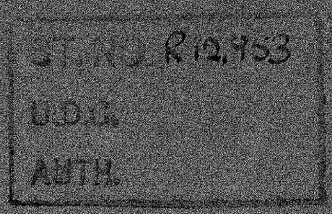

Conversion of

DOUGLAS DAKOTA G-AMZE

for

MITH AUTOPILOT TYPE D DEVELOPMENT

Contract No. 6Aircraft/8911/CB24(a)

Prepared by

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CONTENTS

PART 1 SUMMARY OF REQUIREMENTS

Dakota K.J. 874 was delivered as a standard R.A.F Mark IV paratrooping aircraft. The undermentioned modifications were called for in order to convert it to an aircraft suitable for the carrying out of flight tests & development on the Type "D" Auto Pilot", bearing in mind the lessons learned from previous operations of a Valetta on similar work.

The requirement that the aircraft be placed in a civil category for maintenance entailed the conversion being carried out by a Firm approved by the Air Registration Board for overhaul and maintenance, including Radio, also approved for Design. After discussion, the contract was placed with the College of Aeronautics, Cranfield, whose maintenance and design organization is fully A.R.B. approved, the aircraft being delivered during February, 1953.

The first requirement was the removal of all surplus equipment from the airframe. This included all the paratrooping gear, the seating, which was unsuitable since it ran the full length of the fuselage facing towards the centre gangway, the glider towing attachment in the tail cone, the Bendix W.T. radio gear and the A.3 Auto Pilot. The Bendix Radio was not wanted because it was too bulky and would not be used in connection with Type "D" trials, and it was also intended to operate the Dakota without a wireless operator. The A.3 Auto Pilot was to be removed complete, including the Servo Motors which were in series with the main control cables, so that no servicing of these components would be required under operating conditions.

It was decided that the work bench as used in the Valetta was not the best equipment for this type of work and in lieu of this there would be five pairs of vertical stanchions spaced 2 feet apart centre to centre on which could be mounted flush fitting panels in sections. These sections would take the amplifier, coupling unit and other box units of the Auto Pilot, plus general instruments for Auto Pilot test and development work. This system would obviate the difficulties encountered in the Valetta over the cable harness and installation changes which occur quite frequently and would in general offer all the advantages of the standard racking system. The stanchions were to be installed down the length of the gangway, outboard to starboard, such that their minimum height was 6'6" and the first stanchion to be as near the forward cabin bulkhead as possible. This position was chosen so that the amplifier could be mounted as near to the cockpit as possible in order that ground testing could be carried out more simply with a minimum of chasing between Pilot's Controller and Amplifier. Above the Amplifier were to be mounted indicators showing the A.C. & D.C. power supply levels and indicators showing the position of the output shafts of the Auto Pilot Servo Motors. These latter indicators would simplify the adjustment of the channel balancers in the amplifier and the output of these position transmitters was also to be available for flight test recording by easy disconnection of the indicators. Also on this panel section above the amplifier were to be mounted three warning lamps, one each in parallel with the Auto Pilot channel clutch relays such that the lamps would glow to indicate in the cabin which channels of the Auto Pilot were engaged.

The third pair of stanchions would mount a panel consisting of the Coupling Unit, Condenser Unit & Heading Monitor Amplifier of the Auto Pilot. Static and pitot pressures were to be available at this panel for feeding to height or airspeed monitors or any future developments requiring this facility. The output from the SCS.51 ILS Receivers would

also be wired to this panel so as to be available for the Coupling Unit when required.

On the fifth pair of stanchions were to be the GM.2.B. Gyro Compass Amplifier and Master Indicator. On the second and fourth panel bays in position on the above mentioned bays were to be mounted any additional instruments, the behaviour of which it was required to investigate in flight. Also on these stanchions would be mounted braced shelves 18" deep to form a table on which could be placed Gyro Recorders, test equipment, etc.

At the base of each odd bay was to be a panel carrying D.C. and earth bus bars for use with test equipment and A.C. three phase and single phase power points. For the remainder of the Auto Pilot components, the Pilot's Controller was to be installed in the cockpit on a panel in place of the A.3 Gyro Unit, on the left hand side so as to be accessible to the pilot and the panel so designed that either of the two proposed types could be installed. The Servo Motors for the rudder and elevator would be installed in the tail cone in place of the glider towing gear in order to achieve a direct rod link between servo and control surface and thus eliminate the lost motion associated with control cables which are the standard fitting in Dakota aircraft. The aileron Servo Motor would be mounted in the cabin directly above the aileron cross lever to which it would be joined by a connecting rod and crank. The reason for this choice of position was mainly one of accessibility for changing the Servo Motor, the construction of the Dakota centre section being such that no other suitable position could be found. The obvious alternative of placing this Servo Motor in series with the control cable in place of the A.3 Servos was rejected on account of the necessary cable linkage involved. Desynn transmitters were called for, linked to each Servo Mounting output shaft to give the Servo Motor position indication referred to above. The gyro unit was to be installed under a window on a rigid base on the port side of the cabin near to the C.G. point of the aircraft.

A.C. power supply was to come from three Invertors, a Type 8A, Type 103 for 3 phase 115 v. 400 c.p.s. supply and a Type 1203 for 230 v.50 c.p.s. supply. The Type 8.A, besides a number of other instruments, would be supplying an electric artificial horizon and a turn and slip indicator in the pilot's blind flying panel and therefore a second Type 8.A was required with changeover facilities and a phase failure warning system. These Invertors were to be mounted in the aft part of the cabin on the starboard side so as to be clear of any hydraulic fluid and to be as far away from the "Working" part of the cabin in order to keep the noise level at a minimum.

Some form of sound proofing of the cabin was desirable in order to improve working conditions since the Dakota cabin noise level is abnormally high. A non-slip floor surface was also desirable. Three pairs of seats in the cabin were thought to be sufficient for all normal purposes and these were to be placed on the port side towards the rear of the cabin. Intercomm facilities were to be increased such that there were four points available at the panel bays and one at each seat, plus one point by the Invertor bay. Improved lighting was required and the most suitable system was to have increased overhead lighting used in conjunction with Anglepoise lamps mounted on the panel bays.

An improved instrument layout in the cockpit was considered necessary. The pilot of this aircraft was going to be fully occupied with test work and it was thought essential that a British instrument presentation was required from the safety aspect and from the point of view of tiredness in view of the proposed utilisation of this aircraft. Initially the blind flying panel only would give this presentation but eventually the B.E.A. Pionair instrumentation was to be installed complete. As this layout contained a duplicate B.F.P., this would facilitate any trials with new navigation instruments which may be required.

To provide additional instrumentation for test work, a yaw meter was required and a two-axis control force indicator, the former mounted forward from the nose and the latter attached to the second pilots control column. SCS.51 would need to be modified to give an output sufficient to cover three loads, i.e., two indicators and one Auto Pilot. A camera recorder was required to be installed aft of the panel bays, the instrument fitted to be decided after consideration of the requirement of A.P. 970 Chapter 1011.

In order to cope with the increased electrical loading on the aircraft engine generators, two 5 kw. generators were to be fitted in place of the standard 2.5 kw. generators.

To meet requirements of flight test procedure, it was agreed that a Tape Recorder be installed and connected to the aircraft intercomm system.

PART 2 CONVERSION TO CIVIL CATEGORY

As the rules of acceptance for an ex Military aircraft of the Dakota type by the Air Registration Board are fairly comprehensive, calling for major components of the airframe to be removed and engines certified by an engineer licensed in the category, it was decided to hold an early meeting with the Board to agree on the actual work that would be necessary in order to obtain a Certificate of Airworthiness.

Prior to the meeting, a preliminary inspection was carried out to ascertain the general condition of the aircraft. Having been stored in a 41 Group Unit of the R.A.F. and prepared by the consignor Maintenance Unit for issue to the Service, it was found to be in fairly good condition, and a favourable report was issued by the College Chief Inspector.

At the meeting subsequently held, the Air Registration Board agreed to waive their normal requirements of inspection, bearing in mind the reasonable condition of the aircraft and the fact that the Certificate of Airworthiness would be issued only in sub division G & H covering experimental and demonstration flying. In view of this concession, it was agreed that the validity of the Certificate of Airworthiness would always be dependent upon it remaining in the sub division mentioned; under no circumstances would a normal category be considered.

The Board did insist that all mandatory modifications be embodied; these amounted mainly to fire proofing of the Power Plants and installation of a fire extinguisher system. Details of modifications thus embodied are given in a following paragraph.

To ensure a thorough check of engines, aircraft and ancillary equipment, it was agreed with the Air Registration

Board to carry out a standard Check IV to the approved Maintenance Schedule. This is a check normally carried out after 1,000 hours flying, and is fairly comprehensive, but it was considered that an inspection of this nature was essential in the interests of the Air Registration Board and to the future operators of the aircraft.

In addition the aircraft was checked to the requirements of Mandatory Service Notes issued by C.A.A. Washington, this being a requirement for all Dakota aircraft being recommended for a British Certificate of Airworthiness.

Apart from the normal defects found during inspection the only major replacements were two main fuel tanks which were found to be leaking, and two engine oil coolers.

Appendix 1 is a copy of the Survey Report raised by the Inspection Department which outlines work called for; the actual inspection records and details of Modifications and replacements are held in the Technical Record Office at Cranfield.

MANDATORY MODIFICATIONS EMBODIED

S.599. Introduction of Flameproof Hose foreward of Firewall
S.617. " " " Feathering Circuit.
S.607. Fireproof Power Plant Firewall
S.622. Introduction of engine Fire Extinguisher System
S.694. Introduction of Starter Relay Failure Warning Lights.
S.688. Modification to Fuel Access Panel.
Dak.1095. Introduction of Starter Relay
Dak.1112. Introduction of Steel Elevator Horn Balance

Modifications with prefix "S" are Civil requirements and do not apply to Service Aircraft; equipment thus obtained is shown as Contractors Supply in the equipment section of this report.

A complete overhaul of all radio equipment and installation was carried out, details of which are shown in Part 3.

PART 3 DESIGN, MANUFACTURE & INSTALLATION OF VARIOUS COMPONENTS & ACCESSORIES.

Section 1 Type "D" Auto Pilot. Fixed Parts.

Primary Considerations

At the modification meeting it was decided that the positions selected for the servo motors should satisfy the following conditions:-

1. The motors to be as near as possible to their respective control surfaces in order that a short motor to surface linkage system, with consequent reduction in backlash, be obtained.
2. The motors to be accessible and fairly easily removable so that routine maintenance and any necessary adjustments may quickly and easily be made.

General Information.

In the case of all three servo motor installations the aim was to provide a drive lever movement of approx. 100°.

In order to preclude any possibility of a mechanical lock, positive stops have been provided on the servo motor drive levers to limit their travel. These stops are not intended to replace or render inoperative the existing control surface stops, but will only come into operation should the servo drive become over strained.

Desynn transmitters have been mounted adjacent to the servo motors and linked by connecting rods to the motor drive levers to enable their movements to be recorded.

AILERON INSTALLATION (Dwg.Nos.M.145/1 and M.145/2 and Figures 1, 2, 3, 4, 5)

Since only one servo motor operates the aileron controls, a central position in the control system was required. An inspection of the aircraft revealed a suitable position in the Flap Jack bay in the underbelly of the fuselage and on the C.L of the aircraft. In this bay is the double bell crank lever from which the control cables run out through the wings to the ailerons. It was obviously impractical, due to inaccessibility, to mount the servo motor in this bay and it was therefore decided to mount the motor on the cabin floor immediately above this bay. The system then is as follows:-

The servo motor is mounted on two stiff Z section members which are rigidly bolted to the cabin floor. The drive is by a push rod passing through the cabin floor into the Flap Jack bay, and picking up on a bell crank lever which has been mounted in the bay to swing fore and aft in the vertical plane. This bell crank lever then transmits the drive forward,(by the smaller push rod) direct to the existing double bell crank lever mentioned above and thence to the ailerons through the present control cables.

A movement of $49\frac{1}{2}^{o}$, from neutral, produces full aileron deflection (i.e. total movement of drive lever is 99^{o}). The servo motor and desynn transmitter are enclosed under a box type cover which is easily removable to provide full access to the units.

ELEVATOR INSTALLATION (Dwg.No.M.145/2 and M.145/3 Figure 6)

At the extreme tail of the aircraft, enclosed by the fuselage tail cone, are four heavy lugs, formerly used for the attachment of a glider towing pylon. Two rigid platform, one above the other and approx.14" apart, have been bolted to these lugs. On the lower of the two platforms the elevator servo motor has been mounted with its drive lever in the vertical plane and moving fore and aft. The drive is transmitted, by the short connecting rod, to a fabricated lever which is bolted to the existing forged lever, on the elevator torque tube, by two shear bolts passing through the web.

The total elevator movement is 50^{o}(30^{o} up and 20^{o} down) and with the elevator in the mid-travel position (not neutral) the servo motor drive lever movements to give full up and full down elevator are respectively $46\frac{1}{2}^{o}$ and 49^{o} giving a total drive lever movement of $95\frac{1}{2}^{o}$.

A blister fairing has been added on the lower Starboard side of the tail cone and removal of this fairing provides sufficient access to enable the elevator servo motor to be removed. If required however, the tail cone itself can be completely removed when full all round access to both rudder and elevator installations, will be obtained.

RUDDER INSTALLATION (Dwg.No.M.145/1 and M.145/3 Figures 6, 7, 8).

