

QC
Avro
CF105
AAMS-
105-1

MODEL SPECIFICATION FOR
SUPERSONIC ALL WEATHER
INTERCEPTOR AIRCRAFT
TYPE CF105

UNCLASSIFIED



UNCLASSIFIED

PAGE 1
AAMS-105/1
NOVEMBER 1955

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∴ add-subsequent issues may be used either mutually agreed to between RIA+ and contractor →

except



1. Applicable Specifications and Publications

1.1 Referenced Specifications

except The following specifications and publications, of the issue in effect on 23 April 1954, shall form a part of this specification to the extent stated herein. ~~At the discretion of the Company subsequently dated issues may be used.~~ *unless otherwise stated below*

AIR 7-4	R.C.A.F. Specification for Supersonic All-Weather Interceptor Aircraft Type CF105 (31 August 1955)
CAP 479	Manual of Aircraft Requirements for the Royal Canadian Air Force
ARDCM 80-1	Handbook of Instructions for Aircraft Designers (July 1954)
PWA-2611	Model Specification, JT4A-23 Turbo-Jet Engine, Pratt and Whitney
ORI/4-2	R.C.A.F. Standard Flight Panel
ORI/4-5	Operational Requirements, Exterior Lighting
EL-5040-1	Aircraft Doppler Radar System
MIL-B-5087A	Bonding - Electrical (for Aircraft)
MIL-W-5088A <i>59</i>	Wiring, Aircraft, Installation of
MIL-I-5099	Indicator, Cabin Air Pressure, 1-7/8 Inch Dial, Type MA-1
MIL-H-5440A	Design, Installation and Tests of Aircraft Hydraulic Systems
MIL-F-5572	Fuel, Aircraft Reciprocating Engine
MIL-O-5606	Oil, Hydraulic, Aircraft, Petroleum Base
MIL-F-5624	Fuel, Aircraft Turbine and Jet Engine, Grades JP-3 and JP-4
MIL-S-5700	Stress Analysis Criteria
MIL-N-5877A	Nozzle, Pressure Fuel Servicing, Locking, Type D-1

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*to be reviewed
dates to be added.
Additional Specs to be
added*



1.1 Referenced Specifications (Cont'd)

MIL-I-5997	Instruments and Instrument Panels, Aircraft Installation of
MIL-I-6181B	Interference Limits, Test and Design Requirements, Aircraft Electrical and Electronic Equipment.
MIL-L-6503A	Lighting Equipment, Aircraft, General Specification for Installation of
MIL-C-6818	Clamp, Mounting, Aircraft Instruments
MIL-E-7080	Electrical Equipment, Installation of Aircraft, General Specification
MIL-E-7563	Electrical Equipment, Aircraft, In- stallation of, General
MIL-E-7614	Electrical Equipment, Alternating Current, Aircraft, Installation of, General Specification
MIL-P-7788	Plate, Plastic, Cockpit and Interior Controls Lighting.
MIL-E-7894	Electric Power, Aircraft, Character- istics of
MIL-M-7911	Marking, Identification of Aeronautical Equipment, Assemblies and Parts
MIL-T-7935	Towing Requirements and Provisions for Land and Carrier Type Military Aircraft
MIL-I-8500A	Interchangeability and Replaceability of Component Parts for Aircraft
- MIL-I-8700 (ASG)	Installation and Test of Electronic Equipment in Aircraft, General Spec- ification for
MIL-J-8711 (ASG)	Jack Pads, Aircraft, Design and In- stallation
AN-L-1A-1	Luminescent Material, Fluorescent
Spec. Bulletin ANC-2a	Ground Loads
USAF Spec. 1815B	Flying Qualities of Piloted Airplanes

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1.1 Referenced Specifications (Cont'd)

USAF Spec. 1817	Flutter, Divergence and Reversal of Aircraft, Prevention of
98-24105-S	Marking of Airplanes and Airplane Parts
CGSB 3-GP-22	Aviation Turbine Fuel - Type II
CGSB 3-GP-25	Aviation Fuel
RCAF Specification C-28-96	Luminescent Material, Fluorescent - Radioactive

1.2 Precedence of Requirements

The requirements of all applicable specifications shall be superseded by those of the approved Model Specification. Otherwise, the following order of precedence shall apply:

- (a) AIR 7-4 - R.C.A.F. Specification for Supersonic All-Weather Interceptor Aircraft Type CF105
- (b) Contractor Specifications when approved by the R.C.A.F.
- (c) CAP 479 - Manual of Aircraft Design Requirements for the Royal Canadian Air Force
- (d) ARDCM 80-1 - Handbook of Instructions for Aircraft Designers
- (e) The remaining specifications listed in paragraph 1.1 of this specification.

1.3 Deviations

Deviations are set forth in Appendix II of this document and are indicated throughout the text by the appropriate deviation number in parenthesis in the right hand margin. A definition of 'Deviation' appears in paragraph 6.2. *From date of approval, additional deviations shall be submitted in form of spec amendments.*

num 1.3 - spec can be altered in form of spec amendment to be submitted to I2CDE

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2. Scope

2.1 Aircraft

The aircraft defined herein shall be the first aircraft of the contract and shall be designed to the requirements of the Royal Canadian Air Force Type Specification AIR 7-4 and such additional requirements as may be specified and agreed upon between the R.C.A.F. and the Company.

2.1.1 This specification describes the following aircraft:

2.1.1.1 R.C.A.F. name and mark number - CF105

2.1.1.2 R.C.A.F. aircraft specification number - AIR 7-4 (Issue 3)

2.1.1.3 Manufacturer's name - Avro Aircraft Limited

2.1.1.4 Manufacturer's model designation - CF105

2.1.1.5 Number of engines - two

2.1.1.6 R.C.A.F. name and mark number of engine -

2.1.1.7 R.C.A.F. engine specification number -

2.1.1.8 Engine manufacturer's name - Pratt and Whitney Aircraft
Division of United Aircraft
Corp.

2.1.1.9 Engine manufacturer's model designation - J75 Model
JT4A-23

2.1.1.10 Engine Model Specification number - PWA 2611

2.2 Role

2.2.1 Primary Role

The primary role of the aircraft shall be high altitude, (1)
all-weather, night and day interception and destruction of
airborne enemy bomber aircraft. *wherein is referred in AV 7-4*

2.2.2 Secondary Role

The secondary role of the aircraft shall be low altitude, (1)
all-weather, night and day interception and destruction of
enemy bomber aircraft. However, the aircraft shall be de-
signed to fulfill its primary role and limitations will be
accepted in the fulfillment of its secondary role.

2.3 Crew

The crew shall consist of a pilot and an airborne interception
radar operator.

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3. Requirements

3.1 Characteristics

3.1.1 Three View Drawing

See Figure 1 Page 7

3.1.2 Interior Arrangement Drawing

See Figure 2 Page 8

3.1.3 Performance

The performance shall be estimated assuming:

- (a) All items of removable primary role service load installed and operative.
- (b) N.A.C.A. Standard Atmosphere conditions except where otherwise specified.
- (c) Engine performance in accordance with the Engine Model Specification (J75 model JT4A-25 engine performance data (as of November 1955) utilized. This represents a 3% optimism in fuel consumption relative to J75 model JT4A-23 data).
- (d) All access panels, doors and canopy in the closed position, and landing gear retracted.

3.1.3.1 Tabulated Performance

	<u>Estimated</u>
Combat Load Factor at Combat Speed of Mach 1.5, Combat Altitude of 50,000 feet, and Combat Weight (51,326 lb.):	1.5 (4)
Maximum Level Speed at 50,000 feet and at Combat Weight (51,326 lb.):	Mach 1.99
Maximum Allowable Speed with Overload Fuel Tank installed:	Mach 0.95
Combat Ceiling at Combat Weight (51,326 lb.):	57,200 feet (6)
With aircraft at Normal Gross Weight (58,975 lb.), and positioned at end of runway, elapsed time from pushing first button to start first engine until aircraft becomes airborne:	0.75 min.

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*delete derivations
4, 5, 6*



3.1.3.1 Tabulated Performance (Cont'd)

*not speed
with curves*

Elapsed time to reach a level flight combat speed of Mach 1.5 and a combat altitude of 50,000 feet from the time aircraft becomes airborne during take-off at normal gross weight (58,975 lb.) under sea level conditions:

Estimated

3.7 min.

