate altitude above ground and a magnetic compass installed in the airplane cockpit panel to show direction.

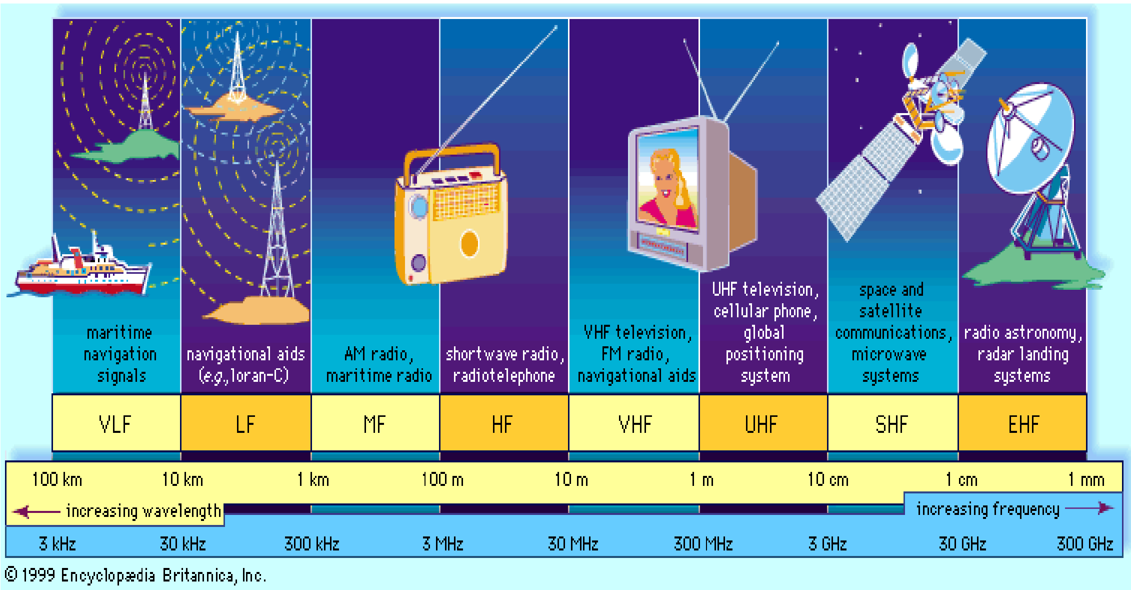
The first radio equipped ATC tower was completed in 1930 at the Cleveland Municipal Airport. By 1935, twenty five ATC towers with radio facilities were operating. In December that year, an Airway Traffic Control Centre started operations at Newark, New Jersey, handling traffic operating between Chicago, Cleveland and Newark using radio facilities. However, pilots and controllers do not communicate directly with each other then. Position information and instructions were relayed by radio operators, airline dispatchers and airport traffic controllers. The en-route controllers displayed the traffic situation using maps and blackboards, with boat-shaped weights called ‘shrimp boats’ to represent aircraft.

Aviation communications further developed from low frequency radio before World War II to very high frequency (VHF) radio after. The first communication satellite was launched in 1956 and improved the range and coverage of air-ground communications (US centennial of flight commission, 2004a). To date, ATC communications use narrower VHF bandwidth and amplitude modulations.

2.2.1 The Frequency

ATC radiotelephony is a form of telecommunications, where transmissions and receptions of signals and sounds take place between controllers and pilots using radio frequencies. Generally, aviation communication is designated frequencies between 108 MHz and 137 MHz, within the Very High Frequency (VHF) band. High Frequency (HF) band is used by aeronautical mobile service (AMS) radio operator for long range communications with aircraft. Radiotelephony communication uses 118.0 to 136.975 MHz, with amplitude modulation. The lower band between 108 and 117.975MHz are used for navigational aids coding purposes (Encyclopedia Britannica, 2007). Figure 2-2 shows the 8 frequency bands in the radio frequency spectrum and some common usage of each band. Presently, increasing congestion and demand for more radiotelephony frequencies had resulted in channel spacing being reduced from 25 to 8.33 kHz in some areas.

Figure 2-2: Frequency Spectrum Bands Usage



In the near future, digital radios, bandwidth reduction and international coordination are contemplated to increase the number of available bandwidth for communications.

Pilot-controller verbal communication on two-way radio uses an open frequency (party line) shared between the controller and all the aircraft operating within the designated area. Only one party could be transmitting at any one time, so each has to take turns in transmitting on this frequency. More parties attempting to relay their messages could mean congestion, interruption or simultaneous transmissions, which may result in loss of information.

2.2.2 The Messages

The number of messages exchanged in ATC radiotelephony depends on the traffic scenario and airspace. Davis et. al. (1963) state that the time spent communicating with aircraft is contributory to total workload of a controller. Pawlak et. al. (1996) however, emphasised that physical evidence of traffic presence and communications does not necessarily reflect the amount of cognitive activity of the controller. Other than the number of traffic handled by the controller, ATC workload generated in the system is also affected by complexity and traffic mix which cause increased communication (Corker, Gore, Fleming, and Lane, 2000). This research will adopt the simplistic approach that if a controller need to communicate more, it indirectly reflects that the traffic is more complex and there are additional tasks to be completed.

Table 2-3 show the stages of aircraft operations with the corresponding ATC communications required between pilot and controller. Some of the instructions shown could be issued by the controller without prior request from the pilot. Theoretically, in a very idealistic ‘no conflicting traffic’ conditions, this half an hour flight from Kuala Lumpur to Singapore would collectively transmit and receive not less than forty messages from departure to arrival gates. Longer flights and busier ATC environment will require more transmissions between pilots and controller. In reality however, there will be additional transmissions for weather information request, advisory on fuel endurance and persons on board, diversionary tracking for weather avoidance, track shortening to save fuel and in busier traffic environment, ATC instructions for traffic management. Congested airspace with more conflicting traffic would translate into ‘interrupted’ aircraft movements and more messages to manage the traffic flow.

Table 2-3 : Example of messages exchange for Kuala Lumpur-Singapore flight

Aircraft operations	Messages
Start engine	(1) Request + Gate and aircraft information / (2) approval / (3) readback / (4) acknowledgement
Pushback from gate	(5) Request / (6) approval + instructions / (7) readback / (8) acknowledgement
Taxying	(9) Request / (10) taxy route + holding point instructions / (11) readback / (12) acknowledgement
Lining up	(13) Advisory 'ready' / (14) line up instructions / (15) readback / (16) acknowledgement
Takeoff	(17) Takeoff clearance (+transfer to approach)/ (18) readback
Initial climb	(19) Contact approach control / (20) initial level + airways instructions / (21) readback / (22) acknowledgement
Transfer to Area Control	(23) Instruction / (24) readback / (25) acknowledgement
Cruising	(26) Contact area control / (27) level + route instructions / (28) readback / (29) acknowledgement
Descend	(30) Request / (31) level instructions / (32) readback / (33) acknowledgement
Transfer to Approach	(34) Instruction / (35) readback / (36) acknowledgement
Final approach	(37) Contact approach / (38) instructions for approach to runway in-use / (39) readback / (40) acknowledgement
Transfer to Tower	(41) Instruction / (42) readback / (43) acknowledgement
Landing	(44) Contact tower / (45) landing clearance / (46) readback/ (47) acknowledgement
Taxying to Gate	(48) Taxy route + gate instructions / (49) readback / (50) acknowledgement

Cardosi and DiFiore (2004) analysed data from studies by Cardosi (1993; 1994), Burki-Cohen (1995) and Cardosi, Brett and Han (1996). This analysis found that in terminal approach radar control, the average controller-pilot transmission was 4.5 messages per minute while tower control averaged 3.8, ground movements 3.5 and en-route control was about 2. These transmissions were however, not all clearances, but included requests for information, salutations, position reports or acknowledgements. In an analysis of a corpus of 7000 messages of routine radiotelephony, Mell (1991c) found that 33% were related to management of aircraft, 33% for speaker turn management, 26% to manage the means of communications and 5% for clarification and correction of messages. Other significant metrics in how ATC voice communications could be analysed include the characteristics of pilots' responses to clearances, type of readback error and percentages, hearback errors, requested repetition of messages and presence of fillers, hesitations and false starts within transmissions.

The message format of ATC radiotelephony is generally standardised. A pilot's initial contact message is in the form of "recipient callsign + speaker callsign + information / request". For example,

> *"Melaka Tower, Academy 335 on frequency One One Eight decimal Zero, request clearance for circuit and landing".*

Messages from pilots must include the callsign of the aircraft making the request or advising the information. Messages from controllers must be preceded by the callsign of the aircraft that the instructions or request is intended for. For example,

> *Pilot: "Malaysian One One Four Niner requesting descend"*
> *Controller: "Malaysian One One Four Niner descend to flight level One Five Zero"*

Detailed explanation, formats and keywords used in radiotelephony messages are contained in The Procedures for Air Navigation-Air Traffic Management (ICAO, 2001e), Annex 10 Volume II – Aeronautical Communications (ICAO, 2001a) and Manual of Radiotelephony (ICAO, 2001f).

2.2.3 The Dialogue

Controllers and pilots benefit from the radiotelephony dialogue as information could be ascertained on:

i. speaker and intended recipient's identities,
ii. accurate disposition of aircraft at present and in future,
iii. instructions required to ensure safety,
iv. flight conditions and requirements,
v. intended actions,
vi. hazardous weather warnings and turbulence, and
vii. conflicting traffic (Hopkin, 1995).

The dialogue consists of advisories, requests, instructions, acknowledgements and courtesies. Pilots may initiate communications to gain permission, for example to pushback aircraft from the parking gate, to start aircraft engines or requesting information, such as temperature and wind velocity. A controller initiates communication to issue instructions, for example to change altitude, or to request for information pertaining to the flight, such as the speed and heading. Factors that lend conversation its depth and flexibility such as formality, politeness, social class, culture, age and gender references are intentionally removed, resulting in a brief, "straight to the point" and quite rigid dialogue.

All the parties involved in the controller-pilots dialogue are not visible to each other. Only the voice can be heard and only words can convey the meaning of a message. Body language cues are not available to assist in understanding a message and tonal or pitch difference do not transmit very well over long distances. For instance, it is not good ATC practice to ask a pilot for the aircraft's speed by using the word "speed" with a questioning lilt in the voice, as it may not be obviously evident on radiotelephony. Proper phraseology and keywords must be used to avoid any ambiguities.

The controller-pilot information exchanges may be used by other aircraft on the same frequency to maintain situational awareness. Pilots are able to visualise the traffic pattern, altitudes, position and direction of other aircraft in the vicinity. This information is especially important for visual environments such as aerodrome traffic zone as it enhanced safety and efficiency of airspace usage.

ATC radiotelephony is also important for controllers to coordinate progress of flight in relation to other flights. The most updated information received from pilots assists in visualising the current traffic situation. Pilots' and controller's situational awareness of past, present and future events evolved with successful communications. Any discrepancies in communication may result in incorrect or incomplete visualisation and situational awareness which pose a risk to safety.

Readback is a stringent requirement in radiotelephony. In the interest of safety, these instructions must always be readback:

a) ATC route clearances;
b) clearances and instructions to enter, land on, take off from, hold short of, cross and backtrack on any runway; and
c) runway-in-use, altimeter settings, SSR codes, level instructions, heading and speed instructions and, whether issued by the controller or contained in ATIS broadcasts, transition levels (ICAO, 2001f).

Pilots must comply at all times with instructions issued by controllers and not deviate from the provisions of a clearance. If an instruction is in any way unacceptable, it is the responsibility of the pilot to advise the controller and request an alternate clearance (DCA Malaysia, 1999; ICAO, 2001e). Within the cockpit, the substance of pilot-controller communication has to be shared between both pilots, accepted as understood and acted upon. These instructions and negotiations between pilot and controller are carried out to achieve optimum flight operations and ensure safety. The most essential information flow between controller and pilot is intended for the controller to issue instructions and for the pilot to receive the correct instructions and conform to them.

ATC communications is described as highly formulated and standardised (Orasanu, Fischer, and Davison, 1997). As in other aspects of ATC, radiotelephony has strict procedures and guidelines on how it should be carried out and managed, to avoid misunderstanding and ambiguities. These guidelines are documented to ensure that message is received intelligibly and without ambiguity. There are guidelines for the identification of speaker and addressee, message format, speech rate, voice tone, readback, and equipment handling techniques. A voice with a slightly higher pitch is known to transmit clearer than a low pitch mumbling voice. Controllers and pilots are supposed to enunciate words clearly and distinctly while maintaining an even speech rate not exceeding 100 words per minute with a constant speaking volume.

Numbers and phonetic spellings are to be spoken at a slower rate, preferably with slight pauses to ease understanding and to allow the writing process (ICAO, 2001f).

The language used for communication is mainly English. The designated glossary of standard words and phrases used are limited and devoid of contextual influences. The message structure and construction differs from general English, in that it lacks grammar and tenses, persisting on brevity and accuracy. More will be discussed on ATC related vocabulary in Chapter 3. Globally, the same guidelines are used by every country that provides air traffic control services. Pilots and controllers are trained to communicate as standards and recommended practices prescribe. On the other hand, it is necessary to maintain a certain degree of proficiency in general English when none of the standard phraseologies are suitable to address such scenarios. As other air traffic related technologies advanced and improved, ATC radiotelephony has to accommodate the increased demand of more users on the frequency as well as enhanced efficiency of traffic management. ATC radiotelephony has been an area of interest for its significant role in ensuring safety of flights. Errors in radiotelephony which contributed to aviation incidents and accidents are usually categorised under communication problems, some of which will be discussed next.

2.3 Communications Problems in Radiotelephony

Verbal communication involves the transmission and receipt of a message through an auditory medium. Errors could originate from various processes in relation to the message relay such as,

i. messages may have failed to be transmitted, or
ii. transmitted but not received, or
iii. received yet not understood or wrongly understood, or
iv. received and understood but wrongly actioned upon.

In a study of the Aviation Safety Reporting System (ASRS), which is one of Federal Aviation Authority's (FAA) safety databases, to identify factors contributing to error, Cardosi, Falzarano and Han (1999) had classified pilot-controller communication errors into three types:

i. Readback/ Hearback errors,
ii. A lack of readback, and
iii. Hearback Errors Type II.

In hearback/ readback error, the controller fails to notice the incorrect readback by the pilot while the Type II is where an incorrect clearance was actually issued by the controller, but the pilot's 'correct' reply fail to alert the controller of the original error.

There are many factors such as workload, speech, hardware, software and interference that affect verbal communications between pilots and controllers. Communication errors such as ambiguous language, memory failures, cross cultural expectations and misunderstandings are also not uncommon in the aviation environment (Redelmeier, Schull, Hux, Tu, and Ferris, 2001). Voice tape analyses of pilot-controller communications (Cardosi, 1993; Cardosi, 1994; Cardosi et al, 1996) found that about one percent of transmissions were erroneous. However, in these analyses, 'error' was confined to readback error types, which is when the pilot wrongly acknowledges any information in the controller's message.

Language proficiency has also been given some attention as lack of it had been identified as contributory to degradation of safety in air traffic control. ICAO Assembly in 1997 had urged that the issue be considered high priority (Mathews, 2004). Non-native English speakers are foreseen to face additional problems due to limited knowledge of the language itself. Semantic barriers such as differences in word meanings, cultural filtering, ambiguity and social rank could add to risk of errors. All these factors, individually or collectively, could contribute towards the partial or total failure of ATC communications in which safety could be jeopardised.

This research concentrated on problems closely related to the usage of language and phraseology in radiotelephony communications between pilots and controllers. The following sub-paragraphs are some aspects of language problems that are common in radiotelephony communication.

2.3.1 Great Expectations

Expectations of common and frequent practices are known to trigger actions that may be usually correct, but nevertheless, not the required one at some particular time. Auditory communication errors due expectations happen not only to humans. Even the neo-tropical frogs in a complex acoustics environment faced the possibility of errors in recognising mating calls. These calls made by the frogs during mating season are vocalised to promote accurate identification of possible mates but expectations (and excitement?) during the season sometimes result in wrong pursuit (Wollerman and Wiley, 2002). Similar errors could and have occurred in ATC environment. An ASRS analysis found pilot's expectation a contributing factor in 36% of communication error that resulted in runway transgression and 28% in altitude deviation (Cardosi et al, 1999).

A recipient's wrong perception of the message contents and thus wrong response may also cause failure in verbal communications. One research study concluded that people at work spend 32.7% of their time listening, as opposed to 25.8% writing, and 18.8% for reading (Adler, 1992). These percentages may prove to be inaccurate for controllers and pilots who need to maintain a continuous listening watch while performing other duties pertaining to aircraft safety. Controllers and pilots have to speak intelligibly in order to be heard distinctively. Both native and non-native English speaker controllers and pilots will have to deal with unfamiliar pronunciation or accent, local terms/ phrases and usage of non-standard phraseology in their line of work. Misunderstanding and communication difficulties due to unclear articulation of messages could be avoided only if all parties concerned adhere to a strict standard of communication discipline in terms of wordings, pronunciation and terminology.

2.3.2 Your Code or Mine?

A pre-requisite of any verbal communication is that you must have a 'thought' that you want to share with or convey to someone. This 'thought' needs to be encoded into a form that could be understood by the intended recipient. This encoding process changes thoughts or ideas into symbols and organises them into a message. An effective communicator ensures that the recipient will be able to decode the conveyed message without unnecessary difficulties. However what should be pointed out is the need of the sender and recipient of a message to share an understanding of the coding system of the message. ATC being global in nature, should ideally have one common global code for users of the system. The present establishment where differences from ICAO's standard and recommended practices exist run the risk of misunderstanding and confusion as there could be more than one meaning to a terminology.

Communications require a common 'language' between the parties involved. This common language, either plain, coded or in symbols should be understood by all parties without ambiguity for the communications to be effective. Whether it is self-interpreted or involving two or more parties, without a common code, misunderstanding could occur. In medicine, clinical judgement by doctors suffers communication errors due to heavy reliance on patients' self reports in evaluating pain and symptoms (Woolf, 2004). In aviation, controllers rely on pilots to provide accurate and timely information while complying with instructions. Pilots on the other hand rely on controllers to issue correct instructions to ensure the safety of flight. This inter-dependence spells the importance of speaking the same language and using the same terminology with specific meanings mutually understood.

Cushing (1994) discussed that ambiguity arises when a word, phrase, sentence or passage could have multiple meanings, either from a language perspective or cultural context. It relates to a clash between individual cognitive and social interactive factors of language use. The intended meaning of a verbal expression may be distorted by misplaced punctuation or pauses, voice intonation and pitching or stressing, causing difficulties in determining whether the statement is a question, request, promise or others. Using pronoun such as 'you' or 'we' instead of proper callsigns as identification or reference could be problematic as it is sometimes unclear about whom or what is referred to. This problem is common in hand-over situations, but also evident in radiotelephony between pilots and controllers.

Accurate derivation of message meanings could also be hampered by unclear/ unfamiliar words, presuppositions or grammar as well as interference. For example, misunderstandings could easily arise from words such as 'to' and 'from' when reporting a distance in relations to a navigational aid. A pilot reporting 'five miles from Kayell VOR' could linguistically mean the aircraft is still flying towards the navigational aid. But the report is also technically applicable if the flight had actually passed over Kayell VOR and is moving away from it. In ATC, especially under non-radar environment, it is of utmost importance that position reports be given accurately as the visualisation of traffic scenario depends on them. The above mentioned report would be more accurate if given as 'five miles north of Kayell VOR'. The awareness of language ambiguities is important to non-native English speakers with limited in-depth knowledge of the language. Mell (2004) suggests that 'language awareness' needs to be created to enhance the effectiveness of foreign language learning while training and testing in aviation communication needs to focus on job specific competencies.

Variations in language and standard phraseology usage are a hindrance to total global understanding and standardisation. For example, the ICAO phraseology "TAXI TO HOLDING POSITION [designation]" means an authorisation to taxi only as far as the designated holding position. It does not include an authorisation to enter the runway. But the FAA has a slightly different phrase which uses almost the same words but with a different meaning. "TAXI INTO

POSITION AND HOLD" as used by FAA means an authorisation inclusive of a taxiing clearance and an authorisation to enter the runway. This is equivalent to ICAO phraseology "LINE UP AND WAIT" which is used to instruct an aircraft to taxi onto the runway and await takeoff clearance. Due to reservations on the ICAO phraseology which uses the word 'POSITION' as above, UK still uses "TAXI HOLDING POINT [designation] for RUNWAY [designation]" (CAA, 2006).

2.3.3 Tendjewberrymud

The efficiency of verbal communication is very much affected by the speaker's pronunciation, voice tone, loudness, speech rate and fluency, which determine how one is heard by others. 'Tendjewberrymud' (ahajokes, 2005) looks fairly alien and unlike an English word at all. But when uttered out loud, at a slower rate, you will then 'hear' what it is meant to be. The pronunciation is distorted and there are no pauses between words, but the speaker did attempt to say 'thank you very much'. Messages in ATC radiotelephony are supposed to be transmitted at a rate of about one hundred words per minute (ICAO, 2001f), disallowing the words to merge together and become incomprehensible to the recipient. Technically there are short pauses between spoken words to differentiate one word from another. The faster one speaks, the closer word syllables would be 'accordioned' together, as well as all the words in the whole message. On radiotelephony, a higher pitch female voice usually transmits better than a throaty low toned voice. A continuous and fluent transmission is easier to understand than one strewn with distracting pauses and fillers such as 'er', 'uhm' and 'ah'.

Homophony is confusion of similar word sounds, which could also cause misunderstanding (Cushing, 1994). ICAO had published guidelines on how numbers and particular words shall be pronounced (ICAO, 2001a) to overcome this problem. In ATC, the North Atlantic Treaty Organisation (NATO) spelling alphabet (Table 2-4) is used to spell out any unfamiliar words. Rome for instance would be spelled out as 'Romeo Oscar Mike Echo'. The pronunciation of alphabets and numbers are specified to avoid any misunderstandings

(Federal Aviation Authorithy, 2003). For example, the number nine shall be pronounced in two syllables as ‘nin-er’ and the number eight’s pronunciation starts with an ‘a’ as in ‘’car’ sound instead of the usual ‘e’ sound.

Table 2-4 : The NATO Spelling Alphabet

Character	Word	Pronunciation
0	Zero	ZE-RO
1	One	WUN
2	Two	TOO
3	Three	TREE
4	Four	FOW-ER
5	Five	FIFE
6	Six	SIX
7	Seven	SEV-EN
8	Eight	AIT
9	Nine	NIN-ER
A	Alfa	**AL**FAH
B	Bravo	**BRAH**VOH
C	Charlie	**CHAR**LEE
D	Delta	**DELL**TAH
E	Echo	**ECK**OH
F	Foxtrot	**FOKS**TROT
G	Golf	GOLF
H	Hotel	HOH**TELL**
I	India	**IN**DEE AH
J	Juliet	**JEW**LEE ETT
K	Kilo	**KEY**LOH
L	Lima	**LEE**MAH
M	Mike	MIKE
N	November	NO**VEM**BER
O	Oscar	**OSS**CAH
P	Papa	PAH**PAH**
Q	Quebec	KEH**BECK**
R	Romeo	**ROW**ME OH
S	Sierra	SEE**AIR**AH
T	Tango	**TANG**GO
U	Uniform	**YOU**NEE FORM
V	Victor	**VIK**TAH
W	Whiskey	**WISS**KEY
X	X-ray	**ECK**SRAY
Y	Yankee	**YAN**GKEY
Z	Zulu	**ZOO**LOO

NOTE- *Syllables to be emphasized in pronunciation are in bold face.*

A controlled flight into terrain (CFIT) accident near Kuala Lumpur in 1989 (Flight Safety Foundation, 1990) was caused by confusion of the word 'two', meant to be a number but understood as 'to'. In the accident, a Boeing 747 from Singapore to Kuala Lumpur was on a 'straight in' for runway 33 and was cleared for a 'Kay-ell' non-directional beacon (NDB) approach with descent clearance issued as,

> *"[callsign], descend <u>two</u> four zero zero cleared for approach...".*

Minimum descent height was 2,400 feet but the aircraft descended lower; for four hundred feet; and impacted a hillside at 600 feet AMSL.

Another problem related to homophony is word endings, especially operators name in aircraft callsigns. Broadcasted over the radio, words such as Asian, Malaysian, Indonesian, Indian and Australian may cause misunderstanding, especially when pronounced very fast. Aircraft operators' name, or 'callsign' should not be truncated and should be pronounced clearly, in full.

Similarities of flight number could also cause confusion. For example, one TAR radiotelephony sample had Malaysian 193, Malaysian 91, Malaysian 31 and Malaysian 3 on the same frequency. ATC and pilots have to be extra vigilant and cautious to ensure the right messages goes to the right aircraft.

2.3.4 Contents Rich Messages

An ATC clearance may contain up to six or seven items, for example:

> *"Malaysian Seven Eight Four / cleared to Bangkok / on Airways Alfa Four Six Four / cruise Flight Level Two Eight Zero / AGOSA Alfa Departure / transponder Three Four Six Seven"*

Transmission of such messages must be clear, precise and not too fast, so as to allow the pilot sufficient time to write down the details. Remember that the pilot needs to read back important details to verify that the instruction is received correctly and understood. Longer messages were found to overload pilot's working memory, increasing risks of incorrect or partial readbacks (Morrow and Rodvolt, 1993). Complexity of a message will also affect the pilot's recall of its contents. Burki-Cohen (1995) analysed responses by types of information, recall errors, miscommunications and request for repeats in a part-task simulation, with complexity ranging from three to five information items. Responses differ for number of items and message presentation, whether in grouped or sequential format.

The combined use of numbers and alphabets in aviation has been a common source of misunderstanding. Similarities in arrangements and repetition of alphanumeric often cause confusion. Problems with using numbers also include digital confusion and reversals on equipment settings. The overlapping numbers range for flight levels, speed and headings could also result in misunderstanding if they are not succeeded by the respective units of measurements. The phrase 'maintain two two zero' could mean speed, FL or heading. Altimeter settings between inches of mercury and millibars are sometimes confused and can cause aircraft to be flown at the 'wrong' altitude (Cushing, 1994). Altitudes could also be mistaken if not paired with the proper unit or pronunced in hundreds and thousands as required.

Copying accuracy however, could not solely be predicted by the number of elements in the message as other factors could be involved (Rantanen and Kokayeff, 2002). Error could occur due to a combination of factors. Callsign confusion is an example of signal recognition error that has resulted in unsafe situations. Mell (1991b) found that 'incoming' messages in emergency calls are structurally abnormal and lengthy, which does hamper ease of understanding and timely rectifying action by the controllers.

2.3.5 Native Language versus English

Code switching is a language-related problem when communicating in a foreign language under a significant amount of stress. The speaker tends to revert to native language words, phrases or syntax which is familiar to the speaker, but may be meaningless to the recipient.

The worst aviation accident in which two Boeing 747s collided on the runway at Los Rodeos Airport, Tenerife in 1977 is an example of a non-English syntax being used. The phrase “WE ARE AT TAKE-OFF” as used by the KLM pilot in the Tenerife accident was Dutch in syntax, referring to the actual action of a takeoff roll. The pilot was concluded to have misunderstood the phrase ‘after takeoff’ used by the controller in issuing the departure instructions as an actual takeoff clearance. Meanwhile the phrase ‘at takeoff’ as used by the pilot in his readback didn’t alert the controller that it meant a takeoff roll is in progress. It was also unfortunate that the controller has a habit of starting his transmissions with the word ‘OK’ which had been taken as an agreement to the takeoff roll. Unfortunately, a pause after ‘OK’ and a clash with another transmission had obliterated the controller’s ‘standby’ instruction (meaning not to takeoff yet) and the additional information that another aircraft was still on the runway. There were other contributing factors; however, communications and language played an important if tragic part in the accident (Secretary of Aviation, 1978).

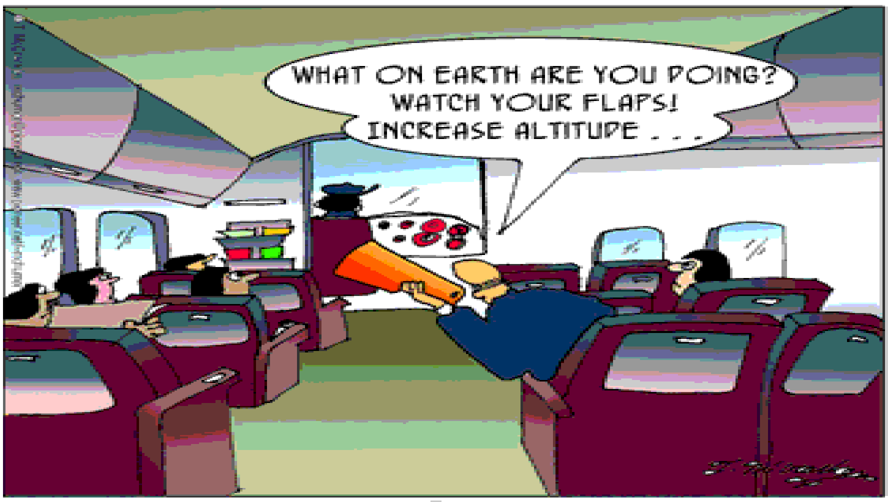
Another example of code switching was noted prior to the midair collision over Zagreb in 1976 between an Inex Adria DC-9-31 and a BEA Trident at 33000 feet. Although the error was attributed to traffic planning and coordination rather than a controller-pilot misunderstanding, the controller had switched from English to Serbo-Croat at the critical moment of attempting to recover from an unsafe situation. Taken by surprise when the Inex Adria reported “passing flight level 325” the controller responded - rather ambiguously - with an instruction to “maintain present altitude”. Essential traffic information next passed by the controller was also in Serbo-Croat, understood by the Inex Adria crew but meaningless to the BEA crew who lost situation awareness of the pending collision and was unable to take avoiding action (Air Disaster.Com, 1997).

2.3.6 About Ozone, Zillion and Apple-sauce

Colloquially, ozone does not refer to the tri-oxygen-atom gas. On the contrary, it means nice, fresh air. Similarly zillion is not a definite number and apple-sauce has nothing to do with apples at all. These are examples of colloquial expressions, which are usually not utilised in formal discourse or writing (The American Heritage, 2004; Wikipedia, 2007). Colloquialism may be single words, phrases or complete aphorism (Oxford University Press, 2004). Common examples are “gonna”, “dead as a doornail” and “there’s more than one way to skin a cat”. Overuse of colloquial words by native speakers may be regarded as an indication of sub-standard proficiency with the language. On the other hand, usage by a non-native speaker could be regarded as an unusual competence with the language. Sometimes, a formal word may also have a colloquial meaning that, while technically incorrect, is recognizable due to common usage by a group of people sharing common knowledge of the subject matter. Colloquialism presents a comprehension problem to those with a more restricted knowledge of the language and to introduce it into ATC radiotelephony may have unacceptable consequences.

2.3.7 Interference and Distraction

In an ATC environment, messages are very time sensitive and any delayed response may have significant safety implications. Interruptions, interference and congestion may cause loss of information, misunderstanding and increased overall workload. Any interruptions or interference during the transmission or receipt of a verbal message could result in message distortion such that the messages received are not the same as those transmitted.



A Back Seat Pilot.

Generally, decisions to act are based on recognition of signals. If signal recognition by the receiver is not absolutely distinct, errors could occur, resulting in missed detection or false alarm. The message in itself could be a source of distraction (Eurocontrol , 2003). Pilots on the takeoff roll or landing sequence are far too busy to handle requests, queries or any form of distracting comments. At those moments, only pertinent safety instructions should be relayed.

An electronically modulated voice is very much reduced in tonal expression and is also devoid of any body language or visual cues. The recipient of a message depends on the entire message to gain full understanding. Other types of external interferences include sights, sounds, and any stimuli in the environment that divert attention from communication. Internal interference is associated with attitude or ‘feelings’ that interferes with encoding so transmitted messages do not represent the original intended ideas or thoughts. Message delivery by a confident individual will be smooth and articulate while negative attitudes and emotions can result in ineffective communications.

ATC radiotelephony is conducted on an open frequency and only one party on that frequency could transmit a message at any one time. This allows everyone on the frequency to monitor all transmissions and be aware of others in the vicinity. However, two or more parties trying to transmit simultaneously will result in messages being blanked-out, producing a high pitch noise or squeal on the radio. Interrupted transmissions or those not clearly understood will require repetitions and clarifications, adding to airtime occupancy and frequency congestion. Careless handling of press-to-talk switches brings a risk of message loss at the beginning or end of transmission if the switch is not engaged fully. Radiotelephony frequency transmitter and receiver performance and reliability are important for continuous, crystal clear transfer of messages.

2.3.8 More Than One Can Handle

Efficiency of ATC communication depends on the amount and complexity of related taskload that the controller or aircrew have to accomplish and be able to manage at the material time. Stein (1985) defined workload as the amount of effort, both physical and psychological, expended in response to system demands (taskload) and also in accordance with the operator's internal standard of performance. He developed the Air Traffic Workload Input Technique (ATWIT) ratings to evaluate workload and taskload. Using these ratings, Manning et. al., (2001) concluded that the number of communication events within an ATC environment is significantly correlated to air traffic workload and taskload. However, the average time for individual communication was found to be negatively related to workload and taskload, as messages are shortened and delivered faster. Taskload overload could result in interference of tasks that subsequently may have an impact on memory of words heard or read as well as the ability to execute commands (Risser, Scerbo, Baldwin, and McNamara, 2002; Risser, McNamara, Baldwin, Scerbo, and Barshi, 2004).

A busy environment or when traffic is bunching would require more important safety-critical tasks to be attended to. Tasks may not be paced out easily, so prioritising and taskload management should consider each task's importance and relevance to ensuring safety. Using a foreign language in which the controller has limited proficiency could add to mental anxiety. Brooker (2003) suggested that workload is a concept which is not easy to define and may not be 'objectively scientific' because it includes subjective elements such as 'internal performance standards' and 'feels'. Where ATC is concerned, although the operational concepts and procedures are highly regulated, the ease of carrying out a task, as well as total task that could be managed safely does depend on the mental well being of the human controller.

2.3.9 By the Book

Day (2002) emphasised that safe radiotelephony demands good discipline from pilots and controllers as communication of operational information is critical and requires accuracy of content and exact delivery. Phrases or word meanings could sometimes be relative, as in suggesting a pilot to 'slow down' without actually clarifying the present speed and the new speed required. The concept is to reduce speed, but it is relative to the original speed and still has to be quantified by how many knots to be reduced.

As plain language is not ideally suited for ATC communications due to cultural acquaintances, subjective concepts and knowledge depth, conformity to the applicable standards is essential. Pilots and controllers undergo hundreds of hours of training to perform their job efficiently. Standard phraseology usage and strict adherence to radiotelephony procedure does not come naturally (Tajima, 2004). It is a skill that has to be learned and practised. Tajima further suggests that training of aviation-ESL be developed with specific regions in mind. This region-specific training program could address any idiosyncratic usage and local difficulties of using standard phraseology in parallel to plain English. This research may contribute information which could be classified as region and type specific that will be useful for training development and enhancement.

2.4 ATC Safety Reporting

In ATC, it is mandatory for safety reports to be submitted whenever safety of flight operations had been jeopardised (ICAO, 2001e). Occurrences could be very minor, where no bodily injury and structural damage is involved or could be extremely tragic with loss of lives and aircraft as in a crash or collision.

2.4.1 Concept and Objective

The concept of safety may generally vary in perspective but in ATC it is considered as a state beyond which the risk of harm to persons or of aircraft damage is unacceptable (ICAO, 2006). It is relative to a state of affairs where inherent risks in the system are tolerable.

ATC is a dynamic environment with ever-changing situations and the personnel should be well equipped and highly trained to maintain safety levels at its best. Enhancement of service and improvements to safety could only be carried out if problematic areas are clearly identified, acknowledged and improved. It may be realistic to say that to achieve a zero accident system is near impossible as every system has its weaknesses.

The logical solution to identify language and communication related factors that had caused aircraft incident and accidents would be to analyse the existing records that include such information. Databases that are available on the web or by search request are especially valuable sources of secondary data for safety analysis. ATC safety occurrences data are kept by a number of organisations. Specifications, set-up, details and formatting of data are determined by the initiating organisation to suit its purposes.

As part of the standard and recommended practices governing the provision of ATC services, contracting states are required by ICAO to establish a mandatory incident reporting system to facilitate the collection of safety deficiencies information. Analyses of all types of incidents are important for early detection of declining safety levels and unsafe, non-standard practices. The changes in policies and approaches to managing safety now include analyses of day to day routine ATC and flight operations either at the ATC units or in the cockpit, to reduce human error.

Ideally, a voluntary and non-punitive incident reporting system which affords protection to the sources of safety information should be established. A reporting system should be a simple process, include a broad reporting base and a well documented format with details of what, where and when to report. Form design and layout should facilitate the report writing, using simple everyday language, non-directive questions and focussed on the detection of and recovery from, an unsafe situation. These safety reports are filed in a manner suitable for easy retrieval and analysis.

2.4.2 Safety Occurrences Databases

The databases normally contain safety occurrence narration by reporting parties described as accurate as possible in chronological order. Very mature and advanced databases allow for multiple key words search and provide a more accurate picture where certain criteria overlapped and are linked. It is a quick and simple way of roughly assessing the magnitude of a problem if the database has the keywords relevant to an intended research. The records kept include details of occurrences that give an insight to the problems or issues being investigated. As an initial investigation into the ATC communication problems, various databases had been accessed for records that relates to keywords such as English, language, language problem, language barrier, miscommunications, ATC, phraseology and a combination of those. The following are descriptions of some relevant safety databases.

2.4.2.1 FAA Aviation Safety Information Analysis and Sharing (ASIAS)

Formerly known as the National Aviation Safety Data Analysis Centre (NASDAC) this site contains a number of databases of different categories, four of which are considered relevant to the research area;

i. The Aviation Safety Reporting System (ASRS) - a voluntary reporting scheme consisting of any unsafe occurrences and hazardous situation reports since 1988. The ASRS receives, processes, and analyses reports of unsafe occurrences and hazardous situations that are voluntarily submitted by pilots, air traffic controllers, and other aviation personnel. Information collected by the ASRS is used to identify hazards and safety discrepancies in the National Airspace System.

ii. The FAA Aircraft Incident Data System (FAIDS) - records since 1978 on incidents involving general aviation and commercial aircraft. The FAIDS database contains data records for general aviation and commercial air carrier incidents since 1978. This database contains incidents only, as ASIAS uses the National Transportation Safety Bureau (NTSB) accident database as the primary source for accident information. The information contained in FAIDS is gathered from several sources including incident reports submitted on FAA Form 8020-5.

iii. The National Transportation Safety Bureau (NTSB) - consists of accident and incident information of civil aircraft since 1983. The NTSB Aviation Accident and Incident Data System contains information collected during an NTSB investigation of an accident or incident involving civil aircraft within the United States, its territories and possessions, and in international waters. The NTSB is an independent Federal agency that investigates every civil aviation accident in the United States and significant accidents in the other modes of transportation, conducts special investigations and safety studies, and issues safety recommendations to prevent future accidents.

iv. Near Mid-Air Collision System (NMACS) - near misses reports from 1992. The Near Midair Collision System (NMACS) database is used to record reports of in flight incidents where two aircraft have closed to an unsafe distance and avoided an actual collision.

2.4.2.2 ICAO's Accident/Incident Data Reporting (ADREP)

ICAO as the governing body of civil aviation keeps a record of aircraft accidents involving any aircraft with a maximum takeoff mass of over 2250 kg and serious incidents involving aircraft over 5700 kg. These reports are submitted by contracting states worldwide, in a predetermined and coded format and electronically stored in the ADREP database. Reports in this database are confidential and the details are only made available to contracting states. The

ADREP search request submitted to ICAO resulted in 11 occurrences on ‘language’, 8 on ‘phraseology’ and 1 on ‘miscommunication’.

2.4.2.3 The Mandatory Occurrence Reporting Scheme (MORS)

This scheme is used in the UK to ensure that the Civil Aviation Authority (CAA) is advised of hazardous or potentially hazardous incidents and defects referred to as occurrences. Knowledge of these occurrences is disseminated for learning purposes by other persons and organisations. MORS allows independent assessment to be made by those concerned; whether inside or outside the CAA; of the safety implications of each occurrence, both in itself and in relation to previous similar occurrences, so that any necessary, appropriate action could be initiated. The overall objective of the CAA in operating the occurrence reporting scheme is to use the reported information to improve the level of flight safety and not to attribute blame (CAA, 2005). Requests for reports can be submitted to the CAA’s Safety Regulation Group, quoting relevant word categories required.

2.4.2.4 The Aviation Safety Network

This online source of information at Aviation Safety Network database consists of descriptions of aviation accidents around the world. A search could be undertaken by year of occurrence, airline, aircraft type, resulting events, country, region and causal factors. Links to official investigation reports and cockpit or ATC transcripts are sometimes available. These reports had been read as background information on past accidents related to language and communication problems faced by pilots and controllers. The Aviation Safety Network database contains about 12,200 aircraft safety occurrences since 1943. However, this source of information may be limited to serious incidents and accidents that involved structural damage to aircraft. The majority of reports include a description of incident, details of aircraft involved and photos. Voice transcripts are also sometimes available.

2.4.2.5 The United Kingdom Airprox Board (UKAB) Reports

'An Airprox is defined as a situation in which, in the opinion of a pilot or a controller, the distance between aircraft as well as their relative positions and speed have been such that the safety of the aircraft involved was, or may have been, compromised'. (DOC 4444, Part I).

The UKAB was formerly the Joint Airprox Assessment Panel (JAAP) and then Joint Airprox Working Group (JAWG). The UKAB Reports contain details of Airproxes in the UK airspace since 1998 with a summarised investigation report by CAA-SRG. The Board discuss and deliberate on all the available information regarding the incident, after which a risk category is assigned.

A	Risk of Collision	An actual risk of collision existed
B	Safety not assured	The safety of the aircraft was compromised
C	No risk of collision	No risk of collision existed
D	Risk not determined	Insufficient information to determine the risk involved, or inconclusive or conflicting evidence preclude such determination

Risk level assessments of Airprox are made on the basis of what actually took place and not on what may or may not have happened (UKAB, 1999).

The UKAB reports are published biannually with the purpose of promoting air safety awareness and understanding, by sharing the lessons to be learned. These reports were chosen to look into ATC incidents and occurrences related to communication and language. Occurrences recorded in this database included military and all type of civil aircraft movements operating in controlled and uncontrolled airspace. The aircraft details, traffic situation and causal factors are explained in detail but the actual radiotelephony transcripts are not included.

Other sources of information are the European Co-ordination Centre for Aviation Incident Reporting System (ECCAIRS) developed by the Aviation authorities in Europe and United Kingdom's Confidential Human Factors Incident Reporting Programme (CHIRP) which complements its Mandatory

Occurrence Reporting System (MORS). ECCAIRS facilitates the pooling of safety information and early detection of potentially hazardous situations and improves initial problems of incompatible data storage formats between European countries as well as the insufficient number of significant occurrences in individual states for a safety analyses by using common classification taxonomies compatible to ADREP. CHIRP is independent from the aviation regulatory authority and is a confidential system. A newsletter is periodically distributed to share safety information and improve safety standards.

For the purpose of this research, the above mentioned databases have a limitation in that they do not contain the words and phraseology exactly as were used in radiotelephony. From a language perspective, it is not possible to analyse linguistic features such as syntax, structure, pronunciation, words usage, numbers usage, wording choice and speech rate. These analyses could be possible if the actual transcripts were available and a taxonomy be used to classify words and phrases usage as well as classification of language errors. Audio data would be advantageous in studying aspects of pronunciation, accent and voice pitch or tone.

In some cases the national legal system may restrict the possibility of data collating and analysis. Major impediments are civil litigation, violation proceedings, criminal proceedings and public disclosure. There are difficulties in sharing incident data because of differing definitions, for example, in the classification of occurrences severity and categorisation of aircraft. The ICAO and Commercial Aviation Safety Team (CAST) are combining efforts to promote work in developing common taxonomies and definitions for phase of flight, occurrence categories and aircraft categorisation, developing work already started by the FAA and NASA.

The Global Aviation Information Network (GAIN) in 2001 has also identified 24 major collection and sharing programmes, but covering only 9 countries and excluding the ICAO's ADREP which collects global data. GAIN is aiming to improve collection and dissemination of safety information worldwide by promoting voluntary collection and sharing of safety information, with participation by airlines, manufacturers, employee groups, governments and other aviation organisations (Hart, 2002; Ferris, 2003).

Malaysia is still developing a comprehensive and easily accessible database of safety occurrences. Presently, the information is still classified as confidential and not available to the public. This may change in future in the interest of safety enhancement and improvements to ATC service.

2.5 Chapter Summary

This chapter introduces air traffic control as a system that provides a service of global nature. The system utilises verbal communications as the prime mode of operations and delivers safety as the commodity. The chapter briefly explains the standardisation, the governing body, general airspace structure, ATC communications, characteristics and metrics of pilot-controller radiotelephony, as well as the problems related to this type of verbal interactions.

Ideally, the application of ATC regulations should be identical throughout the world as flights travel from one part of the globe to another. However, in reality, there are differences, even in the utilisation of phrases or words for air traffic control radiotelephony, which had been technically designed for brevity and accuracy. The issue of non-native English speakers being involved in more safety-related occurrences strongly suggests an ESL perspective be considered for this research. Previous researches had mostly sourced data from United States[1] where presumably the majority of users are native English speakers. An ESL approach to the subject will complement present knowledge and more importantly, is a step forward towards understanding the problems faced by ESL controllers and pilots. ICAO has recognised language deficiencies as a threat to aviation safety and produced the ICAO's Guidelines on Language Proficiency Requirements.

[1] Radiotelephony Data Sources: Baltimore-Washington, Albuquerque, Atlanta, Dallas-Ft. Worth, Dulles, Seattle, Chicago, Philadelphia, Pittsburgh, Los Angeles, Miami and Boston (Cardosi, 1993, 1994, 1996).

Several ATC safety reports databases explored confirmed the existence of language and phraseology usage problems. Such phrases as ‘language problems’, ‘poor English’ and ‘non-standard phraseology’ often appear in safety databases as keywords for classifying safety occurrences. These records of incidences when safety had been jeopardised, however, do not always have information on actual radiotelephony between pilot and air traffic controllers.

Routine radiotelephony could be analysed for deficiencies and language usage characteristics. Real-time routine radiotelephony from an existing ATC facility is possibly the most suitable source of data as it could be randomly selected, spontaneous and represent real life ATC scenarios. This data type would contain routine language and phraseology usage patterns, including non-adherence to standard practices. A detail classification of errors and discrepancies needs to be identified in relevance to the language aspect of ATC radiotelephony. The next chapter will discuss the research subject area from this perspective.

3 LANGUAGE USE IN ATC RADIOTELEPHONY

Dietrich (2004) considers language as the most efficient method of human communication, specifically verbal communications as it is fast, doesn't require technical equipment, adaptable and could be carried out in parallel with other actions. It is this efficiency that renders verbal communication most suitable for air traffic control communication, especially over long distances, which is made possible with radio technology. Controllers could issue instructions to pilots while scanning the flight progress strip display and assessing traffic situation. Pilots could similarly listen and respond to ATC while flying the aircraft and making sure all the switches and displays are in order. Messages and responses are almost instantly transmitted and received. However, language in itself has other imperfections that could contribute to misunderstandings and errors. This chapter looks at the general characteristics of language, the ESL users' perspectives, standard phraseology and what type of deficiencies impact on ATC operations' safety.

3.1 Language is …

3.1.1 The Paradigms

A common entity used by many (Sapir, 1921; Trager, 1949; Chomsky, 1957; Hall, 1964) to describe language is the use of symbols. These vocal symbols are voluntarily produced and systematically arranged to communicate ideas, emotions and desires, thus allowing for cultural interactions. Clark & Clark, (1977) relates rudimentary properties of language to being learnable by children, spoken and understood by adults, able to capture ideas that are normally communicated and must enable interactions of people in a social and cultural context. In an earlier study, Hockett (1960) compared human language usage to animal communication and listed 13 Linguistic Universals which distinguishes human language. Hockett and Altmann (1968) add three more linguistic universals to the earlier list, making the total sixteen. These are listed in Table 3-1, the last three denoted with * were the later additions.

Table 3-1: Linguistic Universals

Vocal-auditory channel	the speaker produced sounds that could be heard by others
Broadcast transmission and directional reception	the signal is sent out in all directions but perceived in a limited direction and within hearing distance
Rapid-fading (Transitoriness)	the signal does not continue over time, it fades rapidly and cannot be heard after fading
Interchangeability	signals are not gender specific, users can both receive and broadcast any signals
Total feedback	speaker can hear and monitor themselves
Specialization	special organs (lips, tongue, throat) are adapted for production of speech
Semanticity	specific signals can be matched with specific meanings.
Arbitrariness	there is no crucial connection between the signal and the physical properties of the object referred to
Discreteness	the basic units of speech (such as sounds) belong to distinct categories with no gradual, continuous shading from one sound to another in the linguistics system.
Displacement	a speaker can talk about things which are not present, or non-existent, allowing conversation about the past, present and the future
Productivity	human languages allow speakers to create novel, never-before-heard utterances that are linguistically and grammatically correct
Traditional Transmission	a native language is not inborn and need to be learnt
Duality of patterning	the small discrete parts of a language can be recombined in a different order but systematic way to create new forms
***Prevarication**	Intentionally make utterances that are false or meaningless
***Reflexibility**	Can use language to talk about language
***Learnability**	Able to speak any of a wide variety of language

(source: Hockett, 1960; *Hockett and Altmann, 1968)

In general spoken languages, one symbol or word does not necessarily stand for only one meaning. Spoken language is also imperfect in that it sometimes is insufficient to describe sensations, goodness and emotions. Understanding of such feelings is achieved through shared human experiences in the form of images, concepts and impressions. The set of rules that determines the systematic and meaningful arrangement of symbols which express thoughts in a language is grammar. All languages have grammar, consisting of phonology, syntax and semantics. Phonology is the study of sounds and how it is used to produce words. Syntax refers to rules that indicate how words are joined together to form phrases and sentences. Semantics are rules governing the meaning of words and sentences. Accent is about differences of pronunciation for the same word. For example, tomatoes may be pronounced with all alphabet sounds intact, or it may also be pronounced as ‘toma(t)oes’ with a silent second ‘t’. Dialect on the other hand, is a variety of the same language that says things a different way, encompassing syntactic, morphology and semantic properties of speech (Oxford University Press, 2004).

Krauss (2002) also identified three properties of language which are important for human interactions; semanticity, generativity and displacement. Semanticity allows for accurate meanings to be understood while generativity is the possibility to rearrange symbols to produce an infinite number of message varieties. Displacement is the property that offers a dimension of remote space and time for events and experiences. While semanticity and displacement may be useful in ATC communications, generativity may not be favourable as messages could be transmitted in many non-standard arrangements, possibly causing confusion.

Krauss further described four paradigms related to language use in verbal communications. The Encoding – Decoding paradigm described the simplest kind of coding which involves one-to-one mapping, where for every signal there is one and only one meaning and for every meaning there is one and only one signal. Speakers will encode their ideas into words, phrases and sentences; and listeners decode these signals in order to recover the underlying ideas. Ideally, the ATC standard phraseologies should fit this one-to-one mapping and misunderstandings could be avoided.

The Communicative Intentions paradigm considers the possibility and potential of multiple meanings, conveyed by even the simplest utterance. Identifying a speaker’s communicative intention is not always a simple or straightforward matter as perception may differ and this obviously is not needed in ATC communications.

Perspective-Taking paradigm discusses speaker's experience of the world from different vantage point that the speaker occupies. Krauss suggests that discrepancies in perception should be accommodated. However, in ATC, perspective taking is always referred to the addressee, not the addressor. For example, in giving directional instructions for navigation, the determination of displacement; either left or right is always referred to the pilot's view, not the controller's. It should be noted nevertheless, that neglect of addressees' perspectives could happen under time pressure or when preoccupied (Keysar, Bar, and Horton, 1998). Such errors may render ATC verbal communication considerably less effective than it should be, and in some situations, unsafe. The safety net of perspectives lost is the fact that language allows for collaborative communications as the normal practice in ATC.

The fourth paradigm is Dialogism, which focussed on the collective activity of language use in communications, coordinating both the contents and roles of speaker or listener. Spontaneous speech requires the speaker to conceptualise the information to be conveyed and formulating a verbal message that is capable of conveying it. Resources of immediate knowledge and perspectives make this process effortless but not necessarily orderly. Sentences may trail off inconclusively, phrases left dangling, listeners interrupt to ask questions or interject comments; and abrupt topic changes are quite normal. What is left unsaid may convey more than what is explicitly stated. These irregularities in language use reflect a communicative process, representing a joint accomplishment by the participants who have collaborated to achieve a common understanding of a subject. Similar interruptive and interjecting communication in ATC is not favourable as it increases the communication channel occupancy. ATC communications requires efficient delivery of messages and clarity of readback to indicate understanding.

Speech is different to writing, which is premeditated and usually read without the presence of the author. Speech in conversation is composed during the course of speaking, requiring immediate and irreversible exchanges. It is a social phenomenon between individuals and could convey politeness, brusqueness, formality, humour, pleasantness and intimidation. In ATC it is imperative that messages convey the correct meaning and contents as each and every detail is equally important to ensure safety. Conveyances of courtesy, humour, pleasantries and grammar are of little importance.

As more and more flights cross international boundaries, cross-cultural communication will be the norm; a phenomenon experienced worldwide as more and more businesses take on a global dimension (Rifkind, 1996). It is important that language use in ATC communications be globally regulated as flights cross international boundaries more often, engaging pilots and controllers of different nationalities in conversations which use a language other than their mother tongue.

3.1.2 Language Measures

Based on information theory, language usage could be measured by the amount of information it conveys per unit of time, proportionate to the amount of symbols needed to efficiently encode it. Transmission of information could be through radio waves, optical fibre or sound waves, in a linear fashion, one symbol after another. Changes in sequence of symbol may have a direct effect on meanings. Symbols are also not equally used. Zipf's Law states that each word is not spoken equally often. The second most frequent word is used about half as frequent as the most frequently used word, the third most frequent word is used about one third as frequent as the most frequently used word and so on (Crystal, 1987). If this concept is true for standard phraseology and aviation terms, then ATC communication training should design the training format to emphasise on a curriculum based on usage needs.

3.1.3 Language Comprehension

Any sounds above the auditory acuity threshold are heard and distinguished as either speech or none-speech. Spoken words are decoded either by synthesis analysis or by template matching. In perceiving normal continuous speech, words are recognised by their acoustic and prosodic differences (Crystal, 1987). Language in spontaneous speech is usually imprecise, with no complex preset theme and planning. Non-fluency is quite normal as speakers cope with attention, perception and memory difficulties. Words are produced rapidly, pronounced rather informally and more often than not, speckled with emotional prosodic effects. Sentences are loosely constructed, often rephrased or repeated and divided into manageable chunks by fillers, pauses or intonations. Social conversations are also rich with courtesy expressions. This is the norm expected due to traditions, culture or social standing. Many theories explain the process of comprehending language from different perspectives.

Chomsky's Transformational-Generative Grammar theory in 1950s claimed that all sentences are generated from a phase structure skeleton that is modified to suit any situation. It was also found that modifications render sentences more complex, into the negative or become ambiguous, thus slowing down comprehension time. However, understanding verbal language is not a linear process of recognising a string of linguistic symbols which are pre arranged to depict a meaning (Scovel, 1998).

Comprehension is highly affected by context and the knowledge the listener possesses for each logogen within a message. Logogen is a recognition unit introduced by Morton (1969) containing information about the sounds of a word, its syntactic and semantic characteristics, and information about the word type. Words that fit into a familiar, known and expected context are comprehended more quickly and remembered more readily. High frequency words are said to be easily and immediately understood while uncommon words have a higher threshold for comprehension.

Morton's (1969) and Scovel's (1998) theory implied that long ATC instructions with many transformations will actually confuse pilots and slows down comprehension while at the same time occupies more working memory and reduces the recall of important keywords and information. Words with multiple meaning are also proven to delay comprehension.

The phoneme restoration effect theory suggests that language comprehension is a highly active process. Missing or deformed sounds in a sentence are 'heard' by the listener based on the expected or normal context of the subject matter (Warren, 1970; Warren and Warren, 1970). For example, consider two descend clearances in which one (a) is commonly issued for terrain clearance:

a. descend **fiv**e thousand five hundred feet, and
b. descend **nin**er thousand five hundred feet.

Issuance of clearance (b) which is uncommon, with a phoneme missing at the end of the word 'niner' may cause it to be 'restored' as 'five'. Though restoring missing phoneme is useful in daily conversation, second guessing an uncertain number in an ATC clearance is not a safe practice. Any uncertainty in ATC has to be clarified, not guessed. The safety net to these possible errors is the stringent readback, hearback and acknowledgement procedures.

Bell (1991) introduced the 'Gestalt Imagery' phenomenon in that a listener will create a visualisation of what is heard as a whole mental model in the process of language comprehension. It is noted that subjects with good imaging are good comprehenders while those with weak imaging are poor comprehenders. From this clinical perspective, successful comprehension of language is linked to the ability to create an image whole, relates to the ability to recall facts, understand ideas, project a prediction, evaluate a situation and draw a conclusion. It is the ability to connect to and interpret both the oral and written language and encompasses the ability to reason and of cognition.

Cutler (2000) suggests that listeners of spoken language will segment continuous speech into its component words. The recognition of spoken utterances is highly native language-specific. A listener's native language's lexicon and grammar constrain the expectations and recognition of phonemes or word sounds. This limitation leads to inefficiency when listening to non-native languages unless the listener acquires multiple proficiencies. Controllers and pilots exposed to various different sounds of English without doubt will initially face difficulty in matching phonemes and logogens, as spoken utterance of a word may differ quite frequently. However, continuous exposure or introduction to such varieties will assist in building a stronger and bigger resource of phonemes and logogens, enabling recognition and understanding.

Linking understanding with how the mind 'hears' is a relevant idea in the context of air traffic control. The study of semantics is related to mental imagery; argued as the best method of understanding meaning. Mental images are considered as representations in the mind that resemble the objects or events being represented while thinking is the manipulation of these mental representation. In ATC, controllers are trained to mentally visualise traffic situations, drawing an accurate disposition of each and every aircraft in a controller's area of responsibility and continuously adjusting this visualisation as situation changes or projecting a future scenario for planning purposes. The pilots on the other hand would have a similar 'mental picture' of his aircraft disposition in relation to its phase of flight, with additional expectations of what should happen next. Ideally, a flight should push-out from the gate, taxi to the runway, take-off, climb to its cruise level, track by the most economical route, descend, land and gate-in without any interruption in its operations. Pilots and controllers 'share' this imagery and information to ensure safety of all flights operating in the vicinity.

Simple, straightforward and positive sentences are easier to understand compared to complex sentences. The negative, passive and interrogative transformations add complications to a sentence and take longer to be understood. The number of transformations in a sentence is inversely correlated to the number of words remembered at the end of the sentence. Adherence to standard phraseology which is familiar in structure and sound will enable efficient comprehension of messages.

From the speakers' perspective, involvement in spontaneous speech would require language accommodation in cases when social and linguistic backgrounds differ. This convergence alter a person's language style to accommodate the other party and become more 'alike' in terms of grammar, vocabulary, speech rate and pronunciation (Siegel, 2003). Convergence facilitates interaction and to some extent, social approval. This is obvious when a proficient language user converse with a foreigner or a young child. Sentences are constructed simpler, with careful choice of wordings and may include usage of catch phrases familiar to the other party. Convergence could also involve slang words and colloquial terms to identify with social or linguistic group.

3.1.4 Second Language Acquisition (SLA) Theories

Language acquisition necessitates the learning of words and how these words should be put together into a sentence to convey the idea it is meant to. Theories of second language learning have to take into account who, what, when and how much needs to be learnt (Spolsky, 1989). Each learner may differ in such factors as age, intelligence, aptitude, personality and motivation. The 'who' factor will influence the process of learning itself as some will appreciate explicit learning while others may prefer implicit learning (Dekeyser, 2003). The benchmark for minimum amount of language knowledge to be learnt is set by the requirements of language function itself in terms of importance; for example phonology versus grammar versus semantics versus culture. Language function may also be relevant to dialect and accent. Other important factors are the best teachers to learn from and the kind of exposure needed, if at all, that may contribute to learning.

The cognitive development theory on language acquisition claims that the human brain is programmed in such a way that it can learn any language to which it is exposed. This innate language acquisition device, assisted by instinct, imitation, reinforcement and conditioning will enable anyone to learn a new language (Pinker, 1994). Exposure will allow collection of data, its processing and utilisation to build up a grammar for the target language. The theory of active grammar construction is much preferred than the imitation or reinforcement theory as it explains that acquiring a language goes beyond memorising, imitating and being corrected for mistakes. Over generalisation and under-extension of rules supports the notion that learners build up vocabulary, grammar and semantic knowledge from what has been previously learned.

Language learners need not unlearn their first language to learn a second language. The learning strategies are similar to the ones used by them when they acquired their first language. While internalising rules and responding to external stimuli of the new language, it is considered natural for any second language learner to commit errors. The errors are an indication as to what strategies are being used to learn the new language. Corder (1967) believes that the processes of first and second language acquisition are fundamentally the same. Differences in utterances between first and second language learners are contributed to maturational development, learning motivation and the circumstances of learning. An analysis of learners' errors would show learning progress and strategies. Learners proceed from a beginner status towards a competent user by gradually building up their own grammar and vocabulary to suit the new language. These bits and pieces of information of the new language are organised into meaningful wholes; as suggested by the Gestalt Law of Organisation[2] (Feldman, 1998).

Selinker (1972; 1974; 1992) uses the term Inter-language as a working model, an adaptive strategy that uses simplification, reduction, over generalisation, transfer, formulaic language, omissions, substitutions and restructuring. It describes the intermediate stage language, emphasising a status between the learner's mother tongue and a target language. Inter-language implies a halfway position between knowing and not knowing the target language when

[2] Gestalt is a psychology term meaning "unified whole", referring to theories of visual perception originally developed by German psychologists in 1920s. It describes people's tendency to organise elements into groups when principles of similarity, continuation, closure and proximity are applied.

habits from the first language are transferred onto the foreign language being learned.

Corder (1971) uses the phrase ‘learners’ idiosyncratic dialect’ to describe the transitional language and the phrase ‘performance analysis’ (Corder, 1975) to describe the learner’s set of target language-oriented repertoires. Corder (1981) defined the structural properties of learner’s Inter-language as having a simple morphological system with a more or less fixed word order. The pronoun system will be simple with a small number of grammatical function words, little or no use of the copula and the absence of an article system. As a language, it may be inaccurate in various respects but it does enable the learner to use the target language to some degree of competence.

Based on those theories, the second language users are said to share a distinct system to that of a native speaker. This system is an accumulation of deviations of performance which are the result of language knowledge incompetence, but also correspond to first language backgrounds. If the inter-language is an approximation of the learners’ current knowledge of the target language, then total competence could only be achieved when the learner could perform as well as a native speaker. Lenneberg (1967) concluded that only 5% of second language learners achieve mastery of the target language by acquiring the latent language structure. The other 95% only rely on latent psychological structure and never quite achieve mastery of the target language. In the case of ATC and standard phraseology, or Aviation English for that matter, the notion of a ‘native user’ may not apply as all aviation personnel start learning from a ‘layman’ level to being experts in the field. Factors such as exposure, integrative motivation and the willingness to adapt may be more influential in Aviation English and standard phraseology learning as the language is learned more as a tool rather than a language in the true aspect.

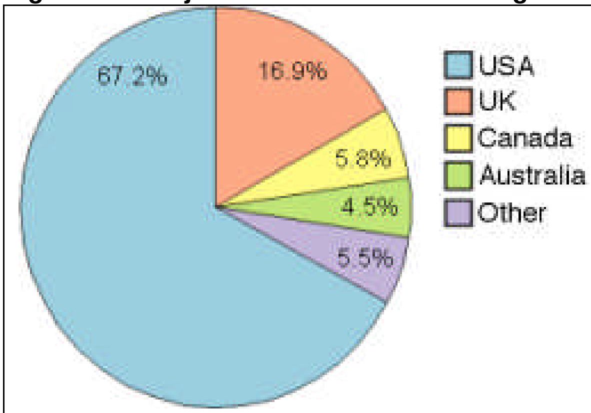
Each language has its own rules, vocabulary and pronunciation which differ from another. Vocabulary is culture specific and sometimes no direct translations exist from one language to another. In the study of language acquisition, the influence of mother tongue (MT), interlanguage (IL) and target language (TL) are given much attention. Comparison analysis yields other term such as Contrastive Analysis (CA), Error Analysis (EA) and Transfer Analysis (TA). Nemser (1971) uses the term 'approximate systems' while Corder (1967) favours the term 'transitional competence' for similar studies involving MT/TL comparison and learners usage of TL. Error Analysis is a process to determine the incidence, nature, cause and consequences of unsuccessful attempt to use a target language, focussing more on erroneous utterances produced by groups of learners. It is a study of linguistic ignorance, of what people do not know about a language and how they cope with it. While these paradigms may not be exactly suited to analysing radiotelephony in terms of language usage, the principle of Error Analysis is applicable to detect degree of adherence to required standards.

Code-switching relates to the use of two languages simultaneously and/or interchangeably (Valdes Fallis, 1976). Even if bilingual fluency is not completely achieved yet, the code-switching allows for filling-up of linguistic or conceptual gaps and multiple communicative purposes. Switching may also be needed when particular words in one language could not be translated into another. Depending on communities and local culture, code-switching could be a norm or an exception. Code-switching could be for isolated words, phrases or whole clauses, but limited by the free morpheme and equivalence constraints. The switched words or phrase must 'sound' and be grammatically correct in both languages. Language switches does not necessarily indicate incompetence in the target language but could be serving purposes such as reporting or quoting a speech, interjections, changing or qualifying a topic, highlighting an issue, emphasising speaker's role and singling out a person. However, switching from one language to another while issuing ATC instruction is not an ideal and safe practice. Terms which may be acceptable and understood by the speaker may not be familiar to the person addressed. It is even more risky when the switching involves a totally different language for whole sentences.

3.1.5 English Language's Dominance

The English language is widely used for conducting businesses, in science and technology development, in pursuit for knowledge, as well as for communication medium. There are approximately 350 million native English speakers around the world. United States alone has more than 215 million native English speakers, equivalent to 67.2 percent of the total. Even though no single language is declared as the national language in United States, English is spoken by the majority. Figure 3-1 shows percentages in other major countries where English is the mother tongue.

Figure 3-1: Major Countries of Native English Speakers

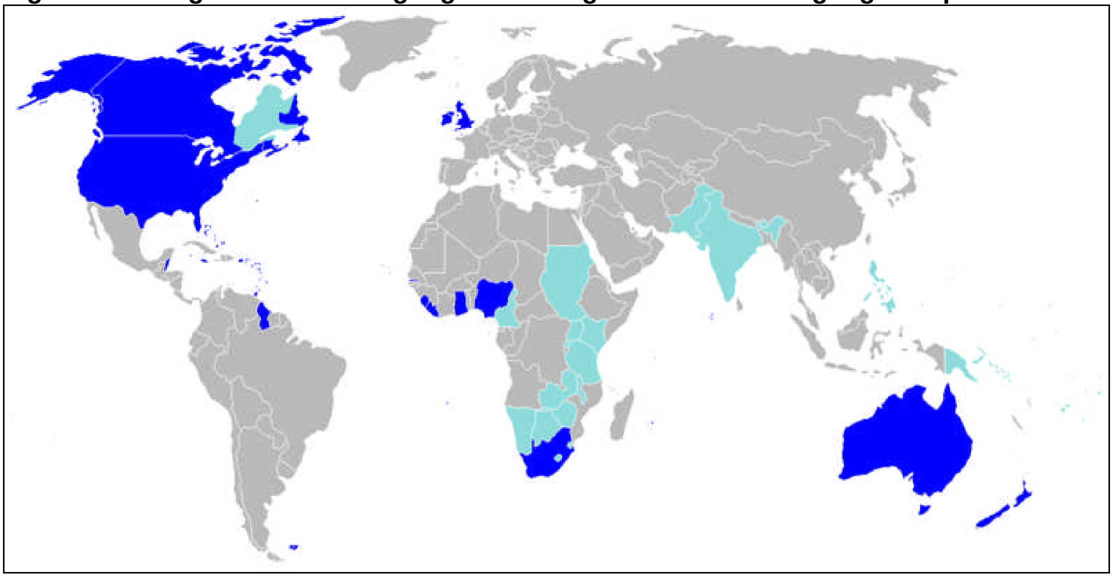


(Source: Crystal, 1997)

Country	Native speakers
USA	215,423,557
UK	58,200,000
Canada	17,694,830
Australia	15,013,965
Republic Of Ireland	3,750,000
South Africa	3,673,203
New Zealand	3,500,000+ (approx)

The English language dominance is further emphasised by the number of people speaking it as a second or foreign language out of necessity or choice. There are about three times as many non-native English speakers as the native users of the language, making the total number of people speaking the language over a billion. Due historical reasons English sometimes co-exists in some countries as the national or official language and lingua franca, as in India, Pakistan, Samoa and Papua New Guinea. These countries use English in official Government business and for legislative purposes. Language policies enforced in some countries promote the usage of some languages while discouraging others, in the effort to cultivate and protect the national ethnic language. Figure 3-2 shows the countries where English is a native language (darker blue) and countries that declare English as a national language (lighter blue).

Figure 3-2: 'English Native Language' and 'English National Language' Map



(Source: http://commons.wikimedia.org/wiki/Image:Anglospeak.png)

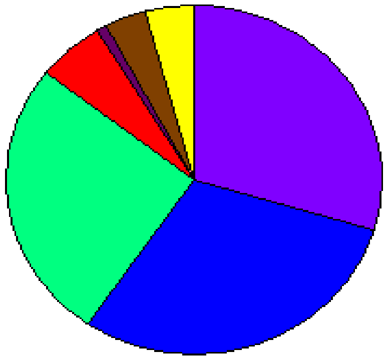
English is declared as the single official language in 23 countries and as one of two official languages in another 11 countries. 50 countries declare English as one of 5 leading daily languages spoken. Extraordinarily, 8 countries (Malawi, Mauritius, Sierra Leone, Uganda, Zambia, Pakistan, Philippines) even proclaim English as the official language but not listing it among the 5 most spoken languages locally (UNESCO, 2005).

Many countries now include English in school curriculum as the foreign language to learn (Kushner, 2003). The English language also has the world's largest vocabulary as it originated from various language sources. It is an inclusive language with many words borrowed and adapted from other languages. This is humorously best epigramed (origin not confirmed) by Nicoll (1990) at http://en.wikipedia.org/wiki/,

"We don't just borrow words. On occasion, English has pursued other languages down alleyways to beat them unconscious and rifle their pockets for new vocabulary".

Some of these contributing languages are shown in Figure 3-3. French, Latin and German have the most influence in words used in the English language.

Figure 3-3: Foreign Languages Influence in English Vocabulary



	French
	Latin
	Germanic languages and predecessors of modern English
	Greek
	All other languages
	Derived from proper names
	No etymology given

(Source: http://www.jgames.co.uk/title/English_language)

The existence of comparable words, irregularities and a variety of pronunciation complicates the learning of English as a second or foreign language. Learning English spelling and pronunciation is not exactly a straightforward exercise. There are many variations to how an arrangement of alphabets could sound. There are also alphabets within a spelling which is 'silent' and do not contribute to the pronunciation of the words. Syntax, grammar and tenses add to the complexity of learning the language. However, these difficulties are common to learning any language that is foreign. The advantage of learning standard phraseology and 'ATC English' is that one does not need to be grammatically correct at all times. Delivered in the correct standard format, messages exchanged between controllers and pilots make absolute sense even if linguistically wrong. Standard Phraseology is designed in such a way that the subjects within a message are sequenced in the order of importance and priority with safety as the prime objective.

3.1.6 Language Proficiency Tests

Acquiring an English language proficiency rating is typical for academic and career purposes. Internationally recognised language proficiency tests are available worldwide and used by many organisations. Two of the most popular and globally recognised tests are the International English Language Testing System (IELTS) and Test of English as a Foreign Language (TOEFL). In Malaysia, the Examinations Council run the Malaysian Universities English Test (MUET) for admission into universities in Malaysia and Singapore.

TOEFL results are given as scores and not describe in any specific bands. A speaking test module which was not part of the earlier TOEFL was added in 2005 in the internet based test module. Score ranges differ for paper-based, computer-based and internet-based tests (ETS, 2005). Proficiency is gauged by scores acquired but no specific description is provided.

IELTS offers an academic module for international universities enrolment and a general training module for other purposes. Test results are set in band scores for each sub-skill tested (speaking, listening, reading and writing), as well as an overall band score. The band scores are described in Table 3-2. The level of mastery of the language is explained in terms of command, inaccuracies, familiarity and understanding of complex language structure.

Table 3-2: IELTS Score Bands Description

Band	Description
9 Expert User	Has fully operational command of the language: appropriate, accurate and fluent with complete understanding.
8 Very Good User	Has fully operational command of the language with only occasional unsystematic inaccuracies and inappropriacies. Misunderstandings may occur in unfamiliar situations. Handles complex detailed argumentation well.
7 Good User	Has operational command of the language, though with occasional inaccuracies, inappropriacies and misunderstandings in some situations. Generally handles complex language well and understands detailed reasoning.
6 Competent User	Has generally effective command of the language despite some inaccuracies, inappropriacies and misunderstandings. Can use and understand fairly complex language, particularly in familiar situations.
5 Modest User	Has partial command of the language, coping with overall meaning in most situations, though is likely to make many mistakes. Should be able to handle basic communication in own field.
4 Limited User	Basic competence is limited to familiar situations. Have frequent problems in understanding and expression. Is not able to use complex language.
3 Extremely Limited User	Conveys and understands only general meaning in very familiar situations. Frequent breakdowns in communication occur.
2 Intermittent User	No real communication is possible except for the most basic information using isolated words or short formulae in familiar situations and to meet immediate needs. Has great difficulty understanding spoken and written English.
1 Non User	Essentially has no ability to use the language beyond possibly a few isolated words.

Source: IELTS (2006)

Table 3-3 show the statistics of IELTS test takers of East Asian region. Malaysian candidates' average overall rating is 6.64. Higher rating was recorded for listening and reading but scores for writing skill was lower. Germany was recorded as the country with the best overall rating of 7.23.

Table 3-3: IELTS Mean Band Score (Academic) 2006 – East Asian Countries

Country	Listening	Reading	Writing	Speaking	Overall
China	5.47	5.80	5.23	5.39	5.53
Hong Kong	6.70	6.75	5.91	6.06	6.42
Indonesia	6.10	6.27	5.43	5.83	5.97
Japan	5.87	5.86	5.33	5.80	5.78
Korea	5.87	5.87	5.36	5.72	5.77
Malaysia	6.93	6.85	6.13	6.41	6.64
Philippines	6.68	6.27	6.18	6.74	6.53
Taiwan	5.52	5.81	5.23	5.66	5.62
Thailand	5.82	5.89	5.28	5.70	5.74
Vietnam	5.59	6.01	5.56	5.70	5.78
					(Source: http://www.ielts.org)

The MUET score bands are described in Table 3-4, similarly outlining the command of the language, fluency and inaccuracies expected. Scaling ranged from poor to limited, modest, satisfactory, good and very good.

Table 3-4: MUET Score Bands Description

Band / Score	Description
6 Very good user 260-300	Very good command, highly expressive, fluent, accurate and appropriate, hardly any inaccuracies. Very good understanding. Functions extremely well in the language.
5 Good user 220-259	Good command, expressive, fluent, accurate and appropriate with minor inaccuracies. Good understanding. Functions well.
4 Competent user 180-219	Satisfactory command of the language. Satisfactory expressive and fluent, appropriate language but with occasional inaccuracies. Satisfactory understanding of language and contexts. Functions satisfactorily in the language.
3 Modest user 140-179	Modest command, modestly expressive and fluent, appropriate with noticeable inaccuracies. Modest understanding. Function modestly.
2 Limited user 101-139	Limited command. Lacks expressiveness, fluency and appropriacy: Inaccurate, breakdown in communication. Limited understanding. Limited ability to function.
1 Extremely limited user Below 100	Poor command. Unable to use language to express ideas, inaccurate, frequent breakdowns in communication. Little or poor understanding. Hardly able to function in the language. Source : MPM (2004)

The proficiency scores in IELTS and MUET both described the competencies in terms of comprehension, usage and recurrence of errors and inaccuracies. The general level accepted as competent is associated with occasional inaccuracies and satisfactory usage of the language. Similar strategies are applied in the establishment of ICAO's proficiency ratings which will be discussed in paragraph 3.2.

3.2 Designated ATC Languages

ICAO as the advisory body of civil aviation recommends that pilots and air traffic controllers be proficient in languages that has been designated for use in the provision of air traffic services. Officially, any language could be designated by a country as the language for ATC communications. However, English has become firmly accepted as the common language for international aviation communication, being the only practical choice at this time for designation as the official first language of radiotelephony communications (Mathews, 2001). Designation of the ATC communication language is on a country by country basis. Russia and South Africa designated local languages, but Taiwan, Germany, France and Malaysia for example, implement an 'all English' policy for ATC communications.

3.2.1 English by Default

The English language gained its status in aviation by default, not by official policy (Crystal, 1997). States that designate a language other than English for air-ground communication shall ensure that communications with international flights could be conducted in English whenever requested. All controller-pilot communications for international flights shall then be carried out in English unless the ATC unit and the pilot of an aircraft mutually agree to use another language (ICAO, 2001a). France for example, used to designate French as the communication language for domestic flights.

There are relevant amendments to ICAO Annex 1, Annex 6, Annex 11 and Annex 10 Volume II, adopted since March 2003. Previously, an ATC and pilots' English language proficiency requirements are very discreetly described.

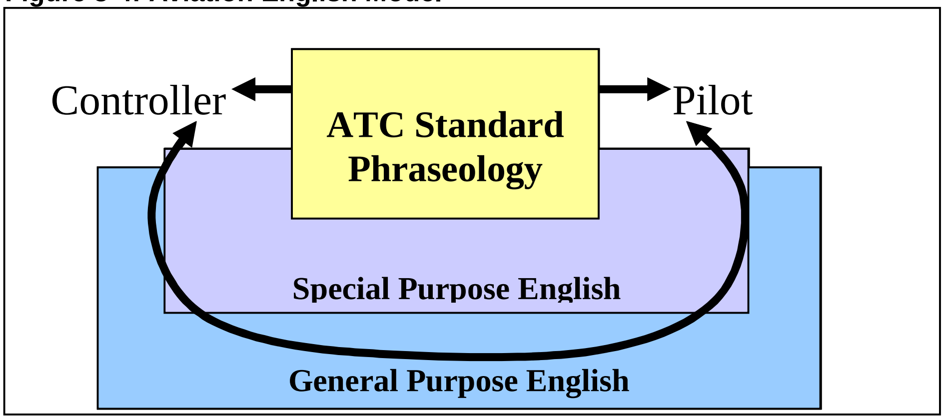
These current amendments clarify and extend existing provisions, consistently emphasising the need for adequate language proficiency for pilots and air traffic controllers. The responsibility to ensure that controllers are able to speak and understand the language(s) used for radiotelephony communications lies with the air traffic service provider (ICAO, 2001b). Operators bear the same responsibility for flight crews (ICAO, 2001c). The new ICAO Language Proficiency Requirements are applicable standard phraseology and to the designated language used for ATC communication. The requirements were adopted in 2003 and are to be enforced in March 2008. These new standards should deal with fundamental aviation language issues (Mitsutomi and O'Brien, 2004). There is also concern regarding language of documents used on board aircraft by aviation personnel, especially if it is different from the language used by inspection authorities. ICAO is also adopting a proposal to get all documents used on board aircraft translated into English (Verhaegen, 2001).

Other researches by Sexton and Helmrich (2000), Varantola (1989), Nordwall (1997), Feldman (1998), Mathews (2001) and Verhaegen (2001) concluded that ATC communications deviate from standard phraseologies towards usage of plain English as workload increases or when abnormal events developed. These studies support the need for controllers and pilots to adhere to the prescribed standards but pointed out that maintaining a certain level of proficiency in the usage of general plain English is absolutely necessary in handling unusual situations.

Aviation English as the term suggests consists of terms and vocabulary that are aviation specific. People not related to the industry may be unfamiliar with some of the terms which are not used in daily conversations, but this holds true for any given specialised subject matter such as medicine, rocket science or geology. Aviation English is also technically oriented, grammatically simple and concise in structure. Standard phraseology is even more constrained as grammatical structure and tenses are ruled out. The exchanges in routine communications are disjunctive, abbreviated and predictable, carried out by a prescribed protocol.

The model of Aviation English (Figure 3-4) as introduced by Mitsutomi and O'Brien (2003) suggests that the components include ATC Standard Phraseology (SP), English for Specific Purposes (ESP) and English for General Purposes (EGP). These three areas combined together form the basis for proficient and safe communications. The SP is considered as the central component but it is very concise and brief, without grammatical markers, determinants or verbs. It has to be supported by ESP and EGP when no prescribed phrases are available to achieve mutual understanding.

Figure 3-4: Aviation English Model



(Mitsutomi & O'Brien, 2003, page 119)

Although rooted in the general language, ESP contains specialty terms of which literacy and fluency will be enhanced by experience and practice. This model shows that without knowledge of general purpose and plain English, the standard phraseology alone may not be sufficient to manage unusual situations.

3.2.2 The ICAO's Language Proficiency Requirements

The ICAO's Annex 1 latest amendments regarding language proficiency are aimed to boost, explain and strengthen the requirements that should be applicable to pilots, air traffic controllers and flight engineers (Mathews, 2003). Improving language proficiency among pilots and controllers will expectedly improve aviation safety (Mathews, 2004) as well as improve awareness of communication pitfalls (Day, 2004). These guidelines clarify the areas and skills that must be acquired before any personnel are considered proficient to handle safety related communications.

The ICAO Annex 1 paragraph 1.2.9.5 (ICAO , 2001d) states that,

> “*Aeroplane and helicopter pilots, flight navigators required to use the radio telephone aboard an aircraft, air traffic controllers and aeronautical station operators should demonstrate the ability to speak and understand the language used for radiotelephony communications to the level specified in the language proficiency requirements”*

The responsibility of the operators to ensure crew members’ language proficiency is stated in Annex 6 paragraph 3.1.6. These amendments emphasise the need to train and certify personnel of the air traffic industry to be proficient in English. The recently published ICAO DOC 9835 – ‘Manual on the Implementation of ICAO Language Proficiency Requirement’, explains these requirements in detail (ICAO, 2004a). In addition, each aviation authority has the option to publish its own supporting documents for local use. FAA details the English language skill standards in the circular 60-28 CFR Parts 61, 63 and 65 while CAA UK outlines the performance objectives and conditions to determine proficiency levels in English in document CAP 624 Part O. ICAO offers DOC 9835 as guidance material to member states to determine their own training and testing metrics for language proficiency. Eurocontrol, for example had developed a Proficiency in English Language (PELA) Test for controllers that satisfies the previous requirements for English language proficiency. The test had recently been updated and enhanced to meet new requirements to demonstrate language proficiency which reflects a range of tasks undertaken in ATC, but with specific focus on language use rather than operational procedures (Enright, 2004).

ICAO’s Proficiency Rating Scale is divided into Levels of 1 to 6 and explained by six ‘holistic’ descriptors of proficiency;

i. Pronunciation – describes dialect/accent as influence by first language or regional variations,

ii. Structure - grammatical structure and sentence pattern appropriate for function and task,
iii. Vocabulary – range, choice of words, paraphrasing ability,
iv. Fluency – speech tempo, presence of fillers, use of discourse markers,
v. Comprehension – cultural variations, and
vi. Interactions – responses, manage discourse relationship.

Level 4 (Operational) is the minimum required proficiency level for radiotelephony communication. At Level 4, the influence of first language or regional variation on pronunciation should not frequently interfere with ease of understanding. There should be creative but well controlled, use of grammatical structures and sentence patterns. Errors may occur, particularly in unusual or unexpected circumstances, but should rarely interfere with meaning.

Vocabulary range and accuracy at Level 4 are usually sufficient to communicate effectively on common, concrete, and work-related topics. Speakers should be able to paraphrase successfully when lacking specific terms, could produce stretches of language at an appropriate tempo without noticeable pauses, distracting fillers and hesitations, and able to make limited use of discourse markers. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but should not prevent effective communication.

Comprehension on common, concrete, and work-related topics is expected to be mostly accurate when the accent or variety used is sufficiently intelligible for an international community of users. However, the speaker's comprehension may be slower or require clarification strategies when dealing with linguistic or situational complication or an unexpected outcome. Responses are usually immediate, appropriate, and informative. A Level 4 speaker could initiate and maintain exchanges even when dealing with an unexpected turn of events. Any apparent misunderstandings are adequately dealt with by checking, confirming, or clarifying (ICAO , 2001d).

When a speaker's capability falls below the expectations of level 4 proficiency, he/ she should be refrained from conducting radiotelephony. The personnel should undergo further training for improvement and be re-evaluated. Recurrent evaluation will also be required for proficiency levels below 6 at specified intervals. Proficiency at Level 4 requires re-evaluation every 3 years and level 5 every 6 years. Personnel with Level 6 proficiency will not require any re-evaluation at all.

Levels 1 through 3 described as Pre-elementary, Elementary, and Pre-operational, are all below the minimum ICAO language proficiency requirement. Levels 5 and 6 describe Extended and Expert levels, in which levels of proficiency are more advanced than the minimum required standard. As a whole, the scales will serve as benchmarks for training and testing, and in assisting candidates to attain the ICAO Operational Level. The detailed holistic description of all ICAO proficiency levels are shown in Appendix B.

3.3 ATC Standard Phraseology

The standard phraseology was established for the purpose of ensuring uniformity in ATC radiotelephony communications. If standard phrases are adhered to when composing a message, any possible ambiguities are expected to be reduced to a minimum (ICAO, 2001f).

3.3.1 Is it a language?

Philips (1991) taxonomised and coded 541 phraseological utterances and 36 structural modifications of the official ICAO's standard phraseology. He observed that there is a special purpose sub-grammar and the speech community is context and domain dependent. By design, standard phraseology is a non-grammatical form of simplified and specialised sub-language as a derivative of the natural language. It should be characterised by its concision, clarity and non-ambiguity, intended to be used without variations throughout the world (Mell, 1991c). For example, a normally spoken question of 'where are you going?' in everyday conversation would be reduced to a two-word phrase of 'request destination' by phraseology design. Ragan (2002) described phraseology as unnatural, idiosyncratic, predictable, disjunctive and abbreviated. It has a prescribed phonetic and grammatical structure. These context specific terms have prescribed meanings with predetermined structures and are self-contained. It also has a lexical limitation that, sometimes, the usage of plain English would be required.

ATC standard phraseology attempts to obliterate the ambiguities of using multiple meaning words and phrases. It also tries to regulate some word sounds so as to be globally identical, given the universal and international nature of aviation. The exchange of information in ATC should strictly follow the prescribed phonetics and phraseology structure without any additional linguistic style and creativity. It is the character of being internationally recognised, with a restricted number of topics and an expectant, predictable and repetitive nature that should contribute to the success of ATC communication. However, as statistics show, expectancy and assumption have on numerous occasions, caused misunderstandings as well. As standard phraseology is not a language in the true sense, it should be used according to strict protocol and procedures. Any deviation from the proper and prescribed protocol of standard phraseology could alter meaning or lead to ambiguity and possibly cause confusion and misunderstanding.

The very nature of being concise and specific, standard phraseology becomes a challenge to memorise, master and use with ease and accuracy (Mitsutomi and O'Brien, 2003). New pilots and controllers all start their career at a point of almost zero knowledge about what standard phraseology is and how to use it. Only frequent practise and experience will improve proficiency. Successful use of phraseology is not isolated from other cognitive workload and may suffer when overall workload becomes more demanding (Villaire, 1994). Insufficient proficiency could also result in 'linguistic stall' (Mitsutomi, 1999) as there is not much choice of paraphrasing the 'lost' phrase.

3.3.2 Lexicon and Radiotelephony Procedures

ICAO Document 6180 – Definitions, which was published in 1949, contained limited entries of phrases as an early regulatory effort to standardise aviation communications. It was superseded by Document 7200, published in 1952 in three languages; English, French and Spanish; with 2,500 entries but still incomplete and had to be expanded by additional relevant entries. New procedures and better technology require additional suitable phrases to be implemented. Sometimes, amendments are needed if an earlier version of phraseology causes confusion or becomes obsolete with changes in technology.

Other ICAO documents for phraseology references include ANNEX 10 Vol II, DOC 4444 – Procedures for Air Navigation Services: Rules of the Air and Air Traffic Services, and DOC 9432 - Manual of Radiotelephony. The ICAO Standard Phraseology Lexicon is updated as and when required but each State can publish its own glossary if it so wishes. UK Civil Aviation Authority published Documents CAP 413 and CAP 483 for this purpose while FAA published Aeronautical Information Manual Order 7110.10P/CG – Pilot/Controller Glossary.

In standard phraseology, numbers are pronounced uniquely, unfamiliar words should be spelled out using the NATO spelling alphabet and phrases are structured to an expected format. Designation for places and points along air routes are standardised, as well as names for navigational aids on the ground and paths on the surface of aerodromes. There are standard units and measurements; height is expressed as altitude or flight levels, distance in nautical miles, time is universally coordinated, description of disposition is referenced to the hour of the clock and there is a standard method of addressing ground or aircraft stations.

A list of standard phraseology sanctioned by the appropriate aviation authority is used in ATC operations. This glossary is based on ICAO's list but could be expanded as necessary for local guidelines. There are specific phrases for different types of aircraft operations, such as start-up, takeoff, climb, descend and land. ATC operations with radar will also have specific radar phraseologies such as identified, squawk, transponder and heading. Restrictions imposed on flights also use specific wordings and phrases.

Differences from ICAO are allowed but must be informed, filed and published in Annex 10 Volume II for the information of other states. 32 states have notified ICAO of 'no difference exist' status while 8 contracting states; Australia, France, Germany, India, New Zealand, Norway, Sweden and UK have filed differences. For example, Germany totally disallows the use of words 'to' and 'for' in reporting or assigning levels and in place of 'verify' uses the word 'check'. New Zealand does not allow certain forms of abbreviated callsigns type. In France, when English is in use the word 'report' is substituted with 'say' while the word 'verify' is not used. Sweden listed a clarification on the usage of words 'hundred' and 'thousand' with whole numbers (ICAO, 2001a). No information is received from other contracting states.

3.4 Language Deficiencies' Impact on ATC Safety

Mell (1991c) summarised that language deficiencies of aircrew or controllers could cause:

- departures from safe operations as in issuing unclear or misleading ATC instructions,
- failures to prevent a departure from safe operations such as being unable to query erroneous transmission by a pilot, or
- failures to initiate a return to safe operations as in usage of non-standard phraseology.

Historical accident data strongly suggests that failure of Language proficiency as a protective layer against an unsafe situation has often led to disaster. For example, in 1993, Chinese pilots flying a United States-made MD-80 attempting to land in northwest China were baffled by an audio alarm from the plane's ground proximity warning system. A cockpit recorder picked up the pilot's last words: "What does 'pull up' mean?" Another accident in 1995 was related to the controller's English not being sufficient for him to understand and articulate the problem of an American Airlines jet having navigational problems. The aircraft crashed into a mountain in Cali, Colombia (Baron, 2004). If the Chinese pilots had understood what ‘pull-up’ meant and if the controller had been able to understand and assist the pilot, the outcome could have been different.

Rasmussen’s (1983) classification of human errors in general refers to skill and knowledge of a person committing the error. Skill-based error is failure in using skills that have been acquired over time and stored in memory, usually at execution of a plan of action. Knowledge-based error is the inability to apply previous knowledge to new situations. Information may have been learned under different circumstances and knowledge may be insufficient for present situation. Rule-based error is related to the inability to recognise or understand circumstances fully. Rules which were applicable to a similar situation encountered before through training or experience are not appropriate for present circumstances. This involves the activation of ‘if-then’ logic but misapplied when the ‘if’ condition is not actually met. Reason (1990), James (1998) and, Wickens and Hollands (2000) used other terms such as slips, errors, mistakes and solecisms. Slips, lapses or omissions are related to processing problems, inclined towards carelessness, divided attention, distraction and preoccupation. Mistakes are deficiencies or failures in judgemental or inferential process involved in the selection of objectives and method. These are harder to detect, complex and constitute a far greater danger as errors are in interpretation or choice of intentions. Solecisms and violations on the other hand are applied for deliberate breach of rules of correctness and actions contrary to standards.

Errors in language usage indicate that an attempt was initiated at communicating but resulted in partial or total failure. A total failure means the message is not understood by the recipient; when the contents makes no sense or have no meaning at all. In partial failure, the recipient may understand a portion of the message well but the remaining may be unclear or not understood at all. The unclear or garbled portion could then be deducted or guessed based on total message context. Parts of message not understood may be clarified or ignored depending on message meaning and completion. Corder (1967) in discussing language learners' errors suggested that occurrence of errors indicate inadequacy in the present teaching techniques and in an imperfect world, errors will continue to happen in spite of best efforts, that resourcefulness should be focussed on techniques to deal with errors after they occurred. In view of aviation safety, waiting until after errors occurred just isn't good enough. More should be done to mitigate the occurrence of errors itself.

When a language learner is faced with difficulties and a state of being ignorant in using the target language, the coping mechanism could either be silence or substitution. If silence were chosen then there could never be an error analysis as there would be no language use error at all. However, in air traffic control communications, none-response is sometimes considered as an error in itself since there will be no confirmation that message had been received and understood correctly. In substitutive coping mechanism, learners compensate for ignorance by paraphrasing or using a best-guess word or phrase as a solution. Ignorance is conceptually different to incompleteness which suggests a global insufficiency across all areas of the target language and could be measured in terms of grammar, acceptability, correctness and strangeness. Grammatical error is observed when words used are not in the correct order without taking context into consideration. Acceptability relates to being contextually correct while grammar is not considered. Ignorance of correctness is referred to prescriptive normative standards, and strangeness / infelicity is about being anomalous, contradictory and using inappropriate expressions. Detecting errors in spoken language is more difficult than written, as is more difficult on screen than a print-out or by one's self than others.

3.4.1 What the Numbers are Saying

The fact that aviation incidents and accidents are recorded in detail enables us to analyse frequencies and types, as well as categorise causal factors. However, there may be slight differences in the structure of databases and searches into the records have to take into account the terminology used during the reporting of those occurrences and categorisation used for keeping records. The following are examples of some established sources of safety information that could be accessed for analysis purposes.

3.4.1.1 FAA Aviation Safety Information Analysis and Sharing (ASIAS)

The ASIAS (formerly NASDAC) databases have been updated and still available for online search as before (FAA, 2006). The relevant databases are the Aviation Safety Reporting Scheme (ASRS), FAA Aircraft Incident data System (FAIDS), National Transportation Safety Bureau (NTSB) and Near Mid-Air Collision System (NMACS).

These databases could be searched by various criteria such as aircraft types, flight type, state, airport and events between two dates. A narrative contents search could be carried out using keywords. A search result will provide query count, total events count and each individual report. Keywords such as ATC, tower, tracon, language, phraseology and miscommunication were used for specific searches. Boolean logic allows for combined keywords search to narrow down the search area scope.

Table 3-5 lists the various search results carried out in September 2007 using keywords associated with this research. Based on events recorded, ASRS has the largest database and the NMACS the smallest. Reports containing the search keyword were listed and details could be extracted online. The table only shows the number of relevant events. However, as these events keywords were not totally independent of each other, the numbers should not simply be added up. Multiple keywords search could assist in narrowing down search criteria and type of events.

Table 3-5: FAA's Databases Search Results (September 2007)

	ASRS	FAIDS	NTSB	NMACS
Total Events	**176570**	**88373**	**63167**	**6351**
ATC	32366	1576	1625	310
Tracon	3127	37	332	78
Enroute	345	1819	885	83
Tower	223	1907	3369	237
Language	912	9	47	1
Phraseology	811	5	28	3
Miscommunication	25	7	6	0
English	637	9	57	0
ATC & language	227	2	8	0
ATC and phraseology	254	2	15	1
ATC & miscommunication	9	3	1	0
ATC & English	174	2	7	0
Tracon & language	6	0	2	0
Tracon and phraseology	27 (0.015%)	0	6	1
Tracon & miscommunication	1	0	0	0
Tracon & English	5	0	4	0
Enroute & language	2	0	1	0
Enroute and phraseology	1	0	3	0
Enroute & miscommunication	0	0	0	0
Enroute & English	0	0	2	0
Tower & language	1	1	16 (0.025%)	0
Tower and phraseology	0	1	18 (0.028%)	1
Tower & miscommunication	3	1	2	0
Tower & English	1	0	18 (0.028%)	0

Not all events were ATC related or associated with any ATC operations environment. For example, NMACS has only 78 out of 6351 records pertaining to 'tracon' and only 1 was 'tracon and phraseology' related. 'English' and 'miscommunication' were not associated with any event in NMACS but found in other databases. The NTSB database showed more records associated with Tower (with language or phraseology or English). 'Tracon and phraseology' showed more records in ASRS. These databases gave an idea of how much the language, phraseology and communication problems affected the ATC operations.

3.4.1.2 UK MORS

A search on MORs for 'language' resulted in 230 reports and 'phraseology' resulted in 143 reports. Other MORS reports listed in the 'language' search are in Appendix C and those categorised by 'phraseology', in Appendix D. Each report contains aircraft type, flight phase, event category, location, date, a pre-title and the précis of actual report.

The following Table 3-6 is an example of a MORS report that was listed under 'language' keyword search. The incident is of an altitude deviation event that took place in Spain involving an Airbus-320.

Table 3-6: Example of UK MORS 'language' Search Results

A/C Type :	A320	**Occurrence Number:**	**00XYZ**
Flight Phase :	Climb	**Occurrence Date :**	ddmmyy
Classification :	Occurrences	**Location :**	Spain
Events :	Altitude Deviation (ATC) Foreign ATC Occurrence	**Location Info :**	
Pretitle :			
After take off A320 changed frequency at 200ft, but was unable to contact new frequency until FL49, when clearance was amended to maintain 5000ft. A320 reached 5350ft before descending back to 5000ft.			
Precis :			
After take off from R/W36L, at 200ft, A320 was given frequency change by Tower, which was acknowledged and actioned. New frequency did not respond to initial call, also all other R/T transmissions were in **local language**. ATC eventually contacted A320 when it was at FL49 and instructed it to maintain 5000ft, due to the slow climb of the preceding a/c. A320 climbing to FL130 on the SID, disconnected autopilot, but reached 5350ft before descending back to 5000ft.			

The pilot reported that a clearance to maintain level was not timely and resulted in a level bust before the aircraft could descend to its assigned level. Usage of local language in radiotelephony with other aircraft on the frequency was claimed by the pilot as contributory to the occurrence.

In the Table 3-7 example, listed under 'phraseology', there was confusion over prominent words 'line up' and 'ready immediately' which had resulted in runway incursion when the pilot fail to notice the requirement 'after landing traffic'.

Table 3-7: Example of UK MORS 'phraseology' Search Result

A/C Type :	B737	**Occurrence Number :**	**0WXYZ**
Flight Phase :	Taxy	**Occurrence Date :**	ddmmyy
Classification :	Occurrences	**Location :**	UK
Events :	ATC Occurrence Runway Incursion	**Location Info :**	
Pretitle :			
B737 was given a conditional line up clearance from R3 holding point after a landing B737, but then observed to have crossed red stop bar ahead of a landing B737. Inbound B737 instructed to go around.			
Precis :			
Inbound B737 at approximately 2nms on final approach to R/W23 was cleared to land. Another B737 was given a conditional line up clearance from R3 holding point to 'line up **after landing traffic** and be ready immediately'. B737 subsequently observed to have crossed red stop bar ahead of landing B737 and instructed to hold position. Both pilots believed initial instruction was 'line up and be ready immediately'. Inbound B737 instructed to go around.			

Normally, a restriction is issued ahead of the instruction to emphasise to the pilot that there is a condition to be met. Structuring the message differently may give pilots the wrong impression as had happened in this occurrence.

3.4.1.3 Aviation Safety Network

This website's database reports are categorised under various headings such as regions and countries, year, contributory factor and outcome.

Table 3-8: Occurrences Attributed to Language/ Communications Problems

Year	Location	Commentary on language / phraseology
1997	Indonesia	ATC **confusion** over direction of aircraft turn
1996	Norway	Pilot's **limited knowledge** of the operating language. Request for alternate runway not understood by ATC Information
1992	Thailand	language **difficulties**, ineffective discussion of unresolved problems, radio communication difficulties between the crew and the air traffic controllers.
1991	California	failure of ATC to maintain situation awareness of traffic situation, culminating in **inappropriate** clearances
1989	Malaysia	"...descend two four zero zero..." was interpreted by the crew as "...to 400..."**Non-standard** phraseology by ATC, crew **misinterpret** instructions
1985	New Jersey	inadequate coordination among ATC, a **misleading** traffic advisory.
1981	France	**imprecise** language between pilot and ATC aircraft flying a holding pattern to lose altitude, but the controller believed aircraft was on direct descent to begin final approach.
1981	California	Crew **failure** to immediately initiate a go-around when instructed to do so by the ATC
1979	India	ATC use of **incorrect** and/or **non-standard** phraseology
1979	Brazil	'…turn right heading 140, just now, over' **Incomplete** ATC instructions,
1979	Italy	**inadequate** ATC assistance (controller distracted)
1977	Lebanon	Language **difficulties** forced Beirut Area Control to repeat approach instructions.
1977	Spain	**misunderstanding** between the tower and the crew, aircraft departed without take-off clearance, mutual use of usual terminology which, however, gave rise to **misinterpretation**.
1977	California	crew **misinterpreted** the IFR clearance and ATC instructions
1975	Washington	ATC: "...maintain five thousand", flight responded "Five thousand. MAC 40641 is out of ten". **Misidentification**.
1973	France	Radio **difficulty** due distance. crew twice tried to request permission to carry out a 360-degree turn, initiated the turn without clearance.
1969	Puerto Rico	**Wrong** position information and **erroneous** instructions, controller was performing beyond the safe limits of his capability
1966	France	"you have 5 miles to the Mont Blanc" the positional correction by ATC was **mis-understood** by the pilot
1960	Brazil	lack of appreciation of the communications **difficulties**, pilot **misunderstand** instructions transmitted by Approach Control
1947	Senegal	radiotelephony communications **difficulties** between the control tower and the aircraft, **insufficient knowledge** of the English language by the controllers in the tower
1947	Washington	**faulty** clearance given by Airway Traffic Control, tacitly approved by the company dispatcher, and accepted by Flight 410

A causal/ contributory factor search listed 21 accidents (Table 3-8) associated with language/ communications problems. Among the language related keywords used in the narrative of the accidents were confusion, limited knowledge, difficulties (speaking/ understanding), non-standard phraselogy, misleading, misinterpretation and imprecise. Based on location, these accidents were not limited to non-native English speaker countries, which suggest that language problems are not always ESL associated.

3.4.2 UK AIRPROX Analyses

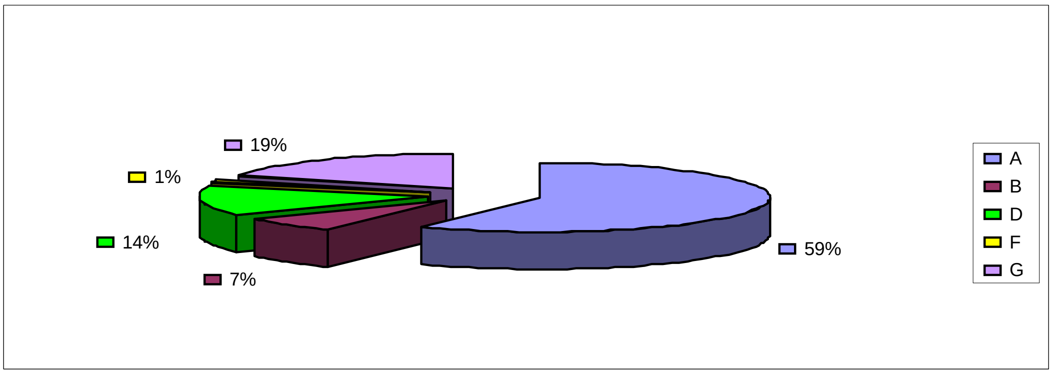
There were in total 1134 reports recorded between 1998 and 2003. Only 151 reports were found to be associated with language or communication related problem contributing to the occurrence. Each of the selected Airprox reports was then categorised based on airspace class and flight phase, and types of discrepancies which contributed to the occurrence were noted. The problem may be relevant to air-ground; between a pilot and a controller; or ground-ground communications; a misunderstanding between controllers and may also be the outcome of a miscommunication between pilots. For the purpose of this initial investigation some general criteria have been used to classify these discrepancies as following:

i. readback/hearback error
ii. alphanumeric confusion
iii. unclear ATC clearance or instructions
iv. non-usage of standard phraseology
v. traffic information not provided / incomplete
vi. displayed information discrepancy / non-usage
vii. insufficient briefing between Controllers / Crew
viii. Inefficient coordination between ATC units
ix. Overloading of communications taskload
x. Equipment or radiotelephony technique

There may be more than one discrepancy in an Airprox. This resulted in a total of 198 discrepancies in 151 Airprox.

Figure 3-5 show the percentages of discrepancies per airspace class. It was noted that discrepancies took place more often (59%) in class A airspace which is busier and under positive control at all times, compared to other classes of airspace. 7% were in Class B airspace, which increased the percentage of discrepancies in positive control airspace to 66%.

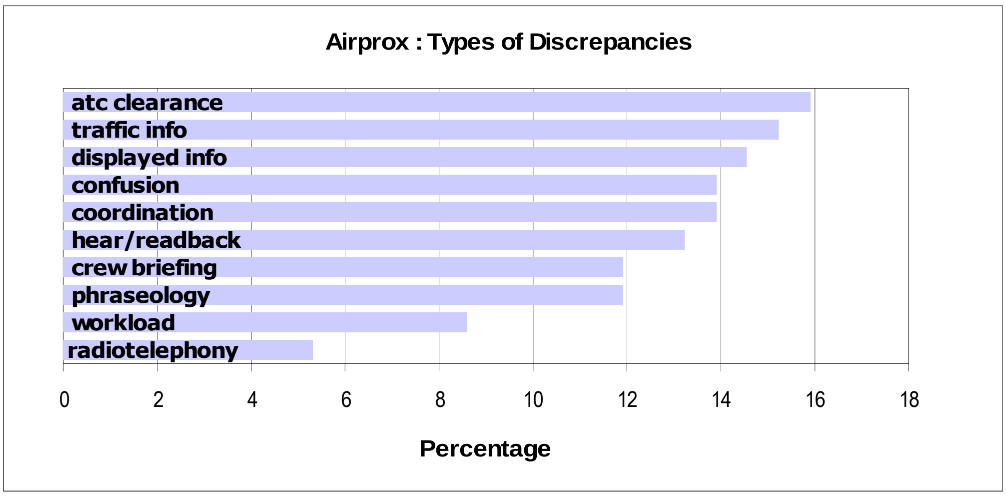
Figure 3-5: Airprox by Airspace Classification



In uncontrolled airspace, Classes F and G where flights receive only flight information, about 20% communication discrepancies were observed. Class D is advisory airspace and responsibility for separation is shared between pilots and controllers. This airspace recorded 14% of the discrepancies. There is very little Class E airspace in the UK and no language or communications discrepancies were recorded in it.

Figure 3-6 shows the types of discrepancies. The lowest percentage, at about 5%, was for ‘radiotelephony technique and equipment problem’. This may be due to advanced and more reliable telecommunication systems now. ATC clearance (unclear or misleading) made up 16% of discrepancies.

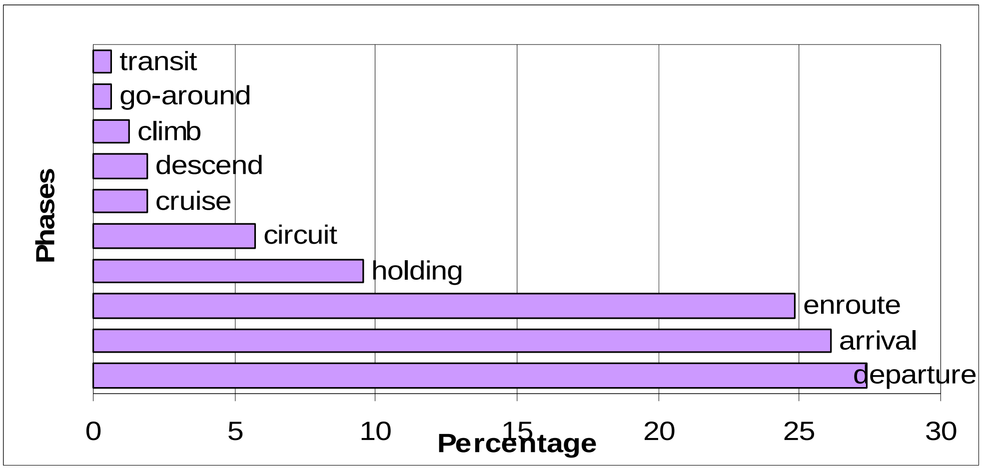
Figure 3-6: Types of Discrepancies



Workload totalled to about 9%, suggesting that problems may have occurred during high, complex traffic situations. Other discrepancies showed between 12 to 15% occurrence, suggesting that problems between controller-pilot (ATC clearance, hear/readback and phraseology) and controller-controller (displayed information, coordination and crew briefing) are seen to be equally significant as Airprox causal factors. 'Traffic info' and 'confusion' type of discrepancies could occur in either pilot-controller or controller-controller communications.

An analysis of the flight phase (Figure 3-7) indicated that the departure, arrival and enroute phases show high percentages of communication discrepancies. This could be attributed to high workload and similarly high communication events between pilots and controller as these phases involved movements of aircraft within the terminal control area (TMA).