On the upper of the two platforms, at the tail of the aircraft, is the rudder servo motor, which has been mounted on the C.L. of aircraft with its drive lever moving in the

horizontal plane. The drive is transmitted by a short connecting rod to a lever which is bolted on to the lower end of the rudder torque tube. The rudder travel is 30° Port & Starboard and measured from the neutral position, the servo motor drive lever movements are, 52½° for Port rudder and 47½° for Starboard rudder giving an overall lever travel of 100°.

An existing access panel on the upper Port side of the tail cone has been enlarged to enable routine maintenance to be carried out and to provide also for removal of the servo motor. As stated previously however the whole tail cone can be removed, if necessary, to provide the fullest accessibility.

GYRO UNIT MOUNTING (Drg.No M.148/1. Figures 9, 10)

In the aircraft cabin, on the Port side forward, a table has been erected to carry the Auto-pilot Gyro Unit. This table, which is bolted direct to the aircraft structure, is completely rigid and is provided with studs for mounting the Gyro Unit. The table is parallel to both fore and aft, and lateral datumns of the aircraft to within ±½°. The Unit is fully accessible.

Section 2. Fuselage Instrument Panel and Rack Assembly. (Figures 11, 12, 13, 14, . Drg M.146/1)

From the illustrations shown looking forward towards the cockpit, it will be seen that ample space has been allowed for operators to work at the front and rear of the panels, at the same time allowing free access to the cockpit area when the various units are mounted on the panels.

The six deep channel section vertical members are mounted to floor members at the bottom and to fuselage frame members and skin at the top, as shown in Drg.No.M146/1, the instrument panels being mounted by bolting to 2 BA Anchor Nuts attached at intervals to the channel section. Thus instrument panels may be added or deleted to Flight requirements with a minimum amount of work.

Five sets of Panels are therefore available with two braced shelves at Panels 2 and 3, which serve as tables for ground test equipment. Taking the panel nearest to the Pilot's cockpit as No.1, the layout of equipment is as follows:-

No.1 Panel

Auto Pilot Amplifier. Rudder Aileron Elevator Servo Desynn Indicators with Warning Lamps.
Auto Pilot Control Switch with Warning Lamp and cutout.
Desynn Indicators for Aileron and Elevator Force.
Desynn Indicators for Yawmeter.
A.C. and D.C. Voltmeters.
Frequency Meter. Compass Indicator.

230 Volt A/C Plug and Socket with Switch. Two Fuse Boxes. Switches for Auto Pilot Servo, Stick Force and Yawmeter Desynns.

No 2 and 4 Panels

Inter Comm. Selector Box, Pre-Amplifier and inter comm. Jack.

No 3 Panel.

Auto Pilot condenser unit and Coupling unit.
230 Volt A.C. Plug and Socket with Switch. Two Fuse Boxes.

No 5 Panel

G.M.2 Compass Master Indicator and Amplifier
15 Rate of Climb Indicators
230 Volt A.C.Plug and Socket with Switch. Two Fuse Boxes.

Section. 3. Stick Force Transmitter(Drg.No.M147/1 and Figure 16)

A standard R.A.E. Two axis transmitter on aileron and elevator was supplied on Loan from Smith's Aircraft Instruments. It was decided that the second pilot's control handwheel be used for installation, Figure 16 showing clearly the arrangements used for mounting. The Transmitter is easily removed from the control column for servicing by removal of two 2 BA Bolts and disconnecting the electrical connection.

All materials used in manufacture of the mounting are non ferrous owing to the close proximity of the magnetic compass.

Two desynn indicators are installed on the forward fuselage instrument Panel wired to the Transmitter through the aircraft 24 Volt D.C. system.

Section. 4. R.A.E. Wind Vane Drg.No.M149/1 and Figures 17,18)

One R.A.E. Mk.II Wind Vane was supplied by Smith's Aircraft Instruments. The installation of the wind vane pole was sited at the nose fuselage position immediately below the hinged portion, thus allowing free access. Method of attachment to the aircraft structure is by a light alloy socket secured radially by 2 BA Bolts and anchor nuts, the socket being secured to a back plate braced to fuselage Frame 20 by cross members and vertical channel members. Attachment to the nose skin is by a welded mild steel socket, the whole assembly being attached by 2 BA Bolts and Anchor Nuts. At the forward end a machined Light Alloy reduction fitting permits the fitment of the $1\frac{3}{8}$" tube to the main 3" tube, the actual wind vane being attached to a light alloy machined fitting pressed into $1\frac{3}{8}$" tube and secured by Pop Rivets. The whole assembly has been designed for quick removal of either the wind vane or the complete supporting tube. Wiring from the vane is led through the centre of the support tube and thence through the aircraft 24 Volt.D.C. system to the desynn indicator on the front fuselage Instrument Panel.

Section 5. Removal of Jack & Heintz Auto Pilot Unit.(Drg.No M150/1)

This requirement presented two problems as removal of the servo unit left a gap in the aircraft control circuit and in addition, being a hydraulic operated system, entailed alteration to that system. The standard hydraulic circuit is that fluid is led from the engine driven pump through a pressure regulator valve to a shut off valve; in the off position the fluid is led back to the hydraulic reservoir. By removing the pipe from this valve to the auto pilot & blanking off, it was thus possible to completely isolate the system, the fluid passing back to the reservoir irrespective of the shut off valve position. All the remaining Auto Pilot Hydraulic pipes were left in situ but blanked off. Thus at any future date should it be decided to revert to Jack & Heintz auto pilot, this can be accomplished with a minimum amount of work. The control cable problem was overcome by manufacture of cable links for elevator, aileron and rudder, to Drg.No.M150/1. As American type flexible cable and swaging presented difficulties, manufacture was sub-contracted to Messrs. Scottish Aviation, Prestwick, the Douglas Aircraft Agents for U.K.

Section. 6. Parachute Stowage and Auto Observer(Figure 10)

When considering the design for this requirement it was agreed that it would be economical to embody the two items into one piece of equipment, i.e., to use the parachute stowage crate as the base on which to assemble the auto observer. A parachute stowage was constructed of plywood and

spruce with compartments to hold eight observer type parachutes. The method of attachment to the metal floor of the cabin is by top hat and right angled members rivetted to the floor, ¼" bolts securing the stowage to these members.

The requirements for the auto observer were as follows:- (1) to be operated by a Vinten K4 Camera, (2) a panel 8" x 6" to accommodate instruments, and made quickly removable in order that instrument presentation could be quickly changed. (3) a pitot static line run, (4) D.C. Power available. Fig. 10 shows the type of box constructed; it will be noted that the back of the instruments are open to the cabin, thus allowing free access when making connections. The instrument panel is accommodated by two vertical slides lined with felt, thus it is retained in position by its own weight and is very quickly removable.

Pitot static lines are run from the starboard side of the cabin to the back of the instrument panel, the pipes being installed behind the cabin interior furnishing. Terminal blocks at the rear of the instrument panel provide means of supplying power for electric instruments, leads being taken to these points from the desynn system installed. The Vinten K4 camera being 12 volt operated is supplied with a resistance to step down the normal aircraft 24 Volt D.C. supply. The whole unit is mounted on anti vibration mountings which are bolted to the spruce members secured to the top surface of the parachute stowage. A modification to the original design introduces a visor for studying instrument behaviour prior to operating the camera.

Section 7 Sound proofing, furnishing and seating (Figure 19)

The aircraft as received was completely devoid of any sound proofing or furnishing and the floor was a standard metal type found in a military Dakota. The requirement for conversion was that the aircraft should be quiet to permit experimental flying under reasonable conditions at the same time improving the cabin heating qualities and lighting. The aircraft was therefore stripped of all Paratroop equipment, Troop seating, glider tow and stretcher carrying gear. It was then decided to divide the main cabin into two parts, the portion from the main entrance door aft to the rear fuselage bulkhead to house the inverters, and from the main entrance door to the front fuselage bulkhead to accommodate experimental equipment and seating.

The question of furnishing and sound proofing presented a financial problem as equipment of this nature was not available from Embodiment Loan sources and to purchase, make up and install the furnishing required would have been an expensive item. The problem was overcome by the College contacting personal acquaintances at No.8 Maintenance Unit, R.A.F., Little Rissington where V.I.P. Dakotas were lying awaiting breakdown and which were fully furnished. By negotiation between M.O.S. R.D. Inst.6 and Air Ministry, authority was received to remove equipment required from selected aircraft. As items of this nature were originally installed to suit local requirements, it was not practical to price the equipment received. Thus it was possible to furnish Dakota G-AMZE at the cost of installation only, there being no material costs.

The following were installed :-

(i) A double walled bulkhead with door assembled just forward of the main entrance door, the crew operating portion could thus be segregated from the invertor station.

(ii) A wooden floor assembled on top of the existing metal one

iii) Sound proofing consisting of 1" thick felt covered by decorative fabric secured to wooden frames attached to fuselage members.

(iv) From the window level to the floor the fuselage is covered with polished ply sections, all joints being covered with polished wooden beading.

Seating had to comply with A.R.B. requirements; this entailed purchase of three pairs of passenger seats from Scottish Aviation and installed to their approved drawings on the port side of the fuselage as illustrated.

Lighting was improved by fitting additional lights in the cabin roof and to the sides of the fuselage. Anglepoise Lamps were also fitted at the following positions:-

(i) At the rear of No.1 Fuselage Instrument Panel.

(ii) The Auto Pilot Gyro Unit position

(iii) The Invertor Station at the rear fuselage position.

Section.8 ELECTRICAL MODIFICATIONS

This requirement called for providing A.C.Power for the following :-

(a) Flying Instruments with two Type 8 Invertors.

(b) Auto Pilot with one Type 103 Invertor.

(c) Test Equipment with one Type 1203 Invertor.

It was therefore necessary to build an invertor station accommodating all the invertor units at one position. The site was agreed at the rear fuselage opposite the main entrance door. Figures 20, 21 and 22. show the general arrangement for installation, the invertors being mounted to a base board which in turn is secured to the fuselage floor, the whole assembly being protected by a built up tubular structure. A switch Panel provides control for the Type 1203 Starting Switch also the change over switch and torque switch for the Type 8 Invertors.

It was necessary to duplicate the Type 8 to provide the Pilot's essential instruments with stand-by power in the event of invertor failure in flight. A phase failure warning light operated by a torque switch is incorporated in the circuit thus warning the pilot of power failure. By operating a manually operated switch situated above the Pilot's Blind Flying Panel, the stand-by invertor is brought into use. D.C.Power is supplied from the aircraft batteries via a common bus bar point. A.C.Power from the 103 and type 8 invertors is led forward to the A.C. Distribution Panel situated on the front Port Cabin bulkhead (Figure 20)

A.C.Power from the Type 1203 is supplied to the power points situated at the bottom of the Fuselage Instrument Panels. The Type 103 Invertor provides A.C.Power for Auto Pilot operation only, power being led to the various units and cut outs, the whole being pilot operated. The entire wiring for the electrical system has been run behind the fuselage furnishing, thus presenting a clean interior at the same time being readily accessible.

To provide sufficient D.C.power to operate the extra electrical equipment installed, it was necessary to fit higher powered engine driven generators. Transport Force Mod. TF47 covered this requirement and a set of parts for embodiment was obtained from No.8 Maintenance Unit on repayment and is shown as Contractors Supply in the equipment section of this Report. The alteration entailed removal of the 2.5 kw and fitment of 5 kw Type Generator with shunts and ammeters.

ANALYSIS OF ADDITIONS TO ELECTRICAL SYSTEM.

Item No.	Service.	No. off	Amps/ Unit	Class	Amps
1.	Instruments	1	20	1	20
2.	Exp.400 c/s Supply	1	60	11	60
3.	Exp. 50 c/s Supply	1	18	11	18
4.	Relays	4	0.5	1	2
5.	Lights	22	.7	11	15
			Total Demand		115 Amps
	Additional Continuous Capacity of Generators				166 Amps
	" " Demand				115 "
	Generator Capacity in excess of Demand				51 Amps

Section.9 Radio Modifications

The following equipment, together with cabling and aerial systems was removed, surplus to requirements

A.R.I. 5083.(GEE). A.R.I. 5506.(REBECCA).Z.B.X./Y.G. BC375/348 (LIASON). The following equipment was retained;

SC522 V.H.F.(TWO). SCR274N. COMMAND. SCR269G.RADIO COMPASS. A.Y.F. RADIO ALTIMETER BC347 INTERCOMMUNICATION. BC733D. I.L.S. LOCALISER. RECEIVER BC357J MARKER RECEIVER

The cabling and aerial systems of the permanent installation were checked, overhauled and modified to civil standards and replacements made where necessary.

All equipments were bench serviced, performance and function tested to A.R.B. requirements, and the I.L.S. equipment modified to incorporate flag warning facilities. The I.L.S. installation was completed by fitting the R89-ARN/5 Glide Path receiver and Indicator 101-C. Additional intercommunication points were fitted out at the test panels and passenger seats in the main cabin, and at selected points in the cockpit. A Wright and Weaire magnetic tape recorder type R.E.H.(1) was installed in the navigators compartment and connected into the intercommunication circuit. A complete survey of the installation was carried out and all equipment and controls tested for correct functioning. Tests were carried out to determine the absence of interference from the aircraft engines and electrical services. Satisfactory air tests of the installation were made, and checks carried out on the calibration of the I.L.S. and radio compass equipments. At the request of the A.R.B. further flight tests were made to determine the polar diagrams of the V.H.F. and I.L.S. aerials, and to check the operational range of these equipments at varying altitudes. Drawings, installation and inspection reports were raised for A.R.B. inspection.