Take-off distance in still air at maximum gross weight (67,730 lb.) at sea level, and standard summer temperature of 38°C, to clear 50 foot obstacle (Maximum Thrust with afterburning):

(5)

6300 feet

Landing distance from 50 foot obstacle in still air under NACA Standard Atmosphere conditions, at a maximum landing weight of 55,000 lb., at sea level (landing parachute operative after touchdown):

(103)

5500 feet

Touchdown Speed

148 knots

3.1.4 Performance Curves

3.1.4.1 Stalling Speed vs Weight - Figure 3 Page 9

3.1.4.2 Speed, Rate of Climb, and Time to Height vs Altitude

3.1.4.2.1 Speed vs Altitude - Figure 4 Page 10

3.1.4.2.2 Rate of Climb vs Altitude - Figure 5 Page 11

3.1.4.2.3 Time to Height vs Altitude - Figure 6 Page 12

3.1.4.3 Take-off Performance vs Weight - Figure 7 Page 13

3.1.4.4 Mission Diagrams

3.1.4.4.1 Combat Radius of Action - Figure 8 Page 14

3.1.4.4.2 Cruising Radius of Action - Figure 9 Page 15

3.1.4.4.3 Overload Range - Figure 10 Page 16

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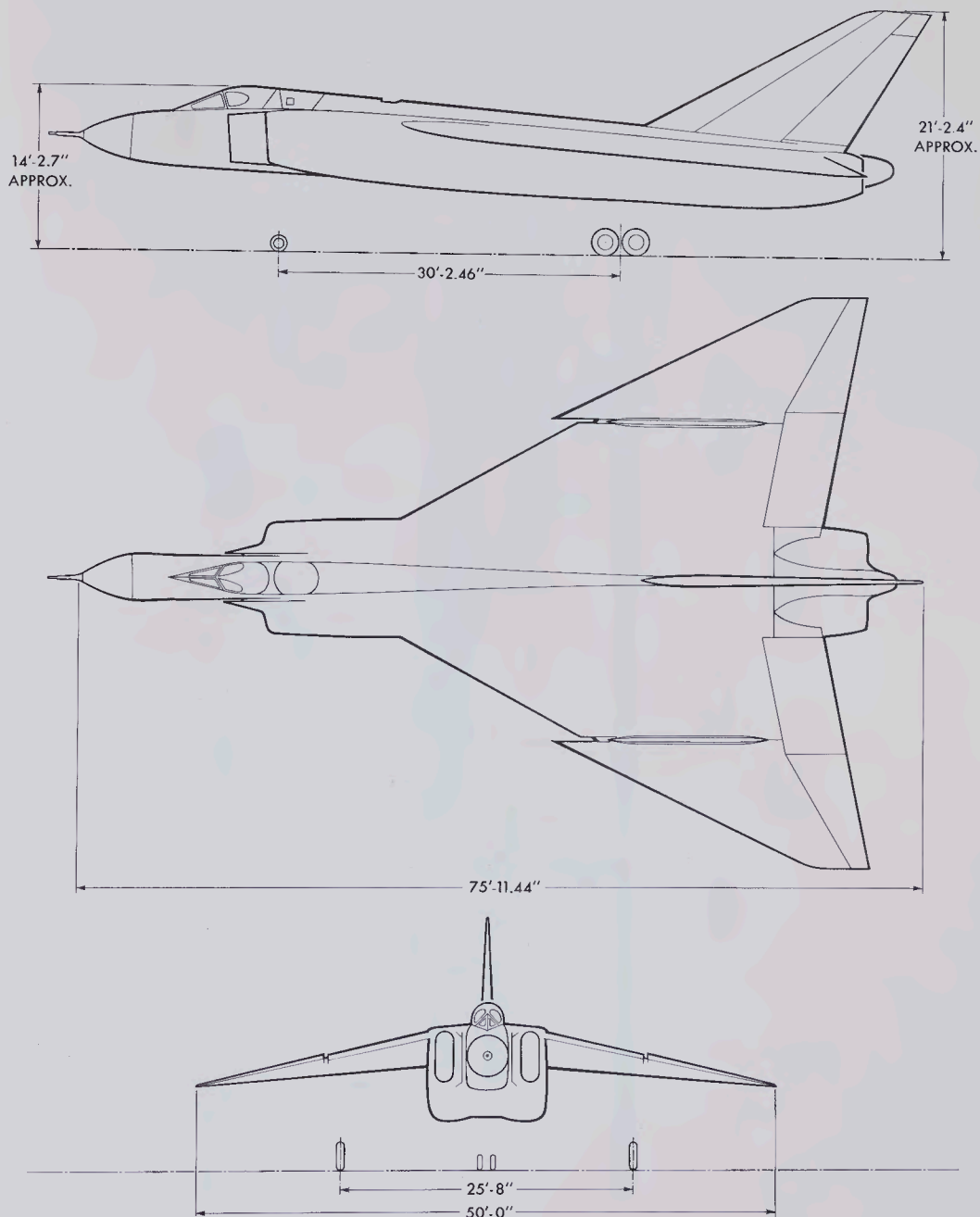
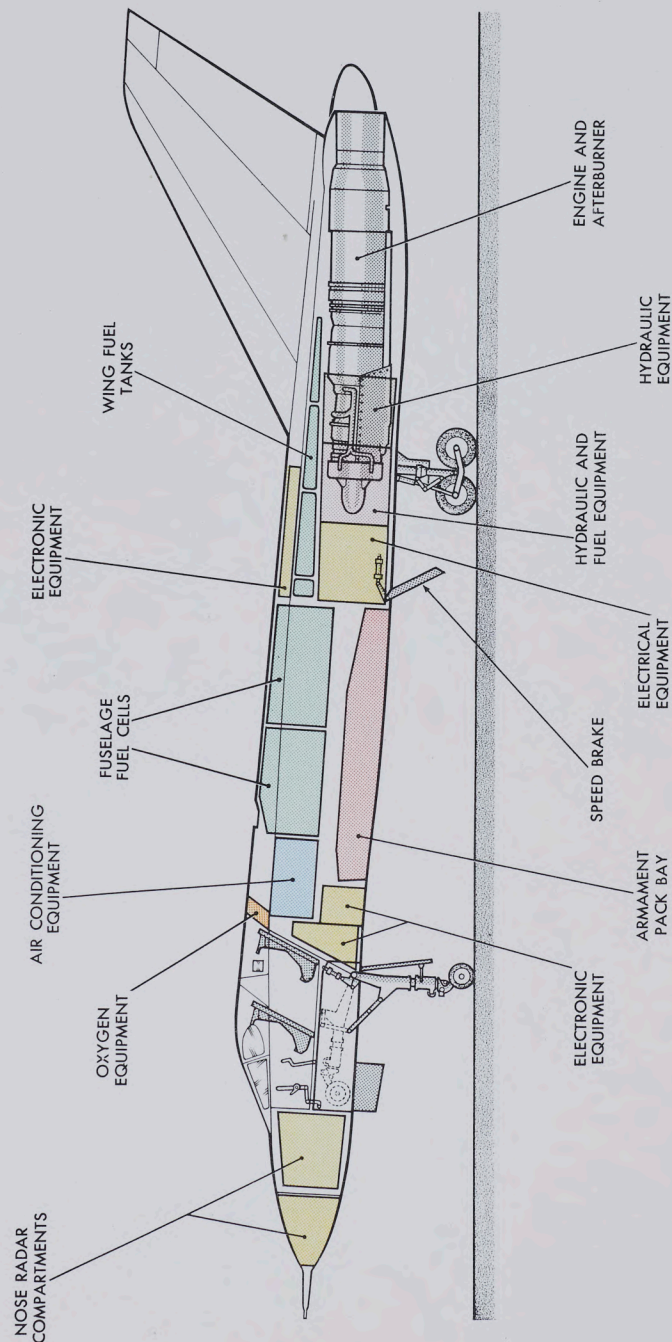