Figure 3-7: Airprox by Flight Phase



Aircraft in transit, on cruise and on a missed approach (go-around) usually follow fixed routings and standard procedures where minimum communication is required. The phases categorised as climb and descend in the data source are those at higher flight levels, where navigational and level changes are less frequent. Circuits and holding showed higher discrepancies as these involved more congested airspace and the possibility of conflict is greater, while communications needs are more frequent.

The Airprox reports are a source of occurrences in the air, involving two aircraft which are considered 'too close for safety'. However, incidents and accidents could also happen where only one aircraft is involved, as in controlled-flight-into-terrain (CFIT) or level busts. On the ground, safety could also be jeopardised by un-authorised entry onto an active runway. Further information and databases from CFIT, level bursts and runway incursion safety occurrences had been looked into to achieve a 'Gate-to-Gate' overall picture of possible communication discrepancies. This information had assisted in mapping the data collection, encoding and analyses phase of the research.

3.4.3 Statistics Don't Lie…

…they just don't tell the whole story. All the numbers and percentages quoted above are real. There have been incidents and accidents which are an indication of human or system failures. ASRS database analysis (Connel, 1995) found that over 70 percent of the first 28,000 confidential (self-disclosure) pilot reports received were related to communication problems. Cardosi, Falzarano and Han's (1999) analysis concluded that readback and hearback errors are influenced by similar callsigns, pilot's expectations and high controller workload. Altitude deviations, loss of standard separation, ATC operational errors, landing on wrong runway and runway transgressions were recorded as the outcomes of these errors. A study by Cardosi (2001) of all the FAA databases that looked at the types of communication errors in surface operations had found that 'forgetting' and 'miscommunication' as the most common factors.

However the number of incidents or accidents recorded in databases could not serve as a performance or safety indicator of ATC and pilots' daily practices. A more 'direct' study has to be carried out to identify routine practises that are not in compliance with prescribed standards. ATC safety management used to react towards unsafe situations after errors have caused failures in which safety has been jeopardised. Recent years have seen more proactive measures in the management of safety in that normal routine operations are analysed for discrepancies and non-adherence to standards. The Line Operations Safety Audit (LOSA) which was carried out in various airlines cockpit operations concluded that these surveys improve performance and enhance safety (ICAO, 2002). A similar concept is now proposed for ATC operations as the Normal Operations Safety Survey (NOSS). Conforming to this concept of analysing routine operations for the benefit of safety, this research will use daily ATC operations communications as a data source in investigating language and standard phraseology errors. The added value will be to involve English Second Language (ESL) user controllers whom interact with pilots of various nationalities. As ESL users have been said to experience more problems and causing more safety occurrences, this data may show the type of common problematic areas of language usage and conditions surrounding it.

The language problems with ESL users may not be completely and clearly described if the research perspective is limited to errors during serious incidents and accidents. It is also unrealistic to assume native English speakers do not have any problems in ATC communications which are mostly in English, with strict and stringent rules applied to usage of words, numbers and phrases. The serious incidents and accidents emphasise how severe the outcome of communications or language errors can be. Threat and error management are now focussing in early detection of system failures (ICAO, 2005). Until now, non-standard practices that are present in routine operations are not given any attention if safety was seen as intact and not jeopardised. Statistics from unsafe occurrences databases pointed to the areas that had gone wrong, investigated and steps recommended for safety enhancement. Analysis of routine operations however, looks at good or bad airmanship, tries to identify safety related practices and to re-enforce adherence to standards. It is an opportunity to repair and improve present deficiencies within the system, indirectly enhancing performance and ensuring safety.

3.5 Chapter Summary

English has been established by default as the lingua franca of international civil aviation. Both native and non-native English speakers are required to communicate in this language in an ATC environment. This chapter looks into the basic characteristics and properties of language, theories of language learning and comprehension, problems related to limited language knowledge and how these affects the fluency and proficiency of language use. ATC radiotelephony utilises standard phraseology instead of general English and there are subtle usage differences between countries. Standard phraseology is rigid in terms of design and lexicon while its usage is guided by the standard and recommended radiotelephony practises. Non-adherence to standard phraseology is considered as discrepancies and errors, as it may pose a risk to safety. However, the lexicon of standard phraseology could not cater for all possible situations and knowledge of plain English is required in certain circumstances.

Language deficiencies' impact on ATC safety is shown by safety databases, signifying the areas and magnitude of phraseology and language problems. These data pointed to errors that attributed towards occurrences but do not contain information on routine radiotelephony operations. However, the records revealed types of common errors and circumstances associated with language-related problems. The FAA databases showed an estimated portion of safety occurrences associated with language and phraseology deficiencies. A detailed study of cases could reveal the context in which keywords were used. An initial exploratory analysis of UK's Airprox Reports suggested factors that should be given due attention in planning data collection program as well as classifying types of errors and discrepancies. An analysis of actual radiotelephony is best suited to explore and identify the characteristics of language and phraseology usage in a routine ATC environment. An ESL perspective is seriously considered as the South East Asia region is seldom involved in ATC research studies and this may be a starting point for more data to be collected here in the future.

4 RESEARCH METHODOLOGY

4.1 Existing Methodologies

There had been many studies involving ATC communication for various different objectives. Among the areas researched and examples are:

i. communication problems (Morrow and Rodvolt, 1992),
ii. communication error types and recurrence (Golaszewski, 1989),
iii. causal factors of safety occurrence (Cardosi et al, 1999),
iv. streamlining the terminologies and taxonomies (Prinzo, 2002),
v. characteristics of radiotelephony (Mell, 1991c), and
vi. correlation of communication activities to ATC taskload and workload (Mills, 1998; Manning et al, 2001)

Data for ATC communication problem research had mostly been sourced from:

i. simulation of an air traffic environment, as used by,
    a. Kanki and Foushee (1989),
    b. Human Technology, Inc (1991),
    c. Risser, Scerbo, Baldwin and McNamara (2002),
    d. Rantanen and Kokayeff (2002),
    e. Burki-Cohen (1995),
    f. Prinzo and Morrow (1999) and
    g. Prinzo (1998).

ii. safety reports databases such as ASRS, as used by,
    a. Cardosi (2001; Cardosi et al, 1999),
    b. Cardosi, Falzarano and Han (1999)
    c. Burian and Barshi (2003) and
    d. Monan (1983).

ii. real-time ATC radiotelephony, as used by,
    a. Morrow, Lee and Rodvolt (1990)
    b. Cardosi (1993)

c. Cardosi (1994)
d. Cardosi, Brett & Han (1996) and
e. Sexton and Helmreich (2000).

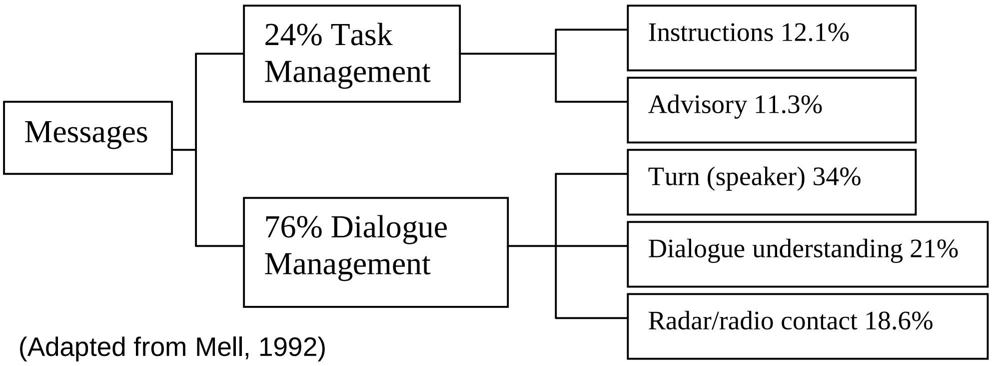
Prinzo and Britton (1993) discussed the relevant literature related to this subject in a general and chronological sequence to establish facts known, approaches used and further research required. The authors recommended streamlining of taxonomies and keywords used for classifying information related to ATC communication, having an ATC audio and video database, and conducting more co-relational studies. Additionally, the current training program should be re-examined to determine suitability, effectiveness and accuracy.

Very few studies had actually focussed on ESL controllers and pilots or the environment in which the majority of participants are of ESL status. An earlier analysis by Mell (1991c) used the English corpus of radiotelephony involving French, English, Spanish and Portugese controllers in European airspace. Out of 7,000 pilot and controller messages, only 70% were in English and controllers initiated 60% of the communications. Speech acts analysis found 33% associated with managing aircraft movements while another 33% were for speaker-recipient identification. Speech acts associated with radio frequencies, SSR codes and radar contact totalled about 26%. A rather significant 5% was attributed to ‘repairs’ or patching-up misunderstandings, implying that there is a real risk of confusion in ATC radiotelephony.

In a second radiotelephony study by Mell () involving ESL controllers, the focus was on discourse analysis of dialogue in abnormal situations. Mell considered that the understanding of non-standard dialogue in terms of pragmatic and discursive characters is critically important in maintaining the safety margin of civil aviation. In this study, only 24 % of messages were found to be associated with task management, in which 12.1% was issuing of instructions and 11.3% was information advisory (refer Figure 4-1). Dialogue management occupied

76% of communication, with 34% for turn management, 21% for dialogue understanding and 18.6% associated with radar/radio contact.

Figure 4-1: Messages type in abnormal situations dialogue



(Adapted from Mell, 1992)

A more recent study involving ESL Italian controllers (Corradini and Cacciari, 2001) concluded that linguistic discrepancies and errors were more frequent in the low workload phases compared to high workload. The opposite was found for redundancies; this category includes courtesies and greetings, negotiation expressions and intrusion of plain language into phraseologies. This study also noted differences in error rate between tower and radar controllers, contributed to age, experience, training and length of service.

4.2 Choosing a Methodology

From the literature reviewed, there emerged various possibilities to undertake this research. The literature which include the operational and technical perspective of air traffic control, combined with the language learning and usage aspects suggest that a balance of knowledge and good operational practice is important to produce language proficient and operationally efficient air traffic controllers and pilots.

4.2.1 Safety Survey versus Questionnaire

Pilots and controllers are required to be continuously vigilant and alert in their daily duties so much so that an earlier intent of carrying out an in-flight / on-duty language experience survey as a method of collecting data was decided not suitable. The intended survey would require the pilots and controllers to record their real life experience of place, time, units involved, an accurate citation of language used and the problems that arise. A pre-formatted report would be provided but the participating pilots and controllers need to allocate time to complete the details. The high workload of these professionals will be further disrupted by adding another task to be attended to within their prime taskload (Pawlak et al, 1996). It was foreseen that the method may not be very productive considering the limitations, commitments and possible risks.

4.2.2 English Second Language Users

The ESL aspect of the radiotelephony problem is often mentioned in investigations of ATC incidents and accidents, suggesting that ‘language problems’ frequently involve non-native English speakers. Previous studies focus on the native English speaking populations and the ESL perspective was not specifically emphasised. Non-native English user pilots and controllers have been highlighted often enough to justify an actual study of their language and phraseology usage. It is understandably logical that non-native speakers would have problems when using a language which is not their mother tongue. This is the key reason why this research was decided to be more beneficial if focussed on non-native users of the English language.

Due to accessibility and practicality many previous studies had sourced data from native English speaking populations. It is for the same reasons that an ESL environment was chosen for this research. This opportunity will contribute additional data from an ESL population and allow a broader scope of ATC communication problems research. If the non-native English users are not proficient enough in some context, then the daily operational behaviour of air traffic controllers and pilots in the ATC system would provide clues and proof of deficiencies and problems faced in the usage of the English language and ATC radiotelephony phraseology. It could then be decided if any discovered deficiencies are of any significant risk to aircraft safety. These deficiencies could also point the areas that need more emphasise in training and annual proficiency checks.

4.2.3 Real-time ATC Radiotelephony

As had been ascertained during literature search, routine radiotelephony data was best suited for this research. The actual words spoken by controllers and pilots were the entities to be studied and analysed. Existing safety occurrences databases are rich with narrative of occurrences but there are limited radiotelephony transcripts accessible. These incidents and safety occurrences are occasional snap-shots from usually round-the-clock non-stop operations and don't provide a clear enough picture of the type of errors happening during normal operations. Furthermore, these occurrences were the consequences of errors or discrepancies that had not been mitigated or not corrected in time before safety was considered infringed. There were no direct linkages to actual daily performance, about what is being practised, and if adherence to standards is complete or otherwise.

Real-time radiotelephony sourced from air traffic control environments consists of actual air traffic controllers and pilots' interactions. The spoken words would be spontaneous, as practised within a working environment, without prior set dialogue or traffic pattern. Live radiotelephony recordings would be representative of air-ground communications and contain samples of exchanges between air traffic controllers and pilots in daily situations. These would be real examples of airmanship in terms of radiotelephony performance. Mell (1991c) commented that incidents only reveal the tip of the submerged iceberg of routine communication. Mell further suggested that the study of routine radiotelephony will disclose the contextual and psychological overview of ATC language training needs. It will show consistent usage patterns while variations should be critically assessed in context of safety and acceptability.

Simulations of air traffic environments have been used before in ATC related studies. Role play in simulations however, could cause loss of fidelity. For the purpose of this research, simulating an ATC environment would require considerable resources in terms of equipment, software, people, remuneration and logistics. It was far more practical and accessible to record real time ATC radiotelephony. Very minimal digital recording equipment was required and it was time efficient. Samples were selected at random from the station's recording facilities with no disturbances or disruptions to ATC operations.

4.2.4 Location Search

The ESL criterion generally disqualifies United States, Canada, Australia, New Zealand and United Kingdom as sources of data since these countries are considered as native English users. Any European country was then considered a practical choice from the accessible point of view but difficulties were foreseen in the radiotelephony transcription phase as local languages and terms may be in use. France for example, designated French as the ground / local language for ATC radiotelephony communications. English is a language used for international flights communications or when specifically requested by pilots. The airspace configuration, local standard operating procedures and operating systems will also not be familiar to the researcher and would take extra time to study and understand.

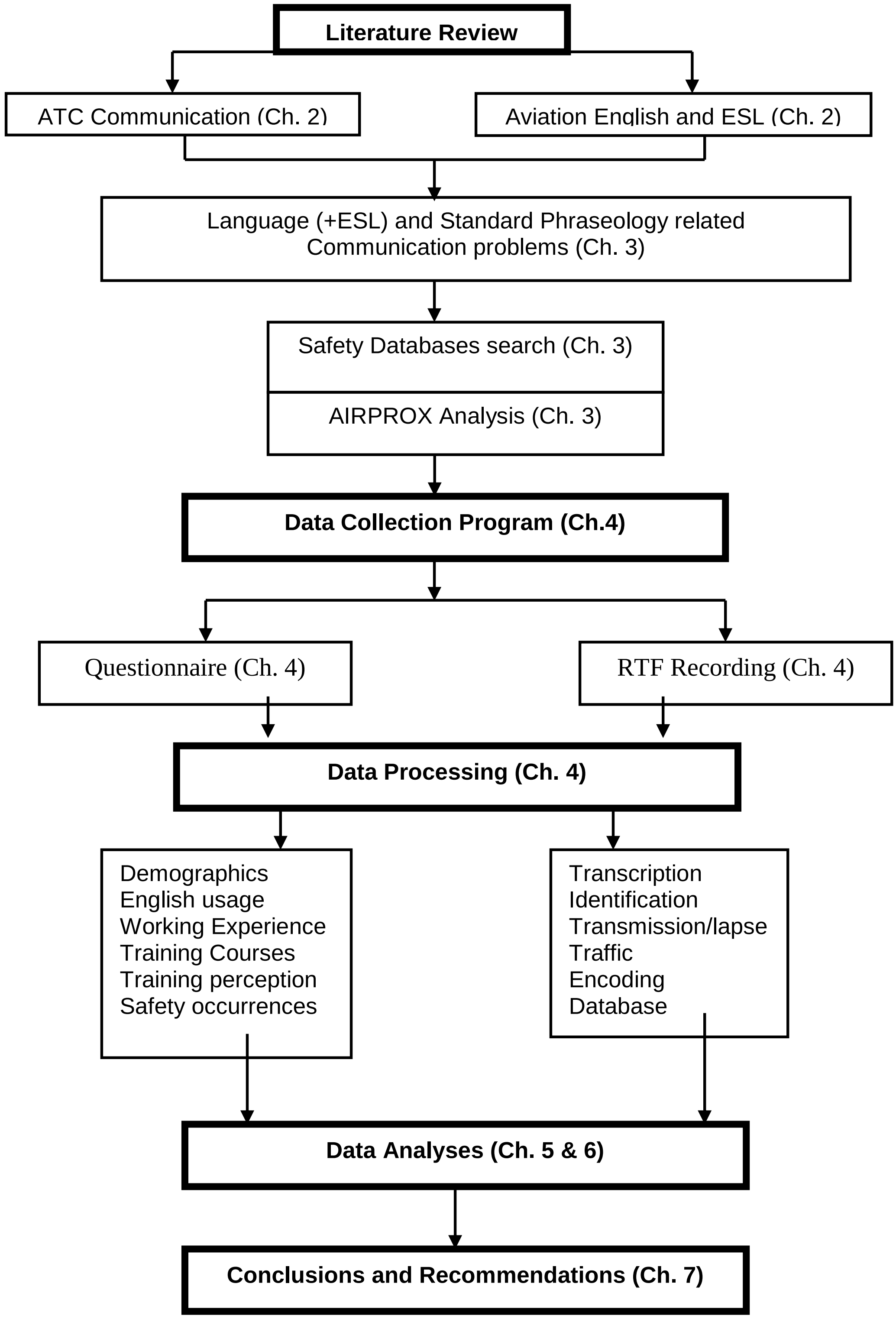
Malaysia was considered ideal for this research for its ESL status. Strong support and cooperation was also obtained from the Department of Civil Aviation (DCA). Authorisation was granted to access recording facilities and ATC workstations. Related documents were made available and all possible assistance was offered.

The radiotelephony 'recording-transcription-coding' method, as will be explained in this chapter has been used before and recognised as suitable and justified for carrying out this type of research. The radiotelephony data was complemented by demographic data collected through a questionnaire. Existing language related taxonomies could be used appropriately for coding and analyses as these were established methodologies and tools.

4.3 Research Work Flowchart

The initial plan was for the research to be completed in less than three and a half years. However, the time needed to process audio data proved to be more extensive than expected. Figure 4-2 summarised the work flow involved in the research and show the proposed chapters for the thesis writing.

Figure 4-2: Research Work Flowchart



Literature review and an initial safety data analyses led to the data collection programme which will be explained in this chapter. Audio data transcription was very tedious and time consuming as integrity and accuracy of data needs to be maintained. Existing voice recognition software is not sophisticated enough to transcribe ATC radiotelephony audio (Churcher, Souter, and Atwell, 1996; Schafer, 2001). All transcriptions were done manually. It was an advantage to use digital audio recording as it allowed repeated playback without risking degradation of audio quality as conventional tape recording would. As the radiotelephony audio was the major data, it was highly important that timings of transmission start and end be noted accurately. Similarly, word pronunciation, pauses and fillers should be transcribed correctly. The identity of the speaker of each transmission must be determined appropriately. Another advantage of digital recording is the possibility of slowing down the playback speed so transmissions could be listened at a portion of the actual spoken speech.

Parsing and encoding of transcribed data was an equally tedious task. Each message transmitted need to be coded for speech acts, aviation topics, phraseology usage and associated errors, as well as other relevant discrepancies. The information was organised in databases for easier handling but the size and complexity of the data itself requires diligent and extensive encoding work.

The analyses phase was more straightforward as it was a matter of assigning the correct variables for suitable analyses. The presentation, interpretation and discussion of results reflect the amount and type of data analysed. The demographic information and radiotelephony data had collectively demonstrated the performance of language and phraseology usage in the Malaysian ATC environments.

4.4 Location Choice: Malaysia

Malaysia was perceived as an ideal site for data collection, based on the fact that the controllers are 100 percent non-native English speakers; using English as either a second or foreign language. Although English is a dominant language for international level businesses as well as higher education and internet, it is only the fifth leading daily language in Malaysia (UNESCO, 2005). The most frequent language used for inter-ethnic communication is Malay, followed by Chinese dialects, Tamil and Javanese.

The first language learnt before academic schooling starts is usually the language used at home among family members. It has to be noted that the terms native language, first language, mother-tongue or arterial language have no standard definition. The general idea is that it refers to the language that was first introduced at home and spoken by immediate family members. As journalistic and common parlance usually associate the term 'mother tongue' to ethnic group, it is realistic to say that controllers in Malaysia are not native users of the English language. This justifies an earlier assumption that the ATC language environment in Malaysian airspace will fundamentally involve English Second Language (ESL) controllers. On occasions, after changes to different linguistic environment, for example education and migration, proficiency in the native language may diminish when another language becomes more dominant. So there may be a difference between mother tongue and the language most frequently used daily.

The pilots operating in Malaysian airspace are presumably a mixture of native and non-native English speakers based on the nationality of the airlines. However, as the Malaysian controllers are all non-native English speakers, the controller-pilot communication would always involve an ESL user. Traffic movements records show about 1% or airlines operating in Malaysian airspace originated from native English speaking countries such as Australia, UK, US, and New Zealand. While this percentage is not absolute in indicating the percentage of native English speaking pilots, it may be safe to assume the actual percentage is significantly low.

The Malaysian Airspace is divided into two Flight Information Regions (FIRs); the Kuala Lumpur and Kota Kinabalu FIRs. Air Traffic Control Centres (ACC) are located in Kuala Lumpur and Kota Kinabalu, with an additional sub-centre in Kuching. Terminal Approach Radar (TAR) Control and Area Radar Control services are provided at the Kuala Lumpur, Kota Kinabalu and Kuching ACC. There are 18 towers in Peninsular (West) Malaysia and 10 in East Malaysia. The selection of workstations for data collection takes into consideration the traffic movements, type of ATC provided and recording facilities available.

Analysis of Incident Investigation Reports was also considered as a possible method. However, as the investigation reports in total are categorised as ‘confidential material’ according to Malaysian government procedures, there would be too much mandatory editing involved that would render the transcript unsuitable for a satisfactory analysis. Real time recorded radiotelephony was seen as a more suitable and acceptable source of data that could be used without much editing and de-identification. It is also realistic to say that not all ATC incidents made it to the investigation stage as some are ‘mutually neutralised’ to avoid policy enforcement.

Strong approval and support from the Department of Civil Aviation Malaysia has made the research possible. Suitable ATC units were selected for radiotelephony recordings based on type of ATC provided, traffic movement and recording facilities. These provided data about what the controllers and pilots chat about in their daily interactions. As the recordings were carried out at the recording facilities and not at the working positions of the controllers, there were no distractions or disruptions to the controllers on duty. The radiotelephony recorded was for live traffic in normal working environment and was useful in analysing discrepancies and non-standard practices.
The radiotelephony data was sufficient to describe just the radiotelephony practises, features, characteristics and discrepancies. However, it does not reflect on the people taking part in the communication. Maybe the gender could be accurately guessed but no information could be surmised about age,

qualification and length of service or if the controller has any other ATC related work experience. To complement the radiotelephony data, a questionnaire was distributed to gain an insight of the controllers' demography.

The findings of this research will directly benefit Malaysia as well as other ATC authorities with similar airspace status. Southeast Asia at the very least consists of much airspace that is managed by ESL controllers. Some states may possibly be interested in analysing local radiotelephony performance and problems, if any.

4.5 Data Collection Methods

Two methods were utilised for data collection:

1. Questionnaire – distributed to controllers
2. Radiotelephony recording – selected ATC units

4.5.1 The Questionnaire

4.5.1.1 Purpose

The questionnaire was aimed at finding out demographic information about the controllers in charge of the Malaysian airspace. Other than the usual personal information, the responses will reveal language preferences, proficiency qualification and work related experience. Respondents were also requested to describe the language related training undergone in terms of formatting and access to materials. A simple evaluation of improvements achieved and suitability of facilitators was also included. The questionnaire further aimed to get a realistic estimate from the respondents on types and frequencies of English language / standard phraseology related problems. The information was useful in understanding the 'people' involved in this research as it complements the radiotelephony data which tells 'what the people are doing'.

4.5.1.2 Format

The questionnaire consists of 5 main sections; A to E. It was in English and designed to be simple, using plain language and easy to complete. As practicable as possible, respondents only need to tick or circle suitable answers. Others would require one word or double numerals answers. However, for those who would like to share more information, the last section (F) provided an opportunity to share their opinion on the subject area. The complete questionnaire is in Appendix E.

The questionnaires were personally distributed through ATC Managers to the controllers at each station. The managers were briefed on the questionnaire objectives and advised that information provided by respondents will be handled with utmost confidentiality. The Director of Kuala Lumpur Air Traffic Control Centre assisted in the collection and return of the questionnaires. Each section is explained in the following paragraphs. There were 190 (35%) respondents and information gathered was managed in an Excel database.

SECTION A : PERSONAL PARTICULARS

The first 8 questions were on personal details. The ATC Licence Numbers were used as cross references to ensure there was no duplication of data. The respondent's name was optional and not recorded in the database.

1. Name :
2. ATC Licence Number : DCA / ATC / L
3. Gender: **M**ale ☐ **F**emale ☐
4. Age: 20 – 25 ☐(1) 26 – 29 ☐(2) 30 – 39 ☐(3) 40 – 49 ☐(4) 50+ ☐(5)
5. Service: less than 3 yrs ☐(1) 4 – 6 yrs ☐ (2) 7 – 10 yrs ☐ (3) 11 – 15 yrs ☐ (4) 16 – 20 yrs ☐(5) more than 20 yrs ☐(6)
6. Station: Area Control Centre ☐(A) Aerodrome ☐(B) ATC College ☐(C) Headquarters ☐(D)
7. Ethnic Group **M**alay ☐ **C**hinese ☐ **I**ndian ☐ **O**ther ☐ **……………………***(please specify)*
8. Academic Qualification **P**hD ☐ **M**asters ☐ **U**niversity Degree ☐ **D**iploma ☐ **H**igh School ☐

The data was entered into a database in codes to cater for statistical analyses. The codes for the responses above are shown in bold or brackets, for example, M to indicate 'male' in Question 3, or numbers (1) to (5) for age groups in Question 4.

In this section, Question 9 was important in identifying if English was one of the three most used languages in daily communications.

9. Languages: (most used daily)
i........................................ **ii.**.................................... **iii.** …………………………….

Questions 10 to 13 deal with the number of ATC ratings the respondents held, ATC related experience and training courses attended. In view of languages and phraseology use, personnel's exposure to various job assignments, experience and training were expected to improve proficiency to some extent.

10. ATC Ratings:

- ☐ None
- ☐ Aerodrome Control
- ☐ Approach Procedure Control
- ☐ Approach Radar Control
- ☐ Area Procedure Control
- ☐ Area Radar Control

11. ATC Operations Experience & Duration

- ☐ Aerodrome Controller ……………………… years
- ☐ Approach Procedure Controller ……………………… years
- ☐ Approach Radar Controller ……………………… years
- ☐ Area Procedure Controller ……………………… years
- ☐ Area Radar Controller ……………………… years
- ☐ None

12. Additional ATC Experience

- ☐ DCA Airport Manager …………………… years
- ☐ ACC Supervisor …………………… years
- ☐ Senior ATCO …………………… years
- ☐ College Instructor …………………… years
- ☐ Training Officer …………………… years
- ☐ ATCO Examiner …………………… years

13. Courses Attended in 2004

- ☐ ATC Primary Course
- ☐ ATC Rating courses
- ☐ Flow Control
- ☐ Aviation English
- ☐ **S**earch **A**nd **R**escue
- ☐ Human Factors
- ☐ PANS-OPS Design
- ☐ Safety Management
- ☐ Others ……………………………………………….*(please specify)*

The information gathered from Section A of the questionnaire was stored as part of a database as shown in Table 4-1. Other information will be added accordingly to include all responses from the questionnaire. This example show details for 7 (fictitious) respondents with IDs 1 to 7 listed in the first column. The numbers are codes for specific information. Age was recorded as the grouping used in Question 4. Respondent 7 was a Malay (Ethnic=M) female (Gender=F), who was a University graduate and had been working for 4 to 6 years. She held 2 ATC ratings; 5 years in Area Procedural and 3 years in Area Radar. English was declared as her second most used language (English=2).

Table 4-1: Examples of Demographic Data from Questionnaire Section A

ID	GENDER	AGE	SERVICE	UNIT	ETHNIC	ACADEMIC	ENGLISH	RATINGS	Experience											Courses 2004
									Aerodrome	Approach	App Radar	Area Proc.	Area Radar	Manager	Supervisor	SATCO	Instructor	Training	Examiner	
1	M	5	6	A	M	H	1	4	5	5	0	2	0	3	4	3	7	2	0	N
2	M	5	6	A	C	H	1	5	7	8	4	8	7	8	2	4	2	6	0	N
3	M	5	6	A	I	H	1	4	0	0	20	25	20	0	0	0	0	0	6	OJT
4	M	4	6	A	O	H	1	5	20	20	18	22	20	8	5	3	1	0	0	N
5	M	4	5	A	I	U	1	5	2	2	6	18	12	0	1	0	0	18	4	OJT
6	M	5	6	A	I	H	1	5	20	11	11	25	25	2	0	0	2	2	2	N
7	F	3	2	A	M	U	2	2	0	0	1	5	3	0	0	0	0	0	0	SAR

In 2004, this respondent had attended the Search and Rescue Course (SAR). Similar information could be deduced for each respondent in the database.

SECTION B : ENGLISH LANGUAGE PROFICIENCY TESTS

This section queried the experience in English Language Proficiency Tests; either for local use or those internationally recognised. The IELTS and TOEFL results have designated validity periods beyond which the rating or score is considered not applicable. The TOEFL score ranges up to 300 for computer based test and up to 677 for paper based test. The TOEIC score range up to 990 points.

1. International English Language Testing System (IELTS)		
Year	Purpose	Overall Rating
		①②③④⑤⑥⑦⑧⑨

☐ Never taken this examination.

2. Test of English as a Foreign Language (TOEFL)		
Year	Purpose	Score

☐ Never taken this examination.

Test of English for International Communications (TOEIC)		
Year	Purpose	Result

☐ Never taken this examination.

Others.

Test(s)	**Year**	**Purpose**	**Result**

Table 4-2: Examples of Demographic Data from Questionnaire Section B

ID	GENDER	AGE	IELTS	TOEFL	TOEIC	Other Test	Aviation English Training	Standard Phraseology training	Radiotelephony Training	Communications Training
8	M	5	0	0	0	N	N	YP	YP	YP
9	M	4	6.0	0	0	N	N	YP	YP	YP
10	M	4	7.0	0	0	N	N	YP	YP	YP
11	M	4	0	0	0	N	YP	YP	YP	YP
12	F	3	5.5	520	0	N	N	YP	YP	YP
13	M	4	0	0	0	N	YS	YP	YP	YP
14	M	1	0	0	0	MUET_3	N	YP	YP	YP

The examples in Table 4-2 show that Respondent 8, 11 and 13 have not taken any English language proficiency tests (0=none). Respondent 9 and 10 both took the IELTS exams while Respondent 12 has taken both IELTS and TOEFL. The results were shown in the respective columns. Respondent 14 took the Malaysian University English Test (MUET) test and achieved a level 3 (possible bands 1 – 6). In view of Aviation English training, only Respondent 13 claimed to have attended a separate course (Y=yes, S=separate) and Respondent 11 claimed to have had training as part of other course (Y=yes, P=part). Other respondents admitted to not having any specific Aviation English training at all (N=no). All respondents agree that standard phraseology, radiotelephony and communications trainings are provided as part of other ATC courses (Y=yes, P=part).

SECTION C : AVIATION ENGLISH AND ATC COMMUNICATION TRAINING

This section was specific to the provision of Aviation English and communications training, the format and the perceived value of the courses in preparation for using English language and standard phraseology in daily work functions.

Questions 1 to 4 of this section only require a Yes or No answer to indicate if these aspects were included or not in the training courses. The information should be useful in designing or improving existing training courses in terms of identifying missing aspects and needs.

1. Did you receive any training for:		
	Yes	**No**
Aviation English		
Standard Phraseology		
Radiotelephony		
ATC communication		

2. Was the training conducted as,		
	part of another ATC training course	**a separate training course**
Aviation English		
Standard Phraseology		
Radiotelephony		
ATC communication		

Key: AE = Aviation English
SP = Standard Phraseology
RT = Radiotelephony
Comms = ATC Communications

3. Indicate if the training format included any of the following:				
	AE	**SP**	**RT**	**Comms**
Classroom lectures				
Simulator exercises				
Public speaking				
Verbal communicational skill				
Listening exercises				
Real radiotelephony examples				
Visits to ATC workstations				
Peer role play exercises				
Interactive computerised exercises				
Handling of unexpected events				
Language proficiency tests				

4. Indicate if the training materials provided to you included:	
Aeronautical Information Publication	
Manual of Air Traffic Services	
ICAO's DOC 4444	
ICAO ANNEX 10 Vol. II	
Manual of Radiotelephony (DOC 9432)	
Filed differences (by any contracting state) to ICAO standard phraseology	
Locally used terms that may differ from ICAO's	
Work-relevant commonly used plain English words	
Potentially confusing words/ phraseology/ numbers	
Specific pronunciation of numbers	
Audio samples of real radiotelephony	
Relevant terminology for potential un-expected events	

Question 5 requested the evaluation of respondents on the improvements achieved after attending language/ phraseology related training. A scale of 1 (very little) to 4 (very good) is used. This information indicated if the trainees find the course attended had been useful in improving necessary personal skills for their job function.

Scale: 1 = very little (further general training will be needed) 2 = adequate (training prepared you for basic daily job function) 3 = good (further specific training not immediately required) 4 = very good (able to handle unfamiliar situations) 5. How would you evaluate the training courses in terms of improvement to Phraseology / English Language in:	
Vocabulary of aviation related words	① ② ③ ④
Vocabulary of specific ATC related words	① ② ③ ④
Glossary of ICAO phraseology	① ② ③ ④
Ability to use correct standard phraseology	① ② ③ ④
Awareness of words with multiple meanings	① ② ③ ④
Awareness of phraseologies that may cause misunderstanding	① ② ③ ④
Correct and clear pronunciation	① ② ③ ④
Recognition of regional / cultural English accents	① ② ③ ④
Conversational fluency	① ② ③ ④
Ability to paraphrase	① ② ③ ④

Question 6 was an evaluation of the teaching facilitators and instructors with a scale of 1 (poor) to 4 (excellent). This gave some idea on the perception of trainees of trainers' suitability.

6. How would you rate the facilitators and instructors of the Aviation English and ATC Communication training at the DCA College, in terms of,			
Teaching techniques	poor	① ② ③ ④	excellent
English Language fluency		① ② ③ ④	
Knowledge of English Language		① ② ③ ④	
Knowledge of standard phraseology		① ② ③ ④	
Knowledge of ATC topics		① ② ③ ④	
Familiarity with ATC operations		① ② ③ ④	
Time management		① ② ③ ④	
Use of teaching aids		① ② ③ ④	

The training institution should benefit from this information as the perception and opinion of course attendees reflects on whether or not the instructors were found to be effective and efficient. Any deficiencies could be dealt with by refresher or enhancement training on instructional techniques.

Each of the evaluation aspects in question 5 and 6 were recorded in the database as shown in Table 4-3, allowing a statistical analysis to be carried out. At a glance, the evaluation varies, depending on personal experience and perception of individual respondents.

Table 4-3: Examples of Respondents' Evaluation of Courses and Instructors

ID	Vocabulary	ATC related words	Standard Phraseology	Phraseology usage	Multiple meanings	Misunderstanding	Pronunciation	Accent	Fluency	Paraphrasing	Techniques	Language Fluency	Knowledge	Standard Phraseology	ATC Knowledge	ATC Operations	Time Management	Teaching Aids
	Improvements (Question 5)										Instructors' (Question 6)							
15	2	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2
16	1	1	1	2	2	2	2	2	2	2	3	3	3	2	2	2	2	2
17	3	3	4	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2
18	3	3	3	3	2	2	2	1	1	1	3	3	3	3	3	3	3	3
19	1	2	2	3	3	3	4	4	4	4	3	3	3	3	3	3	3	3
20	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
21	1	3	3	3	2	3	3	3	2	2	3	3	3	3	2	2	3	2

SECTION D : RADIOTELEPHONY OPERATIONS AND PRACTICES

Section D seeks out the opinion and observation of controllers about their radiotelephony related experience in terms of problems and discrepancies. The percentages acquired may not be accurate but it was a realistic perception from the controllers' point of view about their daily work experience.

Question 1 requested the respondent to estimate a percentage of ATC duty time they actually did deviate from standard phraseology by using any language other than English, or use non-standard phraseology or local jargon.

1. Indicate a percentage of the time within an average shift (6 hours) that controllers use;	
Standard phraseology	0 10 20 30 40 50 60 70 80 90 100
Non-standard phraseology	0 10 20 30 40 50 60 70 80 90 100
Plain English words and phrases	0 10 20 30 40 50 60 70 80 90 100
National language (non English)	0 10 20 30 40 50 60 70 80 90 100
Local 'terms' or 'jargon' understood only by frequent/ local operators in your airspace	0 10 20 30 40 50 60 70 80 90 100

Question 2 dealt with accommodating different accent and language style to assist in message comprehension. One or more of these tactical adjustments may have been applied in daily radiotelephony.

2. Sometimes the accent or style of English usage differs between regions/ nationalities and modifications are made to improve understanding. How often does a controller need to;	
Change 'style' of language use	0 10 20 30 40 50 60 70 80 90 100
Modify or amend standard phrases	0 10 20 30 40 50 60 70 80 90 100
Reduce speech rate	0 10 20 30 40 50 60 70 80 90 100
Repeat complete instructions	0 10 20 30 40 50 60 70 80 90 100

Question 3 tried to gauge the readback practise among pilots.

3. With regard to mandatory readback of ATC instructions and information issued to aircraft; how often does a controller receive;	
Complete readbacks	0 10 20 30 40 50 60 70 80 90 100
Incomplete readbacks (correct but some information omitted)	0 10 20 30 40 50 60 70 80 90 100
Incorrect readbacks (full or partial, but wrong information)	0 10 20 30 40 50 60 70 80 90 100
No readbacks (no information repeated – a readback had to be requested)	0 10 20 30 40 50 60 70 80 90 100

This section was completed by Question 4 about repetitions of messages or parts thereof.

4. There are cases where interference or interruptions had resulted in a message not fully received or understood by pilots. How often does a pilot request verification / repetition of;	
Whole message	0 10 20 30 40 50 60 70 80 90 100
Taxi route	0 10 20 30 40 50 60 70 80 90 100
Traffic sequence for lining up	0 10 20 30 40 50 60 70 80 90 100
Assigned headings	0 10 20 30 40 50 60 70 80 90 100
Authorised level	0 10 20 30 40 50 60 70 80 90 100
Speed restrictions	0 10 20 30 40 50 60 70 80 90 100
Altimeter setting	0 10 20 30 40 50 60 70 80 90 100
Time restrictions (eg. Slot time)	0 10 20 30 40 50 60 70 80 90 100

SECTION E: SAFETY OCCURRENCES

This section tried to acquire a general dimension of incidence/ occurrence related to language and standard phraseology discrepancies within the last 3 months. Although incidents are normally reported, the seriousness and the need-to-report are still very much left to the opinion of the controllers and pilots. Some incidents may not have been reported due to reluctance of handling ‘paperwork’ and if the incident is considered to be not a safety issue.

1. Please indicate (✓) your experience within the last 3 months of any misunderstanding or miscommunication due to:				
	< 5	5 - 10	10 - 15	>15
Usage of non-standard phraseology				
Usage of plain English words or phrases				
Poor level of English				
Unclear pronunciations				
Technical difficulties				
Non-verification of unclear instructions				
Non-verification of unclear information				

A general estimate was requested from the respondents for the outcome that resulted from miscommunication/ misunderstanding for similar time frame. The numbers quoted by the respondents may differ from ATC incident records for the reasons mentioned above

2. How many times have misunderstandings or miscommunications resulted in:	
Increased communications task load	
Increased ATC workload	
Loss of situational awareness (traffic visualisation)	
Loss of separation	
Aircraft proximity	
Runway incursion	
Any other safety related events	

All the responses from the questionnaires were organised in a comprehensive excel worksheet for conversion into SPSS data editor for analyses purposes. The complete version is in Appendix F.

4.5.2 ATC Radiotelephony Recordings

This was the second data collection method. Based on type of control, traffic movements and accessibility of recording facilities, 6 aerodromes were considered suitable for data collection. These were Pulau Pinang, Kuala Lumpur International Airport (KLIA), Melaka, Johor Bahru, Kota Kinabalu and Kuching. Terminal approach and area radar control data were collected at the

Kuala Lumpur Air Traffic Control Centre. Two approach radar and three area radar control positions were involved in the data collection. The locations are shown in Figure 4-3.

Figure 4-3: Locations of Radiotelephony Recordings

Segments of suitable recording times were selected based on duty rosters and daily movements' records showing medium and high traffic density. A digital recorder was used for the recordings and time keeping was converted to that of the recorder, and not the actual date and time to safeguard the identity of those involved. Each segment length was about 30 minutes for area radar control (ARR) and terminal approach radar (TAR) while tower (TWR) segments were about 20 minutes each. 192 controllers' radiotelephony were recorded, totalling to about 73 hours of audio data.

At the recording facility, the selection of voice channels was made with care to ensure all transmitted and received messages were recorded, as well as any communication with ground units. The more sophisticated recording facilities use a multi channel system that records each communication source on different tracks which need to be heard simultaneously to understand the communication taskload of the controller at any particular time. The complete list of workstations, dates, frequencies and channels of recordings done is in

Appendix G. Due to technical inconsistency some of the recordings could not be processed or analysed. The final number of recordings suitable for processing and analyses at each workstation is shown in Table 4-4.

Table 4-4: Radiotelephony Recording Sampling

Station	Type of ATC	Recordings	Total minutes
Kuala Lumpur ACC	Terminal Approach Radar	28	900
Kuala Lumpur ACC	Area Radar	41	1220
Pulau Pinang	Tower	11	220
Melaka	Tower	9	190
Johor Bahru	Tower	12	240
KLIA	Tower	37	730
Kota Kinabalu	Tower	30	560
Kuching	Tower	21	380
Total		**189**	**4400**

4.6 Data Processing

4.6.1 Audio to Text

In the study of communications, language use in speech is recorded, transcribed and broken down into segments and elements of phonetics. There are two ways of phonetic transcription; a broad way which doesn't record all of the aspects (eg. tone, pitch, vowel stress) of how a word is pronounced and a narrow mode which transcribes utterance with specific descriptions of how the word was articulated. Language elements could then be studied from various perspectives depending on the needs and objectives of the research. The technique utilised in this research will be the former but taking into account the specifications required by radiotelephony standard practises which may specify how certain words shall be articulated. The radiotelephony data in this research was coded using a taxonomy which was relevant for ATC air/ ground communications and a classification of errors from an operational and linguistic point of view.

Radiotelephony between controllers and pilots were transcribed verbatim. Start and end transmission time for each message was noted, as well as lapses between transmissions. All spoken words and sounds were transcribed as accurately as possible, including fillers such as ‘ah’, ‘uh’ and ‘er’. Pauses between words in a sentence were marked if it is noticeably longer than usual. Special attention was given to the numeral nine which should be pronounced as 'niner'. In ATC radiotelephony there are strict procedures of how units should be addressed, the issuing of instructions, restrictions and advising of pertinent information. The transcription should capture any deviations from standard procedures in terms of format, pronunciation and speech. Time keeping of transmission duration and total words transmitted was used to calculate average speech rate. It is possible to gauge the communication load within the recording segment.

About 4400 minutes (73 hours) of audio recordings were transcribed. There were approximately 21,000 messages in the audio recordings. Initially, land-line communications were transcribed to understand the context and perspective of traffic movements. These were removed before analysis stage. Controller-pilots communication consists of about 20,500 messages of substance. At planning stage, transcription of these audio files was to be assisted by a few selected Malaysian controllers. However, due to some technical difficulties, only a portion of the work was completed by three selected controllers. The data size, complexity and the need for accuracy put considerable pressure on time management.

Final discussions with DCA officials had concluded that no excessive editing of callsigns and unit names would be necessary if the recording segments were not identified by date and time. The usage of callsign was an aspect that will be analysed and deleting or changing them will diminish the value of data. As flights operate on daily or weekly scheduled basis, any particular day selected for recording could yield the same callsigns. Individual names were deleted if used, as this could link directly to the person addressed. Only the people most familiar with the controllers and pilots will be able to identify individuals based on voice recognition. A request may be submitted to limit access to the actual audio files in view of sensitivity and privacy. Each segment of transcribed radiotelephony was identified by facility identification and sample number.

Table 4-5 shows an example of a message from Malaysian 161 who was trying to establish communication with Approach North. The message details were as following:

LINENUM = Message number (1)

FAC_ID = Kuala Lumpur ACC (A)

SEC_ID = working position Approach North (N)

SAMP_ID = sample number (12)

ST_MIN = the minute (time) transmission starts (3)

ST_SEC = the second (time) transmission starts (40)

END_MIN = the minute (time) transmission ends (3)

END_SEC = the second (time) transmission ends (47)

TX_SEC = transmission length in seconds (7)

LPS_SEC = lapse length in seconds since the previous transmission (4)

SID = Speaker Identity (MAS161)

RID = Recipient Identity (ATC)

Table 4-5: Example of an ATC Radiotelephony Message

LINENUM	FAC_ID	SEC_ID	SAMP_ID	ST_MIN	ST_SEC	END_MIN	END_SEC	TX_SEC	LPS_SEC	SID	RID	MESSAGE
1	A	N	12	**3**	40	**3**	47	7	4	MAS161	ATC	LUMPUR APPROACH NORTH MALAYSIAN ONE SIX ONE SELAMAT PAGI PASSING ONE EIGHT ZERO FOR ONE FIVE ZERO RADAR HEADING ONE THREE ZERO

Malaysian 161 informed the controller of the flight level the aircraft was passing (180) and the flight level that had been authorised (150) as well as the direction of flight (heading 130). This example showed no fillers or pauses as the transmission was delivered fluently and clearly. However, it should be noted that the pilot had used two languages in this transmission. The greeting 'selamat pagi' was in Malay and quite commonly used in the Malaysian airspace, but still not a practise in compliance to the standards. Based on 22 words being transmitted in 7 seconds, it can be approximated that the speech rate was about 180 words per minute.

The next example in Table 4-6 was from line 93 sample number 9 of Approach North. It was an instruction to Singapore 103 to cancel the standard instrument departure (SID) and change flight direction to heading 260. The pilot was advised that this change was to enable a climb to higher altitude once the flight direction had been complied with. Only 17 actual words were transmitted in 6 seconds, making the speech rate 170 words per minute. There were 2 places within the message that fillers (er..) were used.

Table 4-6: Example of an ATC Radiotelephony Message

LINENUM	FAC_ID	SEC_ID	SAMP_ID	ST_MIN	ST_SEC	END_MIN	END_SEC	TX_SEC	LPS_SEC	SID	RID	MESSAGE
93	A	N	9	12	27	12	33	6	15	ATC	SIA103	SINGAPORE ONE ZERO THREE TO FACILITATE YOUR CLIMB ER… CANCEL THE S-I-D TURN LEFT HEADING ER… TWO SIX ZERO

4.6.2 Speech Acts and Aviation Topics

Aviation Topic and Speech Act Taxonomy (ATSAT) was found to be suitable for coding the radiotelephony messages (Searle, 1969; Prinzo and Britton, 1993; Prinzo, Britton, and Hendrix, 1995; Kanki and Prinzo, 1996; Prinzo, 2002). The latest update to ATSAT was the inclusion of complexity measure in a document titled The Communication Data Dictionary and Procedures Manual (Prinzo and Hendrix, work in progress). Table 4-7 contains the Speech Acts categories used for radiotelephony transcript coding. Each speech act is associated with relevant aviation topics to further classify the phrases.

Table 4-7 : Definition of Speech Act Categories and Codes

	Speech Acts	Code	Definition
1	Address / Addressee	**Rid / Sid**	Identifier of station as speaker or receiver for example facility name or aircraft callsign
2	Courtesy	**C**	Word(s) or phrase(s) spoken as an act of courtesy. Eg. Good morning.
3	Instruction / Clearance - readback / acknowledgement	**I**	Phraseology used by a controller in issuing instructions to an aircraft. Eg. Climb to flight level one four zero
4	Advisory / Remark – readback / acknowledgement	**A**	Communication required as part of controller's responsibility to issue pertinent information eg. Traffic, altimeter setting and altitude. It also includes pilot's responsibility in reporting position, altitude or speed.
5	Request – readback/ acknowledgement	**R**	Initiated by pilot or controller for the purpose of acquiring information or authorisation
6	Non-codable	**N**	Remarks or comments that do not fit into the other speech acts, or unintelligible due to delivery technique or technical.

Some additional topics had been added to the list used by Prinzo & Britton (1995) which was based on approach control communications. The data used in this research includes area radar and tower control radiotelephony, thus additional topics were needed to accommodate the wider scope. Table 4-8 show the aviation topics and related codes, as used for processing the radiotelephony data in this research.

Table 4-8 : Aviation Topics, Codes and Explanation

AVIATION TOPIC	Code	Explanation
Speaker identification	**Sid**	identity of the speaker
Receiver identification	**Rid**	identity of the intended recipient
altitude / level	**alt**	Altitude assigned by a controller or readback by a pilot
approach	**app**	Clearance by controller to make an approach to airport or to assigned runway; or readback by a pilot
circuit	**cct**	Clearance related to positions in aerodrome circuit eg. Downwind, base.
communications	**com**	Radio frequency used for communication as assigned by a controller or readback by a pilot
flight details	**fld**	Fuel endurance, POB, etc
general	**gen**	Okay, roger, alright or words used as acknowledgement
heading	**hdg**	An assigned vector or readback by a pilot
holding	**hol**	Holding instructions issued by a controller or readback by a pilot
landing	**ldg**	Authorisation to land on assigned runway or acknowledgement by a pilot
repeat/ verify	**ver**	Say again, confirm
restriction	**rst**	Eg. Crossing time, levels
route / position	**rpo**	Instruction by a controller pertaining to assigned course of aircraft or readback by a pilot. This also applies to positioning on ground for aircraft taxying.
speed	**spd**	Speed assigned by a controller or readback by a pilot
start	**stt**	Engine start-up
takeoff	**tof**	Cleared for takeoff and runway designation
traffic	**tfc**	Information on conflicting traffic eg. Aircraft type, altitude, position
transponder	**ssr**	Beacon code assigned by a controller or ident instructions or readback by a pilot
visual / sighting	**vis**	Declaration of visual contact, in sight.
weather info	**wxi**	Altimeter setting, cloud, wind, weather warning, turbulence
Apology	**apo**	Sorry, apologies
Greetings	**grt**	Good morning, hello, good day
Thank you	**tq**	Words showing appreciation
delivery	**dlv**	unintelligible
equipment	**eqp**	Unserviceability, interference
other	**otr**	

Speech acts and aviation topics codes were used in pairs, for example 'Ialt' to indicate an instruction/readback (I) of an altitude/flight level (alt). These paired codes will be referred to as an 'element'. Only the speaker and recipient identity will use unique codes of Sid and Rid respectively. Transcribed radiotelephony was parsed into speech acts and aviation topics, and then coded by ATSAT elements in the order that these were used. The types of elements were organised in the database corresponding to the messages. The full list of elements is shown in Appendix H.

The following example in Table 4-9 is a message from Indonesian 856 to Kuala Lumpur area radar controller, addressed as Lumpur Control. The message consisted of 5 elements which were listed as T1 to T5. The first element was a courtesy (C) with a greeting (grt), coded as Cgrt. Rid is a recipient identification or who the message was for, which was Lumpur Control. Sid is speaker identification, in this case, Indonesian 856 that transmited the message. 'Flight level three four zero' was altitude information provided by the speaker, coded as Advisory (A) and altitude (alt). The last element was a request (R) for change of altitude, coded as 'Ralt'.

Table 4-9: Identifying Speech Acts and Aviation Topics

Message	T1	T2	T3	T4	T5
GOOD EVENING /	Cgrt				
LUMPUR CONTROL /		Rid			
INDONESIAN EIGHT FIVE SIX /			Sid		
FLIGHT LEVEL THREE FOUR ZERO /				Aalt	
REQUEST DESCEND					Ralt

The total numbers of elements used in each message, as well as number of Instructions and Advisory were noted. In the last example, there was one Advisory and one request but no instruction as the message was transmitted by the pilot.

An example of a controller's message containing 7 elements;

"*Malaysian One Two Eight Nine (Rid) Approach (Sid) Good Evening (Cgrt) Descend Seven Thousand (Ialt) QNH One Zero One … One Zero Zero Seven (Awxi) Fly Heading Two Three Zero (Ihdg) Radar Vector for Final (Arpo)* ".

There were two instructions, two advisories, a courtesy greeting and two for speaker and recipient identities (the elements shown in brackets).

The processing also included word count for each message which could be used to calculate speech rate in words per minute. Numerals were also counted separately as these are used very frequently in ATC. As in the message above, twenty eight words were transmitted in ten seconds, making the speech rate equivalent to 168 words per minute. Out of 28 words, 16 (more than 50%) were numerals. 6 words were used for identification purposes, 2 in greeting, 12 for advisories and only 8 for instructions. There was also a noticeable pause in the middle of the transmission after which the altimeter setting (QNH) information was corrected. Pauses are considered as disfluencies and will be coded accordingly.

4.7 Error Coding

Errors in ATC radiotelephony were coded based on message contents, format and delivery techniques that deviated from the published standard. Each topic had specific keywords or phrases that identified the correctness of the intended messages as stipulated in ICAO Annex 2, ICAO DOC 4444, Malaysia’s Manual of Air Traffic Services and Aeronautical Information Publication Malaysia.

The ATSAT (Prinzo et al, 1995) generally categorises types of errors based on one or more of the following:

a. Grouped – grouping or formatting of numerical information contrary to ICAO standards. For example, in ‘flight level 230’ the numbers should be pronounced ‘two three zero’. Using ‘two thirty’ would be classified as a grouping error.
b. Sequential (non-grouped) – failure to group numbers in accordance to ICAO standards and non-use of the phonetic alphabet. For example, altitude 5,500 feet shall be transmitted as ‘five thousand five hundred feet’ not ‘five five zero zero’ or ‘fifty five hundred’.

c. Omission – leaving out number(s), letter(s) or word(s) as prescribed. For example the callsign Asian Express shall always use both words and not shortened to just ‘Express’ or ‘Asian’ by omitting the other word.
d. Substitution – use of other word(s) or phrase(s) in place of the correct ones. For example ‘what’s your speed’ instead of ‘report speed’.
e. Transposition – number(s) or word(s) used in improper order. For example ‘Malaysian two five six nine’ is transmitted as ‘Malaysian two five nine six’.
f. Excessive verbiage – adding word(s) or phrase(s) to standard phraseology.
g. Partial readback – pilot report or readback that does not include specific keyword of a topic. For example, ‘leaving ten for six’ in reply to a descend clearance is considered partial readback.
h. Disfluency – pause(s), stammer(s), utterance(s) that add no meaning to the message. For example ‘uh’, ‘ah’ or ‘er’. ‘Okay’ could also be a disfluency if not used as a general acknowledgement.
i. Misarticulation – improperly spoken word, slurs, stutters, mumbling etc.

These general descriptions of error group types have been employed in classifying radiotelephony errors for this research. The management of data coding took a more specific approach as in the latest update of ATSAT (Prinzo and Hendrix,). Error coding used numbers to denote different error and additional variables have been added to suit the objectives of this research. The full list of variables, code, keywords and descriptions are shown in Appendix I. Data was organised in an Excel workbook which would be compatible for SPSS analyses later.

Errors were coded for usage, issuance and readback of specific keywords. Provision of weather advisories and traffic information were also coded as these should be accurate and in the recommended format. Pilot’s readback of ATC instructions were coded for presence, reiteration of all pertinent information and queries of instruction details. Queries were different from repeat requests which were associated with the phrase ‘say again’, requesting ATC to repeat the message in full or part. In readback queries, pilot heard and repeated the information, but requested ATC to verify it as correct. Readback errors that are spotted and corrected by the controller were also noted. If readback errors were missed and not corrected, these are coded as hearback errors. The following sub-paragraphs will explain in more detail the types of messages and coded errors.

4.7.1 Usage of Callsigns

Callsign are used by ATC and pilots. It is an item required in most ATC messages for identification of message speaker, identification of message recipient, acknowledgement of message receipt and indication that information had been understood, noted and actioned upon. Table 4-10 show the coding used to denote how correctly callsigns were transmitted in messages.

Table 4-10 : Callsign Usage Codes

Variable Name	Code	Description	Explanation / Example
ATC_CLSGN		**callsign use by ATC or pilot**	
or	1	Complete callsign or permitted abbreviation	No error
P_CLSGN	2	Partial callsign	Just numbers without prefix or non-standard abbreviation
	3	Omission of callsign	No callsign used
	7	Callsign error – transposition of numbers	MALAYSIAN 2625 instead of MALAYSIAN 2526
	8	Callsign error – substitution of numbers	EXPRESS 213 instead of EXPRESS 203
	9	Incorrect number pronunciation	MALAYSIAN ‘SIXTY NINE’ instead of ‘SIX NINER’

Table 4-11 lists codes for callsign miscommunications, consisted of responses by or to the wrong aircraft, or wrong addresses of a station name.

Table 4-11: Callsign Miscommunication Codes

Variable Name	Code	Description	Explanation / Example
CLSGN_MISCOM		**Miscommunication arising from callsign discrepancies**	
	1	Wrong aircraft responded to ATC	
	2	ATC responded to wrong aircraft.	(or addressed aircraft by wrong callsign)
	3	Pilot calling ATC by other unit's name	

In some cases verification of callsign were requested or made by controllers and pilots to ensure identity. These were suitably coded as callsign verification as in Table 4-12.

Table 4-12: Callsign Verification Codes

Variable Name	Code	Description	Explanation / Example
CLSGN_VER		**Request / verification of intended receiver or speaker**	
	1	Pilot request to verify intended receiver	Was that for MERPATI 203?'
	2	ATC request to verify speaker	Confirm MALAYSIAN 12?' or Station calling say again'
	3	Response error corrected / verified	That was for SINGAPORE 112'
	4	Response error not corrected / verified	

4.7.2 Pilot's Initial Contact Messages

These messages were coded for a complete report, partial report or no report of key information. The key information required may vary from one environment to another but generally, these were needed to verify the disposition and identity of the aircraft. Initial contact messages that have no key information contain just the identities, and probably greetings.

4.7.3 Request for Repetition and Verification

Instances when a pilot responded to ATC message by requesting that the message be repeated, either in full or partially for specific parts were coded as 'request for message repeats'. For example,

"Maintain speed Three Hundred say again the descend for Malaysia Six Zero Two please"

Other than the requests such as coded above, pilot may readback messages (implying that the message was heard) but in the same transmission, requests confirmation from ATC that the readback information is correct, such as,

"Confirm climb flight level Three Five Zero Air India Eight Five Four"

Similarly, ATC may also request for repeats of messages or confirmation of relayed information from pilots. For example,

"Asian Express One Zero Three afternoon confirm level Three Six Zero squawk Zero Four Two Four"

These instances were coded as 'Rver' (Request verification).

4.7.4 Altitude Instruction

An example of an ATC message containing an altitude instruction is:

"[Callsign] descend (altitude) Seven Thousand Five Hundred feet QNH One Zero One Zero "

Instructions by ATC pertaining to altitude assignments shall contain the action word ('descend', 'climb' or 'maintain'), numerals of the assigned level or altitude and the corresponding unit of measurement. Numerals shall be pronounced as required, using 3 digits for flight levels and the full thousand and hundred if assigning altitudes. The unit of measurement could be feet, meters or flight level. An altimeter setting (QNH) is sometimes added at the end of the message. ATC altitude instructions were coded for presence of key items and number pronunciation.

4.7.5 Altitude Restriction

These messages involve either a position or time that specific altitude or flight level needs to be maintained or crossed. As these are usually applied for separation purposes, it is important that the restrictions be read back accurately and completely.

4.7.6 Approach Clearance

An approach clearance issued to aircraft contains the wording 'cleared', the type of approach such as ILS, VOR-DME letdown or visual, and the designated runway. Reference to the landing runway shall include the two digit runway number and the position (left/ right/ centre) for multiple runways. For example,

"Malaysian One One Four Seven cleared I-L-S approach Runway Three Two Left Q-N-H One Zero Zero Niner maintain high speed"

These ATC instructions are coded for complete or partial issuance.

4.7.7 Communication Instruction

The keywords associated with communications instructions are the action word 'contact', followed by the unit's name and the radio frequency, including the word 'decimal'. Only the first digit (always the number 'one') of the VHF radio frequency could be omitted as it is the same for any station. For example,

"Asian Express One Zero Seven contact Lumpur Tower (One) One Niner Decimal Four Five"

Coding of communications transfer instructions is based on inclusive or omission of keywords.

4.7.8 Heading Instruction

Heading instructions should include the turn direction or the action word 'fly' and three digit numerals. The importance of correct pronunciation couldn't be stressed more as these instructions are closely associated with separation with conflicting traffic and efficient flight operations, such as intercepting the ILS localiser for landing.

4.7.9 Enroute Holding Instruction

The keywords expected in a holding instruction depends on whether it is a standard holding pattern or otherwise. Standard holding patterns with designated direction and tracks are usually named. For non-designated holding patterns and location, the direction of turn and inbound track need to be clearly issued. In terms of holdings with reference to visual circuits and approaches, the altitude and locality need to be specified.

4.7.10 Landing Clearance

The key phrase that needs to be transmitted in a landing clearance is 'cleared to land'. Without it, the runway is off limits. The clearance shall also clearly assign the runway to be used, especially when an airport has multiple runways.

4.7.11 Route and Position Instructions

The messages that are coded for route/position instructions are those associated with aircraft's disposition, either in the air or on the ground. These include direct tracks, joining airways, taxiing, lining up and standard designated routes.

4.7.12 Speed Control

Speed instructions are quite straight forward, consisting of three digit numerals for speed and the unit 'knots'.

4.7.13 Squawk Code Assignment

Transponder code instructions shall contain the word ‘squawk’ and a four digit code. Any omission is considered as partial instruction.

4.7.14 Takeoff Clearance

Similar to landing instructions, takeoff instructions are primarily associated with tower operations. The action phrase ‘clear for takeoff’ shall only be issued at the end of the whole clearance itself, after designated runway and other relevant information. Runway to be used shall be identified by its two digit numerals and for multiple runways, to include left/ right/ centre.

4.7.15 Advisories

The term ‘weather information’ refers primarily to advisories of altimeter setting information as this should be readback by pilots. The digits of the pressure setting (QNH or QFE) should be accurately stated as this is relevant to safe aircraft operations. Traffic information is advised by ATC to pilots for situational awareness and visualisation, as well as visual sighting where possible. The details which are provided should be accurate in terms of altitude, disposition, aircraft type and distance, so as to avoid misidentification. These advisories are coded for complete relevant contents.

4.7.16 Disfluencies and Excess Verbiage

Disfluencies are associated to insertion of non-words or fillers such as ‘er..’, ‘aah’ or ‘uhm’, and longer than normal pauses in a message. In some occasions, the speaker may also hesitate, stop mid-word or mid-phrase and utter a new word or start a new phrase. These ‘false start’ are also coded as disfluencies. Disfluencies are continuation problem to listeners as these needs to be edited out from the message (Levelt, 1989). Levelt (1983) and, Nakatani and Hirschberg (1994) concluded that the parser of a disfluent message needs to identify the reparandum, the edit interval and the repair interval before comprehending the intended meaning. A conservative figure for disfluencies in spontaneous speech is 6 counts per 100 words (Fox Tree, 1995; Bortfeld, Leon, Bloom, Schober, and Brennan, 2001).

4.7.17 Language Switching

The radiotelephony data collected contain instances when another language other than English had been used by either ATC or pilots. The non-English words and phrases were associated with courtesies and greetings.

4.8 Data Analyses

Demographic and coded radiotelephony data were analysed using SPSS software. As all data was organised in Excel, it was possible to directly export it into SPSS for analyses. Data management was also supported by Microsoft Word. NVivo software has also been suggested as suitable to handle text data. However, due to the size of this research's data NVivo was not utilised as there may be processing capacity constraints. Compatibility with SPSS is also questionable and it was decided as more practical to continue with Excel/ Word/ SPSS software combination.

Demographic information is gathered to provide a picture of the controllers' age, experience and qualification distribution. The analysis of English language usage includes preference, proficiency exam and aviation related training. A cross tabulation will test for variance between groups within the population sampled. Also collected was information on the perception of the value of training courses, improvement attained and materials provided or made available in training. The analyses will be very descriptive and informative in understanding what aspects are lacking and should be improved in terms of English language training, usage and proficiency.

Analyses of radiotelephony data will be similarly straightforward. The basic statistics will be frequency or percentages, comparison and patterns about what actually is being practised daily in an ESL ATC environment such as Malaysia. Some aspects could possibly be studied in comparison between different ATC functions or to previous results from other studies. The error and discrepancies analysis will disclose the present practise and performance of ATC radiotelephony among pilots and controllers. Certain types of errors may impact on safety more seriously than others and should be rectified immediately. Bad habits and non-standard low risk practises, although may not be as risky, do reflect on the standard of professionalism and airmanship. Comparison with previous results and those from other population samples may indicate if the ESL environment under study is worse than, just as good or better in terms of radiotelephony practises.

4.9 Chapter Summary

Malaysia was selected as a suitable location due to the ESL status of radiotelephony environment and accessibility of data. The research received strong support from the Department of Civil Aviation Malaysia. Two methods of data collection were used; a questionnaire and controller-pilot radiotelephony recording.

The questionnaire was distributed to the Malaysian controllers. Information collected includes basic demography and English language usage, qualification and training. Also included was an evaluation of language related training courses and problems in daily work function. The questionnaire is independent from the radiotelephony recordings and these two data should not be individually linked. Correlations could only be implied for groups of selected criteria.

Radiotelephony data was digitally recorded from real-time live air traffic control environments. It was spontaneous, carried out without disruption of daily work-routine, without pre-set dialogue and does not involve any role-playing. The identity of the people being recorded is safeguarded by suppressing the actual date and time of each recording segment. Callsigns are kept as originally used due to its importance in evaluation of radiotelephony practice.

Audio was processed into text by verbatim transcribing, preserving the words, phraseology and fillers usage as accurately as possible. Pauses which were noticeably longer than usual were also noted. Length of transmission and lapses were recorded digitally. The text was parsed into speech acts and aviation topics. Error and disfluencies were coded based on deviation from stipulated standards applicable in the Malaysian airspace.

The findings from these data are expected to exemplify the radiotelephony characteristics in an ATC environment involving ESL controllers and pilots. It will identify the type(s) of common errors and approximate the chances of recurrence. Comparison with other studies involving different samples may point to similarities or peculiarities. The following Chapter 5 will discuss information collected from the questionnaire and Chapter 6 will focus on Radiotelephony data analysis.

5 THE CONTROLLER RESOURCE ANALYSES

This chapter presents and discusses the analyses results of data collected from the questionnaires. It will incorporate the controllers' demographics, usage of the English language, language related training and radiotelephony practises. A total of 188 controllers responded to the questionnaire distributed, which was 35% of the total population surveyed. About 90% of the respondents were full time controllers stationed at either the Air Traffic Control Centres or Aerodromes. The remaining 10% of respondents were Headquarters' officers and College Instructors who were also trained controllers but may not be actively involved in routine operations.

5.1 Demographics Study

The term demographic as used in this research refers to information and discussion about the population under study. However, it was confined to the information collected for the research purposes and was not equivalent to a bona fide demographic study. The similarities were about type setting the groups within the sample, analyses perspectives and description of groups' attributes.

5.1.1 Working Units

Table 5-1 show which DCA units/ division the respondents were located at and the associated ATC operational position they principally worked.

Table 5-1: UNIT * WorkPos Crosstabulation

			Principal Working Position				Total
			TAR	ARR	TWR	NON	
UNIT	ACC	% within UNIT	33.3%	33.3%	29.5%	3.8%	100.0%
		% within WorkPos	65.0%	83.9%	20.5%	60.0%	41.5%
	ADR	% within UNIT	1.1%		97.8%	1.1%	100.0%
		% within WorkPos	2.5%		79.5%	20.0%	48.4%
	College	% within UNIT	60.0%	20.0%		20.0%	100.0%
		% within WorkPos	7.5%	3.2%		20.0%	2.7%
	HQ	% within UNIT	71.4%	28.6%			100.0%
		% within WorkPos	25.0%	12.9%			7.4%
Total		% within UNIT	21.3%	16.5%	59.6%	2.7%	100.0%
		% within WorkPos	100.0%	100.0%	100.0%	100.0%	100.0%

About 41% of the respondents were located at the Air Traffic Control Centre, 48% at Aerodromes, 7% at ATC/ DCA Headquarters and 3% at the ATC Training College. The respondents stationed at the ACC included terminal approach radar, area radar controllers and tower controllers as these ATC positions were co-located in Subang, Kinabalu and Kuching. Multi-rated controllers at these locations were inter-changeable for working position assignments and allow greater flexibility in human resource management. Other tower controllers were station specific as the ratings are limited by locality. The respondents from HQ and College were additional resources for TAR and ARR positions. Overall, the respondents consisted of 21% TAR, 17% ARR and 60% TWR controllers. About 2.7% respondents that did not have any specific working positions were controllers who do not perform active controlling. Other results of cross tabulation analyses in this chapter will automatically exclude these non-operational controllers; thus, the accumulated total percentages will be less than 100%.

5.1.2 Ethnic Groups

Table 5-2 show proportions of ethnic groups. More than 70% of respondents were Malay. There are approximately equal percentages of Chinese, Indian and other ethnic groups. This overall ratio of 7:1:1 for Malay-Indian-Chinese was not maintained in any ATC environment. The nearest was in ARR with a 6:1:1 ratio. Respondents from TAR consisted of 45% Malays, 30% Chinese, 20% Indian and 5% other ethnic origin. ARR were 71% Malays, 16% Indian and 13% Chinese. In TWR there were 83% Malays, 11% other ethnic origin, 4% Indian and 2% Chinese.

Table 5-2: WorkPos * ETHNIC Crosstabulation

			ETHNIC				Total
			M	I	C	O	
WorkPos	TAR	% within WorkPos	45.0%	20.0%	30.0%	5.0%	100.0%
		% within ETHNIC	13.3%	47.1%	63.2%	12.5%	21.3%
	ARR	% within WorkPos	71.0%	16.1%	12.9%		100.0%
		% within ETHNIC	16.3%	29.4%	21.1%		16.5%
	TWR	% within WorkPos	83.0%	3.6%	1.8%	10.7%	100.0%
		% within ETHNIC	68.9%	23.5%	10.5%	75.0%	59.6%
Total		% within WorkPos	71.8%	9.0%	10.1%	8.5%	100.0%
		% within ETHNIC	98.5%	100.0%	94.8%	87.5%	95.2%

5.1.3 Gender

Table 5-3 show the results of cross tabulation between principal working position and gender. About 78% of respondents were male. This female-male proportion of 2:7 generally agrees with common understanding that ATC is a male dominated career. The female-male ratio was about 1:3 in TWR, about 1:2 in ARR and 1:9 in TAR. This ratio however, was not seen to have any direct bearing on language usage.

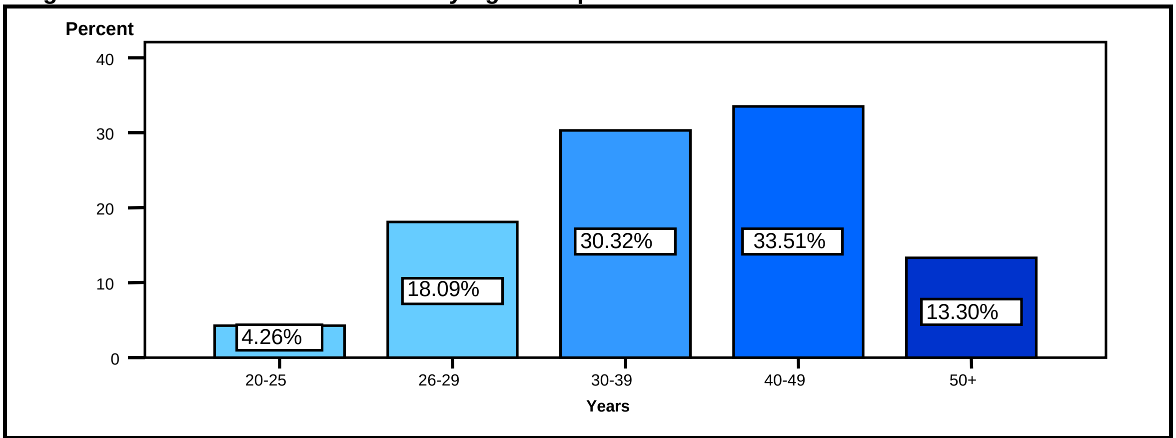
Table 5-3: WorkPos * GENDER Crosstabulation

			GENDER		Total
			F	M	
WorkPos	TAR	% within WorkPos	10.0%	90.0%	100.0%
		% within GENDER	9.5%	24.7%	21.3%
	ARR	% within WorkPos	32.3%	67.7%	100.0%
		% within GENDER	23.8%	14.4%	16.5%
	TWR	% within WorkPos	23.2%	76.8%	100.0%
		% within GENDER	61.9%	58.9%	59.6%
Total		% within WorkPos	22.3%	77.7%	100.0%
		% within GENDER	95.2%	98.0%	96.6%

5.1.4 Age

The controllers' age distribution in Figure 5-1 shows that 22% of respondents were below 30 years of age, while 63% were between 30 to 49 years old. About 13% of respondents were above 50.

Figure 5-1: Controllers' Distribution by Age Groups



A working position-age cross tabulation (Table 5-4) generally showed older controllers in TAR environment and the younger ones in TWR. None of TAR controllers were below 30 and the majority were above 40. Conversely, 75% of the TWR workforce was below 40. The above 40s in TWR were mostly

SATCOs and DCA Managers. ARR were the middle group with 90% controllers aged between 30 and 50.

Table 5-4: WorkPos * AGE Crosstabulation

			AGE					Total
			20 - 25	26 - 30	30 - 39	40 - 49	> 50	
WorkPos	TAR	% within WorkPos			2.5%	55.0%	42.5%	100.0%
		% within AGE			1.8%	34.9%	68.0%	21.3%
	ARR	% within WorkPos			41.9%	48.4%	9.7%	100.0%
		% within AGE			22.8%	23.8%	12.0%	16.5%
	TWR	% within WorkPos	7.1%	29.5%	36.6%	21.4%	4.5%	100.0%
		% within AGE	100.0%	97.1%	71.9%	38.1%	20.0%	59.6%
Total		% within WorkPos	4.3%	18.1%	30.3%	33.5%	13.3%	100.0%
		% within AGE	100.0%	97.1%	96.5%	96.8%	100.0%	98.08%

5.1.5 Academic Qualification

The Table 5-5 show percentages of respondents' by academic qualifications and working positions. 38% of respondents joined the service at secondary education level. The others were tertiary education qualified, with 36% at Diploma and 25% at Degree levels. The different entry levels were due to changes in career scheme and academic qualification requirements. It should be noted that higher qualifications at Masters and PhD degrees are privileged proviso acquired while in service, not a career requirement. The larger portion of TAR controllers were 43% secondary and 35% with degree qualifications. ARR consisted of 54% degree level qualified controllers while 50% of TWR controllers were Diploma qualified.

Table 5-5: WorkPos * ACADEMIC Crosstabulation

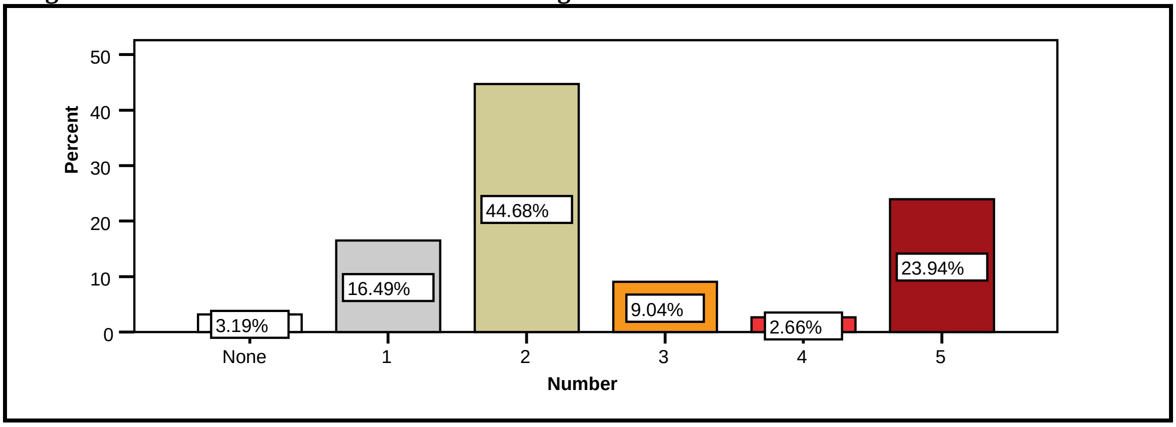
			ACADEMIC				Total
			Secondary	Diploma	Degree	Masters	
WorkPos	TAR	% within WorkPos	42.5%	22.5%	15.0%	20.0%	100.0%
		% within ACADEMIC	23.6%	13.2%	18.8%	53.3%	21.3%
	ARR	% within WorkPos	29.0%	6.5%	48.4%	16.1%	100.0%
		% within ACADEMIC	12.5%	2.9%	46.9%	33.3%	16.5%
	TWR	% within WorkPos	38.4%	50.0%	8.9%	1.8%	100.0%
		% within ACADEMIC	59.7%	82.4%	31.3%	13.3%	59.6%
Total		% within WorkPos	38.3%	36.2%	17.0%	8.0%	100.0%
		% within ACADEMIC	95.8%	98.5%	97.0%	100.0%	97.8%

However, the academic qualification is only a pre-requisite to particular entry points to the ATC service. Specific ATC training and rating still need to be undertaken before controllers were certified fit for duty. In terms of proficiency in using English, the higher levels of education were expected to improve English language usage if studies were completed abroad.

5.1.6 ATC Ratings

Of the 188 respondents, about a quarter held all 5 ratings (Figure 5-2). Those with just 2 ratings made up about 45%. A very small percentage (less than 3%) held 4 ratings.

Figure 5-2: Controllers' Number of ATC Ratings



An SPSS frequency analysis for 'years of experience' for each type of ATC rating produced the results in Table 5-6 to Table 5-10.

Table 5-6: Frequency Table- Aerodrome Control Experience

		Frequency	Percent	Valid %	Cumulative%
Valid	None	43	22.9	22.9	22.9
	<5	46	24.5	24.5	47.3
	5 - 10	57	30.3	30.3	77.7
	10 - 15	16	8.5	8.5	86.2
	15 - 20	17	9.0	9.0	95.2
	20 - 25	5	2.7	2.7	97.9
	25 - 30	4	2.1	2.1	100.0
	Total	188	100.0	100.0	

Table 5-7: Frequency Table - Approach Procedural Control Experience

		Frequency	Percent	Valid %	Cumulative%
Valid	None	73	38.8	38.8	38.8
	<5	46	24.5	24.5	63.3
	5 - 10	40	21.3	21.3	84.6
	10 - 15	13	6.9	6.9	91.5
	15 - 20	7	3.7	3.7	95.2
	20 - 25	5	2.7	2.7	97.9
	25 - 30	4	2.1	2.1	100.0
	Total	188	100.0	100.0	

Table 5-8: Frequency Table - Area Procedural Control Experience

		Frequency	Percent	Valid %	Cumulative%
Valid	None	107	56.9	56.9	56.9
	<5	30	16.0	16.0	72.9
	5 - 10	30	16.0	16.0	88.8
	10 - 15	6	3.2	3.2	92.0
	15 - 20	8	4.3	4.3	96.3
	20 - 25	5	2.7	2.7	98.9
	25 - 30	2	1.1	1.1	100.0
	Total	188	100.0	100.0	

Table 5-9: Frequency Table - Area Radar Control Experience

		Frequency	Percent	Valid %	Cumulative%
Valid	None	126	67.0	67.0	67.0
	<5	23	12.2	12.2	79.3
	5 - 10	28	14.9	14.9	94.1
	10 - 15	5	2.7	2.7	96.8
	15 - 20	5	2.7	2.7	99.5
	20 - 25	1	.5	.5	100.0
	Total	188	100.0	100.0	

Table 5-10: Frequency Table - Approach Radar Control Experience

		Frequency	Percent	Valid %	Cumulative%
Valid	None	146	77.7	77.7	77.7
	<5	15	8.0	8.0	85.6
	5 - 10	14	7.4	7.4	93.1
	10 - 15	5	2.7	2.7	95.7
	15 - 20	8	4.3	4.3	100.0
	Total	188	100.0	100.0	

The results suggested that the human resources of air traffic controllers differ for each type rating. While 77% of Controllers held Aerodrome ratings, the opposite was true for approach radar. Only 22% of the human resource was certified to operate terminal approach radar work stations. The summarised percentages are shown in Table 5-11 for each ATC working position.

Table 5-11: Percentages of Human Resources by ATC Type Rating

Years	Aerodrome	Approach Procedural	Area Procedural	Area Radar	Approach Radar
None	22.9	38.8	56.9	67.0	77.7
1 – 5	24.5	24.5	16.0	12.2	8.0
6 – 10	30.3	21.3	16.0	14.9	7.4
11 – 15	8.5	6.9	3.2	2.7	2.7
16 – 20	9.0	3.7	4.3	2.7	4.3
20 – 25	2.7	2.7	2.7	0.5	0
25 – 30	2.1	2.1	1.1	0	0
Resources	**77%**	**61.2%**	**43.1%**	**33%**	**22.3%**

Approach procedural rating showed 61% resources but this type of control was only practised in some aerodromes. Area procedural, area radar and terminal approach radar control resources were required for Kuala Lumpur, Kuching and Kinabalu ACC operations. The older radar controllers were usually multi-rated and interchangeable between area and terminal approach.

5.1.7 ATC Operational Experience

Years of service varied between less than 3 years to more than 20 years as shown in Table 5-12. The higher percentages were for the 7-10 years (31%) and more than 20 years (28%) groups. The 4-6 years and 16-20 years service group were about 13% each. 5% had served between 11 to 15 years and 8% were very young controllers, having joined the department less than 3 years.

Table 5-12: SERVICE * WorkPos Crosstabulation

			WorkPos			Total
			TAR	ARR	TWR	
SERVICE	< 3 yrs	% within SERVICE			100.0%	100.0%
		% within WorkPos			14.3%	8.5%
	4 – 6 yrs	% within SERVICE		16.7%	83.3%	100.0%
		% within WorkPos		12.9%	17.9%	12.8%
	7 – 10 yrs	% within SERVICE	1.7%	18.6%	72.9%	100.0%
		% within WorkPos	2.5%	35.5%	38.4%	31.4%
	11 – 15 yrs	% within SERVICE			100.0%	100.0%
		% within WorkPos			8.9%	5.3%
	16 – 20 yrs	% within SERVICE	56.0%	20.0%	20.0%	100.0%
		% within WorkPos	35.0%	16.1%	4.5%	13.3%
	> 20 yrs	% within SERVICE	47.2%	20.8%	32.1%	100.0%
		% within WorkPos	62.5%	35.5%	15.2%	28.2%
Total		% within SERVICE	21.3%	16.5%	59.6%	100.0%
		% within WorkPos	100.0%	100.0%	100.0%	100.0%

The career advancement seemed to point towards a TWR-ARR-TAR direction as more experienced controllers were working the TAR position more than others. This suggested that the controllers progressed from area controlling before undergoing certification for terminal approach radar duties. The ARR controllers contained 36% with 7 to 10 years experience and another 36% with more than 20 years experience. TWR controllers included 56% of those with 10 years and less experience. The 5 year gap at 11-15 yrs for TAR and ARR was associated with none-recruitment for these working positions.

5.1.8 Other ATC related Job Assignments

Other than ATC operations experience, the respondents also provided information on six ATC related job assignments; Airport Manager, Area Control Centre (ACC) Supervisor, Senior Air Traffic Control Officer (SATCO), Instructor, Training Officer and Examiner. Tables 5-13 to 5-18 show the respondents' experience by associated number of years for each job assignments.

Table 5-13: Frequency Table – Airport Manager Experience

		Frequency	Percent	Valid %	Cumulative %
Valid	None	166	88.3	88.3	88.3
	< 5	15	8.0	8.0	96.3
	5 - 10	5	2.7	2.7	98.9
	11 - 20	1	.5	.5	99.5
	> 20	1	.5	.5	100.0
	Total	188	100.0	100.0	

Table 5-14: Frequency Table – ACC Supervisor Experience

		Frequency	Percent	Valid %	Cumulative %
Valid	None	166	88.3	88.3	88.3
	< 5	16	8.5	8.5	96.8
	5 - 10	6	3.2	3.2	100.0
	Total	188	100.0	100.0	

Table 5-15: Frequency Table – SATCO Experience

		Frequency	Percent	Valid %	Cumulative %
Valid	None	160	85.1	85.1	85.1
	< 5	21	11.2	11.2	96.3
	5 - 10	5	2.7	2.7	98.9
	11 - 20	1	.5	.5	99.5
	> 20	1	.5	.5	100.0
	Total	188	100.0	100.0	

Table 5-16: Frequency Table – Instructor Experience

		Frequency	Percent	Valid %	Cumulative %
Valid	None	176	93.6	93.6	93.6
	< 5	8	4.3	4.3	97.9
	5 - 10	2	1.1	1.1	98.9
	11 - 20	2	1.1	1.1	100.0
	Total	188	100.0	100.0	

Table 5-17: Frequency Table – Training Officer Experience

		Frequency	Percent	Valid %	Cumulative %
Valid	None	148	78.7	78.7	78.7
	< 5	24	12.8	12.8	91.5
	5 - 10	12	6.4	6.4	97.9
	11 - 20	3	1.6	1.6	99.5
	> 20	1	.5	.5	100.0
	Total	188	100.0	100.0	

Table 5-18: Frequency Table – ATC Examiner Experience

		Frequency	Percent	Valid %	Cumulative %
Valid	None	150	79.8	79.8	79.8
	< 5	27	14.4	14.4	94.1
	5 - 10	10	5.3	5.3	99.5
	11 - 20	1	.5	.5	100.0
	Total	188	100.0	100.0	

Generally, the results pointed out that only a small percentage of respondents have enjoyed opportunities of other job related experience. The lowest percentage was for College Instructor and the highest for Training Officer. The percentages from the SPSS analyses above are summarised in Table 5-19. There were higher percentages for training officer and examiner as these assignments were location specific, not linked to seniority and were usually for shorter duration. Other assignments were associated with seniority, grade and job vacancies, resulting in usually longer tenure and less opportunities.

Table 5-19: ATC related Job Experiences

Years	Aerodrome Manager	ACC Supervisor	SATCO	ATC College Instructor	Training Officer	Examiner
None	88.3	88.3	85.1	93.6	78.7	79.8
1 – 5	8.0	8.5	11.2	4.3	12.8	14.4
6 – 10	2.7	3.2	2.7	1.1	6.4	5.3
11 – 15	0	0	0.5	1.1	1.6	0
16 – 20	0.5	0	0	0	0.5	0.5
21 – 25	0.5	0	0	0	0	0
26 - 30	0	0	0.5	0	0	0
Total	**11.7**	**11.7**	**14.9**	**6.5**	**21.3**	**20.2**

These assignments were expected to expose respondents to a wider usage of the English language as the majority of ATC related administration and activities still use English as its medium of communications.

5.2 The English Language Usage

The questionnaire collected information on English language usage among the controllers. They were asked to indicate 3 languages used most in daily communications. Overall, about 39% of respondents indicated English as the most frequent language used. 57% declared English as the second frequent. Less than 1% used it as the third but about 4% did not indicate English as one of the 3 most used languages at all. The following are the analysis of English language usage from other perspectives.

5.2.1 Where was English used?

The English*Working-Position cross tabulation results in Table 5-20 showed that among the TAR controllers, 70% used English as most frequent, whilst only 42% of ARR controllers did. In ARR, 55% declared English as second most frequent language, as did 67% of TWR controllers.

Table 5-20: ENGLISH * WorkPos Crosstabulation

			WorkPos			Total
			TAR	ARR	TWR	
ENGLISH	1	% within ENGLISH	38.4%	17.8%	42.5%	100.0%
		% within WorkPos	70.0%	41.9%	27.7%	38.8%
	2	% within ENGLISH	10.3%	15.9%	70.1%	100.0%
		% within WorkPos	27.5%	54.8%	67.0%	56.9%
	3	% within ENGLISH	100.0%			100.0%
		% within WorkPos	2.5%			.5%
	0	% within ENGLISH		14.3%	85.7%	100.0%
		% within WorkPos		3.2%	5.4%	3.7%
Total		% within ENGLISH	21.3%	16.5%	59.6%	100.0%
		% within WorkPos	100.0%	100.0%	100.0%	100.0%

The choice of using English in daily communications was also associated with the job location. Officers from HQ and College used the Malay language for governmental official administrative purposes. These respondents only operated as active controllers on a once-monthly basis for licensing requirements and the opportunity to use English in ATC operations were minimised. As can be seen in Table 5-21, only 21% of HQ respondents noted English as the most frequently used language. However, College respondents showed the opposite with 80% choosing English as most frequent. This corresponded with the fact that all ATC related training courses, workshops and seminars are always conducted in English. At the operations units, ACC showed 50% but Aerodromes showed only 30% of respondents using English as most frequent. This may be associated with coordination and ground communications which were more of domestic nature in the aerodromes and international at the ACCs.

Table 5-21: UNIT * ENGLISH Crosstabulation

% within UNIT		UNIT				Total
		ACC	TWR	College	HQ	
ENGLISH	1	50.0%	29.7%	80.0%	21.4%	38.8%
	2	46.2%	64.8%	20.0%	78.6%	56.9%
	3	1.3%				.5%
	0	2.6%	5.5%			3.7%
Total		100.0%	100.0%	100.0%	100.0%	100.0%

5.2.2 Who used English?

The English*Gender cross tabulation result in Table 5-22 showed 41% of the male and 31% female respondents indicated English as the most frequent language used. The larger portions of both genders declared English as second frequent language used.

Table 5-22: ENGLISH * GENDER Crosstabulation

			GENDER F	GENDER M	Total
ENGLISH	1	% within ENGLISH	17.8%	82.2%	100.0%
		% within GENDER	31.0%	41.1%	38.8%
	2	% within ENGLISH	24.3%	75.7%	100.0%
		% within GENDER	61.9%	55.5%	56.9%
	3	% within ENGLISH		100.0%	100.0%
		% within GENDER		.7%	.5%
	0	% within ENGLISH	42.9%	57.1%	100.0%
		% within GENDER	7.1%	2.7%	3.7%
Total		% within ENGLISH	22.3%	77.7%	100.0%
		% within GENDER	100.0%	100.0%	100.0%

None of the female respondent noted English as a third frequently used language but 0.7% of the males did. However, the small percentage that did not include English as 3 most used languages consisted 7.1% of female and 2.7% of male respondents.

The Table 5-23 show English* Age cross tabulation. A larger portion of the above 40s used English as the most frequent language. The 26 to 39s mostly used English as a second while the youngest age group showed a fifty-fifty division.

Table 5-23: ENGLISH * AGE Crosstabulation

			AGE 20-25	AGE 26-30	AGE 30-39	AGE 40-49	AGE >50	Total
ENGLISH	1	% within ENGLISH	5.5%	8.2%	16.4%	43.8%	26.0%	100.0%
		% within AGE	50.0%	17.6%	21.1%	50.8%	76.0%	38.8%
	2	% within ENGLISH	3.7%	24.3%	39.3%	28.0%	4.7%	100.0%
		% within AGE	50.0%	76.5%	73.7%	47.6%	20.0%	56.9%
	3	% within ENGLISH					100.0%	100.0%
		% within AGE					4.0%	.5%
	0	% within ENGLISH		28.6%	42.9%	14.3%		100.0%
		% within AGE		5.9%	5.3%	1.6%		3.7%
Total		% within ENGLISH	4.3%	18.1%	30.3%	33.5%	13.3%	100.0%
		% within AGE	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The Table 5-24 show English usage of ethnic groups. The majority of Chinese and Indian respondents indicated English as the most frequently used. About 22% of the Malays declared English as most frequently used while 76% use it as a second frequent daily language.

Table 5-24: ENGLISH * ETHNIC Crosstabulation

			ETHNIC				Total
			Malay	Chinese	Indian	Others	
ENGLISH	1	% within ENGLISH	41.1%	21.9%	23.3%	13.7%	100.0%
		% within ETHNIC	22.2%	84.2%	100.0%	62.5%	38.8%
	2	% within ENGLISH	95.3%			4.7%	100.0%
		% within ETHNIC	75.6%			31.3%	56.9%
	3	% within ENGLISH		100.0%			100.0%
		% within ETHNIC		5.3%			.5%
	0	% within ENGLISH	42.9%	28.6%		14.3%	100.0%
		% within ETHNIC	2.2%	10.5%		6.3%	3.7%
Total		% within ENGLISH	71.8%	10.1%	9.0%	8.5%	100.0%
		% within ETHNIC	100.0%	100.0%	100.0%	100.0%	100.0%

Cross ethnic communications involving Chinese and Indian respondents were mostly conducted in English and less frequently in Malay. It should be noted that cross ethnic communications involving Malays were usually conducted in the Malay language instead. Other ethnic minorities mostly used English as most or second frequent language.

An analysis of English usage by qualification produced results in Table 5-25. Larger portions of controllers with degree and Diploma qualifications used English as second most frequent language. However, for secondary level education the portions were about equal between most and second frequent users of English. The small percentage of respondents that did not include English in 3 most used languages was from secondary level group.

Table 5-25: ENGLISH * ACADEMIC Crosstabulation

			ACADEMIC				Total
			Secondary	Diploma	Degree	Masters	
ENGLISH	1	% within ENGLISH	49.3%	26.0%	17.8%	6.8%	100.0%
		% within ACADEMIC	50.0%	27.9%	40.6%	33.3%	38.8%
	2	% within ENGLISH	30.8%	42.1%	17.8%	9.3%	100.0%
		% within ACADEMIC	45.8%	66.2%	59.4%	66.7%	56.9%
	3	% within ENGLISH	100.0%				100.0%
		% within ACADEMIC	1.4%				.5%
	0	% within ENGLISH	28.6%	57.1%			100.0%
		% within ACADEMIC	2.8%	5.9%			3.7%
Total		% within ENGLISH	38.3%	36.2%	17.0%	8.0%	100.0%
		% within ACADEMIC	100.0%	100.0%	100.0%	100.0%	100.0%

5.3 ATC Communication and Language Skills

In relations to usage of English in ATC radiotelephony, there were 4 relevant training areas that the respondents were requested to provide information on through Section C of the questionnaire. These were:

i. Aviation English
ii. Standard Phraseology
iii. Radiotelephony Procedures
iv. Communications skills

5.3.1 Courses Attended

Respondents were requested to indicate if they had attended any of these training either as a separate course or incorporated into other ATC courses. Table 5-26 summarised the overall responses (percentages) for training courses attended by respondents. Aviation English had a low respond of only 27%. Standard phraseology (96%), radiotelephony procedures (95%) and ATC communication (91%) trainings showed much higher results, mostly incorporated with other ATC courses.

Table 5-26: ATC Communication/Language Training Attendance

	None	Separate Training	Part of ATC Course
Aviation English	112(60%)	25 (13%)	51 (27%)
Standard Phraseology	7 (4%)	2 (1%)	179 (95%)
Radiotelephony	10 (5%)	2 (1%)	176 (94%)
ATC Communications	16 (9%)	2 (1%)	170 (90%)

The cross tabulation for principal working positions and courses attended are shown in Tables 5-27 to 5-30.

Table 5-27: Work-Position * Aviation English Crosstabulation

			Aviation English			Total
			None	Separate	Combined	
WorkPos	TAR	% within WorkPos	82.5%	2.5%	15.0%	100.0%
		% within TRNG_AE	29.5%	4.0%	11.8%	21.3%
	ARR	% within WorkPos	67.7%	9.7%	22.6%	100.0%
		% within TRNG_AE	18.8%	12.0%	13.7%	16.5%
	TWR	% within WorkPos	50.0%	17.0%	33.0%	100.0%
		% within TRNG_AE	50.0%	76.0%	72.5%	59.6%
Total		% within WorkPos	59.6%	13.3%	27.1%	100.0%
		% within TRNG_AE	100.0%	100.0%	100.0%	100.0%

Aviation English course conducted by DCA college was not a compulsory part of ATC training, neither was it a pre-requisite for ATCO career advancement. About 60% claimed never attended this training, 13% claimed attending a separate course and 27% received combined training (Table 5-27). The respondents claiming to have had Aviation English training were largely from TWR. 83% of TAR and 68% of ARR controllers never attended Aviation English training.

Standard phraseology training had been provided to 96.3% respondents (Table 5-28) of which 95.2% were combined with other ATC courses and 1.1% separate. 3.7% claimed to have not been trained. TAR, ARR and TWR working positions showed similar high percentages of respondents claiming to have been provided this training.

Table 5-28: Work-Position * Standard Phraseology Crosstabulation

			Standard Phraseology			Total
			None	Separate	Combined	
WorkPos	TAR	% within WorkPos	2.5%	2.5%	95.0%	100.0%
		% within TRNG_STDP	14.3%	50.0%	21.2%	21.3%
	ARR	% within WorkPos	6.5%		93.5%	100.0%
		% within TRNG_STDP	28.6%		16.2%	16.5%
	TWR	% within WorkPos	3.6%	.9%	95.5%	100.0%
		% within TRNG_STDP	57.1%	50.0%	59.8%	59.6%
Total		% within WorkPos	3.7%	1.1%	95.2%	100.0%
		% within TRNG_STDP	100.0%	100.0%	100.0%	100.0%

The results for radiotelephony procedures training (Table 5-29) also show similar high percentages of respondents of all ATC working positions having attended combined training. 5.3% of respondents claimed not received training in radiotelephony procedures.

Table 5-29: Work-Position * Radiotelephony Procedures Crosstabulation

			Radiotelephony Procedures			Total
			None	Separate	Combined	
WorkPos	TAR	% within WorkPos		2.5%	97.5%	100.0%
		% within TRNG_RTF		50.0%	22.2%	21.3%
	ARR	% within WorkPos	9.7%		90.3%	100.0%
		% within TRNG_RTF	30.0%		15.9%	16.5%
	TWR	% within WorkPos	6.3%	.9%	92.9%	100.0%
		% within TRNG_RTF	70.0%	50.0%	59.1%	59.6%
Total		% within WorkPos	5.3%	1.1%	93.6%	100.0%
		% within TRNG_RTF	100.0%	100.0%	100.0%	100.0%

Communication skills training (Table 5-30) showed similar high percentages for those having been trained.

Table 5-30: Work-Position * Communication Skills Crosstabulation

			Communication Skills			Total
			None	Separate	Combined	
WorkPos	TAR	% within WorkPos	5.0%	2.5%	92.5%	100.0%
		% within TRNG_COMS	12.5%	50.0%	21.8%	21.3%
	ARR	% within WorkPos	19.4%		80.6%	100.0%
		% within TRNG_COMS	37.5%		14.7%	16.5%
	TWR	% within WorkPos	7.1%	.9%	92.0%	100.0%
		% within TRNG_COMS	50.0%	50.0%	60.6%	59.6%
Total		% within WorkPos	8.5%	1.1%	90.4%	100.0%
		% within TRNG_COMS	100.0%	100.0%	100.0%	100.0%

5.3.2 Training Format

The data was filtered for those claiming to have attended training as earlier mentioned and analysed for items included in the training attended. Table 5-31 summarised the percentages that indicated agreement that the listed items were included as part of the training program.

Table 5-31: Items in Training format

Training Courses	**Aviation English N=76**	**Standard Phraseology N=181**	**Radio Telephony N=178**	**Communications N=172**
	% indicated 'Yes'			
Classroom lectures	**80**	78	69	67
Simulator exercises	45	**91**	**85**	**70**
Public speaking	41	10	9	20
Verbal communications skills	51	32	34	40
Listening exercises	49	46	49	41
Radiotelephony examples	32	53	62	47
Visit ATC workstation	49	58	52	53
Peer role-play exercises	34	40	38	36
Interactive computerised exercises	17	13	13	20
Handling unexpected events	34	53	49	42

The features queried were intended to find out if the language skills such as listening, writing, reading and speaking were incorporated in training. Although linguistic writing may not be intensely used in ATC operations, but other skills are important and useful in building up knowledge and confidence. For ESL users such as these respondents, practical exercises and listening are particularly important as opportunities to converse in English outside of ATC operations may be limited due to cultural expectations and practices. The results showed that most respondents agreed on classroom and simulator sessions in training. Other features received fewer votes, indicating less utilisation in the training courses.

5.3.3 Documents and References

The questionnaire queried if major reference documents and other related information from sources that may not be readily available or accessible to the trainees, were provided during training. The AIP and MATS show high percentages of availability (Table 5-32). These were usually loaned to trainees during training courses. Other ICAO documents were not provided individually and usually need to be shared among course participants, or available as limited library resources. It was noted that queries on terminology and differences from ICAO received poor results when these were actually incorporated in other documents and should have been given emphasise in ATC training.

Table 5-32: Documents and References Provided in Training

Item	% Yes
Manual of Air Traffic Services (MATS)	98
Aeronautical Information Publication (AIP)	97
ICAO PANS-RAC (DOC 4444)	71
Numerals Pronunciation	70
ICAO Annex 10 Volume II	60
Terminology for Unexpected Events	48
Potentially Confusing Terms / Words	43
ICAO Manual of Radiotelephony (DOC 9432)	41
Commonly Used Plain English Terms	33
Real Radiotelephony Samples	32
Local Differences from ICAO	23
Differences from ICAO SARPS	20

5.3.4 Perception of Training Value

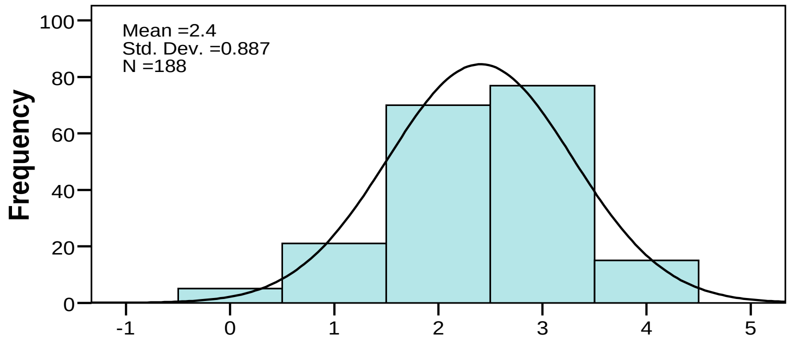
The respondents were requested to rate the improvements attained after attending ATC communication and language related training courses. The scale range from very little (marked 0), adequate (marked 1), good (marked 3) to very good (marked 4). The normal curve was generated by the computer software, as was calculation of mean and standard deviation.

5.3.4.1 Vocabulary and Glossary Knowledge

The vocabulary range is important for the efficiency and effectiveness of ATC function. On average, the respondents considered that the improvements to overall vocabulary knowledge were just above adequate. Following are results for perceived improvements after training courses, in terms of aviation general, ATC specific and standard phraseology vocabularies.

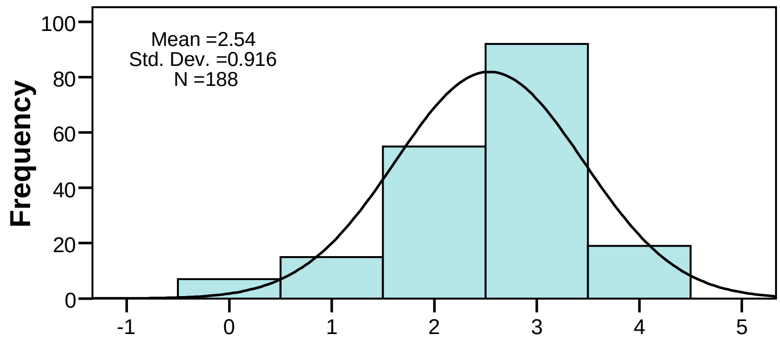
The average rating of aviation general vocabulary (Figure 5-3) was 2.4 with standard deviation of 0.9.

Figure 5-3: Improvement to Aviation (general) Vocabulary



ATC vocabulary average was 2.5 (Figure 5-4) with 0.9 standard deviation.

Figure 5-4: Improvement to ATC (specific) Vocabulary



Standard phraseology also showed similar results with average rating at 2.5 and standard deviation of 0.9 (Figure 5-5). These vocabulary improvements also included some awareness of words with multiple meanings (Figure 5-6), as well as certain standard phraseology that may cause possible misunderstanding (Figure 5-7) in routine ATC operations. These improvements were also perceived as only adequate. Average ratings were 2.5 and standard deviation 0.9.

Figure 5-5: Improvement to Standard Phraseology Vocabulary

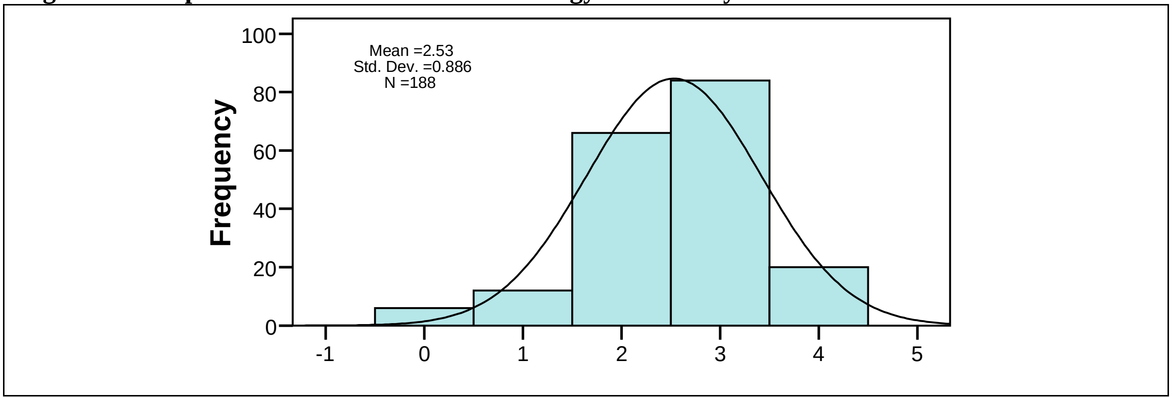


Figure 5-6: Improvement to Multiple Meaning Words Awareness

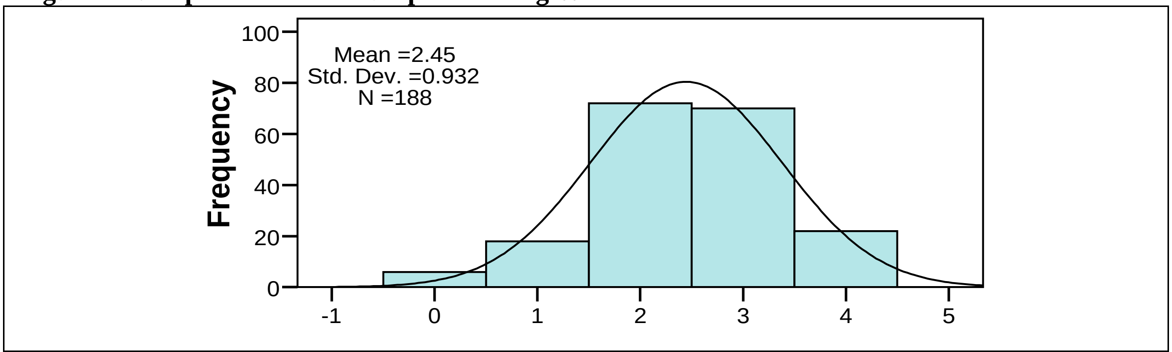
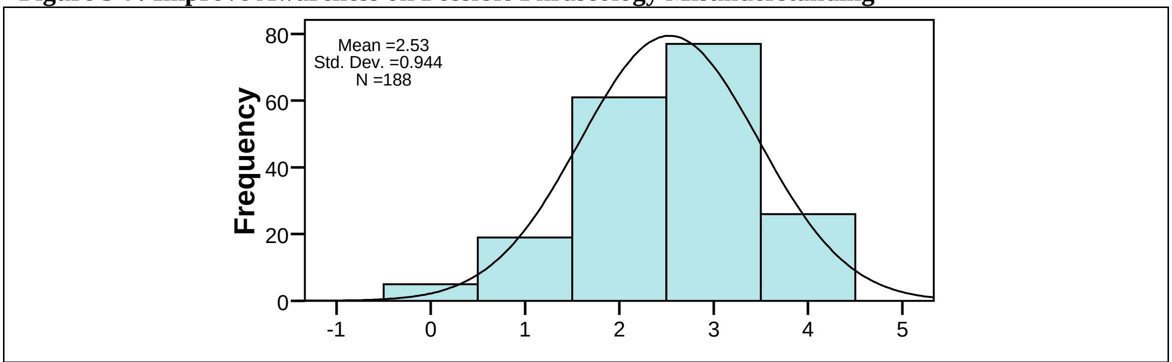


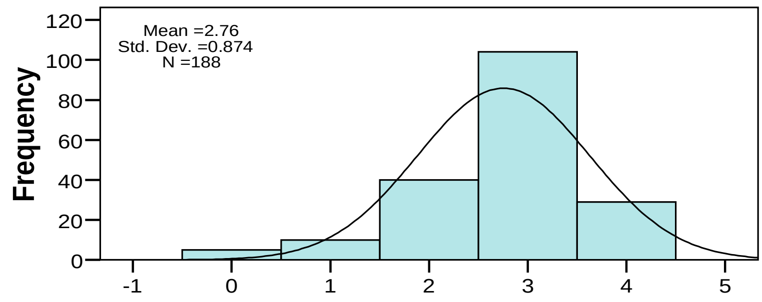
Figure 5-7: Improve Awareness on Possible Phraseology Misunderstanding



5.3.4.2 Practical Use of Language

The training courses were also perceived to be beneficial to practical use of language in routine work. Improvements for standard phraseology usage (Figure 5-8) and pronunciation (Figure 5-9) were much better noted by respondents. This could be contributed to the simulator sessions in which trainees were provided the opportunity to put theory into practise. Similarly, pronunciation improved with increased number of practises and familiarity with phrases and terminology.

