

RESTRICTED

A.P.4505C-P.N.

PILOT'S NOTES
VULCAN B. Mk. IA

RESTRICTED

October, 1961

PILOT'S NOTES
VULCAN B Mk 1A

*Prepared by Direction of the
Minister of Aviation*

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*Promulgated by Command of the
Air Council*

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Notes to Users

1. These Notes are complementary to AP. 129 (6th Edition) Flying, and reference should also be made to the Vulcan Operating Data Manual (AP. 4505C-OD).
2. The Notes are divided by Marker Cards into five Parts, each consisting of a number of Chapters listed on the Marker Card. The Flight Reference Cards, which are stowed in the pocket in the rear (inside) cover, are an integral part of the Notes and reference is made to them, where necessary, throughout the Notes. Further copies of the Cards can be obtained on demand to replace those damaged by constant use. When a Pilot's Notes amendment includes any amendments to the Flight Reference Cards, all copies of the current Flight Reference Cards must be amended when an Amendment List is received. The Flight Reference Cards are re-issued, when necessary, and each Amendment List to the Pilot's Notes states which Issue of Flight Reference Cards is current.
3. Throughout the Notes the Folio Sheet reference number is at the top left-hand corner of each sheet, each Part starting at FS/1. The following conventions also apply:
 - (a) Words in large capital letters in the text indicate the actual markings on the controls concerned.
 - (b) The numbers quoted in brackets after items in the text refer to the illustrations in Part I Chapter 22. The letter refers to the illustration and the figure to the item on that illustration, e.g. (B/15) refers to Fig. B, Item 15.
 - (c) Unless otherwise indicated, all airspeeds, altitudes, accelerometer readings and mach numbers quoted are indicated values.
4. The limitations quoted in Part II are mandatory and are not to be exceeded except in emergency. The contents of other Parts of the book are mainly advisory but instructions containing the word "must" are also mandatory.
5. Each Amendment List instruction sheet includes a list of Special Flying Instructions and a list of the Modifications covered by the Amendment.
6. Modification numbers are only referred to in these Notes when it is necessary to differentiate between pre- and post-mod. states. For ease of reference a list of Modification numbers mentioned in the text is included in the Introduction, with a cross-reference to the location in the text where details of the modification are given.
7. Comments and suggestions regarding Pilot's Notes should be forwarded to the Officer Commanding, Royal Air Force Handling Squadron, Boscombe Down, Wiltshire. ▶

List of Associated Air Publications and Diagrams

| Title | AP No. | Title | AP No. |
|--|--------|---|--------|
| Aircraft automatic stabilisers | 1469S | Parachutes and parachute harnesses | 1182A |
| Aircrew equipment assemblies | 1182 | Powered flying controls—Boulton Paul | 4603C |
| | series | | D & E |
| Aircraft pressure refuelling | 4511 | Safety-harness | 1182B |
| Aircraft pressurising and air conditioning equipment | 4340 | ◀ Search and rescue airborne equipment | 1182D |
| Aircraft refuelling in flight | 4611 | Undercarriage equipment—Dowty | 1803E |
| Aircraft undercarriage equipment—Dowty | 1803E | Vulcan Mk. 1 and 1A General and Technical Information | 4505A |
| Aircraft wheels, tyres and brakes | 2337 | | & C |
| Auto-pilot, Mk. 10 | 1469E | | |
| Bomb carriers | 1664A | | |
| ◀ Data book on safety and survival equipment and flying clothing | 4380 | | AD No. |
| Dinghies and associated equipment | 1182C | Access panels | 6022Q |
| Dunlop equipment fitted to Vulcan aircraft | 4515C | Cabin and aircraft pressurisation | 6022V |
| Electrical manuals | 4343 | De-icing systems | 6022D |
| | series | ECU installation | 6022G |
| Ejection seats and escape equipment | 4288 | Emergency installations | 6022N |
| Flying clothing and survival equipment | 1182E | Fire extinguisher system | 6022M |
| Fuel pumps | 4343D | Flying controls and lubrication | 6022C |
| Hydraulic equipment—Dowty | 1803D | Fuel system | 6022F |
| Instrument manuals | 1275 | Hydraulic system | 6022H |
| | series | Jet efflux—danger areas | 6022X |
| Instrument manual—oxygen equipment | 1275G | Lubrication | 6022B |
| Olympus ECU 10400 | 4501E | Pneumatic system | 6022P |
| | | Vulcan aircraft escape drill | 5558 |

Lubricants

| <i>British Specification</i> | <i>Nomenclature</i> | <i>Ref. No.</i> | <i>NATO Code No.</i> | <i>American Specification</i> | <i>Canadian Specification</i> |
|------------------------------|---------------------|-----------------|----------------------|--------------------------------|-------------------------------|
| DTD585 | OM-15 | 34B/9100572 | H-515 | MIL--H-5606A | 3-GP-26a |
| DTD822A | OX-14 | 34B/9100589 | O-147 | MIL-L-6085A | MIL-L-6085A |
| DERD2487 | OX-38 | 34A/9100591 | O-149 | MIL-L-7808 (emergency only) | — |