FIG. 1

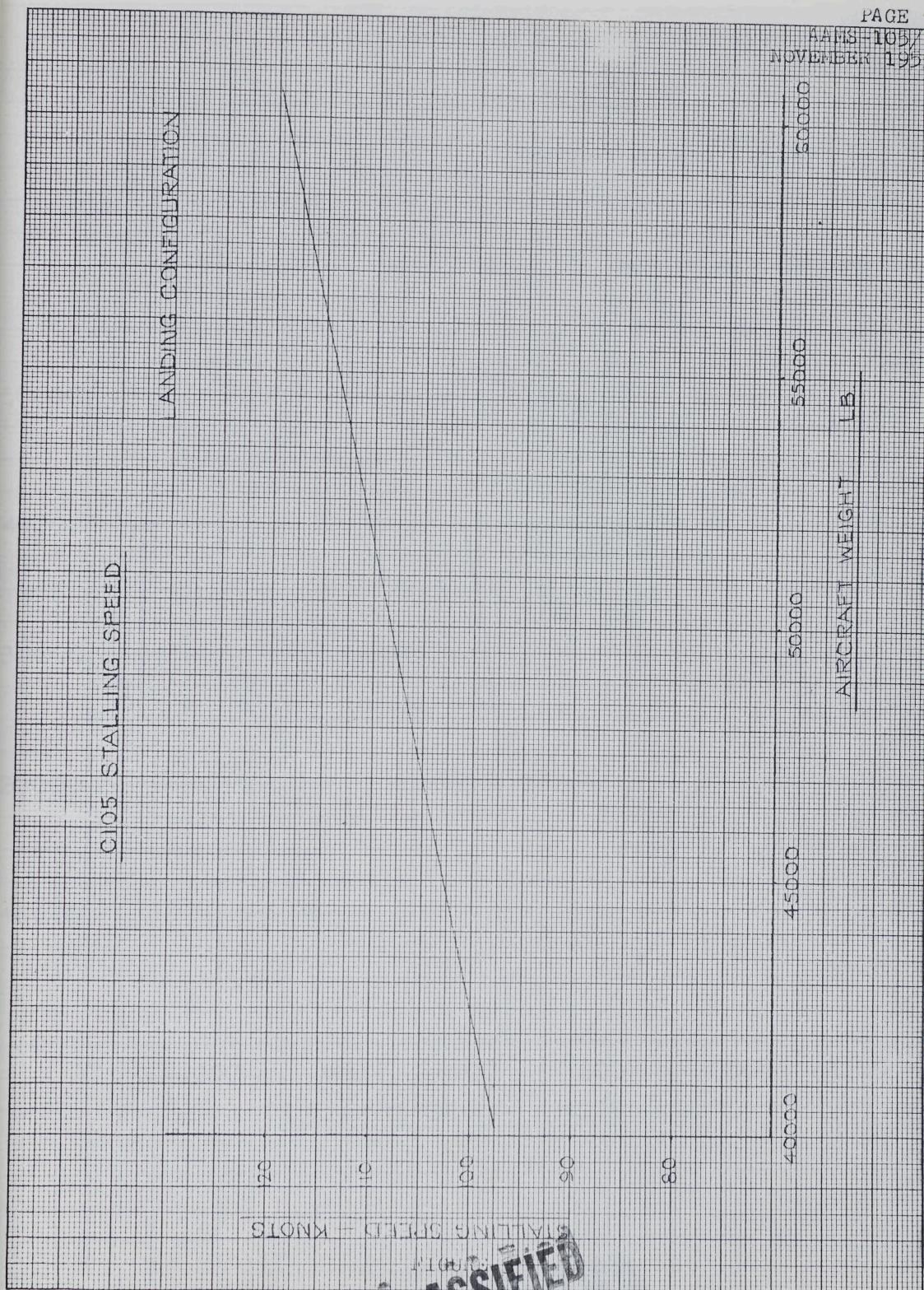
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FIG. 2
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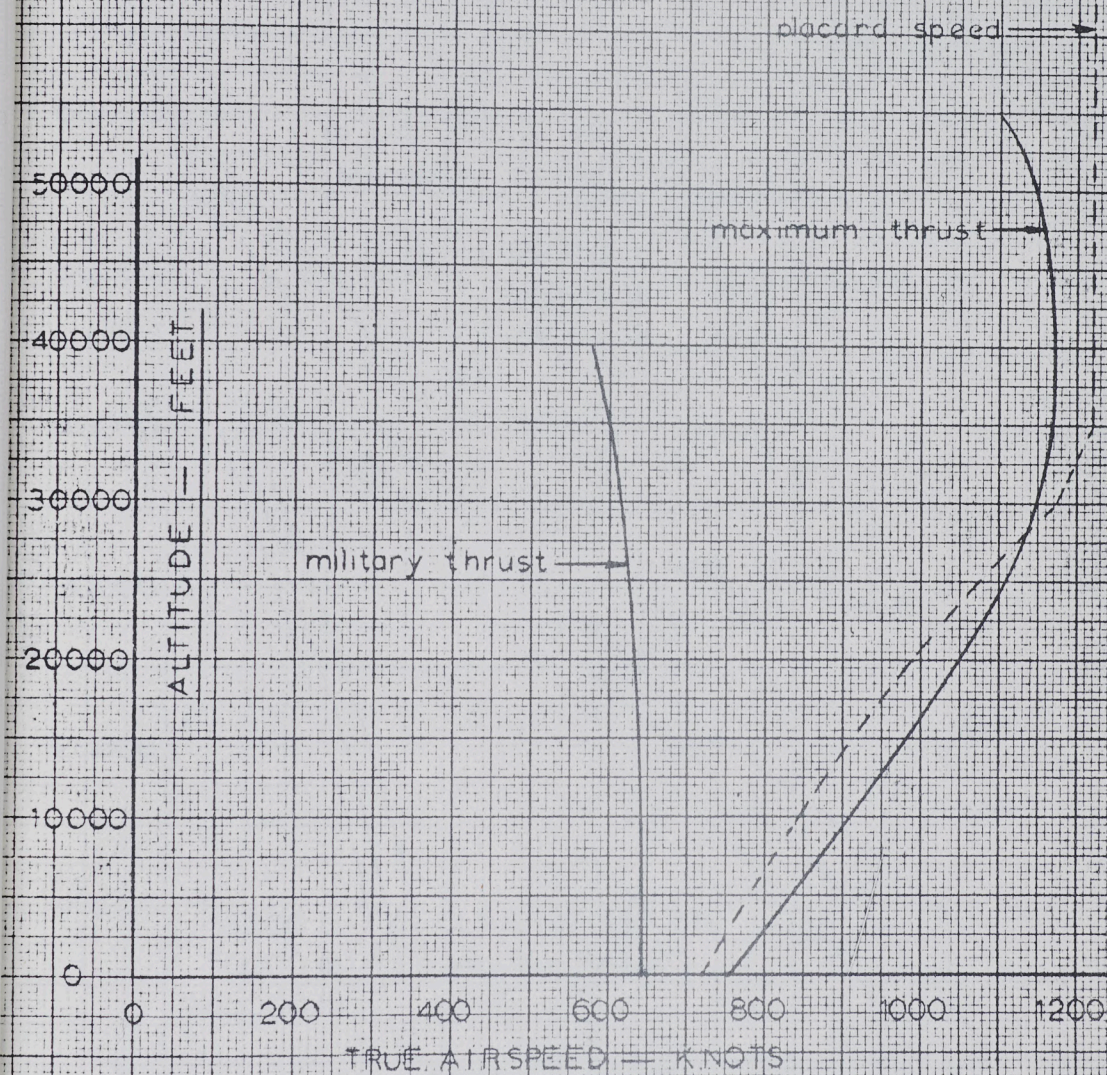
AAHS-10571
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LEVEL FLIGHT TRUE AIRSPEED

