CRANFIELD UNIVERSITY

MICHAEL JOHN COOPER

The Gordian knot of interdependence.
A study of interpersonal team dynamics among RAF ground crew during the Western Desert campaign, June 1940 – February 1943.

Defence and Security
Doctor of Philosophy

PhD
Academic Year: 2021 - 2022

Lead Supervisor: Dr Iftikhar Zaidi
Associate Supervisor: Dr Gemma Collantes Celador
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DEDICATION

This thesis is dedicated to my father, Wilfred ‘Bill’ Cooper who fought against fascism in the Royal Air Force in the Second World War, first in Britain, then Palestine, and afterwards in the crucible of the Western Desert campaign. He encouraged me in all things and being a thoughtful man would have approved of this learning endeavour.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES AND MAPS

LIST OF EQUATIONS

ABSTRACT

This thesis is a study of the previously neglected area of organisational development dealing with interpersonal team dynamics amongst Royal Air Force (RAF) ground crew during the Western Desert campaign June 1940-February1943.In addressing this *lacuna*, particular emphasis is placed on the pilot-fitter-rigger team, an integral part of the Desert Air Force and its constituent squadrons. Although the pilot was designated air crew and not ground crew, to disregard his presence and influence on the team dynamic would not represent the team as it functioned. Their combined skills set enabled the Desert Air Force to adapt to the demands of what was then a modern war, waged in the challenging environmental, logistical, and operational conditions of the Western Desert.

Via qualitative research this thesis examines the primary question, 'How did the pilot-fitter-rigger team in the Desert Air Force during the Second World War form a small, resilient, and effective team? 'The thesis also tests the hypothesis '*Whether or not the team of the pilot-fitter-rigger team in the Desert Air Force during the Second World War constituted a small, resilient, effective team.* 'The *null* hypothesis being, 'N*either Britishness nor the peculiar and particular desert environment played a significant role in creating the pilot- fitter- rigger small team into a resilient and effective entity.'*

This thesis is based primarily on qualitative research, both in terms of organisational development theory and military history contained in both primary and secondary sources relating to human endeavour. The research involves a critical literature review, and where practicable, field visits along with interviews with established historians, technical experts, serving RAF personnel, and Second World War veterans. An element of quantitative data is also employed and considered where logistics, combat strength, and size of air fleets are concerned. The quantitative component is small and synthetic in nature, and therefore does not influence the qualitative data component beyond providing data.

This application of new knowledge relating to ground crew in a desert combat situation makes a novel contribution to academic knowledge by building on previously established peace time organisational development theories and conducting new

empirical work in the examination of the organisational development of RAF ground crew. This new and novel contribution will be of use to the academic community and researchers at large and organisational development practitioners, when developing an understanding of small team dynamics; as well as military historians and the wider public domain for both educational and leisure research. From the research findings and discussion this thesis concludes that both the research question and hypothesis have been tested and found that the pilot-fitter-rigger team in the Desert Air Force during the Second World War did form a small resilient and effective team. The thesis also found that peacetime organisational development theories also applied in a wartime combat situation, making them, at least in these two contexts, transferable proposition. The thesis tested the *null* hypothesis and concluded that *both Britishness and the peculiar and particular desert environment did play a significant role in creating the pilot- fitter-rigger team into a resilient and effective entity.*

Keywords:

Royal Air Force–RAF ground crew, desert combat environment, mobility agility, innovation, leadership, team dynamics, emotional intelligence, multiple intelligences.

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LIST OF ABBREVIATIONS

AOC in C	Air Officer Commanding in Chief
BBC	British Broadcasting Corporation
EI	Emotional Intelligence
HUD	Head Up Display
I.Q.	Intelligence Quotient
JG	*Jagdgeschwader*
MI	Multiple Intelligences
NCO	Non- Commissioned Officer
OR	Operational Research
RAF	Royal Air Force
RCAF	Royal Canadian Air Force
RFC	Royal Flying Corps
RNAS	Royal Naval Air Service

GLOSSARY OF TERMS

Almshouses.	A system of charitable housing founded in Britain in the 10th century for those people in the community who found themselves in reduced circumstances (often financial) and take the form of subsidised accommodation often integrated with social care resources and provision. The system still exists and is active at present.
Auftragstaktik.	The German military doctrine also known as Mission Command in the United Kingdom and the United States, where the emphasis is on the outcome of a mission rather than the specific means of achieving the mission. The doctrine has been a principal component of the German armed forces since the 19th Century.
Biplane.	A type of aircraft with one set of wings (sometimes fabric covered) set above the other and held together with inter-plane struts aligned and tensioned with wire rigging.
Ergonomics.	The study of people's efficiency in their working environment. In the context of this thesis, it relates to the layout of instruments and controls in the cockpit of an aircraft and how easily they fall to hand, or are visible, readable, and accessible for repair, replacement, or calibration.
Few (the).	The collective name by which the fighter pilots of Fighter Command became to be known. The *soubriquet* derived from a speech made to the House of Commons on 20th August 1940 by the then war time Prime Minister Winston Churchill wherein he paid tribute by way of the nation's debt to those same fighter pilots for their actions during the Battle of Britain in which they repulsed the *Luftwaffe.* 'Never in the field of human conflict was so much owed by so many to so few.'
Gordian knot.	The Gordian knot is a legend associated with Alexander the Great, in which the knot was regarded as impenetrable and incapable of being undone. The phrase is used as a metaphor for a problem which has no obvious or easy solution.
Horsepower. (h.p.)	An imperial unit for measuring the power output of an engine. It is equivalent to the power exerted by one horse to raise a weight of 550 lbs a distance of one foot in one second. Or to raise a weight of 33,000 lbs a distance of one foot in one minute.
Luftwaffe (the).	The German equivalent to the Royal Air Force. The *Luftwaffe* came into being in March 1935 and existed until the surrender of the German armed forces in May 1945.
Magneto.	A small electro-mechanical generator containing a permanent magnet and used to provide high-voltage electrical pulses in the ignition systems of piston engine aircraft. In the case of the Merlin

	aircraft engine there were (are) two magnetos fitted to ensure correct engine performance and reliability in service.
Monoplane.	A type of aircraft with one set of wings, which can be situated either at the top, middle, or bottom surface of the fuselage. Usually of stressed metal skin construction.
Occam's razor.	It is a problem-solving principle attributed to the Franciscan friar William of Ockham (ca. 1287-1347). The philosophical principle advocates that one should select the solution with the fewest assumptions attached to it, as the simpler approach tends to be the more testable and more likely to be the correct solution.
Operational Research.	Operational Research is a management technique whereby the sequence of events or operational steps in a process are charted out in the order in which they occur, and their relationship to other events or steps, providing a clear and logical charting of the process. This enables all the stakeholders in the process to understand and assimilate. In the opening months of the Second World War the Air Ministry recognised the importance of applying scientific knowledge and advanced analytical methods to problem solving to improve operational efficiency of its front- line units. Operational Research was implemented in Fighter Command by mid- 1941.
Port.	The side of a ship or aircraft that is on the left when facing forward.
Regia Aeronautica (the).	The Italian air force equivalent to the Royal Air Force. The *Regia Aeronautica* was constituted in 1923 as a part of the Kingdom of Italy. It existed until 1946.
Starboard	The side of a ship or aircraft that is on the right when facing forward.
Torque.	A mechanical force that produces a rotation or twisting moment about a fixed point. The magnitude of the torsional force is usually calculated as 'force x distance' (distance being the distance from the fixed point of rotation).
Warrant Officer.	A Warrant Officer is the highest rank of non-commissioned officer and is a technical expert due to their specialist knowledge and skills gained within a particular field. They are designated an officer by a warrant signed by a Minister of State, or a representative of the Army Council and hold their rank often by virtue of seniority. They are distinct from a commissioned officer who is designated an officer by the Monarch's commission. Warrant Officers are valued as advisers on expert technical matters to Commissioned Officers A Warrant Officer's expert approach often combines two or more individuals with different skills and experience. The term Warrant Officer was defined to the author by one of the Warrant Officers posted to the Battle of Britain Memorial Flight on the author's visit to the flight in March 2016.

CHAPTER 1 INTRODUCTION

The following quotation gives something of the essence of what this thesis is about. It is about team- work, collective endeavour, and the individual's contribution to a greater entity.

> By being part of something beyond the physical self, the individual can achieve a sense of belongingness and can participate in accomplishments beyond individual powers. Moreover, affiliating with others can extend the ego in time as well as space, for individuals can see this contribution to the group as enduring over time even though they themselves may not survive (Kahn *et.al,* 1978).

It is not the authors' intention to write a 'what if' counterfactual history, or a revisionist reprise of the Second World War Both more able authors have covered approaches, but instead will concentrate on the examination of the interpersonal dynamic between Royal Air Force (RAF) ground crew in the roles of fitter and rigger and their pilot. The thesis has, as its central tenet, the fact that there are *lacunae* in the history of the development and organisation of the Royal Air Force as will be demonstrated in the literature review. The Literature Review shows that there has been extensive coverage through books, film and television of the actions and effectiveness of Fighter Command combat aircrew in the Second World War, but no comparable discussion of Fighter Command ground crew, particularly the Pilot-Fitter-Rigger interpersonal dynamic under combat conditions. Therefore, it is important to address these *lacunae* as not to do so would in effect cause the recorded history of RAF Fighter Command to be incomplete and skewed disproportionally towards aircrew. This disproportionality would seem to be accentuated by the commercialisation of the history of the Second World War with its' emphasis on the actions or of aircrew and on the *materiel* of the Second World War. This omission has brought about *lacunae* not only in the history and development of the RAF, but also the applicability or otherwise well documented functional theories related to organisational development and leadership in a combat environment. Through exploring these *lacunae* this thesis will make a contribute to the wider body of

knowledge that will be of the widest use to historians, and researchers both academic and lay, in the fields of military history, geopolitics, and organisational development.

When reading this thesis, it would be useful for the reader to understand the two generic terms 'British,' and 'German' used throughout this thesis. In the case of the term 'British' the author has deemed that in the first instance, the term covers people from the United Kingdom, being England, Wales, Scotland, and Northern Ireland. In the case of people from Southern Ireland who volunteered, the designation 'British Isles' would be more accurate. It should also be remembered that pilots and ground crew were also drawn from the Dominions such as Canada, Australia, New Zealand, South Africa, the two Rhodesia's, the Caribbean and other parts of the British sphere of influence. In addition, a few Americans joined the RAF as pilots. Bearing in mind this eclectic mix of nationalities it would be unnecessarily pedantic and tedious to make the distinction between nationalities every time the term 'British' is used or referred to, so the term 'British' is used for the sake of clarity and convenience. With regard to the term 'German' it should be remembered that 'Germany' became a unified entity in 1871 under Bismarck's Chancellorship. Prior to the unification, 'Germany' consisted of thirty-eight sovereign states and four free cities (Boyd, 2017). Despite unification, regional identities were still uppermost in native 'German' minds regarding themselves for example as 'Saxons, or 'Württembergers' or 'Prussians.' It was not until 1934 that the term 'German' was used as the official national designation for passport purposes. Until then, passport holders were described as Saxon, Prussian, Bavarian, and so on (Lever, 2018). There is also the vexed question of gendered language, the silent gendered language reflecting a man's world, and the language catches the tone of the times.

The approach adopted in this thesis will be to consider the genesis of the RAF during the First World War and the subsequent years of Imperial Policing (Bowyer, 1988), and how those years directly influenced the way in which the RAF organised and structured its squadrons, with the squadron being the basic combat flying unit at an administrative level. When the RAF entered the Second World War on 3rd September 1939 (Gardiner and Wenborn, 1995), it took with it the organisation and structure built up over the preceding twenty-five years (Bowyer, 1984)**;** and it was under war time logistical,

geopolitical, and environmental factors and conditions that RAF squadrons operated. The structure of a squadron dictated that at that stage of the Second World War individual aircraft had an assigned pilot along with two members of ground crew, a fitter and a rigger who were most related to servicing and maintaining of a particular aircraft ('their' aircraft) on the strength of the squadron. The team dynamic between those three people and their close association with an aircraft determined the teams' effectiveness through the presentation and readiness of an aircraft for combat and subsequent performance in combat. The equilibrium of the team dynamic of the three was affected for better or worse by the actions of each individual within the team. The interplay of the actions of the individuals (both jointly and severally) within the team, combined with the task(s) that a team are required to achieve, are captured in John Adair's Functional Leadership Model (Adair 1987) as discussed throughout this thesis. To help illustrate the point regarding how individual actions within a team can contribute or detract from the team's effectiveness; the thesis then explores the interpersonal dynamics of the Pilot-Fitter-Rigger team that existed within the Desert Air Force component of the Royal Air Force operating throughout the Western Desert campaign from 10th June 1940 to 4th February 1943. The Western Desert campaign was chosen by the author as the subject background context specifically because of its harsh and challenging geographical, environmental, and operational conditions that imposed extraordinary psychodynamic and organisational demands on the Pilot-Fitter-Rigger team.

1.1 Historical Background

The purpose in relating the background is to give the historical, military and geopolitical context to the situation that the Desert Air Force was confronted with at the start of the Western Desert campaign, which for the purposes of this thesis is taken to be the point at which Italy declared war on Britain on 10th June 1940.The background and context provide the *rationale* for the research focus on the factors affecting the organisational development of the Desert Air Force and its ground crew. The presence of the Royal Air Force in Egypt, specifically the Western Desert campaign in the Second World War can be traced to the development of air power during the First World War by which time,

the British had turned Egypt into a major military base in support of the ill-fated Gallipoli campaign of 1916.The Royal Flying Corps (RFC, later the RAF) operated several flying training schools in Egypt. After the First World War, the RAF Command presence became known as the Middle East Brigade, later retitled the Middle East Command (Bowyer, 1988).Throughout the next two decades the RAF consolidated its position in Egypt to the extent that by 1936, it had with the agreement of the Egyptian Government through an Anglo–Egyptian treaty unconditional use of Egyptian air space, controlling both operational and training units in Egypt and Palestine as well as the Mediterranean and Aegean Seas (Mangold, 2016; Airpower Review, 2013).

Sir Hugh Trenchard, first Chief of the Air Staff, had the formidable task of rebuilding the RAF out of the post First World War military demobilisation and associated financial restrictions. In September 1919, after a particularly robust exchange of views with Winston Churchill, the Secretary of State for War and Air, over the potential future existence of the RAF; Churchill invited Trenchard to prepare a written statement of his ideas (Boyle, 1962, p. 331).Trenchard succinctly outlined the necessity for the RAF to be a separate independent service (Boyle, 1962).By December 1919,the proposals were presented in a White Paper which Churchill introduced to the House of Commons the same month(Air Power Review, 2013).Within that paper entitled, *An Outline of the Scheme for the Permanent Organisation of the Royal Air Force,* there was a proposal to have no less than eighteen squadrons dispersed overseas (Air Power Review, 2013).The scheme proposed the following dispositions, India was to have eight squadrons with one depot. Egypt, seven squadrons with one depot, and one flight detached to Alexandria. One squadron on Malta with one squadron based on an aircraft carrier in the Mediterranean Sea; lastly Mesopotamia was to receive three squadrons with one depot. In the White Paper Egypt was referred to as the Clapham Junction—a reference to a major transport junction in south London (Air Power Review,2013) of the air between Europe, the Mediterranean and the Middle and Far East situated with comparatively easy reach of the most probable centres of unrest(Air Power Review,2013) making it the obvious locality for a small Royal Air Force reserve (Air Power Review,2013).This was a particularly prescient observation, given the fact that Britain had been awarded several

post-First World War mandates ,including Palestine, Mesopotamia and Transjordan (Lawless, 1980, p 31).In addition, Egypt was a staging post on the projected imperial air route to India, and conveniently contained the Suez Canal which was a vital trade route to the Far East. This was a particularly apposite convergence of strategic military and trade interests.

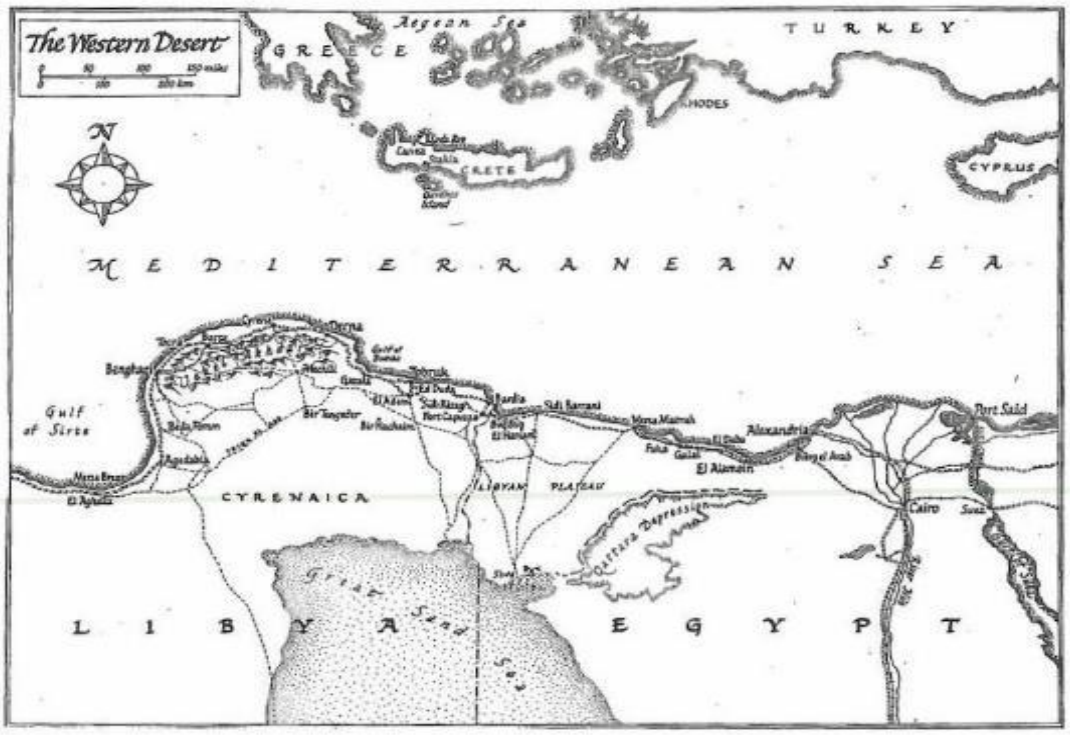
Initially, Trenchard's plans for expansion of the RAF were constrained by three major factors. Firstly, the Air Estimates of March 1919 totalled £66,500,000, (£3,52bn at 2021 prices) (CPI Calculator 2021) this was 12 1/2 percent (or one eighth) of the Army's annual budgetary allocation. Trenchard calculated that the RAF could be reconstructed into an effective force capable of expansion in times of threat for £25,000,000 (Boyle, 1962)(£1.32bn at 2021 prices) (CPI Calculator),the balance of £41,500,000,(£2.2bn at 2021 prices) (CPI Calculator),was to be used to reconfigure the service downwards, to reflect the minimum post war realities considered essential for overseas commitments with a home reserve (Boyle,1962,pp.339-341) Secondly, in 1919 the Government adopted the 'Ten Year Rule', which in essence was a planning assumption based on the thinking that there would be no war involving Britain within ten years (Boyle, 1962, p. 340).This assumption was rolled over from year to year before finally being abandoned in the mid1930s when the threat of war emanating from continental Europe became all too real**.**

Lastly, throughout Trenchard's endeavours to build the RAF there was continuing determination of both the Army through the War Office, and the Royal Navy through the Admiralty to disband the RAF and assimilate the various air components into their respective services. Boyle (1962, p. 369, 271), demonstrates that Trenchard fought a long- running battle to resist the inter-service rivalry by establishing the credibility of the RAF, and proving the concept of air control to the Government**.** According to Boyle(Boyle 1962), he did this by demonstrating to H. M. Treasury the cost effectiveness of policing the Empire by air through identifying campaigns where the RAF could make a maximum impact for minimum cost to the Exchequer. This was much to the chagrin of the Army with its expensive garrisons and long logistical supply chain (Bowyer,1988, p.180). This approach so impressed the Government that the notion of air control was extended to

other British areas of interest in the Middle East. Trenchard continued to implement his vision and ethos for the RAF as Bowyer (1988, p. 20-21) observes, and expanded the service as the demands of Imperial policing grew throughout the Near and Middle East. Air activity of this kind continued intermittently until 1936 when it became obvious that threats of a different nature were emerging in continental Europe (Boyle, 1962, pp. 541-542). By the time of the Munich Crisis of September 1938,28 RAF squadrons were based overseas, of which 16 were based in the Middle East with five based in Egypt, only one of which was a pure fighter squadron. RAF Command in the area was led by the Air Officer Commanding in Chief (AOCinC) and was known as Royal Air Force Middle East (Chapman, 2015,p.304).At that time, the Command was responsible only for Egypt ,but on the outbreak of war the operational brief was clear: the Command would become responsible for units in Iraq (formerly Mesopotamia),Aden British Somaliland, the Sudan, Palestine, Transjordan and Malta (Terraine, 1985, p304). Additionally, as Terraine (Terraine1985) observed, this encapsulated any operations which might occur in East Africa (Ethiopia, Eritrea, and Kenya), Cyprus, Turkey, the Balkans, comprising Yugoslavia, Greece, Bulgaria and Romania and over the Mediterranean Sea, the Red Sea, and the Persian Gulf. The Royal Air Force Middle East potentially covered an area of circa 4 ½ million square miles (Chapman, 2015, pp. 304-305), for which it stationed just under 30 squadrons equipped with around 300 aircraft, most of which were obsolescent. The force in Egypt was primarily engaged in the duty of securing the Suez Canal which provided the trade route *via* the Red Sea to India and beyond, as well as protecting the main Royal Navy Mediterranean anchorage at Alexandria 60 miles from Cairo (Terraine, 1985,p 302).

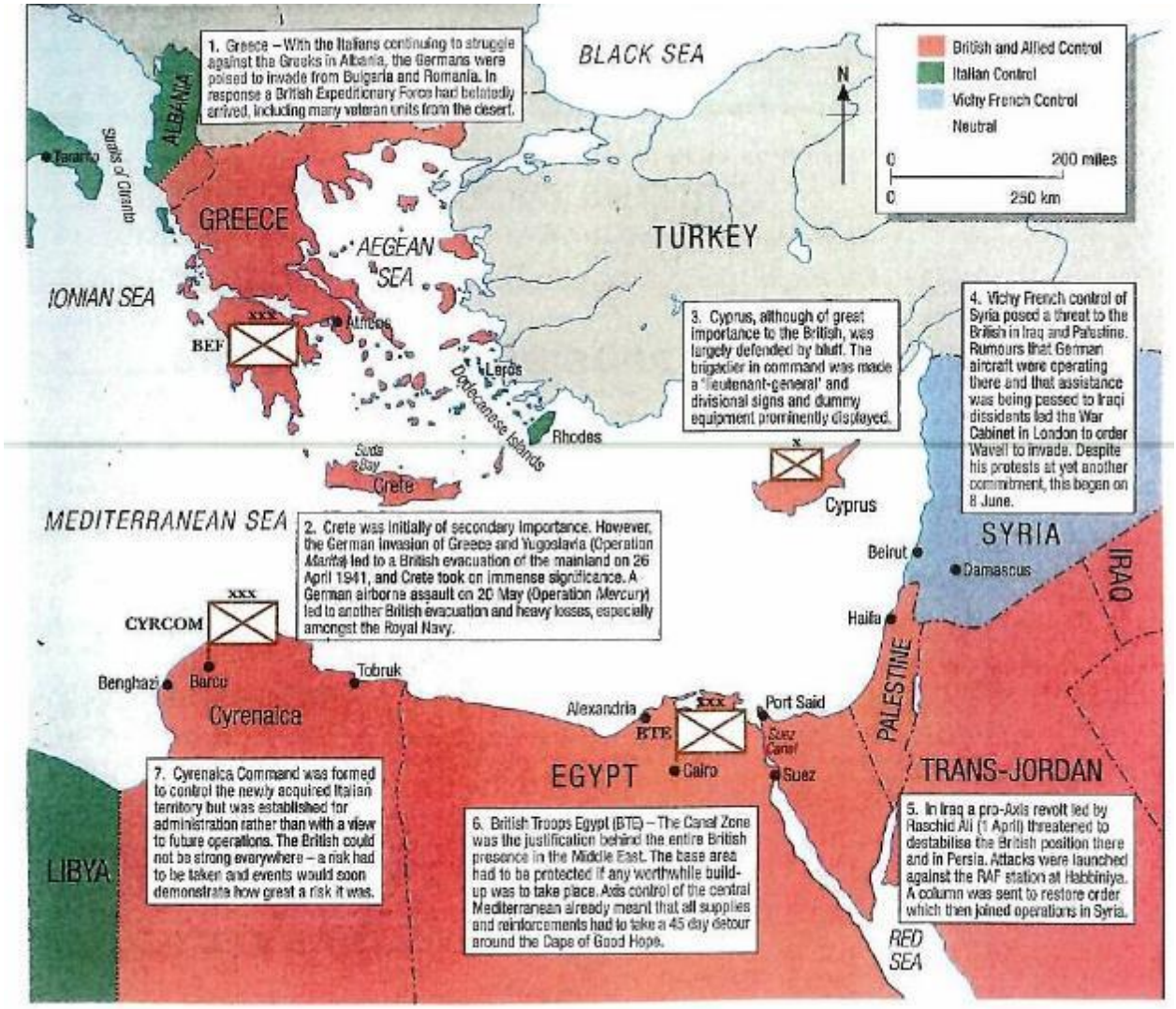
On coming to power in Italy, the Italian fascist dictator Benito Mussolini set about the re-creation of the aspiration of an Italian Empire stretching from Albania in the northern Aegean Sea to the Horn of Africa and Kenya in East Africa, encompassing the North African *littoral* of Libya and Egypt. In the process he resurrected the Roman Empire notion of the Mediterranean as the Italian *Mare Nostrum*– 'our sea' (Agbamu, 2019), using his armed forces to wrest control of the Mediterranean from the Royal Navy (Overy,1980, pp. 164-165). Mussolini hoped that by entering into an alliance with

Hitler's Germany he would benefit economically and militarily, at minimal cost to Italy from what he was convinced would be a final German victory (Overy,1980,p. 40).Mussolini, resentful at the international perception of Italy as the junior partner in the Berlin-Rome Axis alliance(the then Saudi Arabian King Ibn Saud referred to Mussolini as 'Miss O 'Looney') (Mangold, 2016),was impressed by, and jealous of Hitler's early military successes in Europe. Consequently, he was eager to share in the spoils of war whilst at the same time further his ambitions of a Mediterranean empire. Mussolini's ambitions emboldened him to declare war on Britain on the 10th June 1940. Overy (1980, p. 40; 164-165), suggests that he was convinced that Britain's military reverses in the *debacle* of the Norwegian campaign of Spring 1940, followed by the evacuation of the British Expeditionary Force (BEF) from Dunkirk in May 1940 would cause Britain to lose the war quickly; ensuring that military success in North Africa would easily be accomplished. Although the Italian Air Force in Libya was numerically superior to the RAF in Egypt, the majority of their aircraft were obsolete in terms of both design and performance compared to those of the RAF and were no match for their future opponents (Overy 1980,p.41) By the time Italy declared war on Britain with the Italian Army and Air Force already in Libya, there were 15 RAF airfields with associated command structure and infrastructure in Egypt which had become experienced over the previous 20 years of Imperial policing operating on minimal resources and mostly in desert or similar conditions (Bowyer, 1988, p. 101). This organisation would form the basis of the Desert Air Force. Map 1.1 below gives the general orientation of the Western Desert in Mediterranean North Africa.



Map 1.1: The Western Desert
Reproduced by kind permission of Stephen Bungay (2002)

The question then arose of how best to configure the RAF to counter the various threats to the British strategic position in the Mediterranean. The genesis of the Desert Air Force can be found in the organisational changes made by the RAF in response to the gloomy strategic position the British found themselves in May 1941 in the Middle East. (See map 1.2 below).



Map 1.2: The British position in The Mediterranean, March 1941.
Source: Latimer (2001)

The organisational changes were designed to bolster the RAF's front-line operational capability by creating a new tactical organisation known as Air Headquarters Western Desert. This headquarters force was made up of mobile wings and was the foundation for what later emerged as the Desert Air Force. The operation of the Desert Air Force was underpinned by agreements between the RAF and the 8th Army on the future use of air power and the overriding need for air superiority in support of the Army in the Western Desert (Armitage, 1995). The RAF Middle East was geographically spread over the vast North African and Middle East theatres of war and consisted of semi-independent operational groups. In terms of size, it ranged from a single squadron

supporting operations in Aden, to the Desert Air Force that had upwards of 35 squadrons. The organisational chart of RAF Middle East is shown at figure 1.1 below.

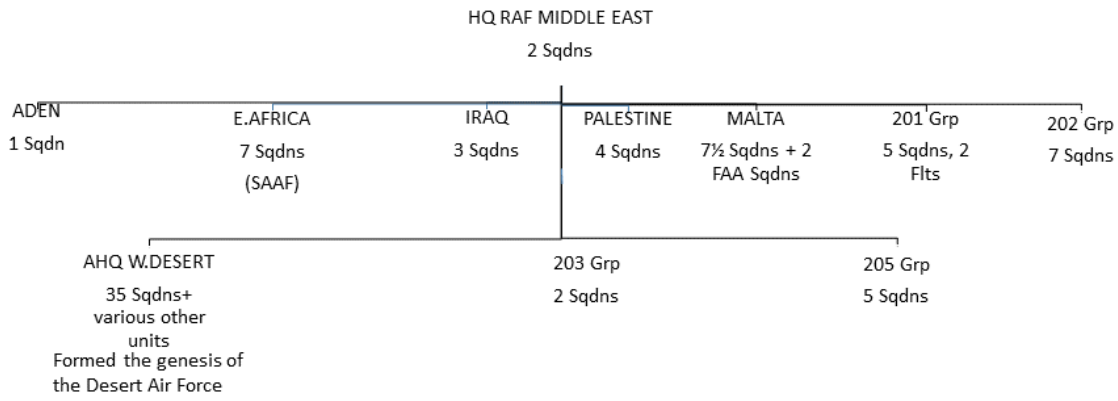


Figure 1.1: Organisational chart RAF Middle East – May 1941.
Source: Bowyer (1984)

Whilst there is much written on the role of the Desert Air Force, the literature review in chapter 2 and discussion in chapter 4 will demonstrate that extraordinarily little is said about the ground crew making up the organisation and more importantly, how they operated and delivered combat capability while geographically and organisationally isolated in the harsh desert environment. How those isolated teams gelled together and performed, arguably played a significant role in the outcome of the Western Desert campaign and the final victory of the Allies over the combined German and Italian forces in the North African campaign. The Desert Air Force came to play a pivotal role in the Western Desert campaign in its own right, as well as supporting the British Army, and to a lesser extent the Royal Navy. The situation that the Desert Air Force found itself was one of operating in what was an extreme desert combat environment at the end of a long logistical chain from Britain. Largely devoid of fixed installations capable of receiving, storing, and despatching supplies needed to conduct the campaign, the Desert Air Force was forced to be innovative in its approach to logistical and operational combat matters.

The campaign required quick thinking on the part of British Desert campaign leaders whilst ensuring that there was sufficient cohesion both at team and individual level to prosecute the campaign. The literature review in chapter 2 will introduce Adair's Action Centred Leadership model as the most appropriate tool to better understand the

context of the Desert Air Force; and how the RAF scheme of engineering trades made the distinction between the tasks and skills required for the various trades; and what was expected of them in their respective roles within a team.

In order to examine and discuss the nature of team dynamics it is important to determine what the respective duties of fitter and rigger were and how they related to each other in the context of an individual aircraft. The duties and responsibilities of fitter and rigger were laid down in Kings Regulations 1938 edition, modified in the 1940 edition. The regulations first published in 1931 are described either as Queens Regulations or Kings Regulations depending on whether a Queen or King is Monarch at the time. They are a collection of orders and regulations in force in the Royal Navy, British Army, Royal Air Force and Commonwealth forces. They form guidance for officers of those armed forces in all matters of discipline and personnel conduct (Air Ministry, 1938b; Air Ministry,1938a). The regulations consist of two parts: Part I: Describes the conditions, circumstances and disciplinary measures relating to the performance that affect the promotion and mustering of fitters and riggers. Part II*:* Describes in detail the differences between the various grades of fitter and rigger along with the knowledge and competencies required to fulfil each trade, and in the case of fitter the various grades.

The regulations also laid down the examination pass marks needed to satisfy the various trade tests and laid out what was required in each of the tests by way of written examination, a manual test including bench fitting, which examined the basic principles of the trade-in question. Lastly, a practical test usually carried out on an aero engine on which the aspiring tradesman was being examined (Air Ministry, 1938a). The regulations clarified the distinction between fitter and rigger in terms of duties, skills, responsibilities and disciplinary matters but were silent on the respective reporting lines and other organisational matters (James,1991, pp.185-189). To help understand their respective places in the squadron organisation, a typical squadron organisational chart is shown at figure 1.2 below. the boxes outlined in red on the organisation chart show the respective fitter and rigger places in the organisation.

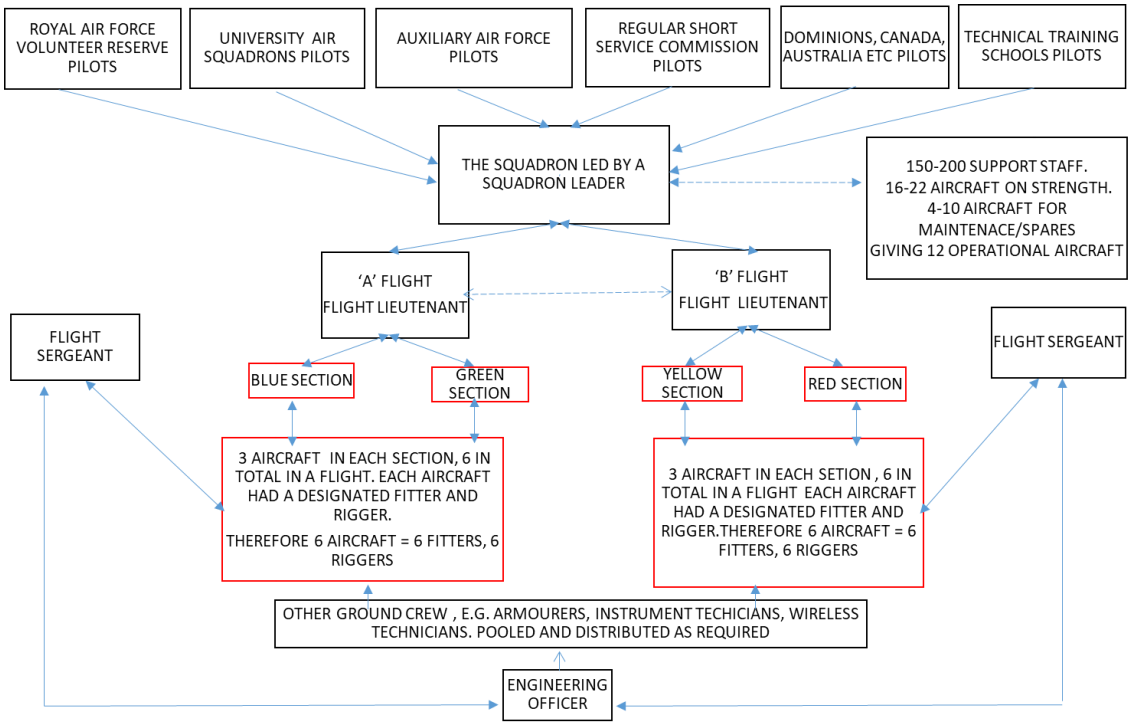


Figure 1.2: Organisation of a typical Fighter Command squadron.

Source: Author's construction

Both fitters and riggers were trained to a level at which they were able to interpret, understand and work to technical drawings and written technical information. Although existing as two separate trades the aircraft would only function effectively if the two trades co-operated together, each having a degree of working knowledge of the other's trade (see figure 1.3 below for typical fitters work and figure 1.4 below, for typical riggers work).

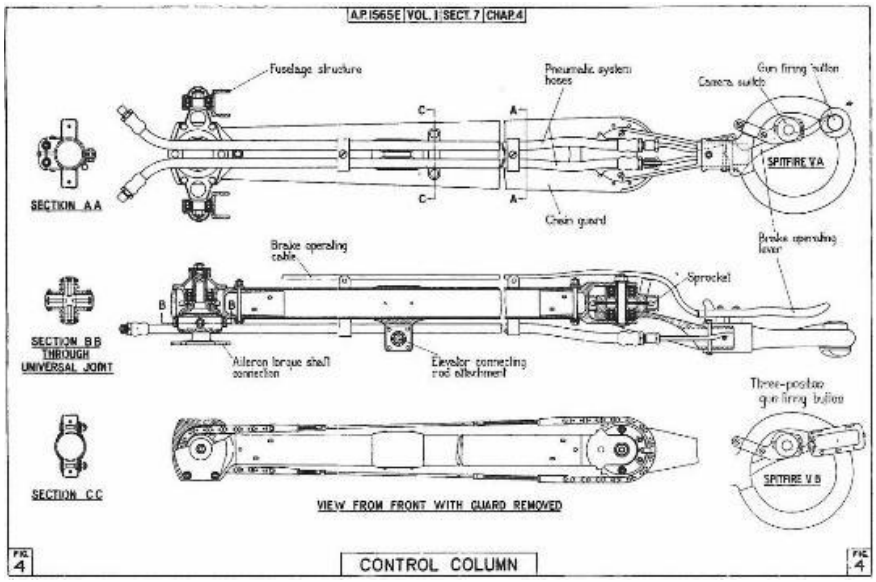


Figure 1.3: Typical example of fitter's assembly work.
Source: HM Stationery Office (1941)

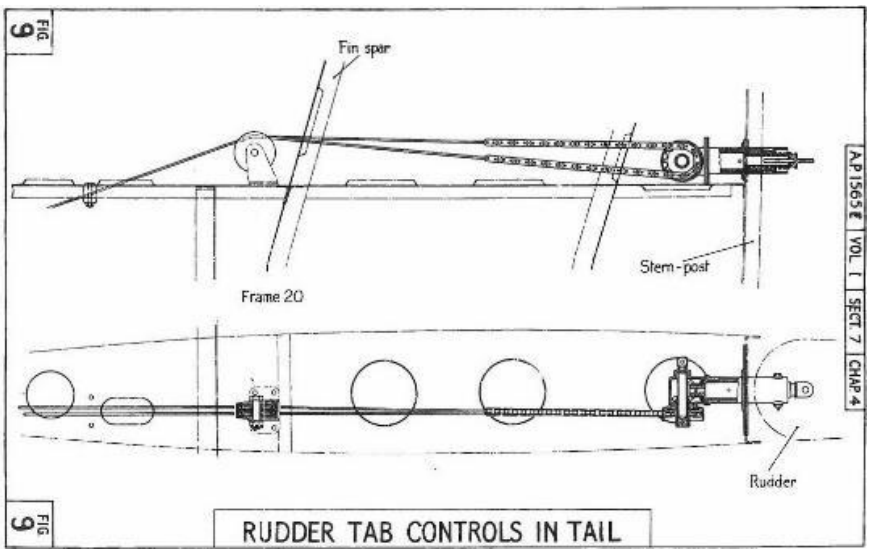
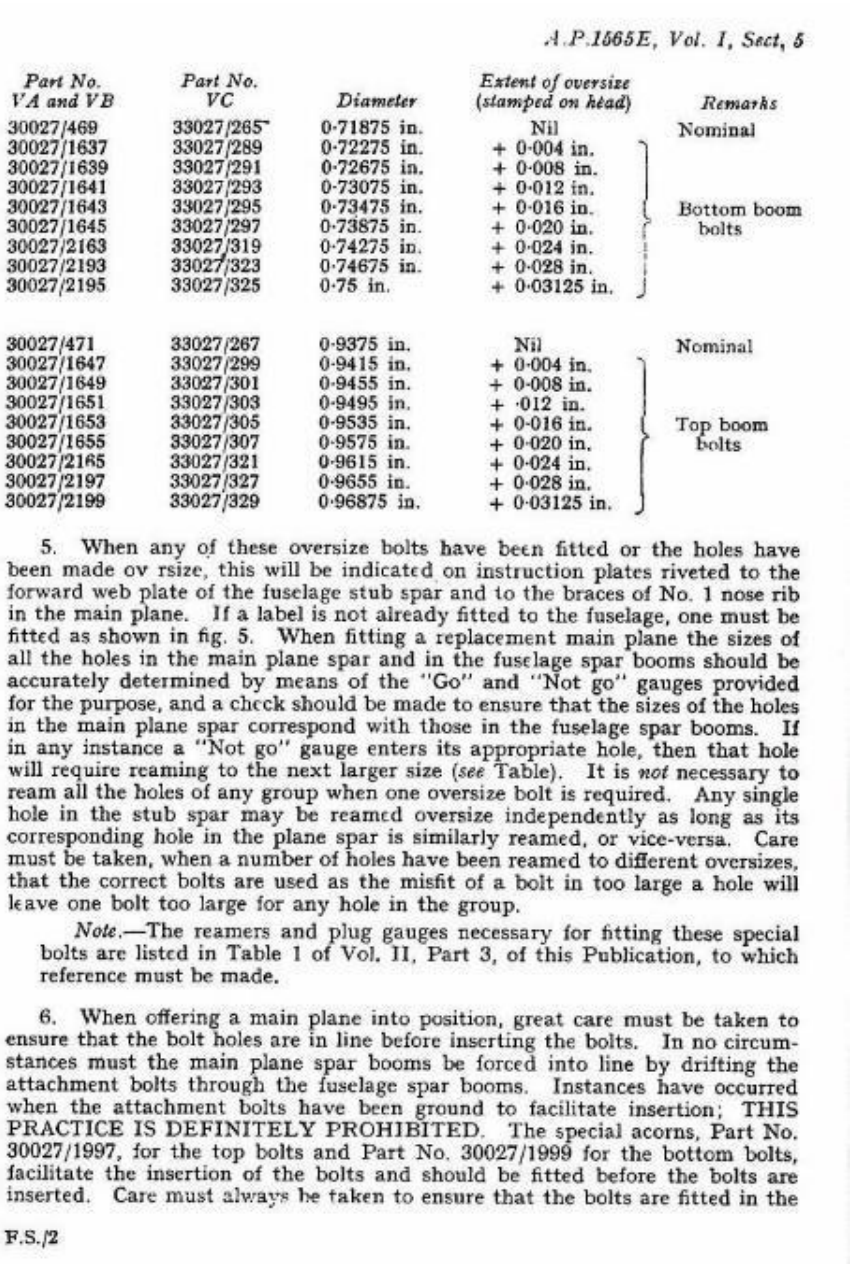


Figure 1.4: Typical example of riggers assembly work.
Source: HM Stationery Office (1941)

The two examples illustrated above were selected to demonstrate the point that the control column shown in figure 1.3 above was directly connected by a system of cables to the tail rudder and trim tab shown in figure 1.4 above. The trim tab gave fine adjustment to the equilibrium of the aircraft in flight. The ability of the rigger to customise the controls and other operating systems and the subsequent behaviour of the aircraft to optimise the pilot's feel for the aircraft-see figures 1.6 and 1.7 below, was

part of the empathetic way of working that was an integral part of the smooth functioning of the team. In inspection and maintenance work figure 1.5 below gives a typical example of the written instructions that fitters were expected to read and interpret and work to, and riggers to have knowledge of in the absence of a fitter.



A.P.1565E, Vol. I, Sect, 5

Part No. VA and VB	*Part No. VC*	*Diameter*	*Extent of oversize (stamped on head)*	*Remarks*
30027/469	33027/265	0·71875 in.	Nil	Nominal
30027/1637	33027/289	0·72275 in.	+ 0·004 in.	
30027/1639	33027/291	0·72675 in.	+ 0·008 in.	
30027/1641	33027/293	0·73075 in.	+ 0·012 in.	
30027/1643	33027/295	0·73475 in.	+ 0·016 in.	Bottom boom bolts
30027/1645	33027/297	0·73875 in.	+ 0·020 in.	
30027/2163	33027/319	0·74275 in.	+ 0·024 in.	
30027/2193	33027/323	0·74675 in.	+ 0·028 in.	
30027/2195	33027/325	0·75 in.	+ 0·03125 in.	
30027/471	33027/267	0·9375 in.	Nil	Nominal
30027/1647	33027/299	0·9415 in.	+ 0·004 in.	
30027/1649	33027/301	0·9455 in.	+ 0·008 in.	
30027/1651	33027/303	0·9495 in.	+ ·012 in.	
30027/1653	33027/305	0·9535 in.	+ 0·016 in.	Top boom bolts
30027/1655	33027/307	0·9575 in.	+ 0·020 in.	
30027/2165	33027/321	0·9615 in.	+ 0·024 in.	
30027/2197	33027/327	0·9655 in.	+ 0·028 in.	
30027/2199	33027/329	0·96875 in.	+ 0·03125 in.	

5. When any of these oversize bolts have been fitted or the holes have been made ov rsize, this will be indicated on instruction plates riveted to the forward web plate of the fuselage stub spar and to the braces of No. 1 nose rib in the main plane. If a label is not already fitted to the fuselage, one must be fitted as shown in fig. 5. When fitting a replacement main plane the sizes of all the holes in the main plane spar and in the fuselage spar booms should be accurately determined by means of the "Go" and "Not go" gauges provided for the purpose, and a check should be made to ensure that the sizes of the holes in the main plane spar correspond with those in the fuselage spar booms. If in any instance a "Not go" gauge enters its appropriate hole, then that hole will require reaming to the next larger size (*see* Table). It is *not* necessary to ream all the holes of any group when one oversize bolt is required. Any single hole in the stub spar may be reamed oversize independently as long as its corresponding hole in the plane spar is similarly reamed, or vice-versa. Care must be taken, when a number of holes have been reamed to different oversizes, that the correct bolts are used as the misfit of a bolt in too large a hole will leave one bolt too large for any hole in the group.

Note.—The reamers and plug gauges necessary for fitting these special bolts are listed in Table 1 of Vol. II, Part 3, of this Publication, to which reference must be made.

6. When offering a main plane into position, great care must be taken to ensure that the bolt holes are in line before inserting the bolts. In no circumstances must the main plane spar booms be forced into line by drifting the attachment bolts through the fuselage spar booms. Instances have occurred when the attachment bolts have been ground to facilitate insertion; THIS PRACTICE IS DEFINITELY PROHIBITED. The special acorns, Part No. 30027/1997, for the top bolts and Part No. 30027/1999 for the bottom bolts, facilitate the insertion of the bolts and should be fitted before the bolts are inserted. Care must always be taken to ensure that the bolts are fitted in the

F.S./2

Figure 1.5: Text on engineering practice.

Source: HM Stationery Office (1941)

The familiarity with each other's role and the potential synergies would indicate that it would be useful to examine Belbin's ideas(1993)on identifying team roles (C.M.I.2011).

The Pilot, Fitter and Rigger needed to work collaboratively and empathetically in extremely difficult circumstances to ensure that an aircraft was presented for combat in a timely and efficient manner. In this context it would seem reasonable to examine the work of Thorndike (1920), Vernon (1933), and Gardner (2011); on multiple intelligences (Management Mania,2016). Their work along with Goleman's theory of Emotional Intelligence (1996) reflect the skills set required of the fitter and rigger on how they were able to 'read' each other's character and abilities .The fast moving mobile combat situation required the team to think intuitively and respond to emerging unpredictable, often life threatening, situations without necessarily referring requests for decisions up the chain of command for affirmation. To enable the reader to gain a better understanding of the nature of the work of a typical fitter and rigger and how they worked together, the author has included an official RAF wartime information film clip giving a brief introduction to the daily inspection of a Spitfire. The film clip can be viewed at figure 1.6. below.

Figure 1.6: Film clip RAF Wartime Information film- Introduction.
Source: https://www.youtube.com/watch?v=b4BXTfDLqRE Accessed 4/8/21

1.2 Ground crew in the context of the Desert Air Force

Having looked at the tasks a ground crew were expected to carry out, the first issue to be addressed is the organisational development of the ground crew most directly concerned with the operational availability of individual aircraft at Desert Air Force front line squadron level. The second issue relates to what exactly the Desert Air Force was doing in the Western Desert and how it sat in the organisational context of the Royal Air Force in the Middle East. There is a considerable body of work referred to in chapter 2 regarding the Western Desert campaign exploits of aircrew; whilst there is little

corresponding body of work on the ground crew. Indeed, such is the volume of work relating to air operations and aircrew and the lack of information pertaining to the ground crew that the uninformed reader might be forgiven for thinking that the air campaign was won solely by the actions of aircrew. This forces the interested but uninformed reader down the path of a few peripheral references made as an aside in works primarily devoted to operations and/or aircrew (Wellum,2002). Consequently, it was a challenge to gather information relating to the activities and contribution made by ground crew to that campaign. This is not to deny the skill and devotion to duty of the aircrew, but it must be remembered that aircraft were made present and ready through the endeavours of ground crew in exceedingly difficult circumstances(Wynne, 1993).This thesis will explore the nature of the pilot-fitter-rigger team dynamic that existed at the micro-level of an individual aircraft, a team dynamic referred to as the 'Golden Trinity' (Bowyer, 1988), as shown in figure 1.7 below.

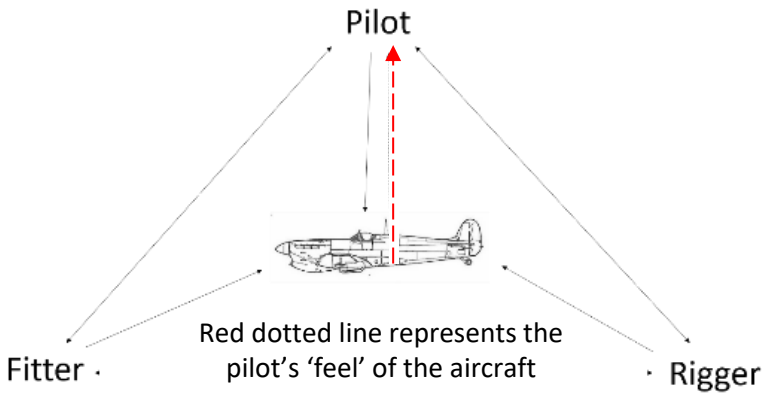


Figure 1.7: The 'Golden Trinity' team dynamic.

Source: Author's adaptation from Bowyer (1988*)*.

In the above figure the twin headed arrows are indicative only of the existence of an interpersonal dynamic, and in the case of the single headed arrow from pilot, fitter, and rigger, a physical task input to the aircraft. It is not representative of the quality, frequency, or any other feature of the dynamic, only that it exists. The film clip that follows provides an example of the flying characteristics of a Spitfire, including Wellum's (Wellum 2002) and other pilots' descriptions of the aircraft, the film clip can be viewed at figure 1.8 below.

Figure 1.8: Film clip Spitfire

Source: Elliptical Wing (2018) (https://www.youtube.com/watch?v=Ouam_l2u9KE)

Accessed 4/8/21

This thesis is an investigation to identify elements of ground crew activity in this particular team dynamic, that could be used as a basis for advancing current scholarship on small team dynamics, particularly the less debated context of combat conditions in a difficult and challenging operational environment. The survey of the literature that will be presented in chapter 2 suggests that scholars have hitherto not drawn these connections. The possible relationships and synergies that might arise will be discussed, compared, and contrasted, to test the *null* hypothesis - that neither Britishness nor the peculiar and particular western desert environment played a significant role in creating the pilot-fitter-rigger team into an effective and resilient entity. The *null* hypothesis will be presented later on in Chapter 3 Methodology, will be fully discussed in chapter 4 Discussion, and conclusions presented in Chapter 5 Conclusions.

1.3 Research Question

The central question answered by this research is *how did the pilot-fitter-rigger team in the Desert Air Force during the Second World War form a small, resilient, and effective team?* Implicit in the question are two aspects, firstly, *did the pilot-fitter-rigger form a*

small, effective, and resilient team? and secondly, if so, what factors explain that dynamic?

The Pilot-Fitter–Rigger team constituted a small effective and resilient team arising out of the nature of the then British Society and the peculiar and particular challenges of the harsh environment in the Western Desert.

In order to answer these questions, the hypothesis for this research is:

The pilot-fitter-rigger in the Desert Air Force during the Second World War constituted a small resilient, and effective team.

While examining teams, the aspects of good leadership and management, context, organisational culture (Katzenbach, & Smith,2015), or 'Britishness' need to be considered, as that latter would translate into the multi-class society that defined Britain at the time. Considering the managerial and leadership aspects of team building as a common factor, the unique elements in this research problem can then be manipulated to describe the *null* Hypothesis that:

Neither Britishness nor the peculiar and particular desert environment played a significant role in creating the pilot- fitter- rigger small team into a resilient and effective entity.

There are definitional aspects that also need to be clarified. Some guidance on what may constitute 'small' is defined by both Graicunas (1937) and Urwick (1957). They cite General Sir Ian Hamilton, who in 1922, wrote the following:

> The nearer we approach the supreme head of the whole organisation, the more we ought to work towards groups of three, the closer we get to the foot of the whole organisation, the more we work towards groups of six.

It would therefore seem reasonable to conclude at this stage that 'small 'in the context of team size falls somewhere between three and six members. Hamilton's experiential, and gut-feel concept of a team, is echoed by Katzenbach and Smith (1993, p.45), who define a team as 'a small group of people with complementary skills who are committed to a common purpose, performance goals and approach for which they are mutually accountable'. Adair (1987, pp.172-173) describes a team as:

> A group in which individuals have a common aim and in which the jobs and skills of each member fit in with those of others, as to take a very mechanical and static analogy- in a jigsaw puzzle, pieces fit together without distortion and together produce some overall pattern.

Moving to the concept of 'resilient' teams Alliger *et al* (2015, p182) define them 'as having the capacity to withstand, overcome, and bounce back from challenges, and do so in a manner that enables sustained performance and ongoing viability Alliger's definition is remarkably similar to the Concise Oxford English Dictionary12thed (1224), which defines resilience as 'of a person or animal able to withstand or recover quickly from difficult conditions. Resistant to setbacks or adversity or hardship.' Given the convergence of the two definitions and their similarity, it would seem reasonable to use Alliger's explanation for the purposes of this thesis. 'Effective' is defined by Adair (1987, p. 172) as 'a team that achieves its aim in the most efficient way and is then ready to take on more challenging tasks if so required'.

By critically examining peacetime theories of organisational development, it will be possible to question whether functional and other leadership theories apply wholly, in part, or indeed at all (thus, falling short) in wartime combat conditions. From the critical examination, conclusions can be drawn as to what lessons can be learned, and what knowledge can be added to organisational development to fill the apparent *lacunae***.** The objective of the research is to present a comprehensive examination of the reasons that explain the extraordinary resilience and effectiveness of the pilot-fitter-rigger team in the Desert Air Force with a view to advancing contemporary leadership and other functional theories on small team interpersonal dynamics. The examination will follow the cycle shown in figure 1.9 below. For the author, the cycle mimics or at least parallels

the critical examination process; the process goes under the mnemonic '**SREDIM'** (Mulej *et al*.2017)**:**

Select the problem, in this instance, the research design.

Record all the data relating to the problem.

Examine the problem.

Determine the solution. **I**nstall the solution, lastly but most importantly,

Maintain the solution.

All the **'SREDIM'** stages ask the element of circumstance questions; Who? What? Why? Where? and, When? The one problematic aspect of the cycle shown in figure 1.9 below is that it does not show the start point of the cycle, neither does it show the point at which the cycle concludes as it must do in any critical examination process. Therefore, for the purposes of this thesis, the author will take the start point as the What? problem selection element, and working clockwise conclude at the Where does it apply? Generalisation element. However, figure 1.9 provides a helpful framework to link process and content towards outlining a research design (Zaidi, 2018; Bryman, 2016).

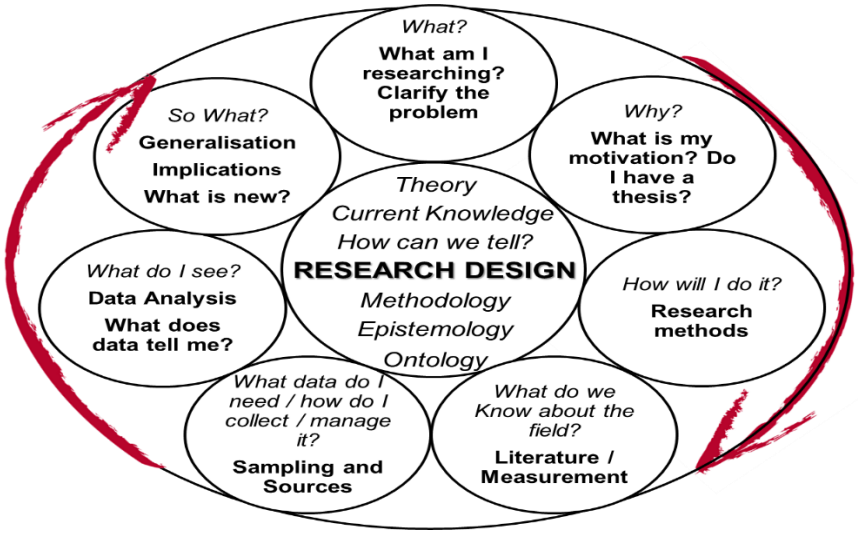


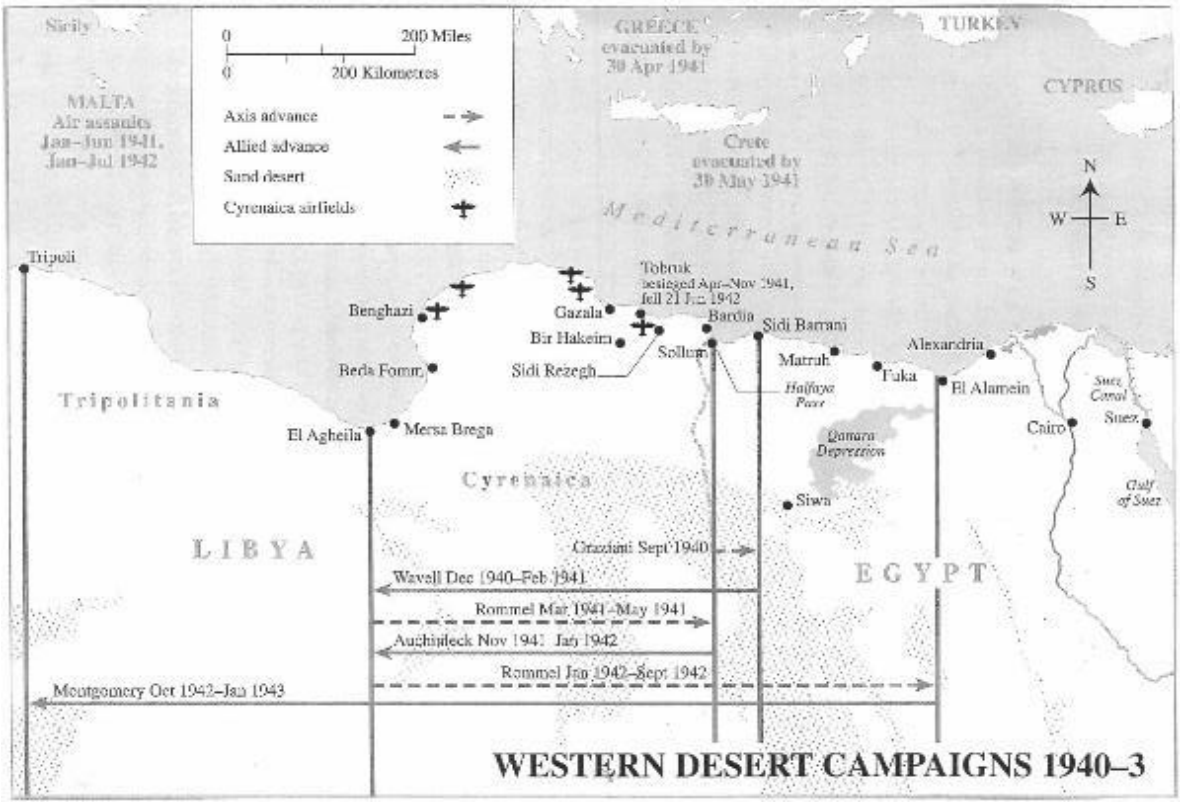
Figure 1.9: Social Science Research Cycle.

Source: Zaidi (2018)

To achieve this aim, it is essential to consider the bigger picture, as alluded to in figure 1.9. In the context of the Desert Air Force, the picture consists of the structure,

organisation, and operational purpose of the Desert Air Force, including an objective examination of how the Desert Air Force organised and operated its squadrons. The logistical, geopolitical, and environmental factors that influenced the working of the Desert Air Force also need to be considered as these directly affected the structure and internal working of the squadrons, moving towards the main focus on the relationships within the 'golden trinity' (see figure 1.7 above), as explained through current academic discourse on leadership and management. This brings us to the final objective of the roles of the two ground-crew, the fitter, and the rigger, who were the two most intricately connected to the servicing and maintenance of aircraft on the squadron. The author's initial inspection shows *prima facie* evidence that there may be linkages or synergies between elements of theories or, indeed, between or across theories in more than one instance. This would indicate that it would be useful to examine Belbin's work on identifying team roles (C.M.I., 2011). The pilot, fitter and rigger needed to work collaboratively and empathetically in extremely difficult circumstances. In this context it would seem reasonable to examine the work on multiple intelligences and team cohesion reflecting the skills set required of the fitter and rigger (Management Mania, 2016).

To enable the reader to understand the geographical scale of the campaign in which the team and other like teams worked, and to put distances into context, the two extremities of the campaign, Tripoli and *El Alamein* are approximately 1,400 miles (2,300 kilometres) apart by the one then existing coastal road. This is the equivalent of one extreme location (Tripoli) being London, the other extremity*(El Alamein)*being Gibraltar(*London to Gibraltar*,no date).(See map 1.3 below).



Map 1.3: Western Desert campaigns 1940-3

Source: Holmes (2001)

The fast- moving mobile combat situation played out over such a large area required a high degree of independent thought and action by front line RAF air and ground crew without constant input from a supervisor or manager of a higher rank. Taking all these factors into account, it would be profitable to relate to the question of delegation within the team and whether delegation was distributed between the fitter and the rigger (Chapman, 2015). The work of Bennis on leadership (Bennis, 1998), and Hersey and Blanchard's (2001) on situational leadership will be of relevance when investigating how the team reacted in changing situations. In common with the British Army and the Royal Navy, the RAF was a hierarchical organisation with (in theory) fixed reporting lines; these reporting relationships and their likely impact on team dynamics can be considered within Graicunas' (1933) Theory of Span of Control. All these theories and models will be considered in chapter 2, Literature Review, and discussed compared, contrasted and analysed in chapter 4, Discussion.

With this objective in mind the research question was derived on the basis of addressing the question '*how did the pilot-fitter-rigger team in the Desert Air Force during the Second World War form a small, resilient and effective team'?* The emphasis on the Western Desert campaign was chosen partly to test the effects of the Western Desert's peculiar and particular environment and geopolitics might have on ground crew in organisational development terms and partly out of family history research. As the Royal Air Force was a particularly British institution and, by extension, the ground crew were for the large part British, a useful adjunct to the research question would be:

***Null Hypothesis**: Neither Britishness nor the peculiar and particular desert environment played a significant role in creating the pilot-fitter-rigger small team into a resilient and effective entity.*

This dual approach of answering the research question, and testing of the *null* hypothesis, it was felt, gave a comprehensive academic insight into the organisational development aspects affecting the work of ground crew as there also appears to be a *lacuna* in that direction.

1.4 Methodology, Data Handling and Ethical Considerations

Organisations are a product of their time and circumstances (Thompson,2008). To properly consider the nature of the Royal Air Force of which the Desert Air Force was a part, it is necessary to consider the factors which influenced the creation and development of the force. This will be achieved through the objectives of the research outlined here. As these factors primarily concern organisational development in a geopolitical and historical setting, leading to a wartime combat situation, it is entirely appropriate to undertake qualitative research using primary and secondary sources relating to human endeavour, opinions, feelings, and values that suggest qualitative data. However, an element of quantitative data also needs to be considered particularly where questions of logistics, combat strength, and size of air fleets are concerned, quantitative data will also be useful where managerial and supervisory span of control

of subordinates can be quantified. While combining qualitative and quantitative data in a single project suggests a mixed methods approach using Qual-Quan research design (Creswell *et al.*2003); the quantitative component is small and synthetic in nature and therefore does not influence the qualitative data component beyond providing data. As such, this is essentially a qualitative research undertaking.

The research question – *How did the pilot- fitter- rigger team in the Desert Air Force during the Second World War form an effective and resilient team?* -examines an area of military history that has received scant attention. It involves investigation and interpretation of archival official reports and histories, along with personal diaries, ephemera and memoirs of the people most directly involved in the actions described. Where practicable, veterans were interviewed. Interviews were conducted on the basis of unstructured interviews based on open ended questions. Interviews with veterans are the one source that will not be replicable within the methodology as in all probability they will have passed away within the next five years or so. Even if they are alive at that point, it would be impracticable and quite possibly intrusive to conduct any sort of interview. At that point, the living oral history aspect of the thesis topic would be beyond reach. That is why the ability to record and gather living oral history is a principal component of the thesis methodology. The above reality also explains why the question of sample size is dictated by the simple fact that all the veterans were in extended old age (mostly in their early to mid-nineties) and even not all of those have the mental acuity or ability to be interviewed. This force of circumstances dictated an extremely small sample size (Bryman and Bell,2015). Good interview practice requires setting interviewees at ease in familiar surroundings, and the Cranfield University CURES ethical requirements was followed throughout the interview process. Interviewee(s)were be advised of the nature and purpose of the interview and their agreement sought as to their comments being attributed or acknowledged and included in the thesis (Bryman and Bell,2015; Williams,2003). Questions of ethics and confidentiality were respected and comments that are off the record are not included. All the official sources used in this thesis are records of historical fact are freely available in the public domain and there are no matters of national security, or relevant to the Official Secrets Act. The

findings were analysed to identify common themes, activities and behaviours which were tested against theoretical assertions, people's recollections, and opinions, with conclusions and observations drawn from the testing process (Bryman and Bell, 2015).