Fuels

| <i>British Specification</i> | <i>Inter-service Designation</i> | <i>Ref. No.</i> | <i>NATO Code No.</i> | <i>American Specification</i> | <i>Canadian Specification</i> |
|--|----------------------------------|-----------------|----------------------|-------------------------------|-------------------------------|
| ◀ Without additive anti-icing ▶ | | | | | |
| DERD2486 | AVTAG | 34A/9100448 | F-45 | MIL-J-5624E | 3-GP-22d |
| DERD2494 | AVTUR/50 | 34A/9431771 | F-35 | MIL-J-5624E | 3-GP-23d |
| ◀ With additive anti-icing (DERD 2451 or MIL-I-2768C) ▶ | | | | | |
| — | AVTAG | 34A/2201037 | F-40 | — | — |
| — | AVTUR | 34A/2201036 | F-34 | — | — |

Fluids

| <i>British Specification</i> | <i>Inter-service Designation</i> | <i>Ref. No.</i> | <i>NATO Code No.</i> | <i>American Specification</i> | <i>Canadian Specification</i> |
|------------------------------|----------------------------------|-----------------|----------------------|-------------------------------|-------------------------------|
| DEF-58 | AL-8 | 34B/9100475 | S-738 | MIL-A-6091A (ASG) | 3-GP-525A |

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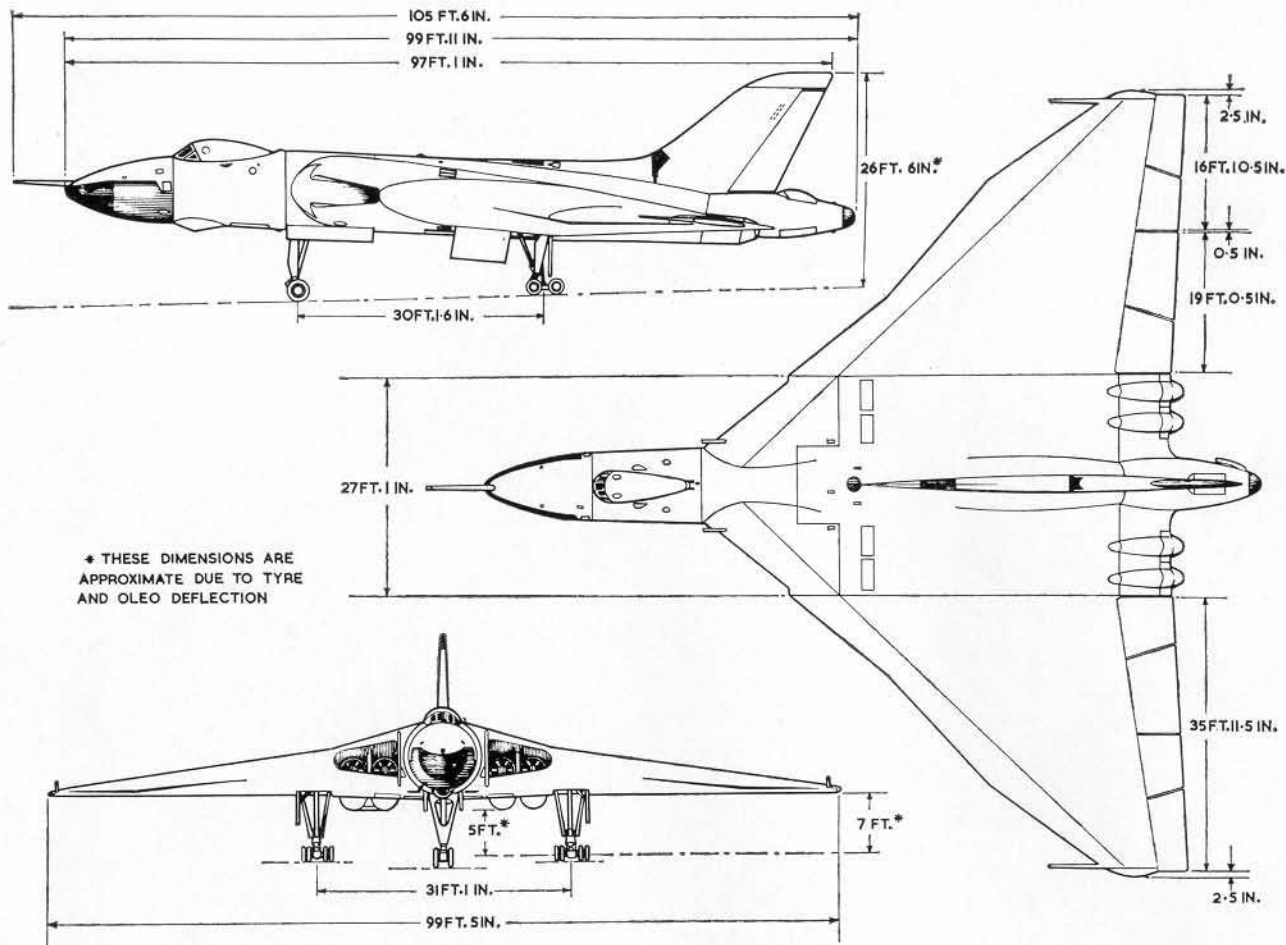