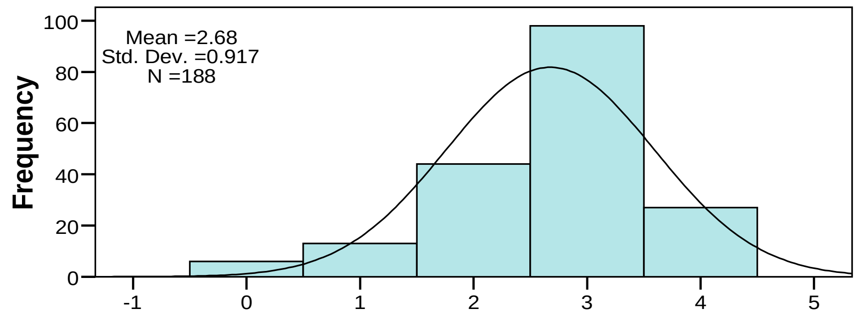
Figure 5-8: Improvement to Standard Phraseology Usage



Standard phraseology usage showed an improvement average rating of 2.8 with standard deviation of 0.9.

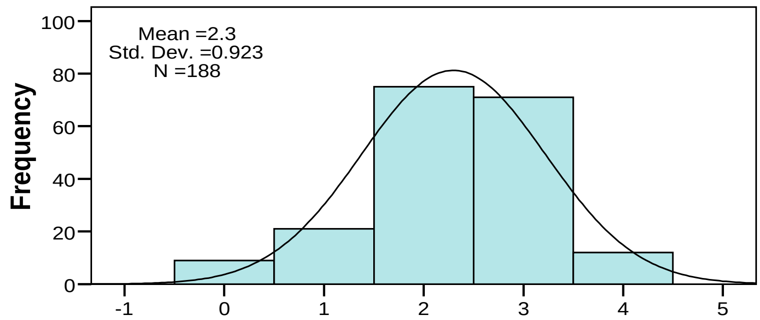
Pronunciation improvement rating was 2.7 with standard deviation of 0.9.

Figure 5-9: Improve on Correct and Clear Pronunciation



Conversational fluency improvements (Figure 5-10) received an average rating of only 2.3 with standard deviation of 0.9. This implied that the ATC related training improved some aspects of ATC operational practises but have less benefit in terms of general conversational context.

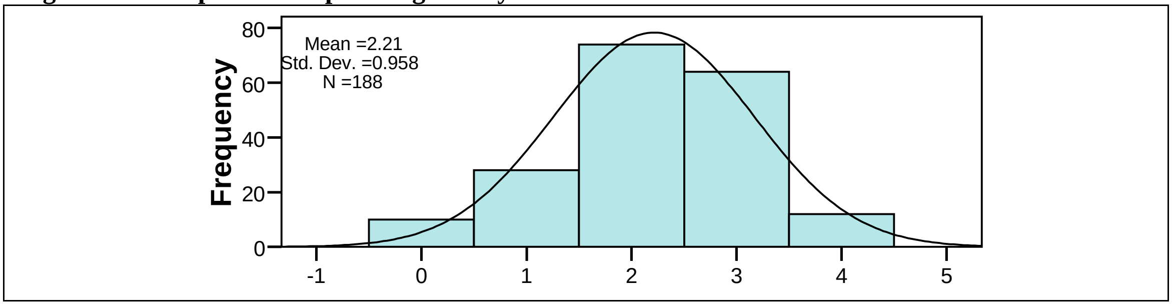
Figure 5-10: Improve Conversational Fluency



The paraphrasing ability improvement (Figure 5 -11) score of only 2.2 also relate to the ability in using plain language to explain or describe, which again, may not be incorporated within the scope of ATC operational exercises.

Controllers presumably learn these skills on the job and through observation of more experienced controllers. Less emphasise on this skill suggested that controllers were left to their own judgement and creativity in handling situations not covered by standard phraseology.

Figure 5-11: Improve Paraphrasing Ability

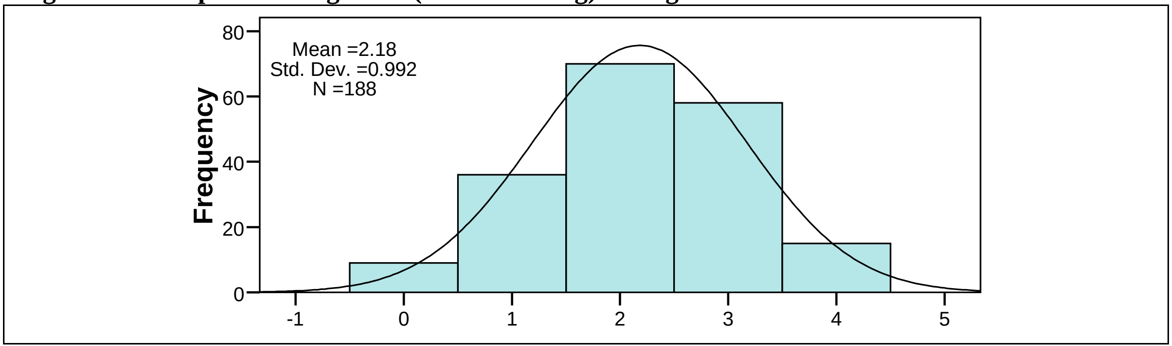


However, the overall combined improvements in practical language usage did contribute to some limited extent, towards better quality ATC communications.

5.3.4.3 Listening and Comprehension

Handling international aircraft in routine ATC operations exposes the controllers to various 'accents' of different nationalities. Not only pronunciations may differ, but also sentences structure and phrases. The improvement on this aspect was perceived as just about adequate, rated at 2.2 (Figure 5-12). This aspect of training could not be realistically put into effect as the roles of pilots in simulated traffic scenarios were played by other controllers. However, recordings of real radiotelephony could expose controllers to what will actually be heard.

Figure 5-12: Improve Recognition (understanding) of English accents

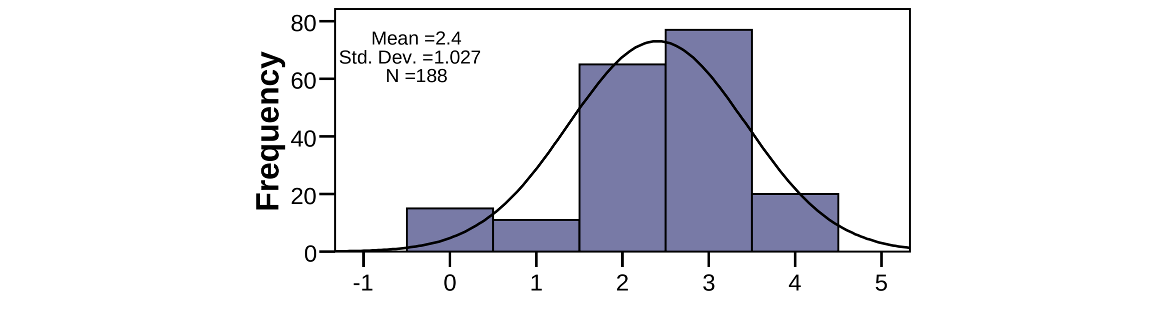


5.3.5 Perception of Training Instructors/Facilitators' Suitability

Efficiency and effectiveness of Instructors and facilitators running training courses contribute to the success or failure of the training objectives. All controllers had undergone some training as part of career development and have an estimation of how satisfactory courses had been conducted. Respondents were requested to rate on a scale of 1 to 4 (poor to excellent) on instructors and facilitators for some relevant aspects of ATC training.

Figure 5-13 show the results for teaching techniques. An average rating of just 2.4 with standard deviation of 1.0 indicated some diversity in techniques.

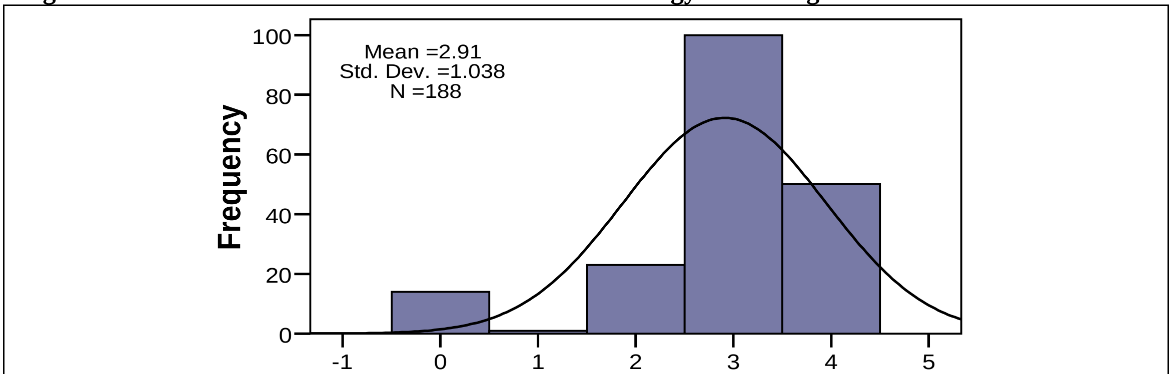
Figure 5-13: Instructors/ Facilitators Teaching Techniques



Respondents generally implied dissatisfaction with instructors' teaching techniques used in ATC courses.

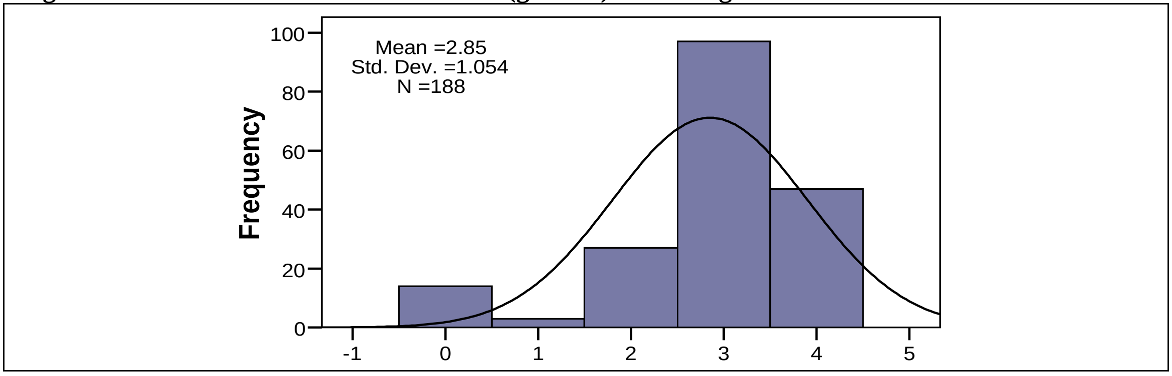
Competent and capable instructors and facilitators are important in the efficient running and success of any training courses. Perception of instructors' standard phraseology knowledge (Figure 5-14) showed a good rating of 2.9, with standard deviation of 1.0.

Figure 5-14: Instructors/ Facilitators Standard Phraseology Knowledge



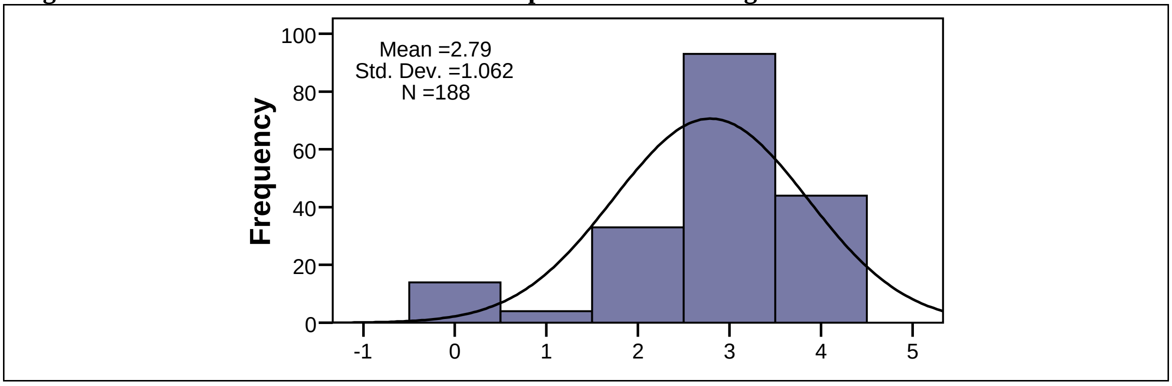
Instructors' general ATC knowledge (Figure 5-15) was also rated 2.9 with standard deviation at 1.1.

Figure 5-15: Instructors/ Facilitators ATC (general) Knowledge



ATC operations knowledge (Figure 5-16) of instructors received a 2.8 rating with standard deviation of 1.0.

Figure 5-16: Instructors/ Facilitators ATC Operations Knowledge



Respondents were generally satisfied that the instructors were suitably qualified and possess relevant knowledge to conduct these relevant training courses.

The results for English Language fluency (Figure 5-17) and the language knowledge itself (Figure 5-18) also showed quite good ratings with averages of 2.7 and 2.8 respectively. Standard deviation for both was 1.0.

Figure 5-17: Instructors/ Facilitators English Language Fluency

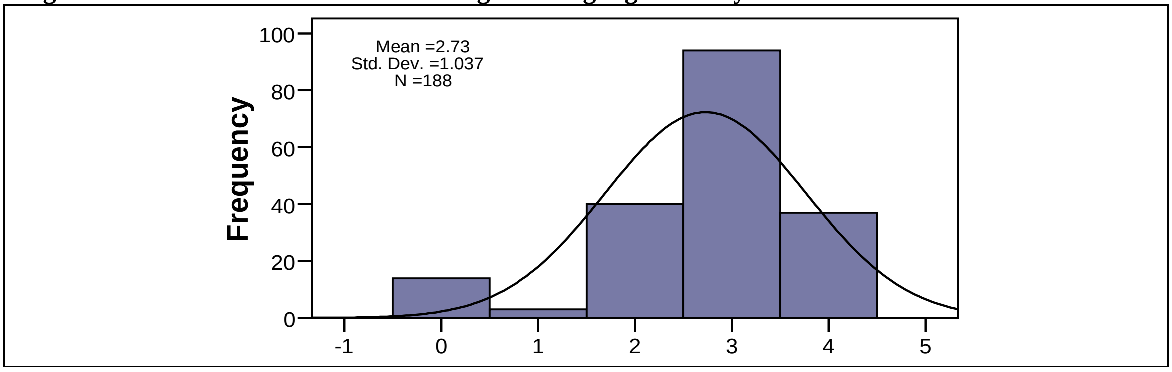
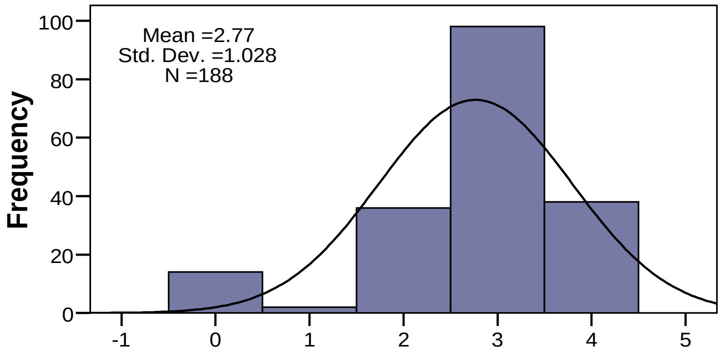
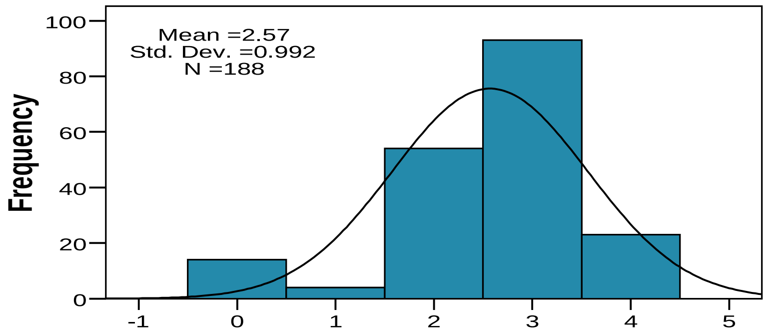


Figure 5-18: Instructors/ Facilitators English Language Knowledge



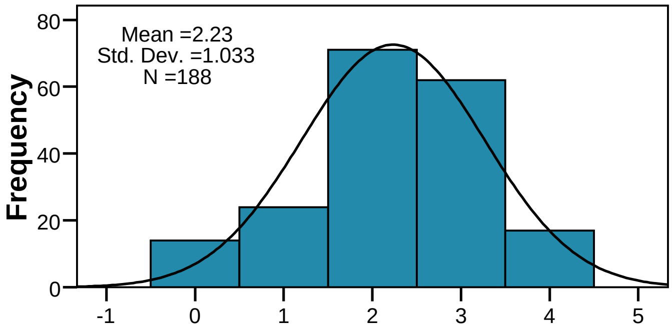
The respondents however, were not as satisfied about time management of training courses as the results show in Figure 5-19. This should be an aspect that needs thought and consideration in planning ATC training courses.

Figure 5-19: Instructors/ Facilitators Time Management



The lowest rating of 2.2 was assigned to usage of teaching aids (Figure -20). This is obviously an aspect to look into. More information is needed on types of teaching aids that will best suit and benefit ATC communication and language training courses.

Figure 5-20: Instructors/ Facilitators Use of Teaching Aids



There should be a balance between theoretical and practical components of the training, making effective use of updated and superior resources that are directly beneficial to trainees. It was noted earlier that computer-based training was not widely incorporated yet. This should be seriously considered as it allows multiple parallel training and more time-efficient. Recording facilities could also benefit as it allows for self monitoring and evaluation.

5.3.6 English Language Proficiency Tests

At the beginning of a controller's carrier, the requirement for English language proficiency is very informal. 'Able to speak and understand' and a passing grade at School Certificate level is sufficient to qualify as a trainee. The controllers were expected to improve their language and standard phraseology knowledge up to the ATC required level through the trainings provided. The respondents were asked to indicate if they have sat for any English Language proficiency exams while in service. The frequency analyses results for TOEFL, IELTS and other tests, including MUET are shown in Tables 5-33 to 5-35.

Table 5-33: IELTS Test Results

		Frequency	Percent	Valid %	Cumulative %
Valid	Not taken test	180	95.7	95.7	95.7
	Level 5.5	1	.5	.5	96.3
	Level 6.0	2	1.1	1.1	97.3
	Level 6.5	1	.5	.5	97.9
	Level 7.0	3	1.6	1.6	99.5
	Level 8.0	1	.5	.5	100.0
	Total	188	100.0	100.0	

Table 5-34: TOEFL Test Results

		Frequency	Percent	Valid %	Cumulative %
Valid	Not taken test	185	98.4	98.4	98.4
	Level 6	1	.5	.5	98.9
	Score 500	1	.5	.5	99.5
	Score 520	1	.5	.5	100.0
	Total	188	100.0	100.0	

Table 5-35: OTR English Proficiency Test Results

		Frequency	Percent	Valid %	Cumulative %
Valid	MUET Level 2	1	.5	.5	.5
	MUET Level 3	1	.5	.5	1.1
	MUET Level 4	1	.5	.5	1.6
	Not taken test	184	97.9	97.9	99.5
	Other test	1	.5	.5	100.0
	Total	188	100.0	100.0	

Very few were found to have sat for an internationally recognised English language proficiency test as these were generally associated with further studies abroad. The MUET result show similarly low count. These results could not be used to conclude on general levels of English language proficiency level. However, based on current evaluation practises, all the licensed controllers are deemed to be proficient to conduct ATC communications and provide ATC services.

Other than the above mentioned tests, the respondents were asked to indicate if a proficiency test was included as part of training programs. Approximately 20% of the controllers indicated that some proficiency evaluation or tests were conducted in Radiotelephony, ATC communication and Standard phraseology training courses attended (Table 5-36). Aviation English show a higher percentage of almost 40% for proficiency test in the training course. The remaining respondents feel that no evaluation was carried out for the training.

Table 5-36: Proficiency Test in Language / ATC training

Proficiency Test in training	Aviation English	ATC Communication	Standard Phraseology	Radiotelephony
No	61.8	83.1	77.9	78.1
Yes	38.2	16.9	22.1	21.9

The English language qualification data was not conclusive. Very few (6%) have sat either the IELTS / TOEFL which are internationally recognised proficiency tests. 2% took the MUET for entry qualification into Malaysian Universities. As a large percentage of university degree / diploma courses are conducted in Malay, academic qualification may not be representative of English proficiency. However, exposures to tertiary education, length of service, management experience and training courses were expected to have an impact to how much and how proficiently English would be used by the controllers. ‘Practice makes perfect’ would be an accurate description of how controllers learn the tricks of the trade. Observation of experienced controllers and through mistakes of oneself or others, assist in developing a familiarity and expertise of the ATC operations. The language competency would be ATC operations specific in terms of vocabulary, speaking and listening skills. Reading and writing skills are less frequently required.

5.4 Phraseology and Language Usage in Radiotelephony

ATC communication requires the use of standard phraseology at all times. However, usage of plain language is expected in circumstances when no standard phraseology suits the situation. In routine ATC however, usage of non-standard phraseology and other language, as well as local terms and jargons are still practised to some extent.

The respondents were requested to provide an approximation of recurrence rate on language related problems that were encountered in routine work. The observed percentages reflected the actuality that the usage of phraseology, plain English and occasional words of other languages in ATC messages were not mutually independent. There were overlapping occasions within some longer messages that standard phraseology was mixed with plain and other language.

Table 5-37 shows the responses on these components as observed by respondents in routine daily ATC communications. On average, standard phraseology usage was observed only 71% of the time. TAR showed best observation for standard phraseology usage. Deviations from standard phraseology usage showed highest in TWR working environment. Overall usage of non-standard phraseology was observed to be about 20%.

Table 5-37: Phraseology and Language Usage in ATC Operations

Mean	WorkPos			
	TAR	ARR	TWR	Total
Standard Phraseology	74.75	66.45	71.07	70.59
Non-standard Phraseology	14.75	17.10	21.34	19.63
Plain English Language	27.50	19.03	30.27	28.19
Other language (not English)	9.75	9.35	17.32	14.79
Local jargon/ terms	10.25	7.74	18.93	15.37

Respondents also observed plain English being used in 28% of transmissions. Plain English phrases were lowest in ARR and highest in TWR. The response for ‘other than English’ and ‘local jargon’ show about 15% overall. These showed highest in TWR and lowest in ARR. If these were associated with courtesies and greetings, the percentages were expected to be lower. Based on voice recordings, it was noted that local ATC-ATC coordination and those with Medan ATC were sometimes carried out in Malay language or a Malay-English mixture, and this had possibly affected the percentages.

Table 5-38 shows the results for modification and adjustment to accommodate comprehension of messages as observed by respondents.

Table 5-38: Modification to Language Usage in ATC Operation

Mean	WorkPos			
	TAR	ARR	TWR	Total
Speech rate (slower)	29.75	33.55	38.48	36.22
Repeat messages upon request	29.25	35.16	34.02	33.62
Intonation / pronunciation 'style'	18.00	24.52	26.79	24.68
Change standard phrases / format	17.00	21.94	27.50	24.63

These include voice intonation, pronunciation, speech rate and repeating keywords for the benefit of the message recipient. Slowing down speech rate and repetition of messages show higher percentages compared to pronunciation or message format. Between the three working environments, TAR showed least modification and adjustments. These showed highest in TWR for speech rate, pronunciation and standard phrases. Repetitions were observed to be used more in ARR. These observations were in line with the earlier percentages on adherence to standard phraseology in messages.

5.4.1 Readback and Verification

The respondents' observation on pilots' readback performances are shown in Table 5-39. Generally, ATC was perceived to get complete readbacks for only about 70% of messages. Partial readbacks were estimated at 35%. It was also noted that about 20% of readback (complete or partial) may contain incorrect key information. No readback were received for about 15% of messages.

Table 5-39: Pilots' Readback Performance

Mean	WorkPos			
	TAR	ARR	TWR	Total
Complete readback of messages	74.00	65.48	69.29	69.36
Partial readback of messages	32.25	32.58	37.14	35.32
Contain incorrect key information	14.13	19.68	21.25	19.76
No readback of key information	9.38	16.77	15.36	14.71

Comparison between ATC environments showed that readback received in TAR was better. It showed highest percentage of complete readbacks and lowest for partials, incorrect information and none readback.

The analyses of Pilots' request for repetitions and verifications of certain key information are presented in Table 5-40. Whole message and authorized level were items most requested to be repeated / verified followed by time restrictions, assigned headings and speed control. The least requests were observed in TAR environment for each item listed. The ARR showed highest request to repeat messages and verify levels, time restrictions, headings and speed. Altimeter setting, traffic sequence and taxy route showed highest in TWR. These were observations made by controllers and may be inaccurate, but it did imply that some messages were not successfully transmitted and understood on the first transmission.

Table 5-40: Pilots' Request for Verification or Repetition

Mean	WorkPos			
	TAR	ARR	TWR	Total
Whole message	15.75	25.48	21.70	21.17
Authorised Level	16.25	27.42	20.00	21.01
Time restrictions	11.50	24.52	16.07	16.81
Assigned Heading	13.00	23.23	14.91	16.06
Speed restrictions	12.25	24.84	11.79	15.11
Altimeter setting	11.00	13.23	14.64	14.36
Traffic sequence	5.68	12.90	13.30	11.73
Taxy route	7.03	8.39	13.75	11.51

5.4.2 Safety Occurrences

The final query in the questionnaire was on respondents' experiences of safety occurrences related to language usage. Table 5-41, shows number of misunderstanding/ miscommunications attributed to listed factors. Technical difficulty which was not language related was also noted to have caused unsuccessful relay of information. Message or part thereof may have been distorted or lost, causing misunderstanding, guess work or the request for repetition. The overall averages did not show significant differences. Between one or two occurrences were observed for each factor.

Table 5-41: Occurence of Misunderstanding / Miscommunication in last 3 months

Mean	WorkPos			
	TAR	ARR	TWR	Total
Technical difficulties	1.15	1.26	1.97	1.69
Unclear pronunciation	1.03	1.10	1.94	1.59
Poor level of English	1.03	1.03	1.81	1.50
Use non-standard phraseology	.93	1.06	1.83	1.49
Use plain English	.95	1.03	1.75	1.45
Non-verify unclear instruction	1.00	.97	1.67	1.40
Non-verify unclear information	1.00	.90	1.69	1.40

However, the observations for individual environment showed slight differences. Observations pointed to more occurrences in TWR compared to TAR and ARR. TAR showed slightly less occurrences associated with technical, pronunciation, level of English, non-standard phraseology and plain English. ARR showed lower observations for non-verification of unclear instructions and information.

Table 5-42 shows the outcome observed due to misunderstandings and miscommunications which were associated with language factors. Generally, the frequencies were low. Increased ATC workload and communications taskload were observed more frequently.

Table 5-42: Outcome of Misunderstanding / Miscommunication in last 3 months

Mean	WorkPos			
	TAR	ARR	TWR	Total
Increased ATC workload	2.00	4.52	2.40	2.66
Increased communications taskload	2.15	4.55	2.21	2.64
Loss of situational awareness	.95	1.90	.98	1.14
Loss of standard separation	.58	1.00	.60	.64
Other safety related occurrences	.40	1.10	.60	.62
Aircraft proximity	.48	1.00	.50	.56
Runway incursion	.40	.55	.35	.38

Between the three ATC environments, ARR showed more outcomes related to language problems. Observations for TAR show slightly better situation compared to TWR.

5.5 Chapter Summary

The responses from the questionnaire enabled some information to be extracted and illustrated the situation. This information may not be absolutely conclusive but may complement other information obtained from the same or similar sources.

The responses showed that the controllers were appropriately trained to carry out ATC operations services which must be tendered in a language which is not their mother tongue. This language, through necessity or choice, had become the most dominant language for about 40% of these controllers. This group consisted mostly of older controllers (late forties and above fifties), of secondary level education, of Indian or Chinese ethnic, were stationed at the ACC and were TAR controllers. These controllers were the product of an education system when English was the medium of communication. Younger controllers that used English most frequently were those who received tertiary level education abroad.

Half of the controllers also named English as the second most frequent language used. Although not many had sat a TOEFL or IELTS for rating of English proficiency, they were deemed to be suitably proficient through evaluations in training courses, ATC rating examination or by academic qualification. The questionnaire responses were not adequate to evaluate or approximate if these controllers were suitably proficient as per ICAO language proficiency guidelines. The holistic descriptions could not be self-appraised but should be evaluated by a certified rater.

The respondents' observations pointed to particular items that need to be given due consideration in ATC communication and language related training, such as,

i. suitability of instructors in terms of knowledge, qualification and relevant operational experience,
ii. teaching aids and resources that could optimise the improvements to trainees capability and knowledge,
iii. computer aided training format, and
iv. efficient time management.

The questionnaire responses had provided some details about the people in the ATC system in Malaysia. It also included some specific self observation of experiences and conduct in real time radiotelephony. Misunderstandings and unsafe outcomes had been observed and experienced, but mitigation had also taken place, preventing further risks to flight safety. What could not be ascertained from these responses was the actual count of occurrences that had digressed into a safety occurrence. Certain facts and figures could only be confirmed by official statistics. In the next chapter, actual radiotelephony characteristics from these respondents' ATC environments will be discussed.

6 ATC RADIOTELEPHONY ANALYSES

The analyses of transcribed and coded radiotelephony data had discovered facts and figures that characterise the samples collected. These data consisted of Terminal Approach Radar (TAR), Area Radar (ARR) and Tower (TWR) data which were analysed separately for comparison. In total, 189 radiotelephony samples totalling to 4450 minutes and containing about 20,000 controller-pilot messages were analysed. The analyses results were overwhelmingly profuse and as practical as possible, these will be combined for clarity and ease of comparison. Section 6.1 explains the flow of results presentation, grouped by similar variables as used in the data coding. The numbers in brackets are the corresponding sections where the items are discussed.

6.1 Analyses Variables

The general characteristics of ATC radiotelephony (6.2) are discussed by these factors:

i. Aircraft movements and patterns (6.2.1),
ii. Transmission occupancy (6.2.2),
iii. Words and numerals usage (6.2.3),
iv. Speech rate (6.2.4), and
v. Speech Acts and Aviation Topics (Elements) usage (6.2.5).

The aspects that were analysed to identify adherence to standard ATC practices, discrepancies and errors in the radiotelephony were:

vi. Callsign usage by pilots and controllers (6.3),
vii. Issuance of ATC instructions (6.4), and
viii. Pilots' readback of instructions (6.5).

In association with sections 6.4 and 6.5, the following instructions were selected for analyses:

Altitude assignments

Altitude restrictions

Approach clearance

Communications transfer

Heading

Holding

Landing clearance

Route / position

Speed control

Transponder code assignments

Takeoff clearance

Altimeter setting

Errors analyses (6.6) in the radiotelephony were examined for;

ix. callsign miscommunications (6.6.1),

x. Pilots' readback of ATC instructions (6.6.2) and

xi. ATC hearback errors (6.6.3).

Other discrepancies (6.7) examined included the following;

xii. Pilots' initial contact messages' contents (6.7.1),

xiii. Advisory of pertinent traffic information (6.7.2),

xiv. Excess Verbiage (6.7.3) and

xv. Disfluencies (6.7.4).

Evidence of verification and safety net (6.8) in the radiotelephony were analysed through;

xvi. ATC correction of pilots' readback errors (6.8.1),

xvii. Verification requests (6.8.2), and

xviii. Requests for message repeats (6.8.3).

The analyses for TAR, ARR and TWR were carried out separately to compare the characteristics between the three ATC environments. The Statistical Package for the Social Sciences (SPSS) software had been used to analyse the coded data. The presentation of the numerous summarised SPSS tables will use colour coding highlights for easier references of the relevant results discussed. TAR will be highlighted in 'peach', ARR in 'pale blue' and TWR in 'lime'. Other general purpose highlight will use Light Yellow or **bold font**.

6.2 General Characteristics of ATC Radiotelephony

This section describes the fundamental aspects of the radiotelephony and shows the differences between the ATC environments.

6.2.1 Aircraft Movements and Patterns

Aircraft movements' pattern differs from one ATC environment to another. Tower traffic movements relates to the usage of parking bays, taxiways and runways. Some aerodrome may also include circuit traffic. Approach radar controller's contact with aircraft is either at the beginning or end phase of the actual flight constrained by limited and busy airspaces. Area radar control generally deals with en-route phase of flight operations, over larger airspace and longer distances than approach radar. These differences in flight operations require different numbers and types of messages exchange between pilots and controllers.

This research's data allows an analyses of traffic patterns in terms of number of aircraft handled, the duration that each aircraft remained 'in contact' with the controller and the number of messages exchanged per aircraft. Table 6-1 show averages for the number of controlled aircraft per 30 minutes, messages per aircraft and contact time per aircraft. The approach radar was found to handle an average of 13 aircraft per thirty minutes, slightly lower than the average for Area radar, which were 14. Tower had the lowest average of only 11 aircraft per thirty minutes.

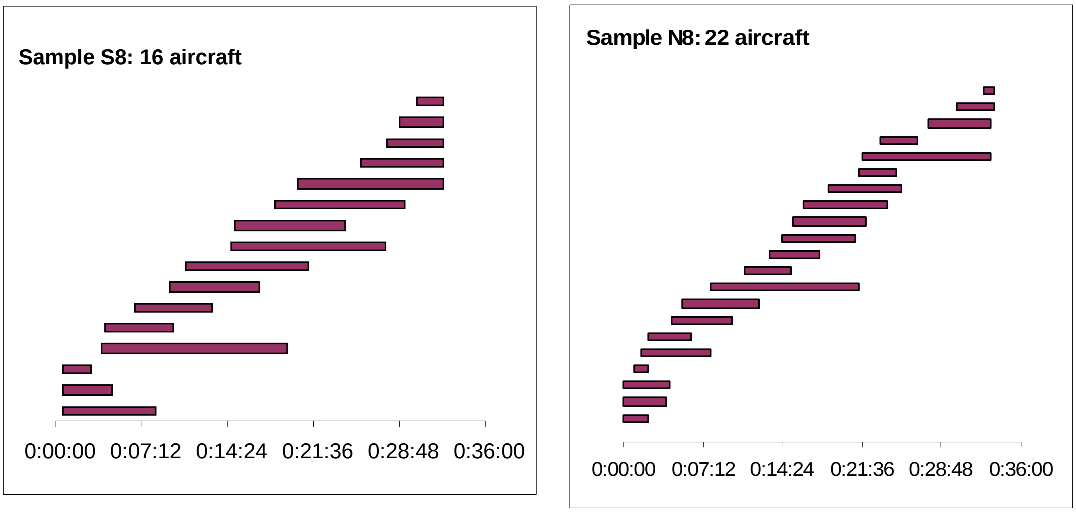
Table 6-1: Average Traffic, Messages and Contact Times

Average	TAR	ARR	TWR
Aircraft per 30 min.	13	14	11
Messages per aircraft	13	10	11
Contact time per aircraft	6.5 minutes	11 minutes	7 minutes

However, approach radar exchanged more messages per aircraft than area radar and aerodrome. What the results pointed out was the need for more communications per aircraft in approach radar environment and these communications were bundled into smaller time frames when the aircraft were in contact.

The following Figures 6-1 to 6-3 are examples of traffic pattern for various radiotelephony samples. Other sets of traffic details are included in Appendix J for TAR, Appendix K for ARR and Appendix L for TWR. Each bar represents an aircraft's in-contact duration, starting at the time communication was established until the time it was transferred to another frequency.

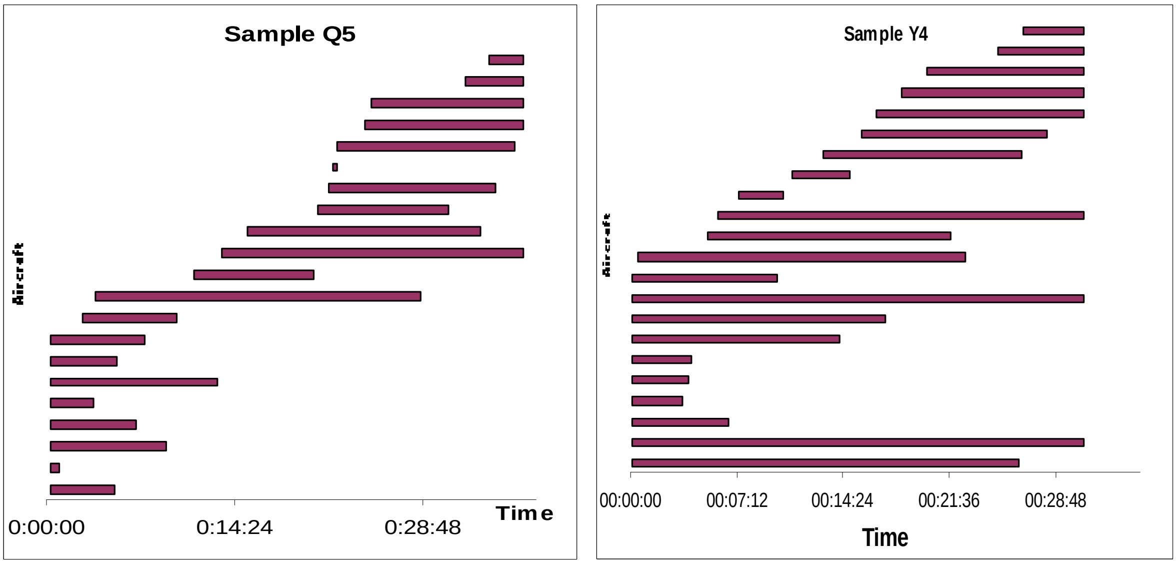
Figure 6-1: Traffic Pattern – Terminal Approach Radar



TAR aircraft's in-contact bars were shorter (Figure 6-1), but it must be appreciated that more communication took place along each of these bars. At any one time, as many as 5 aircraft may be on the frequency. Sample S8 was of arrival traffic into KLIA and sample N8 was departures. A slight difference could be spotted between average lengths of bars in the samples. Arrival aircraft were retained by the TAR controller longer than departures to ensure a safe arrival sequence and standard separation. The departures needed only to be positioned onto the airways and transferred to ARR and usually took a shorter time to sort.

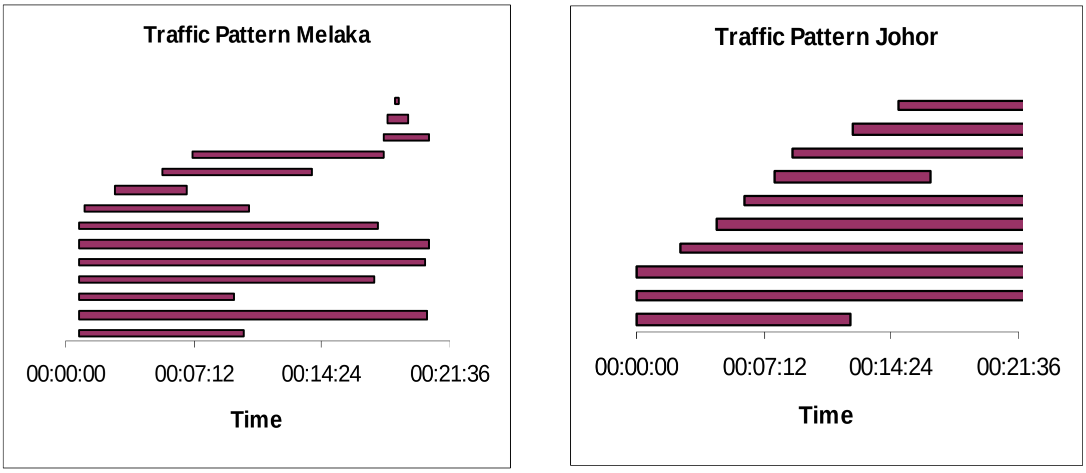
ARR's contact with each aircraft was for a longer duration as reflected by the longer bars (Figure 6-2). The number of aircraft handled simultaneously could be as many as 10, but fewer messages needed to be exchanged with each aircraft. This implied less urgency for radiotelephony in ARR environment. Changes in aircraft disposition were less frequent compared to TAR and TWR. In the ARR environment aircraft climbs to its cruising level and fly along its intended route. Domestic flights may later need to start the descend phase, but long haul flights will progress to the next ATC sector unchanged.

Figure 6-2: Traffic Pattern - Area Radar



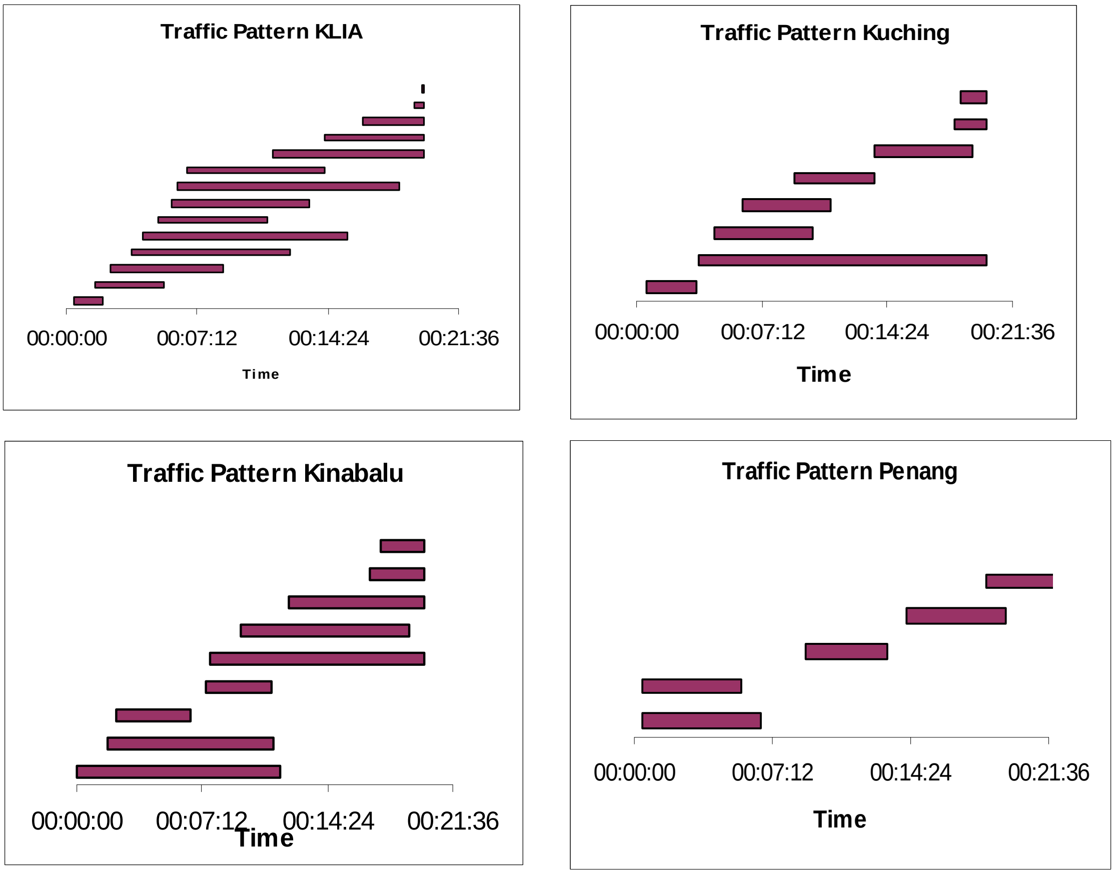
The aerodrome environment showed some varieties in traffic pattern between localities (Figure 6-3). Melaka which primarily handled training traffic showed longer bars that reflected on longer duration of circuit training. Similar pattern could also be seen in Johor where scheduled traffic has shorter bars and training aircraft longer.

Figure 6-3: Traffic Pattern – Melaka and Johor



The other four aerodromes (Figure 6-4) handled predominantly scheduled traffic. Bars were shorter, and have lesser amount of overlaps between ‘in-contact’ duration. Penang’s pattern reflected the least complicated environment where the controller seemingly handled only one or two aircraft at any one time.

Figure 6-4: Traffic Pattern – KLIA, Kuching, Kinabalu and Penang



The examples above illustrated an idea of how demanding the controller-pilot communications could be in any of these ATC environments.

6.2.2 Message's Transmissions Occupancy and Density

Controllers and pilots only communicated when required. There were lapses when no transmission took place but the aircraft remained under the authority of the controller. In the data processing and coding, the time taken to transmit each message and the lapses between transmissions were noted. This information was used to compute the actual portion of time that was occupied in controller-pilot verbal communication as well as speech rate. The tabulated data however did not include the amount of time spent on landline communications with other ATC units.

Transmission occupancy refers to the percentage of total time that exchanges of messages took place between controllers and pilots. The data collected showed different percentages of transmission occupancies (refer Table 6-2) between ATC facilities. The TAR environment had the highest average of transmission occupancy, with messages being transmitted 32% of the time.

Table 6-2: Actual percentage of Transmission Occupancy and Lapses

Station	Recorded Minutes	Transmission Occupancy %
TAR	900	32.3
ARR (Sector Y)	390	30.6
ARR (Sector R)	410	
ARR (Sector Q)	420	
Penang TWR	220	17.9
KLIA TWR	730	26.3
Melaka TWR	190	**43.4** (average 27%)
Johor TWR	250	34.9
Kuching TWR	380	21.04
Kinabalu TWR	560	21.4

The percentage was lower in ARR environment, with an average of 30% and lowest in TWR with transmissions occupying only 27% of the time. However, individual observation for Melaka showed that transmission took place 43% of the time, even higher than approach radar's. Penang actually had the lowest transmission occupancy of only 18%.

Based on the number of messages exchanged within each recorded radiotelephony, an average number of 'transmissions per minute' was computed. These averages are shown in Table 6-3.

Table 6-3: Average Transmissions per minute

Environment	Recorded Minutes	Total Messages	Messages per minute
TAR	900	4928	5.5
ARR	1220	5752	4.7
TWR	2337	9785	4.1

The terminal approach radar environment was found to transmit the most number of messages per minute. On a larger time scale, for example twenty minutes duration, approach radar control on average will have 110 transmissions between pilot and controller while area radar has 100 and aerodrome only 80.

6.2.3 Words and Numerals Usage in Messages

The text transcribed from radiotelephony audio was analysed for words and numerals usage. 'Numerals' include the numbers and words associated with number usage such as thousand, decimal, point, first, second and hundred. The total words usage in each ATC unit is shown in Table 6-4. These amounts however, could not be directly compared as the total usage times were different. The words per minute averages were computed for this purpose.

Table 6-4: Total Time Recorded, Words and Numerals Usage

Station	Time	Total Words	Words / minute	% Numerals
TAR	900	51242	57	56.4
ARR (Sector Y)	390	18557	48	50.6
ARR (Sector R)	410	15460	38	
ARR (Sector Q)	420	24050	57	47.9
Pulau Pinang	220	6443	29	32.5
KLIA	730	35327	48	46.65
Melaka	190	14949	79	43.4
Johor Bahru	250	15946	64	45.08
Kuching	380	12953	34	
Kota Kinabalu	560	18887	34	42.9

The two highest usages were shown for Melaka and Johor. These had raised the TWR average to 48 instead of 36 words per minute if these were not included. ARR average was 47 words per minute. The flying training activities handled by Melaka and Johor had increased the radiotelephony word usage. Generally, the TAR environment used more words per minute than the other ATC environments.

A descriptive analysis of word usage is shown in Table 6-5.

Table 6-5: Descriptive Statistics of Total Word Usage in Messages

Statistics	*TAR*	*ARR*	*TWR*
Mean	10.82	9.66	11.00
Mode	9.00	10.00	9.00
Standard Deviation	5.19	5.21	6.15
Maximum	39	38	47

Per message, the average number of words used did not show significant difference between ATC environments. TAR and TWR averaged 11 words per message and ARR 10 words. The Mode in TAR and TWR was 9, indicating that messages containing 9 words occurred most frequently in these two environments. The mode for ARR is 10 words.

The longest message containing 47 words was transmitted by Johor Tower, advising of weather deterioration and the latest tower observation,

> *"Academy Four Two Three Report Again Benut Maintain Two Thousand QNH One Zero One Zero and advise weather building up everywhere weather building up everywhere visibility from tower observation runway..er…runway One Six at er…Seven thousand meters and raining…raining western and eastern side of the airport"*

In comparison, the longest Approach Radar message contained 39 words consisted more of instructions than advisories;

> *"Asian Express Nine Five Three Good Afternoon route via Melaka for spacing descend altitude Seven thousand feet runway Three Two Left on the Q-N-H One Zero One One after Melaka track direct for fifteen miles finals Three Two Left".*

Area Radar's longest message contained 38 words which included a correction of standard arrival instruction;

> *"Malaysian One Six Two Five identified climb flight level One Five Zero direct DAKUS for sequencing Lumpur LAPIR Two arrival runway Three Two left Melaka transition… Lumpur SASRI Two arrival runway Three Two Left BATU ARANG alfa transition"*

Frequency analyses of messages' lengths produced the results in Table 6-6. The averages were similar, TAR and TWR was 11 while ARR was 10.

Table 6-6: Frequency Analyses Results of Messages Length

Message Length (words)	TAR	ARR	TWR
Average	11	10	11
		% of messages	
1 – 5	12	21	18
6 – 11	50	41	42
12 – 22	35	34	34
> 22	3	4	6

Using the averages, the percentages of half-average, about average and twice-average or more had been computed. Generally about 40% of messages were more than 12 words in length and only about 4% contain more than 20 words. Messages which contain up to the average number of words were also of similar percentage (about 60%) across the three environments. This showed no obvious difference between distributions of message lengths in the three ATC environments.

As shown in Table 6-4 earlier, the average percentage of numerals usage was highest in approach radar (56%) and lowest in aerodrome (42%), implying the regularity of numbers usage in ATC radiotelephony. Numbers are supposed to be pronounced unambiguously with the correct units of measurements to avoid confusion. The importance of numerals in ATC messages is highlighted by the fact that its usage is as frequent as non-numerals. The glossary of words that falls into the numerals category is limited, but the percentage of usage is comparatively similar. A descriptive analysis of numerals usage produced the results in Table 6-7.

Table 6-7: Descriptive Statistics of Numerals Usage in Messages

Statistics	***TAR***	***ARR***	***TWR***
Mean	6	5	5
Median	6	5	4
Mode	6	3	4
Standard Deviation	3	3	3
Range	17	18	23
Minimum	0	0	0
Maximum	17	18	23

The highest average per message was in TAR environment with 6 numerals. ARR and TWR showed similar averages of 5 numerals. Generally, longer messages contained more numerals. The message with the highest numerals recorded was in TWR sample J9, in which 23 out of 35 words were numerals. It was a pilot’s readback of ATC airways clearance with additional information of total people on board and fuel endurance.

*“Cleared to Penang Whiskey **Five Three Four** Alfa **Four Six Four** Flight Level **Three Four Zero** Transponder **Two Six One Three** we have **One One Eight** Endurance **Zero Three Three Zero** Express **Six Three Zero**”*

The message contained seven items of information in which numerals were used. Long messages with lots of numbers such as these need careful notation by the recipient to ensure accuracy, clarity and purpose. It is important that each number is pronounced clearly at a slower rate to allow the writing process.

6.2.4 Speech Rate

Speech Rate is the average words per minute spoken by controllers/ pilots, computed using the total words and transmission occupancy information. Table 6-8 shows average speech rates for each workstation recorded. Based on these information, the approach radar and aerodrome environment have similar average speech rate of about 175 words per minute. In the area radar environment, speech rate was about 155 words per minute. However, these figures are still in excess of ICAO's recommended speech rate of 100 words per minute. Between the aerodromes, KLIA, Melaka and Johor Bahru showed similarly high speech rates of about 180 words per minute. Pulau Pinang, Kuching and Kota Kinabalu's rates were much lower, at about 160. The high speech rate computed were connected to 'busier' ATC operations and the many information types that needed to be transmitted in one message.

Table 6-8 : Computed Average Speech Rate (words per minute)

Station	Total Words Used	Words per minute
Approach Radar	51242	176
Area Radar S1	18557	155
Area Radar S2	15460	
Area Radar S3	24050	
Pulau Pinang	6443	161
KLIA	35327	**184**
Melaka	14949	**181**
Johor Bahru	15946	**183**
Kuching	12953	162
Kota Kinabalu	18887	158

6.2.5 Speech Acts and Aviation Topics (Elements)

The Table 6-9 show the total elements and percentages by speech act type contained in each work station and ATC environments' radiotelephony. TAR used approximately 14 elements per minute of communication, while ARR 12 and TWR 11 elements. The elements associated with identification of speakers and recipients showed percentages of around 40% of total. There were a higher percentage of instruction elements in Approach Radar environment indicating more assertive control of aircraft movements. Instructions percentages were lower in Tower and Area Radar. ARR environment was less time-critical and fewer instructions were needed to manage aircraft movements.

Table 6-9 Total Elements and Speech Acts Percentages

Station	Total Elements	Percentages by Speech Act Type				
		Ident	Instruction	Advisory	Request	Courtesy
TAR (900 mins)	**12651**	**37.7**	**36.5**	**14.8**	**3.3**	**7.3**
ARR (1220 mins)	**14546**	**40.7**	**27.3**	**15.8**	**6.6**	**9.1**
ARR1	*4546*	*40.8*	*25.3*	*15.8*	*7.8*	*8.8*
ARR2	*3700*	*39.6*	*28.7*	*16.2*	*6.3*	*9.3*
ARR3	*6300*	*41.8*	*27.9*	*15.5*	*5.6*	*9.1*
Tower (2330 mins)	**25616**	**38.3**	**33.4**	**17.2**	**4.4**	**6.1**
Pulau Pinang	*1517*	*40.1*	*32.4*	*16.7*	*4.2*	*5.7*
KLIA	*8156*	*36.2*	*35.7*	*13.7*	*2.7*	***11.3***
Melaka	*4047*	*39.2*	*30.4*	***23.2***	*5.1*	*1.5*
Johor Bahru	*3993*	*37.3*	*29.5*	***21.2***	*9.0*	*2.6*
Kuching	*3175*	*38.7*	*35.8*	*14.5*	*3.0*	*7.6*
Kota Kinabalu	*4728*	*38.4*	*36.8*	*14.1*	*2.6*	*7.8*

Advisories were highest in Tower (17.2%), but not significantly lower in other environments. This could be associated with apportioning of safety responsibilities to the pilots by advisory of pertinent impending conflict especially in visual circuit and tower operations. It is observed from the results that advisories were significantly higher in Johor Bahru and Melaka ATC radiotelephony, while Courtesies showed similar results in KLIA. Johor and Melaka on the other hand showed very low percentages for courtesy, suggesting urgency in the delivery of messages with less inclination towards greetings. ARR had the highest percentages for Requests (6.6%) and Courtesy (9.1%). The percentages for TAR were generally in agreement with Prinzo's (1996) results which found 37% Addresses, 35.5% Instructions, 16% Advisory, 5% Courtesy and 2% Requests.

The Table 6-10 show the frequency analyses of number of elements per transmitted message. In all three ATC environments between 80 to 84% of messages contained 2 to 4 elements. These percentages could be translated into probabilistic expectations. For example, in the TAR environment, any message transmitted will have a 50% chance of containing only two elements in it. On the other hand, the likelihood of a message containing 7 elements is only 0.5%. The chances of finding 2 to 4 elements messages was 84% in TAR and about similar in ARR and TWR.

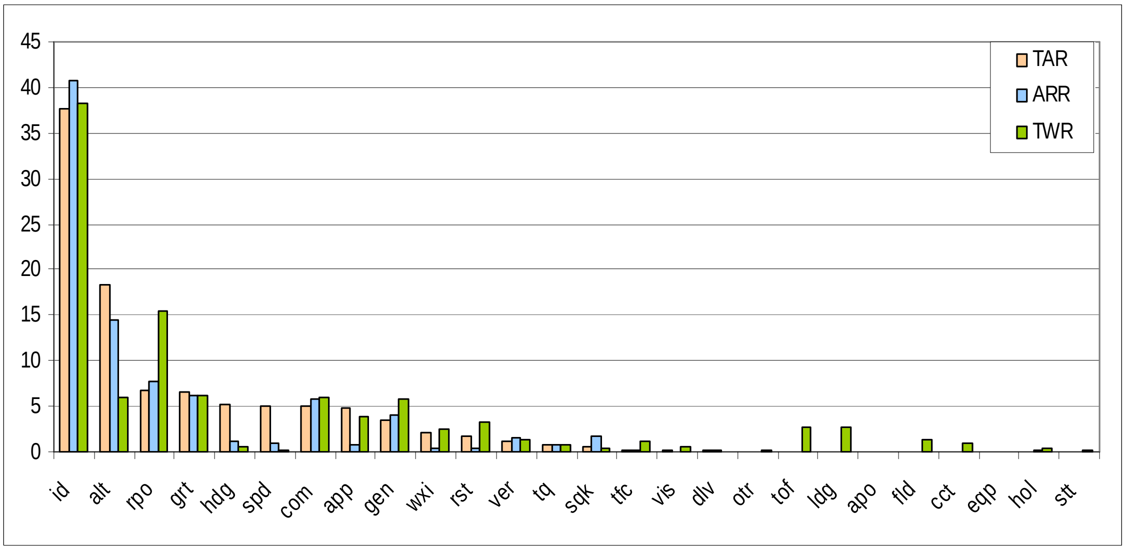
Table 6-10: Instructions and Advisory Elements in TAR Messages

Number of elements in message		TAR	ARR	TWR
Valid	1	9.4	13.5	12.0
	2	50.6	47.9	44.5
	3	23.4	25.8	24.9
	4	10.1	9.0	10.4
	5	4.2	3.2	5.3
	6	1.9	.5	2.4
	7	.5	.0	.6
	8	.0	0	.1
	Total	100.0	100.0	100.0

It was also noted that there was a higher probability of finding single element messages in ARR environment compared to TAR or TWR. Single element messages were usually greetings or general acknowledgements. As more messages contained multiple elements, it was inappropriate to evaluate adherence to standards per whole message. Further discussion on the characteristics of radiotelephony in this thesis will refer to the elements as coded in the database. Comparison will be based on percentages of elements associated with specific speech acts or topics such as identification, instructions or advisory.

Not all elements were used equally frequently. The Figure 6-5 shows a diagrammatic comparison of aviation topics usage between environments.

Figure 6-5: Aviation Topics Usage in ATC Environments



There appeared to be a pattern which conforms to Zipf's Law which suggested that the second most used word (element) was only half as frequent as the most used word while the third most used will be one third as frequent. The comparison of proportions may not be as accurate but there was significant inconsistency between usages of different elements. Table 6-11 show the percentages of each aviation topic usage in each ATC environment.

Table 6-11: Percentages of Aviation Topics Usage in ATC Environments

Aviation Topic	Code	Percentage		
		TAR	ARR	TWR
altitude / level	alt	**18.3**	14.6	6.0
approach	app	**4.9**	0.8	3.9
circuit	cct	0.0	0.0	1.0
communications	com	5.0	5.8	**5.9**
flight details	fld	0.0	0.0	**1.3**
general	gen	3.5	4.0	**5.8**
heading	hdg	**5.2**	1.2	0.6
holding	hol	0.0	0.2	**0.3**
landing	ldg	0.0	0.0	**2.7**
repeat/ verify	**ver**	1.1	1.5	1.3
restriction	rst	1.7	0.4	**3.2**
route / position	rpo	6.8	7.8	**15.5**
speed	spd	**5.0**	1.0	0.2
start	stt	0.0	0.0	**0.2**
takeoff	tof	0.0	0.0	**2.6**
traffic	**tfc**	0.2	0.1	1.1
transponder	sqk	0.6	**1.8**	0.3
visual / sighting	vis	0.1	0.0	**0.5**
weather info	wxi	2.2	0.4	**2.4**
Apology	**apo**	0.0	0.0	0.0
Greetings	**grt**	6.6	6.2	6.3
Thank you	**tq**	0.8	0.7	0.7
delivery	dlv	0.1	**0.3**	0.1
equipment	**eqp**	0.0	0.0	0.0
other	**otr**	0.1	0.1	0.2

Percentages which are highlighted, such as 18.3 for altitude/ level, were the highest amongst the three ATC environments. However, certain topics such as greetings and traffic showed similar usage across all environments. These topics are also highlighted. The three highly used topics in all environments were altitude, route/ position and greetings. Among the less popular topics were holding, apologies and equipment. These percentages indicated the topics that need to be emphasised in ATC training, as well as those that need to be lessened in usage, such as greetings and general acknowledgements which could not represent a correct readback or understanding of information.

6.3 Callsign Usage

Analyses of callsign usage were carried out separately for ATC and pilots' usage, as well as for each ATC environment. Confusion arising from non-standard usage of callsign had been noted as contributory to safety occurrences. This analysis proved how much the controllers adhered to or deviated from the standard practices.

6.3.1 ATC Usage of Callsigns

On average (TAR, ARR and TWR combined), 16.4% of elements used were associated with ATC usage of callsigns (identification). Complete and correct use of callsigns was noted in 71% of elements in TAR, 69% in ARR and 65% in TWR (Table 6-12). This suggests that TAR controllers adhered more to standard practices for callsign usage compared to ARR and TWR controllers

Table 6-12: ATC Usage of Callsigns in ATC Radiotelephony

Messages		**TAR** N=2131, 16.8%	**ARR** N=2284, 15.7%	**TWR** N=4260, 16.6%
Valid	Complete, correct	71.1	69.0	64.7
	Partial	9.6	9.8	19.0
	Omitted	7.0	6.8	6.1
	Numbers transposition	0	.0	.0
	Number substitution	0	.2	.1
	Complete + **pronunciation**	10.3	12.8	8.7
	Partial + transposition	.0	0	0
	Partial + substitution	.1	.1	.0
	Partial + **pronunciation**	1.8	1.2	1.3
	Total	100.0	100.0	100.0
	Total Elements	12651	14546	25616

The remaining elements contained some type of errors. Usage of partial callsigns (truncated and unapproved abbreviation) showed highest in TWR. Pronunciation discrepancies were also commonly found, with a highest of 14% in ARR. In 6.6% of messages callsign were totally omitted. These results indicated that 3 out of 10 identification elements (30%) used by ATC will contain some sort of callsign error. Taking into consideration the recording time, this percentage translated into 42 errors per hour of communications. In terms of identification elements usage, about 1 in 10 will have pronunciation discrepancy, 3 in 1000 a substitution error and 7 in 100 without any callsign used.

6.3.2 Pilots' Usage of Callsigns

About 20.3% of elements in TAR environment were associated with pilots use of callsigns, while in ARR were 18.5% and in TWR 19.4%. Of these elements, about 70% were used complete and correct. Pilots' adherence to standard practices showed similar to ATC with possibility of 42 errors per hour of communications. Truncated and incorrect callsign abbreviations were highest of 13% in TWR and omissions of callsign were highest of 10% in ARR. Pronunciation discrepancies showed highest of 12% in TAR, but also similarly common in ARR and TWR.

Table 6-13: Pilots' Usage of Callsign in ATC Radiotelephony

Messages		**TAR** N=2562, 20.3%	**ARR** N=2697, 18.5%	**TWR** N=4979, 19.4%
Valid	Complete, correct	69.9	71.3	71.2
	Partial	10.2	8.7	12.7
	Omitted	7.6	9.9	8.3
	Number substitution	.1	0	0
	Complete + transposition	0	.0	0
	Complete + substitution	.0	.1	.1
	Complete + **pronunciation**	9.6	8.4	6.8
	Partial + transposition	.0	0	0
	Partial + substitution	0	0	.0
	Partial + **pronunciation**	2.6	1.6	.9
	Total	100.0	100.0	100.0
	Total Elements	12651	14546	25616

6.4 Issuance of ATC Instructions

The instructions issued by ATC were coded for usage of required keywords pertaining to the instruction type and any discrepancies in numerals pronunciation. The results will be presented as interpretation of usage rate per time and possibility of non-adherence to standards. These will describe the elements usage more clearly than just the percentages. It is also easier to compare between ATC environments in terms of usage, adherence and errors.

6.4.1 Altitude

Altitude instructions were most used in TAR environment, consisting 7.4% of total elements and least in TWR environment where it totalled to about 2.6% (Table 6-14). These numbers meant that about one altitude instruction was issued every minute in the TAR environment. In ARR it was one every two minutes and in TWR, one every four minutes. High percentages of more than

90% were shown for complete and correct issuance of altitude instructions in all three environments.

The TAR environment showed lowest percentage for partial instructions. The ARR results showed highest discrepancies of numerals pronunciation. However, the possibility of errors in issuing altitude instructions was more realistically described in terms of rate per time. Non-adherence of 3% in TAR means one error every 18 minutes or every 18 altitude instructions. The 5.3% error in ARR translated into one every 30 minutes (every 15 instructions), and the rate in TWR is one error every hour (every 15 instructions).

Table 6-14: Altitude Instructions Frequency Analyses Table

		TAR N=941, 7.4%	ARR N=797, 5.5%	TWR N=655, 2.6%
Valid	Complete	97.0	94.7	94.0
	Partial	1.1	1.9	5.3
	Complete + pronunciation	1.9	3.4	.6
	Total	100.0	100.0	100.0
Total Elements		12651	14546	25616

An analysis of Melaka data actually resulted with 20% of erroneous altitude instructions. About one altitude instruction was issued every minute and the error rate was one in 12 minutes (1 in 12 instructions). This is more frequent than TAR environment's rate. As TWR with circuit training is a generally busy environment, the higher likelihood of error need to be highlighted in controllers' training programme.

Table 6-15: Frequency Analyses on Altitude Instructions – Melaka

		Frequency	Percent	Valid %	Cumulative %
Valid	Complete	129	7.9	80.1	80.1
	Partial	32	2.0	19.9	100.0
	Total	161	9.9	100.0	

6.4.2 Altitude Restrictions

The radiotelephony samples analysed seemed to be sparse in the issuance of altitude restrictions by ATC. This may be due to the radar environment that allows other types of separation to be applied. Table 6-16 show the Frequency analyses results of altitude restrictions elements.

Table 6-16: Altitude Restrictions Frequency Analyses

		TAR 0.06 %	ARR 0.03 %	TWR 0.01 %
Valid	Complete	7	4	3
	Partial	1	0	0
	Total	8	4	3
Total minutes		900	1220	2337
Total Elements		12651	14546	25616

The associated 8 elements in TAR means about one altitude restriction was issued every two hours. The rate was much less frequent in ARR (one in five hours) and TWR (one in thirteen hours). There was only 1 partially issued altitude restriction within 15 hours of TAR radiotelephony and none in ARR or TWR environments.

6.4.3 Approach Clearance

The usage of approach clearance environment was more associated with TAR and TWR environments (Table 6-17). The one element used in ARR was due to delegation of control in which the ARR controller cleared a Subang Airport arrival for a VOR-DME approach. Under normal circumstances, ARR operation is not associated with approach clearances. The TAR environment's usage of approach clearance was about 12 per hour or one every five minutes. The error rate (partial instruction) was one in three instructions. In TWR environment, an approach clearance was issued approximately every eight minutes. The possibility of a partial instruction is about one every three instructions, similar to TAR.

Table 6-17: Approach Clearance Frequency Analyses

		TAR 1.4 %	ARR 0.01 %	TWR 1.2 %
Valid	Complete	130	1	183
	Partial	53	0	119
	Total	183	1	302
Total time (minutes)		900	1220	2337
Total Elements		12651	14546	25616

6.4.4 Communications Transfer

The elements coded for communications transfer indicated that in TAR environment, one instruction was issued every two and a half minutes (Table 6-18). Every other element used for communication transfer is likely to have an error. In ARR environment, one communications transfer was issued every three minutes. The error rate was approximately one in two instructions issued.

Table 6-18: Communications Transfer Instructions Frequency Analyses

		TAR 2.7 %	ARR 3.0 %	TWR 2.5 %
Valid	Complete	164	174	243
	Partial	139	196	186
	Complete + pronunciation	12	28	125
	Partial + pronunciation	25	34	81
	Total	340	432	635
Total minutes		900	1220	2337
Total Elements		12651	14546	25616

In TWR environment communications transfers were issued one every four minutes. Errors were expected every six minutes or about three out of four instructions.

6.4.5 Heading

The Table 6-19 show the results of heading instructions frequency analyses.

Table 6-19: Heading Instruction Frequency Analyses

		TAR 2.6 %	ARR 0.6 %	TWR 0.3 %
Valid	Complete	270	74	73
	Partial	32	8	6
	Complete + pronunciation	25	0	2
	Total	327	82	81
Total minutes		900	1220	2337
Total Elements		12651	14546	25616

TAR used more (2.6% of total elements) heading instructions than ARR and TWR. One instruction was transmitted every three minutes in TAR, every fifteen minutes in ARR and every twenty-eight minutes in TWR. The likelihood of an error is about one every fifteen minutes in TAR, which is one in every five instructions. In ARR the error rate is one in every two and a half hours (1 in 6 instructions) while in TWR it is one in five hours (about 1 in 10 instructions).

6.4.6 Holding

TAR environment did not contain any holding instructions. The rate of usage in ARR was about one holding instruction every 72 minutes while in TWR was one every 54 minutes (Table 6-20). One in every eight instructions issued in ARR is likely to be incomplete. The rate in TWR is one every 15 instructions.

Table 6-20: ARR Frequency Table: ATC Instruction Holding

		ARR 0.1 %	TWR 1.8 %
Valid	Complete	15	38
	Partial	2	5
	Total	17 (1 instruction every 72 minutes)	43 (I instruction every 54 minutes)
Total minutes		1220	2337
Total Elements		14546	25616

6.4.7 Landing Clearance

Only the TWR environment was associated with landing clearances. The Table 6-21 presented the frequency analyses results of landing instructions for each aerodrome for comparison. Other than KLIA, all the aerodromes used one runway for both landings and departures. It was also found that opposite direction runway operations were sometimes practised.

Table 6-21: Frequency Tables – Landing Instructions per Tower

Station	Element	Frequency	Details
Melaka	Complete	4	12 %
190 minutes	Partial	29	Error in 7 out of 8 instructions
4047 elements	Total (0.8 %)	33	I instruction in 6 minutes
KLIA	Complete	134	95 %
730 minutes	Partial	6	Error in 1 out of 23 instructions
8156 elements	Total (1.7 %)	140	I instruction in 5 minutes
Penang	Complete	29	88 %
220 minutes	Partial	4	Error in 1 out of 8 instructions
1517 elements	Total (2.2 %)	33	1 instruction in 7 minutes
Kuching	Complete	44	92 %
380 minutes	Partial	4	Error in 1 out of 12 instructions
3175 elements	Total (1.5%)	48	1 instruction in 8 minutes
Kinabalu	Complete	63	86 %
560 minutes	Partial	10	Error in 1 out of 7 instructions
4728 elements	Total (1.5%)	73	1 instruction in 8 minutes
Johor	Complete	16	76 %
250 minutes	Partial	5	Error in 1 out of 4 instructions
3993 elements	Total (0.5 %)	21	1 instruction in 12 minutes

The KLIA TWR used landing instructions most frequently and Johor least frequently. KLIA showed least likelihood of errors in landing instructions. However, Melaka's radiotelephony showed a particularly high percentage of partial instructions. This may be contributed to a localised understanding with flying school operators to omit runway designation in landing clearances. While this may cut down frequency congestion, it indirectly encouraged pilots and controllers to apply non-standard practise in routine operations.

The Table 6-22 show the overall frequency analysis for TWR environment. Average usage was about 1.4% of total elements and one instruction was issued in 7 minutes. 83% of instructions were issued correct and complete. No pronunciation errors were noted, but one out of 6 instructions was issued partially, with some keywords omitted.

Table 6-22: TWR Landing Instructions Frequency Analyses

		Frequency	Details
Valid	Complete	290	Correct instructions 83% of time
	Partial	58	Error in 1 out of 6 instructions
	Total	348	1.4 % of elements
Total minutes		2330	1 instruction every 7 minutes
Total Elements		25616	

6.4.8 Route / Position

Frequency analyses of these instructions in the ATC environments produced the results as in Table 6-23. The highest percentage of 6.2% of total elements used was found in TWR environment. Usages were lower in TAR and ARR.

Table 6-23: Route / Position Instruction Frequency Analyses

		TAR 1.5%	ARR 2.8%	TWR 6.2%
Valid	Complete	180	402	1453
	Partial	9	10	126
	Complete + substitution	0	0	1
	Complete + pronunciation	1	0	10
	Total	190	412	1590 (1 in 1.5 minutes)
Total minutes		900	1220	2337
Total Elements		12651	14546	25616

One route / position instruction was transmitted every one and a half minute. In ARR it was less frequent, at about one in three minutes and in TAR about one in five minutes. Generally, issuances of instructions were complete more than 90% of the time. Possibility of an error occurring in TAR was 1 in 19 instructions (every 95 minutes). In ARR it was 1 in 40 instructions (1 in 120 minutes) while in TWR was 1 in 12 instructions (1 in 18 minutes). Only one substitution error was found within 39 hours of TWR radiotelephony and one pronunciation error in 15 hours of TAR radiotelephony. Other error type was of partially issued clearances.

The more frequent use in TWR environment of route position instructions was due to ground movements of aircraft. These included taxiing route, intersection and holding point stops, gate assignments and lining up positioning. Route and positional instructions in TAR were more associated with headings (refer section 6.4.5) than airways or direct tracks as in ARR.

6.4.9 Speed

Table 6-24 show the frequency analysis results of speed instructions. TAR showed the highest usage of speed instructions (2.3%), as speed control is a technique more often used in TAR than other ATC environments. In ARR there was 0.5% elements associated with speed instructions and in TWR only 0.09%.

Table 6-24: TAR Frequency Table: ATC Instruction Speed

		TAR 2.3 %	ARR 0.5 %	TWR 0.09%
Valid	Complete	220	49	1
	Partial	36	24	21
	Complete + pronunciation	30	2	1
	Partial + pronunciation	3	0	0
	Total	289	75	23
Total minutes		900	1220	2337
Total Elements		12651	14546	25616

This translated to 1 instruction in 3 minutes for TAR, 1 in 16 minutes in ARR and 1 in 100 minutes in TWR. The error rate in TAR was 1 in four instructions while in ARR was 1 in three instructions. The possibility of finding an error in a TWR speed instruction was 96%. This could be explained by the nature of TWR operations that do not need to assign a specific speed to an aircraft. The placement and spacing needed were usually achieved by requesting the pilots to ‘slow down’, ‘keep up speed’ or ‘reduce to minimum’. Traffic information and visual sighting by the pilots assist in maintaining the required ATC safety standards for aerodrome environment.

6.4.10 Transponder Code

Table 6-25 show the frequency analyses results of transponder code assignments.

Table 6-25: TAR Frequency Table: ATC Instruction Squawk Code

		TAR 0.02 %	ARR 0.19 %	TWR 0.15 %
Valid	Complete	2	17	39
	Partial	1	10	0
	Total	3	27	39
Total minutes		900	1220	2337
Total Elements		12651	14546	25616

Generally, the percentages of transponder code instructions were small in all three environments. There were only 3 instances in TAR environment (0.02% elements) coded for 'recycling' (refreshing) the transponder code. These were associated with radar identification purposes, averaging once in 5 hours, and one out of three instructions was issued with some keywords omitted.

In ARR environment, transponder code assignments were 0.19% of total elements and associated with establishing or confirming radar contacts. An instruction was issued once in 45 minutes and one out of three of those were partial clearances. In TWR, an instruction was issued once in 59 minutes and no errors were found.

6.4.11 Takeoff Clearance

The frequency analyses for this type of instructions were carried out per aerodrome unit and the results presented in Table 6-26. The total recording time and elements per aerodrome is noted below the station's name. Between 0.6% and 1.7% of elements in TWR environment were associated with takeoff instructions. The usage rate per time was highest in KLIA with one instruction issued in 5 minutes. Penang was the least with 1 instruction per 10 minutes.

Table 6-26: Frequency Analyses Takeoff Clearance in TWR Environment

Station		Frequency	Details
KLIA	Complete	139	100 %
730 minutes	Partial	0	none
8156 elements	Total (1.7 %)	139	1 instruction in 5 minutes
PENANG	Complete	18	78 %
220 minutes	Partial	5	Error in 1 out of 4 instructions
1517 elements	Total (1.5 %)	23	1 instruction in 10 minutes
KUCHING	Complete	44	88 %
380 minutes	Partial	6	Error in 1 out of 8 instructions
3175 elements	Total (1.6 %)	50	1 instruction in 7.6 minutes
KINABALU	Complete	55	79%
560 minutes	Partial	15	Error in 1 out of 5 instructions
4728 elements	Total (1.5 %)	70	1 instruction in 8 minutes
JOHOR	Complete	10	36 %
250 minutes	Partial	18	Error in 2 out of 3 instructions
3993 elements	Total (0.7 %)	28	1 instruction in 9 minutes
MELAKA	Complete	2	8 %
190 minutes	Partial	23	Error in 11 out of 12 instructions
4047 elements	Total (0.6 %)	25	1 instruction in 7.6 minutes

KLIA showed no errors in takeoff instructions implying total adherence to standards at all times. Errors were most likely found in Melaka where 11 out of 12 instructions were issued partially, with some keywords missing. As in landing clearances, the local procedures of Melaka made allowances for these non-standard practices. However, it was non-conforming to ICAO standards.

6.4.12 Altimeter Setting Advisories

These advisories were found more often in TAR than TWR or ARR (Table 6-27). In TAR, 1 altimeter setting advisory was issued every 7 minutes. TWR rate was 1 in 11 minutes and in ARR was 1 in 42 minutes. The percentages of complete advisories were 73% in TAR, 72% in ARR and 96% in TWR. Errors were most likely found in TAR where the odds were 1 in 4 instructions. In ARR it was 1 in 6 and in TWR, 1 in 23 instructions.

Table 6-27: TAR Frequency Table: ATC Weather Advisories

		TAR 1 %	ARR 0.2 %	TWR 0.8%
Valid	Complete	91 (73 %)	21 (72 %)	200 (96 %)
	Partial	8	3	2
	Complete + pronunciation	19	5	7
	Partial + pronunciation	7	0	0
	Total	125	29	209
Total minutes		900	1220	2337
Total Elements		12651	14546	25616

6.5 Pilots' Readback of ATC Instructions

Pilots' readbacks to ATC instructions were coded for inclusion of key information, presence of a readback and queries.

6.5.1 Altitude Instructions Readback

Complete readbacks for altitude instructions were 94% in TAR, 89% in ARR and 83% in TWR (Table 6-28).

Table 6-28: Altitude Pilots' Readback Frequency Analyses

		TAR 7.3 %	ARR 5.1 %	TWR 2.5 %
Valid	Complete	866 (94 %)	659 (89 %)	524 (83 %)
	Partial	18 (1 in 51)	16 (1 in 46)	40 (1 in 15)
	No readback	29 (1 in 32)	55 (1 in 13)	50 (1 in 13)
	Repeat / verify	9 (1 %)	12 (1.6 %)	15 (2.4 %)
	Total	922	742	629
Total Elements		12651	14546	25616

The percentages of requests for repeat or verification were 1% in TAR, 1.6% in ARR and 2.4% in TWR. The possibilities of non-readbacks were 1 in 32 instructions for TAR and 1 in 13 instructions for ARR and TWR. Partial readbacks were more likely found in TWR environment than TAR or ARR. Overall the non-standard practices of not presenting a readback or responding partially were highest in TWR with odds of 1 to 7.

6.5.2 Altitude Restrictions Readback

The Table 6-29 show the frequency analyses results for pilots' readback of altitude restrictions. There was not many issuance of this instruction in all three environments as other methods of separation were used. A repeat request was shown only in ARR environment. Partial or non-readbacks were also considered to be more likely in ARR.

Table 6-29: Altitude Restrictions Pilots' Readback Frequency Analyses

		TAR 0.06 %	ARR 0.04 %	TWR 0.01 %
Valid	Complete	6 (75 %)	3 (50 %)	3 (100 %)
	Partial	1	1	0
	No readback	1	1	0
	Repeat / verify	0	1 (17 %)	0
	Total	8	6	3
Total Elements		12651	14546	25616

6.5.3 Approach Clearance Readback

There was only one approach clearance issued in ARR and this was readback as complete. In TAR environment, complete readback consisted of 57% and queries were 0.6% (Table 6-30). The possibility of a partial readback was 1 in 3 and non-readback was 1 in 10.

Table 6-30: Approach Clearance Pilots' Readback Frequency Analyses

		TAR 1.4 %	ARR 0.007 %	TWR 1.1 %
Valid	Complete	101 (57 %)	1	96 (33 %)
	Partial	58 (1 in 3)	0	139 (1 in 2)
	No readback	18 (1 in 10)	0	50 (1 in 6)
	Repeat / verify	1 (0.6 %)	0	2 (0.7 %)
	Total	178	1	287
Total Elements		12651	14546	25616

In TWR only 33% instructions were readback complete and 0.7% queried. 1 out of 2 instructions were readback partially and 1 in 6 was not readback by the pilots. Collectively, the TWR environment showed a higher likelihood of 2 in 3 non-standard readback (none or partial).

6.5.4 Communications Transfer Readbacks

Communications transfer readbacks by pilots showed low percentages of complete readback in all three ATC environments (Table 6-31). The most was shown in TWR with only 12.5%. Queries for repeats or verification were also of small percentages. In TAR environment, 5 out of 7 readbacks were partials and 1 in 5 were non-readbacks. The odds were lower in ARR and TWR.

Table 6-31: Pilots' Readback Communications Transfer Frequency Analyses

		TAR 2.6 %	ARR 2.6 %	TWR 2.4 %
Valid	Complete	23 (7 %)	22 (6 %)	76 (12.5 %)
	Partial	238 (5 in 7)	297 (3 in 4)	471 (3 in 4)
	No readback	65 (1 in 5)	52 (1 in 7)	46 (1 in 13)
	Repeat / verify	5 (1.5%)	13 (3.4%)	17(2.8%)
	Total	331	384	610
Total Elements		12651	14546	25616

6.5.5 Heading Instructions Readbacks

Heading instructions showed high percentages of over 80% for complete readbacks in each environment (Tables 6.-32). Partial readbacks were 13% in TAR, 12% in ARR and 9% in TWR. None readbacks ranged between 2 to 4%. Only TAR and ARR had about 3% each of queries regarding heading instructions. The odds of getting partial readback were 1 in 7 for TAR, 1 in 8 for ARR and 1 in 11 for TWR. This means pilots in TWR environment were less likely to omit keywords in heading instructions readback. Non-readback was highest in ARR with odds of 1 in 26.

Table 6-32: Heading Pilots' Readback Frequency Analyses

		TAR 2.6 %	ARR 0.5 %	TWR 0.3 %
Valid	Complete	264 (82 %)	63 (82 %)	71 (88 %)
	Partial	43 (1 in 7)	9 (1 in 8)	7 (1 in 11)
	No readback	7 (1 in 46)	3 (1 in 26)	3 (1 in 27)
	Repeat / verify	9 (2.8 %)	2 (2.6 %)	0
	Total	323	77	81
Total Elements		12651	14546	25616

6.5.6 Holding Instructions Readbacks

Elements associated with holding instructions readbacks by pilots were only recorded in ARR and TWR. Complete readbacks were 61 % in TWR (Table 6-

33). Queries showed higher in ARR at 27% or 1 in 4 instructions. Partial and non-readbacks were more likely in ARR (1 in 2) than TWR (1 in 3).

Table 6-33: Holding Pilot's Readback Frequency Analyses

		ARR 0.1 %	TWR 0.15 %
Valid	Complete	4 (27 %)	23 (61 %)
	Partial	3 (1 in 5)	8 (1 in 5)
	No readback	4 (1 in 4)	4 (1 in 9)
	Repeat / verify	4 (27 %)	3 (8%)
	Total	15	38
Total Elements		14546	25616

6.5.7 Landing Clearances Readback

Landing clearances were only recorded in TWR environment. Pilots' readback analysis showed 67% of complete readback (Table 6-34). There were 32% partial readbacks, 0.3% queries and 1.4% none readbacks. This meant that 1 in 3 readbacks were partials that had omitted some keywords. 1 in 70 instructions was not readback by the pilot.

Table 6-34: Landing Clearance Pilot's Readback Frequency Analyses

		Frequency	Valid %	Details
Valid	Complete	232	66.7	2 in 3 readback
	Partial	110	31.6	1 in 3 readback
	No readback	5	1.4	1 in 70 readback
	Repeat / verify	1	.3	
	Total	348	100.0	
Total Elements		25616		

6.5.8 Route/ position Instructions Readbacks

Table 6-35 show the route/ position elements analyses results.

Table 6-35: Route / Position Pilots' Readback Frequency Analyses

		TAR 1.5 %	ARR 2.6 %	TWR 6.0 %
Valid	Complete	147 (79 %)	312 (82 %)	1184 (77 %)
	Partial	19 (1 in 10)	19 (1 in 20)	215 (1 in 7)
	No readback	14 (1 in 13)	32 (1 in 12)	108 (1 in 14)
	Repeat / verify	6 (1 in 31)	18 (1 in 21)	36 (1 in 43)
	Total	186	381	1543
Total Elements		12651	14546	25616

More than 75% of the instructions in all three ATC environments were readback complete. The likelihood of getting a partial readback was highest in TWR environment. None readback was more frequent in ARR environment. ARR also showed highest possibility of verification request from pilots regarding this instruction.

6.5.9 Speed Instructions Readbacks

Speed instructions in TWR environment were not associated with specific numbers but generally a request to slow down or to maintain speed. The readback also reflects this and recorded no complete readbacks (Table 6-36). However, in 1 out of 7 instructions, the pilots fail to reply. 1 out of 11 readbacks was a request to verify the instruction. TAR environment showed 64% and ARR 51% for complete readbacks. The likelihood of partial, none readbacks and repeat/verify for TAR and ARR were lower than TWR.

Table 6-36: Speed Pilots' Readback Frequency Analyses

		TAR 2.2 %	ARR 0.5 %	TWR 0.09 %
Valid	Complete	180 (64 %)	36 (51 %)	0
	Partial	48 (1 in 6)	23 (1 in 3)	17 (3 in 4)
	No readback	42 (1 in 7)	8 (1 in 9)	3 (1 in 7)
	Repeat / verify	12 (1 in 24)	3 (1 in 23)	2 (1 in 11)
	Total	282	70	22
Total Elements		12651	14546	25616

6.5.10 Transponder Code Assignment Readbacks

SSR Code assignments were rarely used in TAR. Only 2 elements were associated with it (Table 6-37). The likelihood of getting complete readback was 74% in ARR and 90% in TWR environment. 1 in 5 instructions in ARR was shown to be readback partially. There were also possibilities of non-readbacks by pilots in all environments.

Table 6-37: Transponder Code Pilots' Readback Frequency Analyses

		TAR	ARR 0.13 %	TWR 0.15 %
Valid	Complete	1 (50 %)	14 (74%)	34 (90 %)
	Partial	0	4 (1 in 5)	0
	No readback	1 (1 in 2)	1	1
	Repeat / verify	0	0	3 (1 in 13)
	Total	2	19	38
Total Elements		12651	14546	25616

6.5.11 Takeoff Clearance Readback

The Table 6-38 show the analysis results of takeoff clearance readback which were associated with TWR environment only.

Table 6-38: TWR Frequency Analyses: Pilots' Readback Takeoff Clearance

		Frequency	Valid %	Details
Valid	Complete	207	61.6	2 in 3 readback
	Partial	108	32.1	1 in 3 readback
	No readback	20	6.0	1 in 17 readbacks
	Repeat / verify	1	.3	
	Total	336	100.0	
Total Elements		25616		

Takeoff clearance readbacks were likely to be complete two thirds of the time. 1 in 3 was a partial readback and 1 in 17 was a none-readback. Very rarely did this instruction need verification.

6.5.12 Altimeter Setting Readbacks

Readback analysis results are shown in Tables 6-39. The highest percentage of complete readbacks was shown in TWR environment.

Table 6-39: Altimeter Setting Pilots' Readback Frequency Analyses

		TAR 1 %	ARR 0.2 %	TWR 0.4 %
Valid	Complete	81 (64 %)	21 (75 %)	74 (77 %)
	Partial	23 (2 in 11)	2 (1 in 14)	1
	No readback	22 (2 in 11)	5 (2 in 11)	17 (2 in 11)
	Repeat / verify	1	0	4 (1 in 24)
	Total	127	28	96
Total Elements		12651	14546	25616

None readbacks were similar in all environments and queries showed highest in TWR environment. Partial readbacks were more likely in TAR environment. There were similar chances of a non readback in all ATC environments. Verification was rare but only slightly more likely in TWR.

6.6 Error Analyses

This section presents the frequency analyses results of elements associated with errors in the radiotelephony.

6.6.1 Callsign Miscommunications

Table 6-40 show the types of miscommunication coded. 17 elements in TAR environment, 15 in ARR and 16 in TWR were associated with callsign miscommunications. The possibility of a callsign miscommunication was generally small, 0.2% in TWR, 0.3% in ARR and 0.4% in TAR. ATC in TAR environment were more likely to respond to the wrong aircraft, but pilots in TWR environment were more likely to respond to messages which were not addressed to them.

Table 6-40: Callsign Miscommunication Frequency Analyses

		TAR	ARR	TWR
Valid	Wrong aircraft respond	2 (of 2131)=0.1%	3 (of 2284)=0.1%	8 (of 4260)=0.2%
	ATC respond wrong aircraft	14 (of 2562)=0.5%	12 (of 2697)=0.4%	6 (of 4979)=0.1%
	Wrong ATC callsign	1 (of 2562)=0.04%	0	2(of 4979)=0.04%
	Total	17 (0.4%)	15 (0.3%)	16 (0.2%)

6.6.2 Readback Errors

Errors in pilots readback were analysed for information type confusion, transposition, substitution and pronunciation errors.

6.6.2.1 Altitude

Readback errors found associated with altitude were of numerals substitution and pronunciation discrepancies types. It was more likely in TAR and ARR environments (Table 6-41) but the chances were quite small. Errors in pronunciation were more common than numerals substitution.

Table 6-41: Altitude Readback Error Frequency Analyses

		TAR 2.1 %	ARR 2.0 %	TWR 0.3 %
Valid	Substitution	5 (0.5%)	9 (0.5%)	5 (0.1%)
	Pronunciation	14 (1.5%)	26 (1.5%)	8 (0.2%)
	Total	19	35	13
Total Altitude Elements (Pilots)		922	1723	4031

6.6.2.2 Altitude Restrictions

No error types were found for altitude restrictions readbacks.

6.6.2.3 Approach Clearance

No error types were found for approach clearance readbacks.

6.6.2.4 Communications Transfer

Encoding for errors in communication transfer readback was slightly adjusted.

7 = error in facility name and

8 = error in frequency to contact (transposition or substitution)

The Table 6-42 show results of communication transfer readback errors. These errors were more common in TWR environment but of similar frequency in TAR and ARR. Pronunciation errors were most likely in TWR but contact frequency errors were about similar in all environments.

Table 6-42: Communication Transfer Readback Error Frequency Analyses

		TAR 14.1 %	ARR 15.1 %	TWR 32 %
Valid	Facility name	0	0	1
	Contact frequency	4 (1.2%)	4 (1.0%)	7 (1.1%)
	Pronunciation	43 (13%)	54 (14%)	187 (31%)
	Total	47	58	195
Total Elements Communications Transfer (Pilots)		331	384	610

6.6.2.5 Heading

Table 6-43 showed the analysis results for heading readback errors. It was about 7 in 100 for TAR environment, mostly associated with pronunciation. There was between 1.2 and 1.5% chance of transposition or substitution error. In ARR there was a 2.6% chance of confusion on information type.

Table 6-43: Heading Readback Error Frequency Analyses

		TAR 7.4 %	ARR 5.2 %	TWR 4.9 %
Valid	Confusion type info	0	2 (2.6%)	0
	Transposition	0	0	1 (1.2%)
	Substitution	5 (1.5%)	1 (1.3%)	1 (1.2%)
	Pronunciation	19 (5.9%)	1	2
	Total	24	4	4
Total Elements Heading (Pilots)		323	77	81

6.6.2.6 Holding

There was no readback error associated with holding instructions.

6.6.2.7 Landing Clearance

Only one instance of landing clearance readback error was recorded in TWR environment, which was a numeral pronunciation error type (Table 6-44).

Table 6-44: TWR Landing Clearance Readback Error Frequency Analysis

		Frequency	Details
Valid	Pronunciation	1	=0.3% chance that this error occurs
Total Elements Landing (Pilots)		348	

As landing clearances are critically important, pilots were more attentive and responsive and errors were not found in the radiotelephony messages associated with these clearances.

6.6.2.8 Route / Position

The Table 6-45 shows route/ position readback error frequency analyses results. This error was more likely to happen in ARR environment with a 1.3% chance. There was also 0.8% likelihood that pilots readback the position name wrongly in ARR environment. Confusion with another type of information, tracking error, pronunciation and transposition also showed small probabilities.

Table 6-45: Route / Position Readback Error Frequency Analyses

		TAR 0.5 %	ARR 1.3 %	TWR 0.8 %
Valid	Confusion type info	0	1 (0.3%)	1 (0.06%)
	Transposition	1	0	0
	Tracking	0	1	2 (0.1%)
	Position name	0	3 (0.8%)	3 (0.2%)
	Pronunciation	0	0	7 (0.5%)
	Total	1	5	13
Total Elements Route/position (Pilots)		186	381	1543

6.6.2.9 Speed

There was no speed readback error in TWR environment. Table 6-46 show the results of frequency analyses for errors in TAR and ARR environments. Errors were twice as likely to happen in TAR environment. The likelihood of substitution errors was quite similar in both environments. Pronunciation errors were more likely in TAR.

Table 6-46: Speed Assignment Readback Error Frequency Analyses

		TAR 16.6 %	ARR 8.5 %
Valid	Substitution	5 (1.8 %)	1 (1.4%)
	Pronunciation	42 (1 in 7 readbacks)	5 (1 in 14 readbacks)
	Total	47	6
Total Elements Speed (Pilots)		282	70

6.6.2.10 Transponder Code

There was only one readback error for transponder code assignments, found in TWR environment (Table 6-47). This was from Johor radiotelephony data in which the speed numerals had been mistakenly understood for another type of information.

Table 6-47: Transponder Code Readback Error Frequency Analyses

		Frequency	Percent	Valid %	Cumulative %
Valid	Confusion type info	1	.0	100.0	100.0
Missing	System	9781	100.0		
Total		9782	100.0		

6.6.2.11 Takeoff Clearance

No readback error was noted for takeoff clearance readback. Similar to landing clearances, these were given full attention and adhered to completely by pilots.

6.6.2.12 Altimeter Setting Advisory

Altimeter setting advisories readback errors were more common in TAR and generally of number pronunciation type (Table 6-48). In TWR environment there was also a likelihood of substitution errors.

Table 6-48: Altimeter Setting Readback Error Frequency Analyses

		TAR 11 %	ARR 17.9 %	TWR 6.3 %
Valid	Substitution	1 (0.8%)	0	3 (3 %)
	Pronunciation	13	5	3
	Total	14	5	6
Total Elements Altimeter (Pilots)		127	28	96

6.6.3 Hearback Errors

Pilots' readback errors that were not noticed by ATC and subsequently not corrected developed into hearback errors. Types of hearback errors coded in the radiotelephony against the originating readback errors are shown in Table 6-49. The numbers shown in grey had no hearback errors.

Table 6-49: Frequency Analyses: Hearback Errors

	TAR		ARR		TWR	
Errors in	readback	hearback	readback	hearback	readback	hearback
Altitude assignments	5	1	9	4	5	4
Heading instructions	5	1	3	0	2	1
Communication transfer	4	1	4	2	8	2
Route / position	1	1	5	0	6	2
Speed control	4	1	1	1	0	0
Transponder	1	0	0	0	1	0
Altimeter Setting	1	0	5	0	3	1

Sometimes a readback error was purposely left uncorrected as there had been no safety risk. An example was the route/position readback error in TAR which was associated with direction of turn for a direct tracking. Similarly for speed if the readback was not exact, but served the purpose of regulating traffic. The highest occurrence shown was for altitude assignment hearback error in TWR environment in which 4 out of 5 readback errors were not corrected by ATC. Altitude readback error in ARR also showed a higher occurrence. It was noted that ATC sometimes accomodated pilot's mistake in readback by issuing another altitude assignment depending on traffic scenario. The following is an example in which 'three five zero' was accommodated by 'one five zero':

ATC:	*Malaysian Six Five identified descend flight level* ***Three Six Zero*** *Nipar Three Alfa Arrival runway Three Two left Istan Alfa transition*
Pilot:	*Okay leaving Three Nine Zero for* ***Three Five Zero*** *Istan Alfa arrival for runway er.. Nipar Three Alfa arrival Istan transition Three Two Left Malaysia Six Five*
ATC:	*Six Five Descend flight level* ***One Five Zero***

The numbers shown in the table should not be converted directly to probabilities of hearback errors as the occurrences were not mutually exclusive from readback errors. For example in ARR environment, altitude hearback error occurred 4 times out of 9 (44%) readback errors. The possibility of an altitude readback error occurring in ARR was actually 1.2% (9 out of 742). So the appropriate probability for altitude hearback error in ARR is 0.44 multiplied by 0.012, which comes out as 0.005, or 1 in 200. However, keeping in perspective the possibility of ATC noticing and accommodating some readback errors, the real threat of an altitude hearback error was actually much smaller.

6.7 Other Discrepancies

Besides the non-adherence to standard practices associated with ATC instructions, codes were also assigned to examine pilots' initial contact messages, advisories, disfluencies, verbosity and language switches.

6.7.1 Pilots' Initial Contact Messages

Table 6-50 show the frequency analyses results of pilots' initial contact messages. There were in total 1225 messages (about 6%) which were considered as pilots' initial contacts to establish communications with ATC. On average percentage of complete messages was less than 30%. In TAR and ARR more than half were partial messages. TWR showed the highest percentage of initial contact messages in which no other information except the aircraft's and the ATC unit's callsign were transmitted. These discrepancies were coded to investigate areas that radiotelephony could be further improved. If these messages were transmitted in full, containing all required information, queries for information may not be needed, number of transmissions will be reduced and the communication frequency will be less congested.

Table 6-50: Pilots' Initial Contact Messages Frequency Analyses

		TAR 6.1 %	ARR 5.6 %	TWR 6.1 %
Valid	Complete	96 (32 %)	69 (21 %)	200 (33 %)
	Partial	167 (56 %)	172 (53 %)	145 (24 %)
	No information	37 (12 %)	83 (26 %)	256 (43 %)
	Total	300	324	601
Total Time		900	1220	2337
Total Messages		4928	5738	9782

6.7.2 Traffic Advisory

Traffic advisories were found most in TWR environment and least in ARR (Table 6-50). This is associate with the nature of activities in the ATC environments in which the information could best be utilised to resolve traffic situations. Traffic information provided in TWR environment was to a large percentage, complete. This assisted in establishing visual contact and eased traffic resolution. In ARR and TAR, visual separation was less practical and controllers employ other separation standards.

Table 6-51: ATC Traffic Advisory Frequency Analyses

		TAR 0.16 %	ARR 0.07 %	TWR 0.6 %
Valid	Complete	6	2	102 (68%)
	Partial	14 (70%)	8 (80%)	47
	Total	20	10	149
Total Elements		12651	14546	25616

6.7.3 Excess Verbiage

The ARR environment (Table 6-52) showed slightly higher percentage of elements associated with excess verbiage. Mostly were for using the word 'roger' or 'okay' within messages.

Table 6-52: Excess Verbiage Frequency Analyses

		TAR 1.8 %	ARR 2.0 %	TWR 1.9 %
Valid	Roger or okay	224	283	471
	Unnecessary adjectives	7	6	3
	Total	231	289	474
Total Elements		12651	14546	25616
Total words (% verbiage)		51242 (0.45%)	58067 (0.5%)	104505 (0.45%)

These words, especially 'okay', hold a special significance as it had been a factor associated with an aircraft accident in Tenerife. In ARR the excess words made up 0.5% of total words used and in TAR and TWR, the percentages were 0.45% each.

An example of excess verbiage in messages exchange from Sample S2:

1	*Pilot:*	*Lumpur Approach South Malaysian Six Zero Two Good Morning on descend passing flight level One Niner Three for One Five Zero information Xray One Zero Zero Niner*
2	*ATC:*	*ROGER Malaysian Six Zero Two Descend Seven Thousand*
3	*Pilot:*	*ROGER descend Seven Thousand Malaysian Six Zero Two Two Seven Zero Knots*
4	*ATC:*	*YOU'RE Number Three AT THE MOMENT*
5	*Pilot:*	*ROGER ER.. WANT US TO SLOW DOWN Six Zero Two*
6	*ATC:*	*TWO FIFTY will be just nice*
7	*Pilot:*	*ROGER Two Five Zero Malaysian Six Zero Two*

In the example above the word 'roger' was used at the beginning of messages 2, 3, 5 and 7. In message 4, the essence was to inform the sequence number of Malaysian Six Zero Two. Message 5 enquired of any speed restrictions and message 6 imposed a speed control. The words shown in capital letters were not part of standard phrases but common in ATC radiotelephony. However, the word 'roger' had been used rather excessively and habitually without any specific benefit to the messages.

6.7.4 Disfluencies

Coding for disfluencies included the usage of 'er..', 'ah..' and similar fillers in between words or phrases, noticeable long pauses in mid-sentence and false starts where transmission stops at 'half words/phrase' and immediately changed to another word/phrase. Examples of fillers in messages:

*"Malaysian **er..** One One Three Seven **er..** descend to **er..** Niner Thousand"*

*"Malaysian Five **er..** contact control **er..** One Three Two decimal Six"*

Overall, disfluencies were lowest in ARR environment and highest in TWR (Table 6-53). The larger portions in each environment were fillers. False starts were found more in ARR than other environments. However, the overall likelihood of disfluencies was only about 1 occurrence in 50 elements or 1 count in 200 words.

Table 6-53: ARR Frequency Table: Disfluencies

		TAR 2.04 %	ARR 1.61 %	TWR 2.26 %
Valid	Fillers (er.., uhm.., ah..)	214 (86%)	143 (61%)	468 (81%)
	Long pauses	2	15	16
	False starts	43 (17%)	76 (32%)	94 (16%)
	Fillers and False start	0	1	1
	Total	259	235	579
Total Elements		12651	14546	25616
Total words		51242	58067	104505

This implied a much better performance than the theorised rate of disfluencies in spontaneous speech which is 6 counts per one hundred words. Although fillers, pauses and false starts are commonly associated with uncertainty and indecision, alternative theories also relate it to tactical strategies to improvise instantaneous decision making. Studies have also shown that disfluencies do not always impair understanding of whole messages.

6.7.5 Language Switching

Usage of other languages was strictly confined to greetings and courtesies. These depended on the perceived nationality of the pilot and familiarity with phrases. Word search in all the radiotelephony transcription produced the results in Table 6-54. The most frequently used were Malay greeting words.

Table 6-54: Usage of non-English Words in ATC Radiotelephony

Words	TAR 51242	ARR 58067	TWR 104505
selamat + (pagi /petang/tengahari)	54	116	168
assalamu’alaikum	7	1	23
sawadi-kap	4	2	0
namaskadam	0	4	0
Percentage out of total words usage	0.13	0.21	0.18

These were associated with well wishes such as ‘selamat pagi’ (good morning) and selamat tengahari (good afternoon). Other non-English words used were assalamu’alaikum (Arabic), sawadi-kap (Thai) and namaskadam (Tamil). The usage of these non-English words was about 0.2% of total words used.

6.8 Verification and Safety Net

Readback by pilots should be monitored closely by ATC to ensure instructions and information are copied and understood correctly. Some errors were made but corrected by ATC. These were coded and analysed for information type.

6.8.1 ATC Corrected Readback Errors

Table 6-55 show the count of readback error corrected for each type listed. These errors were those of confusion, transposition or substitution type. The errors that were not corrected were counted as hearback errors and had been discussed earlier. Overall, the ARR environment showed the highest percentage for 'catching' readback errors.

Table 6-55: TAR Frequency Table: ATC Corrected Readback Errors

		TAR	ARR	TWR
Valid	Altitude assignments	3 of 5	4 of 9	1 of 5
	Heading instructions	4 of 5	3 of 3	1 of 2
	Communication frequency	3 of 4	2 of 4	5 of 7
	Altimeter setting	1 of 1	0	2 of 3
	Route / position	0 of 1	5 of 5	4 of 6
	Total	11 of 16	14 of 19	13 of 23
	% Error Corrected	69	73	56
Total Elements		12651	14546	25616

For individual type of errors, efficiency in correcting was more apparent in TAR and ARR, as the highlighted cells showed.

6.8.2 Callsign Verification

Table 6-56 showed counts of elements associated with request for verification of callsigns.

Table 6-56: Callsign Verification in TAR Environment

		TAR 0.13 %	ARR 0.25 %	TWR 0.09 %
Valid	Pilot request verify	7 (of 2131)=0.3%	6 (of 2284)=0.3%	6 (of 4260)=0.1%
	ATC request verify	5 (of 2562)=0.2%	24 (of 2697)=0.9%	9 (of 4979)=0.2%
	Error corrected	3 (0.1%)	7 (0.3)	8 (0.2%)
	Error not corrected	1	0	0
	Total	16	37	23
Total Elements		12651	14546	25616

Request by pilots were 0.3% both in TAR and ARR. Requests by ATC were 0.9% in ARR. Some elements which were erroneous were corrected directly without a request for verification. These were 0.3% in ARR, 0.2% in TWR and

0.1% in TAR. The callsign miscommunications and verification elements were associated with unsuccessful attempts to relay intended information on first transmission. These were found highest in ARR environment and least in TWR, resulting in extra messages to be transmitted to effect understanding.

6.8.3 Repeat or Verification Requests

The radiotelephony messages were analysed for pilots' requests for ATC to repeat messages in full or in parts, associated with the phrase 'say again'. The results are shown in Table 6-57. Additionally, there were 681 'Rver' elements in which verification was sought by either ATC or Pilot for various types of information. These again, caused extra transmissions as the relay of information was not initially successful.

Table 6-57: Pilot Request Message Repeat

		TAR 0.32 %	ARR 0.33 %	TWR 0.18 %
Valid	Whole message	8	12 (1 in 478)	14
	Part of message	8	7 (1 in 820)	4
	Total	16	19	18
Total Messages		4928	5738	9782
	'Rver' elements	137 (1.1%)	220 (1.5%)	324 (1.3%)
Total Elements		12651	14546	25616

Collectively, verification and repeats were highest in ARR. 1 in 478 messages would be requested to be clarified in full and 1 in 820 clarified in parts. Verification of specific information (element) will be about 1 in 66.

6.9 Chapter Summary

The radiotelephony analyses showed that there were differences between the characteristics of the three ATC environments recorded. A tabulated summary of details for each ATC environments' radiotelephony is included in Appendix M.

The number of messages transmitted per unit time indicated TAR transmitted 5.9, ARR 4.7 and TWR 4.1 messages per minute. These transmission rates were slightly higher than those found by Cardosi & DiFiore (2004) which were TAR 4.5, ARR 2, TWR 3.8 and GND 3.5 messages per minute. However, this could be due to the traffic load and pattern and should not be associated with language deficiency.

Analysis of traffic load also showed differences between environments. TAR environment handled an average of 13 aircraft per 30 minutes and each aircraft was in contact for about 6.5 minutes. The average number of messages exchange per aircraft was 13. In ARR environment average number of aircraft handled was 14, in contact duration of 11 minutes and had 10 messages transmissions. TWR averaged about 11 aircraft per 30 minutes, in contact for 7 minutes and exchanged 11 messages. These numbers were to some extent, against the normal perception that TAR is the busiest ATC working position in terms of total traffic handled. What probably gave that impression is the higher rate of radiotelephony exchanges and transmission occupancy.

The transmission occupancy showed 32.3% in TAR, 30.6% in ARR and 27% in TWR. Anomalies were shown for Melaka (43%) and Johor (35%), which actually boosted the TWR average percentage. However, this occupancy percentage was not inclusive of other ground communication. It also did not reflect on other activities such as planning and monitoring traffic movements.

The construct of messages showed a similar average of 10 words per message in all three environments. Numerals usage differ slightly, 6 per message in TAR, and 5 for ARR and TWR. Similar percentages were shown for ‘short’ messages up to average lengths in all environments. TWR showed slightly higher percentage for twice average length, which was associated with issuing of ATC clearances.

In terms of complexity associated with the number of different topics and speech acts within messages, there was no significant difference between environments. The three most used topics were altitude, route/position and greetings. The majority of messages contained between 2 to 4 elements. Overall, TAR and TWR showed higher percentages of instruction speech acts than ARR which had more requests.

About 40% of elements were associated with identification of speaker and recipient. Mell (1991c) quoted 33% for this category while 33% was categorised as speaker turn management (Mell, 1992). Mell (1991c) also found 33% speech acts associated with management of aircraft movement, 33% for speaker/recipient identification, 26% for frequency, SSR code and radar contact, and 5% for repairs. The present research found that 43% aviation topics were associated with aircraft disposition, with highest usage of altitude, route/position heading and communications. Greetings were regularly used in all three environments.

Another study by Mell (1992) found 24% messages were for task management and 76% for dialogue management. Task management consisted of 12% instructions and 11% advisory, while dialogue management consisted of 34% speaker turn, 21 understanding and 19% radar/radio contact. Corradini and Cacciari (2001) found that discrepancies and error were more frequent in low workload phases whilst redundancies (greetings, negotiations, plain language) were more frequent in high workload. Differences were also noted by Corradini and Cacciari in error rate between environments, associated with age, experience, training and service. The present research did not specify the low and high workload phases, but analysis results could be directly correlated to environments, and indirectly associated with age, experience and training.

Based on callsign usage in radiotelephony by ATC, the most deviations were shown in TWR environment with 27% non-usage of correct callsign format. Pilots' deviation was highest in TWR with 22% unapproved format. Miscommunications arising from callsign usage were about 0.2%, where other than the intended recipient responded to messages or ATC wrongly responded to a different aircraft than the speaker.