Section 10. Alteration to Pilot's Instrument Panel.(Figure 23)

The original intention to convert the existing cockpit instrument panel to the Pionair type as used in B.E.A. aircraft was cancelled in view of cost and labour.

In order to give the first Pilot a presentation of English type instruments, the Blind Flying Panel complete with instruments was removed and a new panel manufacture of slightly larger size was introduced to accommodate the new instruments, these being as follows:-

One A.S.I. Smith's Type 129 A.S.

One Altimeter Smith's Type 74 A.M.

One Turn & Slip Indicator Hughes Mk. X Electric.

One Rate of Climb Indicator Smith's Type 20RC/PC

One Artificial Horizon Smith's Electric

One Compass Gyro Unit Hughes

Further alterations to the panel covering the G.M.2 Compass and Auto Pilot and Electrics are described under the Mods.concerned.

Section 11. Oil Pressure supply for Inductor Type Pressure Gauges.

The requirement was to provide a suitable pressure distribution box coupled to the engine oil output from which could be taken a number of pressure leads to the inductor gauges under test.

A pressure box was manufactured and tested to 300lb per sq.inch. and provided with five $\frac{1}{4}$" B.S.P. connections, one situated at the centre of the box for connection by a flexible hose to a locally manufactured Tee Piece inserted in the oil pressure indicator line. A further four connections located radially around the box provide means of supplying oil at engine pressure to the inductor units when installed, electric leads being taken from there to the fuselage for gauge indication. Provision is made for blanking off any connection when a particular line is not required. The pressure box is installed on the front upper portion of the Port Engine Firewall and is easily accessible.

Section 12 Type G.M.2 Compass (Figure 12 and 23)

Detector Unit

It was decided to install this unit inside the Starboard Mainplane at the position previously occupied by the American Fluxgate detector. This was achieved by using the existing shock mountings and manufacturing an adaptor plate to suit the G.M.2 component. Access is obtained by means of a screwed panel in the upper surface of the mainplane. Cables are led through the mainplane and centre section, suitably cleated, into the fuselage and connected to the amplifier which is mounted on the rear instrument panel, as shown in Figure 12 , the Master Indicator being shown in the same Illustration. The Repeater is fitted on the front instrument panel and cables from this unit are led forward to the Controller fitted at the centre of the main instrument panel forward of the engine controls shown in Figure 23.

Section 13 Pitot Static System

The requirement was that Pitot Static pressures be made available at the rear of the fuselage instrument panels and at the Auto Observer position.

The normal Pitot system for a Dakota provides two Pitot static heads mounted one above the other, the bottom head providing pressure to the First Pilot's Panel and the top to the Second Pilot's Panel, a common static line serving both Panels.

The system was modified so that the bottom head served both Pilot's Panels, leaving the top one to serve instruments

in the rear fuselage, thereby ensuring that Pilot's instruments were operated by a system which was divorced from the experimental side.

Lines were run from the nose fuselage section to the Stbd. and Port sides of cabin and suitable tappings taken off at the points required behind the fuselage instrument panels and at the auto observer position.

PART 4 SUMMARY OF EQUIPMENT DETAILS

Section 1. Introduction

The usual arrangement for obtaining equipment on Embodiment Loan was applied to this Contract. Permission was given to use A.O.G.Experimental Priority for demanding, which proved to be very efficient, at no time was work delayed through demands not being met.

Special Tools and ground equipment were not demanded, as these were already held by the Flight Department at Cranfield being their own property. Civil Modifications and special equipment not being available from R.A.F. Maintenance Units was supplied by the Contractor. In this respect valuable assistance was given by S.Smith & Sons in supplying instruments and equipment for the conversion.

As the aircraft had changed completely during Modification regarding equipment installed, advice was sought from No.1 Equipment Accounting Centre concerning action to be taken when the aircraft was delivered at the end of the Contract. On instructions received, the following Section 2 to 6 of this Part of the report are appended.

Section 2. Equipment alterations affecting Checking List.

(a) Equipment Removed

Ref. No.	Description	Qty.
126JQ/BC348N	Radio Receiver	1
126JQ/BC461A	Reel Control Box	1
126JQ/Type BC.457 Command	Radio Transmitter	1
126JQ/Type 458A Command	" "	1
126JQ/36B5856	Dynamotor Type PE73	1
126JQ/Type BC306A	Antenna Tuning Unit	1
126JQ/34D5889	Trans Tuning Unit 5B	1
"	" " " 10B	1
"	" " " 9B	1
"	" " " 6B	1
"	" " " 26B	1
"	" " " 7B	1
"	" " " 8B	1
126JQ/36D5854	Radio Trans Type BC375E	1
10B/16025	Aerial Loading Unit	1
5U/2548	Panel Control Type 9	1
126JQ/HS33	Head Sets	4
126JQ/35D3887	Microphone Type T17	5
106F/22	Safety Harness	14

(b) Equipment Additional to Checking List received with the Aircraft from Henlow.

Description	Qty.
Axes Fire	2
Lamps Anglepoise	1
Steps Door	1
Pistol Signal	1
Compass P12	1
Rec.Trans.Amp RT7-APN-1	1
Accumulator 12 V	2
Switch Limit Altitude	1
Indicators Altitude	1
Filter Colour Type 51	1
" " ". 52	1
Indicator Radio Compass	1
Rec.Radio Compass R5ARN-7	1
Box Control C4ARN-7	1
Trans.Rec. TR.5043	2
Power Unit 5016A	1
Controller Elec	2
Rec. B.C.453B	1
" " 454B	1
" " 455B	1
Modulation Unit BC456R	1
Amplifier BC347C	1
Dynamotor PE86	1
Amplifier Packard	5
9C/1 Medical First Aid	2
Pilots Note C/W Holder	1
Dynamotor DM.32A	3
" " 33	1
Box Control BC450	1
Power Unit 5016	1
Box Control 451	1
" " 732A	1
Antenna Relay 442AN	1
Rec.BC.733D	1
" " 357J	1
" " ARN5A	1
Indicator Type 101	1
Frequency Meter	1
Rotary Convertor	1
Boxes Jack	5

Equipment Deficient from Checking List as Aircraft received from Henlow.

82 C
67 D
118 D (less 3)

Section 3. Other Equipment Removed

Sect.Ref.No.	Description	Qty.
126JQ/G3110	Unit, Auto Pilot-Jack & Heintz	1
126JQ/43B2330	Bracket assembly, litter webbing strap	36
126JQ/43G1953-3	Strap assembly, litter webbing, inboard	12
126JQ/5205362	Bag assembly, strap type litter stowage	12
126JQ/5140177-22	Block assembly, equip't loading ramp	1
126JQ/4140111	Deflector assembly, winch, cable secondary	1
126JQ/SPEC95-32274	Generator engine-driven, type 01	2
126JQ/AN5735-1	Directional gyro indicator	1
126JQ/AN5820-1	Turn & Bank indicator	1
126JQ/AN5825-1	Rate of climb indicator	1
126JQ/AC20848	Altimeter	1
126JQ/AN5730-2A	Indicator, Magnesyn, remote indicating compass	2
126JQ/AN5730-3	Transmitter, magnesyn, remote indicating compass	1
126JQ/AW17-8-18	Pressure gauge, Auto pilot,oil	1
126JQ/SPEC94-32284	Ammeter 0-150(with external shunt)	2
126JQ/AN5822-1	Filter, air, vacuum operated instruments	2
6J/601	Unit directional control, Jack and Heintz	1
126JQ/4141199	Unit air filter	2
126JQ/24998	Fire extinguisher, Cyl. & valve assembly,Kidde.	1
126JQ/5140604	Installation, glider tow	1
126JQ/C21P	Extinguisher-bracket & fire, Pyrene	1
126JQ/85	Extinguisher-bracket & fire, Foamite	1
126JQ/5141392	Box, assembly, parachute pack control.	1
126JQ/18372	Panel, control, Kidde	1
126JQ/2074412-3-4-33200	Cable assembly, swaged type, ¼" dia.	1
126JQ/5139978-32	Beam assembly, aft seat, support right side	1
126JQ/5139978-30	Beam assembly, forward seat, support right side	1
126JQ/5113184	Bench assembly, passenger, 5-place	3
6J/1003	Unit, bank & climb, control, Jack & Heintz	1
6J/1006	Oil filter for A/3 Gyro pilot	1
6A/1498	Artificial horizon	1

Sect.Ref.No.	Description	Qty.
6A/1294	Air speed indicator	3
6A/685	Altimeter	1
126JQ/4113219	Sheave assembly- cargo cable deflectors	1
126JQ/B3050	Trap- auto pilot oil drain- Jack & Heintz	1
126JQ/4112104	Beam-engine tie-down	4
126JQ/J4000-1	Unit-auto pilot mounting- Jack & Heintz	1
137B/	Plugs sparking "Champion/C355	56
137J/AN6100-3	Pump assembly 2 G.P.H.fluid metering	1
137C/395009-5	Injection Carburettor PD-12F2	1
127B/593	Regulator Assembly 11" diam.- oil	2
127A/885	Brake assembly	4
127A/679	Wheel & bearing assembly 22 x 9.00 x 6 split rim	1
126JQ/5171474	Heat exchanger assembly	1
126JQ/5110509-1	Tank assembly aux.,fuel, R.Hand	1
126JQ/5110508-1	Tank assembly.Main,fuel, R.Hand	1
5C/2472	Switch relay	1
126JQ/RL42B	Trailing Aerial Motor	1
10F/126	Switch Unit Type "J"	1
5U/2399	Rotary Convertor Type Z	1
126JQ/H43G18902	Antenna	2
10FB/366	Switch Unit Type 78	1
126JQ/F10	Fairlead Trailing Antenna	1
126JQ/FT151	Mounting Transmitter FT-151-A	1
10BB/529	Aerial	2
10B/13179	Aerial	1
126JQ/FT247F	Mounting Rack	1
126JQ/WT7	Bead Weight Antenna	1
5C/543	Switch	4
5C/430	Terminal Block	1
5C/432	Terminal Block	2
10AB/858	Mounting Rack	3

Section 4 Equipment Installed - Embodiment Loan

Ref.	Description	Qty.
10X/6510	Crystal	1
10X/6550	"	1
10X/6650	"	1
10X/6750	"	1
10X/8500	"	2
10X/6805.55	"	1
10X/6827.78	"	1

Ref.	Description	Qty.
10X/8090.77	Crystal	1
10X/8146	"	1
10X/8284.62	"	1
10X/8423.08	"	1
10X/8530.78	"	1
10XJ/6683.33	"	1
10XJ/6783.33	"	1
10XJ/6794.44	"	1
10XJ/6805.55	"	1
10XJ/6838.89	"	1
10XJ/8330.76	"	1
10XJ/8469.23	"	1
10XJ/8484.62	"	1
10XJ/8546.15	"	1
5C/430	Terminal Blocks	20
5C/432	" "	12
5C/445	Fuse Box Type "A"	5
5C/549	" " " "B"	1
5C/701	Lamps Cabin Standard	5
5C/719	Terminal Block Type "F"	7
5C/724	Dimmer Switch	5
5C/759	Links End	2
5C/760	Links Middle	6
5C/761	Fuse Box Type "D"	1
5C/868	Terminal Blocks 5 way	19
5C/883	Fuse Box Type "F"	1
5C/884	Links End	12
5C/885	Links Middle	36
5C/886	Fuse Box 8 way	6
5C/1079	Lamps Anglepoise	3
5C/1553	Indicator Lamp(Red)	5
5C/1892	Cover	1
5C/2007	Relays Waymouth RA3	2
5C/2091	Switch Push	2
5C/2472	Switch Type K3	2
5C/2564	Circuit Breaker	1
5C/2853	" "	1
5C/2967	Suppressor Type "O"	3
5C/3945	Relay SMR Type S4	1
5C/4184	Switch SP on & off	6
5C/4197	Switch Change over	1
5C/4310	Torque Switch Type "B"	1
5LX/951230	Lamps Fil'. 24 V 2.8 W	8
5LX/952254	" " 24 V 6 W	5

Ref.	Description	Qty.
5LX/952295	Lamps Fil'. 24 V 12 W	5
5LX/952404	" " 24 V 30 W	4
5LX/953202	" " 24 V 16 W	20
5X/6131	Plug Single	1
5X/6132	Bulkhead Plug 26 way	1
5X/6134	Socket	1
5X/6135	Socket Reverse	1
6B/1465	Holder Watch	1
6D/815	Oxygen Masks	6
10H/9340	Mountings Anti Vib.	8
10A/12160	Headbands	6
10A/12161	Ear Pads	12
10A/13466	Ear Pieces	12
10A/14381	Microphones	6
10A/17621	Mountings Shock Absorber	4
10CV/531	Valve VT.169	1
10CV/664	" VT.202	1
10CV/665	" VT.203	2
10CV/694	" VT.209	1
10CV/1088	" VT.118	2
10CV/1926	" VT.198A	1
10F/10338	Switch Type 152	6
10H/2206	Sockets Type 359	16
10H/4887	Connector	6
10HZ/560090	Socket Mk.IV	1
10HZ/560100	" 3 pin Mk. IV	1
10HZ/970061	Outlet Straight	1
27N/70	Extinguishers Fire	4
27N/72	Flame Switch	2
27N/84	Extinguishers Fire	3
27N/85	Brackets	7
105C/1314	Relay Current	1
105L/46	Lamps 28 V	6
105G/11	Adaptor Socket	1
105L/93	Lamps Fil'. 28 V 6 CP	12
105U/1895	Rotary Invertor	1
106F/22	Belt Safety	1
110D/465	Transmitter	2
110Q/21	Indicator Type 101C	1
126JQ/5110508-1	Tank Fuel Assy R/H	1
126JQ/5110509-1	" " " "	1
126JQ/5171474	Heat Exchanger Assy	1
127A/679	Wheel & Bearing Assy	1
127A/885	Brake Assy	4