combat weight = 51326 lb



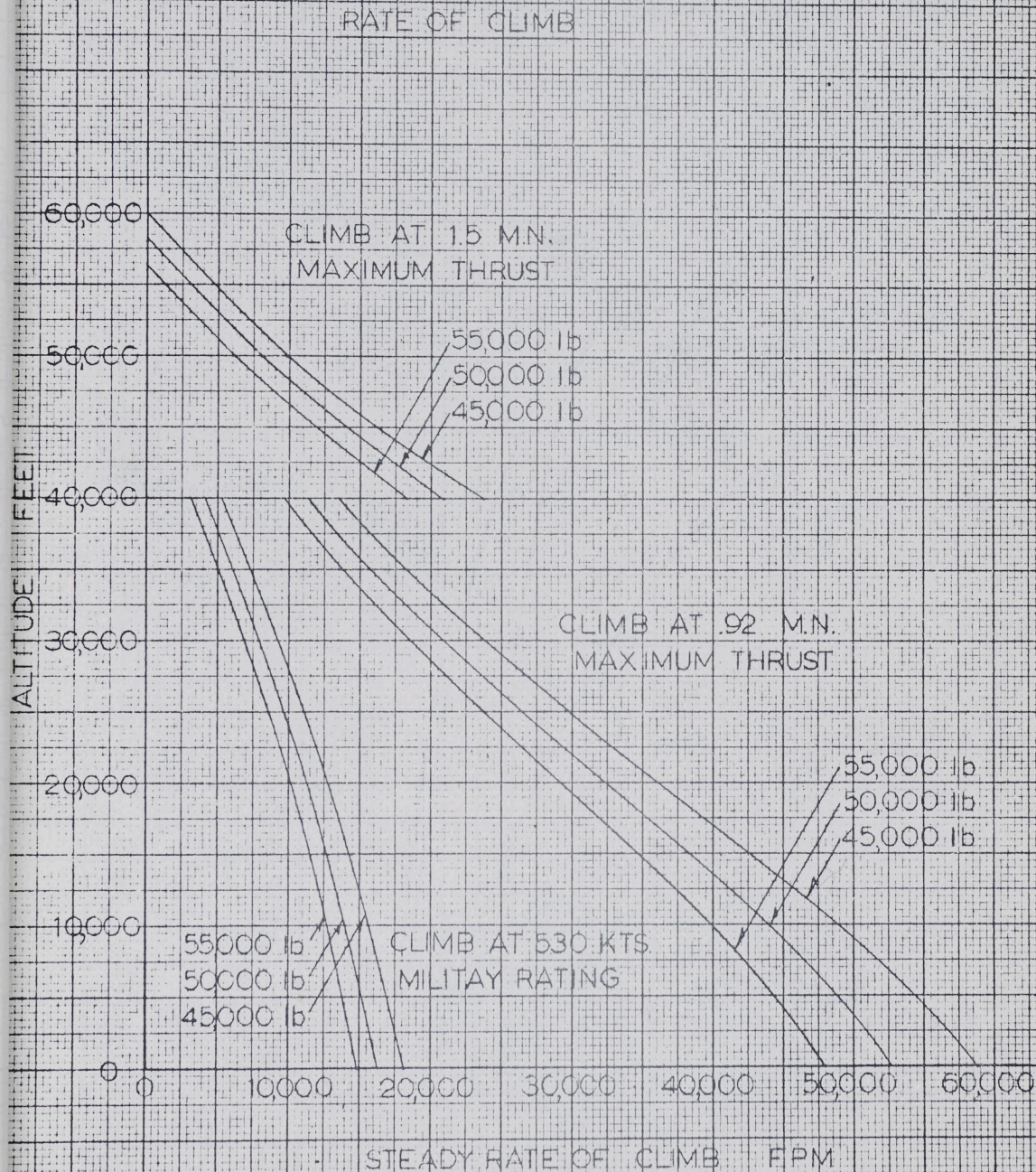


FIGURE
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TIME TO HEIGHT

takeoff weight - 58975 lb

one half minute allowed from
engine start to military rating

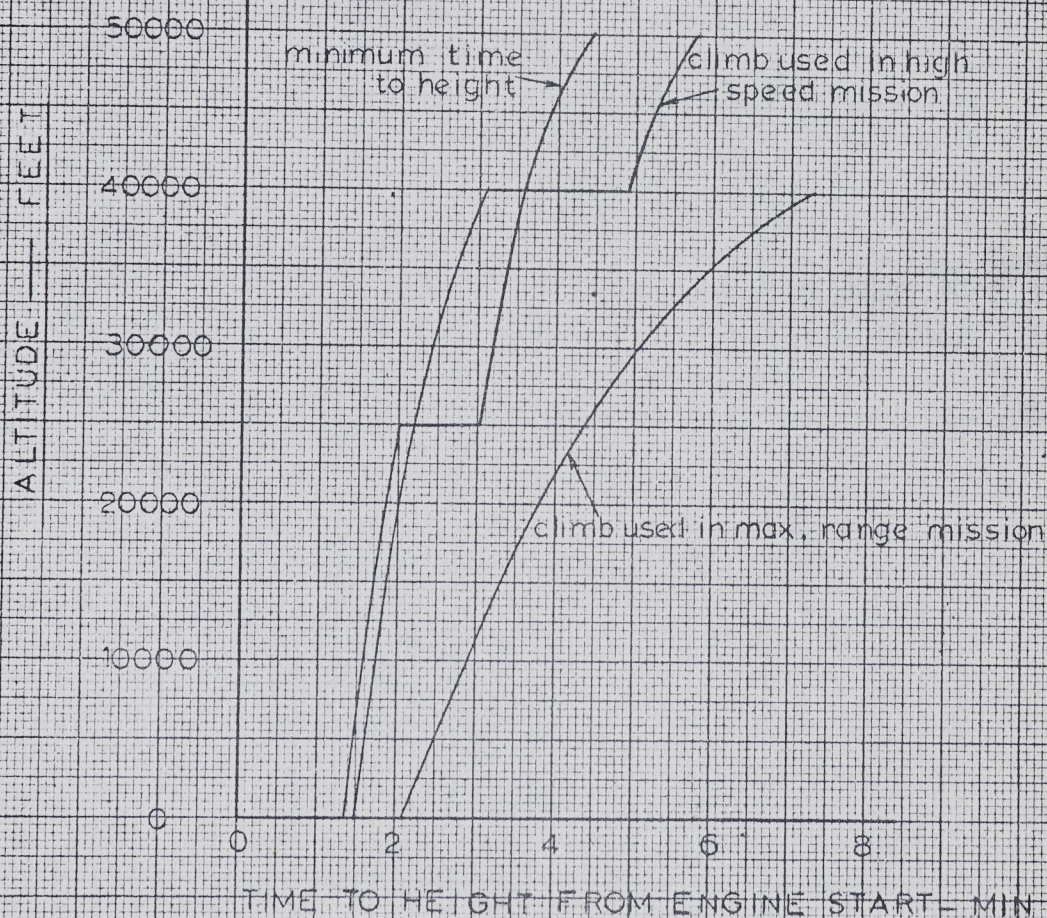


FIGURE 6

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TAKEOFF DISTANCE AT SEA LEVEL

- standard day with a/b
- - - standard day without a/b
- hot day (100°F) with a/b

distance
to clear
50 ft
obstacle

ground
run

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70000

65000

60000

55000

50000

45000

AIRCRAFT WEIGHT
LB

10000

8000

6000

4000

2000

0

TAKEOFF DISTANCE - FT

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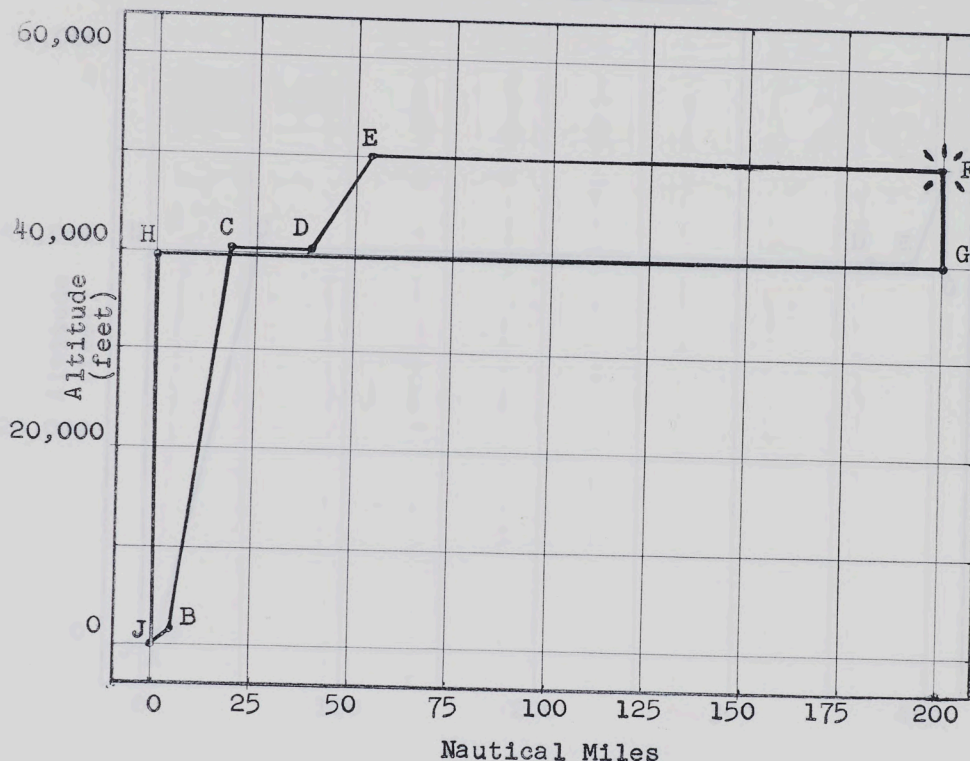
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FORM 1746