The issuances of instructions by ATC were also found to deviate from standard format or were incomplete. The highest partial instructions percentage was shown for communications transfer instructions, followed by approach instructions, speed control and restrictions. Pilots' readback of ATC clearances showed the highest deviations in communications transfer. High percentages were also noted for approach clearance, speed and restrictions. Request for messages repetition was on average about 0.2% overall, while usage of aviation topics associated with 'ver' (verification) were 1.3%. Pilots fail to provide complete initial information on average of 70% contact messages.

In TAR messages, 3.2% contained errors, while ARR 2% and TWR 2.3%. These errors were coded for substitution, transposition and misunderstanding of relayed information. However, most of these errors were corrected. Those that were not corrected and became hearback errors totalled to 0.1% in each environment. Taking into account all messages from all three environments and considering the types of errors coded in the data analyses, collectively, 1% of messages contained some type of error that should not have been committed. This amount was similar to what Cardosi (1993, 1994, and 1996) concluded although the classification of error messages was slightly different.

Other discrepancies coded were excess verbiage, fillers, pauses and language switch. Roger, okay and filler types were commonly found, greeting were sometimes in another language and false starts for immediate correction or changes were also noticed. Collectively, these showed low percentages and did not impair ATC communication. In some instances, these were strategically accommodating thinking time and impromptu decision making to handle the dynamic traffic situation.

7 CONCLUSIONS

7.1 Opening Remarks

This research was undertaken to examine research objectives associated with ATC radiotelephony, English language and ESL speakers. These objectives and sub-objectives are summarised in Chapter 1 part 1.3.

Demographics information was collected by questionnaire, intended to ascertain the population's composition, usage of English language, perception on Aviation English's training format, structure and management; and observation of non-adherence to stipulated standard practises in routine operations. The detailed cross sectional study of ATC radiotelephony was aimed towards identifying and quantifying the radiotelephony characteristics; and to determine types and recurrence of errors related to language and/or phraseology usage. The hypotheses assumed was that "*the characteristics of ATC Radiotelephony involving ESL controllers will show frequent evidence of non-proficiency and language related errors commonly associated with safety occurrences*" (Chapter 1 part 1.4).

The initial assessment of the research area and focus was through a review of UK AIRPROX reports spanning over 7 years. These reports contained information on types of possible errors, class of airspace in which the errors occurred, flight phases and ATC units involved, as well as verification or mitigation steps taken (parts 2.4.2 and 3.4.2). This information pointed towards an appropriate method of data collection and analyses. Information from other databases such as MORS (Appendices C & D), ICAO ADREP and FAA's ASIAS supported and enhanced the information from UK AIRPROX, contributing towards structuring the research as explained in Chapter1 part 1.5 and depicted as a flow chart in Figure 4-2. Previous researches related to the subject area in United States and UK/Europe provided further information on established coding and analyses tools that are appropriate for this research (parts 4.6 and 4.7). The current research investigated ATC radiotelephony for three different environments; Tower, En-route Radar and Approach Radar Control.

7.2 Demographics Composition

This section refers to the results as presented in Chapter 5 on the human resources of the ATC system, the dominance of English language in daily communications and perceptions of training efficiency and non-adherence to standard ATC operations.

7.2.1 Controllers' Demographics

Table 7-1 summarises some factors by ratio description to compare between the three ATC environments investigated in the research (parts 1.3 and 5.1).

Table 7-1: Summarised Description of Controllers' Demographics

% ratio	TAR	ARR	TWR
Ethnic Malay:Chinese:Indian:Others	45 : 30 : 20 : 5	71 : 13 : 16 : 0	83 : 2 : 4 : 11
Gender Male:Female	90 : 10	68 : 32	77 : 23
Majority Age Group	40 – 50+	30 - 49	25 – 40's
Service <11:11-15:>15 years	2 : 0 : 98	49 : 0 : 52	70 : 9 : 20
Education secondary:diploma:degree	43 : 23 : 35	29 : 7 : 64	38 : 50 : 11
English 1:2:3:0	70 : 28 : 2 : 0	42 : 55 : 0 : 3	28 : 67 : 0 : 5

These responses allowed some general description of the controllers in the three ATC environments investigated as follows:

TAR:

- ***a fair mixture of ethnic groups and academic background,***
- ***consists of older age group (40's and 50's),***
- ***9 to 1 male-female ratio,***
- ***more than 15 years in-service experience.***

ARR:

- ***Malay ethnic majority, small portion of Chinese and Indian,***
- ***age group between 30 to 50,***
- ***one third female, two-thirds male***
- ***mixture of in-service experience.***

TWR:

- ***Malay majority, minor portion of other ethnic groups,***
- ***younger age group, 25 to 40s,***
- ***one quarter female, three quarters male,***
- ***largely less 11 years in-service experience.***

7.2.2 English Language Dominance

Usage of English language was more dominant in TAR as 70% declared it as the most frequent daily language. In ARR, more than half the controllers used English as the second frequent language. The dominance was still evident as 40% did declare it as the most frequently used. This dominance was less obvious in TWR as two-thirds of the controllers declared English as the second frequent language used. In both ARR and TWR, a small percentage of controllers did not include English as the first three most frequently used languages. English was most frequently used in the ACC and College by controllers aged over forty, specifically by the majority of Chinese and Indian ethnic groups. Detailed findings on English language usage are explained in Chapter 5 part 5.2.

Air traffic control is a specialised area that requires specific terminology, knowledge and skill. Controllers are trained from scratch and all training is conducted in English. Language proficiency has always been an operational and licensing requirement. Aviation related documents, manuals and notices are published in English. The education system in Malaysia introduced English as a mandatory taught subject and students started learning the language as early as 6 years old. This early exposure and access to reading as well as multi media resources assist in ordinary usage of the language. The language is more dominant in developed city areas and where multi-racial communities are the norm.

7.2.3 Respondents' Perception of Training Courses' Efficiency

The intake into the air traffic controllers' career used to be at secondary education level up to the early 1980's. Tertiary level intake introduced diploma and degree holders into the service. Academic qualifications of TAR controllers were a mixture of levels from different intake groups. In ARR, more controllers were from degree intake and TWR showed more Diploma level intake. However, this did not change the training format and controllers are still required to attend and pass basic courses, as well as rating courses before being licensed for operational ATC duties.

The general perceptions on training (part 5.3) are:

- ***i.*** ***ATC communications, standard phraseology and radiotelephony skills training were generally provided to the majority of controllers.***
- ***ii.*** ***Aviation English training was less readily available, of which only 40% of controllers claim to have attended.***
- ***iii.*** ***The format was classroom lectures orientated with less emphasis on public speaking, role play, verbal communications and listening comprehension. Radiotelephony examples were not well incorporated into the module, as were computerised exercises and handling unexpected situations.***
- ***iv.*** ***Documents and references were noted by respondents as limited or not readily available.***
- ***v.*** ***The responses also emphasised the need for better training format and resources as well as more efficient time management.***
- ***vi.*** ***There were positive opinions on instructors' knowledge of ATC operations and English language usage.***
- ***vii.*** ***Teaching techniques and management of training courses were not so highly valued. These need to be improved as it has a bearing on the achievements of trainees attending training. Better resources should be utilised to enhanced training effectiveness.***
- ***viii.*** ***Benefits from training were more ATC operations related rather than language related. The overall ATC communication and language related training were evaluated by respondents as adequate but not overly successful.***

7.2.4 Non-adherence to Standard Practices

These estimations were based on experience and observation by controllers in daily operations (part 5.4):

i. ***Daily ATC operations contain general non-adherence to standard practices in the range of 30 percent,***
ii. ***Pilots' readback were observed as incomplete or incorrect or both around 30 – 40% of the time,***
iii. ***Standard phraseology was adhered to, at best, about 75% of the time by controllers and pilots,***
iv. ***Message comprehension problems and the need for verification and repeats were observed and estimated to be between 5 to 15%,***
v. ***Most common causes of misunderstanding are poor language usage, unclear pronunciation, incomplete or ambiguous information and usage of non-standard phraseology,***
vi. ***Mitigation of errors were considered quite efficient as the outcome were more likely increased workload or communications taskload than loss of separation or aircraft proximity.***

7.3 A Question of Proficiency

The analyses of radiotelephony had fulfilled the objectives of identifying and quantifying the characteristics of pilot-controller messages. In addition, the types of errors had been determined and possibility of recurrence had been approximated. These had been presented in detail in Chapter 6 and will be summarised and recapped in this section.

7.3.1 Radiotelephony Characteristics

Table 7-2 summarises the results of the analysis for a comparison of characteristics (parts 1.3 and 6.2 - 6.4). Based on general characteristics, the TAR environment seemed to be the busiest. More time was occupied with transmission of messages, more messages were transmitted per unit time and per aircraft, and more instructions were issued compared to ARR and TWR.

Table 7-2: Comparison of General Characteristics of ATC Radiotelephony

Analyses	**TAR**	**ARR**	**TWR**
Transmission occupancy	32.3 %	30.6 %	27 %
Aircraft / 30 minutes	13	14	11
Contact time / aircraft	6.5 minutes	11 minutes	7 minutes
Messages / aircraft	13	10	11
Messages / minute	5.5	4.7	4.1
Messages frequency	1 in 11 seconds	1 in 13 seconds	1 in 15 seconds
Words / message	11	10	11
Numerals / message	6	5	5
Speech rate	176	155	171
Elements / hour	843	715	658
Identification Elements	*37.7 %*	*40.7 %*	*38.3 %*
Instruction Elements	*36.5 %*	*27.3 %*	*33.4 %*
Advisory Elements	*14.8 %*	*15.8 %*	*17.2 %*

The elements and numerals usages also supported the notion that TAR environment has a higher workload compared to ARR or TWR. More advisory elements were found TWR than other environments.

7.3.2 Error Analyses

The parsed messages were coded by a set of 47 variables to evaluate usage of elements, adherence to standards and identification of errors (parts 1.3 and 6.3 – 6.7). The results indicated that the routine ATC radiotelephony contained:

i. ***non- adherence to standard phraseology,***
ii. ***usage of plain language in place of standard phraseology,***
iii. ***non-standard formatting of elements,***
iv. ***not abiding to recommended pronunciation,***
v. ***usage of other language, fillers and verbosity,***
vi. ***need for repetition or verification of messages or information, and***
vii. ***occurrences of misunderstandings and miscommunications.***

Table 7-3 shows the summarised percentages of elements that were coded for errors (non-compliant to required ATC standard practices). Although TWR showed highest percentages in more categories, the differences were not significantly excessive. The types of errors and airspace of occurrence whilst matching those found in the pilot study of Airproxes, are more definitely coded and quantified in the radiotelephony analyses.

Table 7-3: Percentages of Errors in Elements for Categories Analysed

Categories	TAR	ARR	TWR
ATC Callsign Usage	28.9 %	31.0 %	35.3 %
Pilot Callsign Usage	30.1 %	28.7 %	28.8 %
Callsign Miscommunication	0.36 %	1.04 %	0.42 %
ATC Instruction Issued	17.7 %	17.8 %	20.1 %
Pilot Readback	34 %	38 %	41 %
Verbosity	0.8 %	1.5 %	1.8 %
Disfluencies	1.2 %	1.4 %	2.0 %
Resulting readback errors	0.8 %	1 %	0.8 %

The percentage of non-adherence (eg. partial / no readback, non-standard phraseology) showed in the analyses was also found to be quite similar to that estimated or observed by the controllers in the questionnaire responses.

Table 7-4 shows some results of previous and current studies.

Table 7-4: Previous and Present Results on Radiotelephony Analyses

<table>
<tr><th>Reference</th><th>Analysis</th><th>TAR</th><th>ARR</th><th>TWR</th></tr>
<tr><td>Mell (1991)</td><td>Speech acts</td><td colspan="3">33 % aircraft management
33 % speaker turn management
26 % communications mngt.
5 % clarification / correction</td></tr>
<tr><td>Mohd (2008)*</td><td>Elements</td><td colspan="3">39% Identification
32% Instructions
16% Advisories
1.3% verification</td></tr>
<tr><td rowspan="4">Cardosi (1994)
Cardosi et.al.(1996)
Cardosi (1997)</td><td rowspan="3">Pilots' incomplete readbacks</td><td></td><td></td><td>72 %</td></tr>
<tr><td>40 %</td><td></td><td></td></tr>
<tr><td></td><td>29 %</td><td></td></tr>
<tr><td>Readback error</td><td colspan="3">Less 1% of instructions issued</td></tr>
<tr><td rowspan="2">Mohd (2008)*</td><td>Pilots' partial readback</td><td>34 %</td><td>38%</td><td>41 %</td></tr>
<tr><td>Readback error</td><td>0.8 %</td><td>1.0%</td><td>0.8%</td></tr>
<tr><td rowspan="6">Prinzo (1996)</td><td>ATC Address errors</td><td>14 %</td><td></td><td></td></tr>
<tr><td>Pilots' Address errors</td><td>25 %</td><td></td><td></td></tr>
<tr><td>ATC instruction errors</td><td>55 %</td><td></td><td></td></tr>
<tr><td>Pilot readback errors</td><td>53 %</td><td></td><td></td></tr>
<tr><td>Elements errors (ATC)</td><td>40 %</td><td></td><td></td></tr>
<tr><td>Elements errors (Pilots)</td><td>59 %</td><td></td><td></td></tr>
<tr><td rowspan="4">Mohd (2008)*</td><td>ATC callsign errors</td><td>28.9 %</td><td>31.0 %</td><td>35.3 %</td></tr>
<tr><td>Pilots callsign errors</td><td>30.1 %</td><td>28.7 %</td><td>28.8 %</td></tr>
<tr><td>ATC Instructions</td><td>17.7 %</td><td>17.8 %</td><td>20.1 %</td></tr>
<tr><td>Pilots' readback</td><td>34 %</td><td>38 %</td><td>41 %</td></tr>
<tr><td>Cardosi & DiFiore (2004)</td><td>Transmissions per minute</td><td>4.5</td><td>2</td><td>3.8</td></tr>
<tr><td>Mohd (2008)*</td><td>Messages per minute</td><td>5.5</td><td>4.7</td><td>4.1</td></tr>
</table>

Mohd (2008) is the current research (PhD thesis).*

Some were focussed on errors in messages while other results indicated usage of speech acts and aviation topics (Elements). The current research complements some aspects studied before. In comparison, the percentages discovered in this research do not indicate any inferior standards of language and phraseology usage. In fact, some percentages showed better adherence to standards, for example pilots' readback of ATC instructions.

The current research evidence concluded that errors did occur in ATC environments where the controllers are ESL users, but the recurrence rates were not much different from environments in which the controllers were native English users. Based on the findings, it is fair to conclude that routine radiotelephony involving ESL controllers are as 'safe' as those involving native English users (Chapter 1 part 1.3 & 1.4).

7.4 Concluding Note

This research had achieved what it set out to discover. However, it had proven the earlier hypothesis to be false. Although errors were found, these were no more frequent than the percentage previously computed in native English user environment (Chapter 1 part 1.4). There was insufficient evidence to indicate non-proficiency in standard phraseology and English language usage in routine ATC operations.

In terms of originality, the research has sourced and analysed data from a country (Malaysia) and region (South East Asia) not accessed before. This complements previous researches which sourced data from United States and parts of European airspace. A well established methodology and coding tools applied in this research enhanced the value of findings as these could be compared with earlier results.

The deficiencies and discrepancies of the routine ATC radiotelephony in TAR, ARR and TWR environments, in which the controllers were ESL users, were identified. In addition, some observations by controllers were summarised about the training format and structure. Together, these findings should benefit the service provider in future training plans, subject areas to emphasise and particular problematic areas to address.

The information gathered in this research has not contradicted the general assumption that ESL users' radiotelephony will contain errors. However, the occurrence and recurrence of errors in the radiotelephony had **NOT**:

- frequently interfered with ease of understanding,
- interfered with meaning of messages,
- showed lack of vocabulary range,
- frequently prevented effective communication,
- prevented clarification strategies in complicated situations, and
- resulted in failure to adequately deal with misunderstandings.

The conclusions of the research have pointed out that the radiotelephony was not in absolute adherence to ICAO standard and recommended practices. However, the English language was used efficiently and did not adversely affect any ATC functions. There were a recurrence of errors and discrepancies, but these were, to a large percentage, noticed and corrected. In those instances that problems did occur, suitable correctional actions were taken to avoid misunderstanding. These occurrences were observed as very low in recurrence rate and usually mitigated, consequently causing additional communication taskload but were prevented from progressing into an unsafe situation. However, these problems were not noted as frequently causing difficulties to the extent that ATC function and objectives were not achieved.

ATC is a dynamic operation, with ever changing patterns and people participating in the system. Error percentages that the system indicated today may not be as accurate in the future if performance levels are not maintained continuously. The development of controller resources has successfully prepared these controllers for the functions of ATC but there needs to be a constant effort to improve and enhance training and day to day performance, taking into account the growth of the aviation industry and air traffic movements worldwide.

Overall, there was no definite evidence to prove that the controllers were not proficient in using English for routine ATC communications. The research was not meant to evaluate a general proficiency in English; neither could it speculate the performances of pilots and controllers in an emergency situation. It did however realistically examine the radiotelephony characteristics in the Malaysian airspace. Within the scope of routine radiotelephony, the findings of the research could only confirm that the radiotelephony between these ESL controllers and pilots had not shown evidence of serious language incompetence. The language usage in radiotelephony was found not sufficient to evaluate knowledge on subjects related to ATC. Messages used routinely were standardised and formatted to suit the service objectives. The communication recorded only allowed for an evaluation of adherence to recommended practises. Marks of disfluencies such as fillers, hesitations, false starts and verbosity were only found in small percentages and did not hamper or prevent understanding. Fillers, pauses and verbosity were mostly strategically used to allow instantaneous thinking and decision making. Otherwise, it was a bad habit that needs to be unlearnt.

At present, there is no scale or rating to denote a grade to the radiotelephony performance of an ATC system. The regulatory authorities and the industry are unable, as yet, to draw a limit beyond which the amount of discrepancies and errors in a system are considered unacceptable. The holistic descriptions as used by ICAO uses markers such as ‘sometimes’, ‘rarely’, ‘sufficient’, ‘often’, ‘sufficiently’ and ‘adequately’. These markers are not attached to specific numerical values and are more discretionary in evaluation. There is also no definite ranking of error types to prioritise corrective steps. Further conclusive evidence is needed before one type of error could be classified as being more risky than others.

7.5 Managing the Research

This research employed well established methods and utilised a verified taxonomy for encoding. It involved collecting primary data and required meticulous processing. Completion took 46 months and the most tedious, time consuming portion was data collection and processing. Any research such as this need to take into serious account the time constraints, expertise and amount of data collected. Previous studies had also shown that the occurrence of errors may be in 1% of the data. A reasonably large data set was collected for this research to best capture rarer but critical errors that may be missed in a smaller data set.

The audio selection stage was quite complicated as segments selected should be from different controllers, of moderate to high workloads and with suitable audio quality for recording. 7 different locations were involved in the data collection, consisting of 2 out of 5 TAR work positions, 3 out of 6 ARR sectors and 6 out of 20 TWR locations. Over 300 hours of radiotelephony was examined for suitability before the selected 73 hours consisting of 190 segments were digitally recorded. The selection and recording process took about 3 months to complete. These segments represented 95% of TAR controllers, 65% of ARR controllers and 90% of TWR controllers, amounting to a comprehensive cross sectional selection of controllers' radiotelephony. The time of day and seasonal variations were not taken into consideration as the aim was to collect a representative sample from the population studied. The radiotelephony data contained normal daily scenarios, exchanges of messages between pilots and controllers and the non-standard practices that had occurred.

The automatic transcription technology available today has not yet reached the level of sophistication to process ATC radiotelephony audio. Manual transcription of audio into text is a slow and time consuming task, especially when accuracy is of utmost importance. A random cross check of transcription and coding accuracy (as has been done in the current research) by suitably qualified independent person(s) should be seriously considered as quality control measures. The audio quality, speech rate and contents add to the difficulty of transcription work. One minute of audio need at least 10 minutes listening for the transcription to be completed accurately. Collectively, the audio to text transcription took around 8 months to complete. Parsing of messages was equally tedious and required familiarity with the subject matter.

Encoding of the messages segments utilised the ATSAT that best classify the contents as well as discrepancies and errors. As the research was safety related, it was the error recurrence rate and type which were of prime interest. The parsed and coded data was organised in an Excel database for easy accessibility. SPSS software was most suited for character and error analyses to be carried out effectively as well as compatible with Excel.

A similar study of this magnitude could be more time efficient if the transcription work could be carried out by a qualified person. A subject matter expert could also be employed to parse and code messages. In this manner, the researcher only needs to analyse the processed data and interpret the results. However, knowledge of the ATC system and operations is important to realistically construe the results in terms of relevance to routine operations and its correlation to safety.

7.6 Future Research

This research had found answers, but had also found more questions and highlights possible areas of further research. Malaysia is but one country in the South East Asia region where English is used as a second or foreign language. One data source is not enough to allow a generalisation of all countries that have a majority of ESL user controllers. However, taking the language background into consideration, these findings may also be applicable to countries such as Singapore, Thailand, Indonesia, Brunei and Philippines where English plays quite a dominant part in education and business. The controllers in these countries are also ESL users. Other Asian countries such as Japan, Korea and China also use English as a second or foreign language, but there may be differences in language learning policies. A similar study in any of these locations may add further evidence about radiotelephony involving ESL speakers. Other issues are:

i. ***Speech rate***: It was noted that the speech rate computed from the radiotelephony was higher than the recommended 100 words per minute (ICAO, 1992f). Generally, ATC related words (half of which are numerals) are short and messages are transmitted with some urgency, which may be contributory to higher speech rate. However, no conclusion could be fairly formed as there wasn't any specific data on ATC radiotelephony speech rate to compare against. A speech rate of 235 words per minute, stated as 'typical' by Taylor et. al. (2005) did not specify any definite source. It may be worth examining world wide ATC speech rates in comparison to the recommendation by ICAO, which was made in 1950's. Current sophisticated communication technologies could prove that a different speech rate may be safely designated and practised.

ii. ***Abnormal message structure***: In the current research, no emergency and unexpected events were recorded. These occurrences are generally few and far between. However, a specific study into radiotelephony prior, during and after such an event may be relevant to understand changes to routine practices and habits. Mell's (1991b; 1991a) studies had found differences in messages structure of non-routine communications. The present study was unable to include this aspect of the radiotelephony.

iii. ***ATC-ATC messages***: Another form of communications, that these ESL controllers participate in, is the coordination telephony with adjacent ATC units. These are for traffic management, briefing of pertinent information and relaying of relevant information. These are part and parcel of the ATC operations and complement the actual controlling of aircraft. Records had shown that misunderstandings could and had happened within these channels of communications. The different nature to radiotelephony renders a combined study in the present research unsuitable. Separate research is more appropriate to uncover how far this area poses a risk to flight safety. One study that had looked into this area was by Peterson and Bailey (2001). The study attempted to develop and verify taxonomy of communications between the radar controller and the procedural controller at en-route ATC working positions.

iv. ***Error prioritisation***: Presently, there is no specific priority or ranking of errors in terms of risk. An assessment of error recurrence in safety occurrences could possibly show the way forward.

The data collected in this research were analysed for non-adherence to standard practises and errors in different ATC environment, whilst emphasising on the ESL perspective. It is but a small portion of the knowledge gap explored. There are still vast possibilities for in-depth studies on how voice and audio quality, ethnic and gender may affect types and percentages of error.

In terms of data resources, the transcribed messages could be further used for message structure analyses, conversation analysis and ethnomethodology studies. The audio recordings are suitable for listening comprehension practises in controllers and pilots training. It is realistic, represents the actual environment and specific clips could be used for error detection and prevention training. These could also be resourced for voice recognition studies which are still developing better software to transcribe ATC radiotelephony successfully.

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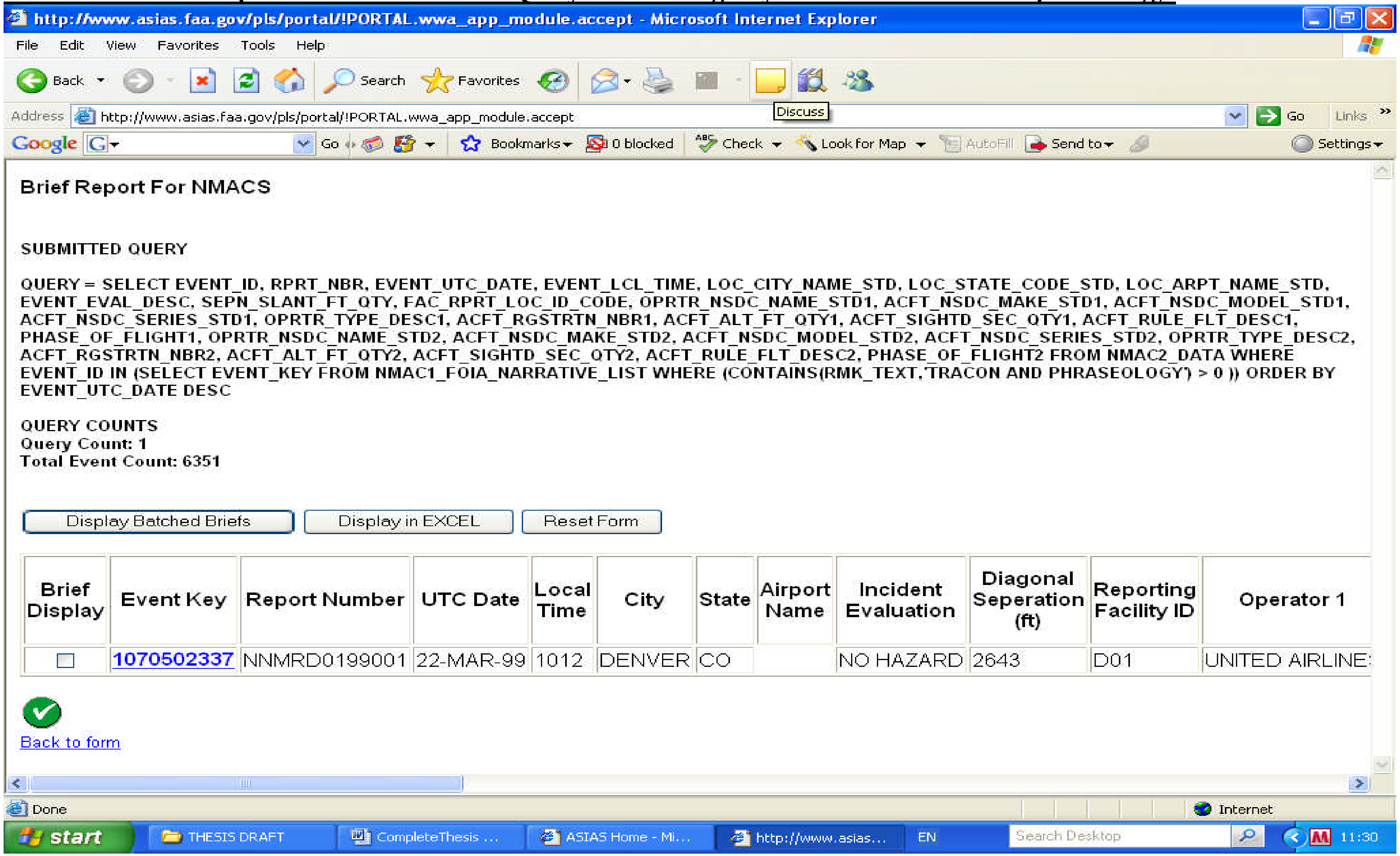
APPENDIX A: Example of NMACS Database Query Result Using Keywords ‘TRACON’ and ‘phraseology’



Brief Report For NMACS

SUBMITTED QUERY

QUERY = SELECT EVENT_ID, RPRT_NBR, EVENT_UTC_DATE, EVENT_LCL_TIME, LOC_CITY_NAME_STD, LOC_STATE_CODE_STD, LOC_ARPT_NAME_STD, EVENT_EVAL_DESC, SEPN_SLANT_FT_QTY, FAC_RPRT_LOC_ID_CODE, OPRTR_NSDC_NAME_STD1, ACFT_NSDC_MAKE_STD1, ACFT_NSDC_MODEL_STD1, ACFT_NSDC_SERIES_STD1, OPRTR_TYPE_DESC1, ACFT_RGSTRTN_NBR1, ACFT_ALT_FT_QTY1, ACFT_SIGHTD_SEC_QTY1, ACFT_RULE_FLT_DESC1, PHASE_OF_FLIGHT1, OPRTR_NSDC_NAME_STD2, ACFT_NSDC_MAKE_STD2, ACFT_NSDC_MODEL_STD2, ACFT_NSDC_SERIES_STD2, OPRTR_TYPE_DESC2, ACFT_RGSTRTN_NBR2, ACFT_ALT_FT_QTY2, ACFT_SIGHTD_SEC_QTY2, ACFT_RULE_FLT_DESC2, PHASE_OF_FLIGHT2 FROM NMAC2_DATA WHERE EVENT_ID IN (SELECT EVENT_KEY FROM NMAC1_FOIA_NARRATIVE_LIST WHERE (CONTAINS(RMK_TEXT,'TRACON AND PHRASEOLOGY') > 0)) ORDER BY EVENT_UTC_DATE DESC

QUERY COUNTS
Query Count: 1
Total Event Count: 6351

Display Batched Briefs | Display in EXCEL | Reset Form

Brief Display	Event Key	Report Number	UTC Date	Local Time	City	State	Airport Name	Incident Evaluation	Diagonal Seperation (ft)	Reporting Facility ID	Operator 1
☐	1070502337	NNMRD0199001	22-MAR-99	1012	DENVER	CO		NO HAZARD	2643	D01	UNITED AIRLINE:

Back to form

APPENDIX B: ICAO LANGUAGE PROFICIENCY RATING SCALE

Expert, Extended and Operational Levels (Source: ICAO Annex 1)

LEVEL	*PRONUNCIATION* *Assumes a dialect and/or accent intelligible to the aeronautical community.*	*STRUCTURE* *Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task.*	*VOCABULARY*	*FLUENCY*	*COMPREHENSION*	*INTERACTIONS*
Expert 6	Pronunciation, stress, rhythm, and intonation, though possibly influenced by the first language or regional variation, almost never interfere with ease of understanding.	Both basic and complex grammatical structures and sentence patterns are consistently well controlled.	Vocabulary range and accuracy are sufficient to communicate effectively on a wide variety of familiar and unfamiliar topics. Vocabulary is idiomatic, nuanced, and sensitive to register.	Able to speak at length with a natural, effortless flow. Varies speech flow for stylistic effect, e.g. to emphasize a point. Uses appropriate discourse markers and connectors spontaneously.	Comprehension is consistently accurate in nearly all contexts and includes comprehension of linguistic and cultural subtleties.	Interacts with ease in nearly all situations. Is sensitive to verbal and non-verbal cues and responds to them appropriately.
Extended 5	Pronunciation, stress, rhythm, and intonation, though influenced by the first language or regional variation, rarely interfere with ease of understanding.	Basic grammatical structures and sentence patterns are consistently well controlled. Complex structures are attempted but with errors which sometimes interfere with meaning.	Vocabulary range and accuracy are sufficient to communicate effectively on common, concrete, and work-related topics. Paraphrases consistently and successfully. Vocabulary is sometimes idiomatic.	Able to speak at length with relative ease on familiar topics but may not vary speech flow as a stylistic device. Can make use of appropriate discourse markers or connectors.	Comprehension is accurate on common, concrete, and work- related topics and mostly accurate when the speaker is confronted with a linguistic or situational complication or an unexpected turn of events. Is able to comprehend a range of speech varieties (dialect and/or accent) or registers.	Responses are immediate, appropriate, and informative. Manages the speaker/ listener relationship effectively.
Operational 4	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation but only sometimes interfere with ease of understanding.	Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or unexpected circumstances, but rarely interfere with meaning.	Vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete, and work-related topics. Can often paraphrase successfully when lacking vocabulary in unusual or unexpected circumstances.	Produces stretches of language at an appropriate tempo. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent effective communication. Can make limited use of discourse markers or connectors. Fillers are not distracting.	Comprehension is mostly accurate on common, concrete, and work- related topics when the accent or variety used is sufficiently intelligible for an international community of users. When the speaker is confronted with a linguistic or situational complication or an unexpected turn of events, comprehension may be slower or require clarification strategies.	Responses are usually immediate, appropriate, and informative. Initiates and maintains exchanges even when dealing with an unexpected turn of events. Deals adequately with apparent misunderstandings by checking, confirming, or clarifying.
Levels 1, 2 and 3 are on subsequent page.						

Pre-operational, Elementary and Pre-elementary Levels

LEVEL	PRONUNCIATION *Assumes a dialect and/or accent intelligible to the aeronautical community.*	STRUCTURE *Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task.*	VOCABULARY	FLUENCY	COMPREHENSION	INTERACTIONS
Levels 4, 5 and 6 are on preceding page.						
Pre-operational 3	Pronunciation, stress, rhythm, and intonation are influenced by the first language or regional variation and frequently interfere with ease of understanding.	Basic grammatical structures and sentence patterns associated with predictable situations are not always well controlled. Errors frequently interfere with meaning.	Vocabulary range and accuracy are often sufficient to communicate on common, concrete, or work-related topics, but range is limited and the word choice often inappropriate. Is often unable to paraphrase successfully when lacking vocabulary.	Produces stretches of language, but phrasing and pausing are often inappropriate. Hesitations or slowness in language processing may prevent effective communication. Fillers are sometimes distracting.	Comprehension is often accurate on common, concrete, and work- related topics when the accent or variety used is sufficiently intelligible for an international community of users. May fail to understand a linguistic or situational complication or an unexpected turn of events.	Responses are sometimes immediate, appropriate, and informative. Can initiate and maintain exchanges with reasonable ease on familiar topics and in predictable situations. Generally inadequate when dealing with an unexpected turn of events.
Elementary 2	Pronunciation, stress, rhythm, and intonation are heavily influenced by the first language or regional variation and usually interfere with ease of understanding.	Shows only limited control of a few simple memorized grammatical structures and sentence patterns.	Limited vocabulary range consisting only of isolated words and memorized phrases.	Can produce very short, isolated, memorized utterances with frequent pausing and a distracting use of fillers to search for expressions and to articulate less familiar words.	Comprehension is limited to isolated, memorized phrases when they are carefully and slowly articulated.	Response time is slow and often inappropriate. Interaction is limited to simple routine exchanges.
Pre-elementary 1	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.

APPENDIX C: Results for 'Language' Query of UK CAA MORS Database

Safety Regulation Group
Safety Investigation & Data Department

Aviation House	Direct Dial	01293 573220	Switchboard	01293 567171
Gatwick Airport South	Direct Fax	01293 573972	Fax	01293 573999
West Sussex	E-mail	sdd@srg.caa.co.uk	Telex	878753
RH6 0YR				

A/C Type :	B767	**Occurrence Number :**	**200000066**
Flight Phase :	Climb	**Occurrence Date :**	09 Jan 2000
Classification :	Occurrences	**Location :**	Barcelona
Events :	ATC Occurrence Altitude Deviation	**Location Info :**	

Pretitle :
Confusion over heading between ATC & crew.
Precis :
After departure the a/c was allegedly given a climb clearance to FL170 & right heading 340 degrees, which was read back. Passing FL70 radar requested a/c to stop climb FL70, climb arrested at FL75. Radar claimed that instructions had been to climb FL170 & right heading 240 degrees. Reporter believes that there might have been language confusion & their readback was not corrected.

A/C Type :	B767	**Occurrence Number :**	**200000094**
Flight Phase :	Climb	**Occurrence Date :**	09 Jan 2000
Classification :	Occurrences	**Location :**	Barcelona
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Confusion between ATC and crew concerning B767's clearance.
Precis :
Following take off from R/W20, on an OKABI 1C SID, a/c changed frequency. The new controller cleared the B767 to FL170 and right heading 340deg, which was read back as the B767 was passing FL70. ATC requested B767 to stop climb at FL70, by which time it was passing FL75. ATC agreed that the B767 should be held at FL80 due to opposite direction traffic at FL90. Subsequently the controller claimed that the B767 had been cleared to climb to FL170 and a right heading of 240deg. P1 states that the readback given was not corrected.

A/C Type :	A320	**Occurrence Number :**	**200000115**
Flight Phase :	Cruise	**Occurrence Date :**	03 Jan 2000
Classification :	Occurrences	**Location :**	Las Palmas
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	THAIS - NERNO

Pretitle :
During climb to cleared FL350 ATC instructed A320 to level off at FL190, which was complied with. Subsequently A320 received a TCAS RA.
Precis :
During A320's climb to FL350 ATC instructed it to level off at FL190 due traffic. A320 then received a TCAS RA of descend, which was complied with. ATC advised. When clear of conflict, ATC cleared A320 to FL350. During the incident Spanish was being spoken to the other a/c.

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200000513**
Flight Phase :	Climb	**Occurrence Date :**	30 Jan 2000
Classification :	Occurrences	**Location :**	English Channel
Events :	Engine/Malfunction Power Loss - First Engine ATC Occurrence	**Location Info :**	

Pretitle :
An MD80 diverting to Gatwick, due to an engine problem, requested step down descents to 2000ft while to

the South of Gatwick:, descent to 2000ft refused. A/c descended to 3000ft.
Precis :
CAA Closure: Whilst the pilot did not actually declare an emergency he did say that he had an engine problem and was descending in order to restart it. This was interpreted as an emergency and the aircraft was put on a 7700 squawk and transferred to a discrete frequency because the en-route frequency was busy. The operator reported afterwards that the engine failure had also caused a pressurisation malfunction requiring a rapid descent, which was requested. However, the loss of pressurisation was unknown to ATC at the time and descent to 2000ft provoked a question about fuel and a certain amount of unease and uncertainty in the minds of the controllers that with only one engine, the crew wished to descend so low so early. When ATC tried to establish why the pilot wished to make such an early descent, confusion arose about fuel. When asked by the controller "can you just advise me, are you descending to use fuel?" the crew misinterpreted this as - did they have enough fuel? - and replied "yes we are descending with fuel enough and everything is OK". There was not only a misunderstanding of language, but a misunderstanding by the foreign pilot of the question, and in that respect the reply confused rather than clarified the situation. Nevertheless, the controller's question "are you descending to use fuel ?" uses rather complex English syntax, and was perhaps always open to mis-interpretation by a pilot whose native tongue is not English.

A/C Type :	B737	**Occurrence Number :**	**200000912**
Flight Phase :	Taxy	**Occurrence Date :**	10 Feb 2000
Classification :	Occurrences	**Location :**	Bucharest
Events :	Ramp Incident	**Location Info :**	

Pretitle :
Potential hazard during B737 pushback due to the ground engineer not being able to speak English.
Precis :

A/C Type :	A320	**Occurrence Number :**	**200001058**
Flight Phase :	Descent	**Occurrence Date :**	17 Feb 2000
Classification :	Occurrences	**Location :**	Malaga
Events :	ATC Conflict	**Location Info :**	

Pretitle :
Alleged poor ATC culminating in a TCAS RA climb.
Precis :
A/c cleared FL130 MAR VOR. With 10nm to run to MAR re-routed to MGA VOR. After 30 seconds and descending through FL155, told to fly to MAR VOR, stop descent FL150. No response to 2 requests by crew for routing after MAR. VHF very busy with Spanish being spoken. Overhead MAR a/c cleared for MAR 1C arrival . On descent & at 5,500 ft abeam R/W 14 threshold a TCAS RA of climb received & complied with against a possible biz-jet. Believed controller training being performed: also possible poor co-ordination between Seville Area Radar & Malaga Approach.

A/C Type :	DHC8	**Occurrence Number :**	**200001130**
Flight Phase :	Taxy	**Occurrence Date :**	26 Feb 2000
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Reporter believes there was inadequate separation between two landing a/c.
Precis :
Reporter states that the DHC8 was established onto R/W09 ILS and instructed to reduce speed to 150kts and then at 8nm, to minimum approach speed. Clearance to land was given relatively early. After landing ATC instructed DHC8 to expedite vacating R/W at RET 15 due 'a/c close behind'. The DHC8 had just vacated the R/W when a B727 passed on its landing roll. Reporter believes B727 landed whilst the DHC8 was still on the R/W centreline. ATC were talking to the B727 in French.

A/C Type :	Piper PA34 Seneca	**Occurrence Number :**	**200001573**
Flight Phase :	Cruise	**Occurrence Date :**	13 Mar 2000
Classification :	Occurrences	**Location :**	Daventry (DTY)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
PA34 failed to follow its ATC heading and came into potential conflict with a B737. Traffic info and avoiding action given.
Precis :
CAA Closure: The pilot appears to have misinterpreted an instruction to continue on heading, made after his initial call, as a clearance to continue on flight plan. Hence, he carried out a turn towards BPK which brought him into conflict with the B737. Appropriate action has been taken.

A/C Type :	A320	**Occurrence Number :**	**200002112**
Flight Phase :	Climb	**Occurrence Date :**	30 Mar 2000
Classification :	Occurrences	**Location :**	Malaga
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Passing FL117 during climb to FL280, A320 was told to maintain FL110. A320 reached FL126 before returning to FL110.

Precis :

After departing R/W14 A320 was cleared to climb to FL280. When passing FL117, ATC told A320 to maintain FL110 on reaching, but was given no reason for this action. A320 called ATC to confirm instruction whilst TCAS showed a B737 above descending. Autopilot disconnected and A320 descended to FL106 at which point the B737 was indicating 800ft above & still descending.

A/C Type :	B757	**Occurrence Number :**	**200002151**
Flight Phase :	Descent	**Occurrence Date :**	03 Apr 2000
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

B757 600ft low over high terrain due to 8000ft/FL80 being used.

Precis :

ATC cleared B757 to descend to FL80, but was subsequently recleared to 8000ft. The pressure setting of 993mb was a difference of 600ft. Crew twice queried the clearance but ATC confirmed 8000ft on QNH. The next controller recleared the B757 to FL80. B757 climbed back to FL80.

A/C Type :	Military	**Occurrence Number :**	**200002295**
Flight Phase :	Climb	**Occurrence Date :**	07 Apr 2000
Classification :	Occurrences	**Location :**	LOMON
Events :	Loss of Standard Separation Altitude Deviation	**Location Info :**	

Pretitle :

Separation lost between two military a/c North of LOMON at FL105. STCA activated. Avoiding action given.

Precis :

One of the foreign military a/c involved was also involved in an altitude excursion inbound to Glasgow on the same day, possibly caused by an altimeter setting problem.
CAA Closure: The military aircraft seemed to ignore ATC instructions and it is possible that they were actually attempting to fly in formation. The responsible military authority has indicated that many of the problems encountered were probably caused by language difficulties. It is not known whether there was a lack of knowledge of procedures for flying in CAS. The military authority has taken appropriate authority in respect of the language problem.

A/C Type :	B777	**Occurrence Number :**	**200002573**
Flight Phase :	Descent	**Occurrence Date :**	07 Apr 2000
Classification :	Occurrences	**Location :**	Caracas
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Caracas ATC cleared B777 for a turn onto final approach to R/W09 from a position that it was unable to comply with.

Precis :

As B777 was approaching airfield , with no warnings it was cleared to turn onto final approach from a position that made it impossible for the aircraft to execute. The B777 requested a turn downwind to give more distance, but ATC did not understand and kept clearing the B777 for the approach. As the LOC and high terrain were approaching and with a B727 1100ft above, also believed to be on the LOC, the B777 elected to turn away from the airfield. Visual separation was maintained with the B727.

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200002911**
Flight Phase :	Descent	**Occurrence Date :**	28 Apr 2000
Classification :	Occurrences	**Location :**	Prestwick
Events :	Altitude Deviation	**Location Info :**	4 SE

Pretitle :

MD80 descended 500ft below its cleared level (FL80) before returning to FL80. Standard separation maintained

Precis :

A/C Type :	Bell 206 Jet Ranger	**Occurrence Number :**	**200002983**

Flight Phase : Flight
Classification : Occurrences
Events : Airspace Infringement
Occurrence Date : 29 Apr 2000
Location : BOURNEMOUTH
Location Info :

Pretitle :
Foreign helicopter infringed the Bournemouth CTR/ATZ. Communications difficult & pilot failed to follow ATC instructions.
Precis :
Helicopter eventually landed in a field short of the southern airfield boundary.
CAA Closure: The pilot reports that he had a radio problem and has apologised for the incident.

A/C Type : MD 80 Srs
Flight Phase : Descent
Classification : Occurrences
Events : TCAS Report
ATC Conflict
Occurrence Number : **200003096**
Occurrence Date : 07 May 2000
Location : London-Heathrow - LHR
Location Info : 15 W

Pretitle :
MD80 came into conflict with a B747 when it failed to turn for ILS R/W09L, due traffic believed to be in the White Waltham circuit, which was on its right and showing on TCAS with no height readout.
Precis :
Traffic info and avoiding action given.
CAA Closure: The pilots report states that the a/c received 2 TCAS warnings at this time when both ATC and pilot workload was high. He attempted to avoid the conflicts but due to the intensity of radio communications had no time to fully explain the situation to ATC.

A/C Type : BAE146
Flight Phase : Climb
Classification : Occurrences
Events : Foreign ATC Occurrence
Occurrence Number : **200003136**
Occurrence Date : 28 Apr 2000
Location : RATUK
Location Info :

Pretitle :
As the BAe146 was approaching its cleared FL260 it was instructed, in French, to level at FL230. Fortunately the P2 understood the instruction and was able to respond.
Precis :
The BAe146 belongs to a UK operator contracted to fly for the French National airline and was using the RT callsign of the French operator. This probably explains why the French controller lapsed back into speaking French.

A/C Type : B737
Flight Phase : Taxy
Classification : Occurrences
Events : Foreign ATC Occurrence
Occurrence Number : **200003200**
Occurrence Date : 09 May 2000
Location : Valencia
Location Info :

Pretitle :
As B737 pushed back from Stand 3, an unmarshalled ATR72 taxied directly in front across Stands 2, 3 and 4, coming close to the tug.
Precis :
After a straight push back from Stand 3, the B737 had obliquely stopped across the taxyway. As the tug was being disconnected, an ATR72 taxied unmarshalled across Stands 2, 3 and 4, directly in front of the B737 and in close proximity to the unattached tug.

A/C Type : Robin 400
Flight Phase : Cruise
Classification : Occurrences
Events : Airspace Infringement
Occurrence Number : **200003226**
Occurrence Date : 11 May 2000
Location : Leeds Bradford (LBA)
Location Info : 5 NE

Pretitle :
Alleged infringement of the Leeds-Bradford CTR (Class D) by a Robin 400. Traffic info given.
Precis :
CAA Closure: No report has yet been received from the pilot concerned. No further CAA action is possible.

A/C Type : SD330
Flight Phase : Taxy
Classification : UK Reportable Accident
Events : Reportable Accident
Ground (AD) Collision - Other A/c
Occurrence Number : **200003538**
Occurrence Date : 25 May 2000
Location : Paris CDG
Location Info :

Pretitle :

UK Reportable Accident : Runway collision - MD83 collided with SD330 during take off run. 1 fatality in SD330. French BEA investigation.

Precis :

The MD83, registered F-GHED, was cleared to take off from runway 27 at Paris Charles de Gaulle. The Shorts 330, registered G-SSWN, was then cleared to line up and to wait as "number two". The controller believed that the two aircraft were at the threshold of the runway, whereas the Shorts had been cleared to use an intermediate taxiway. The Shorts entered the runway at the moment the MD83 was reaching its rotation speed. The tip of the MD83's left wing went through the Shorts 330's cockpit and hit both pilots, one of whom was killed. The MD83 then aborted its take off. As a result of its investigation the French Bureau Enquetes-Accidents made a number of safety recommendations, none of which were addressed to the CAA. The full BEA report can be viewed on http://www.bea-fr.org/anglaise/rapports/rap.htm

CAA Closure: No CAA action appropriate.

A/C Type :	B757	**Occurrence Number :**	**200004060**
Flight Phase :	Climb	**Occurrence Date :**	10 Jun 2000
Classification :	Occurrences	**Location :**	Olbia
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Alleged poor ATC service /potential loss of separation.

Precis :

Departure clearance given & readback as "LGW VIA A/W 9 AJACCIO 5A SQK 1276 CLIMB TO FL160". A/c was subsequently given a radar vector & whilst passing 5000ft a TCAS target was observed closing on the reporters a/c. The PNF attempted to confirm cleared level but due to continuous comms in Italian was unable to do so. A/c levelled at 5700ft & ATC informed of a/c's level & requested to confirm cleared level. Controller stated "maintain 6000ft". Reporter concerned over the safety implications of mixed language ATC. Italian authorities alerted.

A/C Type :	B757	**Occurrence Number :**	**200004065**
Flight Phase :	Cruise	**Occurrence Date :**	10 Jun 2000
Classification :	Occurrences	**Location :**	AIRWAY UN 866
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :

Foreign AIRPROX - B757and unknown a/c on Airway UN866 at FL370. Subject to investigation by the Portuguese authorities.

Precis :

B757 received a TCAS RA. Controller acknowledged his error.

A/C Type :	B737	**Occurrence Number :**	**200004122**
Flight Phase :	Descent	**Occurrence Date :**	13 Jun 2000
Classification :	Occurrences	**Location :**	AVN VOR
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Alleged that the Marseilles Approach Controller was unable to understand simple requests in English.

Precis :

A/c requested to hold away from MRS until a thunderstorm had cleared and then requested radar vectors from the North. Approach controller could not understand this request. A/c self positioned in hold at AVN and was then offered an approach from the South for R/W 14L. As the thunderstorm had now cleared to the South the approach was flown without further incident. Reporter concerned about the controller's English language ability.

A/C Type :	B737	**Occurrence Number :**	**200004311**
Flight Phase :	Descent	**Occurrence Date :**	10 Jun 2000
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	15

Pretitle :

TCAS TA during ILS approach to R/W 27 at CDG. Alleged poor ATC service and most control being conducted in French.

Precis :

A/C Type :	B747	**Occurrence Number :**	**200004734**
Flight Phase :	Climb	**Occurrence Date :**	02 Jul 2000
Classification :	Occurrences	**Location :**	Brookmans Park (BPK)
Events :	Altitude Deviation (ATC) Altitude Deviation	**Location Info :**	

Pretitle :

B747 climbed above cleared FL270. Standard separation maintained.
Precis :
The pilot requested higher from ATC. The controller asked the a/c if FL270 was acceptable to which the a/c replied in the affirmative. The a/c is then unambiguously cleared up to FL270 but the crew replied in guttural tones, "up to 370", which was not detected by the controller concerned.

A/C Type :	B767	**Occurrence Number :**	**200004821**
Flight Phase :	Climb	**Occurrence Date :**	27 Jun 2000
Classification :	Occurrences	**Location :**	Bodrum
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
ATC instructed a/c to maintain FL80 in an area where the MSA is 8500ft (QNH 1007mbs). ATCs English very poor.
Precis :
ATC clearance on ground was RWY 29 DEP AKBUK 1E CLIMB FL100. On passing 7700ft a/c was instructed to maintain FL80. A/c turned back to the BDR VOR to remain terrain safe.

A/C Type :	SD360	**Occurrence Number :**	**200004916**
Flight Phase :	Approach	**Occurrence Date :**	06 Jul 2000
Classification :	Occurrences	**Location :**	Deauville
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
FOREIGN AIRPROX - SD360 and a TB9 on finals for R/W12 at Deauville. Subject to investigation by the French authorities.
Precis :
SD360 on short final when TB-9 in visual RH circuit turned from base leg to final. He had been informed , in French, that he was Nr2 to SD360. SD360 approach broken off to position back to finals. Controller did not inform SD360 of other traffic.

A/C Type :	B757	**Occurrence Number :**	**200005017**
Flight Phase :	Climb	**Occurrence Date :**	12 Jul 2000
Classification :	Occurrences	**Location :**	ORTAC
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
B757 crew believed they had a slot for a route via ORTAC and PATEL and turned at SAM, but a/c was flowed via LND, the "Tangos" and STG.
Precis :
The a/c was permitted to proceed to ORTAC on the wrong route. However, the reporter is concerned about various safety factors and flight planning implications raised by this occurrence.
CAA Closure: ATC took appropriate action to control the situation that was presented to them. The main problem appears to have been lapses in the company's flight planning procedures. More robust procedures have been introduced.

A/C Type :	CL600RJ Regional Jet	**Occurrence Number :**	**200005026**
Flight Phase :	Descent	**Occurrence Date :**	06 Jul 2000
Classification :	Occurrences	**Location :**	Rome Fiumicino
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
CRJ left high on descent into Rome Fiumicino Airport with ATC not replying to descent requests.
Precis :
Pilot kept calling for descent with ATC speaking in Italian on the RT. No acknowledgement of request. Finally given descent at 24nm for R/W 16R from FL140 to 6000ft. High workload resulted.

A/C Type :	B737	**Occurrence Number :**	**200005138**
Flight Phase :	Taxy	**Occurrence Date :**	13 Jul 2000
Classification :	Occurrences	**Location :**	Malaga
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Malaga - B737's line up clearance cancelled after crossing holding point stop bar. 2 a/c then allowed to land.
Precis :
The line up clearance was cancelled to allow a Spanish a/c to land. ATC were informed that reporter's a/c was infringing the runway safe area but ATC allowed the a/c and a following British airliner to land. ATC did warn the landing flights of the reporter's position. Spanish being spoken on the R/T to first inbound a/c.

A/C Type :	B747	**Occurrence Number :**	**200005268**
Flight Phase :	Approach	**Occurrence Date :**	10 Jul 2000
Classification :	Occurrences	**Location :**	Sao Paulo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Due to poor ATC radar positioning, a/c was placed too high on approach. Controller was then unable to understand a request for an orbit. Go-around flown.
Precis :

A/C Type :	B747	**Occurrence Number :**	**200005489**
Flight Phase :	Descent	**Occurrence Date :**	10 Jul 2000
Classification :	Occurrences	**Location :**	Sao Paulo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
B747 was positioned too close behind preceding a/c to allow normal approach profile to be completed. Go-around flown.
Precis :
Poor understanding of English by the controller meant that the controller could not understand a request for an orbit.

A/C Type :	B737	**Occurrence Number :**	**200005530**
Flight Phase :	Hold	**Occurrence Date :**	27 Jul 2000
Classification :	Occurrences	**Location :**	Rome Fiumicino
Events :	Foreign ATC Occurrence Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Rome ATCC had total comms failure.
Precis :
A/c had descended to FL130 in the "TAQ" hold and was told to contact 125.50. A/c unable to contact this or previous frequency. This happened to all a/c on these frequencies, who could not receive a reply from Rome but could "hear each other". This failure also affected all departing a/c on other Rome frequencies. The only comms that could be established were with FCO Landing Tower (118.70). After 7-10 minutes comms re-established on 125.50. It then became clear that Rome ATCC had no contingency plans, as the ATC service allegedly collapsed: with no ETAs, no runway notification, no readbacks and constant conversations in Italian between Italian airliners operating in the area.

A/C Type :	BAE146	**Occurrence Number :**	**200005698**
Flight Phase :	Taxy	**Occurrence Date :**	31 Jul 2000
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
After landing on R/W08R at Paris CDG, the BAe146 was cleared to cross R/W08L at S6. On entering R/W08L an a/c was cleared for take off before the BAe146 had vacated the R/W. ATC admitted error.
Precis :
The BAe146 became aware from a transmission in French that another a/c had been cleared for take-off on R/W08L Subsequent and detailed correspondence to the foreign authority has failed to elicit an explanation of the incident.
CAA Closure: No further CAA action practical.

A/C Type :	B737	**Occurrence Number :**	**200005790**
Flight Phase :	Climb	**Occurrence Date :**	07 Aug 2000
Classification :	Occurrences	**Location :**	Barcelona
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
Foreign AIRPROX - B737 and low wing, twin engine a/c. Subject to investigation by the Spanish authority.
Precis :
The unknown a/c passed right to left climbing through the B737's level. ATC stated that the a/c had been cleared, with the B737 in sight. The reporter states the crew had not heard this clearance spoken in English.

A/C Type :	A320	**Occurrence Number :**	**200005980**
Flight Phase :	Climb	**Occurrence Date :**	15 Aug 2000
Classification :	Occurrences	**Location :**	Malaga
Events :	Airprox - Foreign TCAS Report	**Location Info :**	

Pretitle :
Foreign AIRPROX - A320 and CN235. Subject to investigation by the Spanish authority.
Precis :
Following departure and during climb, A320 was asked to maintain R/W heading. At the same time the A320 had TCAS indication on visual descending opposite direction CN235. During a conversation in Spanish, the A320 manoeuvred left to increase separation.

A/C Type :	Piper PA32	**Occurrence Number :**	**200006122**
Flight Phase :	Cruise	**Occurrence Date :**	18 Aug 2000
Classification :	Occurrences	**Location :**	Dover (DVR)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
Indecision by LATCC concerning who would be working a foreign PA32 inbound to Oxford. Avoiding action given.
Precis :
CAA Closure: The PA32 was routing to Oxford from Hilversum. In mid-Channel the aircraft called LATCC FIS (E) with a request to join CAS at DVR on an IFR plan. Terminal Control could not accept the aircraft below FL90 and in the exchange between TC and the FIR over the level the fact that they would accept the aircraft was lost. The aircraft was instructed to contact Thames Radar which it did. It appeared that the pilot not only found it difficult to remain at a level due to the weather, but also to understand English or English ATC procedures. Considerable doubt was also raised as to whether the pilot was able to conform to IFR Flight Rules. However, notwithstanding that there was some misunderstanding between ATS units regarding the clearance, the primary cause of the incident was that the PA32 entered CAS even though a clearance to do so had not been issued to the pilot. No further CAA action is possible.

A/C Type :	B757	**Occurrence Number :**	**200006478**
Flight Phase :	Taxy	**Occurrence Date :**	27 Aug 2000
Classification :	Occurrences	**Location :**	Figari
Events :	Ground (AD) Occurrence	**Location Info :**	Corsica

Pretitle :
During taxy to ramp, a sheep walked on to the runway centreline, forcing the aircraft to stop.
Precis :
Due to poor English in the tower, it took several attempts to convey the problem. It was also noted that there was a considerable amount of loose gravel on the apron.

A/C Type :	BE200 Super King Air	**Occurrence Number :**	**200006551**
Flight Phase :	Climb	**Occurrence Date :**	04 Sep 2000
Classification :	Occurrences	**Location :**	Bovingdon (BNN)
Events :	Altitude Deviation	**Location Info :**	3 NE

Pretitle :
BE200 failed to stop at 5000ft during its climb on the CPT3B SID.
Precis :
The a/c was observed climbing above 5000ft , the initial SID altitude. The pilots command of English was poor but the controller established that the a/c was climbing to FL100 but could not establish why. The a/c was instructed to climb to FL70 but was later seen at FL74 before descending back to FL70. The operator was alerted and has taken appropriate action.

A/C Type :	B767	**Occurrence Number :**	**200006661**
Flight Phase :	Hold	**Occurrence Date :**	02 Sep 2000
Classification :	Occurrences	**Location :**	DRAMO
Events :	Airprox - Foreign TCAS Report Airprox - Foreign	**Location Info :**	Hold

Pretitle :
FOREIGN AIRPROX-B767 and a Hercules at SINTRA at FL70. Subject to investigation by the French authorities.
Precis :
B767 was given descent clearance to FL60. Descent was not actioned as TCAS TA had showed another a/c, estimated approx 500 feet below, opposite direction. Climb RA was followed as other a/c was not visual. Reporter comments that controller allowed a number of a/c close to the hold, most of which were controlled in French. Controller appeared to be under pressure. The French authorities investigation concluded that the main cause of this AIRPROX was a penetration of Class D airspace by the Hercules. Possible relevant factors, 1/Complexity of the TMA and lack of legibility of the 1/500 000 map, 2/Workload placed on the Hercules pilots by the operation of several frequencies simultaneously and 3/High level of R/T on frequency. Appropriate actions

have been taken as a result of this AIRPROX. French AIRPROX risk assessment Cat B.

A/C Type :	Robin 400	**Occurrence Number :**	**200006748**
Flight Phase :	Cruise	**Occurrence Date :**	10 Sep 2000
Classification :	Occurrences	**Location :**	Luton (LUT)
Events :	Airspace Infringement	**Location Info :**	

Pretitle :
Infringement of the Luton CTR (Class D). Traffic information given. Standard separation maintained.
Precis :
The pilot concerned allegedly spoke very little English. See also occnums 1997/03355 and 1998/02914.

A/C Type :	B757	**Occurrence Number :**	**200007053**
Flight Phase :	Descent	**Occurrence Date :**	20 Sep 2000
Classification :	Occurrences	**Location :**	Paris Orly
Events :	Airprox - Foreign	**Location Info :**	20 NM

Pretitle :
FOREIGN AIRPROX - B757 and MD80 at 4900ft on approach to Orly. Subject to investigation by the French authorities.
Precis :
French language being used to all a/c except reporters. The French investigation into this AIRPROX concluded that it was caused by "bad command of the radar guidance" by the controller concerned. A contributory factor was the controllers intent to keep his a/c within the geographical limits managed with CDG when a co-ordination to obtain some airspace temporarily would have resolved the problem. French risk assessment CAT B. Appropriate follow up action has been taken.

A/C Type :	B737	**Occurrence Number :**	**200007190**
Flight Phase :	Climb	**Occurrence Date :**	22 Sep 2000
Classification :	Occurrences	**Location :**	CGG
Events :	Airprox - Foreign	**Location Info :**	VOR near

Pretitle :
Foreign Airprox - between B737 and an unidentified a/c.
Precis :
B737 was in the climb to high level when Bordeaux ATC instructed a/c to stop climb at FL280 and turn 40 degrees right, due conflicting traffic at FL290. Instruction was given in French language and by the time the crew received it in English the B737 was approaching FL290. Autopilot disengaged and a/c returned rapidly to FL280.

A/C Type :	B737	**Occurrence Number :**	**200007392**
Flight Phase :	Taxy	**Occurrence Date :**	04 Oct 2000
Classification :	Occurrences	**Location :**	Valencia
Events :	Ramp Incident Foreign ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :
Breakdown of communication between Headset Operative (HO) and a/c, as well as ATC and a/c.
Precis :
Reporter stated that during pushback the a/c was pushed the wrong way: the crew experienced great difficulty with the HO who was unable to communicate in standard phraseology or in plain English. During the conversation from the reporter to the HO there was a conversation in Spanish between a local Spanish operator and ATC . Presumably as a result of this, an ATR taxied towards the reporter's a/c and passed very close down its right hand side at a high taxi speed off the taxi way, through Stands 16 and 17. There were other a/c parked on 15 and 18. The B737 ended up without the parking brake set, still connected to the tug, stationary and in a state of confusion as to ATC requirements.

A/C Type :	CL600RJ Regional Jet	**Occurrence Number :**	**200007471**
Flight Phase :	Approach	**Occurrence Date :**	06 Oct 2000
Classification :	Occurrences	**Location :**	Milan Malpensa
Events :	Adverse Weather Diversion /Return	**Location Info :**	

Pretitle :
Severe unforecast weather conditions at Milan Malpensa. CL600RJ diverted to Linate.
Precis :
Forecast for Malpensa indicated no CBs or Thunderstorms, with wind 010 degrees 8 kts. Actual weather large CBs, strong westerly wind, hail, lightning and heavy rain. Windshear caution received at 1500ft and a/c went around. ATC reported runway 'flooded' but P1 missed the call due to the controller's accent. A/c initially entered

the hold, following missed approach but the weather was too severe and a/c diverted.

A/C Type :	B737	**Occurrence Number :**	**200007558**
Flight Phase :	Climb	**Occurrence Date :**	11 Oct 2000
Classification :	Occurrences	**Location :**	Barkway (BKY)
Events :	UK Airprox Loss of Standard Separation UK Airprox	**Location Info :**	6 SW

Pretitle :
UK AIRPROX 169/00 - IL76 and a B737 6nm SW of Barkway VOR at FL100.
Precis :
The incident occurred when the IL76 descended in response to a clearance addressed to another flight, resulting in the IL76 coming into conflict with the B737. In addition, the controller significantly contributed to the cause by not recognising that the intended addressee of the descent clearance had not yet arrived on the frequency, and did not detect that the readback had been erroneously made by the IL76 crew. On realising the mistake, the controller subsequently took quick action to seek confirmation that the IL76 was maintaining its original assigned level, although the IL76 subsequently commenced a descent. Separation was lost with the B737, but no resolution instructions or traffic information was passed to the IL76. The incident will be subject to assessment by UKAB.
CAA Closure: Appropriate ATC action taken.

A/C Type :	B747	**Occurrence Number :**	**200007667**
Flight Phase :	Cruise	**Occurrence Date :**	05 Oct 2000
Classification :	Occurrences	**Location :**	NY 360/50
Events :	TCAS Report Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Traffic, taking avoiding action by descending from FL330 to FL310, caused a B747, cruising at FL310, to receive a TCAS TA. B747 turned right to offset track by 1nm. Traffic climbed back to FL320.
Precis :
Traffic reported later that descent was required because of other a/c at FL330. Traffic dialogue with ATC was conducted in French.

A/C Type :	EMB 145	**Occurrence Number :**	**200008342**
Flight Phase :	Taxy	**Occurrence Date :**	03 Nov 2000
Classification :	Occurrences	**Location :**	Milan Malpensa
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Potential conflict between an EMB145 taxying to Stand Y2 and an opposite direction a/c. A/c was marshalled around the EMB145, which was then recleared to Stand Y5.
Precis :
EMB145 had originally been allocated Stand Y5, but was cleared to park on Stand Y2, due to an a/c pushing back near Stand Y5. As the EMB145 was taxying along its cleared route, the P1 became aware of a conflict between the EMB145 and opposite direction a/c. The EMB145, which initially had its taxy light on, stopped, but the other a/c continued to taxy and only stopped when the EMB145 repeatedly flashed its landing lights. Subsequently there was no room left for a safe manoeuvre of either a/c on taxy centre lines. Eventually the other a/c was marshalled around the EMB145, which was then recleared to park on Stand Y5. The other a/c had been issued ATC taxi instructions in Italian.

A/C Type :	CL600RJ Regional Jet	**Occurrence Number :**	**200008496**
Flight Phase :	Climb	**Occurrence Date :**	02 Nov 2000
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	SID

Pretitle :
Disagreement between crew and ATC over whether CRJ was in the correct position whilst on a NURMO 8A SID.
Precis :
On a/c arrival at waypoint PG272, whilst on a NURMO 8A departure from Runway 27R at CDG, the controller requested an immediate turn to heading 360 and stated that a/c was not on the SID. Crew re-confirmed and cross checked position twice and both crew agreed that they were exactly where they were meant to be. The controller insisted that they were not and kept the a/c on the heading. Reporter believes that another a/c may have called ATC (in French) and reported a "near miss".

A/C Type :	Falcon 900	**Occurrence Number :**	**200008547**
Flight Phase :	Climb	**Occurrence Date :**	19 Nov 2000

Classification :	Occurrences	**Location :**	Bovingdon (BNN)
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
Falcon 900 climbed 500 feet above its cleared FL80, due to incorrect pressure setting. Pilot apologised and set the correct pressure. Standard separation maintained.
Precis :

A/C Type :	Fokker F27 Friendship	**Occurrence Number :**	**200008617**
Flight Phase :	Climb	**Occurrence Date :**	19 Nov 2000
Classification :	Occurrences	**Location :**	Dean Cross (DCS)
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
Fk27 climbed above its cleared flight level and was asked to check its pressure setting. A/c had Glasgow QNH set. Pilot told to set 1013mb and descended back to FL170. Standard separation maintained
Precis :

A/C Type :	BAE ATP	**Occurrence Number :**	**200008758**
Flight Phase :	Climb	**Occurrence Date :**	22 Nov 2000
Classification :	Occurrences	**Location :**	PNA SW
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Confusion between crew and ATC over ATP's correct FL.
Precis :
Initial pre-start clearance from Pamplona was FL170. During taxy this was amended to FL90. After take-off handed to Madrid on 133.95, and then cleared FL160 and told to contact Madrid on another frequency that could not be understood. FL160 read back and re-confirmation of frequency requested. 120.9 was given. However, a/c unable to make contact on that frequency but could hear other a/c talking to Madrid. Approximately 5 minutes later, re-contacted Madrid on 133.95 and told that a/c was only cleared to FL90. Both crew adamant that the crew received a clearance to climb to FL160. Another a/c with a similar callsign was on the frequency. Spanish language being spoken on R/T. Spanish ATC authorities alerted to this incident.

A/C Type :	A321	**Occurrence Number :**	**200008865**
Flight Phase :	Descent	**Occurrence Date :**	23 Nov 2000
Classification :	Occurrences	**Location :**	Lanzarote
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :
During approach to R/W21, the A321 received a TCAS RA on visual military traffic in the 11 o'clock position. Language communication problems.
Precis :
During approach, level at 3300ft, the A321 requested to fly overhead the field to visually position left base for R/W21. This was approved at the pilot's discretion. A321 was also told that it was Nr 1and cleared to land. When the A321 was over the field, passing 1500ft, a military a/c was observed in the 11 o'clock position. A few seconds later a TCAS RA was received. Tower advised, who after a moment informed the A321 it was Nr 2 to land. Reporter believes the incident was partly caused by the use of Spanish which did not allow the reporter to get a 'picture' of the traffic in the area.

A/C Type :	EMB 145	**Occurrence Number :**	**200008991**
Flight Phase :	Climb	**Occurrence Date :**	29 Nov 2000
Classification :	Occurrences	**Location :**	AMOGA
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	30 S

Pretitle :
EMB145 was cleared to climb above the SID level of FL100 (FL100 gives a 1000ft separation from inbound traffic). Approaching FL110 EMB145 received a TCAS RA of descend which was complied with.
Precis :
EMB145 was cleared to climb to FL180, expedite through FL120. Approaching FL110 EMB145 received a TCAS RA of descend. Whilst complying with TCAS, ATC instructed the EMB145 to change heading. TCAS action reported to ATC. Also French was being spoken to other traffic at time of incident.

A/C Type :	BAE146	**Occurrence Number :**	**200100327**
Flight Phase :	Flight	**Occurrence Date :**	18 Jan 2001
Classification :	Occurrences	**Location :**	Toulouse
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
ATC Occurrence - Bordeaux control called a/c repeatedly in French.
Precis :
It took several attempts to successfully establish 2-way communication in English.

A/C Type :	B737	**Occurrence Number :**	**200100328**
Flight Phase :	Parked	**Occurrence Date :**	17 Jan 2001
Classification :	Occurrences	**Location :**	Milan Malpensa
Events :	Ground (AD) Occurrence	**Location Info :**	

Pretitle :
Runway state information unavailable - snow conditions at Malpensa. B757 crew unable to determine rwy condition, due to lack of ATIS information and language difficulties.
Precis :
A/c crew examined and determined rwy state visually and proceeded.

A/C Type :	B757	**Occurrence Number :**	**200100389**
Flight Phase :	Parked	**Occurrence Date :**	09 Jan 2001
Classification :	Occurrences	**Location :**	Lisbon
Events :	Smoke / Fumes (not engine) Adverse Weather Ground (AD) Occurrence	**Location Info :**	

Pretitle :
Smoke/haze in cabin during boarding. Passengers disembarked, QRH drill actioned, smoke cleared. Suspect heavy rain entered APU ducting.
Precis :
Fire crew did not speak English and initially went to wrong stand. A/c checked, no faults evident, unable to locate source of smoke. Suspect heavy rain at time of incident entered APU ducting, adjacent a/c experienced similar incident.

A/C Type :	B767	**Occurrence Number :**	**200100468**
Flight Phase :	Descent	**Occurrence Date :**	22 Jan 2001
Classification :	Occurrences	**Location :**	Puerto Vallarta
Events :	Foreign ATC Occurrence Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - B767 approaching airport was given altimeter setting of 3001. Due poor quality of RT crew believed altimeter setting to be 1001. As soon as VOR started, discrepancy apparent.
Precis :
Approaching airport, B767 was expecting 1013 (QNH from AERAD charts). Pressure setting 3001 was given, but due to the poor RT quality and heavy accent the crew read back 1001, with no correction from ATC. As soon as the VOR started, the discrepancy became apparent. Approach continued because of good weather and visual with R/W22 from start of approach.

A/C Type :	A320	**Occurrence Number :**	**200100500**
Flight Phase :	Cruise	**Occurrence Date :**	23 Jan 2001
Classification :	Occurrences	**Location :**	France
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - A320 was given avoiding action, due to possible conflict with military a/c. A320 unable to monitor situation due to foreign language being used.
Precis :

A/C Type :	Not Applicable	**Occurrence Number :**	**200100664**
Flight Phase :	Not Applicable	**Occurrence Date :**	26 Jan 2001
Classification :	Occurrences	**Location :**	Biggin (BIG)
Events :	Runway Incursion	**Location Info :**	

Pretitle :
Lorry and white van crossed the threshold of Runway 29 without clearance.
Precis :
Both (foreign) drivers were supposed to wait for an escort but, presumably because of language difficulties, crossed anyway. The company receiving the goods has since apologised for the incident.

A/C Type :	Fokker 100	**Occurrence Number :**	**200009588**
Flight Phase :	Taxy	**Occurrence Date :**	19 Dec 2000

Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Runway incursion at CDG.
Precis :
After landing on 08R , the a/c was cleared to vacate and hold short of 08L on S5. The training captain then looked up from his landing 'flow' checks to note that the a/c appeared to have taxied through the CAT1 holding point at S5. Captain was told to stop and he explained that he thought he had taxied through the Cat 2/3 hold and was continuing to the Cat 1 holding point. ATC then instructed a/c to hold position. ATC then spoke to an a/c on the 08L threshold and cleared it for take-off. The a/c rotated well before the Fokker's position and once airborne ATC advised him in French that the Fokker had gone through the hold point at S5.

A/C Type :	A300	**Occurrence Number :**	**200100714**
Flight Phase :	Climb	**Occurrence Date :**	04 Feb 2001
Classification :	Occurrences	**Location :**	Brookmans Park (BPK)
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
A300 departed Luton on a CLN 6B SID, and climbed straight to 5000ft before BPK and before making contact with LATCC. Pilot's English poor. Pilot advised of error. Standard separation maintained.
Precis :
See also occnum 2000/08393. The operators report states that during the SID there was a combination of problems with the Autoflight System and the crews actions. The annunciation system did not work correctly although the flight director gave correct information on the MCP. Nevertheless the crew should have taken the problem into account. Appropriate follow up action has been taken by the operator concerned.

A/C Type :	B737	**Occurrence Number :**	**200100821**
Flight Phase :	Flight	**Occurrence Date :**	07 Feb 2001
Classification :	Occurrences	**Location :**	LATCC - Lakes Sector
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
Telephony designator lead to callsign confusion and pronunciation problems.
Precis :
Operator alerted.

A/C Type :	A300	**Occurrence Number :**	**200100988**
Flight Phase :	Climb	**Occurrence Date :**	19 Jan 2001
Classification :	Occurrences	**Location :**	Luton (LUT)
Events :	Altitude Deviation RT Problems	**Location Info :**	

Pretitle :
ATC Incident - A300 on a CPT 3B SID climbed to 5500ft before contacting frequency 119.77. A300 was asked to maintain 5000ft then cleared to climb to FL70. A/c observed to have descended to 4500ft.
Precis :
See also occs 200008393 and 2001/00714. A number of attempts to contact the foreign operator concerned have failed to elicit a response.
CAA Closure: No further CAA action practical.

A/C Type :	Unknown	**Occurrence Number :**	**200101725**
Flight Phase :	Cruise	**Occurrence Date :**	13 Mar 2001
Classification :	Occurrences	**Location :**	London-Heathrow - LHR CTR
Events :	Airspace Infringement	**Location Info :**	

Pretitle :
Infringement of the Heathrow Control Zone by an unidentified a/c. Heathrow departures affected.
Precis :
Pilot appeared to have a limited understanding of English.

A/C Type :	BAE146	**Occurrence Number :**	**200101823**
Flight Phase :	Cruise	**Occurrence Date :**	10 Mar 2001
Classification :	Occurrences	**Location :**	Paris
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - BAe146 was given ATC instructions in the French language, but the French speaking P2 replied in English.

Precis :
The French speaking P2 was doing the R/T on a BAe146 operating in French airspace and when the a/c was transferred, all initial calls initiated by BAe146 were responded to by ATC in English. Subsequent calls initiated by ATC were in French, but the crew responded in English. On transfer to approach the BAe146's call was replied to in French and so were the following instructions. The P2 read back the instruction in English making some mistakes that were not corrected by ATC. Due to a discrepancy between the P1 and P2 as to the meaning of the clearance, the P1 requested clarification which was received in English and subsequent transmissions were in English.

A/C Type :	A320	**Occurrence Number :**	**200101832**
Flight Phase :	Descent	**Occurrence Date :**	20 Mar 2001
Classification :	Occurrences	**Location :**	BRC
Events :	Airprox - Foreign	**Location Info :**	20 N

Pretitle :
Foreign AIRPROX - A320 and another airliner 20nm N of BRC at FL100.
Precis :
As A320 was descending to cleared FL100 on approach, the controller was speaking French to opposite direction traffic on climb out from aerodrome. The A320 received a TCAS TA, but not an RA, on visual traffic, which levelled at FL100 and passed down the RH side. ATC informed.

A/C Type :	B737	**Occurrence Number :**	**200102415**
Flight Phase :	Approach	**Occurrence Date :**	23 Mar 2001
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
With B737 on short finals to Runway 27L at 600-700 feet, ATC reported a helicopter at the threshold of 27L.
Precis :
ATC were queried as the crew were not visual with the helicopter. ATC then stated "helicopter is 200 feet above the threshold of 27L". Shortly after crew spotted helicopter in a 200 feet hover approximately 200 yards south of the threshold and elected to continue approach.

A/C Type :	BAE146	**Occurrence Number :**	**200102499**
Flight Phase :	Approach	**Occurrence Date :**	31 Mar 2001
Classification :	Occurrences	**Location :**	Chambery
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
BAe146 received and reacted to a TCAS RA against a light a/c whilst at 2300 feet on approach to Chambery.
Precis :
When ATC were subsequently questioned about this incident they stated that a light a/c had departed R/W 36 and was maintaining visual separation with the BAe146. The light a/c had received ATC instructions in French and the BAe146 crew were not alerted to it at any time.

A/C Type :	B737	**Occurrence Number :**	**200103208**
Flight Phase :	Descent	**Occurrence Date :**	13 May 2001
Classification :	Occurrences	**Location :**	Kalamata
Events :	GPWS Report RT Problems Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - B737 descending to 7000ft reported poor radio transmissions, loss of DME and garbled VOR. During climb back to 9000ft, B737 received a brief GPWS.
Precis :
B737 was cleared to descend to 9000ft. B737 recommenced descent to 7000ft at 15 DME KAL VOR. Reporter requested a left turn 15 due weather avoidance. There was no reply from ATC, then a garbled response descend 7000ft QNH. B737 maintained track 215 and started descent, then all at the same time there was (1) No response from ATC, despite several calls on boxes 1 and 2, (2) KAL DME lost, (3) Ident on KAL VOR on recheck garbled, and (4) GPS P1's side had been giving RAIM (Receiver Autonomous Integrity Monitoring) warnings. B737 commenced an immediate climb back to 9000ft during which the GPWS warning sounded once briefly. Comms eventually re-established and the VOR procedure was carried out from the KAL VOR from 9000ft instead of 7000ft.

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200103246**
Flight Phase :	Climb	**Occurrence Date :**	15 May 2001
Classification :	Occurrences	**Location :**	London-Gatwick - LGW

Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :

Altitude deviation - MD80 noted at 6000 ft instead of cleared 5000ft whilst outbound from Gatwick. Standard separation maintained.

Precis :

Investigations indicate that the crews understanding of English appeared poor and the readback of the initial ATC clearance was unintelligible but was accepted as confirmation by ATC.

A/C Type :	Piper PA46 Malibu	**Occurrence Number :**	**200103533**
Flight Phase :	Cruise	**Occurrence Date :**	28 May 2001
Classification :	Occurrences	**Location :**	ABERDEEN (ADN)
Events :	Airspace Infringement	**Location Info :**	15 SW

Pretitle :

ATC Incident - Infringement of Airway P600 (Class A) by a PA46 receiving a FIS. Avoiding action given to a DHC8.

Precis :

The PA46 pilot subsequently reported that he believed that, having submitted a flight plan, clearance to enter CAS was automatic. The pilot has been reminded of the responsibility to obtain clearance before entering CAS.
CAA Closure: Appropriate CAA action taken.

A/C Type :	Piper PA28	**Occurrence Number :**	**200103635**
Flight Phase :	Cruise	**Occurrence Date :**	30 May 2001
Classification :	Occurrences	**Location :**	Birmingham
Events :	Airspace Infringement	**Location Info :**	Honiley 7 NW

Pretitle :

ATC Incident - Infringement of the Birmingham CTR (Class D) by a PA28R, due to the foreign pilot failing to understand the ATC instructions given to him.

Precis :

Standard separation maintained.

A/C Type :	Piper PA30 Twin Comanche	**Occurrence Number :**	**200103891**
Flight Phase :	Cruise	**Occurrence Date :**	09 Jun 2001
Classification :	Occurrences	**Location :**	WOTAN
Events :	Loss of Standard Separation	**Location Info :**	5 N

Pretitle :

ATC Incident - Separation lost between a DHC8 and a PA30 on Airway G1. Conflict Alert activated.

Precis :

The PA30 was westbound on Airway G1 at FL120, under the control of the Area Radar SC. The DHC8 had departed from Birmingham for Exeter under IFR and when approximately 7nm north of the airway boundary called the Bristol APR for a radar service outside CAS and to arrange a crossing clearance through the airway at FL120. Although the DHC8's details had been pre-noted by Birmingham its proximity to the airway boundary when it called required the Bristol controller to act quickly to co-ordinate a crossing clearance with the Area Sector. Area Sector controllers had already detected the as yet 'unknown' traffic tracking on a converging course with the PA30 within the Airway. The PA30 was warned of the traffic but the foreign pilot appeared to have difficulty in comprehending the traffic information. Eventually an agreement was reached with the Area SC that the Bristol APR would descend the DHC8 to FL 110 and pass astern of the PA30. Descent clearance (and traffic information) was issued to the DHC8 when it was just under 7nm from the PA30 and turn instructions were issued when it was at a range of 5nm. Minimum separation occurred a short while later when horizontal separation reduced to 3.9nm at the point when the DHC8 was 500 feet below the PA30. Although horizontal separation reduced further to less than 2.5nm, almost 1000 feet vertical separation had been established by then and tracks were now diverging. There was no risk of collision. It has subsequently been established that the Bristol APR had mistakenly believed that the application of 3nm separation was sufficient in these circumstances. This was not the case and in conjunction with SRG, Bristol's MATS Part 2 has been appropriately amended to clarify the circumstances and conditions where the application of 3nm radar separation may be applied. In addition, Bristol ATC have opened a dialogue with the DHC8 operator to emphasise the importance of flights establishing communications with Bristol early where it is the intention to seek a crossing of Class A controlled airspace.
CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200103986**
Flight Phase :	Landing	**Occurrence Date :**	12 May 2001
Classification :	Occurrences	**Location :**	Caen
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
FOREIGN AIRPROX-B737 and a CAP10B at Caen airport at 600 feet. Subject to investigation by the French authorities.
Precis :

A/C Type :	Fokker 100	**Occurrence Number :**	**200104127**
Flight Phase :	Taxy	**Occurrence Date :**	17 Jun 2001
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Clearance confusion, ATC used both English and French. Potential misunderstanding avoided due pilots able to speak both languages.
Precis :
A/c cleared to line-up behind Air France B737 and wait. An Air France B737 was rolling from taxi-way at the time, so P2 replied to ATC that subject a/c would line-up behind departing B737 and wait. ATC then cleared another Air France B737 to land using French. P1 queried clearance with P2, B737 confirmed visually on finals at approximately 2 miles. P2 (French national) again checked clearance with ATC who advised that subject a/c was to line-up after B737 on finals. Reporter concerned that use of both languages and ambiguous clearance could have resulted in a hazardous situation, which was averted because both pilots could speak French.

A/C Type :	B737	**Occurrence Number :**	**200104422**
Flight Phase :	Taxy	**Occurrence Date :**	24 Jun 2001
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Ramp Incident	**Location Info :**	

Pretitle :
Non-standard push-back. Ground spoke French and used hand signals. Communication between ground and flight crew inadequate.
Precis :
Push-back initially normal with brakes off and call to start engines. As a/c stopped, flight crew assumed it would be pulled forward to align with taxi-way. However, a/c began heading slowly back towards terminal, at which point flight crew realised they were disconnected from main gear remote control push machine. Brakes were applied and ground controller disconnected his headset prior to uneventful taxi.

A/C Type :	B737	**Occurrence Number :**	**200104465**
Flight Phase :	Taxy	**Occurrence Date :**	30 Jun 2001
Classification :	Occurrences	**Location :**	Palma
Events :	Ramp Incident	**Location Info :**	

Pretitle :
Non-English speaking ground engineer gave a/c clearance to commence taxi (using hand signals) while baggage conveyor belt was still in front of RH engine.
Precis :
P1 observed object in front of RH engine as taxi commenced, adjacent ground crew also saw problem and immediately moved mobile baggage conveyor.

A/C Type :	A320	**Occurrence Number :**	**200104472**
Flight Phase :	Cruise	**Occurrence Date :**	02 Jul 2001
Classification :	Occurrences	**Location :**	Narbo
Events :	Smoke / Fumes (not engine) Emergency Call Foreign ATC Occurrence	**Location Info :**	S

Pretitle :
ECAM avionics smoke warning. PAN declared. No fault found. Attributed to high humidity.
Precis :
At FL370 during cruise, ECAM avionics smoke warning activated although there was no visible sign of smoke. PAN declared (which was allegedly not acknowledged by ATC), and flight continued to destination with constant monitoring of flight deck and pax cabin. During taxy-in the flight crew were advised that intermittent non-odorous smoke had emanated from the overhead vents in the cabin during latter stages of approach. The aircraft was parked on the taxiway and a slight delay encountered before the arrival of steps and buses. Passengers then disembarked without further incident. Avionics / cargo compartments inspected with no evidence of smoke, and system tested satisfactorily. The operator's investigation revealed no defect which could have attributed or caused smoke/smoke warning. The operator investigated a re-designed smoke detector, but found it no more reliable than the current type due to problems with dust and airborne particles. As thee was no odour and no defects were found, it is assumed that the warning was caused by high humidity causing water vapour to be seen as "smoke" form the air vents. See also 200106064.

CAA Closure: The hazard is adequately controlled by the actions stated above.

A/C Type :	B737	**Occurrence Number :**	**200104550**
Flight Phase :	Descent	**Occurrence Date :**	01 Jul 2001
Classification :	Occurrences	**Location :**	Malaga
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Missed approach executed by B737 due to an Airbus still on the runway. Tower ATC failed to provide any information. ATC in Spanish.

Precis :

A/C Type :	B757	**Occurrence Number :**	**200104695**
Flight Phase :	Taxy	**Occurrence Date :**	06 Jul 2001
Classification :	Occurrences	**Location :**	Malaga
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Crew brought B757 to a sudden halt to give way to an MD80 thereby preventing a potential ground collision.

Precis :

B757 was exiting via D5 onto the parallel taxi-way for R/W 32 when the First Officer warned the Captain of the MD80 exiting very quickly from D4. It is believed that the MD80 crew had no intention of giving way. Spanish R/T in use.

A/C Type :	SA332 Super Puma	**Occurrence Number :**	**200105051**
Flight Phase :	Parked	**Occurrence Date :**	20 Jul 2001
Classification :	Occurrences	**Location :**	North Sea
Events :	Ground (AD) Occurrence	**Location Info :**	

Pretitle :

Excessive ship movement - exceedance of roll limits on ship's helideck.

Precis :

The Crystal Ocean Weather was telephoned through to operations, but did not include the Pitch, Roll & Heave. Crew requested PR & H as the Ocean Alliance, which was in close proximity, was reporting 4.4 meters heave. The weather was passed as R 0.3 P 1.5 & H1.3. Flight departed. In accordance with standard procedures, the ship was called on ‘log’ frequency, then 'radio' frequency but there was no reply to either. Communication was established with the nearby Britannia platform, but they had no communication with the Crystal Ocean. Descent was initiated at 100 miles, (Crystal Ocean was 120 NM) with communications finally established on ‘radio’ frequency at 9 miles to go, (4 mins before ETA). Log frequency was not manned and so the ship had to be directed to this frequency. The ship weather was again requested and PR & H figures were passed as 1.8/0.4/1.7. The ship was circled and appeared to be stable most of the time with some heave at times. A landing was carried out and the crew left the anti-colls on, so as to assess the deck movement; whilst it appeared to be more than that stated, it seemed to be within limits. The outbound load of 723 lbs, included some large boxes in the cabin. Only 2 deck crew were available, the HLO + 1. P1 remained on the brakes whilst P2 climbed out on deck to supervise and in the event did most of the unloading himself. Suddenly, the motion of the ship picked up noticeably. P1 asked for a read-out of the heave which was reported as 1.7 meters. P1 questioned this and asked if there was a record of the heave and being told there was, requested a printout of the last 10 minutes. P1 was then told that it was not available. P1 was unhappy with the deck movement and stated that they would be lifting as soon as P2 was on board. The deck movement then increased further, to a completely unacceptable level which was sensed by P2 on deck who, through his experience, realised it was time to return to his seat. The aircraft lifted out of the chocks and just before departure, P1 noticed 8deg left roll and 4deg right roll and suspected that the right wheel was at least light on the wheels during the immediate time prior to lift, with 8deg left roll. After departure, P1 raised the ship on the radio and stated that the details passed about ship movement were totally unacceptable and highly inaccurate, making the deck a very dangerous operating environment. It was not possible to raise the ship again, which was also supposed to have flight watched the aircraft until the pilot advised en-route contact. On return to Aberdeen it was discovered that a mail bag had been put into the boot which was neither advised to the crew, nor manifested. During communications it became obvious that the ship's radio operator's knowledge of English was limited. Operations advised that only a partial departure message had been relayed and that was only after pressure from the radio room. See also 2000/09490. Following discussions with the vessel owner, helicopter operations resumed on 27 July 2001 to the operator's satisfaction.

CAA Closure: The hazard is controlled by the actions stated above.

A/C Type :	B747	**Occurrence Number :**	**200105059**
Flight Phase :	Cruise	**Occurrence Date :**	23 Jul 2001
Classification :	Occurrences	**Location :**	KIPPA
Events :	Loss of Standard Separation	**Location Info :**	

	Altitude Deviation		

Pretitle :
Loss of separation between B747 and two military jets. Initial reports attribute cause to foreign military crew language difficulties.
Precis :
The 4 foreign military jets were on an air-to-air combat training exercise over the North Sea, in a designated area. On completion, the formation cleared the area, contacted London Mil for descent, and were cleared from FL390 to FL280, 1000 ft above a B747. The foreign crew reported that there was some difficulty with radio reception, and they believed they had been cleared to descend to FL260. During the descent they observed the B747, and maintained their heading but increased their rate of descent to avoid. As the formation was levelling at FL260, it was instructed to maintain FL280, and initiated a climb back, keeping the B747 in sight.
CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200105169**
Flight Phase :	Cruise	**Occurrence Date :**	24 Jul 2001
Classification :	Occurrences	**Location :**	Geneva
Events :	Airprox - Foreign	**Location Info :**	15 SW

Pretitle :
FOREIGN AIRPROX-B737 and unknown a/c at FL290 15nm SW of GVA. Subject to investigation by the Swiss authorities.
Precis :
B737 received and actioned a TCAS RA. The Swiss authorities have advised that the cause of this AIRPROX was a misunderstanding between the controller and the crew of the other a/c probably due to their lack of knowledge of English. Swiss risk assessment CAT B. The Swiss authorities have contacted the airline over this problem.

A/C Type :	B767	**Occurrence Number :**	**200105171**
Flight Phase :	Approach	**Occurrence Date :**	24 Jul 2001
Classification :	Occurrences	**Location :**	Gerona
Events :	A/c Equipment / System Malfunction Ground (AD) Occurrence	**Location Info :**	

Pretitle :
Leading Edge (L/E) slat asymmetry.
Precis :
The aircraft was established on finals and the flaps were selected to 20 when an EICAS warning 'LE SLAT ASSYM' displayed. A go-around was initiated and the aircraft returned to the hold whilst the QRH was consulted. The Pilot Reference Manual was also consulted to check landing distance as the aircraft was tankering round-trip fuel. Once all checklists had been completed, the aircraft was established on finals for an uneventful flap 25 landing. On clearing the runway the aircraft requested that the Fire Services check the brakes, however difficulty was experienced communicating directly with the Fire Truck/Services as the fire crew could not speak English and could only liaise with the tower. When parked the first officer inspected the brakes and declared normal operations.

A/C Type :	B737	**Occurrence Number :**	**200105199**
Flight Phase :	Hold	**Occurrence Date :**	28 Jul 2001
Classification :	Occurrences	**Location :**	Murcia
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Reporter concerned at ATC service given. On contact with tower, B737 informed of a delayed landing due to Gliding activity. When asked duration of delay informed 10-20mins.
Precis :
Reporter states that on first contact with tower, B737 informed of a delay to their landing due to Gliding activity. When asked duration of delay, B737 was told maybe 10-15-20mins. Reporter concerned that priority was given to gliders over commercial traffic, also fuel state, absence of activity from NOTAMs and poor English by ATC. ATC were also happy for B737 to divert.

A/C Type :	A300	**Occurrence Number :**	**200105530**
Flight Phase :	Climb	**Occurrence Date :**	06 Aug 2001
Classification :	Occurrences	**Location :**	Bodrum
Events :	Altitude Deviation (ATC)	**Location Info :**	

Pretitle :
Crew of A300 allegedly received a poor ATC service at Bodrum.
Precis :

Various modified ATC clearances were received until passing 5600 feet in the climb when the a/c was instructed to maintain 4000 feet. A/c levelled at FL60 and ATC informed.

A/C Type :	B737	**Occurrence Number :**	**200105793**
Flight Phase :	Approach	**Occurrence Date :**	11 Aug 2001
Classification :	Occurrences	**Location :**	Murcia
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :

Foreign AIRPROX - B737 and a microlight. Subject to investigation by the Spanish authority.

Precis :

B737 at 2400ft on final to R/W05 was cleared to land. At 1400ft the crew became aware of TCAS traffic ahead and below. ATC then issued the a/c (a microlight), which was on base leg, a clear instruction that it was Nr 2 to land . The microlight then entered an orbit. Subsequently the B737 crew looked for and acquired the microlight visually as it was climbing above the B737. Microlight pilot had difficulty understanding English and did not acknowledge many clearances.

A/C Type :	B737	**Occurrence Number :**	**200105904**
Flight Phase :	Taxy	**Occurrence Date :**	17 Aug 2001
Classification :	Occurrences	**Location :**	Palma
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

B737 had to stop to avoid a collision with an ATR72 at the hold for R/W 24R at Palma. Spanish being spoken on the R/T.

Precis :

A/C Type :	SA365 Dauphin	**Occurrence Number :**	**200105954**
Flight Phase :	Approach	**Occurrence Date :**	24 Aug 2001
Classification :	Occurrences	**Location :**	Battersea
Events :	UK Airprox	**Location Info :**	

Pretitle :

UK AIRPROX 154/2001 - Bell 206 and SA365 final approach to R/W21 at Battersea.

Precis :

The Bell 206 was joining London Battersea Heliport from the West, called ATC passing Barnes, and was cleared to join downwind left hand for R/W21. Traffic information was passed on an SA365 inbound via Vauxhall Bridge. The specification of a circuit direction to the Bell 206 was at variance with the Battersea MATS Part 2. The SA365 made its initial call over Vauxhall Bridge at 1500 ft, and was advised as number 2 behind the Bell 206, which was at the time overhead the heliport on its downwind leg. No specific joining instruction was passed to the SA365, nor was any mention made of the flight remaining North of the river to maintain separation from the Bell 206. It was the controller's responsibility to provide separation in accordance with local procedures. Due to the bends in the river, the controller could not see the SA365, but estimated that the Bell 206 would complete its approach safely ahead of the SA365. The controller's view to the East was restricted by trees, and the situation was not helped by the late initial call from the SA365. When the controller eventually saw the SA365, it was realised that the 2 helicopters were on conflicting flight paths. Instructions were passed to the SA365, which the pilot found somewhat confusing. However, the SA365 pilot then saw the Bell 206, and keeping it in sight descended behind it to position as number 2. The incident will be subject to assessment by UKAB.
CAA Closure: No further CAA action appropriate.

A/C Type :	B737	**Occurrence Number :**	**200105971**
Flight Phase :	Initial Climb	**Occurrence Date :**	24 Aug 2001
Classification :	Occurrences	**Location :**	Thessaloniki
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :

Foreign ATC Incident - After take off from R/W28 B737 received and complied with a TCAS RA.

Precis :

During the B737's take off roll the crew heard a conversation in Greek and the words 'go around'. TCAS showed an a/c above and slightly behind for the latter stage of the take off roll. The B737 did not hear ATC issue any avoiding instruction to it or the other a/c. B737 was aware of the other a/c at all times and appropriate action was taken following the TCAS RA.

A/C Type :	BAE146	**Occurrence Number :**	**200106461**
Flight Phase :	Parked	**Occurrence Date :**	13 Sep 2001
Classification :	Occurrences	**Location :**	Milan Linate
Events :	Ground (AD) Occurrence	**Location Info :**	

Pretitle :
Refueller deliberately adjusted the ordered and selected fuel figure.
Precis :
The P1 personally went up the ladder and selected 7,500 kgs of fuel and then returned to the flight deck. Later the P1 returned to the re-fuel panel and found the refueller was up the ladder and that the selection had been increased to 7,700kgs. The P1 was unable to ascertain from the Italian worker why the selection had been changed. See also 2001/06619. The foreign handling agent subsequently reported that the procedure adopted was designed to allow fuel pressure relief during hose disconnection, rather than to load more fuel. Language difficulties did not help. The UK operator has issued a NOTAC, advising crews of the problems experienced, and to be vigilant.
CAA Closure: Appropriate operator action taken.

A/C Type :	BAE146	**Occurrence Number :**	**200106619**
Flight Phase :	Parked	**Occurrence Date :**	20 Sep 2001
Classification :	Occurrences	**Location :**	Milan Linate
Events :	Ground (AD) Occurrence	**Location Info :**	

Pretitle :
Refuelling incident - Refueller intent on adding additional fuel to specified 7100 kgs to BAe146. Refueller did not speak English.
Precis :
See "Master" occnum 2001/06461.

A/C Type :	B737	**Occurrence Number :**	**200106804**
Flight Phase :	Climb	**Occurrence Date :**	04 Sep 2001
Classification :	Occurrences	**Location :**	NTS
Events :	Altitude Deviation (ATC)	**Location Info :**	180 S

Pretitle :
ATC incident - Late ATC re-clearance to crew of B737. During climb to FL310 ATC requested climb stopped at FL280. A/c reached FL286 before descent initiated.
Precis :
The situation was compounded by the fact that majority of ATC transmission was in French leading to poor awareness of other a/c.

A/C Type :	Unknown	**Occurrence Number :**	**200107027**
Flight Phase :	Climb	**Occurrence Date :**	02 Oct 2001
Classification :	Occurrences	**Location :**	Rio De Janeiro
Events :	Foreign ATC Occurrence Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC incident - ATC at Rio de Janeiro allegedly changed SID after take off leading to a 270 degree left turn.
Precis :
On clearance delivery the ATC clearance was confirmed 3 times as a CARMI 1 departure, involving a right turn downwind. The standard of English was poor and had to be reconfirmed. After take-off ATC queried the SID and a 270 left turn had to be initiated. ATC eventually confirmed the SID required and gave a radar heading of 260 degrees and gave a radial to establish on. The controlling was poor as was the English phraseology used. The Brazilian investigation concluded that the incident was caused by the poor English of the inexperienced under training controller and the wrong pronunciation of the MARICA ONE procedure. Appropriate ATC follow up action has been taken.

A/C Type :	B757	**Occurrence Number :**	**200107176**
Flight Phase :	Approach	**Occurrence Date :**	15 Oct 2001
Classification :	Occurrences	**Location :**	Lanzarote
Events :	RT Problems Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - B757 initiated a go-around at 400ft due loss of communications with tower on final approach.
Precis :
B757 on visual approach to R/W03 was instructed to contact tower on frequency 118.90 (usual tower frequency is 120.70). The B757 was at 3nm final when it called 118.90 using the left VHF box, where the controller was heard speaking Spanish. B757 reported 'final approach R/W03' and the controller queried reporter's callsign, who restated callsign and position. Again controller queried the callsign and B757 again responded with callsign and position. The frequency then went quiet. By now the B757 was on short finals. One pilot then transmitted

requesting landing clearance whilst the other pilot selected alternate tower frequency 120.70. Pilot initiated a go around at 400ft and contact established on frequency 120.70 during go around, and subsequent clearance for a visual circuit and landing was given. During taxy in the controller confirmed tower frequency as 120.70 and reported that the B757 had actually been cleared to land on frequency 121.50. Operation of the left VHF box was normal throughout both sectors.

A/C Type :	B737	**Occurrence Number :**	**200107245**
Flight Phase :	Descent	**Occurrence Date :**	18 Oct 2001
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Occurrence - Poor ATC service provided to a B737 on descent/approach to Madrid.
Precis :
Crew were initially instructed to hold at PARLA FL150, landing ILS R/W 33. Before reaching PARLA they were instructed to proceed to POT (VOR), for ILS approach R/W 18R (R/W change in progress). Cleared to FL110 & frequency change. After reaching POT instructed to DUKKE (waypoint) and after speed control enquiry with no reply, reduced to 220kts. Approaching DUKKE preceding a/c (right to left approx 5nm on TCAS) cleared for a VOR/DME 18R. On enquiry as to approach type - informed a VOR/DME 18R. Frequency change, descent requested, no reply, so requested radio check. Callsign confusion (correct callsign was Midland 8G9 - addressed as 8GA). Instructed heading 360 degrees. Another frequency change. No reply. Finally addressed as 8GB and cleared to RBO (VOR). At this time 50% of transmissions were in Spanish. Preceding a/c (A321- visual contact) now showing 4nm on TCAS (still no speed control). Enquired speed control - no reply. Therefore configured Flap 1 190kts. Frequency change at RBO (again callsign confusion 8GA) instructed VOR/DME 18 R and min 190kts to 6 DME. Frequency change to Tower and cleared to LOC for ILS 18R. B737 reduced to minimum approach speed and subsequently advised by Tower to reduce speed. Satisfactory landing completed.

A/C Type :	B777	**Occurrence Number :**	**200107313**
Flight Phase :	Cruise	**Occurrence Date :**	11 Oct 2001
Classification :	Occurrences	**Location :**	Niamey
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
Foreign AIRPROX - B777 and another airliner. Subject to investigation by the Niger authority
Precis :
B777 southbound on Airway at FL350 was asked by ATC to confirm maintaining FL370. ATC cleared the B777 for immediate climb to FL370. At this point an a/c appeared on TCAS at 38nm northbound at FL350. B777 reached FL370 as the a/c passed each other. ATC claimed to have been calling the B777, but nothing was heard, also the other airliner claimed to have called on frequency 126.9, but again nothing was heard by the B777. B777 stated that ATC were unreadable for a lot of the time. French language being used.

A/C Type :	AN124	**Occurrence Number :**	**200107406**
Flight Phase :	Climb	**Occurrence Date :**	25 Oct 2001
Classification :	Occurrences	**Location :**	Daventry (DTY)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
AN124 allegedly entered CAS at FL80 at Daventry without appropriate clearance. Attributed to language difficulties. Standard separation maintained.
Precis :

A/C Type :	Military	**Occurrence Number :**	**200107439**
Flight Phase :	Cruise	**Occurrence Date :**	26 Oct 2001
Classification :	Occurrences	**Location :**	East Midlands
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
ATC Incident - Conflict alert activated when 2 military jets with poor R/T and height keeping, allegedly descended below their cleared level. Traffic info and avoiding action given to a BAe146.
Precis :
A pair of military a/c that had been observed deviating from their cleared FL280 by plus and minus 400ft prior to entering sector were put on heading 335deg. On initial contact with a BAe146, it was instructed to climb to FL260 and fly heading 330deg. Both the BAe146 and the military a/c were then given further heading changes, and the military a/c instructed 'left heading 330'. Subsequently the military a/c were observed at FL290 and climbing. When this was queried pilot reported maintaining FL280 but shortly after stated 'FL330 was our last clearance'. During the military a/cs rapid descent it passed through FL280 to FL272. Traffic info and avoiding action given to the BAe146 and avoiding action to the pair of military jets. A subsequent report from the military crew stated that they were experiencing poor radio reception due to a technical problem, and their difficulty in

understanding radio calls was due to this, and radio saturation problems, rather than a lack of language understanding.
CAA Closure: No further CAA action practical.

A/C Type :	B747	**Occurrence Number :**	**200107504**
Flight Phase :	Cruise	**Occurrence Date :**	29 Oct 2001
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	RT Problems ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - For 15mins a foreign B747 with radio problems taking intermittent ATC instructions, allegedly failed to follow ATC procedures, which resulted in an increase in ATC workload.
Precis :
Due to radio problems, foreign B747 lost contact on frequencies 124.92, 121.22 and 119.72 and subsequently could not establish on ILS R/W27R. The operator subsequently reported that the radio problems emanated from a short circuit in the a/c ILS selector panel, which was rectified.
CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200107569**
Flight Phase :	Take Off	**Occurrence Date :**	05 Apr 2001
Classification :	Occurrences	**Location :**	Rome Fiumicino
Events :	Foreign ATC Occurrence Rejected Take-Off	**Location Info :**	

Pretitle :
Foreign ATC Incident - B737 at holding point was cleared to take off. An expeditious line-up, followed by rolling take-off was executed. ATC then instructed B737 to stop. Take off rejected at 65kts.
Precis :
Whilst B737 was at holding point it received clearance to take off R/W25. An expeditious line-up, followed by rolling take-off was executed. ATC then instructed B737 to stop, which took a couple of seconds to comply with due to the instruction not being very clear. Take off rejected at 65kts with power stable, R/W vacated and brakes cooled. ATC had ordered RTO due to a/c on finals to R/W16R being faster than anticipated.

A/C Type :	A321	**Occurrence Number :**	**200107791**
Flight Phase :	Climb	**Occurrence Date :**	08 Nov 2001
Classification :	Occurrences	**Location :**	GADOR
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
Foreign AIRPROX - A321 and unknown a/c. Subject to investigation by the Spanish authority.
Precis :
A321's initial clearance was via VIBAS FL140, but a GADOR 1A was requested which was approved by ATC, but with a ROC of 2000ft/min. As A321 turned towards GADOR traffic was seen below flying from left to right at 8nms. A321 was cleared to climb to FL280 and then received a TCAS TA on the climbing traffic which was now 5nms and 1000ft below. A321 increased ROC. All conversations with the other a/c were in Spanish.

A/C Type :	A320	**Occurrence Number :**	**200107880**
Flight Phase :	Descent	**Occurrence Date :**	12 Nov 2001
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - When A320 was locked onto localiser for R/W33, ATC gave radar vectors to allow another a/c to approach before A320. Extensive use of Spanish on R/T.
Precis :
Use of Spanish was a severe hindrance to the crew's understanding of the situation around them.

A/C Type :	B737	**Occurrence Number :**	**200108026**
Flight Phase :	Descent	**Occurrence Date :**	22 Nov 2001
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
FOREIGN AIRPROX-B737 and Swearingen Merlin on approach to R/W 27L at CDG. Subject to investigation by the French authorities. TCAS TA.
Precis :
Reporter states that AIRPROX was caused by a lack of ATC awareness which led to the other a/c involved heading to cross the B737's path at the same level. ATC allegedly unaware of conflict until B737 called

established 27L. French and English being used over the R/T. The French authorities confirm ATC error. The French investigation revealed that the AIRPROX was caused by an unsuitable first instruction to the Merlin, heading 160 , which was associated with an anticipation of descent to FL50 which had not been vacated by the B737. A second heading given to the Merlin also failed to resolve the conflict. Contributory factors were high ATC workload and the large speed differential between the 2 a/c involved. French AIRPROX risk assessment CAT A.

A/C Type :	Falcon 900	**Occurrence Number :**	**200108243**
Flight Phase :	Approach	**Occurrence Date :**	03 Dec 2001
Classification :	Occurrences	**Location :**	Northolt
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - DA900 made an approach to R/W07 below airfield minima and below glide path. DA900 initiated a go around approximately 0.5nm from R/W07 threshold.

Precis :

CAA Closure: The operator's report states that both the pilots were very experienced professional pilots who have flown hundreds of PAR approaches each. They both state that they had great difficulty in understanding the directions and terminology used by the final PAR approach controller. This was allegedly exacerbated by distorted or scratchy radio reception on his frequency. All directions issued were discussed between the pilots. Whilst on the approach the pilot flying elected to use the autopilot. Whilst on descent he used autopilot inputs to follow the directions of the controller whilst discussion continued about the controller's directions. The resultant misunderstanding of the terminology used by the controller caused the a/c to be controlled so as to proceed below the glide path while the pilot erroneously thought he was being advised he was above the glide path. The a/c levelled out at minimums, and the pilot disconnected the autopilot and performed a missed approach. On the next approach the a/c was flown without autopilot to a successful landing. Appropriate and comprehensive remedial action is being taken by the operator concerned.

A/C Type :	B777	**Occurrence Number :**	**200108351**
Flight Phase :	Parked	**Occurrence Date :**	16 Nov 2001
Classification :	Occurrences	**Location :**	Calcutta
Events :	Flight Crew Occurrence A/c Equipment / System Malfunction Foreign ATC Occurrence	**Location Info :**	

Pretitle :

SID in chart booklet superseded but information in NUBRIEF inadequate to cross check FMC stored SID.

Precis :

Aerad SID chart G6 for CCU (Calcutta) allegedly gives no current or appropriate westerly departure. Reporter comments that NUBRIEF advises only that Dhanbad NDB is withdrawn and replaced by Tepal waypoint and to expect Tepal 1 SID. Reporter concerned that Tepal 1 SID in FMC database is substantially different from former Dhanbad 1 SID and, therefore, SID cannot be cross checked. A cross check with ATC (difficult due to poor English) revealed eventually that expected SID was closer to old Dhanbad 1 than Tepal 1 shown in FMC. Reporter suggests that FMC database should be cross-checked with correct Tepal 1 SID and chart amended also to show correct Tepal 1 SID.