Fig. 1 General Arrangement Vulcan Mk. 1A

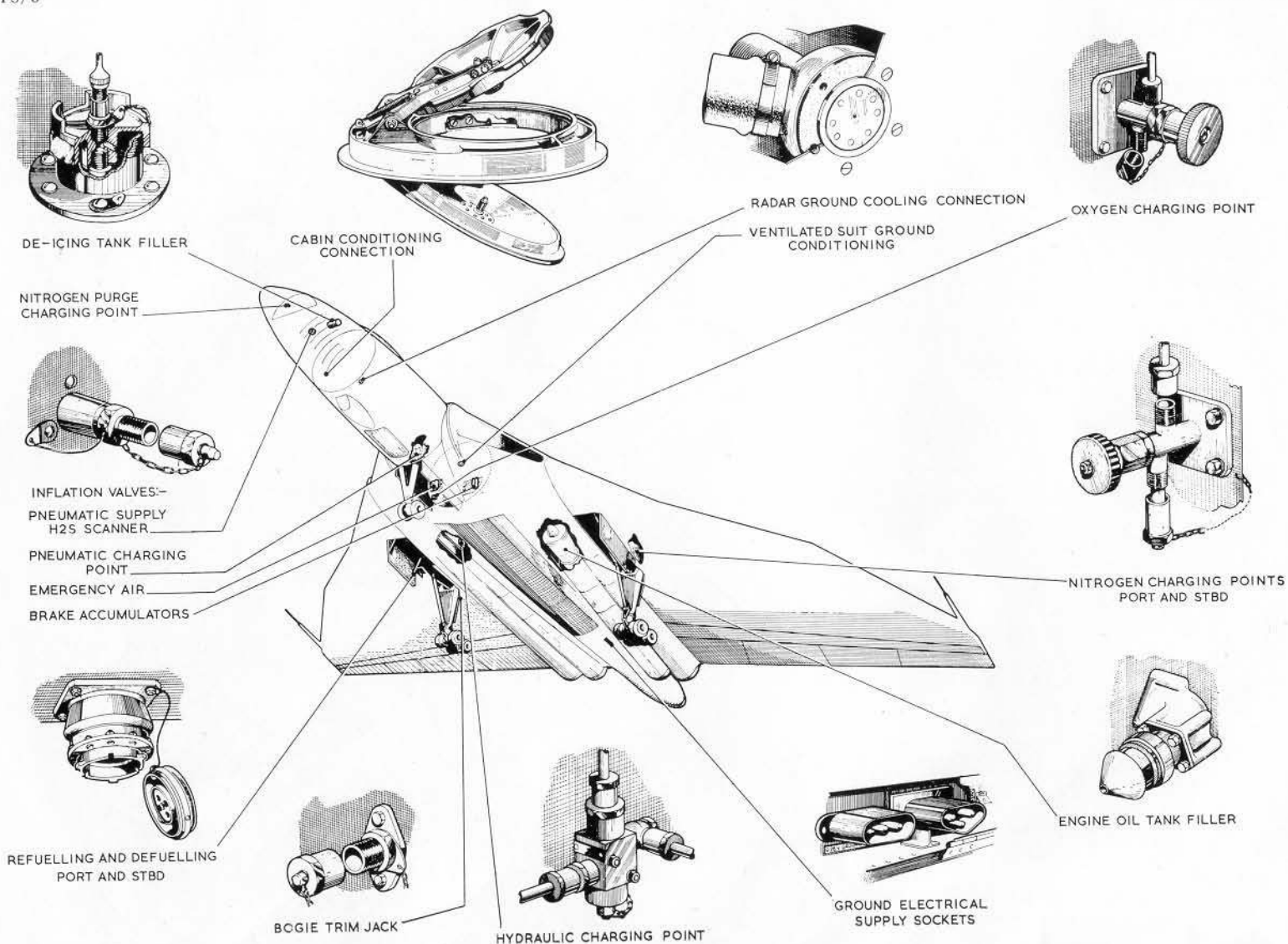


Fig 2 Vulcan B Mk 1A

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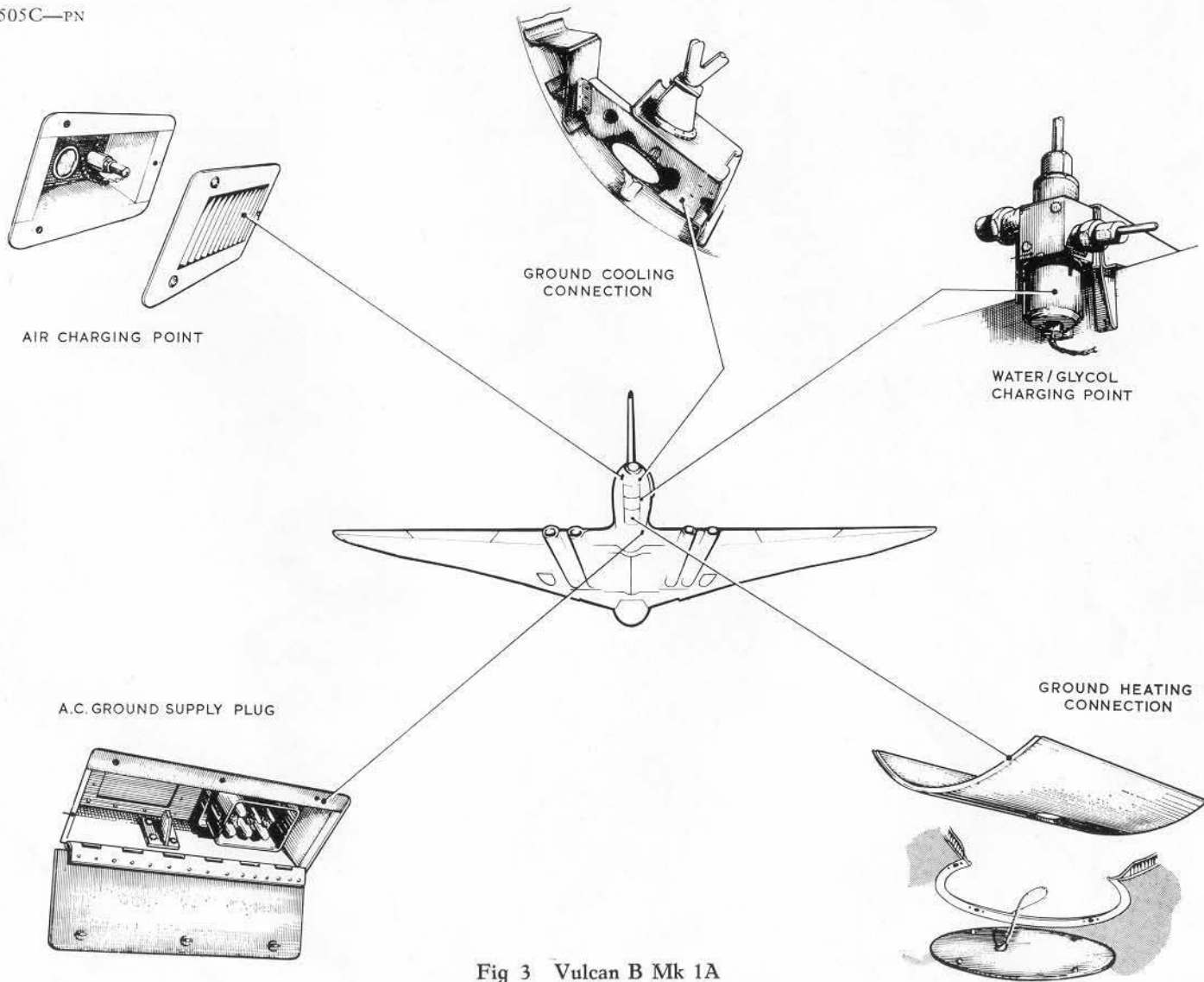


Fig 3 Vulcan B Mk 1A

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Leading Particulars

Principal Dimensions

| | ft. | in. |
|--|-----------------------------|-----|
| Overall length (refuelling probe tip to tail radome) | 105 | 6 |
| Overall length (nose to top of fin) | 97 | 1 |
| Overall length (nose to tail radome) | 99 | 11 |
| Wing span | 99 | 5 |
| Height to top of fin | 26 | 6 |
| Wheel track | 31 | 1 |
| Wheel base | 30 | 2 |
| Load classification number (LCN) | See Operating Data Handbook | |

Fuel System

| | |
|--------------|----------------|
| Type of fuel | AVTAG or AVTUR |
|--------------|----------------|