1.5 Academic Value and Key Contribution

This thesis will address *lacunae* in the history and development of air power as far as there has been extensive discussion and analysis of the actions of the Desert Air Force aircrew in combat in the Second World War, but no corresponding critical examination of the actions and effectiveness of Desert Air Force ground crew under the same conditions. The academic value and contribution are achieved by supplementing the existing knowledge on the military history of the Royal Air Force in terms of organisational development, through the application of peacetime leadership and functional organisational development theories to a combat situation. The application of the new knowledge relating to ground crew in combat situations will make an original contribution by building on previous work (both published and in private papers) by others; and by testing previously accepted theories and conducting empirical work not done before will demonstrate originality. This originality will enable the Author to create a new context with known material but with a new focus on the activities and organisational development of ground crew. The new focus will be of use in developing an understanding of small team dynamics to the academic community organisational development practitioners, military historians, and researchers, as well as the wider public domain for both educational and leisure research. Although, it would be impracticable to expect that all findings could transfer across to other settings, as some would be specific to that particular time. For example, could the Western Desert context apply equally well to examples such as the Suez Crisis 1956, the Aden Emergency 1963-1967, the Gulf War 1990-1999, the 4th Afghan War 2001-2021? All are desert combat situations albeit more modern, but with similar characteristics.

1.6 Chapter Summary

At the outset of chapter one, the author clarified that this thesis was not a 'what if' project based on speculation, but an examination of two but interrelated *lacunae* in the

development of the Royal Air Force in terms of both operations and organisational development. For clarity, working definitions of the terms 'British' and 'German' were included and elaborated to help guide the reader through the thesis. The approach of the thesis was based on the concept of Adair's Action Centred Leadership theory and was first introduced to the reader. The chapter then described the historical and geopolitical background to the British presence in Egypt and, by extension, how the Royal Air Force acting as an agent of the British Government, came to have a presence in Egypt and an influence on the geopolitics of the Middle East region. The thesis then took a retrospective look at the role of Trenchard in developing the RAF into an independent entity and its' *role* as an Imperial Policeman in the interwar years of 1919-1939. Particular emphasis was placed on the funding and cost-effectiveness of the RAF in that policing *role. C*hapter one also looked at events leading up to the Western Desert campaign, and this discussion was supplemented by maps 1.1, 1.2 and 1.3 illustrating the location of the Western Desert and the place of the Western Desert in the broader British strategic position in the Mediterranean and the Middle East. This exposition was further augmented by the organisational chart presented at figure 1.1 showing the structure of the RAF in the Middle East. At this point, the reader would have had a macro-appreciation of the geopolitics of the region, the British strategic position in the Middle East and the organisation of the RAF in the region. Moving on the micro aspects of the campaign the thesis then set out the duties and responsibilities of a fitter and rigger as laid down in Kings Regulations, along with an organisational chart showing the structure of a typical Fighter Command squadron along with diagrams at figures 1.3 and 1.4 showing typical examples of fitters and riggers work and an example of the engineering standards that there were trained to and expected to follow. Finally at the micro team level, figure 1.7 illustrated the 'Golden Trinity' dynamic, referred to by Bowyer (1988) and adapted in the thesis by the author to include the three interpersonal dynamics and their inputs to an aircraft under their care. Lastly the research question allied research cycle, methodology, data handling and ethical considerations were all discussed and their contribution in determining academic value and contribution to the sum of academic knowledge.

This chapter has set out the historical basis and operational analysis of the context in which the RAF came to be in the Middle East prior to Italy declaring war on Great Britain on the 10thJune 1940 which heralded the start of the Western Desert campaign. In chapter 2, the author reviews the literature and re-presents the key elements such as the research question, hypothesis, and *null* hypothesis along with a methodology. The author will also discuss discovering new knowledge on team dynamics in a desert combat environment, combined with existing organisational development knowledge will be centred on leadership and organisational development theories. This legitimises the need to engage in the literature review in the next chapter that will provide the evidence to support the claim to academic contribution, and at the same time delineate the boundaries of the analysis and discussion around the leadership and organisational theories relevant to this thesis in the context of the Desert Air Force in the Western Desert.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Chapter one presented a historical background to the presence of the RAF in the Mediterranean, North Africa, and the Middle East. Specifically, the start of the Western Desert campaign in June 1940.The Desert War was like no other theatre of war, the environmental conditions were harsh and unyielding, affecting all the combatants, be they British, German, or Italian. Having introduced the key elements such as the research question, objectives, hypotheses (including the *null*), and methodology; it is

now appropriate in Chapter 2 to review the historiography relevant to the socio-economic, geopolitical, and organisational development factors that shaped the RAF presence in the North African theatre and the Western Desert in particular. The Literature Review has two purposes, to provide a foundation for the author's research and precisely identify the *lacunae.*

Over the years preceding this thesis, the author read extensively on the Royal Air Force as part of his leisure and family history research; and through that reading became aware that there appeared to him as it did to English (1996) that there was a dearth of data relating to the human 'soft' side of the Second World War. There was a corresponding emphasis on the strategy, operations, and technology of the Second World War. This dearth was particularly noticeable with regard to the subject of ground crew who supported air crew in the delivery of combat operations. This omission is to the detriment of the historiography of the Second World War and presents a partial and incomplete picture and analysis of the combat situation at the time. The historiography researched for the compilation of this thesis yielded the fact that in over three hundred works referred to in this thesis, only one, *From the Ground Up*, by Adkin (1983) related specifically to the work of ground crew, the type of people they were, their characteristics, their training, their skills set and their contribution to the operations of the Royal Air Force. The reading of the historiography, raised in the mind of the author from a professional managerial perspective how did those ground crew, in the first instance the fitter and rigger, collaborate with their pilot as a team under extremely difficult circumstances to produce the results they did. The author is conversant with the work of leading organisational development thinkers and practitioners and concluded that the synergy of the two aspects, the operational and the organisational development might yield useful academic knowledge results. When the author was presented with the opportunity to undertake part time academic research leading to a Doctorate, he resolved to set out to examine the apparent *lacunae* in both the operational and organisational development of the Royal Air Force with regard to ground crew.

The aphorism that 'history is written by the victors' is usually attributed to the British war time Prime Minister Winston Churchill. The German Dictator Adolf Hitler also said, 'it's not the truth that matters but victory' (Lockwood, 2014). This potential distortion through hindsight is a warning to all those who seek to understand the past. Looking back the reader must always make a conscious effort to seek contrary or diverging accounts to rescue the largely forgotten, the defeated and the eclipsed (in this case, ground crew) from what the Marxist historian E.P. Thompson called 'the enormous condescension of posterity' (Thompson, 1963). However, it must be remembered that 'history is written by the victors' in this instance leads inevitably to a predominately white middle class British and American basis for the literature review. This thesis will set out to try to seek out those contrary or diverging accounts and set them out for discussion and analysis. Not only that, but the author is also minded that the thesis should measure up to the past, convince the present, and speak to posterity; and that the thesis in the manner of language is accessible to all those of whatever background, ability or education who wish to acquire knowledge for their benefit.

The literature review has two threads. The first is a review of the literature relevant to the organisational development of the RAF from its formation on 1st April 1918 up until the effective conclusion of the Western Desert campaign. This will set the historical geopolitical, and military context for the second thread. The second is a review of the literature relating to the geopolitical and environmental conditions, air operations and organisational developments that existed in the Desert Air Force in the Western Desert campaign. The official dates given for the Western Desert campaign are accepted as beginning on the 10th June 1940 until the German armed forces finally crossed the border from Libya into Tunisia on the 4th February 1943.The review gives an overview of what has been said, who the sources and key writers are, what questions are being asked, and what is the prevailing view of the campaign. The review also provides a critical assessment of the existing organisational development literature, outlining where the weaknesses and gaps are, contrasting the views of particular authors, and raising questions. As well as being a summary, the review also evaluates and shows relationships between dissimilar categories or between works in the same category so

that key themes and trends emerge, and forms chapter two of this thesis as a context setting chapter. On the question of dependability, all the written sources are freely available in the public domain and official sources providing a proven 'audit trail' where the provenance of data can be traced back to its source. All the site visits are replicable as the sites visited still exist. Both primary and secondary sources will be used in the research. Primary source material found in official historical documents, the National Archives Kew; personal diaries and papers held at the Royal Air Force Museum archives at Hendon, and Cranfield University Barrington and Kings Norton Libraries. The conclusions will be based on careful analysis of the findings gained through the primary and secondary sources; and will be presented in a balanced and rational way to explain, the complexities of the situation.

The literature review sets the context for this thesis by describing a fast-moving, fluid, mobile war in extreme desert environmental conditions which were equally harsh on all the protagonists. It highlights the development of airpower tactics by the RAF and the part that innovative operational solutions (some on the initiative of the ground crew) played in the conduct of air operations. The review has highlighted the importance of teamwork in air operations especially that of the RAF and the review also touches on the flawed tactics the Luftwaffe used which led to them neglecting teamwork through applying the German military doctrine of *Auftragstaktik* (Gunther,2012), with its emphasis on the individual, causing them to lose cohesion and underperform which ultimately cost them air superiority. The loss of superiority contributed in a large way to the Germans losing the Western Desert campaign, and ultimately the North African theatre.

Out of the 521 published works (300 plus cited in this thesis) from all *genres* and sources this author has consulted or reviewed in drafting this thesis, only two works representing 0.4 per cent of the works consulted, deal exclusively with the experiences and actions of RAF ground crew (Mawdsley,2003; Adkin,1983). Mawdsleys' work does not relate to Fighter Command and is written in the context of his experiences in Bomber Command. For all its promise, it is not a particularly informative read and yields little in the way that is useful to this thesis. Mawdsley makes it clear that he wanted to get things

off his chest, and it was written in such a way as it really only makes sense to somebody who had been on that particular base at that particular time or had knowledge of the people on the base and other bases like the one described. The work can be discounted as having little literary merit or informative content on ground crew. Adkin (1983) deals with the history of RAF ground crew from the emergence of aviation, up to the end of the Second World War. However, for all its descriptions and contribution to the history and development of the RAF, the book does not describe the duties and responsibilities of the various trades; somehow the reader is supposed to be able to determine or infer those aspects through the text. Not everybody reading the work would realise that the only way of finding out about the duties of the various trades would be to consult Kings' Regulations as did this author. The fact that the book does not include those details detracts from the claim to be a history of RAF ground crew, and in that respect the book is a partially incomplete record, but nevertheless still a good (and the only) source. So, discounting Mawdsleys' (2013) work, only one work, that of Adkins' (1983), deals in any way comprehensively with ground crew, this represents a nugatory total of 0.2 per cent of the works consulted by the author. The literature review shows that there has been extensive coverage through books, film and television of the actions and effectiveness of Fighter Command combat aircrew in the Second World War, but no comparable discussion of Fighter Command ground crew, particularly the pilot-fitter-rigger interpersonal dynamic under combat conditions. Therefore, it is important to address these *lacunae* as not to do so would in effect cause the record to be significantly shewed towards aircrew. This omission has brought about *lacunae* not only in the history and development of the RAF, but also the applicability or otherwise of functional theories related to organisational development and leadership in a combat environment.

2.2 Scope and Context

In determining a relevant theoretical framework for this thesis, the author selected what he considered to be the most practical and pragmatic theory that would best suit the purposes of this thesis, that of Adair's Action Centred Leadership theory. In so doing it would be first useful to consider Adair's biographical background and practical career which lead him to develop his model.

Adair is widely regarded as the UK's foremost authority on leadership and leadership development in organisations. He has written over forty books and more than a million managers have taken his Action Centred Leadership programmes. His work in formulating his model was informed by his time studying the academic work on leadership at the Universities of Ohio and Michigan in America, he was also a member of the British armed forces and lectured in military history and leadership training at the Royal Military Academy Sandhurst. He is also prominent in academia both in the UK and abroad and holds a number of posts at professorial and Emeritus fellowship level.

The theoretical framework based on Adair's Action Centred Leadership model shown in the Venn diagram in figure 2.1 below and referred to throughout this thesis determines the scope of the thesis through an examination of the three core management responsibilities identified by Adair.

- Achieving the task.
- Managing the team or group.
- Managing individuals.

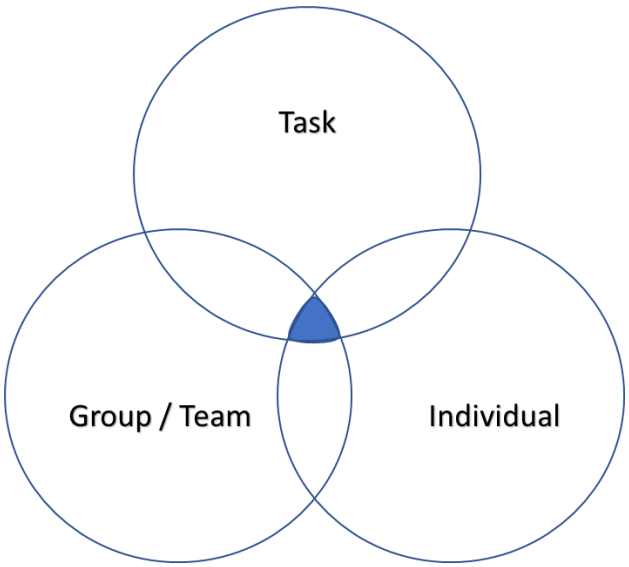


Figure 2.1: Adair's Action Centred Leadership Venn diagram

Source: *Effective Teambuilding- How to make a winning team*. Adair, Pan 1987.

The literature review has revealed three major themes best illustrated in a Venn diagram, see figure 2.2 below.

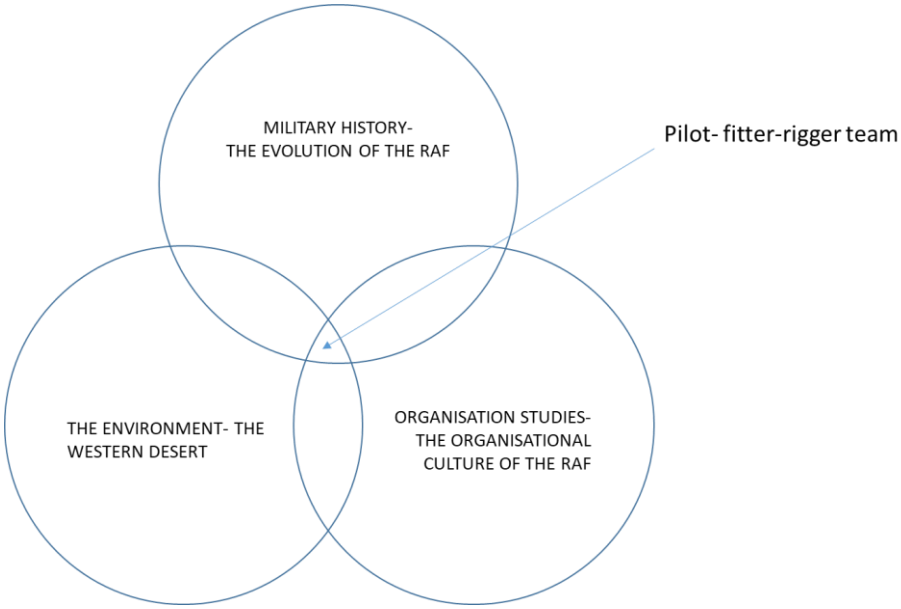


Figure 2.2: Major Themes - Venn diagram.

Source: Author's elaboration, adapted from Adair; *Effective teambuilding- How to make a winning team* (Adair, 1987).

For the reader to gain an understanding of how the three major themes relate to each other the author has used the same Venn diagram format as used by Adair. Then taking the two Venn diagrams at figures 2.1 and 2.2, the author has produced a further elaboration at figure 2.3 below illustrating the factors affecting the team.

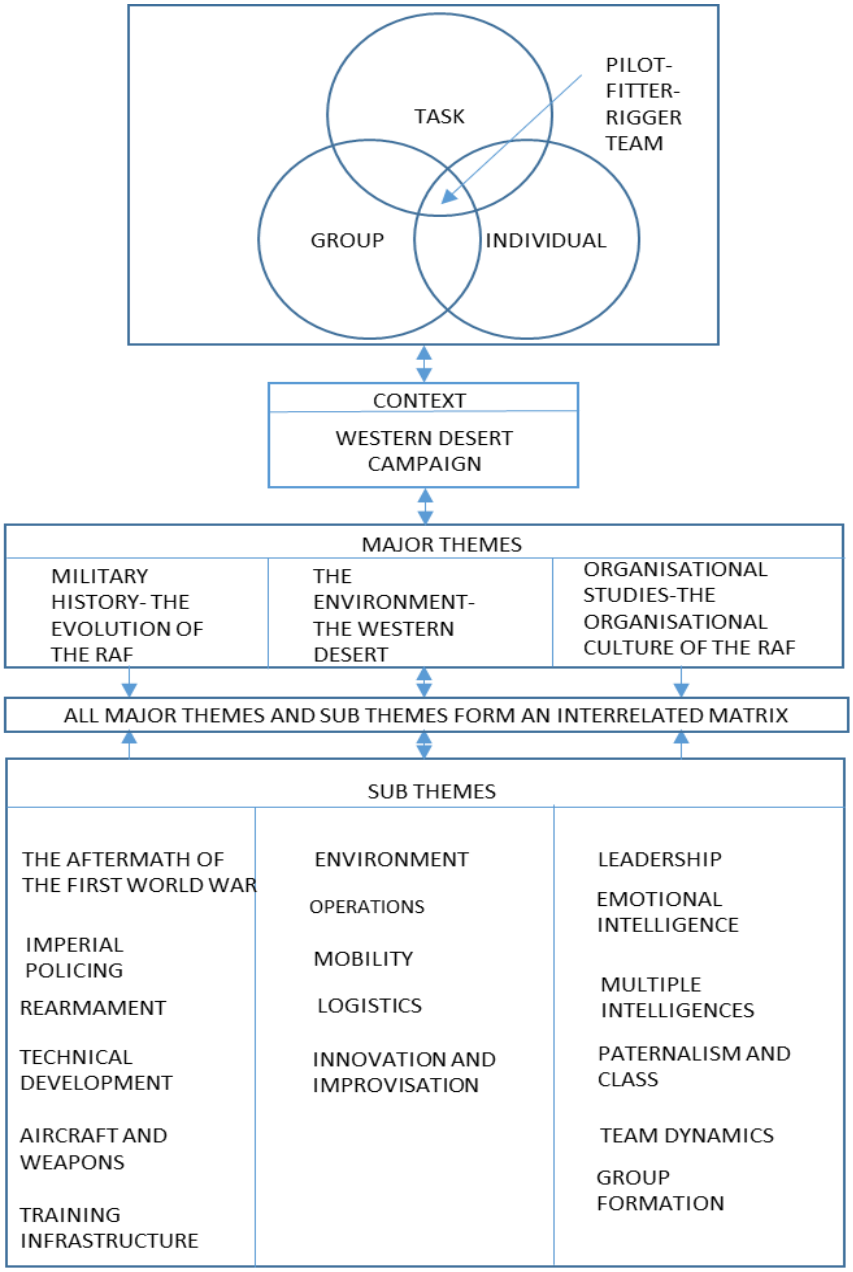


Figure 2.3: Expanded theoretical framework.

Source: Author's elaboration of Adair's Action Centred Leadership model (Adair, 1984; 2015)

There have been many critics of Adair's theories, the most significant being that his work remains exploratory and therefore lacks academic rigour. CMI (n.d.). Critics argue that he lacks 'real substance in that he is merely stating the obvious, common- sense view.' There is continued relevance of Adair, the fact that his work remains part of business schools and military institutions that pride themselves on leadership development, such

as the Royal Military Academy, Sandhurst. 'For many others' as CMI (2020) elaborates, 'it is exactly this practical simplicity and clarity about what a leader should do that is so valuable-and timeless.' While some leading textbooks on leadership such as Northouse (2019), Bass (2008) and Yukl (2021) ignore Adair's work altogether, Gill (2011) suggests that if one makes a more strategic interpretation, Adair's Action Centred Leadership model has immense utility in use.

Figure 2.3 places the team at the centre with all Adair's elements acting upon the team. Therefore, it can be seen through figure 2.3 that all three of Adair's elements act upon the team across all three themes and sub themes. For example, the 'task' element can be seen to be present in all three major themes as the 'task' was a product of the evolution of the RAF through changing technology, it was influenced by the organisational structure of the RAF with its various ranks and trades, and it was conducted in the Western Desert combat environment. Therefore, it is not simply a matter of overlaying, superimposing, or ascribing the 'task' element of Adair's Venn diagram to the 'Military History-the Evolution of the RAF' element; or the 'Group/Team' element to the 'The Environment-The Western Desert,' or indeed the 'individual' element to 'Organisational Studies-The Organisational Culture of the RAF.' The two Venn diagram representations form in effect a matrix which figure 2.3 below seeks to illustrate. Figure 2.3 shows that the RAF entered the Second World War in 1939 with 21 years military history and evolution behind it (27 years if the antecedent RFC is included). The Western Desert campaign was one of several contained within the Second World War. The desert environment was a major contributory factor affecting both the evolution of the RAF in terms of *inter alia* infrastructure and aircraft and weapons, and directly impacted on the pilot-fitter-rigger team dynamic. The team was also subject to the organisational development factors of which leadership, paternalism, and class, along with emotional intelligence are a selection identified through primary and secondary research by this author. See figure 2.4 below.

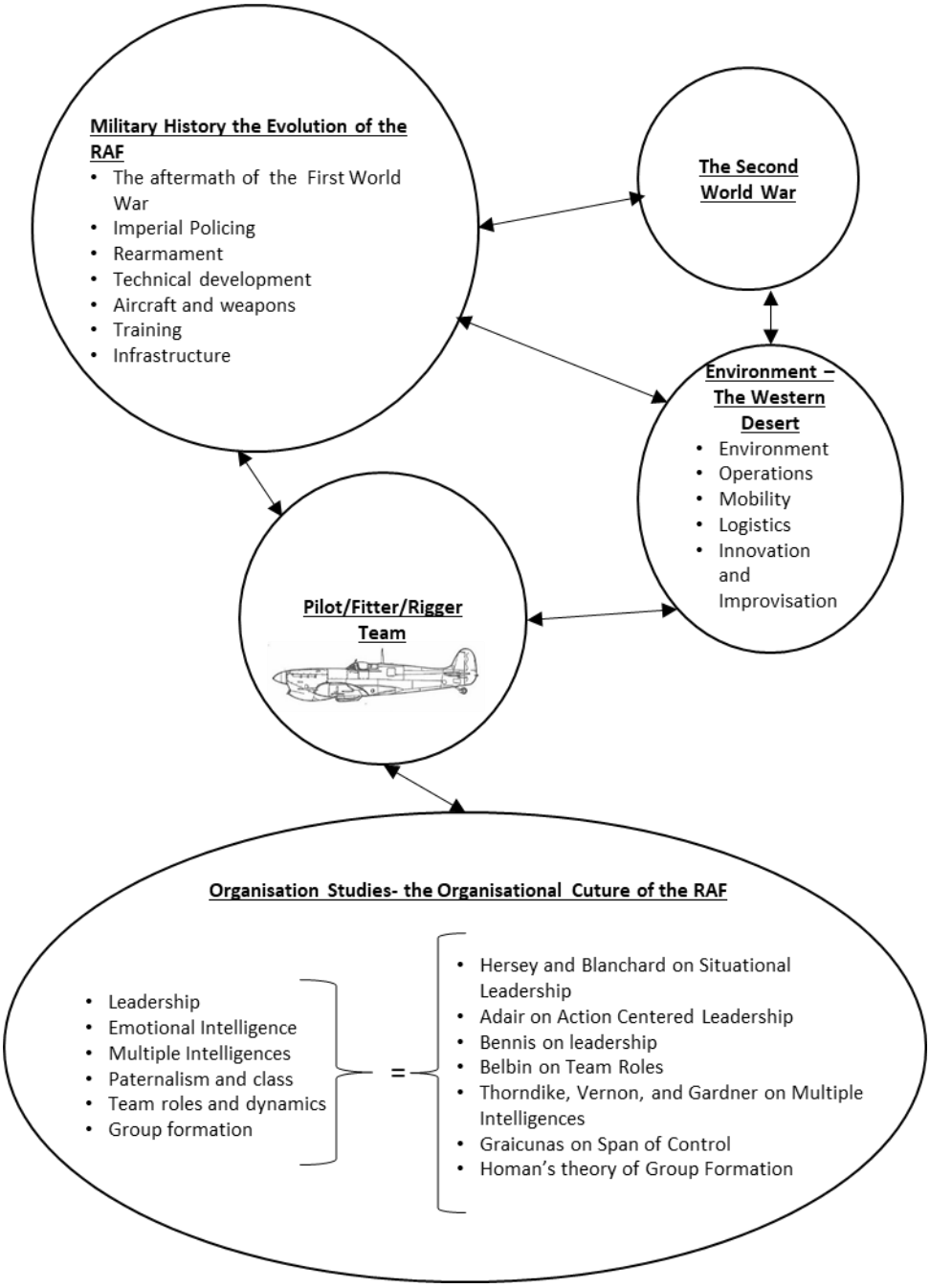


Figure 2.4: Factors Affecting the Team
Source: Author's elaboration

The first major theme is the evolution of the RAF from its formation on 1st April 1918 until the effective conclusion of the Western Desert campaign in February 1943.This will set the historical, socio-economic, geo-political and military context for the second theme on the Western Desert campaign, and the organisational development context for the third theme. The second major theme relates to the geo-political and environmental conditions, air operations, and organisational factors that were peculiar

to the RAF Desert Air Force in the Western Desert campaign. The third major theme is how commercial and academic works on organisational development might relate to the growth, development and operations of the RAF and the Desert Air Force. Therefore, it is reasonable to set the literature review within the context of the three themes described above. The literature review will provide a critical assessment of the existing historiography with regard to the research question, the hypothesis, and *null* hypothesis, and the objectives of the research. It will outline where the weaknesses and more significantly the gaps are, contrasting the views of particular authors, and raising questions, exploring key sources, and the prevailing view of the campaign. The literature review will also evaluate and show relationships between different genres of work, both on military history and organisational development or between works in those same *genres*; so that key themes and trends emerge. Where they do emerge the published material relevant to each theme or trend will be used to set the context for the methodology in Chapter Three. Where new evidence becomes known in the course of the literature review, the evidence will be analysed and, where appropriate, new knowledge claims will be made as part of the academic value and contribution.

Each of these three themes have sub-themes discussed in the literature review and will cover the historiography including the major factors that influenced the development of the RAF in the Mediterranean ,North Africa and the Middle East, and within that theatre, how the Desert Air Force performed in the Western Desert campaign of June 1940 to February 1943.Whilst it is relatively easy to locate and refer to work on organisational development, and the air component of the Western Desert campaign, work on the activities of the ground crew proved more challenging, being almost absent. This absence finds a resonance in English's work '*The cream of the crop'* (English, 1996) describing the human factor side of selection and recruitment of air crew into the Royal Canadian Air Force (RCAF).

Early in the book English writes,

> --- the human dimension of air warfare has been widely overlooked in military literature although personnel considerations have at least as much influence on the effectiveness of air forces as material and operational factors (p.3).

He also makes the following point,

> Although often overlooked in the historical literature because of the apparent dependence of air forces on technology, the optimal use of human assets is just as important in fighting an air war as it is fighting on land or at sea (p. 8).

Most studies in military history have had a 'preoccupation with weapons, tactics, technology and grand strategy, but have generally ignored the vast human dimension of battle' (English, 1996, p.6). English goes on to say 'For historians interested in the relations between science and society, 'periods of national upheaval, such as wartime, provide an excellent setting for analysis' (p.4). Locating sources for this thesis reflected the fact that the vast majority of secondary sources published on the North African theatre focus on the ground and naval actions. The emphasis on the ground campaign and the actions of the 8th Army in particular may be due to the enduring 'Monty' myth (Arnold 2015 ch6) of Montgomery as the all-conquering hero of Alamein, due in large part to Montgomery's genius for public relations, self-promotion, and self-aggrandisement. This is a myth that still lingers, some veterans revere him as a decisive leader whilst other observers regard him as a bombastic, arrogant, self- serving egotist (Arnold 2015, chs6,9 *passim)*

The war in the Mediterranean, North Africa and the Middle East was vital for the British (and later their Allies) to control, for to lose that would be to lose a significant source of oil vital to the British war effort (Bungay, 2002, pp. 11-12; Ehlers, 2015, p. xi). Moreover, it would potentially have opened the way for the Axis forces to directly threaten India, the Jewel in the Crown (Holmes, 2005, p. xxi) of the British Empire at that time. However,

as the literature review will demonstrate, the situation was far more complex than the outcome of one land battle, however successful, and depended in large part on the extraordinary level of interdependence between the services, making it in effect a combined all arms conflict. The complex situation in the Western Desert with its series of engagements in what were in effect highly mobile battles (Operation Compass and Operation Brevity being two examples) amply demonstrates the point made by Thompson (1967) that organisations are open systems, open to all aspects of the environment in which they exist and consequently are a product of their time and circumstances (Thompson, 2008, pp. xix-xx). Clausewitz, in his seminal work v*om Krieg* (*On War*) (1915) writes that 'the nature of armies is determined by the nature of the civilisation in which they exist' [thesis author's emphasis added],see also Michael Howard and Peter Paret's interpretation (Clausewitz, 1979, pp. 279-282; Zaidi and Watters, 2021). Also, Clark (2017, p.5) cites the historian Sir Michael Howard to the same effect. These environmental aspects and their effects on the Desert Air Force will be examined and discussed later in the literature review. The RAF had a particular approach to team- work based around the squadron that had developed over the years since the inception of the RFC in 1912and the successor RAF in 1918 (Renwick,2012, pp.19-53). Grounded partly in the history and development of the RAF (35, p.2.) and partly in the society that it existed within. Teamwork is affected by the actions of the individuals within it (Sheffield,1999; C.M.I.,2015; Belbin,1993); whether the actions be positive or negative, making the team effective or ineffective.

2.3 The Historiography Considered

The historiography will be considered across the three major themes identified through the literature review, and as the thesis is concerned with organisational development, the prime focus of the review will be on men and *materiel*. The historiography available comes from six sources within three broadly defined *genres* identified by the Author and distributed across the commercial and academic sectors. The structure described here is represented in the historiography tree shown at figure 2.5 below.

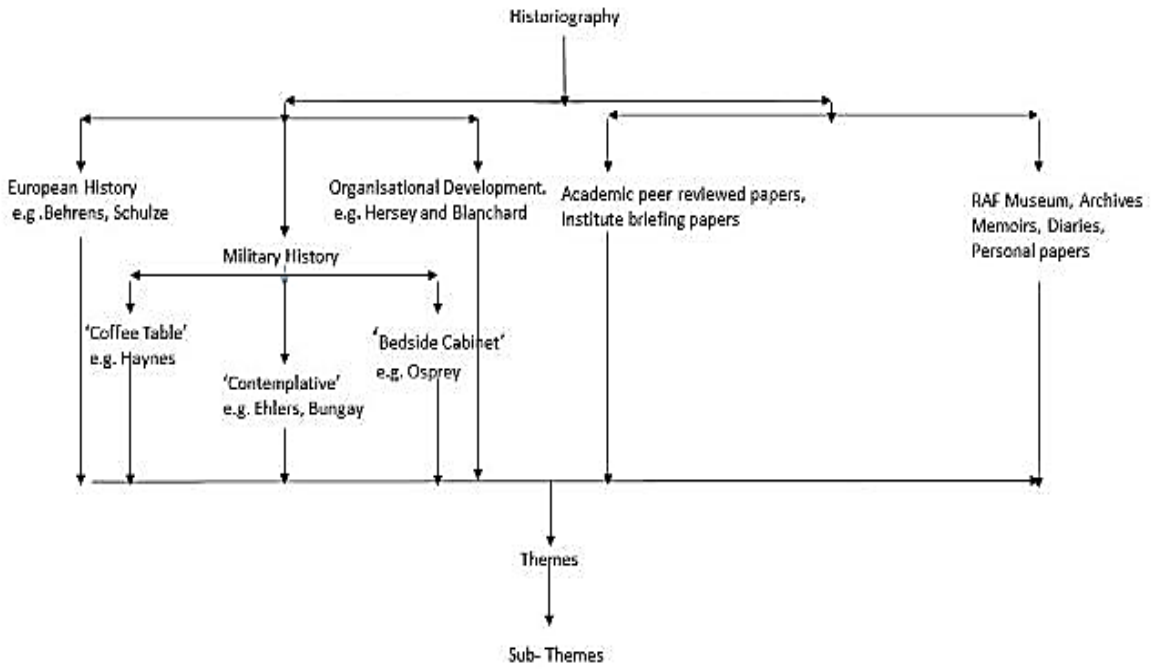


Figure 2.5: Historiography tree

Source: author's elaboration

2.3.1 The first *genre* Commercial Publications

The first *genre* comprises of commercial publications by established authors and historians (Bungay,2002; Adams,2011; Behrens,1985), or publishing houses (Collier and Time-Life Books,1977); all are widely available and targeted at the reader concerned with research both at a learning level for professional employment self-advancement, or at leisure. Within this *genre* the Author has identified three *sub genres.*

2.3.2 The first *sub-genre* 'Coffee Table' Publications

The first is what are commonly described as 'coffee table' publications, those publications are aimed primarily at the broader market of casual reader, sometimes in paperback form (Wellum, 2002).

2.3.3 The second sub-*genre* 'Bedside Cabinet' Publications

The second *subgenre* comprises of those works the author identifies as 'bedside cabinet' reading, those aimed at lighter reading often on a specific narrow topic, designed for

the casual reader to dip in and out of, and turn a few pages (Latimer, 2001)**.** They provide a good entry level to more sustained contemplative research.

2.3.4 The third subgenre 'Contemplative' Publications

The third sub-genre consists of commercial publications such as Bungay's (2002) work *Alamein,* and Ehlers (2015) work on the Mediterranean air war. These works are designed to promote a deeper understanding of the subject matter and sit somewhere between the 'coffee table'/ 'bedside cabinet' *genre* and the more academic *genre* described next.

2.3.5 The second *genre* Academic peer reviewed papers and Institute briefing papers

Turning to the academic sector, there are peer reviewed academic works and journal papers available through the Cranfield University Barrington Library, or directly online *via* the internet (Senior, 1997; Bonebright, 2010), or from sources such as the British Library in the UK.

2.3.6 The third *genre* the RAF Museum at Hendon, the National Archives, and other official documents

Twin sources are the Archives at the Royal Air Force Museum Hendon which holds a collection of memoirs, diaries, and personal papers of the various stakeholders in the Western Desert at the time. Additionally, the National Archives at Kew for the Air Files series relating to official matters. Both these sources will be used in Chapters 4 and 5. There is also the current issue of the British policy document on defence doctrine (British Defence Doctrine 5th Ed); (Chiefs of Staff, 2014) to consider. This document is published by the Development Concepts and Doctrine Centre (DCDC)Shrivenham, England. The purpose of the Doctrine is to explain the military instrument of power and its utility both in and beyond warfare. Doctrine draws on the lessons of history, upon original thinking and from experiences gained from training and operations. It sets out the fundamental principles by which military force is employed. The British Defence Doctrine is recommended reading for all members of the Armed Forces, both in regular and reserve service. The British Defence Doctrine is of particular relevance to officers of mid-level

seniority and above in command and staff appointments. In the case of joint operations mid-level is regarded as Lieutenant Colonel, and in the case of a single command that of Major.

The document is divided into three chapters.

Chapter 1–Strategy. Chapter 1 provides an overview of strategy. It outlines concepts of security, national interests, understanding and the link between strategy and policy.

Chapter 2–Characteristics of the military instrument. Chapter 2 outlines the characteristics of the military instrument. The chapter describes fighting power, leadership, and the centrality of joint, integrated, and multinational action.

Chapter 3–The utility of Defence. Chapter 3 describes the utility of Defence – it situates Defence's key role as deterring threats to British security and prosperity. The chapter outlines the concepts of hard and soft power and how these are used through deterrence, coercion, and defence engagement activities. The chapter concludes by outlining the employment of armed force.

The publication is succinct and to the point, which is to be expected from a military source, and whilst not readable from an 'enjoyment' point of view it was informative. Having now identified the three major themes, see fig2.2 above, the historiography sources and *genre,* it is now possible to move to the situation where the historiography can be considered across those major themes and a comprehensive comparative analysis derived.

2.4 Military History the Evolution of the Royal Air Force

2.4.1 The genesis of the RAF

The birth of Britain's air force came about on 1st April 1911, when an Army Order created an Air Battalion of the Royal Engineers; the Battalion functioned for one year, after which a Royal Warrant dated 13th April 1912 brought the Royal Flying Corps (RFC) into existence (Armitage, 1995).The Corps was split into two wings, a Naval Wing, later the Royal Naval Air Service (RNAS),and a Military Wing. The Military Wing was planned

to consist of 182 Officers and 182 N.C.O.s. One of the Officers seconded to the service was Hugh Trenchard, an Officer in the Royal Scots Fusiliers, a fortunate posting as later events were to demonstrate (James, 1991). The formation of squadrons followed very shortly after the establishment of the force, the squadron being the basic administrative unit. The term squadron was later derived from the French term e*scadrille*; a unit of European air command as in France in the First World War typically containing ten or more aircraft (James1991,p.120). A squadron normally consisted of one type of aeroplane, such as fighters in the case of Fighter Command (James,1991,p.45). It was a local headquarters, and a node in the communications system separate from the wing or group headquarters from which orders to carry out a particular operation would be sent to a squadron, and the squadron would look after the operational details itself.

2.4.2 The First World War

In the years leading up to 1914 Europe had been drifting towards war, and by 1914 was a powder keg. What is remarkable is not that it exploded, but that it had taken so long to explode. On the outbreak of the First World War on August 4th1914, the British air strength was less than that of the other major continental powers of Russia, France, and Germany. The Royal Flying Corps (RFC) and the Royal Naval Air Service (RNAS) had a combined strength of 218 land aeroplanes, 52 seaplanes and seven airships of that total less than 100 of those aeroplanes were in airworthy condition. There were 276 officers and 1,797 other ranks (James,1991, p.12). The 1$^{st\ of}$ April 1918 saw the Royal Flying Corps and the Royal Naval Air Service combine to become the Royal Air Force (RAF) with Hugh Trenchard in charge. By the time the Armistice was signed in 1919, the Royal Air Force had 188 operational squadrons, and in addition there were 56 training stations consisting of three training squadrons, along with 19 free standing training squadrons (Hammerton,1941,p,17).

2.4.3 The Decline and fall of Four Empires

The 1918-19Armistice bringing the First World War to an end precipitated between 1918 and 1923 the collapse of the Ottoman, Hapsburg, Romanov, and Hohenzollern European Empires in a welter of economic chaos, ethnic upheaval and revolution, leaving behind

them a dangerous mixture of factional nationalism and a European power vacuum (Reynolds,2013, pp. 41-85). Despite the Armistice and the Treaty of Versailles of 1919,the perceptive French Soldier Marshal Foch said 'this is not a peace. It is an Armistice for twenty years' (Taylor and Hayton,2016,p.11), and the British Prime Minister Lloyd George said that the treaty was more of a 'hell peace than a heaven peace', and that 'we will have to do the whole thing over again in twenty- five years at three times the cost' (p. 11).

2.4.4 The Effects on the British Empire

Out of the Treaty of Versailles in 1919, Britain acquired several mandates throughout the world which stretched Britain's resources even further. Those responsibilities led to a conflict in budgetary terms. On the one hand, there was a vast demobilisation of the armed forces after the Armistice, with the concomitant reduction in budget. On the other, there was an increased commitment to keeping law and order in the newly acquired territories spread over the Middle East and the Indian sub-continent (Orange, 1992,pp.85-127;James,1991,p.124). Some acquisitions had perceived benefits, for example the mandate over southern Iraq gave access to the emergent oil fields in the Middle East; and the Palestinian mandate gave additional control over routes in the Middle East and the Suez Canal. However, the partition of Iraq (Mangold, 2016) presaged trouble with France, which as a result of the secret Sykes-Picot agreement of 1916 between Britain and France, handed France governance over northern Iraq and all of Syria (Reynolds,2013,pp.96-103). See map 2.1 below. The French presence in Syria was to be particularly unfortunate for the British in the Second World War as the pro-German Vichy French faction became the governing power in Syria and provided facilities and support to the German armed forces in their attempted drive south through the Caucasus to the Middle East oil fields (Mangold, 2016, pp. 172-177).

2.4.5 The Emergence of the Middle East as an Issue for Britain

In 1915 Britain and France tried to resolve the tensions that their rival ambitions in the region were causing by entering into a secret agreement known as the Sykes-Picot Agreement (Reynolds,2013, p.97;Barr, 2011, pp. 11-36) by which they split the

atrophied Ottoman Middle East empire between them by an arbitrary line, running from Acre on the Mediterranean coast, inland, and then northeast to Kirkuk close to the Persian border. See map 2.1 below.

Map 2.1: The Sykes-Picot Agreement of May 1916
Source: Bing images; see also Birdine (2018)

Everywhere to the north of the line was regarded as within the French sphere of influence, whilst everywhere to the south was regarded as within the British sphere of influence. In November 1917 in an effort to counter French proposals for an international mandate for Palestine once it had been apportioned, the British government issued the Balfour Declaration to British Zionists, outlining the Government's support for the establishment of a national home for the Jewish people in Palestine, whilst at the same time recognising the rights and aspirations of other non-Jewish communities. Both the Sykes–Picot agreement (Barr, 2011, pp. 20-36), and the Balfour Declaration (Barr, 2011, p. 56; Lawless, 1980, p. 30) unwittingly set the scene for later nationalist, ethnic and sectarian violence, which the British found impossible to police, especially in Palestine, and brought them into diplomatic and economic conflict with the French (Barr, 2011). The discovery of oil in northern Iraq and its' potential effect

on the British war effort added a strategic dimension to the Anglo-French rivalry with the realisation of the significance of oil as a driver in any future war. As early as 1915, the British Admiralty concluded that oil was four times more efficient than coal as a means of propelling its' fleet of warships and were in the process of thinking through its need to convert its' ships to oil firing (Barr,2011,p.65).This was quite apart from the importance of oil as a lubricant in what was generally recognised as an age of highly mechanised warfare, so whoever controlled the Middle East oilfields secured themselves an advantage in resources in time of war, whilst at the same time satisfying the growing consumer society domestically (Reynolds, 2013, pp. 103, 130-131; Barr, 2011, p. 163).

2.4.6 Britain Post First World War

The effects of the First World War had far-reaching consequences (Reynolds,2013) for British society. Although Britain had not been invaded or had suffered the wholesale destruction of property and land, a generation of young men had been depleted with one in eight men (12percent) killed, and the country was exhausted economically. Paradoxically, the Empire was not only intact, but had actually grown to its greatest extent through the acquisition of new mandates throughout the world particularly in the Middle East and Far East. There was social revulsion in Britain at the scale of the calamity, and the sentiment of 'never again' grew. Coupled with the scaling-back of the armed forces to peace-time levels and the adoption by the government of the 'ten-year rule' renewed annually (Orange,2013, p.70-71), which hypothesised that defence spending would be predicated on Britain not having to fight another war within ten years. These two combined factors led to a situation in which it was exceedingly difficult for the nascent RAF to grow and consolidate itself.

2.4.7 The Changing Balance of Power in Continental Europe

The end of the First World War helped precipitate the fall of the four ruling dynasties in Europe creating a power vacuum which numerous countries and nationalist politicians sought to exploit Only the expanded British Empire stayed intact (Goodson,1953, pp. 83-127;Clayton and Craig,2002). Germany and Russia were perhaps the most volatile

countries in Europe with Germany the more prominent of the two. The Russian revolution of 1917 was largely contained internally, but Germany was wracked by both political and economic instability both internally and internationally. There were a succession of ineffective coalition governments and the most promising, the Weimar Republic in Germany, was fatally undermined politically and economically (Goodson, 1953, pp. 96-97; Moss, 2004, pp. 10-11; Peukert,1993). Nationalist parties seizing on the perceived weaknesses of parliamentary democracy manoeuvred for power, paving the way for first the rise of Benito Mussolini in Italy in 1925,then Adolf Hitler in Germany in 1933. Later, the Spanish Civil War in 1936 brought Francisco Franco to power in Spain. The rise of Franco was to have important ramifications for the later conduct of Hitler's war, through his involvement on the side of Franco and his Nationalist forces in the Spanish Civil War. The fledgling *Luftwaffe* in the form of the *Legion Condor* (Condor Legion), provided over 3,800 men and initially 100 aircraft and their involvement in air combat against the Republicans predominately backed by international socialists and Stalin's Russia, served to develop and hone the combat skills of the *Luftwaffe* (Robinson, 2016,p.1). Germany felt particularly aggrieved by the imposition of the terms of the Treaty of Versailles (the '*Diktat*' as they saw it) ,and throughout the 1920s and 1930s sought to redress the balance and regain its place as the pre-eminent European power (Goodson, pp. 125-127). Hitler played on the political and economic circumstances in Germany, and after coming to power in 1933 embarked on a programme of rearmament to equip Germany for what he saw as the triumph of German National Socialism over the weaker European Democracies (Goodson p78 p 98). He also wanted to deal with what he saw as the revolutionary Jewish-Bolshevik socio- political threat to Germany emanating out of Russia to the east. In 1935 Hitler announced the existence of the *Luftwaffe*, and in Britain the government announced the expansion of the Royal Air Force to counter the perceived threat posed by Hitler. In a German parallel, Hitler authorised the expansion of the other two arms of the *Wehrmacht* (Armed Forces) consisting of the *Heer* (Army)and the *Kreigsmarine* (Navy) (Davis, 1975).

Throughout the 1920s and 1930s Britain was haunted by the consequences of the First World War and mention has been made previously of the sentiment 'never again' that

pervaded British domestic and foreign policy. The desire to avoid another catastrophic war gave rise to a considerable body of pacifist feeling, and by the end of the 1920s and the beginning of the 1930s that feeling had permeated British society. In 1928,the Cambridge University debating society the Cambridge Union carried the motion 'that lasting peace can only be secured by the people of England adopting an uncompromising attitude to pacifism' (Parkinson 2009). This was followed in February 1933 by the Oxford University debating society the Oxford Union carrying by 275 votes to 153 the (in)famous motion that 'this House will in no circumstances fight for King and Country' (Parkinson, 2009). The government, recognising the national mood and the general state of unpreparedness of the British armed forces after 15 years of disarmament and recession, pursued a policy of appeasing Hitler in the hope that by acquiescing to his territorial demands he would be satisfied whilst at the same time carrying out limited rearmament. The government thought that by doing so it would avoid a war in which Stanley Baldwin averred 'The bomber will always get through' (Hyde, 1976, p. 498; Moss, 2004, p. 32) bringing large scale destruction to the civilian population for the first time (Reynolds, 2012, pp. 225-228). Consequently, the British government pursued a dual policy of limited rearmament whilst seeking a diplomatic solution to Hitler's demands (Reynolds 2012pp. 228-235). British rearmament increased in tempo as the realisation grew that another war was a growing reality , and by 1938 rearmament was dramatically scaled up to meet the worsening European political situation. This ambivalence in British preparations can best be summed up in Neville Chamberlain's words, 'Hoping for the best, preparing for the worst' (McDonough, 1998, p. 43).

2.4.8 The Rise of the Royal Air Force

On 1st April 1918, the Royal Flying Corps (RFC) and the Royal Naval Air Service (RNAS) combined to become the Royal Air Force (RAF), and Hugh Trenchard became the first Chief of the Air Staff. Trenchard laid down the basic principles of air strategy, by using the report on the future of air power written in 1917 by the influential South African leader and politician Jan Smuts, (Moss, 2004, p. 31). At the same time, he implemented the Constitution of the RAF previously written in 1912 by the then Director of Military Aviation, Major-General Sir David Henderson, intended as the Charter for the RFC

(James, 1991; Boyle, 1962, p. 331). In the demobilisation of the armed services after the First World War, the drive for economy at all costs in the 1920s (Boyle, 1962, p, 327), coupled with the financial crises and disarmament conferences of the 1930s, only the determination of Trenchard kept the RAF in being. He was able to demonstrate to the British Government in the form of the Treasury, the cost effectiveness of imperial policing through air power compared against the cost of maintaining large army garrisons, particularly in the Middle East and the Northwest Frontier of India (Boyle1962p.369). By demonstrating the cost effectiveness, agility and resilience of the RAF in those theatres, he was able to defend attempts by both the Army and the Royal Navy to dismember and absorb the RAF. He secured the future of the service, whilst at the same time accruing valuable experience of fighting a mobile offensive air war with minimal resources in a hostile desert environment, something which was to be of benefit later on in the Western Desert (Boyle,1962 pp.394-395; Bowyer,1988, pp,101-103,197, 235-239).

Trenchard was able to expand the service under extremely difficult circumstances. In so doing, he managed to harness the emerging aviation technology with the type of people who were able to recognise the potential of the new service and push the boundaries of technology to re-arm and re-equip the service in the face of the growing threat of a second continental war in Europe. Not only did this require suitable people with the right attitude and aptitude (Carter,2002, p.5); it also required the training and development infrastructure and facilities to support the growing requirements of the expanding service allied to securing sources of government funding. Through Trenchard and like-minded people such as Sir William Weir, the Secretary of State for Air, later 1st Viscount Weir; the RAF was able to harness the emerging aero technology and private aircraft industry resources of the 1930s to re-arm and re-equip (Reader,1968). Weir ,Reader explains, persuaded Trenchard to accept the post of Chief of the Air Staff, and later Weir was called upon to fight the internal political battles against the particular vociferous demands of the Admiralty (Reader 1968, pp. 98-109). From 1935 to 1938,he was closely associated with every aspect of the Government's rearmament plans and his work with Lord Swinton at the Air Ministry unquestionably helped lay the

foundations of the Royal Air Force in the Second World War. These foundations produced aircraft designs such as the Hurricane and Spitfire which in every respect were a quantum leap forward over what existed previously in fighter aircraft design. Development was such that by the summer of 1936 the Vickers Supermarine Spitfire was dubbed 'the fastest military aeroplane in the world' (Reynolds,2013p.66). At the same time Trenchard invested heavily in recruitment and training through the establishment of both RAF Cranwell in the eastern county of Lincolnshire and RAF Halton in Buckinghamshire, dealing with officer training and technical training respectively (James,1991,pp. 106-108). In the same vein, the RAF was able to access the best abilities in the private research and development sector to contribute to the re-armament programme (Reader,1968,pp. 221-223). By the summer of 1939 although still somewhat under-resourced and still in the process of re-equipping, the RAF prepared itself for what was fast becoming the inevitable war with Germany.

2.4.9 Organisational Development the Organisational Culture of the Royal Air Force.

At this point it is reasonable to consider what might constitute the definition of an 'organisation' in the context of the RAF in the Western Desert campaign point in time. Seidel (2005) reinforcing Luhmann, suggests that 'the organisation is a social system that reproduces itself as the basis of decisions' (or decision communications). He then goes on to address the nebulous concept of 'organisational culture.' Luhmann (1995) identified what he called the third type of social system but only addressed the concept very briefly. However, Seidel's (2005) view was that organisational culture was the communicative medium in which the organisation reproduced itself. The medium being that part of society in which the organisation finds itself and reproduces itself, and on the other hand is continually modified through those operations of the organisation that make it possible. This proposition leads the reader back to Clausewitz's dictum that' the nature of armies is determined by the nature of the civilisation in which they exist'(Clausewitz, 1915).So it would seem that on the basis of that dictum Clausewitz thought of the explanation first. Seidel (2005) then goes on to quote Barney (1981) that managing 'organisational culture' is impossible and possessing

a ‘successful’ culture means having a strategic advantage due to its inimitability. On the other hand, Tharp (n.d.) uses Schein (2004) as having developed a clear definition of organisational culture as ‘a pattern of shared basic assumptions that the group learned as it solved its’ problems of external adaption and internal integration that has worked well enough to be considered valid and therefore taught to new members as the way to perceive, think, and feel in relation to those problems’.

Schein illustrates his concept of organisational culture in the Venn diagram shown in figure 2.6 below.

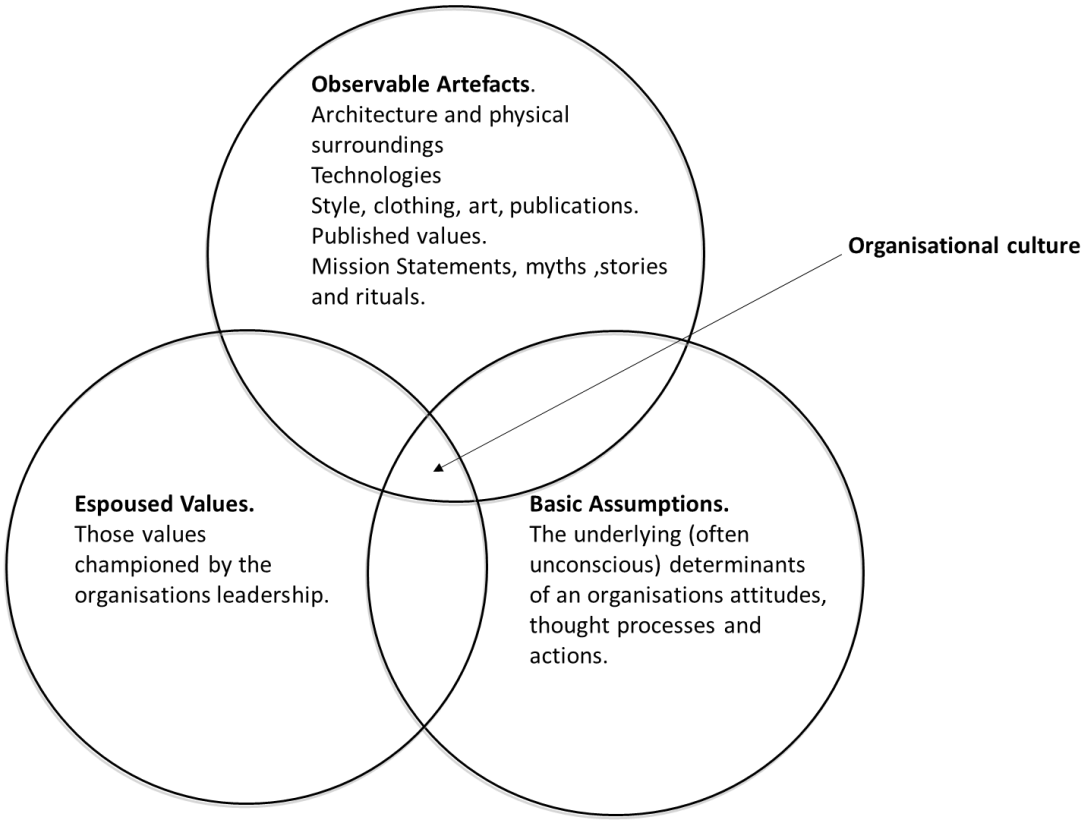


Figure 2.6: Schein’s Organisational Culture

Source**:** *Defining Culture and Organisational Culture from Anthropology to the Office* (Tharp, n.d.).

There has been continued growth and apparently limitless demand for books on military history, in particular recent anniversaries of the First World War campaigns, and the perennial favourite the Second World War; the output geared to the commercial market

which can broadly be divided into three separate, distinct but inter-related *genres.* The first *genre* caters for what can broadly be defined as the leisure 'coffee table' research sector, described to the author by Ross Mahoney the Head Archivist at the Royal Air Force Museum Hendon, as 'The Airfix School of History' (Mahoney, 2017), in that it provides a broad based popular mainstream account of history. Being both easy to access and assimilate, readily constructable, and readily translates into spin-off products such as Digital Versatile Discs (DVDs) for home viewing, television dramas and docudrama, internet excerpts, and other downloads to the internet. Wellum's best-selling autobiography *First Light* (2002), is a good example of an autobiography and subsequent DVD. He describes his emotions and experiences as the youngest pilot in the RAF, when at the age of 18 (hence, the nick name 'Boy'), he first flew a Spitfire with 92 Squadron from Kenley in the county of Kent, South-East England. He writes with sensitivity that catches the heat of the moment of combat, and the mental and physical strain that went with it. In his book, he refers to his ground crew in glowing terms in several instances (Wellum, 2002, pp. 2.4,139,159,219-221,242). Although not a previously established author, the power and presence of Wellum's writing was deemed sufficient for the British Broadcasting Corporation (BBC) to film a one-off drama production under the same title as the book, which was screened nationally and received to critical acclaim. The BBC, subsequently, converted the programme into a Digital Versatile Disc (DVD), and although the relevant sequences are short, the interplay between Wellum and his ground crew are well brought out in a way that the written word cannot convey. In the film clip that follows, the older man in the leather jerkin expressing his concern is the fitter, and it is instructive to note that he addresses the younger less experienced commissioned officer as 'sir.' The younger man, the rigger keeps to the background. The fitter immediately assesses the aircraft as beyond immediate local repair and says 'she'll have to go away sir' meaning to a maintenance depot for major repair. (Note the use of the gendered language in the use of 'she' relating to the aircraft). The pilot in this instance, Wellum replies 'you'll have to rustle me up another one then.' This expectation accords with Neil's experiences recounted in interviews (Neil 2015-2018) with this author that a replacement aircraft would be

forthcoming in short order; it was not the pilot's prerogative to question the how-but only the when. A film clip from the film *'First light'* can be viewed below at figure 2.7 (see also picture at figure 2.8 below)

Figure 2.7: Film clip First Light-dogfight

Source: https://www.youtube.com/watch?v=CDifnYZWxmE. Accessed 4/8/21.

Figure 2.8: Ground crew at work on a Spitfire

Source: First Light (Wellum, 2009 photo 6 pp82-83)

Wellum refers to the stand-to period where at dawn (first light),the fitters would start the aircraft engines, and run them to warm up the engines, and carry out pre-flight checks in expectation of a quick take-off (scramble).A skilled fitter, whilst sitting in a cockpit with the engine running, would listen to the engine both at idle speed and higher speed under load, scanning the instruments as a visual check, detecting anything that might need attention. A fitter's tactile sense would enable him to detect any unwarranted or excess vibration denoting significant engine problems. At the same time, the rigger would be attending to anything structural on the airframe, and between them, brief the pilot on the condition of the aeroplane (Wellum,2009, p.139)**.** Wellum then describes the feeling of the closeness of the team, and of the empathy that characterised the team on his return form combat. 'I climb out of the cockpit and my fitter and rigger are waiting, as always. What stalwarts they are, both utterly loyal to 'their' pilot, dedicated and uncomplaining. They are both smiling and friendly' (2009 p.139) He then goes on to recount the conversation that are resonant of the type of the fitter would have had with the pilot in briefing the pilot as to the operational condition of the aeroplane. 'Twenty-five drop on both mags' sir. When reading and decoding this

conversation it should be remembered that in nearly all cases the fitter, an experienced older man and artisan worker often with many years' prior pre-war experience service who, although outranked by the younger less experienced officer, demonstrates the informality of the exchange between team members by using the shorthand expression of 'mags' for magnetos and 'twenty- five' is the voltage drop across each magneto. It can be seen from the exchange that the conversation is both authoritative on the part of the fitter yet at the same time deferential to the rank of the pilot as an officer or sergeant, who the fitter is required to address as 'sir. This briefing immediately alerts the pilot to the fact that he has to keep a watchful eye on the electrical performance of his engine on which his life would (or could) depend.

Later on in the book, he muses on the team dynamic and the close bond that existed within the team (The Telegraph, 2018). What he was articulating without knowing it was what has been described as 'the extraordinarily tight knot of dependence between those who did the flying and those who did the maintenance' (Boyle,1962,p.515;see also the Telegraph,2018).The unspoken yet mutually understood country house paternal conventions of the team are captured perfectly.(see the writing of Sheffield on the 'Country House' atmosphere discussed later) .In the dedication of his book *Last of the Few* (2010), Arthur recognised the fact that little had been written about the parallel but less glamorous experiences of the supporting ground crew, and went some way towards redressing the balance when he wrote; 'This book is dedicated to 'the Few' and those on the ground who supported them. We owe them an incalculable debt.' Perhaps, recognising the fact that there is a gap in the historiography he has produced a series of books in the *Voices* series in which he presents quotes culled from ordinary men and women on their experiences and thoughts relating to war. By using conversations both Wellum and Arthur (but particularly Arthur) present their accounts as vivid eyewitness accounts of life with ground crew in Fighter Command with its' interpersonal relationships.

On leadership, Sheffield's (1999) work on officer-man relations in the British Army in the First World War does not on initial encounter seem to have much bearing on RAF ground crew in the Second World War. However, on closer inspection the book makes

several points which resonate with later developments in the RAF. Although the points refer to the professional volunteer British Expeditionary Force (BEF)and later the much-expanded conscript British Army, the sentiments and ethos that he identifies are transferable across time and between services. In this instance from the Army across to the RAF. This was especially true as many of the RAF's senior commanders, Trenchard and Dowding for example, were originally pilots in the Royal Flying Corps (RFC), initially the air arm of the Army. Right at the beginning of the book, Sheffield (1999,p.4) describes how the officer-man dynamic followed the pattern of the ideal 'Country House' relationship between the landlord and a tenant, with loyalty and deference being given in exchange for paternalism and leadership, paternalism carrying the notion of '*noblesse oblige'*(p. 5). Privilege entails responsibility, and the obligation to do right by the men under an officer's command, not only in operational matters but extending to considerable elements of pastoral care.

Sheffield goes on to expand the 'Country House' point by citing:

> A Yeomanry Regiment that may be said to be an expression of the best part of the county on horseback, its' ranks manned from the homesteads and farms whose tenure has often been held for successive generations and officered from the great houses (1999 p. 270).

He then goes on to cite one officer's writings on the family atmosphere 'at stables.

This approach is emphasised by English (1996) in his work on the recruitment and training for the Royal Canadian Air Force (RCAF) where he says that Officers, especially those living in an Officers Mess, were encouraged to behave like gentry. Sheffield cites Stradling in his booklet '*Customs of the Service*, *helpful hints and advice to those newly commissioned'* (Stradling, 1943). Although Wellum was not from a 'Country House' background ,there are strong elements of that ethos in the conversations with his ground crew. The 'Country House' atmosphere is also reflected in the words of an unknown pilot from 56 Squadron. 'What made war tolerable–exciting, even pleasurable-was this. It was if you went out for a day's sport from a pleasant country house in which you had the privilege to live in' (Arthur,2010; James,1991). The atmosphere was also

reflected in the style of airfield station architecture throughout the United Kingdom, designed by the acclaimed architect Lutyens which was meant to encourage a dignified and sedate manner of life (James, 1991). See figure 2.9 below

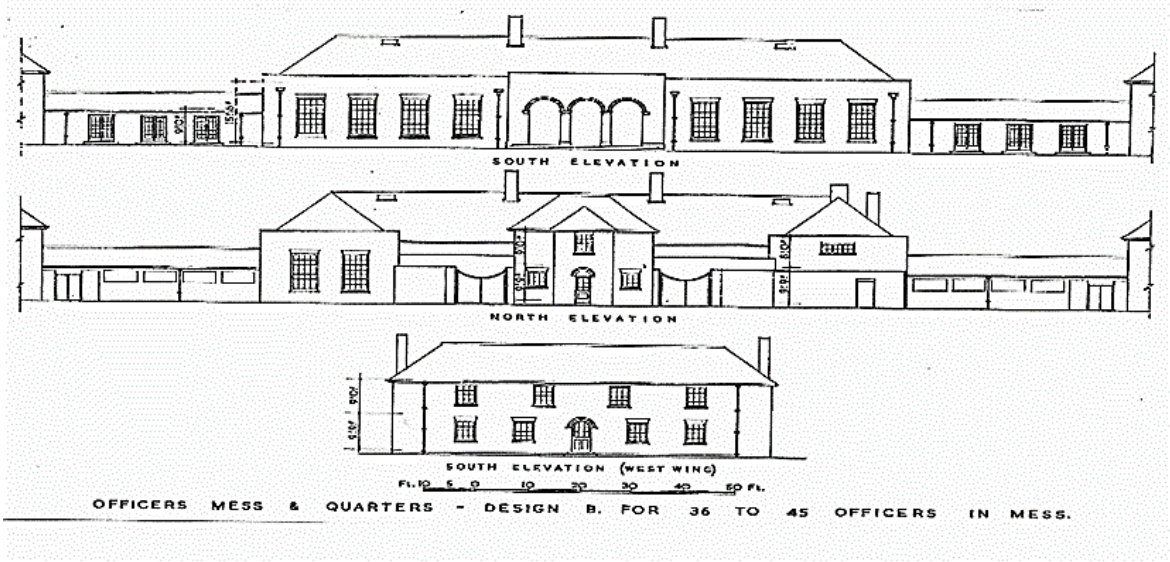


Figure 2.9: Typical Lutyens Design for RAF Officers Mess

Source: Falconer (2018, p. 40)

Taking the Country House analogy further it is valid, in this author's opinion, to compare the pilot walking out to his Spitfire or Hurricane and his conversations with his ground crew, to that of the Young Master of the house walking out to his prize hunter horse (The Times, 2018), and talking to his groom and stable lad who have previously saddled up and prepared the horse. Sheffield (1999) then goes on to outline what might constitute leadership in military matters, which then leads on to a discussion on deference and its part in the unspoken but mutually understood officer-man relationship. By the onset of the Second World War British society was less deferential than it was at the time of the First World War, however this author would suggest that there was still a majority measure of deference (Moss,2004). Although, this declined as the war progressed, with the move toward a more equal and just post-war society. The idea that a total war entitled the participating population to a decent existence is to be found in (James, 2002), a 'New Jerusalem' (Barnett, 1995 pp 123-151,152-164). In his work *England Your England* the novelist and writer George Orwell (1941) observed the

ordinary men and women who thought that if this total war was being fought by them, it should also be fought *for* them (Orwell's emphasis), houses that were not verminous slums, basic food that would nourish rather than sicken; schools for their children; proper medical care; help for the aged and infirm (Orwell 1941).