A/C Type :	B737	**Occurrence Number :**	**200108689**
Flight Phase :	Parked	**Occurrence Date :**	23 Dec 2001
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - As B737's slot time approached P1 found it difficult to contact ATC and get a clear picture of the situation as Spanish was spoken on delivery, ground and tower frequencies.

Precis :

A/C Type :	BAE146	**Occurrence Number :**	**200200365**
Flight Phase :	Taxy	**Occurrence Date :**	05 Jan 2002
Classification :	Occurrences	**Location :**	Chambery
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - BAe146 at hold had been cleared to backtrack R/W36. A single engine a/c on approach was observed heading for the BAe146. BAe146 moved onto R/W and light a/c landed on grass.

Precis :

BAe146 had been cleared to line up and backtrack R/W36. On checking, a single engine a/c was noticed on approach. BAe146 stopped at hold and was told by ATC to expedite. BAe146 informed ATC that it would not be

ready on turn round. There was no answer. ATC spoke to the light a/c in French, who replied in French. BAe146 held position, it was then realised that the light a/c was heading for the BAe146. BAe146 moved onto R/W and light a/c landed on grass parallel to the R/W. All details of the incident were passed to the French authorities, who are conducting a full investigation, and will advise when completed.
CAA Closure: Appropriate foreign authority action being taken.

A/C Type :	B777	**Occurrence Number :**	**200200494**
Flight Phase :	Climb	**Occurrence Date :**	25 Jan 2002
Classification :	Occurrences	**Location :**	PUERTO CABE PBL VOR
Events :	Altitude Deviation (ATC) Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Occurrence- B777 and unknown a/c. Subject to investigation by the Venezualan authority.
Precis :
As B777 was passing FL284 during its cleared climb to FL390, ATC called B777 to maintain FL280, due to an a/c on a reciprocal heading descending to FL290. B777 descended back to FL280. The Venezuelan authorities have identified an ATC error and appropriate remedial action has been taken.

A/C Type :	B757	**Occurrence Number :**	**200200736**
Flight Phase :	Cruise	**Occurrence Date :**	07 Feb 2002
Classification :	Occurrences	**Location :**	Valencia
Events :	Airprox - Foreign TCAS Report Airprox - Foreign	**Location Info :**	

Pretitle :
Foreign AIRPROX - B757 and an MD80. Subject to investigation by the Spanish authority.
Precis :
B757 approaching VLC VOR at FL330 was cleared to descend to FL230 with visual MD80 tracking right to left at FL320 in one o'clock position. P2 (flying) confirmed with P1 traffic and started descent. B757 then received a TCAS RA and P2 asked P1 'do you want to follow them', but P1 thought he had said 'do you want control' and said no you do it, meaning for P2 to carry out RA drill. MD80 was visual and B757's track would always take it behind, but due to MD80 being 30degs off reciprocal track the clearance was less than originally intended. There was no risk as MD80 passed down left side of B757.

A/C Type :	B737	**Occurrence Number :**	**200200834**
Flight Phase :	Climb	**Occurrence Date :**	09 Feb 2002
Classification :	Occurrences	**Location :**	Biggin (BIG)
Events :	Altitude Deviation	**Location Info :**	5 SW

Pretitle :
ATC Incident - B737 departed on a CLN SID and cleared to climb to FL80, but subsequently seen passing FL84. As there was no traffic to affect B737 was cleared to FL100. Standard separation maintained.
Precis :
Pilots English poor.

A/C Type :	A321	**Occurrence Number :**	**200201404**
Flight Phase :	Descent	**Occurrence Date :**	02 Mar 2002
Classification :	Occurrences	**Location :**	SAPCO
Events :	ATC Occurrence	**Location Info :**	6 S

Pretitle :
Possible unauthorised transmissions on East Midlands Approach frequency 134.17, 6nm south SAPCO. Appropriate ATC action taken.
Precis :

A/C Type :	B737	**Occurrence Number :**	**200201824**
Flight Phase :	Taxy	**Occurrence Date :**	24 Mar 2002
Classification :	Occurrences	**Location :**	Nantes
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
FOREIGN AIRPROX-B737 allegedly cleared for take-off three times at Nantes while a TB10 was holding on the runway.
Precis :
B737 crew questioned take-off clearance due to light a/c on runway. ATC cleared B737 twice more and then instructed B737 to hold position when clearance was questioned for a third time. ATC allegedly spoke in French to the light a/c throughout. Light a/c eventually commenced take-off, following which B737 departed without

further incident. The severity of the incident was brought to the attention of the French authorities, who are taking appropriate action. The French AIRPROX investigation concluded that the controller having lined up the TB10 from an intermediate position then forgot about it. The Local controller's workload was high. Contributory factors were non-detection of the TB10 when making a visual check due to difficulty in adjusting the light contrast with the blinds and non-use of the phraseology "line up and wait" which could have reinforced the controller's mental image of the situation.
CAA Closure: No further CAA action required.

A/C Type :	B757	**Occurrence Number :**	**200201959**
Flight Phase :	Climb	**Occurrence Date :**	29 Mar 2002
Classification :	Occurrences	**Location :**	
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
FOREIGN AIRPROX/TCAS RA-B757 and a B737 at FL305 climbing out of Banjul. Subject to investigation by the Senegalese authority.
Precis :
B757 crew actioned a TCAS RA descend instruction. The B737 was communicating with Dakar radio in French.

A/C Type :	B757	**Occurrence Number :**	**200201964**
Flight Phase :	Climb	**Occurrence Date :**	02 Apr 2002
Classification :	Occurrences	**Location :**	Las Palmas
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :
Foreign ATC Incident - During climb after take off, B757 received a TCAS RA of descend, on military circuit traffic. Traffic turned right and passed down B757's LH side. ATC informed of TCAS RA.
Precis :
Whilst B757 was on stand, ground frequency issued ATC clearance of 1st altitude of 5000ft. At handover to Tower, they were speaking with military circuit traffic in Spanish and cleared B757 to line up after and then immediate take off. On climb out traffic observed on TCAS and obtained visually in 10 o'clock position. When TCAS TA sounded, B757 reduced ROC, this was followed by RA of descend. Traffic turned right and passed down B757's LH side. B757 levelled at 5000ft and informed tower of RA who transferred B757 to approach who were also informed of RA . Approach confirmed clearance issued should have been 'Stop climb at 3000ft'.

A/C Type :	B767	**Occurrence Number :**	**200201985**
Flight Phase :	Descent	**Occurrence Date :**	30 Mar 2002
Classification :	Occurrences	**Location :**	PIXOT
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
ATC gave an a/c clearance in French to climb through subject B767 level (FL170) to FL180. Potential conflict.
Precis :
B767 observed other traffic on TCAS, but were not visual. ATC asked other a/c, in French, if they were visual with B767. They were and so were cleared to climb through B767 FL170 to FL180. B767 P1 had a sufficient understanding of French to understand ATC clearance. Potential hazard. The French authorities response stated that, formally, the controller did not infringe any rule, the French regulation stipulating that the language to be used in radio exchanges is either French (with French speakers) or English. In the case of a visual crossing, the agreement of only one pilot is required. They further advised that studies are under way to revise the French CAA regulations and it is believed that visual crossing clearances is one of the points to be revised.
CAA Closure: No further CAA action practical.

A/C Type :	A319	**Occurrence Number :**	**200202034**
Flight Phase :	Parked	**Occurrence Date :**	26 Mar 2002
Classification :	Occurrences	**Location :**	Lyon
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Twice A319 stopped push back from Stand C61. First time due to RJ100 pushing back from adjacent Stand C43 and second time due to a/c taxiing behind. Third attempt satisfactory.
Precis :
A319 requested and given push back clearance from Stand C61. After push back started, P2 advised push back crew of an RJ100 pushing back from adjacent Stand C43. Push back stopped and ATC informed. ATC believed A319 was on Stand C63 not C61. Once RJ100 had cleared, clearance received and push back commenced, but had to be stopped again as another a/c taxied behind. ATC told A319 to stop and once a/c clear, push back re-commenced. Confusion over stand and clearance may have been caused by language problems and a/c's call sign "363" on Stand C61. The French investigation has revealed that the controller wrote on his strip that the

A319 was on Stand C43. They strongly believe that the controller confused the stand numbers and reporters call sign.

A/C Type : BAE146 **Occurrence Number :** **200202134**
Flight Phase : Climb **Occurrence Date :** 04 Apr 2002
Classification : Occurrences **Location :** Paris CDG
Events : Foreign ATC Occurrence **Location Info :**
Pretitle :
Foreign ATC incident - RJ100 departed R/W09R on a OPALE 9G SID and cleared by ATC to turn right, which was twice queried by crew. Right turn commenced and immediately instructed by ATC to turn left.
Precis :
RJ100 departed R/W09R on a OPALE 9G SID and cleared by ATC to turn right heading North, which was twice queried by crew and both times controller confirmed right turn heading North. P1 was visual with a B747 level at 2000ft. Right turn started at 3800ft climbing to FL100. In right turn ATC gave immediate instructions to turn left.

Initial investigation has revealed that the controller thought he was telling the BAe146 to turn left, but in fact instructed it to turn right. Appropriate action is being taken by the foreign authority.

A/C Type : A321 **Occurrence Number :** **200202272**
Flight Phase : Climb **Occurrence Date :** 02 Apr 2002
Classification : Occurrences **Location :** Palma
Events : Foreign ATC Occurrence **Location Info :**
Pretitle :
After departing Palma, A321 crew allege that Barcelona frequency 134.67 was blocked for 3mins by conversation in Spanish between ATC and another a/c. Palma then allocated A321 a different frequency.
Precis :

A/C Type : A300 **Occurrence Number :** **200202381**
Flight Phase : Approach **Occurrence Date :** 12 Apr 2002
Classification : Occurrences **Location :** Rimini
Events : GPWS Report **Location Info :**
Pretitle :
GPWS 'Terrain' Mode 2A warning.
Precis :
The aircraft was overhead the VOR at 5000 ft. and had been cleared for an ILS approach but while making a LH turn a GPWS 'Terrain - Pull Up' warning sounded and a GPWS 'Red Light' displayed. Autothrottles and autopilot were disconnect and the aircraft climbed, reaching 9000 ft. over the sea to the east of Rimini before the warning ceased. A subsequent approach and landing was completed without incident. The reporter notes that there was confusion between the aircraft and ATC as the flight crew informed ATC that they were obeying a GPWS command whilst ATC believed the aircraft was navigating using GPS, adding that GPS was unreliable in the Rimini area.

A/C Type : B777 **Occurrence Number :** **200202455**
Flight Phase : Approach **Occurrence Date :** 17 Apr 2002
Classification : Occurrences **Location :** Bogota
Events : Foreign ATC Occurrence **Location Info :**
Pretitle :
B777, on approach into Bogota, allegedly experienced difficulty obtaining essential information from ATC due frequency blocked by continuous and unnecessary conversations in Spanish.
Precis :
Additionally, flight crew allege that they were repeatedly asked for their a/c registration, point of departure and other similar questions while parking, which is a time of very high workload.

A/C Type : B737 **Occurrence Number :** **200202560**
Flight Phase : Descent **Occurrence Date :** 19 Apr 2002
Classification : Occurrences **Location :** LORES
Events : Foreign ATC Occurrence **Location Info :**
Altitude Deviation (ATC)
Pretitle :
Foreign ATC Incident - ATC cleared B737 to descend from FL280 to FL180. Passing FL275 during high ROD ATC instructed B737 to maintain FL280. Descent stopped below FL260 and B737 cleared to FL260.
Precis :
High ATC workload.
A/C Type : Gulfstream 2 **Occurrence Number :** **200202667**
Flight Phase : Climb **Occurrence Date :** 27 Apr 2002

Classification :	Occurrences	**Location :**	Luton (LUT)
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
ATC Incident - After take off from R/W26 G2 failed to follow the CPT 3B SID heading and climbed above its cleared altitude of 5000ft. Pilot reported having problems with the compass.
Precis :
The Gulfstream 2 pilot reported having a compass problem, and requested vectors to assist. The G2 was reminded to maintain 5000 ft as it passed 5300 ft, and the a/c ahead was climbed from 6000 ft to FL80 to maintain prescribed separation.
CAA Closure: No further CAA action required.

A/C Type :	B757	**Occurrence Number :**	**200202704**
Flight Phase :	Cruise	**Occurrence Date :**	27 Apr 2002
Classification :	Occurrences	**Location :**	En Route
Events :	Pressurisation Failure Emergency Call Emergency Descent RT Problems Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Pressurisation malfunction - aircraft unable to maintain pressurisation on one bleed. MAYDAY declared. Emergency descent.
Precis :
LH bleed tripped at FL390 and aircraft was unable to maintain cabin height (cabin rate of climb increased from 500fpm to 1000fpm). PAN declared followed immediately by a MAYDAY when no response was initially received from ATC. Rapid descent then initiated and oxygen masks donned as a precaution. Aircraft then levelled at FL290 when cabin altitude stabilised. QRH drills actioned, bleed reset and all systems operated normally. MAYDAY cancelled and flight continued to destination at FL330. Investigation found the LH engine fan air valve plate spindle and bearings severely worn and the valve plate seized in an almost closed position - valve replaced.

A/C Type :	Microlight	**Occurrence Number :**	**200202905**
Flight Phase :	Cruise	**Occurrence Date :**	01 May 2002
Classification :	Occurrences	**Location :**	Glasgow (GOW)
Events :	Airspace Infringement	**Location Info :**	

Pretitle :
Alleged infringement of Glasgow CTR (Class D) by microlight at 2000ft.
Precis :
Microlight entered CAS without clearance and then failed to respond to repeated ATC instructions (attributed to poor English). Microlight track took it into potential confliction with departing a/c, one departure stopped until microlight had vacated vicinity. An investigation by the foreign authority determined that the pilot mis-read his chart, and did not appreciate that CAS extended from ground level in the Class D airspace around Glasgow. The pilot also experienced radio problems which resulted in not receiving transmissions from Glasgow. Appropriate action was taken by the foreign authority.
CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200203085**
Flight Phase :	Approach	**Occurrence Date :**	16 May 2002
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
ATC instructed B737 to go-around from 400ft at Paris CDG due B747 lined up for take-off yet to commence take-off roll.
Precis :
B737 on approach to R/W09R, 5nm behind B747. ATC then instructed another B747 (in French) to line-up after landing B747. Seeing the B747 commence taxi from holding point to threshold, B737 questioned ATC but was told to continue approach. However, ATC then instructed B737 to go-around from 400ft as B747 was yet to commence take-off roll.

A/C Type :	B747	**Occurrence Number :**	**200203325**
Flight Phase :	Cruise	**Occurrence Date :**	23 May 2002
Classification :	Occurrences	**Location :**	TADEX
Events :	ATC Occurrence	**Location Info :**	15 E

Pretitle :

Repeated unauthorised deviations from flight plan route by B747, 15nm East of TADEX at FL370. Potential conflict with Falcon 900. STCA activated, standard separation maintained.
Precis :
Investigations indicate that the flight was given a clearance to Heathrow which was different from the planned route. The flight was cleared PRAWN, 59/50,59/40,58/30,57/20, NIBOG, TADEX then planned route. The filed flight plan had been via 57/20, MASIT, DEVOL, RINUS and DUBLIN. Therefore when the B747 crossed TADEX it turned onto UN560 to Dublin. It appears that the confusion arose because the crew did not copy the requirement to track to Belfast. Consequently the FMC would have turned the a/c automatically after TADEX direct to Dublin. The event coincided with communication difficulties which delayed the crew response to ATC.
CAA Closure: No further CAA action practical.

A/C Type :	BE200 Super King Air	**Occurrence Number :**	**200203349**
Flight Phase :	Climb	**Occurrence Date :**	22 May 2002
Classification :	Occurrences	**Location :**	Lambourne (LAM)
Events :	Altitude Deviation	**Location Info :**	10 E

Pretitle :
ATC Incident - BE200 was cleared to climb to FL80, but observed passing FL81 when pilot requested confirmation of cleared level being FL90. BE200 reached FL84 before descending back to FL80.
Precis :
BE200 was cleared to climb to FL80 underneath an inbound A300 at FL90. BE200 observed passing FL81 when pilot requested confirmation of the cleared level being FL90. BE200 turned and told to descend to FL80. BE200 reached FL84 before descending back to FL80. Standard separation maintained.

A/C Type :	A320	**Occurrence Number :**	**200203374**
Flight Phase :	Descent	**Occurrence Date :**	22 May 2002
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Reporter states poor ATC vectoring resulted in reduced separation and late landing clearance given to A320.
Precis :
Reporter states that ATC vectored A320 away from airfield to allow other local airline a/c to join approach first. A320 was turned in 2nm behind an A300. On approach ATC reported separation distance as 4.5nm but reporter believes it was closer to 2.5nm. Final landing clearance given below 10ft due long roll out of preceding a/c. All communication to other inbound a/c was in local language.

A/C Type :	B737	**Occurrence Number :**	**200203413**
Flight Phase :	Circuit	**Occurrence Date :**	27 May 2002
Classification :	Occurrences	**Location :**	Malaga
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
TCAS RA "monitor vertical speed" received on a conflicting a/c indicating 300 feet above. Other a/c was into the setting sun and could not be visually acquired. Spanish being spoken on frequency.
Precis :

A/C Type :	Falcon 50	**Occurrence Number :**	**200203552**
Flight Phase :	Climb	**Occurrence Date :**	28 May 2002
Classification :	Occurrences	**Location :**	Bristol International
Events :	Altitude Deviation ATC Occurrence	**Location Info :**	7NNW

Pretitle :
Altitude deviation. Falcon 50 climbed through cleared 3000ft towards FL90, 7nm NNW of Bristol Lulsgate. Potential conflict with B737 at FL90. Standard separation maintained.
Precis :
Falcon 50 allegedly commenced take-off without clearance, failed to select instructed frequency (124.35) and then climbed through cleared 3000ft. The pilot's report subsequently received acknowledged that a changed clearance, correctly read back, was not followed. The pilot apologised for the misunderstanding, and for the frequency confusion.
CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200203569**
Flight Phase :	Descent	**Occurrence Date :**	19 May 2002
Classification :	Occurrences	**Location :**	Figari
Events :	Airprox - Foreign	**Location Info :**	

	TCAS Report Altitude Deviation		

Pretitle :
FOREIGN AIRPROX/TCAS RA - B737 and Cessna single at 4000ft on approach into Figari. Subject to French authority investigation.
Precis :
Communication between ATC and light a/c was in French.

A/C Type :	Piper PA28	**Occurrence Number :**	**200203924**
Flight Phase :	Cruise	**Occurrence Date :**	08 May 2002
Classification :	Occurrences	**Location :**	Brize Norton
Events :	Airspace Infringement	**Location Info :**	

Pretitle :
ATC Incident - Infringement of the Brize Norton CTR (Class D) by a PA28. Avoiding right turn given to a climbing B757 and traffic info to a military a/c. Standard separation maintained.
Precis :
Chief Flying Instructor telephoned and apologised, stating that the duty instructor and foreign student involved in the infringement had been debriefed.

A/C Type :	A319	**Occurrence Number :**	**200203969**
Flight Phase :	Climb	**Occurrence Date :**	12 Jun 2002
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	30 N

Pretitle :
Foreign ATC Incident - A319 believed it was cleared to climb to FL240. Passing FL130 with high rate of climb, A319 instructed to maintain FL140 on reaching. Traffic seen on TCAS at FL150 4-5nms abeam.
Precis :
Both crew heard the clearance to FL240 which was clearly read back. Alleged poor standard of ATC with clipped and non standard R/T often in Spanish.

A/C Type :	A320	**Occurrence Number :**	**200204161**
Flight Phase :	Climb	**Occurrence Date :**	23 Jun 2002
Classification :	Occurrences	**Location :**	Alexandria, Egypt
Events :	Foreign ATC Occurrence Altitude Deviation (ATC)	**Location Info :**	5 NE

Pretitle :
Foreign ATC Incident - As A320 was passing 3500ft during its climb to FL140, ATC asked to maintain 3000ft. A320 descended back to 3000ft and given avoidance heading due conflicting traffic.
Precis :
After A320 took off climbing unrestricted to FL140 on a heading, TCAS traffic was noted ahead and above. On contacting ATC, A320 was asked to maintain 3000ft. A320 was passing 3500ft so autopilot disconnected and a/c descended back to 3000ft. An avoidance heading was given, and when clear of traffic A320 cleared to climb to FL140.

A/C Type :	B737	**Occurrence Number :**	**200204189**
Flight Phase :	Descent	**Occurrence Date :**	21 Jun 2002
Classification :	Occurrences	**Location :**	St Petersburg
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - B737 was cleared to descend to FL167. Approaching FL197 ATC asked B737 to maintain FL197 and subsequently gave immediate climb to FL217 and left turn, which was complied with.
Precis :
Alleged poor ATC vectoring/service. Information received indicates that the controller failed to tell the pilot that he would be taken through the localiser. Additionally, twice instructions were given to 600 metres instead of 6600 metres. Appropriate ATC remedial action has been taken as a result of this incident.

A/C Type :	Other	**Occurrence Number :**	**200204427**
Flight Phase :	Cruise	**Occurrence Date :**	30 Jun 2002
Classification :	Occurrences	**Location :**	Compton (CPT)
Events :	Airspace Infringement Airspace Infringement	**Location Info :**	5N

Pretitle :
Infringement of LTMA by Extra 400 at FL170, 5nm North of Compton.
Precis :

Investigations indicated that the primary cause of this incident was the pilot entering CAS without a clearance. The Farnborough controller however did not act on the fact that the pilot had advised that he was inbound to CPT at FL170. The pilot's report subsequently received indicated that the pilot believed that filing a flight plan gave automatic authority to enter CAS. The pilot has been advised, through the appropriate foreign authority, that positive clearance from ATC to join CAS is required in the UK before an a/c can enter.
CAA Closure: No further CAA action required.

A/C Type :	B747	**Occurrence Number :**	**200204821**
Flight Phase :	Cruise	**Occurrence Date :**	15 Jul 2002
Classification :	Occurrences	**Location :**	SILVA
Events :	UK Airprox TCAS Report A/c Equipment / System Malfunction	**Location Info :**	NE

Pretitle :
UK AIRPROX 114/2002 - B747 and military a/c at FL260 Northeast of SILVA. B747 received TCAS RA, avoiding action issued.
Precis :
The B747 was at FL260, and the controller, on seeing another a/c with unknown intentions, gave the B747 a precautionary turn. The B747 subsequently received a TCAS RA on the unidentified traffic, and turned left and descended. At the same time ATC gave an avoiding turn and traffic information. The intruding a/c was a foreign military a/c, operating in a military ACMI exercise area/range. The ACMI tracking system had failed, and the military a/c's inertial navigation system developed a position error, leading to the infringement of CAS. The military pilot had visual contact with the B747 at 3 nm. The incident will be subject to assessment by UKAB.
CAA Closure: No further CAA action required.

A/C Type :	BAE146	**Occurrence Number :**	**200204882**
Flight Phase :	Climb	**Occurrence Date :**	13 Jul 2002
Classification :	Occurrences	**Location :**	
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
Non-compliance with ATC instructions by RJ100 climbing out of Heathrow at 4000ft.
Precis :
Pilot continuously queried ATC instructions, which were repeated, and failed to comply with instructions on several separate occasions. Standard separation maintained throughout. The pilot's report, subsequently received, acknowledged that the RJ100 crew had received a cabin emergency light soon after take off, and whilst attempting to confirm with the cabin crew the nature of the problem, had become distracted and stressful over the potentially serious incident. Consequently the crew became uncertain of the assigned heading and height instructions, and reported being unable to confirm because of the high R/T loading. The cabin emergency warning proved to be spurious.
CAA Closure: No further CAA action required.

A/C Type :	Other	**Occurrence Number :**	**200204946**
Flight Phase :	Approach	**Occurrence Date :**	12 Jul 2002
Classification :	Occurrences	**Location :**	Le Touquet
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
Foreign AIRPROX - ZLIN Z37A and a Yak. Subject to investigation by the French authority.
Precis :
In severe rain and poor visibility the Zlin was instructed to join downwind R/W14 and whilst downwind was cleared to land Nr 1. On final approach at a height of approximately 50ft, pilot became aware of a Yak approaching R/W at high speed from opposite end and descending rapidly. Zlin immediately broke off the approach and initiated a very low sharp turn to the left to avoid oncoming Yak. After landing Yak pilot approached reporter and apologised for causing the go around and also informed reporter that the Yak had been cleared by ATC in French, to give a low level pass against R/W in use.

A/C Type :	A319	**Occurrence Number :**	**200205077**
Flight Phase :	Climb	**Occurrence Date :**	18 Jul 2002
Classification :	Occurrences	**Location :**	AUTUN
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	10 NE

Pretitle :
Foreign ATC Incident - A319 on a radar heading passing FL285 received a TCAS RA when it was cleared to climb from FL280 to FL310 through the level of an a/c at FL290.

Precis :
A319 was on a radar heading at FL280 when ATC asked if it was visual with traffic in one o'clock position 1000ft above. On replying affirmative A319 was told to maintain visual contact and cleared it to climb to FL310. Passing FL285 A319 received a TCAS RA of maintain vertical speed. French being used on the frequency. The French investigation indicates that following the a/c receiving a visual separation clearance from ATC, they (ATC), forgot to release it from its assigned heading. The heading assigned led to a traffic convergence and the subsequent TCAS RAs that both a/c received.

A/C Type :	A320	**Occurrence Number :**	**200205584**
Flight Phase :	Approach	**Occurrence Date :**	03 Aug 2002
Classification :	Occurrences	**Location :**	Bologna
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
Foreign AIRPROX - A320 and unknown light a/c. Subject to investigation by the Italian authority.
Precis :
At 7nms during A320's approach to R/W12 it was cleared for the ILS and instructed to continue. Calls were made at the 'outer marker' and at '2nms', but no reply was received to these calls. At approximately 450ft a light a/c was observed in the 2 o'clock position at same level, passing right to left. A320's flight path was taking it below and away from the light a/c and approach was continued. Due to local language being used, A320 being unsure of traffic situation, and no word from Tower, a go around was initiated.

A/C Type :	B737	**Occurrence Number :**	**200205639**
Flight Phase :	Taxy	**Occurrence Date :**	31 Jul 2002
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign Ground Incident - Due to change of stand from 92 to 32, ATC instructed B737 to perform a 180deg right turn, which if followed would have resulted in a collision with an a/c parked on Stand 36.
Precis :
Due to change of stand from 92 to 32, ATC instructed B737 to perform a 180deg right turn, which if followed would have resulted in a collision with an a/c parked on Stand 36. After many requests for a 'follow me' vehicle/ marshaller, one was provided. Reporter believed that some problems existed due to poor English being used.

A/C Type :	BAE146	**Occurrence Number :**	**200206205**
Flight Phase :	Hold	**Occurrence Date :**	28 Aug 2002
Classification :	Occurrences	**Location :**	Marseilles
Events :	Airprox - Foreign Airprox - Foreign	**Location Info :**	

Pretitle :
FOREIGN ATC INCIDENT-Whilst BAe146 was holding on R/W 32R a B737 landed on the r/w after the displaced threshold, 660 metres ahead of the BAe146.
Precis :
French BEA Investigation. The BAe146 was cleared to 'line up and wait 32R'. The instruction was read back and a/c entered runway. On lining up an a/c was seen turning onto final approach at 4 to 5 miles. With the BAe146's TCAS showing the inbound at 2nm and +500 feet and still no take off clearance, the PNF transmitted that the flight was lined up on 32R with landing traffic 300 feet behind. There was then a transmission in French and approximately 20 seconds later the B737 flew directly overhead by 100-200 feet and landed about 600 metres ahead. Queries regarding this incident with ATC received an unclear response.

A/C Type :	A321	**Occurrence Number :**	**200206377**
Flight Phase :	Descent	**Occurrence Date :**	08 Sep 2002
Classification :	Occurrences	**Location :**	Lanzarote
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :
Foreign ATC Incident - A321 which had been cleared nr 1 visual RH for R/W03 was not advised of a PA28 that was nr 2 to land. A321 received a TCAS alert.
Precis :
PA28 on a VFR flight had been cleared in Spanish to be nr 2 to an A321 which was on visual final to R/W03. PA28 advised tower that he had A321 in sight. A321 received a TCAS alert and PA28 was observed below and ahead. Due to speed differential A321 overtook the PA28 very quickly. A321 carried out an uneventful landing.

A/C Type :	Fokker 100	**Occurrence Number :**	**200206380**
Flight Phase :	Descent	**Occurrence Date :**	08 Sep 2002

Classification :	Occurrences	**Location :**	Venice
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :
Foreign ATC Incident - Whilst in the hold, ATC cleared FK100 to descend from FL100 to 6000ft with traffic below at FL80. FK100 levelled at FL90 and advised ATC. Use of foreign language involved.
Precis :

A/C Type :	A319	**Occurrence Number :**	**200206440**
Flight Phase :	Taxy	**Occurrence Date :**	05 Sep 2002
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - A319 entered and lined up on Madrid R/W36L out of ATC designated order. Local language was being used during this incident.
Precis :
Reporter's A319 arrived at holding point of R/W36L in time for its ATC slot, behind Operator 1's MD80. A B747 also Operator 1 was on R/W waiting to depart and an A320 Operator 1, which A319 had followed to the holding point, was to the right of A319. Subsequently an A321 Operator 1 drew up behind the A320 and later on another MD80 belonging to Operator 2 drew up behind the A321. ATC then cleared A319 to line up behind the MD80 (ATC claim that the MD80 Operator's name 2 was used in the clearance). B747 and A320 departed and A319 moved beyond the holding point, following MD80 Operator 1. When MD80 departed A319 lined up on R/W36L. ATC told A319 to taxi off as it should have lined up behind the MD80 Operator 2. ATC instruction complied with. Reporter stated that all ATC calls except the ones to the A319 were all in local language.

A/C Type :	Learjet	**Occurrence Number :**	**200206772**
Flight Phase :	Descent	**Occurrence Date :**	16 Sep 2002
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Learjet was given several headings and altitude changes, some taking it into CBs, before being cleared for approach to R/W18R. Learjet three dots high on approach.
Precis :
Learjet was instructed to enter hold at DUKKE at FL190 with no EAT given, then handed to ATCC controller who immediately gave a heading of 090deg. After being given several heading and altitude changes, some taking a/c into CBs, and handed to several controllers within ATCC, who all held conversations in local language, Learjet repeatedly requested headings. Subsequently Learjet told controller its destination and was informed that parking there was full, then given a heading and told to report established. At no time was Learjet cleared to intercept LOC or glide until this point, which turned out be R/W18R at the alternate airport. Approach was three dots high as crew was unfamiliar with this airport. A very comprehensive report was subsequently received from the Spanish authorities, in which it was acknowledged that, overall, the ATS services given to the Learjet were far from ideal. Improvements in the service which were identified will be incorporated in the local ATC refresher course programme.
CAA Closure: No further CAA action required.

A/C Type :	B777	**Occurrence Number :**	**200206844**
Flight Phase :	Approach	**Occurrence Date :**	02 Sep 2002
Classification :	Occurrences	**Location :**	Sao Paulo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - Due to ATC giving B777 a tight turn and keeping it high, the approach was fast and flap selection was late. B777 initiated a go around at approximately 500ft.
Precis :
During a busy ATC environment and with language problems, B777 found it difficult contacting approach controller to state that they were unable to maintain ATC's requested speed. The operator has contacted the Brazilian authorities requesting a phrase that would be understood by ATC and that crew could use to alert ATC to the fact that a/c are unable to comply with their demands and to request extra track miles. The Brazilian authorities state that controller misunderstood the performance of the a/c. Appropriate follow up action has been taken.

A/C Type :	A310	**Occurrence Number :**	**200207023**
Flight Phase :	Climb	**Occurrence Date :**	27 Sep 2002
Classification :	Occurrences	**Location :**	Southend (SND)
Events :	Altitude Deviation	**Location Info :**	7 SE

	Altitude Deviation (ATC)		

Pretitle :
ATC Incident - A310 cleared to climb to FL70 and later instructed to contact frequency 120.52. Reply was difficult to understand. Subsequently A310 climbed towards FL120.
Precis :
A310 was cleared to climb to FL70 as per Standing agreement and subsequently transferred to frequency 120.52. The readback was difficult to understand, but the controller assumed that the A310 had changed frequency. The a/c did however return to the frequency seeking confirmation that it had been cleared up to FL120. ATC replied by repeating the frequency 120.52. The A310 did not contact this frequency until after entering the sector passing FL94 and later checked in, climbing to FL120. A310 instructed to maintain FL100 and turn left 105degs. Mode C indicated FL103 then FL106, and A310 instructed to maintain FL110. Pilot believed A310 had been cleared to FL120 by the previous controller. The a/c's RT transmissions were of poor quality.

A/C Type :	A320	**Occurrence Number :**	**200207153**
Flight Phase :	Approach	**Occurrence Date :**	02 Oct 2002
Classification :	Occurrences	**Location :**	Amsterdam
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Alleged A320 received poor radar vectoring during an ILS approach to R/W06. A320 elected to go visual at the outer marker and disconnected automatics.
Precis :
Reporter states that A320 was at 2000ft on a radar heading 130deg, 6.5nm to threshold, when ATC allegedly forgot to turn A320 onto an intercept for R/W06 ILS. A320 was unable to query the lack of instruction as ATC were talking to other a/c in local language. A320 went through the localiser on a heading of 130deg, when ATC gave an instruction to turn left heading 030deg to intercept localiser and descend to 1800ft. This heading gave an intercept inside the outer marker (outer marker altitude should be 1280ft). Due to lack of further descent clearance or a more suitable radar vector A320 went visual at the outer marker. Automatics disconnected iaw SOPs and a/c configured accordingly. Approach fully stable at 500ft above threshold.

A/C Type :	A321	**Occurrence Number :**	**200207168**
Flight Phase :	Cruise	**Occurrence Date :**	05 Oct 2002
Classification :	Occurrences	**Location :**	BEGAS
Events :	UK Airprox Loss of Standard Separation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :
UK AIRPROX 195/2002 - A321 and B737 at FL360 at BEGAS.
Precis :
The B737 was issued with an Oceanic clearance by Shanwick to cross BEGAS at FL370. Madrid ACC were advised of the clearance. However, the pilot was not cleared to the Oceanic level by Madrid (only FL360), nor did he query why he had not been cleared to that level. Both a/c received and reacted to TCAS RAs. This AIRPROX has been reviewed by the United Kingdom AIRPROX Board (UKAB).
CAA Closure: No further CAA action however the CAA has requested that the Spanish authorities forward a copy of their investigation into this incident.

A/C Type :	A320	**Occurrence Number :**	**200207458**
Flight Phase :	Cruise	**Occurrence Date :**	14 Oct 2002
Classification :	Occurrences	**Location :**	ELGAR
Events :	Loss of Standard Separation TCAS Report	**Location Info :**	5 S

Pretitle :
ATC Incident - A320 failed to follow ATC heading instructions and lost separation with a B767, which received a TCAS RA of climb on A320. Traffic info and avoiding action given to A320.
Precis :
The A320 was on a heading of 005 deg and the B767 on a heading of 010 deg, at FL260, when the A320 called turning right onto 075 deg, towards the B767. The A320 was instructed to descend to FL:240 more than once, which was not acknowledged. Avoiding action was then given, which again was not acknowledged. The B767 received a TCAS RA, which was not actioned as the A320 was in sight. The A320 was eventually contacted and instructed to route direct, but on failing to comply the A320 was given a heading of 000 deg, before being directed to destination. It was apparent from the A320 pilot's report, subsequently received, that there was some confusion on the flight deck over the heading and FL on an allegedly busy frequency, involving the A320 receiving both a TCAS TA and RA which the crew attempted to follow.
CAA Closure: No further CAA action practical.

A/C Type :	BAE146	**Occurrence Number :**	**200207495**
Flight Phase :	Descent	**Occurrence Date :**	05 Oct 2002
Classification :	Occurrences	**Location :**	Tours
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - No radar or ATC service available below FL60 to BAe146.
Precis :
28nms from destination BAe146 was informed that foreign ATCC control radar service would be terminated and descent below FL60 was at pilot's risk and discretion. There was no co-ordination to destination's approach frequency. On approach frequency there was an auto statement playing that ATZ was closed/deactivated. BAe146 landed safely, but reporter believes that for weekend public transport operations, more protection must be provided. See also 200207523. The operator subsequently negotiated appropriate opening times with the destination ATC unit.
CAA Closure: Appropriate operator action taken.

A/C Type :	A320	**Occurrence Number :**	**200207722**
Flight Phase :	Climb	**Occurrence Date :**	20 Sep 2002
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence RT Problems	**Location Info :**	

Pretitle :
Foreign ATC Incident - Unauthorised climb to follow SID heights after radio contact with ATC temporarily lost.
Precis :
A320's initial departure clearance was to stop climb at 5000ft. After departure tower changed A320 to radar, but following a rapidly spoken instruction with an accent, P1 readback 120.9 instead of 127.9, which was not challenged by ATC. A320 tried new frequency without success. Meanwhile P2 (HP) announced a climb to FL80 was needed to meet minimum SID altitude, which P1 authorised before going back to tower frequency who then gave correct onward frequency. They were aware of A320's climb.

A/C Type :	B777	**Occurrence Number :**	**200208132**
Flight Phase :	Parked	**Occurrence Date :**	05 Nov 2002
Classification :	Occurrences	**Location :**	Beijing
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - B777 had been cleared to push and start from Gate 214. Then several a/c manoeuvred in vicinity of B777, infringing its pushback zone. B777 gave way to 5 a/c.
Precis :
Alleged that national a/c were either not monitoring the ground frequency or simply ignoring instructions. The Chinese investigation revealed that the frequency was very busy with 19 a/c on the frequency within 10 minutes. Due to construction work all landing traffic on 36R was crowded onto one taxiway. One Chinese a/c had been instructed (in Chinese) to give way to the B777 but as the B777 crew were not alerted in English they were not aware of this situation.

A/C Type :	Falcon 20/200	**Occurrence Number :**	**200208183**
Flight Phase :	Climb	**Occurrence Date :**	07 Nov 2002
Classification :	Occurrences	**Location :**	Northolt
Events :	Altitude Deviation Altitude Deviation	**Location Info :**	

Pretitle :
Falcon 20 climbed above the SID altitude outbound from Northolt. A/c almost unreadable, had a constant 'ident', failed to follow the departure route and had poor English.
Precis :
Standard separation maintained. See also occs 199802163 and 199805001. The operator subsequently stated that whilst performing the CPT4Y SID in turbulent conditions the a/c lost a generator. This led to the failure of the autopilot to capture the assigned 3000 feet and the a/c therefore exceeded that altitude.
CAA Closure: No further CAA action practical.

A/C Type :	CL600RJ Regional Jet	**Occurrence Number :**	**200208201**
Flight Phase :	Approach	**Occurrence Date :**	30 Oct 2002
Classification :	Occurrences	**Location :**	Brussels
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - CRJ was given very late landing clearance due to vehicle in the touchdown area. At 150ft

vehicle was clear of R/W and CRJ was 'cleared to land'.
Precis :
At 6 DME CRJ was handed over from approach to Tower and at 4.5 dme checked in with Tower and told to continue approach. At 1.2 dme passing 300ft AGL CRJ checked with tower if cleared to land and again told to continue. At 200ft AGL (decision height) CRJ became visual and continued visually. At this point a vehicle was spotted around the touchdown area, rapidly vacating the R/W. At 150ft vehicle was clear of R/W and CRJ was 'cleared to land'. Conversation between Tower and vehicle was in local language. LVPs in force, Tower did not inform the crew of the presence of the vehicle.

A/C Type :	A321	**Occurrence Number :**	**200208220**
Flight Phase :	Climb	**Occurrence Date :**	11 Nov 2002
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Insufficient notice of level change could have resulted in an altitude deviation and a possible TCAS RA. Local language being used at time of incident.
Precis :

A/C Type :	A321	**Occurrence Number :**	**200208222**
Flight Phase :	Descent	**Occurrence Date :**	13 Nov 2002
Classification :	Occurrences	**Location :**	CRL VOR
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	8

Pretitle :
Foreign ATC Incident - A321 was at FL110 when a B737 was cleared to climb through its level. ATC gave left turn to A321 which received a TCAS RA. A/P engaged throughout.
Precis :
A321 was at FL110 when a B737 was cleared to climb through its level. B737 observed on TCAS approaching from the two o'clock position. ATC ordered A321 to turn left turn immediately, during which A321 received a TCAS RA for approximately 5secs. B737 was also observed to turn left. Situation awareness was difficult for A321 crew to establish early as communications between B737 and ATC were in French.

A/C Type :	A320	**Occurrence Number :**	**200208800**
Flight Phase :	Take Off	**Occurrence Date :**	29 Nov 2002
Classification :	Occurrences	**Location :**	Sofia
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - A320's take off clearance from R/W27 cancelled after brakes had been released, due to proximity of an a/c landing on same R/W, which subsequently carried out a go-around.
Precis :
A320 was initially informed of R/W09 for departure, but was changed to R/W27 as part of the taxi clearance. A320 held position for approximately 30secs to make sure A320 could accept R/W27. ATC insisted A320 start taxiing ASAP and on approaching threshold awaited for an ATC clearance. Cabin checks were still being carried out and ATC were informed that A320 would need a further minute before being ready. A320 cleared to line up with an a/c approximately 14nms out. With cabin checks complete A320 was given an immediate take off clearance and subsequently an initial clearance, but due to deliverance of clearance, needed two attempts to decipher the altitude and squawk. A320 released brakes and had only moved a couple of metres when told to hold position. P1 read back 'aborting take off' and the traffic on approach was instructed to go around. Crew believe original traffic information was inaccurate.

A/C Type :	B737	**Occurrence Number :**	**200209062**
Flight Phase :	Taxy	**Occurrence Date :**	12 Dec 2002
Classification :	Occurrences	**Location :**	Santiago, Spain
Events :	Ground (AD) Occurrence	**Location Info :**	

Pretitle :
Foreign Ground Incident - Throughout tow of B737 ground crew would not use headsets, but used poor non standard hand signals. Subsequently tow bar disconnected without any reference to flight deck.
Precis :
During tow of B737 from stand to 'Industrial Area' with P1 and P2 on flight deck, due no engineering staff present, ground crew would not use headsets despite being asked and having the equipment. Instead throughout the tow poor non standard hand signals were used. When B737 was reaching the 'Industrial Area' the tow bar was disconnected without reference to flight deck crew. Crew's first indication was the ground crew walking away and the tug reversing.

A/C Type :	B737	**Occurrence Number :**	**200300105**
Flight Phase :	Descent	**Occurrence Date :**	02 Jan 2003
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - During B737's approach to R/W18R, local language was used to other a/c. This meant B737 crew were unable to establish a mental picture of the arrival sequence.

Precis :

There have been other similar reports submitted.

A/C Type :	AN12	**Occurrence Number :**	**200300373**
Flight Phase :	Cruise	**Occurrence Date :**	22 Jan 2003
Classification :	Occurrences	**Location :**	St Abbs (SAB)
Events :	A/c Equipment / System Malfunction A/c Equipment / System Failure ATC Occurrence	**Location Info :**	

Pretitle :

AN12 Mode C malfunction at SAB. P1 called level at FL235 but Mode C indicated FL226. Second transponder selected, but this failed completely.

Precis :

P1 allegedly failed to understand ATC request to switch off Mode C and reverted to initial transponder which continued to display incorrect altitude. Subsequent ATC units were advised of Mode C malfunction before transfer. A report subsequently received from the foreign operator indicated that the primary transponder failure resulted from static pressure line icing, and the secondary to incorrect connections, both of which were corrected after flight.

CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200300386**
Flight Phase :	Taxy	**Occurrence Date :**	21 Jan 2003
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - For 10-15mins during later stages of B737's taxi to R/W and holding prior to take off, only local language spoken. P2 could speak the language thus crew were aware of events.

Precis :

See also occs 200203374, 200203969, 200206440, 200206772 and 200300105,

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A/C Type :	B737	**Occurrence Number :**	**200300595**
Flight Phase :	Descent	**Occurrence Date :**	02 Feb 2003
Classification :	Occurrences	**Location :**	Alicante
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :

Foreign ATC Incident - B737 passing 5000ft during cleared descent to 2200ft, was given traffic info on light a/c maintaining 3500ft. Traffic seen on TCAS and visual. Descent stopped at 4200ft.

Precis :

B737 had been cleared to descend to 2200ft on the VOR/DME procedure R/W28. Passing 5000ft ATC gave B737 traffic info on light a/c, which displayed on TCAS, but there was no height readout. When B737 was passing 4500ft ATC advised that light a/c was maintaining 3500ft. Descent stopped at 4200ft and light a/c became visual. Light a/c passed directly underneath B737 and when clear, B737 resumed descent to 2200ft. Also pilot of light a/c communicated with ATC in local language.

A/C Type :	AN2	**Occurrence Number :**	**200300657**
Flight Phase :	Cruise	**Occurrence Date :**	07 Jan 2003
Classification :	Occurrences	**Location :**	Scampton
Events :	Airspace Infringement	**Location Info :**	

Pretitle :

ATC Incident - Infringement of active EG R313 (Scampton) by an AN2. Prior to departure, pilot was given assistance planning his route and had been warned about R313.

Precis :

The a/c was in the process of leaving the UK for Brazil when this incident occurred. The relevant foreign authority was contacted and a pilot's report received. This report stated that he did not have "correct information

about the en route area".
CAA Closure: No further CAA action practical.

A/C Type :	B737	**Occurrence Number :**	**200301165**
Flight Phase :	Climb	**Occurrence Date :**	25 Feb 2003
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	A/c Equipment / System Failure APU Fire / Failure Emergency Call Diversion /Return A/c Equipment / System Malfunction	**Location Info :**	

Pretitle :
Nr2 generator failed and APU start unsuccessful. VSCF failed. APU anti-surge valve failed.
Precis :
Nr2 generator tripped 'Off' during the climb, with the BIAS light illuminating. An APU start was then attempted, resulting in 'APU Fault' and 'No start' warnings. The CB panel was checked and two further unsuccessful APU starts were attempted. After consulting the QRH, a PAN was declared and the aircraft returned to the departure airport. The passengers were briefed via the PA, but the SCA later advised the volume was low and some passengers failed to hear the announcement, which others were unable to understand due to language difficulties. Defect diagnosis carried out resulting in No.2 VSCF replacement Subsequent strip report confirmed unit was defective - short circuit in power module. With regard to APU defect, this was tested successfully on the ground and operated correctly. Aircraft was released with requests for further crew reports. Subsequent reports established that the starting difficulties were confined to higher altitudes. Various trouble shooting activity carried out resulting in replacement of Anti-surge valve which resolved the problem.
CAA Closure: The Hazard is adequately controlled by existing requirements, procedures and documentation.

A/C Type :	Falcon 900	**Occurrence Number :**	**200301339**
Flight Phase :	Taxy	**Occurrence Date :**	05 Mar 2003
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	Runway Incursion	**Location Info :**	

Pretitle :
ATC Incident - F900 failed to follow ATC taxy/conditional line up clearance and crossed red stop bar at Block 88/87 and attempted to line up on R/W27L at same time as an MD82.
Precis :
See also 200304002. The foreign operator concerned has failed to respond to a number of attempts to elicit an explanation.
CAA Closure: No further CAA action practical.

A/C Type :	A319	**Occurrence Number :**	**200301658**
Flight Phase :	Approach	**Occurrence Date :**	22 Feb 2003
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Low go-around on Runway 18R Madrid due to crew being unable to confirm whether they were cleared to land.
Precis :
When crew checked in with Tower, with an a/c 2.7 nm ahead, they were unable to understand whether they had a landing clearance. Tower spoke continuously in Spanish until the a/c was over the threshold.

A/C Type :	A319	**Occurrence Number :**	**200301706**
Flight Phase :	Climb	**Occurrence Date :**	10 Mar 2003
Classification :	Occurrences	**Location :**	
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
Flight crew believed, and read back, climb to FL340, while ATC stated cleared altitude was to FL330.
Precis :
On a climb request to FL370, Brest control allegedly cleared the aircraft to climb initially to FL340, with FL340 being read back by the flight crew. After levelling off, ATC informed the flight crew that clearance had only been given to FL330 prior to continuing to FL370. Comment made by crew that "a common language would be a good idea". The tapes were subsequently checked by ATC and it was confirmed that the aircraft had, in fact, been cleared to FL340.

A/C Type :	B727	**Occurrence Number :**	**200301799**
Flight Phase :	Cruise	**Occurrence Date :**	25 Mar 2003

Classification :	Occurrences	**Location :**	ATO VOR
Events :	Airprox - Foreign TCAS Report Loss of Standard Separation	**Location Info :**	20 NE

Pretitle :
FOREIGN AIRPROX - B727 and unidentified a/c at FL260 under control of Madrid ATCC. B727 received TCAS RA.
Precis :
B727 initially received TCAS TA and contacted Madrid ATCC who were slow to respond. By the time Madrid ATCC had contact B727, TCAS RA had been received with appropriate action taken. ATCC then queried why B727 had departed from cleared level, despite being twice informed of TCAS RA and subsequent avoiding action. B727 crew allege that Madrid ATCC service was poor and that Spanish language was frequently used.

A/C Type :	MS Rallye	**Occurrence Number :**	**200301975**
Flight Phase :	Descent	**Occurrence Date :**	22 Mar 2003
Classification :	Occurrences	**Location :**	Newtownard
Events :	UK Airprox (non ATC related)	**Location Info :**	

Pretitle :
UK AIRPROX 30/2003 - Rallye 110ST and a Bell 206 1nm Southeast of Newtownard at 1000ft.
Precis :

A/C Type :	B757	**Occurrence Number :**	**200302288**
Flight Phase :	Climb	**Occurrence Date :**	15 Apr 2003
Classification :	Occurrences	**Location :**	Banjul
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Following departure B757 was involved in two potential conflicts within 5 minute period.
Precis :
Whilst on ground B757 received a clearance of YF VOR climb FL330. After departure contact established with next sector and as B757 was passing FL36 was told to maintain FL40 due opposite direction traffic at FL50. After maintaining FL40 for approximately 20nms, no traffic observed, B757 was cleared to FL330 and expedite passing FL110 due opposite direction traffic at FL110. Passing FL90 B757 told to maintain FL100. 30 seconds after an FK27 was seen, estimating to be maintaining FL90, which B757 queried with ATC, who confirmed FK27 was climbing through FL95 to maintain FL110. The FK27 was being controlled in French.

A/C Type :	B737	**Occurrence Number :**	**200302352**
Flight Phase :	Climb	**Occurrence Date :**	08 Apr 2003
Classification :	Occurrences	**Location :**	Rome
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :
B737 received TCAS RA against A320 at 5000ft under Rome ACC control. A320 also received TCAS RA. Appropriate action taken, standard separation maintained.
Precis :
B737 initially cleared to climb out of Rome Ciampino to 5000ft. B737 then continued at 5000ft towards Rome Fiumicino, which was using R/W34R. ATC then instructed B737 to descend to 3000ft immediately. This was shortly followed by the TCAS RA. B737 flight crew allege that foreign language was used by ATC on RT, which could have been a contributory factor to the incident.

A/C Type :	Cessna C550 Citation 2	**Occurrence Number :**	**200302408**
Flight Phase :	Taxy	**Occurrence Date :**	23 Apr 2003
Classification :	Occurrences	**Location :**	Luton (LUT)
Events :	ATC Occurrence Runway Incursion	**Location Info :**	

Pretitle :
ATC Incident - C550 allegedly failed to follow ATC instructions and taxied beyond holding point B1, crossing an illuminated stop bar and entering active R/W08.
Precis :
C550 was cleared by GMC to holding point B1, which is the last holding point prior to R/W08. Pilot correctly acknowledged this clearance. C550 was then passed its ATC clearance, which was read back correctly (believed) and then transferred to Tower. It is possible that flight crew's attention was preoccupied with copying clearance and re-briefing as they approached the holding point, resulting in C550 crossing holding point B1. MATS Part 2 requires controllers, unless previously requested by flight crew, to offer ATC clearances to flight

crew at the time that engine start is approved to enable crews to pre-brief at time of lower workload.

A/C Type :	B757	**Occurrence Number :**	**200302495**
Flight Phase :	Descent	**Occurrence Date :**	19 Apr 2003
Classification :	Occurrences	**Location :**	Palma
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - ATIS indicated R/W24L for landing and controllers reaffirmed this. B757 was then cleared for ILS R/W24L, but it became apparent ILS was u/s. B757 carried out a visual landing.

Precis :

ATIS indicated R/W24L for landing and several controllers reaffirmed this. Approach control cleared B757 for approach and call ATC for visual R/W24L. It soon became apparent ILS R/W24 was u/s, although B757 was locked on and glide path looked good. LOC then disappeared and then reappeared. A few seconds later it went off the air. B757 was visual and disconnected the automatics for a visual landing. B757 had not been pre warned that there was a problem with the ILS.

A/C Type :	B757	**Occurrence Number :**	**200302539**
Flight Phase :	Descent	**Occurrence Date :**	28 Apr 2003
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - ATC asked a B757 during its ILS approach to R/W09R, to maintain 3000ft and R/W heading due to a B737 being vectored to adjacent R/W08R through B757's final approach path.

Precis :

During incident B757 received no TCAS warnings. Reporter considers that the Paris radar sequencing was poor and the crew's attempts to obtain a clear picture of the sequencing was hindered by French language instructions being issued to some of the other a/c. Controller workload high. Appropriate foreign authority alerted.

A/C Type :	A320	**Occurrence Number :**	**200302643**
Flight Phase :	Climb	**Occurrence Date :**	04 May 2003
Classification :	Occurrences	**Location :**	Palma
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - A320 climbing to FL120 received a TCAS TA on reciprocal traffic above descending through its level. ATC informed and A320 made a 40 deg right turn. Traffic passed abeam at 3nm.

Precis :

Spanish language being used on the frequency reducing situational awareness.

A/C Type :	A321	**Occurrence Number :**	**200302655**
Flight Phase :	Climb	**Occurrence Date :**	01 May 2003
Classification :	Occurrences	**Location :**	Lisbon
Events :	Foreign ATC Occurrence TCAS Report Altitude Deviation (ATC)	**Location Info :**	

Pretitle :

Lisbon ATCC allegedly missed an incorrect read back by A321at FL340, which subsequently received a TCAS RA against opposite direction traffic at FL350.

Precis :

During cruise at FL340, Lisbon ATCC asked A321 if they could take FL360. A321 advised ATCC that they could and were then cleared to climb to FL360. However, this instruction was immediately cancelled and the A321 advised to expect clearance in 2mins. Approximately 1min later, all three flight crew claim to have heard their clearance to climb to FL360 and the P2 (a Dutch national) responded accordingly. A321 commenced climb but soon received a TCAS RA against opposite direction traffic at FL350 (which was subsequently issued avoiding action). Lisbon ATCC then instructed A321 to maintain FL340 and advised that second climb clearance had actually been issued to a different (Dutch) a/c.

A/C Type :	B737	**Occurrence Number :**	**200302856**
Flight Phase :	Cruise	**Occurrence Date :**	11 May 2003
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - B737 inbound to Gatwick with a suspected tyre burst could have misinterpreted a consideration of an alternative airfield as an instruction to divert.

Precis :
The aircraft was inbound to Gatwick and it was believed that it may have burst a tyre on departure. The standard message was passed by the ATCO on behalf of the BAA ODM requesting the pilot to consider diverting elsewhere. It would appear that no published information is available to pilots indicating that this action may be taken. This particular Captain appeared to have interpreted the message as a directive to divert, which it was not. The situation will be monitored for any future similar incidents.
CAA Closure: No further CAA action required.

A/C Type :	A321	**Occurrence Number :**	**200302971**
Flight Phase :	Cruise	**Occurrence Date :**	12 May 2003
Classification :	Occurrences	**Location :**	NEVEL
Events :	Wake Turbulence	**Location Info :**	

Pretitle :
A321 encountered wake turbulence during cruise at FL350 at NEVEL under control of Casablanca ATCC, from opposite direction B747 at FL360. 35deg RH roll experienced.
Precis :

A/C Type :	BE90 King Air	**Occurrence Number :**	**200303005**
Flight Phase :	Climb	**Occurrence Date :**	14 May 2003
Classification :	Occurrences	**Location :**	Stansted
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - After BE90 took off from R/W23 it turned left, instead of the expected right turn to follow the CPT 3R SID. Appropriate action taken and standard separation maintained.
Precis :
Controller cleared BE90 on a CPT 3R SID, but pilot spoke with a very heavy accent and read back was difficult to decipher. Controller accepted readback as CPT, but pilot reported to LTCC that he had said LAM 3R, as filed on his FPL. This incident has highlighted incorrect use of LAM departure, as this route is only available for Stansted - Heathrow transits. However IFPS (Integrated Flight Plan Processing System) accepts a/c with this routeing and some flight data does not list restrictions. A request will be sent to IFPS to amend their database and restrict use of these routeings. Appropriate ATC action has been taken.

A/C Type :	Piper PA44 Seminole	**Occurrence Number :**	**200303072**
Flight Phase :	Cruise	**Occurrence Date :**	20 May 2003
Classification :	Occurrences	**Location :**	Daventry (DTY)
Events :	ATC Occurrence Airspace Infringement	**Location Info :**	6 E

Pretitle :
ATC Incident - PA44 receiving a FIS wanted to join CAS at Daventry and was repeatedly told to 'remain clear of controlled airspace', but still entered CAS without a clearance.
Precis :
When a PA44 wanting to join CAS at Daventry called, controller instructed that it was on a FIS and to 'remain clear of controlled airspace'. PA44 observed climbing through FL76 and was again informed to remain clear of CAS. PA44 continued climbing to FL110 and repeatedly told that no clearance to join CAS had been given. A comprehensive report subsequently received from the PA44 pilot stated that after a delayed take off, difficulty was experienced with radio reception on both London Control and London Info. Eventually, whilst still experiencing reception and language problems, the pilot thought he heard a transponder code issued, and mistakenly thought that gave permission to enter CAS. The pilot acknowledged and apologised for his mistake.
CAA Closure: No further CAA action required.

A/C Type :	CL600RJ Regional Jet	**Occurrence Number :**	**200303162**
Flight Phase :	Taxy	**Occurrence Date :**	03 May 2003
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - CL600RJ lined up on R/W27L and whilst waiting for Vortex spacing from a departing DC10 an a/c on finals initiated a Go-around.
Precis :
CL600RJ was cleared to line up from intersection Y11 R/W27L, with a DC10 just airborne from Y13 intersection (full length). CL600RJ saw an a/c on final approach, which appeared to be at approximately 6nms. CL600RJ advised Tower that it would still require another 2 minutes, as at that point the DC10 had been airborne for 1 minute by reporter's timing. Tower advised 'it is no problem for me' and cleared CL600RJ for take off. After approximately 1 minute tower queried the delay advising of traffic at 2nms. CL600RJ confirmed that a further 45 seconds were required, but this timing was queried by Tower, who then spoke local language to landing a/c.

CL600RJ then reported rolling and landing a/c went around.

A/C Type :	A320	**Occurrence Number :**	**200303375**
Flight Phase :	Descent	**Occurrence Date :**	20 May 2003
Classification :	Occurrences	**Location :**	GROSSETO
Events :	Loss of Standard Separation Foreign ATC Occurrence Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :
A320 allegedly received inconsistent instructions from ATC during descent into Rome Fiumicino on frequency 125.5. Altitude deviation due late ATC re-clearance and loss of separation experienced.
Precis :
A320 initially cleared to descend to FL200. However, passing FL230, ATC re-cleared a/c to FL230. A320 descended to FL218 before recovering to FL230. A320 was then issued another clearance to FL200 but, passing FL210, was re-cleared to FL210. On this occasion, A320 descended to FL207 before recovering to FL210. Flight crew comment that controller workload was high and that the standard of English used deteriorated. Appropriate ATC authority alerted.

A/C Type :	A321	**Occurrence Number :**	**200303395**
Flight Phase :	Descent	**Occurrence Date :**	28 May 2003
Classification :	Occurrences	**Location :**	Malaga
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
FORIGN AIRPROX - A321 and A320/1 at 5500ft during approach into Malaga. A321 carried out evasive manoeuvre to avoid further conflict.
Precis :
A321 cleared to descend to 5500ft for ILS approach to R/W14 and instructed to reduce speed. Approaching 5500ft, P2 observed another a/c approximately 1500ft above passing left to right. This a/c continued to descend and then turned left into conflict with A321, which subsequently performed an evasive manoeuvre. High proportion of RT was in Spanish. Subject to investigation by Spanish authorities.

A/C Type :	B737	**Occurrence Number :**	**200303575**
Flight Phase :	Descent	**Occurrence Date :**	06 Jun 2003
Classification :	Occurrences	**Location :**	Trent (TNT)
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
ATC Incident - B737 allegedly descended below its cleared FL270. Pilot believed B737 had been cleared to FL250. As there were no other a/c in the vicinity B737 was cleared to FL250.
Precis :
Pilot had a very strong accent and had requested a repeat of the clearance " FL270 45DME before POL".

A/C Type :	B777	**Occurrence Number :**	**200303641**
Flight Phase :	Flight	**Occurrence Date :**	06 Jun 2003
Classification :	Occurrences	**Location :**	En Route
Events :	Flight Crew Occurrence	**Location Info :**	

Pretitle :
Communication difficulty between crew and mainly non-English speaking passengers. Safety hazard in an emergency.
Precis :
The reporter comments that no Chinese speaking cabin crew members were part of the crew complement on this service into China, despite the fact that 2 appropriately qualified cabin crew members are normally carried on this route. On the ICN to LHR sector it was estimated that three-quarters of the passengers in World Traveller class were non-English speaking. Also, the safety video was only available in the English language. The reporter is concerned that during an emergency there would have been severe communications problems with such a large group of passengers, which would have compromised aircraft/passenger safety. The reporter confirms that 2 other crews in ICN also did not have any Chinese-speaking crew amongst their complement.

A/C Type :	B737	**Occurrence Number :**	**200303728**
Flight Phase :	Descent	**Occurrence Date :**	15 Jun 2003
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence Altitude Deviation	**Location Info :**	

Pretitle :

Foreign ATC Incident - B737 descending to FL50 for approach to R/W27L was given traffic info on outbound helicopter at 4000ft. B737's TCAS then showed helicopter at FL50 and descent stopped at FL60.
Precis :
B737 was cleared to descend to FL50 on a radar heading for approach to R/W27L. B737 also given traffic info on outbound helicopter at 4000ft that would pass below. When helicopter appeared on B737's TCAS it showed helicopter level at either 5000ft or FL50. B737 stopped descent at FL60 and helicopter passed within 3nm. ATC and helicopter were speaking in local language.

A/C Type :	B737	**Occurrence Number :**	**200303812**
Flight Phase :	Climb	**Occurrence Date :**	14 Jun 2003
Classification :	Occurrences	**Location :**	Manchester (MCT)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - B737 allegedly failed to follow an amendment to the HON 1R SID, resulting in a following departure being given a heading to ensure separation, visual separation maintained.
Precis :
B737 was given an amendment to the HON 1R SID to fly to 5dme, then turn left heading 190deg climbing to 5000ft. B737 appeared to turn left at 2dme and reported routeing direct to HON to MACC. The next departure, which was rolling when B737 turned early, was turned onto a heading to ensure separation. Visual separation maintained at all times and B737 observed establishing on track. Due to language problems, no further comments were made on R/T.

A/C Type :	B747	**Occurrence Number :**	**200303819**
Flight Phase :	Cruise	**Occurrence Date :**	19 Jun 2003
Classification :	Occurrences	**Location :**	Oceanic
Events :	UK Airprox Loss of Standard Separation Altitude Deviation	**Location Info :**	N4615 W02457

Pretitle :
UK AIRPROX 80/2003 - B747 and A340 at N4615 W02457 at FL370.
Precis :
B747 at N4615 W02457 was cleared to climb to FL370 after passing 22W, but initiated climb immediately and came into conflict with an airliner at FL370. Avoiding action (immediate descent instruction) issued. See also 200303809. The B747 pilot's report subsequently received indicates that the B747 crew believed they were cleared by Shanwick to commence the climb, which was read back. The duty Radio Officer at Ballygirreen did not obtain a correct readback of the clearance passed by the ScOACC controller. The incident will be subject to assessment by UKAB.
CAA Closure: No further CAA action required.

A/C Type :	CL600 RJ700	**Occurrence Number :**	**200303841**
Flight Phase :	Approach	**Occurrence Date :**	09 Jun 2003
Classification :	Occurrences	**Location :**	Bordeaux
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Alleged potential conflict with a team of aerobatic a/c following CRJ late landing clearance at Bordeaux.
Precis :
CRJ had been instructed to report to ATC at 4 DME. However, from 5 DME to 4 DME, controller was continuously talking to a/c in French and CRJ was unable to report. CRJ attempted to contact ATC on numerous occasions, before eventually establishing contact when landing clearance was received. Just after landing, an aerobatic display team were observed carrying out a low fly-by overhead in the opposite direction to the landing traffic. Suspect ATC had been in communication with these a/c. Occurrence "Opened" 18/07/2003 to facilitate an investigation.

A/C Type :	B737	**Occurrence Number :**	**200304053**
Flight Phase :	Climb	**Occurrence Date :**	25 Jun 2003
Classification :	Occurrences	**Location :**	Brookmans Park (BPK)
Events :	ATC Occurrence	**Location Info :**	5E

Pretitle :
B737 allegedly failed to comply with ATC instructions.
Precis :
B737, at FL110 and routing via Brookmans Park following a BPK4K SID from Heathrow, was erroneously issued a RH turn heading 070. B737 should have been instructed to perform a LH turn. ATC controller (trainee) issued the correct clearance several times. Numerous read backs followed, including one stating heading 120 which took the B737 towards holding traffic in Lambourne hold. Mentor took control and vectored B737 away from

Lambourne. Avoiding action and traffic info issued. Standard separation maintained.

A/C Type :	B747	**Occurrence Number :**	**200304162**
Flight Phase :	Cruise	**Occurrence Date :**	22 Jun 2003
Classification :	Occurrences	**Location :**	En Route
Events :	Engine/Malfunction Power Loss - First Engine Emergency Call Emergency Descent RT Problems Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Nr1 engine failure during cruise. Emergency declared. Precautionary descent. Alleged communication problem with Mumbai ATC. Full authority fuel control (FAFC) failed.
Precis :
At FL310 shortly after top of climb, nr1engine fuel valve failed causing nr1 engine to run down. QRH engine failure/shutdown checklist actioned and an emergency declared to ATC at Mumbai (on HF 5601) who allegedly failed to understand the descent request. Descent clearance to FL270 obtained on Karachi VHF 126.5 and flight continued to destination where a successful autoland was carried out. See also 200303943 (similar incident, same aircraft 2 days earlier). Following strip examination of the changed components, the fuel metering unit (FMU), the full authority fuel control (FAFC) and the dedicated generator (DG), the root cause was identified as a defective FAFC which had a contaminated internal connection (short circuit on card D07275B)which would have caused spurious auto-start shut off vale commands to the FMU. Considered to be an isolated occurrence by the operator's propulsion department based on the research of the aircraft maintenance records and fleet technical system monitoring data. The incident was discussed with the production personnel involved from which it was determined that the defect was intermittent in nature and therefore difficult to trace. In addition, the initial maintenance input had a pre-determined FMU change called up based on standard fault isolation procedures. Following the first event the remaining components were changed as a continuation of the troubleshooting and as a precaution due to the nature of the defect. No further action proposed.
CAA Closure: The hazard is adequately controlled by existing requirements, procedures and documentation.

A/C Type :	Robinson R22	**Occurrence Number :**	**200304420**
Flight Phase :	Cruise	**Occurrence Date :**	30 Jun 2003
Classification :	Occurrences	**Location :**	Lyneham
Events :	Airspace Infringement	**Location Info :**	6

Pretitle :
ATC Incident - Infringement of the Lyneham CTR (Class D). Pilot called requesting FIS, but when asked to confirm position reported being lost. A/c asked to squawk, identified and given heading.
Precis :

A/C Type :	Microlight	**Occurrence Number :**	**200304482**
Flight Phase :	Cruise	**Occurrence Date :**	11 Jul 2003
Classification :	Occurrences	**Location :**	Bournemouth
Events :	Airspace Infringement	**Location Info :**	

Pretitle :
ATC Incident - Alleged infringement of the Bournemouth CTR (Class D) by foreign pilot who had difficulty understanding ATC instructions due to poor English.
Precis :
The appropriate foreign authority has been fully informed on this incident.
CAA Closure: No further CAA action practical.

A/C Type :	CL600 RJ700	**Occurrence Number :**	**200304603**
Flight Phase :	Descent	**Occurrence Date :**	16 Jun 2003
Classification :	Occurrences	**Location :**	Nice
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Increased workload for crew who had to repeat themselves on frequency to ATC, either to gain a response or make themselves understood, both prior to and after declaring a PAN.
Precis :
Reporter alleges that ATC displayed a lack of understanding of calls made by the crew on a number of occasions.
CAA Closure: The French authorities report that the unit responsible for investigating this incident received notification almost 2 months after the incident occurred. Although the local unit were asked to investigate, the elapsed time involved meant that the radar and radio data had been returned to service; data is retained for 30

days. The pilot concerned allegedly did not report the event on the frequency.

A/C Type :	A320	**Occurrence Number :**	**200304665**
Flight Phase :	Descent	**Occurrence Date :**	16 Jul 2003
Classification :	Occurrences	**Location :**	Erevan
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Alleged erroneous instructions by Erevan ATC.
Precis :
A320 initially carrying out an INDUR 1A approach to Erevan, but ATC delayed descent which necessitated a change to an INDUR 1B approach. ATC then allegedly proceeded to repeatedly misdirect A320 towards high ground below MSA. A320 crew declined headings issued and followed the procedure for an INDUR 1B approach. The Armenian report indicates that the crew misheard the ATC heading of 265 degrees as 165 degrees following which confusion occurred.

A/C Type :	B747	**Occurrence Number :**	**200304701**
Flight Phase :	Cruise	**Occurrence Date :**	10 Jul 2003
Classification :	Occurrences	**Location :**	Algiers
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Algerian ATC allegedly spoke in French, to French speaking a/c. Reduction of situational awareness for English speaking crews in the area.
Precis :

A/C Type :	A320	**Occurrence Number :**	**200304844**
Flight Phase :	Taxy	**Occurrence Date :**	23 Jul 2003
Classification :	Occurrences	**Location :**	Stansted
Events :	Runway Incursion ATC Occurrence	**Location Info :**	

Pretitle :
A320 given conditional clearance to line-up at Stansted but reported not ready and so clearance was cancelled. However, A320 then proceeded to line-up without appropriate clearance.
Precis :
The ADC position was being operated by a mentor and trainee. The A320 was given a clearance to line up and wait on R/W23. The trainee then initiated a telephone call to the TC North West coordinator. At the same time, the pilot reported that he was not yet ready and would need 2 or 3 minutes. The response from ATC was "..cancel line up hold position" and then the trainee continued with the telephone conversation. The crew responded but neither the trainee nor the mentor assimilated this. The A320 continued and lined up. No further safety incident took place as there was no other traffic affected by the runway being occupied.
CAA Closure: Appropriate ATC action taken.

A/C Type :	B737	**Occurrence Number :**	**200304878**
Flight Phase :	Take Off	**Occurrence Date :**	26 Jun 2003
Classification :	Occurrences	**Location :**	Prague
Events :	Rejected Take-Off Flight Crew Occurrence	**Location Info :**	

Pretitle :
Take off rejected due to configuration warning. Flaps were not in the take off position. Flaps reset and subsequent take off proceeded normally.
Precis :
Failure to set take off flap attributed (by crew) to a combination of factors and distractions leading to a complacent and hastily completed checklist.

A/C Type :	B737	**Occurrence Number :**	**200305021**
Flight Phase :	Hold	**Occurrence Date :**	27 Jul 2003
Classification :	Occurrences	**Location :**	Lambourne (LAM)
Events :	TCAS Report ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - B737 descending to FL90, advised ATC it was stopping at FL100 due possibly to traffic climbing to FL80. A following B747 then called descending to FL100.
Precis :
B737 being vectored from LAM for R/W27R was released at FL90, but advised that it was stopping its descent at FL100, due to concerns of traffic below. ATC informed B737 of traffic which was climbing to FL80. A B747

following the B737 then called descending to FL100 and instructed to stop descent at FL110, which was acknowledged. Believed that the B747 may have intended descending below its cleared FL. The quality of spoken English during this incident was poor with simultaneous transmissions evident.

A/C Type :	Piper PA46 Malibu	**Occurrence Number :**	**200305290**
Flight Phase :	Climb	**Occurrence Date :**	06 Aug 2003
Classification :	Occurrences	**Location :**	Bournemouth
Events :	UK Airprox	**Location Info :**	8 SE

Pretitle :

UK AIRPROX 121/2003 - PA46 and a BE76 8nm Southeast of Bournemouth at 2000ft.

Precis :

PA46 allegedly departed from allocated clearance and came into conflict with a BE76 carry out an ILS approach. The PA46 pilot's report indicates that the foreign national was picking up his a/c after partially completed maintenance. When airborne an a/c warning alarm then sounded with the pilot trying to check the problem. He was aware to turn to the right on departure but not of any specific heading. The pilot was also having trouble in the speed of delivery of ATC instructions. ATC aspects included not reinforcing the direction required, non use of VRPs and alleged poor radar performance.
CAA Closure: Appropriate ATC follow up action has been taken. This AIRPROX is now subject to a separate review by the United Kingdom AIRPROX Board (UKAB).

A/C Type :	B757	**Occurrence Number :**	**200305478**
Flight Phase :	Taxy	**Occurrence Date :**	10 Aug 2003
Classification :	Occurrences	**Location :**	Nice
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - B757 holding at C1 was cleared to cross R/W04L. After releasing brakes and starting to move, crew heard ATC clear another a/c for landing in local dialect. Crossing stopped.

Precis :

Foreign authority has been alerted to this incident.

A/C Type :	B757	**Occurrence Number :**	**200305977**
Flight Phase :	Descent	**Occurrence Date :**	28 Aug 2003
Classification :	Occurrences	**Location :**	BAMAR
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	25 N

Pretitle :

B757 received TCAS RA descending through FL250 towards cleared FL240, 25nm North of BAMAR, against A321 below. ATC had been speaking to A321 in Spanish, so B757 crew unaware of A321 cleared level.

Precis :

A/C Type :	Falcon 2000	**Occurrence Number :**	**200306050**
Flight Phase :	Climb	**Occurrence Date :**	01 Sep 2003
Classification :	Occurrences	**Location :**	Bovingdon (BNN)
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	4 SE

Pretitle :

A Falcon 2000 allegedly failed to comply with the climb profile whilst on the CPT 5X SID. A similar incident occurred a few minutes later involving a C550, same operator.

Precis :

Falcon 2000 on the CPT 5X SID called ATC and correctly reported climbing to 3000ft and advised by ATC 'further climb shortly'. In fact Falcon 2000 should have continued its climb iaw with the SID to be at 5000ft 4nm prior to BNN, but in fact was still at 3000ft 2nm prior to BNN. It is believed that due to the ATC statement the foreign pilot may have been under the impression that further climb would be at instruction of ATC. Appropriate ATC action will be taken. The second incident which occurred a few minutes later involved a C550, same operator, ATC had instructed C550 to continue iaw with SID, but a/c continued at 3000ft for an extended period and was only passing 4000ft approximately 1nm prior to BNN. The operator is to be alerted to these incidents.

A/C Type :	A320	**Occurrence Number :**	**200306210**
Flight Phase :	Descent	**Occurrence Date :**	07 Sep 2003
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	Altitude Deviation	**Location Info :**	

Pretitle :

Following vectors for R/W27R A320 allegedly descended 500ft below its cleared altitude of 4000ft whilst on base leg for R/W27R. A320 reminded of its cleared altitude. Standard separation maintained.

Precis :

A/C Type :	B737	**Occurrence Number :**	**200306245**
Flight Phase :	Hold	**Occurrence Date :**	10 Sep 2003
Classification :	Occurrences	**Location :**	Lambourne (LAM)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

B737 in the LAM Hold was given an EAT of 1030hrs. Subsequently B737 was seen leaving LAM heading 230deg and pilot informed controller of this action. B737 instructed to return to LAM immediately.

Precis :

Pilot's English poor.

A/C Type :	BAE146	**Occurrence Number :**	**200306304**
Flight Phase :	Taxy	**Occurrence Date :**	09 Sep 2003
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Alleged poor ATC at Madrid. Landing A310 observed passing just behind tail of RJ100 which was exiting R/W33 via RET K1. ATC persistently spoke in Spanish. Recurring problem at this location.

Precis :

See also 200306501, 200306907, 200308055 and 200308058.

A/C Type :	A320	**Occurrence Number :**	**200306501**
Flight Phase :	Descent	**Occurrence Date :**	13 Sep 2003
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :

A320 was cleared to descend to FL90 and heading 180deg, then cleared direct to RBO to regain STAR. During turn and passing FL110, A320 received/complied with a TCAS RA of climb on traffic at FL100.

Precis :

Frequency was busy and local language used at time of incident. Investigation continues under occ 200306304

A/C Type :	B737	**Occurrence Number :**	**200306646**
Flight Phase :	Climb	**Occurrence Date :**	17 Sep 2003
Classification :	Occurrences	**Location :**	Verona Brescia
Events :	Foreign ATC Occurrence TCAS Report	**Location Info :**	

Pretitle :

B737 received a TCAS RA during climb out of Verona Brescia at 3000ft against light a/c orbiting over airfield.

Precis :

With B737 following SID at 3000ft, heading 120deg, ATC issued instruction to change heading to 090deg but did not specify left or right. B737 crew attempted to clarify with ATC but were unable to establish contact due to ATC talking to another a/c in Italian. B737 slowly commenced a left turn before establishing contact with ATC who advised that a right turn should have been commenced. This was performed, with a TCAS RA then being received against a light a/c orbiting over airfield. Appropriate action taken.

A/C Type :	B737	**Occurrence Number :**	**200307427**
Flight Phase :	Taxy	**Occurrence Date :**	26 Oct 2003
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	ATC Occurrence Runway Incursion	**Location Info :**	

Pretitle :

B737 was instructed 'after the landing B737 at 2nms line up 26L at B1', which was read back. B737 subsequently observed crossing B1 stopbar. An inbound B737 was sent around. Pilot apologised.

Precis :

On handover to London pilot apologised stating B737 had only just crossed stopbar and that there was no intention of lining up on R/W26L. Pilots English reported as poor.

A/C Type :	CL600 RJ700	**Occurrence Number :**	**200307530**
Flight Phase :	Descent	**Occurrence Date :**	25 Oct 2003
Classification :	Occurrences	**Location :**	Bordeaux
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

CRJ 700 cleared for ILS R/W23 and told to report at 4nm. At 4nm called ATC, but transmissions from ATC were in local language. CRJ 700 was given a late landing clearance due departing a/c.
Precis :
Departing a/c performed a rolling take-off and CRJ 700 received its landing clearance at 300 feet AGL/1 mile.

A/C Type :	B737	**Occurrence Number :**	**200307694**
Flight Phase :	Hold	**Occurrence Date :**	05 Nov 2003
Classification :	Occurrences	**Location :**	Ghardaia
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Alleged poor ATC communications/overload involving ATCC and Tower. Many communications in local language.
Precis :
During descent towards GHA VOR, ATCC became overloaded. B737 eventually cleared to descent to FL120, but not released by ATCC, even though they were told B737 was in two-way contact with Tower. B737 informed Tower it was taking up the hold at GHA at FL120, but they had difficulty in understanding this. At the same time B737 was released by ATCC and Tower cleared it to descend to FL110. Another a/c was also holding at GHA at FL110, they were in the NDB hold and B737 was in the VOR hold, less than 5nm track separation. B737 remained at FL120 until other a/c had descended through FL90 by mutual agreement of both pilots not ATC.

A/C Type :	B747	**Occurrence Number :**	**200307910**
Flight Phase :	Cruise	**Occurrence Date :**	13 Nov 2003
Classification :	Occurrences	**Location :**	Oceanic
Events :	Loss of Standard Separation	**Location Info :**	52N020W

Pretitle :
Loss of Oceanic separation between B747 and B777 at FL350, 54N020W. B747 crew had mistaken reporting points MALOT/ MOLAK.
Precis :
B747 crew allege that they readback MOLAK to Gander ATCC. Gander ATCC had issued a clearance via MALOT and they have subsequently stated that the pilot's accent may well have masked the incorrect readback of MOLAK. The a/c also twice readback a heavily accented "MOLAK" on HF to Ballygirreen (different controllers) which went undetected on both occasions and which was readback to the crew as "MALOT" without being challenged by them. The conflict was detected when the B777 was still well within Shannon radar cover and appropriate and effective action alleviated any actual risk. This is the first incident of confusion between MALOT and MOLAK.

A/C Type :	A321	**Occurrence Number :**	**200307939**
Flight Phase :	Climb	**Occurrence Date :**	16 Nov 2003
Classification :	Occurrences	**Location :**	Almaty
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
A321 passing FL247 during cleared climb to FL256 received a TCAS TA followed by RA 'adjust vertical speed' on known opposite direction traffic. SOPs followed. R/T with unknown was in local language.
Precis :

A/C Type :	B747	**Occurrence Number :**	**200308085**
Flight Phase :	Cruise	**Occurrence Date :**	19 Nov 2003
Classification :	Occurrences	**Location :**	Airway B200
Events :	Airprox - Foreign TCAS Report A/c Equipment / System Malfunction	**Location Info :**	Surgut

Pretitle :
Foreign AIRPROX - B747 and a Tu154M. Subject to investigation by the Russian authority.
Precis :
B747 cruising at 10600mtrs on Airway B200, received TCAS TA on descending traffic above that initially stopped its descent 800ft above B747, then continued a rapid descent. B747 received TCAS RA of descend and autopilot disconnected. B747 descended approximately 400-500ft. When clear of conflict B747 returned to 10600mtrs, but when autopilot re-engaged for level off, B747 gained approximately 300ft in capturing. All communications between ATC and other a/c were in local language making it impossible for B747 to monitor other a/c's clearances. The Russian investigation revealed that this incident was caused by a malfunctioning transponder in the Tu154, ie the height readout was malfunctioning. The crew of the Tu154 confirmed that their a/c was level at 11100 metres at the time of the event.

A/C Type :	Unknown	**Occurrence Number :**	**200308325**
Flight Phase :	Taxy	**Occurrence Date :**	29 Nov 2003
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence Ground (AD) Occurrence	**Location Info :**	

Pretitle :

Airbus failed to follow ATC taxy instructions to hold at ROKIT and taxied to Block 133/134.

Precis :

Airbus instructed to 'follow the greens, hold at ROKIT for 27R', which was read back correctly. It was then noticed on SMR that Airbus had gone passed ROKIT and was at Block 133/134 stopbar. This was queried and foreign crew replied they had greens taking Airbus past ROKIT and therefore did not hold. Investigations revealed that the instructions given were clear and unambiguous and were read back correctly. Upon arriving at ROKIT the greens continued to the r/w and the pilots continued on the greens. In the 27R holding area for outbounds, there are 3 routes through blocks 133, 134 and 137 only one of which will throw up the stop bar at ROKIT. The frequency was very busy at the time. The AGL system is to be replaced in July 05 and a review of the lighting arrangements in the holding areas is being discussed.

A/C Type :	B767	**Occurrence Number :**	**200308501**
Flight Phase :	Approach	**Occurrence Date :**	26 Nov 2003
Classification :	Occurrences	**Location :**	Barcelona
Events :	Foreign ATC Occurrence Flight Crew Occurrence	**Location Info :**	

Pretitle :

ILS allegedly withdrawn from service without warning during B767 approach to Barcelona. Additionally, B767 was then vectored close to preceding a/c, with numerous speed reductions required.

Precis :

ATIS and brief had given no indication of ILS maintenance at Barcelona. Preceding a/c was cleared to approach using ILS. B767 was then cleared to intercept BCN 067 radial before being cleared for a VOR DME approach. There was no mention of ILS being unserviceable but rapid conversation in Spanish followed, leading reporter to believe that maintenance had withdrawn ILS from service with very little warning. Additionally, ATC vectored B767 close to preceding A319 and continuously instructed B767 to reduce speed. With B767 at 3000ft, crew were advised that they were flying 40kts faster than the A319 although B767 crew do not believe this was the case. At this point, A319 showed as 2nm ahead of B767 on TCAS. While attempting to reduce speed iaw ATC instruction, B767 crew selected flap 25 before the landing gear was locked down, resulting in a brief gear not locked warning. Flap 20 was reselected to silence warning and approach continued without incident with landing clearance being received from ATC at 100ft.

A/C Type :	Not Applicable	**Occurrence Number :**	**200308702**
Flight Phase :	Not Applicable	**Occurrence Date :**	12 Dec 2003
Classification :	Occurrences	**Location :**	LACC - Clacton
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

Overload between 1430-1500hrs, LACC Sectors 13 and 14 (Clacton West High and Low).

Precis :

At the time of the Overload there were no flow restrictions in place. The Traffic Manager had been informed that sectors 13/14 could be split if necessary and so was not monitoring the bandboxed sector. The Watch Supervisor had planned to operate with 7 sectors on LAGs East and North with 3 on East. This assumed that North Sea remained as one sector and Clacton could be split tactically to deal with the expected late afternoon rush. The LAS had planned to operate with 8 controllers on 6 positions increasing to 10 for 8 later. Due to two controllers arriving late, at 1330, there were only 5 for 4 on Clacton and 2 for 2 on North Sea. He liaised with the Traffic Manager and confirmed that the potential demand on Clacton would not require it being split until early evening. The TLPD showed a peak of 26/15 was visibly reducing to 23/15 and then 16/15. The actual traffic was 21/15, 24/15 and 24/15. The TSF for the sector was 38/60 but between 1400-1459, 56 a/c entered the sector. The Tactical controller took over the position at 1431 when there were already 10 a/c in the sector. Sector capacity was calculated as being a constant throughput of 8 a/c. Traffic volume remained at between 9-13 for the next 30 minutes. The traffic situation was complex which further increased the controllers' workload. The sector team were under the impression that there were insufficient staff to split the sector, however, there were 3 controllers on breaks that were available. Between 1440-1450, the sector team became concerned and the Planner actively assisted the tactical in decision making. RTF loading increased significantly and by 1449, pilots were being told to stand by. The LAS North arrived, at 1450, to Support the Tactical controller but this was not very effective due to the time required for the Support controller to assimilate the traffic situation. Further staff were called but, by then, the situation was too complex to hand over and split the sector. It was then decided to operate in a 'man and boy' mode. Between 1435-1450 a total of 21 a/c entered the sector, equivalent to a rate of 78/60. During the overload period 29 a/c entered the sector, equivalent to 60/60. The Traffic

Manager did not actively monitor the sector as he understood that it could be split if necessary and so flow management was effectively delegated to the LAS. The primary tool for the LAS was TLPD which did not give a timely warning, and when the demand became obvious it was too late to take effective action. TACT showed that the parameters set for both sectors was breached but it was later established that a predicted demand of 46 changed to an actual delivery of 56. It was found that 15 a/c which arrived in the hour were not in the predicted TACT demand. 8 were expected in the previous hour and 5 in the following one, with 2 a/c not appearing in TACT. This gave TACT a prediction accuracy of only 64%. Standard separation was maintained throughout. Appropriate action is being taken at the unit to address the best way that a Support Controller can be utilised together with reviewing the method of recalling staff in similar circumstances.
CAA Closure: Appropriate ATC action taken.

A/C Type :	B777	**Occurrence Number :**	**200308953**
Flight Phase :	Climb	**Occurrence Date :**	21 Dec 2003
Classification :	Occurrences	**Location :**	Sao Paulo
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :
Foreign AIRPROX - B777 and unidentified a/c. Subject to investigation by the Brazilian authority.
Precis :
As B777 was climbing through 2000ft whilst on a TONI SID it received a TCAS TA on slow climbing traffic below. ATC seemed unaware of this traffic. B777 increased its ROC to avoid an RA. B777 reported traffic to ATC, but controller seemed not to understand, due possibly to poor English.

A/C Type :	EMB 145	**Occurrence Number :**	**200308999**
Flight Phase :	Descent	**Occurrence Date :**	23 Dec 2003
Classification :	Occurrences	**Location :**	Paris CDG
Events :	ATC Engineering	**Location Info :**	

Pretitle :
A/c captured glide path approximately 2.5nm earlier than published approach procedure. A/c subsequently noted low on profile until 7nm when A/P disconnected and Localiser DME approach flown.
Precis :
On taxi in ATC were advised of problem experienced and asked if other a/c had reported this problem. The reply was no, however, as the crew were shutting down the a/c they made out a conversation in French that another a/c had a problem with the glide path. This was queried with Ground who confirmed that an Air France B737 that had been Nr 2 to the reporter's a/c had experienced a similar problem.

A/C Type :	B737	**Occurrence Number :**	**200309069**
Flight Phase :	Climb	**Occurrence Date :**	29 Dec 2003
Classification :	Occurrences	**Location :**	Bologna
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
After B737 departed R/W30 and in left turn on SID, ATC requested a right turn then a left turn, due conflicting traffic. In both turns B737 received a 'bank angle' warning.
Precis :
Following departure from R/W30, B737 told to proceed to LUPOS, which is a left turn. Whilst in left turn to LUPOS, B737 was asked its heading and ATC then requested right turn due conflicting traffic. Autopilot disconnected and right turn flown, during which B737 received a 'bank angle' warning. ATC then told B737 to turn left due conflicting traffic. Left turn initiated and again a 'bank angle' warning occurred. Whilst in left turn crew told to fly direct to LUPOS and autopilot re-engaged.

A/C Type :	A320	**Occurrence Number :**	**200400037**
Flight Phase :	Taxy	**Occurrence Date :**	04 Jan 2004
Classification :	Occurrences	**Location :**	Malaga
Events :	Foreign ATC Occurrence Runway Incursion	**Location Info :**	

Pretitle :
Due to local language being spoken there was some confusion concerning A320's line up clearance, which was subsequently cancelled . A320 was almost on the R/W and an inbound a/c had to go around.
Precis :
A320 was asked if it was ready for an immediate departure and replied 'yes', but received no clearance to line up. A320 was then cleared for an immediate rolling departure and as it approached R/W, line up was cancelled. A320 braked sharply, but this left a/c almost on the R/W. An inbound a/c was instructed to go around and A320 cleared to line up and depart. Controller was speaking Spanish at time of incident, which led to confusion.

A/C Type :	BAE146	**Occurrence Number :**	**200309075**

Flight Phase :	Descent	**Occurrence Date :**	27 Dec 2003
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
BAe146 called established R/W26L and told to reposition R/W26R due vehicles on R/W26L. At no time was problem communicated to BAe146 prior to approach as these transmissions were in local language.
Precis :
BAe146 at CRL VOR given vectors for R/W26L and eventually put onto heading 220deg to call established R/W26L. BAe146 became established and changed to Tower who asked BAe146 to confirm established R/W26R. Pilot replied negative and ATC asked if a/c could reposition R/W26R. Initially pilot declined, but was then told R/W26L not available due vehicles on R/W. BAe146 then vectored to R/W26R. At no time was problem or QNH change communicated in English prior to approach.

A/C Type :	B747	**Occurrence Number :**	**200309114**
Flight Phase :	Climb	**Occurrence Date :**	30 Dec 2003
Classification :	Occurrences	**Location :**	Tokyo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
B747 believed it had been cleared to climb to FL310, but approaching 7000ft on the SID it was clear this was not correct. B747 levelled at 7000ft iaw SID and clarification from ATC was sought.
Precis :
ATC had difficulty in understanding the crew's query over the clearance. Reporter states that if the ATC unit had given an initial clearance of "Expect FL310" the incident would have been avoided.

A/C Type :	A320	**Occurrence Number :**	**200400545**
Flight Phase :	Climb	**Occurrence Date :**	25 Jan 2004
Classification :	Occurrences	**Location :**	Madrid
Events :	Altitude Deviation (ATC) Foreign ATC Occurrence	**Location Info :**	

Pretitle :
After take off A320 changed frequency at 200ft, but was unable to contact new frequency until FL49, when clearance was amended to maintain 5000ft. A320 reached 5350ft before descending back to 5000ft.
Precis :
After take off from R/W36L, at 200ft, A320 was given frequency change by Tower, which was acknowledged and actioned. New frequency did not respond to initial call, also all other R/T transmissions were in local language. ATC eventually contacted A320 when it was at FL49 and instructed it to maintain 5000ft, due to the slow climb of the preceding a/c. A320 climbing to FL130 on the SID, disconnected autopilot, but reached 5350ft before descending back to 5000ft.

A/C Type :	DO 328JET	**Occurrence Number :**	**200400636**
Flight Phase :	Climb	**Occurrence Date :**	02 Feb 2004
Classification :	Occurrences	**Location :**	Port Harcourt
Events :	Engine/Malfunction Power Loss - First Engine Emergency Call Diversion /Return	**Location Info :**	

Pretitle :
LH engine failure after take off. MAYDAY declared. Aircraft returned.
Precis :
At approx 2800ft during climb out, a loud bang was heard followed by a brief rumbling noise and low frequency vibrations, accompanied by a sudden yaw. LH engine failure suspected because LH engine parameters decreased in comparison with the RH engine; this also agreed with the aircraft yaw response (yaw to left). The aircraft attitude was stabilised whilst the crew briefly assessed the problem iaw the emergency checklist. ATC were then informed and a return to the airfield was requested. The aircraft was cleared for initial descent and then handed back to the ATC tower for further clearance. The crew experienced some difficulty in explaining to the ATC tower controller that they had declared an emergency and wanted clearance for an emergency landing. When the airfield was visual, the aircraft was manoeuvred to position for a visual left base join for R/W 21. The post-flight inspection of the LH engine confirmed that the oil level was satisfactory and there was no sign of a birdstrike but there was evidence of impact by small fragments inside the cold exhaust duct with numerous different sized pieces of metal evident in the hot exhaust duct. Suspect HPT1 turbine blade failure. See also 200106824.

A/C Type :	BAE146	**Occurrence Number :**	**200400677**
Flight Phase :	Taxy	**Occurrence Date :**	01 Feb 2004
Classification :	Occurrences	**Location :**	Paris CDG

Events :	Foreign ATC Occurrence Windshear / Gusts	**Location Info :**

Pretitle :

An inbound B737 and an outbound a/c had conversations in French with ATC concerning windshear, but when RJ100 was cleared for take off there was no mention of windshear until queried by pilot.

Precis :

Whilst RJ100 was at holding point K7 waiting for take off from R/W27L, an inbound B737 landed on R/W27L and reported windshear in the local language. Once B737 had cleared R/W another a/c was cleared for take off, again clearance was in local language but reporter's limited understanding of the language believed this clearance included a report of windshear and wind speeds up to 35kts. RJ100 was cleared to line up and then take off. At no time did controller mention windshear. Crew queried if there had been any reports of windshear and controller then gave windshear information.

Number of Records : 230

APPENDIX D: Results for 'Phraseology' Query of UK CAA MORS Database

Safety Regulation Group
Safety Investigation & Data Department

Aviation House	Direct Dial	01293 573220	Switchboard	01293 567171
Gatwick Airport South	Direct Fax	01293 573972	Fax	01293 573999
West Sussex	E-mail	sdd@srg.caa.co.uk	Telex	878753
RH6 0YR				

These records were retrieved from the UK CAA Mandatory Occurrence Reporting (MOR) system by a member of the SIDD Department

The MOR system records include information reported to the CAA, information obtained from CAA investigations, and deductions by CAA staff based on the available information. The authenticity of the contents or the absence of errors and omissions cannot be guaranteed. Records in this system commenced on 1 January 1976 coincident with the introduction of Mandatory Occurrence Reporting in the UK, but occurrences reported voluntarily are also included, and no distinction is made between them.

Note: Any data provided from these records are made available on the understanding that they are only to be used for purposes of Flight Safety and must not be used for other purposes.

A/C Type :	ATR 42	**Occurrence Number :**	**200000035**
Flight Phase :	Cruise	**Occurrence Date :**	10 Jan 2000
Classification :	Occurrences	**Location :**	Detling (DET)
Events :	A/c Technical Occurrence	**Location Info :**	10 SW

Pretitle :
Nr1 engine oil pressure fell to zero. Engine shut down. Mayday call later downgraded to Pan. Checklist actioned & a/c descended. Returned & landed safely.
Precis :
Loss of oil pressure associated with engine assembly procedure. A new assembly procedure was introduced in 1997 but this engine was built prior to introduction of the revised procedure.
CAA Closure: Hazard adequately controlled by existing requirements/procedures.

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200000513**
Flight Phase :	Climb	**Occurrence Date :**	30 Jan 2000
Classification :	Occurrences	**Location :**	English Channel
Events :	Engine/Malfunction Power Loss - First Engine ATC Occurrence	**Location Info :**	

Pretitle :
An MD80 diverting to Gatwick, due to an engine problem, requested step down descents to 2000ft while to the South of Gatwick:, descent to 2000ft refused. A/c descended to 3000ft.
Precis :
CAA Closure: Whilst the pilot did not actually declare an emergency he did say that he had an engine problem and was descending in order to restart it. This was interpreted as an emergency and the aircraft was put on a 7700 squawk and transferred to a discrete frequency because the en-route frequency was busy. The operator reported afterwards that the engine failure had also caused a pressurisation malfunction requiring a rapid descent, which was requested. However, the loss of pressurisation was unknown to ATC at the time and descent to 2000ft provoked a question about fuel and a certain amount of unease and uncertainty in the minds of the controllers that with only one engine, the crew wished to descend so low so early. When ATC tried to establish why the pilot wished to make such an early descent, confusion arose about fuel. When asked by the controller "can you just advise me, are you descending to use fuel?" the crew misinterpreted this as - did they have enough fuel? - and replied "yes we are descending with fuel enough and everything is OK". There was not only a misunderstanding of language, but a misunderstanding by the foreign pilot of the question, and in that respect the reply confused rather than clarified the situation. Nevertheless, the controller's question "are you descending to use fuel ?" uses rather complex English syntax, and was perhaps always open to mis-interpretation by a pilot whose native tongue is not English.

A/C Type :	B737	**Occurrence Number :**	**200000693**
Flight Phase :	Taxy	**Occurrence Date :**	18 Jan 2000
Classification :	Occurrences	**Location :**	Brussels
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
Confusion over R/W line up clearance.
Precis :
There was a company B737 ahead and the Tower requested reporter's a/c (B737) to "line up after the Malev 737 from Whisky" This was read back. Then the tower called reporter's aircraft and amended line up clearance to "line up after the company B737" (which was ahead of both the Malev B737 and the Company B757 at holding point B1). This was understood by both P1 & P2 & read back. P1 then duly lined up. The next call from ATC was for the Malev B737 to take off. Immediately, a " company B757" pilot called to ATC saying that the

reporter's a/c had taken an incorrect clearance & was lined up in front of the Malev.

A/C Type : Military
Flight Phase : Cruise
Classification : Occurrences
Events : ATC Occurrence
Occurrence Number : **200000935**
Occurrence Date : 17 Feb 2000
Location : Berry Head (BHD)
Location Info :
Pretitle :
Military a/c inbound to Valley caused excessive workload for LATCC staff due fuel shortage & a late indication of this situation.
Precis :
Shortly after this incident 3 similar a/c inbound to the same military airfield had to divert to Liverpool after calling PAN/Mayday with fuel shortages.

A/C Type : B747
Flight Phase : Descent
Classification : Occurrences
Events : Altitude Deviation
Occurrence Number : **200001251**
Occurrence Date : 01 Mar 2000
Location : London-Gatwick - LGW
Location Info :
Pretitle :
Confusion between crew & ATC over B747's cleared flight level.
Precis :
Crew believed they received a descent clearance to FL100 & set the MCP, which was confirmed by both pilots & read back by the P1. Passing FL106, ATC requested a/c to confirm cleared FL110. The R/T tape confirms that the ATC clearance was to FL110, which was correctly read back.
CAA Closure: The operator is to include details of this & a similar incident 2000/01497 in their next edition of their bulletin. The operator notes that neither readback from the crews contained the use of the word 'flight level' or the use of the standard phrase 'flight level one hundred'. The bulletin will highlight the need to correctly use both of these phrases.

A/C Type : B757
Flight Phase : Climb
Classification : Occurrences
Events : UK Airprox
Altitude Deviation
Loss of Standard Separation
Occurrence Number : **200001297**
Occurrence Date : 04 Mar 2000
Location : Midhurst (MID)
Location Info : 6 E
Pretitle :
UK AIRPROX - B757 and BAC 1-11 6nm East of Midhurst at FL80.
Precis :
B757 cleared on a BOGNA SID from Gatwick climbing to altitude 6000ft. The B757 pilot took a climb clearance to FL150 addressed to another aircraft, same company.
CAA Closure: The operator has acknowledged the errors and actions of the crew and taken appropriate corrective action This Airprox is now subject to a review and collision risk assessment by the UKAB.

A/C Type : B737
Flight Phase : Taxy
Classification : Occurrences
Events : Runway Incursion
ATC Occurrence
Occurrence Number : **200001363**
Occurrence Date : 03 Mar 2000
Location : London-Gatwick - LGW
Location Info :
Pretitle :
B737 misinterpreted ATC instruction & lined up on R/W 26L without clearance. Inbound B737 sent around at 2nm.
Precis :
A B737 was cleared for take off 26L & was rolling. Another B737 was at A2 holding point & cleared to line up after the next landing a/c (another B737). A fourth B737 was instructed to line up (from M1 holding point) after the departing B737. The pilot of this a/c took his traffic to be the B737 already rolling on 26L & proceeded to line up on 26L. ATC training in progress. See Digest 00/D/05.
CAA Closure: ATC error due ambiguous instructions. The confusion arose because the B737 already cleared for take off & the 1st B737 to line up were wearing the same colours but with a different callsign/company. Appropriate ATC remedial action has been taken.

A/C Type : B747
Flight Phase : Landing
Classification : Occurrences
Events : Flight Crew Occurrence
Foreign ATC Occurrence
Poor Visibility
Occurrence Number : **200001441**
Occurrence Date : 11 Feb 2000
Location : Lagos
Location Info :
Pretitle :
A/c landed without ATC clearance.
Precis :

When a/c was established on ILS at 12 miles, ATC instructed flight crew to confirm when a/c was leaving 2200ft. However, high workload in poor visibility caused flight crew to omit call to ATC on leaving 2200ft. At 600ft, flight crew were visual with runway, confirmed that it was clear and therefore assumed that a/c had been cleared to land. Flight crew realised their error/omission when, at end of landing roll, ATC asked if a/c had passed 2200ft. Reporter alleges that poor ATC phraseology & high workload meant that flight crew assumed that landing clearance had been given when visual and the runway was confirmed clear. Reporter also alleges that a late landing clearance was given to following a/c & previously to his a/c on 12Feb2000. The operator's ATS Manager led a Technical Mission to Lagos during which the poor performance (equipment and human) as well as the Late Landing clearance were discussed. The Authorities there have committed to improve their standards.
CAA Closure: The hazard is adequately controlled by the operator's actions.

A/C Type : B747 **Occurrence Number :** **200001497**
Flight Phase : Descent **Occurrence Date :** 12 Mar 2000
Classification : Occurrences **Location :** WILLO
Events : ATC Conflict, UK Airprox **Location Info :** 20W
Pretitle :
UK AIRPROX - B747 & BAe146 at FL100 at WILLO.
Precis :
CAA Closure: Aircrew error/altitude excursion on the part of the B747 crew. The a/c had been cleared to descend to FL110 but the crew set the MCP to FL100. Appropriate remedial action has been taken by the operator concerned. This AIRPROX is now subject to a separate review by the United Kingdom AIRPROX Board (UKAB).

A/C Type : B747 **Occurrence Number :** **200001707**
Flight Phase : Cruise **Occurrence Date :** 18 Mar 2000
Classification : Occurrences **Location :** REFSO
Events : ATC Occurrence **Location Info :**
Pretitle :
Callsign confusion - Fltnums "507" & "907", same operator.
Precis :
Both a/c were on the same frequency at the same time & were taking each others instructions. The controller also believes that "507" was acknowledging instructions without using his callsign. See also occnum 199805056. This incident has been brought to the attention of the foreign operator concerned.

A/C Type : Saab F340 **Occurrence Number :** **200002050**
Flight Phase : Cruise **Occurrence Date :** 09 Mar 2000
Classification : Occurrences **Location :** Perth (PTH)
Events : ATC Occurrence **Location Info :**
Pretitle :
Confusion between crew and ATC concerning SF340's descent clearance.
Precis :
CAA Closure: When the SF340 called ATC the response from the controller was a series of numbers, with no company prefix, followed by instructions to descend when ready to FL90. The SF340 responded with a readback of the instruction and the numerical part of the callsign. 4 minutes later, when the SF340 reported leaving FL190, the controller responded by stating that a clearance had not been issued. A/c climbed back to FL180 from FL173.

A/C Type : B737 **Occurrence Number :** **200002196**
Flight Phase : Cruise **Occurrence Date :** 28 Mar 2000
Classification : Occurrences **Location :** Bordeaux
Events : Foreign ATC Occurrence **Location Info :** 30 S
Pretitle :
Misunderstanding between ATC and crew concerning B737's cleared flight level.
Precis :
The reporter states that ATC called the B737 'Fltnum 302 'is cleared 350 - what will your mach number be?'. The pilot read back 'cleared 350, mach .75', to which ATC said 'call you back'. At 31800ft in a climb ATC called to say that the B737 had not been cleared to climb: apparently the controller had said 'if cleared 350'.

A/C Type : B767 **Occurrence Number :** **200002654**
Flight Phase : Climb **Occurrence Date :** 19 Apr 2000
Classification : Occurrences **Location :** Saski
Events : ATC Occurrence **Location Info :**
Pretitle :
Filed flight plan was not the correct ICAO RTF code for the operator. When the B767 called, it used a callsign with over 7 alphanumerics.
Precis :
Confusion resulted at a busy time, as the callsign printed on the FPS was different from that on the radar display

and what the a/c was using. Operator informed and asked to comply with the correct procedures in future.
CAA Closure: The a/c commander concerned has acknowledged his mistake. A reminder has been sent to all the operators pilots in an attempt to avoid any future incidents.

A/C Type :	B747	**Occurrence Number :**	**200002887**
Flight Phase :	Approach	**Occurrence Date :**	28 Apr 2000
Classification :	Serious Incidents	**Location :**	London-Heathrow - LHR
Events :	ATC Conflict	**Location Info :**	

Pretitle :
SERIOUS INCIDENT-Conflict when a B747 was given a late go-around, over an A321 lined up on R/W09R which had its take off clearance cancelled..
Precis :
AAIB Field Investigation. ATC training in progress.
CAA Closure: ATC error. The Departure Controller mentor misjudged the spacing required between the 2 a/c. The controller planned to allow the A321 to depart ahead of the B747 but because he failed to monitor the FPS of the departing a/c, he based his understanding of the situation on erroneous information. Despite concerns shown by his trainee, the controller continued with his plan beyond the point where it needed to be changed to affect a safe orderly flow of air traffic. Remedial action was taken at too late a stage, allowing the B747 to overfly the A321 at an unsafe altitude. The controller did however cancel the A321's take-off clearance. Appropriate ATC remedial action has been taken. See also AAIB "Yellow Book" report (Aircraft Incident Report No 1/2001, Ref EW/C2000/4/6) published 12/06/01 which contained 3 Safety Recommendations. See also CAA FACTOR F11/2001 published on the same date.

A/C Type :	B737	**Occurrence Number :**	**200003212**
Flight Phase :	Take Off	**Occurrence Date :**	10 May 2000
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	Runway Incursion ATC Occurrence	**Location Info :**	

Pretitle :
A321 failed to follow ATC clearance & entered the edge of 09R at Block 85 as a B737 was taking off from 09R.
Precis :
The controller attempted to stop the B737's take off but without success. The incident was subsequently discussed with the B737 pilot & it was established that ATC used incorrect phraseology when trying to stop its take off. The RT tape shows "**** hold position err you can see the **** has nearly entered the runway". This transmission was 40 seconds after the "clear take-off" message & the P1 of the B737 reports he was passing 80 kts, could see that the runway was not infringed & the approaching a/c had stopped & therefore considered it safe to continue. See Digest 00/D/06.

A/C Type :	A320	**Occurrence Number :**	**200003726**
Flight Phase :	Taxy	**Occurrence Date :**	29 May 2000
Classification :	Occurrences	**Location :**	Glasgow (GOW)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
A320 crossed active R/W 28 without clearance.
Precis :
The A320 requested taxi clearance for R/W 23. The ground controller, a trainee, told the a/c to taxi "to holding point alpha four for two three..QNH...". Alpha four is the holding point at R/W28 threshold & was the clearance limit since R/W28 was in use. The pilot did not appreciate the significance of the clearance however the controller having noticed the taxi speed of the A320 instructed it to expedite the crossing of R/W 28 as a light a/c was on short final for that runway. There have been previous incidents of a/c crossing this active runway & suggested improvements in phraseology has been widely publicised. As a result of this incident this phraseology has been issued as a SI & will be incorporated in the next MATS Part 2 update.

A/C Type :	DC10	**Occurrence Number :**	**200003881**
Flight Phase :	Descent	**Occurrence Date :**	02 Jun 2000
Classification :	Occurrences	**Location :**	Dean Cross (DCS)
Events :	Altitude Deviation	**Location Info :**	10 S

Pretitle :
ATC incident - Believed that the crew of a DC10 misinterpreted a descent clearance of FL190 & attempted to descend to FL100. Excursion noted when a/c was at FL170. Standard separation maintained.
Precis :
This is an example of a level bust being caused by the use of non-standard RT phraseology. A/c was cleared to be "FL190 level ten before LAKEY" . The readback was FL190 & ten before LAKEY. The controller then noticed the a/c passing FL190 descending. On being advised of his cleared level , the pilot replied that he thought he had been cleared FL190 & then "10" (FL100) before LAKEY. The correct ATC RT phraseology for these type of instructions must include a horizontal distance measurement such as nautical miles or DME i.e. "Descend to FL190 to be level 10 DME before LAKEY" which should prevent this kind of confusion.