Ref.	Description	Qty.
127B/593	Regulator Assy	2
137B Type RS19/2R.	Plugs Sparking	56
137C/395009-5	Injection Carburettor	1
137J/744-6A	Pump Assy	1

Section 5 Equipment installed Contractors Supply Description

Dakota Mod.S.599A	1 set
" " S.617	1 set
" " S.607	1 set
" " S.622	1 set
Seats Passenger	3 pairs
Control column gaiter Mod.	1 set
Control Cable M150/A	2 off
" " M150/B	1 off
Wright & Weaire Tape Recorder Model REH(1)	1 off
Spares Box for Tape Recorder	1 off
Code 74AM Altimeter	1 off
Code 129AS. Air Speed Indicator	1 off
Code 20RC/PC Rate of Climb Indicator	1 off
CodeSC135 Cable Harness Gyro Compass	1 set
CodeS11 Selector Switch " "	1 off
Code TE1515 A.C.Voltmeter	1 off
Code TE1517 D.C.Voltmeter	1 off
Code S109 Frequency Meter	1 off
Code 6A/742 Compass Repeater	1 off
Code SN3615 Warning Lamps	4 off
Code STD321 Plug 6 way fixed	2 off
Code STD333 Sockets 6 way fixed	2 off
Code 151FL Desynn Indicator	8 off
Code SN3615 Power Supply Cables	2 off
Code 129FL Desynn Transmitter	3 off
Code XAL2496 Blind Flying Panel	1 off
Code SN3615 Power Cables for B.F.P.	3 off
Code SKR273 Junction Box 3 way	2 off
Code XAC2507 Instrument Panel	1 off
Code V951 GM. 2 Compass Gyro Unit	1 off
Code V953 " " Amplifier	1 off
Code V959 " " Master Indicator	1 off
Code V808 " " Junction Box	1 off
Code V800 " " Detector Unit	1 off
Code V805 " " Control Unit	1 off
Code V954 " " Amplifier Mounting	1 off
Generators 5 kw. C/W Shunts	2 off
Ammeter 0-300	2 off

Section 6. Equipment installed Property of S.Smith & Sons Ltd

Code No.	Serial No.	Description	Qty.	Location
129AS	511/26	A.S.I.	1	Auto Observer
74AN	4839/24	Altimeter	1	" "
5ACA	63408	Clock	1	" "
-	-	Vinten K Camera with case	1	" "
-	-	Panel Instrument	1	" "
27RC/PC	-	Ind.Rate of Climb	24	Fuselage Inst. Panel
48720	-	Clock	1	Pilots Inst. Panel.
Type 8A	-	Invertor	2	Rear Fuselage
Type 103	-	"	1	" "
Type 1203	-	Invertor & starter	1	" "
Type 15	-	Control Panel	1	" "
-	-	R.AA.E.Wind Vane	1	Front Fuselage
-	-	Stick Force Trans-mitter	1	2nd Pilot's Stick
-	-	Amplifier Mounting	1	Fuselage Inst. Panel.
-	-	Coupling Unit Mounting	1	- do -
11AH326	326	Artificial Horizon	1	Blind Flying Panel
-	-	Servo Mounting Adaptors	3	Auto Pilots Unit
-	-	Nut Rings	6	- do -
-	-	Servo Motor Mountings	3	- do -
V294/1		Turn & Slip Indicator	1	Pilots Panel

PART 5 DESIGN APPROVAL

The detail parts of the servo-motor mountings and mechanism were stressed to carry a load equivalent to the maximum torsional strength of the output shaft of the motor. All parts were shown to have an adequate reserve factor.

An analysis of additions to the electrical system was prepared showing that the additional demand is covered by additional generator capacity with an adequate margin.

An analysis of the flying controls under auto-pilot operation was made, based on flight trials under manual control with stick force and control surface deflection indicators in use(Flight Test reports Nos. 1, 2, 9).

This satisfactorily proved thatif there was a fault in the auto-pilot leading to a run-away of any servo-motor:-

1. the maximum and minimum permissible normal accelerations on the aeroplane structure would not be exceeded

2. the loads imposed on the fin would not be greater than those from which it was originally designed.

3. the maximum permissible aileron angle would not be exceeded at any speed.

When runaway trials were carried out the results of this investigation were confirmed (Flight test report No.10).

Subsequently the Air Registration Board required further trials and design investigation of the effect of change of C.G. position and trim change on the elevator runaways. These were carried out(Flight Test report No.17) and analysis showed that the worst combination would not exceed the structural limitations of the aeroplane.

The design calculations were collected in the form of an Addendum to Type Record and copies were supplied to :-

Air Registration Board

M.O.S. (R.D.Inst.6).

Smith's Aircraft Instruments Ltd.

Certificate of Airworthiness

The Certificate issued on Nov.2nd places the aircraft in sub divisions G & H being an experimental & demonstration category but permits non fare paying passengers to be carried. No operating limitations have been imposed although it is normal for the Air Registration Board to specify a minimum height at which the Auto Pilot will be operated. So as not to restrict the aircraft during trials an arrangement has been made between the Board & Smiths Aircraft Instruments regarding the safe operating height. A physical limitation has however been imposed which lays down that the Pilot must be strapped in when the aircraft is flying with the Auto Pilot in operation.

PART 6. FLIGHT TRIALS

Work on the aircraft was completed early in June ready for initial Flight, but complete stress clearance for the Auto Pilot installation was not at that time permissible, owing to lack of essential basic information regarding the aircraft structure. Assistance was requested in this direction from the U.S.A. by M.o.S. R.D. Inst.6, but as delay was inevitable clearance for Flight had to be obtained from the Air Registration Board.

At a meeting held with the Board it was decided to allow flight trials to proceed operating under "B" conditions, i.e. the aircraft would be permitted to fly with certain restriction without a Certificate of Airworthiness. This concession is

vested only in Design organizations holding A.R.B. Approval and applies usually to prototype aircraft.

It was agreed by R.D.Inst.6 that to permit test flying it would be convenient to run two Contracts concurrently i.e. the College Contract for the conversion and Smith's Aircraft Instrument Contract for operating , this was put into effect the first flight being carried out on June 9th. Subsequent test and handling trials were then completed, the aircraft finally being accepted by Smith's on June 29th. From that date until Nov.2nd when the Certificate of Airworthiness was issued, the aircraft continued to fly at Cranfield operated by Smiths Aircraft Instruments. A total of 84½ hrs.were flown operating under "B" conditions.

A.R.B. Flight Tests.

Introduction

Prior to granting a Certificate of Airworthiness, the Air Registration Board required test flights to be carried out to complete Dakota IV Flight Test Schedule No 12. This includes reports on the behaviour of engines, (both on the ground and in the air under various operating conditions), the handling of the aircraft under simulated emergency conditions and the functioning of certain ancillary equipment. Exhaustive tests of Radio equipment(V.H.F.sets, H.F.set, I.L.S. installation, and Radio Compass) were also called for, including polar diagram for both V.H.F.sets.

Report and Results

1. In accordance with the A.R.B. Flight Test Schedule the engines were run up on the ground, and found to be satisfactory.
2. Take off characteristics and engine readings normal
3. Climb after take off normal.
4. En route climb Starboard engine feathered was found to be up to A.R.B. requirements with engine R.P.M. 2,500. At 2,550 R.P.M.(as called for by A.R.B.) the propeller was on the fine pitch stop, and rate of climb suffered slightly, - by making a reduction of 50 R.P.M. performance was satisfactory.
5. Port engine feathered. As for 4.above
6. Engine readings and aircraft trim under standard cruising conditions were normal.
7. Stalling characteristics were good on the aircraft both in the cruising and landing configurations, - there was no tendancy to drop a wing in either case.
8. A simulated balked landing was carried out after normal approach with wheels and flaps down, - on overshooting, no abnormal characteristics were noted, and stick forces and trim positions were normal.
9. Engine failure was simulated by rapidly throttling the engine and feathering, - no abnormal features.
10. A maximum speed test(diving to 194 kts.) showed no proneness to control over-balance, or abnormal stick forces, - the propeller governing was satisfactory.
11. In the functioning test, controls, trimmers, flaps, gear, electrical system, instruments, de-icing gear, and other ancilliaries were all operated and found to be satisfactory.

12. Radio Air Tests

Functioning Tests.

(a) Both V.H.F. sets were given a functional and range test. This was done by calling Rugby on 119.7 m/c at 2,000' (20 miles range) and 6,000' (60 miles range) in both cases on both sets, performance was good.

(b) H.F. Functional and range check was carried out at 60 miles from the ground station, and although heavy static was encountered, the test was quite satisfactory.

(c) Radio Compass was exhaustively tested, both by automatic bearings and snap loop bearings, and a check air swing was carried out. This equipment is in good condition and results are well above average.

(d) I.L.S. installation was tested by measurement through localizer and glidepath beams, and a range check was carried out at 20 miles range at 2,000' both inbound and outbound. Although not called for by A.R.B. it is interesting to note that a good signal was obtained at 80 miles at 6,000' on the inbound leg.

(e) In addition to the tests in (b) above, the H.F. Command installation has been tested on the Watford and Hurn Radio Ranges with good results.

(f) Polar diagrams of both V.H.F. sets will be obtained by flying on precomputed tracks over Northampton, and measurements of the unmodulated signal will be taken by the Pailton ground station.

Conclusion

The Dakota test. Results were normal and well within the limits defined by the Air Registration Board for the issue of a Certificate of Airworthiness.

APPENDIX I

Inspection Survey Report

Airframe Total Hrs. 2926.25 since new.

Engine Port, Type Twin Wasp R.1830/90D, Ser. No.459984/623201
Total Hrs. 211.50 since overhaul.

Propeller Port, Type Hamilton A5/156, Ser.No.FC.6114
Total Hrs. 39 since overhaul.

Engine Stbd., Type Twin Wasp R.1830/90D, Ser.No.328816/601989
Total Hrs.211.50 since overhaul.

Propeller Stbd.,Type Hamilton A5/156, Ser.No.RR.1822
Total Hrs. 13.20 since overhaul.

1. Carry out Check IV to approved schedule DF/ENG/15/1
2. Removable radio equipment to be inspected to separate schedule.
3. The following A.R.B. essential Mods.to be embodied:-
   Scottish Aviation Mods. S.599,S.617, S.607,S.622,S.1095
   S.688,S.694.
4. The following A.R.B. essential mods were found embodied:-
   Scottish Aviation Mods. S.646 or 652,1097, 1099,1106,1107,
   Mod 1105 made inapplicable by Mandatory Notes App.
   A Iss. 2 Item 4
5. Mandatory Notes liated in Dak. Mandatory Note Summary Issue 2
   and App.A.Iss. 2 have been checked on Aircraft and the
   following notes require remedial action:-

   41-47-1 Control surface rebalance- required on Elevator

   44-7-1 Rudder hinge Bracket Bolts.

   44-15-1 New type Elevator Horns (also Mod.Dak. 1112)

   46-13-5 Replace Canvas control column boots with Rubber type.

   47-51-12 To Preclude carburettor icing.

   50-46-1 To prove feathering oil supply
   App. A Issue 2 Item 4- To make inoperative Non Ram air
   intake system.
   Item 8 To check Nav.lights for compliance with A.N.O. Sched.
   2 Sect. XII Para.66
6. Satisfy Notices to L.A.E.'s Nos. 5,15 and 35
7. Remove all Military Markings
8. Paint Registration letters on Wing and fuselage as per
   A.N.O's Article 8 Sched.1.
9. Modifications of aircraft to suit M.O.S. requirements on
   instrument installation, Smiths Type D Auto Pilot, installa-
   tion of test instruments, installation of passenger seats.
10. Bonding check of aircraft after conversion.
11. Weight and C.G. check E.W. painted on fuselage.
12. Civil log books to be raised for propellers, engines and
    airframe.
13. Fuel flow check to be carried out.
14. Compass swing to be carried out.

ILLUSTRATIONS

1. Aileron Servo Linkage viewed from under side of fuselage looking forward.
2. Aileron Servo Linkage viewed from under side of fuselage looking aft.
3. Aileron Servo and Desynn installation close up.
4. Aileron Servo installation showing position in main cabin.
5. Aileron Servo showing hinged protective cover in position.
6. General view of Rudder (Top) and Elevator (Lower) servos installed at the tail cone position of the fuselage showing mounting platform and attachment.
7. Rudder Servo Linkage showing method of connection to the aircraft rudder post.
8. Rudder Servo and Desynn layout viewed from starboard.
9. Auto Pilot Gyro Unit mounting table showing assembly in fuselage.
10. Parachute stowage with Auto Observor mounted on top, and Auto Pilot Gyro Unit.
11. & 12 General arrangements of instrument panels assembled in main cabin.
13. A.C. Distribution Panel on forward cabin bulkhead.
14. View in cabin looking forward, showing work table arrangement.
15. Auto Pilot Amplifier, Coupling Unit and Condenser assemblies mounted to fuselage panels.
16. Stick Force Transmitter assembled to Second Pilot's Control handwheel.
17. View showing Yawmeter final assembly.
18. Mounting of Yawmeter pole and attachment to fuselage frames.
19. Interior of cabin looking aft showing seat layout and rear bulkhead with door leading to invertor compartment.
20. Invertor station in rear fuselage opposite main entrance door.
21. Invertor station with maintenance panels removed.
22. Invertor station looking down as plan view showing layout of units.
23. View showing modified Pilot's Blind Flying Panel, mounting of Auto Pilot Controller, and G.M.2 Compass Controller.
24-26. External views of the aircraft.