The thought of a better, brighter future must have been a powerful motivational component to get the war over as quickly as possible. Sheffield (1999) also refers to an analysis from 1938 of the ambiguities of the officer-man relationship in which the officer is portrayed as boyish and middle aged, cool and reckless, grave and humorous, aloof and intimate, a martinet lapsing into indulgent father, a thwarter becoming an aider and abettor, and enemy melting into friend (Sheffield, 1999; also, Clayton, 2002;Shores, 2012). Sheffield (1999) contends that it is valid to talk of a war generation who shared common experiences, and he uses Roebuck's words; 'Under battle conditions class lines came to be overshadowed by the shared experiences of combat and the mutuality of death'. The conditions of war made contact between upper-class officers and lower-class soldiers inevitable and gave them a set of common experiences and interdependencies which neither group shared with civilians of their own class In his work Sheffield (1999) comments on the 'Country House' ethos in officer-man relationships, and whilst it is reasonable to extrapolate that senior RAF commanders who had been in the RFC and early days of the RAF did not change their man management habits, and they carried this approach over into the Second World War .In writing this thesis the author could find little evidence that there was the same degree of concern for the men under their command as described by Sheffield. That is to say that senior commanders were un ware of their responsibilities in that direction, but that it was exceedingly difficult in the conditions of the Western Desert to exercise the same degree of pastoral care. Certainly, Tedder the Air Officer Commanding in Chief (AOCinC) Middle East, took the responsibility to visit men away from headquarters and go up the line and observe operations, and canvass the opinions of his frontline personnel and pilots. Likewise, Coningham, his Desert Air Force operations commander, voiced his opinion as to equality of treatment of all participants, but given the unique harsh desert operating conditions combined with the high degree of mobility and pace of operations

required, these conditions conspired against any sustained efforts on pastoral care. It also has to be remembered that what Sheffield was describing was a large, (certainly in the first three years up until 1917) a static war of attrition, where for all its brutality it was easier to supply and administer with all the support services nearby (McLaine,1979).

2.4.10 Leadership and Organisational Development

When considering this thesis, a number of background factors should be borne in mind by the reader as they influence the question of organisational development. 'History is a continuum of events' (Behrens,1995,.14). with no finite end. Therefore, when considering organisational development, it is reasonable to regard the Age of Enlightenment (1688 to approximately 1789) (https://www.britannica.com),as that period in history which saw the emergence of rational scientific, and social scientific thought, discovery, and social reform. (Behrens,1995,pp.11–20). This process of introspection in Europe led eventually to that period in Great Britain known as the Industrial Revolution in which organisational development grew up through the efforts of *entrepreneurs* and industrialists. Early notables being Robert Owen (1771- 1858), (Hatcher,2013) and later in North America the 'Father of Scientific Management' Frederick Taylor (1856 – 1915) (CMI, 2012). The Age of Enlightenment had different outcomes in countries across Europe. In the nascent Germany, the socio- political trend in Prussia and other states was for individuals to coalesce around the emerging notion of Germandom, however vague. It was at that time expressed through the concepts of *Kultur* (culture) and *Geschichte* (history), and the notion of nationalism that grew around those concepts (Schulze, 1991, pp.46–47). The emergence of nationalism in Prussia grew in parallel with the continued expansion of the British Empire. In these two phenomena lay the genesis of the two national states military thinking and eventual conflict. Developments in both countries gave rise to other factors that affected their respective societies. In Prussia, the emerging nationalist and liberal sentiments gave rise to the forming of the *Burschenschaften* (student association movements) (Behrens, pp. 51-52). Founded in *Jena* in 1815 with the motto *Ehre, Freiheit, Vaterland*, (Honour, Freedom, Fatherland). The *Burschenschaften* developed the cult of young male university students displaying their masculinity usually through hard drinking, and sword duelling (usually

with rapiers) involving high levels of control. What the British would recognise and describe as the 'stiff upper lip, in not shrinking from the blade. Participants practiced self- control to the point where they did not flinch in combat (Behrens, p88). Training to overcome the reflex action was a measure of self-discipline and part of the ethos of the heroic individual. The mark of honour was to have a duelling scar on the cheek; it was regarded as a rite of passage and test of manhood, combined with military skill and fearlessness**.** In addition to the *Burschenschaften,* another pillar of the nationalist movement emerged through Friedrich Ludwig Jahn's *Turngeselleschaft* (gymnastics society) founded in 1811 (Behrens,1995 p 51). The principles of which were to strengthen not only participant's physique, but also their will power, command spirit and character. They also undertook night marches and military manoeuvres, and in common with the *Burschenschaften,* practised fencing, and additionally crossbow shooting to hone their state of preparedness for mobilisation (Behrens 1995 p. 51).

The Prussian social reforms of Frederick the Great produced a modern compulsory public education system designed to reach the entire population, predating compulsory schooling in England by over a hundred years. However, where the two systems diverged was the concept of the 'Public School,' one that was uniquely British. In Prussia, the nearest equivalent was a small group of five to six schools established in the states of *Sachsen-Anhalt* (Saxony Anhalt) and *Thüringen* (Thuringia). The earliest and best known was *Schulpforta,* founded in 1543 at *Pforta* Abbey near *Naumberg* in *Sachsen-Anhalt*. Reaching its zenith between 1601 and 1626,it had by 1815 come under Prussian influence and later Imperial German influence.*(Landeschule-pforta.de).*Education reform and provision in England lagged far behind developments in Prussia, and it was not until the Education Act of 1902 in England, that State secondary schools were established (Eaglesham, 2010) .Public schools in England could trace their lineage to circa 600 A.D. with the founding of King's School Canterbury in Kent, these considerably predated *Schulpforta* and others. These parallel developments gave rise to the situation where, on the one hand there was the Prussian military doctrine of *Auftragstaktik,* with its emphasis on the individual (Muth,2011), and on the other was the British concept of collective effort through team work developed through the prism of both team sport in

British working class society (Simms 2014), and the particular British institution of the public school (May, 2009).These very different socio–political outcomes had a direct bearing on the parallel organisational development of the RAF and the *Luftwaffe* (the RAF's principal opponent in the Western Desert).

What has been presented up to now in this thesis is a review of the literature relating to the historical evolution of the RAF and the wartime combat conditions it endured, along with formative aspects of British society. At this point it is now appropriate to consider the organisational development theories that impinge on teamwork, particularly those that relate to the pilot-fitter-rigger team in their particular position in the Western Desert. The teamwork dynamic being considered is one of a three-man team working under extreme physical and emotional stress and psychological pressure, often in mortal danger operating in a hostile environment in all its manifestations. They had a large degree of inter-dependence on, and with each other, requiring rapid decision-making on an *ad hoc* basis on their own initiative in response to a fast-moving fluid combat situation. Often without direct leadership, management, or supervision. What is apparent from the likes of Orange (2014;1992), Overy (1980) and Holland (2006) in this literature review is that the Desert Air Force became an agile, mobile, self- contained air force led by senior officers who had previous experience of managing air power resources firstly in the First World War, and for some officers directing air power resources during the inter-war period of imperial policing in the Middle East. The fast-moving fluid air war in the Western Desert called for a considerable amount of initiative and innovative thinking in constantly changing situations. The Desert Air Force, along with its predecessors, tended to produce a host of highly individual, even unorthodox, aircrew men such as Dawson. Yet in the Mediterranean air war such men found a vocation in the un-bureaucratic atmosphere of any operational unit.

The Desert Air Force came to play a pivotal role in the Western Desert campaign through its support to the British Army, and to a lesser but still significant extent the Royal Navy. The situation that the Desert Air Force found itself was one of operating in what was an extreme desert combat environment at the end of a long logistical chain from Britain. Largely devoid of fixed installations capable of supporting supplies needed to conduct

the campaign, the Desert Air Force was forced to be innovative in its approach to logistical and operational combat matters. The fast moving, mobile campaign required quick thinking on the part of British desert campaign leaders to adapt to constantly changing combat situations; whilst ensuring that there was sufficient cohesion both at team and individual level to prosecute the campaign. Therefore, it would seem reasonable to consider Adair's Action Centred Leadership model as the most appropriate in this respect (CMI 2015).

The RAF scheme of engineering trades made the distinction between the tasks and skills required of the various trades and what was required of them in their respective roles within a team. This would then indicate that it would be useful to examine Belbin's work on identifying team roles (Belbin,1993). The pilot, fitter and rigger needed to work collaboratively and empathetically in extremely difficult circumstances to ensure that an aircraft was presented for combat in a timely and efficient manner. In this context it would seem reasonable to examine the work of Thorndike, Vernon, and Gardner on multiple intelligences (Gardner,1983) along with Goleman's theory of Emotional Intelligence (Goleman,1996)**.** The fast-moving mobile combat situation required the team to think intuitively and respond to emerging unpredictable, and often life-threatening situations without necessarily referring requests for decisions up the chain of command for affirmation. Therefore, there was a high degree of independent thought and action without constant input from a supervisor or manager of a higher rank.

Taking all these factors into account, it would be profitable to relate the work of Bennis (1998) on leadership, and Hersey and Blanchard's (2001) work on situational leadership. In common with the Army and the Royal Navy the RAF was a hierarchical organisation with (in theory) fixed reporting lines, these reporting relationships and their likely impact on team dynamics can be considered within Graicunas (2011) Theory of Span of Control. The literature review then examined a selection of academic peer reviewed papers, and journal articles. These were selected by the author as those most likely to put forward a view germane to the various theories being discussed. A particularly interesting paper in the opinion of the author is by Senior (1997, pp.22-27), that links Belbin's team role theory, Tuckman's Forming, Storming, Norming ,Performing, model,

situational leadership, and neuroscience together, to demonstrate how leadership changes as a team matures and develops (CMI, 2011). This work also has clear connections both to the work of Goleman on emotional intelligence and that of Hersey and Blanchard on situational leadership. Goleman's work apart from Miller (2014) is the only one that goes towards presenting a 'holistic' approach to leadership and team dynamics.

2.5 Team Dynamics

Belbin is a leading figure in developing team role theory, and in his research conducted in the 1970s, he identified eight (later nine) useful roles which are necessary for a successful team (Belbin,1993; CMI 2015, pp.1-5). See Table 2.1 below.

Table 2.1: Belbin's Team Roles

ROLE	DESCRIPTION AND TEAM CONTRIBUTION
PLANT	Creative, Imaginative, unorthodox. Solves difficult problems.
RESOURCE INVESTIGATOR	Extrovert, enthusiastic, communicative. Explores opportunities. Develops contacts.
CO-ORDINATOR	Mature, confident, a good chairperson. Clarifies goals, promotes decision making, delegates well.
SHAPER	Challenging, dynamic, thrives on pressure. The drive and courage to overcome obstacles.
MONITOR EVALUATOR	Sober, strategic, and discerning. Sees all options. Judges accurately.
TEAM WORKER	Co-operative, mild, perceptive, and diplomatic. Listens, builds, averts friction.
IMPLEMENTER	Disciplined, reliable, conservative, and efficient. Turns ideas into practical actions.
COMPLETER- FINISHER	Painstaking, conscientious, anxious. Searches out errors and omissions. Delivers on time.
SPECIALIST	Single-minded, self- starting, dedicated. Provides knowledge and skills in rare supply.

Source: author, adapted from Belbin

Interestingly, all of his roles have what Belbin describes as allowable weaknesses, and not allowable weaknesses (Belbin, 1993); see table 2.2. below. This is the first instance, to the author's knowledge, of a theory referring to what is not permissible, or of negative characteristics or behaviour. Until now everything the author has read in the literature review has been predicated on positive aspects and behaviour, and what should happen or be done, and not, in the author's opinion, what also should not be done, which can be equally powerful experiences, learning points, motivators or de-motivators. This recognition of the negative as well as the positive, is in the author's opinion and experience a realistic pragmatic approach. Belbin's team roles do not have to be present all the time for all the team members, but identify which attributes are needed to be present for a team. In Belbin's words 'a team role describes a pattern of behaviour characteristic of the way in which one team member interacts with another and their performance serves to facilitate the progress of the team as a whole.' Belbin's team roles are used to identify people's behaviour, strengths, and weaknesses in the workplace (Senior, 1998, p 56). See Table 2.2 below.

Table 2.2: Belbin's Identification and Assessment of Weaknesses in Team Roles

TEAM ROLE	WEAKNESSES	
	ALLOWABLE	NOT ALLOWABLE
PLANT	Preoccupation with ideas and neglect of practical matters	Strong 'ownership' of ideas when co-operation with others would yield better results
RESOURCE INVESTIGATOR	Loss of enthusiasm once initial excitement has passed	Letting clients down by neglecting follow-up arrangements
CO-ORDINATOR	An inclination to be lazy if someone else can be found to do the work	Taking credit for the effort of the team
SHAPER	A proneness to frustration and irritation	Inability to recover situation with good humour or apology
MONITOR EVALUATOR	Scepticism with logic at its core	Cynicism without logic
TEAMWORKER	Indecision on crucial issues	Avoiding situations that may entail pressure

TEAM ROLE	WEAKNESSES	
	ALLOWABLE	NOT ALLOWABLE
IMPLEMENTOR	Adherence to the orthodox and proven	Obstructing change
COMPLETER FINISHER	Perfectionism	Obsessional behaviour
SPECIALIST	Acquiring knowledge for its own sake	Ignoring factors outside own area of competence

Source: author adapted from Belbin.

Effective teamwork can never operate in a totalitarian culture where deviation from the norm is not allowed, the deviation from the norm can be seen in the earlier references to informal groups, and relaxed uniform dress code (See figures 2.9 and 2.15 below). As evidenced by Bungay in his discussions as a Director of Ashridge Business School with this author (2014,2015,2016,2017) and in Bungay's work as an international consultant. Belbin's work is still popular amongst organisational development consultants and trainers. Also, Bungay's work at Ashridge Business School attests to the continuing validity of Belbin's work and it is pertinent to remember that as of March 2016 the Royal Air Force used Belbin's work as part of their examination for N.C.O. selection and promotion. Belbin claims that high team performance is associated with teams that are balanced in terms of the roles represented amongst members. This is examined in a paper (Senior,1997) which sets out to evaluate Belbin's team role theory in terms of ability to predict team performance; the results gave some support to the link Belbin makes between team role balance and team performance. The essence of Belbin's theory is that given knowledge of the abilities and characteristics of individual team members, success or failure of the whole can be predicted within certain limits. As a result, unsuccessful teams can be improved by analysing their shortcomings and making changes. It is also important for individuals within the team to understand the roles others play, when and how to let another team member take over, and how to improve matters and compensate for shortcomings. Each team member can play two or three roles and should learn to adapt behaviour to the needs of the team objectives. Although each of the nine roles have to be filled for a team to function effectively (Belbin, 1993).

They are not needed in equal measure, nor are they needed at the same time. There can be fewer than nine people in a team since people are capable of fulfilling secondary roles. Interestingly, all of his roles have what Belbin describes as allowable weaknesses, and not allowable weaknesses (p. 56). There has been discussion around the validity of the nine roles identified. Senior's (1997,1998) work examines, amongst other things, the fact that some team roles are so different from others that they are unlikely to co-exist as natural team roles within one person; also, the frequency with which team roles are represented and whether some team roles are scarcer than others (Senior 1997,1998). Belbin claims that high team performance is associated with teams that are balanced in terms of the team roles represented amongst team members. This is examined in papers by Senior on team roles and team performance (Senior,1997;1993), which sets out to evaluate Belbin's team role theory in terms of ability to predict team performance; the results gave some support to the link Belbin makes between team role balance and team performance. The idea is encapsulated in two statements made by Belbin. Each team needs an optimum balance in both functional and team roles, the ideal blend will depend on the goals and tasks the team faces. A team can deploy its technical resources to best advantage only when it has the requisite range of team roles to ensure sufficient team- work.

2.6 Multiple Intelligences and Team Cohesion.

Goleman is not the first person to write and theorise on Intelligence and its emotional and multiple facets. In 1920 Thorndike forwarded his theory on intelligence, identifying three mutually independent variables (Management Mania, 2016). This was elaborated later on in the early 1930s by Vernon (1933) and his work on 'Social Intelligence'. Further detailed work on multiple intelligences was carried out by Gardner (2011), who identified seven different mutually independent intelligences. To assist the reader in understanding the various classes of intelligence defined by Thorndike, Vernon, and Gardner, and how they might correlate. The thesis author has summarised the classes in table 2.3 below:

Table 2.3: Correlation Between Intelligence Theories

<table>
<tr><td colspan="4">1920 >>>>>>>>>>>>>>>>1930>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>1995</td></tr>
<tr><td>THORNDIKE'S INTELLIGENCE THEORY</td><td>VERNON</td><td>GARDNER MULTIPLE INTELLIGENCE THEORY</td><td>GOLEMAN</td></tr>
<tr><td>ABSTRACT INTELLIGENCE</td><td rowspan="5"></td><td>LINGUISTIC INTELLIGENCE</td><td rowspan="7">EMOTIONAL INTELLIGENCE</td></tr>
<tr><td rowspan="2">MECHANICAL INTELLIGENCE</td><td>LOGICAL INTELLIGENCE</td></tr>
<tr><td>MUSICAL INTELLIGENCE</td></tr>
<tr><td>SPATIAL INTELLIGENCE</td></tr>
<tr><td>BODILY-KINESTHETIC INTELLIGENCE</td></tr>
<tr><td rowspan="2">SOCIAL INTELLIGENCE</td><td rowspan="2"></td><td>INTERPERSONAL INTELLIGENCE</td></tr>
<tr><td>INTRAPERSONAL INTELLIGENCE</td></tr>
</table>

Source: Author's elaboration, adapted from Thorndike (1920), Vernon (1933) Gardner (1983), and Goleman (1996).

From the author's interpretation of the table, it would appear that the various classes of intelligence that Thorndike, Vernon, and Gardner are proposing are facets of what Goleman labels as emotional intelligence; and that the term emotional Intelligence embraces all those facets. Goleman (1996) defined emotional intelligence as a capacity 'for recognising our own and others' feelings, for motivating ourselves, and for managing our emotions, both within ourselves and in our relationships'. Goleman's interest in Emotional Intelligence (EI) arose from a realisation that Intelligence Quotient (IQ) was not the sole arbiter or pre-requisite for having a successful life. In Emotional Intelligence he identifies many people who, whilst brilliant academically, were nevertheless failures socially or in corporate life. Conversely, he identifies others who were not qualified or distinguished in academic terms but were still successful in terms of their lives and business achievements. He went on to relate business acumen to

emotional intelligence. He went further and identified a number of EI competencies and discussed how high emotional intelligence can make all the difference between success and failure (see Adair's work above). Goleman, Boyatzis, and McKee (2013, pp.253-256), write that for them leadership competencies fall into four categories. Whatever leaders set out to do, it is how they do it, and effective leadership works through harnessing the emotions. The leader in any human group is the one to whom others look to for assurance and clarity when facing uncertainty or threat, or when there is a job to be done (p.5), and the leader has the power to sway everybody's emotions. Goleman, Boyatzis, and McKee (2013, pp. 53-79) identify six leadership styles.

In a subsequent work, Goleman (2013) writes those effective leaders need to direct attention to where it needs to go, and this, he says this for him is the primal task of leadership. Effective leaders need to be able to shift attention to the right place at the right time, sense trends and emerging realities and seize opportunities. Because organisations and teams consist of numbers of people this gives them an accumulative attention far more distributable than an individual, with a division of labour in who pays attention to what. This multiple focus powers an organisation's attention capacity for reading and responding to complex systems (Goleman, Boyatzis, and McKee, 2013, pp. 209-210). Finding the right balance within a team means identifying the most influential person in the team- this identifies the informal leader and tells how the team operates. Informal leaders tend to be more self-aware, they tend to have the smallest gap between their own perception of their abilities, and those of others. The authors (Goleman, Boyatzis, and McKee, 2013) discuss why emotional intelligence, which includes not only self-awareness and impulse control, but persistence, zeal, motivation, empathy, and social deftness can matter more than Intelligence Quotient (I.Q.) (Goleman, 2015, p.1).

Goleman then goes on to discuss group intelligence, which is wherever people come together to collaborate, and where there is a real sense of group I.Q., being the sum total of the talents and skills of all those involved. The most crucial element is not the average I.Q. but emotional intelligence, and it is the ability of the team to harmonise that makes the team successful. Each person brings characteristics and talents to the

team which Belbin describes in his work, so in this respect the thinking of Goleman and Belbin are very much alike, and the team can be no cleverer than the sum total of all the talents, but it can underperform if its internal mechanisms do not allow people to share their talents. Informal networks are especially critical for managing unanticipated problems, they deal with those problems through a complex web of social ties formed through interpersonal communications and solidify over time into stable networks. Highly adaptive informal networks move diagonally and elliptically, skipping entire functions to get things done (Goleman, Boyatzis, and McKee, 2013, p. 157).

What Goleman describes as empathy and social skills also applies to the person-environment (PE) fit, or the compatibility that occurs when individual and work environmental characteristics are well matched; and person-group (PG) or person–team fit, describes the interpersonal compatibility between individuals and members of their immediate workgroups (Kristof-Brown et al., 2014, pp. 969-989). PG is defined as the compatibility between individuals and their workgroups (Kristof 1996). All forms of PG fit are concerned with how an individuals' personal characteristics interact with those of other team members to predict individual – level outcomes.PG fit relates to individual outcomes through two primary mechanisms, each coinciding with a major type of fit. Supplementary fit-describes compatibility that occurs when individuals are similar to each other in terms of values or goals and convergence. Complementary fit is where the individual and the environment compete with each other. It is based on the psychological process of need fulfilment in which one party's needs are met by the other (or another party). Team level collective fit can be defined as team members shared assessment of compatibility with each other, and with the requirements of the task environment. Transformational leaders are generally recognised as influencing their followers by heightening their self- awareness, instilling a sense of purpose and mission, and influencing them to transcend lower order needs of survival, security identified by Maslow in his Hierarchy of Needs theory; and aspire to the higher levels identified by Maslow, those of belonging, prestige, and self-fulfilment for the sake of the long term benefit of the group to which they belong (Hoffman *et al*.2011, pp.779-796). Hersey and Blanchard claim that there are four distinct dimensions of leader behaviour associated

with transformational leadership (Hoffman *et al*.2011,p780). Idealised influence/ charisma- whereby leaders influence followers by arousing strong emotions and loyalty. Inspirational motivation, where the leader communicates high expectations, uses symbols and imaging to focus effort, and expresses the importance of organisational purposes. Intellectual stimulation-where the leader increases followers' awareness of problems and encourages them to view problems from a new perspective. Individual consideration-where the leader provides support and encouragement by giving personal attention to, and successfully advising followers.

Transformational leaders articulate a vision that emphasises the way in which the collective goals are consonant with follower values, causing the followers to regard organisational goals as their own, and give extra effort towards goals and accomplishments (Bono & Judge, 2003; Shamir et al, 1993).Bungay (2011) suggests that the effect of transformational leadership on team effectiveness is dependent on the followers perceiving consistency with their organisations values, as opposed to the personal values of the leader.

In interviews with the author and in his work, Bungay (Bungay 2010) draws extensively on his experience as a management consultant, senior manager, and a respected military historian. He examines the 19th century Prussian army which built its agility on the initiative of its empowered junior officers to show how effective organisations can be created. Bungay writes that leading is a human activity that is moral and emotional. This emotional thread has clear links with the work of Goleman. He discusses the ability of the leader to motivate and if possible, inspire followers so that they are willing to go in the direction and perform their own tasks better than they would have done had the leader not been there (Bungay, 2010, p. 229). He then discusses the need for a leader to balance the tasks, defining the task(s) of the group building the team, and developing the people within the team this is a clear reference to Adair's Action Centred Leadership model. Interestingly however, he takes the opposing view to Goleman on collective intelligence when he says 'the intelligence of an organisation is never equal to the sum of the intelligence of the people who work in it. It is either more or less'(Bungay,2011 p241). He makes the point that scientists who study complexity have shown that

complex adaptive organisations can be created by following very simple rules (2011p. 241). He then describes what he labels self-organising networks (2011p242) and concludes by offering what he describes as GBOs 'Glimpses of the Blindingly Obvious' (2011p.243). However, they come with the caveat that as they are glimpses, they may be missed if not paying attention. The first and last of the ten are particularly apt, as he says, 'we are finite human beings with limited knowledge and independent will,' and '*What has not been made simple, cannot be made clear and what is not clear will not get done* (2011p.243). [Author's emphasis added)

2.7 Contingency Theories

2.7.1 Situational Leadership

Hersey, Blanchard, and Johnson developed the theory of situational leadership, whereby an effective leader changes or adapts their style of leadership according to the situation and the maturity of the people being influenced (Hersey, Blanchard & Johnson,2001, p 151). Maturity consists of two components; Job maturity is related to the ability to do something and has to do with knowledge and skills. Psychological maturity is related to the willingness or motivation to do something; and has to do with confidence and commitment (2001p.157). Hersey, Blanchard, and Johnson are of the opinion that there are four approaches that can be applied dependent on the maturity of the group. 'Telling' is for low maturity, which is people who are both unable and unwilling to take responsibility to do something; and are competent or confident. 'Selling' is for low to moderate maturity, that is, people who are unable but willing to take responsibility, and are confident but lack the requisite skills at that time. 'Participating' is for moderate to high maturity, people who are able but unwilling to do what the leader wants. Hersey, Blanchard, and Johnson (2001.p153), suggest that 'delegating' is for high maturity, people who are both able and willing or confident to take responsibility. They seek to demonstrate the utility of situational leadership through weaving the various other theories into a holistic approach, using *inter alia* Maslow's hierarchy of needs theory, Herzberg's hygiene factors and motivators, McGregor's theory X and Y, and the work of both Argyris and Likert. The end result was

a series of grids with a curvilinear line showing the various correlations (2001 pp. 292-311) leading to the unsurprising conclusion that. 'There is still much that is unknown about human behaviour. Unanswered questions remain, and further research is necessary.'

2.7.2 Action Centred Leadership

The author's conversations with Bungay in his consultancy capacity dealing with clients on an international basis confirm that Adair is widely regarded as a leading authority on leadership and leadership development. He was a professor of leadership studies and the United Nations Chair of Strategic Leadership. Adair firmly believed that leadership can be taught, that it does not depend on personal traits, and that it is a transferrable skill. This idea, according to Bungay, remains popular because they are practical and relevant to managers irrespective of their working environment. Adair's work draws a clear distinction between leadership and management, the latter he contends is rooted in the mechanistic application of control techniques, and systems. This would appear to parallel Bennis's thoughts on managers who accept the *status quo* and apply systems and procedures at face value unquestioningly. Action Centred leadership has proved to be an enduring approach defining leadership in terms of three overlapping and interdependent circles which is both practical and simple. The individual's needs are physical, psychological and status, and in Adair's estimation the needs overlap. In 2011, Plymouth University Business School produced a short teaching piece on the utility of Adair's model, as illustrated in figure 2.10 below.

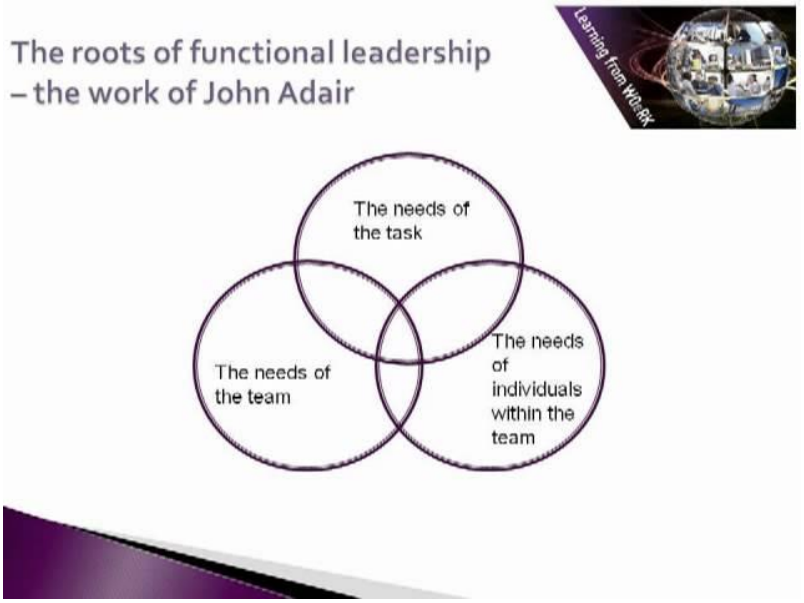


Figure 2.10: The roots of Functional Leadership - John Adair
Source: Plymouth University Business School. Available from https://www.youtube.com/watch?v=QZ8ft0coLpc.Accessed 21/6/21

The Plymouth University piece regards Adair's work as a reaction to what was seen at the time as the over-scientific approach to organisational development, with Adair's work being seen as a more person orientated approach. Its' utility lies in its simplicity and applicability across all work situations. Adair (2010) addresses the question of motivation in three parts.

(1) Understanding motivation-what is motivation and factors that affect both the team and the individual.

(2) Bridging the gap-how to balance the interrelationship and demands of each of the three circles, inspiring others, and

(3) How to draw the best out of people. Self-motivation, selecting motivated people, target setting and progress as motivators, rewards, and recognition. Adair then writes at length on leadership (Adair, 1984).

2.7.3 Can Leaders be Managers, and Managers be Leaders?

Bennis (Bennis 1998) presents the differences between a leader and a manager in a binary either/or situation, those differences being stark and mutually exclusive; in other words, a person can either be a leader or a manager. He is proposing that a leader and

a manager possess distinctive characteristics along with differing attributes. In this respect he differs from Goleman (1996,2013) in that he (Bennis)takes a polarised view of people's attributes and abilities. Bennis places little emphasis on the softer emotional intelligence side of organisational development; or the fact that people's responses can vary depending on the situations they find themselves in. In that respect he diverges from Hersey and Blanchard who recognise that situational leadership is a reality. Bennis describes the process of managing people as 'herding cats' (Bennis, 1998, p.7); and people of course will not allow themselves to be herded. They may however be coaxed, cajoled, persuaded, and gently led. But such individualism in part is what makes leading a group or team exciting and challenging. Managers are necessary, leaders are essential. Leadership, is of the spirit, compounded of personality and vision. 'Management is of the mind, more a matter of accurate calculation, statistics, methods, timetable and routine'(Bennis,1998,p.64).In the same military vein, Montgomery defines leadership in his autobiography as 'The capacity and the will to rally men and women to a common purpose, and the character which inspires confidence' (Montgomery,2007,p.80). This definition broadly converges with Adair's as Montgomery talks of a 'common purpose' which fits Adair's' Task' element, although 'men and women' is a looser definition of Adair's' Team' and 'Individual' elements. The phrases 'capacity and will' and 'character' all relate to the leader's ability to articulate the way forward and present it to the team/individuals. Bennis (1998) then sets out what he perceives to be the essential qualities of a leader and how they differ from that of a manager [1998,p 63].The author has set out a table showing the differences, see table 2.4 below.

Table 2.4: Differences between a leader and a manager

LEADER	MANAGER
Innovates	Administers
Is an original	Is a copy
Develops	Maintains
Inspires trust	Controls
Long range perspective	Short range perspective
Asks what and why	Asks how and when
Has their eye on the horizon	Has their eye on the bottom line
Challenges '*status quo*'	Accepts '*status quo*'
Is their own person	Is a 'good soldier'
Does the right thing	Does things right

Source: Author adapted from Bennis

Kotter, (1990), also addresses the matter of Leadership and how it differs from that of management. He thought that leaders do not produce consistency and order but produce movement through articulating a vision of the future along with the strategies for bringing that vision about. The strategy involves communicating the direction to those people in the organisation who understand that vision and are committed to achieving it. The leader also needs to keep those people moving in the right direction despite any major political, bureaucratic and resource barriers to change appealing to often untapped human needs, values, and emotions. Whereas management brings order and consistency through planning and budgeting, setting targets or goals for the future, along with detailed steps for achieving those targets and allocating resources to accomplish those plans necessary to fulfil the vision. In addition, managers need to establish an organisational structure along with jobs and skills needed to fulfil those

plans, including delegating responsibility for tasks, and establishing systems to monitor implementation and performance with appropriate feedback and corrective actions. The monitoring procedure allows for identification of deviations i.e., 'problems' along with measures for resolving them.

2.7.4 Environmental and Situational Leadership

Hersey, Blanchard, and Johnson(2001)developed the theory of situational leadership, whereby an effective leader changed or adapted their style of leadership according to the situation and the maturity of the people being influenced (Hersey, Blanchard & Johnson,2001,p151).This goes some way to converging with Goleman's approach on emotional intelligence in that Hersey and Blanchard recognise that the leadership dynamic can change depending on the circumstances and that those changed circumstances are recognised by the leader. It is not a 'one size fits all' approach as would seem to be advocated by Bennis. Further research by Korman (1966) concluded that since situations differ, so must a leader's style. This was reinforced by Gibb and Hare (1961) who stressed the need for democratic, permissive group orientated leadership; but recognised that there may be instances where a more autocratic, authoritarian style of leadership (such as some forms of military leadership) would be appropriate. The general conclusion arrived at was, that there is no 'best' style of leadership, and that successful leaders are those who can adapt their leader behaviour to meet the needs of their followers and of particular situations. Sanford (1950) was of the opinion that there is some justification for regarding the followers as the most crucial factor in any leadership event. Followers in any leadership event are pivotal, not only because individually they accept or reject the leader, but collectively they can determine whatever personal power a leader might have.

2.7.5 The Environment- The Western Desert

One of the most comprehensive and magisterial works on the desert war that illustrates the desert environmental conditions has been compiled by the French author and historian Pallud (2012). Comprising nearly six hundred pages, it chronicles the campaign from June 1940 to May 1943.The extensive text is accompanied by a comprehensive

photographic record of actions, equipment, and locations, including towns, settlements, and other notable places and landmarks. The unique aspect of this work is, as the '*Then and Now*' title suggests, a comparison of then and now using wartime archive photographs alongside present day colour photographs taken from the same spot or as near as can be practicably accessed. Particularly striking comparisons can be seen under the heading Fall of Tobruk (Pallud,2012, pp.294-311), and of the actions around Sollum and Bardia. Away from headquarters, and 'up the blue' as the desert was known, Kings Regulations relating to uniform dress code counted for nothing and pilots in particular disregarded the strictures about wearing a service collar and tie (see figure 2.11below). Some of this was sartorial informality away from the strictures of headquarters, but the disregard was also essential to survival. A fighter pilot's life depended on keeping a continuous lookout through 270 degrees for enemy planes, (See figure 3.2 below), and wearing a collar and tie restricted head movement and soon chafed the neck leading to desert sores. Quite a few wore cravats, or silk scarves instead (see figure2.11below). Men acquired sunglasses looted off dead Germans (German optics being much prized as being superior to British optics), grew beards, wore only shorts with rolled down socks and boots. Amongst the pilots, cricket jumpers along with university scarves and corduroy trousers were essential in the cold evenings. Some ground staff adopted Arab desert headgear and face scarves to protect themselves against the hot wind, the sun, and the pervasive fine gritty sand. *The Desert War Then and Now* shows two photographs, one depicting the onset of a *Khamseen* sandstorm and one of a soldier demonstrating the type of facial protection so vital to surviving such a storm(Pallud,2012,p.419).The desert was a great personal leveller; distinction between ranks quickly disappeared in combat (Clayton and Craig 2002p278). Officers, Non-Commissioned Officers, (NCOs) and other ranks regarded themselves as one group all in the same position. In such an atmosphere of easy comradeship (see figure 2.11 below) there was no need for formal discipline–would you do this please?' was about as strong as an order got (Clayton & Craig, 2002pp 342-343).

260 Squadron pilots. Left to right: Lionel Sheppard, Cundy, Edwards, Fallows, Gilboe

Figure 2.11: Informal group of pilots

Source: *End of the Beginning,* (Hodder and Staughton, 2002)

The desert made no distinction between friend and foe, it was as hard on the Germans and Italians as it was on the Allies. The Western Desert campaign in North Africa was fought in a desert area, which is on a much larger scale and unlike the four deserts or semi deserts found elsewhere in Europe (Liddell-Hart, 2011; Collier, 1977). In those areas rainfall usually amounts to less than 250 mm (10 inches) a year, and in some years may experience no rainfall at all. The Western Desert combat theatre considered in this thesis is classified as a hot desert climate on the internationally recognised *Koppen* climate classification BWk (Peel, Finlayson & McMahn,2007, pp.1633-1644). A hot desert climate typically can reach a day- time temperature of over 40 C, (104F). Some desert locations consistently experience exceedingly hot temperatures all year round, even during winter. These locations feature some of the highest average temperatures recorded. Recognising that desert environmental conditions were so demanding on operations, the Air Ministry in London published a pamphlet (Air Ministry, n.d.) which was distributed to all aircrew serving in desert regions. The pamphlet outlined emergency advice on how to survive in desert conditions and faced with the prospect of having to walk out of the desert. Several scholars have noted the gruelling environmental conditions in the Western Desert (Bungay, 2002; Dimbleby, 2012; Pallaud, 2012; Moorehead, 1944), Clayton and Craig (2002, pp.109,216-235) wrote that

the feeling in the Western Desert was one of two adversaries against a common foe and living conditions under canvas were spartan. (See figure 2.12 below):

Figure 2.12: Desert living conditions.

Source: Omert (2007)

Marlantes, in his book *What it is like to go to War* (2011, pp.229–232) cites the example of a German armoured reconnaissance unit who at one point over the course of a few days, came to a 'gentlemen's agreement' with the British Royal Dragoons and 11th Hussars, to trade a supply of quinine to the British for the return of their Medical Officer who had been captured. Subsequently, they arrived at an agreed situation whereby hostilities finished for the day at 17.00 (5pm 'Tea-Time') (Marlantes,2011 pp.124-125). Dimbleby's *Destiny in the Desert* (2012) draws on first-hand accounts and official records and charts the political and strategic realities that lay behind the conflict in North Africa, from the first Italian soldiers entering Libya to the months that led to the final Allied victory. It provides a portrait of what it was like for the politicians, civil servants, military commanders, and the armed forces who struggled and sacrificed their health and lives on the harsh, dusty battlefield where the second Battle of *El Alamein* was fought. The book was later turned into a BBC TV drama-documentary *The Road to El Alamein*

broadcast on BBC 1.Dimbleby also gave a one-hour lecture attended by the author, on the topic followed by a sale of his book and book signing at the National Army Museum, Chelsea, London in June 2013.The author is of the opinion that the inclusion of this reference to the lecture is important, as although it is not strictly within the bounds of a conventional literature review. However, the fact that the lecture was tied to the book and disseminated to an erudite audience at a national institution lends credence to the provenance of the source. The following extracts relate to the time of the second battle of *El Alamein* from 23rd October to 4th November 1942.'The Eighth Army's superiority in infantry and tanks was matched in the skies above the battlefield ------ one bombing raid alone, in the mid-afternoon of 2nd November prompted 200 German infantrymen to throw down their arms and surrender' (Dimbleby, 2012, p.415). On the Desert Air Force's air effort, Dimbleby writes. 'When the RAF joined the fray-flying no less than 1,000 bombing and fighter raids on the 24th (October) alone-the German gunners reacted by using the 88mms in their original anti-aircraft role' (2012, p.385).

In his work *Together we Stand*, Holland (2006, pp. 51 175,271) writes on the remarkable logistical efforts of the Desert Air Force:

> --- Arthur 'Mary' Coningham had lost around 600 fighters and 140 bombers since the beginning of May 1942.That he was able to keep these strikes going was due to the extraordinary efforts of the Middle East Maintenance and Supply Organisation run by Air Vice-Marshal Grahame Dawson.

Later on, in the same work Holland writes on improvisation in the desert with no fixed facilities and little or no sophisticated workshop equipment:

> The ground crews had been stripped of much of their equipment, to enable them to move at a moment's notice, but despite this handicap they maintained an extraordinary level of serviceability. By working through the night, they ensured that the Desert Air Force was able to keep around 80 per cent of its strength for much of the time (2006 p.174).

Holland then pays particular attention to the maintenance and repair service managed by Air Vice-Marshal Graham Dawson, who was a highly unorthodox 'can-do' manager with a 'make do and mend' and 'managing somehow' approach. So instrumental was Dawson to the success of the Desert Air Force that Ehlers devotes five pages to his achievements which by any engineering yardstick are impressive (Ehlers, 2015, pp.134-138; see also Shores, 2012,p.417).Dawson even took the unorthodox measure of establishing a network of engine repair workshops in the back streets of Cairo (HMSO, 1945,p.38).See figure 2.13 below:

Figure 2.13: Back Street Maintenance in Cairo.

Source: HMSO (1945) RAF Middle East, the Official History of Air Operations February 1942-January 1943.

In his drive for innovation, Dawson also commandeered the ancient network of caves at Tura in the Mokattam hills south of Cairo as workshops. He had the cave walls whitewashed, along with the installation of lighting, electrical power, and concrete floors (HMSO,1945, p37). See figure 2.14 below. Not only were they secure and bombproof, but they also provided a cool and less dust laden environment for repairs.

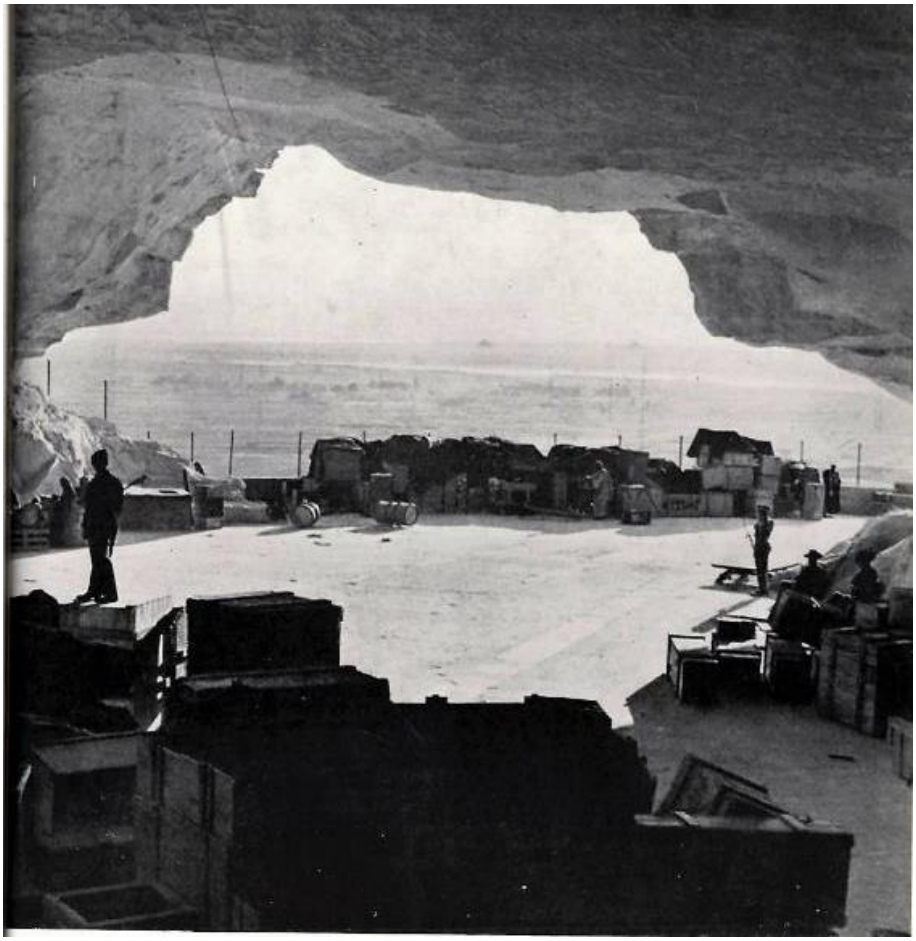


Figure 2.14: Tura Caves in The Mokattam Hills

Source: RAF Middle East, the Official History of Air Operations February 1942-January 1943. HMSO Crown Copyright 1945.

2.7.6 Team Dynamics.

Teams can exist in a variety of guises in organisations and in the context of this thesis the pilot-fitter-rigger team can be considered to be a task force, a work unit, and to an extent, a quality team, and an improvement team. Inspection of the team leadership model and the eight standards show that they can be applied to the pilot-fitter-rigger team (Northouse, 2013. P.287). Given the situations and operational environment that the team worked in, leadership often became shared or distributed amongst team members as conditions varied. In some instances, the pilot would give instructions as to what needed to be done, in other instances, either the fitter or the rigger would take the lead, so the team dynamic had considerable capacity (2013p.299). The fluid tactical

situation in the Western Desert often required team members to engage in collective decision making to help the team adapt to the fast-moving battle situation (2013 p. 293). The respected war correspondent, Moorehead (1944, p39), compared the campaign to a battle at sea. At the outset of the Western Desert campaign, the RAF presence in Egypt was under-resourced and equipped with aircraft that were, in the main, obsolete, and distributed over a wide area, responding to army requests for supporting air operations on an *ad hoc* basis which greatly diluted its operational capacity. By the time the campaign drew to a close in February 1943 the Desert Air Force was a dynamic, self-supporting, innovative mobile force with up-to-date aircraft and equipment served by well organised logistical support, all capable of operating over long distances- it had been transformed by the collective effort of the organisation. Extracts from Caddick-Adams' *Monty and Rommel–Parallel Lives* (Adams, 2011, pp.268–271) give some idea of the privations, heat, the desert '*Khamseen'* sandstorms and working conditions. Bungay (2002), in *Alamein* describes the environment, and the plague of flies that afflicted everybody along with the desperate water situation. The water was heavily chlorinated and the team bonding ritual of tea making the 'brew up' took place at the least excuse. Tea kept the forces going; and was performed at least three or four times a day; and nothing was allowed to interfere with it (see figure 2.15 below). Crews learned how to brew tea while on the move, and crews of disabled vehicles or tanks were observed to get out and make tea behind their vehicle in the middle of a battle. However, there was an element of British self-effacing dark humour, in that a tank that had been hit and exploded subsequently catching fire trapping the crew inside was said to be 'brewing up.'

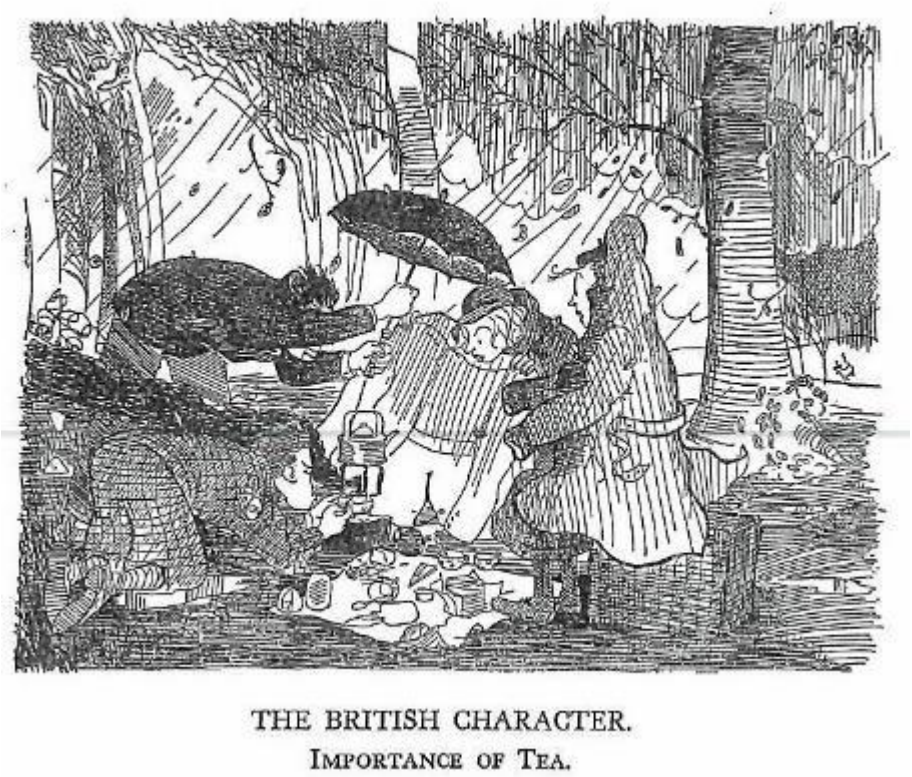


Figure 2.15: Importance of Tea.

Source: Pont t*he British Character* (1982)

In the featureless landscape some found that the monotony, the unbroken succession of empty, ugly insipid days, resulted in a form of depression known as desert weariness inducing a mental torpor which, if unchecked became total apathy, and morale and efficiency declined. The Western Desert represented a harsh unyielding environment in which to wage war, both Moorehead (1944 Bungay2002), describe desert conditions. Bungay (2002) is colourful in his description of living conditions and personal hygiene factors, leaving little to the imagination of the reader. If and when leave was granted, everybody went to Cairo or Alexandria, but most went to Cairo. Cairo was a complete contrast with conditions in the desert. To those in the front line less than 100 miles away, the juxtaposition of the two worlds must have seemed surreal. There was no food or drink rationing, people could eat as much as they liked and were safe. Its' luxurious restaurants, bars, night clubs and brothels were always full. It was an old imperial city full of mystique, and effortless superiority which the British cultivated across the Empire. Polo was played, and officers relaxed at the Gezira Sporting Club occupying most of the

southern part of Gezira Island with gardens, nine sports pitches and courts, a 5,250-yard golf course and a racecourse (Cooper,2013,pp.38–39). A favourite place was the famous terrace of Shepeard's Hotel (see figure 2.16 below),away from the terrace inside the hotel, women were not allowed in the Long Bar so that the men could talk freely(pp.94-95).Dress code was informal uniform(pp.242-243).(See figure 2.17 below).Neither was there a shortage of female companions for men who had been in the desert for often months at a time, some women came to make a profitable free-lance living from what Montgomery coyly referred to as 'horizontal refreshment'. Some came for the social life and party circuit, some came as refugees, and some came hunting for a husband in a time of great insecurity (Cooper,2013, pp.119,127-130).

Figure 2.16: Shepeards Hotel, Cairo.

Source: Cooper, A. Cairo in the War 1939-1945 pp 130-131. John Murray 2013.

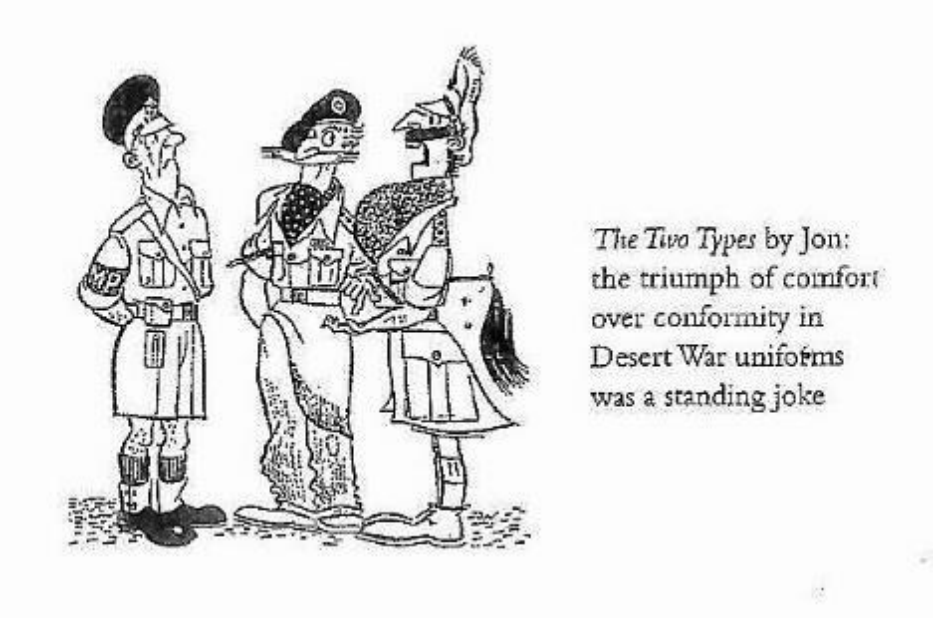


Figure 2.17: Informal Dress Code

Source: Cooper (2013 pp242-243)

There was also a thriving literary and artistic set centred on the *salon* of the British Diplomat Sir Miles Lampson, later Lord Killearn, and his wife, Jacqueline. They threw glamorous parties for what became known as the 'darling belt' including Evelyn Waugh, Noel Coward, Lawrence Durrell, and the Cairo *literati* (Cooper,2013 pp.253–266). Staff officers in Cairo were perceived by many in the desert to have an easy posting, so much so that they earned themselves the sarcastic *soubriquet* of the 'Gabardine Swine' (Bungay,2002,p.96).Their freshly pressed and privately tailored uniforms attractive to the women. The works of the like of Bungay, Caddick-Adams, Cooper, and Dimbleby cited above, all state what happened and when, blending history, individual experiences, and analysis with a writer's eye for a story that will appeal to the commercial market. This together with what appears in some literary quarters to be a predilection with headline, or celebrity figures such as Churchill and Montgomery somewhat distort the exposition of history, leading to other equally important aspects being neglected or overlooked such as the first two battles that formed the trilogy of the *El Alamein* battles; the first battle of *El Alamein*, July 1942 and soon after, the battle at *Alam al Halfa* in August/September 1942,which could give the less discerning or aware reader a partially

rounded view of history-eventually giving rise to a reductionist‘ Bad History’ or the ‘Airfix school of History’(Mahoney, 2017).

That same reader could be forgiven for gaining the impression that the Second World War from the British viewpoint consisted of the invasion of Poland, the fighting retreat and evacuation of the BEF from Dunkirk, the Battle of Britain, the *Blitz,* the *denoument* of the second and final battle at *El Alamein* in October/November 1942, then D-Day and VE and VJ Day, with nothing much happening in between. This approach to history satisfies only the populist person in the street school of history, perpetuating myths and/or selective suppositions. This superficial understanding gave rise to the remark in an interview to this author by Christopher Dorman O’Gowan, whose father ‘Chink’ Dorman Smith, as Auchinleck’s Deputy Chief of Staff, was responsible for the defence at the first battle of *El Alamein*, was that ‘orthodox history is for the ignorant’ (Dorman O’Gowan (Smith), 2016). Headline history makes for bestselling ‘coffee-table’ books and maximises the income stream of the writer but may contribute little to historical debate and encourages the view that the Second World War was a series of separate unrelated events. However, they are useful works in their own right describing the campaign or action in detail in their narratives.

The work of Graicunas (1937) is quantitative in nature and takes the principal form of an algebraic formula which purports to determine the number of interpersonal relationships within a group when a number of subordinates is stated. His work was directed at identifying the lack of a theoretical basis for the empirical belief in limiting the span of control. He summed up the prevailing view of the reason for limiting the span of control as ‘One of the surest sources of delay and confusion is to allow any superior to be directly responsible for too many subordinates. Graicunas also cited the controversial General Sir Ian Hamilton (1922) of the ill-fated Gallipoli campaign who said

> The nearer we approach the supreme head of the whole organisation, the more we ought to work towards groups of three; the closer we get to the foot of the organisation, the more we work towards groups of six’

Graicunas suggested that the maximum number of subordinates should be five, and probably four in most cases. His work contains formulas, a table, and a chart, showing the exponential growth in complexity of relationships as the number of reporting subordinates increases. Graicunas refers to 'relationships' and although he does not explicitly define the term 'relationship' he refers to interpersonal working relationships. Using the formula (see equation 2.1 below), the number of relationships (r) can be found if the number of subordinates (n) is given (see table 2.5 below).

For example, if a supervisor has 5 subordinates (n=5) then the number of relationships (r) that they have to control can be calculated.

Equation 2.1: Graicunas Equation Calculating Span of Control

$$r = n\left(\frac{2n}{2} + (n-1)\right)$$

Where r = number of relationships

n = number of subordinates

$$r = 5\left(\frac{2n}{2} + (5-1)\right)$$

$$= 5(5+4)$$

$$= 5(9)$$

$$= 45$$

Source: Graicunas, theory of Span of Control and formula (Graicunas, 2011)

Table 2.5: Correlation between number of subordinates and resulting relationships.

Number of subordinates	Number of relationships
1	1
2	4
3	18
4	48
5	100
6	180

Source: Graicunas, V.A. Theory of Span of Control and Formula (Graicunas, 2011)

According to Graicunas when the number of subordinates increases then there is an increase in the direct single relationships. Direct group relationships and cross relationships. As the number of subordinates increase arithmetically, the number of relationships amongst them also increases geometrically. According to Graicunas a senior manager can only effectively manage six subordinates which by his formula gives a total of 180 inter-personal relationships. So, how many is too many when it comes to subordinates? There is no hard or fast answer. It is very much up to judgement in each case, one that is affected by factors such as the ability and style of the manager, the scope and scale of the work assigned to the individual team members, and the amount of interaction that happens between and amongst team members and the manager. Graicunas's approach was purely mathematical and in that respect was mechanistic and took no account of the quality of the relationships, their frequency, duration, and complexity; only that they existed. However, his work is useful in that gives a leader or manager a good indication of the volume of relationships and ability to 'size' the situation being considered.

2.7.7 Group Formation

In his work on human groups Homans,(1951),uses amongst others, a case study utilising the work done by Mayo *et al* on the 'Hawthorne effect' at the Hawthorne Chicago Illinois plant of Western Electric. Homans and his colleagues were interested in the research as far as it illustrated how working people behaved. 'A group of people behaved in these ways, among others for a certain period of time' (Homans, 1951p48). Homans looked at people who participated together in events and concluded that 'participating together 'is positive interaction, and a group is defined by the interaction of its members (Homans, 1951p 84). He also said that individuals may belong to more than one group and that a group may be a subgroup of a larger entity; with the primary group being the group where each member of the group is able to interact with every other member (Homans,1951p85). The theory postulates that a group exists within a three-part environment (see Table 2.6 below).

Table 2.6: Homans three-part environment

ENVIRONMENT	COMPONENTS
PHYSICAL	Terrain, Climate, Layout
CULTURAL	Norms, Values, Goals
TECHNOLOGICAL	State of Knowledge

Source: Author, elaborated from Homans (1951)

The environment imposes certain activities and interactions which arouse emotions and attitudes (sentiments) towards each other, and the environment seldom wholly determines social relationships. These activities, interactions and sentiments combine to create the external system Homans (1951), increased interactions produce sentiments towards one another developed by members of the group in the course of their life together that are not specified by the external environment Homans (1951). Homans called this the internal system Homans (1951) and those the external and internal systems were interdependent but combined to make up the total social system

Homans (1951). He also went on to say that ‘a social system has one overall characteristic; it is an organised whole made up of units that are themselves organised’ (Homans (1951).

A review of the British Defence Doctrine 5thEd (BDD) reveals four points that are worth discussing.

1. The concept of *'Mission Command'* enshrined in the publication seems from the author’s research reading, to be a direct lift of the German military doctrine *'Auftragstaktik'* developed by the Prussian Great General Staff after the Prussian defeat at Jena and Auerstadt of 1806 and perfected by the *Wehrmacht* in the Second World War. Also, in any case why embrace a doctrine from an organisational source that has lost two major world wars in the last one hundred years? If the concept of *Mission Command* has been appropriated from the German *Wehrmacht,* then it would seem to the author that it is not a particularly sound source of military doctrine. Lastly and most importantly nowhere in the publication is there any apparent reference to the principle of 'feedback' in the *Mission Command* model, unless that is, the principle is implied. If it is indeed an omission then in the author’s opinion this undermines the concept, as the lack of feedback effectively makes the system an 'open loop system' liable to going out of control very quickly. It has been the author’s experience as a manager designing, implementing, and managing manufacturing and administrative systems, the principle of feedback is fundamental to the satisfactory functioning of any command and/or control system.

2.8 Summary of the literature review-

2.8.1 key messages

The literature review started with the evolution of the RAF, moved on to examine the environment of the Western Desert in which the Desert Air Force operated; and how its organisational development was influenced by European history starting with the Age of Enlightenment. Prussia and Britain are compared and contrasted as parallel examples on how social and military thinking developed throughout the 19th and 20th centuries

in their respective societies. The review then developed the theme by examining published work on military history and it is here across all the *genres* looked at, the dearth of writing and knowledge of the work and organisational development of ground crew becomes apparent. The predilection with the exploits of air crew at the expense of ground crew is understandable up to a point, as is the case in so many instances, the publishing houses and associated media to a great extent lead and set the agenda as to what people read and assimilate; and of course, to make a financial profit out of populist history- 'The Airfix School of History' (Mahoney 2017). Aspiring and established authors and the 71 Military History publishers and 493 Academic publishers (Publishing Global, n.d.) have commercial considerations to consider, for example, will the item sell? Will it make a commercial return on the investment and prove lucrative to the publisher and author alike? Figures from the Publishers Association representing UK book publishers for the year 2020 for which market figures are available; show that the total value of the UK publishing industry stands at £6.3 bn. Taking the sectors most relevant to this thesis, the individual consumer publishing sector stands at £2bn with the academic publishing sector standing at £3.95bn. Digital and audio representing the balance (Statista, 2020).

All the military history works surveyed in this literature review concentrate almost without exception on the strategic and tactical picture, they describe events, actions, and the *materiel* of the campaign, but pay little attention to the 'soft' human side of the campaign, and how the people involved interacted. There are a few instances of well-meaning, well intentioned platitudes directed at ground crew but there is no concerted attempt to explore or understand their working dynamic and *milieu(x).* Given this preponderance of evidence, it would seem that writers find it easier and more comfortable to write about things such as the Spitfire, AVRO Lancaster bomber or the German Tiger tank, rather than about people. Inanimate objects such as aircraft or tanks do not have a counter view or their own position, whereas people come with points of view, their intellectual position, and emotion. The discussion can get complicated as in the case of the successful post war libel suit brought against the serving Prime Minister Winston Churchill, by Eric 'Chink' Dorman O'Gowan (Smith) over his [Dorman Smith's] contribution to the first battle of *El Alamein*. Authorship is well distributed across the

campaign, all describing what happened, when it happened and where, who was involved, along with the *materiel* but nobody really questions the historical *status quo.* All the authors go along with the established orthodox history, and there is no real dissent amongst the military history writing community as to events. It is only when the memoirs, diaries, and personal papers of ground crew in the Western Desert are examined does a different picture emerge, a more authentic powerful unfiltered picture, one which gives a more detailed individual account of what it was like to be scared, nearly always thirsty, extremely uncomfortable, and sometimes hungry at the forefront of the Western Desert campaign.

Through the literature review the author has examined 330 works used in this thesis relating to the conduct of the Second World War including the Western Desert campaign. The author has not been able to discern any academic discussion, analysis, or disagreement between authors as to the conduct of the war. Everyone seems to agree with everyone on everything and go along with the *status quo* that 'we' (the British and the Allies) won and that 'they' (the Germans and Italians) lost. The degree of agreement between authors is reminiscent of Dr Pangloss's view in Voltaire's satire *Candide* that in this best possible world, everything happens out of absolute necessity, and that everything happens for the best. In other words, putting the best possible interpretation on events. The only point of contention the author could draw out is that Holland in his work (2006 64,pp 419-420] is more sanguine than other historians over the potential threat to British oil interests in the Middle East. The British had an historical presence in Egypt, partly to protect the strategically important Suez Canal as part of the trade route to the Empire in India and East Asia, partly to counter French influence in Syria and partly to protect and husband the Middle East oil fields in Iraq. He advances the point that the loss of the oil fields would not have been the strategic loss history postulates, as the Middle East only supplied the British in the region, and that anyway oil could always be sourced from British territory in the Caribbean and from America. However this overlooks the fact that by the end of May 1941 oil stocks in the United Kingdom had fallen below the level that had been declared to be the absolute minimum for safety (Forczyk, 2016).

After reading a relevant selection of academic papers in the course of the literature review, it is the author's conclusion that there are two general comments to be made regarding academic papers. Firstly, there is a lack of context, consequently it is difficult to get a feel for the situation and the people being theorised about, which after all is the main point, examining, analysing, and discussing human behaviour and endeavour. Secondly, academic papers propose a situation which may exist in pure terms, for example, Bennis's (1998) work on the differences between a leader and a manager is satisfactory for describing what *should* happen in absolute terms, but pays no regard to what *might* happen, or what *does* happen in the real world. This is especially important if the academic papers are to have constructive utility for leaders and managers in their real world of day-to-day work; otherwise there is the temptation on the part of the busy leader or manager to say, 'this is all very interesting and useful to know as background knowledge, but how does this help me to solve my immediate problem'? A case in point demonstrates the question of the academic utility of inquiry and research in the course of the research for this thesis the author contacted a well-known owner of a company which restores, maintains, and operates vintage Second World War piston engine aircraft on the UK and European air show circuit and film work. The aim of the contact was to interview her (the owner) with a view to gaining her judgement on the qualities and characteristics of ground crew using Belbin's team roles as a questionnaire. She declined saying 'I do not have time for academics, I have got a business to run (Grace 2016).

With the exception of Goleman and chapter thirteen of Hersey, Blanchard, and Johnson's work the literature on leadership and organisational development although comprehensive, deals with theories in isolation to one another. This could lead to a fragmented overview of the field of organisational development, in much the same way that the historiography consulted thus far gives a fragmented overview of the Second World War. Goleman has come closest to a 'holistic' approach; developing his work on Emotional Intelligence which focuses on how well a person understands their own and other people's emotions and their ability to use that emotional information to guide their thinking, behaviour, and work performance. Goleman also postulates that IQ is not

the sole arbiter of a persons' intelligence and acknowledges the theoretical links with leadership theory. With the exception of Cubbon (1969, pp.111-128) and Sheffield (1999), none of the works or papers explicitly consider gender, ethnicity, cultural, or social factors such as class (in the United Kingdom context), and national characteristics, and whether those factors translate across cultural boundaries. Consequently, they treat people as a homogenous group existing in a detached neutral state. Whether this is intentional to reduce the situation to a minimum and retain objectivity is hard to ascertain, but if there is an intention to exclude or ignore those factors then the work may be rightly open to criticism in today's multi-cultural society. Cubbon's (1969) paper recognises the importance of social context and refers to the urban social conditions prevailing in Chicago in the mid-1920s, and its' effects on the people being studied. On the question of multiple intelligences, the various works of Thorndike (1920), Vernon (1933), and Gardner (2011), seem to cover the same broad areas but with their respective nuanced themes. Both Thorndike and Vernon address the question of social intelligence which broadly coincides with Gardner's (2011) work on inter and intra-personal intelligence. However, all the work on multiple intelligences could be subsumed under the heading of emotional intelligence (see table 2.3 above). The work on multiple intelligences allied with Homan's (1951) work on group formation has real pragmatic utility with regard to ground crew in the Western Desert, working as they were in particularly dynamic situation requiring a significant input of group decision making with very little direct management or supervision.

The literature review and associated research has identified and described three distinct but inter-related *genres* of literature relevant to the RAF and the Desert Air Force operating in the Western Desert campaign from June 1940 to February 1943.It gives an overview of what has been said, who the key writers are, and the emergent key themes factors and sub- themes and provides an early context setting chapter. On reading the literature it becomes readily apparent is that the three *genres* deal exclusively with the geopolitics, strategy, tactics, and operations associated with the Western Desert campaign with the emphasis firmly on the work of allied aircrew with only passing albeit, `fulsome references and praise to the parallel work of the associated ground crew.