Tank Capacities (Approximate) :

| Tank Group | Tank No. | Capacity Gallons | Capacity—Pounds | |
|---|-------------------|---------------------|---------------------|---------------------|
| | | | AVTUR 8.0lb/gall | AVTAG 7.7lb/gall |
| 1 and 4 (outboard, port and starboard) | 1 | 2×630 | 2×5,040 | 2×4,851 |
| | 4 | 2×630 | 2×5,040 | 2×4,851 |
| | 5 | 2×513 | 2×4,104 | 2×3,950 |
| | 7 | 2×550 | 2×4,400 | 2×4,235 |
| | Total each group | 2×2,323 | 2×18,584 | 2×17,887 |
| | Total both groups | 4,646 | 37,168 | 35,774 |
| 2 and 3 (inboard, port and starboard) | 2 | 2×950 | 2×7,600 | 2×7,315 |
| | 3 | 2×630 | 2×5,040 | 2×4,851 |
| | 6 | 2×737 | 2×5,896 | 2×5,675 |
| | Total each group | 2×2,317 | 2×18,536 | 2×17,841 |
| | Total both groups | 4,634 | 37,072 | 35,682 |
| | Total fuel | 9,280 | 74,240 | 71,456 |

Power Units

| | |
|------------------------------|-------------|
| Name | Olympus 104 |
| Type | Turbo-jet |
| Number | Four |
| Static thrust (at sea-level) | 13,500 lb |

Oil system

| | |
|--------------------------|--------------------------------|
| Type | Integral with engine |
| Oil | NATO Code No. 0-149 |
| Tank capacity | 7 galls oil, 3 galls air space |
| Starting system | Electrical |
| Electrical starter motor | Rotax C8601 |

Engine-driven auxiliaries

| | |
|-----------------|--------------------------------|
| Hydraulic pumps | 3 (on engines Nos. 1, 2 and 3) |
| Generators | 4-22½ kW (one on each engine) |

Hydraulic System

| | |
|--------------------|--------------------------------|
| Pumps | 3 (on engines Nos. 1, 2 and 3) |
| Working pressure | 3,600-4,000 psi |
| Reservoir capacity | 2¼ galls |
| System capacity | 12 galls |
| Fluid | Oil NATO Code No. H-515 |

Emergency Air System

| | |
|-------------------|-----------|
| Cylinders | 2 |
| Charging pressure | 3,000 psi |

Pneumatic System—Entrance Door

| | |
|-------------------|-----------|
| Cylinders | 2 |
| Charging pressure | 2,000 psi |

Pneumatic System—H₂S Scanner

| | |
|-------------------|-----------|
| Cylinder | 1 |
| Charging pressure | 1,800 psi |

Safety Equipment—continued

Rear crew:

| | |
|----------------------------|------------------------------|
| Seats | Special |
| Safety-harnesses | Type ZC |
| Parachutes | Mk 20 |
| (include EO Set Mk 3C) | |
| Survival pack | Type S |
| (include dinghy Type SS) | |
| Aircraft multi-seat dinghy | Type MS5, capacity five crew |

Nitrogen purge—flight re-fuelling:

| | |
|---------------------------|------------|
| Cylinder | One |
| Charge pressure | 1,800 psi |
| Capacity | 750 litres |

Electrical System

| | |
|-----------------------------------|---------------------------|
| Type | Earth return, single pole |
| Generators (4) | 112-volt DC, 22½ kW |
| Batteries (5) | 24-volt 40 amp hour |
| Rotary transformers (3) | Type AM 1050 |
| Inverters (5) | 3 Type 350, 2 type 153 |
| Turbo-alternator for ECM | |
| Supplies (TGA 30) | 200-volt AC 30 KVA |

Radio and intercomm

| | |
|----------------------------------|-----------------|
| VHF | TR 1985/TR 1986 |
| UHF | ARC/52 |
| Intercomm (normal) | A1961 |
| Intercomm (conference) | A1961 |
| HF transmitter | T4188 |
| HF receiver | R4187 |

INTRODUCTION

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1 General

The Vulcan B Mk. 1A is a four-engined all-metal aircraft of delta planform and is powered by Olympus Mk. 104 turbo-jet engines, each developing 13,500 lb static thrust at sea-level. Provision is made for in-flight refuelling.

2 Crew

(a) The aircraft is operated by a crew of five accommodated in a pressure cabin, as follows :—

- 1st pilot
- Co-pilot
- Air electronics officer (AEO)
- Navigator/plotter
- Navigator/radar

Provision is made for carrying one extra crew member.

(b) The two pilots are seated side-by-side in ejection seats, on a raised platform at the front of the cabin, normally referred to as the cockpit. Behind the pilots, facing aft in what is referred to as the cabin, are the rear crew members.

The rear members have bucket-type seats ; they sit facing one long table, behind which is a crate carrying their equipment. A prone bombing position is provided in a blister below the pilots' floor, the bomb aiming duties being performed by one of the navigators.