DRAWINGS

M.145/1. Installation of rudder Servo motor

M.145/2. Installation of Elevator Servo motor

M.145/3. Arrangement of Mounting Platforms.

M.145/4. Detail of Operating Rods.

M.145/5. Mounting of Aileron Servo motor.

M.145/6. Arrangement of Aileron Servo Linkage.

M.145/7. Stop Plates.

M.145/8. Stop.

M.146/1. Fuselage Panel Rack.

M.147/1. Arrangement of Stick Force Transmitter mounting.

M.148/1. Table mounting for Gyro Unit.

M.149/1. Mounting of RAE Wind Vane.

M.149/1. Control cable inserts to replace Jack and Heintz Servo Unit.

C.A/DAIC/8 Sheet 1. Theoretical circuit of invertors and control gear.

C.A/DAIC/8 Sheet 2. Theoretical circuit distribution fuselage panels.

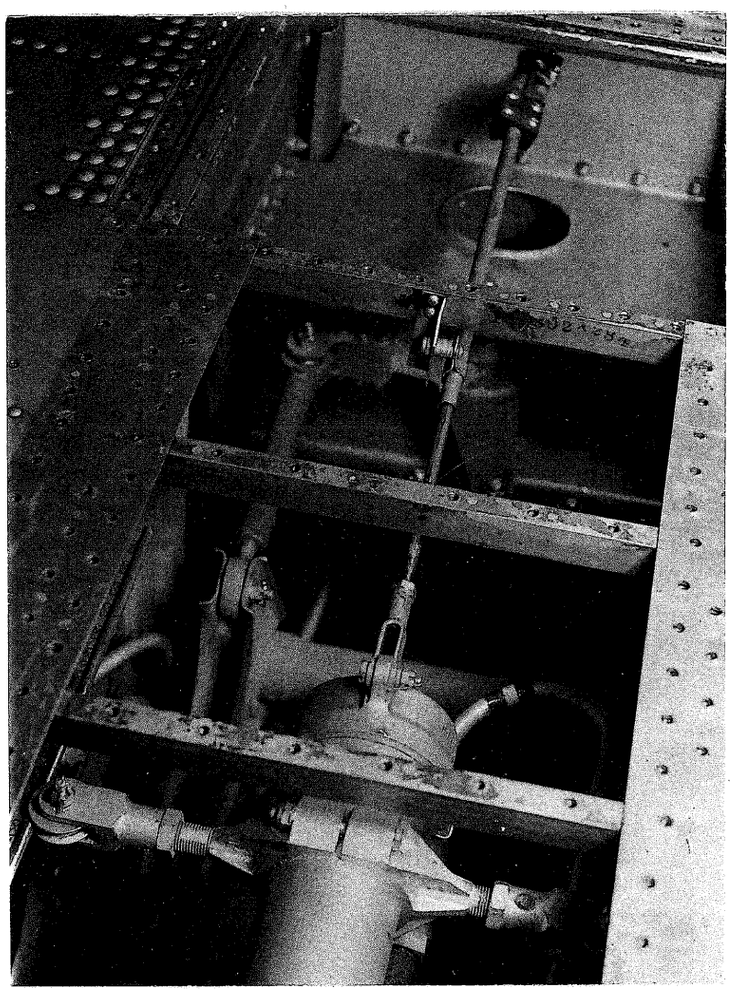


Fig.1. Aileron Servo Linkage looking forward.

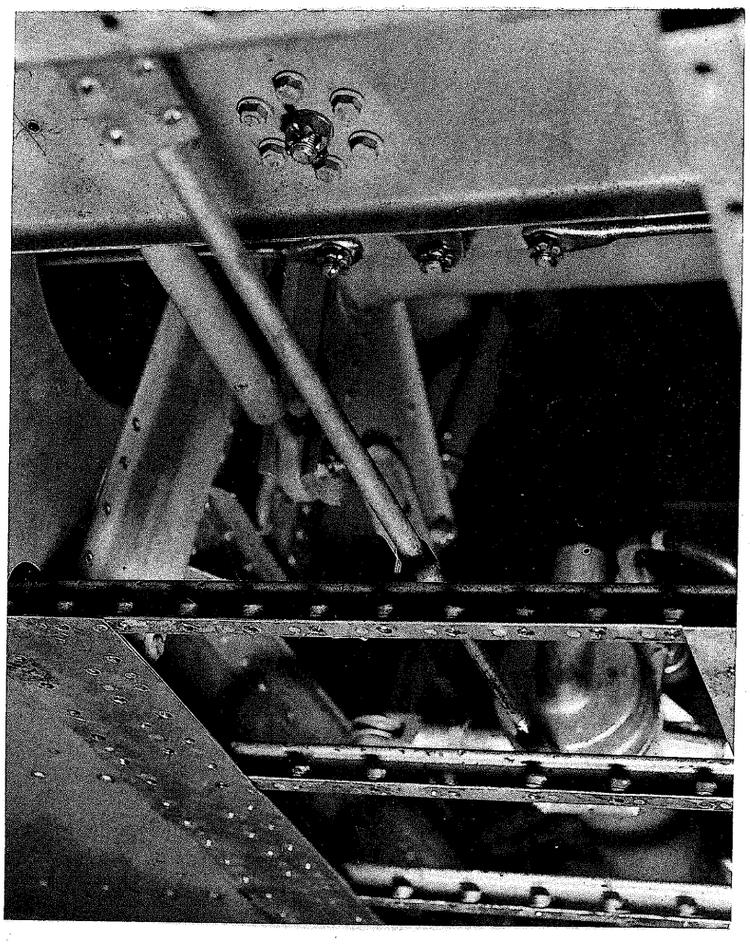


Fig.2. Aileron Servo Linkage looking aft.

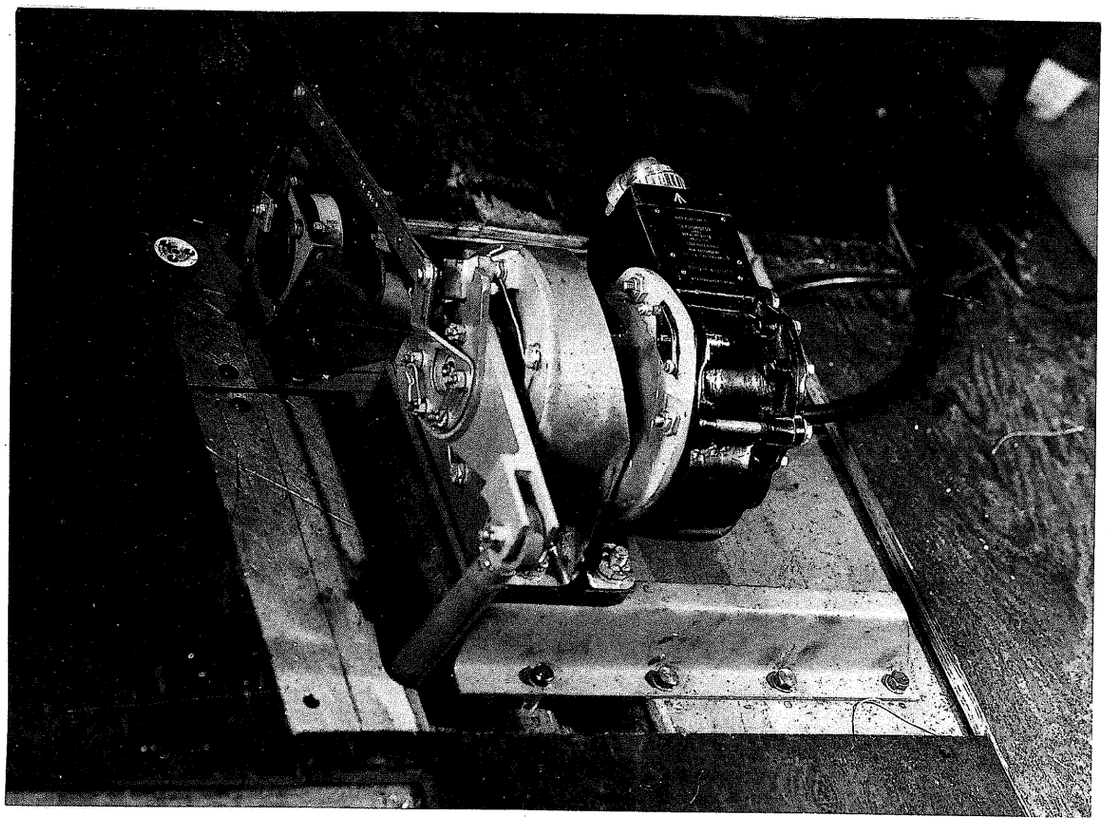


Fig. 3. Aileron Servo and Desynn installation

Fig. 4. Aileron Servo installation

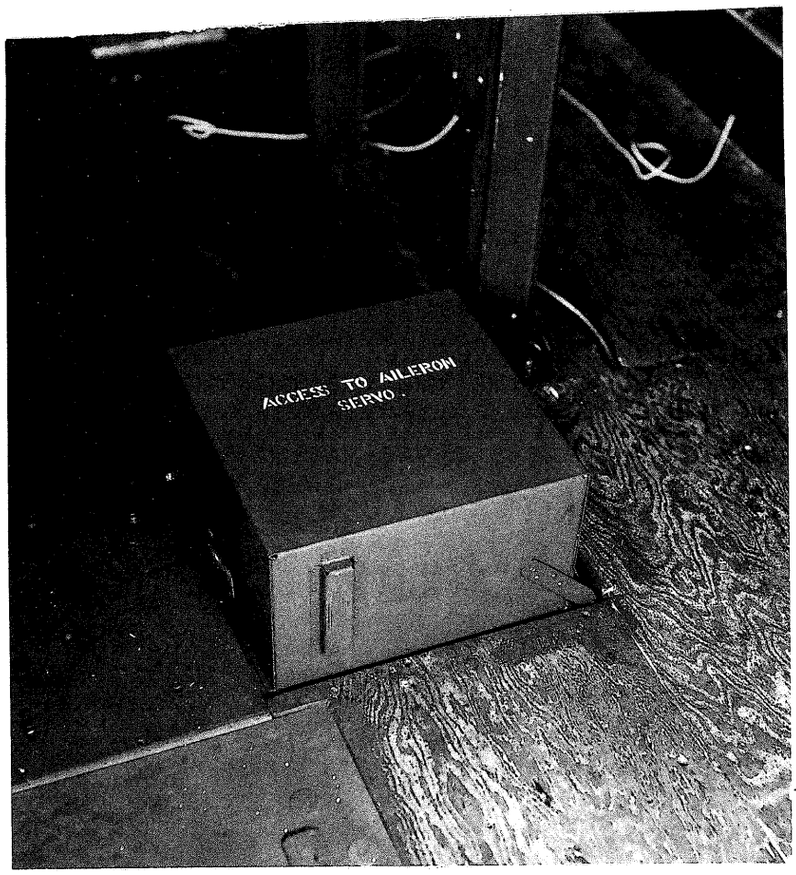


Fig. 5. Aileron Servo showing hinged protective cover in position

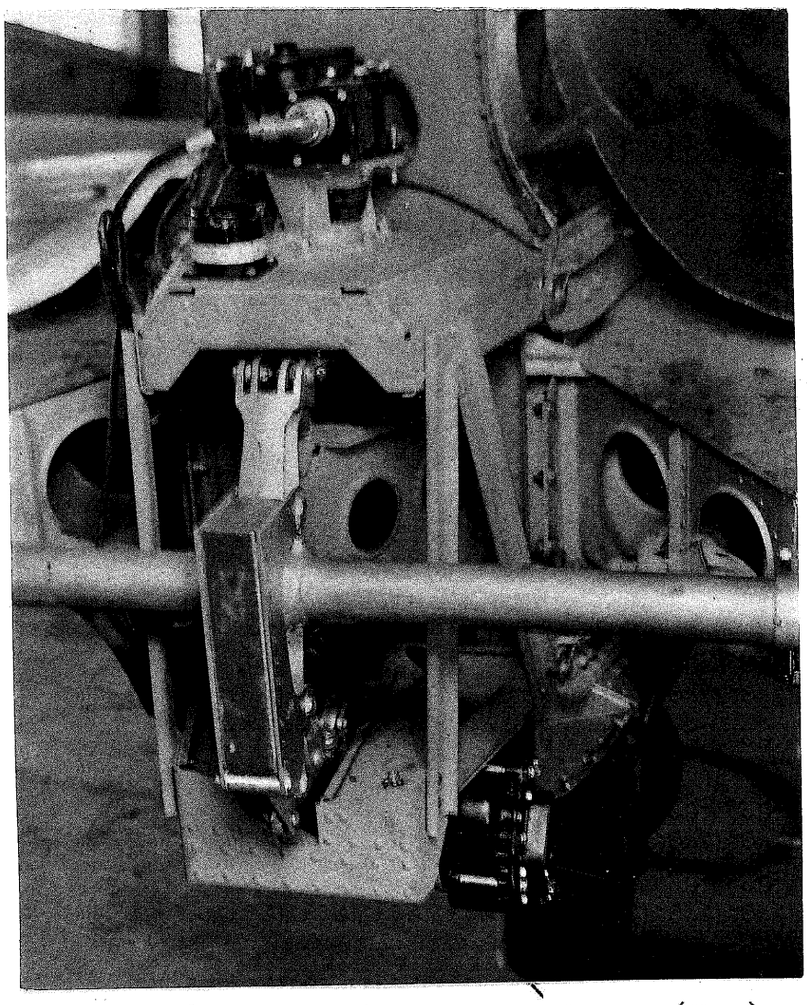


Fig. 6. General view of Rudder(Top) and Elevator(Lower)