All the works reviewed take the ground crew contribution as a given. The emphasis on aircrew to the virtual exclusion of ground crew gives rise to two separate but inter-related *lacunae* in the history and development of the RAF. The first *lacuna* lies in the virtual absence of comprehensive written work, discussion and analysis of the contribution made by ground crew to the Western Desert campaign in terms of operations, duties, and responsibilities. The second *lacuna* which follows from the first is in question of the organisational development of ground crew and the examination of interpersonal dynamics in the context of the pilot-fitter-rigger teamwork in the Western Desert campaign. Taken together these two interrelated *lacunae* show that there is no substantive work or body of knowledge on ground crew within the Desert Air Force in the Western Desert campaign. This gives rise to a general *lacuna* in the history of the operational and organisational development of the Royal Air Force.

To help inform the discussion of the literature review and to give an idea of the UK market context, the size of the publishing market for both consumer and academic markets in the UK were identified along with their financial indicators. The author then returned to his argument that academic works are, with the exception in Cubbons' (1969 work on the' Hawthorne Effect', deficient in that they lack context and consequently it is difficult for those works to be sufficiently attractive to everyday leaders and managers. The historiography of the Western Desert campaign is subsumed in the historiography of the Second World War as a whole. As the research question concerns itself with organisational development aspects of the interpersonal team interpersonal dynamics of teams in the Western Desert campaign, the literature review had to consider the campaign at both a strategic and tactical military level in that conflict, as well as set the organisational development aspects of the team's interpersonal dynamics in the context of the campaign and the wider context of the Second World War. From an examination of the literature available across all publishing sectors it can be concluded that there are principally six sources of published research data, and they are distributed across three broad *genres.*

The first *genre* comprises commercial publications by established authors and historians which are widely available and target a readership concerned with research both at a

learning level for professional employment, self- advancement, or for leisure. This *genre* can be subdivided into a further three *sub- genre(s*). The first is what are commonly described as 'coffee table' publications, those publications which are aimed primarily at the broader market of casual readers, sometimes in paperback form. The second *sub-genre* comprises of those works the author identifies as 'bedside cabinet' reading, those aimed at lighter reading often on a specific narrow topic, designed for the casual reader to dip in and out of, and turn a few pages (Latimer,2001). They provide a good entry level to more sustained contemplative research. The third *sub-genre* consists of 'contemplative' publications such as Bungay's (2002) work on *El Alamein*, and Ehlers (2015) work on the Mediterranean air war. These types of work are designed to promote a deeper understanding of the subject matter and sit somewhere between the 'coffee table' and 'bedside cabinet' *genre* and the more academic *genre* described next.

Turning to the second *genre*, the academic sector, there are peer reviewed academic works and journal papers available through the Cranfield University Barrington Library, professional organisational development organisations, or directly on-line *via* the internet; and authoritative organisational development publications such as The Harvard Business Review. It is the author's conclusion that having read the academic papers in detail during the research for that there are two general comments to be made regarding academic papers. Firstly, there is a lack of context, consequently it is difficult to get a 'feel' for the situation and the people being theorised about, which after all is the main point, examining, analysing, and discussing human behaviour and endeavour. Secondly, academic papers propose a situation which may exist in pure terms, for example, Bennis's (1998) work on the differences between a leader and a manager whilst satisfactory for describing what *should* happen in absolute terms, disregards what *might* happen, or what *does* happen in the real world.

The third *genre* consists of official archives, memoirs, diaries, and personal papers; the authoritative sources are the Archives at the Royal Air Force Museum, which holds amongst its records, a collection of memoirs, diaries, and personal papers of the various stakeholders in the Western Desert at the time. Also, the National Archives at Kew for the Air Files series relating to official matters. Both repositories of sources were

consulted extensively and provided invaluable background information. This was particularly relevant with regard to the collection of personal papers and diaries held at the RAF Museum, Hendon, the content of which provided what could be regarded as a 'first hand 'record of events unfiltered through commercial or official considerations- they provided a much-needed human aspect and colour to what were otherwise colourless sources.

It can be concluded from the literature review that there are two separate *lacunae(e).* The first is in the history of the development and organisation of the Royal Air Force. The second is in the fact that there is no comparable discussion of Fighter Command ground crew, particularly the pilot-fitter-rigger interpersonal team dynamic under combat conditions.

CHAPTER 3 METHODOLOGY

The first two chapters have set the context for the thesis, by describing the sequence of events that bought the Royal Air Force to Egypt prior to the Western Desert campaign, and the literature relating to its' operations and organisational development. To help set the framework and inform the methodology that follows in this chapter, the author has constructed a matrix detailing the type of data that is needed to be gained from the research and is shown at table 3.1 below.

Table 3.1: Data Matrix

TYPE OF DATA NEEDED	WHAT THE AUTHOR REQUIRES	METHOD	
CONTEXTUAL	Organisational background and development, history, structure, values, culture, leadership, and functional organisational development theories.	Literature review, official histories, reports, correspondence, observations, artifacts, internet, field visits.	Triangulation of information
DEMOGRAPHIC	Descriptive information regarding participants' age, gender, and ethnicity.	Participant interviews, literature review, biographies.	
PERCEPTUAL	Participants' descriptions and explanations of their experience as related to the phenomena under study.	Participant interviews, biographies, literature review.	
RESEARCH QUESTION	The research questions.	Participant interviews, literature review, documents, correspondence, observations.	

Source: Author's elaboration.

3.1 Overview of Data Requirements.

The thesis combines the social science discipline of organisational development with the history branch of the humanities, specifically military history, and when considering the historical development of organisational development, it is reasonable in the author's opinion to be cognisant with the period known as the Age of Enlightenment (Gay, 1966), and the emergence of rational scientific thought. Scientific thought radically shaped both the British and German national social contexts and their respective differing notions of collective endeavour. These differing notions fed into their respective military thinking having a direct impact on the conduct of the Western Desert campaign. The combination of organisational development and history had a direct bearing on elements of the literature review. Therefore, holding that cognisance in the background, the research question is set in the context of a military organisation, in this case the Royal Air Force operating in a desert combat theatre in the early 1940s.To better understand the question, it is necessary to collect and analyse data in four areas:

Contextual (see table 3.1 above). The first data element is contextual in that it relates to the culture and environment of the organisation in question, in this case the Royal Air Force-specifically the Desert Air Force which was in this instance a part of the Royal Air Force exclusively engaged in the Western Desert campaign. This is important, because elements within the environment and culture may influence behaviour as observed by Lewin (1935). The fundamental proposition is that people's behaviour is related to the interaction between the person and the environment in which the person is situated. Therefore, it would seem sensible to consider the question of what information is to be gathered in a holistic way. Such information will include the history and organisational development of the RAF, its' structure particularly at a squadron level. Also included will be information on its leaders, their strategy and tactics when conducting the Western Desert campaign and its contribution to the greater strategy of winning the Second World War. Also, information will be collected on the *materiel* such as aircraft, equipment and facilities and infrastructure at their disposal. An important aspect will describe the geographical, environmental, and physical conditions prevailing in the Western Desert and its significant effect on the conduct of the campaign. This effect was

felt by both the RAF and the *Luftwaffe (*the RAF's principal opponent in the campaign) and proved to be a great leveller on the armed forces of both the British and the Germans. The primary method of collecting the contextual information has been through a critical literature review of commercial publications describing the history and development of the RAF, both in terms of operations and in terms of organisational development encompassing both structure and training. This will be in tandem with the collection of information through official histories, RAF internal documents and correspondence, as it would be impossible through interviews to gather the volume or depth of information needed for this thesis; there is only so much information that can be gleaned from interviewing elderly men.

Demographic-see table 3.1 above. The fact that so few Fighter Command pilots, and ground crew are alive and able to be interviewed necessarily makes for both a small sample (Battle of Britain Historical Society,2018) and one that is exclusively white male, and composed without exception by individuals that are now in their mid to late 90s.In the 1940s, fighter pilots were drawn from several sources depending on their background and education. See Organisational chart at figure 1.1 above.

Regulars: These could be either, Regular full time RAF Officer pilots on a short service commission.

Or

Graduates: University graduates who had previously attended a public school (James, 1991, p. 143) and were recruited directly from university (this also included squadrons formed around particular universities and known as University Air Squadrons UAS).

Or

Sergeant Pilots: Those who had completed a technical apprenticeship at one of the RAFs technical training schools, and who showed aptitude as a pilot.

Or

RAF Volunteer Reserves-RAFVR: Those civilians who were prepared to commit to volunteering some of their spare time to learn how to fly, as the title implies, it was in effect a volunteer strategic reserve.

Or

RAF Auxiliary Air Force (RAF-AAF): Those civilians wealthy enough to be able to purchase, maintain and fly their own private aircraft at weekends. The province of the wealthy.

Lastly,

Sergeant Pilots from the Dominions: A category that included volunteers from other countries, notably Australia, New Zealand, South Africa, both Rhodesia's, Canada.

It should be noted that individuals in Britain who either volunteered or were conscripted as pilots, were, depending on their social standing commissioned as a Pilot Officer immediately after training. (Neil2016). For ground crew the situation was much more straightforward. They were recruited from the skilled lower middle classes who held the school certificate from secondary education. On entry to the service, each entrant moved through one of the various technical training schools learning their appropriate trade skills and were examined according to Kings Regulations regarding competence (Air Ministry,1938a). Once qualified they were posted to a squadron according to operational requirements (Neil 2016).The social conventions of Britain and the RAF at the time (Stradling,1943), deemed it sufficient that pilots who were passed technical apprentices, or overseas and Dominion volunteers could only attain the rank of Sergeant (Neil 2016). Progression beyond Sergeant to the status of Commissioned Officer (Pilot Officer)could and did happen (Neil 2016)**;** but in some quarters was viewed with suspicion (Neil2016). The differentiation between pilots who were commissioned officers and pilots who were sergeants, may have a bearing on the team dynamic as the two groups were drawn from different social backgrounds, with their differing social attitudes and values, especially those pilots whose origin lay outside the UK such as

Australians/ New Zealanders/ Canadians/Americans. The social conditions produced the situation whereby Officers had their Officer's Mess (Neil 2016), see also (Stradling,1943). Sergeants had their Mess, and ground crew used the airfield canteen as a mess . Each was socially distinct with its own conventions, and the three messes never mixed on or off duty (Neil 2016).

Perceptual (see table 3.1 above). Depending on who was being interviewed, the direction of the questions was adapted to suit the interviewee. Although the interviews were unstructured, closed questions were introduced to triangulate specific points, such as notable events and personalities. This was done to build up a comprehensive context synthesis of what squadron conditions or operations were like. Questions were designed to be as natural and conversational as possible to tease out the participants feelings on what were often highly charged emotional events and individual experiences. The major participant (Neil) described events and experiences in a way that was authoritative but without being authoritarian. On more than one occasion he described events that had affected him deeply at the time and obviously still affected him at the time of the interview. When interviewing him, questions were asked about his relationship(s) with his fitter and rigger, how he perceived those relationships? What was his opinion of their abilities? How did he see them personally as individuals and as a group?

With interviewing ground crew, the questioning was reversed in that the interviewee was asked about his relationship with the pilot, his perception of the pilot and what factors dictated the working performance and routine of the fitter and rigger. It should be noted by the reader that although this content is under the 'perception' heading, it would perhaps be unfair to the interviewees to treat them as not being facts. The interviewees were direct participants, in the period of time under investigation and the information gleaned by the author from the interviews was as a result of conversations held on events experienced beyond the normal peace time experience. As such they tell the story of what they held to be true.

3.2 Research Question and Hypotheses

Synthesising the literature and the initial research questions the following two tailed hypothesis emerges from the research question first set out in chapter 1 Introduction.

How did the pilot-fitter-rigger team in the Desert Air Force during the Second World War form a small, resilient effective team? The hypothesis that flows from the research question is that:

The Pilot-Fitter-Rigger team constituted a small effective and resilient team arising out of the nature of the then British society and the peculiar and particular challenges of the harsh environment in the Western Desert.

The *null* which flows from the research question, remains unchanged from that first stated in chapter 1 Introduction:

Neither Britishness nor the peculiar and particular Western Desert environment played a significant role in creating the pilot-fitter-rigger team in to a resilient and effective entity.

Scholarship is divided on the use of hypothesis in qualitative research. Research approaches are broadly categorised as qualitative, quantitative, or mixed (Brymn,2016; Watkins & Gioia,2015). Qualitative research is built on data that is either audio-visual, conversational, or narrative, and can also be numeric. A qualitative hypothesis, according to Chigbu (2019), can take this approach in explaining a phenomenon. The testing of hypotheses in qualitative research 'does not strictly mean the same thing as testing of hypotheses in quantitative research.' Chigbu (2019) demonstrates that qualitative hypotheses have a distinctive place within qualitative research by using a variety of analytical tools including visual relationship within post-positivist research. He

clarifies, how to formulate and 'test' hypotheses qualitatively using visual or diagrammatical approaches.

3.3 Research Design

The starting point of the design process was defined by the timeframe of the Western Desert campaign. However, in the scope of the research there will be a necessary compromise as it is not possible within the bounds of this thesis to examine the whole of the Western Desert campaign and the myriad interpersonal dynamics contained within it. This would result in research which would be enormous in scope but limited in depth. By focussing on the air force component and ground crew team context and within that context, the sub- set of the pilot-fitter-rigger team dynamic a greater depth of research will be achieved but at the expense of scope, which may be more limited but without sacrificing generalisability on the utility on the various theories being tested. For example, do organisational development theories developed in peace time America translate across into British organisational development culture, specifically RAF ground crew in the Western Desert in a combat environment? Taking the timeframe of the Western Desert campaign as 10th June 1940–4thFebruary 1943, the first step was to identify and review as far as possible, literature on military history that covered the research period. It was noted that the literature consisted of diverse levels of scope. Whilst some of the literature covered specific events (Bungay, 2002; Clayton & Craig, 2002), others covered the campaign in general (Adams, 2011) whilst others covered the entire North African campaign (Pallud, 2012).

The author took the decision at the outset that although the primary focus was on the Western Desert campaign it would be sensible to have cognisance of the scope of the titles covering the North African campaign so as to be aware of the exogenous influences and circumstances that did not fit neatly into the period. This scope helped explain why things were the way they were in the lead up to the Western Desert campaign, and the outcomes as a result of the end of the campaign. Taking the Western Desert campaign as the *status quo*, the author sought to determine how it was that the Desert Air Force acted the way it did, and within that organisation how and why the pilot-fitter-rigger

team acted the way it did. To do this several data collection methods were used as will be seen below.

3.4 Qualitative Research

The *rationale* for selecting qualitative research is that the purpose of qualitative research examines things that cannot be quantified such as human behaviour and emotions; and aspires to give explanation and meaning to those behaviour and emotions. An additional strength of qualitative research is the ability to contrast and compare data gathered through the critical literature review and accommodate more than one aspect or opposing points of view giving a comprehensive holistic view of the question under discussion. The careful examination of the five subjective variables, the elements of circumstance, who, what, where, why, and when, lead to the conclusion that the best way of treating the situation is to employ the interpretive group of methods which focusses understanding a phenomenon in a comprehensive holistic way. The research method requires the Deductive approach, (See figure 3.1 below) using the literature review, site visits, interviews and media sources to draw specific conclusions from the data set around the context of the Western Desert campaign; and within that campaign taking the pilot-fitter-rigger team as a basis, to test to see whether or not functional and other leadership theories fall short.

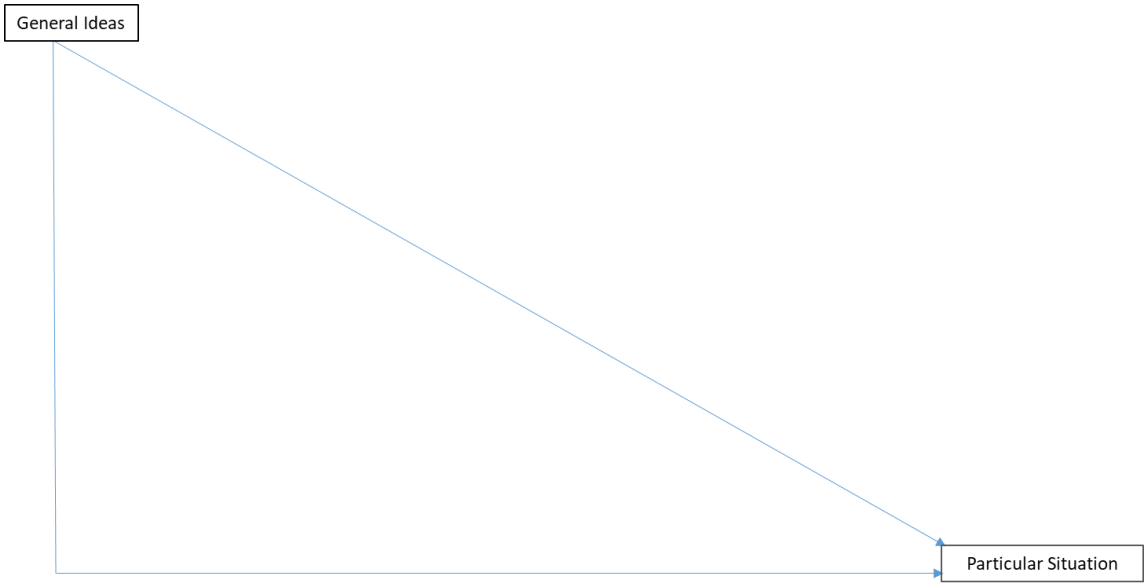


Figure 3.1: The Deductive Approach

Source: Cranfield University – Assignment and Dissertation writing p.14 undated

The deductive approach emphasises the collaborative nature of learning and the importance of cultural and social context, where all cognitive functions are believed to originate in, and explained as arising out of social interactions. Social constructivists hold the assumption that individuals seek understanding of the world in which they live and work. The theory originated post the 1917 Russian revolution through the work of the Russian psychologist Vygotsky**.**(University College Dublin,nodate) (Berkley University of California, no date)**.** The theory was taken up and developed and refined by Dewey (University College Dublin, no date), who thought that learning was grounded in real experience and not acquired through repetitive rote memorisation. That learning happens through sustained enquiry, study, reflection, and consideration of alternatives and their possibilities. Other theorists such as Piaget (University College Dublin, no date) added to the theory by postulating that learning is a dynamic process during which people actively construct knowledge by creating and testing their own theories of the world. The work of Vygotsky (no date) influenced the work of Bruner who thought that different processes were used by people in problem solving and that these vary from person to person, and that good learning lay within social interaction (University College Dublin,no date)**.**

The discussion chapter 4 and conclusions chapter 5 will use the research tradition of phenomenology, which is the study of phenomena, the appearances of things or things, as they appear in our experience. It studies conscious experience as experienced from the subjective or first-person point of view. It involves the identification of a shared experience and the universal nature of the experience. It attempts to identify a shared experience among individuals undergoing that shared phenomenon along with its essence. Thus, it is an interpretive process and focusses on the interpersonal dynamics within the pilot-fitter-rigger team. This process requires a careful examination and interpretation of the phenomenon under investigation to determine the why, how, or by what means the team acted to produce identifiable and observable outcomes. The objective of the research is to answer the research question, address the hypothesis and *null* hypothesis. The views and the meanings attached to them are negotiated socially and historically and formed through interaction with others through historical and cultural norms that operate in the participant's lives. Those meanings are constructed by people as they engage with the environment they are interpreting. They also engage with their world and make sense of it based on their historical and social perspectives. Qualitative research seeks to understand the context or setting of the participants through visiting the contexts and gathering information personally. This is particularly so in the case of the pilot-fitter-rigger team in a demanding desert environment under combat conditions. In such a situation where plainly the team did not want to be in harm's way, cognitive dissonance could well arise (McLeod, 2014) as a result of being placed in a position of forced compliance behaviour (McLeod, 2014)**.** The author will seek to establish the meaning of the pilot-fitter-rigger team dynamic and explain that meaning in that particular situation. This involves identifying the team group dynamic as a phenomenon and studying how it develops shared patterns of behaviour over time. This interaction is described by Homans in his Theory of Interaction (Homans,1951). Aided by the historical context set out in chapter 1 Introduction and the Historiography critically reviewed in chapter 2 Literature Review; the resulting discussion in chapter 4 will take the thesis narrative on by combining the constructivist, phenomenological, and deductive approaches to produce a comprehensive holistic understanding of the pilot-

fitter-rigger team in the Western Desert campaign. This understanding will then form the basis of drawing sound conclusions later on in Chapter 5 Conclusions.

3.5 Programmed interviews, and limitations on the sample size

For the purposes of the thesis the author prefers the term 'research participants' when dealing with individuals. In the case of veterans that have been interviewed there is very little latitude in deciding who to select for interview as there are so few left alive (four at the time of writing), according to the Battle of Britain Historical Society (2018). In that context they become in some respects the 'default' participant(s). Qualitative research can be seen as deficient because of the personal interpretation of the data made by the researcher which can give rise to bias in the interpretation of the data leading to bias in the conclusions, (although this potential bias can be mitigated through the use of evidence) created by such an interpretation; and the difficulty in generalising findings to a large group because of the small number of participants studied. This may be so in the case of veterans but in this particular instance there is no viable alternative. In the author's opinion, a small interview sample was better than no sample at all. It is the author's position borne out through his experience of interviewing individuals, that there is no substitute for asking the person who was there. Holmes (2001) also discusses the importance of talking to veterans in person. Patton (2002) also advises that there is greater learning from a small number of carefully selected participants than gathering standardised information from a much larger audience. Also, whilst face to face interviews may be labour and time intensive and susceptible to bias, they provide a much richer source and allow for flexible probing through careful questioning. Whilst this thesis has extensively examined the primary and secondary written and physical sources there is no substitute for asking the person who was there what conditions were like. However, this brings its own problems in that veterans of that period and campaign are all in their 90th decade. According to the Battle of Britain Historical Society Roll of Honour, (Battle of Britain Historical Society,no date) a total of 2,936 air crew took part in the Battle of Britain, of that total, 2,342 were from the United Kingdom, the balance of 594 were drawn from the Dominions (already referred to above) and other countries. Of those 2,936 who participated 1,497 were killed or mortally wounded, dying later ,a

casualty rate of 50.1 percent (Battle of Britain Historical Society, no date).Those who survived the Battle of Britain were either posted away to other squadrons as training instructors, or to other combat squadrons in other campaigns where the vagaries of war accounted for further numbers. Those vagaries and the passage of time with natural mortality has led to an exceedingly small sample of interviewees; as of May 2018, the Battle of Britain Roll of Honour lists only four known living veterans (Battle of Britain Historical Society, 2018). Added to this is the fact that of those remaining, very few have either the mental acuity, stamina, or circumstances to facilitate close questioning however sensitively managed.

In the case of other participants there is more latitude in terms of choice, however there is an element of selection when it comes to interviewing historians with a knowledge of the Western Desert campaign (Bungay,2002;2003).All the individuals participating in interviews whether by default or by selection were judged by the same criteria-based sampling, as they either had first-hand knowledge flying of fighter aircraft, or of maintaining them, or of military practice and discipline and the conduct of the Western Desert campaign. Each individual was contacted through a third party who had knowledge of the author's research and facilitated the initial contact.

The initial contact was followed up by the author in a telephone conversation with the participant and their agreement sought regarding an interview. At the outset of all interviews, the interviewee(s)had been advised of the nature and purpose of the interview and their agreement sought as to their comments being attributed or acknowledged and included in the thesis. Confidentiality was respected and comments that were off the record not included. Through the third-party process of 'snowballing' involving the veteran's network and with some serendipity, the author was able to establish contact and interview on an extended basis at 95 years old, the foremost and most active of the surviving Fighter Command pilots from that era. His combat history and profile suited the author's needs exactly, he is a veteran of the Battle of Britain followed by the siege of Malta (Holland,2010) where between both campaigns he achieved 'ace' status (Neil,2010; Cull Galea, 2017). He also participated in other European and East Asia campaigns. He eventually retired as Wing Commander with

operational and administrative control of three Fighter Command squadrons (Neil, 2018). This placed him ideally through his biography and oral history to give valuable insights not only into the pilot-fitter-rigger team dynamic, but also the background context of Fighter Command front line combat squadrons.

In addition to the fighter pilot interviews, through the same serendipity as gaining access to a pilot, the author also gained through the informal veterans' network access to a rigger who not only served in the Western Desert campaign but was posted to the same squadron at the same time as the fighter pilot interviewed by the author. This enabled the author not only to elicit details of the Western Desert campaign, but to triangulate information between the two participants. To add further to the triangulation, the author sourced a picture of the two men together at a squadron reunion in 2011 (Neil,2010, pp. 96-97). There is also a picture taken in 1940 of the rigger placing him in the same place at the same time on the same squadron (Moreton 2010 p14) as the pilot.

Bearing in mind the ages of the interviewees and their circumstances outlined above, the author took the policy decision at the outset not to electronically record the dialogue which was felt could possibly come across as too formal and unsettle the interviewee proving counter- productive, producing binary 'yes/no' answers to questions. Instead, the author took copious notes which were then written up the next day into comprehensive text files indexed and stored securely. The research conformed to the principles of ethical research contained in Cranfield University's CURES standards, and designed, conducted, and reviewed in a way that ensured its integrity and quality. Interviewees and other participants were fully informed on the purpose, methods and intended use of the research, what their participation in the research entailed, and what (if any) risks were involved. At the outset of any interview, interviewees and other participants were asked if they gave their informed consent to their participation voluntarily free of coercion and were asked to sign Cranfield University's informed consent form. The confidentiality of information supplied by interviewees and other participants relating to individuals both living and dead, was respected, otherwise all information supplied was placed in the public domain through this thesis. At no point did any of the veterans or participants request or expect anonymity, quite to the

contrary they wanted to be attributed to ensure that their story entered the public domain. Where requested by interviewees and other participant, notes of interviews and other background material were given to them. Harm to interviewees and participants was avoided. The independence and impartiality of the author was made clear to all interviewees and participants and any conflicts of interest or potential partiality were made explicit.

All interviews were conducted on the basis of either prolonged or shorter interviews depending on the circumstances (Yin, 2014, p.111; Bryman, 2016, pp.197-219). The interviews involved putting open questions to the interviewees in their own home, which enabled a much freer flow of information than might otherwise be the case. The author used the practice of asking the same question at a different point in the interview in a different guise to cross check and validate the veracity of the replies, it should also be recognised that veterans' personal recollections are at a considerable distance both in time and in location and are at the outer limits of their memory. There has been one instance of a particular series of three interviews with one key interviewee taking place over eight hours in total. The key interviewee was critical to the success of the information collection process, providing invaluable first-hand recollections and insights into the pilot-fitter-rigger team dynamic. Where appropriate closed questions were introduced to validate certain points or to conclude a line of conversation. Where veterans were interviewed there was, out of necessity, a degree of identifying and weeding out of the subjective from the objective observations and recollections. In the data and interview responses there was also an element of racial, social, gender, or class distinction reflecting the structure of British society during the 1940s. However, those instances are drawn from the records of the day and reflect the then contemporary society. It is important to remember that the quotes used in this thesis were either written or spoken by people under extreme physical or psychological stress. They are included to give context to the historical setting and should not be judged in the context of today's behavioural standards in society.

Where representatives of commercial organisations such as the RAF Museum at Hendon or serving armed forces, personnel were interviewed at their place of work, this was

done with prior agreement through the appropriate Public Relations or Human Resource function, using the same interview principles, but some questions were adapted or modified to suit circumstances. The act of interviewing veterans surrounded by their memorabilia and ephemera proved to be a profoundly powerful and moving experience, conducting extended interviews listening to very ordinary men in their considerable old age, describing the quite extraordinary things that they did as young RAF ground crew and Officers. They did so, without thought of reward, ennoblement, or celebrity status. All the interview questions were answered politely, but at the same time the interviewees were concerned that they might be seen to be 'shooting a line' (boasting or exaggerating) their involvement in a conflict that defined their generation and changed the shape of the modern world. Neil, in particular, when recounting episodes 'left the room' metaphorically speaking in recalling a long past event which was obviously still very real, eighty years later. The one constant refrain throughout the veteran interviews was 'I didn't do anything extraordinary, there were no heroics; I just did the same job as everybody else was doing–all we ask is to be remembered.' The programme of interviews also includes a historian who has not only written work published on the Western Desert campaign (Bungay, 2002;2003) but is also a director of an international firm of management consultants. He is also a director at a leading UK business school and lectures there on organisational development. He was at one time, a consultant for the Boston Consulting Group. He has provided valuable insights into aspects of team- work in a military combat. He agreed to continue to be interviewed throughout the data collection process and provided valuable insights into organisational development team dynamics.

3.6 Research sites and visits

Earlier reference has been made to the Desert Air Force as a component of the Royal Air Force, the Royal Air Force being the overarching organisation and part of the triumvirate of the British armed forces during the Second World War. With this in mind, the author arranged a visit to the maintenance workshop hanger of the RAF Battle of Britain Memorial Flight based at Coningsby Lincolnshire to view at first hand the maintenance and repair of the vintage piston engine aircraft of the type used in the Western Desert

campaign and operated by the Flight on behalf of the Nation on public and State occasions. The visit included an individual tour of the workshop floor with a serving Warrant Officer as a guide. The author observed ground crew working on a variety of vintage piston engine aircraft and was able to discuss maintenance procedure and ask questions of the officer. There was also an opportunity after the tour to have a question-and-answer session on maintenance and repair practice and team dynamics with the two Engineering Warrant Officers responsible for the workshop function. One Warrant Officer dealt with the recruitment, training, motivation, and discipline of ground crew, the second Warrant Officer dealt with the engineering, technical, and maintenance aspect of operations. However, there was some degree of flexibility and overlap between the two as far as day-to-day management was concerned, both Officers having a high degree of awareness of the other officer's responsibilities, (an interesting parallel between the fitter and the rigger). It was significant during the course of the visit to find out from the Warrant Officer in charge of training that at that time (Bell 2016), Belbin's (1993) work on identifying team roles formed part of a Non- Commissioned Officer's (N.C.O) selection exam for progression to Warrant Officer. This is important as it demonstrates that Belbin's work is still current and in use.

To develop the information gathering process and facilitate the process of triangulation, the author also visited North Weald airfield in Essex northeast of London. home to 249 squadron and others at the time of the Battle of Britain and shortly after, The airfield exists largely as it was during the Second World War and still retains many original wartime buildings and maintenance hangers along with much of the infrastructure needed at the time to disperse aircraft It is possible to walk the open- air dispersal sites where the aircraft were serviced and worked on between missions. Consequently, it retains much of its wartime 'feel' (several of the original buildings still bear the marks of wartime bomb damage). This site is particularly appropriate as it was a Fighter Command airfield heavily committed to the defence of London and the southeast of England in the Battle of Britain. The airfield contains a museum dedicated to the history of the airfield and its war time operations. There, at the airfield, the author was able to gauge the 'feel' of a typical Fighter Command airfield and its infrastructure. This was one

aspect of being able to develop a holistic picture of what constituted a typical Fighter Command squadron. It was during that visit, that the author had a conversation with the museum historian and through that conversation was given a number of contact names and contact details who might prove useful to interview. The museum historian contacted the people concerned and gained clearance for the author to speak to them. All contacts were through an informal network of veterans who knew each other either by being in the same squadron, or by squadron association social events or reputation. At the same time as undertaking the literature review and interviews, the author arranged field visits to other locations not only to interview service personnel as in the case of the Battle of Britain Memorial Flight at Coningsby. This and other visits proved useful to have technical engineering discussions on the practical difficulties associated with husbanding complex aircraft engines and associated mechanical systems in a sand laden, dusty, gritty desert atmosphere which can be detrimental to the performance of an engine. The programme of visits enabled the author to triangulate aspects of the data gathered to produce a comprehensive understanding of the variety of factors affecting the pilot-fitter-rigger team and by extension, the squadron at large.

In addition, the author gained access to the cockpit of a Spitfire currently on display at the RAF Museum, Hendon. Although not an example of the version of the Spitfire shown below at figure 3.2 below, or one used in the Western Desert campaign, it is virtually identical in the layout of the cockpit. This enabled the author to gain an appreciation of the cramped working environment area of the pilot, the fitter, and the rigger (Airlife 1999); and to observe and note the ergonomics of the cockpit (Airlife 1999) which determined to a great extent the way in which the fitter and the rigger performed their duties.

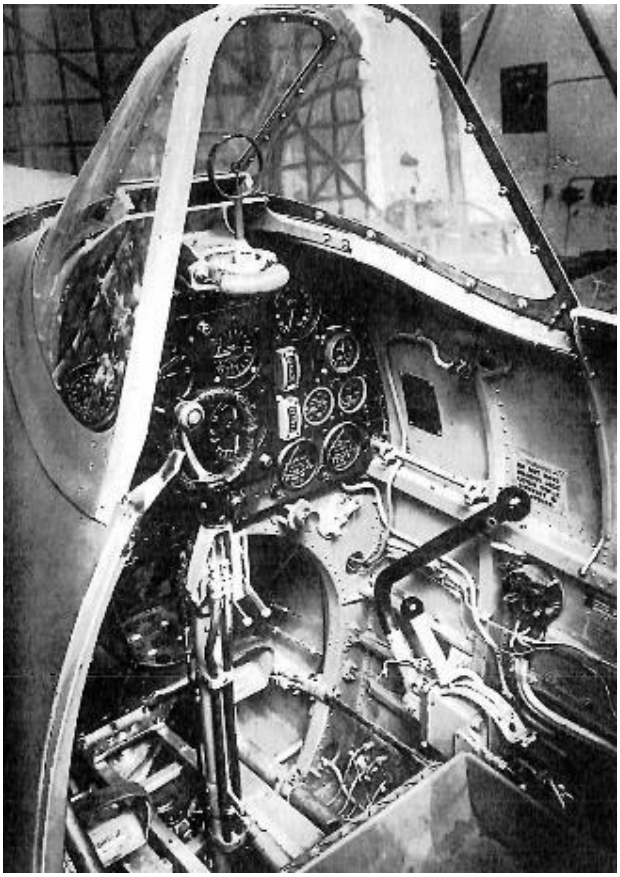


Figure 3.2: Spitfire Cockpit

Source: Airlife (1999) *Fighting Cockpits, 1914-2000*,

3.7 Consideration of bias and reflexivity

There are several facets to the author's background that relate to bias and reflexivity. Firstly, the author's late father was an RAF fitter initially with 249 squadron at North Weald in Essex, then later through a series of events part of 127 squadron in Palestine and the Western Desert for the duration of the Western Desert campaign. The author has a clear recollection that at about the age of four he was taken by his father to one of the air displays at Hendon whilst it was still an operational RAF airfield. This was followed up in later years by annual visits with his father during the early 1960s to the annual Farnborough air show. Whilst in secondary education the author won the school year prize for his work in the humanities, notably geography. The second is that the author as a qualified mechanical engineer is fully conversant with mechanical engineering practice and terminology. Lastly, having been a public sector senior

manager and policy advisor for twenty-five years at a strategic level, latterly at a national level, the author is well acquainted with the theories of leadership, and other functional theories on organisational development. Over the years the author has had senior managerial experience of the pragmatic application of organisational development theories particularly Adair's Action Centred Leadership, and Belbin's work on team roles. The author had the prime responsibility of developing effective team- work in a highly politicised, party-political public sector working environment. The application of theory and the various outcomes have been of great interest to the author, proving useful to compare the 'theory' with 'what actually happens on the ground.'

3.8 The Theoretical Framework

As this thesis is focussed on the pilot-fitter-rigger team in a desert combat environment it would seem that an appropriate method for examining the team dynamic would be to use Adair's Action Centred Leadership model as the starting point combined with a consideration of Belbin's team role theory (CMI, 2011; Belbin, 1993(Adair, 1987). Adair's Action Centred Leadership model is commonly represented by the three circle Venn diagram (see figure 2.1 above) which illustrates Adair's three core management responsibilities.

- Achieving the task
- Managing the team or group
- Managing individuals

It is not simply a matter of superimposing Adair's Venn diagram on the themes and sub themes (see figure 3.3 below). Adair's Venn diagram needs to be considered in the context of the three themes and their associated sub-themes identified in the literature review and shown in the Venn diagram (see figure3.3 below).

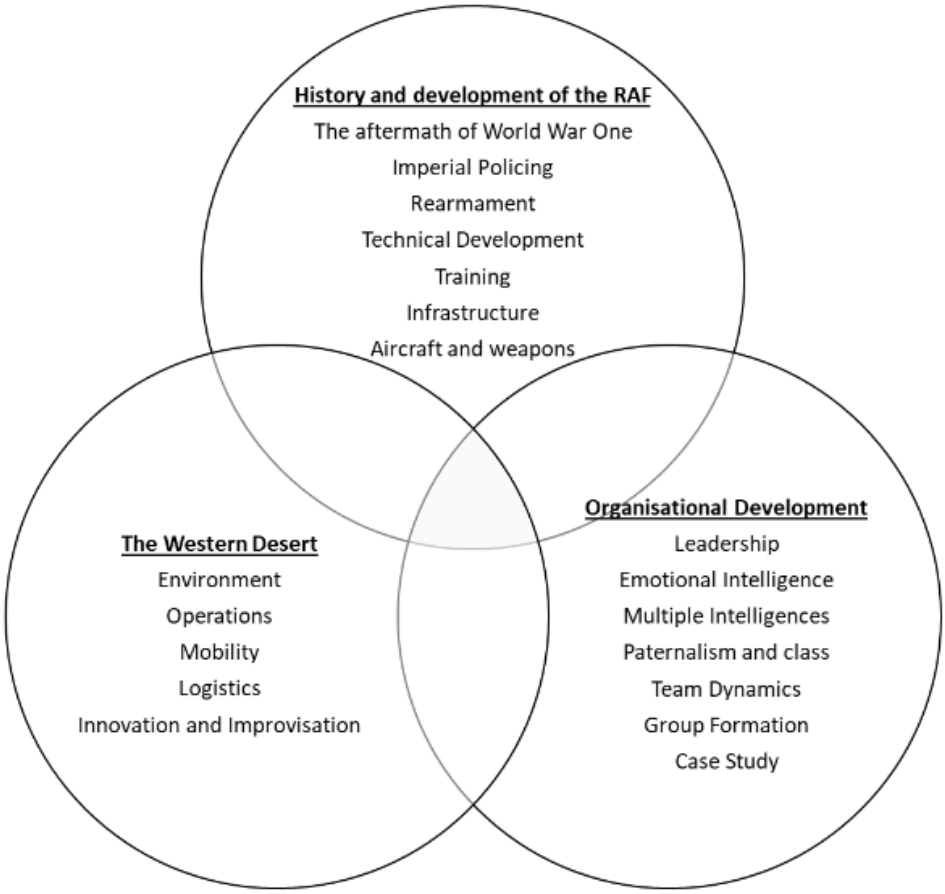


Figure 3.3: Themes and Sub Themes

Source: Author's elaboration from primary and secondary data.

Although Adair's model considers the three core responsibilities and is vital in providing an overarching framework in which to consider team dynamics, it does not consider the characteristics of the individual team or group members and the effects that those characteristics can have in determining whether or not a team is effective. This is the province of Belbin's work on team roles which will be considered in the context of the two Venn diagrams shown above in figures 2.2 above and 3.3 above.

Belbin On Team Roles

Belbin identified up to nine useful roles (see table3.2 below) which are necessary for a successful team to come into existence All the characteristics do not have be present in one person all the time but represent what would be considered to be the dominant characteristic(s) of a person. They are not needed in equal measure, nor are they needed

at the same time as people are capable of taking on back-up roles when there is less need for them to fulfil a primary team role. As this thesis is principally concerned with determining whether or not the pilot-fitter-rigger team constituted a resilient and effective team or not, it is central to examine and discuss Belbin's contribution to teamwork.

Table 3.2: Belbin's team roles

ROLE	DESCRIPTION AND TEAM CONTRIBUTION
PLANT	Creative, Imaginative, unorthodox. Solves difficult problems.
RESOURCE INVESTIGATOR	Extrovert, enthusiastic, communicative. Explores opportunities. Develops contacts.
CO-ORDINATOR	Mature, confident, a good chairperson. Clarifies goals, promotes decision making, delegates well.
SHAPER	Challenging, dynamic, thrives on pressure. The drive and courage to overcome obstacles.
MONITOR EVALUATOR	Sober, strategic, and discerning. Sees all options. Judges accurately.
TEAM WORKER	Co-operative, mild, perceptive, and diplomatic. Listens, builds, averts friction.
IMPLEMENTER	Disciplined, reliable, conservative, and efficient. Turns ideas into practical actions.
COMPLETER- FINISHER	Painstaking, conscientious, anxious. Searches out errors and omissions. Delivers on time.
SPECIALIST	Single-minded, self- starting, dedicated. Provides knowledge and skills in rare supply.

Source: Author's adaptation from Belbin.

Chapter 4 Discussion will provide a comprehensive, methodical, inclusive overview on whether or not other organisational development and leadership theories apply, apply in part, and to what degree; or not at all and thus fall short. In addition, a number of other relevant academic papers, journal articles and books on organisational development aspects such as organisational culture, social intelligence, team roles, and group theory will be reviewed, discussed, and incorporated where appropriate. The various theories under examination will be tested to evaluate whether or not they

wholly apply, apply in part in the context of the pilot-fitter-rigger team to see whether they are.

1. Logical and coherent,

2. Clear and to the point,

3. Fit with the research data, and

4. Applicable to more than one place situation or person.

Whilst it will be useful to discuss each theory or work as a separate entity, given the potential for cross correlation of theories it may prove possible to produce an 'holistic' view of the theoretical situation which would be equally useful and represent an original approach to the matter. Given that for some of the theories there is at this stage *prima facie* evidence of some correlation between and across theories it may prove possible for the author to produce a simple matrix (See table 3.3 below), showing the degree of the correlation on a simple scale of 1-3, with 1 being a strong correlation, 2 having some correlation, and 3 having a weak correlation and 0 having no correlation. The matrix is completed below and discussed in chapter 4 and conclusions drawn in chapter 5. This last chapter will take the factors outlined above into account and conclude whether or not the research question and the hypotheses have been tested and satisfied; and whether or not a holistic stance could be advanced.

Table 3.3: Management theory matrix

THEORY TITLE	Adair's Action Centred Leadership	Belbin's Team roles	Thorndike, Vernon, and Gardner on Multiple Intelligences	Goleman on Emotional Intelligence	Bennis on Leadership	Hersey and Blanchard on Situational Leadership	Graicunas on Span of Control
ADAIR'S ACTION CENTRED LEADERSHIP		1	1	1	2	1	0/3
BELBIN'S TEAM ROLES	1		1	1	2	1	0/ 3
THORNDIKE, VERNON, AND GARDNER ON MULTIPLE INTELLIGENCES	1	1		1	2	1	0
GOLEMAN ON EMOTIONAL INTELLIGENCE	1	1	1		2	1	0
BENNIS ON LEADERSHIP	2	2	2	2		1	0/3
HERSEY AND BLANCHARD ON SITUATIONAL LEADERSHIP	1	1	1	1	1		0
GRAICUNAS ON SPAN OF CONTROL	0/3	0/3	0	0	0	0	

Source: author's elaboration.

3.9 Summary and key messages

Chapters 1 and 2 taken together set out the background context, conditions and parameters that combine to give an overview of the position of the Desert Air Force specifically the pilot-fitter-rigger team over the period of the Western Desert campaign, 10th June 1940 to 4thFebruary 1943. This chapter sets out the method to be used to investigate the situation, and the *rationale* for the application of specific procedures or techniques used to collect and analyse data applied in understanding the situation in the Western Desert. The methodology used as the basis for the research discusses the ways in which qualitative research data are garnered, analysed, and discussed in this chapter. The research process is laid out starting with ethical considerations, moving through bias and reflexivity to the method and its limitations, especially with regard to the interviewing of veteran participants. The use of observation through site visits, and finally the theoretical framework adopted, raising the possibilities of synergies across, or between theories all of which will set the scene for chapter 4 discussion. The methodology is primarily a process of qualitative research using the deductive approach including a minor synthetic element of quantitative research, which strives to answer the research question and test the *null* hypothesis utilising both primary and secondary sources. The research question being '*how did the pilot-fitter-rigger team in the Desert Air Force during the Second World War form a small, resilient and effective team'?* In addition to answering the research question the opportunity was taken to test the *null* hypothesis that '*Neither Britishness nor the peculiar and particular desert environment played a significant role in creating the pilot- fitter- rigger team into an effective and resilient entity.'* In considering how to proceed with the methodology the author was mindful of the importance of talking to veterans and was aware that in this instance the process was governed by the imperative of time as at the data collection stage there were very few surviving veterans with relevant oral history capable of being interviewed. By virtue of the 'old boy' veterans' network and pure serendipity, the author was able to contact and interview two veterans who not only knew each other personally from their time together on the same squadron, but also possessed relevant desert combat experience. Other interviewees were selected through first-hand knowledge in some

manner, augmented by a programme of field visits by the author. By a process of flexible probing, asking closed and open questions in a careful manner with triangulation of answers, the author was able to extract from interviewees, valuable data on the pilot-fitter-rigger team, their interpersonal dynamics, and their work. It can be concluded that given the interpersonal nature of the research, qualitative research using the deductive process was the appropriate course to take. In addition, veterans or other stakeholders were interviewed wherever possible to gain 'first hand' accounts of a situation or action. However, care was exercised during interviews to recognise subjective content from the objective and separate out the two elements, triangulating data at every opportunity. Given the technical nature of some of the data, supplementary evidence such as technical manuals, illustrations and audio/visual sources were used to enable the reader to gain a 'holistic' appreciation of the matter under discussion and its contextual setting.

CHAPTER 4 DISCUSSION, THE PRIMARY AND SECONDARY DATA IN THE CONTEXT OF ADAIR'S ACTION CENTERED LEADERSHIP MODEL

4.1 Introduction

This chapter draws primary and secondary data together into the theoretical framework for this research with a view to achieving the thesis research objectives. This chapter contributes to the attainment of the objectives of this Doctoral thesis by using the theoretical framework presented in previous chapters to analyse the collected primary and secondary data. Adair's model (Adair 1984, 2015) deals with the elements he identified as Task, Team, and Individual, previously discussed in chapters 1 and 2.

4.2 The development of the data set

The starting point for the development of the data set is Figure 2.3, developed in Chapter 3.The Expanded Theoretical Framework (based on Adair's Action Centred Leadership model) shows that there are three major themes identified from the data for discussion in the thesis. *Viz* Military History-The Evolution of the RAF, the Environment-The Western Desert, Organisational Studies-The Organisational Culture of the RAF. Each of the major themes has a number of derived sub themes and are applicable across the three elements of Adair's Action Centred Leadership Venn diagram at the Task, Group, and Individual level. Citations whether they be Primary (colour coded red) or Secondary (colour coded green) (See appendices 1 and 2) to differentiate them, were entered under each theme, the sub theme and the Task, Group, or Individual element.

This chapter therefore looks at how those elements apply to the activities of the pilot-fitter-rigger team in the Desert Air Force in the Western Desert campaign. Primary and secondary data were incorporated into two coded matrices, and each matrix was assigned the three major themes identified in the literature review. The citations were then further assigned across the various sub themes. In total two representative matrix pages from each of the major themes are discussed. This gives a total of six pages encompassing all three major themes and all sub themes. Given the nature of the data

in the matrices, this comprehensive approach to the discussion enables the reader to gain an overall appreciation of the factors affecting the pilot-fitter-rigger team. The adjectives 'small' 'resilient, ' and 'effective' are linked to team and organisational development through an expanded theoretical framework (see figure 2.3 restated below for clarity).The chapter will also look at contemporary British Defence Doctrine Defence 5th Ed to explore whether there has been a continuity into current RAF learning and development from the experiences of Desert warfare and in particular the Western Desert campaign.

4.3 Applying Adair's Action Centred Leadership to the Empirical Data

Action Centred Leadership defines leadership in terms of three elements represented by overlapping and interdependent circles forming a Venn diagram. The task, the group or team, and the individual. Adair's model asserts that the three elements are the watchwords of leadership, as people expect leaders to help them achieve the common task, build the synergy of teamwork, and respond to individual needs. (Adair 1984, 1987, 2010, 2015). The Task needs work groups or organisations to come into effect, because one person alone cannot accomplish it.

4.4 The Task according to Adair

For the purposes of this thesis the immediate task is that of the ground crew most directly concerned with an aircraft, (the fitter and rigger) in bringing it to a combat ready condition and presenting it to the pilot for combat operations (see the RAF information film clip at fig 1.6 above).However, it should be remembered that this task would have been replicated approximately another eleven times by eleven other identical two man teams (three men when the pilot is taken into account in the decision making process) across a typical RAF squadron bringing it to a state of combat readiness. So, what exists in effect is a hierarchy of tasks, the basic task at an individual aircraft level is subsumed into the task of preparing the section of three aircraft ready for combat, the section itself being subsumed into a flight of six aircraft, which in turn is subsumed into a squadron of approximately twelve operational aircraft. The process of bringing a squadron to combat readiness is a parallel process across approximately twelve aircraft, it is not

sequential. The precise numbers of aircraft available at each task level would depend on the level of attrition experienced by the squadron in combat, as well as the number of aircraft being worked on for repairs and unavailable, being serviced, or held ready as replacements for aircraft lost or damaged. A rough estimation based on experience or 'rule of thumb' (Phrases.org.uk 2021) was that for a typical Fighter Command squadron of twenty aircraft, approximately six aircraft would be under repair, two more being withdrawn for routine servicing, and twelve available for combat.

4.5 The Group or Team according to Adair

As with the task, the basic team would consist of a fitter and a rigger at an individual aircraft level; with the pilot constituting the third member of the team liaising with the fitter and rigger as to the operation and 'feel' of the aircraft. The group or team needed constant promotion and retention of group cohesiveness to ensure that it functioned efficiently. Although the thesis considers the three-man team as an entity, the pilot takes up a slightly ambiguous position within the team, in that he did not conduct any maintenance on the aircraft but was the end user. Thus, he had to have a close interpersonal dynamic with the fitter and the rigger so that all three team members understood the requirements of the situation. This was particularly relevant as a pilot's life and combat survival could depend on the quality of work conducted by the fitter and rigger which explains how a close and deep empathetic understanding was needed within the team. During operations and after combat, the pilot would give feedback to the fitter and the rigger as to the flying condition of the aircraft in order for the fitter and rigger to conduct their respective tasks. This enabled them to rectify any faults or improve things that could be done immediately and locally, without the aircraft being sent away to workshops well to the rear of the combat zone for rectification.

4.6 The Individual according to Adair

The Individual needs are physical ones such as well-being, surroundings, and psychological ones of recognition, sense of purpose and achievement, status, and the need to give and receive from others in a work environment. The team under consideration in this thesis consisted of three individuals at the micro level of an

individual aircraft. These were the pilot, the fitter and the rigger-the pilot was nearly always a commissioned officer, and in some cases a sergeant (a non-commissioned officer) but even then, both ranks were senior to ground crew (with the notable exception of a Flight Sergeant) who were not officers of either type but described as 'other ranks.' The fitter who was a skilled electro-mechanical tradesman and often the lead figure was effectively *primus inter pares* with the rigger in matters of presenting the aircraft to the pilot. He was responsible for maintaining the engine and associated ancillary equipment. Being a skilled tradesman, he would be able to direct the work of the rigger as necessary and have some oversight of the rigger's work; the rigger being, a semi-skilled tradesman who dealt with the repair and maintenance of the airframe and all the flying controls. He would on occasions take direction from the fitter, as necessary. Adair's view is that leadership exists at three levels, the strategic, the operational, and the functional. These three levels can be seen within the context of the Desert Air Force operating in the Western Desert campaign. Functional leadership of teams of between five to twenty people existed at the level of a squadron flight, involving six aircraft and corresponding total of eighteen team members comprising 6 pilots,6 fitters,6 riggers (this total could and did fluctuate depending on combat casualties and aircraft availability),all managed by a flight sergeant in liaison with the relevant flight lieutenant, and overseen for quality by the squadron Engineering Officer.(See organisational chart at figure 1.2 above).Operational leadership existed where the normal establishment of two flights reported to a squadron leader. Strategic leadership existed at the level where three squadrons were constituted in a Wing with overall accountability for all levels of leadership. These three ascending and expanding levels of leadership and the corresponding increase in the numbers of people being managed demonstrates a clear link with the algebraic formula work of Graicunas (2011) on how the number of relationships to be managed in a team expand as the team size increases. Therefore, it can be seen from the discussion above that the three elements of Adair's Venn diagram are not only inter-related, but indispensable to each other and overlap at the centre signifying where the team is most effective.

4.7 The examples drawn from the data set, and the process of coding

In any information gathering process or critical examination of a matter or situation there are five questions known as 'the elements of circumstance, (Aristotle cited in Sloan, M. 2010) that need to be addressed as being fundamental to the situation under consideration. The elements are Who? What? Why? Where? and When? In this chapter the matrices address the following. Firstly, Who? The pilot-fitter-rigger team within the context of a Desert Air Force squadron of the RAF. What? The examination of the teamwork between the three men, the pilot, fitter and rigger team, and the location of the dynamic in the wider organisational development and operational context. Why? This is located in the wider context of the Second World War and the associated geo-politics and history of the time. Where? The Western Desert campaign situated in North Africa June 1940-February 1943.When? The period of the Western Desert campaign June 1940–February 1943.This is located in the wider context of the Second World War and the associated geo-politics and history of the time. In this way using these questions it can be demonstrated that the data gathered is both robust and saturated. Robust in that the data is sturdy, compiled over a large number of citations from both primary and secondary sources, and saturated in that at the time of writing no 'new' data germane to the thesis is being discovered. Each of the 6 matrices were then populated by sifting through each of the 272 primary and secondary sources forming the historiography used in the thesis and entering the citation in the appropriate data set. There are a total of 2,636 primary and secondary source citations reflecting data gathered from veterans, veterans' extended family, field visits, historians**,** current aeronautical practice related to piston engine aircraft, and technical experts. Using this format, it is possible to select a perspective or topic and follow the links not only across the data sets but follow them using either primary or secondary sources down through the major themes, sub- themes and the three Action Centred Leadership elements. For example, it is possible to trace the links of the aftermath of the First World War heralding Britain's *role* of Imperial policeman in the newly mandated areas of the Middle East, and the operational effects that *role* had on the rearmament of the RAF. The technical development needed to police remote desert areas and the sorts of aircraft needed to fulfil that *role* and the

parallel training and infrastructure that needed to be instituted. Another example of how circumstances are interlinked, is the aftermath of the First World War and its long-lasting economic, social, and political effects in hampering the rearmament of the RAF to meet the growing threat of European fascism. There are also links to experience gained by the RAF as Imperial policeman in the inter-war years proving invaluable in operating in the Western Desert Campaign and the high degree of improvisation and innovation that was required in that campaign.

Of the 2,696 citations representing one hundred per cent of citations (see appendices 1and 2), they are split accordingly. A total of 436 primary source citations represents 16.2 per cent of the total citations

1. 36 citations for Military History-the Evolution of the RAF.
2. 196 citations for The Environment-the Western Desert.
3. 204 citations for Organisational Studies-the Organisational Culture of the RAF.

A visual representation of the data is shown on a bar chart here at figure 4.1:

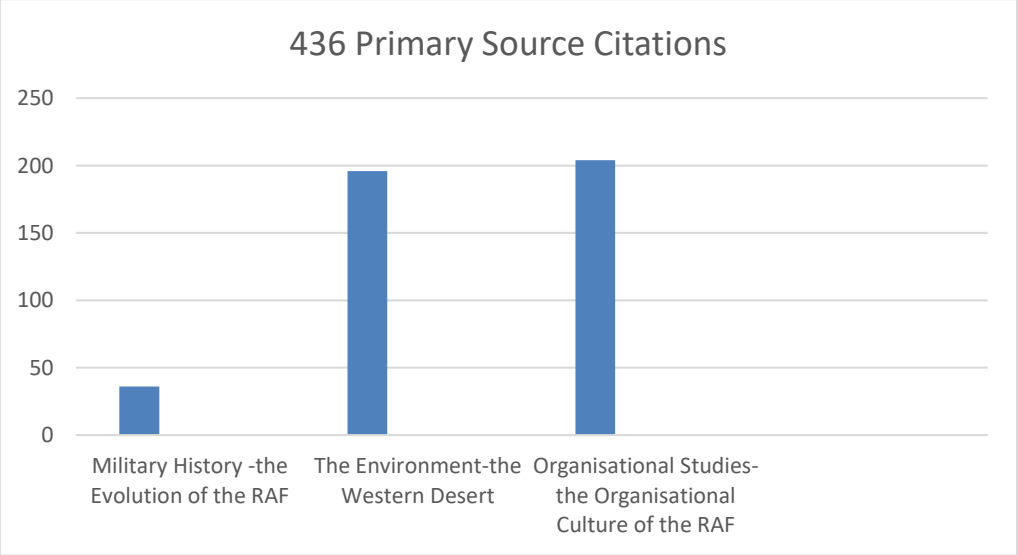


Figure 4.1: Primary Source Citations

Source: Author's elaboration from the data

A total of 2,260 secondary source citations represents 83.8 per cent of the total citations

1. 415 citations for Military History-the Evolution of the RAF.
2. 503 citations for The Environment-the Western Desert.
3. 1,242 citations for Organisational Studies-the Organisational Culture of the RAF

A visual representation of the data is shown on a bar chart here at figure 4.2:

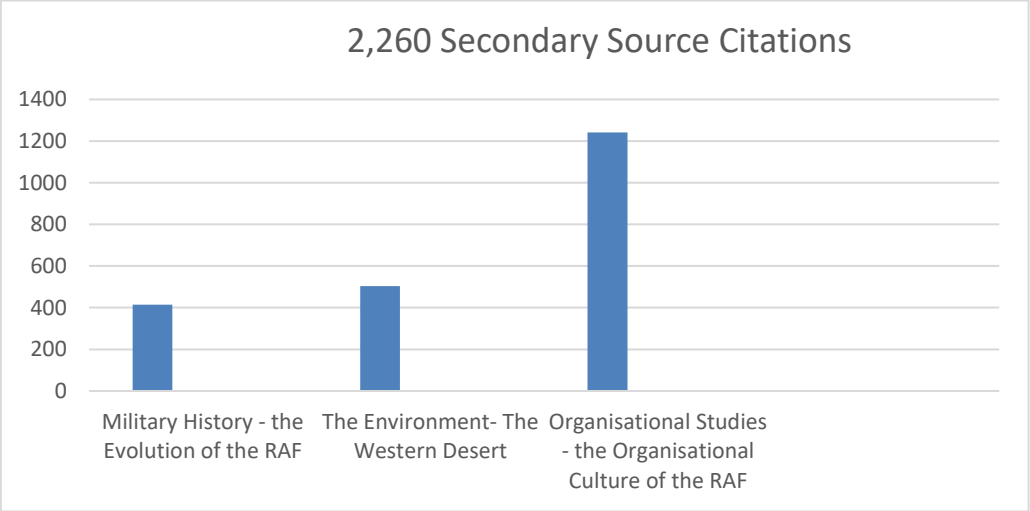


Figure 4.2: Secondary Source Citations

Source: Author's elaboration from the data

Held separately by the author as part of the background to this thesis, are three image files used in the compilation of this thesis, comprising additional visual aids (not replicable here for reasons of software technical limitations). These conform to the same theme and sub-themes so they and the data set form not only a textual representation but an aural and visual representation of the theme(s) which the author believes to be both robust and saturated. It can be appreciated that the volume of citations and their interdependence give rise to an exceedingly enormous number of combinations estimated at circa 37,000. To attempt to specify every combination would be beyond practical application in this thesis. Therefore, as part of the discussion narrative, 6 matrices (see appendices 1and 2 below) set out how the data set functions have been chosen and set out to demonstrate various perspectives or topics within the theoretical framework of Adair's Action Centred Leadership theory. In addition, a number of other complementary organisational development theories centred on leadership, emotional intelligence, multiple intelligences, group formation, and span of control will be discussed. It should also be noted that for completeness when compiling the matrices some 300 works contained in a separate bibliography have been referred to but not cited in the matrices.

4.8 Consideration of the adjectives 'small,' 'resilient, and 'effective,'

The six examples drawn from the data set are now discussed to discover whether they conform to the definitions of 'small,' 'resilient,' and 'effective' contained in the research question. These terms will be considered in organisational development terms including Adair's Action Centred Leadership theory (Adair, 1987) and Belbin's (1993) work on characteristics of a team. The three adjectives will then be discussed in the context of how they relate to the entity of a 'team' where team is also defined. The adjectives 'small,' 'resilient,' and 'effective' have been referred to previously in the research question section in chapter 1, and it is useful to restate them here as an aid to discussion.

Adair passes no judgement on what, is deemed to be 'small.' Adair's position is that the size of the team is dependent on the nature of the task and other circumstances. Some guidance on what may constitute 'small' is defined by both Graicunas (1937) and Urwick (1957). They both cite General Sir Ian Hamilton, who in 1922, wrote the following:

> The nearer we approach the supreme head of the whole organisation, the more we ought to work towards groups of three, the closer we get to the foot of the whole organisation, the more we work towards groups of six.

It would therefore seem reasonable to conclude at this stage that 'small' in the context of team size falls somewhere between three and six members. Hamilton's, experiential gut-feel concept of a team, is echoed by Katzenbach and Smith (2015), who define a team as 'a small group of people with complementary skills who are committed to a common purpose, performance goals and approach, for which they are mutually accountable.' Adair (1987, pp.172-173) describes a team as:

> A group in which individuals have a common aim and in which the jobs and skills of each member fit in with those of others, as-to take a very mechanical and static analogy-in a jigsaw puzzle, pieces fit together without distortion and together produce some overall pattern.

Moving to the concept of 'resilient' teams Alliger *et al* (2015, p 182) defines the concept 'as having the capacity to withstand, overcome, and bounce back from challenges, and do so in a manner that enables sustained performance and ongoing viability'. Alliger's

definition is remarkably similar to the Concise Oxford English Dictionary 12th ed, which defines resilience as 'of a person or animal able to withstand or recover quickly from difficult conditions. Resistant to setbacks or adversity or hardship.' Given the convergence of the two definitions and their similarity, it would seem reasonable to use Alliger's explanation for the purposes of this thesis. 'Effective' is defined by Adair (1987, p.172) as 'a team that achieves its aim in the most efficient way and is then ready to take on more challenging tasks if so required.'

To frame the discussion, six examples (two from each of Adair's three elements) have been selected which test the research question and encompass the evolution of the RAF post First World War through to the Western Desert campaign. The examples also span the broad spectrum of the entity of the pilot-fitter–rigger team and test to see whether the examples conform to, or satisfy the three definitions discussed above, and also in chapter 1. The Venn diagram generated by the author previously shown at fig 2.2 above is restated below for clarity in understanding how the major themes relate to each other and conditions the discussion on coding. Although there are three discrete major themes previously referred to above, they mesh with each other and produce as a Venn diagram does, a synergy at the centre where the three elements overlap. To endeavour to discuss them in an integrated manner would, it is suggested, produce a discussion that would be difficult to follow. Therefore, the author took the decision to discuss each theme as a separate entity and through the process of coding and subsequent discussion, demonstrate how the three elements related to each other to produce a holistic picture of how the organisational development elements relate to each other.

4.9. Military History, the Evolution of the RAF,

4.9.1 The Task

4.9.1.1 The aftermath of the First World War and Imperial policing

To gain an appreciation of the evolution of the RAF during the inter- war and Imperial policing years and the type of aircraft flown in the period 1918-1939, the author interviewed John 'Smudger' Smith, and Tony Lowe at the Aircraft Restoration Company

Duxford, Cambridgeshire. Both men are internationally recognised as expert vintage aircraft restoration artisan craftsmen. Working as part of the Aircraft Restoration Company they undertake commissions from around the world to restore or re-construct vintage and classic aircraft. In their workshop they were able to demonstrate to the author the skills required to restore and re-construct such aircraft. Current aviation legislation prohibits them from constructing a completely new aircraft, instead they have to restore, re-construct or make new individual components, some from original manufacturers' drawings and specifications (many of which are scarce). Some from copying existing components, and some from educated guesswork conditioned by aviation mechanical engineering knowledge. The skills and knowledge they demonstrated to the author were virtually identical to that of fitter and rigger, ('Smudger' Smith having being ex RAF metalworker) except that some aspects are conditioned by modern legislation such as the Health and Safety at Work Act. When interviewed, both 'Smudger 'Smith and Tony Lowe emphasised the vital importance of keeping all mechanical parts clean and free of grit and sand as ingress of both would either prevent components from being assembled accurately or completely and/or bring about premature mechanical failure in combat service. This clean condition proved exceedingly difficult to achieve in the gritty dust-laden environment of the Western Desert.

4.9.1.2 Rearmament

During the 1918-1939 interwar years, particularly the latter years 1936-1939, the RAF transitioned from First World War wood and fabric biplanes to stressed skin technologically advanced (for the day) monoplanes. The scaling up of the rearmament schemes produced not only an increase in the total number of aircraft manufactured, but also a quantum leap in the type of aircraft produced. This change in the type of aircraft from the then predominating First World War wood and fabric biplane (Jefford, 2001, p.119)**,** to modern, stressed metal skinned aircraft brought about large-scale changes both in the construction materials, the method of construction along with the manufacturing skills needed to support and develop the rearmament schemes. The fact that the RAF was by the mid to late 1930s still flying First World War designs was owed

to three prevailing factors, firstly the paucity of funds allocated to the RAF for the replacement of what were rapidly becoming obsolete designs, secondly, the institutional conservative nature of British aircraft design and development, and lastly, the equally conservative views of RAF fighter pilots and senior commanders(many of them veterans of the First World War)who were used to flying biplanes with a fixed undercarriage and an open cockpit (see figure 4.3 below).The purpose of including the photographs at figures 4.3, 4.4,and 4.5 is to give a visual demonstration to the reader of the fundamental difference between the First World War design biplanes and the more sophisticated later generation of stressed skin Second World War monoplanes.