Handgrips and handles are located at suitable positions in the cabin to enable rear crew members to move quickly to the entrance door. The pilots' ladder, when in the stowed position, provides hand holds for the AEO and the nav/plotter when they are moving to the entrance door.

3 Instrument layout

(a) The pilots' instruments and controls are on the front panel (divided into four sections), the port and starboard consoles, the centre (retractable) console and the throttle quadrant.

(b) On the port and starboard walls of the cabin are panels containing circuit-breakers, fuses and relays.

(c) Additional engine instruments are located at the AEO's station.

4 Panels in cabin

The following panels are accessible in the cabin :—

| <i>Panel No.</i> | <i>Position and description</i> |
|------------------|--|
| 1P | Pilot's instrument panel (four sections) |
| 2P | Fuel contents panel (forward of throttle quadrant) |
| 3P | Fuse and relay panel (port side of cabin) |
| 4P | Fuse and relay panel (starboard side of cabin) |

| <i>Panel No.</i> | <i>Position and description</i> |
|------------------|---|
| 5P | Retractable console |
| 6P | Port console |
| 7P | Starboard console |
| 8P | Prone bombing panel |
| 9P | Bombing control panel (nav/bomb-aimer) |
| 10P | Generator control panel (AEO), referred to as DC control panel |
| 11P | Radio and radar supplies panel (rear pressure bulkhead), referred to as AC supplies panel |
| 12P | Navigators' and AEO's panel |
| 54P | Intercomm panel (port side cabin, under crew floor) |
| 71P | Turbo-alternator control panel (AEO) |
| 81P | ECM power supplies panel (AEO) |

5 Equipment bays

The following equipment bays are outside the pressure cabin: the nosewheel bay, the main undercarriage bays, the bomb-bay, the turbo-alternator bay (aft of the starboard main wheel bay), and the power compartment which is aft of the bomb-bay. These bays contain electrical power distribution and fuse panels: in addition the main undercarriage bays contain the refuelling/defuelling panels and the nosewheel bay contains the hydraulic accumulator and pressure gauges for the wheel brakes.

6 Modifications referred to in text

| <i>Mod No.</i> | <i>Effect of embodiment of Modification</i> | <i>Location in text</i> |
|----------------|---|-------------------------|
| STI/Vulcan/223 | To relieve pressure in the defuelling lines | I, 1, para. 12(a) |
| 159 | To introduce collapsible guards over escape door jacks | V, 3, para 2(a) |
| 686 | To reduce flow of air to outer leading edge of anti-icing system, and to blank off fin anti-icing | I, 12, para 6 |
| 777 | Stiffening of inboard leading edge to cater for airframe anti-icing system | I, 12, para 6 |

| <i>Mod No.</i> | <i>Effect of embodiment of Modification</i> | <i>Location in text</i> |
|----------------|--|---|
| MB 881 | Introduction of seat-pan firing handle on ejection seats | I, 18, paras 3 & 16 I, 15, para. 3(a)(i) |
| 940 | Introduces inching control unit and a flame stat, and renders the anti-icing system operative | I, 12, para. 6 |
| 1091 | Introduction of separate engine anti-icing switches | I, 12, para 4(d) |
| 1143 | Introduction of flow restrictor valves in fuel tanks 3, 4, 5, 6 and 7 | I, 2, paras 2(a) & 11(a) |
| 1236 | Deletion of locking devices on bomb-door locking struts | I, 19, para 2(d) |
| 1280 | Repositioning of bogie micro-switches, permitting normal recycling of undercarriage | I, 13, para. 2(g) |
| 1377 | Introduction of two-needle type ASI at co-pilot's station | I, 20, para. 2(a) |
| 1630 | Introduction of TACAN | I, 16, para. 11(c) |
| 1793 | Introduction of earthing point in nose-wheel bay | I, 7, para. 5 |
| 1884 | Provides AEO with facility to manually control the output frequency of the BAT should the normal frequency system fail | I, 21, para. 3(b) |
| 1996 | Introduction of oil temperature gauges | I, 3, paras. 8 & 9 |
| 2045 | New switches for abandon aircraft and emergency decompression switches | I, 11, para. 5(g) |
| ES 2319 | Introduction of downward pull negative-G restraint strap | I, 18, para. 2 |

7 Modification state

These Notes have been compiled assuming that the following Modifications have been embodied:—

| <i>Mod. No.</i> | <i>Effect of embodiment of Modification</i> |
|-----------------|---|
| 10 | Window launching fixed fittings introduced |
| BC 15 | Introduction of heading information selector switch |
| BC 35 | Introduction of nosewheel steering override (Mod. 1747) |
| 38 | Flight refuelling receiver fixed fittings introduced |