MISSION DIAGRAM

COMBAT RADIUS OF ACTION

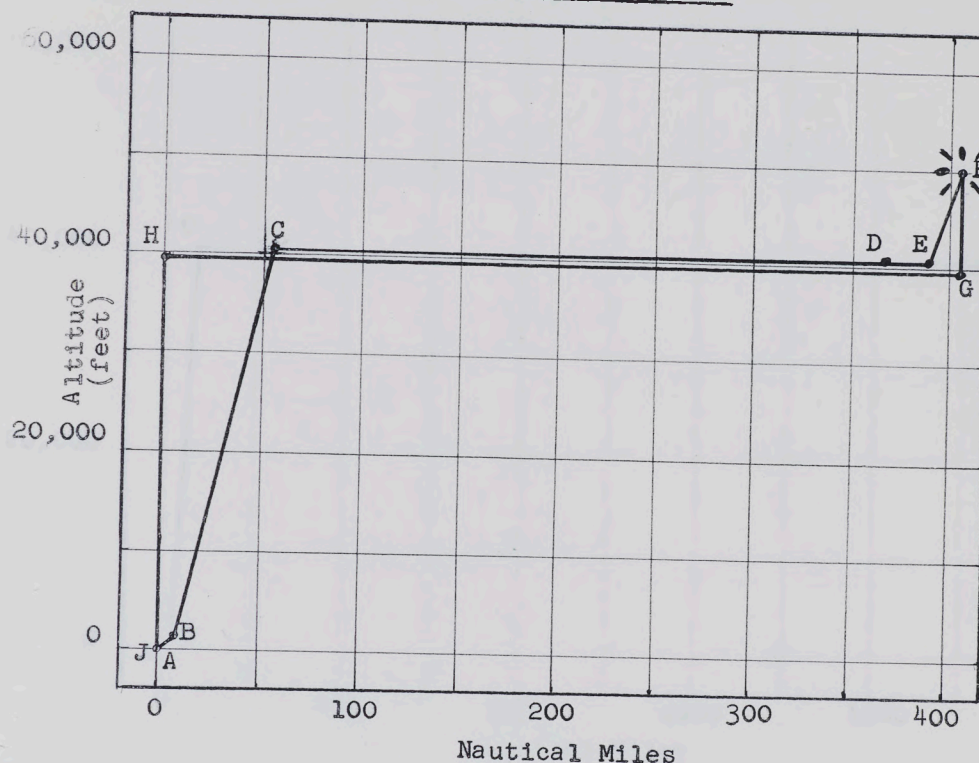


CONDITION	DIST. N.M.	TIME MINS.	FUEL LB.
A Engine Start	-	.50	100
A Take-Off to Unstick (Mil Rating)	-	.41	170
A-B Accel. to Mach .92 (A/B Lit)	3.6	.60	1040
B-C Climb to 40,000' at Mach .92 (A/B Lit)	14.8	1.60	1570
C-D Accel. to Mach 1.5 (A/B Lit)	21.5	1.80	1290
D-E Climb to 50,000' at Mach 1.5 (A/B Lit)	12.5	.87	650
E-F Cruise Out 50,000' at Mach 1.5	147.6	10.25	4350
F Combat 50,000' at Mach 1.5 (A/B Lit)	-	5.00	2650
F-G Descend to 40,000'	-	1.20	40
G-H Cruise Back (Max. Range)	200	22.64	1750
H Stack at 40,000' (Max. End.)	-	15.00	1100
H-J Descend to S.L.	-	3.80	128
J Land with 5 Min. Fuel (Max. End.)	-	5.00	460
TOTAL	400	68.67	15298

FIGURE 1
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MISSION DIAGRAM
CRUISING RADIUS OF ACTION



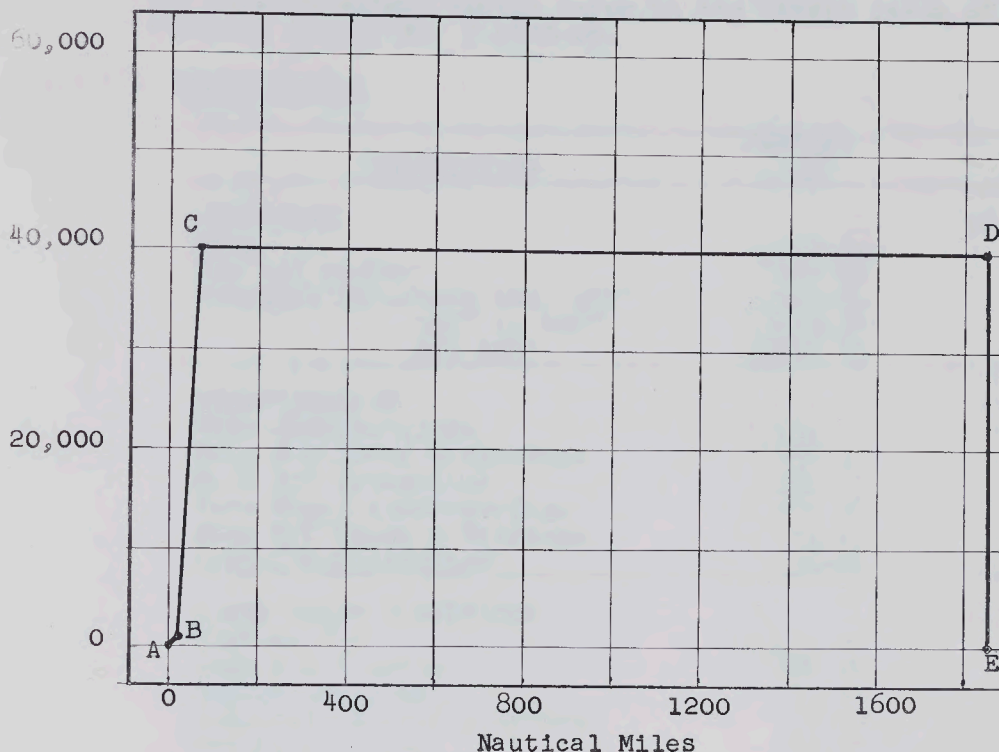
CONDITION		DIST. N.M.	TIME MINS.	FUEL LB.
A	Engine Start	-	.50	100
A	Take-Off to Unstick (Mil Rating)	-	.41	170
A-B	Accel. to 530 Kts. (Mil Rating)	7.0	1.20	520
B-C	Climb to 40,000' at .530 Kts. (Mil Rating)	45.5	5.17	1350
C-D	Cruise out 40,000' (Max. Range)	322.0	36.50	3410
D-E	Accel. to Mach 1.5 40,000' (A/B Lit)	19.7	1.65	1190
E-F	Climb to 50,000' at Mach 1.5 (A/B Lit)	11.5	.80	590
F	Combat 50,000' at Mach 1.5 (A/B Lit)	-	5.00	2650
F-G	Descend to 40,000'	-	1.20	40
G-H	Cruise Back 40,000' (Max. Range)	406	45.96	3590
H	Stack at 40,000' (Max. Endurance)	-	15.00	1100
H-J	Descend to Sea Level	-	3.80	128
J	Land with 5 Min. Fuel (Max. End.)	-	5.00	460
TOTAL		812	122.00	15298

FIGURE 9
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MISSION DIAGRAM

OVERLOAD RANGE



CONDITION	DIST. N.M.	TIME MINS.	FUEL LB
A Engine Start	-	.50	100
A Take-Off Unstick (Mil Rating)	-	.52	212
A-B Accel. to 530 Kts. (Mil Rating)	8.2	1.40	631
B-C Climb to 40,000' 530 Kts. (Mil Rating)	61.0	6.90	1740
C-D Cruise 40,000' (Max. Range)	1790	203.00	19313
D Stack at 40,000' (Max. Endurance)	-	15.00	1139
D-E Descend to S.L. (Idling)	-	3.80	132
E Land with 5 Min. Fuel (Max. Endurance)	-	5.00	476
TOTAL	1859	246.12	23743

FIGURE 10

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3.1.5 Weight and Balance

to be completely reviewed

The estimated weight for the first aircraft is as follows.
For current weight status refer to the latest issue of Avro
Aircraft Report No. 7-0400-05.

3.1.5.1 Basic Weight

DESCRIPTION	WEIGHT LB.	
STRUCTURE		16,830
Wing	9,542.56	
Fin and Rudder	912.02	
Fuselage Structure Fwd. 255"	2,200.09	
255" to 485"	1,523.08	
Aft 485"	2,652.27	
UNDERCARRIAGE		2,861
Main Undercarriage	1,839.6	
Main U/C Doors & Fairings	287.32	
Main U/C Hydraulics	295.56	
Nose Wheel Undercarriage	294.00	
Nose U/C Doors & Fairings	25.92	
Nose U/C Hydraulics	118.95	
POWER PLANT & SERVICES		13,889
Engines J75	12,647.00	
Gear Box & Drive	150.00	
Engine Controls	25.10	
Pneumatic Starting System	70.00	
Engine De-Icing	65.75	
Fire Extinguishing System	64.27	
Engine Mountings & Brackets	221.11	
Fuel System	645.35	
FLYING CONTROLS GROUP		1,724
Mechanical Flying Controls	784.89	
Flying Controls Electronics	108.00	
Flying Controls Hydraulics	830.87	
EQUIPMENT FIXED & REMOVABLE		6,535
Instruments	57.30	
Probe	15.00	
Oxygen System	46.12	
Air Conditioning System	624.95	
Hydraulic Main System	215.66	
Brake Parachute	68.03	
Electrical System	767.74	
Low Pressure Pneumatics	16.60	
Oil & Hydraulic Fluid Cooling	119.80	

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3.1.5.1 Basic Weight (Cont'd)

DESCRIPTION	WEIGHT LB.
EQUIPMENT FIXED & REMOVABLE(Cont'd)	
Intake De-Icing	101.72
Radio & Radar Fixed	150.00
Radio & Radar Fixed Allowance	771.10
Canopy Actuation	47.00
Cabin Consoles	20.85
Radar Door Actuation	10.00
Radome Anti-Icing	16.80
Cabin Insulation	11.91
Cockpit Pressure Sealing	20.00
Ejector Seats	204.00
Emergency Provision	16.95
Radar Removable	380.7
Radar Removable, Allowance for	879.00
Radio Removable & I.F.F.	113.50
Radio Removable, Allowance for	162.70
Missile Pack Structure, Allowance for	676.17
Missile Pack Mechanism Allowance for	410.48
Missile Pack Hydraulics, Allowance for	293.00
Missile Pack Electronics Allowance for	318.00
AIRCRAFT WEIGHT EMPTY	41,839
USEFUL LOAD	17,136
Crew	430.00
Oil	85.08
Alcohol for Radome De-Icing	22.00
Residual Fuel	219.80
Fuel for Combat Mission	15,298.00
Missiles (Armament) Allowance for	1,042.40
Oxygen Charge	13.39
Engine Fire Extinguisher Fluid	25.00
Normal Combat Mission	58,975.00
Half Combat Mission Fuel 980 @ 7.8 lb./gal.	7,649.00
Combat Weight (Half Combat Mission Fuel)	51,326.00
Operational Weight Empty	43,677.00

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3.1.5.1 Basic Weight (Cont'd)

DESCRIPTION	WEIGHT LB.
Maximum Internal Fuel 2,544 gal. @ 7.8 lb./gal.	19,843.00
A.U.W. Max. Internal Fuel	63,520.00
Max. External Fuel, 500 gal. @ 7.8 lb./gal. & Drop Tank	4,210.00
A.U.W. Max. Internal & External Fuel	67,730.00

3.1.5.2 Unit Weights

- (a) Wing Group (Gross Area 1225 sq. ft.) 7.778 lb./sq. ft.
- (b) Vertical Tail (Gross Area 158.79 sq. ft.) 5.737 lb./sq. ft.
- (c) Fuel System (Capacity 2544 Imp. Gal.) .253 lb./Imp. Gal.
- (d) Lubrication System - Not applicable.
- (e) Cooling System - Not applicable.