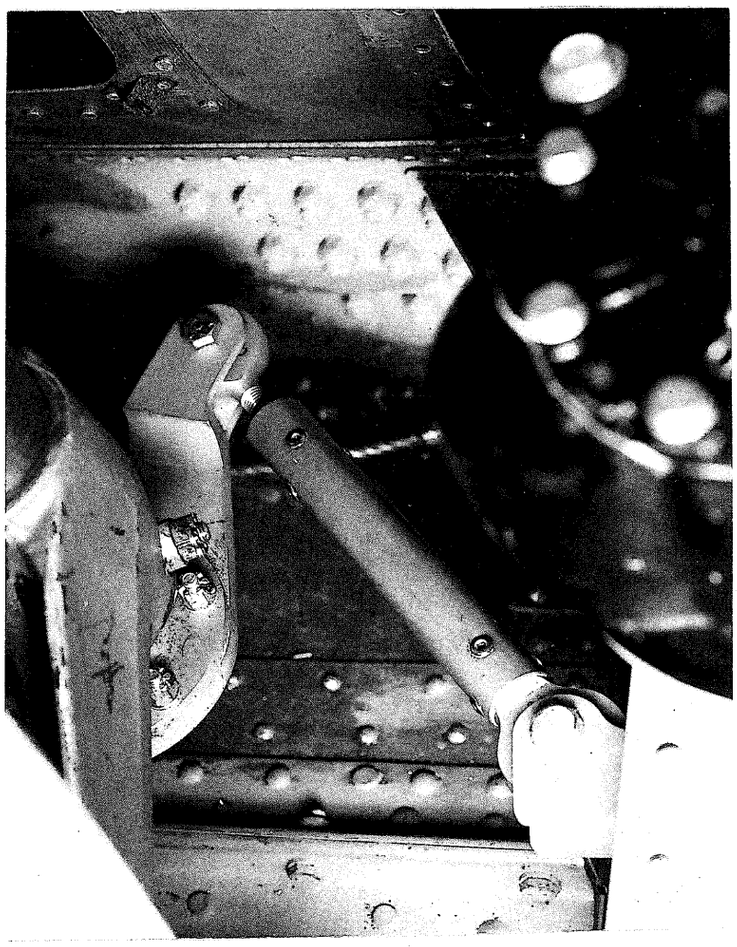


Fig. 7. Rudder Servo Linkage

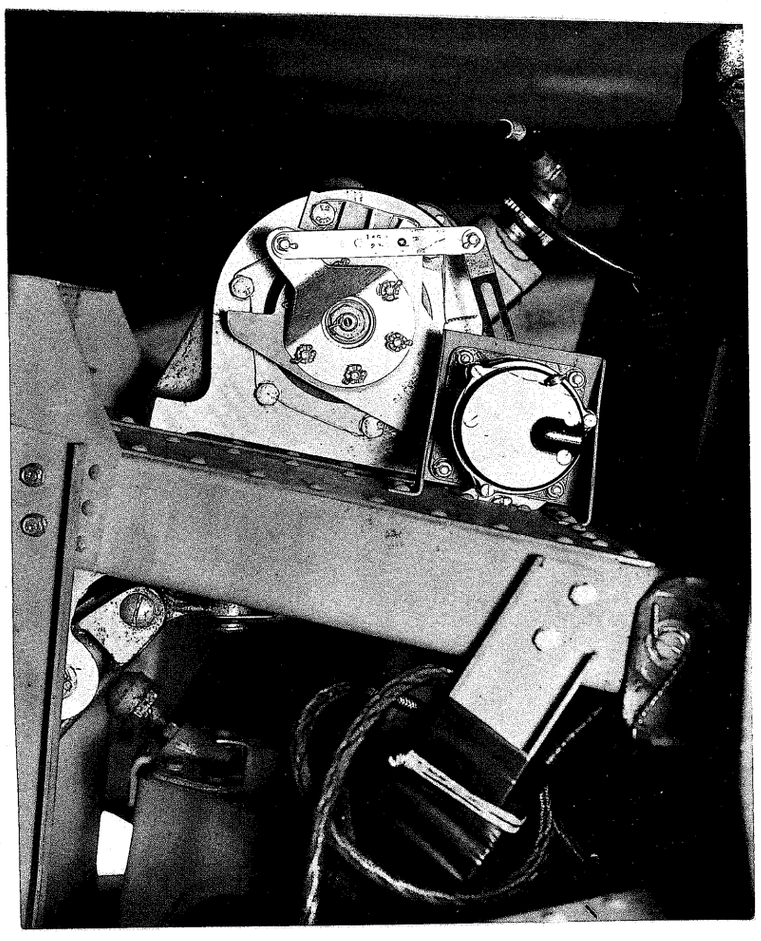


Fig. 8. Rudder Servo and Desynn layout

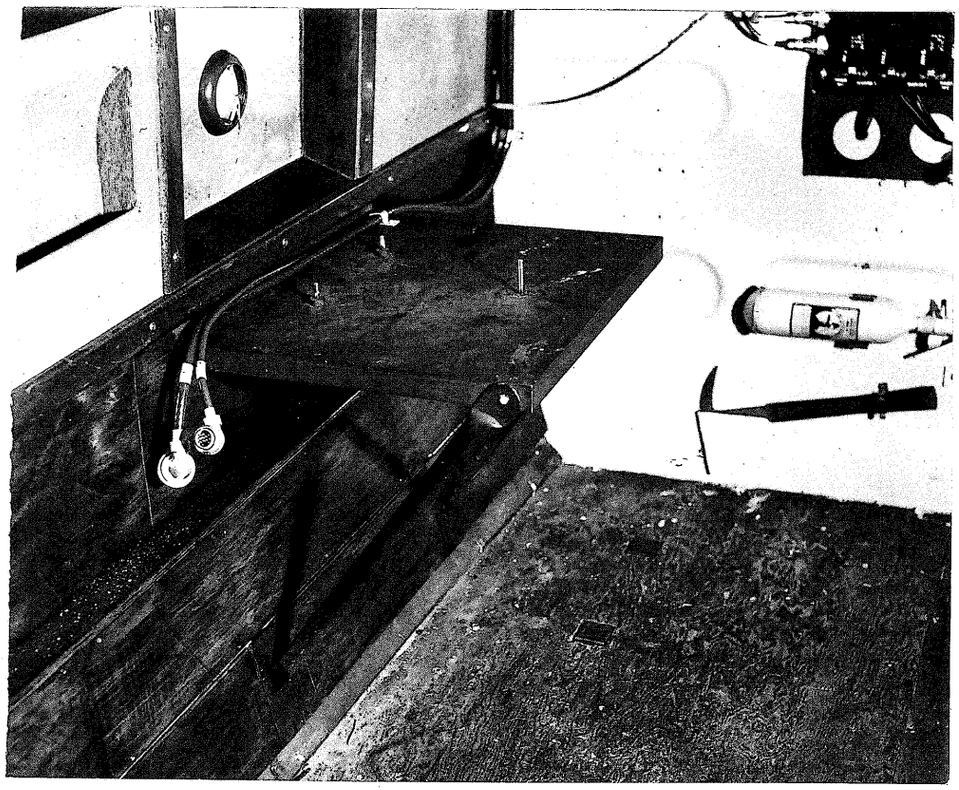


Fig.9. Auto Pilot Gyro Unit mounting table

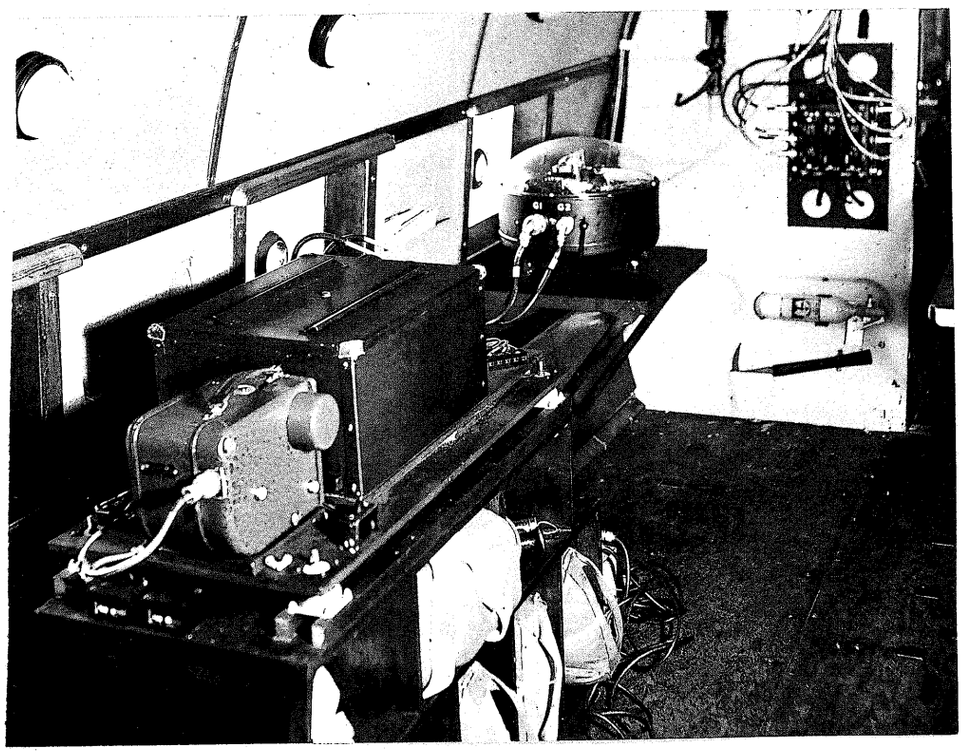


Fig.10. Parachute stowage with Auto Observer

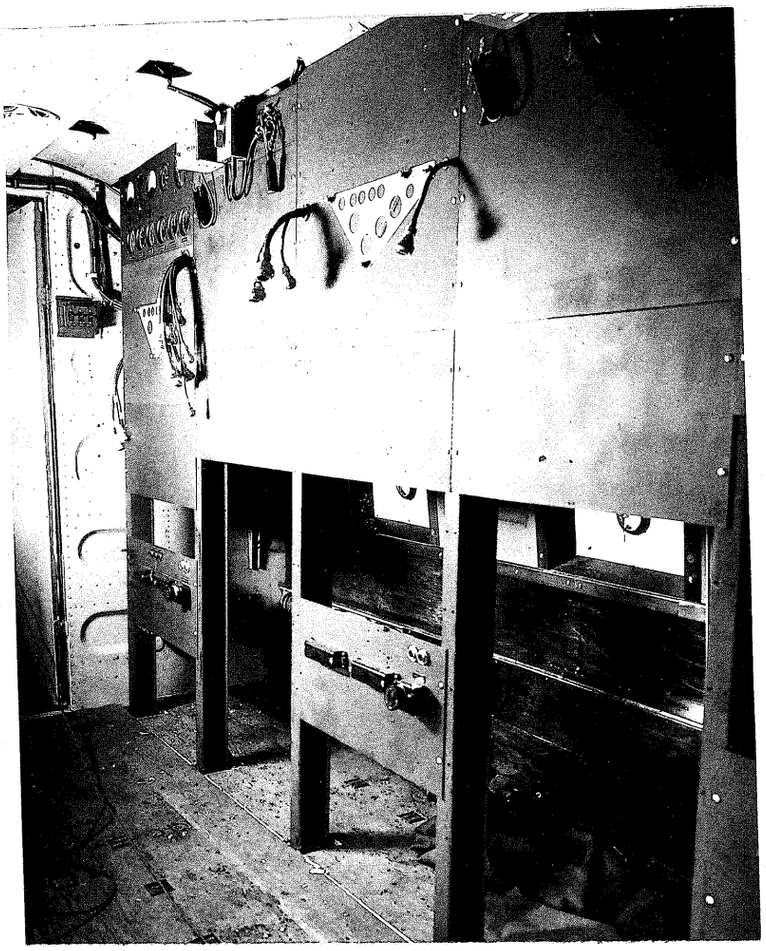


Fig.11. General arrangements of instrument panels

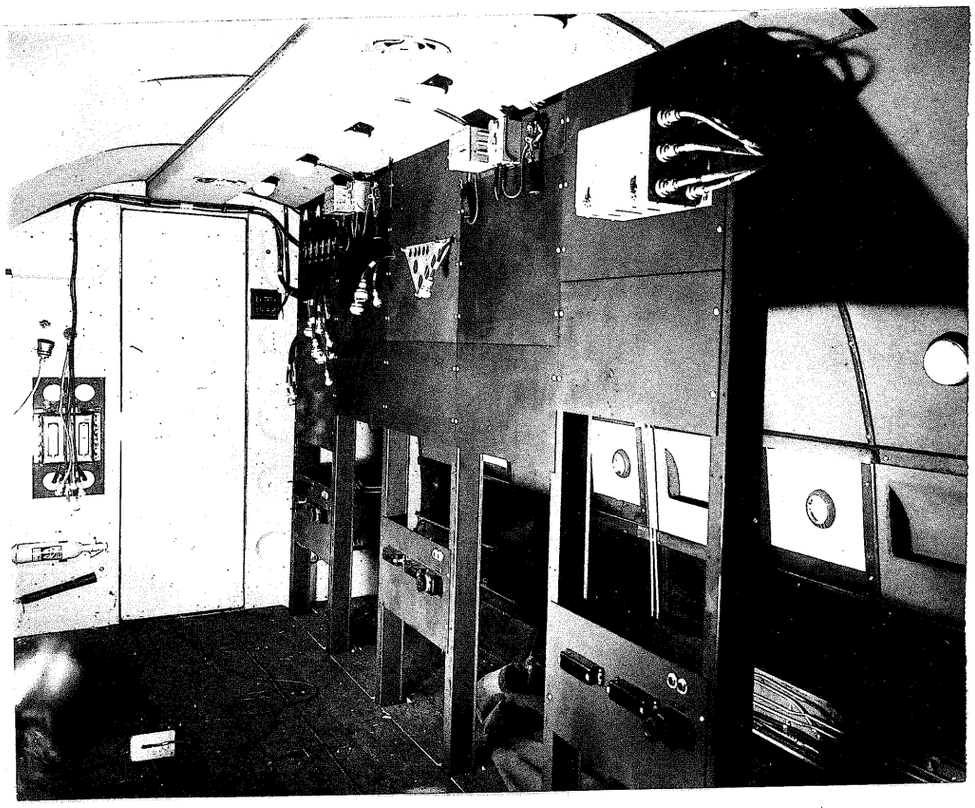