A/C Type :	B757	**Occurrence Number :**	**200004093**
Flight Phase :	Descent	**Occurrence Date :**	06 Jun 2000
Classification :	Occurrences	**Location :**	Norwich
Events :	UK Airprox ATC Conflict TCAS Report	**Location Info :**	5 SW

Pretitle :
UK AIRPROX - B757 and flight of two military jets 5nm South West of Norwich at FL60.
Precis :
CAA Closure. The lead military jet pilot reported that they were making an approach to RAF Lakenheath whilst receiving a RIS from London Mil who first gave traffic information at a range of 10 to 15nm. Radar lock acquired on the traffic and the flt descended to altitude 5000ft. Passing 6200ft, mil controller called traffic at range of 3nm and asked if pilots visual. Visual contact obtained shortly afterwards as flt became VMC and conflict confirmed. Flt climbed to 7500ft to avoid and assessed miss distance as 1000ft vertical. The Norwich Approach Controller, who was controlling the B757, did not inform the pilot of the type of ATC service being provided and the B757 pilot believed he was under Radar Control, whereas outside controlled airspace it should have been a RAS. Additionally, the initial avoiding action from the controller lacked clarity. By the time the controller's avoiding action was repeated, the B757 pilot reported visual with the traffic and he then followed his TCAS RA to resolve the confliction. This Airprox is now subject to an independent review from the UK Airprox Board (UKAB).

A/C Type :	B737	**Occurrence Number :**	**200004378**
Flight Phase :	Approach	**Occurrence Date :**	19 Jun 2000
Classification :	Occurrences	**Location :**	Belfast (BEL)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
A B737 was instructed to go around due to a B767 still on its take off roll on R/W07.
Precis :
See also occ 2000/03212.
CAA Closure: The B767 was cleared to line up and hold. Shortly afterwards the B737 called right base on a visual approach. The controller asked the B767 if he was ready for departure, and the reply, based on securing the cabin, was "not more than 60secs". The a/c was cleared for take-off. When the B767 reported rolling, about 2 mins later, it was told to "hold position", which it could not do since it was at 50Kt. The B767 continued to roll and the B737 crew, who were aware of the problem, broke off its approach. The incident occurred because the B767 took longer to roll than the controller had assumed and also the controller did not use correct phraseology to stop the take-off. Appropriate ATC action has been taken.

A/C Type :	B737	**Occurrence Number :**	**200004669**
Flight Phase :	Take Off	**Occurrence Date :**	21 Jun 2000
Classification :	Occurrences	**Location :**	Frankfurt
Events :	Foreign ATC Occurrence Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Potential misinterpretation of take-off clearance.
Precis :
B737 was lined up on 25R and Tower told flight to be ready immediate take-off. The P1 only heard "immediate take off", but due to good visibility could see 2 a/c crossing the runway.

A/C Type :	B747	**Occurrence Number :**	**200004675**
Flight Phase :	Taxy	**Occurrence Date :**	25 Jun 2000
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :
Due to a line-up clearance misunderstanding, a foreign B767 allegedly taxied within 10 metres of the nose of a B747 whilst holding for 27R.
Precis :
The B747 pilot believed that the foreign B767 crew misinterpreted their ATC clearance. They understood he had been cleared by ATC to line-up "after the British Airways B757 on R/W 23" but had inadvertently lined up after the wrong British Airways B757 and that this had gone unnoticed by ATC. Whilst aerodrome controllers will endeavour to ensure that the correct sequence is achieved and will step in if thought to be unsafe, it is ultimately the a/c commander's responsibility for safe ground manoeuvring.
CAA Closure: No further CAA action required.

A/C Type :	Piper PA28	**Occurrence Number :**	**200004728**
Flight Phase :	Cruise	**Occurrence Date :**	28 Jun 2000
Classification :	Occurrences	**Location :**	Shoreham
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
A PA28 was using a radio callsign which does not comply with approved company/registration abbreviation. See also occ 1999/03813.
Precis :
CAA Closure: The flying school has reminded all its members of the need to use approved callsigns. ATC has also been requested to contact the FS if further problems are encountered.

A/C Type :	Balloon	**Occurrence Number :**	**200005682**
Flight Phase :	Cruise	**Occurrence Date :**	05 Aug 2000
Classification :	Occurrences	**Location :**	Bristol International
Events :	Wake Turbulence Emergency Call Forced Landing Flight Crew Occurrence	**Location Info :**	2nm E

Pretitle :
Balloon encountered wake vortex from A310. Balloon canopy damaged. 4 POB - 3 minor injuries.
Precis :
The balloon lifted off at 0520 from a site 5nm north east of Bristol Airport. At 0530 the pilot contacted Bristol ATC to report that the balloon would be heading 160deg at approx 10kt, at up to 2000ft. At 0555 an A310 was receiving radar vectors for an ILS approach to runway 27 at Bristol. ATC advised that there were several balloons in the area, drifting in a southerly direction. At 0608 the A310 was established on the ILS at 5nm and commenced a descent from 2200ft amsl. At the same time the balloon pilot reported that he was "Abeam on your extended centreline 5km east of the field at 500ft QNH1025". ATC responded "There is Airbus traffic just going over the top of you on the ILS now". In fact the A310 was still 3nm from the balloon. The A310 passed over the balloon at an altitude of 1300ft amsl, 2nm inbound on the ILS. The balloon was operating at an altitude of 500ft amsl thus, with the canopy extended some 80ft above the basket, separation between the two craft was about 700ft. The balloon was not seen by the A310 pilots but the balloon pilot saw the A310 pass overhead and started the burner to arrest a sink. Once the aircraft had passed he noticed a ripple in the canopy. Very soon after this the envelope was violently forced downwards such that it was below the basket which had itself tipped to approx 30deg. With the burner at full deflection the flame could not be directed into the mouth of the envelope. A few seconds later the envelope swung violently upwards and all the occupants of the basket were flung to the floor, suffering minor injuries. The pilot again attempted to direct the burner flame into the mouth of the envelope but was unsuccessful because it remained closed. The balloon continued to be knocked about by turbulence and the pilot then burned through the material to get air into the envelope. He managed to regain some control, put out a PAN call and made a successful emergency landing in a field. Despite the pilot’s initial report, the actual track of the balloon was 200deg, taking it within 2.5 miles of the airport. In the pilot’s later position report, 5km was misinterpreted by the controller as 5nm. Hot air balloons are not usually visible on a radar screen, so the pilot's report was the sole means by which the controller could determine the balloon’s location. The UK AIP requires pilots making position reports to use nautical miles. However, balloon pilots normally use Ordnance Survey (OS) 1:50,000 maps onto which aeronautical information has been transposed, although an aeronautical 1:500,000 chart is also carried. The OS maps have a 1km square grid overlay which greatly facilitates the assessment of distances. Therefore, when communicating by R/T with each other or their retrieve crews, balloonists commonly use metres or kilometres. ICAO recommend a minimum spacing of 6nm when a 'Light' aircraft is crossing behind a 'Heavy' aircraft at the same altitude, or less than 1000ft below, and the CAA minimum is 8nm. There are no published minima for the operation of balloons with regard to wake turbulence separation. CAA 'General Aviation Safety Sense Leaflet 15B Wake Vortex' states that the lighter the aircraft the more vulnerable it would be to a turbulence upset. There are no records of any previous wake turbulence encounters between balloons and aircraft in the UK. In the event of such an encounter being anticipated there are some options a balloon pilot could take to avoid the wake vortex. He may have the opportunity to climb above the aircraft track or, under favourable conditions, to land in a safe area until the danger has passed. The British Balloon and Airship Club have drawn attention to this matter in their September 2000 edition of the 'Pilot's Circular'. There is also an article to remind pilots of the importance of using standard phraseology when giving position reports. See AAIB Bulletin 12/2000, ref: EW/G2000/08/05.

A/C Type :	B747	**Occurrence Number :**	**200005854**
Flight Phase :	Climb	**Occurrence Date :**	03 Aug 2000
Classification :	Occurrences	**Location :**	Tokyo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Incorrect altimeter setting phraseology used by Tokyo ATC led to confusion on the flight deck.
Precis :
Upon changing from Narita departure to Tokyo Control, a/c was cleared to "maintain 7000ft on QNH 992". Japan uses altimeter settings in inches not in millibars, so altimeter setting was immediately queried. "Confirm QNH 992 millibars or Altimeter 29.92 inches ? The reply was "affirm", so it was queried again. "Do you mean 29.92 inches?". The reply to this was "affirm, climb 14,000ft on 29.92 inches. Reporter opined that the practice of using only 3 digits when using inches as the pressure datum is very misleading and potentially unsafe. In this case the altitude difference between 992 millibars and 29.92 inches would have been 600ft.

A/C Type :	B747	**Occurrence Number :**	**200005868**
Flight Phase :	Approach	**Occurrence Date :**	07 Aug 2000
Classification :	Occurrences	**Location :**	New York Newark
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Cleared for ILS approach with no glideslope/DME available.
Precis :
The a/c was proceeding direct to TEB at 3000ft expecting an approach to R/W 22L at Newark for which the glideslope was NOTAM U/S. Instructions received were "maintain 3000ft to the marker, cleared ILS 22 Left, contact Tower 118.3". No glideslope or DME information was received on internal equipment. New York TRACON subsequently contacted and advised that normal clearance in the event of an ILS partial serviceability should be "cleared to ILS Rwy XX, Glideslope not available". TRACON have undertaken to ensure that all controllers adhere to standard phraseology.

A/C Type :	B777	**Occurrence Number :**	**200006698**
Flight Phase :	Descent	**Occurrence Date :**	10 Sep 2000
Classification :	Occurrences	**Location :**	AMMAN
Events :	Emergency Call ATC Occurrence	**Location Info :**	Rep Point

Pretitle :
B777 pilot declared a "medical emergency" to ATC and was given priority without initially using the correct phraseology.
Precis :

A/C Type :	B747	**Occurrence Number :**	**200006881**
Flight Phase :	Initial Climb	**Occurrence Date :**	16 Sep 2000
Classification :	Serious Incidents	**Location :**	Manchester (MCT)
Events :	ATC Conflict	**Location Info :**	

Pretitle :
UK AIRPROX 149/00 - B747 and a BAC1-11 at Manchester airport.
Precis :
The BAC 1-11 was instructed to line up on R/W24R at Manchester, behind a landing A320. Shortly afterwards, a B747 reported on final approach for R/W24R, and advised that the a/c was very heavy and would require the full length of the R/W. After landing, the A320 was slow to vacate the R/W, and by the time it had vacated and the BAC1-11 was cleared for take off, the B747 was approx 1.5 nm from touchdown. The BAC1-11 began its take off when the B747 was at 0.5 nm. The B747 pilot reported visual with the traffic and was cleared to land after the departing traffic. However, the B747 pilot elected to carry out a go-around and to make a right turn. Subsequently the controller instructed the B747 to turn onto 330 deg and climb to 3500 ft., whilst the BAC1-11 continued on its outbound routing involving a left turn after departure. The closest point between the B747 and the BAC1-11 was when the BAC1-11 was still rolling down the R/W and the B747 had commenced its right turn, a distance of approx 480 m. The incident was subject to assessment by UKAB, and to a Field Investigation by the AAIB. See AAIB Bulletin No 6/2001, Ref EW/C2000/9/5.
CAA Closure: Appropriate ATC personnel action taken.

A/C Type :	B747	**Occurrence Number :**	**200007102**
Flight Phase :	Hold	**Occurrence Date :**	23 Sep 2000
Classification :	Occurrences	**Location :**	WILLO
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	Hold

Pretitle :
B747 entered the WILLO hold incorrectly.
Precis :
The B747 was inbound to Gatwick and had been held at POMPI for a period of time. It was then cleared "XXX , your hold is cancelled, make a right turn now to WILLO, descend Flight Level 170". The a/c replied "right turn direct WILLO, descend FL170, thank you". Subsequently the a/c routed direct to WILLO, without using the entry fix of HOLLY, crossed WILLO and then turned on to a South Easterly track as it commenced its "dirty entry". An ATC source subsequently commented that, controllers should clear a/c under their own navigation to holds, with the entry points for these holds to be mentioned in their onward clearance, or a form of words such as "route to the WILLO hold" could be used.

A/C Type :	Cessna C560 Citation 5	**Occurrence Number :**	**200007629**
Flight Phase :	Climb	**Occurrence Date :**	13 Oct 2000
Classification :	Occurrences	**Location :**	Scunthorpe
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	Radar Corridor

Pretitle :
Cessna 560 climbed 600 feet above cleared FL100. Standard separation maintained.
Precis :

Manchester enquired with Humberside over this incident and the controller stated that he had not personally repeated the a/c's cleared level to him but told him that he was passing clear of traffic "maintaining FL110". It is considered possible that the a/c may have taken this as a climb clearance.

A/C Type :	Piper PA28	**Occurrence Number :**	**200007685**
Flight Phase :	Cruise	**Occurrence Date :**	14 Oct 2000
Classification :	Occurrences	**Location :**	Shoreham
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
A PA28 was using an unauthorised abbreviated callsign. See also occs 1999/03813 and 2000/04728.
Precis :
CAA Closure: The operator was informed of the use of the unauthorised callsign and has taken appropriate action.

A/C Type :	B767	**Occurrence Number :**	**200008214**
Flight Phase :	Descent	**Occurrence Date :**	03 Nov 2000
Classification :	Occurrences	**Location :**	Bristol International
Events :	ATC Conflict Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :
Conflict Alert activated when a B767 descended below its cleared flight level. Traffic info and avoiding action given. Separation maintained.
Precis :
B767 came on frequency descending to FL270 and was given further descent to FL150. Following co-ordination with next sector it was agreed to stop the B767 at FL160. B767 was instructed to stop descent at FL160 to which the crew responded, "roger report 160" (this non-standard response was not challenged), and subsequently a further instruction to be level at FL160 by abeam KENET, which was acknowledged by "Wilco". B767 transferred to next sector and observed to be level at FL160 for several sweeps before descending to FL150. A BAe146 at FL150 was given an avoiding heading and descended to FL140.

A/C Type :	B757	**Occurrence Number :**	**200008229**
Flight Phase :	Descent	**Occurrence Date :**	03 Nov 2000
Classification :	Occurrences	**Location :**	Ganta
Events :	Foreign ATC Occurrence Altitude Deviation (ATC)	**Location Info :**	

Pretitle :
Confusion concerning B757's cleared flight level, due to the use of non-standard radio transmission by ATC.
Precis :
Reporter states that the B757, operating at a speed of 270kts, was cleared by ATC to 'descend level two five zero, reduce two six zero'. On passing FL258 ATC instructed B757 to 'maintain two six zero' to which the pilot confirmed that the B757 was maintaining 260kts. ATC then said 'maintain level two six zero' by this time the B757 was passing FL256 and ATC cleared the B757 to descend to FL240.

A/C Type :	B757	**Occurrence Number :**	**200008654**
Flight Phase :	Climb	**Occurrence Date :**	22 Nov 2000
Classification :	Occurrences	**Location :**	Daventry (DTY)
Events :	UK Airprox	**Location Info :**	8 W

Pretitle :
UK AIRPROX 192/00 - B757 and military jet 8nm West of DTY VOR at FL100.
Precis :
AAIB Investigation. The B757 was level at FL100, and advised of military traffic 1000 ft above and crossing left to right. This traffic was seen on TCAS, and shortly after the traffic passed clear, whilst in cloud, the B737 crew became aware of an a/c on their left at very close range and about the same level. The military a/c engines were heard, and wake turbulence encountered, but with no time to take any avoiding action. The military a/c were a formation pair, with only the leader squawking, under military radar control. The leader was granted a request to climb from FL100 to FL110, but this was not heard by the No 2, non-squawking, a/c which remained at FL100. The No 2 became aware of a "shadow" flashing rapidly down the right-hand side, and after an ATC query asking the flight to confirm that both a/c were at FL110, the No 2 climbed rapidly to FL110. Two safety recommendations were made (2000-71 and 2001-31), relating to establishing safety assurance based on the use of SSR codes for a/c in formation, and the applicability of revised RT procedures for formations in Class F and G airspace. The incident was also subject to assessment by UKAB. See AAIB Bulletin 5/2001, Ref EW/C2000/11/05, and UKAB Airprox Report 192/00.
CAA Closure: CAA FACTOR F12/2001, detailing the CAA responses to the 2 AAIB Safety Recommendations, was issued on 15 June 2001. Any further CAA action required will be progressed via the "Annual Review of AAIB Recommendations" procedure.

A/C Type :	HS125	**Occurrence Number :**	**200008904**
Flight Phase :	Take Off	**Occurrence Date :**	30 Nov 2000

Classification :	Occurrences	**Location :**	Farnborough
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :

Confusion over an HS125's take off clearance from R/W 25 when a vehicle had been cleared to cross the runway.

Precis :

Investigations indicate that the pilot failed to use the correct phraseology when given departure instructions and read back cleared for take off. The controller had also cleared a vehicle to cross the runway. The pilot was told that he had not been given take off clearance, however, the pilot replied that he was cleared for take off. The controller instructed the vehicle to hold position but he was not aware of the vehicle's position relative to the runway. The a/c took off without take off clearance and was not instructed by the controller to hold position. Appropriate ATC action has been taken on various aspects as a result of this incident.

A/C Type :	BAE146	**Occurrence Number :**	**200009317**
Flight Phase :	Descent	**Occurrence Date :**	21 Dec 2000
Classification :	Occurrences	**Location :**	HOLLY
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :

RJ100 was instructed to turn right on to heading 280 degrees but a/c turned left and into conflict with an ATR72. Separation lost. Traffic information and avoiding action given.

Precis :

The a/c was instructed to turn right the long way, onto heading 280 degrees (this was not actually the longest way to heading 280 degrees but the controller did specify the direction of turn). When the pilot was asked to confirm turning right, he stated he was turning the long way round, to heading 280 degrees. Further investigations have revealed that the controller failed to establish the original heading of the RJ100 and the crew acknowledged the instruction but did not mention the direction of turn, just 'the long way round'. It was later established that a right turn would involve a 140 degree manoeuvre whereas a left turn would involve 220. The RJ100 crew turned left , without querying the direction and came into conflict with the ATR72. Appropriate local ATC remedial action has been taken.

A/C Type :	GD Eqp Svs	**Occurrence Number :**	**200100270**
Flight Phase :	Not Applicable	**Occurrence Date :**	17 Jan 2001
Classification :	Occurrences	**Location :**	Manchester (MCT)
Events :	Ground (AD) Occurrence	**Location Info :**	

Pretitle :

R/W incursion - At 1600hrs whilst the Rescue Fire Fighting Service was towing an unserviceable vehicle across R/W24R the tow rope broke. Removal of the vehicle complete by 1615hrs.

Precis :

Inspection and research of the broken cable concluded that it was not suitable for towing a fire appliance. Instructions have been issued to not use cables for appliance recovery. In addition, instructions have been issued and a training programme instigated covering runway clearance reporting and R/T terminology.
CAA Closure: Appropriate action taken by airport authorities.

A/C Type :	Saab F340	**Occurrence Number :**	**200100300**
Flight Phase :	Take Off	**Occurrence Date :**	12 Jan 2001
Classification :	Occurrences	**Location :**	Manchester (MCT)
Events :	Runway Incursion Rejected Take-Off ATC Occurrence Security Event	**Location Info :**	

Pretitle :

Vehicle was sent to chase fox off R/W06L. When clear, a Saab 340 was given take off clearance. Saab 340 observed vehicle crossing R/W and take off run aborted. When vehicle clear of R/W a/c took off.

Precis :

Whilst the Saab 340 was lining up for R/W06L, another a/c reported a fox on the R/W. Ground staff were cleared to enter the R/W to chase the fox off. When the vehicle and fox were clear of R/W, take off clearance was issued and acknowledged to/by the Saab 340. During take off roll, vehicle was seen to cross the R/W 300-500mtrs ahead. Saab 340 decided to abort take off, also a/c instructed to stop by ATC. A/c stopped abeam intersection and when vehicle was clear of R/W a/c was re-cleared for take off. The ATC report states having given permission for the vehicle to cross the runway to chase off the fox , further permission was given to continue but to remain South of Runway 06L at all times - this was acknowledged. On speaking to the vehicle driver subsequent to the incident it appears that he misunderstood the clearance he had been given. An investigation into this incident revealed that the vehicle reported when he had sight of the fox and the Tower Controller requested "to call me off the runway please". The driver replied that "the fox is off the runway on the grass area". Tower Control asked "are you clear, confirm?". The reply to this was "the fox is off the runway - I can try and disperse it a bit further south." The Tower Controller agreed to this plan to keep the fox moving southwards and

added "just remain clear of 06L please" There was no readback to this last instruction. The controller concerned has been counselled on the importance of using correct phraseology and ensuring that read backs are received. In addition, the vehicle driver has been re-trained.
CAA Closure: Appropriate local action taken.

A/C Type :	B737	**Occurrence Number :**	**200100386**
Flight Phase :	Approach	**Occurrence Date :**	23 Jan 2001
Classification :	Occurrences	**Location :**	Milan Malpensa
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
Reduced separation under low visibility procedures - Milan ATC operated 4nm separation during low visibility procedures.
Precis :
A/c queried 4nm separation under low visibility. Milan ATC appeared not to understand phraseology.

A/C Type :	B777	**Occurrence Number :**	**200100406**
Flight Phase :	Take Off	**Occurrence Date :**	16 Jan 2001
Classification :	Occurrences	**Location :**	Toronto
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Take off clearance to B777 issued by ATC while another a/c (the previous landing) was still on R/W 24.
Precis :
The P2 queried the clearance but the controller did not seem concerned at the situation. Weather - drizzle at night. Relevant Canadian authorities alerted. The response from the Canadian authorities was that the controller was operating consistent with existing procedures although the phraseology was not.

A/C Type :	B747	**Occurrence Number :**	**200100523**
Flight Phase :	Descent	**Occurrence Date :**	27 Jan 2001
Classification :	Occurrences	**Location :**	SPRAT
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - Controller had to repeat an expect clearance of FL310 level by SPRAT 2-3 times. B747 was subsequently cleared to FL310, but when South of SPRAT it was still at FL330 and descending.
Precis :
Standard separation maintained.

A/C Type :	A321	**Occurrence Number :**	**200100736**
Flight Phase :	Descent	**Occurrence Date :**	05 Feb 2001
Classification :	Occurrences	**Location :**	TIGER
Events :	Altitude Deviation	**Location Info :**	30 SE

Pretitle :
ATC Incident - A321 allegedly descended below its cleared flight level of FL210. As standard separation was maintained A321 was given continuous descent to FL160.
Precis :
A321 had been descended to FL210 and told to expect FL160 abeam TIGER.

A/C Type :	A321	**Occurrence Number :**	**200100887**
Flight Phase :	Cruise	**Occurrence Date :**	09 Feb 2001
Classification :	Occurrences	**Location :**	LATCC - N Sea Sector
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - Fltnums 1262 and 1226, same operator, were warned of the similar callsigns, which was acknowledged, but Fltnum 1226 persisted in replying to ATC instructions without using any callsign.
Precis :
Attempts to contact the foreign operator have been unsuccessful.
CAA Closure: No further CAA action possible.

A/C Type :	B777	**Occurrence Number :**	**200101120**
Flight Phase :	Cruise	**Occurrence Date :**	19 Feb 2001
Classification :	Occurrences	**Location :**	Gander ATCC
Events :	Foreign ATC Occurrence Altitude Deviation	**Location Info :**	

Pretitle :
Foreign ATC Incident - Confusion between flight crew and ATC resulted in B777 climbing from FL370 to FL380 without clearance. Crew apologised for the error.
Precis :
Reporter states that ATC had cleared the B777 when ready FL380. The crew understood that the B777 was cleared to climb from FL370 to FL380, but ATC had actually said advise when ready climb FL380.

A/C Type :	GD Eqp Svs	**Occurrence Number :**	**200101560**
Flight Phase :	Not Applicable	**Occurrence Date :**	05 Mar 2001
Classification :	Occurrences	**Location :**	Glasgow (GOW)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - During a busy period the GMC allocated Stand 19, which was occupied by a BA41, to an inbound a/c. The apron became blocked by the inbound a/c waiting for the BA41 to vacate the stand.

Precis :

During a busy period the GMC allocated Stand 19 to an inbound a/c. The controller then realised that the stand was occupied by a BA41 and instructed the inbound a/c to hold short of the stand until it had been vacated. The controller then confirmed the BA41 was ready for pushback and instructed it to push far enough back to allow the inbound a/c onto the stand. Prior to this an SF340 on Stand 16 had started and been given pushback clearance. The BA41 was informed of the SF340's movement and told it could pushback to abeam Stand 18. Immediately after this the SF340 requested taxy clearance and was told it could taxy in turn and would be following a BA41 in the cul-de-sac to A1 for departure R/W23. The SF340 then taxied behind the BA41 which had not yet pushed back, rather than waiting to follow it. Investigations revealed that the incident arose from a misunderstanding by the SF340, as to the position of the BA41 it was to follow. There was a similar incident the previous day being investigated under occ 2001/01559.

A/C Type :	B747	**Occurrence Number :**	**200102093**
Flight Phase :	Descent	**Occurrence Date :**	29 Mar 2001
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence RT Problems	**Location Info :**	

Pretitle :

ATC Incident - B747 consistently failed to use its callsign when acknowledging clearances, which led to increase in ATC workload, as the controller had to query which a/c had accepted the clearance.

Precis :

A/C Type :	A320	**Occurrence Number :**	**200102141**
Flight Phase :	Descent	**Occurrence Date :**	31 Mar 2001
Classification :	Occurrences	**Location :**	HAZEL
Events :	Altitude Deviation Altitude Deviation (ATC) UK Airprox	**Location Info :**	

Pretitle :

UK AIRPROX-50/2001-A320 descended 500 feet below its cleared FL130 due to confusion over cleared flight level. Standard separation maintained.

Precis :

Investigations indicate that the A320 was instructed to descend to FL130, to be level abeam HAZEL, speed 270 kts. The crew read back 'Down err seven er zero confirm and to be level er one three zero abeam HAZEL', omitting the words flight level. ATC believed the speed instruction had been acknowledged but it appears the a/c intended to descend to FL70. The read back was seeking confirmation of the accuracy of the clearance but the ATCO under training did not reply and missed the incorrect read back. Appropriate ATC remedial action taken.

A/C Type :	BAE146	**Occurrence Number :**	**200102155**
Flight Phase :	Taxy	**Occurrence Date :**	31 Mar 2001
Classification :	Occurrences	**Location :**	Glasgow (GOW)
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :

RJ100 cleared to A4 but taxied across A4 and the Runway 28 threshold.

Precis :

The a/c was cleared by the controller concerned to "taxy to holding point Alpha four for runway 23 eventually". The pilot read back the clearance correctly but failed to follow it. The controller concerned did not use the local phraseology that had recently been publicised in order to prevent this type of incident. Appropriate local ATC remedial action has been taken.

A/C Type :	B747	**Occurrence Number :**	**200102624**
Flight Phase :	Taxy	**Occurrence Date :**	23 Apr 2001
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	Ground (AD) Collision - Obstacle / Vehicle Ground (AD) Collision - Obstacle / Vehicle	**Location Info :**	

Pretitle :

Tug disconnected from B747 after pushback. B747 taxied forward and hit the tug which was directly in front of *nosewheel. No damage or injuries.*

Precis :

AAIB AARF investigation. The crew believe that the visual signal portion of the ground crew clearance was missed. The ground engineer had disconnected and was unable to give a verbal warning. The operators investigation identified the immediate cause of this incident as being the a/c starting to taxi before the final visual clearance had been received from the headset operator. The report indicated that both flight crew and ground crew had deviated from push back procedures and standard phraseology. It also highlighted several shortcomings in the operators stated push back procedures applicable to both ground and flight crew.The investigation made several internal safety recommendations to amend current procedures in order to prevent any recurrences. (See also AAIB Bulletin 11/2000 Ref: EW/G2001/04/18).

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200103246**
Flight Phase :	Climb	**Occurrence Date :**	15 May 2001
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :

Altitude deviation - MD80 noted at 6000 ft instead of cleared 5000ft whilst outbound from Gatwick. Standard separation maintained.

Precis :

Investigations indicate that the crews understanding of English appeared poor and the readback of the initial ATC clearance was unintelligible but was accepted as confirmation by ATC.

A/C Type :	A319	**Occurrence Number :**	**200104153**
Flight Phase :	Climb	**Occurrence Date :**	20 Jun 2001
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Airprox - Foreign	**Location Info :**	7nm

Pretitle :

FOREIGN AIRPROX-A319 and a Beech 90 at FL60 7nm from CDG. Subject to investigation by the French authorities.

Precis :

The French investigation into this AIRPROX concluded that it was caused by a late detection of the conflict by the Dep controller. The controller authorised the Beech to turn onto heading 090 without taking account of the existence of CDG departures. There was then a poor resolution of the conflict because the controller did not take into account the differences in performance between the 2 a/c. The controller also failed to use emergency phraseology when detecting the conflict. French risk assessment CAT B.

A/C Type :	EMB 110 Bandeirante	**Occurrence Number :**	**200104245**
Flight Phase :	Take Off	**Occurrence Date :**	22 Jun 2001
Classification :	Occurrences	**Location :**	Norwich
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - E110 took off from R/W04 without ATC clearance.

Precis :

The E110 was holding at point 'C1' awaiting its CTOT (Calculated Take Off Time) of 1613hrs. The E110 was issued with its departure instructions and informed that the controller would call back with the airways joining clearance. The controller observed a helicopter, which had been instructed to vacate R/W27 via taxyway after landing, touch down on R/W27. The controller then called the E110 to give the airways joining clearance, but the a/c was already rotating after taking off from R/W04 at 1602hrs. The crew subsequently acknowledged their mistake, and commented that the confusion arose over the term "after take off" being used by ATC in the clearance, rather than "after departure". The crew has been interviewed by the company chief pilot.
CAA Closure: Appropriate operator action taken.

A/C Type :	B777	**Occurrence Number :**	**200105507**
Flight Phase :	Parked	**Occurrence Date :**	07 Aug 2001
Classification :	Occurrences	**Location :**	Tampa
Events :	Ramp Incident	**Location Info :**	

Pretitle :

Unsafe non-standard pushback to a B777 by ground engineer at Tampa airport.

Precis :

A/c was pushed back tail first from stand. Right hand engine was started and a/c then moved forward 5 metres. Crew thought tug was still attached and was pulling a/c, however tug had been disconnected unseen and brakes to park not requested by ground engineer. A/c brakes applied. Engineer later disconnected before being cleared by crew. Engineer was using non-standard phraseology throughout the push back and did not warn the crew that the a/c was rolling towards the terminal, unconnected to the tug.

A/C Type :	B767	**Occurrence Number :**	**200106008**
Flight Phase :	Cruise	**Occurrence Date :**	26 Aug 2001

Classification :	Occurrences	**Location :**	SEPAL
Events :	Loss of Standard Separation ATC Conflict	**Location Info :**	

Pretitle :
ATC Incident - Loss of separation when a B767 entered Oceanic airspace without a clearance. A B737 and another B767 were given traffic info.
Precis :
At 1330hrs controller received messages from foreign ATCC of estimates for the OAC boundary of 1402hrs (B767) and 1407hrs (A340). Normal procedures are that traffic request OAC clearance within 30mins of the boundary. At 15-20mins prior to the a/c reaching the boundary, the foreign ATCC was telephoned and asked that the flights contact Ballygirreen on frequency 5598 immediately for their OAC clearance. Approximately 5mins later the a/c still had not called Ballygirreen and the controller again telephoned foreign ATCC to get them to contact the a/c and again gave the frequency 5598. Ballygirreen was asked to SELCAL the a/c concerned. Approximately 8-10mins to the boundary the controller was alerting Planning to the scenario, when the Foreign ATCC phoned asking for confirmation of the frequency. At 1357hrs the Planner received a request from Ballygirreen for the B767 est SEPAL at 1401hrs requesting FL330. The only level available was FL260. The Foreign ATCC was contacted to ask if the B767 could be descended to cross SEPAL at FL260, but they had lost contact and it was heading for Oceanic airspace at FL330. The Planner phoned the en-route controller to descend a B737 at FL330, which was in conflict with the B767. B737 was given traffic info and descended to FL325, and another B767 at FL320 was given traffic info on the B737. The Planner then co-ordinated and instructed the B767 to return back to Foreign airspace.
CAA Closure: The operator's report states that they asked Brest Control for the Oceanic Clearance and the answer was "**7561 do not cross LAPEX without contact on HF with Shanwick". The flight then contacted Shanwick on HF and their alleged answer was "**7561 positive contact...Standby...". The crew then called Brest back stating "**7561 positive contact with Shanwick". Brest then said "OK, Bye,Bye" On initial re-contact with Shanwick the flight was told to standby, and Shanwick subsequently called back stating "** do not enter into Oceanic Area, return to LAPEX and contact Brest". The a/c contacted Brest and received vectors back to LAPEX to enter a hold at FL330. 37 minutes later they were cleared to enter Shanwick Oceanic Airspace. The a/c subsequently diverted to Bermuda to refuel.

A/C Type :	A321	**Occurrence Number :**	**200106276**
Flight Phase :	Climb	**Occurrence Date :**	09 Sep 2001
Classification :	Occurrences	**Location :**	Bovingdon (BNN)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - Controller twice received improper read backs. Standard separation maintained.
Precis :
Controller cleared Fltnum '753C' to climb to FL210. The reply received was 'Roger FL210'. Controller immediately asked the station to state their callsign and the reply was something like '***715C was that FL210 for us'. '715C' informed that it was not. The operator has subsequently issued a notice to all crews, to ensure that the cockpit environment is sterile during climb and descent, and to be more vigilant in monitoring R/T.
CAA Closure: Appropriate operator action taken.

A/C Type :	Grumman AA5	**Occurrence Number :**	**200106609**
Flight Phase :	Take Off	**Occurrence Date :**	19 Sep 2001
Classification :	Occurrences	**Location :**	Londonderry
Events :	Runway Incursion	**Location Info :**	

Pretitle :
Aerodrome incident - During take off from Londonderry, Grumman AA5 almost collided with airport vehicle that was cleared to carry out a bird control patrol.
Precis :
ATC permitted the bird patrol operator to carry out a bird patrol on all areas, to remain East of R/W02 which was the active R/W. The vehicle was equipped with a ground frequency radio allowing cross coupling of the ATC frequency to the ground frequency, which was selected. The AA5 requested, and received clearance for, a touch and go, and during the take off phase the bird control vehicle was observed driving fast towards the R/W intersection. A call from the Tower to hold position resulted in the vehicle managing to stop at the edge of R/W02, and the AA5 became airborne safely. See also 2000/02031.
CAA Closure: Appropriate and comprehensive remedial action has been taken by the Airport authority concerned.

A/C Type :	EMB 145	**Occurrence Number :**	**200106626**
Flight Phase :	Taxy	**Occurrence Date :**	20 Sep 2001
Classification :	Occurrences	**Location :**	Manchester (MCT)
Events :	Runway Incursion	**Location Info :**	

Pretitle :
ATC Incident - An EMB145 failed to follow ATC taxy instructions and entered R/W06L. The EMB145 was instructed to leave the R/W and the error was pointed out to the pilot, for which he apologised.
Precis :

A B757 was lined up full length of R/W06L and an A320 was given a conditional line up clearance behind the B757. The EMB145 was instructed after departing A320, line up 06L at AF, which was read back correctly. When B757 departed EMB145 lined up ahead of the A320. Controller pointed out the error, for which pilot apologised. EMB145 was asked to vacate R/W at AE. EMB145 departed after A320 without further incident. The incident concerned has also been discussed with the controller and appropriate action has been taken by the a/c operator. The ATC investigation has revealed the potential for misinterpretation of the relevant section of the MATS part 1 and appropriate action is being taken on this aspect.

A/C Type :	BAE146	**Occurrence Number :**	**200106880**
Flight Phase :	Initial Climb	**Occurrence Date :**	01 Oct 2001
Classification :	Occurrences	**Location :**	Nice
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :

Foreign AIRPROX - RJ100 and EMB 145. Subject to investigation by the French authority.

Precis :

Reporter states that shortly after the RJ100 had taken off from R/W22L and about to turn left on the SID, the P1, in the RH seat, noticed an a/c slightly above, passing from right to left ahead. The left turn was not initiated and very shortly afterwards the controller instructed the RJ100 to maintain heading. At 900ft the traffic showed on TCAS to be 200ft above and was to the left of the RJ100. The crew of the inbound EMB 145 became confused as to the actual R/W in use. During this confusion the crew, whilst intending to select "NAV" mode to track as required to the next waypoint, inadvertently entered "APR" mode thus disabling the 'ASEL' function, and the a/c subsequently descended through the previously cleared altitude (2500 ft) to 1500 ft. The a/c then received a TCAS RA which was not actioned because of visual contact with the RJ100.

A/C Type :	Unknown	**Occurrence Number :**	**200107027**
Flight Phase :	Climb	**Occurrence Date :**	02 Oct 2001
Classification :	Occurrences	**Location :**	Rio De Janeiro
Events :	Foreign ATC Occurrence Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC incident - ATC at Rio de Janeiro allegedly changed SID after take off leading to a 270 degree left turn.

Precis :

On clearance delivery the ATC clearance was confirmed 3 times as a CARMI 1 departure, involving a right turn downwind. The standard of English was poor and had to be reconfirmed. After take-off ATC queried the SID and a 270 left turn had to be initiated. ATC eventually confirmed the SID required and gave a radar heading of 260 degrees and gave a radial to establish on. The controlling was poor as was the English phraseology used. The Brazilian investigation concluded that the incident was caused by the poor English of the inexperienced under training controller and the wrong pronunciation of the MARICA ONE procedure. Appropriate ATC follow up action has been taken.

A/C Type :	B737	**Occurrence Number :**	**200107394**
Flight Phase :	Taxy	**Occurrence Date :**	13 Oct 2001
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - Reporter believes taxy instructions, given to B737 after landing on R/W26L, caused confusion, resulting in a/c turning onto Stand 08L instead of 108L. ATC has been alerted by operator.

Precis :

After B737 landed on R/W26L, reporter requested taxy instructions and believed clearance as 08L J-R-L, which was read back. Ground confirmed read back, but as B737 turned into Stand 08L crew again queried clearance and ground then said a/c should have taken 'J'. Reporter believes confusion caused by ground reading stand allocation of 108L first and this being heard by the B737 as 08L. The operator has alerted ATC to this incident. ATS investigations confirm that the B737 was instructed to taxy to Stand 108L via J, R and L. The crew readback "08L say again?" and the controller confirmed the taxiway routing but did not pick up the incorrect stand. The phraseology used was abbreviated and it was not until the crew asked again that they realised the allocated Stand was 108L.

A/C Type :	B777	**Occurrence Number :**	**200107678**
Flight Phase :	Taxy	**Occurrence Date :**	08 Nov 2001
Classification :	Occurrences	**Location :**	Philadelphia
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - High volume of ground movements combined with poor R/T phraseology led to a reduction of safety margins. Also potential conflict between taxying B777 and B737.

Precis :

During high volume of a/c ground movements, a number of a/c accepted clearances that were given to other a/c without ATC realising the error. For example, it took several calls from outbound Fltnum '066' to get ATC to realise that there was an inbound company a/c Fltnum '069', same a/c type, also on the taxyways. The situation was compounded by ATC using non standard R/T. A B777 had been cleared to taxy to 'Y', but when it saw a B737 vacating R/W27R at 'T' and enter 'K' in front of the B777, the B777 was brought to a halt to allow B737 to continue its taxy. The FAA investigation into this incident identified controller performance deficiencies. Appropriate remedial action has been taken.

A/C Type :	B747	**Occurrence Number :**	**200107811**
Flight Phase :	Descent	**Occurrence Date :**	14 Nov 2001
Classification :	Occurrences	**Location :**	Barkway (BKY)
Events :	Altitude Deviation	**Location Info :**	3 SE

Pretitle :

ATC Incident - B747 descended below its cleared FL80. Traffic info and avoiding action given to B747 due to a B737 climbing to FL70. Standard separation maintained.

Precis :

An inbound B747 cleared to FL80 was told to continue its heading and assigned a speed. At the same time an outbound B737 was cleared to climb to FL70. The B747 was observed passing FL77 and told to climb back to FL80 and given an avoiding turn. B747 reached FL75 before climbing back to FL80 and subsequently passed behind the B737 with approximately 2500ft vertical separation. The operator who was fully alerted to this incident is taking appropriate and comprehensive fleet wide remedial action.

A/C Type :	Falcon 900	**Occurrence Number :**	**200108243**
Flight Phase :	Approach	**Occurrence Date :**	03 Dec 2001
Classification :	Occurrences	**Location :**	Northolt
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - DA900 made an approach to R/W07 below airfield minima and below glide path. DA900 initiated a go around approximately 0.5nm from R/W07 threshold.

Precis :

CAA Closure: The operator's report states that both the pilots were very experienced professional pilots who have flown hundreds of PAR approaches each. They both state that they had great difficulty in understanding the directions and terminology used by the final PAR approach controller. This was allegedly exacerbated by distorted or scratchy radio reception on his frequency. All directions issued were discussed between the pilots. Whilst on the approach the pilot flying elected to use the autopilot. Whilst on descent he used autopilot inputs to follow the directions of the controller whilst discussion continued about the controller's directions. The resultant misunderstanding of the terminology used by the controller caused the a/c to be controlled so as to proceed below the glide path while the pilot erroneously thought he was being advised he was above the glide path. The a/c levelled out at minimums, and the pilot disconnected the autopilot and performed a missed approach. On the next approach the a/c was flown without autopilot to a successful landing. Appropriate and comprehensive remedial action is being taken by the operator concerned.

A/C Type :	Learjet	**Occurrence Number :**	**200108248**
Flight Phase :	Approach	**Occurrence Date :**	03 Dec 2001
Classification :	Occurrences	**Location :**	Northolt
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - It appeared Learjet was not familiar with PAR approaches and phraseology, subsequently descended below the glide path. Learjet instructed to break off approach and go around carried out

Precis :

CAA Closure: The operators report states that the P1 was quite nervous as his chief pilot was acting as assistant pilot and it was the first time they had flown together. The P1 was not well prepared to fly a PAR approach which he did not often have opportunities to fly. On the first approach the P1 states that his rate of descent was quite fast, following the go-around from this approach the assistant stated that for the second approach the P1 would take care of heading and speed and the assistant manage the rate of descent. An appropriate debrief occurred after this flight with the P1 admitting he was very disappointed with his performance.

A/C Type :	DC10	**Occurrence Number :**	**200108293**
Flight Phase :	Climb	**Occurrence Date :**	09 Dec 2001
Classification :	Occurrences	**Location :**	WILLO
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :

ATC Incident - Controller cleared an a/c to climb to FL170, but this instruction was read back by a DC10. Controller did not notice the incorrect read back and DC10 climbed above its cleared altitude.

Precis :

DC10 had been previously told to maintain 6000ft, but was observed climbing out of 6000ft. When questioned, DC10 stated it had been cleared to FL170 and had read this back. This incorrect read back had not been picked

up by the controller, who had cleared another a/c Fltnum '81' to climb to FL170, but '81' was later observed having never taken this instruction. The ATC mentor's headset had failed and he believed that he was in the process of changing headsets when the missed readback occurred. The DC10 failed to use its call sign in any response to ATC instructions while on this frequency. The operator has alerted all crew members to use full call signs for all flights.
CAA Closure: Appropriate operator action taken.

A/C Type :	A320	**Occurrence Number :**	**200108547**
Flight Phase :	Descent	**Occurrence Date :**	20 Dec 2001
Classification :	Occurrences	**Location :**	Lanzarote
Events :	Foreign ATC Occurrence Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Possible descent below cleared altitude following confusion between ATC and crew over a height restriction whilst on a visual approach.
Precis :
Canaries ATC approved a visual approach to R/W 03. Descent made to 3500 feet QNH whilst positioning downwind RH. P2 then questioned P1 if a/c should be maintaining 5000 feet. Canaries ATC queried, who stated that 5000 feet was the cleared altitude but now cleared visual and to contact Tower.

A/C Type :	SD360	**Occurrence Number :**	**200108587**
Flight Phase :	Climb	**Occurrence Date :**	22 Dec 2001
Classification :	Occurrences	**Location :**	Brecon (BCN)
Events :	ATC Conflict ATC Conflict	**Location Info :**	SE

Pretitle :
Alleged that the Bristol Lulsgate controller transferred the wrong outbound flight to the LATCC Sector 05 controller. LATCC provided immediate avoiding action to maintain separation.
Precis :
An F27 was working Bristol Lulsgate descending through FL90 into Lulsgate when a fltnum "***856" was transferred to London on track RADNO climbing FL85 and in direct conflict. In a subsequent telecon the Lulsgate controller stated that he had transferred "856" by mistake thinking he had transferred a fltnum "411" of the same operator. The controller at Bristol gave a position to "856" which was the actual position of "411" but the crew did not query this. The crew on hearing the frequency change instruction, readback the frequency but did not state their callsign.

A/C Type :	B777	**Occurrence Number :**	**200108641**
Flight Phase :	Initial Climb	**Occurrence Date :**	27 Dec 2001
Classification :	Occurrences	**Location :**	Rio De Janeiro
Events :	Airprox - Foreign TCAS Report Airprox - Foreign	**Location Info :**	

Pretitle :
FOREIGN AIRPROX - B777 and small transport a/c. Subject to investigation by the Brazilian authority.
Precis :
After take off from R/W10 and passing approximately 500ft, B777 received a TCAS TA followed by RA. B777 levelled and a turboprop a/c was seen on the LH side turning to the Northeast. AIRPROX reported to Tower frequency 118.2, but no explanation was given by ATC. The Brazilian investigation concluded that this AIRPROX was caused by poor phraseology on the part of the controller concerned combined with a radar fault.

A/C Type :	A321	**Occurrence Number :**	**200200011**
Flight Phase :	Take Off	**Occurrence Date :**	03 Jan 2002
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :
ATC instructed A321 to reject take-off at 90kts due B747 on approach at Heathrow. Traffic information and avoiding action given, B747 instructed to go-around. Standard separation maintained.
Precis :
Attributed to a combination of preceding a/c (B777) being slow to depart and B747 being faster than anticipated on the approach. Investigations have indicated that this incident was caused by poor judgement in lining up the A321. Appropriate ATC remedial action has been taken.

A/C Type :	B737	**Occurrence Number :**	**200200206**
Flight Phase :	Descent	**Occurrence Date :**	15 Jan 2002
Classification :	Occurrences	**Location :**	Cliff
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

Incorrect RT phraseology.

Precis :

On two occasions, when instructed to descend, B737 pilot replied "At our discretion". On each occasion, ATC instructed a/c "negative, descend now". The operator and crew have been reminded that, whilst obtaining clarification is always considered good practice if any doubt exists, any unnecessary use of RT transmissions will have an impact, particularly on a very busy frequency.

CAA Closure: No further CAA action required.

A/C Type :	DO 328	**Occurrence Number :**	**200200242**
Flight Phase :	Hold	**Occurrence Date :**	15 Jan 2002
Classification :	Occurrences	**Location :**	LANAK
Events :	Altitude Deviation Altitude Deviation	**Location Info :**	

Pretitle :

Flight number "317G" accepted a call intended for another operator flight number "30G" in LANAK hold, resulting in altitude deviation. Standard separation maintained.

Precis :

Do328 (flight number "317G") was entering the hold at FL100 at LANAK, with an EMB145 (another operator flight number "30G") holding at FL90. ATC instructed the EMB145 to descend to FL80, but this was acknowledged by the DO328. The controller failed to notice the incorrect readback, (the tape review indicates that the readback error was not obvious and that "317G" did not use his company designator) and both a/c commenced descents. Scottish Sector then observed the Do328 descending through FL84, with the EMB145 level at FL80. ATC then instructed the Do328 to climb and level at FL90. Appropriate ATC remedial action has been taken as a result of this incident.

A/C Type :	B777	**Occurrence Number :**	**200201232**
Flight Phase :	Climb	**Occurrence Date :**	26 Feb 2002
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	Loss of Standard Separation TCAS Report	**Location Info :**	4SW

Pretitle :

Loss of separation between B777 and B747 at 4300ft, 4nm Southwest of Heathrow. Both had departed 27R at Heathrow. TCAS and STCA activated, traffic information and avoiding action given.

Precis :

The B747 was airborne on a MID4F SID and the B777 was cleared for take off on a DVR5F SID. The required minimum separation between such departures was 2 min. A subsequent examination of the RTF tape indicated that only one min had been applied. At the time there was a strong South-westerly wind blowing, and this added to the problem. The B777 was transferred to London Control, and the controller there immediately issued avoiding action as there was virtually no vertical separation and only 2 nm laterally.

CAA Closure: Appropriate local ATC action taken.

A/C Type :	A340	**Occurrence Number :**	**200201429**
Flight Phase :	Climb	**Occurrence Date :**	07 Mar 2002
Classification :	Occurrences	**Location :**	GIBSO
Events :	UK Airprox	**Location Info :**	7 NE

Pretitle :

UK AIRPROX-16/2002-A340 and a military jet at GIBSO at FL230.

Precis :

In accordance with the standing agreement, the A340 had to be positioned on the North side of Airway R8, which was achieved. However, although perhaps not immediately apparent to the controller, the radar recording showed the A340 track slowly converging with the Northern boundary of the Airway, rather than remaining parallel with it. The A340 reached the Airway boundary, and continued tracking along its edge. It was then released on its own navigation to Lands End VOR, some 149 nm distance, and transferred to the next sector. The radar recording showed the A340 just outside the Airway at this stage. Subsequently the A340 was cleared up to FL270, and the STCA activated against fast moving traffic outside CAS approaching the A340 from the West in a climb. A right turn and traffic information was passed, with the unknown traffic closing to 6 nm as the A340 regained CAS. Ultimately the unknown a/c did not penetrate CAS. The incident will be subject to assessment by UKAB.

CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200201824**
Flight Phase :	Taxy	**Occurrence Date :**	24 Mar 2002
Classification :	Occurrences	**Location :**	Nantes
Events :	Airprox - Foreign	**Location Info :**	

Pretitle :

FOREIGN AIRPROX-B737 allegedly cleared for take-off three times at Nantes while a TB10 was holding on the runway.

Precis :

B737 crew questioned take-off clearance due to light a/c on runway. ATC cleared B737 twice more and then instructed B737 to hold position when clearance was questioned for a third time. ATC allegedly spoke in French to the light a/c throughout. Light a/c eventually commenced take-off, following which B737 departed without further incident. The severity of the incident was brought to the attention of the French authorities, who are taking appropriate action. The French AIRPROX investigation concluded that the controller having lined up the TB10 from an intermediate position then forgot about it. The Local controller's workload was high. Contributory factors were non-detection of the TB10 when making a visual check due to difficulty in adjusting the light contrast with the blinds and non-use of the phraseology "line up and wait" which could have reinforced the controller's mental image of the situation.
CAA Closure: No further CAA action required.

A/C Type :	BE200 Super King Air	**Occurrence Number :**	**200202236**
Flight Phase :	Approach	**Occurrence Date :**	02 Apr 2002
Classification :	Occurrences	**Location :**	Bournemouth
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
Alleged use of very poor non standard R/T. Pilot on later stages of approach failed to read back headings and accept vectoring.
Precis :
On transfer to Tower confusion was caused by non standard phraseology. Appropriate CAA action has been taken as a result of this incident.

A/C Type :	B767	**Occurrence Number :**	**200202443**
Flight Phase :	Taxy	**Occurrence Date :**	03 Apr 2002
Classification :	Occurrences	**Location :**	New York JFK
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - B767 believed it had been cleared to line up on R/W31L, which it did. Subsequently ATC instructed an a/c on approach to go around.
Precis :
The B767 taxiing to R/W31L behind an MD80 was cleared to 'taxi up to him and hold short', which was read back as 'follow him and hold short". After MD80 started its roll, B767 taxied into position and held as it believed it had been instructed. When B767 had been lined up for a short while, an a/c was instructed to go around. Terminology used on this incident will be discussed when FAA visit the operator at the end of April.

A/C Type :	B757	**Occurrence Number :**	**200202793**
Flight Phase :	Descent	**Occurrence Date :**	01 May 2002
Classification :	Occurrences	**Location :**	Manchester (MCT)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - Due to operator changing its name, the three letter code in the Fltnum also changed, but the company telephony still remained the same, which caused confusion to controllers.
Precis :

A/C Type :	EMB 145	**Occurrence Number :**	**200203251**
Flight Phase :	Descent	**Occurrence Date :**	13 May 2002
Classification :	Occurrences	**Location :**	Lambourne (LAM)
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	35 E

Pretitle :
Altitude deviation - EMB145 descended through cleared FL270 to FL250 during descent into Birmingham. Alleged that incorrect readback was not detected by ATC.
Precis :
Investigations revealed that the flight was issued a descent clearance to FL270. However, in his response the pilot asked to confirm if the level cleared was FL250 to which the SC responded, erroneously, that it was and the flight accordingly continued descent to FL250. No other flight was apparently involved but the error was identified when the pilot reported at the 'wrong' level on the next sector frequency.
CAA Closure: Appropriate personnel action has been completed at the Unit concerned.

A/C Type :	A319	**Occurrence Number :**	**200203969**
Flight Phase :	Climb	**Occurrence Date :**	12 Jun 2002
Classification :	Occurrences	**Location :**	Madrid
Events :	Foreign ATC Occurrence	**Location Info :**	30 N

Pretitle :
Foreign ATC Incident - A319 believed it was cleared to climb to FL240. Passing FL130 with high rate of climb, A319 instructed to maintain FL140 on reaching. Traffic seen on TCAS at FL150 4-5nms abeam.
Precis :
Both crew heard the clearance to FL240 which was clearly read back. Alleged poor standard of ATC with clipped

and non standard R/T often in Spanish.

A/C Type :	A320	**Occurrence Number :**	**200204037**
Flight Phase :	Approach	**Occurrence Date :**	17 Jun 2002
Classification :	Occurrences	**Location :**	Bodrum
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Alleged poor ATC service provided at Bodrum. Recurring problem.

Precis :

ATC RT allegedly non-standard and ambiguous. ATC also failed to comply with Jeppesen chart information. Similar problem experienced by operator on following day (18 Jun 2002). A number of attempts to elicit a response to this incident from the appropriate foreign authority have been unsuccessful.
CAA Closure: No further CAA action practical.

A/C Type :	DO 328	**Occurrence Number :**	**200204106**
Flight Phase :	Circuit	**Occurrence Date :**	18 Jun 2002
Classification :	Occurrences	**Location :**	London City - LCY
Events :	Loss of Standard Separation	**Location Info :**	4 SE

Pretitle :

ATC Incident - Tower informed controller that a DO328 would be making a RH orbit for spacing, but DO328 then observed to enter a LH orbit towards a CL600 and separation was lost.

Precis :

Whilst resolving a vortex spacing problem between an F50 and a DO328, the London City ADC Controller asked the latter a/c if it wished an orbit. However, phraseology used was somewhat ambiguous, resulting in its pilot carrying out a left hand turn. This brought it into confliction with the CL600, inbound to Biggin Hill. The CL600 was given an avoiding action climb and turn. Minimum separation approximately 2nm/600ft.
CAA Closure: Appropriate ATC personnel action taken.

A/C Type :	SA332 Super Puma	**Occurrence Number :**	**200204540**
Flight Phase :	Cruise	**Occurrence Date :**	03 Jul 2002
Classification :	Occurrences	**Location :**	BANFF
Events :	UK Airprox UK Airprox	**Location Info :**	

Pretitle :

UK AIRPROX-104/2002- 2 military jets and an AS332 near Banff at 1600 feet.

Precis :

The military jets were in close formation, in receipt of a FIS, at 1000 ft on Rad Alt. The formation was too low for identification, but the controller advised of traffic in the area at 1600 ft. The military a/c captain thought that the formation could be seen on radar and, after converting the Rad Alt height using SPS to around 1600 ft, incorrectly believed that the reported traffic was in fact the military formation. Consequently, the military captain thought that the formation was the only traffic in the area. About 1 min later the AS332 was seen late, with no time for avoiding action, and the military a/c crossed 50 m ahead of and about 100 ft above the helicopter. The AS332 was VMC inbound to Aberdeen, under a limited RIS at 1000 ft on the RPS. The military traffic was reported at 3 nm to the NE at 1700 ft, which would pass down the left hand side of the AS332. A subsequent message reported the jets passing the helicopter, when they were seen at a range of 1/4 nm. The helicopter was pitched nose down to avoid, with the jets passing about 100 m down the port side, 100 ft above. The incident was subject to assessment by UKAB.
CAA Closure: No further CAA action required.

A/C Type :	B737	**Occurrence Number :**	**200205146**
Flight Phase :	Descent	**Occurrence Date :**	22 Jul 2002
Classification :	Occurrences	**Location :**	LOGAN
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	15 W

Pretitle :

B737 crew misinterpreted an instruction to stop descent at FL320 as a descent clearance to FL220. Altitude excursion occurred but standard separation maintained.

Precis :

The a/c was originally descended to FL280 but ATC then amended the clearance to "Stop your descent FL320". The read back was "220 924". The R/T indicates that the difference between 320 and 220 is only just discernible and was not detected by the controller. The a/c was then QSY'd and on its first call to the next sector called passing 310 for 220. The R/T tape shows that the pilot consistently failed to use the company call sign or the word "Flight Level" hence "220 924". Operator alerted.

A/C Type :	Saab F340	**Occurrence Number :**	**200205268**
Flight Phase :	Descent	**Occurrence Date :**	23 Jul 2002
Classification :	Occurrences	**Location :**	Aberdeen (ADN)
Events :	Loss of Standard Separation	**Location Info :**	10S

Pretitle :
Loss of separation between SF340 and J31 at 3000ft, 10nm South of Aberdeen. SMF activated. Appropriate ATC action taken.
Precis :
ATC controller misjudged J31 speed and rate of turn and so issued a 90deg turn on 10nm final in an attempt to maintain separation with SF340. SMF analysis later confirmed that separation had been lost between J31 and SF340 although they were on diverging tracks at that time. ATC controller was aware of potential conflict throughout. Appropriate local action taken.

A/C Type :	Not Applicable	**Occurrence Number :**	**200205546**
Flight Phase :	Not Applicable	**Occurrence Date :**	05 Aug 2002
Classification :	Occurrences	**Location :**	LACC - Hurn
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
Overload at 1415hrs, LACC Sectors 19, 20 and 21 (Hurn East, West and Low).
Precis :
This Overload took place during an afternoon shift when preparations were being made for a Deploy, Download & Cutover (DD&C) to take place later. During this preparation it was not possible to split sectors at short notice. Regulations had been applied to S19 and 20 at 22/60 and 18/60 respectively. Shortly after the shift started there were reports of crews making weather avoidance manoeuvres and so the rates were further reduced to 18/60 and 15/60 from 1320. The sector was flowed for single manning but due to the amount of traffic and complexity the controller became overloaded and a colleague was called back to assist. The standard of RTF discipline by crews was poor and, with the increasing number of a/c on frequency, the controller began talking faster which added to the need for repeat transmissions. The combined S19/20/21 actual rate between 1400-1459 was 37 (regulation should have kept this to 33) but during 1401-1420, 17 a/c entered the sector, equivalent to a rate of 51/60. Standard separation was maintained throughout.
CAA Closure: Appropriate ATC action taken.

A/C Type :	B737	**Occurrence Number :**	**200205575**
Flight Phase :	Cruise	**Occurrence Date :**	07 Aug 2002
Classification :	Occurrences	**Location :**	Compton (CPT)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - Alleged poor R/T discipline by B737. Transmissions were clipped, incorrect or missing readback of instructions, and frequent use of callsign 'one oh three' (103).
Precis :
Poor R/T discipline has been discussed with the operator in the past.

A/C Type :	Gardan 80	**Occurrence Number :**	**200205933**
Flight Phase :	Cruise	**Occurrence Date :**	20 Aug 2002
Classification :	Occurrences	**Location :**	Birmingham
Events :	Airspace Infringement Airspace Infringement	**Location Info :**	2 NNW

Pretitle :
ATC Incident - Alleged infringement of the Birmingham CTR (Class D). Traffic info and avoiding action given to a departing CL600RJ. Standard separation maintained.
Precis :
Appropriate CAA action has been taken as a result of this incident.

A/C Type :	Piper PA28	**Occurrence Number :**	**200206086**
Flight Phase :	Circuit	**Occurrence Date :**	27 Aug 2002
Classification :	Occurrences	**Location :**	Cardiff (CDF)
Events :	UK Airprox	**Location Info :**	

Pretitle :
UK AIRPROX 150/2002 - EMB145 and a PA28 at Cardiff at 500ft.
Precis :
The Tower position was being operated by a mentor and low-experience trainee. The EMB145 requested and was given use of the non-duty R/W12. As the a/c was taxying for that R/W, a PA28 requested a VFR rejoin from a local flight, and was cleared to join on base leg for the duty R/W30. The mentor's plan was to depart the EMB145 first, but when the PA28 reported on base leg the trainee, without reference to the mentor, instructed it to report final number one. The mentor then told the trainee to instruct the PA28 to orbit on base leg. No readback of this instruction was received. The EMB145 was cleared for take off R/W12 and was rolling when the PA28 reported final for R/W30. An avoiding action right turn was issued to the PA28 and the EMB145 turned right at about 100 feet. The 2 a/c are believed to have passed 0.75 nm/300 ft apart. The incident will be subject to assessment by UKAB.
CAA Closure: Appropriate ATC personnel action taken.

A/C Type :	DO 328	**Occurrence Number :**	**200206221**
Flight Phase :	Cruise	**Occurrence Date :**	30 Aug 2002

Classification :	Occurrences	**Location :**	Polehill (POL)
Events :	Loss of Standard Separation	**Location Info :**	

Pretitle :

ATC Incident - Following handover of sector, controller did not notice that an A320 was catching up a DO328 until STCA activated. Traffic info and avoiding action given. Separation lost.

Precis :

The faster A320 was following the DO328, both at FL260. During ATC controller handover, which was protracted due in part to RT difficulties with another a/c on the frequency, the outgoing Radar controller and Co-ordinator had not recognised the "catch up" situation and did not brief the oncoming Radar controller. The oncoming controller was alerted to the situation by STCA, avoiding action instructions were issued, but standard phraseology was not employed.
CAA Closure: Appropriate ATC action taken.

A/C Type :	A320	**Occurrence Number :**	**200206283**
Flight Phase :	Descent	**Occurrence Date :**	30 Aug 2002
Classification :	Occurrences	**Location :**	
Events :	Foreign ATC Occurrence Altitude Deviation TCAS Report Foreign ATC Occurrence	**Location Info :**	

Pretitle :

TCAS TA received following R/T confusion regarding cleared flight level.

Precis :

A/c was given descent on approaching FL350 to FL240 which was read back. On passing FL338 Madrid requested a/c stop descent at FL340 due opposite traffic at FL330. Autopilot disconnected and climb back commenced, lowest level reached was FL331. Subsequent conversation with ATC confirmed that actual descent clearance was FL340 and not FL240. It appears that both ATC and crew misheard the word "two" as "three" and vice-versa.

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200206319**
Flight Phase :	Descent	**Occurrence Date :**	03 Sep 2002
Classification :	Occurrences	**Location :**	Compton (CPT)
Events :	Altitude Deviation (ATC) Altitude Deviation	**Location Info :**	SE

Pretitle :

Level excursion - MD82 crew using abbreviated RT phraseology made 2 errors in readback which went undetected at the ATC units concerned. Standard separation maintained.

Precis :

The a/c was instructed to "descend FL140 40 miles before Midhurst". The pilot read back "descend FL140, 40 before Midhurst". The controller acknowledged and transferred the a/c to LTCC. On the next frequency the a/c reported "leaving 15 down to 40", the controller acknowledging, having missed the first digit of 140. The errors were detected as the a/c was descending through FL118 for FL40. The operator has been alerted, and accepts that the RTF phraseology from his crew was inaccurate, and has taken steps to remind the crew concerned and all their other crews of the absolute need to use complete and not abbreviated phraseology, especially within the LTMA.

A/C Type :	Cessna C525 Citationjet	**Occurrence Number :**	**200206417**
Flight Phase :	Descent	**Occurrence Date :**	06 Sep 2002
Classification :	Occurrences	**Location :**	Lambourne (LAM)
Events :	Altitude Deviation	**Location Info :**	

Pretitle :

ATC Incident - C525 observed passing through FL160 when cleared to descend to FL170, which had been read back correctly. Standard separation maintained.

Precis :

When level was queried with the pilot he responded that he was descending to FL70. Pilot was using abbreviated R/T phraseology. Operator alerted.

A/C Type :	Cessna 152	**Occurrence Number :**	**200206445**
Flight Phase :	Cruise	**Occurrence Date :**	08 Sep 2002
Classification :	Occurrences	**Location :**	London City - LCY
Events :	ATC Occurrence	**Location Info :**	3 E

Pretitle :

ATC Incident - Controller accepted VFR traffic from another unit, but subsequently misidentified a/c concerned. Traffic info given to inbound Saab 2000. SMF activated.

Precis :

Thames Radar transferred a C152 VFR flight to London City, giving its squawk and route. Shortly after a SB2000 6nm from touchdown to R/W28 was also transferred to London City. London City then requested release on a BAe146, which was approved subject to C152. Thames then asked London City if it had the C152 against the SB2000 and received a reply in the affirmative. C152 then requested vector for the Isle of Dogs, but London City estimated that it was already in the vicinity of the Isle of Dogs. Thames called to pass details on another VFR transit holding at the Isle of Dogs awaiting departure of BAe146 and during this co-ordination it became apparent that London City had misidentified the C152 which was actually orbiting to the North of final approach. Investigations have revealed that the misunderstanding was caused initially by the use of inappropriate phraseology by both controllers concerned. Appropriate ATC remedial action has been taken as a result of this incident.

A/C Type :	B737	**Occurrence Number :**	**200206739**
Flight Phase :	Descent	**Occurrence Date :**	18 Sep 2002
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	Loss of Standard Separation ATC Occurrence	**Location Info :**	15W

Pretitle :

Loss of separation between two B737 a/c at 4000ft, 15nm West of Heathrow. One B737 allegedly failed to comply with ATC instructions. Avoiding action and traffic information issued to other B737.

Precis :

Both a/c were being vectored inbound to 09L at Heathrow. B737 (A) was being positioned ahead of the other B737 and was downwind left hand descending to 4000 feet. B737 (B) had been routed underneath the OCK stack and positioned downwind right hand, also at 4000 feet. B737 (B) was then turned right onto 305º towards base leg and, shortly afterwards, turned right onto 340º and instructed to reduce speed to 180 kt. B737 (A) was instructed to turn left onto 140º but, possibly due to the fact the transmission was clipped, the crew did not respond immediately. The controller confirmed to the crew the instruction was for them and to turn further left onto 140º to establish on the ILS. The controller had anticipated a tighter turn by B737 (A) and the lack of this resulted in the two a/c coming into conflict. Avoiding action was passed to B737 (B) and the crew reported both visual and having a TCAS contact. Separation was lost before being quickly restored due to the track divergence.
CAA Closure: Appropriate ATC remedial action has been taken.

A/C Type :	B777	**Occurrence Number :**	**200206844**
Flight Phase :	Approach	**Occurrence Date :**	02 Sep 2002
Classification :	Occurrences	**Location :**	Sao Paulo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - Due to ATC giving B777 a tight turn and keeping it high, the approach was fast and flap selection was late. B777 initiated a go around at approximately 500ft.

Precis :

During a busy ATC environment and with language problems, B777 found it difficult contacting approach controller to state that they were unable to maintain ATC's requested speed. The operator has contacted the Brazilian authorities requesting a phrase that would be understood by ATC and that crew could use to alert ATC to the fact that a/c are unable to comply with their demands and to request extra track miles. The Brazilian authorities state that controller misunderstood the performance of the a/c. Appropriate follow up action has been taken.

A/C Type :	B767	**Occurrence Number :**	**200207531**
Flight Phase :	Descent	**Occurrence Date :**	17 Oct 2002
Classification :	Occurrences	**Location :**	Faro
Events :	Airprox - Foreign TCAS Report A/c Equipment / System Malfunction	**Location Info :**	

Pretitle :

Foreign AIRPROX - B767 and a light a/c. Subject to investigation by the Portuguese authority.

Precis :

B767 on radar vectors to R/W28 was cleared to descend from 4000ft to 3000ft on an intercept heading. B767 became aware of a TCAS return ahead, level at 3000ft and visually acquired a light a/c. ATC cleared B767 for a visual approach to which P1 replied ' cleared approach and contact a/c ahead at 3000ft'. ATC replied 'Roger continue descent'. The light a/c was observed to commence a left turn, still level at 3000ft, which would cross B767's intended track. B767 began a gentle right turn and reduced descent rate. TCAS then gave 'monitor vertical speed' followed by 'climb'. TCAS RA complied with and light a/c passed down LH side. RA reported to ATC who replied 'disregard, the a/c's transponder is incorrect', which was queried and ATC called the a/c to confirm that it was at 1500ft. A/c replied 'negative, 3000ft as requested'. ATC then instructed a/c to orbit left. The Portuguese investigation has revealed that the light a/c was on a training flight and had been instructed to "descend one thousand five hundred". The student descended from 4500 to 3000. The a/c's transponder had an intermittent fault. The controller made an error of judgement in assuming the a/c had descended as cleared.

A/C Type :	BAE146	**Occurrence Number :**	**200207535**
Flight Phase :	Taxy	**Occurrence Date :**	16 Oct 2002

Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	Runway Incursion Runway Incursion	**Location Info :**	

Pretitle :
ATC Incident - BAe146 was cleared to line up after a departing B757, but at night mistook an Airbus as the B757 and crossed holding point at Block 75 and entered R/W27L. Appropriate action taken.
Precis :
BAe146 at Block 75, holding point for R/W27L, was cleared by tower to line up on R/W27L after departing BA B757. There were no stop bars at this holding point. The only a/c to be seen from this holding point was a BA a/c lined up on R/W27, which the BAe146 believed was the B757, and a B747 at adjacent holding point Block 76. On departure of BA a/c, BAe146 taxied to line up on R/W27L. B747 was also seen to be taxiing parallel to BAe146. ATC cleared B747 for take off and BAe146 immediately called ATC to say that it had entered the R/W. B747's take off clearance was cancelled. BAe146 reported it had been cleared after the B757 and was informed that it was an Airbus that had departed. The ATC report states that the BAe 146 (which was on the North-side) was given a conditional line-up clearance after a "British B757 from the south-side". Whilst the clearance was read back, it was not read back in full, ' after the B757 to line up, (flight number) '. Following this incident a detailed review of multiple line up procedures has taken place at Heathrow. All Local Competency Examiners (LCEs) have been instructed to pay specific attention to this subject and to ensure all controllers comply with the requisite procedures. A listing of all line up incidents has been issued to them for discussion with the controllers at the unit. Increased vigilance is expected to resolve the problems that have been experienced in the past. The situation will be monitored.

A/C Type :	B747	**Occurrence Number :**	**200207638**
Flight Phase :	Climb	**Occurrence Date :**	10 Oct 2002
Classification :	Occurrences	**Location :**	Tokyo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Foreign ATC Incident - Reporter believes that after B747 departed R/W34L on a SYE 4 SID an ambiguous climb clearance was given by ATC.
Precis :
As B747 was passing 1000ft after departure from R/W34L on a SYE 4 SID, which has a stop altitude of 7000ft. B747 was transferred to Departure Control, who told B747 to 'climb FL310 observe restrictions'. 31000ft had been put into MCP before clearance was verified with ATC, who seemed surprised that B747 might climb beyond 7000ft as this was its cleared level. The Japanese investigations have confirmed that a misleading clearance was given. Appropriate ATC remedial action has been taken.

A/C Type :	A321	**Occurrence Number :**	**200207994**
Flight Phase :	Climb	**Occurrence Date :**	03 Nov 2002
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence	**Location Info :**	3W

Pretitle :
Call sign confusion between same operator flight numbers "5179" and "5141". "5179" accepted a call intended for "5141" while at 1500ft, 3nm West of Heathrow.
Precis :
"5179" allegedly displayed poor RT technique prior to incident.

A/C Type :	B767	**Occurrence Number :**	**200208280**
Flight Phase :	Climb	**Occurrence Date :**	13 Nov 2002
Classification :	Occurrences	**Location :**	Bovingdon (BNN)
Events :	Altitude Deviation	**Location Info :**	

Pretitle :
ATC Incident - B767 was cleared to climb to FL80, but observed reaching FL85. Controller queried this, giving standard pressure setting. B767 descended back to FL80. Standard separation maintained.
Precis :
Pilot also using non standard phraseology. Operator fully alerted. See also 200207856.

A/C Type :	Fokker 50	**Occurrence Number :**	**200208293**
Flight Phase :	Cruise	**Occurrence Date :**	14 Nov 2002
Classification :	Occurrences	**Location :**	REFSO
Events :	UK Airprox Loss of Standard Separation	**Location Info :**	

Pretitle :
UK AIRPROX 223/2002 - FK50 and an ATR72 at REFSO at FL180. ATC error. Traffic information and avoiding action given.
Precis :
The ATR72 had been accepted into the sector at FL180. The FK50 had originally been accepted at FL180 but this was revised to FL160. When the FK50 came on frequency the controller advised it to 'maintain FL180 on reaching'. This was clearly read back by the crew but not detected by the controller. As a consequence the FK50

climbed into conflict with the ATR72. This AIRPROX will now be subject to a separate review by the United Kingdom AIRPROX Board (UKAB).
CAA Closure: Appropriate local ATC remedial action has been taken as a result of this AIRPROX.

A/C Type :	B737	**Occurrence Number :**	**200208500**
Flight Phase :	Climb	**Occurrence Date :**	21 Nov 2002
Classification :	Occurrences	**Location :**	Woodley (WOD)
Events :	Altitude Deviation (ATC) Altitude Deviation	**Location Info :**	

Pretitle :
ATC Incident - Due to confusion and ambiguity in exchanges between ATC and pilot, B737 climbed above its cleared altitude of 6000ft. Standard separation maintained.
Precis :
B737 was observed climbing through its cleared level of 6000ft. When questioned pilot stated climbing to FL330. After take off B737 requested FL330 and was asked to report its cleared level. Pilot replied 'initially 60'. ATC then cleared B737 'no ATC speed restriction', which pilot read back as 'confirm no restriction' and it is believed interpreted this as a clearance to climb to FL330. The operator has been fully alerted to this incident and the importance of correct phraseology.

A/C Type :	DHC8	**Occurrence Number :**	**200208739**
Flight Phase :	Descent	**Occurrence Date :**	24 Nov 2002
Classification :	Occurrences	**Location :**	Southampton (SAM)
Events :	Diversion /Return ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - Standard landing clearance not available from ATC after being advised that RVR reading was below (absolute ?) minima for approach. DHC8 diverted.
Precis :
Investigations indicate that the DHC8 was about to commence an ILS approach in conditions of fluctuating RVR readings. The RVR decreased during the approach. ATC failed to follow the 'Absolute Minima' procedures as detailed in MATS Part 1 and only passed the second part of the phraseology. This caused confusion with the DHC8 crew who commenced a go around as they could not obtain a landing clearance from ATC. Further guidance has been given to the unit ATCOs.

A/C Type :	CL600RJ Regional Jet	**Occurrence Number :**	**200208908**
Flight Phase :	Climb	**Occurrence Date :**	10 Dec 2002
Classification :	Occurrences	**Location :**	Ockham (OCK)
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :
ATC Incident - A/c on a SAM 2P SID was cleared to 4000ft, but read back 7000ft, which was not picked up by the controller. A/c observed passing 6000ft and action taken to maintain standard separation.
Precis :
On contacting LTCC the a/c was instructed to "maintain 4000 feet". Although the instruction was clear the a/c replied "7000 feet (flt number). The "7000 feet" was unreadable but the controller did not request confirmation of the readback. Appropriate and comprehensive advice has been passed to the operator concerned.

A/C Type :	B737	**Occurrence Number :**	**200209120**
Flight Phase :	Climb	**Occurrence Date :**	19 Dec 2002
Classification :	Occurrences	**Location :**	Prestwick
Events :	Altitude Deviation (ATC) Altitude Deviation	**Location Info :**	18 SE

Pretitle :
ATC Incident - B737 misinterpreted and then incorrectly read back a heading clearance as a climb clearance, which was not picked up by the controller. Standard separation maintained.
Precis :
After B737 had departed it had been co-ordinated to climb to FL90. Subsequently B737 observed passing FL100, which ATC queried and pilot reported climbing to FL160. ATC stopped climb at FL130. Investigations revealed that B737 had acknowledged climb to FL90, but when later given a heading of 160deg, responded 'up to 160', which was not picked up by the controller. Appropriate local ATC remedial action has been taken as a result of this incident. Operator alerted.

A/C Type :	A310	**Occurrence Number :**	**200209231**
Flight Phase :	Climb	**Occurrence Date :**	26 Dec 2002
Classification :	Occurrences	**Location :**	Honiley (HON)
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	5 SE

Pretitle :

ATC Incident - After A310 departed R/W15 on DTY 2E SID, it was cleared to climb to FL60, but read back 'for two six zero', which was not detected by the controller. Standard separation maintained.

Precis :

A310 departed R/W15 on DTY 2E SID and was cleared to climbed to FL60, but read back 'for two six zero', which was not picked up by the controller. On transfer to next sector A310 was expected to be climbing to FL60 and pilot reported 'climbing to six zero'. When A310 was observed at FL64, subsequently pilot confirmed 'climbing FL260'. Appropriate ATC remedial action has been taken on the read back aspects. Additionally, the operator has been passed full details of this event and alerted to the need for correct RT phraseology.

A/C Type :	A320	**Occurrence Number :**	**200209288**
Flight Phase :	Climb	**Occurrence Date :**	29 Dec 2002
Classification :	Occurrences	**Location :**	Ockham (OCK)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - Alleged poor R/T and airmanship. A320 failed to report passing/cleared altitude or give proper read backs, also did not use call sign on several occasions despite being reminded.

Precis :

The A320 captain, an experienced foreign operator in UK airspace, subsequently had no recollection of the reported incidents. However, the captain accepted that they occurred, and promised to take the necessary measures to ensure they did not happen again.

CAA Closure: No further CAA action required.

A/C Type :	HS125	**Occurrence Number :**	**200300575**
Flight Phase :	Descent	**Occurrence Date :**	31 Jan 2003
Classification :	Occurrences	**Location :**	Farnborough
Events :	UK Airprox Loss of Standard Separation Airspace Infringement	**Location Info :**	15NW

Pretitle :

UK AIRPROX 6/2003 - HS125 and Enstrom F28F at 5000ft, 15nm Northwest of Farnborough, inside the LTMA. Avoiding action and traffic information issued.

Precis :

The Enstrom was working Farnborough under a RIS at 5000 feet, routing towards CPT. The HS125 was inbound to Farnborough from Airways under the control of the TC OCK controller, descending to 5000 feet under the 'Silent Handover' procedures between the 2 units. The Farnborough controller realised the confliction when the a/c were approximately 6nm apart. The pilot of the Enstrom was asked to confirm his altitude and on receiving confirmation it was still 5000 feet , traffic information and a subsequent avoiding action turn was given. TC were advised and issued avoiding action to the HS125. The base of the LTMA in the AIRPROX position was 5000 feet. The pilot of the Enstrom had not received clearance to enter CAS although he may have been lulled into a false sense of security as the previous Farnborough controller had informed him of CAS ahead and that he would be kept advised.

CAA Closure: Appropriate ATC personnel action has been taken as a result of this AIRPROX. This AIRPROX has been subject to a separate review by the United Kingdom AIRPROX Board (UKAB).

A/C Type :	CL600RJ Regional Jet	**Occurrence Number :**	**200300705**
Flight Phase :	Descent	**Occurrence Date :**	05 Feb 2003
Classification :	Occurrences	**Location :**	Lambourne (LAM)
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	

Pretitle :

ATC Incident - CL600RJ descended below its cleared FL90 due to confusion by crew involving a heading instruction of 280deg. A/c observed at FL83. Standard separation maintained.

Precis :

On first contact CL600RJ was cleared to descend to FL90 and later instructed to leave LAM heading 280deg. When approaching the fix, CL600RJ's Mode C observed at FL83 and controller asked pilot to confirm cleared FL90. Pilot replied 'Roger descending FL90'. Controller told pilot that its Mode C was reading FL83 and to climb immediately to FL90. On leaving the stack pilot reported that there had been some confusion when heading of 280degs had been issued (280 / FL80). An examination of the RT tape reveals that the ATC instruction was "*******, turn left to Lambourne, leave heading 280, speed 220". The response was "Left turn to Lambourne, speed 220, descend level 80, *******". The "descend level 80" was a little distorted but the controller missed the incorrect readback. To avoid errors of this nature the controller should use the word "degrees" when assigning a heading. Appropriate ATC follow up action taken, with the operator having received full details of the incident.

A/C Type :	EMB 145	**Occurrence Number :**	**200301181**
Flight Phase :	Descent	**Occurrence Date :**	26 Feb 2003
Classification :	Occurrences	**Location :**	WILLO
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - Poor RTF. EMB145 allegedly failed to use full call sign despite many attempts at asking pilot to do so.
Precis :

A/C Type :	SA355 Ecureuil Twin	**Occurrence Number :**	**200301342**
Flight Phase :	Take Off	**Occurrence Date :**	03 Mar 2003
Classification :	Occurrences	**Location :**	Stansted
Events :	ATC Occurrence ATC Occurrence	**Location Info :**	

Pretitle :
ATC Incident - SA355 allegedly failed to follow ATC taxy instructions and then misinterpreted the zone clearance as a take off clearance. Appropriate advice given.
Precis :
AS355 parked on Stand 506 was cleared to taxy to holding point GA1, which was correctly read back. Shortly after controller offered SA355 its zone clearance, of which some had to be repeated or was not read back. Subsequently an operations vehicle called reporting that AS355 was going down Taxyway F. Controller instructed SA355 to turn 180degs to return to GA. Pilot acknowledged this, but by this time SA355 was seen to be airborne. Pilot apologised stating that he believed ATC zone clearance was a take off clearance. SA355 then returned to GA for departure on R/W23. Appropriate advice will be given to controller concerning their actions in this incident.

A/C Type :	Military	**Occurrence Number :**	**200301609**
Flight Phase :	Cruise	**Occurrence Date :**	17 Mar 2003
Classification :	Occurrences	**Location :**	Aberdeen (ADN)
Events :	UK Airprox Altitude Deviation	**Location Info :**	23 S

Pretitle :
UK AIRPROX 23/2003 - Jetstream 32 and military a/c 25nm South of Aberdeen at FL110.
Precis :
The Jetstream was in the cruise at FL110 and made aware of co-ordinated military traffic in the vicinity not above FL100. Subsequently, avoiding action was given to the Jetstream when one of the military jets, previously observed on radar at FL097, began to climb rapidly. The military a/c was seen by the Jetstream. The military pilot reported breaking off from an exercise and, not receiving any traffic updates for at least 3 min, once clear of the area began a climb. A visual search did not detect any conflict. The incident will be subject to assessment by UKAB.
CAA Closure: No further CAA action required.

A/C Type :	A320	**Occurrence Number :**	**200301674**
Flight Phase :	Taxy	**Occurrence Date :**	18 Mar 2003
Classification :	Occurrences	**Location :**	Addis Ababa
Events :	Foreign ATC Occurrence Foreign ATC Occurrence Runway Incursion	**Location Info :**	

Pretitle :
Ambiguous taxi clearance issued to A320 by Addis Ababa ground controller.
Precis :
A320 issued taxi clearance to holding point for R/W07L via taxiways C1 and F, which also forms part of R/W07L. During slow taxi along taxiway C1, a light a/c was observed backtracking R/W07L/taxiway F with another light a/c commencing a go-around. A320 was then cleared to backtrack and line-up. Take-off was uneventful but, during initial climb, A320 crew were informed that they had entered R/W07L/taxiway F without clearance.

A/C Type :	A330	**Occurrence Number :**	**200302373**
Flight Phase :	Cruise	**Occurrence Date :**	22 Apr 2003
Classification :	Occurrences	**Location :**	Oceanic
Events :	A/c Equipment / System Malfunction Diversion /Return ATC Occurrence Loss of Standard Separation	**Location Info :**	N55 W25

Pretitle :
ATC Incident - Oceanic separation lost when A330 at FL380 with a generator problem, adopted contingency procedures and descended. A330 diverted to Gatwick.
Precis :
At no time did the a/c declare an emergency. Occurrence "Opened" to facilitate further investigation WEF 20/05/2003. An operator's report subsequently received noted that the captain did not declare an emergency, but thought that his intentions were clear to the controller. The operator will publicise the need for clear, concise communications and correct emergency declaration to its crews.
CAA Closure: Appropriate operator action taken.

A/C Type :	B737	**Occurrence Number :**	**200302601**
Flight Phase :	Climb	**Occurrence Date :**	30 Apr 2003
Classification :	Occurrences	**Location :**	Ibiza
Events :	Altitude Deviation (ATC)	**Location Info :**	

Pretitle :

Foreign ATC Incident - As B737 was passing FL185 during climb to FL200, it was recleared to FL190. B737 reached FL195 before descending back to FL190. P1 advised ATC of level bust.

Precis :

Non standard phraseology was used by ATC when instructing the flight to maintain FL190 which resulted in the PNF missing the radio call. The PF did pick up the call but due the a/c's climb rate and slow a/c response to the MCP selection was unable to prevent the altitude excursion.

A/C Type :	B737	**Occurrence Number :**	**200302833**
Flight Phase :	Taxy	**Occurrence Date :**	09 May 2003
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	Runway Incursion ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - B737 allegedly failed to follow ATC taxi instructions to pull into B1 and hold, and lined up on R/W26L instead. Inbound A320 was sent around.

Precis :

The B737 was taxying for departure and ATC asked whether a departure from B1 was acceptable. The crew advised that it was, but non standard phraseology was used by ATC and the crew misinterpreted this as a line up clearance. A BAe146 had been given take off clearance and an A320 was on final. After the BAe146 had commenced its take off roll a conditional clearance to line up after the landing A320 was issued to the B737. It was then noted that the B737 was already lining up and so the A320 was sent around.
CAA Closure: Appropriate local ATC action taken.

A/C Type :	B737	**Occurrence Number :**	**200302856**
Flight Phase :	Cruise	**Occurrence Date :**	11 May 2003
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - B737 inbound to Gatwick with a suspected tyre burst could have misinterpreted a consideration of an alternative airfield as an instruction to divert.

Precis :

The aircraft was inbound to Gatwick and it was believed that it may have burst a tyre on departure. The standard message was passed by the ATCO on behalf of the BAA ODM requesting the pilot to consider diverting elsewhere. It would appear that no published information is available to pilots indicating that this action may be taken. This particular Captain appeared to have interpreted the message as a directive to divert, which it was not. The situation will be monitored for any future similar incidents.
CAA Closure: No further CAA action required.

A/C Type :	DC10	**Occurrence Number :**	**200303215**
Flight Phase :	Initial Climb	**Occurrence Date :**	25 May 2003
Classification :	Occurrences	**Location :**	Manchester (MCT)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

DC10 selected incorrect frequency following departure from Manchester.

Precis :

Prior to departure, DC10 was informed that a non-standard frequency (133.8) would be used. This was read-back correctly, but DC10 subsequently selected an incorrect frequency. When cleared for take-off the crew read back their callsign and "Roger" only.

A/C Type :	Learjet	**Occurrence Number :**	**200303295**
Flight Phase :	Taxy	**Occurrence Date :**	28 May 2003
Classification :	Occurrences	**Location :**	Manchester (MCT)
Events :	Runway Incursion ATC Occurrence	**Location Info :**	

Pretitle :

Incorrect line-up/runway incursion by Learjet at Manchester.

Precis :

Military a/c issued a conditional line-up clearance following a landing B737, with the Learjet issued a conditional line-up after the military a/c. Once B737 had vacated R/W24R, military a/c was issued take-off clearance but was unable to do so as the Learjet had crossed a red stop bar and incorrectly lined up in front of the military a/c. Investigations have revealed that the incident was caused by the Air Controller believing that the Learjet was at Link J1 when it was at JA. The Learjet pilot did report that it was holding at JA, but this was not detected/picked up. The pilot of the Learjet read back the conditional element of its clearance incorrectly and this was not detected by the controller. The ATC workload on this day had been very high and controller fatigue could have been a factor in this incident. Appropriate and comprehensive local ATC follow up action has been taken as a result of this incident.

A/C Type :	Military	**Occurrence Number :**	**200303992**
Flight Phase :	Cruise	**Occurrence Date :**	24 Jun 2003
Classification :	Occurrences	**Location :**	Aberdeen (ADN)
Events :	UK Airprox	**Location Info :**	35 S

Pretitle :

UK AIRPROX 86/2003 - Jetstream 32 and two military jets 35nm South of Aberdeen at FL195.

Precis :

The Jetstream was en route from Aberdeen to Leeds in the climb under a RAS. The controller observed military traffic in the vicinity so attempted to co-ordinate with military ATC, and was advised that the military traffic would head East. The civil controller therefore elected to take the Jetstream West and then South. The military traffic continued NE so a further turn onto 310 deg and traffic information was passed, with the military a/c indicating FL120 at 5 nm range on radar. The military traffic and Jetstream labels then merged, so the Jetstream, now at FL120, was given an avoiding action turn, and the Jetstream reported visual. The military a/c were given traffic information on the Jetstream and instructed to stop climb at 12000 ft. The Jetstream was acquired visually, and the military a/c elected to turn right to increase lateral separation. The incident will be subject to assessment by UKAB.

CAA Closure: No further CAA action required.

A/C Type :	Falcon 900	**Occurrence Number :**	**200304002**
Flight Phase :	Descent	**Occurrence Date :**	20 Jun 2003
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - Alleged poor R/T discipline. F900 consistently failed to use its callsign when acknowledging instructions. Controller asked F900 to use its callsign, but it still did not comply.

Precis :

Investigation progressed under 200301339.

A/C Type :	A321	**Occurrence Number :**	**200304513**
Flight Phase :	Descent	**Occurrence Date :**	12 Jul 2003
Classification :	Occurrences	**Location :**	Corfu
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - Alleged that A321 received poor ATC/radar procedures at night during approach to R/W35 with radio aids U/S.

Precis :

The foreign authority in a comprehensive response have stated that the a/c was under positive radar control at all times. The a/c was in a vectoring area where the minimum altitude is 2900 feet and the a/c was correctly cleared to descend to 3000 feet. The U/S radio aid (the GAR VOR/DME) was NOTAM promulgated as U/S. The report states that in the weather conditions pertaining (visibility in excess of 14nm) the visual approach was the best solution to expedite traffic. However if the pilot was unhappy with the visibility he should have refused the clearance and asked to execute the procedure. The incident has been presented and analysed by the Kerkira controllers and the importance of using correct phraseology emphasised.

CAA Closure: No further CAA action.

A/C Type :	CL600 RJ700	**Occurrence Number :**	**200304603**
Flight Phase :	Descent	**Occurrence Date :**	16 Jun 2003
Classification :	Occurrences	**Location :**	Nice
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Foreign ATC Incident - Increased workload for crew who had to repeat themselves on frequency to ATC, either to gain a response or make themselves understood, both prior to and after declaring a PAN.

Precis :

Reporter alleges that ATC displayed a lack of understanding of calls made by the crew on a number of occasions.

CAA Closure: The French authorities report that the unit responsible for investigating this incident received notification almost 2 months after the incident occurred. Although the local unit were asked to investigate, the elapsed time involved meant that the radar and radio data had been returned to service; data is retained for 30 days. The pilot concerned allegedly did not report the event on the frequency.

A/C Type :	A320	**Occurrence Number :**	**200304844**
Flight Phase :	Taxy	**Occurrence Date :**	23 Jul 2003
Classification :	Occurrences	**Location :**	Stansted

Events :	Runway Incursion ATC Occurrence	**Location Info :**	

Pretitle :

A320 given conditional clearance to line-up at Stansted but reported not ready and so clearance was cancelled. However, A320 then proceeded to line-up without appropriate clearance.

Precis :

The ADC position was being operated by a mentor and trainee. The A320 was given a clearance to line up and wait on R/W23. The trainee then initiated a telephone call to the TC North West coordinator. At the same time, the pilot reported that he was not yet ready and would need 2 or 3 minutes. The response from ATC was "..cancel line up hold position" and then the trainee continued with the telephone conversation. The crew responded but neither the trainee nor the mentor assimilated this. The A320 continued and lined up. No further safety incident took place as there was no other traffic affected by the runway being occupied.
CAA Closure: Appropriate ATC action taken.

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200305267**
Flight Phase :	Climb	**Occurrence Date :**	04 Aug 2003
Classification :	Occurrences	**Location :**	Wallasey (WAL)
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident -Misunderstanding of cleared FL and requested FL by pilot. The initial call from the a/c did not register with the controller as FL290 requesting FL310.

Precis :

Standard separation maintained.

A/C Type :	MD 80 Srs	**Occurrence Number :**	**200305326**
Flight Phase :	Taxy	**Occurrence Date :**	06 Aug 2003
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence Runway Incursion	**Location Info :**	

Pretitle :

ATC Incident - MD80 was cleared to line up after BA Airbus (A320) on the RH side, but lined up after a BA A319 that was in front and had just departed. MD80 cleared to take off followed by the A320.

Precis :

A/C Type :	B777	**Occurrence Number :**	**200305500**
Flight Phase :	Climb	**Occurrence Date :**	12 Aug 2003
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - Controller concerned about phraseology used by ATC and a/c during stepped climb on the SIDs.

Precis :

See also occ 200303756 and 200305502,

A/C Type :	B767	**Occurrence Number :**	**200305502**
Flight Phase :	Climb	**Occurrence Date :**	12 Aug 2003
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - Controller concerned of phraseology used by ATC and a/c during stepped climb on the SIDs.

Precis :

B767 on a LAM SID called 'climbing to altitude 6000ft' and controller immediately instructed B767 to stop climb at 4000ft. Phraseology used by B767 made controller unsure if a/c was climbing straight to 6000ft or step climbing to 6000ft. ATC workload increased. See also occ 200303756. Investigation continues under occ 200305500.

A/C Type :	Unknown	**Occurrence Number :**	**200305869**
Flight Phase :	Cruise	**Occurrence Date :**	26 Aug 2003
Classification :	Occurrences	**Location :**	NIBOG
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC received inadequate acknowledgements from numerous a/c when transferring them from SCACC to Oceanic frequencies at NIBOG and MIMKU.

Precis :

The controller received a variety of responses some stated "roger", others callsign only and some frequency only.

A/C Type :	B747	**Occurrence Number :**	**200305870**
Flight Phase :	Climb	**Occurrence Date :**	26 Aug 2003

Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence	**Location Info :**	5S

Pretitle :

Farnborough ATC turned C650 at 3000ft into potential conflict with B747, Heathrow outbound climbing through 2000ft. Avoiding action and traffic info issued to B747. Standard separation maintained.

Precis :

See also 200305870. R/W06 was in use by Farnborough and, due to danger area activity, it was necessary to vector departing traffic around the area. The C650 was instructed to climb straight ahead to 3000 feet after departure. The a/c called the Approach Radar controller and was identified before being placed under a RAS. The controller instructed the crew to turn right (the long way round) onto heading 275º and climb to 3000 feet. The crew questioned the direction and this was confirmed. Whilst dealing with another a/c, the controller noticed that the C650 was turning left and not right, so advised the pilot again to turn right. He then coordinated with TC and advised them what had happened. The Heathrow INT South controller took avoiding action with a B747 and maintained separation against the C650 which was subsequently vectored clear of the Heathrow RMA. CAA Closure: Appropriate ATC action taken.

A/C Type :	A320	**Occurrence Number :**	**200305876**
Flight Phase :	Taxy	**Occurrence Date :**	23 Aug 2003
Classification :	Occurrences	**Location :**	Bristol International
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

ATC Incident - After landing on R/W27 in LVP conditions and reporting 'R/W vacated' ATC told A320 to report approaching G3, but A320 subsequently crossed illuminated stop bar at G3.

Precis :

A320 landed on R/W27 in LVP conditions and reported 'R/W vacated' via Taxyway G. A320 then told by ATC to 'report approaching holding point G3', which was read back correctly. A320 was given imprecise taxy instructions, which did not specifically include the parking stand as clearance limit nor a positive routeing. A320 crossed G3 red stop bar and observed by ATC approaching West Apron. Crew confirmed A320 was now passing abeam D1 holding point. ATC asked A320 if stop bar was on and crew replied that it was not. Stop bar checked immediately. A320 then taxied past Stand 2 and stopped abeam Stand 4. A320 then cleared to park on Stand 4. Subsequently crew called ATC and stated that they believed the stop bar at G3 was illuminated, but they had been looking out for other things, due to LVP conditions. Appropriate action has been taken by ATC and a TBS Ops Notice 60/03 has been issued to all ATCOs.

A/C Type :	Falcon 2000	**Occurrence Number :**	**200306050**
Flight Phase :	Climb	**Occurrence Date :**	01 Sep 2003
Classification :	Occurrences	**Location :**	Bovingdon (BNN)
Events :	Altitude Deviation Altitude Deviation (ATC)	**Location Info :**	4 SE

Pretitle :

A Falcon 2000 allegedly failed to comply with the climb profile whilst on the CPT 5X SID. A similar incident occurred a few minutes later involving a C550, same operator.

Precis :

Falcon 2000 on the CPT 5X SID called ATC and correctly reported climbing to 3000ft and advised by ATC 'further climb shortly'. In fact Falcon 2000 should have continued its climb iaw with the SID to be at 5000ft 4nm prior to BNN, but in fact was still at 3000ft 2nm prior to BNN. It is believed that due to the ATC statement the foreign pilot may have been under the impression that further climb would be at instruction of ATC. Appropriate ATC action will be taken. The second incident which occurred a few minutes later involved a C550, same operator, ATC had instructed C550 to continue iaw with SID, but a/c continued at 3000ft for an extended period and was only passing 4000ft approximately 1nm prior to BNN. The operator is to be alerted to these incidents.

A/C Type :	MD11	**Occurrence Number :**	**200306197**
Flight Phase :	Descent	**Occurrence Date :**	07 Sep 2003
Classification :	Occurrences	**Location :**	London-Heathrow - LHR
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

Twice MD11 omitted any a/c callsign from readbacks to ATC instructions.

Precis :

A/C Type :	B737	**Occurrence Number :**	**200306239**
Flight Phase :	Descent	**Occurrence Date :**	30 Aug 2003
Classification :	Occurrences	**Location :**	Palma
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

When pilot enquired why B737 was being held, unauthorised phraseology was used by foreign controller.

Precis :

A/C Type :	Piper PA31	**Occurrence Number :**	**200307408**
Flight Phase :	Cruise	**Occurrence Date :**	24 Oct 2003

Classification :	Occurrences	**Location :**	Glasgow (GOW)
Events :	UK Airprox Airspace Infringement TCAS Report Loss of Standard Separation	**Location Info :**	9 ENE

Pretitle :
UK AIRPROX 166/2003 - Between SF340 and a PA31 9nms ENE of Glasgow at 3000ft.
Precis :
SF340 was on a RH visual approach to R/W23, when PA31 entered CTR without clearance. Traffic info given to SF340, which then took avoiding action. The incident will be subject to assessment by UKAB.
CAA Closure: Appropriate CAA action taken.

A/C Type :	B737	**Occurrence Number :**	**200307427**
Flight Phase :	Taxy	**Occurrence Date :**	26 Oct 2003
Classification :	Occurrences	**Location :**	London-Gatwick - LGW
Events :	ATC Occurrence Runway Incursion	**Location Info :**	

Pretitle :
B737 was instructed 'after the landing B737 at 2nms line up 26L at B1', which was read back. B737 subsequently observed crossing B1 stopbar. An inbound B737 was sent around. Pilot apologised.
Precis :
On handover to London pilot apologised stating B737 had only just crossed stopbar and that there was no intention of lining up on R/W26L. Pilots English reported as poor.

A/C Type :	B737	**Occurrence Number :**	**200307542**
Flight Phase :	Take Off	**Occurrence Date :**	29 Oct 2003
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :
Confusion concerning B737's take off clearance. After take off B737 called 'airborne' and ATC said that B737 had been told to cancel its take off.
Precis :
ATC lined up and cleared B737 for take off, but due to fog and icing conditions an engine run up was carried out. ATC was unaware of this requirement. At end of run up ATC said something about the take off. P2 thought ATC said 'cancel T/O', P1 thought ATC said 'confirm T/O'. P2 tried to confirm clearance with no response. B737 then reported 'rolling', again no response from ATC. After take off B737 called 'airborne' and ATC said that B737 had been told to cancel its take off. A comprehensive investigation into the incident was conducted by the operator and the relevant foreign authority departments. It looked into the ATC procedures, flight deck interpretations and phraseology, and concluded that the failure of the B737 to stop underlined the need for extreme vigilance in all runway operations. The incident also highlighted the matter of cross cockpit authority and assertiveness. It was recommended that the use of the phrase "take off" in an instruction to stop be raised with the appropriate phraseology authority, and that the foreign ATC review its rules for issuance of take off clearance in LVPs.
CAA Closure: Appropriate operator action taken.

A/C Type :	B737	**Occurrence Number :**	**200308270**
Flight Phase :	Descent	**Occurrence Date :**	03 Nov 2003
Classification :	Occurrences	**Location :**	Paris CDG
Events :	Airprox - Foreign TCAS Report	**Location Info :**	

Pretitle :
Foreign AIRPROX - B737 and unknown a/c. Subject to investigation by the French authority.
Precis :
B737 was cleared to establish ILS R/W26L, when an a/c was noticed on TCAS South of ILS, 1000ft above and tracking to same point on ILS centreline. Other a/c started to descend, which was queried with ATC. ATC stated that a/c was joining same ILS 1000ft above. B737 informed ATC that a/c was descending. A/c continued its descent and ATC turned B737 North and told other traffic to fly 180deg. Autopilot disconnected. B737 was visual with traffic at all times. ATC then cleared B737 which was now 17nm from airfield to descend to 1000ft, this was queried and B737 was recleared to 2000ft. The French investigation into this AIRPROX revealed that it was caused by "the descent at 3000 feet (instead of 4000 feet) of the other a/c, after an ambiguous phraseology for a traffic information". Contributing factors were the choice of runways : the B737 was arriving from the North for the southern runways and the other a/c routing from the South for the northern. The sector was also overloaded. Appropriate follow up action has been taken by the French authorities.

A/C Type :	B737	**Occurrence Number :**	**200308762**
Flight Phase :	Taxy	**Occurrence Date :**	17 Dec 2003
Classification :	Occurrences	**Location :**	Stansted
Events :	ATC Occurrence	**Location Info :**	

Runway Incursion

Pretitle :

B737 was given a conditional line up clearance from R3 holding point after a landing B737, but then observed to have crossed red stop bar ahead of a landing B737. Inbound B737 instructed to go around.

Precis :

Inbound B737 at approximately 2nms on final approach to R/W23 was cleared to land. Another B737 was given a conditional line up clearance from R3 holding point to 'line up after landing traffic and be ready immediately'. B737 subsequently observed to have crossed red stop bar ahead of landing B737 and instructed to hold position. Both pilots believed initial instruction was 'line up and be ready immediately'. Inbound B737 instructed to go around. Investigation revealed co-ordination errors in handling the missed approach by the Tower controller, which are being dealt with at local level.

A/C Type :	GD Eqp Svs	**Occurrence Number :**	**200308822**
Flight Phase :	Not Applicable	**Occurrence Date :**	15 Dec 2003
Classification :	Occurrences	**Location :**	Belfast (BEL)
Events :	ATC Occurrence Ground (AD) Occurrence	**Location Info :**	

Pretitle :

Military bowser wanting to cross R/W17 failed to follow ATC instructions to stop at J2 Hold. Bowser told to stop as there was an HS748 on its take off run. Bowser stopped and HS748 took off.

Precis :

Fuel bowser requested crossing clearance of R/W17 as HS748 was departing R/W17. Vehicle instructed to hold position, but subsequently observed crossing J2 Hold at which point controller told vehicle to stop immediately. Vehicle stopped beyond holding point, but clear of R/W. HS748 continued its take off run. The military have taken appropriate local action.

A/C Type :	Fokker 70	**Occurrence Number :**	**200309049**
Flight Phase :	Climb	**Occurrence Date :**	22 Dec 2003
Classification :	Occurrences	**Location :**	Humberside
Events :	ATC Occurrence	**Location Info :**	

Pretitle :

After take off from R/W21, FK70 did not make expected left turn and reported heading 210deg. It is believed that foreign crew misinterpreted R/W number as a heading. Standard separation maintained.

Precis :

After FK70 became airborne from R/W21, it called climbing from 2000ft to FL230. FK70 identified and placed under a RAS. FK70 was expected to turn left after departure direct to OTBED to join CAS, but reported continuing on R/W heading of 210deg. FK70 was cleared to turn left to OTBED. It appears the foreign crew misinterpreted R/W21, given in its take off clearance, as a heading.

A/C Type :	EMB 145	**Occurrence Number :**	**200400027**
Flight Phase :	Climb	**Occurrence Date :**	01 Jan 2004
Classification :	Occurrences	**Location :**	Milan Malpensa
Events :	Foreign ATC Occurrence	**Location Info :**	20 W

Pretitle :

After departing R/W35R and passing FL110 heading towards RMG, EMB145 was recleared to FL190 and 'when able' direct AOSTA. Reporter believes this was an ambiguous clearance in a mountainous area.

Precis :

A/C Type :	B747	**Occurrence Number :**	**200309114**
Flight Phase :	Climb	**Occurrence Date :**	30 Dec 2003
Classification :	Occurrences	**Location :**	Tokyo
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

B747 believed it had been cleared to climb to FL310, but approaching 7000ft on the SID it was clear this was not correct. B747 levelled at 7000ft iaw SID and clarification from ATC was sought.

Precis :

ATC had difficulty in understanding the crew's query over the clearance. Reporter states that if the ATC unit had given an initial clearance of "Expect FL310" the incident would have been avoided.

A/C Type :	A320	**Occurrence Number :**	**200400381**
Flight Phase :	Taxy	**Occurrence Date :**	14 Jan 2004
Classification :	Occurrences	**Location :**	Copenhagen
Events :	Foreign ATC Occurrence	**Location Info :**	

Pretitle :

Misunderstanding over ATC taxi clearance during taxy for departure from R/W04R.

Precis :

A320 had been de-iced in pan on Taxyway A and cleared by ATC to join 'Taxyway Alpha, hold short R/W30 as a/c landing on R/W30'. Tower cleared A320 'to enter R/W30, to the right to join Taxyway Charlie'. A320 crossed

R/W30 with landing traffic at 7nm and joined Taxyway Foxtrot. Controller had expected A320 to enter R/W, complete a 150deg turn and join Taxyway Charlie. Having joined Taxyway Foxtrot, A320 rejoined a queue for crossing R/W30 for departure from R/W04R. The Danish investigation revealed that the instructions given were "Cross R/W 30 via right turn to join Taxiway C". The controller realised afterwards that the word cross was misplaced and led to the misunderstanding, since he wanted the a/c to enter the runway, make a 150 degrees turn to the right and leave the runway on Taxiway C. In conclusion this incident was caused by inappropriate phraseology leading to a misunderstanding. Safety was not compromised.

Number of Records : 143

APPENDIX E: ATC Demographic Data Collection Questionnaire

SECTION A : PERSONAL PARTICULARS

This section is to gather information for a general demographic analysis. Identifying information is necessary for record keeping but will not be included in analysis.

Please fill in the blanks and tick ✓ or shade ☐ as appropriate.

1. Name :
2. ATC Licence Number : DCA / ATC / L
3. Gender: Male ☐ Female ☐
4. Age: 20 – 25 ☐ 26 – 29 ☐ 30 – 39 ☐ 40 – 49 ☐ 50+ ☐
5. Service: less than 3 yrs ☐ 4 – 6 yrs ☐ 7 – 10 yrs ☐ 11 – 15 yrs ☐ 16 – 20 yrs ☐ more than 20 yrs ☐
6. Station: Area Control Centre ☐ Aerodrome ☐ ATC College ☐ Headquarters ☐
7. Ethnic Group Malay ☐ Chinese ☐ Indian ☐ Other ☐ **……………………***(please specify)*
8. Academic Qualification PhD ☐ Masters ☐ University Degree ☐ Diploma ☐ High School ☐
9. Language(s): (frequently used) **i.**...................................... **ii.**.................................... **iii.** ……………………………..
10. ATC Ratings: ☐ None ☐ Aerodrome Control ☐ Approach Procedure Control ☐ Approach Radar Control ☐ Area Procedure Control ☐ Area Radar Control
11. ATC Operations Experience & Duration ☐ Aerodrome Controller ……………………… years ☐ Approach Procedure Controller ……………………… years ☐ Approach Radar Controller ……………………… years ☐ Area Procedure Controller ……………………… years ☐ Area Radar Controller ……………………… years ☐ None
12. Additional ATC Experience ☐ DCA Airport Manager …………………… years ☐ ACC Supervisor …………………… years ☐ SATCO …………………… years ☐ College Instructor …………………… years ☐ Training Officer …………………… years ☐ ATCO Examiner …………………… years
13. Courses Attended in 2004 ☐ ATC Primary Course ☐ ATC Rating courses ☐ Flow Control ☐ Aviation English ☐ Search and Rescue ☐ Human Factors ☐ PANS-OPS Design ☐ Safety Management ☐ Others ………………………………………………*(please specify)*

SECTION B : ENGLISH LANGUAGE PROFICIENCY TESTS

This section is about your experience in English Language Proficiency Tests; either locally or internationally recognised. You may have taken a test more than once for different purposes. Please provide following information for test(s) that you have taken.

1. Language Testing System (IELTS)

Tick ✓ or shade as appropriate

Year	Purpose	Overall Rating
		①②③④⑤⑥⑦⑧⑨
		①②③④⑤⑥⑦⑧⑨
		①②③④⑤⑥⑦⑧⑨

☐ Never taken this examination.

2. Test of English as a Foreign Language (TOEFL)?

Year	Purpose	Score

☐ Never taken this examination.

3. Test of English for International Communications (TOEIC)?

Year	Purpose	Result

☐ Never taken this examination.