3.1.5.3 Balance

The c.g. limits of the aircraft are estimated to be:

Forward Limit	28% of the M.A.C. (limited structurally)
Aft Limit	31% of the M.A.C. (limited aerodynamically)

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3.1.6 Areas (~~Not to be used for inspection purposes~~) *delete*

Wing area (including ailerons, elevators and 390.50 sq. ft. of fuselage and not including extended leading edge)	1225.00 sq. ft.
Aileron area (aft of hinge line)	66.55 sq. ft.
Elevator area (aft of hinge line)	106.90 sq. ft.
Vertical tail area (including rudder)	158.79 sq. ft.
Fin area	120.62 sq. ft.
Rudder area (aft of hinge line)	38.17 sq. ft.
Speed brake area - 2 - (Projected)	14.367 sq. ft.

should include extended Leading Edge

3.1.7 Dimensions and General Data (~~Not to be used for inspection purposes~~)

3.1.7.1 Wings

Span	50 ft. 0.00 in.
Chord - Root	45 ft. 0.00 in.
- Construction Tip	4 ft. 0.00 in.
Mean Aerodynamic Chord	30 ft. 2.61 in.
Airfoil Section - Inner Wing	
- Profile ..	.0003.5-6-3.7 (Modified)
- Camber0075 (Modified)
- Leading Edge Droop	8.0 degrees
- Outer Wing	
- Profile ..	.0003.5-6-3.7 (Modified)
..	.0003.8-6-3.7
- Camber0075 (Modified)
- Leading Edge Droop	4.0 degrees
Incidence - Root	0 degrees
- Construction Tip	0 degrees
Sweep back - Leading Edge	61.45 degrees
- Trailing Edge	11.21 degrees
- $\frac{1}{4}$ Chord	55.00 degrees
Anhedral	4.00 degrees
Aspect Ratio	2.04
Ailerons - Span (each)	10 ft. 0.00 in.
- Chord (average percent wing chord)	
- Root ..	25.735
- Tip ...	35.000
Elevators - Span (each)	10 ft. 2.00 in.
- Chord (average percent wing chord)	
- Root ..	14.109
- Tip ...	25.735

what % chord

3.1.7.2 Horizontal Tail

Not applicable.

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3.1.7.3 Vertical Tail

Span 12 ft. 10.50 in.
Chord - Root 19 ft. 0.00 in.
 - Construction Tip 5 ft. 8.00 in.
Mean Aerodynamic Chord 13 ft. 6.41 in.
Airfoil Section0004-6-3.7 (Modified)
Sweep back - Leading Edge 59.34 degrees
 - Trailing Edge 33.08 degrees
 - $\frac{1}{4}$ Chord 55.00 degrees
Aspect Ratio 1.04
Rudder - Span (average) 9 ft. 11.00 in.
 - Chord (average percent vertical
 tail chord) 30.00 in.

3.1.7.4 Speed Brakes

Span (each) 2 ft. 1.08 in.
Chord 4 ft. 1.00 in.

3.1.7.5 Height of Aircraft

Reference to ground static line 21 ft. 2.07 in.

3.1.7.6 Length of Aircraft (Not including 3 ft. (approx.) probe)

Aircraft reference line level 75 ft. 11.45 in.

3.1.7.7 Propeller

Not applicable.

3.1.7.8 Landing Gear

Tread 25 ft. 7.34 in.
Wheel Base 30 ft. 2.46 in.

3.1.7.9 Ground Angle

Angle between aircraft reference line and
ground static line 4.55 degrees

3.1.8 Control Surfaces and Corresponding Control Movements (Not to be used for inspection purposes)

		<u>Surface Movement</u>	<u>Control Movement</u>
Ailerons:	up and down	19°	14.20°
Elevators:	up	30°	14.5°
	down	20°	9.67°
Rudder:	left and right	30°	3.25 in.
Speed Brake		60°	-

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3.2.5 Production, Maintenance and Repair

The design of the aircraft shall be such as to be suitable for large scale production. Consideration shall be given during the design to provide access to the aircraft and installed equipment to facilitate ease of replacement, maintenance, and repair. Maintenance provisions incorporated in the aircraft and the equipment installed therein shall conform to:

- (a) Requirements ^{covered by CAP 479 or as otherwise issued by the RCAF} ~~issued by D.N.D. or approved by the R.C.A.F. as covered by CAP 479 Chapter 4, or~~
- (b) Requirements covered by ARDCM 80-1.

The above considerations and requirements shall be subordinate only to the fulfillment of the primary role of the aircraft and to the safety of the crew.

3.2.6 Climatic Conditions

The aircraft shall be designed to meet the environmental conditions given in ARDCM 80-1, and additionally for operation within the design flight conditions.

All contractor furnished equipment installed in the aircraft shall be designed to meet the environmental conditions given in ARDCM 80-1 and additionally, where the pressure altitude and/or temperature is in excess of that covered by ARDCM 80-1 the requirements in the Company Equipment Specifications and Company Specification Avrocan E-266, as applicable, shall govern.

V2 (A7) approved

3.2.7 Noise and Vibration

The aircraft shall be designed so that the local vibration characteristics shall not exceed the limits specified in the applicable equipment specification.

within glide envelope

Noise levels at the head positions ^{normal} of the occupants at their respective stations, during flight ~~under cruising~~ conditions shall not ~~normally~~ exceed the values as given in CAP 479 paragraph 20.04.

3.2.8 Processes

Processes used in construction of the airframe and contractor furnished equipment incorporated in the various systems installed therein shall conform to:

- (a) Requirements issued by D.N.D. or approved by the R.C.A.F. as covered by CAP 479 Part 5 (including

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3.2.8 Processes (Cont'd)

(a) (Cont'd)

Processes covered by R.C.A.F. approved Company Specifications; or

to become item (c)

(b) Requirements covered by ARDCM 80-1.

3.2.9 Finish

The finish on all parts and components shall be in accordance with Avro Aircraft Company Standard CSD 2, and CAP 479 Part 5 and RCAF approved

3.2.10 Colour Scheme and Identification Markings

Aircraft components and aircraft parts shall be marked in accordance with MIL-M-7911 and Specification 98-24105-5. The aircraft exterior colour scheme and markings shall conform to:

(a) CAP 479 Chapter 6; or
b EO 05-1-20 ; or

(b) Company Drawings, where not covered by (a) *or (b)*

3.2.11 Pipeline Identification

All pipeline and electrical conduit in the aircraft shall be marked in accordance with CAP 479 Chapter 6, together with such additional markings as may be required by the specification governing each system.

3.2.12 Electrical Circuit Identification

Identification of electrical circuits shall be in accordance with the requirements of Specification MIL-W-5088A, and as additionally agreed between the R.C.A.F. and the Company. *quote reference*

3.2.13 Interchangeability

Interchangeability and replaceability shall conform to the requirements of Specification MIL-I-8500A *plus deviations in APP II* and ~~Avro Aircraft Report QC-E-8.~~

3.2.14 Lubrication

The lubrication schedule and types of lubricants to be used shall be as detailed in the Description and Maintenance Instructions for the CF105 aircraft. *Add grease specs*



3.2.15 Equipment

Contractor furnished equipment incorporated in the various systems installed in the aircraft shall conform to:

- (a) Requirements issued by D.N.D. or approved by the R.C.A.F., as covered by CAP 479 Part 5; or
- (b) Requirements covered by ARDCM 80-1; or
- (c) R.C.A.F. approved Company specifications.

Government supplied equipment shall be suitable for use under the conditions appropriate to its purpose in the aircraft and shall be installed in the aircraft without modification by the Company.

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3.3 Aerodynamics

3.3.1 General

The aircraft shall be a high wing, delta planform with 40° anhedral, and of moderate wing loading. The utmost consideration shall be given to cleanness of design with all antennas flush mounted and protuberances kept to a minimum.

as designed in Av 7-4.

* The aerodynamic characteristics of the aircraft shall be such as to permit the accomplishment of the primary role as stated in paragraph 2.2.1. These characteristics, including performance, controllability, stability and flutter shall conform to the requirements of ARDCM 80-1, except as stated in the Deviations given in Appendix II.