Fig.12. General arrangements of instrument panels

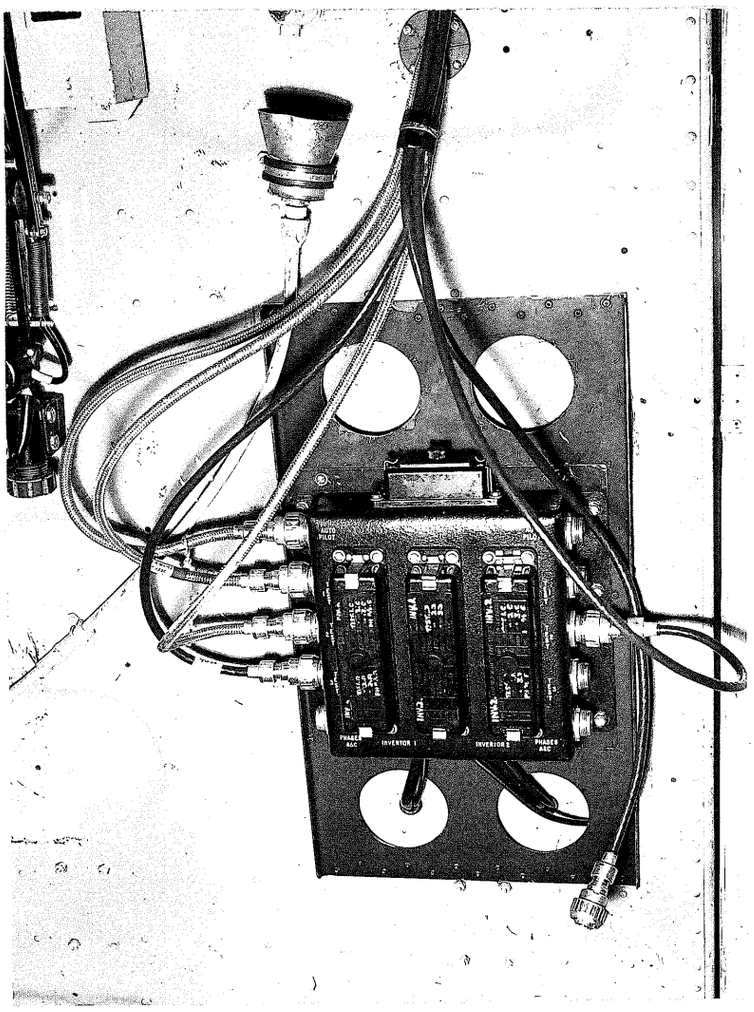


Fig.13. A.C.Distribution Panel

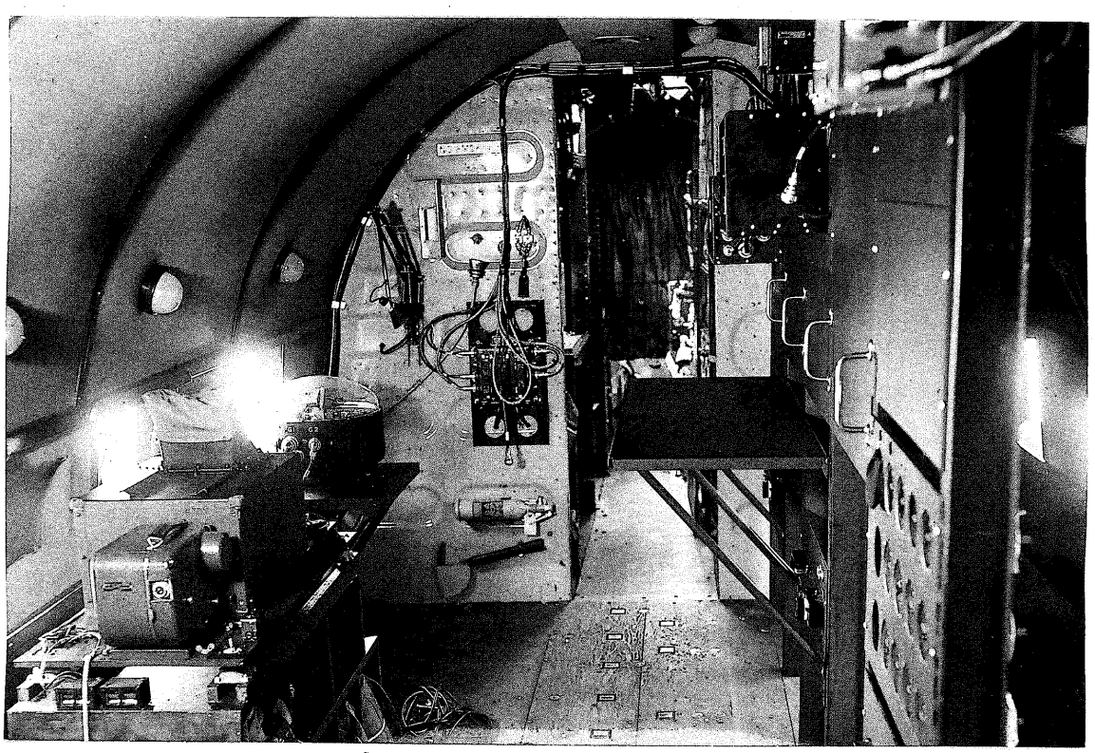


Fig.14. View in cabin looking forward

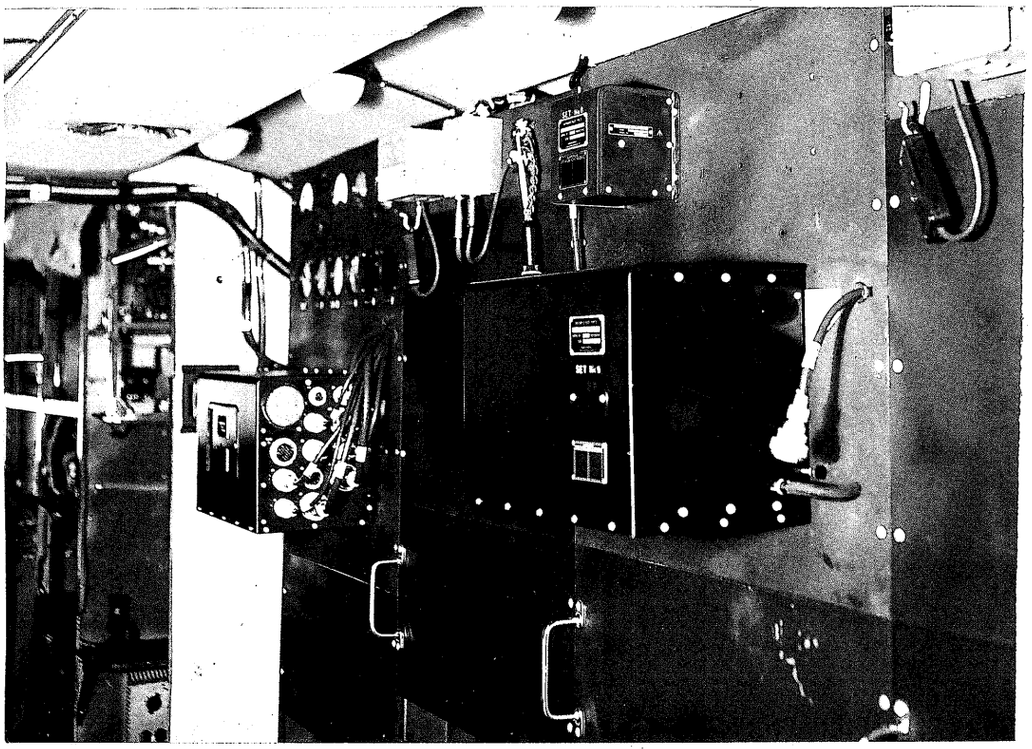
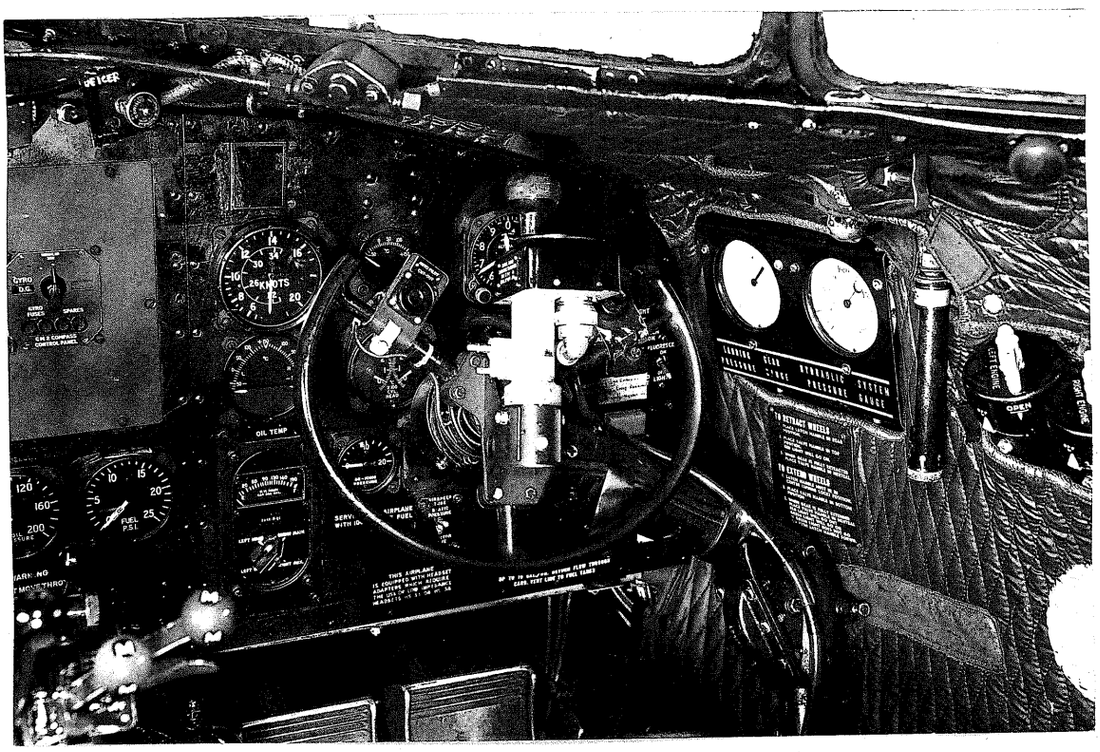


Fig.15. Auto Pilot Amplifier, Coupling Unit and Condenser assemblies



/Fig.16 Stick Force Transmitter

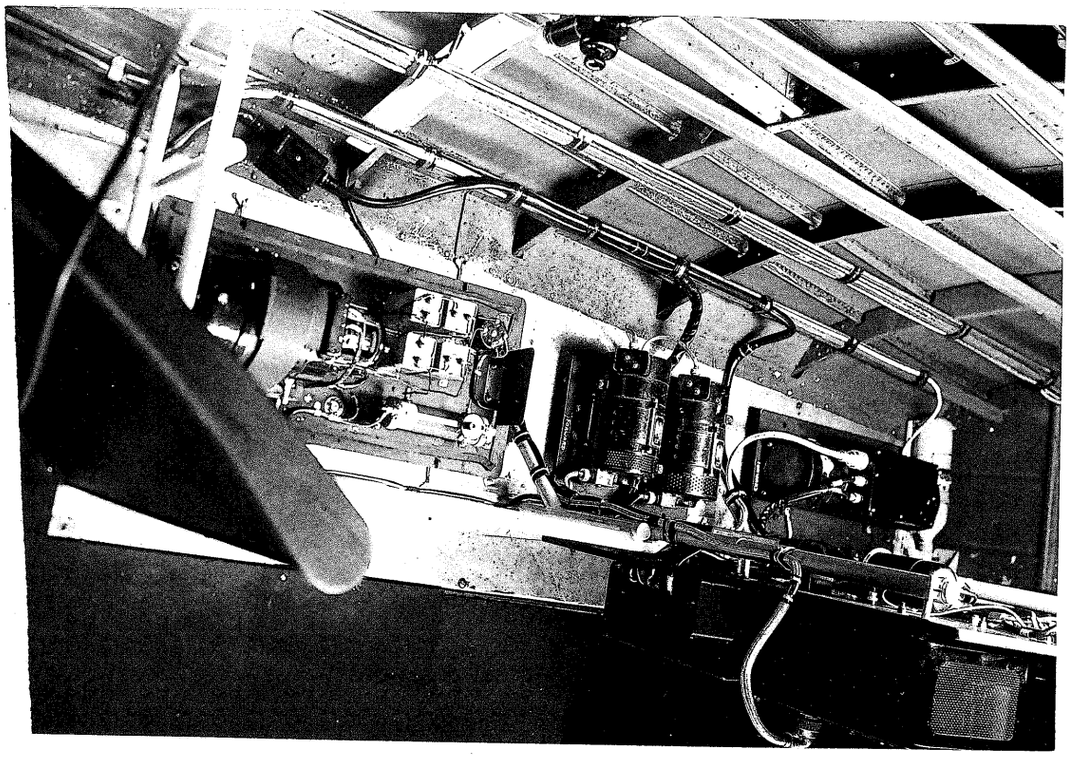


Fig.22. Invertor station looking down as plan view.