4. Others.

Test(s)	Year	Purpose	Result

SECTION C : AVIATION ENGLISH AND ATC COMMUNICATION TRAINING

This section is about the training provided to you pertaining to your career as Air Traffic Controllers. We are interested in information relevant to Aviation English, Radiotelephony and ATC Communications training in preparation for using English Language in daily work functions.

1. Did you receive any training for:

Please ✓ as appropriate

	Yes	**No**
Aviation English		
Standard Phraseology		
Radiotelephony		
ATC communication		

2. Was the training conducted as,

Please ✓ as appropriate

	part of another ATC training course	a separate training course
Aviation English		
Standard Phraseology		
Radiotelephony		
ATC communication		

3. Indicate if the training format included any of the following:

Please ✓ as appropriate.

	AE	**SP**	**RT**	**Comms**
Classroom lectures				
Simulator exercises				
Public speaking				
Verbal communicational skill				
Listening exercises				
Real radiotelephony examples				
Visits to ATC workstations				
Peer role play exercises				
Interactive computerised exercises				
Handling of unexpected events				
Language proficiency tests				

Key: **AE = Aviation English**
SP = Standard Phraseology
RT = Radiotelephony
Comms = ATC Communications

4. Indicate if the training materials provided to you included:

Please ✓ or ✗

Aeronautical Information Publication	
Manual of Air Traffic Services	
ICAO's DOC 4444	
ICAO ANNEX 10 Vol. II	
Manual of Radiotelephony (DOC 9432)	
Filed differences (by any contracting state) to ICAO standard phraseology	
Locally used terms that may differ from ICAO's	
Work-relevant commonly used plain English words	
Potentially confusing words/ phraseology/ numbers	
Specific pronunciation of numbers	
Audio samples of real radiotelephony	
Relevant terminology for potential un-expected events	

5. How would you evaluate the training course in terms of improvement to Phraseology / English Language in:

Scale: 1 = very little (further general training will be needed)
2 = adequate (training prepared you for basic daily job function)
3 = good (further specific training not immediately required)
4 = very good (able to handle unfamiliar situations)

Please ✓ or shade as appropriate

Vocabulary of aviation related words	① ② ③ ④
Vocabulary of specific ATC related words	① ② ③ ④
Glossary of ICAO phraseology	① ② ③ ④
Ability to use correct standard phraseology	① ② ③ ④
Awareness of words with multiple meanings	① ② ③ ④
Awareness of phraseologies that may cause misunderstanding	① ② ③ ④
Correct and clear pronunciation	① ② ③ ④
Recognition of regional / cultural English accents	① ② ③ ④
Conversational fluency	① ② ③ ④
Ability to paraphrase	① ② ③ ④

6. How would you rate the facilitators and instructors of the Aviation English and ATC Communication training at the DCA College, in terms of,

Please ✓ or shade as appropriate

Teaching techniques	poor	① ② ③ ④	excellent
English Language fluency		① ② ③ ④	
Knowledge of English Language		① ② ③ ④	
Knowledge of standard phraseology		① ② ③ ④	
Knowledge of ATC topics		① ② ③ ④	
Familiarity with ATC operations		① ② ③ ④	
Time management		① ② ③ ④	
Use of teaching aids		① ② ③ ④	

SECTION D : RADIOTELEPHONY OPERATIONS AND PRACTICES

This section seeks your opinion based on observation of routine/daily radiotelephony practises, in terms of problematic areas and the seriousness of such problems.

Please circle between 0% (=never) and 100% (=always)

1. Indicate a percentage of the time within an average shift (6 hours) that controllers use;

Standard phraseology	0 10 20 30 40 50 60 70 80 90 100
Non-standard phraseology	0 10 20 30 40 50 60 70 80 90 100
Plain English words and phrases	0 10 20 30 40 50 60 70 80 90 100
National language (non English)	0 10 20 30 40 50 60 70 80 90 100
Local ‘terms’ or ‘jargon’ understood only by frequent/ local operators in your airspace	0 10 20 30 40 50 60 70 80 90 100
Sum total	100 %

2. Sometimes, the accent or style of English usage differs between regions/ nationalities and modifications is made to improve understanding. How often does a controller need to;

Change ‘style’ of language use	0 10 20 30 40 50 60 70 80 90 100
Modify or amend standard phrases	0 10 20 30 40 50 60 70 80 90 100
Reduce speech rate	0 10 20 30 40 50 60 70 80 90 100
Repeat complete instructions	0 10 20 30 40 50 60 70 80 90 100

3. With regards to mandatory readback of ATC instructions and information issued to aircraft; how often does a controller receives;

Complete readbacks	0 10 20 30 40 50 60 70 80 90 100
Incomplete readbacks (correct but some information omitted)	0 10 20 30 40 50 60 70 80 90 100
Incorrect readbacks (full or partial, but wrong information)	0 10 20 30 40 50 60 70 80 90 100
No readbacks (no information repeated – a readback had to be requested)	0 10 20 30 40 50 60 70 80 90 100

4. There are cases where interference or interruptions had resulted in a message not fully received or understood by pilots. How often does a pilot request verification / repetition of;

Whole message	0 10 20 30 40 50 60 70 80 90 100
Taxi route	0 10 20 30 40 50 60 70 80 90 100
Traffic sequence for lining up	0 10 20 30 40 50 60 70 80 90 100
Assigned headings	0 10 20 30 40 50 60 70 80 90 100
Authorised level	0 10 20 30 40 50 60 70 80 90 100
Speed restrictions	0 10 20 30 40 50 60 70 80 90 100
Altimeter setting	0 10 20 30 40 50 60 70 80 90 100
Time restrictions (eg. Slot time)	0 10 20 30 40 50 60 70 80 90 100

SECTION E: SAFETY OCCURRENCES

1. Please indicate (✓) your experience within the last 3 months of any misunderstanding or miscommunication due to:

	< 5	5 - 10	10 - 15	>15
Usage of non-standard phraseology				
Usage of plain English words or phrases				
Poor level of English				
Unclear pronunciations				
Technical difficulties				
Non-verification of unclear instructions				
Non-verification of unclear information				

2. How many times have misunderstandings or miscommunications resulted in:

Increased communications task load	
Increased ATC workload	
Loss of situational awareness (traffic visualisation)	
Loss of separation	
Aircraft proximity	
Runway incursion	
Any other safety related events	

SECTION F : OTHER COMMENTS / INFORMATION

Thank you for your feedback and cooperation. If you are interested in the outputs from the research, please insert your e-mail address below.

APPENDIX F: AIR TRAFFIC CONTROLLERS' DEMOGRAPHIC DATABASE

ID	CONSENT	GENDER	AGE	SERVICE	UNIT	ETHNIC	ACADEMIC	ENGLISH	RATINGS	XPR_ADR	XPR_APP	XPR_APR	XPR_ARP	XPR_ARR	XPR_MGR	XPR_SPV	XPR_SAT	XPR_INS	XPR_TRO	XPR_XMR	MngtEx	COS_04	IELTS	TOEFL	TOEIC	OTR_TEST	TRNG_AE	TRNG_STDP	TRNG_RTF	TRNG_COMS	AE_LECT	AE_SIM	AE_PUB	AE_COMSKL	AE_LISTN	AE_AUDIO	AE_VST	AE_ROLE	AE_COMPTR	AE_UNEXPCTD	AE_TEST	STDP_LECT	STDP_SIM	STDP_PUB	STDP_COMSKL	STDP_LISTN	STDP_AUDIO	STDP_VST	STDP_ROLE	STDP_COMPTR	STDP_UNEXPCTD	STDP_TEST	RTF_LECT	RTF_SIM	RTF_PUB	RTF_COMSKL	RTF_LISTN	RTF_AUDIO	RTF_VST	RTF_ROLE	RTF_COMPTR	RTF_UNEXPCTD	RTF_TEST	COMS_LECT	COMS_SIM	COMS_PUB	COMS_COMSKL	COMS_LISTN	COMS_AUDIO	COMS_VST	COMS_ROLE	COMS_COMPTR	COMS_UNEXPCTD	COMS_TEST	TRNG_AIP	TRNG_MATS
32	Y	M	5	6	A	M	H	1	4	5	5	0	2	0	3	4	3	7	2	0	19	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y
84	N	M	5	6	A	C	H	1	5	7	8	4	8	7	8	2	4	2	6	0	22	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N
87	Y	M	5	6	A	I	H	1	5	4	0	18	0	0	0	9	0	0	6	4	19	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y	Y	Y	N	N	N	Y	N	Y	Y
94	N	M	5	6	A	C	H	3	5	3	1	20	6	6	0	4	0	0	1	10	15	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
95	Y	M	5	6	A	I	H	1	4	0	0	20	25	20	0	0	0	0	0	6	6	OJT	0.0	0	0	N	N	N	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
100	Y	M	5	6	A	I	H	1	5	20	20	20	18	18	0	0	0	0	15	3	18	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	Y
120	Y	M	4	6	A	O	H	1	5	20	20	18	22	20	8	5	3	1	0	0	17	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
123	Y	M	4	5	A	I	U	1	5	2	2	6	18	12	0	1	0	0	18	4	23	OJT	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y
180	Y	M	5	6	A	I	H	1	5	20	11	11	25	25	2	0	0	2	2	2	8	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	Y	Y
188	Y	M	4	6	A	C	M	1	5	3	2	10	2	10	3	0	0	0	0	0	3	HF	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
191	Y	M	5	6	A	C	H	1	5	20	20	10	15	15	0	0	Y	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	N	N	N	N	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	N	Y	Y
200	Y	M	4	6	A	I	H	1	5	14	11	0	8	6	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y
202	Y	M	5	6	A	I	H	1	4	12	11	0	6	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
207	Y	M	4	6	A	M	D	1	5	20	10	3	14	13	2	0	4	0	0	0	6	FC	0.0	0	0	N	YP	YS	YS	YS	Y	Y	Y	N	N	N	Y	N	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	N	Y	Y	N	Y	N	N	Y	Y	N	N	N	N	N	N	Y	N	N	Y	Y	N	N	Y	N	N	Y	Y
208	Y	M	4	6	A	M	D	1	5	20	20	1	9	8	0	0	0	0	0	1	1	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y	Y	Y	N	N	N	Y	N	Y	Y	N	Y	Y	Y	N	N	N	Y	N	Y	Y
213	N	M	5	6	A	M	H	1	5	14	4	3	3	4	2	0	0	0	3	2	7	FC	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y
222	Y	M	4	5	A	M	D	2	5	18	10	2	10	8	3	0	5	0	0	2	10	FC	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
233	Y	M	4	5	A	M	D	1	5	19	10	4	9	9	0	0	0	0	4	4	8	OJT	0.0	0	0	N	YS	YP	YP	YP	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y	N	Y	N	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
235	Y	F	4	5	A	M	D	2	1	0	0	0	16	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
273	Y	M	4	6	A	M	H	1	3	2	3	0	5	0	1	0	0	0	0	0	1	R	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y
282	Y	M	4	6	A	M	D	2	2	12	0	0	8	0	0	0	0	0	0	0	0	R	0.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
285	Y	M	4	6	A	C	H	1	3	14	4	0	5	2	0	0	0	0	0	0	0	N	0.0	6	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	N	N	N	Y	N	N	N	Y	Y
365	Y	M	3	4	A	M	D	2	3	10	10	0	3	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
376	N	M	5	6	B	M	H	2	3	15	1	0	1	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
394	Y	M	4	4	A	M	D	2	3	6	6	0	5	0	0	0	4	0	0	0	4	SM	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
437	Y	M	5	6	A	M	H	1	1	0	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
450	Y	M	4	5	A	M	H	2	1	12	0	0	0	0	0	0	0	0	0	0	0	SM	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	Y	Y	N	Y	N	N	Y	Y	N	N	N	Y	N	N	Y	N	Y	Y	Y	Y	N	N	N	Y	N	Y	N	Y	N	Y	N	N	Y	N	N	Y	Y	Y	Y	N	Y	Y
460	Y	F	3	3	A	M	U	2	2	0	0	0	7	2	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	Y	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
463	Y	M	3	3	A	M	U	2	2	0	0	0	8	7	0	0	0	0	7	0	7	R	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y
467	Y	M	4	3	A	I	U	1	2	0	0	0	8	8	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	N	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y
470	Y	F	3	3	A	M	U	2	2	0	0	0	8	7	0	0	0	0	0	0	0	OJT	0.0	500	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y
471	Y	M	4	6	A	M	H	2	1	4	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	Y	N	N	Y	N	Y	N	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	Y	Y
519	Y	F	3	3	B	M	D	2	2	8	0	0	0	0	0	0	0	0	5	0	5	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	N	N	N	N	Y	Y
522	Y	M	3	2	A	M	U	2	2	0	0	0	5	1	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y
524	Y	F	3	3	A	M	U	1	2	0	0	0	6	4	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y
525	Y	M	3	3	A	M	U	2	2	0	0	0	7	4	0	0	0	0	7	0	7	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	Y	N	Y	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	N	N	Y	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	N	N	Y	N	Y	Y	N	Y	N	Y	Y
539	Y	M	3	3	B	M	D	1	2	8	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
540	Y	M	3	3	B	M	D	2	1	4	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	N	YP	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
555	Y	F	3	3	A	M	M	2	5	0	0	1	7	7	0	0	0	0	0	0	0	R	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y
594	Y	F	3	2	A	M	U	2	2	0	0	0	5	3	0	0	0	0	0	0	0	SAR	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
595	Y	F	3	2	A	M	D	2	2	2	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y
609	Y	M	3	3	A	M	U	2	2	2	0	0	7	6	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	N	N	N	Y	N	Y	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
624	Y	M	3	2	A	M	U	2	1	0	0	0	6	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	Y	Y	N	N	N	N	N	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y
627	Y	F	3	3	A	M	U	2	3	3	0	0	6	5	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
662	Y	M	3	2	B	M	D	2	1	1	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
680	N	M	2	2	B	M	D	1	1	6	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YS	YS	YS	Y	N	N	Y	Y	N	Y	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	Y	Y
683	Y	F	2	2	B	M	D	2	1	2	1	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	N	N	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	Y	Y	N	Y	N	Y	N	Y	Y
727	N	M	2	2	A	M	H	2	2	1	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
728	N	M	3	3	A	M	H	2	1	0	0	0	0	0	0	0	0	0	2	0	2	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	N	Y	N	Y	N	N	N	Y	N	Y	N	Y	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	Y	Y
825	Y	M	2	1	A	M	U	2	1	0	0	0	2	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
827	Y	M	1	1	A	M	M	1	1	0	0	0	1	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y
828	N	F	2	1	A	M	U	2	1	0	0	0	1	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y
830	Y	M	2	1	A	M	U	1	1	0	0	0	2	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y
832	Y	F	3	1	A	M	U	1	1	0	0	0	0	0	0	0	0	0	0	0	0	RVSM	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	N	Y	Y
834	Y	M	2	1	A	M	U	2	1	0	0	0	1	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	Y	Y	Y	N	Y	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
862	Y	F	1	1	A	O	D	1	2	1	1	0	0	0	0	0	0	0	0	0	0	R	0.0	0	0	N	YS	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y
866	Y	M	3	3	A	M	H	2	1	0	0	0	0	0	0	0	0	0	0	0	0	FDP	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	N	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	Y	N	Y	N	N	N	Y
868	Y	F	2	3	A	M	H	2	1	0	0	0	0	0	0	0	0	0	0	0	0	FDP	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	N	N	Y	N	N	N	Y	Y	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N	N	N	N	Y	N	N	N	Y	N	Y	N	N	N	N	Y	N	N	N	Y	Y	Y
869	Y	F	3	3	A	O	H	2	0	0	0	0	0	0	0	0	0	0	0	0	0	FDP	0.0	0	0	N	N	YP	YP	YP	N	N	Y	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	Y	Y
870	Y	M	2	3	A	M	H	2	1	0	0	0	0	0	0	0	0	0	0	0	0	FDP	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	N	N	Y	Y
884	Y	F	2	3	A	M	H	2	1	0	0	0	0	0	0	0	0	0	0	0	0	FDP	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	Y	Y	N	N	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y
885	Y	F	2	3	A	M	H	2	1	0	0	0	0	0	0	0	0	0	0	0	0	FDP	0.0	0	0	N	YP	YP	YP	YP	Y	N	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	Y	Y
901	Y	M	3	3	A	M	H	2	2	0	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	Y	Y	N	N	N	N	N	Y	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y
N	Y	M	3	3	A	M	H	2	0	0	0	0	0	0	0	0	0	0	0	0	0	AE	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	N	Y	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N	Y	N	N	N	Y	N	Y	Y	N	N	Y	Y
N	Y	M	4	3	A	M	D	2	0	0	0	0	0	0	0	0	0	0	0	0	0	Pr	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	Y	Y
125	Y	M	4	5	A	M	U	2	5	9	9	1	10	8	8	0	0	0	6	8	22	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	Y	Y
118	Y	M	4	5	D	M	M	2	2	0	0	0	8	0	0	0	0	0	0	0	0	N	6.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
126	Y	M	4	5	D	M	M	2	5	13	0	9	18	15	0	3	0	0	0	3	6	N	7.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	N	Y	N	N	N	Y	Y
209	Y	M	4	5	D	M	D	1	5	6	6	5	2	2	0	1	0	0	0	2	3	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y
466	Y	M	4	3	D	C	M	1	4	0	0	0	6	6	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
249	Y	M	4	5	D	M	M	2	5	17	17	5	10	10	0	0	0	0	0	3	3	SM	0.0	0	0	Y	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y	N	Y	N	N	N	Y	Y

206	Y	M	4	5	D	M	D	2	5	8	8	4	3	3	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
111	Y	M	4	5	D	M	U	2	2	0	0	0	3	2	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	Y	N	Y	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y
99	N	M	5	6	C	I	M	1	5	6	4	20	4	3	0	0	0	13	0	0	13	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	N	N	Y	Y
103	Y	M	4	6	C	M	M	2	2	0	0	0	20	18	0	0	0	2	0	0	2	TrM	7.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y
108	N	M	4	5	C	I	M	1	5	5	1	14	10	10	0	0	0	5	0	0	5	N	8.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	Y	N	N	Y	N	N	N	Y	Y	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	Y	Y
146	N	M	4	5	C	C	U	1	5	13	13	1	13	5	0	3	0	5	2	5	15	N	0.0	0	0	N	YS	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y
192	Y	M	5	6	C	I	H	1	5	4	6	11	6	4	0	0	0	9	0	0	9	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Y	N	Y	Y
104	Y	M	4	6	D	M	M	2	5	5	5	15	12	10	0	8	0	0	15	3	26	N	6.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	Y	N	N	N	Y	N	N	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y
114	Y	M	4	6	D	M	M	2	5	2	0	14	14	14	0	3	0	0	0	4	7	AE	7.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	Y	N	N	Y	N	N	Y	N	N	N	N	Y	N	Y	Y
115	Y	M	4	5	D	M	M	2	2	0	0	0	5	2	0	0	0	0	0	0	0	DG	6.5	0	0	N	Y	YP	YP	YP	Y	N	N	N	N	N	N	N	N	N	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y
127	Y	M	4	5	D	M	M	2	5	2	18	18	5	5	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
223	Y	M	4	6	D	M	D	1	5	5	2	5	3	5	2	1	5	0	5	1	14	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y
N	Y	M	3	3	D	M	U	2	0	0	0	0	0	0	0	0	0	0	0	0	0	O	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
336	Y	M	4	6	B	O	H	1	3	26	3	0	1	0	21	0	0	0	0	0	21	O	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
496	Y	M	3	3	B	O	H	1	2	9	1	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
77	Y	M	5	6	D	M	H	2	1	8	8	10	3	10	0	2	2	14	0	5	23	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	Y	N	Y	N	Y	Y	N	N	N	Y	Y	Y	N	Y	N	Y	Y	N	N	N	Y	Y	Y	N	Y	N	Y	Y
68	N	M	5	6	A	M	H	2	5	5	5	9	9	5	0	5	1	5	5	0	16	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y
135	Y	M	5	6	A	C	D	1	5	20	30	10	30	10	6	6	15	0	5	10	42	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y
157	Y	M	5	6	A	C	H	1	5	20	30	10	30	10	0	10	10	0	5	10	35	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	Y
162	Y	F	5	6	A	C	H	1	5	28	23	8	21	8	0	6	2	0	0	10	18	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	Y	Y	N	Y	Y	N	N	N	Y	Y	N	Y	Y	N	Y	Y	N	N	N	Y	N	N	Y	N	N	Y	Y
165	Y	F	4	5	A	C	U	1	5	17	17	17	17	17	0	5	0	0	3	2	10	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	N	Y	N	N	N	Y	Y	N	N	N	N	Y	Y
166	Y	M	4	5	A	C	U	1	5	16	10	1	1	1	16	0	0	0	0	16	32	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
171	Y	M	4	5	A	C	U	1	5	8	14	9	14	9	0	10	2	0	0	9	21	AvM	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	Y	Y	Y	Y	N	N	Y	N	N	N	Y	Y	Y	Y	Y	N	Y	Y
319	Y	M	5	6	A	C	H	1	5	35	30	8	25	8	1	2	2	0	5	0	10	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
324	Y	F	4	6	A	C	H	1	5	0	0	8	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	N	Y	N	Y	N	Y	N	Y	Y	N	Y	N	Y	N	Y	N	Y	N	Y	Y	N	Y	N	Y	N	Y	N	Y	N	Y	Y
387	N	F	3	5	B	M	H	2	2	12	12	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	Y	Y
548	N	M	3	3	B	M	D	2	2	7	2	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	N	F	5	6	A	C	H	1	5	20	2	0	1	0	10	0	10	0	10	0	30	R	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	Y
N	N	F	4	6	A	C	H	0	3	25	0	0	10	10	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
N	Y	M	4	5	A	M	U	1	5	16	12	8	16	8	0	2	0	0	10	4	16	SM_FC	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y
N	N	F	3	4	B	O	H	1	2	10	3	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
N	N	M	3	4	A	C	D	0	2	15	0	0	5	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y
N	N	F	3	3	A	M	U	1	3	0	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
N	N	F	2	3	B	O	H	2	0	0	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y
N	N	M	2	3	B	M	H	2	1	9	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y
N	N	F	2	3	B	O	H	2	1	4	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y
N	N	F	3	2	A	M	U	1	2	0	0	0	2	3	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y
298	Y	M	5	6	B	O	H	1	5	24	24	9	20	9	1	4	0	0	10	3	18	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
383	Y	M	4	5	B	M	H	2	2	11	11	0	0	0	0	0	1	0	3	3	7	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y
412	Y	M	4	5	B	O	H	2	3	14	14	0	0	0	0	0	3	0	0	3	6	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	Y	N	Y	N	Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y
414	Y	F	3	4	B	O	H	2	2	9	9	0	0	0	0	0	1	0	0	1	2	N	5.5	520	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
552	Y	M	4	5	B	M	H	1	1	0	10	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	N	Y	N	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y
677	Y	M	2	2	B	M	D	1	2	6	6	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	N	N	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
685	Y	M	2	2	B	M	D	2	6	6	0	0	0	0	0	0	0	0	5	0	5	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
886	Y	M	2	2	B	O	D	0	2	1	1	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
887	Y	M	1	1	B	M	D	2	2	1	1	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	MUET_3	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	Y	N	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
710	Y	M	2	2	B	M	D	1	2	5	5	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	N	N	Y	N	N	N	N	Y	Y	N	Y	N	N	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
264	Y	M	4	6	B	M	H	2	5	24	24	0	0	0	5	0	0	0	0	5	10	PM	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y	N	N	N	Y	Y	Y	N	N	N	Y	Y
378	Y	M	5	6	B	M	H	2	2	10	10	0	0	0	0	0	9	0	9	9	27	R	0.0	0	0	N	YS	YP	YP	YP	Y	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	Y
452	Y	M	3	3	B	M	D	2	2	9	9	0	0	0	0	0	0	0	0	0	0	SM	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	N	Y	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Y	N	Y	N	N	Y	N	Y	Y
456	Y	M	3	3	B	M	D	2	2	8	8	0	0	0	0	0	0	0	5	0	5	OJT	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
504	Y	M	2	3	B	M	D	2	2	8	8	0	0	0	0	0	0	0	5	0	5	OJT	0.0	0	0	N	YS	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
589	Y	M	2	3	B	M	D	2	2	7	7	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
640	Y	M	2	3	B	M	D	2	2	7	7	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	N	Y	Y	Y	Y	N	Y	N	N	Y	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	Y	N	N	Y	N	Y	Y
693	Y	F	2	2	B	M	D	0	2	5	5	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
721	Y	F	2	2	B	M	D	2	2	4	4	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	N	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	Y	N	N	N	N	Y	Y
876	Y	F	1	1	B	M	D	2	2	2	2	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
874	Y	F	1	1	B	M	D	2	2	1	1	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	N	Y	N	Y	N	N	Y	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	N	Y	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	Y	Y
291	Y	M	4	6	B	M	H	2	3	20	5	0	0	0	1	0	1	0	1	1	4	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y
377	N	M	5	6	B	M	H	2	2	10	10	0	0	0	0	0	0	0	10	0	10	SM	0.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
422	Y	M	4	6	B	M	H	2	1	10	0	0	0	0	0	0	4	0	0	0	4	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
487	N	M	3	3	B	M	H	2	2	5	5	0	0	0	0	0	0	0	0	0	0	AE	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y
663	N	M	3	2	B	M	D	2	2	4	4	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
N	N	M	3	3	B	M	D	2	2	7	3	0	0	0	0	0	4	0	0	0	4	AE	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
N	N	0	0	0	B	0	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
259	Y	M	4	6	B	M	H	2	3	23	23	0	0	0	0	0	0	0	0	0	0	OJT	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y
841	Y	M	2	1	B	M	D	1	2	2	2	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	MUET_4	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
842	Y	M	2	1	B	M	D	2	2	1	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
375	Y	M	4	6	B	I	H	1	2	14	14	0	0	0	0	0	6	0	5	4	15	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
395	Y	F	3	4	B	M	U	2	2	10	10	0	0	0	0	0	0	0	10	0	10	OJT	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	Y
543	Y	M	3	3	B	M	D	2	2	7	5	0	0	0	0	0	0	0	2	0	2	OJT	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
N	Y	M	3	2	B	M	D	1	2	6	6	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
669	Y	M	3	2	B	M	D	2	2	5	5	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	N	N	Y	Y	N	N	N	Y	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	N	N	N	N	N	Y	N	Y	Y
840	Y	M	1	1	B	I	D	1	2	2	2	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	MUET_2	YS	YP	YP	YP	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	Y	N	N	Y	Y
289	N	M	4	6	B	M	H	1	3	25	25	0	1	0	1	0	10	0	10	5	26	N	0.0	0	0	N	Y	YP	YP	YP	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
520	Y	F	3	3	B	M	D	2	2	7	7	0	0	0	0	0	0	0	0	0	0	OJT	0.0	0	0	N	Y	N	N	N	Y	N	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
206	Y	M	4	5	A	M	D	2	5	9	9	3	6	6	4	0	0	0	0	6	10	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
292	Y	M	4	6	A	I	H	1	3	17	14	0	0	0	0	0	0	0	12	0	12	R	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	Y	N	Y	Y
379	Y	M	4	6	A	I	H	1	4	10	10	0	5	1	0	0	0	3	3	0	6	R	0.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y

436	Y	F	4	6	B	O	H	1	1	8	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	N	N	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	Y
440	Y	M	4	6	B	I	H	1	1	10	0	0	0	0	0	0	0	0	0	0	0	R	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	Y
492	N	M	3	3	A	M	D	2	2	9	2	0	0	0	0	0	0	0	0	0	0	PO	0.0	0	0	N	YP	YP	YP	YP	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	Y	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y
533	Y	M	3	3	B	M	D	1	2	7	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	N	N	N	N	Y	N	Y	Y	N	Y	Y	N	N	N	N	Y	N	Y	Y	N	Y	Y	N	N	N	N	Y	N	Y	Y
591	N	M	2	2	B	M	U	2	1	6	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	N	N	N	N	N	N	Y	N	N	Y	N	N	Y	N	Y	Y	N	Y	Y	N	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	N	Y	N	Y	Y
457	Y	M	3	B	M	D	2	3	9	9	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	Y	N	N	N	N	N	Y	Y	N	Y	Y	Y	N	N	N	N	N	Y	Y	N	N	Y	Y	N	N	N	N	N	Y	Y	N	N	Y	Y	N	N	N	N	N	Y	Y
515	Y	M	3	3	B	M	D	2	2	6	6	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	N	Y	Y	Y	Y	N	N	N	N	Y	N	N	Y	Y	Y	Y	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	N	N	Y	Y	Y	Y	Y	N	N	N	Y	Y
499	Y	M	3	3	B	M	D	2	2	7	7	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	Y	N	N	N	Y	Y	Y	N	Y	Y	N	Y	N	N	N	N	N	Y	N	Y	N	N	Y	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y	N	N	N	N	N	Y	Y	Y
106	N	M	4	6	B	M	U	2	5	8	8	0	10	10	5	0	0	0	0	8	13	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	N	N	N	N	N	N	Y	Y	N	Y	Y
670	Y	M	3	2	B	M	D	2	2	5	5	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	N	Y	N	Y	Y	Y	N	Y	Y	Y	N	N	Y	N	N	Y	N	N	N	N	Y	N	N	Y	Y	N	Y	N	N	N	Y	N	Y	Y	Y	N	Y	N	N	Y	Y	Y	Y
410	Y	F	4	6	B	M	H	2	3	7	7	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	N	Y	Y	N	N	N	N	Y	Y	N	Y	N	Y	Y	Y	N	Y	N	Y	Y	N	Y	N	Y	Y	Y	N	N	N	Y	Y	N	Y	Y	Y	Y	N	N	N	N	Y	Y
861	Y	M	1	1	B	M	D	2	2	1	1	0	0	0	0	0	0	0	0	0	0	R	0.0	0	0	N	YP	YP	YP	YP	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	Y	N	Y	N	Y	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y
212	Y	M	5	6	B	C	H	1	2	30	30	0	0	0	0	0	28	0	0	0	28	N	0.0	0	0	N	N	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y
651	N	M	4	3	B	M	U	1	2	7	7	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	Y	Y	Y	N	N	N	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	Y	Y	N	Y	N	N	Y	Y
875	Y	F	1	1	B	M	D	1	2	1	1	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	Y	Y	Y	N	N	N	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y	N	Y	Y	Y
494	Y	M	3	3	B	M	D	2	2	9	9	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	N	Y	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
587	Y	M	2	2	B	M	D	2	2	6	6	0	0	0	0	0	0	0	0	0	0	E	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	N	Y	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
493	Y	M	3	3	B	M	D	1	2	8	8	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YP	YP	YP	YP	Y	N	Y	Y	Y	N	Y	Y	N	N	Y	Y	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	Y
465	Y	M	4	3	B	M	M	2	5	0	0	0	7	5	0	0	0	0	0	0	0	AvM	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	N	N	Y	N	N	N	N	N	Y	N	N	N	N	Y	Y
373	Y	M	4	3	B	M	H	1	2	10	10	0	0	0	0	0	0	0	3	0	3	OJT	0.0	0	0	N	YS	YP	YP	YP	Y	N	Y	Y	N	N	N	N	N	N	Y	N	Y	N	N	N	Y	Y	N	N	N	N	N	Y	N	Y	N	N	Y	N	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	Y	Y
799	Y	F	3	3	B	M	H	2	1	1	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	N	N	N	N	Y	Y	N	Y	N	Y	N	N	N	N	N	N	N	Y	Y
604	Y	M	2	2	B	M	D	2	1	5	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	N	N	N	N	Y	Y	Y	N	N	Y	Y	N	Y	N	N	Y	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y
675	Y	F	2	2	B	M	D	2	2	6	5	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	Y	N	N	N	Y	Y	N	Y	N	Y	N	Y	N	N	N	Y	N	Y	Y
530	Y	M	3	3	B	M	D	2	2	7	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	N	Y	N	N	Y	N	Y	Y	N	N	Y	Y	N	N	N	Y	Y	N	Y	N	Y	N	Y	N	N	N	Y	N	Y	Y
505	Y	M	2	3	B	M	D	2	2	5	3	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	N	N	N	Y	Y	Y	N	N	Y	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	N	Y	Y
441	Y	M	4	3	B	M	H	2	2	7	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	YS	YP	YP	YP	Y	N	N	N	N	N	N	Y	Y	Y	N	N	Y	N	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	Y	Y	N	N	N	N	Y	Y
489	Y	M	4	4	B	I	H	1	2	7	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	Y	Y
512	Y	M	2	3	B	M	D	2	2	3	5	0	0	0	0	0	0	0	0	0	0	OLS	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	Y	Y
510	Y	M	2	3	B	M	D	2	2	7	0	0	0	0	0	0	0	0	0	0	0	OJT	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	Y	N	N	N	Y	N	N	N	N	Y	N	N	N	N	N	N	N	Y	Y
364	Y	M	4	4	B	M	D	2	2	7	5	0	0	0	0	0	2	0	5	3	10	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	Y	Y	Y	Y	N	Y	N	Y	Y	N	N	Y	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N	N	Y	Y
628	Y	M	3	3	B	M	U	2	3	0	1	0	7	5	0	0	0	0	0	0	0	0	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y
N	Y	F	3	3	B	M	H	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	N	N
584	Y	F	3	3	B	M	D	1	2	6	6	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
585	Y	M	3	3	B	M	D	0	2	7	7	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
444	Y	M	3	4	B	O	H	1	2	11	11	0	0	0	0	0	0	0	0	0	0	R	0.0	0	0	N	YP	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	N	N	N	N	Y	Y
859	Y	M	2	1	B	O	D	1	2	1	1	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
766	Y	M	2	2	B	M	H	2	2	2	2	0	0	0	0	0	0	0	0	0	0	N	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
419	Y	M	4	4	B	O	H	1	2	11	11	0	0	0	0	0	5	0	0	0	5	OJT	0.0	0	0	N	N	YP	YP	YP	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	Y	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	Y	N	N	N	Y	Y	N	N	N	N	Y	Y

TRNG_4444	TRNG_ANX10V2	TRNG_9432	TRNG_DIF	TRNG_LOCAL	TRNG_PLAIN	TRNG_CONFUS	TRNG_NUMERAL	TRNG_AUDIO	TRNG_UNEXPCTD	IMPROV_VOCAB	IMPROV_ATC	IMPROV_STDP	IMPROV_USE.STDP	IMPROV_MEAN	IMPROV_MISUND	IMPROV_PRONUN	IMPROV_ACCENT	IMPROV_FLUEN	IMPROV_PARAPHR	INS_TECNQ	INS_FLUEN	INS_KNOW	INS_STDP	INS_ATC	INS_OPS	INS_TIME	INS_TAID	OPS_STDP	OPS_NONSTDP	OPS_ENG	OPS_XENG	OPS_JRGON	OPS_STYL	OPS_TERM	OPS_RATE	OPS_RETX	RDBK_FULL	RDBK_XFULL	RDBK_WRONG	RDBK_NONE	RETX_MSG	RETX_TXYRUT	RETX_SEQ	RETX_HDG	RETX_LVL	RETX_SPD	RETX_QNH	RETX_TIME	OCUR_XSTDP	OCUR_PLAIN	OCUR_XPROF	OCUR_PRONUN	OCUR_TECH	OCUR_CONFUS	OCUR_XINFO	RESULT_TASKLOAD	RESULT_WORKLOAD	RESULT_XSA	RESULT_XSEP	RESULT_APROX	RESULT_INCURS	RESULT_OTR
Y	Y	Y	N	Y	N	Y	Y	Y	Y	2	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	2	60	20	10	10	0	40	20	30	10	50	20	10	20	40	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Y	N	N	N	Y	N	Y	N	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60	10	10	20	0	10	20	30	10	80	20	20	0	10	0	0	10	10	10	10	10	1	1	1	1	2	1	1	0	0	0	0	2	0	0
Y	Y	N	N	Y	N	Y	Y	Y	Y	1	3	3	3	2	3	3	3	2	2	3	3	3	3	2	2	3	2	50	20	10	10	10	40	50	50	30	80	70	30	20	50	0	0	30	30	20	10	40	1	0	0	0	0	1	1	5	5	0	0	0	0	0
Y	Y	Y	N	N	N	Y	Y	N	Y	1	1	1	2	2	2	2	2	2	2	3	3	3	2	2	2	2	2	90	10	10	10	0	0	10	10	10	90	10	10	0	10	0	0	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	2	0	0	0
N	N	N	N	N	N	N	N	N	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90	10	90	0	0	10	10	80	80	90	20	20	10	30	0	0	0	30	30	60	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Y	Y	N	N	Y	Y	Y	Y	N	3	3	4	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	90	20	80	10	10	0	10	20	40	80	20	20	10	30	0	0	10	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Y	Y	Y	Y	N	Y	Y	Y	Y	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	90	10	0	0	0	10	0	80	60	80	60	20	30	30	N	N	30	30	30	0	30	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Y	Y	Y	N	N	N	N	Y	N	Y	3	3	3	3	2	2	2	1	1	1	3	3	3	3	3	3	3	3	90	10	90	10	0	10	10	10	10	90	10	10	10	10	10	10	10	10	10	10	10	1	1	1	1	1	1	1	4	4	1	0	0	0	1
Y	Y	N	N	N	Y	Y	Y	Y	Y	1	2	2	3	3	3	4	4	4	4	3	3	3	3	3	3	3	3	90	0	10	0	0	0	0	20	20	90	10	10	10	10	10	10	10	10	10	10	10	1	1	2	2	2	2	2	10	10	10	2	0	0	5
N	N	N	N	N	N	N	Y	N	N	2	2	2	2	1	1	1	1	2	2	2	3	3	3	2	3	3	3	70	10	10	0	10	10	10	10	10	90	90	10	10	0	10	0	10	10	10	10	10	1	1	1	1	1	1	1	0	0	0	1	0	0	0
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N	N	N	N	N	N	N	N	N	N	1	3	3	3	2	1	2	1	1	1	1	2	2	3	3	3	3	1	20	10	10	40	20	30	30	10	30	30	30	30	40	30	20	30	30	20	20	0	0	1	1	2	0	2	1	1	0	5	0	0	0	0	5
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N	N	N	N	N	N	N	N	N	N	2	3	2	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2	70	30	40	10	50	50	60	60	70	80	70	40	20	30	20	30	40	20	30	30	20	1	2	1	1	2	1	1	0	0	0	0	0	0	0
Y	Y	Y	N	N	N	N	N	N	N	2	0	0	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	80	20	10	10	0	10	10	50	40	80	40	10	0	30	40	10	0	0	0	0	20	2	1	1	2	1	2	2	5	10	0	0	0	0	0
Y	N	N	N	N	N	N	Y	N	Y	3	3	3	2	2	3	3	1	1	1	3	3	3	3	3	3	2	2	80	20	80	40	0	0	0	30	20	80	30	10	20	0	30	10	0	10	0	10	40	2	2	2	1	1	1	1	15	0	0	0	0	1	15
Y	Y	Y	N	N	N	N	N	N	N	2	3	2	3	3	3	2	2	2	2	3	3	3	3	3	3	3	3	70	30	60	10	60	70	60	70	90	10	10	10	20	10	0	0	0	0	0	0	0	1	1	2	2	1	1	1	0	0	0	0	0	0	0
Y	Y	Y	N	N	N	N	N	N	N	2	3	2	3	2	2	2	2	2	2	3	3	3	3	3	3	4	4	70	30	60	10	30	60	50	70	70	90	10	10	10	10	10	0	0	0	0	0	0	1	1	2	2	1	1	1	0	0	0	0	0	0	0
N	N	N	N	N	N	N	N	N	Y	4	4	4	4	4	4	4	4	4	4	2	3	3	4	4	1	4	1	50	10	10	10	20	50	60	30	10	70	50	40	10	10	10	10	0	10	10	10	10	1	1	1	1	1	1	1	0	0	0	0	0	0	0
N	N	N	N	N	N	N	N	N	N	3	3	2	3	2	2	3	3	2	2	2	2	2	3	3	2	2	2	90	10	10	10	0	50	50	60	80	80	70	70	30	70	10	10	10	10	10	40	10	1	1	1	1	1	1	1	0	0	0	0	0	0	0
N	N	N	N	N	N	N	Y	N	Y	4	4	4	4	4	4	4	4	4	4	2	3	3	4	4	1	4	1	50	10	10	20	10	50	60	30	10	70	50	40	10	10	10	10	0	10	0	10	10	1	1	1	1	1	1	1	0	0	0	0	0	0	0
N	N	N	N	N	N	N	N	N	N	3	3	3	3	3	3	3	3	3	3	2	2	3	3	3	3	3	1	50	10	10	10	20	50	60	30	10	70	50	40	10	10	10	10	0	10	10	10	10	1	1	1	1	1	1	1	0	0	0	0	0	0	0
N	N	N	N	N	Y	Y	Y	Y	N	3	4	3	4	3	3	4	2	3	3	3	4	4	4	4	4	3	3	70	0	10	10	10	10	10	10	10	90	10	0	0	10	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Y	Y	N	N	N	Y	Y	N	N	N	2	3	3	3	2	3	3	3	3	3	2	3	3	3	3	3	3	3	80	70	50	50	70	70	70	70	70	80	70	10	10	10	10	30	0	30	0	20	10	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	60	20	20	0	0	10	10	10	10	80	90	30	20	10	0	20	20	20	0	0	10	1	1	1	1	1	1	1	5	5	5	5	5	5	5
N	Y	N	N	N	N	N	Y	N	N	3	2	2	2	2	2	2	1	1	1	3	3	4	3	3	3	3	3	90	70	70	90	80	60	80	70	80	80	70	20	10	50	30	70	0	80	0	20	40	1	2	1	1	1	2	2	5	5	0	0	0	0	0
N	N	N	N	Y	N	Y	Y	Y	Y	2	2	2	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	70	30	20	0	50	20	30	40	40	60	30	10	10	50	20	20	30	40	40	30	10	0	0	0	0	0	0	0	10	10	5	5	5	5	5
Y	N	N	N	N	N	Y	Y	N	Y	2	2	2	2	2	2	2	0	0	0	2	3	3	2	3	3	3	2	70	20	10	0	0	0	10	40	50	80	10	10	0	30	10	10	40	20	20	0	50	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Y	Y	N	N	N	N	N	Y	N	N	2	2	2	3	2	2	3	1	1	1	2	2	2	2	1	3	1	1	70	30	10	10	0	10	10	50	50	90	40	30	10	30	10	10	30	40	30	10	10	0	0	0	0	0	1	0	30	30	10	0	1	0	10

N	N	N	N	N	N	N	Y	N	N	2	2	2	3	3	3	3	3	4	3	3	3	3	3	3	3	1	2	90	0	10	0	0	0	0	10	10	70	10	10	10	10	0	0	20	20	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
N	N	N	N	N	N	N	N	N	N	1	1	2	2	2	1	2	1	1	1	2	2	3	3	3	2	2	2	60	20	10	10	0	10	20	20	20	90	0	20	10	0	0	0	0	0	0	0	0	2	1	2	1	1	1	1	0	0	0	0	0	0	0
Y	Y	Y	N	N	N	N	Y	Y	Y	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	90	50	80	60	80	40	70	60	50	90	80	40	20	20	50	50	60	60	40	30	20	2	1	1	1	1	1	1	3	6	1	1	5	2	2
Y	Y	N	N	N	N	Y	Y	Y	Y	1	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	60	10	10	10	10	30	60	60	40	80	50	30	10	40	10	10	30	10	10	10	10	0	1	1	2	2	1	1	4	4	0	0	0	0	0
N	Y	N	Y	Y	N	Y	Y	N	Y	2	2	2	3	3	3	3	2	2	2	3	3	3	3	3	3	3	3	100	0	50	70	30	70	70	90	90	90	70	30	10	20	30	20	30	20	30	10	40	2	3	3	2	2	3	3	5	10	2	0	0	0	0
N	N	N	N	Y	Y	Y	Y	Y	N	2	2	2	2	2	2	3	1	1	1	1	2	2	2	2	2	2	2	80	10	10	0	0	0	10	20	20	70	20	10	0	10	10	0	0	20	0	10	30	4	4	4	0	0	0	0	3	3	0	0	0	0	0
Y	Y	Y	N	N	N	N	Y	N	N	3	3	3	3	2	3	2	2	3	3	3	3	3	4	3	3	3	3	100	20	40	10	30	40	20	30	10	90	30	10	10	10	10	10	0	50	30	40	20	4	7	4	7	12	4	4	4	7	4	0	0	0	0
Y	Y	Y	Y	N	N	Y	Y	Y	Y	3	3	3	4	4	4	4	3	3	3	3	4	4	4	4	3	4	4	90	10	40	0	0	10	10	10	10	90	10	10	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	N	N	N	N	N	Y	Y	N	Y	2	3	3	3	3	3	3	2	2	2	2	2	3	3	3	3	2	2	70	30	60	50	20	20	10	60	30	80	20	10	0	20	10	20	20	20	20	30	20	12	12	7	12	4	7	7	20	20	10	5	2	1	1
Y	Y	Y	N	N	N	Y	N	N	N	3	3	3	3	2	2	3	2	2	2	3	3	3	3	3	3	3	3	80	40	30	10	0	30	0	100	80	80	10	10	10	0	0	0	0	20	10	30	20	7	4	4	7	4	4	4	0	0	0	0	0	0	0
Y	Y	Y	N	N	Y	N	Y	N	N	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2	100	20	50	10	10	10	30	40	40	90	80	20	10	10	10	0	0	40	40	10	10	4	4	4	4	12	7	7	4	4	0	0	0	0	0
Y	N	N	N	N	Y	Y	Y	N	Y	3	3	3	3	2	3	3	3	3	3	3	3	3	4	4	4	3	3	90	40	40	30	30	30	40	40	30	80	40	20	10	40	10	0	0	0	0	0	0	4	4	4	4	4	4	4	0	0	1	1	0	0	0
N	N	N	N	N	N	N	N	N	N	2	2	2	3	2	3	3	2	2	2	3	4	3	3	3	4	3	2	80	10	10	0	0	10	20	10	10	90	10	10	0	10	10	0	0	10	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	90	10	10	10	10	10	10	10	10	90	10	10	10	0	10	10	10	10	10	10	10	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	Y	Y	N	N	Y	Y	N	N	2	2	2	3	2	2	3	2	3	3	3	4	3	3	3	3	3	3	40	20	20	10	10	20	10	20	20	80	20	10	10	30	10	20	10	10	10	10	10	4	4	4	4	4	4	4	7	7	3	3	3	3	3
Y	Y	Y	Y	N	N	Y	N	N	N	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	60	10	10	10	10	20	10	20	10	80	70	10	10	10	10	10	10	10	10	10	10	4	4	4	4	4	4	4	3	3	3	3	3	3	3
Y	Y	Y	Y	N	N	Y	Y	N	N	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	60	10	10	10	10	20	10	20	10	70	50	10	10	10	10	10	10	10	10	10	10	4	4	4	4	4	4	4	4	7	4	4	4	4	4
N	N	N	N	N	Y	Y	Y	N	N	3	3	3	3	2	3	3	2	2	2	3	3	3	3	3	3	2	2	70	10	10	10	0	20	10	30	30	60	20	20	10	30	10	10	20	20	0	30	10	4	4	4	4	4	4	4	3	5	0	0	0	0	0
Y	Y	Y	N	N	N	N	N	N	N	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	70	50	50	10	10	10	0	80	80	60	40	30	10	40	10	10	10	30	20	20	30	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	Y	N	N	Y	N	N	N	N	2	2	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	70	40	50	0	0	0	0	50	50	70	30	30	10	10	10	10	10	10	0	30	10	0	0	0	7	0	0	4	0	0	0	0	0	0	0
Y	Y	Y	N	N	Y	Y	Y	N	Y	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	60	10	10	10	10	20	20	30	30	80	10	10	0	0	10	0	0	0	0	10	10	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	N	N	N	N	N	Y	N	N	2	2	3	3	2	2	3	2	2	2	4	4	3	3	3	3	3	1	90	60	40	10	20	60	50	80	40	50	30	30	10	0	30	20	20	10	10	40	10	7	4	12	7	7	4	4	6	2	0	0	0	0	0
Y	Y	N	N	N	Y	Y	Y	N	Y	3	3	3	3	3	3	3	2	2	3	3	4	4	4	4	4	3	3	60	10	10	10	10	20	20	30	30	70	20	10	0	0	10	0	0	0	0	10	10	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	N	N	N	N	N	N	N	Y	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	3	3	70	10	10	10	10	20	10	30	30	70	30	20	0	10	10	10	0	0	0	10	10	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	N	N	N	N	N	Y	Y	N	3	3	3	4	3	2	3	3	3	3	4	4	4	4	3	4	3	1	90	80	60	20	20	50	50	70	40	60	50	40	20	20	10	20	20	10	10	20	20	4	4	7	7	7	4	4	5	3	0	0	0	0	0
Y	Y	Y	N	N	N	N	Y	N	N	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	3	3	60	10	10	10	10	10	10	10	10	80	10	10	10	10	10	10	0	0	0	0	0	4	4	4	4	4	4	4	0	0	0	1	0	0	0
Y	Y	N	N	N	N	N	N	N	Y	3	3	3	3	3	3	3	2	2	3	4	4	4	4	4	4	4	2	40	10	0	40	10	20	20	20	20	80	10	10	0	0	10	0	0	0	0	10	10	4	4	4	44	4	4	4	0	0	0	0	0	0	0
Y	Y	N	N	N	N	N	Y	N	Y	3	3	3	3	2	2	3	1	2	1	4	4	4	3	4	4	3	1	90	50	30	0	30	10	20	30	50	80	30	10	10	10	20	10	30	40	20	30	40	4	4	12	7	7	12	12	4	3	0	0	0	0	0
Y	Y	N	N	N	N	N	N	Y	Y	3	3	3	3	4	4	4	2	2	1	3	4	4	4	4	3	3	2	60	10	10	10	10	20	20	40	20	80	10	10	10	0	10	0	0	10	0	0	0	4	4	4	4	0	0	0	3	3	0	0	0	1	0
Y	Y	N	N	N	N	N	N	N	Y	3	3	3	3	3	3	3	2	2	3	4	4	4	4	4	4	4	2	40	10	0	40	10	20	20	20	20	80	10	10	0	0	10	0	0	0	0	10	10	4	4	4	4	4	4	4	2	1	0	0	0	0	0
Y	N	N	N	N	N	Y	Y	N	Y	2	2	3	2	3	2	2	2	2	2	3	3	3	3	3	4	3	2	80	10	10	0	0	10	10	20	30	80	20	10	10	10	0	0	10	10	20	10	30	4	4	0	4	0	0	0	2	2	0	0	0	0	0
N	N	N	N	N	N	N	N	N	N	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	50	50	10	10	40	40	20	10	20	30	10	0	10	0	10	10	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	N	N	N	N	N	N	N	N	N	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	90	0	10	0	0	10	10	10	10	80	10	10	0	10	0	10	0	10	10	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N	N	N	N	N	N	N	N	N	N	2	2	2	2	2	2	2	2	2	2	2	3	3	3	2	2	2	2	80	10	10	0	0	50	50	40	40	80	20	30	30	30	10	10	30	30	20	10	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Y	Y	Y	N	N	N	N	N	N	N	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	3	1	70	20	70	20	20	40	40	40	30	70	50	20	10	70	50	50	50	50	50	50	50	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	N	N	Y	Y	N	Y	N	N	2	2	2	3	2	2	3	2	3	2	2	3	3	3	3	3	2	2	30	20	20	0	30	50	50	50	50	50	70	30	10	30	10	10	30	30	10	10	10	4	4	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	N	N	N	N	N	N	N	N	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	60	60	60	60	60	70	70	70	70	70	80	80	90	80	70	70	80	80	80	70	70	4	0	4	4	4	4	4	0	0	0	0	0	0	0
Y	Y	Y	Y	Y	N	Y	Y	Y	N	4	4	4	4	4	4	4	3	3	3	4	4	4	4	4	4	3	3	100	10	10	10	0	0	10	10	10	90	10	10	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX G: List of ATC Radiotelephony Recorded Segments

	ID	DMY	FREQUENCY MHz	CHANNEL	START hh:mm:ss	STOP hh:mm:ss	ELAPSE minutes
1	N1	050122	124.2	63	01:15:00	01:55:00	39
2	N2	050120	124.2	63	02:06:00	02:26:00	19
3	N3	050114	124.2	63	22:30:00	23:30:00	63
4	N4	050108	124.2	63	05:35:00	06:05:00	34
5	N5	050120	124.2	63	05:40:00	06:10:00	30
6	N6	050123	124.2	63_17	05:45:00	06:15:00	32
7	N7	050124	124.2	63_17	07:45:00	08:15:00	31
8	N8	050118	124.2	17	01:25:00	02:00:00	34
9	N9	050125	124.2	17	00:30:00	01:00:00	31
10	N10	050121	124.2	17	12:20:00	12:50:00	33
11	N11	050116	124.2	17	13:35:00	14:05:00	31
12	N12	050128	124.2	17	00:05:00	00:35:00	30
13	S1	050120	119.45	47	02:28:00	02:38:00	14
14	S2	050114	119.45	47	22:58:00	23:30:00	33
15	S3	050113	119.45	47	10:35:00	11:05:00	34
16	S4	050113	119.45	47	22:30:00	23:10:00	38
17	S5	050108	119.45	47	05:45:00	06:20:00	35
18	S6	050108	119.45	47	10:45:00	11:15:00	32
19	S7	050122	119.45	47_26	12:00:00	12:30:00	33
20	S8	050123	119.45	47_26	09:45:00	10:20:00	36
21	S9	050124	119.45	47_26	06:10:00	06:40:00	31
22	S10	050118	119.45	26	10:00:00	10:30:00	30
23	S11	050125	119.45	26	11:47:00	12:20:00	34
24	S12	050121	119.45	26	12:40:00	13:10:00	31
25	S13	050116	119.45	26	06:30:00	07:00:00	33
26	S14	050128	119.45	26	00:30:00	01:00:00	32
27	S15	050130	119.45	26	05:40:00	06:25:00	44
28	S16	050130	119.45	26	09:00:00	09:30:00	35
29	Y1	050120	132.8	40_48	02:58:00	03:18:00	20
30	Y2	050114	132.8	40_48	22:30:00	23:08:00	35
31	Y3	050113	132.8	40_48	22:30:00	23:00:00	30
32	Y4	050108	132.8	40_48	22:00:00	22:30:00	30
33	Y5	050120	132.8	40_48	05:07:00	05:40:00	30
34	Y6	050122	132.8	40_48	04:45:00	05:15:00	30
35	Y7	050123	132.8	40_48_3	05:00:00	05:35:00	30
36	Y8	050124	132.8	40_48_3	06:00:00	06:30:00	30
37	Y9	050118	132.8	3	21:50:00	22:20:00	30
38	Y10	050125	132.8	3	06:40:00	07:10:00	30
39	Y11	050121	132.8	3	22:30:00	23:00:00	30
40	Y12	050116	132.8	3	11:30:00	12:00:00	30
41	Y13	050128	132.8	3	06:15:00	06:45:00	30
42	Y14	050130	132.8	3	22:00:00	22:30:00	30
43	R1	050114	121.25	61	12:30:00	13:10:00	40
44	R2	050113	121.25	61	12:35:00	13:15:00	48
45	R3	050108	121.25	61	08:00:00	08:35:00	30
46	R4	050108	121.25	61	09:45:00	10:15:00	30
47	R5	050120	121.25	61	10:00:00	10:20:00	20
48	R6	050122	121.25	61	04:20:00	04:45:00	27
49	R7	050123	121.25	61_21	08:05:00	08:35:00	36
50	R8	050124	123.75	21	05:50:00	06:20:00	31
51	R9	050118	121.25	21	11:40:00	12:10:00	34
52	R10	050125	123.75	21	06:30:00	07:00:00	31

53	R11	050121	123.75	21	12:45:00	13:15:00	30
54	R12	050116	123.75	21	05:45:00	06:15:00	30
55	R13	050128	123.75	21	05:40:00	06:10:00	31
56	R14	050130	123.75	21	08:45:00	09:15:00	30
57	Q1	050120	132.6	42	06:33:00	07:13:00	11
58	Q2	050114	132.6	42_45	10:38:00	11:08:00	30
59	Q3	050113	132.6	42_45	05:55:00	06:25:00	33
60	Q4	050113	132.6	42_45	10:36:00	11:08:00	33
61	Q5	050108	132.6	42_45	10:25:00	11:00:00	36
62	Q6	050122	132.6	42_45	09:45:00	10:20:00	31
63	Q7	050123	132.6	42_45_15	10:05:00	10:40:00	32
64	Q8	050124	132.6	42_45_15	06:00:00	06:30:00	39
65	Q9	050118	132.6	15	11:45:00	12:15:00	31
66	Q10	050125	132.6	15	10:20:00	10:50:00	32
67	Q11	050121	132.6	15	12:40:00	13:10:00	30
68	Q12	050116	132.6	15	01:15:00	01:45:00	31
69	Q13	050128	132.6	15	08:30:00	09:00:00	36
70	Q14	050130	132.6	15	07:55:00	08:25:00	31
71	P1	070705	121.1	17, 9	02:17:00	02:42:00	25
72	P2	170705	121.1	17, 9	03:58:00	04:18:00	20
73	P3	170705	121.1	17, 9	06:10:00	06:30:00	20
74	P4	190705	121.1	17, 9	01:19:00	01:44:00	25
75	P5	200705	121.1	17, 9	00:16:00	00:40:00	24
76	P6	210705	121.1	17, 9	01:08:00	01:29:00	21
77	P7	210705	121.1	17, 9	05:55:00	06:20:00	25
78	P8	230705	121.1	17, 9	01:10:00	01:34:00	24
79	P9	160705	121.1	17, 9	04:01:00	04:27:00	26
80	P10	150705	121.1	17, 9	12:25:00	12:50:00	25
81	P11	240705	121.1	17, 9	04:15:00	04:35:00	21
82	M1	010605	118.0	1	00:05:00	00:25:00	20
83	M2	010605	118.0	1	01:43:00	02:06:00	23
84	M3	010605	118.0	1	03:27:00	03:47:00	20
85	M4	010605	118.0	1	06:17:00	06:37:00	20
86	M5	010605	118.0	1	07:00:00	07:20:00	20
87	M6	010605	118.0	1	08:01:00	08:21:00	20
88	M7	020605	118.0	1	08:16:00	08:37:00	21
89	M8	020605	118.0	1	09:35:00	09:55:00	20
90	M9	020605	118.0	1	07:42:00	08:02:00	20
91	M10	030605	118.0	1	04:09:00	04:29:00	20
92	J1	280705	124.7	7, 10	02:15:00	02:35:00	20
93	J2	240705	124.7	7, 10	02:20:00	02:40:00	20
94	J3	230705	124.7	7, 10	02:20:00	02:40:00	20
95	J4	270705	124.7	7, 10	02:15:00	02:35:00	20
96	J5	150705	124.7	7, 10	02:15:00	02:35:00	20
97	J6	250705	124.7	7, 10	02:20:00	02:40:00	20
98	J7	220705	124.7	7, 10	02:20:00	02:40:00	20
99	J8	080705	124.7	7, 10	02:20:00	02:40:00	20
100	J9	130705	124.7	7, 10	02:20:00	02:40:00	20
101	J10	100705	124.7	7, 10	02:20:00	02:40:00	20
102	J11	160705	124.7	7, 10	02:35:00	02:55:00	20
103	J12	050705	124.7	7, 10	07:40:00	08:00:00	20
104	G1	030805	118.1	5, 24	02:20:00	02:40:00	20
105	G2	270705	118.1	5, 24	03:12:00	03:32:00	20
106	G3	090805	118.1	5, 24	04:00:00	04:20:00	20

107	G4	190705	118.1	5, 24	04:00:00	04:20:00	20
108	G5	160705	118.1	5, 24	02:14:00	02:34:00	20
109	G6	260705	118.1	5, 24	03:05:00	03:25:00	20
110	G7	090705	118.1	5, 24	02:08:00	02:28:00	20
111	G8	080805	118.1	5, 24	02:15:00	02:35:00	20
112	G9	050805	118.1	5, 24	03:34:00	03:54:00	20
113	G10	310705	118.1	5, 24	04:30:00	04:50:00	20
114	G11	290705	118.1	5, 24	02:10:00	02:30:00	20
115	G12	040805	118.1	5, 24	02:18:00	02:38:00	20
116	G13	140705	118.1	5, 24	02:10:00	02:30:00	20
117	G14	300705	118.1	5, 24	03:30:00	03:50:00	20
118	G15	160705	118.1	5, 24	04:00:00	04:20:00	20
119	G16	280705	118.1	5, 24	03:38:00	03:58:00	20
120	G17	140805	118.1	5, 24	07:33:00	07:53:00	20
121	G18	190705	118.1	5, 24	04:20:00	04:40:00	20
122	G19	110805	118.1	5, 24	02:09:00	02:29:00	20
123	G20	060805	118.1	5, 24	02:13:00	02:33:00	20
124	G21	140805	118.1	5, 24	03:35:00	03:55:00	20
125	V1	070705	118.3	8, 39	01:35:00	01:55:00	20
126	V2	080705	118.3	8, 39	02:01:00	02:21:00	20
127	V3	160705	118.3	8, 39	04:09:00	04:29:00	20
128	V4	110705	118.3	8, 39	03:54:00	04:14:00	20
129	V5	260705	118.3	8, 39	03:01:00	03:21:00	20
130	V6	160705	118.3	8, 39	01:30:00	01:50:00	20
131	V7	210805	118.3	8, 39	03:10:00	03:30:00	20
132	V8	010705	118.3	8, 39	02:01:00	02:21:00	20
133	V9	220705	118.3	8, 39	02:02:00	02:22:00	20
134	V10	030805	118.3	8, 39	03:25:00	03:45:00	20
135	V11	130805	118.3	8, 39	01:56:00	02:16:00	20
136	V12	150705	118.3	8, 39	02:05:00	02:25:00	20
137	V13	030705	118.3	8, 39	03:19:00	03:39:00	20
138	V14	150705	118.3	8, 39	03:23:00	03:43:00	20
139	V15	070805	118.3	8, 39	04:10:00	04:30:00	20
140	V16	040705	118.3	8, 39	02:14:00	02:34:00	20
141	V17	100805	118.3	8, 39	01:12:00	02:32:00	20
142	V18	240705	118.3	8, 39	03:39:00	03:59:00	20
143	V19	040805	118.3	8, 39	02:18:00	02:38:00	20
144	V20	190805	118.3	8, 39	02:02:00	02:22:00	20
145	V21	260705	118.3	8, 39	04:05:00	04:25:00	20
146	V22	080705	118.3	8, 39	03:15:00	03:35:00	20
147	V23	070705	118.3	8, 39	02:41:00	03:01:00	20
148	V24	050705	118.3	8, 39	02:12:00	02:32:00	20
149	V25	060805	118.3	8, 39	01:29:00	01:49:00	20
150	V26	100805	118.3	8, 39	01:04:00	01:24:00	20
151	V27	030705	118.3	8, 39	03:43:00	04:03:00	20
152	V28	120705	118.3	8, 39	04:07:00	04:27:00	20
153	V29	310705	118.3	8, 39	03:26:00	03:46:00	20
154	V30	020705	118.3	8, 39	03:10:00	03:30:00	20
155	V31	040805	118.3	8, 39	03:40:00	04:00:00	20
156	K1	020705	QAL	Auto	06:30:00	06:50:00	20
157	K2	100805	DEP	Auto	07:31:00	07:51:00	20
158	K3	160805	QAL	Auto	08:30:00	08:50:00	20
159	K4	030805	DEP	Auto	05:40:00	06:00:00	20
160	K5	030705	QAL	Auto	05:32:00	05:52:00	20
161	K6	040805	QAL	Auto	06:37:00	06:57:00	20
162	K7	170805	QAL	Auto	10:23:00	10:43:00	20

163	K8	160805	QAL	Auto	04:38:00	04:58:00	20
164	K9	170805	QAL	Auto	06:32:00	06:52:00	20
165	K10	020705	DEP	Auto	01:47:00	02:07:00	20
166	K11	030705	DEP	Auto	05:39:00	05:59:00	20
167	K12	110805	DEP	Auto	07:52:00	08:12:00	20
168	K13	090805	DEP	Auto	06:43:00	07:03:00	20
169	K14	170805	DEP	Auto	10:12:00	10:32:00	20
170	K15	090805	QAL	Auto	05:00:00	05:20:00	20
171	K16	170805	DEP	Auto	00:15:00	00:35:00	20
172	K17	030805	QAL	Auto	03:57:00	04:17:00	20
173	K18	110805	QAL	Auto	12:55:00	13:15:00	20
174	K19	030705	DEP	Auto	02:03:00	02:23:00	20
175	K20	020705	QAL	Auto	05:32:00	05:52:00	20
176	K21	020705	DEP	Auto	07:00:00	07:20:00	20
177	K22	180805	QAL	Auto	00:30:00	00:50:00	20
178	K23	150805	QAL	Auto	08:04:00	08:24:00	20
179	K24	030805	DEP	Auto	07:23:00	07:43:00	20
180	K25	090805	QAL	Auto	06:40:00	07:00:00	20
181	K26	040805	DEP	Auto	06:49:00	07:09:00	20
182	K27	150805	DEP	Auto	07:29:00	07:49:00	20
183	K28	160805	QAL	Auto	00:28:00	00:48:00	20
184	K29	150805	QAL	Auto	09:45:00	10:05:00	20
185	K30	020705	DEP	Auto	05:47:00	06:07:00	20
186	K31	150805	QAL	Auto	13:24:00	13:44:00	20
187	K32	180805	QAL	Auto	13:03:00	13:23:00	20
188	K33	090805	DEP	Auto	00:21:00	00:41:00	20
189	K34	160805	DEP	Auto	00:14:00	00:34:00	20
190	K35	020705	DEP	Auto	00:27:00	00:47:00	20
191	K36	020805	DEP	Auto	06:42:00	07:02:00	20
192	K37	180805	QAL	Auto	08:27:00	08:47:00	20

APPENDIX H: SPEECH ACTS AND AVIATION TOPICS CODES

	SPEECH ACTS	CODE		AVIATION TOPIC	CODE	Remarks
1	Addressee / Address		1	Speaker identification	**Sid**	Callsign of unit transmitting message
			2	Receiver identification	**Rid**	Callsign of unit message intended for
2	Instructions / Clearance - Readback / Acknowledgement	**I**				
3	Advisory / Remark - Readback / Acknowledgement	**A**				
4	Request - Readback / Acknowledgement	**R**				
			1	altitude / level	**alt**	flight level or altitude in feet
			2	approach	**app**	flight operations towards runway / for landing
			3	circuit	**cct**	related to circuit eg downwind, touch and go
			4	communications	**com**	frequency or unit
			5	flight details	**fld**	registration/ persons on board/ fuel endurance /aircraft type
			6	general	**gen**	eg. Copied, roger, okay, wilco, go ahead
			7	heading	**hdg**	turn direction or fly a heading
			8	holding	**hol**	orbit or hold at position
			9	landing	**ldg**	specific for 'cleared to land' instructions
			10	repeat/ verify	**ver**	say again', confirm …
			11	restriction	**rst**	time/ altitude
			12	route / position	**rpo**	track direct / join airways / via route or fix
			13	speed	**spd**	specific speed or general (eg. slow down, best speed)
			14	start	**stt**	engine startup
			15	takeoff	**tof**	specific for 'cleared for takeoff' instructions
			16	traffic	**tfc**	information on conflicting traffic
			17	transponder	**sqk**	assign(ed) transponder code
			18	visual / sighting	**vis**	reporting visual (terrain / traffic)
			19	weather info	**wxi**	QNH / wind/ visibility/ turbulence

5	Courtesy	**C**	1 2 3	Apology Greetings Thank you	**apo** **grt** **tq**	eg. sorry eg. Good morning, maam, sir eg. Thanks, appreciate that.
6	Non-codable remarks	**N**	1 2 3	delivery equipment other	**dlv** **eqp** **otr**	simultaneous/ interrupted transmission interference, noise, failures other than defined topics

APPENDIX I: ENCODING VARIABLES AND DESCRIPTIONS

Col	Variable Names	Value	Description	Explanation
A	LINENUM	(number)	(transmissions in sequence)	
B	FAC_ID		ATC Unit	
		A	Air Traffic Control Centre	
		K	KLIA	
		M	MELAKA	
		P	PENANG	
		J	JOHOR BHARU	
		V	KOTA KINABALU	
		G	KUCHING	
C	SEC_ID		Working Position	
		N	APPROACH NORTH	
		S	APPROACH SOUTH	
		Y	SECTOR 1 RADAR	
		R	SECTOR 2 RADAR	
		Q	SECTOR 3 RADAR	
		T	TOWER	
D	SAMP_ID	(number)	Sample ID (recording segments)	
E	ST_MIN	mm	Transmission start time (minutes)	
F	ST_SEC	ss	Transmission start time (seconds)	
G	END_MIN	mm	Transmission end time (minutes)	
H	END_SEC	ss	Transmission end time (seconds)	
I	TX_TIME	(number)	Total time (seconds) to transmit the message	TOT_WD / TOT_SEC = SPEECH RATE
J	LPS_TIME	(number)	transmission-free time before next transmission was made	Will be used to calculate transmission free time (no communications taskload?)
K	SID	(callsign)	Speaker of the transmission	
L	RID	(callsign)	Receiver of the transmission	
M	MESSAGE		Radio transmission by ATC or pilot	

N - U	T1 - T8		Aviation Topics within the Speech Act categories	Use Topic identifiers as listed, entered in the order that they appear in the transmission
V	TOT_TPC	(number)	Total number of Aviation Topics in message	
W	TOT_INS		Total number of instructions in message	
X	TOT_ADV		Total number of advisories in message	
Y	TOT_WDS	(number)	Total number of words in message	TOT_WD / TOT_SEC = SPEECH RATE
Z	TOT_NUM	(number)	count of numbers used in message	
AA	WDS_SID	(number)	count of words used for speaker identity	
AB	WDS_RID	(number)	count of words used for receiver identity	
AC	WDS_INST	(number)	count of words used for instruction	
AD	WDS_ADV	(number)	count of words used for advisory	
AE	WDS_REQ	(number)	count of words used for requests	
AF	WDS_CTSY	(number)	count of words used for courtesy	

1	AG	ATC_CLSGN		**callsign use by ATC or pilot**	
		or	1	Complete callsign or permitted abbreviation	No error
2	AH	P_CLSGN	2	Partial callsign	just numbers without prefix or non-standard abbreviation
			3	Omission of callsign	No callsign used
			7	Error - transposition of numbers	MALAYSIAN 2625 instead of MALAYSIAN 2526
			8	Error - substitution of numbers	EXPRESS 213 instead of EXPRESS 203
			9	Incorrect number pronunciation	MALAYSIAN 'SIXTY NINE' instead of 'SIX NINER'
3	AI	CLSGN_MISCOM		**Miscommunication arising from callsign discrepancies**	
			1	wrong aircraft responded to ATC	
			2	ATC responded to wrong aircraft.	(or addressed acft by wrong callsign)
			3	Pilot calling ATC by other unit's name	
4	AJ	CLSGN_VER		**Request / verification of intended receiver or speaker**	
			1	Pilot request to verify intended receiver	Was that for MERPATI 203?'
			2	ATC request to verify speaker	Confirm MALAYSIAN 12?' or Station calling say again'
			3	Response error corrected / verified	That was for SINGAPORE 112'
			4	Response error not corrected / verified	

5	AK	P_IC_INFO		**Information provided by pilot on initial contact transmission**	Key info expected : callsign, position, altitude, route
			1	Complete report	All key information provided
			2	Partial report	omission of any key information.
			3	None	only callsign
6	AL	P_REQ_RPT		**Pilot's request repeat of message**	
			1	Whole transmission	say again' or similar expression.
			2	Partially	say all after …'
7	AM	ATC_INST_ALT		**ATC Instruction (ALTITUDE)**	keywords are 'maintain/descend/climb', correct numbering of altitude or flight level and the word 'flight level / feet'
			1	Complete instruction	use all keywords
			2	partial instruction	omission of any keywords
			9	Incorrect number pronunciation	descend 'six five' instead of 'six thousand five hundred'
8	AN	P_RDBK_ALT		**Pilot's readback of altitude assignment**	keywords: flight level / feet and numerals
			1	Complete Readback	Readback of instruction with keywords
			2	Partial readback	Ommision of any keyword
			3	No readback of altitude	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query altitude assignment
9	AO	RDBK_ERR_ALT		**Readback error type (altitude)**	
			6	Confusion with numbers of another type of information	readback altitude instruction as heading or speed
			7	Transposition of numbers	three one zero' instead of 'one three zero'
			8	Substitution of numbers	two thousand five hundred' instead of 'three thousand five hundred'
			9	Incorrect number pronunciation	eg. Climb 'two-fifty' instead of 'two five zero'
10	AP	ATC_INST_ALTRES		**ATC Instruction (ALTITUDE RESTRICTION)**	Keywords: maintain/ cross/ at/ above/ below, point/ fix/ time and digits of altitude. May be phrased as 'not below STAR-steps/profile'. 'Expedite' is not a restriction.
			1	Complete instruction	with required keywords.
			2	Partial instruction	omission of keywords, or usage of 'best / good rate'

11	AQ	P_RDBK_ALTRES		**Pilot's readback of altitude restriction**	time/point, altitude/flight level/feet
			1	Complete readback	Complete readback of restrictions' key information
			2	Partial readback	omission of key information.
			3	No readback of restriction	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query altitude restrictions
12	AR	RDBK_ERR_ALTRES		**Readback error type (altitude restrictions)**	
			6	Confusion with another type of restriction/ information	
			7	Transposition of numbers/ restrictions	
			8	Substitution of numbers/ restrictions	
			9	Incorrect number pronunciation	
13	AS	ATC_INST_APP		**ATC Instruction (APPROACH CLEARANCE)**	Keywords: 'cleared', 'approach type / name', 'runway number (left/right/centre).
			1	Complete clearance	use all keywords
			2	partial clearance	omission of any keyword
			9	Incorrect number pronunciation	
14	AT	P_RDBK_APP		**Pilot's readback of Approach Clearance**	
			1	Complete readback	Readback with all keywords
			2	Partial readback	omission of approach type or runway number
			3	No readback of approach clearance	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query approach clearance
15	AU	RDBK_ERR_APP		**readback error type (approach clearance)**	
			6	Confusion with numbers of another type of information	
			7	error in runway assignment	
			8	error in approach type	
			9	Incorrect number pronunciation	

16	AV	ATC_INST_COM		**ATC Instruction (COMMUNICATION)**	Keywords: 'contact', 'decimal', contact location / facility and at least 3 frequency digits (2 before and 1 after decimal)
			1	Complete Instruction	use all keywords
			2	Partial instruction	incomplete frequency digits or omission of keywords or facility.
			9	Incorrect number pronunciation	
17	AW	P_RDBK_COM		**Pilot's readback of Frequency instruction**	
			1	Complete readback	Readback with all keywords
			2	Partial readback	omission of facility/ contact location or frequency digits
			3	No readback of communications instruction	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query frequency
18	AX	RDBK_ERR_COM		**readback error type (frequency)**	
			6	Confusion with numbers of another type of information	
			7	error in facility callsign	
			8	error in frequency to contact	
			9	Incorrect number pronunciation	eg. 'one-eighteen five' (1185)
19	AY	ATC_INST_HDG		**ATC Instruction (HEADING)**	Keywords: Turn direction/fly, heading, numbers, degrees.
			1	Complete Instruction	use all keywords
			2	Partial instruction	omission of keywords.
			9	Incorrect number pronunciation	
20	AZ	P_RDBK_HDG		**Pilot's readback of heading instruction**	turn direction or fly, numerals, degrees
			1	Complete readback	Readback with all keywords
			2	Partial readback	omission of key info.
			3	No readback of heading	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query heading instructions

21	BA	RDBK_ERR_HDG		**Readback error type (heading)**	
			6	Confusion with numbers of another type of information	
			7	Transposition of numbers	
			8	Substitution of numbers or direction	
			9	Incorrect number pronunciation	eg. Heading ‘two fifty’
22	BB	ATC_INST_HOL		**ATC Instruction (HOLDING)**	Keywords: direction (left/righthand), fix/place
			1	Complete Instruction	use all keywords
			2	Partial instruction	omission of keywords.
			9	Incorrect number pronunciation	
23	BC	P_RDBK_HOL		**Pilot’s readback of holding instruction**	turn direction or fly, numerals, degrees
			1	Complete readback	Readback with all keywords
			2	Partial readback	omission of key info.
			3	No readback of holding	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query holding instructions
24	BD	RDBK_ERR_HOL		**Readback error type (holding)**	
			6	Confusion with another type of information	
			7	error in fix / place	
			8	error in holding direction	
			9	Incorrect number pronunciation	eg. ‘nine’ instead of ‘niner’
25	BE	ATC_INST_LDG		**ATC Instruction (LANDING)**	Keywords: ‘clear to land’, runway assignment
			1	Complete Instruction	use all keywords
			2	Partial instruction	omission of keywords
			9	Incorrect number pronunciation	
26	BF	P_RDBK_LDG		**Pilot’s readback of landing instruction**	
			1	Complete readback	Readback with all keywords
			2	Partial readback	omission of key info.
			3	No readback of landing clearance	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query landing instructions

27	BG	RDBK_ERR_LDG		**Readback error type (landing)**	
			6	Confusion with another type of information	
			7	Transposition of numbers	eg. Runway 'two three' instead of 'three two'
			8	Substitution of numbers or direction	eg. 'left' runway instead of 'right'
			9	Incorrect number pronunciation	eg. runway 'ten' instead of 'one zero'
28	BH	ATC_INST_RPO		**ATC Instruction (ROUTE/ POSITION)**	Keywords: 'direct' / 'intercept' / 'join', the airway number / SID/STAR name / fix/taxiway or runway designation for a localisor intercept.
			1	Complete Instruction	use all keywords
			2	Partial instruction	omission of keyword or route/fix name / number
29	BI	P_RDBK_RPO		**Pilot's readback of Route/ Position Instruction**	
			1	Complete readback	Readback with all keywords
			2	Partial readback	Omission of route/fix name/number
			3	no readback of route or position	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query route
30	BJ	RDBK_ERR_RPO		**readback error type (route/ position)**	
			6	Confusion with another type of information	
			7	track/ route error	
			8	position error	
			9	incorrect number pronunciation	
31	BK	ATC_INST_SPD		**ATC Instruction (SPEED)**	keywords: 'speed', '3 digit numerals' and knots or as Mach point/ decimal and 2 digit numerals
			1	Complete Instruction	use all keywords
			2	Partial instruction	Omission of any keywords.
			9	Incorrect number pronunciation	
32	BL	P_RDBK_SPD		**Pilot's readback of speed instruction**	
			1	Complete readback	Readback with all keywords
			2	Partial readback	Omission of any keywords.
			3	No readback of speed	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query speed assignment

33	BM	RDBK_ERR_SPD		**Readback error type (speed)**	
			6	Number confusion with another type of information	
			7	transposition of numbers	
			8	substitution of numbers	
			9	Incorrect number pronunciation	

34	BN	ATC_INST_SQK		**ATC Instruction (TRANSPONDER)**	Keywords: 'squawk' and 4 digits numerals
			1	Complete Instruction	use all keywords
			2	Partial instruction	omission of keyword 'squawk'
35	BO	P_RDBK_SQK		**Pilot's readback of Transponder code**	
			1	Complete readback	Complete readback of keyword and 4 digits of code
			2	Partial readback	Omission of keyword or readback of less than 4 digits..
			3	No readback of transponder code	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat/query transponder code
36	BP	RDBK_ERR_SQK		**readback error type (transponder)**	
			6	Confusion with numbers of another type of information	
			7	transposition of numbers	
			8	substitution of numbers	
			9	incorrect number pronunciation	eg. Twenty-one fifty-five (2155)
37	BQ	ATC_INST_TOF		**ATC Instruction (TAKEOFF)**	Keywords: runway assignment, 'clear for takeoff'
			1	Complete Instruction	use all keywords
			2	Partial instruction	omission of any keywords
			9	Incorrect number pronunciation	
38	BR	P_RDBK_TOF		**Pilot's readback of takeoff instruction**	
			1	Complete readback	Readback with all keywords
			2	Partial readback	omission of keywords.
			3	No readback of takeoff	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat / query takeoff instructions

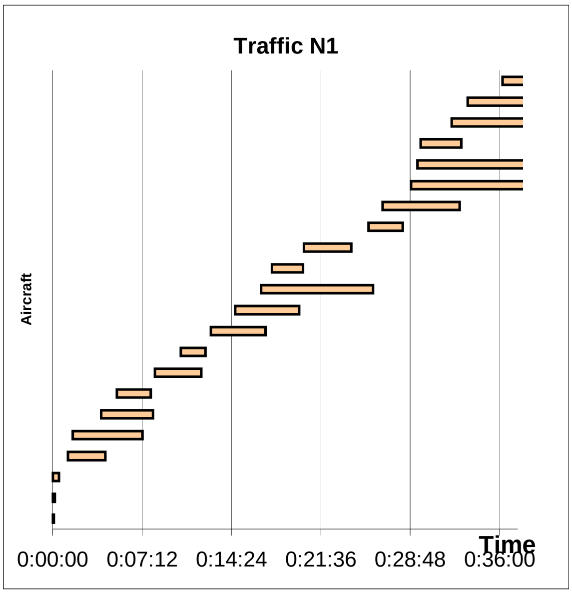
39	BS	RDBK_ERR_TOF		**Readback error type (takeoff)**	
			6	Confusion with other type of information	
			7	Transposition of numbers	
			8	Substitution of numbers or direction	
			9	Incorrect number pronunciation	
40	BT	ATC_ADV_WXI		**ATC Advisory (ALTIMETER SETTING)**	Keywords:'altimeter' / QNH / QFE and the digits
			1	Complete advisory	includes all keyword
			2	partial advisory	omission of any keyword
41	BU	P_RDBK_WXI		**Pilot's readback of Altimeter setting**	
			1	Complete readback	Readback with keyword and digits
			2	partial readback	Omission of QNH digits
			3	No readback of altimeter setting	other general acknowledgement or courtesy
			4	Request repeat / verification	Pilot request repeat/query altimeter setting
42	BV	RDBK_ERR_WXI		**readback error type (altimeter setting)**	
			6	Confusion with numbers of another type of information	
			7	transposition of numbers	
			8	substitution of numbers	
			9	incorrect number pronunciation	eg. Ten-eleven (1011)
43	BW	ATC_ADV_TFC		**ATC Advisory (TRAFFIC)**	Keywords: 'traffic', position, direction-bound, altitude.
			1	Complete Advisory	all keywords
			2	Partial Advisory	
44	BX	ATC_COR_ERR		**ATC correction of Readback Error**	
			1	Altitude assignment	
			2	Heading assignment	
			3	Communications frequency or station	
			4	Altimeter Setting	
			5	Route / position	
			6	Speed	

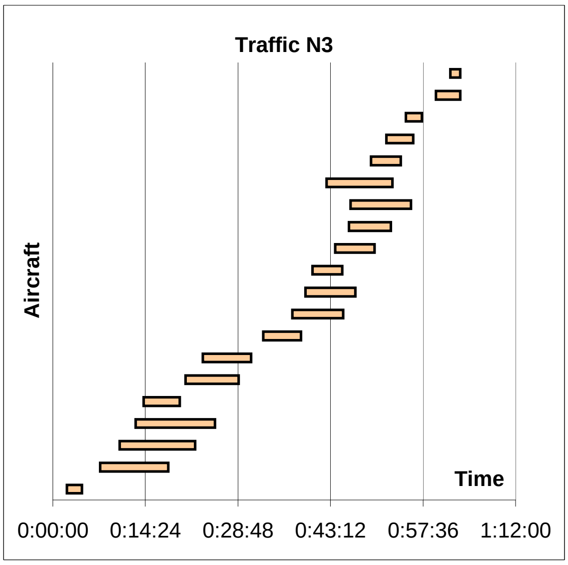
45	BY	HRBK_ERR		**ATC Hearback error type (no response to readback error in)**	
			1	Altitude assignment	
			2	Heading assignment	
			3	Communications frequency or station	
			4	Altimeter Setting	
			5	Route / position	
			6	Speed	
46	BZ	XS_VRBGE		**Any excessive verbiage in transmission**	usage of unnecessary words/phrases
			1	Controller	
			2	pilot	
47	CA	DYSFL		**DYSFLUENCIES**	lapses / word fillers / meaningless hesitations (er.., uhm, ah..)
			1	Controller	
			2	pilot	

CB	COMMENTS	additional info about message

APPENDIX J: TAR TRAFFIC LISTS AND PATTERNS

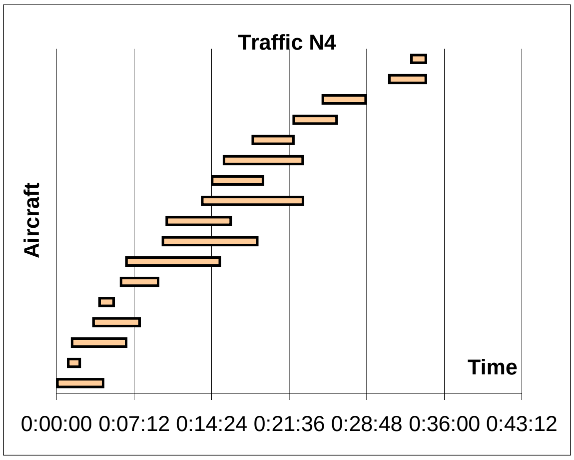
Ref	Aircraft	Contact	Duration	Transfer	Traffic	Epoch	Contact	CT / acft
N1	AXM 335	0:00:02	0:00:05	0:00:07				
	MAS 1332	0:00:02	0:00:10	0:00:12				
	GIA 857	0:00:02	0:00:31	0:00:33				
	TSE603	0:01:14	0:03:02	0:04:16				
	MAS 711	0:01:37	0:05:39	0:07:16				
	MAS 352	0:03:55	0:04:12	0:08:07				
	GIA 818	0:05:10	0:02:46	0:07:56				
	MAS 750	0:08:15	0:03:45	0:12:00				
	MAS 702	0:10:19	0:02:01	0:12:20				
	MAS 1268	0:12:44	0:04:27	0:17:11				
	JAL 6660	0:14:42	0:05:11	0:19:53				
	MAS 1139	0:16:47	0:09:03	0:25:50				
	MAS 72	0:17:40	0:02:32	0:20:12				
	MAS 1138	0:20:14	0:03:50	0:24:04				
	ALK 316	0:25:26	0:02:48	0:28:14				
	MAS 135	0:26:34	0:06:14	0:32:48				
	BVT 188	0:28:52	0:09:58	0:38:50				
	MAS 1203	0:29:23	0:08:53	0:38:16				
	MAS 388	0:29:38	0:03:18	0:32:56				
	IAC 956	0:32:08	0:06:42	0:38:50				
	MAS 151	0:33:26	0:05:24	0:38:50				
	MAS 376	0:36:14	0:02:36	0:38:50	22	00:38:50	01:33:07	0:04:14
N2	MAS 715	0:00:01	0:05:44	0:05:45				
	MAS 125	0:00:01	0:05:12	0:05:13				
	MAS 1385	0:01:16	0:06:11	0:07:27				
	AXM 102	0:03:44	0:06:31	0:10:15				
	MAS 151	0:04:05	0:04:58	0:09:03				
	BVT 188	0:00:01	0:12:21	0:12:22				
	IAC 956	0:06:12	0:03:02	0:09:14				
	MAS 708	0:08:34	0:04:44	0:13:18				
	AXM 912	0:10:52	0:04:36	0:15:28				
	MAS 141	0:13:18	0:06:10	0:19:28				
	MAS 784	0:16:07	0:03:21	0:19:28	11	00:19:28	01:02:50	0:05:43
N3	MAS 5	0:02:12	0:02:24	0:04:36				
	MAS 193	0:07:21	0:10:40	0:18:01				
	MAS 91	0:10:23	0:11:49	0:22:12				
	MAS 31	0:12:52	0:12:26	0:25:18				
	UPS 6912	0:14:09	0:05:40	0:19:49				
	MAS 3	0:20:40	0:08:19	0:28:59				
	MAS 157	0:23:19	0:07:34	0:30:53				
	MAS 9	0:32:43	0:05:56	0:38:39				
	MAS 1427	0:37:16	0:07:58	0:45:14				
	N550TM	0:39:18	0:07:48	0:47:06				
	LNI 283	0:40:25	0:04:41	0:45:06				
	KAL 367	0:43:56	0:06:10	0:50:06				
	AUA 1	0:46:06	0:06:33	0:52:39				
	MAS 191	0:46:20	0:09:27	0:55:47				
	MAS 1133	0:42:36	0:10:19	0:52:55				
	MAS 2604	0:49:31	0:04:39	0:54:10				
	AXM 334	0:51:55	0:04:14	0:56:09				





	AXM 312	0:54:55	0:02:33	0:57:28				
	MNA 831	0:59:37	0:03:50	1:03:27				
	AXM 346	1:01:51	0:01:36	1:03:27	20	01:01:15	02:14:36	0:06:44

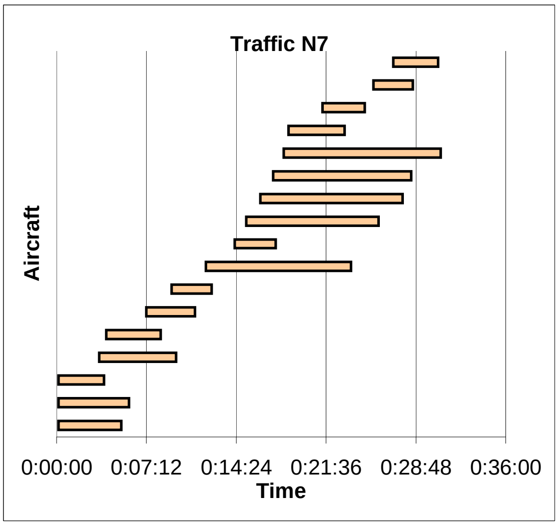
N4	MAS 751	0:00:05	0:04:17	0:04:22				
	UAE 346	0:01:06	0:01:06	0:02:12				
	MAS 1447	0:01:28	0:05:02	0:06:30				
	MAS 758	0:03:27	0:04:18	0:07:45				
	MAS 861	0:04:01	0:01:19	0:05:20				
	THA 416	0:06:00	0:03:29	0:09:29				
	POT 425	0:06:31	0:08:41	0:15:12				
	RMF 591A	0:09:53	0:08:47	0:18:40				
	MAS 2564	0:10:15	0:05:58	0:16:13				
	BVT 185	0:13:33	0:09:22	0:22:55				
	MAS 1145	0:14:28	0:04:45	0:19:13				
	RMF 591B	0:15:33	0:07:20	0:22:53				
	MAS 721	0:18:13	0:03:48	0:22:01				
	MAS 1208	0:22:01	0:04:01	0:26:02				
	MAS 755	0:24:44	0:04:01	0:28:45				
	HVN 759	0:30:55	0:03:25	0:34:20				
	GIA 851	0:32:57	0:01:23	0:34:20	17	00:34:20	01:21:02	0:04:46



N5	MAS 5200	0:00:02	0:03:30	0:03:32				
	THA 416	0:00:16	0:04:33	0:04:49				
	BVT 185	0:02:43	0:14:47	0:17:30				
	AXM 272	0:03:50	0:04:47	0:08:37				
	MAS 1145	0:07:48	0:09:30	0:17:18				
	MAS 6184	0:10:37	0:04:47	0:15:24				
	MAS 721	0:14:44	0:04:08	0:18:52				
	AXM 882	0:19:56	0:04:08	0:24:04				
	HVN 759	0:22:23	0:04:59	0:27:22				
	MAS 1208	0:22:43	0:04:25	0:27:08				
	BAW 3453	0:24:11	0:01:54	0:26:05				
	MAS 1638	0:24:53	0:03:26	0:28:19	12	00:28:19	01:04:54	0:05:25

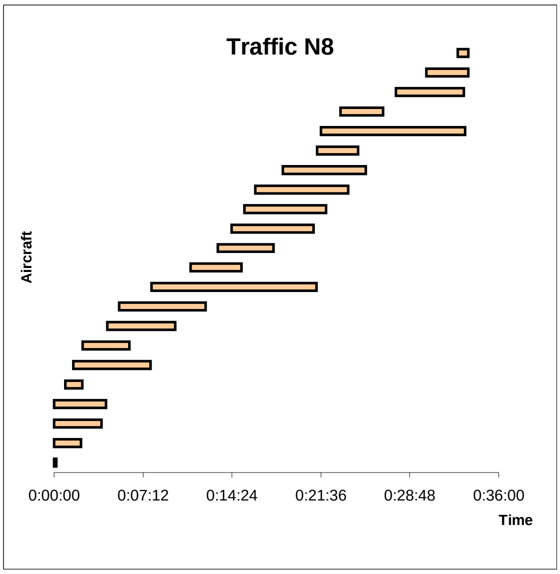
N6	BVT 185	0:00:04	0:06:14	0:06:18				
	MAS 758	0:00:20	0:04:23	0:04:43				
	ALK 312	0:00:04	0:00:37	0:00:41				
	MAS 2564	0:00:04	0:02:32	0:02:36				
	MAS 1146	0:05:19	0:03:40	0:08:59				
	MAS 721	0:07:40	0:05:29	0:13:09				
	MAS 2526	0:11:02	0:03:13	0:14:15				
	AXM 954	0:13:18	0:05:18	0:18:36				
	IYE 862	0:15:17	0:04:44	0:20:01				
	MAS 1208	0:15:39	0:03:11	0:18:50				
	AXM 882	0:18:02	0:04:32	0:22:34				
	GFA 286	0:24:58	0:02:45	0:27:43				
	CAL 678	0:28:04	0:04:13	0:32:17	13	00:32:17	00:50:51	0:03:55

N7	MAS 7	0:00:09	0:05:03	0:05:12
	MAS 782	0:00:09	0:05:41	0:05:50
	HVN 758	0:00:09	0:03:40	0:03:49
	MAS 11	0:03:25	0:06:11	0:09:36
	MAS 94	0:03:59	0:04:23	0:08:22
	AXM 256	0:07:11	0:03:56	0:11:07
	EVA 228	0:09:13	0:03:14	0:12:27
	MAS 1209	0:11:58	0:11:39	0:23:37
	RBA 874	0:14:16	0:03:20	0:17:36
	MAS 1149	0:15:12	0:10:38	0:25:50
	MAS 741	0:16:20	0:11:25	0:27:45
	RMF 557	0:17:22	0:11:05	0:28:27
	SINTA 210	0:18:12	0:12:37	0:30:49
	AXM 208	0:18:36	0:04:30	0:23:06
	MAS 1276	0:21:19	0:03:24	0:24:43
	AXM 314	0:25:24	0:03:11	0:28:35
	MAS 605	0:26:59	0:03:38	0:30:37



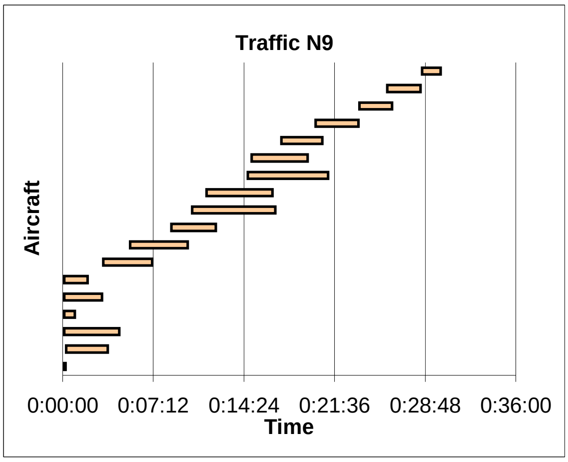
17 00:30:49 01:47:35 0:06:20

N8	KEN 736	0:00:00	0:00:13	0:00:13
	MAS 750	0:00:00	0:02:12	0:02:12
	NCA 242	0:00:00	0:03:52	0:03:52
	MAS 711	0:00:00	0:04:13	0:04:13
	MAS 1321	0:00:55	0:01:23	0:02:18
	9MKNS	0:01:33	0:06:17	0:07:50
	MAS 1138	0:02:18	0:03:50	0:06:08
	MAS 72	0:04:19	0:05:31	0:09:50
	MAS 5411	0:05:16	0:07:01	0:12:17
	TSE 54	0:07:53	0:13:23	0:21:16
	MAS 1268	0:11:03	0:04:09	0:15:12
	MAS 754	0:13:15	0:04:32	0:17:47
	AXM 347	0:14:22	0:06:40	0:21:02
	MAS 871	0:15:24	0:06:38	0:22:02
	MAS 1139	0:16:18	0:07:32	0:23:50
	MAS 388	0:18:31	0:06:44	0:25:15
	IAC 956	0:21:18	0:03:20	0:24:38
	BVT 188	0:21:37	0:11:41	0:33:18
	AXM 321	0:23:11	0:03:28	0:26:39
	MAS 376	0:27:40	0:05:32	0:33:12
	BBG 088	0:30:09	0:03:25	0:33:34
	MAS 125	0:32:41	0:00:53	0:33:34



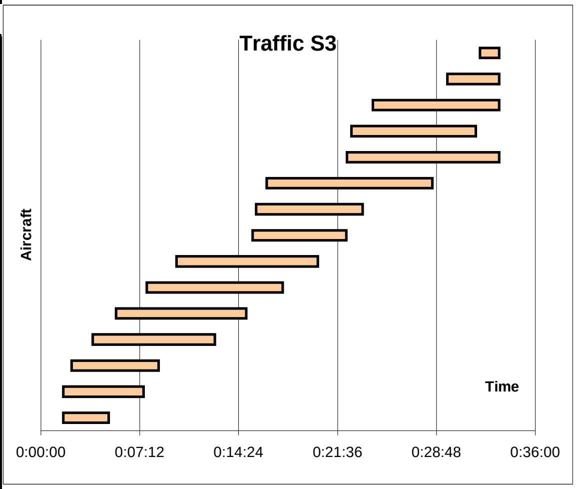
22 00:33:34 1:52:29 0:05:07

N9	RMF 524	0:00:07	0:00:08	0:00:15
	MAS 1384	0:00:17	0:03:20	0:03:37
	MAS 1137	0:00:07	0:04:24	0:04:31
	AXM 942	0:00:07	0:00:53	0:01:00
	MAS 601	0:00:07	0:03:02	0:03:09
	CPA 720	0:00:07	0:01:54	0:02:01
	MAS 2712	0:03:14	0:03:54	0:07:08
	MAS 5	0:05:21	0:04:37	0:09:58
	CSN 366	0:08:38	0:03:34	0:12:12
	UZB 551	0:10:17	0:06:38	0:16:55
	SIA 103	0:11:26	0:05:15	0:16:41
	AXM 313	0:14:43	0:06:23	0:21:06
	MAS 1432	0:15:01	0:04:28	0:19:29



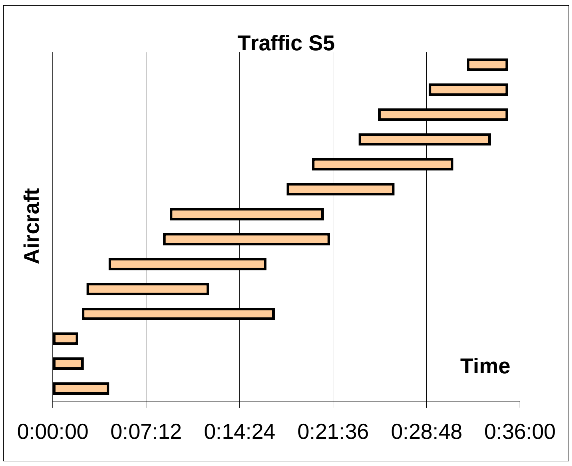
	THA 420	0:17:23	0:03:16	0:20:39				
	CAL 652	0:20:05	0:03:26	0:23:31				
	MAS 2612	0:23:35	0:02:36	0:26:11				
	JAL 6660	0:25:47	0:02:40	0:28:27				
	AXM 936	0:28:33	0:01:31	0:30:04	18	00:30:04	1:01:59	0:03:27
N10	TSE 604	0:00:40	0:00:11	0:00:51				
	MAS 1456	0:00:54	0:02:40	0:03:34				
	9MSSN	0:00:40	0:09:29	0:10:09				
	MAS 2624	0:00:40	0:02:06	0:02:46				
	MAS 1338	0:02:53	0:03:50	0:06:43				
	AXM 50	0:05:41	0:03:33	0:09:14				
	MAS 1268	0:07:35	0:04:18	0:11:53				
	THA 418	0:09:23	0:05:50	0:15:13				
	MAS 1163	0:11:31	0:07:09	0:18:40				
	AXM 253	0:13:53	0:06:27	0:20:20				
	MAS 1405	0:15:33	0:05:58	0:21:31				
	MAS 2598	0:16:48	0:04:56	0:21:44				
	AXM 210	0:19:22	0:04:04	0:23:26				
	AXM 358	0:23:25	0:02:21	0:25:46				
	MAS 2532	0:29:09	0:04:23	0:33:32	15	0:33:32	1:07:15	0:04:29
N11	MAS 1133	0:01:21	0:00:14	0:01:35				
	JAL 722	0:01:36	0:05:02	0:06:38				
	MAS 1063	0:04:12	0:05:25	0:09:37				
	MAS 131	0:08:03	0:05:33	0:13:36				
	MAS 2626	0:11:58	0:03:58	0:15:56				
	MAS 2532	0:14:43	0:07:01	0:21:44				
	SIA 119	0:19:01	0:05:26	0:24:27				
	MAS 1471	0:20:13	0:05:12	0:25:25				
	MAS 1165	0:20:32	0:07:02	0:27:34				
	MAS 1292	0:29:53	0:00:53	0:30:46				
	AXM 316	0:27:00	0:03:46	0:30:46	11	0:29:25	0:49:32	0:04:30
N12	MAS 161	0:03:40	0:17:59	0:21:39				
	IAC 955	0:04:04	0:20:00	0:24:04				
	TSE 326	0:10:53	0:07:56	0:18:49				
	9MAAF	0:12:10	0:18:00	0:30:10				
	RMF 570	0:13:09	0:13:09	0:26:18				
	MAS 1137	0:16:10	0:10:25	0:26:35				
	MAS 2551	0:18:23	0:10:54	0:29:17				
	MAS 2525	0:18:58	0:11:12	0:30:10				
	CPA 720	0:24:56	0:05:14	0:30:10				
	MAS 6185	0:29:49	0:00:21	0:30:10	10	0:27:10	1:55:10	0:11:31
S1	AXM 943	0:00:04	0:07:22	0:07:26				
	MAS 2603	0:00:04	0:02:15	0:02:19				
	MAS 2711	0:00:04	0:09:16	0:09:20				
	AXM 201	0:08:30	0:03:32	0:12:02	4	0:12:02	0:22:25	0:05:36
S2	FDX 5193	0:00:05	0:05:11	0:05:16				
	UPS 6912	0:00:05	0:02:30	0:02:35				
	JAL 6669	0:00:54	0:09:50	0:10:44				
	MAS 3	0:04:53	0:06:19	0:11:12				

	SIA 102	0:05:16	0:11:28	0:16:44				
	MAS 157	0:06:38	0:08:25	0:15:03				
	MAS2547	0:07:04	0:12:00	0:19:04				
	MAS 1034	0:14:04	0:08:37	0:22:41				
	MAS 9	0:14:20	0:07:15	0:21:35				
	MAS 1427	0:20:56	0:06:08	0:27:04				
	MAS 1133	0:28:33	0:04:08	0:32:41				
	MAS 602	0:29:36	0:03:05	0:32:41				
	MAS 191	0:31:30	0:01:11	0:32:41	13	0:32:41	1:26:07	0:06:37



S3	TSE 53	0:01:38	0:03:20	0:04:58				
	CPA 721	0:01:38	0:05:52	0:07:30				
	MAS 753	0:02:14	0:06:21	0:08:35				
	MAS 720	0:03:46	0:08:55	0:12:41				
	MAS 377	0:05:28	0:09:31	0:14:59				
	THA 417	0:07:42	0:09:55	0:17:37				
	MAS 6123	0:09:53	0:10:19	0:20:12				
	MAS 7	0:15:25	0:06:51	0:22:16				
	MAS 759	0:15:40	0:07:47	0:23:27				
	MNA 930	0:16:26	0:12:05	0:28:31				
	MAS 2705	0:22:17	0:11:07	0:33:24				
	BBG 082	0:22:37	0:09:05	0:31:42				
	MAS 1058	0:24:10	0:09:14	0:33:24				
	QTA 352	0:29:36	0:03:48	0:33:24				
	MAS 130	0:31:58	0:01:26	0:33:24	15	0:31:46	1:55:36	0:07:42

S4	MAS 23	0:00:36	0:10:09	0:10:45				
	MAS 202	0:00:36	0:02:28	0:03:04				
	AUS 1	0:00:36	0:03:39	0:04:15				
	MAS 3	0:08:43	0:12:36	0:21:19				
	FDX 19	0:14:59	0:10:52	0:25:51				
	MAS 179	0:22:04	0:15:21	0:37:25				
	JAL 6669	0:24:29	0:12:17	0:36:46				
	UPS 6912	0:28:31	0:10:07	0:38:38				
	MAS 2637	0:36:17	0:02:21	0:38:38				
	LNI 283	0:36:46	0:01:52	0:38:38				
	SIA 102	0:37:28	0:01:10	0:38:38				
	GADING 01	0:38:00	0:00:38	0:38:38	12	0:38:38	1:23:30	0:06:57

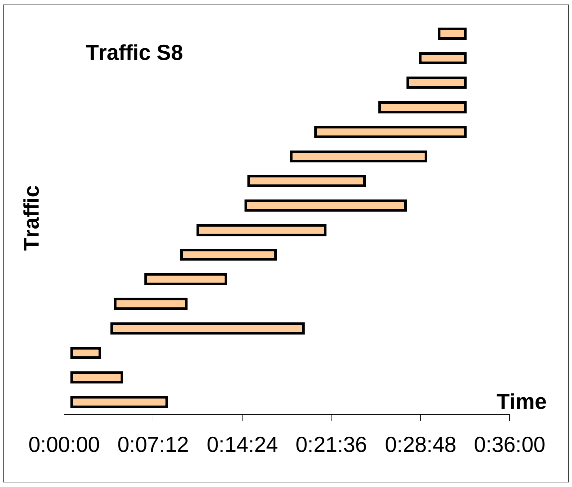


S5	MAS 1447	0:00:07	0:04:10	0:04:17				
	MAS 751	0:00:07	0:02:12	0:02:19				
	MAS 861	0:00:07	0:01:47	0:01:54				
	HLR 717	0:02:20	0:14:42	0:17:02				
	MAS 710	0:02:42	0:09:17	0:11:59				
	POT 425	0:04:25	0:11:59	0:16:24				
	MAS 2515	0:08:37	0:12:41	0:21:18				
	MAS 1145	0:09:08	0:11:40	0:20:48				
	MAS 755	0:18:07	0:08:08	0:26:15				
	AXM 203	0:20:05	0:10:43	0:30:48				
	HVN 759	0:23:41	0:10:00	0:33:41				
	EVA 227	0:25:10	0:09:51	0:35:01				
	RBA 873	0:29:05	0:05:56	0:35:01				
	MAS 870	0:32:01	0:03:00	0:35:01	14	0:35:00	1:56:06	0:08:18

S6	MAS 377	0:00:04	0:08:45	0:08:49				
	THA 417	0:02:24	0:04:40	0:07:04				
	MAS 1058	0:07:42	0:11:13	0:18:55				
	MAS 65	0:10:13	0:11:10	0:21:23				
	MNI 930	0:12:19	0:11:50	0:24:09				
	AXM 209	0:15:06	0:12:49	0:27:55				
	MAS 2529	0:16:18	0:13:26	0:29:44				
	MAS 391	0:13:42	0:12:02	0:25:44				
	AXM 105	0:19:59	0:11:54	0:31:53				
	MAS 1459	0:27:59	0:03:54	0:31:53				
	AXM 349	0:31:24	0:00:29	0:31:53	11	0:31:53	1:42:12	0:09:17

S7	MAS 783	0:00:07	0:04:17	0:04:24				
	JAL 721	0:00:07	0:06:09	0:06:16				
	MAS 705	0:00:07	0:00:20	0:00:27				
	MAS 703	0:00:31	0:10:49	0:11:20				
	MAS 1289	0:00:07	0:03:07	0:03:14				
	AXM 163	0:00:07	0:11:01	0:11:08				
	AXM 305	0:04:11	0:07:47	0:11:58				
	CAL 651	0:00:07	0:17:43	0:17:50				
	AXM 349	0:07:09	0:07:46	0:14:55				
	MAS 065	0:10:14	0:12:12	0:22:26				
	MAS 753	0:15:45	0:08:59	0:24:44				
	MAS 72	0:20:35	0:09:00	0:29:35				
	MAS 1405	0:24:20	0:07:14	0:31:34				
	SIA 118	0:28:33	0:04:40	0:33:13				
	UPS 6911	0:30:00	0:03:13	0:33:13	15	0:33:13	1:54:17	0:07:37

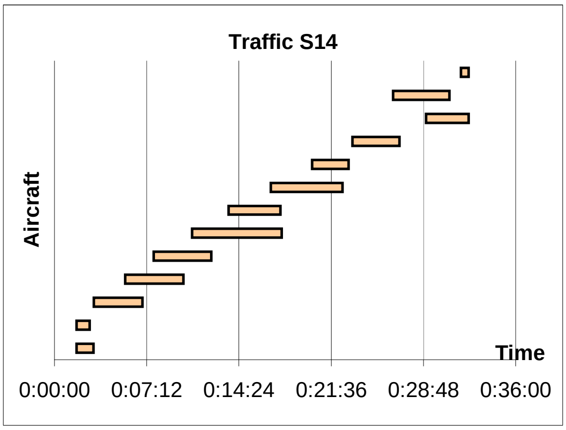
S8	MAS 753	0:00:37	0:07:43	0:08:20				
	AXM 315	0:00:37	0:04:06	0:04:43				
	SIA 116	0:00:37	0:02:18	0:02:55				
	MAS 73	0:03:51	0:15:31	0:19:22				
	MAS 353	0:04:09	0:05:46	0:09:55				
	MAS 1	0:06:36	0:06:30	0:13:06				
	MAS 1157	0:09:30	0:07:37	0:17:07				
	MAS 759	0:10:48	0:10:19	0:21:07				
	AXM 955	0:14:42	0:12:56	0:27:38				
	MAS 865	0:14:55	0:09:24	0:24:19				
	UAE 338	0:18:22	0:10:55	0:29:17				
	MAS 608	0:20:20	0:12:08	0:32:28				
	MAS 730	0:25:30	0:06:58	0:32:28				
	MAS 7047	0:27:47	0:04:41	0:32:28				
	JAL 723	0:28:47	0:03:41	0:32:28				
	AXM 333	0:30:18	0:02:10	0:32:28	16	0:32:28	2:02:43	0:07:40