Above: Gloster Gauntlets of No 19 Squadron, also at Mildenhall in July 1935. The Gauntlet was introduced in May of that year, and with a top speed of 230mph was appreciably faster than its predecessor, the Bristol Bulldog. However, its open cockpit, bulky air-cooled radial engine and armament of only two fuselage-mounted machine guns all dated back to World War 1. HU 26040

Figure 4.3: Typical pre- Second World War RAF biplane 1935.
Source: Adkin, F. From the ground up. Airlife Publishing Ltd 1983 p174)

4.9.1.3 Technical development, Aircraft and Weapons

The advent of a new generation of aircraft were more technically advanced than their First World War predecessors, where First World War biplanes usually only carried one or two rifle calibre machine guns, the new Hurricanes (See figure 4.4 below) and Spitfires (See figure 4.5 below) were armed with eight rifle calibre machine guns with

four guns mounted internally in each wing (See figure 4.6 below) the wing being strong enough to withstand the mechanical stresses of the combined firing power of four guns (See figure 4.7 below).

LEFT The initial and early production standard of the Hurricane Mk I is evident in this view of K5083 in a late stage of its development flying in 1937 at Martlesham Heath.

Figure 4.4: Hawker Hurricane in Flight

Source: Blackah, P. Lowe, Malcolm, V. and Blackah, L Hawker Hurricane 1935 onwards (all marks) Owners' Workshop Manual Haynes Publishing 2010 p 13

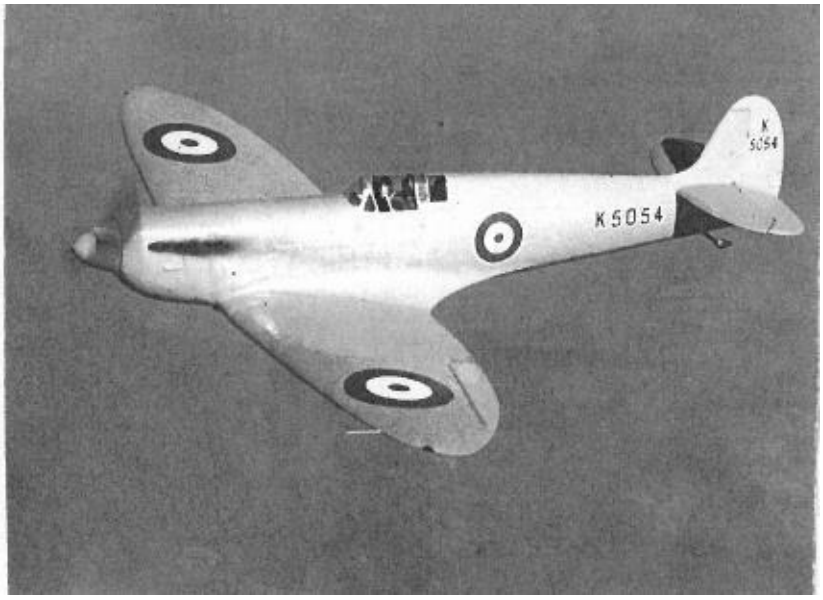
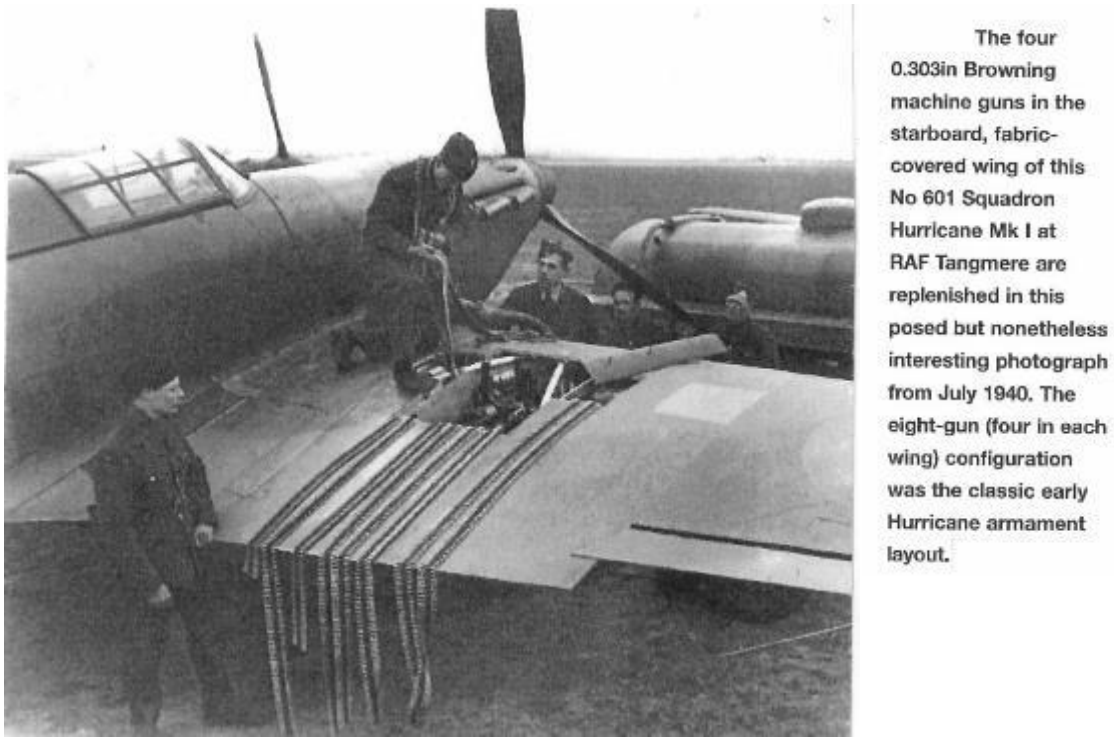


Figure 4.5: Supermarine Spitfire in it flight-test programme.

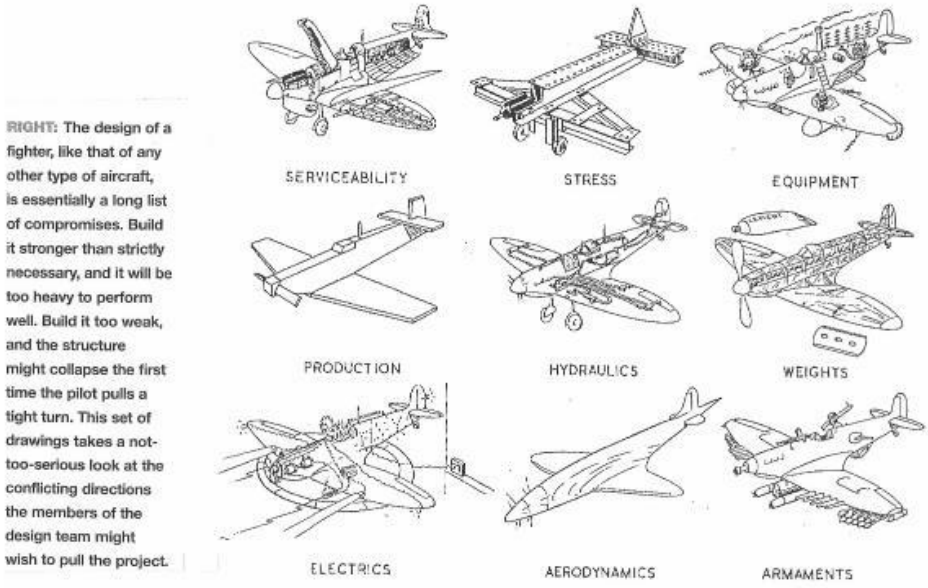
Source: Price, Dr. A. and Blackah, P. Supermarine Spitfire 1936 onwards (all marks) Owners' Workshop Manual Haynes Publishing Company 2007.p 22.



The four 0.303in Browning machine guns in the starboard, fabric-covered wing of this No 601 Squadron Hurricane Mk I at RAF Tangmere are replenished in this posed but nonetheless interesting photograph from July 1940. The eight-gun (four in each wing) configuration was the classic early Hurricane armament layout.

Figure 4.6: Hawker Hurricane wing armament.

Source: Blackah, P. Malcolm, V. and Blackah, L. Hawker Hurricane 1935 onwards (all marks) Owners' Workshop Manual Haynes Publishing 2010 p66



RIGHT: The design of a fighter, like that of any other type of aircraft, is essentially a long list of compromises. Build it stronger than strictly necessary, and it will be too heavy to perform well. Build it too weak, and the structure might collapse the first time the pilot pulls a tight turn. This set of drawings takes a not-too-serious look at the conflicting directions the members of the design team might wish to pull the project.

Figure 4.7: Fighter aircraft design considerations.

Source: Price, Dr. A., and Blackah P. Supermarine Spitfire 1936 onwards (all marks) Owners' Workshop Manual Haynes Publishing Company 2007.p 22.

The twin engine Bristol Blenheim (see figure 4.8 below) carried the innovation further by mounting a single machine gun in a powered gun turret in the upper fuselage operated by an air gunner seated inside the Perspex domed turret. This innovation was quickly followed by the installation of four machine guns mounted on the forward underside of the aircraft which were aimed and operated by the pilot.

Figure 4.8: Bristol Blenheim in flight.

Source: Speight (1940, pp. 64-65)

Also, for the first time, aircraft were fitted with radio transmitters/receivers, permitting pilots to communicate not only with each other in air combat, but be able to be directed into combat by ground controllers. Controllers situated away from the immediate combat had a comprehensive overview of the way a particular action was developing and were able to marshal and direct the aircraft in the most efficient and effective way to engage the *Luftwaffe.* This ability to co-ordinate combat performance was later to prove a pivotal factor in the Western Desert campaign where the Desert Air Force was

able to provide close air and ground support to the British Army in its actions against Rommel's *Afrika Korps,* and the *Luftwaffe.*

4.9.1.4 Training and infrastructure

New and radically different aircraft and equipment needed an equally radical and different level of training of ground crew (Adkin, 1983). Not only were the aircraft different in the construction of their airframes, transitioning from wood framed, fabric covered structures to precision machined strong stressed metal skin and structures; the engines need to power the new aircraft were also radically different in their design philosophy from their predecessors. Whereas First World War biplanes had predominately air-cooled radial engines (See figure 4.3 above), the new generation of fighter aircraft tended towards liquid cooled 'vee' engines; so, called as their cylinder banks were arranged in a 'vee' shape when viewed from the front**.** This type of engine was particularly sophisticated and complex in its design and operation, comprising in the case of the Rolls Royce Merlin containing eleven thousand individual components (see figure 4.9 below).

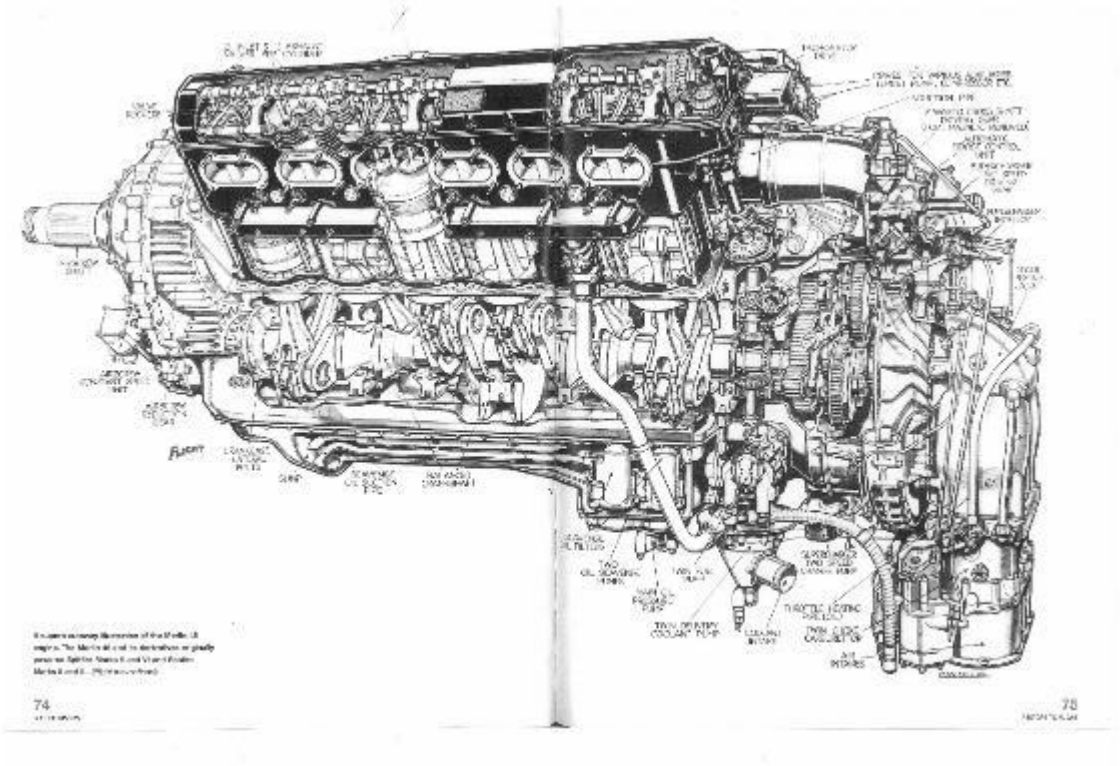


Figure 4.9: Cutaway diagram of Rolls Royce Merlin engine as fitted to the Hawker Hurricane and Supermarine Spitfire

Source: Price and Blackah (2007, pp. 74-75)

After training as laid down in Kings Regulations (Air Ministry, 1938a;Air Ministry, 1938b) the fitter and rigger were expected and required to have a comprehensive knowledge of the construction, operation, servicing, repair, and maintenance of all such engines and airframes. To enable the reader to appreciate the scale of the technological advancements the author will use an analogy; it was as if First World War biplanes represented the manual typewriter, with the new generation of fighter aircraft representing current word processing technology on a smartphone, where only the layout of the keyboard and the engineering principles remained constant. Everything else had changed, with nothing in between in the execution; all compressed into a five-year time frame approximating to 1935-1939. Early on in the evolution of the RAF, Trenchard (Boyle 1962) recognised the need to develop a system and infrastructure that would be capable of supporting the technical training and education of RAF personnel, both for officers and N.C.Os. Officers needed to be trained in how to handle, navigate, and fly the newer more powerful breed of aircraft, such aircraft needed careful

handling both on the ground and in the air, if only to avoid malfunctions, and accidents, with fatalities draining away manpower. Neil, in a primary source interview with the author recounted how when taxying a Hurricane or Spitfire on the ground before take-off, the pilot's forward view was obstructed by the long nose of the aircraft needed to house the engine, so extreme care had to be taken not to collide with another aircraft or hit ground crew or other obstructions hidden from view (See figure 4.10 below) . The film clip below illustrates to the reader, the situation where a pilot forgets to lower his undercarriage on his final approach to landing, and is only just averted from having a serious, potentially fatal landing accident. It also shows a ground crew member directing the aircraft on the ground to its correct location on the airfield. The film clip is important in that points up the importance of ground crew having good spatial awareness in their ability to judge the size of the taxying aircraft and the presence of other potential obstructions or hazards. This spatial awareness is another facet of multiple intelligence identified by Thorndike (1920, pp.227-235)

Figure 4.10: Film clip from the film Battle of Britain

Source: https://youtu.be/DVKPS5aPvOc Spitfire Productions 1969. Accessed 4/8/21

The pilot also had to take care to execute a swift take off to avoid as Neil said in a primary source interview with the author, 'boiling the bloody engine' (*sic*) as large powerful liquid cooled aircraft piston engines generate much heat and can boil dry very quickly, (much like a kettle boiling dry). Excess heat undissipated by the cooling effect of forward motion, produces considerable expansion of engine components causing excessive friction thus seizing the engine necessitating a complete engine change to the dismay of the ground crew. In addition to officers, N.C.O.s needed to be trained in the complexities and technologies of the emerging designs such that they were capable of servicing,

repairing, and maintaining the aircraft in an airworthy, timely, efficient, and effective manner. To do this the concept of Training Command was devised early on and implemented based on two branch Commands, Flying Training Command, and Technical Training Command. For Officers undergoing Flying Training this was principally centred on the Royal Air Force College, Cranwell in the eastern English county of Lincolnshire (Bowyer, 1988), whilst Technical Training was established through a network of technical training schools, with the principal centre of training established at Halton near Aylesbury in Buckinghamshire (Bowyer, 1988, pp.19-20).

For both Commands, entrants were drawn from all sections of their respective social classes. For officers undergoing Flying training this was predominately from the public school or University graduate stream drawn from the then middle and upper classes, and from the Dominions as previously noted (see also the squadron organisation chart above). For Technical training, entrants were drawn from secondary school leavers, predominantly lower-middle classes with professions such as draughtsman, mechanical engineers; and manual working classes from artisan trades such as motor mechanics, carpenters and wood workers, electricians, and plumbers (James, 1991). This is further evidence that entrants were required to have not only the skills in their allocated trade, but they had to possess multiple intelligences (Thorndike, 1920;Gardiner & Wenborn, 1995) along with emotional intelligence (Goleman, 1996;2013) to understand how the different trades meshed together to produce an integrated service maintenance service.

4.10 Military History-The evolution of the RAF summarised-the key messages

Summarising this major theme illustrates that post First World War the RAF had the responsibility of policing by air, large distant tracts of the British Empire which at that time was at its zenith. Post First World War spending restrictions, successive government policy, and widespread British pacifist public sentiments obliged the RAF to operate with the minimum of resources in locations far from the United Kingdom making supply and resource logistics difficult and protracted. The fact that the majority of the operational theatres were inhospitable (Boyle 1962, Bowyer 1988) although not

fully appreciated at the time, proved to be invaluable in terms of learned behaviour when confronting the *Luftwaffe* nearly a decade later in the Western Desert. The RAF also had to contend with starting from a very low base of suitable modern aircraft to face the *Luftwaffe* and the *Regia Aeronautica.*

4.11 Environment, the Western Desert,

4.11.1The group

In considering the major themes and sub themes one principal fact must be taken into consideration, that of the environment of the Western Desert and the Western Desert campaign. War demonstrates society's fine balance and reveals the inherent delicacy of civilization. It is one thing to formulate any organisational development theory in the assumed comparatively, safe, and secure environment of peace time industrially developed western countries. In contrast it is quite another to consider any theory(ies) in an unsafe front line combat environment with the ever-present threat of life-changing physical injury, or death. The Western Desert campaign was fought in an environment which was (is) unlike anything found in Europe and recognised as a hot desert climate with extremes of temperature experienced both by day and at night**.** The dry gritty, sandy topsoil was (is) pervasive and was (is) highly detrimental to all forms of mechanical transport. The distances existing between habitations and fixed infrastructure produced challenges for the logistics of (re-)supply, including water essential for survival. Added to this, the open expansive topography of the coastal plain on which the Western Desert is situated, brought about a style of mobile fast-moving warfare that was particular to that campaign (Moorehead, 1944) this mobile style had profound effects on both operations and mobility; and required innovation and improvisation to keep up with the pace of combat developments.

The RAF benefitted greatly from having previous experience of Imperial policing operating in a hostile desert environment and having a *cadre* of leaders, both officers and N.C.O.s who were well versed in the ways of operating in and adapting to the ways of the desert (Bowyer, 1988)**.** Some appreciation of the degree of heat experienced in the Western Desert by ground crew can be gained from a North American study

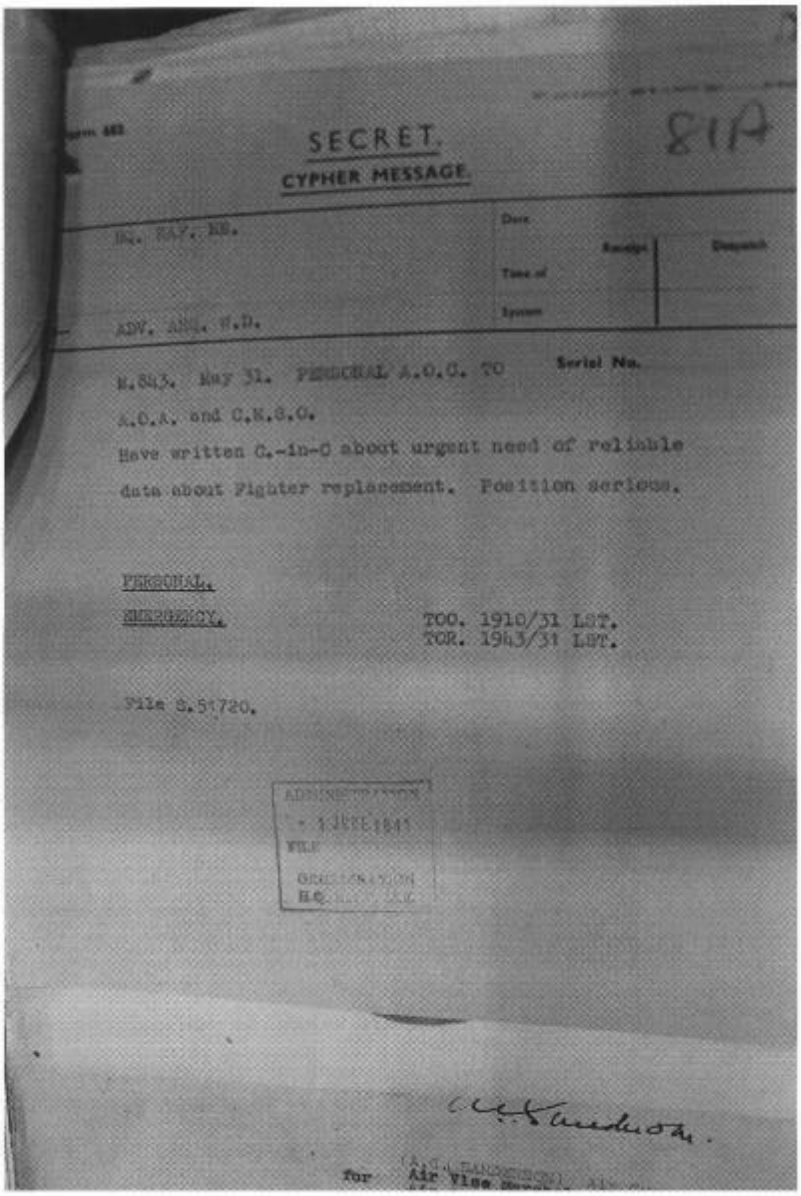
conducted by Arizona State University in 2018 (ASU News, 2018) which found that an average saloon car reached internal temperatures in the range of 95 degrees Fahrenheit (35C) after less than one hours exposure to direct sunlight and up to 157 degrees Fahrenheit (69C) depending on the length of exposure to direct sunlight, the size of the car, and the internal materials of the car. The results give a good indicator of the degree of heat ground crew had to contend with in their daily routine working inside, or close to metal skinned aircraft. Consider now that the ground crew had to work in, on, or around the aircraft and for some inexplicable reason the aircraft would not start or idle properly. The ground crew had to find the fault and rectify the problem, not only was there an operational imperative to get the aircraft to start and or idle properly. There was the considerable fact that the *Luftwaffe* or *Regia Aeronautica* might appear at any moment fervently intent on killing the ground crew; those circumstances then represent the desert environmental situation that the fitter and rigger found themselves in day after day. The author has personally observed several Second World War combat aircraft closely on a particular day and noticed that on each aircraft the airframe skin is approximately 3 millimetres thick aluminium (3mm in metric units or $1/8^{th}$ of an inch in imperial units), with no sound or other insulation. The day the author conducted his observations was a moderately warm day (approx. 23C), and the skin of the aircraft was uncomfortably hot to the touch, equivalent to standing next to a one bar electric fire. The temperature in a typical cockpit with its Perspex canopy covering was in excess of 30 C. For ground crew working on the engines the workplace environment was equally perilous, the engines and the cockpit on some aircraft were several feet from the ground, and in the case of larger aircraft could be as much as twenty from the ground. Working on a step ladder without a safety harness (long before health and safety or working at height legislation could prove hazardous (See figure 4.12 below **),** as ground crew could fall, or slide off the aircraft onto the ground.

When not contemplating the *Luftwaffe* or *Regia Aeronautica,* or adapting to the oppressive desert heat, ground crew had to contend with the sand, as fine as talcum powder. The sand got into every orifice and machine part and formed deceptive crusts on areas of soft sand capable of swallowing small vehicles and people. Often towering

sandstorms which the Egyptians called *Khamseen,* and the Libyans *qibli* developed, when all fighting ceased and both sides settled down and waited. (Pallud 2012). The *Khamseen* was a wind sweeping across the Sahara, it reached the north with the heat of a blow torch. Besides the sand, snakes, scorpions, and spiders spread their fair share of horror stories amongst front-line personnel and new recruits alike (Caddick-Adams, 2011)**.** Boots were turned upside down at night to avoid scorpions crawling into them to escape the cold of the desert night. The ends of the legs of fold-up camp beds were placed in petrol-filled shallow tins to stop poisonous spiders, scorpions, and other insects from crawling up the legs and onto the sleeper. People sleeping in the open rolled themselves tightly into their blanket, wrapped their groundsheet around them, and did the drawstrings up tightly to deter intruders. Moorehead (1944) in his work *African Trilogy* written whilst he was a war correspondent at the time of the Western Desert campaign, recounts how the British learned to live with the desert and not try to master it as the Italians attempted to and failed. He recounts how the desert surface impeded mobility through choking clouds of dust. He describes the absolute dependency on the provision of adequate water supplies through efficient logistics and the inadequacy of the British 'flimsy' can which carried either water or petrol. Most strikingly, he sets out in six reasons why, in his opinion, the British had initial setbacks in the Western Desert campaign. Moorehead (1944) then cites the failure to get supplies forward, the failure to capture Benghazi situated in Libya, working as a port and an air base, poor communications, the slow recovery of vehicles, the exceptional weather, lastly, the superiority of German guns and tanks.

4.11.2 Operations.

The RAF entered the Western Desert campaign with a varied collection of aircraft some of which were obsolete First World War types of biplanes and some the new generation of monoplane fighters. Fighter resources in general were much needed, a signal from RAF headquarters Middle East to the Air Ministry in London demonstrates the urgent need for fighter replacements which could take many weeks or even months to materialise even *via* the 'Takoradi' route discussed elsewhere (See figure 4.11 below).



SECRET.

CYPHER MESSAGE.

HQ. RAF. ME.

ADV. AHQ. W.D.

Date

Time of Receipt

Time of Despatch

System

Serial No.

M.843. May 31. PERSONAL A.O.C. TO

A.O.A. and C.M.S.O.

Have written C.-in-C about urgent need of reliable data about Fighter replacement. Position serious.

PERSONAL.

EMERGENCY.

TOO. 1910/31 LST.
TOR. 1943/31 LST.

File S.51720.

ADMINISTRATION
1 JUNE 1941
FILE
ORGANISATION
H.Q.

for Air Vice Marshal

Figure 4.11: Signal from RAF Middle East regarding fighter aircraft replacements

Source: Air File 23/1048 National Archives Kew.

Notwithstanding all the achievements on the ground, facilities remained basic, often primitive, for a large part of the RAF. Away from places such as Cairo, Alexandria, Heliopolis, and Aboukir in and around the Nile Delta; fixed installations barely existed, sleeping, and living in tented facilities or slit trenches were the norm. In the vastness of the desert, all day-to-day aircraft maintenance and running repairs were done in the open exposed to the full heat of the desert. (See fig 4.12 below). Note the precarious nature of the ladder work.

Figure 4.12: Day to day maintenance and running repairs in the open on a Bristol Beau fighter, Fighter – Bomber.

Source: Bing Images

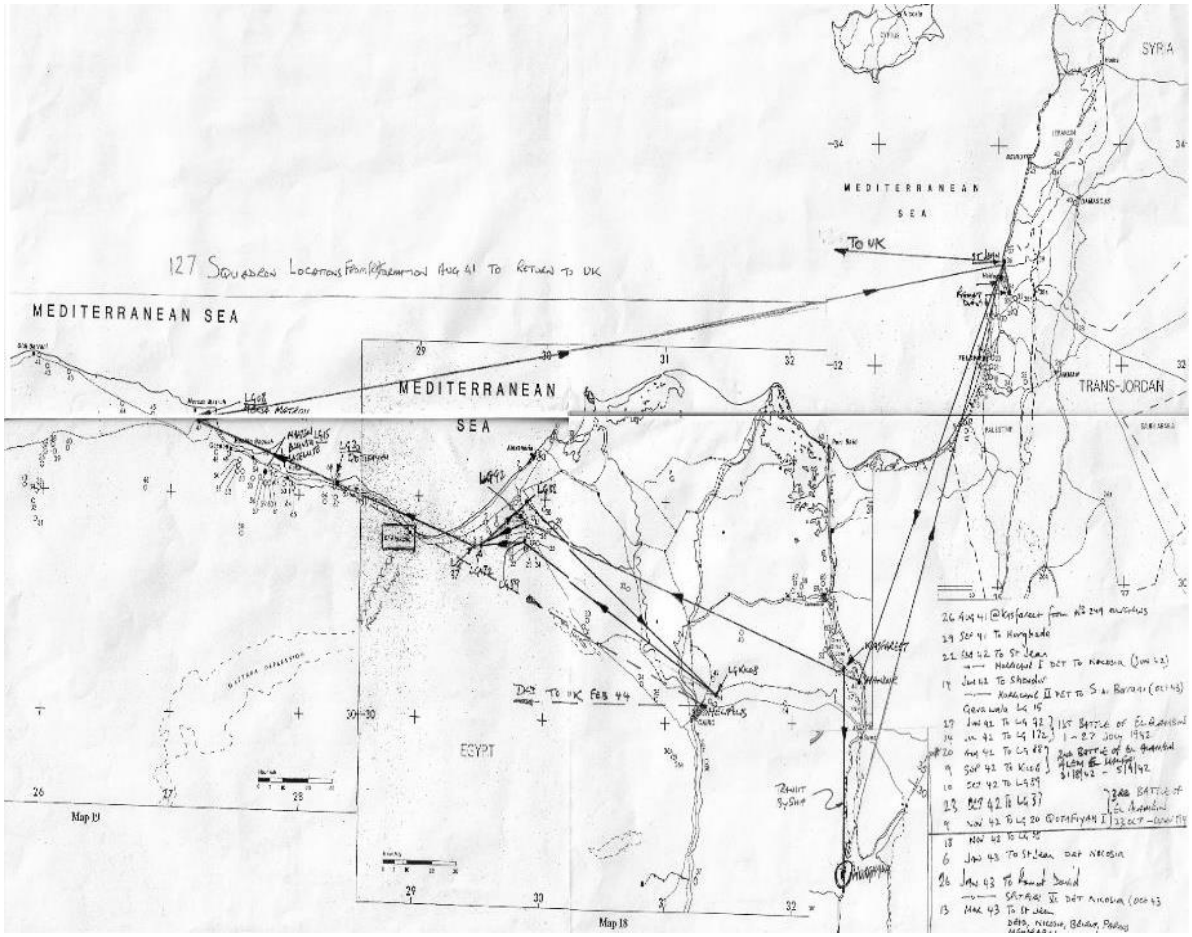
The ground crews had been stripped of much of their equipment, to enable them to move at a moments' notice, but despite this handicap they maintained an extraordinary level of serviceability. By working through the night, they ensured that the Desert Air Force was able to keep around 80 per cent of its strength for much of the time**.** Bigger requirements such as engine refurbishment, major repairs, aircraft rebuilds after crashing, or significant battle damage were transported back to workshops either at Heliopolis or Aboukir in the Nile Delta well away from the front line. (See figure 4.13 below).

Figure 4.13: A Hawker Hurricane salvaged from the Western Desert loaded onto a captured Italian lorry and trailer, for return in convoy to British workshops for repair.

Source Bing images.

As there were no fixed facilities and infrastructure, a series of rudimentary airstrips were surveyed and designated as numbered landing ground and given the designation 'LG' and sometimes a number to differentiate them where one or more were located close together. Where a significant geographical feature or settlement was close to hand a name was also used (Jefford, 2001)**.** Often, landing grounds were located by map coordinates only, and the designated area was cleared of stones, the surface levelled as best as could be done with resources to hand, and dispersal areas marked out crudely with the previously cleared stones. The squadron(s) would then arrive and set up their tented facilities. Everything was done to facilitate a rapid transfer between landing grounds with all workshop machinery, tools and stores items based on trucks ready to

be packed away and secured at short notice. A typical example was the Hawker Hurricane equipped 127 squadron who moved completely by truck and rail firstly from Egypt to Palestine then back to Egypt (See map 4.1 below).



Map 4.1: Detailing the Desert Air Force 127 squadron's movements, Egypt- Palestine-Egypt.

Source: author's elaboration developed and annotated from Jefford (2001)

The inventory of Desert Air Force aircraft was expanded greatly by an influx of American designed and built aircraft such as the P.40 'Kittyhawk' fighter bomber (see fig4.16 below) as a result of the implementation of the 'lend-lease' scheme agreed between the then British Prime Minister Winston Churchill, and the American President Theodore Roosevelt. However, the influx of the much-needed aircraft brought its own problems, pilots had to be trained in how to fly the new aircraft with their particular handling characteristics, (See 'stocky' Edward's quote below) and ground crews had to be trained in the maintenance and servicing *regimes* of the new aircraft. There was the

additional problem that the new aircraft were built to American engineering standards and items such as nuts and bolts, screws, individual gear wheels and complete gear trains and other parts would simply not fit as American and British engineering standards were incompatible although superficially looking the same to a lay observer,(Oberg, 1970, pp. 1116–1126,1233-1342). This incompatibility obliged fitters and riggers to adapt parts through re-screw threading of nuts and bolts ,re-machining, or fabricating whole new parts; in much the same manner as 'Smudger' Smith does today, fitters often working from mobile workshops based on lorries. The fast moving mobile nature of the Western Desert campaign often resulted in the RAF acquiring numbers of captured German *Luftwaffe* and Italian *Regia Aeronautica* aircraft . Working on the basis of making the maximum use of the resources to hand, they pressed some of the captured aircraft into Desert Air Force service in transport or communications *roles* after being repaired, then repainted in British camouflage colours, often using the nearest equivalent colours from captured German or Italian stores paint supplies (see figure 4.14 below). The word 'clipper' painted on the side of the aircraft is a wry reference to the pre-Second World War American Boeing Corporation luxurious flying boats that plied the trans-North Atlantic air routes, whereas the Junkers JU 52 interior was basic in the extreme.

Figure 4.14: A German Junkers JU 52 transport aircraft captured by the British and pressed Into RAF service.

Source: Bing images.

The practice of utilising multiple sourced aircraft added a third dimension to the problem of operations as German and Italian aircraft were manufactured to different engineering standards using the metric system of manufacturing. Thus, it was entirely possible for a situation to arise where a squadron could be operating with three or four nationalities of aircraft with three quite different standards relating to repair and servicing. This had an impact on logistics, particularly in relation to the flow of aircraft and spares, which explains the widespread practice of improvisation and innovation that will be discussed in the section below. Operations in the Western Desert brought their own particular problems, aircraft engines by their very nature raised sand dust clouds on take-off and landing (see figure 4.15 below). Previous mention has been made regarding the problems experienced by pilots when taxying into a take-off position, the forward visibility problems were exacerbated by the dust clouds created by the propeller wash. Visibility problems were so bad that a fitter or rigger was obliged to sit on a wing close to the tip to give hand signals to the pilot enabling him to manoeuvre to a take- off position (see figure 4.16 below). Indeed, any significant movement of personnel or equipment raised such clouds adding to the problem. The resulting dust clouds also gave away their tactical position and could bring down enemy bombardment.

Figure 4.15: Aircraft take- off or landing dust trails

Source: Bing images.

Figure 4.16: A Desert Air Force 112 squadron, P40 Kittyhawk fighter manoeuvring for take-off with a fitter sitting on the port wing directing the pilot 'straight ahead'

Source: Sharpe (2002, p47)

Taken together, figures 4.12,4.15 and 4.16 amply demonstrate the hazardous working conditions that the fitter and rigger and other ground crew worked under. Figure 4.16 is particularly notable in that the fitter is sitting around two metres from the ground (approximately six and a quarter feet) on what is a moving platform with a smooth surface, in close proximity to a four metre (approximately twelve to thirteen feet) metal blade propeller rotating at around 1,000 revolutions per minute (rpm) in a dust storm. The fine dust found ingress into engine air-filters causing engines to clog and stop running, it permeated into engine bearings causing premature wear and tear Engine air filters on Bristol Blenheim fighter bombers needed cleaning out every five flying hours, the cleaning out took one man three hours on each occasion. Holland (2006), in his work *Together we Stand* Holland writes on the remarkable logistical efforts of the Desert Air Force, which was due to the extraordinary efforts of the Middle East Maintenance and Supply Organisation run by Air Vice-Marshal Dawson. Dawson, working closely with Air Commodore Elmhurst as administrator, ensured that aircraft continued to arrive at the front. It was Elmhurst who, in the lull preceding the battles had made plans through the application of the management technique of Operational Research (OR), (Air File 23 series 1941,1942.) that would enable the RAF to move forward or back quickly, should the land battle require a rapid advance or retreat. Through the application of Operational Research, the fighter and bomber wings were split into two parties so that

pilots, aircrew, and aircraft would never be out of action and would be able to operate for a couple of days with only half of their men and equipment, while the other half was moving forward or back to a new location. Then, the two parties would swop *roles* (Holland,2006).

At this point it is pertinent to discuss primary source material held at two principal locations. The first source is the official 'Air' series files stored at the National Archives at Kew. The second source is the official archive material held at the RAF Museum at Hendon. Documents at both sources are held either in original war time hard copy or on microfiche, and in the case of the National Archives have been open for inspection since 1972.

4.11.3 Air Ministry, Air File 27/929 127 Squadron Operations Record Book (Air Ministry,1942)

As the title suggests, an Operations Record Book ORB)reports on a daily basis, operations that were undertaken by the squadron concerned. Each entry gives the place, date, time and summary of events, and depending on circumstances can be quite detailed and provide a wealth of information for the historian or researcher (Air Ministry, 1942). What is remarkable is not only the detail included in each report-some days' entries are almost hourly depending on the pace of events; but that someone took the time, effort and perseverance to sit down in a tent during what is now accepted as being one of the pivotal battles of the Second World War and type up the reports on a manual typewriter, or if circumstances were difficult, written up by hand.

4.11.4 Air File 23/1048 Notes on Organisational Difficulties Especially during Mobile Warfare (Air Ministry, 1938b), 11/41- 2/42)

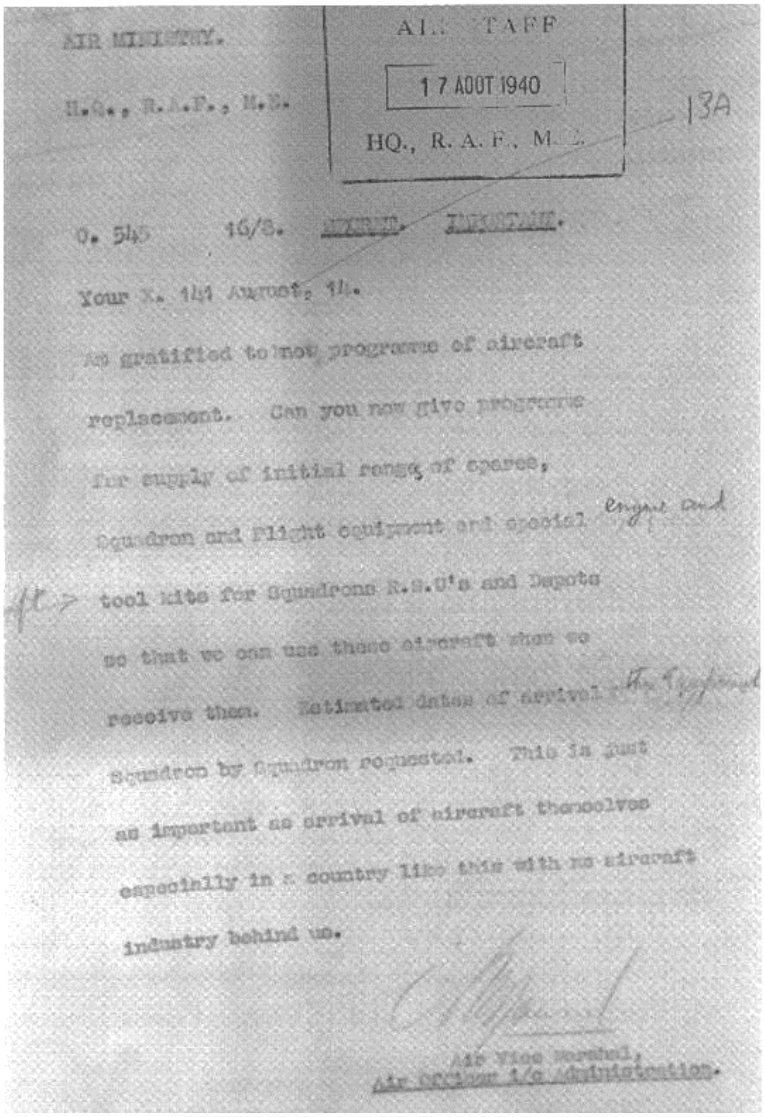
This relatively modest understated title belies the contents of the file. It details the various fighter and bomber wings down to squadron level as well as administrative and supply units, and support units based at the rear. The most important item in the file, however, is what is referred to as the Russell Report-Western Desert, a fifteen-page report drawn up by Air Commodore Russell (RAF HQ,M.E. March 1942) in response to

the operational, logistical, and organisational chaos that ensued during the retreat of the RAF and 8th Army post- operation 'Crusader' .It amounts to what is ,in effect, an internal consultant's report presented to the Chief Executive, Air Officer Commanding in Chief (AOCinC) Air Vice- Marshal Tedder, and the senior management team (Coningham, Elmhurst, Dawson, *et al*) . Handwritten marginalia show what was agreed, what was done, and pertinently what was not agreed, and the report was signed off by Tedder. Given the nature of the report and the suggestions put forward and its implementation, it is remarkable that nowhere in the historiography encountered thus far by the author has there been any reference in part or in full to the report or the reforms it brought about. The way the historiography reads, is that changes were part of the steep learning curve experienced by the Desert Air Force in its' combat evolution and transformation; the Russell Report as a catalyst for change has not been acknowledged. Perhaps the answer lies in the fact that the report does not reflect well on either the RAF or the 8thArmy either in terms of leadership, combat ability logistic, planning and co-operation. Tedder, perhaps for his own internal political reasons of RAF / Army harmony, decided to implement the report locally and quietly, sparing both organisations any further embarrassment. Neither would there be any benefit from exciting Churchill's attention over the matter, given his propensity to try to micro-manage operations at a distance (Alanbrook, 1940, p.96 Danchev,1941, p 170). Nor would Tedder want Portal, Chief of the Air Staff at the Air Ministry, asking penetrating questions. The conclusion that can be drawn from the episode is that Tedder had the desire to manage his 'team' and retain the ability to take and implement decisions close to the point of execution. In this respect he was acting in line with Adair's Action Centred Leadership model (Adair, 1987; 1984). Tedder was mindful of the 'team' element in that he had to consolidate the changes through an effective senior management team. Those changes had to be filtered down to operational managers at the front line who were charged with conducting those changes effectively. Then through the 'task' element carry through the prosecution of the air component of the Western Desert campaign, whilst at the same time ensuring that the 'individual' element of people's

needs was satisfied as far as possible given the circumstances and conditions both environmental and operational.

4.11.5 Air File 23/1402 Notes by AOC in C on Western Desert Problems *(Air File-23/1402.1940)*

This file is a series of correspondence between the Headquarters RAF Middle East and the Chief of the Air Staff at the Air Ministry in London on the question of deliveries of aircraft and, crucially, spare parts for those and other aircraft to the Middle East. (See figures 4.17,4.18,4.21and 4.22 below)


AIR MINISTRY.

A.I. STAFF
17 AOUT 1940
HQ., R. A. F., M. E.

13A

O. 545 16/8.

Your X. 144 August, 11.

As gratified to not programme of aircraft replacement. Can you now give programme for supply of initial ranges of spares, Squadron and Flight equipment and special engine and tool kits for Squadrons R.S.U's and Depots so that we can use these aircraft when we receive them. Estimated dates of arrival Squadron by Squadron requested. This is just as important as arrival of aircraft themselves especially in a country like this with no aircraft industry behind us.

Air Vice Marshal,
Air Officer i/c Administration.

Figure 4.17: Copy of signal marked ‘Secret’ and ‘Important’ referring to spares position, and lack of aircraft industry infrastructure In Egypt

Source: Air File 23/1402 National Archives Kew

4.11.6 Air File 23/6493 Maintenance, Supply, and Salvage Organisation-Western Desert 1942. 10pp plus 7 flow charts and diagrams as appendices.

This file details how the service operated, along with service unit dispositions, and contain Operational Research flow charts. For an example of the application of Operational Research (see figure 4.18 below) showing how the numerous services were structured and inter-related operationally. It is an illustrated diagrammatic operations manual and service specification combined (Air File 23/6493 RAF.H.Q. M.E.). This file and the documents in it were circulated to all the relevant officers, logistical and administrative staff, give a clear visual representation on how the salvage and maintenance organisation was supposed to function. Not only that, but the order in which the various functions occurred and how they interrelated to produce an effective and efficient service .By representing the service in that way, personnel responsible for executing the process would have clarity in what was needed to be done, how it was to be done, thus removing any ambiguity from the process.

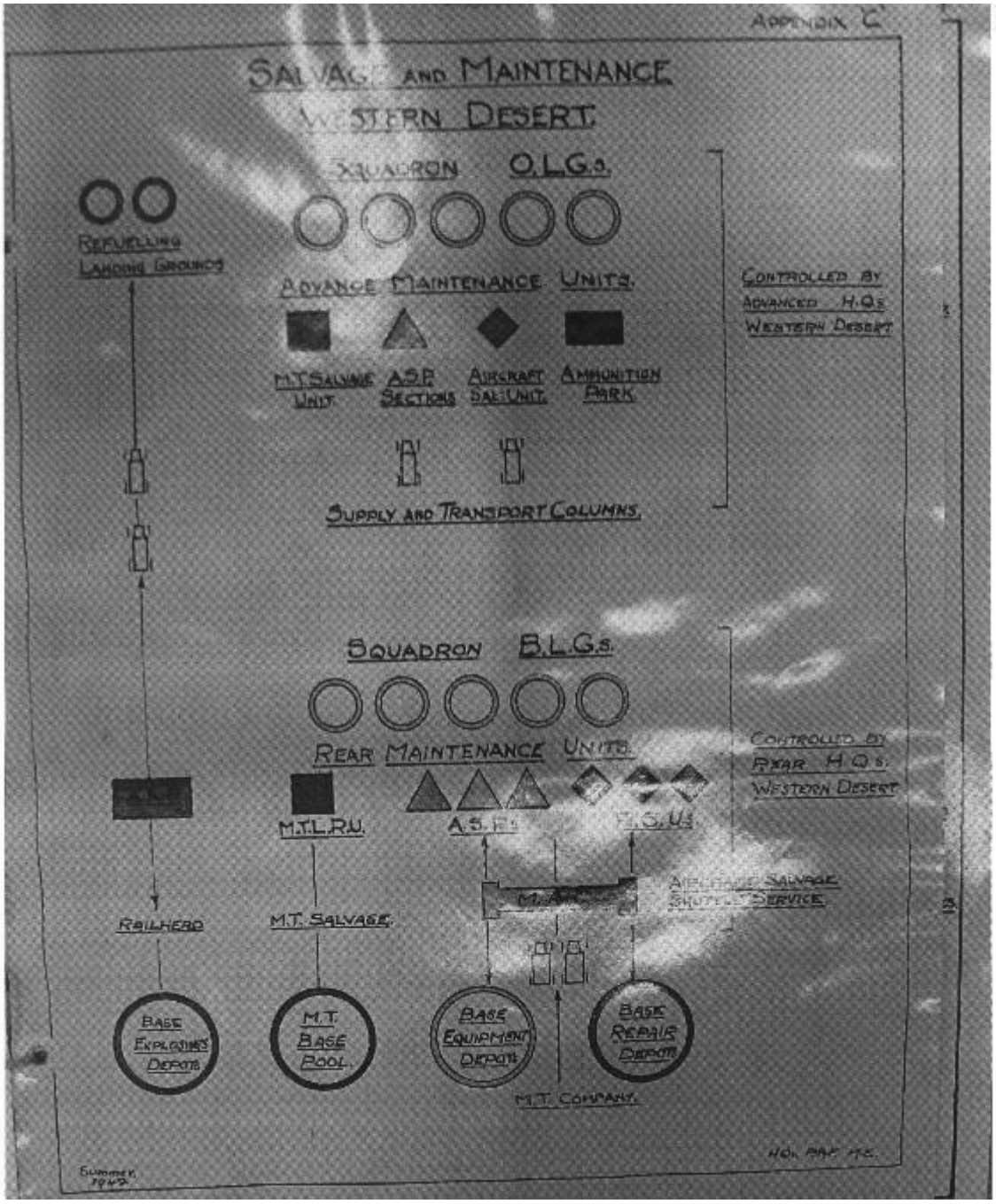


Figure 4.18: Operational Research chart illustrating the structure of the salvage and maintenance support service in the Western Desert

Source; Air File 23/6493 National Archives Kew.

Other official primary sources are contained in the post Second World War work, *The Official History of the RAF 1939-1945* co- authored by Richards and St George Saunders published in three volumes by Her Majesty's Stationery Office (HMSO).Officially commissioned, the three volumes are Vol I *The fight at odds 1934-1941,* Vol II *The fight*

avails 1941 – 1944, Vol III *The fight is won 1944-1945* (Richards & Saunders, 1953) Based throughout on official documents, they are largely confined to operations and operational policy. As the authors declare their preface to volume l, they accept that for reasons of space they cannot cover all the other activities that underpin operations. However, they sketch in naval, military, or diplomatic background as appropriate for air activity to be seen in its true perspective. It is with Volume ll that this thesis concerns itself with, especially chapters IX, X, and XI which take in the time period covered by this thesis. On reading the chapters and having read the works cited previously in this thesis there was little that was in effect new. What has appeared to happen is that the entire work of the volume (and the other two volumes), has been selectively used by other authors as source material for their various works. This is in no way to disparage any of the works, but it does induce the feeling in the author that it has all been done and said before.

The next source is Bracknell paper No 3, *A Symposium on the Land/Air Co-operation in the Mediterranean War 1940 -43*, sponsored jointly by the Royal Air Force Historical Society and the Royal Air Force Staff College Bracknell. It covers the full range of issues encountered in that theatre with speakers on subjects such as Land / Air Co-operation; and how the joint system worked in the Mediterranean theatre. References are made to the interdiction of German supply lines by RAF bombers. There are several pages devoted to the command system and the Tedder-Coningham-Dawson-Elmhurst team and its overarching contribution to the success of the Desert Air Force, and where Tedder laid out his four principles for successful air operations.

4.11.6 Ground Crew Memoirs, Diaries and Personal Papers

The archive material at the RAF Museum Hendon contains what are the most illuminating unofficial authentic sources on the conduct and progress of the Western Desert campaign. On opening the archive file boxes it is a peculiar sensation to handle, and in some cases, notice the smell of the documents in their original eighty plus years' condition. The documents record the situation through the eyes of the ordinary RAF men, recording not only the situation as was, but adding the writer's personal

observations and emotions which provide the background human context. It should be noted that at the time, the keeping of personal diaries and memoirs was strictly forbidden and was a court martial-able offence lest the writer be captured, and the contents could be of use to the Germans and Italians in divining tactical information and insights into the morale of the RAF. The sources vary from a type-written manuscript compiled after the war, through to handwritten loose- leaf pages and exercise books. Some have sketches of local scenes, and in one example described below, a Letts pocket diary; whatever was to hand at the time. What they have in common is that they all appear to be written as a process of catharsis as the writer tried to make sense of what was happening around him and to him. The writer may also have had an eye for recording their experiences for posterity or for family history. From the material it can be discerned that they were intelligent young men, often sensitive and artistic as well. A typical example is a birthday card drawn in soft pencil complete with shading, sent home to a son on the occasion of the son's fourth birthday. Looking at the card, from the construction of the text '**A HAPPY BIRTHDAY**, with its' line spacing, choice of font and meticulous construction would indicate that the sender had some sort of engineering background, that of a draughtsman in a factory drawing office possibly (See figure 4.19 below).

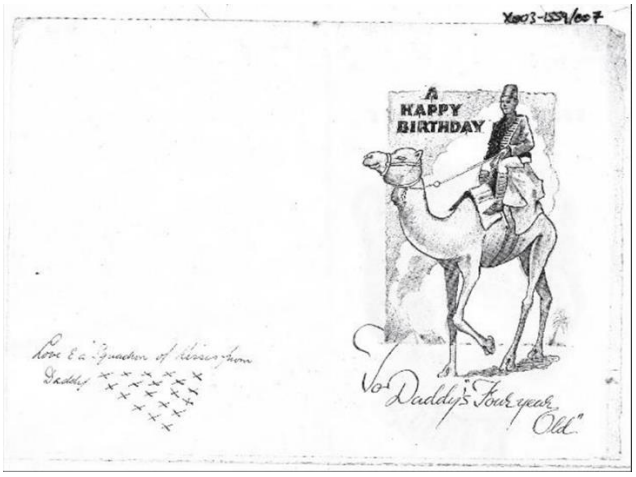


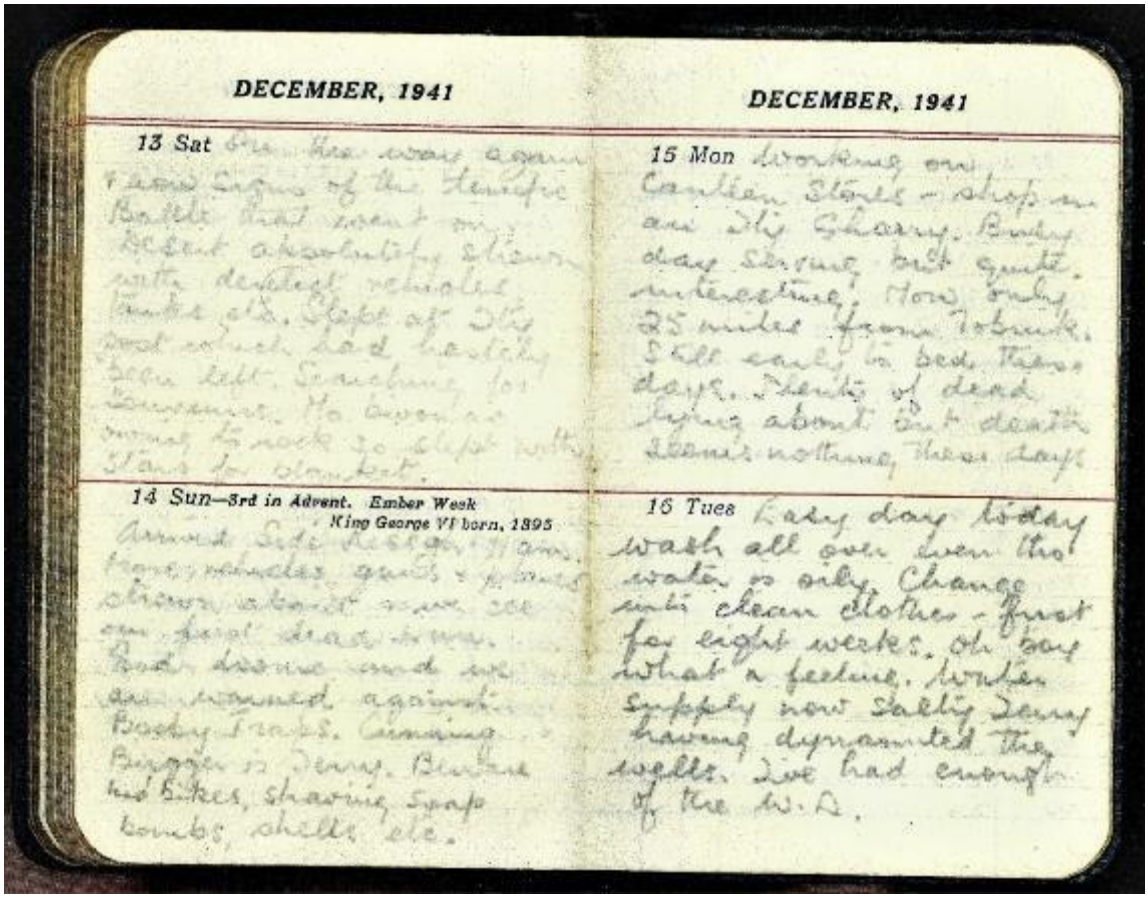
Figure 4.19: Specimen hand drawn birthday card sent to UK family by unknown ground crew member.

Source: Royal Air Force Museum Hendon Archives document ref x003-1559/007

The overriding sentiment in other archived cards and drawings was of the yearning to be at home with families, and away from the crucible of war. Whatever their reasons or motivation for setting down their memoirs, they form a valuable authentic insight into the world of ordinary ground crew personnel in the Western Desert campaign. They are authentic in a way that other works cannot be because the writer was there. They are not filtered through literary licence or commercial demands or reader expectation; there is a sense of immediacy and of raw emotion. The author sifted through the entire archive of personal papers considering the fact that the accounts were written by men who were not established authors and whose memoirs were of varying literary merit and selected several that gave the best overall picture of events. Those sources were the most difficult and the most emotive to read dispassionately, as in no case was there any indication as to whether the writer survived the war to fulfil his wish.

R. Aston, 'RAF Museum Archives. Document Ref X003-4638/001. Diary of Ronald Aston 1/1/1941-1/1/1942' (RAF Museum Hendon, 1941)

This source, perhaps the best of the items, takes the form of a Letts pocket diary for the year 1941 and chronicles Aston's progress from early experiences of the RAF in the UK in the first five months of 1941 through to his posting to Egypt and subsequently the Western Desert in July 1941. He kept a meticulous daily record of events written in a neat copperplate script and his observations and comments throughout the diary show him to be an erudite, thoughtful, sensitive person acutely aware of events, sometimes scared beyond belief, and in places his thoughts are often at variance with the usual positive established propaganda line. They also reflect the fact that he was a young man far from home in a deeply unfamiliar country and society. His entry for 3rdAugust 1941 reads 'Train from Cairo, wogs. *(sic)* everywhere.' Aston took great care over his diary because despite all the hardships and conditions, it is in perfect unmarked clean condition, complete, even to having the original pencil stored in the spine. (See figure 4.20 below).



DECEMBER, 1941

13 Sat

14 Sun—3rd in Advent. Ember Week
King George VI born, 1895

DECEMBER, 1941

15 Mon

16 Tues

Figure 4.20: Typical diary pages of L.A.C. (leading aircraftman) Ronald Aston 1/1/41-31/12/41.

Source: Royal Air Force Museum Hendon Archives document ref X003-4638/001.

His entries over the period July 1941 to December 1941 reflect his opinions on the Egyptian population and their society, living conditions in the desert, the conduct and realities of war, and the chaos of the retreat post operation 'Crusader'**.** His entry for 24th November 1941 reads 'Big tank battle in progress and sqdn very busy (particularly the armourers). Enemy armoured column breaks through and advancing this way (5.p.m.). We pack ready for evacuation.' He then goes on to describe the chaos that ensued in the retreat in the wake of Operation Crusader (this chaos and the outcomes were identified in the 'Russell Report' referred to above and discussed elsewhere in this thesis). 12th December 1941 'Left our drome (Fort Madelina) at 11.a.m. after usual colossal cock up*. (sic)* made 21 miles today and slept in open. Even bully beef tastes good when you're hungry and cold.' He also describes the realities of war and the privations

of the ground crew, 15th December 1941' Now only 25 miles from Tobruk--- plenty of dead lying about, but death means nothing these days' .29thOctober 1941 'Water rationed to 1/2 gallon per day per man'. The entries conclude on 31st December 1941 as the year diary finishes then. There are no further diaries or other record after that date, the archives give no further clue as to Aston's fate.

Desert War Diary 213 sqdn by John Walton

In his memoirs Walton confides his thoughts and feelings on the leadership of the war and is very uncomplimentary on both Churchill and Montgomery (Walton 2000, P31). Walton also comments on social conditions and speculates on what British society might look like 20 to 30 years hence. He then writes acerbic comments regarding the war, P47 'Bloody useless war'. P66. 'Sgt Pilots,18 or 20, what a waste of youth. Sacrificed for sake of stupid people who are in power. More on the informality of squadron life P58. Winter cold, sleeping with socks on. Made beds out of old packing cases and sacking, sold 10 to officers. P59. 'Pep talk by the C.O. spoke of comradeship, lacking at home, too much bullshit! (*sic).* Out here we get on with job. No time wasting with Bull. Pilots appreciate keeping them alive. (Walton's underlining). This underlining by the writer serves to highlight the nature of the team dynamic, in that the more emotionally intelligent and aware pilots astutely came to realise just how much their destiny could be held in the hands of the fitter and rigger. The pilot's life could very much depend on the acts of commission or more importantly omission by 'his' fitter or rigger. Later there is more on living conditions and the conduct of the war p65. 'Bath in empty ammo tin = 1 gallon. Ration is 3 gallons week, dirty laundry washed in bath water. Shower made from petrol can and rainwater. Ironing done on bed.'

All the way with 72 sqdn (Lancaster, no date)

This source confides on the maintenance problems of Supermarine Spitfires caused by the ingress of sand and grit into the engine electro-mechanical components, and the measures taken to counter the effects as the following quotation shows.

> Now the Mk5's was fully equipped with filters for the air intakes, and we didn't suffer a great deal of trouble from spark plug trouble due to sand. However, when we got the 9's every trip we were getting trouble with plugs, and eventually within a few days we had to start changing the front 8 plugs, 2 in each cylinder, of the first two cylinders on each side due to the fact that they were full of sand and obviously mag drop was beyond allowance. Not only that, but the automatic boost controls also got full of sand as well and these had to be removed, cleaned, lubricated, and put back----

Med War Zone, RAF. Or Sand, Fleas, and Olive Groves. Joffrey Barton Flick RCAF. (Barton-Flick, n.d.)

The last source from those selected by the author was written by a Canadian and offers an outsider's view of the British and the conduct of the war. Flick writes of the enervating desert heat, the living conditions, and despite all the tribulations the compelling sense of responsibility, dedication, and integrity of his ground crew, P21.

> I remember 107 M.U. chiefly for the heat that descended upon the place in April. It was the worst I experienced in the Mediterranean. Temperatures rose to 120 degrees in the shade without a breath of wind. Door handles burned to the touch. In the aircraft being serviced in the hot open sand, men were working stripped to the waist in the close stifling heat that only the inside of a metal aircraft baking in the sun could produce. In spite of the heat, output remained good. My men were tops. They were all British and had a sense of responsibility and integrity that kept them going without checking. Sometimes when I went around to do inspections in aircraft, I wondered how they could stand it all day. At the end of April, the whole camp was congratulated on having turned out more than two hundred finished aircraft for the month. In May I took a working party with a travelling workshop up the Western Desert Road to Sidi Barrani to fit I.F.F. to a South African fighter squadron of Kittyhawks. We were so short of certain

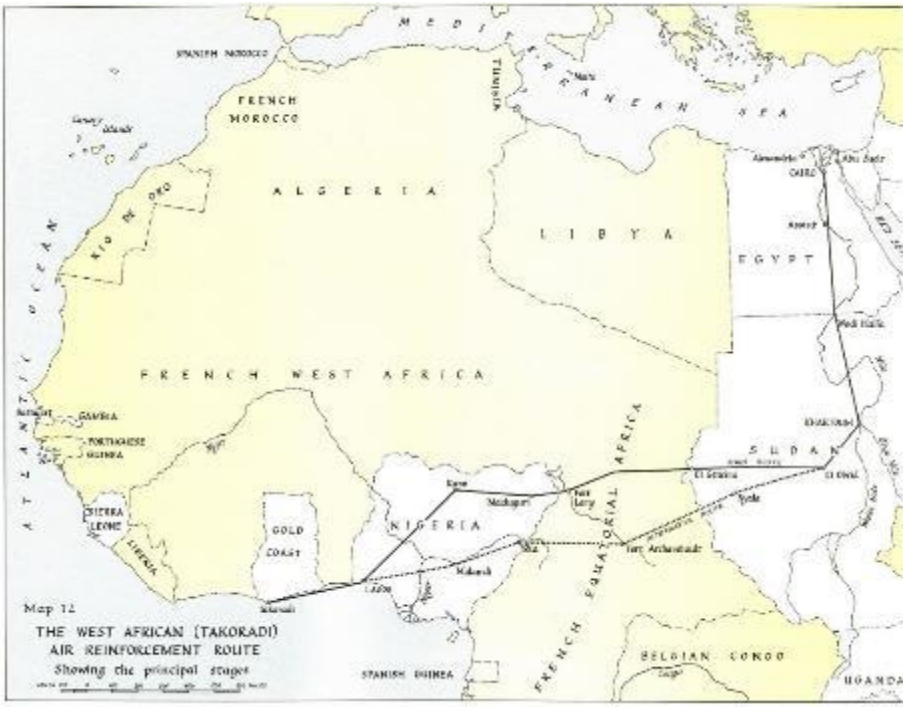
materials that we had to call at all the dumps of crashed aircraft along the way to scrounge odds and ends of equipment.

During his research, the author has acquired the text of a poem by Sykes entitled '*Three cheers for the man on the ground,* who as ground crew was a radio technician. By 1942, nearly halfway through the Second World War, Sykes had become acutely aware of the dichotomy in the public recognition of aircrew at the expense of ground crew, and his poem albeit light-heartedly sardonic in the extract that follows, is none the less a plea for ground crew recognition. 'They'll raise a cheer and buy lots of beer, for a pilot who's *(sic)* home on leave. But they don't give a jigger for a flight mech or rigger with nothing but props on his sleeve' (Sykes, 1942).Post war Sykes went on to be a national comedic actor on the wireless, film, T.V. and stage.

All the above sources describing as they do every day live conditions of ordinary RAF men give a valuable insight into their innermost thoughts, their attitudes towards their comrades will be particularly helpful in discussing the third and final major theme below in 4.7. 'Organisational Development-the Organisational Culture of the RAF.'

4.11.7 Logistics and the application of Operational Research

The supply and flow on a secure basis of aircraft needed for the Western Desert campaign was a significant logistical problem. The most obvious convoy route from Britain to the North African Mediterranean ports was via the Western Approaches Southwest of Britain, across the Bay of Biscay thence past Gibraltar, then across the Mediterranean *via* the British base on the island of Malta to either Alexandria or Cairo in Egypt. This was the shortest route, but still proved far too dangerous as a supply route, being open as it was to Atlantic attack by German long- range air or sea attack virtually all the way. An alternative supply route known as the 'Takoradi' Route was developed whereby British and American convoys delivered entire aircraft in crates to the port of Takoradi situated in what was then known as the 'Gold Coast' at that time part of the British Empire (now modern independent Ghana). (See Map 4.2 below).