3.3.1.1 Special Characteristics

The wing leading edge shall be slotted, extended and drooped (as described in paragraph 3.5.2.3) to prevent "pitch-up" at high lift coefficients and to extend the aerodynamic aft center of gravity limit.

- * A maximum camber of $0.75\%C$ (Negative) shall be incorporated in the wing design in order to reduce the required elevator deflection and to increase the airplane ceiling.

The air intake for the air induction system to the engine shall be preceded by a fixed wedge shaped ramp adjacent to the fuselage. The wedge angle of the ramp shall be designed so as to:

- (a) Induce (at supersonic mach numbers) an oblique shock wave near the lip of the ramp and a shock wave normal to the ramp in order to reduce intake pressure losses.
- (b) Prevent formation of a shock wave within the engine air intake.
- (c) Provide for a minimum amount of spillage drag at supersonic mach numbers.

deleted
{ A boundary layer bleed shall be installed between the fixed ramp and the fuselage to prevent boundary layer breakaway and to improve intake efficiency.

A two position annular by-pass around the engines shall be provided to increase the intake stable mass flow range, improve intake efficiency, reduce spillage drag and supply air to the exhaust nozzle ejector.

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3.3.1.2 Aerodynamic Data

Aerodynamic data, including lift, moment, drag, yaw, thrust, take-off and landing, stability and controllability characteristics of the aircraft will be found in the reports listed in Appendix III.

3.3.2 Stability and Control

List
Deviations
in APP II

The aircraft shall be designed to meet the stability and control requirements of U.S.A.F. Specification 1815B except as stated in Avro Aircraft Report Number Aero Data 66.

*There is a new spec, to use
the negative with G to use
it instead*

3.3.3 Aero-Elasticity

Flutter and divergence calculations shall be computed in accordance with the requirements of U.S.A.F. Specification 1817.

and tests conducted

The lift factor above Mach 1.0 shall decrease as a function of skin temperature.

Up to the maximum speed limited by Mach 0.9.

3.3.3.1 Flight Envelope

The aircraft shall be designed to operate at weights in excess of 47,000 pounds and at altitudes in excess of 50,000 feet.

3.3.3.2 Flight Envelope

In addition to the above the flight envelope shall be as shown in the following flight envelope:

Sea Level:	Figure 11	Page 20
10,000 Feet:	Figure 12	Page 21
20,000 Feet:	Figure 13	Page 22
30,000 Feet:	Figure 14	Page 23
40,000 Feet:	Figure 15	Page 24
50,000 Feet:	Figure 16	Page 25
60,000 Feet:	Figure 17	Page 26
70,000 Feet:	Figure 18	Page 27
80,000 Feet:	Figure 19	Page 28

The following envelope, as outlined in the flight envelope, shall be as shown in the following flight envelope:

Line A-B - Positive Envelope
Line B-C - Negative Envelope

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3.4 Structural Design Criteria

The structural design of the aircraft shall be in accordance with the requirements of Specification MIL-S-5700 and limit load factors as stated below, and shall be based on a weight for stress analysis of 47,000 lb. (100)
(101)
(102)
(103)

3.4.1 Limit Flight Load Factors

3.4.1.1 Gross Weight for Stress Analysis 47,000 Lb.

		Clean Configuration	Missile Firing	Aux. Tank Inst
<u>Maneuver</u>	Positive	+7.33 *	+4.00	+4.50 **
	Negative	-3.00	0.	-1.50 **
<u>Gust</u>	Positive	+3.9		
	Negative	-1.9		

* The limit load factor above Mach 1.0 shall decrease from 7.33 as a function of skin temperature. (99)

** Up to the structural speed limitation of Mach 0.95.

3.4.1.2 Weight in Excess of 47,000 Lb.

In the clean configuration and at weights in excess of 47,000 lb., the aircraft limit flight maneuver load factor shall be:

$$n_1 = \frac{47000}{W} \times n$$

3.4.1.3 Flight Envelopes

In addition to the above the limit flight load factors shall be as shown in the following flight envelopes.

Sea Level:	Figure 11 Page 30
10,000 feet:	Figure 12 Page 31
20,000 feet:	Figure 13 Page 32
30,000 feet:	Figure 14 Page 33
Tropopause:	Figure 15 Page 34
40,000 feet:	Figure 16 Page 35
50,000 feet:	Figure 17 Page 36
60,000 feet:	Figure 18 Page 37
70,000 feet:	Figure 19 Page 38

The following symbols, as utilized on the above noted flight envelopes, shall be defined as:

Line A-B = Positive Structural Maneuver Limit
Line D-C = Negative Structural Maneuver Limit

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3.4.1.3 Flight Envelopes (Cont'd)

Line B-C = Limit Dive Speed
Lines H = Positive Gust
Lines J = Negative Gust
 $V_E = V \sqrt{\sigma}$ KTS. = Equivalent Air Speed (Knots)
M = Mach Number

3.4.1.4 Load Factors in Roll

The limit flight maneuver load factors in rolling shall be in accordance with the requirements of MIL-S-5702 except that the maximum load factor in a rolling pull-out shall be 4.89. (9)

3.4.1.5 Load Factors in Spin

The limit flight maneuver load factors in spin shall be in accordance with the requirements of MIL-S-5702 except that yawing velocity in a flat spin shall be reduced from 5 radians per second to 3.5 radians per second. (8)

3.4.2 Limit Ground Load Factors

The design limit ground load factors shall be computed in accordance with the requirements of Specification Bulletin ANC-2a. (7)

3.4.3 Limit Diving Speed

The limit diving speed shall be as shown on the flight envelopes (Reference paragraph 3.4.1).

3.4.4 Ditching Criteria

Not applicable.

3.4.5 Ultimate Loads

All limit loads derived from the above criteria shall be multiplied by 1.365 to obtain ultimate loads.

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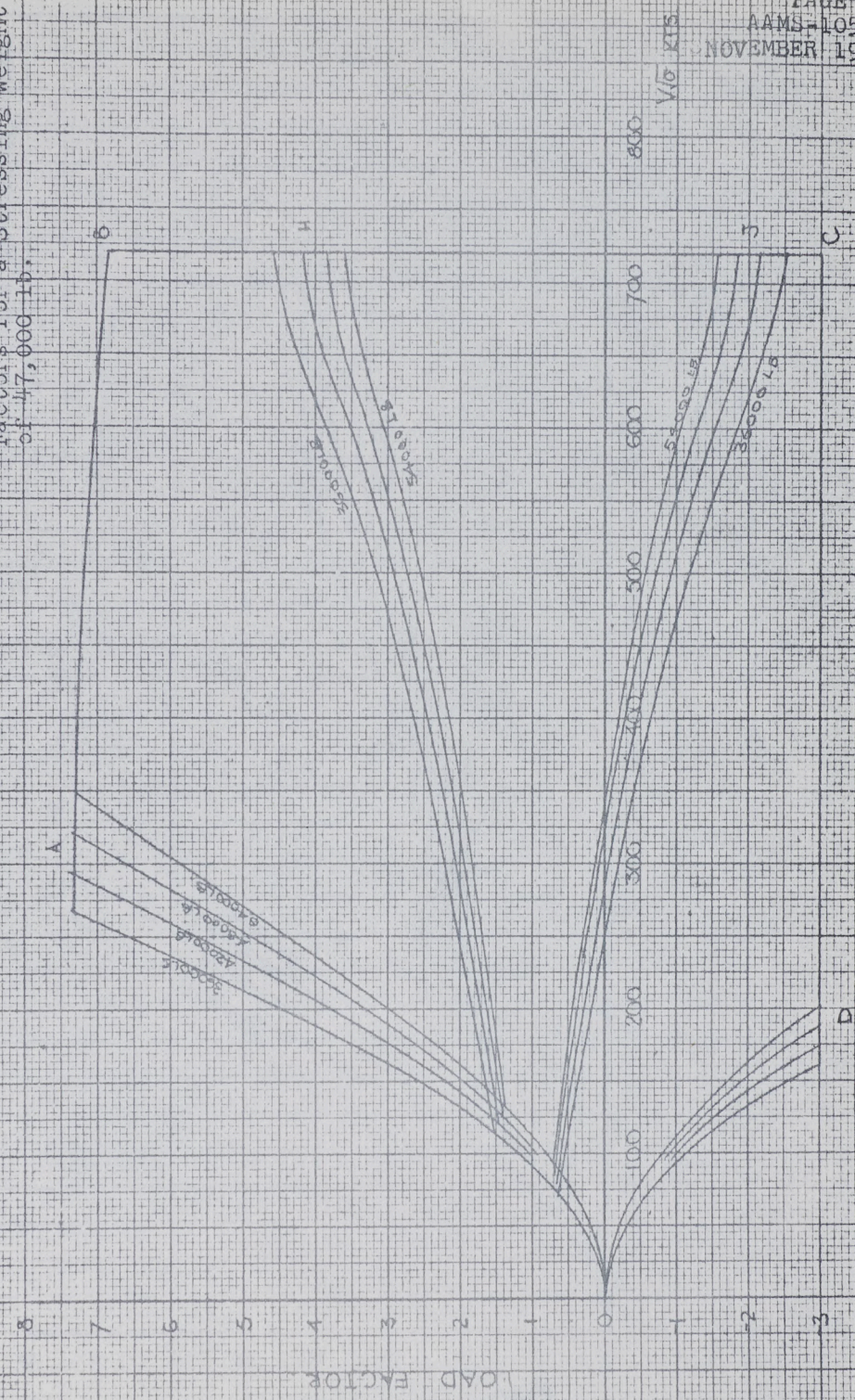
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C105-1225 (0759 CAMBER) FLIGHT ENVELOPE

SEA LEVEL

M = 0.01513 V_e

Structural Limit Maneuver Load Factors for a Stressing Weight of 47,000 lb.