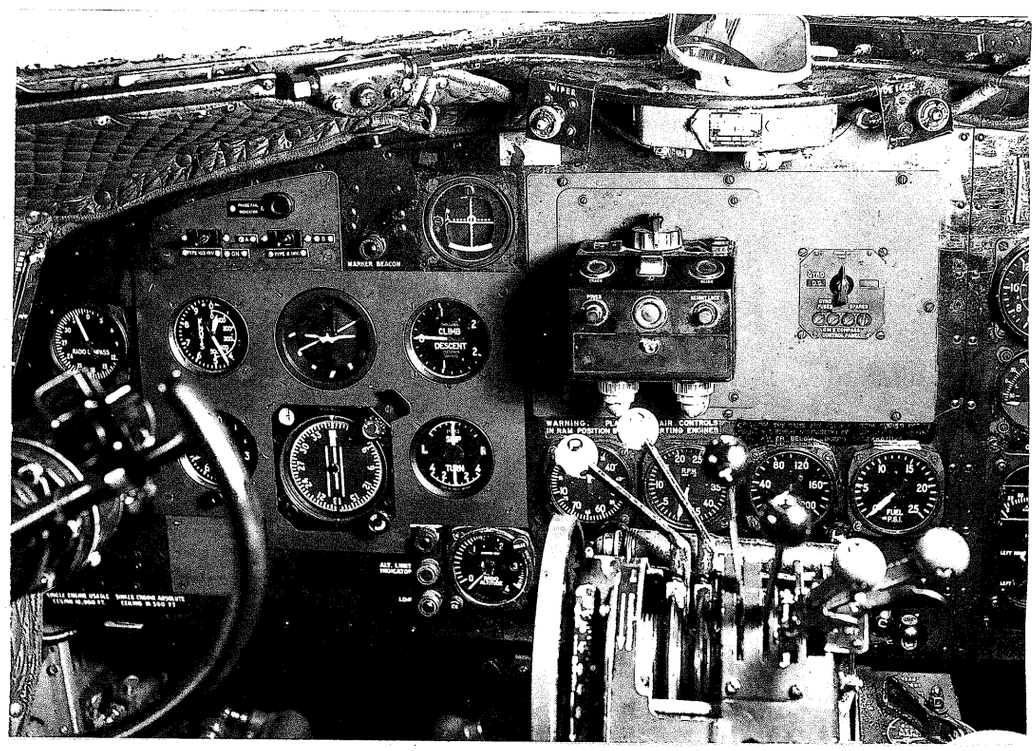


Fig.23. View showing modified Pilot's Blind Flying Panel.

Fig.20. Invertor station in rear fuselage.

Fig.21. Invertor station with maintenance panels removed.

Fig.19(a) Interior of cabin looking aft

Fig.19(b) Interior of cabin looking aft

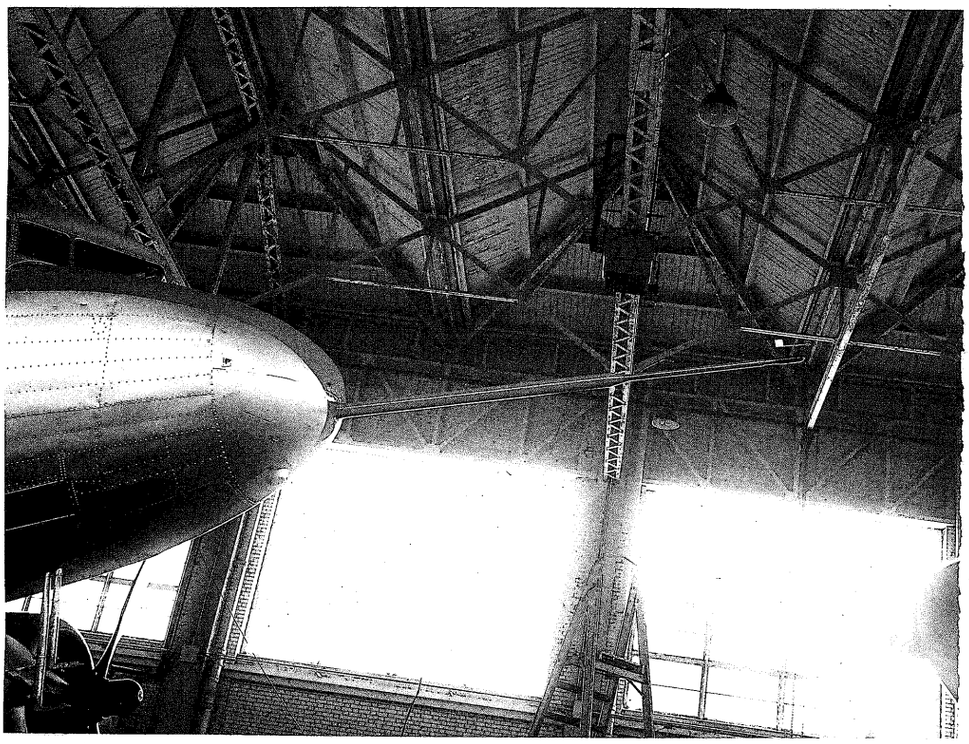


Fig.17. Yawmeter final assembly

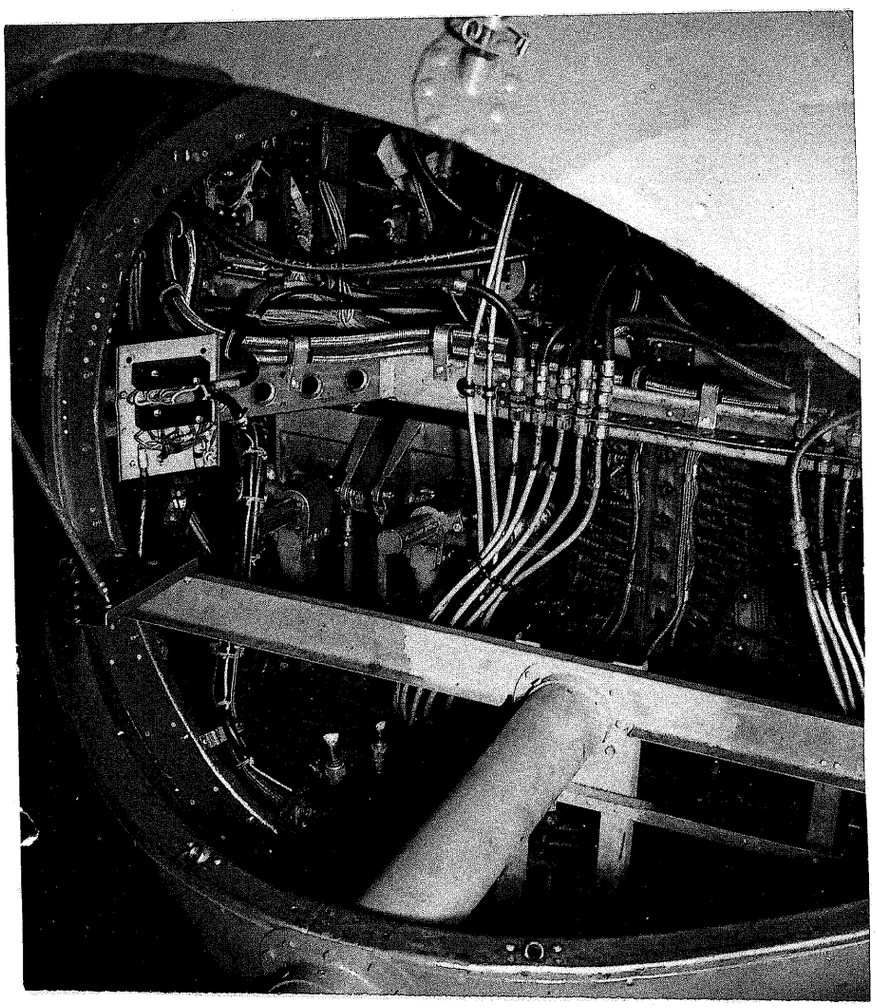
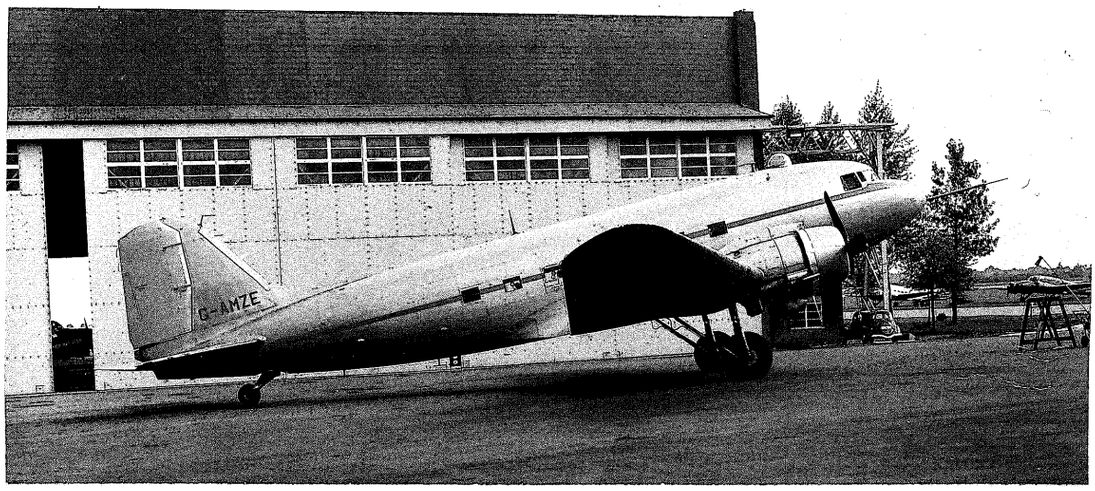
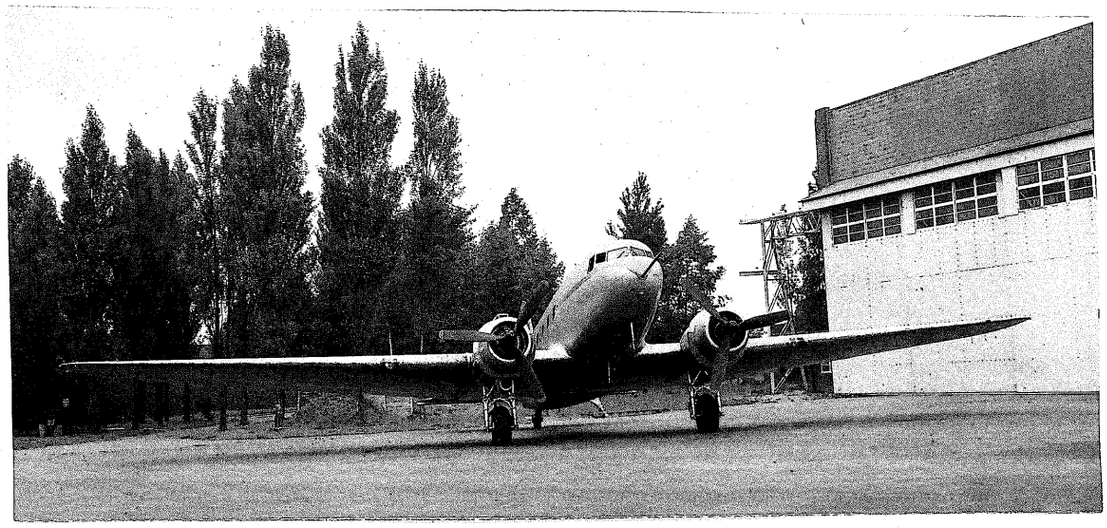


Fig.18. Mounting of Yawmeter pole





Figs.24-26. External views of the aircraft.