Map 4.2: Takoradi route, supply route of reinforcement aircraft.

Source: Bing images.

There in Takoradi, they were unloaded, assembled by ground crew, test flown by pilots and then delivered by air across the centre of Africa to the Sudan, then northwards to airfields in Egypt, where they were dispersed to the various squadrons (See figures 4.21 and 4.22 below). The route across Africa had been previously identified in the 1920s and 1930s by the RAF as part of its Imperial policing remit. Even allowing for the fact that the air route was known before-hand it was still a hazardous undertaking, flying mostly single engine aircraft across the remote and uninhabited African interior.

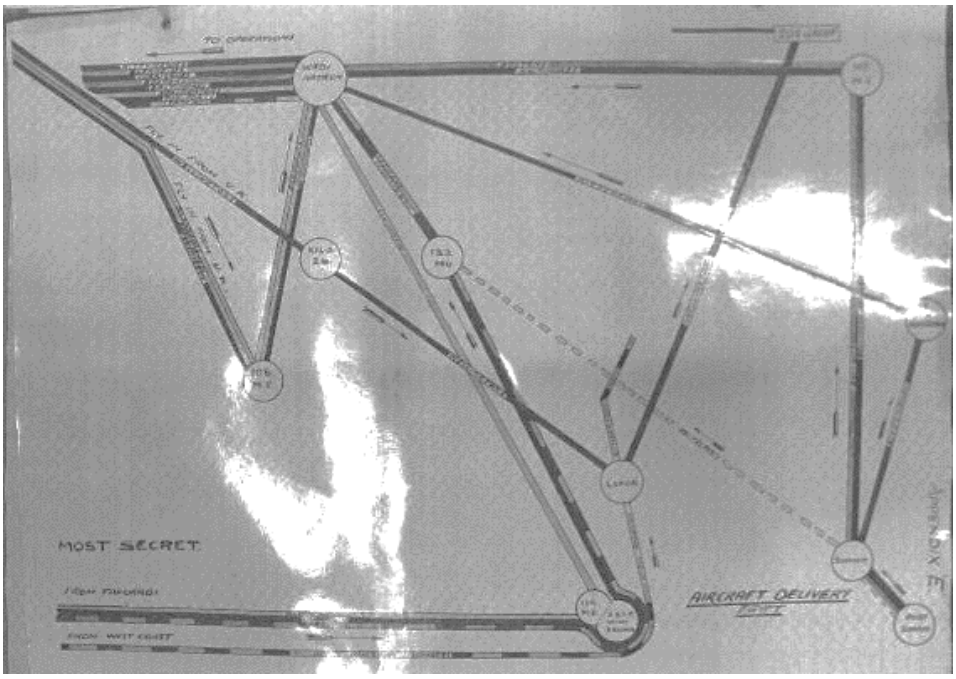


Figure 4.21: Operational Research chart illustrating supply of reinforcement aircraft *via* the 'Takoradi' route.

Source: Air File 23/6493. National Archives Kew.

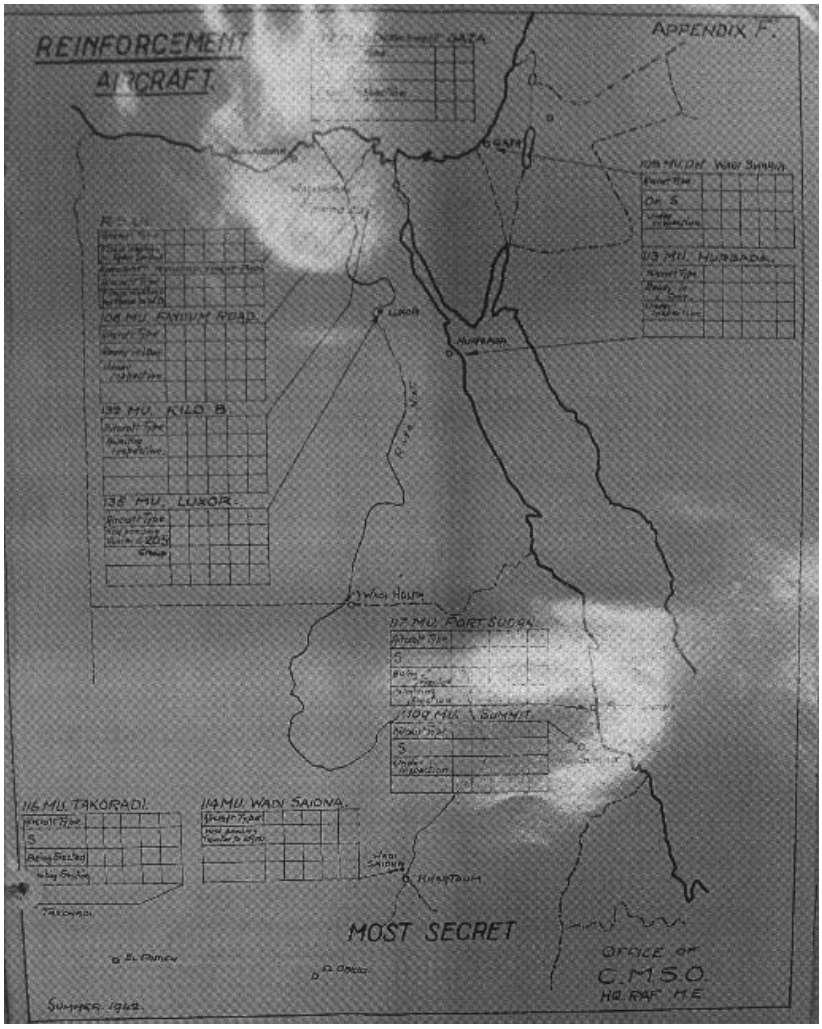


Figure 4.22: Operational Research Chart 'Most Secret' illustrating dispersal destinations of reinforcement aircraft *via* the 'Takoradi' route

Source: Air File 23/6493 National Archives Kew.

Taken together map 4.2 above and figures 4.17, 4.18 ,4.21, and 4.22,above give a good visual representation of the logistics and supply route taken by replacement aircraft. The figures give the sequence of events needed to deal with the preparation and flight testing of replacement aircraft on arrival by sea convoy at Takoradi. They also detail the routes needed to be flown to ensure the safe and efficient delivery of replacement aircraft. So important were these documents to the Desert Air Force's tactical war effort, both documents were stamped 'most secret' an indication of their importance and should be dealt with in a secure manner to avoid falling into German (or Italian) hands which would have been of use in interdicting or disrupting Desert Air Force supply lines.

4.11.8 Innovation and improvisation.

The Western Desert campaign was significantly different from previous campaigns British armed forces had been obliged to undertake thus far in the Second World War. Indeed, with the exception of the disastrous Norway campaign none of the other actions could be termed a 'campaign,' and had happened at what were in distance terms, 'local' actions. The fighting defensive retreat to Dunkirk in northern France was conducted within 120 miles from London, which put into perspective is approximately the same distance from London to the British Midlands city of Birmingham or the British West Country city of Bristol. The Battle of Britain, a defensive air battle was conducted almost exclusively over the British home counties of Kent, Sussex, Surrey, Hampshire, and Essex, in full view of the British populace at home often in their back gardens taking afternoon tea, at school, or at work (Bungay, 2001). All of the actions up until the Western Desert campaign required relatively short logistical trails across relatively benign territory. This was particularly so where *materiel* was close to hand, and there was also the advantage of (to use a cricketing analogy) the home side playing against the 'tourists' (Bungay, 2002). It has also to be remembered that the Western Desert campaign with its *denouement* at the second battle of *El Alamein* (Bungay, 2001), was the first time the British armed forces had gone on the offensive against the German and Italian armed forces in any significant numbers in a sustained manner. The surrender of Singapore to the Japanese armed forces only served to demonstrate the logistical difficulties in supplying British armed forces over long distances; and must probably have been very much in the mind of military logisticians.

The Desert Air Force situated as it was, a long way from Britain at the end of a long and always hazardous logistical chain was forced to rely on its integral skills base to innovate and improvise as it could not afford the time or luxury of referring things requiring decision back to the Air Ministry in London; or for advice to aircraft manufacturers dispersed around Britain. Given the communications of the time a decision could be a long time coming and even then, may not be what was required. Papers in the possession of the author gathered from the National Archives at Kew for his family research shows that in the case of a typical ship convoy (in this case convoy WS8b) it

would take upwards of three months for supplies and personnel to reach Egypt from the Scottish Clyde port near Glasgow in Scotland, *via* Freetown in Sierra Leone and Cape town in South Africa.

Previous Imperial policing experience of operating in an extreme desert environment provided the RAF and through it the Desert Air Force, with knowledge and skills in how to deal with operational conditions in the Western Desert. This enabled the force to develop solutions using its in house skills base to enable it to operate effectively. Familiarity with the heat of the desert was such that experienced ground crew would keep simple hand tools such as screwdrivers, open-ended, or ring spanners in a bucket of water, as metal hand tools left lying-in direct sunlight became too hot to handle after a short time (Bell,2016). James 'Stocky' Edwards of 260 squadron, gives an example of technical innovation devised between him and his ground crew.

> --- It was all one could do simply to fly the Kittyhawk. To avoid being shot down needed a head on a swivel-to look down into the cockpit even for a split second with 109s about was sure death. Since the Kittyhawk could fishtail and skid violently if not flown smoothly, which left little chance of hitting anything. I had the mercury ball portion of a needle and bank instrument placed right below my gunsight so that I could see it all the time, even without staring at it-this took the guesswork out of flying smoothly (Shores,2012).

What Edwards describes in the quote above is that his ground crew had in all probability just devised a prototype version of the Head up Display (HUD) used in modern fighter aircraft.

As delivered, early Hawker Hurricanes and Supermarine Spitfires were fitted with a bulky 'Vokes' dust filter under the nose which degraded their respective performance characteristics. In an effort to mitigate the problem the maintenance facilities ground crew of 103 Maintenance Unit Aboukir Egypt, designed, fabricated, and fitted a less bulky, more streamlined, and more effective filter restoring the performance of both aircraft. The fitting passed into RAF parlance as the 'Aboukir' filter (Snowden, 2012, p

p.53,63), and still referred to today as a fitting for vintage Spitfires or Hurricanes. The same Maintenance Unit at Aboukir found a solution to the high-flying *Luftwaffe* photo-reconnaissance aircraft that regularly overflew the Suez Canal to record British troop ship movements. At the time conventional RAF aircraft could not reach the altitudes required to combat the intruders.103 Maintenance Unit modified the engines, wings, and propellers of two Supermarine Spitfires along with other design measures to enable them to reach the heights needed and intercept the *Luftwaffe* (Snowden, 2012, pp.53, 63).The modification proved a success and the *Luftwaffe* overflights ceased. (See also the section on innovation discussed later in this chapter). What is remarkable is that eighty years ago, RAF ground crew were able to produce a single engine propeller driven fighter without sophisticated avionics (even the radio was stripped out to save weight) capable of ascending to heights of 42,000 feet (12,800 metres) to combat the menace. It is worth remembering that todays' modern commercial jet aircraft commonly fly at circa 35,000 feet (10,668 metres), 7,000 feet (2,133 metres) lower (thesis author's emphasis added).

Tedder in his paper 'Air power in War' (1946), makes the point that air superiority was secured and maintained by a wide and constantly changing variety of operations which were always offensive in nature. This variety of operations required a concomitant wide range of aircraft with differing operational characteristics. He then goes onto make the point that 'air superiority' is a somewhat nebulous concept and that it consists of many factors, of which performance, reserves and supplies being the main factors, but there are others such as command, morale, training, numbers of personnel, and technical performance; air superiority only becomes apparent when all the above factors converge at a given time and place. To reinforce the point on air superiority Coningham in his paper (Coningham, 1946) talks of the organisational innovation of having joint working with the Army. This is hardly new thinking but for two organisations used to working independently and thinking in organisational 'silos' this was a ground-breaking venture.

4.12 Environment- the Western Desert summarised

In summary the end product was the creation of a Desert Air Force operating in an extreme desert environment, a force that was fully mobile, flexible in its response to tactical demands, robust, independent, and largely self–sufficient. Often innovative and capable of improvisation in reduced circumstances at the end of a long hazardous logistical supply chain. This capability developed out of previous experience of the inter war years of Imperial policing enabled the Desert Air Force to survive and in an extreme environment, breeding a resilience that allowed it to operate effectively in challenging circumstances.

4.13 The organisational culture of the RAF

4.13.1 Organisational culture

4.13.1.1. Paternalism and class

For all the *camaraderie* centred on the aircraft, Neil did say in a primary source interview with the author that the respect was at 'arms-length according to the social and class conventions of the day. Pilots and ground crew when off duty kept to their own social circle and did not mix together preferring to drink in their own particular pub. In the case of Neil's squadron,249 squadron based at North Weald Essex, northeast of London, officers and pilots congregated at the 'Thatched House' public house, whilst ground crew used 'The Cock,' both pubs located locally to the nearest small town of Epping. This social distinction and the need for officers to keep their distance from 'other ranks' is underscored in Stradling's work on the obligations of officers. The code of conduct expected of officers in their RAF service duties and in society at large was illustrated by Stradling in his work *'customs of the service for the newly commissioned,'* advising amongst other behavioural aspects that when traveling by train, 'Officers should always travel 1st class so as not to mix with other ranks who would be travelling 3rd class (p19). On leadership Stradling advises that 'Young officers have been selected to lead their fellow-men in war; they must therefore develop the qualities of leadership----The qualities of leadership are many, and amongst those most essential are tact, efficiency

and a forceful character' (Stradling, 1943 pp22-23); whilst at the same time not to exclude men of 'small means and humble origins '(Overy, 2018 p91). In addition to all those perceived social qualities, the entry standards were exacting right up until the start of the Second World War (James, 1991). It is also worth noting that at the start of the First World War racial discrimination excluded many people from the air arms, and commissions were denied to anybody not 'of pure European descent.' The only known Afro-Caribbean pilot appeared in Royal Flying Corps (RFC) records in 1917, and in accordance with the standards of the time was denied a commission and ranked as a Sergeant pilot (James, 1991).

Whatever the official standards were, some degree of social bias crept in as Neil recounted that when a candidate presented himself for interview at ADASTRAL HOUSE in central London, the first question asked by the recruitment panel was 'what was the registration number of the taxi that brought you here'? (James 1991).This was not only a test of the candidate's power of observation and situational awareness, but also a subtle way of weeding out those thought not suitable as anybody who had arrived either by underground train, or worse still by bus, was not a 'gentleman, 'walking, provided that it was from one's club in central London was permissible. For 'other ranks,' that is, for Non-Commissioned Officers (NCOs) the social route was different, the basic requirement was the School Certificate. This was a social statement that the bulk of the skilled artisan tradesmen and thus the majority of the other ranks of the RAF were recruited from at least the lower middle classes (James, 1991). Entrants would have been a person such as the son of a foreman, or of the skilled workers such as motor mechanic, or of the corner shop known as 'trade' in British social parlance.

The RAF evolved out of the Royal Flying Corps (RFC) which itself had its genesis in the British Army. The fledgling RFC and then the RAF was heavily dependent on the Army for provisions, uniforms and living and messing quarters, like any new organisation it took time to establish its independence from the depredations of both the Army and the Royal Navy who saw no need for an independent air service. It took all of Trenchard's tenacious organisational and political lobbying skills to steer the RAF through its formative years. It was only natural that initially the manpower (for it was <u>man</u>power)

(thesis author's emphasis added), drawn from the British Army, both for officers and other ranks) brought with it the trappings of Army organisation, ranks, customs, and habits both operational and social. Drawn as they were (for officers at least) from the upper echelons of the then heavily stratified British society social distinctions lingered on, for as Neil recounted to the author in one of his primary source interviews, on joining 249 squadron at North Weald he was regarded with suspicion by the then commanding officer Grandy, who thought Neil not to be of the 'right type 'as Neil had previously worked in a Bank, and had not attended a public school or was from a notable family, in other words not a 'gentleman'. By 1919,the educational recruitment standards for aspiring RAF officers had been established, as Trenchard recognised that in building an effective organisation he had to instil a group cohesiveness, and he did this through inculcating an exacting attitude towards standards of excellence both in technical expertise and in personal conduct and appearance; and that every officer should be capable of flying regardless of service branch along with a 'certain amount of intelligence' being indispensable along with a 'certain moral temper' being coded language for a 'gentleman'. Not for nothing was the Royal Flying Corps (RFC) known as the Royal Flying Club.

4.14 Team Dynamics

As part of the series of interviews for this thesis, the author discussed with the interviewees Belbin's team roles and asked what in their experiences were their perceptions of ground crew roles and characteristics. All interviewees were asked to rank the three most important roles and characteristics from 1 to 3 with 1 being the most important. These ranked perceptions are displayed on a matrix (see table 4.1 below), then analysed and discussed.

Table 4.1: Interviewee's perceptions Of Belbin's team roles

Interviewee	BELBIN'S TEAM ROLES								
	Plant	Resource Investigator	Co-ordinator	Shaper	Monitor Evaluator	Team Worker	Implementer	Completer Finisher	Specialist
Dr Stephen Bungay			3rd			1st		2nd	
Christopher Dorman O'Gowan LLB	1st			2nd					
Jim Nicolson M.A.	2nd							1st	3rd
Carmel Zammit			3rd	1st				2nd	
Tom Neil DFC* Bar			2nd			1st		3rd	
David Irwin of Historic Aero Engines							2nd	1st	3rd
Warrant Officers Kevin Ball and Paul Routledge of The Battle of Britain Memorial Flight	1st		3rd			2nd			
John 'Smudge' Smith of the Aero Restoration Company			Joint 2nd	3rd		Joint 2nd	1st		
Tony Lowe of the Aero Restoration Company					3rd	2nd			
Dave Lee of RPM Technik		1st			3rd	2nd			1st
Ranking Choices	1^{st} x 2 2^{nd} x 1	1^{st} x 1	2^{nd} x2 3^{rd} x3	1^{st} x1 2^{nd} 1 3^{rd} x1	3^{rd} x2	1^{st} x2 2^{nd} x4	1^{st} x1 2^{nd} x1	1^{st} x2 2^{nd} x2 3^{rd} x1	1^{st} x1 3^{rd} x2
Choices total	3	1	5	3	2	6	2	5	3

Source: author's elaboration of data generated from interviewees.

The author makes no pretence that the sample is statistically significant, and recognises that the sample is extremely small (due to the small number of surviving veterans, and interview opportunities) but that serious consideration should be given to Neil's preferences whose ranking of 1=team worker, 2=completer finisher, 3=co-ordinator, relate to his combat fighter pilot experience with direct and enduring contact with ground crew in a variety of combat theatres over the period of the Second World War. It should be recognised that all the other interviewees had some direct (as in the case of the two Warrant Officers attached to the Battle of Britain Memorial Flight), or others indirectly in a private, technical, or research capacity. All interviewees had a degree of knowledge relating to the work and duties of both fitter and rigger. None of the interviewees had prior knowledge of other interviewee's choices and selected their

perceptions independently. Of all ten interviewees, two interviewees ranked 'team worker' first with four interviewees ranking the same characteristic as second; this gave a total of six out of ten interviewees ranked choices. The next two characteristics, those of 'co-ordinator' and 'completer finisher' were ranked second in interviewee's perceptions with five out of ten interviewees. The third and final ranking was evenly distributed between that of 'plant,' 'shaper,' and 'specialist.' So, on the *primae facie* reading of the results, it would seem that there is a perception in interviewee's minds that the most desirable characteristic is that of team worker, supplemented by those of co-ordinator and completer finisher, and lastly by the more specialist ability to shape outcomes. These perceptions broadly accord to the descriptions of fitter and rigger work contained in the various film clips, official documents, King's Regulations, and other research works cited (Thesis author's emphasis added). As an aside, on the subject of teamwork Neil in a primary source interview with the author recounted an occasion when he (Neil) was going on leave, as a mark of their affection for him and team bonding, his ground crew filled up his car with petrol and provided him with 10 x 5-gallon tins of petrol at a time when the official petrol ration was six gallons a month! He went on to say that had he been stopped by either the civilian police or Military Police, they all would have been court martialled with immediate effect.

The issue of team dynamics was addressed by Graicunas (1937) in his paper citing the lack of theoretical basis for the empirical belief in limiting the span of control. Graicunas thought the theoretical evidence in favour of limiting the span of control was overwhelming. To back this up he cited the limited span of an individual's attention, which was then exemplified by research suggesting that people could deal with no more than six digits. Graicunas also pointed to what he saw as an error in thinking, namely, that the relationships to be managed consisted only of those between the supervisor and individual subordinates. But, as he pointed out, there were relationships between subordinates and between the supervisor and groups of subordinates that had to be factored into the equation. Graicunas summed up the prevailing view of the reason for limiting the span of control in these words. 'One of the surest sources of delay and

confusion is to allow any superior to be responsible for the control of too many subordinates.' Urwick cited in Graicunas (1937) put it in stronger terms.

> There is nothing which rots morale more quickly and more completely than poor communication and indecisiveness, the feeling that those in authority do not know their own minds; and there is no condition which more quickly produces a sense of indecision among subordinates or more effectively hampers communication than being responsible to a superior who has a too wide span of control.

By way of illustration of the point, Moorehead devotes four pages of his work '*African Trilogy* '(Moorhead, 1944) on the complacent mental attitude of the armed forces in the Western Desert, an attitude that was born out of ignorance of what they were facing in an enemy, and ignorance of the changing political and social atmosphere back in Britain. Deep disillusionment with the British Conservative party post Munich had set in, and there was a growing drift to the 'left' in politics. This leftward drift had to be channelled by officers through identification with the struggle by the Russian armed forces against the Germans on the Eastern Front. Later in the same work he muses on the reasons for fighting, what is 'victory'? (Zaidi 2011). What sort of post war society awaited them on their return home? At one point there was a growing feeling that something was being held back from them, that they were being asked to fight for a cause which politicians and leaders did not find vital enough to state clearly. This absence of cause dragged fighting morale down and needed to be lifted through objective information and boosting through regular news, entertainment, and reading material. Although there was a high degree of ignorance there was also an element of emotional intelligence, enough to recognise that things could not go on the way they had been with the rigid class distinctions of pre-war Britain with its paternalism and class divisions. This gnawing feeling that social change was in the air and inevitable, was described immediately post Second World War in July 1945 by the writer, politician and diarist, Harold Nicolson in his private diary (Nicolson, 1968).

Graicunas and later, Urwick both noted the existence of pressures to increase the span of control. First of course, is the tendency of people to want to report directly to the

leader or manager, whoever they might be. Second, is the tendency to build organisational empires, third is the pressure to reduce costs of management overhead. Fourth is the commendable desire to shorten the chain of command. Fifth, extending the span of control necessarily flattens the organisation and drives authority and responsibility downward, both of which are favourites of those who would wish to democratise an organisation. Sixth, the existence in seemingly well- run organisations of spans of control larger than five or six invalidates the concept of limiting the span of control. The main thrust of Urwick's work was to counter the arguments being made against limits on the span of control. In all cases, Urwick pointed out, the benefits of flattening the organisation, forcing authority and initiative downward, and reducing the overhead costs of management had to be weighed against the costs of confusion and indecision that accompany a span of control that is too broad. Often, he claimed, the latter outweighed the former. The fundamental question of course was, and still is, how many is too many? In the context of the Army, the full extent of group cohesion is to be seen in the regiment, whose corporate identity is often reinforced by distinctive uniforms and insignia, its roots lie deeply in the smallest of military groups. The importance of the primary group of ten, whose members were in face-to-face contact was recognised long before psychologists or sociologists had turned their attention to the question of group behaviour.

Gustav Le Bon, (1895) in *'Psychologie des Foules'* made the crucial statement that, even if we understand the individual, we are forced to acknowledge that they act differently in a group. *Le Bon* argued that whatever the occupations, character and intelligence of the individuals who make up the group, the fact that they have been transformed into a group gives them a sort of 'collective mind' or group think which causes them to think and act in a manner quite different from that which might be expected of the isolated individual. He went on to suggest that a 'racial consciousness' emerged within the group. The group displays a number of special characteristics: it has a sensation of power, springing from its numbers; its members lose their individual sense of responsibility; feelings can be communicated within the group by an almost hypnotic contagion, and the group acquires a wide suggestibility of which this contagion is but a small element.

The individual's conscious personality disappears, and an unconscious personality appears. 'He is no longer himself but has become an automaton who has ceased to be guided by his own will.' Groups go to extremes, suspicions become certainties, and antipathy becomes hatred. They respect force, and demand strength from their leaders, they have a marked distrust for innovations, and a profound regard for tradition. The overt purpose of such small unit groupings was either tactical, as in the case of the seventeenth-century musketeers, or administrative as it was with the Prussian *'Kamerad-schaft.' But* it was recognised that the close relationship which sprang up between the members of the group had positive advantages in battle. The British *Regulations for the Rifle Corps* of 1800 emphasised comradeship, trust, and respect as the basis for group cohesion which states *inter alia*-----'After this arrangement is made the captain will then establish his messes, which are invariably by squads. Ten, is the best number for a mess to consist of.' In more recent wars, the squadron, rifle squad or section, the fire team, or the weapon group built around a crew served weapon, have been the lowest common denominator of comradeship. A corporal and six men in a trench, or a flight lieutenant and his five pilots were completely committed to their social grouping, so that no one could have any doubts about the moral and physical failings of his friends since everyone's life depended on the reliability of each. The precise details of small group organisation inevitably vary with the development of weapons and tactics, but it is striking how often groups of three or four, and eight or ten have featured in units from the Macedonian file to the eight man 'brick' in Northern Ireland or the three-pilot section in the Royal Air Force. Whatever the size of the small group, its effectiveness as a motivator is recognised by theorists and veterans alike. 'Fighting for your mates 'is crucial in enabling soldiers to persist in combat under conditions of supreme privation, fear, and uncertainty.' However, the downside of too much tradition can be more of a weakness than a strength. Whilst it gives a serviceman or woman something to fight for that is greater than themselves; elevating unchanged tradition too high can perpetuate technical backwardness, where 'we've always done it this way' in terms of numbers becomes the mantra.

4.15 Emotional Intelligence

The organisational development theories used to expound this thesis such as Bennis (1998) on the leader/manager dichotomy. Homans (1951) on group theory, and Gardner (2011), and Thorndike (1920) on intelligence and multiple intelligences, although comprehensive, deal with theories in isolation to one another. Goleman has come closest to a 'holistic' approach with his theory of 'Emotional Intelligence '(EI). The theory focuses on how well a person understands their own and other peoples' emotions, and their ability to use that emotional information to guide their thinking, behaviour, and work performance (Goleman, 1994) ;(Goleman and Boyatzis, 2013) :(Goleman, 2013). Goleman (1994) also postulates that IQ (Intelligence Quotient) is not the sole arbiter of a persons' intelligence and acknowledges the theoretical links with leadership. The sub-themes of emotional intelligence and multiple intelligences as separate aspects will prove useful in this thesis to examine the close links between them and how they interrelate in the duties of both fitter and rigger. To develop and explain the links between the two sub- themes the author will use the contents of table 4.1 previously shown above. This table will be used in the context (previously referred to above) of adapting two standard production line Supermarine Spitfires into high altitude interceptors by the ground crew of 103 Maintenance Unit at Aboukir in the Egyptian Nile Delta. This example serves as a model in demonstrating how the fitters and riggers harnessed their emotional and multiple intelligences to achieve a task through team working. The adaptation involved significant changes to the engine and airframe and involved both fitters and riggers in their respective *roles.* The adaptations and modifications were part of a carefully thought through process relating to the design of the aircraft, for to change one aspect of the design would have consequences for the performance of the aircraft as a whole which would have initiated compensating design changes. In effect this was both a process and product development albeit on a bespoke *'ad hoc'* basis. The initial scheme of adaptations would have been developed by the engineering officer in consultation with the fitters and riggers. Their opinions and operational experience would have been sought and the scheme would have been modified in the light of the feedback.

4.16. Multiple Intelligences

Using the model outlined above and taking Thorndike's Intelligence theory first 'Abstract Intelligence' involves taking the abstract notion of adapting the Supermarine Spitfire to meet a specific need, and how those adaptations might work out in practice. Up to that point in the Western Desert campaign no aircraft had been required to fly at such a high altitude, so the problem had no precedent, and the practicality was unknown at that point; it was very much a case of 'trial and error 'to determine the outcomes. 'Mechanical Intelligence' speaks for itself in that there must be the facility to convert the abstract notion into a practical mechanical solution for example would substituting one design of propeller for another have any implications for the performance of the aircraft. If so, what were they likely to be and how, if necessary, could they be mitigated? The same process would have been entered into with regard to the adaptation to extending the wingspan to give the aircraft high altitude capability. The rigger would have had an input at this point as adaptations to the wings would have involved modifications to the airframe and to the wire and pulley system for controlling the aircraft in flight (see figure1.4 above). The full process of 'trial and error' would have involved a high degree of social intelligence (Vernon,2016), in collaborative effort and cohesion between the team members, to determine the best way forward. Using Gardner's multiple intelligence theory, there would have been considerable linguistic intelligence capability to express complex abstract ideas in engineering terms that all the participants would recognise and identify with, and be able to implement (Gardner,1983). Those conversations would have immediately been familiar to the group thus reinforcing the concept of group cohesion, belonging, and identity. The group would also have had to possess excellent numeracy skills in order to read engineering drawings and interpret them.

In an age before computer information technology aided design, or electronic calculators, the group would, as part of their numeracy skills be able to manually carry out both long division and long multiplication use a slide rule, logarithm and anti-logarithm tables and other mathematical tables to calculate mechanical details. Logical intelligence (Gardner 1983) would have been used to say, 'if we do this then that will

happen-how do we deal with that outcome'? Using an example of the engine supercharger uprating, the team would appreciate that there would be the need for changes to other aspects of the engine management system to accommodate the uprating. In this situation the possible application of musical intelligence (Gardner 1983) would be for the engineering officer and the fitters to listen to the tone of the engine at various power settings to determine whether there are any problems or changes that needed to be made. Musical intelligence in the sense that the theory proposes is not wholly applicable, as the engine sound would not be music in the conventional sense. However, on the other hand bodily kinaesthetic sense is paramount as both fitter and rigger were expected to work long hours often in confined spaces in difficult body postures using engineering hand tools that needed a craftsman's manual dexterity to use and calibrate accurately**.** Lastly there is the question of interpersonal intelligence which must be present to allow the team to function effectively, and to allow the free flow of ideas not only horizontally within the team fitter to rigger and *vice versa* but vertically from the team up to the engineering officer who would communicate back down to the team and would have been the final arbiter of what was to be done. This is 360-degree feedback. Of course, at the end of the adaptations the aircraft would have had to be flight tested to see whether the adaptations produced the performance requirements; and stemming from flight testing whether or not any further adaptations or modifications were needed, reiterating the 'trial and error' process.

At this stage in the discussion, it is worth repeating, that from the author's interpretation of the table (see table 2.3 above) it would appear that the various classes of intelligence that Thorndike, Vernon, and Gardner are proposing are facets of what Goleman labels as emotional intelligence; and that the term emotional Intelligence embraces and overarches all those facets. Goleman defined emotional intelligence as a capacity 'for recognising our own and others' feelings, for motivating ourselves, and for managing our emotions, both within ourselves and in our relationships' (HBR, 2015).

4.17 Group Formation

4.17.1 Homan's theory of group formation

In his work on human groups Homans (1951) uses amongst others, a case study using the work done by Mayo *et al* on the 'Hawthorne Effect' at the Hawthorne, Chicago Illinois plant of Western Electric in North America. Homans and his colleagues were interested in the research as far as the study illustrated how working people behaved. 'A group of people behaved in these ways, among others for a certain period of time' (p. 48).Homans looked at people who participated together in events and concluded that 'participating together' is interaction, and a group is defined by the interaction of its members (p. 84).He also said that individuals may belong to more than one group and that a group may be a sub-group of a larger entity; with the primary group being the group where each member of the group is able to interact with every other member (p. 85).The theory postulates that a group exists within a three part environment (See Table 4.2. below).

Table 4.2: Homans three- part environment

ENVIRONMENT	COMPONENTS
PHYSICAL	Terrain, Climate, Layout
CULTURAL	Norms, Values, Goals
TECHNOLOGICAL	State of Knowledge

Source: author, adapted from Homans.

The environment imposes certain activities and interactions which arouse emotions and attitudes (sentiments) towards each other, and the environment seldom wholly determines social relationships. These activities, interactions and sentiments combine to create the external system (p 90). Increased interactions produce sentiments towards one another developed by members of the group in the course of their life together that are not specified by the external environment (p. 109). Homans called this the internal system (p.109), and that the external and internal systems were

interdependent, and when combined make up the total social system (p. 87).He went on to say that 'a social system has one overall characteristic, it is an organised whole made up of units that are themselves organised'(p.113). In an attempt to reconcile the various theories relating to an individual and the group, Homans thought that the following statements hold true.

> An individual brings to the group certain characteristics of mind and certain sentiments expressed as needs. The group has a method of co-operation that ensures those characteristics and needs result in natural and appropriate behaviour in certain circumstances, and that those behaviours ought and must be deployed in those situations. If the individual does not conform to the group norms or expectations, the group will institute sanctions against the individual (Homans, 1951, pp.319,320).

Business papers such as The Harvard Business Review (Pentland 2012), discuss the need to communicate frequently talk and listen equally and explore ideas and information outside of the group. Linked with this are two papers by the same author discussing the ten qualities of an effective team player (Brounstein, 2013), and the differences between work groups and teams and plans for getting the group's work done. In other kinds of work groups, managers more commonly work with staff individually to set goals and determine assignments. Of course, in many cases, managers, assign work with little discussion or collaboration with the staff members; staff are then left to determine what is expected and how best to get it done.

4.18 Leadership

Recognition must be paid to the fact that the pilot-fitter-rigger team existed within a hierarchy of teams certainly within a squadron and thus within the greater RAF scheme of organisation (See organisation chart figure1.2 above)**.** The organisational culture of the RAF reflected the greater scheme of things at the time of the Western Desert campaign in that the RAF was led predominately by officers who had been educated at one of Britain's public schools whose ethos was to educate and produce a *cadre* of future leaders in prominent public life, the home Civil and Colonial services local government,

the armed forces ,the church and future national politicians. The existence of public schools was rooted in British history where all the forerunners of public schools were either 'poor schools' or grammar schools, teaching Latin and Greek, which were essential to the life of the medieval Church, and a necessity for entry to either Oxford or Cambridge (May 2009, p. 19). By the late 18th century, the trend was moving away from home tutelage, partly as a result of a growing population, and a declining infant mortality rate resulting in larger families, which often gave rise to the need to send boys away to boarding school. For public schools, this demand continued into the 19th century as rapid industrialisation during the Industrial Revolution produced a large and prosperous middle class, who despite being regarded as 'trade', might hope to turn their sons into gentlemen by sending them to the right school. Generally, sons of the aristocracy did not have to earn their living, and if they did, they were likely to enter either the Church or the Army considered occupations for gentlemen, where training was given. The expanding British Empire had been constructed and maintained by the output of the Victorian public school, they produced English gentlemen with a passionate conception of fair play, and good manners (Wishon, 2013, p.72). Protection of the weak and 'playing the game' and how to play a straight bat at cricket, a phrase still used today to denote straightforward dealing in life. Cricket mattered at public schools-there were, in the conventions of the game, a subtext of loyalty to the team, (Thesis author's emphasis added) (Simms, 2014. p. 7). Obedience to the rules (Thesis author's emphasis added), respect for the authority of the umpire-all this spoke of Imperial design. At Kings School Worcester, there is a cricket pavilion inscribed with the words 'In memory of those who, having learnt in this place to play the game for their school, played it also for their country during the years 1914-1918' (Paxman, 2011).This is a direct reference to Henry Newbolt's(1892, pp. 196-197) *Vitai Lampada* (The Torch of Life) which describes the *denouement* of a cricket match in the close at Kings School Worcester, where the school cricket captain comes to the crease with a fine sense of duty and obligation. The poem is a metaphor for the desperate situation the British found themselves in during a battle in the Sudan to rescue General Gordon, where the British participants are exhorted to 'play up, play up, play the game' .Encapsulating this

view of the importance of sport in character forming, in this instance competitive rowing on the nearby river Thames, is the ‘Eton Boating Song’ the sound track which exhorts rowing crews to ’swing, swing together’ can be heard here:

Figure 4.23: Soundtrack of the Eton boating song

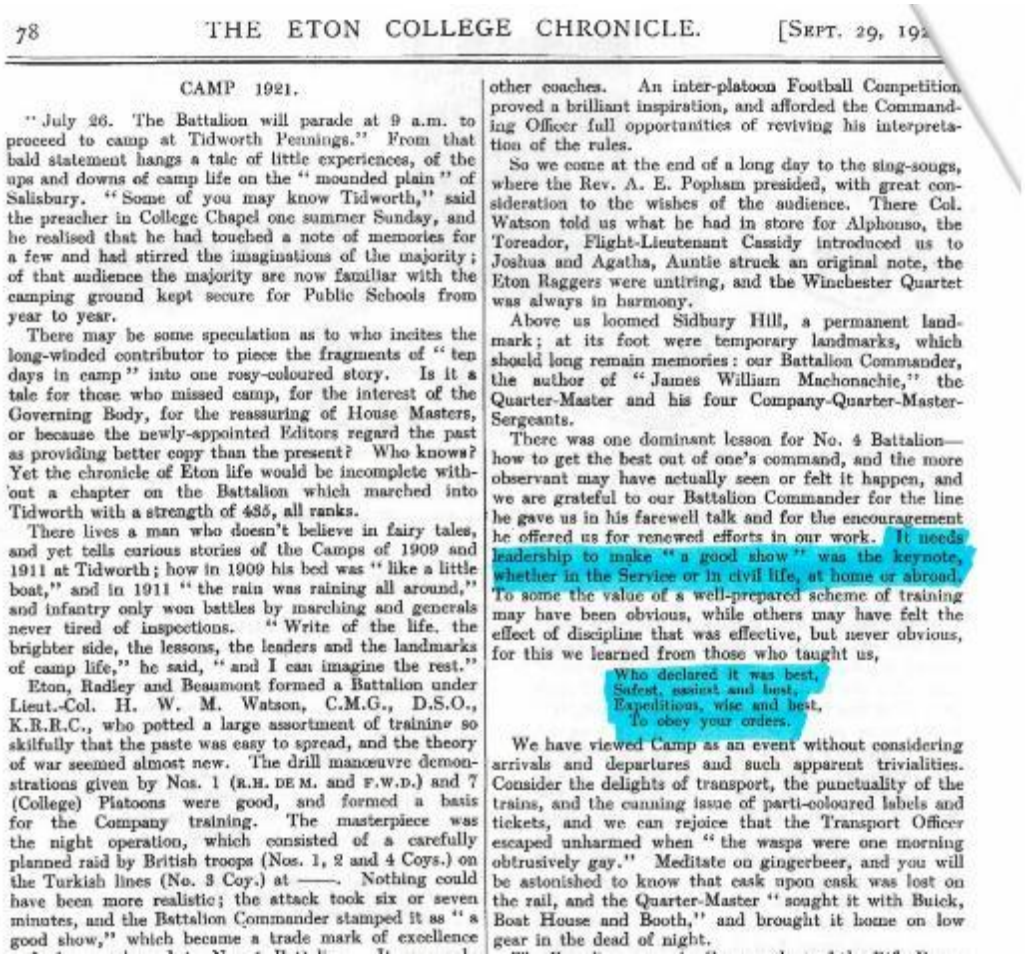
Source: https://youtu.be/leU1kbtIZUI

The sentiments in the song alluding to effortless superiority through collective effort, fits neatly with the epithet ‘Sudan was said to be the land of the Blacks ruled by Blues’ (Paxman, 2011). Public schools did not exist entirely to make colonial officials and army officers, but the values they inculcated especially through team sports were particularly attuned to the requirements of running and administering an Empire. The cartoonist Pont captured the essence of the British character in his work (Pont, 1938), and the image below gently lampoons the British love of team sports and collective endeavour through sport (see figure 4.23 below).

Figure 4.24: The British Character.

Source: Pont (1938, p. 112)

Arnold, the reforming headmaster of Rugby School, summed up the school's approach towards moral certainty and self- discipline as 'you should feel like officers in the Army or Navy where want of moral courage would, indeed be thought of as cowardice' (p. 23). Thring, another reformer and headmaster of Uppingham public school in the County of Rutland, thought that the education he planned to provide 'should shape not only the brain and body but the spirit too: it must inculcate duty and honour and grit to ensure upright living' (Richardson, 2014).Eton College in the county of Berkshire established the concept of 'Officer Training Corps' holding annual field days where pupils held mock military manoeuvres (See fig 4.24 below).



78 THE ETON COLLEGE CHRONICLE. [SEPT. 29, 192

CAMP 1921.

"July 26. The Battalion will parade at 9 a.m. to proceed to camp at Tidworth Pennings." From that bald statement hangs a tale of little experiences, of the ups and downs of camp life on the "mounded plain" of Salisbury. "Some of you may know Tidworth," said the preacher in College Chapel one summer Sunday, and he realised that he had touched a note of memories for a few and had stirred the imaginations of the majority; of that audience the majority are now familiar with the camping ground kept secure for Public Schools from year to year.

There may be some speculation as to who incites the long-winded contributor to piece the fragments of "ten days in camp" into one rosy-coloured story. Is it a tale for those who missed camp, for the interest of the Governing Body, for the reassuring of House Masters, or because the newly-appointed Editors regard the past as providing better copy than the present? Who knows? Yet the chronicle of Eton life would be incomplete without a chapter on the Battalion which marched into Tidworth with a strength of 435, all ranks.

There lives a man who doesn't believe in fairy tales, and yet tells curious stories of the Camps of 1909 and 1911 at Tidworth; how in 1909 his bed was "like a little boat," and in 1911 "the rain was raining all around," and infantry only won battles by marching and generals never tired of inspections. "Write of the life, the brighter side, the lessons, the leaders and the landmarks of camp life," he said, "and I can imagine the rest."

Eton, Radley and Beaumont formed a Battalion under Lieut.-Col. H. W. M. Watson, C.M.G., D.S.O., K.R.R.C., who potted a large assortment of training so skilfully that the paste was easy to spread, and the theory of war seemed almost new. The drill manœuvre demonstrations given by Nos. 1 (R.H. DE M. and F.W.D.) and 7 (College) Platoons were good, and formed a basis for the Company training. The masterpiece was the night operation, which consisted of a carefully planned raid by British troops (Nos. 1, 2 and 4 Coys.) on the Turkish lines (No. 3 Coy.) at ——. Nothing could have been more realistic; the attack took six or seven minutes, and the Battalion Commander stamped it as "a good show," which became a trade mark of excellence other coaches. An inter-platoon Football Competition proved a brilliant inspiration, and afforded the Commanding Officer full opportunities of reviving his interpretation of the rules.

So we come at the end of a long day to the sing-songs, where the Rev. A. E. Popham presided, with great consideration to the wishes of the audience. There Col. Watson told us what he had in store for Alphonso, the Toreador, Flight-Lieutenant Cassidy introduced us to Joshua and Agatha, Auntie struck an original note, the Eton Raggers were untiring, and the Winchester Quartet was always in harmony.

Above us loomed Sidbury Hill, a permanent landmark; at its foot were temporary landmarks, which should long remain memories: our Battalion Commander, the author of "James William Machonachie," the Quarter-Master and his four Company-Quarter-Master-Sergeants.

There was one dominant lesson for No. 4 Battalion—how to get the best out of one's command, and the more observant may have actually seen or felt it happen, and we are grateful to our Battalion Commander for the line he gave us in his farewell talk and for the encouragement he offered us for renewed efforts in our work. It needs leadership to make "a good show" was the keynote, whether in the Service or in civil life, at home or abroad. To some the value of a well-prepared scheme of training may have been obvious, while others may have felt the effect of discipline that was effective, but never obvious, for this we learned from those who taught us,

Who declared it was best,
Safest, assist and best,
Expeditious, wise and best,
To obey your orders.

We have viewed Camp as an event without considering arrivals and departures and such apparent trivialities. Consider the delights of transport, the punctuality of the trains, and the cunning issue of parti-coloured labels and tickets, and we can rejoice that the Transport Officer escaped unharmed when "the wasps were one morning obtrusively gay." Meditate on gingerbeer, and you will be astonished to know that cask upon cask was lost on the rail, and the Quarter-Master "sought it with Buick, Boat House and Booth," and brought it home on low gear in the dead of night.

Figure 4.25: Extract from The Eton College Chronicle.

Source: Eton College Chronical (September 29th1921, p. 78) Eton College archives reproduced by kind permission of the College

In addition to field days the College's Officer Training Corps established shooting parties where small arms drill and marksmanship were practised and refined (See fig 4.25 below).

19. Shooting – wholly illegal. This group of friends poached 2,260 head of game between October 1908 and July 1910. It is good to record that rather more than the average number survived the War, perhaps because of their skills, and became related by marriage.

20. A Shooting VIII in Corps Uniform in the late nineteenth century, posed in front of the colonnade of School Yard

Figure 4.26: Typical Eton College Officer Training Corps shooting parties from the 19th And 20th Centuries

Source: Eton College archives reproduced by kind permission of the College.

On the question of character in his paper '*the development of air power'* Coningham (1946) describes the three essential qualifications an air commander needs to possess to exercise leadership. He must know his 'stuff.' Have the courage of his opinions and possess maximum good will. He then goes on to say that'-----efficiency based on knowledge and character is what counts. 'In the same paper he also expounds what he believes to be the secret of successful operations exploiting the essential qualifications.

> Air superiority is the first requirement for any major land operation. The strength of the air power lies in its flexibility and capacity for rapid concentration. It follows that control must be centralised in an Air Commander and command exercised through Air Force channels. Air Forces

> must be concentrated in use and not dispersed in penny packets. The commanders and their two staffs (RAF and Army) must work together. The plan of operations should be mutually adjusted and combined from the start. The last two statements endorse the necessity for joint inter- service leadership.

In the early days of the RAF there was an evident dichotomy, on the one hand there was the need to demobilise large sections of each of the armed forces at the end of the First World War, whilst there was a pressing need to police the British Empire and the newly acquired mandates awarded to Britain as part of the Treaty of Versailles and subsequent agreements. In the concluding stages of the First World War the RAF had been costing approximately £1 million a day (At today's value £44.99 million a day) a sum that needed to be reduced in peacetime, and the then Prime Minister Lloyd George considered making substantial economies at the expense of the RAF (Boyle, 1962).

So, it was fortunate that Trenchard was able to demonstrate to the British Government's Treasury the cost-effectiveness of policing the British Empire and Mandates through the flexible deployment and use of air power. In 1920-21 the military occupation of Iraq by the British Army had cost £32 million (At 2021 values £1.44 billion) and by 1927-28 through the use of air power the cost had been reduced to £1.65 million (At 2021 values £74.2million) (Overy,1980); a total reduction of around 94 percent. The fiscal implications helped to underwrite the principle of security through air power and led Churchill to say later that 'I think the Air Force was a great economy in maintaining order in these wild countries' (Overy, 1980) Using this scenario a government committee endorsed the RAF plans to expand the home defence strength to 600 aircraft to match French air power, who at the time were thought to be the biggest military threat to Britain.

Shortly post First World War, Trenchard produced an 800-word business plan for the revised future peace time establishment of the RAF in which he set out the essentials of the service as he saw them and presented the paper to Churchill as his Minister, and Churchill broadly supported his proposals. This left Trenchard relatively free of the

politicking at Cabinet level, but still having to fend off the desires of both the Army and the Royal Navy to dismember the RAF and subsume the relevant parts into their own organisations (Boyle 1962).The inter service rivalry over the question of whether the Royal Navy in particular should have its own air component rumbled on throughout the remainder of the 1920s and throughout the 1930s until the matter was finally decided in the latter half of the 1930s by the Inskip Review (Boyle 1962). The review concluded that the Royal Navy should have its own dedicated air component split off from the RAF and placed under Royal Navy command and known thereafter as the Fleet Air Arm. Throughout Trenchard had resisted the hiving off of that part of the RAF, but had to bow to the inevitable .From an organisational point of view it made sense as the fleet component would often be far from Britain, either at sea or in some part of the Empire. So, it was logical that in those situations local oversight would be entirely appropriate to allow for a rapid response to developing situations without constantly referring matters back to London for a decision. However, it is understandable that Trenchard would be protective of the organisation that he had nurtured over the previous decade and a half, and would have regarded the split as a thin end of a large wedge, encouraging the British Army to agitate for its own dedicated Air Corps or Arm.

Part of Trenchard's strategy for raising the profile of the RAF was to arrange annual air pageants at Hendon aerodrome in north- west London (Boyle, 1962). This had several purposes, it showcased the new aviation technology to the public, a technology which at that point was only around 25 years old and rapidly developing, the pageants also demonstrated the RAF's presence in the skies over Britain and the Empire with its implied capabilities both offensive and defensive. Trenchard also ensued that by co-operation with the private sector aero technology *entrepreneurs*, the RAF was at the forefront of developing the emerging aviation technology. So popular were the air pageants that the London Underground in the shape of the London Passenger Transport Board (LPTB) undertook a programme of works to install extra train capacity infrastructure at nearby Colindale Underground station to deal with the passenger numbers attending the pageants. These works still form part of the station complex observable today. The pageants also served to impress outside observers and

governments from other countries who might place orders for the modern technology with British manufacturers; notable examples of export orders were the Hawker Hart, Gloster Gamecock and Gladiator biplane fighters which were sold abroad, and much later the Bristol Blenheim monoplane light bomber (see fig 4.10 above). All of this was good public relations material for Trenchard and helped (as he put it) increase his (P) political dining out power which up until the time of the air pageants was lacking (Boyle, 1962).

What Trenchard had created was what Trist and Banforth (1951), cited in Thompson (2008), described as being a sociotechnical system that contained both human and non-human resources and facilities. Human resources in the form of officers, both flying and non- flying and ground crew; non- human resources in the form of aircraft, airfield sites and associated infrastructure and all manner of consumable supplies. The RAF was instrumentally rational (Thompson, 2008), the job (in this case) the Western Desert campaign had to be concluded successfully as part of the wider conflict of the Second World War. Although an organisational chart would show each branch of the RAF as a separate entity, and although each branch would not necessarily directly correspond with each other, they had a high degree of interdependence on each other for the force as a whole to function effectively. For example, to keep aircraft in an operational airworthy condition, a consistent, regular supply of components and spare parts would need to be to hand or arrive in a timely fashion to allow ground crew to maintain the aircraft. This supply in turn, would be dependent on an efficient quartermaster's organisation ordering the components or parts from the manufacturer, whilst at the same time ensuring sufficient stocks are held in the stores system ready for despatch. This is what Thompson describes as 'pooled interdependence,' this interdependence was particularly vital to the Desert Air Force as there was no indigenous aircraft industry in Egypt (See fig 4.17 above) and all supplies had to arrive either via the 'Takoradi 'route (See Map 4.2 and figs 4.17 and 4.8 above) or via sea convoy from either the United Kingdom, or America using the long hazardous sea route around the bottom of Africa *via* Cape town. When the 'Takoradi' route was finally closed in May 1943 a total of 5,300

British and American aircraft had been delivered to Egypt using the route (Cull and Galea 2018).

The independence also needed to be sequential in that the stores system must supply the right spare parts or components to enable the fitters and riggers to function effectively. Quite often this proved not to be the case as spare parts were simply not available in time to deal with a rapidly evolving combat situation; and this was where the question of the exercise of multiple intelligences through improvisation and innovation on the part of the ground crew came into play (Thompson, 2008). Fitters and riggers were forced into the position of developing expedient short-term measures to overcome an immediate situation. An example being the development of the Aboukir air filter to replace the less efficient standard Vokes filter on Spitfires and Hurricanes. Using the analogy of the stores part there was also a high degree of reciprocity in that the output of one part of the system (the stores system issuing the spare part) becomes the input for another part, (the fitter dismantling the old part and installing the new part). Co-ordination of the whole of the inputs / outputs was complicated by the fact previously referred to that the RAF kept a wide inventory of aircraft types from both British and American manufacturing sources, where components were not compatible. This was further complicated by the fact that the RAF also used captured German and Italian aircraft that were manufactured to the continental European metric engineering standards which were incompatible with British and American manufacturing standards. The RAF, in common with other military organisations had a distinct hierarchy which enabled it to deal with the matter of interdependence, being a complex sequential and reciprocal sociotechnical system. (Thompson, 2008). This complexity was dealt with by forming basic groups (the squadron) to deal with reciprocal independence as a first order group where inter-contingency is greatest with second order groups (support services) dealing with matters of lesser inter-contingency. Wherever possible those groups would have formed homogenous units to facilitate co-ordination (Thompson, 2008). This complex sociotechnical system found itself at war in the Western Desert, and Shores and Ring (2012) present in their chapter twelve, ‘conclusions’ with a full discussion and analysis of operations in the Western Desert. They point up a number of

conclusions, initially they discuss the high losses encountered by the Desert Air Force, this fits with the fact that at the outset at least the Desert Air Force were flying a number of technically inferior aircraft to the *Luftwaffe* and the appearance of the *Luftwaffe* ace or *'experte'* in the skies over the Western Desert which contributed to the high loss rate.

To try to gain an impression and 'feel' of what it was like to sit and work in the cockpit of a British Second World War fighter aircraft of the type used in the Western Desert campaign, the author gained access to a cockpit of a Spitfire at the RAF Museum Hendon. The initial impression on entering the cockpit was one of intensely restricted 360-degree vision, the forward view is obstructed by the long nose housing the engine, the view to either side is obstructed by the wings, and the rear view, the most crucial view of all is obstructed by the spine of the rear fuselage. This particular mark of Spitfire was not fitted with a rear-view mirror on the upper framing of the cockpit, so the pilot had to constantly turn his head through 270 degrees to try to see what was coming up behind him. This omission seems difficult to comprehend, for as Neil said in one primary source interview with the author 'it was always the blighter of a *Hun (sic)* that you did not see, that shot you down.' The term *'Hun*' being an RAF colloquial collective term for Germans, pilot or otherwise. Neil also clearly remembered in the same primary source interview that at one time 249 squadron ground crew would, after consultation with 'their' pilot go into the nearest town (in this case Epping in the county of Essex),and out of their own money, buy chromed metal wing mirrors or internal rear view mirrors meant for cars and then adapt them to fit on the outside top of the cockpit windscreen framing to afford the pilot a reasonable rearward view. The cockpit itself is quite confined both in width and in height especially for a person of above average build, although the author is of moderate build, the author's shoulders rubbed against each of the cockpit side sills and the author also had to bend his head a little, to close the sliding Perspex canopy. The cockpit environment presented a quite constricted flying environment for the pilot and one that must have presented an extremely challenging working environment for any fitter or rigger. This would have been especially true in the heat of the Western Desert where exposed metal became too hot to touch. The cockpit environment gave the overall impression of being somewhat claustrophobic and

although the flying instrumentation and controls were close to hand by virtue of the confined space, the controls themselves largely represented a poor ergonomic design and layout and seemed to be positioned for ease of production or chance placement rather than for ease of operation by the pilot.

4.19 Summary of Military History the evolution of the RAF.

The evolution of the RAF was linear and homogenous, its genesis lay in the British Army when on 1st April 1911, an Army Order created an Air Battalion of the Royal Engineers becoming on April 1912 the Royal Flying Corps (RFC). The sea borne element became the Royal Naval Air Service (RNAS). On the 1st April 1918 those two elements amalgamated to form the Royal Air Force (RAF). In the twenty-nine years between its genesis and the start of the Western Desert campaign the force was one of initially a war time force, becoming during the inter-war years a peacekeeping/policing operating on a much-reduced budget in a significant pacifist domestic political environment. The inter-war years also saw the RAF subject to intense inter-service rivalry seeking the disbandment and dispersal of the force; finally reforming into a much-expanded force to meet the increasing threat of another major European conflict. In addition to the rapid expansion, it had to develop and absorb the emerging new aero technology transitioning from First World War biplane construction to stressed metal skin high performance monoplane fighter technology within a space of four years. As a by-product of its years of acting as imperial policeman, often in remote desert or semi desert regions of the British Empire, the RAF acquired the fundamental skills set to enable it to adapt to the conditions of the Western Desert. In primary source interviews with Neil the author discussed the question of morale and feeling within 249 squadron, Neil confirmed that it was ‘a happy and joyful squadron, intimate and friendly’. He went on to say that morale in the squadron was high and there were many highly decorated pilots on the squadron strength which helped to contribute to a strong sense of identity. (A case in point is the fact that one of 249s pilots Nicolson was awarded the Victoria Cross (VC) for an action over Southampton in August 1940. (He was the only pilot in the whole of Fighter Command during the Second World War to be so awarded). In a subsequent interview Neil returned to the subject of ground crew, and the themes of

emotional intelligence, multiple intelligences, paternalism and class, team dynamics and group formation. He said that there was mutual respect both ways between the pilot and ground crew, as the pilot received the aircraft in flying order, his job was to fly the aircraft and not to understand in depth how the aircraft worked; he regarded the aircraft as a 'black box.' Neil went on to say that pilots had complete confidence in the ground crew to prepare and present 'their' aircraft in perfect order. This was achieved and verified through the pilot signing the 'Form 700' presented to him by the fitter signifying that an aircraft was signed off as being operational and airworthy.

4.20 The Environment, the Western Desert

Despite all the advantages bestowed on the RAF Desert Air Force, the force was still small and inadequate for the task called upon to perform; but by the end of the Western Desert campaign, it had taken up what Terraine (1985) describes as 'the right of the line' in the vanguard, a position of honour. At the outset, the RAF had the responsibility of operating over four and half million square miles of which the Western Desert was one part but a significant part, situated as it was adjacent to and including the Suez Canal, a major artery carrying communications between Britain and the East Asian parts of the British Empire. In addition, there was the fact that about one twelfth (eight percent) of the United Kingdom's oil supplies was shipped through the Suez Canal, a matter which was to become of vital importance as the Second World War progressed. Particularly so as Hitler had devised his plan 'Orient' of June 11, 1941, envisaging a giant pincer movement with Libya on one side and down through the Caucasus on the other (Terraine,1985), so the Western Desert had to be defended and held, and by extension the Egyptian Nile Delta with all its strategic implications for the British. Placed at the very end of a long logistics tail, the Desert Air Force was forced back very much on its in-house resources to operate. This involved restructuring the maintenance services of which the Mokattam cave complex (see figure 2.12 above) used by Dawson very much came into its own as it provided secure bombproof facilities for storage and maintenance. Likewise, the diversification of repairs to the back street repair shops of Cairo (see figure 2.11 above) were outstanding examples of innovation and lateral thinking by Dawson who with his enterprising spirit (and much against Air Ministry

policy) revolutionised the maintenance support services. One of the 'benefits' to the British of owning an Empire was that they were able to freely use the facilities at Takoradi on the Gold Coast (now modern Ghana) as a staging post for the much needed secure and consistent delivery, assembly, and onward transit of aircraft to Egypt. These two examples referred to above, demonstrate how vital it was to think creatively to overcome demanding situations.

However not everything was satisfactory, it very rarely is in any large complex organisation especially one that is operating in a hostile geo-political environment and one with the ever-present threat of mortal danger, life changing injuries, or wholesale destruction of infrastructure and facilities. Nowhere is this better demonstrated than in the aftermath of operation 'Crusader' over the period November 1941 to February 1942 when British armed forces fell back in considerable disarray, the RAF substance of which was laid bare for Tedder and his senior management team to see in the Russell Report previously referred to above. Reading the report and seeing the marginalia as to what was absorbed by way of the learning process would seem to indicate that at least the Desert Air Force was in some respects a learning organisation capable of adaptation and change. The extreme nature of the mobile war in the Western Desert placed equally extreme demands on ground crew especially the fitter-rigger-team. Terraine (1982) cites aircraft availability figures in the range of 67 percent up to 82 percent which whilst interesting in themselves do not in the author's opinion, throw much analytical light on availability as Terraine does not cite what the availability figure should be. It would be a better measure if those figures were judged against an official availability percentage, then a truer picture could emerge as to the endeavour of the ground crew. This is not to deny the fortitude or resilience of ground crew working as they did under enormous pressure in hostile conditions, but it presents only a partial picture.

There are other disturbing features which the author has come across in the thesis research. The first is the suspicion that the number of operational *sorties* being flown by Desert Air Force squadrons was exaggerated by squadrons, this was brought to light in Air File 23/1048 (previously referred to above) where the report's author tactfully suggests that by cross-referencing operational *sortie* claims against actual logistical

records, leads to the conclusion that the over claiming of *sorties* was in the region of sixty percent**.** If this was a true reflection of actuality, then that is most disturbing as it then casts doubt on the veracity of the received history. Was the over-claiming a result of administrative errors in the fog of war or was it something more orchestrated to make it look as if the Desert Air Force was more efficient and effective than it actually was? Perhaps an example of 'look busy chaps somebody's coming.' In addition, Terraine (1982) cites the grossly inefficient standard four- gallon commercial fuel tin, the flimsy which would split and leak its content at the slightest provocation. This is cited in another instance by Lieutenant-General Sir Francis Tuker who estimated that half of all petrol transported in flimsies 'was lost due to failure of the cans and spillage. (Tuker *Approach to Battle* Cassell 1963 p17 .). So poor was the design and manufacture of the flimsy that British personnel resorted to using captured German petrol cans which were much superior in capacity, design, and robustness. Known as 'Jerry Cans' they were much sought after. The name 'Jerry Can' now forms part of every-day accepted English language. These two examples of all not being well with the Desert Air Force lie outside the immediate scope of this thesis, but nevertheless impinge directly on the work of the fitter-rigger team. The first example, that of over-claiming throws a different light on the operational tempo and what constitutes the truth in operational matters. The second regarding the flimsy, is a national wartime scandal, and could form a worthy basis for further academic research, followed up by a paper on the subject matter.

Lastly there is the desert environment itself, although a harsh unyielding environment the British with their operational and logistical experience stretching back over twenty years in the Middle East and the British mandates such as Palestine understood the situation and adjusted to it especially after Dawson arrived. This gave them an inherent psychological advantage wherein they improvised and innovated to suit the moment whereas, neither the *Luftwaffe* nor the *Regia Aeronautica* fully adapted to conditions and suffered both technically and logistically. *Kesselring* the German Officer in overall charge of the German side of the campaign ruefully acknowledged that the British with their experience of the desert were far more adept at campaigning in that environment than were either the Germans or their allies the Italians (Ehlers, 2015).

The British especially the Government, fully appreciated the geo-strategic importance of the Western Desert situated as it was in the North African Mediterranean and regarded the whole of the Mediterranean as a single geo-strategic unit (Ehlers, 2015). This importance rested on several advantages that would accrue to the British if they were to hold the position. Holding the region would have several effects; it would deny the Axis powers access to the oil fields in the Middle East, the loss of which would be disastrous to the British war effort. Holding the region would close the opportunity to any Axis attempt to invade southern Russia northwards from the Middle East. Similarly, the region proved to be a ready conduit by which Allied Lease-Lend equipment and materials flowed into Russia to aid their war effort. It also denies the Axis powers naval access including submarines, transit through the Suez Canal into the Red Sea and onwards to the British Empire in East Asia. It would also prevent the potential loss of the British mandate of Palestine, at that time a base for RAF fighters engaged against the *Vichy* French pro- German forces in Syria. The loss of Palestine would have in all probability led to the loss (sooner rather than later as it transpired) of the island of Cyprus with its RAF facilities. All the above effects would frustrate any attempt by the Germans and the Japanese to execute a large pincer movement possibly capturing India- the Jewel in the Crown of the British Empire.

It is beyond the scope of this thesis to engage in a 'what if' discussion on all or any of the six points raised above, but it is necessary to include them to demonstrate the factors behind the British Government's thinking on grand strategy and policy making, and the vital importance of the Western Desert campaign in that thinking. Thus it was vital to hold the line at the most defensible point, a point at which the British flank could not be turned, for as Moorehead (1944) observed, fighting in the desert was like fighting at sea where each side sought to outflank and outmanoeuvre each other; with no solid obstacle on which to pin their respective flank(s), Moorhead's analogy of fighting at sea accurately describes the situation that the Desert Air Force found itself in (Ehlers,2015). It was obliged to become an exceptionally agile, institutionally highly mobile, a complete air force acting within a larger complete air force-RAF Middle East. The intensity of the mobility combined with the harsh operating conditions in the desert

gave rise to significant wear and tear both on motor transport support vehicles such as mobile workshops and other types, and on aircraft as well. Dust or dirt of any description are anathema to mechanical systems, none more so than high performance aircraft engines which were maintenance heavy under normal circumstances. In a primary source interview with the author Neil attested to that phenomenon, where sand ingress into the engine happened to him on six occasions in eight weeks, causing him to either return to base with a disabled aircraft, or crash land and return as best he could. Maintenance requirements were exacerbated by the ingress of the fine desert sand dust previously referred to and became and additional burden on the fitter-rigger team as they worked continuously to keep engines and dust filters clean and serviceable; a task that at times must have assumed almost Sisyphean proportions. It must have been a tenuous existence sometimes wondering whether spares and replacement parts and supplies would arrive, and even if they did, would they be of the right type or in sufficient quantity?

On occasions riggers repaired returning damaged aircraft by cutting open the otherwise useless flimsy fuel cans, flattening the metal out and repairing by pop riveting surface panels as the correct panels were not available on site or were miles away in the store's depot at Cairo, Aboukir, or Alexandria-time was of the essence. Allied with improvisation and innovation at airfield level was the parallel development and reorganisation of the maintenance and repair services which resulted in a vast improvement in the availability and supply of most things necessary to keep the Desert Air Force operational. Ehlers (2015) observes that over longer distances, Tedder devised an air transport plan (the Tedder Plan) designed to keep units supplied in bulk. This is where the use of captured German transport aircraft were put to effective use as the principal German transport aircraft the *Junkers* 52 (JU 52) (see fig 4.14 above) had significant payload advantages over obsolete British types. Not only did it have large cargo side doors offering easy loading and unloading but it was capable of using its seating capacity to ferry replacement or additional personnel, in effect they became an informal airline within the Desert Air Force.