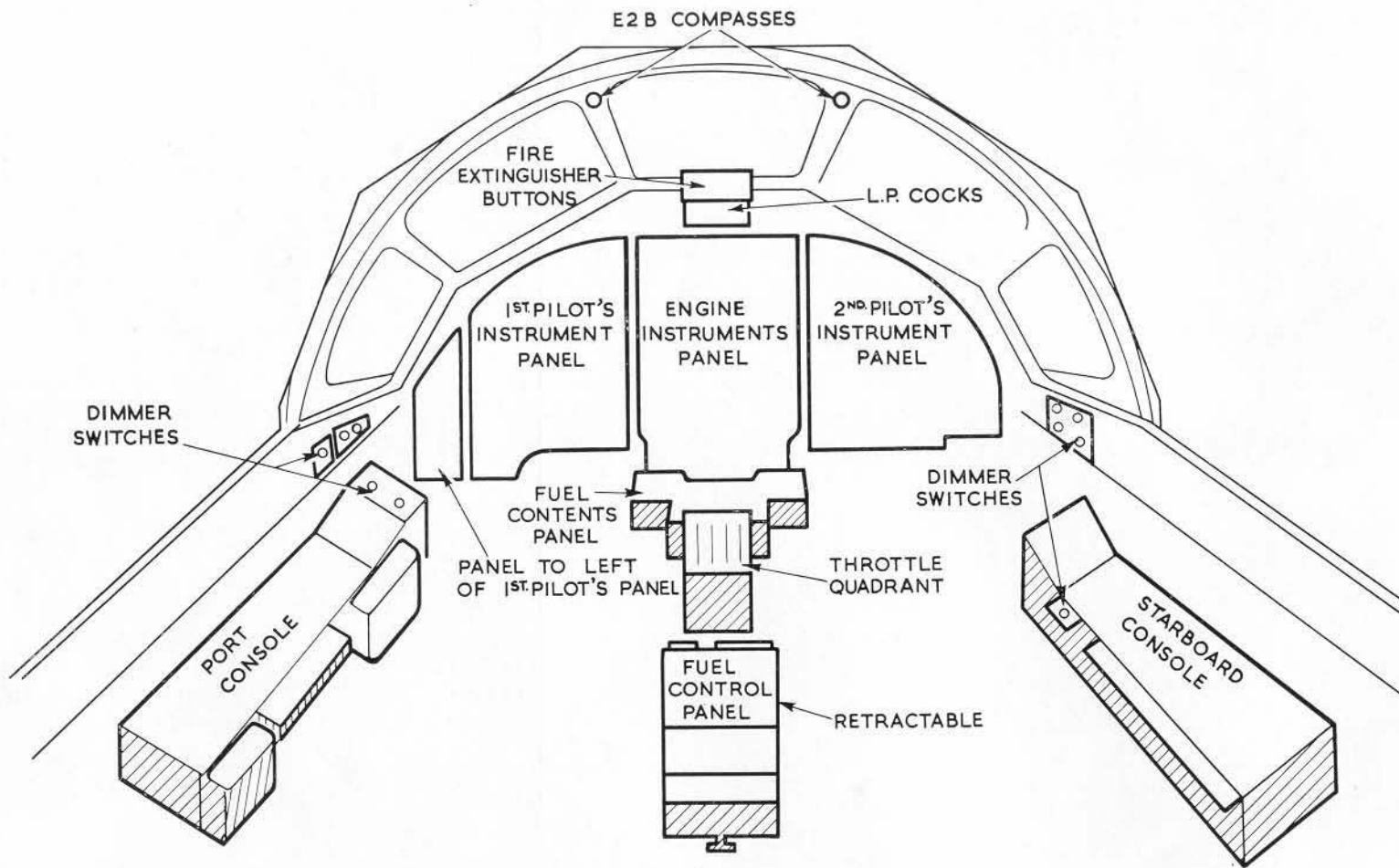


Fig. 1 Cockpit Layout

These Notes have been compiled assuming that the following Modifications have been embodied :—(Contd.)