S9	MAS 710	0:00:19	0:02:28	0:02:47
	MAS 69	0:00:19	0:07:31	0:07:50
	EVA 227	0:03:23	0:11:34	0:14:57
	HVA 759	0:00:19	0:04:16	0:04:35
	GFA 282	0:06:22	0:06:39	0:13:01
	AXM 953	0:11:38	0:09:48	0:21:26
	MAS 870	0:10:06	0:09:27	0:19:33
	MAS 606	0:15:36	0:10:07	0:25:43
	MAS 787	0:17:11	0:06:07	0:23:18

	AXM 103	0:24:35	0:07:08	0:31:43				
	MAS 6153	0:25:12	0:06:31	0:31:43	11	0:31:43	1:21:36	0:07:25
S10	UAE 338	0:01:10	0:01:43	0:02:53				
	AXM 955	0:03:17	0:09:04	0:12:21				
	MAS 608	0:03:42	0:11:45	0:15:27				
	MAS 720	0:07:08	0:11:37	0:18:45				
	MAS 1	0:11:07	0:07:51	0:18:58				
	MAS 1157	0:20:40	0:06:05	0:26:45				
	AXM 305	0:23:08	0:05:13	0:28:21				
	CPA 721	0:27:47	0:02:27	0:30:14				
	MAS 377	0:29:54	0:00:20	0:30:14	9	0:29:14	0:56:05	0:06:14
S11	MAS 1289	0:00:08	0:09:00	0:09:08				
	JAL 722	0:04:32	0:10:38	0:15:10				
	MAS 148	0:05:22	0:11:30	0:16:52				
	MAS 1161	0:06:10	0:05:33	0:11:43				
	MAS 783	0:11:59	0:07:48	0:19:47				
	MAS 122	0:15:56	0:09:02	0:24:58				
	MAS 2617	0:18:35	0:08:36	0:27:11				
	CAL 651	0:20:46	0:09:02	0:29:48				
	MAS 71	0:22:09	0:09:35	0:31:44	9	0:31:44	1:20:44	0:08:58
S12	MAS 1163	0:00:00	0:05:39	0:05:39				
	MAS 2747	0:00:00	0:08:07	0:08:07				
	MAS 1062	0:00:00	0:03:13	0:03:13				
	MAS 1405	0:02:43	0:07:31	0:10:14				
	MAS 2609	0:11:29	0:11:00	0:22:29				
	GIA 856	0:12:20	0:07:53	0:20:13				
	AXM 107	0:15:58	0:09:47	0:25:45				
	MAS 722	0:20:14	0:10:58	0:31:12				
	MAS 1465	0:24:31	0:06:56	0:31:27				
	MAS 852	0:25:00	0:06:27	0:31:27				
	MAS 2715	0:26:22	0:05:05	0:31:27				
	MAS 2663	0:27:58	0:03:29	0:31:27				
	PAL 507	0:28:19	0:03:08	0:31:27	13	0:31:27	1:29:13	0:06:52
S13	AXM 862	0:00:34	0:00:08	0:00:42				
	MAS 69	0:00:34	0:03:25	0:03:59				
	MAS 870	0:02:58	0:06:08	0:09:06				
	AXM 953	0:04:48	0:07:07	0:11:55				
	AXM 103	0:06:52	0:10:40	0:17:32				
	GFA 286	0:07:19	0:07:06	0:14:25				
	AXM 203	0:12:55	0:09:17	0:22:12				
	MAS 785	0:15:25	0:05:35	0:21:00				
	AXM 303	0:19:30	0:05:38	0:25:08				
	KLM 809	0:21:18	0:07:16	0:28:34	10	00:28:34	1:02:20	0:06:14

S14	MAS 601	0:01:44	0:01:20	0:03:04				
	MAS 760	0:01:44	0:01:03	0:02:47				
	CSN 366	0:03:04	0:03:50	0:06:54				
	AXM 880	0:05:31	0:04:35	0:10:06				
	MAS 5	0:07:45	0:04:31	0:12:16				
	MAS 380	0:10:44	0:07:02	0:17:46				
	RNA 414	0:13:35	0:04:05	0:17:40				
	AMT 691	0:16:53	0:05:37	0:22:30				
	SIA 103	0:20:07	0:02:52	0:22:59				
	UPS 6912	0:23:15	0:03:43	0:26:58				
	CAL 652	0:29:00	0:03:21	0:32:21				
	MAS 1432	0:26:26	0:04:25	0:30:51				
	THA 420	0:31:44	0:00:37	0:32:21	13	0:31:21	0:47:01	0:03:37



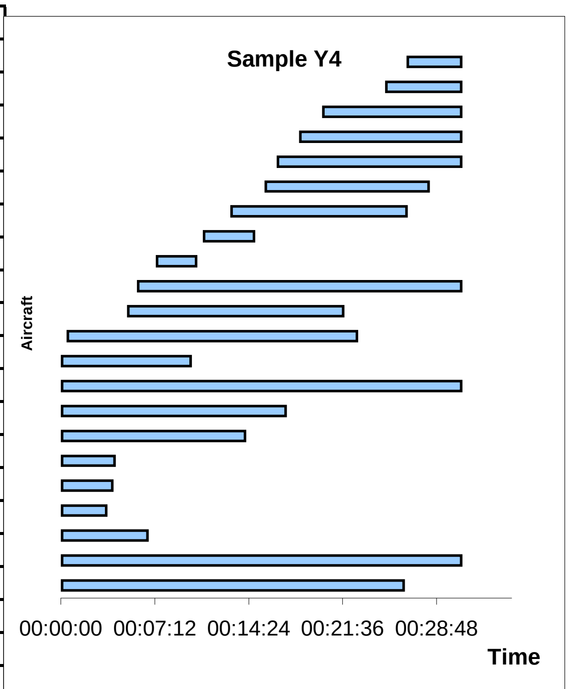
S15	CAL 655	0:00:42	0:03:52	00:04:34				
	MAS 710	0:00:42	0:09:30	00:10:12				
	MAS 755	0:08:07	0:06:35	00:14:42				
	MAS 2613	0:13:32	0:07:56	00:21:28				
	AXM 361	0:21:49	0:09:40	00:31:29				
	EVA 227	0:25:13	0:09:21	00:34:34				
	RBA 873	0:26:22	0:09:43	00:36:05				
	MAS 69	0:27:27	0:10:54	00:38:21				
	MAS 606	0:35:36	0:07:28	00:43:04				
	MAS 1145	0:37:31	0:04:51	00:42:22				
	AXM 862	0:41:43	0:01:21	00:43:04	11	00:43:04	1:21:11	0:07:23

S16	MAS 1052	0:00:03	0:03:51	0:03:54				
	AXM 273	0:00:03	0:10:06	0:10:09				
	MAS 159	0:00:03	0:06:09	0:06:12				
	MAS 1281	0:15:39	0:13:15	0:28:54				
	MAS 1153	0:16:56	0:04:32	0:21:28				
	MAS 865	0:17:22	0:07:01	0:24:23				
	SIA 116	0:28:08	0:06:49	0:34:57				
	MAS 353	0:30:31	0:04:26	0:34:57	8	0:34:57	0:56:09	0:07:01

Aircraft	372			
Elapse		15:08:48		
Total Contact			38:38:35	
Contact per aircraft				0:06:14

APPENDIX K: AREA RADAR TRAFFIC LISTS AND PATTERNS

Ref	Aircraft	Contact	Duration	Transfer	Traffic	Epoch	Contact	Time/Acft
Y1	MAS 1140	00:00:03	00:14:18	00:14:21				
	SIA 191	00:00:03	00:04:20	00:04:23				
	AXM 630	00:00:03	00:11:17	00:11:20				
	TSE 52	00:00:03	00:04:38	00:04:41				
	JAL 4401	00:00:03	00:20:30	00:20:33				
	MAS 6123	00:00:03	00:20:30	00:20:33				
	MAS 1438	00:09:00	00:11:33	00:20:33				
	THA 415	00:15:08	00:05:25	00:20:33				
	SIA 455	00:16:40	00:03:53	00:20:33				
	MAS 12	00:19:16	00:01:17	00:20:33	10	00:20:33	1:37:41	00:09:46
Y3	MAS 3	00:31:11	00:04:18	00:35:29				
	MAS 179	00:31:11	00:18:41	00:49:52				
	SIA 317	00:31:11	00:04:48	00:35:59				
	O 9458	00:31:11	00:25:22	00:56:33				
	IAC 955	00:31:11	00:17:35	00:48:46				
	IAC 957	00:31:11	00:18:31	00:49:42				
	QFA 32	00:31:11	00:20:34	00:51:45				
	AUSY 039	00:31:11	00:27:39	00:58:50	8	00:27:39	2:17:28	0:17:11
Y4	MAS 21	00:00:06	00:26:12	00:26:18				
	MAS 5	00:00:06	00:30:37	00:30:43				
	MAS 23	00:00:06	00:06:34	00:06:40				
	SIA 429	00:00:06	00:03:24	00:03:30				
	SIA 327	00:00:06	00:03:52	00:03:58				
	THA 490	00:00:06	00:04:02	00:04:08				
	IAC 957	00:00:06	00:14:03	00:14:09				
	SIA 323	00:00:06	00:17:09	00:17:15				
	SIA 325	00:00:06	00:30:37	00:30:43				
	MAS 179	00:00:06	00:09:52	00:09:58				
	QTR 425	00:00:32	00:22:12	00:22:44				
	SQC 7973	00:05:11	00:16:29	00:21:40				
	MAS 7363	00:05:56	00:24:47	00:30:43				
	IAC 555	00:07:22	00:03:01	00:10:23				
	HLR 717	00:10:59	00:03:51	00:14:50				
	MAS 6140	00:13:06	00:13:25	00:26:31				
	AIC 480	00:15:43	00:12:30	00:28:13				
	SIA 317	00:16:38	00:14:05	00:30:43				
	SIA 403	00:18:21	00:12:22	00:30:43				
	MAS 6136	00:20:08	00:10:35	00:30:43				
	TSE 75	00:24:57	00:05:46	00:30:43				
	PO 725	00:26:36	00:04:07	00:30:43	22	00:30:43	4:49:32	0:13:10
Y5	MAS 5200	00:07:11	00:25:36	00:32:47				
	LNI 288	00:07:11	00:00:26	00:07:37				
	MAS 1447	00:07:11	00:02:32	00:09:43				
	GFA 488	00:07:11	00:02:44	00:09:55				
	AXM 301	00:07:11	00:11:42	00:18:53				
	UAE 404	00:12:37	00:21:56	00:34:33				
	UNL010W	00:13:00	00:09:09	00:22:09				
	MAS 160	00:15:09	00:19:24	00:34:33				
	QTR 188	00:19:31	00:04:49	00:24:20				
	QTR 199	00:20:10	00:08:59	00:29:09				

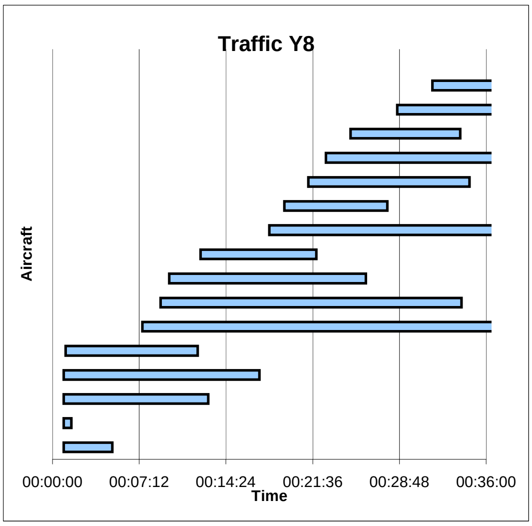


	AXM 302	00:07:11	00:14:06	00:21:17				
	SIA 320	00:23:10	00:11:23	00:34:33				
	MAS 861	00:24:59	00:05:28	00:30:27				
	SIA 456	00:29:11	00:05:22	00:34:33				
	MAS 1145	00:33:01	00:01:32	00:34:33				
	SIA 319	00:31:58	00:02:35	00:34:33	16	00:27:33	2:27:43	0:09:14

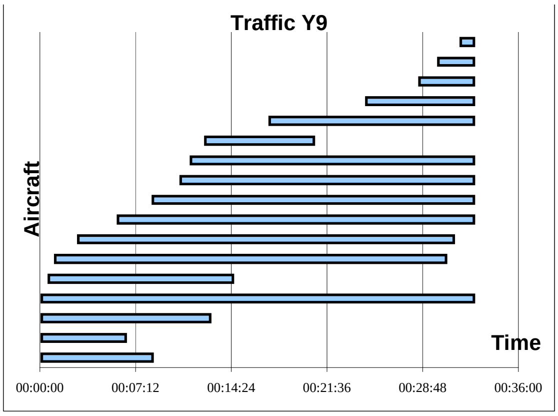
Y6	QTR 198	00:00:04	00:07:56	00:08:00				
	MAS 31	00:00:04	00:00:16	00:00:20				
	IMT 387	00:00:22	00:27:55	00:28:17				
	MAS 6143	00:03:24	00:10:08	00:13:32				
	UN 010W	00:05:46	00:10:43	00:16:29				
	MAS 1447	00:04:10	00:23:04	00:27:14				
	LNI 288	00:10:52	00:06:42	00:17:34				
	UAE 404	00:15:10	00:12:13	00:27:23				
	CLX 795	00:22:37	00:05:40	00:28:17				
	AXM 631	00:23:24	00:04:53	00:28:17	10	00:28:17	1:49:30	0:10:57

Y7	BBG 872	00:01:47	00:29:16	00:31:03				
	MAS 1447	00:00:07	00:05:52	00:05:59				
	MAS 652	00:00:07	00:03:05	00:03:12				
	MAS 1471D	00:00:07	00:07:55	00:08:02				
	AXM 301	00:00:07	00:21:55	00:22:02				
	TSE 302	00:11:34	00:16:02	00:27:36				
	SIA 461	00:13:01	00:18:02	00:31:03				
	UN 200W	00:13:58	00:17:05	00:31:03				
	JTY 188	00:13:27	00:04:48	00:18:15				
	SIA 472	00:18:51	00:12:12	00:31:03				
	MAS 1638	00:19:16	00:11:47	00:31:03				
	MAS 7	00:20:33	00:10:30	00:31:03				
	AIC 472	00:26:45	00:04:18	00:31:03				
	UBA 502	00:28:09	00:02:54	00:31:03	14	00:30:03	2:45:41	0:11:50

Y8	UN 010W	00:00:56	00:04:03	00:04:59				
	SIA 319	00:00:56	00:00:40	00:01:36				
	THA 416	00:00:56	00:12:01	00:12:57				
	MAS 787	00:00:56	00:16:17	00:17:13				
	SQC 7883	00:01:06	00:10:59	00:12:05				
	MAS 785	00:07:27	00:29:29	00:36:56				
	KLM 809	00:08:58	00:25:01	00:33:59				
	MAS 1208	00:09:42	00:16:20	00:26:02				
	SIA 455	00:12:18	00:09:38	00:21:56				
	AXM 303	00:18:00	00:21:02	00:39:02				
	MAS 6153	00:19:15	00:08:35	00:27:50				
	MAS 1146	00:21:15	00:13:24	00:34:39				
	TGW 882	00:22:42	00:16:20	00:39:02				
	MAS 1625	00:24:44	00:09:08	00:33:52				
	KLM 837	00:28:37	00:10:25	00:39:02				
	MNA 189	00:31:33	00:06:14	00:37:47				
	MAS 614	00:38:27	00:00:35	00:39:02	17	00:39:02	3:30:11	0:12:22

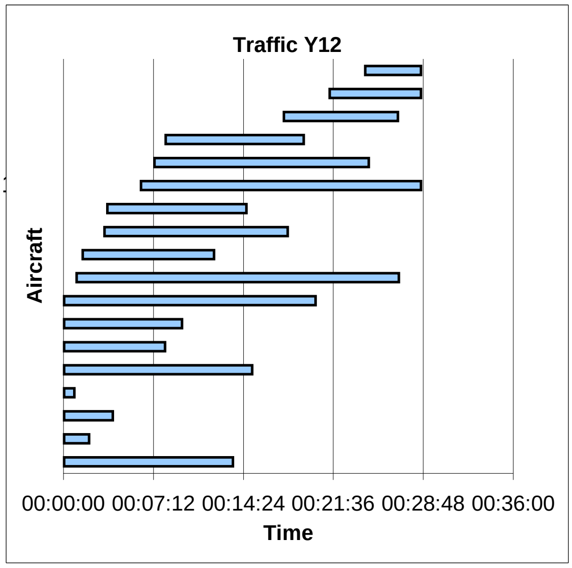


Y9	SIA 339	00:00:08	00:08:22	00:08:30
	GFA 149	00:00:08	00:06:21	00:06:29
	SIA 25	00:00:08	00:12:42	00:12:50
	SQC 7356	00:00:08	00:32:32	00:32:40



	MAS 195	00:00:40	00:13:53	00:14:33				
	MAS 179	00:01:10	00:29:25	00:30:35				
	MAS 5	00:02:54	00:28:16	00:31:10				
	MAS 15	00:05:52	00:26:48	00:32:40				
	IRA 957	00:08:30	00:24:10	00:32:40				
	MAS 17	00:10:35	00:22:05	00:32:40				
	TO 9167	00:11:22	00:21:18	00:32:40				
	SIA 403	00:12:27	00:08:11	00:20:38				
	SIA 333	00:17:17	00:15:23	00:32:40				
	IMT 377	00:24:34	00:08:06	00:32:40				
	MAS 91	00:28:33	00:04:07	00:32:40				
	AIC 480	00:29:59	00:02:41	00:32:40				
	MAS 3	00:31:40	00:01:00	00:32:40	17	00:32:40	4:25:20	0:15:36
Y10	MAS 1146	00:00:38	00:09:05	00:09:43				
	CAL 673	00:00:38	00:00:36	00:01:14				
	KLM 809	00:00:38	00:08:02	00:08:40				
	LNI 289	00:00:38	00:03:59	00:04:37				
	MAS 1147	00:02:25	00:10:32	00:12:57				
	UBA 502	00:00:38	00:03:27	00:04:05				
	AXM 882	00:00:38	00:08:13	00:08:51				
	9MINA	00:00:38	00:04:05	00:04:43				
	BMAI	00:00:38	00:05:50	00:06:28				
	KLM 837	00:00:38	00:08:42	00:09:20				
	JTY 189	00:09:22	00:03:47	00:13:09				
	AXM 303	00:00:38	00:12:33	00:13:11				
	UNL011W	00:16:31	00:09:02	00:25:33				
	SVW 125X	00:19:14	00:17:17	00:36:31				
	AXM 873	00:31:04	00:05:27	00:36:31				
	UNL010W	00:36:00	00:00:31	00:36:31	16	00:36:31	1:51:08	0:06:57
Y11	QFA 32	00:00:04	00:28:23	00:28:27				
	MAS 21	00:00:04	00:04:07	00:04:11				
	IAC 957	00:00:04	00:03:26	00:03:30				
	MAS 91	00:00:04	00:18:04	00:18:08				
	MAS 193	00:06:46	00:05:38	00:12:24				
	IAC 555	00:00:04	00:07:43	00:07:47				
	SIA 317	00:00:04	00:12:44	00:12:48				
	SIA 411	00:16:51	00:13:38	00:30:29				
	CLX 794	00:19:23	00:11:06	00:30:29				
	CHH 494	00:25:26	00:05:03	00:30:29				
	MAS 199	00:29:13	00:01:16	00:30:29	11	00:30:29	1:51:08	0:10:06
Y12	MAS 1161	00:00:03	00:13:32	00:13:35				
	AXM 863	00:00:03	00:02:01	00:02:04				
	MAS 674	00:00:03	00:03:55	00:03:58				
	MAS 1453	00:00:03	00:00:51	00:00:54				
	AXM 884	00:00:03	00:15:04	00:15:07				
	SLK 368	00:00:03	00:08:06	00:08:09				
	SLK 758	00:00:03	00:09:28	00:09:31				
	9MISJ	00:00:03	00:20:09	00:20:12				
	MAS 783	00:01:03	00:25:49	00:26:52				
	LTU 9938	00:01:33	00:10:31	00:12:04				
	SIA 198	00:03:17	00:14:41	00:17:58				
	SQC 7353	00:03:30	00:11:10	00:14:40				

AXM 349	00:06:12	00:22:26	00:28:38
MAS 194	00:07:17	00:17:11	00:24:28
ALK 476	00:08:10	00:11:05	00:19:15
CPA 721	00:17:38	00:09:09	00:26:47
MAS 1164	00:21:18	00:07:20	00:28:38
MAS 180	00:24:09	00:04:29	00:28:38



Y13

MAS 1146	00:01:30	00:03:05	00:04:35				
LNI 289	00:03:00	00:10:41	00:13:41				
MAS 787	00:01:30	00:18:24	00:19:54				
AXM 882	00:04:38	00:24:41	00:29:19				
MAS 8204	00:05:04	00:09:27	00:14:31				
MAS 1625	00:12:06	00:07:56	00:20:02				
AXM 303	00:14:33	00:15:45	00:30:18				
MAS 785	00:15:07	00:15:11	00:30:18				
CAL 673	00:15:37	00:07:17	00:22:54				
KLM 835	00:15:50	00:14:28	00:30:18				
JTY 189	00:19:36	00:08:22	00:27:58				
MAS 1147	00:29:43	00:00:35	00:30:18	12	00:29:18	2:15:52	0:11:19

Y14

SIA 327	00:00:00	00:27:52	00:27:52				
MAS 6140	00:00:00	00:12:34	00:12:34				
MAS 195	00:01:23	00:04:06	00:05:29				
SIA 323	00:02:36	00:26:58	00:29:34				
MAS 15	00:00:00	00:19:18	00:19:18				
MAS 5	00:05:30	00:24:04	00:29:34				
SIA 403	00:08:29	00:03:26	00:11:55				
GFA 149	00:00:00	00:10:11	00:10:11				
SIA 345	00:09:29	00:20:05	00:29:34				
SIA 25	00:00:00	00:12:03	00:12:03				
MAS 91	00:14:45	00:14:49	00:29:34				
SIA 333	00:15:29	00:14:05	00:29:34				
IAC 555	00:22:00	00:07:34	00:29:34				
MAS 7221	00:22:19	00:07:01	00:29:20	14	00:29:34	3:24:06	0:14:35

R1

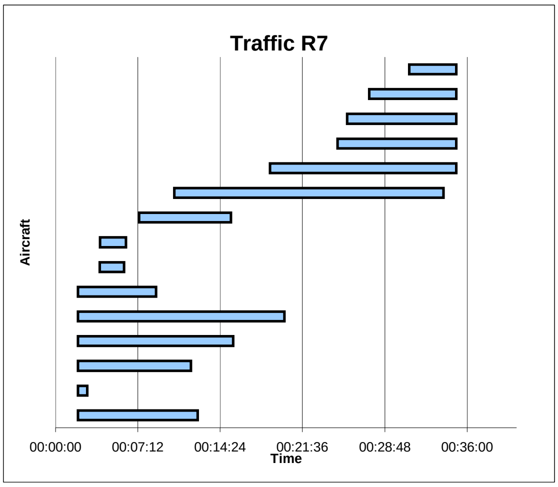
CSN 433	00:00:05	00:14:25	00:14:30				
SLK 288	00:00:05	00:01:39	00:01:44				
PKTVK	00:00:05	00:01:47	00:01:52				
SIA 118	00:04:49	00:04:38	00:09:27				
GIA 856	00:05:22	00:06:49	00:12:11				
CPA 735	00:00:05	00:06:47	00:06:52				
MAS 1062	00:08:55	00:09:43	00:18:38				
GIA 8211	00:15:50	00:14:48	00:30:38				
AXM 358	00:16:30	00:13:57	00:30:27				
AXM 957	00:29:43	00:07:24	00:37:07				
MAS 722	00:31:45	00:06:02	00:37:47				
AXM 955	00:32:01	00:07:33	00:39:34				
MAS 852	00:33:32	00:06:02	00:39:34				
SIA412	00:38:20	00:01:14	00:39:34	14	00:39:34	1:42:48	0:07:21

R2

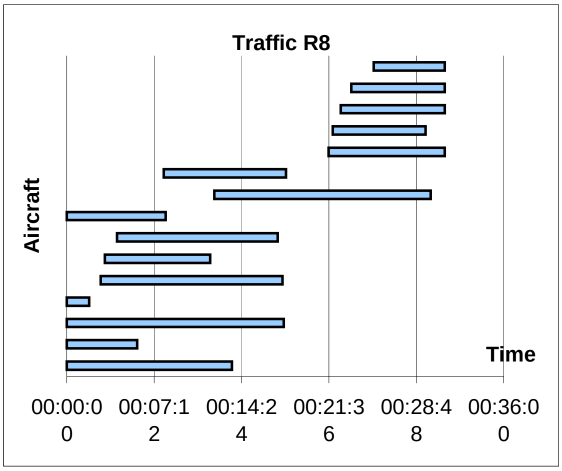
MAS 1059	00:00:07	00:07:44	00:07:51
DMG 4416	00:02:23	00:07:47	00:10:10
SIA 412	00:06:21	00:12:53	00:19:14
UAE 412	00:06:45	00:16:26	00:23:11
MAS 852	00:13:30	00:08:22	00:21:52

	AXM 358	00:16:01	00:14:15	00:30:16				
	MAS 722	00:16:49	00:08:23	00:25:12				
	GIA 4211	00:03:02	00:19:55	00:22:57				
	IYE 863	00:26:48	00:08:02	00:34:50				
	KLM 810	00:25:16	00:08:24	00:33:40				
	AXM 957	00:33:43	00:01:07	00:34:50	11	00:34:50	1:53:18	0:10:18
R3	MAS 605	00:00:39	00:02:37	00:03:16				
	JTY 8239	00:00:39	00:10:54	00:11:33				
	DLH 788	00:04:58	00:14:18	00:19:16				
	MAS 714	00:00:39	00:05:43	00:06:22				
	JTY 238	00:00:39	00:11:57	00:12:36				
	GIA 816	00:14:11	00:05:19	00:19:30				
	MAS 1052	00:15:23	00:09:02	00:24:25				
	AXM 954	00:16:23	00:09:01	00:25:24				
	SAF 6138	00:00:39	00:19:04	00:19:43	9	00:25:24	1:27:55	0:09:46
R4	GIA 838	00:00:03	00:15:58	00:16:01				
	MAS 608	00:04:00	00:12:08	00:16:08				
	BAW 15	00:00:03	00:11:07	00:11:10				
	GFA 487	00:06:02	00:09:22	00:15:24				
	N168BF	00:00:03	00:07:32	00:07:35				
	QFA 10	00:17:35	00:12:42	00:30:17				
	AFR 256	00:00:03	00:30:14	00:30:17				
	GIA 819	00:00:03	00:22:50	00:22:53				
	MAS 720	00:23:44	00:06:33	00:30:17				
	UBA 255	00:00:03	00:28:00	00:28:03	10	00:30:17	2:36:26	0:15:39
R5	AXM 955	00:00:44	00:07:40	00:08:24				
	QFA 10	00:00:44	00:00:31	00:01:15				
	SIA 321	00:01:15	00:15:51	00:17:06				
	SQC 7992	00:02:28	00:10:53	00:13:21				
	AXM 956	00:02:03	00:13:12	00:15:15				
	SQC 7355	00:06:50	00:13:09	00:19:59				
	MAS 721	00:07:30	00:05:28	00:12:58				
	MAS 608	00:15:23	00:04:36	00:19:59				
	AXM 916	00:15:42	00:04:17	00:19:59				
	AXM 256	00:16:09	00:03:50	00:19:59	10	00:19:59	1:19:27	0:07:57
R6	MAS 603	00:00:00	00:01:04	00:01:04				
	SLK 751	00:00:00	00:13:08	00:13:08				
	MDL 191	00:06:15	00:11:48	00:18:03				
	MAU 647	00:00:00	00:16:06	00:16:06				
	IMT 387	00:19:13	00:01:56	00:21:09				
	SFB 911	00:00:00	00:20:36	00:20:36				
	SUMO 94	00:20:38	00:00:31	00:21:09	7	00:21:09	1:05:09	0:09:18

R7	MAS 605	00:01:57	00:10:31	00:12:28				
	ALK 312	00:01:57	00:00:51	00:02:48				
	MAS 1051	00:01:57	00:09:56	00:11:53				
	UZB 1701	00:01:57	00:13:37	00:15:34				
	UAE 348	00:01:57	00:18:06	00:20:03				
	MAS 711	00:01:57	00:06:52	00:08:49				
	SIA 326	00:03:52	00:02:09	00:06:01				
	DLH 778	00:03:54	00:02:18	00:06:12				
	SIA 196	00:07:19	00:08:04	00:15:23				
	SOA 516	00:10:23	00:23:34	00:33:57				
	KLM 809	00:18:46	00:16:19	00:35:05				
	SFB 911	00:24:40	00:10:25	00:35:05				
	MNA 830	00:25:30	00:09:35	00:35:05				
	AXM 901	00:27:27	00:07:38	00:35:05				
	IYE 862	00:30:57	00:04:08	00:35:05	15	00:34:05	2:24:03	0:09:36



R8	ALK 312	00:00:00	00:13:38	00:13:38				
	AIC 470	00:00:00	00:05:49	00:05:49				
	MAS 5410	00:00:00	00:17:55	00:17:55				
	SLK 744	00:00:00	00:01:53	00:01:53				
	SIA 452	00:02:47	00:15:01	00:17:48				
	MAS 710	00:03:09	00:08:41	00:11:50				
	GIA 851	00:04:08	00:13:16	00:17:24				
	MNA 9502	00:00:00	00:08:10	00:08:10				
	SIA 319	00:12:10	00:17:51	00:30:01				
	MAS 721	00:08:00	00:10:05	00:18:05				
	AXM 954	00:21:34	00:09:36	00:31:10				
	MAS 870	00:21:55	00:07:40	00:29:35				
	SQC 7883	00:22:34	00:08:36	00:31:10				
	AXM 953	00:23:26	00:07:44	00:31:10				
	MAS 606	00:25:17	00:05:53	00:31:10	15	00:31:10	2:31:48	0:10:07



R9	JAL 721	00:00:08	00:06:22	00:06:30				
	MAS 1059	00:00:08	00:07:00	00:07:08				
	MAS 607	00:10:01	00:13:38	00:23:39				
	MAS 148	00:14:38	00:13:42	00:28:20				
	MNA 931	00:25:32	00:03:54	00:29:26				
	QFA 683	00:27:36	00:05:37	00:33:13				
	MAS 122	00:32:44	00:00:29	00:33:13	7	00:33:13	0:50:42	0:07:15

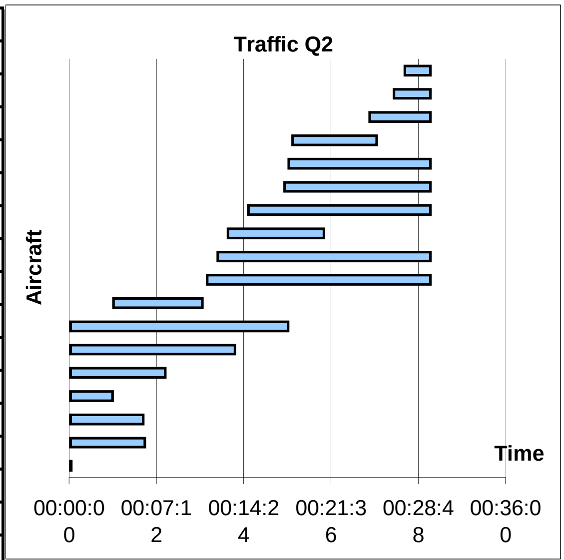
R10	FIN 911	00:00:08	00:17:10	00:17:18				
	MAS 870	00:00:25	00:06:07	00:06:32				
	9MAZZ	00:00:53	00:10:21	00:11:14				
	JSA 862	00:01:31	00:01:45	00:03:16				
	AXM 954	00:00:08	00:02:24	00:02:32				
	SIA 111	00:07:45	00:09:29	00:17:14				
	GIA 821	00:08:04	00:04:31	00:12:35				
	KLM 837	00:18:17	00:04:46	00:23:03				
	MAS 1059	00:15:04	00:13:14	00:28:18				
	AXM 913	00:25:18	00:04:44	00:30:02	10	00:30:02	1:14:31	0:07:27

R11	GIA 856	00:00:00		
	SQC 7395	00:00:00		00:06:57
	AXM 358	00:00:44		00:17:50
	SIA 452	00:01:33		

	SIA 26	00:00:00		
	GIA 856	00:04:23		00:05:30
	SLK 368	00:04:54		
	MAS 722	00:06:16		00:13:40
	SIA 412			00:08:30
	MAS 852	00:11:51		00:18:15
	SIA 410	00:16:49		00:24:05
	AXM 957	00:27:28		00:29:15
	MAS 1063	00:28:57		00:29:15

Q1	MAS 1276	00:00:45	00:08:56	00:09:41				
	MAS 765	00:01:05	00:09:08	00:10:13				
	T.JERUNG	00:01:33	00:06:41	00:08:14				
	MAS 2528	00:00:45	00:02:44	00:03:29				
	HOBO4099	00:03:45	00:06:28	00:10:13				
	9MABC	00:00:45	00:08:25	00:09:10				
	AXM 208	00:00:45	00:05:10	00:05:55				
	SIA 065	00:00:45	00:06:01	00:06:46	8	00:10:13	0:53:33	0:06:42

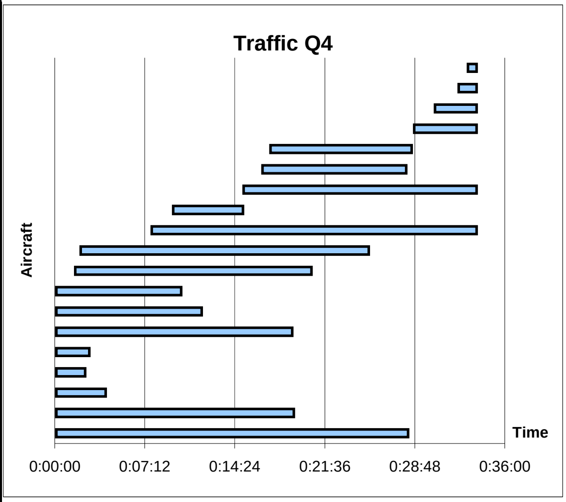
Q2	RCH 122	00:00:08	00:00:05	00:00:13				
	TSE 3506	00:00:08	00:06:08	00:06:16				
	MAS 759	00:00:08	00:06:01	00:06:09				
	THY 60	00:00:08	00:03:29	00:03:37				
	SIA 67	00:00:08	00:07:50	00:07:58				
	SAS 973	00:00:08	00:13:35	00:13:43				
	BKP 503	00:00:08	00:17:57	00:18:05				
	JAL 723	00:03:40	00:07:21	00:11:01				
	MAS 1402	00:11:24	00:18:26	00:29:50				
	MAS 753	00:12:16	00:17:34	00:29:50				
	AXM 112	00:13:06	00:07:56	00:21:02				
	RMF 670	00:14:48	00:15:02	00:29:50				
	MAS 2636	00:17:46	00:12:04	00:29:50				
	CAL 674	00:18:07	00:11:43	00:29:50				
	AXM 209	00:18:26	00:06:58	00:25:24				
	BIS 6326	00:24:48	00:05:02	00:29:50				
	AXM 258	00:26:48	00:03:02	00:29:50				
	MAS 74	00:27:41	00:02:09	00:29:50	18	00:29:50	2:42:22	0:09:01



Q3	RBA873	0:00:54	0:03:41	0:04:35				
	MAS2564	0:00:54	0:09:32	0:10:26				
	SIA63	0:00:54	0:13:44	0:14:38				
	TGW108	0:00:54	0:14:44	0:15:38				
	SIA319	0:03:09	0:20:04	0:23:13				
	SIA64	0:05:38	0:27:31	0:33:09				
	AXM261	0:07:51	0:09:08	0:16:59				
	RMF702	0:17:14	0:11:54	0:29:08				
	MAS69	0:17:53	0:05:35	0:23:28				
	GFA286	0:18:30	0:14:39	0:33:09				
	CPA712	0:19:48	0:13:21	0:33:09				
	AIQ5012	0:28:00	0:05:09	0:33:09				
	MAS2746	0:31:04	0:02:05	0:33:09				
	AXM103	0:32:40	0:00:29	0:33:09	14	0:33:00	2:31:36	10:50

Q4	TSE 3202	0:00:08	0:28:09	0:28:17
	THA 412	0:00:08	0:19:01	0:19:09
	MAS 753	0:00:08	0:03:58	0:04:06

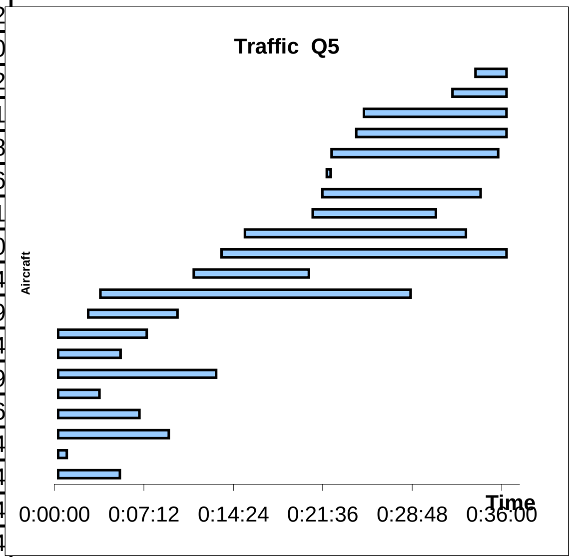
CPA 721	0:00:08	0:02:19	0:02:27
9MSTM	0:00:08	0:02:39	0:02:47
MAS 759	0:00:08	0:18:53	0:19:01
MAS 377	0:00:08	0:11:39	0:11:47
SWR 182	0:00:08	0:10:00	0:10:08
SAS 973	0:01:39	0:18:55	0:20:34
SIA 067	0:02:04	0:23:04	0:25:08
TSE 3506	0:07:46	0:26:00	0:33:46
MAS 1282	0:09:28	0:05:37	0:15:05
MAS 1402	0:15:06	0:18:40	0:33:46
AXM 264	0:16:37	0:11:32	0:28:09
MAS 2705	0:17:15	0:11:20	0:28:35
SIA 068	0:28:46	0:05:00	0:33:46
MAS 391	0:30:25	0:03:21	0:33:46
AXM 112	0:32:19	0:01:27	0:33:46
BAW 3453	0:33:03	0:00:43	0:33:46



19 0:33:46 3:42:17 0:11:42

Q5

AAR852	0:00:18	0:05:00	0:05:18
CPA716	0:00:18	0:00:43	0:01:01
CPA721	0:00:18	0:08:56	0:09:14
MAS1335	0:00:18	0:06:34	0:06:52
TSE3506	0:00:18	0:03:22	0:03:40
CPA724	0:00:18	0:12:44	0:13:02
SIA321	0:00:18	0:05:03	0:05:21
THA412	0:00:18	0:07:10	0:07:28
MAS1282	0:02:43	0:07:13	0:09:56
SIA67	0:03:42	0:24:59	0:28:41
MAS377	0:11:13	0:09:17	0:20:30
SWR182	0:13:28	0:22:56	0:36:24
MAS1402	0:15:20	0:17:49	0:33:09
MAS65	0:20:48	0:09:56	0:30:44
MAS391	0:21:34	0:12:45	0:34:19
MAS1058	0:21:56	0:00:20	0:22:16
AXM209	0:22:18	0:13:26	0:35:44
MAS2529	0:24:18	0:12:06	0:36:24
AXM105	0:24:55	0:11:29	0:36:24
MAS74	0:32:02	0:04:22	0:36:24
SIA68	0:33:53	0:02:31	0:36:24

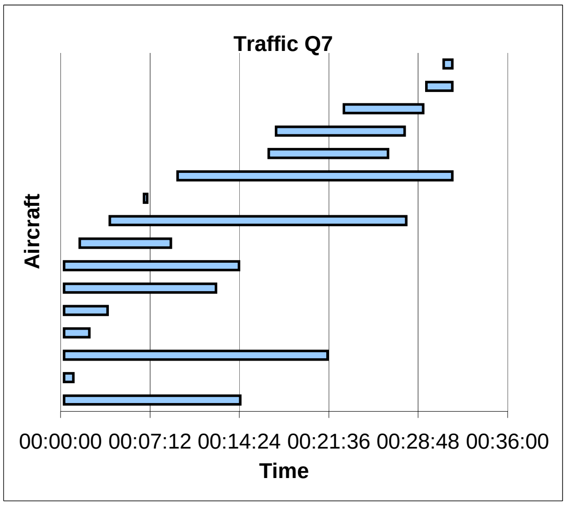


21 0:36:24 3:18:41 09:28

Q6

TSE 3506	0:01:42	0:23:00	0:24:42
JSA 501	0:02:10	0:25:05	0:27:15
MAS 73	0:03:04	0:12:26	0:15:30
CAL 674	0:01:42	0:12:13	0:13:55
TGW 109	0:01:42	0:07:12	0:08:54
THA 412	0:09:00	0:21:33	0:30:33
SWR 182	0:09:27	0:21:06	0:30:33
AXM 264	0:09:55	0:11:05	0:21:00
JAL 723	0:13:01	0:07:32	0:20:33
THA 409	0:01:42	0:14:25	0:16:07
SIA 321	0:01:42	0:16:53	0:18:35
MAS 1335	0:19:35	0:10:58	0:30:33
AXM 104	0:27:41	0:02:52	0:30:33
NAF 44	00:28:17	0:02:16	0:30:33
CPA 721	00:28:44	0:01:49	0:30:33

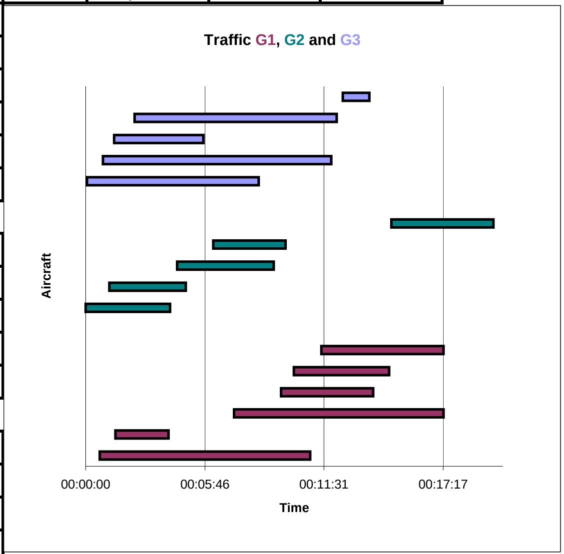
15 00:29:33 3:10:25 0:12:42

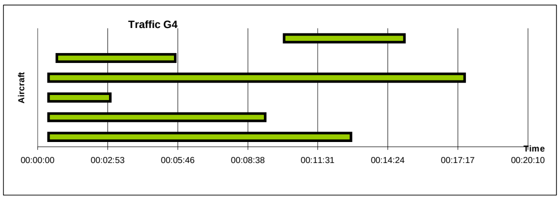


Q7	MAS 1335	00:00:17	0:14:13	00:14:30				
	THA 409	00:00:17	0:00:47	00:01:04				
	THA 412	00:00:17	0:21:15	00:21:32				
	MAS 7047	00:00:17	0:02:03	00:02:20				
	AXM 264	00:00:17	0:03:32	00:03:49				
	STQ 501	00:00:17	0:12:15	00:12:32				
	FIN 97	00:00:17	0:14:07	00:14:24				
	JAL 723	00:01:33	0:07:22	00:08:55				
	SWR 182	00:03:58	0:23:54	00:27:52				
	SIA 430	00:06:44	0:00:16	00:07:00				
	CAL 674	00:09:25	0:22:10	00:31:35				
	CPA 721	00:16:46	0:09:38	00:26:24				
	MAS 377	00:17:21	0:10:23	00:27:44				
	MAS 2538	00:22:49	0:06:24	00:29:13				
	MAS 1402	00:29:28	0:02:07	00:31:35				
	MAS 2705	00:30:51	0:00:44	00:31:35	16	00:31:35	2:31:10	0:09:27
Q8	SIA 066	00:00:10	0:00:06	00:00:16				
	UBA 232	00:00:10	0:17:39	00:17:49				
	MAS 69	00:00:10	0:04:40	00:04:50				
	EVA 227	00:03:48	0:09:39	00:13:27				
	AIQ 5012	00:04:54	0:24:37	00:29:31				
	BVT 787	00:05:57	0:29:45	00:35:42				
	GFA 282	00:00:10	0:11:29	00:11:39				
	TGW 108	00:00:10	0:08:07	00:08:17				
	CPA 712	00:12:54	0:25:14	00:38:08				
	MAS 2746	00:17:51	0:11:49	00:29:40				
	AXM 103	00:23:08	0:11:29	00:34:37				
	CPA 713	00:27:37	0:10:31	00:38:08				
	HVN 756	00:30:15	0:07:53	00:38:08				
	CAL 657	00:32:18	0:05:50	00:38:08				
	MAS 2616	00:27:59	0:10:09	00:38:08	15	00:38:08	3:08:57	0:12:36
Q9	MAS 71	00:02:15	0:08:14	00:10:29				
	SIA 436	00:02:15	0:12:25	00:14:40				
	SIA 416	00:02:15	0:14:10	00:16:25				
	TGW 138	00:02:15	0:00:51	00:03:06				
	AXM 209	00:03:07	0:09:39	00:12:46				
	AXM 105	00:05:56	0:09:14	00:15:10				
	MEGA 200	00:02:15	0:14:53	00:17:08				
	BAW 9	00:06:50	0:07:40	00:14:30				
	CAL 651	00:09:51	0:11:12	00:21:03				
	MAS 1405	00:10:30	0:17:46	00:28:16				
	QFA 2	00:12:09	0:08:14	00:20:23				
	TGW 113	00:13:14	0:17:16	00:30:30				
	MAS 2531	00:13:31	0:11:57	00:25:28				
	AXM 112	00:15:12	0:06:11	00:21:23				
	TSE 3506	00:15:44	0:14:46	00:30:30				
	THA 991	00:22:33	0:07:57	00:30:30	16	00:28:30	2:52:25	0:10:47
				Aircraft	435			
				Elapse		16:01:42		
				Total Contact			78:29:50	
				Contact per aircraft				0:10:50

APPENDIX L: TOWER TRAFFIC LISTS AND PATTERNS

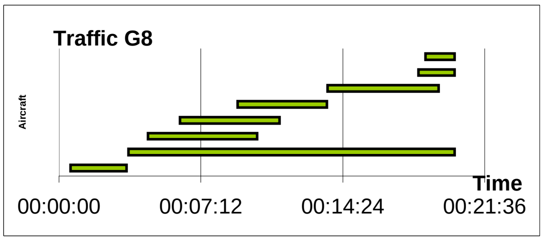
Ref	Aircraft	Contact	Duration	Transfer	Traffic	Epoch	Contact	Time/Acft
G1	CEKAL 21	00:00:41	00:10:11	00:10:52				
	MAS 2332	00:01:26	00:02:35	00:04:01				
	BTV 822	00:07:10	00:10:09	00:17:19				
	MAS 2805	00:09:27	00:04:28	00:13:55				
	TSE 505	00:10:04	00:04:37	00:14:41				
	MAS 2743	00:11:24	00:05:55	00:17:19				
G2	MAS 2261	00:00:00	00:04:06	00:04:06				
	MAS 2507	00:01:09	00:03:42	00:04:51				
	AXM 202	00:04:25	00:04:41	00:09:06				
	MAS 637	00:06:10	00:03:31	00:09:41				
	MAS 2508	00:14:47	00:04:57	00:19:44				
G3	MAS 2266	00:00:04	00:08:19	00:08:23				
	POL 11Q	00:00:50	00:11:03	00:11:53				
	MAS 2807	00:01:23	00:04:19	00:05:42				
	PCHOP 5	00:02:22	00:09:47	00:12:09				
	AXM 203	00:12:26	00:01:18	00:13:44	5	00:13:44	0:34:46	0:06:57
G4	9MACA	00:00:27	00:12:27	00:12:54				
	MAS 2266	00:00:27	00:08:55	00:09:22				
	MAS 2807	00:00:27	00:02:33	00:03:00				
	AXM 203	00:00:27	00:17:07	00:17:34				
	MAS 2610	00:00:47	00:04:53	00:05:40				
	CALBR 1	00:10:08	00:04:58	00:15:06	6	00:17:34	0:50:53	0:08:29
G5	TSE 522	00:00:08	00:00:23	00:00:31				
	MAS 2805	00:01:34	00:04:52	00:06:26				
	9MBCT	00:04:04	00:08:55	00:12:59				
	MAS 2332	00:10:20	00:03:15	00:13:35				
	BTV 822	00:12:30	00:03:28	00:15:58				
	TSE 503	00:13:42	00:04:49	00:18:31	6	00:18:31	0:25:42	0:04:17
G6	MAS 2507	00:01:31	00:00:22	00:01:53				
	MAS 637	00:04:53	00:02:41	00:07:34				
	RMF 443	00:01:31	00:17:40	00:19:11				
	AXM 202	00:06:47	00:03:49	00:10:36				
	MAS 2261	00:09:59	00:05:37	00:15:36				
	MAS 2508	00:18:10	00:01:01	00:19:11	6	00:19:11	0:31:10	0:05:12
G7	9MAYQ	00:00:15	00:07:32	00:07:47				
	MAS 2805	00:01:13	00:05:26	00:06:39				
	TSE 505	00:00:15	00:03:47	00:04:02				
	9MAVM	00:07:15	00:03:55	00:11:10				
	POL 11P	00:09:53	00:04:41	00:14:34				
	MAS 2332	00:10:50	00:05:07	00:15:57				
	CEKAL 22	00:14:02	00:05:29	00:19:31	7	00:19:31	0:35:57	0:05:08
G8	MAS 2332	00:00:35	00:02:52	00:03:27				
	9MSGJ	00:03:31	00:16:34	00:20:05				
	MAS 2805	00:04:31	00:05:33	00:10:04				
	BTV 822	00:06:08	00:05:04	00:11:12				





	MAS 3805	00:09:04	00:04:33	00:13:37				
	9MAYQ	00:13:38	00:05:39	00:19:17				
	MAS 2295	00:18:14	00:01:51	00:20:05				
	RMF 444	00:18:36	00:01:29	00:20:05	8	00:20:05	0:43:35	0:05:27

G9	RMF 380	00:00:09	00:06:53	00:07:02				
	AXM 202	00:00:40	00:05:05	00:05:45				
	MAS 2508	00:00:09	00:01:15	00:01:24				
	CEKAL 20	00:00:09	00:10:21	00:10:30				
	MAS 2610	00:16:51	00:02:45	00:19:36	5	00:19:36	0:26:19	0:05:16



G10	9MEAP	00:00:23	00:01:41	00:02:04				
	AXM 202	00:00:23	00:02:17	00:02:40				
	MAS 2515	00:07:43	00:06:26	00:14:09				
	AXM 204	00:09:12	00:04:00	00:13:12				
	9MACA	00:00:23	00:05:31	00:05:54				
	MAS 2691	00:14:33	00:04:49	00:19:22				
	MAS 2610	00:16:51	00:03:07	00:19:58	7	00:19:58	0:27:51	0:03:59

G11	9MHRM	00:00:06	00:01:29	00:01:35				
	MAS 2805	00:02:20	00:05:37	00:07:57				
	BTV 822	00:02:51	00:06:32	00:09:23				
	MAS 2332	00:05:36	00:08:50	00:14:26				
	MAS 5	00:09:44	00:03:54	00:13:38				
	CEKAL 20	00:16:04	00:02:52	00:18:56	6	00:18:56	0:29:14	0:04:52

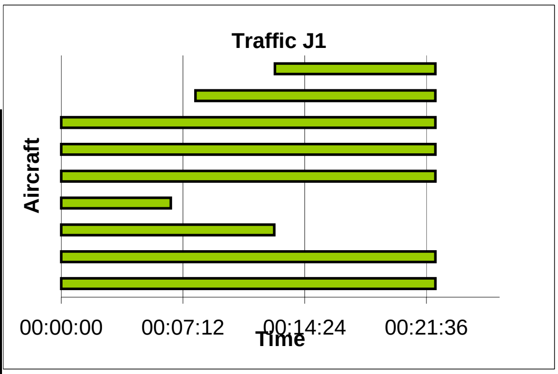
G12	CLBR 2	00:00:01	00:02:20	00:02:21				
	MAS 3805	00:00:01	00:01:11	00:01:12				
	TSE 505	00:02:26	00:02:06	00:04:32				
	BTV 822	00:06:20	00:04:27	00:10:47				
	MAS 3805	00:07:42	00:09:09	00:16:51				
	MAS 2743	00:17:24	00:00:14	00:17:38	6	00:17:38	0:19:27	0:03:15

G13	9MSGJ	00:00:05	00:06:39	00:06:44				
	MAS 2805	00:00:05	00:02:47	00:02:52				
	RMF 444	00:00:05	00:17:13	00:17:18				
	TSE 505	00:01:30	00:02:35	00:04:05				
	MAS 2332	00:10:46	00:01:16	00:12:02				
	MAS 3805	00:12:06	00:02:01	00:14:07				
	9MSGJ	00:15:31	00:02:38	00:18:09	7	00:18:09	0:35:09	0:05:01

G14	MAS 2508	00:00:40	00:04:43	00:05:23				
	MAS 716	00:00:40	00:00:20	00:01:00				
	RMF 444	00:02:19	00:14:48	00:17:07				
	AXM 202	00:03:31	00:05:52	00:09:23				
	9MACA	00:00:40	00:19:10	00:19:50	5	00:19:50	0:44:53	0:08:59

G15	MAS 2610	00:00:06	00:05:03	00:05:09				
	MAS 716	00:00:06	00:02:03	00:02:09				
	MAS 2266	00:05:33	00:04:36	00:10:09				
	AXM 203	00:11:02	00:01:59	00:13:01				
	CEKAL 01	00:08:46	00:10:39	00:19:25				
	TSE 504	00:19:03	00:00:22	00:19:25	6	00:19:25	0:24:42	0:04:07

G16	TSE 505	00:00:17	00:05:41	00:05:58				
	MAS 2663	00:01:30	00:03:52	00:05:22				
	MAS 2610	00:05:22	00:04:00	00:09:22				
	AXM 202	00:08:49	00:04:18	00:13:07				
	CEKAL 24	00:15:28	00:00:16	00:15:44	5	00:15:44	0:18:07	0:03:37
G17	MAS 3806	00:03:11	00:03:28	00:06:39				
	MAS 2746	00:05:08	00:04:15	00:09:23				
	MAS 2813	00:08:48	00:05:57	00:14:45				
	MAS 2564	00:15:47	00:03:57	00:19:44	4	00:16:44	0:17:37	0:04:24
G18	BADAK 03	00:00:01	00:07:13	00:07:14				
	9MACA	00:00:27	00:08:51	00:09:18				
	CEKAL 02	00:01:14	00:05:08	00:06:22				
	MAS 2454	00:09:22	00:01:27	00:10:49				
	MAS 2515	00:12:30	00:02:00	00:14:30				
	BADAK 03	00:19:03	00:00:40	00:19:43	6	00:19:43	0:25:19	0:04:13
G19	BTV 822	00:00:37	00:01:37	00:02:14				
	MAS 2805	00:05:20	00:04:19	00:09:39				
	TSE 504	00:08:09	00:07:02	00:15:11				
	MAS 2332	00:13:28	00:02:56	00:16:24				
	MAS 3805	00:17:40	00:01:43	00:19:23	5	00:19:23	0:17:37	0:03:31
G20	MAS 2805	00:00:04	00:03:07	00:03:11				
	BTV 822	00:09:38	00:01:56	00:11:34				
	MAS 2332	00:12:35	00:01:52	00:14:27	3	00:14:27	0:06:55	0:02:18
G21	9MACA	00:00:30	00:13:54	00:14:24				
	AXM 202	00:01:52	00:04:14	00:06:06				
	MAS 2337	00:06:21	00:00:11	00:06:32				
	9MEST	00:09:08	00:04:15	00:13:23				
	MAS 2337	00:17:59	00:00:18	00:18:17	5	00:18:17	0:22:52	0:04:34

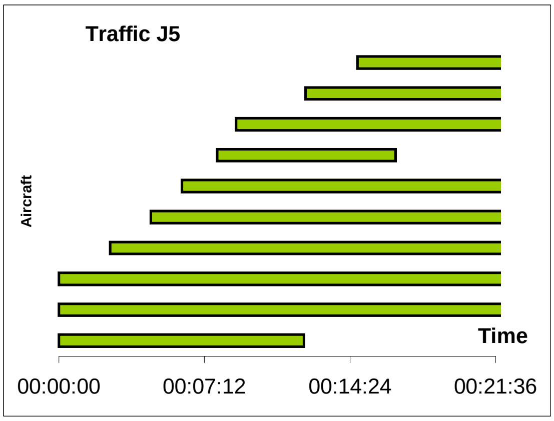


J1	AXM 630	00:00:00	00:22:09	00:22:09				
	ACAD 153	00:00:00	00:22:09	00:22:09				
	MAS 2508	00:00:00	00:12:37	00:12:37				
	MAS 2505	00:00:00	00:06:30	00:06:30				
	ELITE 15	00:00:00	00:22:09	00:22:09				
	ACAD 153	00:00:00	00:22:09	00:22:09				
	ACAD 08X	00:00:00	00:22:09	00:22:09				
	PCHOP 1	00:07:56	00:14:13	00:22:09				
	PUTRA 05	00:12:38	00:09:31	00:22:09	9	00:22:09	2:33:36	0:17:04
J2	MAS 2508	00:00:00	00:10:49	00:10:49				
	MAS 2505	00:03:25	00:12:32	00:15:57				
	AXM 630	00:00:00	00:13:39	00:13:39				
	ELITE 15	00:00:00	00:19:55	00:19:55				
	9MJMV	00:05:45	00:14:10	00:19:55	5	00:19:55	1:11:05	0:14:13
J3	MAS 2505	00:00:00	00:09:48	00:09:48				

ELITE 15	00:00:00	00:21:51	00:21:51				
MAS 2508	00:00:46	00:13:07	00:13:53				
AXM 630	00:06:19	00:10:45	00:17:04				
VHLOE	00:16:26	00:05:25	00:21:51				
ELITE 11	00:00:00	00:19:01	00:19:01	6	00:21:51	1:19:57	0:13:20

J4

ACAD 26	00:00:00	00:19:43	00:19:43				
ACAD 03	00:00:00	00:19:43	00:19:43				
MAS 2508	00:01:36	00:11:50	00:13:26				
ACAD 08X	00:00:00	00:19:43	00:19:43				
ACAD 25	00:00:00	00:19:43	00:19:43				
MAS 2505	00:08:12	00:08:54	00:17:06				
ACAD 21	00:11:52	00:07:51	00:19:43				
9MJFC	00:13:38	00:06:05	00:19:43	8	00:19:43	1:53:32	0:14:11



J5

MAS 2508	00:00:00	00:12:08	00:12:08				
9MWCF	00:00:00	00:22:45	00:22:45				
9MEML	00:00:00	00:22:45	00:22:45				
ACAD 22	00:02:32	00:20:13	00:22:45				
POL 11O	00:04:33	00:18:12	00:22:45				
ACAD 355	00:06:05	00:16:40	00:22:45				
MAS 2505	00:07:50	00:08:50	00:16:40				
ACAD 03	00:08:46	00:13:59	00:22:45				
AXM 630	00:12:12	00:10:33	00:22:45				
9MJMV	00:14:46	00:07:59	00:22:45	10	00:22:45	2:34:04	0:15:24

J6

AXM 630	00:00:00	00:19:32	00:19:32				
AXM 353	00:00:00	00:11:42	00:11:42				
MAS 2505	00:02:58	00:16:34	00:19:32				
ACAD 08X	00:00:00	00:19:32	00:19:32				
ACAD 13	00:00:00	00:19:32	00:19:32	5	00:19:32	1:26:52	0:17:22

J7

MAS 2505	00:01:28	00:09:23	00:10:51				
MAS 2508	00:01:28	00:05:03	00:06:31				
AXM 630	00:04:42	00:14:31	00:19:13				
ELITE 15	00:01:28	00:17:45	00:19:13				
9VBOZ	00:18:17	00:00:56	00:19:13	5	00:18:13	0:47:38	0:09:32

J8

AXM 630	00:00:00	00:21:04	00:21:04				
9MANA	00:00:00	00:21:04	00:21:04				
MAS 2508	00:02:28	00:09:36	00:12:04				
MAS 2505	00:03:48	00:13:22	00:17:10				
9VBOZ	00:06:04	00:15:00	00:21:04				
ACAD 06X	00:06:42	00:14:22	00:21:04	6	00:21:04	1:34:28	0:15:45

J9

MAS 2505	00:01:01	00:18:54	00:19:55				
ELITE 15	00:01:01	00:18:54	00:19:55				
MAS 2508	00:03:23	00:12:40	00:16:03				
AXM 630	00:03:58	00:09:42	00:13:40	4	00:18:55	1:00:10	0:15:03

J10

MAS 2508	00:00:00	00:01:03	00:01:03

	ACAD 06X	00:00:00	00:06:06	00:06:06				
	9MJMV	00:00:00	00:20:36	00:20:36				
	ELITE 12	00:00:00	00:20:36	00:20:36				
	9MBLV	00:00:00	00:08:00	00:08:00				
	ELITE 15	00:00:00	00:20:36	00:20:36				
	9MWCF	00:01:34	00:19:02	00:20:36				
	MAS 2505	00:04:45	00:08:25	00:13:10				
	AXM 630	00:05:49	00:13:56	00:19:45				
	9MSJI	00:06:41	00:13:55	00:20:36				
	ACAD352	00:08:44	00:11:52	00:20:36	11	00:20:36	2:24:07	00:13:06

J11	MAS 2508	00:00:00	00:20:59	00:20:59				
	ACAD 10	00:00:00	00:10:08	00:10:08				
	ACAD 21	00:00:00	00:20:59	00:20:59				
	AXM 630	00:02:59	00:18:00	00:20:59				
	PCHOP 6	00:00:00	00:20:59	00:20:59				
	MAS 2505	00:07:56	00:13:03	00:20:59				
	ACAD 428	00:15:52	00:05:07	00:20:59	7	00:20:59	1:49:15	00:15:36

J12	ELITE 11	00:00:00	00:22:50	00:22:50				
	ACAD 23	00:00:00	00:14:08	00:14:08				
	MAS 2516	00:00:36	00:22:14	00:22:50				
	ACAD 21	00:00:00	00:22:50	00:22:50				
	ACAD 24	00:00:00	00:22:50	00:22:50				
	MAS 1051	00:09:23	00:09:59	00:19:22				
	TRNR 771	00:16:14	00:06:36	00:22:50	7	00:22:50	2:01:27	00:17:21

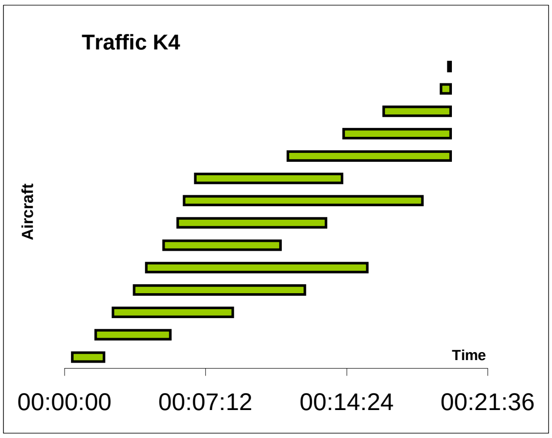
K1	KLM 809	00:00:17	0:05:56	00:06:13				
	AXM 912	00:00:17	0:00:52	00:01:09				
	HVN 756	00:00:54	0:00:59	00:01:53				
	AXM 323	00:00:17	0:03:37	00:03:54				
	MAS 1625	00:02:33	0:06:37	00:09:10				
	MAS 787	00:06:23	0:05:52	00:12:15				
	UAE 346	00:12:21	0:04:50	00:17:11				
	MAS 2707	00:15:37	0:05:01	00:20:38				
	AIC 853	00:18:21	0:02:43	00:21:04				
	MAS 606	00:20:43	0:00:21	00:21:04	10	00:21:04	0:36:48	0:03:41

K2	AXM 256	00:00:30	0:01:27	00:01:57				
	EVA 228	00:04:58	0:04:42	00:09:40				
	AXM 208	00:05:15	0:00:24	00:05:39				
	MAS 873	00:12:24	0:01:35	00:13:59				
	MAS 1148	00:13:25	0:02:39	00:16:04				
	MAS 605	00:14:00	0:04:41	00:18:41				
	KLM 809	00:16:19	0:03:47	00:20:06	7	00:20:06	0:19:15	0:02:45

K3	MNI 830	00:00:06	0:00:51	00:00:57
	MAS 67	00:00:06	0:02:16	00:02:22
	MAS 89	00:01:33	0:03:31	00:05:04
	AXM 913	00:01:46	0:06:04	00:07:50
	MAS 864	00:04:24	0:06:06	00:10:30
	MAS 1052	00:10:39	0:03:12	00:13:51
	UAE 338	00:13:15	0:06:35	00:19:50
	MAS 1153	00:16:05	0:03:52	00:19:57

	EAF 9901	00:19:51	0:00:06	00:19:57	9	00:19:57	0:32:33	0:03:37

K4	ALK 312	00:00:24	0:01:38	00:02:02				
	AXM 882	00:01:35	0:03:50	00:05:25				
	MAS 87	00:02:28	0:06:08	00:08:36				
	AXM 203	00:03:33	0:08:44	00:12:17				
	MAU 643	00:04:10	0:11:18	00:15:28				
	AXM 322	00:05:03	0:05:59	00:11:02				
	GIA 851	00:05:46	0:07:36	00:13:22				
	AXM 272	00:06:06	0:12:11	00:18:17				
	MAS 2515	00:06:40	0:07:31	00:14:11				
	LNI 283	00:11:24	0:08:19	00:19:43				
	SVA 835	00:14:15	0:05:28	00:19:43				
	MAS 1208	00:16:17	0:03:26	00:19:43				
	GIA 817	00:19:13	0:00:30	00:19:43				
	MAS 721	00:19:35	0:00:08	00:19:43	14	00:19:43	1:22:46	0:05:55



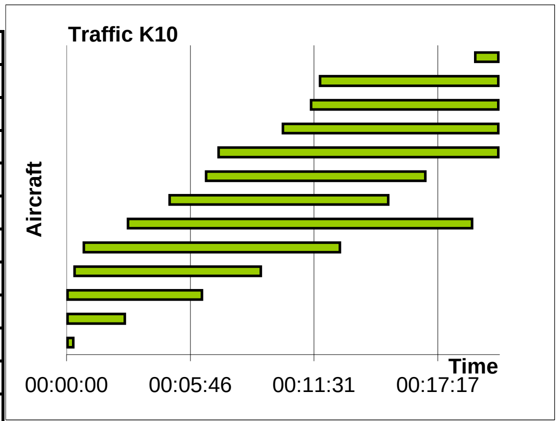
K5	CLX 795	00:00:23	0:04:36	00:04:59				
	MAS 751	00:00:41	0:06:27	00:07:08				
	SIA 110	00:00:23	0:04:46	00:05:09				
	AXM 937	00:04:49	0:04:55	00:09:44				
	MAS 87	00:05:40	0:06:11	00:11:51				
	CAL 655	00:09:00	0:05:48	00:14:48				
	AXM 301	00:11:01	0:06:43	00:17:44				
	MAS 755	00:12:41	0:07:22	00:20:03	8	00:20:03	0:46:48	0:05:51

K6	CAL 657	00:00:02	0:00:20	00:00:22				
	AXM 205	00:00:02	0:04:33	00:04:35				
	MAS 787	00:02:07	0:04:47	00:06:54				
	MAS 606	00:04:16	0:06:03	00:10:19				
	MAS 1625	00:05:17	0:07:35	00:12:52				
	MAS 69	00:09:12	0:05:42	00:14:54				
	IAC 853	00:11:10	0:08:37	00:19:47				
	MAS 7095	00:17:19	0:02:28	00:19:47				
	HVN 759	00:19:20	0:00:27	00:19:47	9	00:19:47	0:40:32	0:04:30

K7	JAL 723	00:00:09	0:00:47	00:00:56				
	CPA 721	00:00:09	0:03:49	00:03:58				
	MAS 720	00:01:00	0:06:55	00:07:55				
	MAS 353	00:03:12	0:08:11	00:11:23				
	AXM 305	00:05:49	0:05:24	00:11:13				
	MAS 608	00:07:03	0:06:52	00:13:55				
	UAE 346	00:12:11	0:05:27	00:17:38				
	MAS 753	00:14:21	0:05:05	00:19:26				
	MAS 1335	00:16:54	0:02:32	00:19:26				
	AXM 883	00:19:15	0:00:11	00:19:26	10	00:19:26	0:45:13	0:04:31

K8	MAS 2605	00:00:10	0:04:08	00:04:18
	MAS 2507	00:00:10	0:01:13	00:01:23
	MAS 1389	00:01:57	0:04:50	00:06:47
	AXM 347	00:03:18	0:05:58	00:09:16
	ALK 312	00:06:30	0:07:32	00:14:02
	MAS 2741	00:10:38	0:04:53	00:15:31
	SVA 836	00:13:22	0:06:20	00:19:42

	AXM 161	00:16:53	0:02:49	00:19:42	8	00:19:42	0:37:43	0:04:43
K9	MAS 7095	00:00:22	0:00:42	00:01:04				
	CAL 271	00:00:22	0:04:26	00:04:48				
	AXM 205	00:01:27	0:04:15	00:05:42				
	MAS 69	00:03:12	0:04:53	00:08:05				
	MAS 1625	00:06:33	0:04:36	00:11:09				
	IAC 853	00:09:06	0:06:33	00:15:39				
	MAS 2707	00:11:54	0:04:24	00:16:18				
	RBA 873	00:14:02	0:05:46	00:19:48				
	MAS 606	00:17:56	0:02:03	00:19:59				
	MAS 11	00:19:50	0:00:09	00:19:59	10	00:19:59	0:37:47	0:03:47
K10	MAS 750	00:00:03	0:00:17	00:00:20				
	MAS 350	00:00:03	0:02:41	00:02:44				
	ALK 316	00:00:03	0:06:16	00:06:19				
	MAS 711	00:00:22	0:08:42	00:09:04				
	MAS 611	00:00:48	0:11:56	00:12:44				
	MAS 376	00:02:52	0:16:02	00:18:54				
	AXM 102	00:04:48	0:10:11	00:14:59				
	AXM 936	00:06:30	0:10:13	00:16:43				
	IAC 956	00:07:05	0:13:02	00:20:07				
	MAS 754	00:10:04	0:10:03	00:20:07				
	MAS 125	00:11:23	0:08:44	00:20:07				
	MAS 860	00:11:48	0:08:19	00:20:07				
	AXM 302	00:19:02	0:01:05	00:20:07	13	00:20:07	1:47:31	0:08:16
K11	MAS 2564	00:00:11	0:01:50	00:02:01				
	MAS 1446	00:03:05	0:01:20	00:04:25				
	AXM 882	00:03:29	0:02:47	00:06:16				
	LNI 283	00:04:39	0:03:30	00:08:09				
	AXM 338	00:05:46	0:04:55	00:10:41				
	QTR 620	00:11:04	0:01:43	00:12:47				
	ALK 312	00:11:56	0:02:39	00:14:35				
	MAS 1146	00:13:02	0:03:55	00:16:57				
	MAS 721	00:19:03	0:00:46	00:19:49				
	MAS 120	00:19:20	0:00:29	00:19:49	10	00:19:49	0:23:54	0:02:23
K12	MAS 605	00:00:05	0:05:13	00:05:18				
	KLM 809	00:01:00	0:06:46	00:07:46				
	AXM 256	00:01:11	0:01:26	00:02:37				
	MAS 1276	00:04:51	0:05:52	00:10:43				
	MAS 1148	00:08:59	0:04:22	00:13:21				
	MAS 1336	00:11:49	0:04:03	00:15:52				
	IYE 862	00:17:00	0:01:42	00:18:42				
	MAS 603	00:17:52	0:01:16	00:19:08	8	00:19:08	0:30:40	0:03:50
K13	MAS 758	00:00:17	0:00:35	00:00:52				
	MAS 1146	00:00:26	0:04:44	00:05:10				
	HVN 756	00:00:57	0:02:18	00:03:15				
	MAS 1051	00:05:39	0:01:55	00:07:34				
	GIA 821	00:08:15	0:01:33	00:09:48				
	MAS 2616	00:10:22	0:01:42	00:12:04				
	MAS 2746	00:11:25	0:03:06	00:14:31				

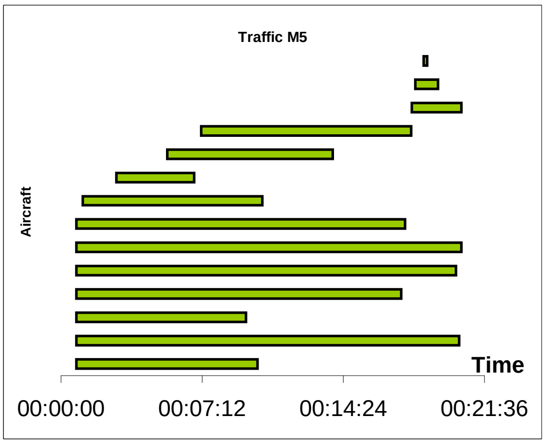


	MAS 864	00:12:54	0:03:58	00:16:52				
	CPA 722	00:13:38	0:05:25	00:19:03				
	AXM 104	00:15:30	0:04:14	00:19:44				
	AXM 913	00:17:33	0:02:11	00:19:44				
	MAS 2564	00:18:14	0:01:30	00:19:44	12	00:19:44	0:33:11	0:02:46
K14	AXM 348	00:00:10	0:08:48	00:08:58				
	MAS 1158	00:00:47	0:10:36	00:11:23				
	MAS 2716	00:00:10	0:01:04	00:01:14				
	CXA 852	00:00:10	0:03:32	00:03:42				
	UAE 339	00:02:34	0:11:18	00:13:52				
	SVA 2823	00:00:10	0:05:47	00:05:57				
	MAS 1282	00:04:41	0:11:38	00:16:19				
	MAS 1057	00:06:33	0:12:04	00:18:37				
	MAS 190	00:12:22	0:06:47	00:19:09				
	AXM 156	00:12:37	0:06:32	00:19:09	10	00:19:09	1:18:06	0:07:49
K15	AXM 153	00:00:09	0:05:50	00:05:59				
	AXM 323	00:00:33	0:07:39	00:08:12				
	AXM 161	00:00:09	0:01:00	00:01:09				
	MAS 1327	00:00:09	0:03:01	00:03:10				
	HVN 757	00:09:11	0:05:00	00:14:11				
	CSZ 795	00:12:40	0:04:56	00:17:36				
	ALK 312	00:13:18	0:06:07	00:19:25				
	MAS 1147	00:16:30	0:03:05	00:19:35				
	MAS 87	00:18:12	0:01:23	00:19:35	9	00:19:35	0:38:01	0:04:13
K16	MAS 1384	00:00:10	0:01:07	00:01:17				
	CAL 654	00:01:33	0:04:32	00:06:05				
	MAS 601	00:00:10	0:03:25	00:03:35				
	AXM 352	00:03:51	0:04:37	00:08:28				
	FDX 19	00:04:41	0:00:12	00:04:53				
	MAS 2504	00:06:16	0:04:39	00:10:55				
	MAS 2712	00:10:57	0:02:53	00:13:50				
	EAF 9901	00:12:08	0:04:22	00:16:30				
	MAS 871	00:14:31	0:04:22	00:18:53				
	CSN 366	00:18:28	0:00:50	00:19:18				
	AXM 880	00:18:54	0:00:24	00:19:18	11	00:19:18	0:31:23	0:02:51
K17	THA 415	00:00:11	0:07:59	00:08:10				
	QTR 620	00:00:11	0:03:56	00:04:07				
	MAU 643	00:09:48	0:05:22	00:15:10				
	AXM 101	00:13:07	0:06:16	00:19:23				
	AXM 957	00:13:09	0:04:00	00:17:09				
	MAS 861	00:15:45	0:06:01	00:21:46				
	MAS 854	00:17:38	0:04:21	00:21:59				
	GIA 850	00:21:49	0:00:10	00:21:59	8	00:21:59	0:38:05	0:04:46
K18	MAS 709	00:00:15	0:01:12	00:01:27				
	MAS 1062	00:00:59	0:05:26	00:06:25				
	SIA 118	00:01:02	0:02:25	00:03:27				
	MAS 2747	00:04:02	0:04:43	00:08:45				
	MAS 122	00:06:26	0:06:20	00:12:46				
	MAS 148	00:09:04	0:05:51	00:14:55				

	MAS 7387	00:11:59	0:05:26	00:17:25				
	MAS 1465	00:14:02	0:06:08	00:20:10				
	MAS 2609	00:17:31	0:02:39	00:20:10	9	00:20:10	0:40:10	0:04:28
K19	CPA 720	00:00:08	0:00:14	00:00:22				
	AXM 912	00:00:08	0:03:06	00:03:14				
	MAS 125	00:00:08	0:07:33	00:07:41				
	MAS 135	00:00:08	0:10:06	00:10:14				
	IAC 956	00:00:08	0:05:04	00:05:12				
	AXM 102	00:04:21	0:08:11	00:12:32				
	MAS 708	00:07:15	0:07:48	00:15:03				
	MAS 752	00:07:50	0:09:33	00:17:23				
	MAS 8	00:11:59	0:07:31	00:19:30				
	MAS 784	00:16:26	0:03:23	00:19:49				
	MAS 141	00:18:08	0:01:41	00:19:49	11	00:19:49	1:04:10	0:05:50
M1	ACAD 521	00:05:00	0:04:35	00:09:35				
	ACAD 352	00:05:00	0:12:44	00:17:44				
	ACAD 304	00:06:50	0:11:13	00:18:03				
	ACAD 357	00:05:00	0:12:46	00:17:46				
	ACAD 345	00:05:00	0:16:00	00:21:00				
	ACAD 337	00:15:18	0:10:33	00:25:51				
	ACAD 23	00:16:13	0:09:38	00:25:51				
	ACAD 521	00:21:33	0:04:18	00:25:51				
	ACAD 08T	00:24:03	0:01:48	00:25:51	9	00:20:51	1:23:35	0:09:17
M2	ACAD 04	0:43:25	0:09:29	0:52:54				
	ACAD 333	0:44:36	0:13:06	0:57:42				
	ACAD 23	0:43:25	0:03:19	0:46:44				
	ACAD 12	0:43:25	0:23:04	1:06:29				
	ACAD 411	0:43:25	0:09:33	0:52:58				
	ACAD 22	0:47:23	0:19:06	1:06:29				
	ACAD 334	0:43:25	0:17:20	1:00:45				
	ACAD 324	0:47:58	0:18:31	1:06:29				
	ACAD 08T	0:52:23	0:14:06	1:06:29				
	ACAD 411	1:03:36	0:02:53	1:06:29	10	0:23:04	2:10:27	0:13:03
M3	ACAD 345	00:27:13	0:13:31	00:40:44				
	ACAD 21	00:27:13	0:13:02	00:40:15				
	ACAD 24	00:27:13	0:01:08	00:28:21				
	POL 11O	00:27:13	0:04:56	00:32:09				
	ACAD 313	00:30:04	0:17:52	00:47:56				
	ACAD 336	00:27:13	0:13:42	00:40:55				
	ACAD 04	00:30:36	0:14:11	00:44:47				
	ACAD 10	00:33:41	0:14:15	00:47:56				
	ACAD 550	00:35:18	0:12:38	00:47:56				
	ACAD 12	00:38:58	0:08:58	00:47:56				
	ACAD 526	00:41:19	0:06:37	00:47:56				
	ACAD 22	00:38:03	0:09:53	00:47:56	12	00:20:43	2:10:43	0:10:54
M4	ACAD 335	00:17:28	0:10:54	00:28:22				
	ACAD 409	00:17:28	0:20:33	00:38:01				
	ACAD 329	00:17:28	0:06:23	00:23:51				
	ACAD 08X	00:17:28	0:20:04	00:37:32				

ACAD 382	00:17:28	0:18:39	00:36:07				
ACAD 04T	00:23:53	0:14:08	00:38:01				
ACAD 12	00:24:21	0:13:40	00:38:01				
ACAD 328	00:27:36	0:10:25	00:38:01				
ACAD 22	00:29:00	0:09:01	00:38:01				
ACAD 11	00:29:56	0:08:05	00:38:01	10	00:20:33	2:11:52	0:13:11

M5	ACAD 554	00:00:47	0:09:15	00:10:02				
	ACAD 409	00:00:47	0:19:33	00:20:20				
	ACAD 23	00:00:47	0:08:40	00:09:27				
	ACAD 11	00:00:47	0:16:35	00:17:22				
	POL 11O	00:00:47	0:19:23	00:20:10				
	ACAD 21	00:00:47	0:19:39	00:20:26				
	ACAD 355	00:00:47	0:16:47	00:17:34				
	ACAD 526	00:01:07	0:09:10	00:10:17				
	ACAD 411	00:02:49	0:03:59	00:06:48				
	ACAD 12	00:05:25	0:08:28	00:13:53				
	ACAD 328	00:07:09	0:10:44	00:17:53				
	ACAD 22	00:17:54	0:02:32	00:20:26				
	ACAD 24	00:18:04	0:01:11	00:19:15				
	ACAD 04T	00:18:30	0:00:12	00:18:42	14	00:20:26	2:26:08	0:10:26

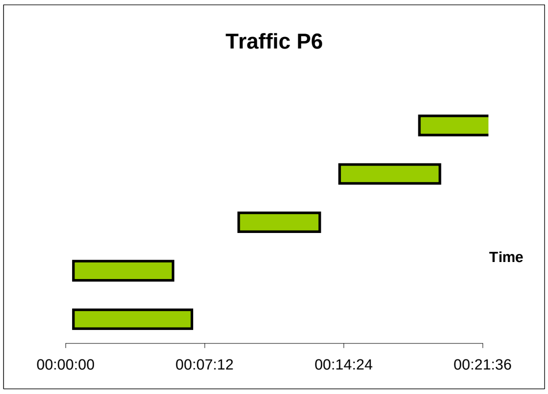


M6	ACAD 12	00:01:03	0:14:46	00:15:49				
	ACAD 346	00:01:03	0:02:40	00:03:43				
	ACAD 18	00:01:52	0:20:30	00:22:22				
	ACAD 526	00:01:03	0:21:19	00:22:22				
	BVT 582	00:02:16	0:06:47	00:09:03				
	ACAD 23	00:01:03	0:21:03	00:22:06				
	ACAD 22	00:01:03	0:12:39	00:13:42				
	ACAD 24	00:01:03	0:20:34	00:21:37				
	ACAD 411	00:07:49	0:14:33	00:22:22				
	ACAD 19	00:08:02	0:14:20	00:22:22				
	9MYCB	00:10:19	0:12:03	00:22:22				
	ACAD 383	00:18:44	0:03:38	00:22:22				
	ACAD 14	00:19:32	0:02:50	00:22:22	13	00:21:19	2:47:42	0:12:54

M7	BVT 582	00:06:13	0:04:09	00:10:22				
	ACAD 21	00:06:13	0:08:19	00:14:32				
	ACAD 416	00:06:13	0:00:20	00:06:33				
	ACAD 07X	00:06:13	0:17:14	00:23:27				
	ACAD 23	00:06:13	0:22:13	00:28:26				
	ACAD 08T	00:06:13	0:17:21	00:23:34				
	ACAD 339	00:06:13	0:03:20	00:09:33				
	ACAD 413	00:06:13	0:03:24	00:09:37				
	ACAD 420	00:13:06	0:15:39	00:28:45				
	ACAD 429	00:22:00	0:06:45	00:28:45				
	ACAD 236	00:24:46	0:03:59	00:28:45				
	ACAD 332	00:26:30	0:02:15	00:28:45				
	ACAD 14	00:27:00	0:01:45	00:28:45	13	00:22:32	1:46:43	0:08:13

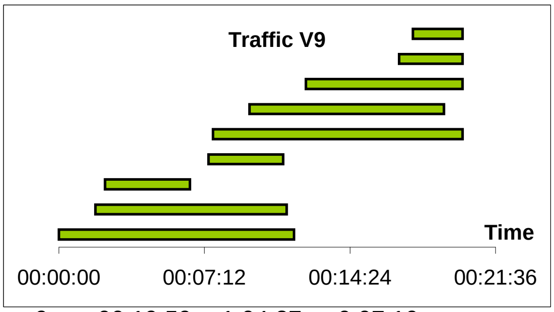
M9	ACAD 413	00:11:51	0:21:56	00:33:47
	ACAD 11	00:13:00	0:20:47	00:33:47
	ACAD 21	00:11:51	0:05:08	00:16:59
	ACAD 339	00:14:05	0:19:42	00:33:47

	ACAD 20	00:11:51	0:13:38	00:25:29				
	ACAD 537	00:21:20	0:12:27	00:33:47				
	BVT 582	00:22:44	0:08:04	00:30:48				
	ACAD 21	00:29:52	0:03:55	00:33:47				
	ACAD 23	00:32:26	0:01:21	00:33:47	9	00:21:56	1:46:58	0:11:53
M10	ACAD 24	00:09:26	0:03:41	00:13:07				
	ACAD 328	00:09:31	0:20:29	00:30:00				
	ACAD 14	00:09:26	0:20:34	00:30:00				
	ACAD 13	00:09:26	0:03:50	00:13:16				
	9MBDW	00:09:26	0:11:18	00:20:44				
	ACAD 12	00:09:26	0:09:29	00:18:55				
	ACAD 23	00:09:26	0:20:34	00:30:00				
	ACAD 335	00:09:26	0:16:25	00:25:51				
	ACAD 04	00:09:26	0:03:44	00:13:10				
	ACAD 18	00:09:26	0:13:54	00:23:20				
	ACAD 338	00:15:44	0:10:01	00:25:45	11	00:20:34	2:13:59	0:12:11
P1	MEGA 21C	00:00:52	0:21:29	00:22:21				
	CEKAL 06	00:10:12	0:05:27	00:15:39				
	ADAM 881	00:11:17	0:06:32	00:17:49				
	9MEAJ	00:17:51	0:03:46	00:21:37				
	SIA 191	00:21:06	0:01:15	00:22:21	5	00:22:21	0:38:29	0:07:42
P2	AXM 631	00:00:42	0:00:59	00:01:41				
	MAS 652	00:04:48	0:03:03	00:07:51				
	MAS 1492	00:07:56	0:04:44	00:12:40				
	FDX 5140	00:08:58	0:07:47	00:16:45				
	TSE 3438	00:13:16	0:03:10	00:16:26	5	00:16:45	0:19:43	0:03:57
P3	9MBLV	00:06:53	0:05:46	00:12:39				
	FDX 5140	00:12:10	0:01:13	00:13:23				
	CAL 674	00:19:29	0:03:22	00:22:51				
	AXM 314	00:20:16	0:04:25	00:24:41				
	MAS 1145	00:24:45	0:01:56	00:26:41	5	00:20:41	0:16:42	0:03:20
P4	SIA 192	00:00:30	0:04:19	00:04:49				
	UPS 6912	00:02:48	0:05:29	00:08:17				
	MAS 1139	00:03:05	0:02:22	00:05:27				
	PUTRA 04	00:10:50	0:11:00	00:21:50				
	ADAM 880	00:13:14	0:05:19	00:18:33	5	00:21:50	0:28:29	0:05:42
P5	CSN 396	00:01:19	0:07:10	00:08:29				
	ALK 831	00:03:07	0:04:50	00:07:57				
	UPS 6912	00:09:45	0:04:05	00:13:50				
	AXM 313	00:12:37	0:03:36	00:16:13				
	MAS 1134	00:16:17	0:04:33	00:20:50				
P6	MAS 1139	00:00:24	0:06:09	00:06:33				
	FDX 19	00:00:24	0:05:10	00:05:34				
	UPS 6912	00:08:58	0:04:12	00:13:10				
	MAS 6062	00:14:11	0:05:13	00:19:24				
	SIA 192	00:18:19	0:04:13	00:22:32				
	ADAM 880	00:21:38	0:01:49	00:23:27	6	00:23:27	0:26:46	0:05:21



P7	FDX 19	00:00:35	0:01:42	00:02:17				
	TSE 3437	00:02:21	0:03:50	00:06:11				
	MAS 1170	00:06:12	0:04:38	00:10:50				
	JTY 189	00:09:36	0:01:56	00:11:32				
	MAS 1489	00:16:00	0:03:55	00:19:55	5	00:19:55	0:16:01	0:03:12
P8	FDX 5193	00:00:22	0:08:11	00:08:33				
	UPS 6912	00:04:53	0:04:38	00:09:31				
	MAS 1139	00:08:57	0:01:20	00:10:17				
	SIA 192	00:14:17	0:05:52	00:20:09				
	ADAM 880	00:17:08	0:04:22	00:21:30	5	00:21:30	0:24:23	0:04:53
P9	9MBLV	00:01:39	0:04:11	00:05:50				
	LNI 289	00:05:07	0:04:53	00:10:00				
	MAS 652	00:14:18	0:04:54	00:19:12				
	MAS 1492	00:18:33	0:01:11	00:19:44				
	AXM 631	00:18:45	0:04:37	00:23:22	5	00:22:22	0:19:46	0:03:57
P10	MAS 1163	00:00:36	0:05:46	00:06:22				
	CPA 721	00:00:43	0:05:24	00:06:07				
	UPS 6911	00:06:24	0:07:18	00:13:42				
	MAS 1164	00:08:40	0:05:09	00:13:49				
	MAS 658	00:12:36	0:05:56	00:18:32	5	00:18:32	0:29:33	0:05:55
P11	MAS 1492	00:02:16	0:00:24	00:02:40				
	MAS 652	00:02:53	0:04:28	00:07:21				
	LNI 289	00:03:33	0:04:39	00:08:12				
	FDX 5140	00:10:28	0:08:19	00:18:47				
	MAS 1170	00:18:48	0:01:51	00:20:39	5	00:18:39	0:19:41	0:03:56
V1	MAS 2086	00:00:14	00:01:51	00:02:05				
	AXM 100	00:00:14	00:01:14	00:01:28				
	MAS 2088	00:02:29	00:12:49	00:15:18				
	POL 11M	00:04:41	00:05:58	00:10:39				
	MAS 2604	00:08:25	00:07:02	00:15:27				
	9MSTV	00:19:35	00:00:37	00:20:12	6	0:29:31	0:29:31	0:04:55
V2	MAS 2804	00:00:14	00:01:51	00:02:05				
	AXM 100	00:00:14	00:01:14	00:01:28				
	MAS 2008	00:02:29	00:12:49	00:15:18				
	POL 11M	00:04:41	00:05:58	00:10:39				
	MAS 2604	00:08:25	00:07:02	00:15:27				
6	9MSTV	00:19:35	00:00:37	00:20:12	6	00:20:12	0:29:31	0:04:55
V3	9MSTV	00:00:23	00:01:30	00:01:53				
	AXM 102	00:00:23	00:00:40	00:01:03				
	RMF 547	00:03:20	00:08:39	00:11:59				
	MAS 69	00:09:51	00:04:34	00:14:25				
	MAS 2608	00:14:00	00:05:36	00:19:36	5	00:19:36	0:20:59	0:04:12
V4	MAS 2613	00:00:05	00:01:43	00:01:48				
	AXM 102	00:00:05	00:01:22	00:01:27				
	RMF 375	00:02:02	00:06:19	00:08:21				

	MAS 384	00:05:03	00:03:40	00:08:43				
	MAS 2124	00:10:10	00:03:37	00:13:47	5	00:13:47	0:16:41	0:03:20
V5	9MAYN	00:00:02	00:07:10	00:07:12				
	HAD 061	00:02:13	00:04:48	00:07:01				
	9MLLD	00:03:10	00:10:40	00:13:50				
	MAS 69	00:08:53	00:07:56	00:16:49				
	MAS 2131	00:12:41	00:04:34	00:17:15				
	MAS 87	00:16:30	00:02:37	00:19:07	6	00:19:07	0:37:45	0:06:17
V6	MAS 2807	00:00:00	00:03:12	00:03:12				
	9MSTV	00:00:00	00:01:58	00:01:58				
	MAS 2008	00:06:13	00:07:44	00:13:57				
	MAS 2086	00:09:08	00:04:28	00:13:36				
	AXM 101	00:19:32	00:00:19	00:19:51	5	00:19:51	0:17:41	0:03:32
V7	MAS 2619	00:00:01	00:01:28	00:01:29				
	MAS 69	00:02:49	00:06:45	00:09:34				
	MAS 2853	00:03:23	00:03:55	00:07:18				
	MAS 2605	00:07:29	00:02:54	00:10:23				
	MAS 396	00:13:21	00:01:15	00:14:36				
	MAS 2131	00:14:57	00:02:53	00:17:50				
	MAS 087	00:19:38	00:00:11	00:19:49	7	00:19:49	0:19:21	0:02:46
V8	MAS 2008	00:00:12	00:06:58	00:07:10				
	MAS 2122D	00:04:46	00:09:32	00:14:18				
	AXM 101	00:05:04	00:06:48	00:11:52				
	MAS 2804	00:12:41	00:05:07	00:17:48				
	MAS 2126	00:16:16	00:02:46	00:19:02				
	MAS 396	00:18:49	00:00:13	00:19:02	6	00:19:02	0:31:24	0:05:14
V9	9MLLT	00:00:00	00:11:39	00:11:39				
	MAS 2126	00:01:48	00:09:29	00:11:17				
	AXM 101	00:02:17	00:04:13	00:06:30				
	MAS 2804	00:07:24	00:03:43	00:11:07				
	MAS 2619	00:07:37	00:12:22	00:19:59				
	9MLLA	00:09:26	00:09:38	00:19:04				
	MAS 396	00:12:13	00:07:46	00:19:59				
	MAS 2807	00:16:50	00:03:09	00:19:59				
	MAS 2806	00:17:31	00:02:28	00:19:59	9	00:19:59	1:04:27	0:07:10
V10	MEGA 21C	00:00:08	00:00:09	00:00:17				
	MAS 394	00:00:08	00:05:12	00:05:20				
	MAS 87	00:05:39	00:05:20	00:10:59				
	MAS 2050	00:11:32	00:06:37	00:18:09				
	MAS 2802	00:11:59	00:03:37	00:15:36				
	MAS 2087	00:14:18	00:03:51	00:18:09				
	MAS 384	00:18:03	00:00:06	00:18:09	7	00:18:09	0:24:52	0:03:33
V11	MAS 2086	00:00:01	00:05:23	00:05:24				
	MAS 5138	00:00:01	00:15:14	00:15:15				
	V8BKH	00:01:34	00:14:31	00:16:05				
	TSE 317	00:04:11	00:06:47	00:10:58				
	MAS 2619	00:12:13	00:03:22	00:15:35				



	MAS 384	00:16:38	00:03:29	00:20:07				
	AXM 101	00:18:37	00:01:30	00:20:07				
	MAS 2804	00:18:44	00:01:23	00:20:07	8	00:20:07	0:51:39	0:06:27
V12	MAS 2804	00:00:01	00:01:03	00:01:04				
	MAS 2619	00:00:01	00:01:32	00:01:33				
	AXM 101	00:02:29	00:02:21	00:04:50				
	MAS 2126	00:06:19	00:06:00	00:12:19				
	MAS 2806	00:11:02	00:06:14	00:17:16				
	MAS 396	00:18:39	00:00:11	00:18:50	6	00:18:50	0:17:21	0:02:53
V13	MAS 2131	00:00:32	00:00:54	00:01:26				
	MAS 87	00:06:23	00:01:05	00:07:28				
	MAS 2097	00:09:18	00:05:21	00:14:39				
	MAS 393	00:10:40	00:01:17	00:11:57	4	00:14:39	0:08:37	0:02:09
V14	MAS 87	00:01:00	00:02:14	00:03:14				
	MAS 396	00:04:43	00:01:39	00:06:22				
	MAS 2087	00:10:58	00:04:49	00:15:47				
	MAS 2050	00:13:04	00:05:57	00:19:01				
	RMF 547	00:19:21	00:01:08	00:20:29				
	MAS 2802	00:19:36	00:01:20	00:20:56	6	00:20:56	0:17:07	0:02:51
V15	MAS 2085	00:00:05	00:00:12	00:00:17				
	POL 11M	00:00:05	00:19:30	00:19:35				
	9MAUA	00:04:17	00:05:42	00:09:59				
	MAS 2805	00:06:53	00:01:22	00:08:15				
	AXM 100	00:14:56	00:04:39	00:19:35	5	00:19:35	0:31:25	0:06:17
V16	MAS 384	00:00:02	00:05:56	00:05:58				
	9MLLD	00:01:13	00:09:45	00:10:58				
	MAS 2806	00:03:44	00:10:36	00:14:20				
	AXM 101	00:03:55	00:05:22	00:09:17				
	MAS 2126	00:08:29	00:06:37	00:15:06				
	MAS 87	00:11:52	00:06:59	00:18:51				
	MAS 2043D	00:15:52	00:02:59	00:18:51	7	00:18:51	0:48:14	0:06:53
V17	MAS 2126	00:00:05	00:11:06	00:11:11				
	MAS 2804	00:00:05	00:01:53	00:01:58				
	MAS 384	00:03:24	00:08:59	00:12:23				
	MAS 2806	00:09:56	00:06:42	00:16:38				
	9MSAC	00:14:11	00:05:18	00:19:29				
	MAS 87	00:15:02	00:04:27	00:19:29	6	00:19:29	0:38:25	0:06:24
V18	MAS 2050	00:01:16	00:00:40	00:01:56				
	MAS 2604	00:05:24	00:09:13	00:14:37				
	MAS 382	00:05:45	00:06:35	00:12:20				
	MAS 2865	00:11:12	00:04:05	00:15:17				
	MAS 2853	00:11:49	00:06:08	00:17:57	5	00:17:57	0:26:41	0:05:20
V19	MAS 2126	00:00:12	00:03:07	00:03:19				
	MAS 2806	00:10:46	00:05:37	00:16:23				
	MAS 87	00:07:20	00:05:45	00:13:05				
	MAS 396	00:13:25	00:06:28	00:19:53				

	9MAXH	00:13:50	00:06:03	00:19:53	5	00:19:53	0:27:00	0:05:24
V21	MAS 2640	00:00:14	00:09:21	00:09:35				
	MAS 2477	00:03:56	00:03:32	00:07:28				
	HDA 060	00:09:43	00:01:39	00:11:22				
	MAS 2613	00:09:55	00:04:16	00:14:11				
	MAS 69	00:13:41	00:02:42	00:16:23				
	MAS 2608	00:16:25	00:01:26	00:17:51	6	00:17:51	0:22:56	0:03:49
V22	POL 11M	00:00:22	00:06:01	00:06:23				
	MAS 396	00:00:56	00:04:00	00:04:56				
	MAS 69	00:07:30	00:06:57	00:14:27				
	MAS 2802	00:11:30	00:04:58	00:16:28				
	MAS 87	00:06:50	00:10:07	00:16:57				
	MAS 2050	00:16:10	00:03:56	00:20:06				
	HAD 060	00:19:00	00:01:06	00:20:06	7	00:20:06	0:37:05	0:05:18
V23	9MAXH	00:02:31	00:06:24	00:08:55				
	MAS 2865	00:04:34	00:03:35	00:08:09				
	MAS 2605	00:06:14	00:03:02	00:09:16				
	9MSTV	00:14:55	00:03:11	00:18:06	4	00:18:06	0:16:12	0:04:03
V24	MAS 2126	00:00:48	00:04:24	00:05:12				
	MAS 384	00:02:11	00:07:08	00:09:19				
	MAS 2806	00:05:18	00:09:39	00:14:57				
	MAS 87	00:08:13	00:07:07	00:15:20				
	9MSTV	00:09:55	00:05:37	00:15:32	5	00:15:32	0:33:55	0:06:47
V25	MAS 2807	00:00:25	00:02:07	00:02:32				
	AXM 100	00:00:25	00:00:30	00:00:55				
	MAS 2604	00:03:14	00:06:25	00:09:39				
	MAS 2008	00:07:17	00:05:08	00:12:25				
	PCHOP 4	00:08:24	00:09:21	00:17:45				
	MAS 2086	00:09:50	00:07:46	00:17:36				
	MAS 2127	00:17:19	00:00:26	00:17:45	7	00:17:45	0:31:43	0:04:32
V26	MAS 3006	00:00:09	00:03:35	00:03:44				
	9MSAC	00:00:43	00:12:41	00:13:24				
	MAS 2129	00:04:16	00:06:13	00:10:29				
	MAS 2805	00:06:33	00:05:40	00:12:13				
	9MAUA	00:07:39	00:08:28	00:16:07				
	AXM 100	00:15:01	00:04:34	00:19:35	6	00:19:35	0:41:11	0:06:52
V27	MAS 2802	00:00:45	00:05:07	00:05:52				
	MAS 2050	00:00:52	00:04:12	00:05:04				
	MAS 382	00:05:09	00:02:30	00:07:39				
	MAS 2640	00:11:58	00:06:25	00:18:23				
	MAS 2124	00:17:26	00:01:43	00:19:09	5	00:19:09	0:19:57	0:03:59
V28	MAS 2613	00:01:33	00:04:36	00:06:09				
	DRG 060	00:01:49	00:01:19	00:03:08				
	MAS 2477	00:04:17	00:07:33	00:11:50				
	MAS 69	00:04:31	00:12:28	00:16:59				
	MAS 2608	00:06:21	00:10:25	00:16:46				

	MAS 2124	00:10:18	00:04:32	00:14:50				
	MAS 2802	00:15:22	00:04:17	00:19:39				
	MAS 2050	00:16:14	00:03:25	00:19:39				
	MAS 265	00:18:08	00:01:31	00:19:39				
	AXM 102	00:18:47	00:00:52	00:19:39	10	00:19:39	0:50:58	0:05:06
V29	MAS 386	00:02:11	00:01:16	00:03:27				
	MAS 2802	00:02:25	00:06:25	00:08:50				
	MAS 87	00:03:45	00:05:46	00:09:31				
	MAS 2050	00:13:18	00:04:43	00:18:01				
	MAS 2087	00:13:34	00:03:47	00:17:21	5	00:16:01	0:21:57	0:04:23
V30	MAS 2131	00:01:03	00:01:48	00:02:51				
	MAS 394	00:04:21	00:02:19	00:06:40				
	MAS3005	00:09:23	00:06:00	00:15:23				
	MAS 87	00:15:03	00:01:52	00:16:55	4	00:15:55	0:11:59	0:03:00
V31	MAS 2050	00:00:00	00:05:17	00:05:17				
	MAS 2087	00:01:16	00:06:42	00:07:58				
	MAS 382	00:02:51	00:05:44	00:08:35				
	9MLLD	00:00:00	00:19:18	00:19:18				
	MAS 2802	00:06:57	00:04:45	00:11:42				
	MAS 2640	00:18:07	00:01:11	00:19:18				
	9MSTS	00:14:16	00:05:02	00:19:18	7	00:19:18	0:47:59	0:06:51
				Aircraft	725			
				Elapse		33:16:43		
				Total Contact			83:14:11	
				Contact per aircraft				0:06:33

APPENDIX M: SUMMARIES OF RADIOTELEPHONY CHARACTERISTICS

TAR RADIOTELEPHONY CHARACTERISTICS

Recorded Minutes	900
Total Messages	4928
Total Words	51242
Total Elements	12651

ATC callsign	2131	Pilot miscommunication	2	Excess verbiage	97	
with errors	618	ATC miscommunication	14	Disfluencies	155	
Pilot callsign	2562	c/s verify	15			
with errors	771	Initial contact	300			
		partial	204			
ATC INSTRUCTIONS		PILOTS' READBACK		READBACK ERRORS TYPE		HEARBACK ERRORS
Altitude	941	Altitude	922			
partial	10	partial	18	substitution	5	1
pronunciation	18	none	29	pronunciation	14	
		verify	9			
Altitude Restriction	8	Altitude Restriction	8			
partial	1	partial	1			
pronunciation	0	none	1			
		verify	0			
Approach	183	Approach	178			
partial	53	partial	58			
pronunciation	0	none	18			
		verify	1			
Communications	340	Communications	331	facility name	0	
partial	164	partial	238	frequency	4	1
pronunciation	12	none	65	pronunciation	43	
		verify	5			
Heading	327	Heading	323			1
partial	32	partial	43	substitution	5	
pronunciation	25	none	7	pronunciation	19	
		verify	9			

Holding 0 partial pronunciation	Holding 0 partial none verify			
Landing 0 partial pronunciation	Landing 0 partial none verify			
Route/position 190 partial 9 pronunciation 1	Route/position 186 partial 19 none 14 verify 6	substitution 1	1	
Speed 289 partial 39 pronunciation 30	Speed 282 partial 48 none 42 verify 12	substitution 4 pronunciation 42	1	
SSR code 3 partial 1 pronunciation	SSR 2 partial 0 none 1 verify 0	confusion 1		
Takeoff 0 partial pronunciation	Takeoff 0 partial none verify			
QNH 125 partial 15 pronunciation 19	QNH 127 partial 23 none 22 verify 1	substitution 1 pronunciation 13		
Traffic Advisory 20 partial 14 pronunciation				

ARR RADIOTELEPHONY CHARACTERISTICS

Minutes	1220
Messages	5738
Words	58067
Elements	14546

ATC callsign	2284		pilot miscom		3	Excess verbiage	227
with errors		708	ATC miscom		12	Disfluencies	204
Pilot callsign	2697		c/s verify		37		
with errors		771	Initial contact	324			
			partial		255		

ATC INSTRUCTIONS			PILOTS' READBACK			READBACK ERRORS TYPE		HEARBACK ERRORS
Altitude	797		Altitude	742				
partial		15	partial		16	substitution	9	4
pronunciation		27	none		55	pronunciation	26	
			verify		12			
Altitude Restriction	4		Altitude Restriction	6				
partial		0	partial		1			
pronunciation		0	none		1			
			verify		1			
Approach	1		Approach	1				
partial		0	partial		0			
pronunciation		0	none		0			
			verify		0			
Communications	432		Communications	384		facility name	0	
partial		230	partial		297	frequency	4	2
pronunciation		28	none		52	pronunciation	54	
			verify		13			
Heading	82		Heading	77		confusion	2	0
partial		8	partial		9	substitution	1	
pronunciation		0	none		3	pronunciation	1	
			verify		2			

Holding 17 partial 2 pronunciation 0	Holding 15 partial 3 none 4 verify 4			
Landing 0 partial 0 pronunciation 0	Landing 0 partial 0 none 0 verify 0	confusion substitution		
Route/position 412 partial 10 pronunciation 0	Route/position 381 partial 19 none 32 verify 18	confusion 1 tracking 1 point name 3 pronunciation 0	0	
Speed 75 partial 24 pronunciation 2	Speed 70 partial 23 none 8 verify 3	substitution 1 pronunciation 5	1	
SSR code 27 partial 10 pronunciation 0	SSR 19 partial 4 none 1 verify 0	confusion 0		
Takeoff 0 partial 0 pronunciation 0	Takeoff 0 partial 0 none 0 verify 0			
QNH 29 partial 3 pronunciation 5	QNH 28 partial 2 none 5 verify 0	substitution 0 pronunciation 5		
Traffic Advisory 10 partial 8 pronunciation 0				

TWR RADIOTELEPHONY CHARACTERISTICS

Minutes	2337
Messages	9782
Words	104505
Elements	25616

ATC callsign	4260		pilot miscom			8	Excess verbiage	459	
with errors		1503	ATC miscom			6	Disfluencies	507	
Pilot callsign	4979		c/s verify			23			
with errors		1433	Initial contact		601				
				partial		401			
ATC INSTRUCTIONS			PILOTS' READBACK				READBACK ERRORS TYPE		HEARBACK ERRORS
Altitude	655		Altitude		629				
partial		35		partial		40	substitution	5	4
pronunciation		4		none		50			
				verify		15	pronunciation	8	
Alt. Restriction	3		Alt. Restriction		3				
partial		0		partial		0			
pronunciation		0		none		0			
				verify		0			
Approach	302		Approach		287				
partial		119		partial		139			
pronunciation		0		none		50			
				verify		2			
Communications	635		Communications		610				
partial		267		partial		471	facility name	1	
pronunciation		125		none		46	frequency	7	2
				verify		17	pronunciation	187	
Heading	81		Heading		81		confusion	0	
partial		6		partial		7	substitution	1	1
pronunciation		2		none		3	transposition	1	
				verify		0	pronunciation	2	

Holding 43 partial 5 pronunciation 0	Holding 38 partial 8 none 4 verify 3			
Landing 348 partial 58 pronunciation 0	Landing 348 partial 110 none 5 verify 1	confusion substitution 1		
Route/position 1590 partial 127 pronunciation 10	Route/posn. 1543 partial 215 none 108 verify 36	confusion 1 tracking 2 point name 3 pronunciation 7	2	
Speed 23 partial 21 pronunciation 1	Speed 22 partial 17 none 8 verify 2			
SSR code 39 partial 0 pronunciation 0	SSR 38 partial 0 none 1 verify 3	confusion 1		
Takeoff 335 partial 67 pronunciation 0	Takeoff 336 partial 108 none 20 verify 1			
QNH 209 partial 2 pronunciation 7	QNH 96 partial 1 none 17 verify 4	substitution 3 pronunciation 3	1	
A. Tfc 149 partial 47 pronunciation 0				