Mention of Dawson's maintenance and supply service must be made here, and although it has been referred to earlier in the thesis, it is essential that it be discussed here as the whole service proved crucial to the functioning of the Desert Air Force. Dawson was brought in by Tedder to radically reshape and reorganise the system. This he did ruthlessly and efficiently, his methods were unorthodox, and he had a vast technical knowledge and inventiveness and took no hesitation in working around people who he thought less driven and insightful as he. In so doing he alienated many other senior officers in the organisation including the Air Staff bureaucracy in London, who may have resented him for them not having thought of the ideas earlier themselves and making them look inadequate. Portal Chief of the Air Staff warned Tedder several times to keep him under control, but Dawson achieved results which is what counted in the Western Desert. He was regarded as a maverick and usually mavericks in an organisation tend to destabilise, but in this case, Tedder harnessed his talents, shielded him from being dismissed and gave him a free hand. It would be no exaggeration to say that Dawson in Tedder's opinion made it possible to increase air strength and fend off the *Luftwaffe in* 1941 leading to their eventual defeat in 1943 (Ehlers, 2015).

Until March 1942, the co-operation between the RAF and the Army and Royal Navy had been very much on an informal basis negotiated at a local level which often resulted in the inefficient use of resources and patchy results .March 1942 saw for the first time the publication of what in today's management parlance would be known as a service level agreement in this case a pamphlet entitled '*Middle East Training Pamphlet (Army and RAF)No 3A Direct Air Support,* which for the first time codified what the mutual expectations of each service were in the delivery of air power in the Western Desert. It distinguished between direct and indirect air support and cleared up any ambiguity or misapprehension in people's minds about just what it was that could be expected of the RAF. Importantly it made clear not only what could be done but also what would / could **not** (Thesis author's emphasis added) be done (Ehlers,2015). In this approach Tedder was again ahead of his time as service level agreements are now widespread practice where there is a client-contractor relationship, with the client in this case the British Army, and the contractor, being the RAF. This might be simplifying matters a little, as

the split might not have been that distinct in the Western Desert. Either service would have had elements of both functions, but it underscores the principle of who does what, where, when, and how.

4.21. Summary of the Environment the Western Desert.

The Desert Air Force had its genesis in the Royal Air Force Middle East which spanned an exceptionally large operational area including the Western Desert, operationally, at least initially it contained several types of obsolete aircraft that were inferior to the types put into the air by the *Luftwaffe* and to a lesser extent the *Regia Aeronautica*. The large operational area led to the dispersal of resources and support services leading to logistical problems regarding the supply of spares and supplies such as fuel and consumable materials including essential water. These problems were exacerbated by the harsh desert environment where the provision of all spares and consumable materials such as water food and particularly fuel were conditioned by the topography and climate of the Western Desert. A particularly severe problem was the secure supply of petrol which was delivered in standard four- gallon fuel tins known as flimsies which were not robust and unsuited to the rough handling in transit. This lack of robustness was allegedly responsible for a scandalous fifty percent wastage of fuel due to leakage in transit. This institutional disorganisation became readily apparent in the RAF retreat from the front line in 1941 and the operational and logistical shortcomings were laid bare in an RAF internal review document known as the Russell Report presented to Tedder and his senior management team later in 1941. There was also some evidence of over-claiming of *sorties* by RAF squadrons casting doubt on their operational effectiveness, both these issues were matters of concern to the senior management team and were dealt with at a local level at RAF Middle East Headquarters. The war correspondent Morehead (1944) likened the desert fighting to fighting at sea where each of the warring forces had no discernible flank that could be turned, so it became inevitable that the campaign became one of agile mobile warfare as each protagonist sought to outmanoeuvre the other to gain an advantage. From an organisational and managerial standpoint, Tedder was ahead of his time when he issued the training pamphlet outlining what it was the RAF, and the Desert Air Force could do and could/

would not do. This in effect what is now known in modern management parlance as a Service Level Agreement and helped to manage expectations of both the British Army and the Royal Navy (but principally the army). The summary shows that despite all the handicaps of operating in a harsh desert environment, the Desert Air force continued to take the offensive to the German and Italian armed forces, albeit after the initial hiatus described in the Russell Report. The recorded changes instituted as a result of the Russell Report demonstrate that the Desert Air Force was a learning organisation capable of adapting its operations in the light of experience, yet another example of a resilient organisation capable of rebounding after difficult circumstances.

Of course, all of the strategy, tactics, or *materiel* would be for nothing if it were not for the individual human input. English (1996) in his work writes extensively on the human dimension of Royal Canadian Air Force (RCAF) aircrew training and cites Ruggle as observing 'that most studies in military history have had a preoccupation with weapons, tactics, technology and grand strategy, but have generally ignored the vast human dimension of battle.' This would certainly seem to be borne out by this author's own research for this thesis where less than one quarter per cent of the several hundred plus primary and secondary sources deal with the human element in any depth. English then goes on to draw attention to the fact that it is the optimal use of human assets is just as important in fighting an air war as it is in fighting on land or at sea. When working on his development plans for the post First World War RAF, Trenchard paid a great deal of attention to the human element in his recruitment plans for both commissioned and non-commissioned ranks. By today's social standards his thinking on recruitment qualities and background seems archaic, unacceptable and in some cases discriminatory and possibly illegal, but to judge by today's standards would be wrong. The standards have to be looked at in the context of British society as it was then and what were generally accepted as the *status quo* on people's respective place or station in society and their expectations from life (Bishop, 2017). It was envisaged and certainly expected that officers would be drawn from the top strata of British society and supplemented where necessary by outstanding candidates drawn from the ranks, but even there it proved difficult but not impossible for an able candidate to rise higher than the rank of

sergeant pilot although as the Second World War progressed and attrition took its toll pilots were promoted from sergeant and gained a commission (Bishop, 2017).Great emphasis was placed on officers to behave in the moral code of a gentleman (Stradling, 1943). Other ranks that of sergeant and below were not subject to the same exhortations but were expected to uphold the high technical standards of the service. There is an apocryphal story known to the author of a squadron / regimental dance at which the notice was displayed as being open to Officers and their ladies, Sergeants and their wives, other ranks, and their women. (Thesis author's emphasis added). If the story proves to be true, then it reflects the assumption that women from the upper classes were ladies with descending social respectability through the ranks. But nevertheless, the social order prevailed, and Trenchard worked within it. Immediately post First World War the Member of Parliament and air force officer Hugh Cecil was charged with looking into the recruitment polices and system of entry into the albeit much reduced peacetime RAF needed to produce continuity into the service and ensure a new generation of young men who would bring with them fresh ideas. The report tendered in March 1919 was entitled*' Preliminary Education of Candidates for Royal Air Force Commissions'* and in addition to the gentlemanly qualities discussed earlier recommended selecting those from the universities and the public schools, including those 'who have a literary taste' as well as those of a scientific background (Overy, 1980). The scientific background was thought necessary as the air force became more technically minded, and a cadet college was opened in November 1919 at Cranwell in the County of Lincolnshire where these qualities would be put to the test. Trenchard told a gathering of RAF officers that the intention was to recruit the 'intelligent class, who can learn quickly and absorb quickly' (Overy, 1980).This statement is in itself a revealing comment, was it meant to infer that intelligence was the prerogative of class (James,1991), and that people who did not possess class were unintelligent or less intelligent than those of a higher class(James, 1991)?Or was it recognising intelligence cut across the then social classes and was distributed more evenly, and that they as a group represented 'the intelligent class'? The most charitable interpretation that can be employed is to accept the latter hypothesis and that Trenchard recognised that

intelligence came from all sectors and many forms from the then society and that it needed harnessing in a collective collegial way for the benefit of the air force. Research into intelligence by notables such as Goleman, Thorndike and Gardner showed that intelligence has many facets. The ability of an RAF commissioned officer to lead and manage people would have been of paramount importance, so in that context what Goleman describes as emotional intelligence would have needed to be at the forefront of an officer's skill set. In Gardner's multiple intelligence theory, several intelligences would have been needed, for example, logical skills to determine a best course of action in a volatile combat situation, interpersonal skills for dealing with others in a wide variety of situations, intrapersonal skills for dealing with their own internal contradictions, and often violent experiences. Bodily kinaesthetic intelligence in understanding the interface between man and the various combat aircraft experienced and lastly but most importantly spatial skills vital for pilots and other flying *roles*. This holistic approach was recognised in the first RAF apprentice scheme established in 1920 to train a new generation of technician ground crew, with the most successful apprentices enabled to move on to commissioned officer status (Overy, 1980).

The 1902 Education Act empowered local education authorities to expand secondary education up to the age of sixteen. However, it was conditional in that there was a fee element payable, which although graduated on a sliding scale depending on parental ability to pay precluded some of the poorest sections of British society (James, 1991). This had the consequence of limiting secondary education to the sons of the upper working class and lower middle class, the son of a foreman or of a corner shop keeper, trade 'in popular British social parlance. This sector proved to be the fountain head of recruitment to ground crew. Although they may not have possessed the formal or social qualifications of the officer class, they possessed through adversity, a good grounding in what now would be called life experience or street wise living off their wits to make their way in life. In a primary source interview with the author, Neil described ground crew generally as 'wayward puppies' employing every short cut and manoeuvre to gain an advantage either for themselves or for 'their 'pilot; witness the episode described earlier of Neil being supplied with extra petrol outside of his ration allowance when he went on

leave. For all his egalitarian ethos it is interesting to note that even Neil had a slightly condescending attitude towards ground crew in his 'wayward puppies' remark, and after retirement as Wing Commander from the RAF in the 1960s did not keep in touch with his ground crew. It was only sometime later when being measured for a suit in London's Saville Row did somebody say 'hello sir' it was his ex- fitter from 249 squadron who then measured him for his suit, afterwards they did keep in touch *via* the typically British medium of a Christmas card with a round robin letter included, this evidently constituted keeping in touch, and was about as far as each man would go in bridging the social divide. During the research for this thesis the author encountered this residual social divide in that many of the officers descendants live (d) comfortably in the counties surrounding London and in the south east, especially the socially agreeable and comfortable counties of Hampshire, Wiltshire, Surrey, and Norfolk, whereas the sole surviving rigger able available to be interviewed by the author was living in somewhat modest reduced circumstances in an Alms house on an estate in Peckham, a basic inner-city area of south east London.

The onset of the Second World War provided many young men with opportunities to escape the suffocating social structure of pre-war Britain. It also held out the prospect of adventure and chance to travel with possible social advancement through interaction and meeting with different classes. Whilst commissioned officers would have had their own social codes of conduct and language (Bowyer, 1988), non-commissioned officers and other ranks would have had theirs too, what Sheffield refers to in his work as 'pukka talk' an *argot* that only they understood which reinforced the social cohesion of the group or team (Sheffield, 1999). When discussing the next meal, a typical turn of phrase might be like 'taro chinas shufti this! Duff scoff peachy if Ombasha can't buddly it,' this contains a mixture of London cockney rhyming slang, along with words of Indian sub-continent origin (Clayton,2002),and other phrases and adjectives acquired during the RAFs' service in the Middle and Far East as Imperial policeman (Bowyer, 1988).To help decipher the conversation 'china's is London cockney rhyming slang, and 'chinas' is itself abbreviated from china plates = mates (friends). Shufti means to look at, or to regard upon, duff is a subjective adjective for being of bad quality, scoff is food or a meal eaten

in a hurry and peachy is a good chance of any outcome,(author).To translate this further into everyday modern English is to give the conversation as' hello everybody look here, there's a high chance of a bad meal tonight(or today) if the corporal cannot change the rations'. Also, a humorous conversation would be having a Turkish = Turkish bath=laugh. This *argot* also applied to other situations, so for example a spectacular aircraft crash would be a wizard prang, in the drink would be a crash landing in the sea, duff gen would mean bad or unreliable information, bint would denote a woman, usually young and attractive. Reverting to cockney rhyming slang, London ground crew when talking of domestic matters would refer to the trouble and strife=wife. A universal term was a Dear John meaning receiving a letter from a wife or girlfriend telling the recipient that the relationship was at an end with a divorce or separation imminent. In some cases, to assuage the unpleasantness (or celebrate, depending on the state of the relationship) the letter was displayed on the squadron notice board and disseminated around the squadron. This and the instances cited above were all informal ways of reinforcing the group. Away from the social *milieu* of the team the shared experience of constantly leapfrogging over other groups or team to arrive at landing ground location served to enhance the cohesiveness of the team, each member coming to rely on the others to play their part to ensure effectiveness. They innovated as they went, adapting Italian bombs and fuel for use in RAF aircraft, and the work of Desert Air Force logisticians developed immense logistical support to be mobile over large areas (Ehlers ,2015).

Although the Desert Air Force evolved into an agile, institutionally mobile force with immense logistical support, the initial stages of the campaign under the Air Officer Commanding in Chief (A O C in C), Longmore (Tedder's predecessor) proved to be difficult, with resources thinly spread. This led Longmore to the position where he felt he had to make the position clear to Churchill that in his opinion the RAF in the Middle East was not getting its fair share of aircraft. This and other pugnacious signals, whilst although truthful and accurate was not what Churchill and the War Cabinet and the Air Staff in London wanted to hear. They wanted solutions and not what, was moan, moan, moan (Ehlers, 2015). The tension led to Longmore recalled to London and replaced by Tedder, which fortuitously tuned out to be a good appointment. Tedder knew how to

play the political aspects of the situation and couched his signals in far more acceptable terms, he relied on the support of Portal Chief of the Air Staff for what Tedder had in mind for the Western Desert campaign. Whatever qualities Longmore might have possessed as a commanding officer and combat leader, he was not as tactful or emotionally intelligent as Tedder. Tedder combined background, training, and temperament, he was intelligent, energetic, and inquisitive, but also introspective, quiet, and calm. He was in many respects one of the few intellectuals, who attained high rank. However, there was another factor that affected his leadership, he had suffered personal tragedy in the Second World War, losing his wife and two sons and saw his main purpose as killing Germans.

4.22 Organisational Studies, Leadership

4.22.1 Key messages

The preamble to chapter 4 explained the selection of Adair's Action Centred Leadership model as the theoretical framework of the thesis. The chapter then went on to describe how Adair's model related to the team, the task, and the individual. The use of team, task and individual set the parameters for the coded data set (see appendices 1and 2) as each of the three major themes, which were expanded using the sub themes identified and the associated *genre(s)* identified from both primary and secondary sources. Given the potential large number of permutations generated by the coding process and the impracticability of discussing all the permutations, the author took the policy decision to inform the discussion by selecting six typical example pages of coded data, three from primary sources (colour coded red) and three from secondary sources (colour coded green) and discuss those in the context of team task and individual, in this way each element of Adair's Action Centred Leadership model could be directly related to the coded data. This approach then formed the basis of an in- depth discussion exploring all aspects of the Western Desert campaign. Before moving on to the discussion on organisational development and leadership as they apply to the Western Desert campaign it is felt to be worth restating for emphasis some general observations on the academic papers both referred to and cited in this thesis. After

reading a relevant selection of academic papers in the course of the literature review and re- reading them in the preparation of this discussion chapter it is the author's opinion that the same two general comments are to be made. Firstly, there is a lack of context, consequently it is difficult to get a feel for the situation and the people being theorised about, which after all is the main point, examining, analysing, and discussing human behaviour and endeavour. Secondly, academic papers propose a situation which may exist in pure terms, describing what *should* happen in absolute terms, but pay no regard to what *might* happen, or what *does* happen in the real world. This is especially important if the academic papers are to have utility for leaders and managers in their real world of day- to-day work. None of the works or papers explicitly consider gender, ethnicity, cultural or social factors such as class (in the United Kingdom context), and national characteristics, and whether those factors translate across cultural boundaries. For example, do Goleman's and other organisational practitioners work in North America apply equally in Britain? Consequently, they treat people as a homogenous group existing in a detached neutral state. But the most important question is whether organisational development theories developed in the relative security of peacetime also apply equally in the case of wartime specifically in combat situations where there is a high chance of mortal danger, life threatening, or life changing injuries. There is also the question of the embedded personal values the organisational practitioner brings subliminally to their work. Would for example a female organisational development practitioner such as Mary Parker Follett, or a researcher of Black, Asian or minority ethnic background arrive at the same conclusions as Adair-a white middle class male? It is hard to say and is a matter for conjecture, but the author feels that the point has to be made and held in the mind of the reader of this thesis. Whether this white middle class male one size fits all approach is intentional to reduce the situation to a minimum is hard to ascertain, but if there is an intention to exclude or ignore those factors then the work may be rightly and justly open to criticism in today's multi- cultural society. It is worth reminding the reader that Cubbon's paper previously discussed in the literature review rightly recognises the importance of social context and refers to the urban social

conditions prevailing in Chicago in the mid-1920s, and its' effects on the people being observed.

4.23 Organisational Studies, Leadership.

In organisational development terms, no team or individual exists in isolation from their respective organisation, they reside within the greater scheme of things. For the purposes of this thesis the discussion around leadership will centre on the pilot-fitter–rigger team placed in the context of Adair's Action Centred Leadership model. The model functions on three levels. The strategic leader (Thesis author's emphasis added) makes things happen, by providing direction and inspiration, ideally working towards transformational leadership in that they understand and articulate the organisation's objectives. They also need know how the work of each team and individual contributes to the wider goals of the organisation. The operational leader (Thesis author's emphasis added) needs to influence and inform their team, and interpret goals and results, initiate plans, and projects. They should have the skills necessary to implement decisions, and network where necessary. The functional leader (Thesis author's emphasis added) needs planning, organising and briefing skills; they need to define the task and exert control over the task. At the same time, they need to support and motivate their team members, with the ability to evaluate their effectiveness, and lastly to lead by example.

Tedder's strategic leadership through his management style and approach was thoughtful, methodical, and highly inclusive style (Ehlers, 2015) tempering boldness with forethought and paying attention to logistics. Orange (1992, 2014) says that along with Tedder, Coningham also fitted this mould, although in his case he also displayed large elements of both operational and functional leadership. Orange also makes the point which is worth restating and is especially true in the case of Dawson referred to earlier, that.

> The Desert Air Force, along with its predecessors and successors, tended to produce a host of highly individual, even unorthodox, aircrew men, yet in

> the Mediterranean air war such men found a vocation in the un-bureaucratic atmosphere of any operational unit, where the book had little relevance.

Tedder practiced what is now known as the 'tight- loose' style of leadership, a variation on the doctrine of '*Auftragstaktik*' *w*hereby his instructions would be in the form of general directives, often verbal, and that all detailed orders in the squadrons would be the responsibility of the local commander (Ehlers, 2015). Tedder was an effective leader in that at one end of the management spectrum he was able to deal with Churchill on grand strategic matters along with Portal, Chief of the Air Staff on strategic and tactical operational matters. In different situations he was equally comfortable visiting pilots at the front line and sitting on the desert floor surrounded by pilots listening to and acting on matters that concerned them. In this aspect he demonstrated the attributes of a functional leader, supporting and motivating his pilots. It is hard to imagine a present-day Chief Executive of a national branch of a multinational concern sitting in the car park of the branch discussing local operational matters with the company's' delivery drivers. But that is precisely what Tedder did, and he was widely liked for his humility in dealing with others and this garnered him much respect amongst his personnel. So, what he did in effect, was to vary his style of leadership according to the situation (Hersey & Blanchard, 1969;2001) combining the relationship dimension with the task dimension balancing one against the other to produce optimum results. He,(Tedder) had the attributes needed to be an effective leader ,he had the knowledge gained through his combat experience in the First World War, and his knowledge accumulated (Northouse, 2013) during the interwar years in his various Directorial posts (Orange, 2013, 2014). He had the motivation acquired as a result of his personal family war-time losses, and he had the personality needed to drive the Desert Air Force's operations (Northouse, 2013). However, he did not achieve results singlehandedly. In leading the Desert Air Force, he was fortunate in having a senior management team, in the form of the supporting triumvirate of Coningham (Orange, 1992) who commanded the Desert Air Force on the ground, Dawson as the innovative maintenance and supplies manager, and Elmhurst who was a supreme organiser who managed all the back-office human resource, administrative and operational research support services. Both Dawson and

Elmhurst demonstrated elements of both functional and operational leadership in their respective functions. Not only was there synergy at an operational level there was synergy at the interpersonal level with each member of the *quadrumvirate* understanding the operational position of the others and their consequent needs.

4.23.1 Leadership and the Pilot- Fitter- Rigger team.

In considering leadership and the pilot-fitter-rigger team it is worth restating the interpersonal team dynamic that existed within the functional team, and figure 1.7 from chapter 1 is restated here to aid the discussion.

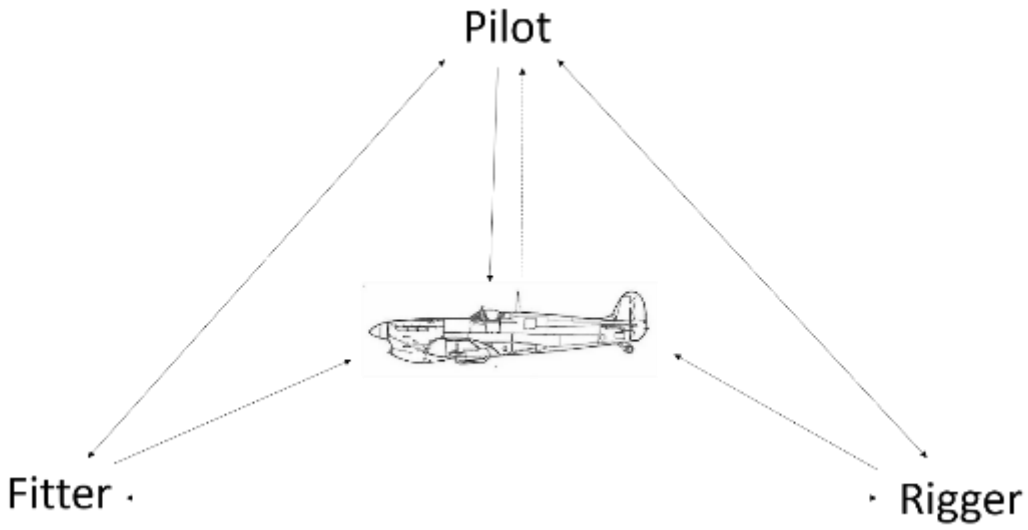


Figure 1.7 restated for clarity

This figure shows that the aircraft forms the centrepiece of the dynamic, and the actions of the three members of the team coalesce around the aircraft in order to keep it in an operational combat condition. The dynamic is known as the 'Golden Trinity' (Bowyer 1988). To help discuss the dynamic the author has constructed three composite cameo biographies of a pilot, fitter, and rigger from his research and interviews to illustrate their respective dynamic; and for the purposes of the discussion are known as Tom, Dick, and Harry.

4.23.2 The interpersonal dynamics of the pilot, Tom

Tom was born in 1920 in the Merseyside town of Bootle near to the city of Liverpool in the county of Lancashire, into a comfortable middle-class family. His father worked in a professional capacity for the Lancashire and Yorkshire Railway (L&Y) company. After completing his education Tom worked in a clerical post in a bank but became restless and joined the RAF Volunteer Reserve at the age of eighteen in 1938. After posting to flying training school he completed the course and commissioned as pilot officer. Initially posted to 56 squadron, then onto 249 squadron at North Weald situated in County of Essex northeast of London. He took part in the Battle of Britain in the summer and autumn of 1940 claiming sixteen *Luftwaffe* aircraft. Then the siege of Malta in 1941-1942 claiming one *Regia Aeronautica* aircraft, his tally of seventeen made him a middle ranking triple 'ace'. He survived the war and retired from the RAF in the 1960s with the rank of Wing Commander, he went on to be a director of a well-established firm of shoemakers based in Norwich in the County of Norfolk in eastern England. He was also a successful author, consultant to international, national, and local RAF commemorative events. He died in July 2018 aged 97.

The principal and only purpose of the pilot was to fly the aircraft in combat and report any defects or flying characteristics back to the fitter and or rigger. As the fitter was the more skilled of the two tradesmen, it would normally be to the fitter that the pilot would report them to. Depending on the characteristics of the defect, the fitter would decide whether the situation could be attended to by the fitter alone, or acting in concert with the rigger, or the rigger attending to the situation; or indeed whether the defect was not capable of rectification at the airfield or landing ground level and that the aircraft would have to be taken away for attention in a larger workshop away from the front line. In addition to the interpersonal dynamics already discussed, this particular dynamic can also be seen in the film clip displayed earlier (see figure 2.8 above). The pilot's dynamic would be conditioned by his personal relationship with his ground crew and his personal ability to describe the situation to them (Wellum, 2002). Some pilots like Tom for instance with limited mechanical knowledge, regarded the aircraft as a black box with little understanding of the workings of the aircraft. Tom's expectation would be for the

aircraft to be repaired as soon as possible and returned to service or a replacement aircraft overnight. On the other hand, pilots who had been ex-apprentices and had become sergeant pilots would possess a good deal of mechanical knowledge and would be able to give a better picture in describing the situation to the fitter or rigger. A description like 'excessive vibration at 2,000 revs per minute in fine pitch' would be invaluable to the fitter in describing the situation for rectification, whereas the description of 'she's shaking a lot' would not be at all helpful. Some damage such as combat damage to the surface of the aircraft would be self- evident and the fitter and rigger would intuitively know what needed to be done. Other cases of damage would be more subtle such as oil pressure drop and would need the pilot and fitter to work in concert to remedy the problem. The fitter would work on the oil pump then ask the rigger sitting in the cockpit to run up the engine to monitor the oil pressure at different engine speeds and temperatures.

4.23.3 The interpersonal dynamics of the fitter, Dick

Dick was born at Egham in the County of Surrey southwest of London in 1919 and spent his pre teenage years there, moving up to northwest London in his early teenage years. In common with his peers, he left school at fourteen and went to work as a wood machinist in a woodworking factory in nearby Harlesden northwest London. Having a practical mind, he quickly learnt how to set up and use the woodworking machinery. He was also quite politically aware and closely followed the immediate pre-Second World War political developments, and in 1939 at the age of twenty he volunteered for the RAF very much minded to fight fascism. After extensive technical training his first posting was in December 1940 to 249 squadron (the same squadron as Neil).There he worked as a fitter on Hurricanes from December 1940 until the squadron was posted abroad, ostensibly to Egypt in May 1941 .However the exigencies of war determined that the aircrew and aircraft travelled by a different route and were curtailed at the island of Malta to take part in the defence of Malta, against the combined attacks of the *Luftwaffe* and the *Regia Aeronautica.* The ground crew who by this time at Herghada on the Red Sea coast at the other end of the Mediterranean without their aircrew and aircraft were posted to 127 squadron. The combined 127 squadron personnel then went on to

Palestine to counter the *Vichy* French presence in Syria. Then onto Egypt where they became part of the Desert Air Force making a prolonged series of tactical moves across the Western Desert. The tactical moves culminated at a landing ground approximately thirty miles behind the front line at the second decisive battle of *El Alamein* in late October / early November 1942. By this time, Dick had over a years' experience of the agile mobile warfare described earlier in this thesis. He was to stay in the Western Desert after the conclusion of the campaign and returned to Britain in 1943. He survived the war, and demobbed back to civilian life in 1949, working first as a printer for the Bank of England, and later on the production side of the *Financial Times* newspaper. He died in November 1982 at age 62.

The fitter was a skilled mechanic- a practical artisan man, some of the pre- Second World War intake would have been civilian apprentice trained prior to joining the RAF. The war time intake would have been trained at one of the technical training schools, whichever trade they passed out as, they were both highly trained according to the provisions of the Kings Regulations (Air Ministry, 1938, 1940 Part1 and Part 2). The fitter would have extensive knowledge of how the engine would have been manufactured and assembled and would know how to assemble and disassemble engines or parts of engines and fault find. They would have been adept at understanding what the pilot was saying and interpreting the likely course of rectification. The fitter was the pilot's first point of contact; and their dynamic would be very much conditioned by their mutual interpersonal dynamic and respect. This is witnessed by the author's conversation with Neil and the episode of the additional petrol given to him by his ground crew.

4.23.4 The interpersonal dynamics of the rigger, Harry

Harry was born in Eltham southeast London also in 1919 and like Dick also left school at fourteen, going to work repairing motorcycles and the *Lagonda* brand of luxury cars. He too, volunteered for the RAF and in common with Dick undertook extensive technical training as a rigger and likewise posted to 249 squadron around the same time as Tom and Dick following the same path to Palestine and the Middle East as Dick. After the second battle of *El Alamein,* he was posted away from the Western Desert to follow the

Allied advance through Sicily and then on to Italy. The rigger although trained to the same Kings Regulations standards as the fitter was regarded as not as highly skilled as a fitter and was in some respects the fitter's backup. For the rigger, defects were nearly always visible such as battle damage, others required more investigation, so if a pilot reported that his aircraft had started flying port (left) wing down a rigger would have to check all the flying surfaces, control cables and linkages (see figure 1.4 above) for wear and tear and / or combat damage, and if nothing was obvious resort to deeper investigation. He would have been knowledgeable on sheet metal fabrication work and the properties of metals and their relative strengths, merits, and demerits. He also survived the war like Tom and Dick and returned to civilian life in the automobile industry, and died in 2017, aged 97.

In that respect the team were much like the Tedder-Coningham-Dawson-Elmhurst senior management team, working in a functional context. Whatever, their respective roles and skill sets they had to understand the other person and what was required; and at times depending on the task at hand take the lead in deciding what was to be done, and how those tasks contributed to the greater goal of the squadron. Both being Londoners Dick and Harry would have been drawn from the same social *milieu* and would have immediately had an affinity and understood each other's London *argot.* Having described the factors influencing the team and their backgrounds, deeper analysis would indicate that the team operated very much under the Leader–Member Exchange LMX theory conditions (Northouse, 2013). Taking the three-phase model advanced under the theory (Graen & Uhl-Bein, 1995) that of stranger-acquaintance-mature partnership phases it should be possible to discuss the interpersonal dynamics occurring within the team and offer some discussion on the applicability of those phases.

4.23.5 The 'stranger' phase.

This phase accords with Tuckman's forming stage of his team development model (Chapman, 2015; Nestor, 2013; Bonebright, no date). This would occur when the pilot is absent, either through being killed in combat, injured, and hospitalised, or posted away for operational reasons. The replacement pilot would be an unknown quantity in his

interpersonal dealings with the fitter and rigger. The new dynamic would take a while to emerge and be tested in the course of operations-that is if the pilot survived long enough in combat to move to the next phase, that of acquaintance where his manner of working would become clearer to the fitter and rigger. Naturally, the fitter and rigger would be looking for a pilot who would be pleasant, trusting, co-operative and agreeable, but the overall expectation is that the pilot would perform (Chapman, 2013) . There may be an element of initial distrust in the quality of the newcomer, what his personal qualities were and how he displayed them.

4.23.6 The 'acquaintance' phase.

This phase accords with Tuckman's storming and norming stages of his team development model (Chapman, 2015; Nestor, 2013; Bonebright, no date). This occurs at the stage where the interpersonal dynamics between the pilot and the fitter and rigger are identified, negotiated (in the sense that they are recognised and dealt with, and ways and means of collaborative working are determined) and some form of *modus operandi* is established to the satisfaction of the team. The pilot is no longer the new boy but is conditionally becoming part of the team. Trust and respect for each other begins to be developed, there is less focus on individuals own self-interests and more on the purposes and goals of the group (Northouse, 2013).

4.23.7 The 'mature partnership' phase.

This phase accords with Tuckman's performing stage of his team development model. This phase occurs when the team has settled on what constitutes the norms and dynamics that the team feels comfortable with, and that they can work within (Chapman, 2015; Nestor, 2013; Bonebright, no date). By this stage, the new pilot is a known quantity, and his interpersonal dynamics are recognised and accepted. It is marked by high quality exchanges between the pilot fitter and rigger, bringing with it a high degree of trust, respect for each other's skill set and an unspoken obligation toward each other. This partnership is transformational in that it assists the team members to move beyond their own self- interests to accomplish the higher goals of the team and organisation; at this stage, the team could truly be said to be performing. It is purported

that the LMX theory has a weakness in that it mitigates against fairness in that it can generate 'in groups' and 'out groups, having said that wartime combat situations are unfair, often extremely so, the author can think of nothing so unfair as losing one's life. There is little that can be done about mitigating the unfairness except to be victorious (Northouse, 2013). So, in this context a degree of unfairness is inevitable. In this instance the pilot-fitter-rigger team can be regarded as the 'in group,' but it would be hard to conceive of an 'out group' except the *Luftwaffe* and the *Regia Aeronautica.* Given all the above, it would seem reasonable to think that the pilot-fitter–rigger team operated under the theoretical conditions of the LMX theory. What is described above could equally apply to the arrival of a replacement fitter or rigger into the team. The example of the pilot was used as it was more likely that due to combat attrition, there could be a significant throughput of pilots. Neil, in his primary source interviews with the author cited the example of a new boy who would arrive in the officer's mess in the morning, be introduced to his fellow pilots and be dead by the evening, a victim of the *Luftwaffe.* The entire process was repeated several times in his experience.

In operating under the conditions of the Leader Member Exchange (LMX) theory it also has to be recognised that the team operated as a formal closed group .Formal in the sense that the fitter and rigger were specifically selected (posted) and recognised as a team to complete a task (maintain, service and repair aircraft), innovate,(solutions to operational problems in the Western Desert)solve a problem, or provide a service or a product(product is less applicable in the Western Desert campaign).Service could be construed as a repair and maintenance service. They were a closed group in that all three team members had to have specific qualifications or experience to 'qualify' as members of the team. They constituted a functional team in that they had a managed hierarchy and specific core functions (Clegg & Kronberger 2016). Whatever the dynamics of the team, the stark reality was that the pilot's life was to a significant extent dependent on the ability of the fitter to coax the maximum performance out of the aircraft's engine, and the rigger to ensure that the aircraft was properly trimmed for combat flight. Reciprocally both the fitter and rigger understood that the pilot's life and probable hoped for safe return was equally largely dependent on their professionalism.

Thompson (2008) refers to sociotechnical systems in considering organisational structures, which is a structure comprising of both human and non- human resources and facilities; and in the Desert Air Force there is a perfect example of such a system. There is cited above, the interdependence between the three team members and together they had a pooled interdependence. But is also sequential in that unless the pilot informs the fitter of a problem, the fitter cannot perform his work sequence or fault tracing. Or, depending on the nature of the problem, the rigger cannot perform his work sequence. Although there is pooled interdependence between the three team members the pilot sat outside the pooled interdependence; as once he had advised the fitter and or the rigger of the situation, he then became a passive recipient of the remedy and took on trust what the fitter and or rigger said to him regarding what had been done. Thompson (2008) also recognises that there will be co-ordination between the team members, this translates for example, into the rigger not being able, to connect up the cables to the flying surfaces until the fitter has resolved the problem; with the control column and advised the rigger that he can go ahead and connect up. Co-ordination would have also involved through standardisation, and where appropriate, mutual adjustment whether it was through standardisation of parts or through set frequency routine servicing of the aircraft. For example, a Supermarine Spitfire would require servicing every thirty hours flying time, this was non-negotiable and especially important in the harsh dust laden desert environment. After the service, the fitter would be responsible for completing the Form 700 which recorded that the aircraft had been serviced and was in a fit state to be handed back to the pilot. The pilot would be obliged to countersign the Form 700 to the effect that he had received the aircraft in a fit state to fly in combat. There is also the matter of hierarchy to take into account, the pilot-fitter–rigger team existed in a well- defined military hierarchy in the context of the squadron (see figure 1.2 above), and matters beyond the ability or knowledge of the fitter and or rigger would be referred up the chain of command through the relevant flight sergeant, to the squadron engineering officer for expert opinion or a decision on how the matter was to be dealt with. Each squadron had its' own engineering officer who would have had other duties as well as deciding on repair matters, so it would have

been that a particular problem brought to his attention would have had to join the queue in priority order (Thompson, 2008). The example above illustrates the interdependence of each operational element or trade and underscores the paramount need for teamwork, co-ordination, and the emotional intelligence needed to be aware of demands being placed on other parts of the organisation and the resolution and reconciliation of those needs.

4.24 Military Doctrine

The literature review has previously referred to the publication entitled the British Defence Doctrine 5th Ed (BDD) (Chiefs of Staff, 2015) which specifically states that the aim of military strategy is to ensure coherent and effective strategic planning when using the Armed Forces. That Military strategy is inherently joint. It also sits above single-Service interests, tying together military capabilities to deliver an effect that meets the short-term requirement, but is firmly rooted in a clear understanding of the long-term policy ends. (Thesis author's emphasis added). The British Defence Doctrine 5th Ed (BDD) also states that sustainability is an essential element to create credible and effective fighting power. It is enabled by combining logistics, (Logistics links the strategic base including infrastructure, stock, and industrial capacity) with deployed forces. Operational tempo will only be as fast as available logistics capacity, personnel, and administrative force structures; Infrastructure; and communications and information management.

With the arrival of Tedder in the Middle East in May 1941, he set about establishing the Desert Air Force as a separate self- reliant mobile force operating in co-operation with both the Army and Royal Navy, (Thesis author's emphasis added). So, by using Tedder's example it can be seen that the principles established then, are present in the current Defence Doctrine. In this he employed his skills and knowledge gained by him in commanding squadrons in the inter war years in the Middle East. He was ably assisted by Coningham who directed the operational tactical side of air power, Dawson who built up the salvage, repair, servicing, and maintenance back up services, and Elmhurst who reformed and regularised the administrative and logistical support services. Tedder

concerned himself with the high-level strategic direction of the Western Desert campaign and also dealt with the 'political' aspects of the campaign dealing as he did with Churchill through Portal Chief of the Air Staff in London, and with Portal directly on operational matters. He developed good working relationships with the Army, particularly Auchinleck (and later on in the early days with Montgomery, Auchinleck's successor). In conjunction with his management team of Coningham, Dawson and Elmhurst, (but principally Coningham) he developed the Desert Air Force Air doctrine which was published and disseminated to commanders as to what exactly the Desert Air Force could do or not do (Thesis author's emphasis added).Also laid out were what sort of circumstances air power could be employed. Tedder also recognised the importance of being visible as a leader and one who would listen to people's concerns. This was also the habit of Coningham and Dawson who would both regularly visit front line units to assess the situation for themselves and filter out the background 'noise.'

The British Defence Doctrine 5th Ed says that when applying force, threats may be countered by disrupting, defeating, or destroying an opponent. In summary, disruption degrades operations (a broader effect than simply disruption) diminishes an opponent's will, cohesion, and overall capacity to the extent that they are no longer able to maintain a tangible threat or prevent friendly forces from achieving their objectives. It can be seen from the literature review that, that was exactly what the Desert Air Force was doing in that it was disrupting the German and Italian supply lines, either through interdiction of shipping convoys in the Mediterranean or along the coastal road route from the German base at Tripoli to their forward positions, or by continual bombing of their positions. To illustrate the point, it is worth restating the following three extracts Dimbleby (2012) relates to the time of the second Battle of *El Alamein* from 23rd October to 4th November 1942.

> The Eighth Army's superiority in infantry and tanks was matched in the skies above the battlefield ------ one bombing raid alone, in the mid-afternoon of 2nd November prompted 200 German infantrymen to throw down their arms and surrender (p. 145).

In his work *Together We Stand*. Holland (2016, pp. 51, 175, 271) writes on the remarkable logistical efforts of the Desert Air Force:

> --- Arthur 'Mary' Coningham had lost around 600 fighters and 140 bombers since the beginning of May 1942.That he was able to keep these strikes going was due to the extraordinary efforts of the Middle East Maintenance and Supply Organisation run by Air Vice-Marshal Grahame Dawson.

Later in the same work Holland writes on improvisation in the desert with no fixed facilities and little or no sophisticated workshop equipment:

> The ground crews had been stripped of much of their equipment, to enable them to move at a moment's notice, but despite this handicap they maintained an extraordinary level of serviceability. By working through the night, they ensured that the Desert Air Force was able to keep around 80 per cent of its strength for much of the time (p. 174).

He then pays particular attention to the maintenance and repair service managed by Dawson, who was a highly unorthodox can-do manager with a make do and mend and managing somehow approach. So instrumental was Dawson to the success of the Desert Air Force that Ehlers devotes five pages to his achievements which by any engineering yardstick are impressive (Ehlers, 2015,pp.134-138; Shores, 2012, p.417).Dawson even took the unorthodox measure of establishing a network of engine repair workshops in the back streets of Cairo (see figure 2.7 above). Using the examples contained in the above extracts, it can be clearly seen that the Desert Air Force employed the principles later contained in the British Defence Doctrine 5th Ed (Chiefs of Staff, 2015); and that those principles and the lessons learned from those principles have been carried forward and incorporated into contemporary military doctrine.

4.25 Organisational Development theories and their linkages.

4.25.1 Applicability of theories.

4.25.1 .1 Adair's Action Centred Leadership model.

Using the model as the theoretical framework validated the theory, as the coded matrices and ensuing discussion demonstrated. The elements of the task, the group / team and the individual were all discussed and proven through triangulating the programme of interviews, literature review, and site visits. Therefore, Adair's Action Centred Leadership is applicable as a theoretical framework. Not only is the framework applicable, but the findings also demonstrate that the theoretical framework and the various theories described below generated in peacetime also apply in a combat situation, making them transferable in both contexts.

4.25.1.2 Belbin's work on identifying team roles.

At the conclusion of each of the author's interviews, each interviewee was asked to give their assessment of Belbin's team roles, and which three constituted the most important roles, ranked 1to 3; 1 being the most important. Whilst it is recognised that statistically the answers are insignificant, they should have importance attached to them, as each interviewee is connected in some way (some significantly as in the case of Neil the ex-Fighter Command pilot) with the work of ground crew Each interviewee was able to relate to the roles and their relevance to the work of ground crew, although in one instance one interviewee could not decide between two characteristics. Their opinions are tabulated at table 4.1 below which is restated below for clarity.

Table 4.1: restated for clarity

	BELBIN'S TEAM ROLES								
Interviewee	Plant	Resource Investigator	Co-ordinator	Shaper	Monitor Evaluator	Team Worker	Implementer	Completer Finisher	Specialist
Dr Stephen Bungay			3rd			1st		2nd	
Christopher Dorman O'Gowan LLB	1st			2nd					
Jim Nicolson M.A	2nd							1st	3rd
Carmel Zammit			3rd	1st				2nd	
Tom Neil DFC* Bar			2nd			1st		3rd	
David Irwin of Historic Aero Engines							2nd	1st	3rd
Warrant Officers Kevin Ball and Paul Routledge of "The Battle of Britain Memorial Flight	1st		3rd			2nd			
John 'Smudge' Smith of the Aero Restoration Company			Joint 2nd	3rd		Joint 2nd	1st		
Tony Lowe of the Aero Restoration Company					3rd	2nd			
Dave Lee of RPM Technik		1st			3rd	2nd			1st
Ranking Choices	1^{st} x 2 2^{nd} x 1	1^{st} x 1	2^{nd} x2 3^{rd} x3	1^{st} x1 2^{nd} 1 3^{rd} x1	3^{rd} x2	1^{st} x2 2^{nd} x4	1^{st} x1 2^{nd} x1	1^{st} x2 2^{nd} x2 3^{rd} x1	1^{st} x1 3^{rd} x2
Choices total	3	1	5	3	1	6	2	5	3

Source: author's Data gained from interviewees

Of particular importance to the analysis is the fact that the two serving RAF Warrant Officers interviewed as part of the preparation of this thesis confirmed that the RAF at the time of interviewing (2016) utilised Belbin's team roles in N.C.O. promotion exams. Both Warrant officers affirmed their complete confidence in the relevance and applicability of Belbin's team roles in their day- to- day work and management of the ground crew under their control. It is interesting to note that in all the interviewees, the author could recognise to some degree the characteristics identified by Belbin, either in others (that they have had or continue to have responsibility for) or in some instances in themselves. Therefore, it would seem from the data evidence that Belbin's team roles apply to the work of the fitter and rigger.

4.25.1.3 The work of Thorndike, Vernon, and Gardener on multiple intelligences.

The evidential data gathered clearly demonstrated that to operate successfully as a team in conjunction with the pilot, the fitter and rigger had not only been trained in their assigned trade but be able to think outside of the box in a fast moving, mobile, combat situation. Ground crews were often thrown back on their own resources and required to innovate and improvise to ensure that the Desert Air Force remained operational. Examples in the data show where multiple intelligences were at play, interpreting engineering specifications, implementing field modifications to aircraft to re- purpose or enhance their combat performance. At Table 2.3 the author illustrated what in his opinion were the correlations between the various intelligence theories. From the data it would seem that what Thorndike describes as Abstract Intelligence correlates with what Gardner describes as both Linguistic and Logical Intelligence Linguistic in the context of being able to read complex engineering specifications and drawings, and logical in fault finding on an engine- if 'a' happens then it follows that 'b' will be the resultant outcome. What Thorndike describes as Mechanical Intelligence equates to Gardner's Musical, Spatial and Bodily-Kinaesthetic Intelligence. The term Mechanical refers not to mechanics in the engineering sense but in how the human body reacts to and interprets its' surroundings. For both fitter and rigger spatial intelligence is necessary to relate to how the aircraft behaves on the ground and in the air. Bodily-Kinaesthetic intelligence is also necessary to understand the interface between the aircraft and the pilot and to a lesser extent between the aircraft and the fitter and rigger. A slightly different interpretation of Musical Intelligence was the ability of a skilled fitter to listen to the sound of an aircraft engine at various speeds and be able to divine whether the engine is running correctly or not, and if not, what the likely defect might be and the remedy.

4.25.1.4 Goleman's theory of Emotional Intelligence.

Goleman has, in the author's opinion as an organisational development practitioner and a student of the discipline, come closest to a holistic approach to examining and explaining human intelligence and emotion in his work on Emotional Intelligence.

Goleman recognised that Intelligence Quotient (IQ) was not the sole arbiter or pre-requisite for having a successful life. He contends that there are six leadership styles, which would seem to suggest that there is a convergence with what Hersey and Blanchard describe as Situational Leadership whereby a leader adapts their approach and style according to the prevailing situation. Tedder was a prime example of this, at one end of the spectrum he dealt with the Prime Minister Winston Churchill on the grand strategic direction of the Second World War, whilst at another time sit crossed legged on the desert floor informally discussing tactical and local matters with Desert Air Force pilots. Goleman also identified a number of personality attributes that an emotionally intelligent person possesses of, self-awareness, impulse control, persistence, zeal, motivation, empathy, social deftness and how those attributes can be harnessed in an emotionally intelligent person. Taking the fitter and rigger as examples, self-awareness arose in that they were aware of how their conduct and technical professionalism impacted on others, notably the pilot whose life could, and did depend on their thoroughness in completing their work. Zeal in applying themselves to their allotted task in exceptional circumstances, this zealousness was a counterpart to motivation to get the job done to further the war effort and defeat the *Luftwaffe,* and by extension the Germans and their allies. Empathy, in that the fitter and the rigger had to understand the other's mind set, and that of the pilot; not only in the team context but in the wider context of the squadron, and also in a wider context, the conduct of the Second World War. This empathy was in concert with a social deftness, the ability to co-exist with others in extremely difficult circumstances with the ever present risk of mortal danger or life changing injury .So it would appear from the evidence that certainly the fitter and rigger possessed multiple intelligences and emotional intelligence, and that the work of Thorndike (1920),Vernon (1933) and Gardner (2011) applies to the work of the fitter and rigger, but to what precise degree in each individual would need further extensive research outside of this thesis.

4.25.1.5 Bennis's work on leadership.

Here is where the author takes issue with the work of Bennis, who presents the differences between a leader and a manager in a binary either- or situation, and that

the differences are stark and mutually exclusive. In other words, a person can either be a leader or a manager. Whilst the author accepts that in some instances the distinction between leaders and managers may be clear, the author would contend that the differences are less absolute, more nuanced than Bennis is proposing .In relating these absolutes to the pilot-fitter–rigger team, it could be said that the pilot by virtue of the fact that he was the commissioned officer, or at least senior rank NCO in the team that he would be the leader; perhaps in some transient instances that might be the case. However, Neil in his primary source interviews with the author made it clear that he was wholly reliant on his fitter and rigger and their expert knowledge, and was in no position to lead, or to dictate a course of action. He was the passive recipient of their inputs. Similarly, although the fitter was the acknowledged senior there was an element of *primus inter pares* with the rigger, he had to defer to the knowledge of the rigger in instances, and the reverse would apply to the rigger. Also, there would be instances where the two men would have to work collaboratively to achieve a task, there being no clearly defined leader or manager. In this instance either or both men would have to innovate, with administration confined to form filling and requesting signature or counter signature. Bennis makes the point that leaders challenge the *'status quo,'* although both the fitter and rigger could lead neither of them were in the position to challenge the Western Desert *'status quo,'* they had to accept the position and work within it. Even people who are recognised as leaders could and did cross over into management as is demonstrated in the case of the then Prime Minister Winston Churchill who couldn't resist the temptation to intervene and micromanage the Allied war effort, causing his Chief of the Imperial General Staff Alan Brooke much annoyance and frustration (Alan Brooke, Danchev, and Todman, 2001). Therefore, using the examples cited above the author would conclude that the work of Bennis is applicable in part, and wholly applicable only in well-defined absolute circumstances.

4.25.1.6 Hersey and Blanchard's work on situational leadership.

Hersey and Blanchard put forward the proposition that an effective leader adapted their style of leadership according to the situation, and that there were two components that conditioned the process. Firstly, that there was job maturity, related to the ability to do

something, and is linked to knowledge and skills secondly there must be psychological maturity, the willingness and motivation to do something. From their technical training both the fitter and the rigger were properly qualified and competent to carry out their respective functions, so they were job mature in that context. Perhaps they were willing to do something in the context of having no choice in the matter in combat or achieving combat readiness. However, they may have been motivated by the thought that if they did not do something then they were letting themselves, the pilot, the squadron, and the wider war effort down. Having examined the four levels of approach needed depending on the maturity of the group, that the delegating approach pertained as the team was mature and people were able(through technical training),willing(in the context of having no choice in the matter)and confident enough to take responsibility for the task Those situational transactions were particularly relevant where the formal leader may be many miles away from the group, difficult to contact,(or possibly incapacitated or dead),with no time to refer requests for a decision up the chain of command. Therefore, in these situations an informal leader emerged, and the leadership would change from individual to individual depending on the requirements of the job in hand. The example of the *ad hoc* informal development at a local level of the high-altitude Spitfire is a prime example of the situation previously discussed where a team worked under much the same conditions as described above, but in this instance the leader in the shape of the engineering officer was closer to hand on site and kept oversight of the project at a distance, the project being only one of his responsibilities. Therefore, on the data evidence on specific examples, the work of Hersey and Blanchard applies to the fitter and rigger.

4.25.1.7 Graicunas Theory of span of Control.

Graicunas (1937) sought through quantitative analysis in the form of an algebraic formula which purports to determine the number of interpersonal relationships within a group when a number of subordinates is stated. His work was directed at identifying the lack of a theoretical basis for the empirical belief in limiting the span of control. Graicunas summed up the prevailing view of the reason for limiting the span of control as ‘One of the surest sources of delay and confusion is to allow any superior to be

personally responsible for too many subordinates' (Graicunas, 1937). Graicunas also cited General Sir Ian Hamilton who said

> The nearer we approach the supreme head of the whole organisation, the more we ought to work towards groups of three; the closer we get to the foot of the organisation, the more we work towards groups of six.

Graicunas suggested that the maximum number of subordinates should be five, and probably four in most cases. Graicunas' work contains formulas, a table, and a chart displayed and discussed earlier, showing the exponential growth in numbers bringing complexity of relationships as the number of reporting subordinates increases. The table previously shown at table 2.5 is restated below for clarity.

Table 2.5: Correlation between number of subordinates and resulting relationships

Number of subordinates	Number of relationships
1	1
2	4
3	18
4	48
5	100
6	180

Source: Graicunas (2011)

In the case of the pilot-fitter-rigger team the nearest benchmark is two subordinates, although it must be recognised that although both the fitter and rigger were subordinate to the pilot by virtue of rank, they were not subordinate in terms of task in fact in the converse applied as both men were superior to the pilot because they had the technical knowledge on which the pilot's life might depend. Therefore, using figure 1.7 The 'Golden Trinity' team dynamic and the table above it can be seen that there were four interpersonal relationship dynamics that existed and had to be managed. (Six if the pilot is considered but not as a subordinate). This would seem to validate what Sir Ian Hamilton said in the quotation immediately above. It is interesting to note that a typical squadron organisation reflects this approach (see figure 1.2 above) with two sections

of three aircraft and approximately twelve aircraft available, each reflecting a group of six. It is also interesting to note that typically three squadrons constituted a Wing, being a larger operational tactical grouping. Therefore, on the basis of the data evidence it would seem that Graicunas formula for calculating the number of subordinates and resulting relationships is a pragmatic guide to be used with caution to aid the determination of the span of control and thus the number of hierarchical layers in an organisation.

4.25.1.8 Homan's theory of Group Formation.

In his research into how people behaved, Homans used the work done by Mayo *et al* on the Hawthorne Effect. He determined that people may belong to one group, what he called the sub-group, and that the sub-group may be part pf a larger entity. In the case of the pilot, fitter, and rigger they were the sub-group that itself was subsumed within a section of three aircraft, which in turn was subsumed in a flight of six aircraft, which was subsumed into a squadron, and a squadron into a wing consisting of three or four squadrons. (See figure 1.2 above) Homans refers to the three components that impacted on the team. The first, the environment is particularly relevant as the desert environment conditioned every aspect of the team's work. The terrain provided the perfect environment for a mobile, fast moving combat environment, and the climate produced immense heat and the fine dusty gritty surface deleterious to aircraft, vehicles, and men (Moorhead, 1944); and the heat could prove fatal if not effectively managed. The elements of the cultural component, norms, values, and goals can be summed up under the notion of Britishness discussed below along with the organisational culture of the RAF and the ultimate goal of victory over the Germans and their allies in the Second World War. The technological element–the state of the knowledge was determined by the technical training of the fitter and the rigger. In this respect the pilot usually lay outside of the team as he was not a technical expert, some sergeant pilots by virtue of their previous technical training did have that knowledge and could contribute to discussions within the team. But for the greater part, the technological aspects were the province of the fitter and the rigger. From Homans' work it can be seen that an individual brings characteristics of mind to the group, and this

would converge with the work of Belbin on team member characteristics previously discussed. The team also had a way of collaborative working where the leadership changed hands between the fitter and rigger depending on the situation and facilitated a wholly natural and appropriate method of working focussed on fault finding and rectification and where necessary, innovation and improvisation (Hersey Blanchard, and Johnson 2001). So, from the evidence presented it would seem that the three elements of Homans theory of group formation applies to the fitter and rigger.

4.26 Summary of Organisational Studies.

4.26.1 Key messages

When summarising organisational development and its' applicability to the Desert Air Force, it is important to recognise that there are, in the author's opinion deficiencies and shortcomings in the academic sources cited in this thesis. The fundamental issues stem from a lack of context which would help identify where in society, and in which society and sector of society the work is located. Consequently, it is difficult to determine whether or not the work cited would be capable of crossing social or cultural boundaries.

From the discussion on the eight theories used in the compilation of this thesis, it can be seen that six of the eight organisational theories used in the compilation of this thesis apply.

1. Adair's work on Action Centred leadership
2. Belbin's work on team characteristics
3. The work of Thorndike, Vernon, and Gardner on multiple intelligences.
4. Goleman's work on Emotional Intelligence
5. Hersey and Blanchard on situational leadership
6. Homans theory of group formation

The seventh, Graicunas algebraic formula on the span of control is useful as a guide, but caution should be exercised in the rigid application of the formula. The last theory,

that of Bennis applies in part and is conditional on the absolute distinction between a leader and a manager.

The works with the exception of Cubbon (1969) on the Hawthorne Effect are silent on their societal positioning, and thus in the author's opinion are quite deficient in that respect, and in today's multicultural society would not be acceptable in some quarters. Tedders' leadership style was discussed and its efficacy in leading the Desert Air Force along with the harmonious workings of his senior management team. However, two negative aspects were noted and discussed relating to the Russell Report of 1941 and the allegations of over-claiming of *sorties* by Desert Air Force squadrons which raises doubts on the veracity of other operational data. The restating of the 'Golden Trinity' figure (Bowyer, 1984) set the context for an examination of the individual dynamics of the pilot-fitter-rigger team members and the development of the three phases of team development along with biographical cameos of the three team members to help illustrate the dynamics involved. The dynamics were then discussed in the context of LMX theory (Northouse, 2013) leading on to Thompson's work on how technology and structure condition organisations in action (Thompson, 2008). Earlier in the thesis in chapter three Methodology the author referred to a Management Theory Matrix through which he aspired to demonstrate the theories utilised in the thesis and determine have some degree of correlation with each other. In this way it is hoped that the reader will arrive at a more holistic picture of organisational development theories in the Western Desert campaign. The matrix is shown at table 3.4 p143 above completed by the author with 1= strong correlation, 2= some correlation, 3= weak correlation. 0= no correlation.

4.26.2 Using and interpreting the Matrix.

The Management Theory Matrix is constructed by placing Adair's Action Centred leadership as the theoretical framework in the top left-hand corner of the matrix and working across and down the other organisational development theories used, are listed on each axis. As one theory cannot be compared against itself, the matrix boxes where they coincide on each axis are blanked out. Thus, it is possible using this layout to explore

for example the correlation in theoretical terms between Adair's Action Centred Leadership and Belbin's team roles, or between Adair's Action Centred Leadership and Goleman's work on Emotional Intelligence (EI). Not only is it possible to explore correlation along the horizontal axis, but it is also possible to explore correlations down the vertical axis, so by adopting this approach it may prove possible for the reader to gain a clearer appreciation of how the various organisational development theories might correlate to each other in an holistic way; and not exist in a vacuum with each of the other theories (see management theory matrix at table 3.4 above).

4.26.3 The matrix discussed

The matrix (table 3.4 above) displays that there are strong correlations between Adair's Action Centred Leadership with other organisational development theories dealing with team roles, multiple intelligences, and emotional intelligence, and as may be expected, with situational leadership, and leaders as a distinct attribute. To put this in the context of the pilot–fitter–rigger team, the team had a distinct **task** to perform*, viz* the maintenance and presentation of an aeroplane, 'their' aeroplane in a combat ready condition. The **team** had to work in a cohesive manner, be aware of, and draw on each other's skills and needs to present the aeroplane in a timely manner, often in a life threatening or life changing physical environment. Everyone had to use his skills to maximum advantage to expedite the maintenance or repair in the minimum time possible to maximise the operational effectiveness of the squadron.

The thesis has previously referred to the fact that the team needed the ability to think laterally using multiple intelligences to derive innovative solutions to one off situations, such as the development of high altitude Supermarine Spitfires. The thought processes involved in that development demonstrated the strong correlation between the possession of emotional intelligence and the employment of multiple intelligences in deriving workable practical solutions. The matrix also displays that at a secondary level there is some correlation between the absolute distinction between a leader and a manager and that of situational leadership and multiple intelligences, and emotional intelligence. Using the team context again, it is quite possible that whilst the team had

a well-defined hierarchy of skills, there would be instances where, due to combat circumstances a leader might emerge to deal with a specific circumstance and revert to their behavioural type once the situation had been resolved or had passed. At a tertiary level, it can be seen from the matrix that there is no correlation or at best a weak correlation between the formulaic approach of Graicunas in determining the span of control of a supervisor or manager and that of leadership, both at an Action Centred level and at a situational level. This can be attributed to that whilst formulas can be useful in aiding background thinking it would be constraining (not least controversial) if a leader or manager used the formula in its pure form. Lastly, as set out at the tertiary level, there would seem to be no correlation between the formulaic approach and the majority of the organisational development theories used in this thesis. This is because the formula is just that, a formula, and should only be used as an aid to a leaders' or managers' background thinking, and not function as an absolute arbiter of determining subordinate numbers as the formula takes no account of an individuals, skills, attributes, or contribution to the greater team.

4.26.4 Summary of Correlations

The matrix as set out above was designed to demonstrate and explore the potential correlations between the various organisational development theories used in this thesis. It can be seen that utilising Adair's Action Centred leadership as the theoretical framework, the various organisational development theories demonstrate that there are correlations on three levels, with the formulaic approach in the majority of theories having no correlation, with only a weak correlation in a small minority of theories. Therefore, on the basis of the evidence of the matrix, it would seem that there is a case to be advanced that in the context of the pilot–fitter–rigger team working as part of the Desert Air Force in the Western Desert campaign, the separate organisational development theories used in this thesis can be considered as constituting a holistic theoretical approach.

As a lead into the conclusions in chapter 5 the various theories have been examined to determine whether they were Logical and coherent, clear and to the point, fitted the

research data, and applicable to more than one place, situation, or person. This last aspect is particularly relevant as it would be useful to test whether those theories developed as they were in peacetime, equally applied in a wartime combat setting.

Adair's Action Centred Leadership was selected as the theoretical framework for the thesis, precisely for the reason that it fits all the criteria listed in 1-4 above; and uses a Venn diagram as an easily recognisable learning aid. The author was familiar with the principles through his work as a manager in the successful practical day to day application of the principles in the public sector. Each of the three elements are relevant and appropriate to organisational development, and the example of the Plymouth University film clip demonstrates that the model is still current and taught at Undergraduate level. Belbin's work also fits all the criteria and is in current use throughout the Royal Air Force in the promotion examinations for Non-Commissioned Officers (N.C.Os.). Belbin's work is clearly demonstrable in the work of fitter and rigger and enables those members to complete their tasks, contribute to the work of the group/team and fulfil individual characteristics. So, it can be seen that the two theories and models work well in tandem.

Multiple intelligences require some thought on the part of the reader as not every reader may be entirely familiar with the spatial concept especially if they are of a not particularly practical mind set. This would require some familiarisation with how the concept worked with regard to a combat fighter aircraft, and the ergonomic interface between the pilot, fitter, and rigger. The various intelligence descriptions converge well with Goleman's concept of Emotional Intelligence and can be subsumed in the generic description of Emotional Intelligence. However, to fully appreciate Goleman's work on Emotional Intelligence the author is of the opinion that some prior knowledge of organisational development is required. In everyday settings, Goleman's work is relatable as the reader may be familiar with somebody who may be socially deft but possess no academic qualifications, having the ability to 'read' people. Equally the converse applies, and an academically gifted person may be socially awkward and *gauche*. However, with regard to the work of Bennis, the author disagrees with Bennis on the absolute distinctions he makes regarding leaders and managers. This makes his

work somewhat difficult to apply in real life, but they are useful as a starting point, and thus his work lies slightly to one side of the discussion.

The discussion regarding the applicability of Bennis's work is even more problematic with the formula put forward by Graicunas, as organisational development theories when applied through industrial relations to re-purposing or reshaping organisations are difficult and sensitive enough in their application. When engaging with the people affected, any formulaic approach must be treated with extreme caution and not put forward in isolation as a solution to the situation of the organisation. Graicunas's work like that of Bennis is useful as background context and as an aid to thinking. Therefore, like the work of Bennis, Graicunas's formula should lie slightly to one side of the discussion. But it is instructive to note that the structure of an RAF squadron lies very much like units of three or six, which reflects what Graicunas had to say on the matter of span of control, and also reflects what Hamilton had to say on military organisation. Lastly Homans' three components are fully recognisable in the Western Desert campaign; the **Physical** manifested in the desert climate and terrain of the Western Desert, the **Cultural** reflected in the interpersonal dynamics of the pilot-fitter-rigger team, and the **Technological** through the combat aircraft used in the campaign and technical support services that underpinned the campaign. In summary it can be seen that all the theories with the possible conditional exception of the works of Bennis on leadership and that of Graicunas on the span of control have close interrelations and taken together give a holistic picture of how organisational development theories applied in the Western Desert campaign. These close interrelations would suggest that as the theories apply to more than one place, situation, or person that organisational development theories developed in peacetime apply equally in a war time combat situation, and in that respect, they represent transferable aspects of human behaviour in that particular contextual setting.

4.27 Testing the *Null* Hypothesis and the notion of Britishness.

Having discussed the subject of organisational development in the context of the pilot-fitter-rigger team, it is now appropriate to test the *Null* Hypothesis attached to the

research question. The *null* being-*neither Britishness nor the peculiar and particular desert environment played a significant role in creating the pilot- fitter- rigger small team into an effective and resilient entity*. If it is accepted that Clausewitz's dictum 'the *nature of armies is determined by the nature of the civilisation in which they exist'* (Clausewitz, 1915), then it must follow that to fully test the *null* it would be useful to discuss the notion of Britishness, and further discuss the influence of the desert environment on the pilot-fitter-rigger team. In discussing the notion of Britishness, it would be necessary to frame the discussion in the context of Schein's Venn diagram previously shown at figure 2.5 above and restated here for clarity of discussion.