| <i>Mod. No.</i> | <i>Effect of embodiment of Modification</i> |
|-----------------|---|
| BC 54 | Additional oxygen supply magnetic indicator, fitted at nav/plotter's station; enables check of oxygen supply at nav/radar's prone station |
| BC 60 | Provision of simultaneous engine starting |
| 108 | Introduction of T4 bombsight |
| 176 | To introduce improved flow control system. Revised heating control panel on starboard console |
| 177 | Ventilated suit installation introduced |
| 206 | Introduction of triple-pressure gauge |
| 209 | Depressurisation of cabin does not occur on operation of entrance door lever |
| 210 | Re-routing of hydraulic pipe lines in nosewheel bay |
| 256 | To introduce ILS audio output in the intercomm |
| 265 | Introduces facility to increase warm-air flow |
| 274 | Introduction of double-level float switches and double-acting refuelling shut-off valves |
| 291 | Introduction of conference intercomm and station boxes |
| 298 | Electrics modified to permit type 153 inverters to be started up under no-load conditions |
| 334 | Introduction of radar altimeter Mk. 6A in lieu of Mk. 6 |
| 347 | To introduce switching in Mk. 4B compass circuit |
| 353 | Introduction of zero-reader installation |
| 374 | Introduction of fatigue meter |
| 394 | Introduction of oxygen point at sextant position |
| 395 | Deletion of Type 100A inverter. Flight instruments to operate from No. 3 inverter |
| 424 | AMU connected to static vents in lieu of starboard pressure head |
| 426 | Altitude restriction on IFF no longer operative |
| 432 | Introduction of anti-flash screens |
| 436 | To enable VHF aerial to provide sense facilities for radio compass |
| 445 | To permit isolation of NBS equipment from bomb gear |
| 454 | Introduction of VG recorder |
| MB 491 | Barostatic release time-delay reduced from 3 seconds to $1\frac{1}{4}$ seconds and G-stop introduced on ejection seats |
| 467 | Stiffening of bomb-bay structure to prevent generator warning lights flickering |
| 503 | Introduction of fixed fitting for additional crew members' seat |
| 505 | Introduction of Mk. 19B altimeter |
| 510 | Introduction of VHF tones—simulated bombing provision |
| 515 | To introduce three charged oxygen cylinders in lieu of three dummy cylinders |
| 522 | To reposition H2S scanner pressurisation switch and gauge on nav/bomb-aimer's panel |
| 531 | Introduction of re-designed inlet and outlet ducting to the cold-air unit |
| 549 | Increased tank capacity of windscreen de-icing system |
| 555 | Repositioning of starboard sextant intercomm socket to waist level |
| 559 | Introduction of time-of-fall calculator Mk. 2A |
| Eng. 564 | Introduction of steel discs and blades in zero and first stages of LP compressor |
| 593 | To introduce time-delay relays to overcome surge of current when airbrakes are reversed in operation |
| 601 | Introduces underheat control in supply to AVS |
| 602 | To make provision for UHF |
| 613 | To make provision for ECM installation including ARI 5919 |
| 614 | Provision of static lines for rear aircrew |
| 620 | (introducing MB |
| 595, 596) | Transfer of EO sets to back of ejection seats |
| & MB 313 | Fairing of parachute container |
| & MB 504 | Introducing B type firing handle |
| 621 | Introduction of electrical load ammeters |
| 622 | To introduce frequency meter and voltmeter at navigator's station for checking AC supplies (see Mod. 1186) |

These Notes have been compiled assuming that the following Modifications have been embodied:—(Contd.)

| <i>Mod. No.</i> | <i>Effect of embodiment of Modification</i> |
|-----------------|--|
| 623 | To permit operation of the entrance door opening from a selector switch at the navigator's station |
| ◀◀ | |
| 697 | To improve 112-volt generator system |
| 708 | Introduction of windscreen wiper for windscreen centre panel and increased rate of flow of windscreen anti-icing system |
| 718 | To improve ejection of window Embodied with Mod. 10 |
| 758 | Deletion of portable oxygen supply and introduction of extension oxygen supply tubes |
| 820 | Introduction of lamps for illumination of flight refuelling probe |
| 822 | To re-orientate the flight refuelling panel |
| 823 | Introduction of flight refuelling probe shut-off valve |
| 858 | Introduction of later type refuelling valves in fuel system and to make provision for and introduce electrical time-delay for tank selection |
| 865 | Flight refuelling—miscellaneous alterations to refuelling piping and fuel level switch mounting, to rectify errors found on embodiment of Mod. 274 |

| <i>Mod. No.</i> | <i>Effect of embodiment of Modification</i> |
|-----------------|--|
| 869 | To delete probe de-icing system and to introduce a blow-off valve in the nitrogen purging line |
| 874 | Introduction of Type 120 voltage regulator |
| 951 | Improves the flight refuelling electrical system |
| ▶▶ | |
| Eng. 971 | Introduction of polished HP compressor blades |
| 982 | Flashing white lights introduced, navigation lights steady |
| 1070 | Introduction of test switch for anti-icing heater in ECM condenser intake |
| 1138 | Introduction of bomb-release safety lock |
| 1144 | Introduction of blanking plates in wing duct heating system |
| 1186 | Alterations necessary to embody Mod. 622 on aircraft having Mod. 291 embodied |
| 1262 | Introduction of an improved undercarriage selector switch |
| 1283 | Positive stop on crew door-opening mechanism. Prior to embodiment of this Mod., it is possible to operate the emergency door opening system from the external door-opening control |
| 1402 | Introduction of revised JPT datums |
| 1429 | Introduction of tank pressurisation indicators |
| 1542 | Introduction of revised door-opening torque shaft and permits use of the door-opening switch introduced by Mod. 623 |
| 1747 | Introduction of nose-wheel steering override (BC 35) |



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