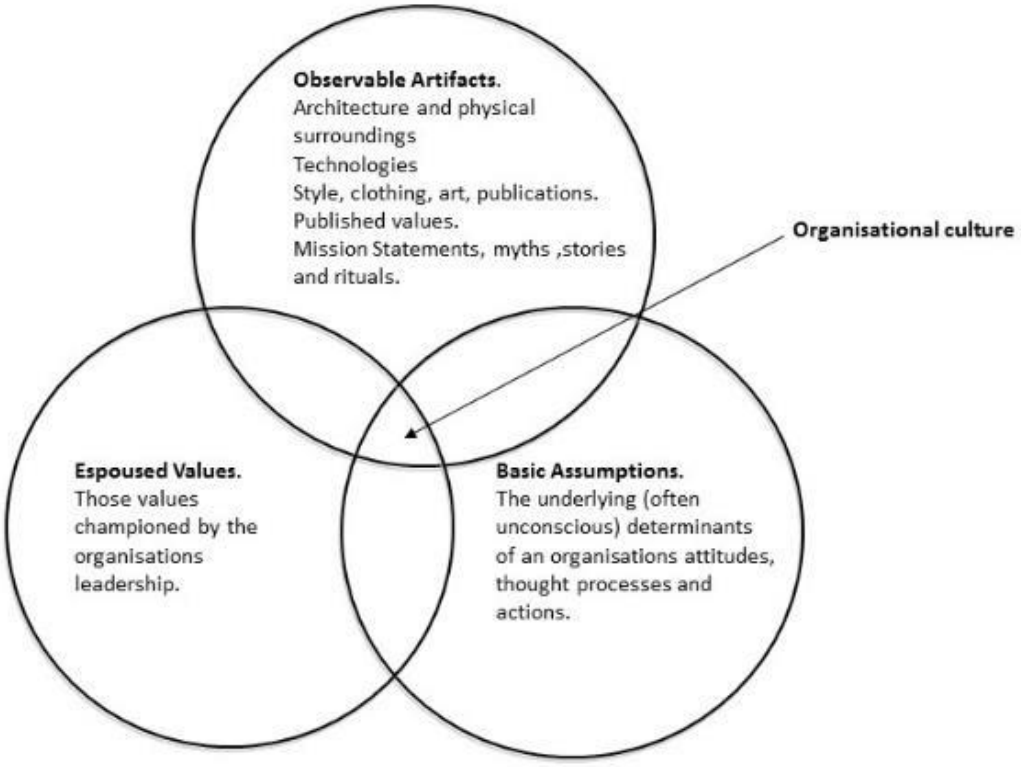


Figure 2.5 Schein's Organisational Culture Venn diagram restated for clarity

Although Schein's Venn diagram relates to organisational culture, the author is of the opinion that the components of the Venn diagram would equally apply to the discussion on Britishness and transfers well into the discussion as will be demonstrated. Schein's Venn diagram consists of three components, Observable Artefacts, Espoused Values, and Basic Assumptions, so to discuss the notion of Britishness each component is

examined in turn and then combined to identify the notion of Britishness at the centre where the three circles overlap. The Oxford Concise Dictionary 12thed defines British in the first instance *'as relating to Great Britain, or the United Kingdom'*. The United Kingdom comprises of England, Wales, Scotland, and Northern Ireland. However, it must be recognised that the four component countries jointly and severally, represent a diverse range of cultures, all four of which were present in the RAF, the Desert Air Force, and the pilot-fitter-rigger teams throughout the RAF. To undertake to discuss all four aspects of Britishness and how they contribute to the overall notion, would be a task well beyond the scope and volume of this thesis; so, a more generic concept of Britishness encompassing all four cultures must suffice for testing the *null* hypothesis. When considering the notion of Britishness, the author has endeavoured to describe the situation as it existed then at the time of the Western Desert campaign and not judge the notion using today's societal standards in hindsight, it is describing the situation as it existed then, and not whether it was right or wrong at that time

4.27.1 Observable Artefacts.

The architecture of the United Kingdom was (and still is) wide and varied, being very different at its furthest extent being bounded by Rathlin Island located off the coast of County Antrim in Northern Ireland to the North Foreland, north of the port of Dover in the County of Kent, and the Fenlands of the County of Norfolk, and from the Shetland Isles located north of the far northern Scottish county of Caithness, to the Scilly Isles located in the Western Approaches where they meet the confluence of the Atlantic Ocean and the English Channel. So, the architecture experienced by ground crew drawn from those quarters would be quite different. Contrast a typical crofter's cottage of County Antrim or the Shetland isles, (see figure 4.27 below) with the urban slum tenement dwellings of large cities such as London, Liverpool, or Newcastle. (See figure 4.28 below).

Figure 4.27: Typical crofter's cottage.

Source; Bing images

Figure 4.28: Typical British inner city slum tenement dwellings.

Source: Bing Images

Or, the thatched cottages of the Norfolk Fens, to the industrial miner's cottages of the South Wales coalfield towns. In between there would be the imposing metropolitan buildings of London, Belfast, Birmingham, Sheffield, and other large Industrial Revolution towns of the Northeast and Northwest England. Ground crew drawn from

the metropolitan cities would have grown up used to the imposing civic, social, and ecclesiastical buildings which spoke of duty, deference, industry, commerce, and by implication the British Empire. (See figure 4.29 below).

Figure 4.29: Leeds Town Hall, County of Yorkshire.

Source: Bing Images

Likewise, their location would reflect their physical surroundings, County Antrim and the Shetland Isles were sparsely populated rural agricultural and fishing communities, with distant links to urban conurbations with for example, the nearest railway station to the Shetland Isles being on mainland Norway, rather than at Wick in Caithness. Contrast these locations with the urban sprawl and environmental pollution of the Black Country industrial area to the west of Birmingham, with towns like Wolverhampton or Dudley as focal points. At the time of the Second World War and the Western Desert campaign, Britain was an economy based on heavy industry (shipbuilding, iron and steel production, coal mining and textiles, being classic examples). The privatised railways were the prime movers of goods and commodities and the produce of heavy industry. The railway network was extensive, reaching every corner of Britain with steam locomotives (themselves a product of British heavy industry) the prime motive power. Many ground crew would have been drawn from those branches of heavy industry that

employing practical artisan men. At the turn of the 20th Century at about the time many of the future ground crew were born, Harland and Wolff the firm of shipbuilders operated the largest shipyard in the world in Belfast Northern Ireland, employing some 15,000 workers. (Mayo, 2016). In contrast the modern technology of aviation with its emphasis on sleek modernity, with the promise of adventure was also an attractive proposition to young men, seeking to escape urban deprivation, suffocating social restrictions, mass unemployment, and environmental pollution. The late 1920s and 1930s also promoted the idea of modernity in all social areas, the artistic style Art Deco with its clean geometric patterns for home fittings and soft furnishing was fashionable (See figure 4.30 below).

Figure 4.30: Typical Art Deco house interior

Source: Bing Images

Along with Art Deco interiors, *Bauhaus* the architectural style (ironically) conceived in Dessau, Germany was heavily promoted by property developers in Britain. (See figure 4.31 below).

Figure 4.31: Typical *Bauhaus* architecture the 'Isokon' flats, Lawn Road, Belsize Park, London.

Source: Bing Images

There was a parallel movement to modernise the railways ,and streamlining of locomotives and whole trains was public relations 'spin' with the various railway companies emphasising speed and comfort to lure passengers onto their trains It is interesting to note that the designer of the Supermarine Spitfire, R.J. Mitchell attained top marks in his school for mathematics and art, and served his early years as a mechanical engineering apprentice at the Kerr Stewart steam locomotive works based in his home town of Stoke on Trent in the West Midlands County of Staffordshire. At that time British industrial design philosophy placed great emphasis on 'modernity' through aesthetics in appearance and of elegance in design, often at the expense of ease

of maintenance or repair (see fig 4.32 below, not a Kerr Stewart product design, but a case in point and Mitchell's early education, artistic skills, and design experiences may well have influenced his design philosophy in developing the classic elegance of the Supermarine Spitfire. In the case of the Supermarine Spitfire the elegance had two outcomes, the design, especially the visually pleasing elliptical wing plan form contributed significantly to the aircraft's combat agility, and at the same time elevated the difficult to maintain, Supermarine Spitfire to status of an icon representing British defiance in the face of adversity, and by extension Britishness in the British social consciousness.

Figure 4.32: A British 1930s streamlined express steam locomotive

Source: Bing images

Everywhere there were publications extolling the virtue of travel, labour saving appliances for the home; and a few affluent people purchased the new invention- the television set.

4.27.2 Espoused values

Whatever the social innovations, British society remained conservative in its outlook and *mores,* immense value was set by marriage between a man and a woman and was expected to last for life; a woman was expected to resign her job on getting married and become the home maker. Thrift, probity, and homeownership rose as people responded to the marketing of a stable orientated, home-owning 'nine to five jobs for life,' society**.** The London based Metropolitan Railway company heavily promoted its' property development portfolio along its route out of London into the Chiltern Hills, extolling the virtues of Metroland embracing relaxed country living (see figure 4.33 below).

Figure 4.33: A Metropolitan Railway poster advertising country life

Source: Bing images

British history is replete with myths, King Alfred burning the cakes whilst he was masquerading as a commoner, King Arthur, and his knights of the round table, reflecting chivalrous conduct against wrong doers and injustice (the round table purporting to be

King Arthur's hangs in Winchester). Richard *Couer de Lion* (Richard the Lionheart) representing the just and brave Monarch. All these, and stories of Admiral Nelson with his victory over the combined navies of France and Spain at the battle of Trafalgar, and the Duke of Wellington likewise over the French at the Battle of Waterloo. These all project the image of a land steeped in tradition, history and military might with a worldwide reach. This image is encapsulated in the patriotic hymn composition '*I vow to thee my country'* composed by Cecil Spring Rice between 1908 and 1912 and set to music by Gustav Holst as Jupiter in his Planet suite (see figure 4.34 below).

Figure 4.34: Soundtrack of I Vow to Thee My Country

Source: YouTube (n.d. (a))

The espoused values were exclusively those championed by the upper ruling class, the Monarchy, the land-owning aristocracy, the politicians of the day, and the upper echelons of all three branches of the armed services, the legal establishment, the judiciary, and the established Anglican Church. That body of opinion formers was underpinned by the throughput of the English public school system which fed into all facets of the ruling classes. British society was still largely deferential to those considered 'their betters' and there was universal admiration for the Monarchy with its' values of continuity, stability, and order.

4.27.3 Basic assumptions

Throughout, and in the background was the British constitution, a nebulous concept, not enshrined in any one document but accumulated through various sources and practices over the centuries, with the expectation that everyone would receive equal and just treatment before the law without preferment or privilege. The cartoonist and illustrator 'Pont' (1938) summed up the notion of the British character and two of his cartoons have been used in this thesis to demonstrate the essence of the British character (see figures 2.13 and 4.23 above).

The notion of Britishness could vary depending on who was being asked at the time and their social *milieu*. Take Northern Ireland for example, to understand the social dichotomy of Northern Ireland that existed at that time, it is first important to have a brief *'tour de horizon'* of the geo-politics of that part of Britain The prolonged campaign for Irish Home Rule and independence from the rule of Westminster culminated in the partition of Ireland in 1921-1922 with the six counties of what became the new country of Northern Ireland (aka the new province of Ulster) staying with Britain and having a Parliament at Stormont in Belfast. The remaining twenty-six counties became the Irish Free State independent of Westminster with a Parliament (Dail) established in Dublin, the capital city of the new Free State. Historically Ireland consisted of four provinces, Ulster, Leinster, Munster, and Connaught. Historical geo-political Ulster comprised nine counties with a Roman Catholic majority. The new Ulster comprised of six counties with the new international border gerrymandered to ensure that the voting and administrative majority lay with the Protestants, thus the Roman Catholic population became disenfranchised second-class citizens in what they regarded as their own country; and institutional discrimination against Roman Catholics quickly followed. This anti-Roman Catholic sentiment was perfectly articulated in an infamous 1933 speech by Basil Brooke the Unionist politician and extensive landowner around the County Fermanagh town of Brookeborough. That 'he wouldn't have a Catholic about his own place,' an articulation of the Establishment view widely held by senior Ulster Unionists including the then Ulster Prime Minister James Craig. Brooke further qualified his assertion by claiming that Roman Catholics were 'endeavouring to get in everywhere

and were out with all their force and might to destroy the power and constitution of Ulster'.(The Irish News Newspaper 3rd September 2018). He went further by appealing to loyalists, that, 'wherever possible to employ good Protestant lads and lasses' (in Ulster vernacular lasses=women, often young women) (author). Brookeborough's stance and rhetoric was supported by the then Prime Minister of Northern Ireland James Craig who questioned on the matter replied,-----'that those appointed by us possess the most unimpeachable loyalty to the King and Constitution. That is my whole object in carrying on a Protestant Government for a Protestant people.' Given this vehement level of hyperbolic rhetoric it is unsurprising then that Roman Catholics felt threatened and disadvantaged.

If a Northern Ireland (Ulster) Protestant were to be asked at the outbreak of the Second World War of their notion of Britishness they would unfailingly say that it was allegiance and loyalty to the Monarchy and to Union with the rest of Great Britain – the 'Loyalist' concept, dating back to the Irish Battle of the Boyne in July 1690, when the Protestant King of England, William of Orange defeated the insurgent Roman Catholic forces led by the ex-King James II of England who sought to re-establish his Roman Catholic Monarchy. If a Northern Ireland (Ulster) Roman Catholic were also asked the same question about the notion of Britishness in 1940, the answer would be different. They would have had minimal, if any, loyalty to the Monarchy, they would have looked to what they regarded as their kinfolk and co-religionists in the Irish Free State for their culture and society, and to the Dail (the Free State Parliament) in Dublin for their constitutional ethos, and to His Holiness the Pope in Rome for spiritual guidance, and not to the British Monarch as Defender of the Faith. The Welsh and Scottish both forming a more homogenous population would not give such a polarised opinion if asked the same question then. This disconnect was exacerbated by the fact that under the terms of the Act of Settlement of 1701 (Parliament, 1701), no Roman Catholic could ascend to the British throne, (which still applies today).This provision was then incorporated into two subsequent Acts of Parliament, the Act of Union of 1707(Parliament, 1707)which created the Kingdom of Great Britain, and the Act of Union of 1801 (Parliament, 1801) which incorporated the whole of the island of Ireland into

Great Britain. The resulting discriminatory society led to the situation whereby Northern Ireland Roman Catholics joined the RAF not out of loyalty to the British Monarchy and establishment but may have joined out of wishing to escape a repressive discriminatory society, with its attendant deprivation, insecurity, lack of prospects, and the ever-present threat of sectarian violence. Joining the RAF held out the prospect of regular pay and conditions, some self- esteem, and pride in their professional trade, where at least they might receive a modicum of equality, even anonymity. However, for the substantial majority of Britons, the basic assumption underlying Britishness was that Britain for all its' social imperfections (and there were many according to Neil in conversation with the author), had a long and illustrious history. That history along with stable enduring institutions such as the Monarchy, shown here in the form of the war time monarch King George VI (6th) (See figure 4.35 below); were worth defending. Even allowing for cinematic licence Churchill's speech to the House of Commons contained in the film clip (See figure 4.36 below) amply demonstrates the point.

Figure 4.35: A Second World War photograph of the British Monarch King George VI wearing the uniform of the Royal Navy.

Source: Bing Images

The conclusion that can be drawn is that the glue that bound the pilot-fitter-rigger team together was the shared social cohesive experience (whatever its disadvantages or advantages), tangible as in the case of visible artifacts, in the form of imposing civic buildings or intangible such as the identity of the British self. The alternative was to succumb to what was then generally regarded as an odious fascist dictatorship bent on destroying democracy, (and what could be described in legal terms) as the 'quiet enjoyment' of British democracy, and by extension the British Empire world influence. So, the notion of Britishness whilst not entirely homogenous, was garnered from every corner of Britain and coalesced around defending the *status quo* of British society. The notion that the war time Prime Minister Winston Churchill referred to in his speech to the House of Commons on the 28th May 1940, in which he employed to great effect his five principle elements of rhetorical speech contained in his 1897 essay '*The Scaffolding of Rhetoric*' (Churchill, 1897) In that speech he expounded his notion of Britishness, effectively a call to arms; he built on the notion by saying at point 2.45 in the clip 'we will defend our island whatever the cost may be, 'and finally in his peroration upping the *ante* by saying at point 3.03 in the clip 'we shall never surrender'. This illustrates his defence of the notion of Britishness. The phrase may also have resonated with Ulster Protestants whose watchword against the perceived Roman Catholic constitutional and societal threat was (and still is) 'no surrender.'

Figure 4.36: Film clip from The Darkest Hour.
Source: YouTube Universal Pictures (2018)

4.28 The peculiar and particular influence of the desert environment.

The malign influence of the desert environment on the operations of the RAF and the Desert Air Force in particular, have been referred to at length in this thesis above; and it is felt unnecessary to repeat those influences here, suffice to say that they were demanding on men, machines and *materiel,* and many aspects of operations needed especial care and attention. Particularly the logistics needed to supply the Desert Air Force over large distances which could (and did) fluctuate constantly according to the vicissitudes of the Western Desert campaign. (See Map 4.1 above). This was especially vital with regard to the supply of water and other liquids such as fuel and lubricants, which makes all the more incomprehensible, the complete inadequacy of the British 'flimsy' liquid (in most cases petrol) container. With its' previous experience of inter-war British Imperial policing in the Middle and East Asia, particularly the Middle East, the RAF became particularly adept at operating in an agile, mobile capacity in the harsh environment. The RAF adapted to the desert conditions whereas, the *Luftwaffe* did not come to terms with the desert conditions, and the *Regia Aeronautica* also tried to master the desert conditions and failed.

4.29 Summary of Discussion

4.29.1 Key messages

Chapter 4'Discussion' opened with a preamble on how Adair's Action Centred leadership theory be used as the theoretical framework for this thesis. This was augmented by illustrating an expanded theoretical framework identifying the three major themes and subthemes that were drawn from the historiography. The expansion discussed the three component factors of the theory, the task, the group / team, and the individual. There then followed a description and discussion on the process of coding the primary (colour coded red) and secondary sources (colour coded green) onto a series of matrices along with a quantification of the sources. This enabled the reader to gain an appreciation of the scale and nature of the data gathered and coded. From the coded data six examples were drawn at random to help expand the discussion and to demonstrate the interrelationship of the major themes and sub themes. In the process of discussing the

coded matrices, data was drawn out indicating that some aspects of the operations of the Desert Air Force were not entirely satisfactory and in particular the revelation that there was the possibility that some Desert Air Force squadrons were over-claiming on the number of *sorties* flown in a period. This and the contents of the Russell Report discussed above raise concerns in the author's mind over the veracity of some of the somewhat 'Panglossian' received history of the Western Desert campaign. The organisational development component of the discussion examined the social dimension of recruitment into the RAF and also discussed in some detail the various organisational development theories used to construct the discussion. There followed a discussion on the concept of leadership and in particular Tedder's style of leadership and its' downward effect on the pilot-fitter-rigger team. To give context to the discussion, the author constructed three cameo biographies of each member of the team using information drawn from his interviews with RAF veterans, blended with information drawn from primary and secondary sources. The three-man team was then subject to scrutiny using work on the Leader Member Exchange (LMX) theory developed by Clegg, Kornberger, and Pitsis. The eight organisational development theories used in the compilation of the thesis were discussed and summarised and it was found that out of the eight theories discussed, six theories wholly applied, one theory in the form of an algebraic formula should be used with caution in its application to people and one theory on leadership was found to conditionally apply depending on the absolute distinction between a leader and a manager.

In testing the *Null* hypothesis, the discussion using and adapting Schein's Venn diagram on cultural identity focussed on the notion of Britishness and its roots in the four different societies found at that time in Britain. It would seem that the notion of Britishness is a nebulous concept in the minds of the four societies founded on their life and societal experiences conditioned by the observable artefacts they could see around them, the espoused values articulated by their societies and the basic assumptions that underpinned those espoused values. The peculiar and particular environmental conditions in the Western Desert were familiar to the RAF with its' nearly twenty years' experience of Imperial policing in the Middle East and Far East, and although the RAF

was initially hampered by the obsolescence of many of its aircraft, the organisation quickly relearnt the lessons of coping in such an environment and adapted quickly, something their adversaries failed to accomplish.

This chapter drew on the analysis of primary and secondary data to achieve the objectives of this research. Primary and secondary source material were incorporated into two coded matrices, each matrix was accorded the three major themes identified in the literature review, and the citations were accorded across the various sub-themes (giving the data set). This enabled six representative examples which it was felt best illustrated the theoretical framework and the activities of the ground crew team under scrutiny drawn from the data set. These examples were then discussed in detail across the three major themes and sub-themes using the military history gleaned from the literature review and set against various organisational development theories, also from the literature review and selected as being most appropriate for use in this thesis. Some organisational development theories were selected as they are in contemporary use, for example Adair's Action centred Leadership (as evidenced by the University of Plymouth's visual tutorial), and Belbin's team characteristics which are currently used as part of Non-Commissioned officers (N.C.O.s) selection exams at the Royal Air Force's Battle of Britain Memorial Flight. Other theories the author felt that reflected a 'holistic' approach to organisational development such as Goleman's work on Emotional Intelligence. Various works on Multiple Intelligences are also discussed as dealing with significant aspects of ground crews' activities. Having fully discussed the research question and associated hypotheses across all the major themes and sub-themes; each major theme is summarised to enable the reader to gain an overview of what has been discussed and sets the scene for conclusions to be drawn in chapter 5.

The chapter then turned its' attention to considering the lessons learned from history and whether those lessons learned in the Western Desert by way of operational doctrine were reflected in the current British Defence Doctrine 5th Ed, and it was found that there was a continuum of learning, and that the British Defence Doctrine 5th Ed did include those lessons learned in the Western Desert. In addition, the *null* hypothesis regarding the concept of Britishness and the desert environment and their non-contribution to

ground crew activities was tested, and on the basis of the evidence found in the data, the *null* hypothesis fell. The concept of Britishness founded out of the Age of Enlightenment lead to the collective endeavour through the medium of sport and officer leadership. The character building through that collective endeavour at English public schools was found to be a profound influence in the practice of leadership throughout the Royal Air Force at commissioned officer level and the knock-on effects on the activities of the pilot-fitter-rigger team and their respective roles. Taken together these conclusions garnered from the primary and secondary sources form the context in arriving at definitive conclusions in the next and last chapter, chapter 5.

CHAPTER 5 CONCLUSIONS

5.1 A retrospective on the thesis

In the introduction to this thesis, the author set out what the objectives for this research were. The aim was to seek out the further evidence on events in the Western Desert campaign, whilst addressing the apparent *lacuna* in the history and development of the Royal Air Force with respect to ground crew and the concurrent *lacuna* in the organisational development of the Royal Air Force. What this thesis is not about, is a 'what if 'counterfactual history, or a revisionist reprise of the Second World War. The author is mindful that 'History is written by the victors' and that 'it is not the truth that matters but victory.' So, it would seem from the two statements that in victory the truth can be distorted, obscured, or lost. (Zaidi 2011). The thesis focussed on answering the research question posed in chapter one, *viz* '*How did the pilot-fitter-rigger team in the Desert Air Force during the Second World War form a small, resilient and effective team*'? Also tested, was the *null* hypothesis contained in chapter one, that '*Neither Britishness nor the peculiar desert environment played a significant role in creating the pilot-fitter-rigger small team into an effective and resilient entity.'* Taken together, the findings make an original contribution to academic knowledge, building on previous work both published and archival. Testing previously accepted organisational development theories and conducting empirical work not done before on a neglected area of military history and organisational development. In composing this thesis, the author endeavoured to demonstrate a balance of sound academic argumentation and the application of Occam's razor, using plain language and short uncomplicated words so as to be accessible to all those of whatever background, ability, or education who wish to acquire knowledge for their benefit; and to avoid as Thompson (1963) put it, 'the enormous condescension of posterity'.

The thesis then goes onto lay out the key messages conveyed in answering the research question and the testing of the *null* hypothesis and draws conclusions on the three major themes identified in the literature review. This last chapter, chapter 5 goes on to formulate future research paths (possibly for others) as well as perspectives discovered

by the author in his research and preparation of this thesis. Perspectives that whilst worthy of research, lie outside the direct *locus* of this thesis.

5.2 Answering the research question

5.2.1 Key messages

The literature review concluded that there are two separate *lacunae(e).* The first is in the history of the development and organisation of the Royal Air Force. The second lies in the fact that there is no comparable discussion of Fighter Command ground crew, particularly the pilot-fitter-rigger interpersonal team dynamic under combat conditions. From discussion around the research data, it can be concluded that the pilot-fitter-rigger team did (thesis author's emphasis added), form a small, effective, and resilient entity. Small in that the team consisted of three men which correlates with Adair's stated position that the size of the team is dependent on the nature of the task and other circumstances. Resilient in that they operated successfully in a challenging adverse desert environment in conditions of great hardship and often in mortal danger, whilst retaining the capacity to withstand, overcome, and bounce back from challenges doing so in a manner that enabled sustained performance and viability. Effective in that they achieved their aims in the most efficient way, sustaining performance levels, and taking on more challenging tasks when required.

QED

5.3 Testing the *Null* Hypothesis

5.3.1 Key messages

The *null* hypothesis has been tested through the literature review, and found from data and discussion, that there is a lack of evidence to support the *null* in that '*Neither Britishness nor the peculiar and particular desert environment played a significant role in creating the pilot- fitter- rigger small team into a resilient and effective entity.'* Also discussed was the notion of Britishness and its' development within British society. The conclusion was reached that Britishness played a fundamental role in the development

of the RAF with its emphasis on team effort and cohesion, (Thesis author's emphasis added). This cohesion was a result partly through the particular conditions brought about by British societal developments post the Age of Enlightenment; and also, through the Royal Air Force's familiarity with desert operating conditions learned through its' previous inter war years as Imperial policeman to the British Empire.

Q E D

5.4 Implications for existing academic knowledge

The fact that the two separate but interrelated *lacunae* have been identified as existing, highlights the fact that the historiography and academic knowledge is partial, incomplete, and skewed towards the endeavours and actions of air crew (however worthy and meritorious) to the detriment of ground crew. This thesis sets out to address those *lacunae.*

5.5 Conclusions on the correlation of theories overarching the three themes

5.5.1Key messages

It can be concluded from the discussion of the eight organisational development theories used in the compilation of this thesis, six of the theories utilised have a close degree of correlation; Adair's work on Action Centred Leadership and Belbin's work on team characteristics correlate closely as Belbin's team characteristics impact directly on all three elements of Adair's Venn diagram, the ability to complete the task in hand whilst conditioning the collective and personal attributes of the team members. The work of Thorndike, Vernon, and Gardner on multiple intelligences applied to both the fitter and rigger in their ability to 'read' each other in particular, are fundamental to the teams' resilience and personal survival in extremely challenging circumstances. This empathy highlights the close relationship between Adair's work on action centred leadership and Belbin's work on team characteristics, in that for a team to be fully effective the team members have to possess the right personal characteristics. Likewise, Goleman's work on Emotional Intelligence equally applies as the team members needed

a high degree of interpersonal empathy and ability to 'read' each other just in order to survive both the desert environment and combat conditions. So, on the data presented, multiple intelligences and emotional intelligence have a close correlation as evidenced by a maintenance unit team of fitters and riggers in the development of the high altitude Supermarine Spitfire.

Hersey and Blanchard's work on situational leadership also plays a significant part in the teams' existence for as the team faced rapidly changing circumstances, different people would come to the fore as leaders in the moment and then reassume their assigned role when the moment had passed. The three elements of Homan's theory on group formation are identifiable as applying to the team, and the conditions under which they operated, particularly the environmental element relating to the particular and peculiar desert conditions. One theory that of Bennis on leadership, applies in part and is conditional on the absolute distinction between a leader and a manager.

Graicunas algebraic formula on the span of control is useful as a guide to thinking, but caution should be exercised in the rigid application of the quantitative formula as dealing with numbers of people especially in a combat situation is a sensitive qualitative issue, and although this has some correlation with all the other theories, as a quantitative approach it lies to one side.

QED

It can be concluded that all the theories with the possible heavily conditional inclusion of the works of Graicunas on the span of control and Bennis on leadership, have close interrelations, and taken together give a holistic picture of how organisational development theories pertained in the Western Desert campaign. (See management theory grid at table 3.4 above). These close interrelations would suggest that as the theories apply to more than one place, situation or person, organisational development theories developed in peacetime apply equally in a war time combat situation, and in that respect (and in that context only) they represent the transferability of human interpersonal dynamics and behaviour.

QED

On the basis of the evidence of the matrix, it would seem that there is a case to be advanced that in the context of the pilot–fitter–rigger team working as part of the Desert Air Force in the Western Desert campaign, some of the separate organisational development theories used in this thesis can be considered as constituting a holistic theoretical entity. This is evidenced through the close correlations between Adair's and Belbin's work referred to above and the evidential data demonstrating that the many facets of intelligence identified in Thorndike, Gardner *et al* can be subsumed under what Goleman describes as Emotional Intelligence.

QED

It can be concluded from inspection of the academic works reviewed, that (with the exception of Cubbon (1969) on the Hawthorne Effect) the works lack context with regard to background detail on gender, age, ethnicity, societal background, and discussion as to whether the findings are transferable across those societal aspects, or across time. For those reasons, some sections of the organisational development community in contemporary society may find them inadmissible and preclude their use in some sectors. It can be concluded that this thesis through the data reviewed, and discussion makes a significant contribution to academic knowledge by identifying two separate but interrelated *lacunae* in the history and development of the Royal Air Force, and the associated organisational development of the Royal Air Force with regard to effective teamwork. The identification of those two *lacunae* is fundamental to the understanding of how the Royal Air Force developed as a learning organisation.

QED

It can be concluded that on *primae facie* reading of data gathered from the (albeit small) sample of ten interviewees, it would seem that there is sufficient evidence for a perception in interviewee's minds that the primary, and most desirable characteristic attributable to both fitter and rigger is that of team worker team first and foremost, followed by characteristics of co-ordinator and completer finisher, and lastly by the

more specialist ability to shape outcomes. These perceptions broadly accord to the descriptions of fitter and rigger work contained in the various film clips, official documents, Kings Regulations, and other research works cited (Thesis author's emphasis added).

QED

From the dataset, it is evident that academic knowledge on the subject of Royal Air Force ground crew is deficient by the almost total absence of data, (0.2 percent of the data contained in the literature review). This finding confirms the authors' perception that the historiography does not identify this fundamental dynamic to any meaningful extent, and certainly not to the extent that it ought to. This *lacuna* is significant both in the history and development of the Royal Air Force, and in the context of organisational development theories and discussion on the subject of effective team- work. It can be concluded that although it would be impracticable to expect that all findings could transfer across to other settings as some would be peculiar to that particular time, it is reasonable to expect that some could, and that the lessons learned transfer across time and campaigns. For example, could the aspects of the Western Desert context apply equally well to examples such as the Suez Crisis 1956, the Aden Emergency 1963-1967, the Gulf War 1990-1999, and the various recent Afghan Wars up to the 4th Afghan War 2001-2021? All are desert combat situations albeit more modern but with similar characteristics. Such learning experiences from the Western Desert campaign and other desert campaigns could form a nucleus of retained knowledge that might inform any future campaign undertaken by the British armed forces in similar operational and environmental circumstances.

QED

Within the historiography of the Second World War of which the Western Desert campaign is a strategic and tactical component, there are broadly six sources with three emergent major themes contained within three genre(s)of published work. They are restated as; Military History-the Evolution of the Royal Air Force. The Environment– the Western Desert. Organisational Studies-the organisational culture of the Royal Air Force.

Organisational Studies-the organisational culture of the Royal Air Force; and their associated sub- themes were discussed and examined in the literature review contained in chapter two. Topics discussed included the genesis of the RAF and its' interwar development and role as Imperial policeman. Leadership, team dynamics through the works of Adair and Belbin, multiple intelligence(s), and team cohesion. Particularly note-worthy to the author in compiling this thesis, is that the organisational development international consultant Bungay states that in his experience, 'what has not been made simple, cannot be made clear, and what is not clear will not get done' (Bungay, 2011). (Thesis author's emphasis added). There then followed an examination of contingency theories, situational leadership action centred leadership, and Bennis's perceived differences between what constitutes a leader, and that of manager.

Out of the 521 works of all types consulted in the preparation of this thesis, remarkably only one work representing 0.2 percent of the total number of works dealt specifically with the subject of ground crew. Chapter 4 then considered the theoretical framework of the thesis which would inform the research and Adair's Action Centred Leadership Venn diagram was illustrated in figure 2.1. above, this was supplemented by illustrating the three major themes gleaned from the literature review shown also as a Venn diagram shown at figure 2.2. above. It was also noted that within the three major themes there were a number of sub- themes. Figure 2.3 above, illustrating the factors affecting the pilot-fitter-rigger team identified through the major themes and sub themes.

5.6 Military History- the evolution of the Royal Air Force

Post First World War the RAF had the responsibility of policing by air, large distant often remote tracts of the British Empire which at that time was at its zenith (an example being Palestine, later modern Israel).Throughout the 1920s spending restrictions, successive government policies encapsulated in the Ten Year Rule, along with widespread British pacifist public sentiments obliged the RAF to operate in a cost effective(almost parsimonious)manner with the minimum of resources in locations far from the United Kingdom making supply and resource logistics difficult and protracted. The fact that the

majority of the operational theatres were inhospitable, proved to be invaluable in terms of learned behaviour when confronting the *Luftwaffe* and the *Regia Aeronautica* nearly a decade later in the Western Desert. The RAF also had to contend with starting from a very low base of suitable modern aircraft to face the *Luftwaffe* and less so with the *Regia Aeronautica,* and by dint of endeavour managed to assimilate numbers of modern aircraft and newly trained personnel and use them effectively. It can be concluded from examination of the data, that the Royal Air Force as a learning organisation successfully managed the transition from First World War aviation technology to high speed technologically advanced aircraft designs; whilst at the same time expanding from a peace-keeping setting into a combat ready setting, developing highly trained, technically orientated disciplined personnel, capable of operating in challenging war time operational environments.

QED

5.7 Environment- the Western Desert

From previous experience of the inter war years of Imperial policing, the Desert Air Force developed a capability to survive and operate in extreme circumstances breeding a resilience that allowed it to operate effectively in challenging circumstances. It can be concluded from examination of the data that the Desert Air Force operating as it did, in an extreme desert environment, became a force that was fully mobile, flexible in its response to tactical demands, robust, independent and institutionally largely self – sufficient, innovative and often capable of improvisation in reduced circumstances at the end of a long hazardous, protracted, logistical supply chain.

QED

5.8 Organisational Studies- the organisational culture of the Royal Air Force.

It can be concluded from examination of the data that the historiography concentrates on the strategic, tactical, and operational aspects of the Second World War. This is to the detriment of the organisational development human aspect. In the whole of the

literature review and other bibliographical sources only 0.2 percent of the works consulted dealt with the ground crew aspect in any depth. Not only that, but the literature also written by the victors is very much 'Panglossian' in its treatment of the Second World War and the Western Desert campaign.

QED

5.9 Future research paths, and perspectives discovered

The way forward is bound up with whether or not the author is successful at his *Viva Voce* anticipated to take place in February2022. Should success ensue then the question arises of how to deal with the perspectives discovered during thesis research and how that would condition future research paths. The author is a retired civil servant whose last post was as a Railways Policy Advisor to the Secretary of State for Transport, at Westminster, and was also previously a principal local government officer, and is past statutory retirement age. This thesis has been written with two matters in mind, firstly the thesis is dedicated to the author's late father who encouraged him in all things and placed great store in personal education-his own education having been cut short by the Second World War. Post war austerity Britain was not an easy society for a working-class artisan man in his newly demobbed position to gain access to further or higher education. This thesis is a moral debt- a debt repaid. Secondly being retired the author does not have a career path, and this thesis is a retirement undertaking and to some extent is a leisure pastime in his later years. Therefore, given his personal circumstances it is hard at the present for the author to envisage a way forward and associated future research paths.

The following are perspectives discovered by the author during his thesis research that fall outside the immediate purview of this thesis and are peripheral to it. They may prove worthy of research by others and could form the basis of either peer reviewed paper(s), a master's Dissertation, or a PhD thesis. The author has included explanatory notes where they may be useful. Specialist subjects such as medical or psychiatric topics lie outside of the author's competence.

5.10 Explanatory notes

All the indicators and evidence from the previous chapters leads to the conclusion that although the British Defence Doctrine 5thEd is from the present time (Chiefs of Staff, 2014), the doctrine contains lessons learnt from the activities of the Desert Air Force in the Western Desert campaign. The concept of strategy being a joint enterprise is borne out by Tedder's (Orange,2014; Orange,1992, pp.34-35,37-39,43; Orange,2013) influence in developing close personal and operating relationships with the British Army and to a lesser extent the Royal Navy. It transcended the single service interests of all three services. It satisfied the criteria of sustainability in that the Desert Air Force proved itself adept at surviving and operating in the peculiar and particular Western Desert environment, becoming a credible and effective mobile, agile fighting power. It was underpinned by extraordinarily robust decentralised and dispersed maintenance and repair logistical network that enabled the Desert Air Force to operate effectively over large areas at short notice, responding to the fluid ever changing tactical situation. In parallel with the logistical arrangements, the communications and information management systems were radically revised. The systematic and systemic revisions ensured additional and replacement aircraft, spares and *materiel* were available in the right place at the right time to ensure that combat operations were undertaken. The author speculates that what part, past events, and British involvement in actions such as the Suez Crisis 1956, the Aden Emergency 1963-1967, the Gulf War 1990-1999, the various recent Afghan wars up to the 4th Afghan war 2001- 2012, has had on modern military thought and strategy, tactics, and doctrine.

Amongst the bundle of papers contained in Air File 23/1048 lodged at the National Archives Kew, is a report entitled the Russell Report, Item 1A in which the report's author, Air Commodore Russell describes the structural, operational and logistical shortcomings of the RAF post the retreat of the British Armed Forces from Gazala in what he coyly refers to as '*Notes on Administrative and Organisational difficulties affecting the RAF in the Western Desert and Cyrenaica during the period of mobile warfare November 1941-February 1942.'* It amounts to an internal consultants' report on the condition of the RAF in the Western Desert and makes tactful suggestions to the

Air Officer Commanding in Chief (AOCinC) Middle East, Tedder, and the senior management team as to remedies to improve structural, operational, and logistical performance in the future. In the same bundle, item 68A is a memorandum from a Group Captain Jackman in which he draws attention to para 26 iii in the Russell Report and he raises the question of over-claiming of aerial combat claims by RAF pilots and the parallel overstating of the daily number operational *sorties* by RAF squadrons. This aspect of over-claiming is nothing new in combat situations, but the apparent overstating of operational *sorties* by 60 percent is more disturbing as it could cast doubt over the operational integrity of the Desert Air Force and runs counter to the received history. Nowhere in the historiography of the Western Desert campaign did the author find any reference to the report, and from the file bundle it would seem that the report was dealt with by Tedder and his team at a local Middle East Command level. The marginalia notes show that some items were agreed some not agreed and the report as a whole would appear to have been accepted for action. Neither does there seem to be any reference to the matter being referred up the chain of command to Alan Brooke Chief of the Imperial General Staff (CIGS) or Portal the Chief of the Air Staff (CAS) both in London, and to Churchill for his attention. Given the fact that the report does not reflect well either on the RAF and the British Army, it is understandable that Tedder/Auchinleck would wish to remedy the matter at a local level without the attentions of the people mentioned above. The point of raising this perspective is that, was it kept quiet for (P) political reasons given all the unwelcome news emanating from the Western Desert and the British prosecution of the Second World War in general at that time, and why has it never been represented in the historiography of the Western Desert?

The author has discussed with his primary supervisor, the 'what if' perspective of the likelihood of a drive by the German *Wehrmacht* as part of the Eastern Front campaign, down through the Caucasus capturing the oilfields situated there, and on into the Middle East and capturing the Middle East oilfields which would have been catastrophic for the British. Here, another file Air File 23/1402 refers to the perceived threat of a German drive in that region and also through the Balkans threatening both Cyprus and

Palestine, and the Allied supply route through the Middle East to southern Russia. This perspective also raises the prospect articulated in Adolf Hitler's Plan Orient of June 1941 of a large pincer movement on India through the Middle East by the Germans and the threat of a Japanese invasion of India via Burma. It might prove possible to research this perspective further to determine how credible the threat was, and to the outcomes.

It is a matter of recorded fact that the British issue fuel can was not fit for purpose being referred to as flimsies (Bungay 2002 p71). Matters got to such a nadir, that wherever possible, captured German fuel cans were used by the British being much prized as having a bigger capacity and a far more robust construction and ease of use. They were referred to as 'Jerry cans' a phrase still in use today and is used as the accepted description. Tuker, the Commanding Officer of the 4th Indian Division in his work *Approach to Battle* Cassell 1963 p 17, calculated that approximately 50 per cent of British fuel supply was lost in transit due to broken or leaking tins. This assertion seems worth testing because if it is found to be true then that is astounding and constitutes a national wartime scandal. Tuker is also cited in the same vein in Terraine (1985).

With regard to Field Marshal Rommel, it is well known that he was an aggressive initiative-taking commander with a cavalier regard for logistics. His precipitous advances in the Western Desert seem on first inspection to conform to the spirit of the German doctrine of *Auftragstaktik.* But on closer inspection it would seem that by disregarding feedback and kept his superiors ignorant as to what he was doing, he undermined the integrity of the doctrine which relied on feedback to create a closed loop system, in effect *Auftragstaktik* became an open loop system and along with Rommel ultimately became out of control Clark (2017) for a discussion on Rommel's application of *Auftragstaktik*. See also Bracknell Symposium paper *No3 the End of the Beginning* p 36. Therefore, on the evidence thus far, the author would contend that far from being hailed as a German hero (The author recognises the German propaganda and domestic politics of the situation) Rommel should have been court martialled for losing the North Africa theatre of operations for the Germans and Italians.

Lynch, T, Elliott, and Thompson (2010) p 191 cite that combat stress produced up to 30 percent psychiatric casualties in the Desert Air force. Here again, this runs counter to the received wisdom that all was well within the Desert Air force and the propaganda line in general. The 30 percent assertion needs testing. From pictures, film footage and the narrative it is demonstrable that ground crew worked long hours in the relentless desert sun in temperatures hovering around 40C. Pictures often show ground crew wearing only shorts rolled down socks and boots, sometimes wearing a hat. Given what is now known regarding the health hazards of working for prolonged periods without skin protection in intense sun, it might prove fruitful to medically research the basis for a dissertation or thesis by others, the incidence of skin cancers and other related health issues amongst Desert Air Force ground crew post Second World War. This research could prove useful in identifying and managing the personal physical risks to armed forces individuals working in extended circumstances in direct sunlight and temperatures.

5.11 Concluding thoughts

On the first two cover pages of this thesis the author referred to the term Gordian knot as a metaphor in which the knot was regarded as impenetrable and incapable of being undone and has no obvious or easy solution. The author felt this to be particularly apt when considering interpersonal dynamics. It would be a bold and pretentious claim, almost hubristic by the author to have made a clean cut through the knot in this thesis, it is more a partial modest, unravelling or loosening of the knot in that most difficult and sensitive of subjects, interpersonal dynamics, and relationships.

At the end of one of the author's four primary source interviews with the ex- Fighter Command pilot Neil, the author asked Neil whether in his opinion given the perceived inequalities in contemporary British society, was the British victory outcome of the Second World War including the Western Desert campaign 'worth it'? He unhesitatingly emphatically replied 'yes it was worth it. Britain is a much better place now than it was pre-war, and things could not have continued as they were.' There were gross social inequalities, and throughout the 1930s enduring systemic structural mass

unemployment, in substantial parts of the country;(Gardiner, 2010, pp. 35-216, esp. p. 69). This mirrors Moorehead (1944) on just what it was, the British including the Desert Air Force and others were fighting for. In the first instance, the overthrow of an odious Fascist regime bent on German *Weltmacht,* and out of that endeavour and sacrifice, the parallel emergence of a fairer, more just, and equal British society. The British social upheaval caused by the Second World War proved to be a catalyst for fundamental social change and reform in post war Britain. The Beveridge Report published in 1942 (Barnett,1995;1986) paved the way for the establishment in 1947 of the National Health Service (NHS) providing for the first time, universal health care for all regardless of means, background, or ability. It is an interesting insight that the Labour Party politician Aneurin (Nye)Bevan, the architect of the National Health Service (NHS) used as his template, the social welfare provisions made by the private railway company the Great Western Railway (GWR) at its principal works and headquarters at Swindon, in the County of Wiltshire, England. In the field of education, the 1944 Education Act brought in by Churchill's Minister for Education, R.A. Butler, heralded a greatly needed and long overdue radical reform of the British education system and provision. Nationalisation (or de-privatisation, to use the modern term) in 1947 of much of the British service sector and industry including the railways, the coal mines, and the steel industry brought a feeling that at last the ordinary person in the street had a stake and a say in how Britain's resources were managed and used, and in how the country was governed. The 1945 post war Attlee government's 'New Jerusalem' (Barnett,1995;1986) had a difficult birth, hardly had the Second World War finished when it was followed by the bitterly cold, protracted winter of 1946-1947 when snow lasted on the ground until March 1947, bringing food and coal shortages across the country. War time rationing still in force at that time, was tightened, and the fragile post war economy made many people wonder in the face of continued hardship just what sort of 'victory' had been achieved (Zaidi2011). Rationing persisted throughout the late 1940s and early 1950s not disappearing altogether until 1953, eight years after war's end. The author clearly remembers as a small child going with his parents to a large department store in central London so his father could buy a bicycle, a new bicycle, as the post war steel shortage

eased allowing consumer goods to reappear in the shops. That was the true meaning of the term Austerity.

But perhaps the last word lies with the Western Desert. Once the pandemonium of war had passed, the desert reverted to its silent enigmatic self, the shifting sand first covering, uncovering, and then recovering the detritus of war (See figure 5.1 below).

Figure 5.1: Abandoned British truck in the present day (2021) Western Desert

Source: Shutterstock images

Now, only the headstones of the residents of the Western Desert war cemeteries dotted along the Western Desert's *littoral* speak from the past to the historian. Then, there are the as yet undiscovered and unburied dead in the desert interior, who will speak for them? Do (did)they think it was all worth it? It is important to recognise that this thesis is about the infinite adaptability of the human spirit in the most challenging of circumstances. The few veterans that the author interviewed in the preparation of this thesis are now dead and the oral living history is beyond reach and needs to be safeguarded. The veterans the author interviewed were adamant that all they required, was to be remembered. So, it is entirely appropriate to remember them through this thesis through listening to their voices; their memories resurrect the many of those, including ground crew who were lost As the few remaining veterans pass on, historians and researchers will be thrown back on sources that whilst numerous, are deficient

especially regarding the human ‘soft’ element and consequently are one dimensional, and lack the emotion and ‘feel’ of the situation, and in the case of academic work, history is much the poorer for that.

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APPENDIX 1: CODING MATRICES – PRIMARY SOURCES

Military History- The Evolution of the RAF	1 The aftermath of the First World War	2 Imperial Policing	3 Rearmament	4 Technical Development	5 Aircraft and Weapons	6 Training and Infrastructure
Task	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company Duxford.	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company Duxford.	Anon (1941) The ABC of the RAF. A pocket encyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Details of rearmament schemes Speight (1940) pp 26-27, 59.	Anon (1941) The ABC of the RAF. A pocket encyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Details of rearmament schemes Speight (1940) pp 26-27, 59.	Anon (1941) The ABC of the RAF. A pocket encyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Details of rearmament schemes Speight (1940) pp 26-27, 59.	Extract from St George Saunders '*The fight avails'* pp160-168 (1953) links to Kings Regulations Air Publication 1112 4th Ed 10/38 and 10/40 detailing trade tests for fitters and riggers. Details of rearmament schemes Speight (1940) pp 26-27, 59.
Group	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company Duxford	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company.	Anon (1941) The ABC of the RAF. A pocket cyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Details of rearmament schemes Speight (1940) pp 26-27, 59.	Anon (1941) The ABC of the RAF. A pocket cyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Details of rearmament schemes Speight (1940) pp 26-27, 59.	Anon (1941) The ABC of the RAF. A pocket cyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Details of rearmament schemes Speight (1940) pp 26-27, 59.	Articles in Air Training Corps Gazette Vol IV No2 February 1944. Anon (1941) The ABC of the RAF. A pocket cyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Interview with BBMF Warrant Officers on their operations. Kings Regulations Air Publication 1112 4th Ed 10/38

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Task	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company Duxford Guide to surviving in a desert. Air Ministry pamphlet 225	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company. Guide to surviving in a desert. Air Ministry pamphlet 225	Moorehead (1944) p 10. On coming to terms with the desert to make it liveable in. Moorehead (1944) p261 cites a Major General on the 'wastage' of petrol due to inadequate petrol cans and	Moorehead (1944) p 10. On coming to terms with the desert to make it liveable in. Moorehead (1944) p261 cites a Major General on the 'wastage' of petrol due to inadequate petrol cans and	Interview with BBMF Warrant Officers on their operations. Anon (1941) The ABC of the RAF. A pocket cyclopaedia on all aspects of the RAF. Designed to appeal to 'air	

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	Med War Zone RAF or Sand, Fleas, and Olive Groves. Personal papers of Joffrey Barton Flick RCAF. RAF Museum Hendon Archives, REF B3787. Desert War Diary 213 Sqdn. Personal papers of John Walton. RAF Museum Hendon Archives REF X 001-0600. Personal Diary of Leading Aircraftman Ronald Aston 1/1/41- 31/12/41.RAF Museum Hendon Archives REF X003-4638/001. All the way with 72 Sqdn. Personal papers of J. Lancaster. RAF Museum Hendon Archives REF X004-2307.	Med War Zone RAF or Sand, Fleas, and Olive Groves. Personal papers of Joffrey Barton Flick RCAF. RAF Museum Hendon Archives, REF B3787. Desert War Diary 213 Sqdn. Personal papers of John Walton. RAF Museum Hendon Archives REF X 001-0600. Personal Diary of Leading Aircraftman Ronald Aston 1/1/41- 31/12/41.RAF Museum Hendon Archives REF X003-4638/001. All the way with 72 Sqdn. Personal papers of J. Lancaster. RAF Museum Hendon Archives REF X004-2307.	effect on conduct of the campaign. Moorehead (1944) p 262) on the logistics and the law of the desert. Moorehead (1944) pp268-269. Cites six reasons why the British were deficient in the Western Desert campaign. Moorehead (1944) p343. Regards the desert as a superb fighting arena. Moorehead (1944) pp 368 - 369. Pays tribute and spirit of the RAF its operations, mobility, and logistics. Moorehead (1944) pp416-417 on a 'clean cut war' devoid of atrocities. A soldier's war. Playing cricket in a big way. National Archives Kew Air File 23/1402. Bundle of correspondence relating to operational and logistical matters. National Archives Kew Air File 23/1048. Russell Report on 'Administrative and	effect on conduct of the campaign. Moorehead (1944) p 262) on the logistics and the law of the desert. Moorehead (1944) pp268-269. Cites six reasons why the British were deficient in the Western Desert campaign. Moorehead (1944) p343. Regards the desert as a superb fighting arena. Moorehead (1944) pp 368 - 369. Pays tribute and spirit of the RAF its operations, mobility, and logistics. Moorehead (1944) pp416-417 on a 'clean cut war' devoid of atrocities. A soldier's war. Playing cricket in a big way. National Archives Kew Air File 23/1402. Bundle of correspondence relating to operational and logistical matters. National Archives Kew Air File 23/1048. Russell Report on 'Administrative and	minded' members of the public. Articles in Air Training Corps Gazette Vol IV No2 February 1944. Extract from St George Saunders '*The fight avails'* (1953) pp160-168 Tedder (1946) Extract from 'Air Power in War'. Coningham (1946) The development of air power. Moorehead (1944) p 10. On coming to terms with the desert to make it liveable in. Moorehead (1944) p261 cites a Major General on the 'wastage' of petrol due to inadequate petrol cans and effect on conduct of the campaign. Moorehead (1944) p 262) on the logistics and the law of the desert. Moorehead (1944) pp268-269.	

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Military History- The Evolution of the RAF	**1 The aftermath of the First World War**	**2 Imperial Policing**	**3 Rearmament**	**4 Technical Development**	**5 Aircraft and Weapons**	**6 Training and Infrastructure**
Environment- The Western Desert	**1 Environment**	**2 Operations**	**3 Mobility**	**4 Logistics**	**5 Innovation and Improvisation**	
Individual	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company Duxford Med War Zone RAF or Sand, Fleas, and Olive Groves. Personal papers of Joffrey Barton Flick RCAF. RAF Museum Hendon Archives, REF B3787. Desert War Diary 213 Sqdn. Personal papers of John Walton. RAF Museum Hendon Archives REF X 001-0600. Personal Diary of Leading Aircraftman Ronald Aston 1/1/41- 31/12/41.RAF Museum Hendon Archives REF X003-4638/001. All the way with 72 Sqdn. Personal papers of J. Lancaster. RAF Museum Hendon Archives REF X004-2307.	Interview with John 'Smudge 'Smith and Tony Lowe at the Aircraft Restoration Company. Med War Zone RAF or Sand, Fleas, and Olive Groves. Personal papers of Joffrey Barton Flick RCAF. RAF Museum Hendon Archives, REF B3787. Desert War Diary 213 Sqdn. Personal papers of John Walton. RAF Museum Hendon Archives REF X 001-0600. Personal Diary of Leading Aircraftman Ronald Aston 1/1/41- 31/12/41. RAF Museum Hendon Archives REF X003-4638/001. All the way with 72 Sqdn. Personal papers of J. Lancaster. RAF Museum Hendon Archives REF X004-2307.	Moorehead (1944) p 10. On coming to terms with the desert to make it liveable in. Moorehead (1944) p261 cites a Major General on the 'wastage' of petrol due to inadequate petrol cans and effect on conduct of the campaign. Moorehead (1944) p 262) on the logistics and the law of the desert. Moorehead (1944) pp268-269. Cites six reasons why the British were deficient in the Western Desert campaign. Moorehead (1944) p343. Regards the desert as a superb fighting arena. Moorehead (1944) pp 368 - 369. Pays tribute and spirit of the RAF its operations, mobility, and logistics. Moorehead (1944) pp416-417 on a 'clean cut war' devoid of atrocities. A soldier's war. Playing cricket in a big way.	Moorehead (1944) p 10. On coming to terms with the desert to make it liveable in. Moorehead (1944) p261 cites a Major General on the 'wastage' of petrol due to inadequate petrol cans and effect on conduct of the campaign. Moorehead (1944) p 262) on the logistics and the law of the desert. Moorehead (1944) pp268-269. Cites six reasons why the British were deficient in the Western Desert campaign. Moorehead (1944) p343. Regards the desert as a superb fighting arena. Moorehead (1944) pp 368 - 369. Pays tribute and spirit of the RAF its operations, mobility, and logistics. Moorehead (1944) pp416-417 on a 'clean cut war' devoid of atrocities. A soldier's war. Playing cricket in a big way.	Interview with BBMF Warrant Officers on their operations. Anon (1941) The ABC of the RAF. A pocket cyclopaedia on all aspects of the RAF. Designed to appeal to 'air minded' members of the public. Articles in Air Training Corps Gazette Vol IV No2 February 1944. Extract from St George Saunders '*The fight avails'* (1953) pp160-168 Tedder (1946) Extract from 'Air Power in War'. Coningham (1946) 'The development of air power.' Moorehead (1944) p 10. On coming to terms with the desert to make it liveable in. Moorehead (1944) p261 cites a Major General on the 'wastage' of petrol due to inadequate petrol cans and	

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APPENDIX 2: CODING MATRIX – SECONDARY SOURCES

Environment- The Western Desert	1 Environment	2 Operations	3 Mobility	4 Logistics	5 Innovation and Improvisation
Individual	*How resilience works* Coutu cited in *HBR's 10 must reads* (2015) pp 105-118. Reference to the skills and experience of the RAF gained in the Middle East Bowyer (1988) pp286-290. Officers and paternal leadership Sheffield (1999.p 4, 5, 8 pp11- 13, pp 41-44, p71,93 109,126,132,134,163,180. For a full discussion and analysis of Western Desert operations see Shores and Ring (1969) esp. chapter 12. Holland (2006) pp174-175 writes on desert operations and logistics. Clayton and Craig (2002) p 49 effects of a desert 'khamsin' dust storm. Boyle (1962) p394. Trenchard's 'Handymen' ethos passed down to Desert Air Force as 'can do' attitude. Ehlers (2015) pp134-138. For a detailed discussion on Dawson's	*How resilience works* Coutu cited in *HBR's 10 must reads* (2015) pp 105-118. Reference to 'Pink's War. First instance of the RAF acting independently of the Army Bowyer (1988) p176. Reference to the skills and experience of the RAF gained in the Middle East Bowyer (1988) pp286-290. Officers and paternal leadership Sheffield (1999). p 4,5,8 pp11- 13, pp41-44, p71,93 109,126,132,134,163,180 For a full discussion and analysis of Western Desert operations see Shores and Ring (1969) esp. chapter 12. Holland (2006) pp174-175 writes on desert operations and logistics. Clayton and Craig (2002) p 49 effects of a desert 'khamsin' dust storm. Boyle (1962) p394.	*How resilience works* Coutu cited in *HBR's 10 must reads* (2015) pp 105-118. Reference to the skills and experience of the RAF gained in the Middle East Bowyer (1988) pp286-290. Officers and paternal leadership Sheffield (1999). p 4,5,8 pp11- 13, pp41-44, p71,93 109,126,132,134,163,180 For a full discussion and analysis of Western Desert operations see Shores and Ring (1969) esp. chapter 12. Holland (2006) pp174-175 writes on desert operations and logistics Clayton and Craig (2002) p 49 effects of a desert 'khamsin' dust storm. Boyle (1962) p394. Trenchard's 'Handymen' ethos passed down to Desert Air Force as 'can do' attitude. Ehlers (2015) pp56-57 describes the Desert Air Force as 'exceptionally	*How resilience works* Coutu cited in *HBR's 10 must reads* (2015) pp 105-118. Reference to the skills and experience of the RAF gained in the Middle East Bowyer (1988) pp286-290. Officers and paternal leadership Sheffield (1999). p 4,5,8 pp11- 13, pp41-44, p71,93 109,126,132,134,163,180 For a full discussion and analysis of Western Desert operations see Shores and Ring (1969) esp. chapter 12. Holland (2006) pp174-175 writes on desert operations and logistics. Clayton and Craig (2002) p 49 effects of a desert 'khamsin' dust storm. Boyle (1962) p394. Trenchard's 'Handymen' ethos passed down to Desert Air Force as 'can do' attitude. Ehlers (2015) pp 56-57 describes the Desert Air Force as 'exceptionally agile' and	*How resilience works* Coutu cited in *HBR's 10 must reads* 2015 pp 105-118. Reference to the skills and experience of the RAF gained in the Middle East Bowyer (1988) pp286-290. Officers and paternal leadership Sheffield (1999). p 4,5,8 pp11- 13, pp41-44, p71,93 109,126,132,134,163,180 For a full discussion and analysis of Western Desert operations see Shores and Ring (1969) esp. chapter 12. Holland (2006) pp174-175 writes on desert operations and logistics. Clayton and Craig (2002) p 49 effects of a desert 'khamsin' dust storm. Boyle (1962) p394. Trenchard's 'Handymen' ethos passed down to Desert Air Force as 'can do' attitude. Ehlers (2015) pp56-57 describes the Desert Air Force as 'exceptionally

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	repair and maintenance innovations and practice. Ehlers (2015) p172 again emphasises British familiarity with Empire and associated complexities. Ehlers (2015) pp175-176 another reference to Desert Air Force mobility and agility in operations. Ehlers (2015) pp185-188, further in-depth discussion around Desert Air Force innovation in a crisis. Bishop (2017) p 229 the effect of desert environment on maintenance and operations. Mentions Blenheim air filters as an example. Cox and Gray (2002) In chapter 9 by Gladman pp 188 - 203 give a detailed analysis of the development of Tactical Air Doctrine in North Africa 1940-43. Bracknell Paper No3 (1992) Agenda item 3 Terraine pp3-13 *land /air co-operation* for a verbatim record of the discussion p 13 bomber interdiction of Rommel's supply lines. Agenda item 7 pp34-45 for an analysis of desert Air Force *commanders and the command system.*	Trenchard's 'Handymen' ethos passed down to Desert Air Force as 'can do' attitude. Ehlers (2015) pp56-57 describes the Desert Air Force as 'exceptionally agile' and 'institutionally mobile' with immense logistical support. Ehlers (2015) p 106. Reference to Tedders air transport capability plan. Ehlers (2015) pp134-138. For a detailed discussion on Dawson's repair and maintenance innovations and practice. Ehlers (2015) p138 refers to British previous experience of desert operating conditions. Ehlers (2015) p172 again emphasises British familiarity with Empire and associated complexities. Ehlers (2015) pp175-176 another reference to Desert Air Force mobility and agility in operations. Ehlers (2015) pp185-188, further in-depth discussion around Desert Air Force innovation in a crisis. Bishop (2017) p 229 the effect of desert environment on maintenance and operations. Mentions Blenheim air filters as an example.	agile' and 'institutionally mobile' with immense logistical support. Ehlers (2015) p 106. Reference to Tedders air transport capability plan. Ehlers (2015) pp134-138. For a detailed discussion on Dawson's repair and maintenance innovations and practice. Ehlers (2015) p138 refers to British previous experience of desert operating conditions. Ehlers (2015) p172 again emphasises British familiarity with Empire and associated complexities. Ehlers (2015) pp175-176 another reference to Desert Air Force mobility and agility in operations. Ehlers (2015) pp185-188, further in-depth discussion around Desert Air Force innovation in a crisis. Bishop (2017) p 229 the effect of desert environment on maintenance and operations. Mentions Blenheim air filters as an example. Barr (2011) pp 207-211 describes the Middle East situation *vis a vis* the Vichy French, and German influence in Syria and Iraq. Cox and Gray (2002)	'institutionally mobile' with immense logistical support. Ehlers (2015) p 106. Reference to Tedders air transport capability plan. Ehlers (2015) pp134-138. For a detailed discussion on Dawson's repair and maintenance innovations and practice. Ehlers (2015) p138 refers to British previous experience of desert operating conditions. Ehlers (2015) p172 again emphasises British familiarity with Empire and associated complexities. Ehlers (2015) pp175-176 another reference to Desert Air Force mobility and agility in operations. Ehlers (2015) pp185-188, further in-depth discussion around Desert Air Force innovation in a crisis. Bishop (2017) p 229 the effect of desert environment on maintenance and operations. Mentions Blenheim air filters as an example. Barr (2011) pp 207-211 describes the Middle East situation *vis a vis* the Vichy French, and German influence in Syria and Iraq. Cox and Gray (2002)	agile' and 'institutionally mobile' with immense logistical support. Ehlers (2015) p 106. Reference to Tedders air transport capability plan. Ehlers (2015) pp134-138. For a detailed discussion on Dawson's repair and maintenance innovations and practice. Ehlers (2015) p138 refers to British previous experience of desert operating conditions. Ehlers (2015) p172 again emphasises British familiarity with Empire and associated complexities. Ehlers (2015) pp175-176 another reference to Desert Air Force mobility and agility in operations. Ehlers (2015) pp185-188, further in-depth discussion around Desert Air Force innovation in a crisis. Bishop (2017) p 229 the effect of desert environment on maintenance and operations. Mentions Blenheim air filters as an example. Barr (2011) pp 207-211 describes the Middle East situation *vis a vis* the Vichy French, and German influence in Syria and Iraq. Cox and Gray (2002)

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	Overy (1980) Chapter 6 Describes leadership, Organisation and Training. Esp. p 137-145 on recruitment and training of ground crew. Also, pp144-145 on morale and military tradition. Orange (2013) p192 Cites Dawson's managerial motto 'managing somehow.' Orange (1990) p42 Describes Coningham taking up staff duties in Egypt in 1924. Experience that would serve him well with the Desert Air Force in 1942. Orange (1990) p 93. Refers to Coningham's weekly briefing of Wing Commanders to disseminate every aspect of operations. Pallud (2012) gives magisterial coverage, written and photographic of all aspects of the Western Desert campaign. Esp. pp 312-416 covering the period of 1st Battle of El Alamein, Battle at Alam al Halfa, and 2nd Battle of El Alamein. Shores, Massimello, Guest, Olnyk, Bock. 2012- 2016. Between them over three volumes give a comprehensive and minutely detailed account of all RAF operations in The Western Desert.	Barr (2011) pp 207-211 describes the Middle East situation *vis a vis* the Vichy French, and German influence in Syria and Iraq. Cox and Gray (2002) In chapter 9 by Gladman pp 188 - 203 give a detailed analysis of the development of Tactical Air Doctrine in North Africa 1940-43. Cox and Gray (2002) in chapter 10pp 207-222 by Dye examine logistics, Doctrine and the Impact of War: The RAF's Experience in the Second World War. Overy (1980) Chapter 6 Describes leadership, Organisation and Training. Esp. p 137-145 on recruitment and training of ground crew. Also, pp144-145 on morale and military tradition. Orange (2013) p192 Cites Dawson's managerial motto 'managing somehow. Orange (2001) pp 162-163, credits Park with laying the foundations for the Desert Air Force. P165 discusses Parks' high- profile leadership. Orange (1990) p42 Describes Coningham taking up staff duties in Egypt in 1924. Experience that would serve him	In chapter 9 by Gladman pp 188 - 203 give a detailed analysis of the development of Tactical Air Doctrine in North Africa 1940-43. Cox and Gray (2002) in chapter 10pp 207-222 by Dye examine logistics, Doctrine and the Impact of War: The RAF's Experience in the Second World War. Overy (1980) Chapter 6 Describes leadership, Organisation and Training. Esp. p 137-145 on recruitment and training of ground crew. Also, pp144-145 on morale and military tradition. Orange (2013) p192 Cites Dawson's managerial motto 'managing somehow. Orange (2001) pp 162-163, credits Park with laying the foundations for the Desert Air Force. P165 discusses Parks' high- profile leadership. Orange (1990) p42 Describes Coningham taking up staff duties in Egypt in 1924. Experience that would serve him well with the Desert Air Force in 1942. Orange (1990) p 93. Refers to Coningham's weekly briefing of Wing Commanders to	In chapter 9 by Gladman pp 188 - 203 give a detailed analysis of the development of Tactical Air Doctrine in North Africa 1940-43. Cox and Gray (2002) in chapter 10pp 207-222 by Dye examine logistics, Doctrine and the Impact of War: The RAF's Experience in the Second World War. Overy (1980) Chapter 6 Describes leadership, Organisation and Training. Esp. p 137-145 on recruitment and training of ground crew. Also, pp144-145 on morale and military tradition. Orange (2013) p192 Cites Dawson's managerial motto 'managing somehow. Orange (2001) pp 162-163, credits Park with laying the foundations for the Desert Air Force. P165 discusses Parks' high- profile leadership. Orange (1990) p42 Describes Coningham taking up staff duties in Egypt in 1924. Experience that would serve him well with the Desert Air Force in 1942. Orange (1990) p 93. Refers to Coningham's weekly briefing of Wing Commanders to	In chapter 9 by Gladman pp 188 - 203 give a detailed analysis of the development of Tactical Air Doctrine in North Africa 1940-43. Overy (1980) Chapter 6 Describes leadership, Organisation and Training. Esp. p 137-145 on recruitment and training of ground crew. Also, pp144-145 on morale and military tradition. Orange (2013) p192 Cites Dawson's managerial motto 'managing somehow. Orange (2001) pp 162-163, credits Park with laying the foundations for the Desert Air Force. P165 discusses Parks' high- profile leadership. Orange (1990) p42 Describes Coningham taking up staff duties in Egypt in 1924. Experience that would serve him well with the Desert Air Force in 1942. Orange (1990) p 93. Refers to Coningham's weekly briefing of Wing Commanders to disseminate every aspect of operations.

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