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C105

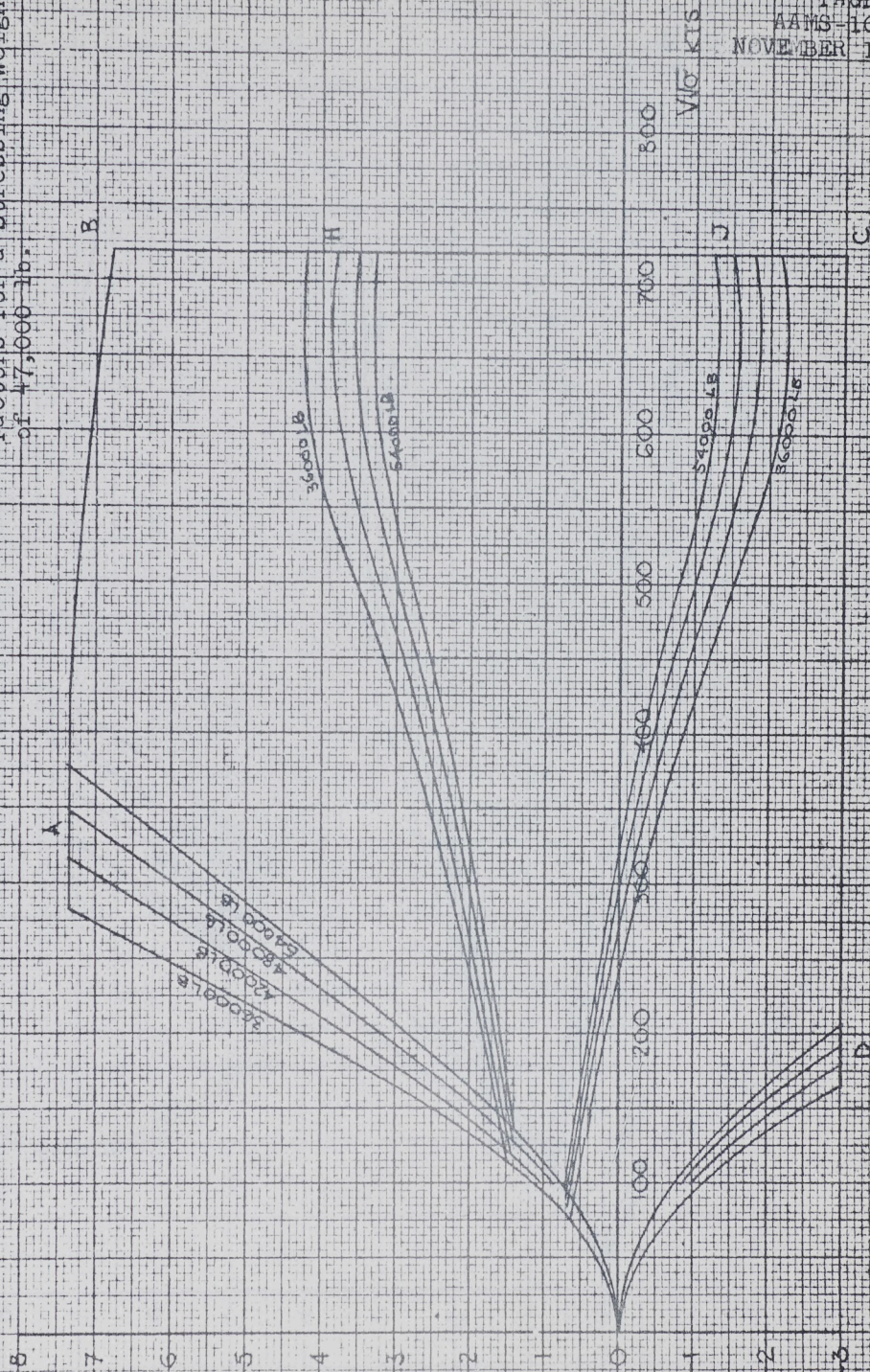
1225 (0.75% CAMBER)

FLIGHT ENVELOPE

10,000 FT

$M = .001824 V_e$

Structural Limit Maneuver Load
Factors for a Stressing Weight
of 47,000 lb.



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C105

1225 (0.75% CAMBER)

FLIGHT ENVELOPE

20000 FT

M = .002232 Ve

Structural Limit Maneuver Load Factors for a Stressing Weight of 47,000 lb.

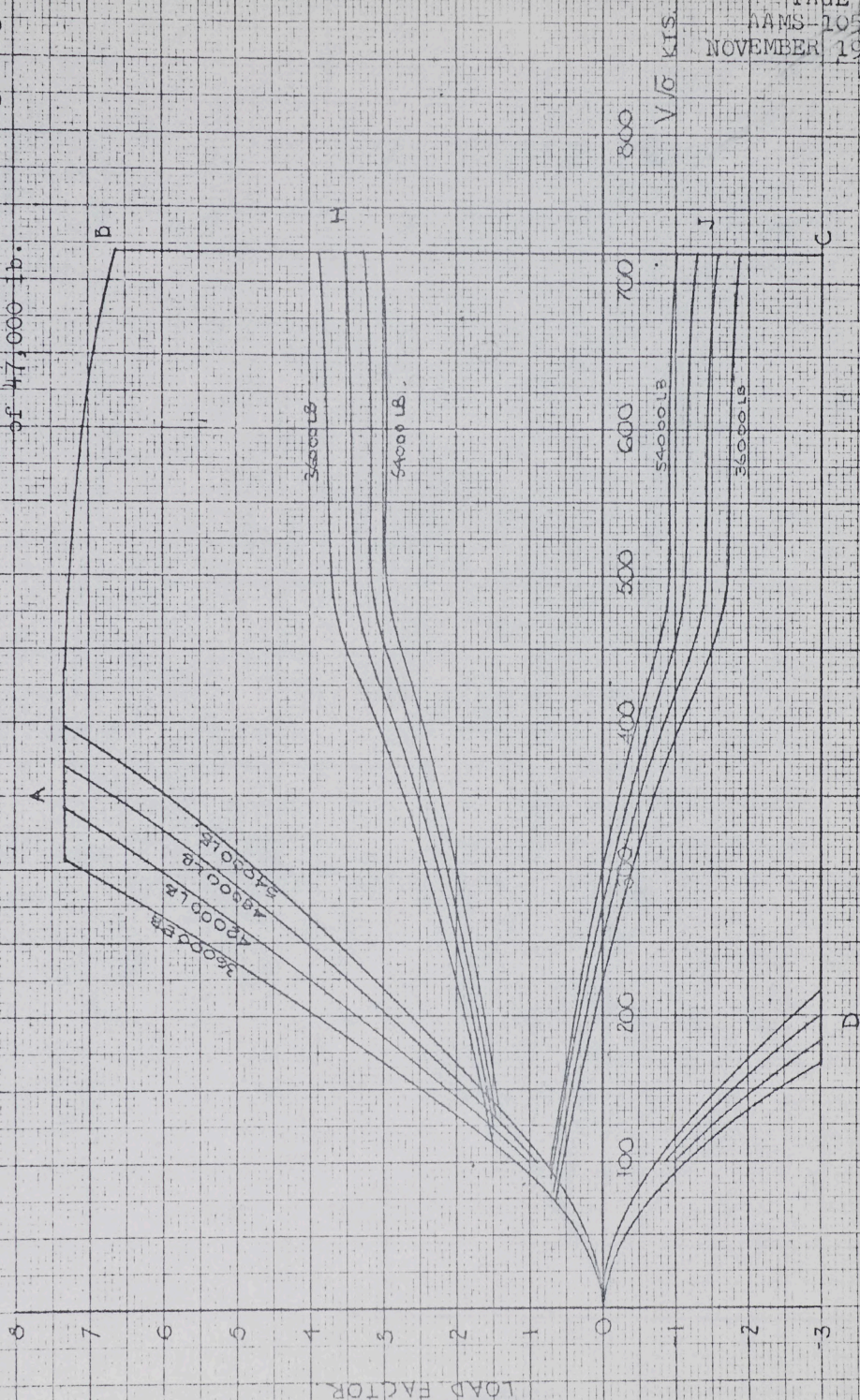


FIGURE 13

SECRET

FORM 1746

0105

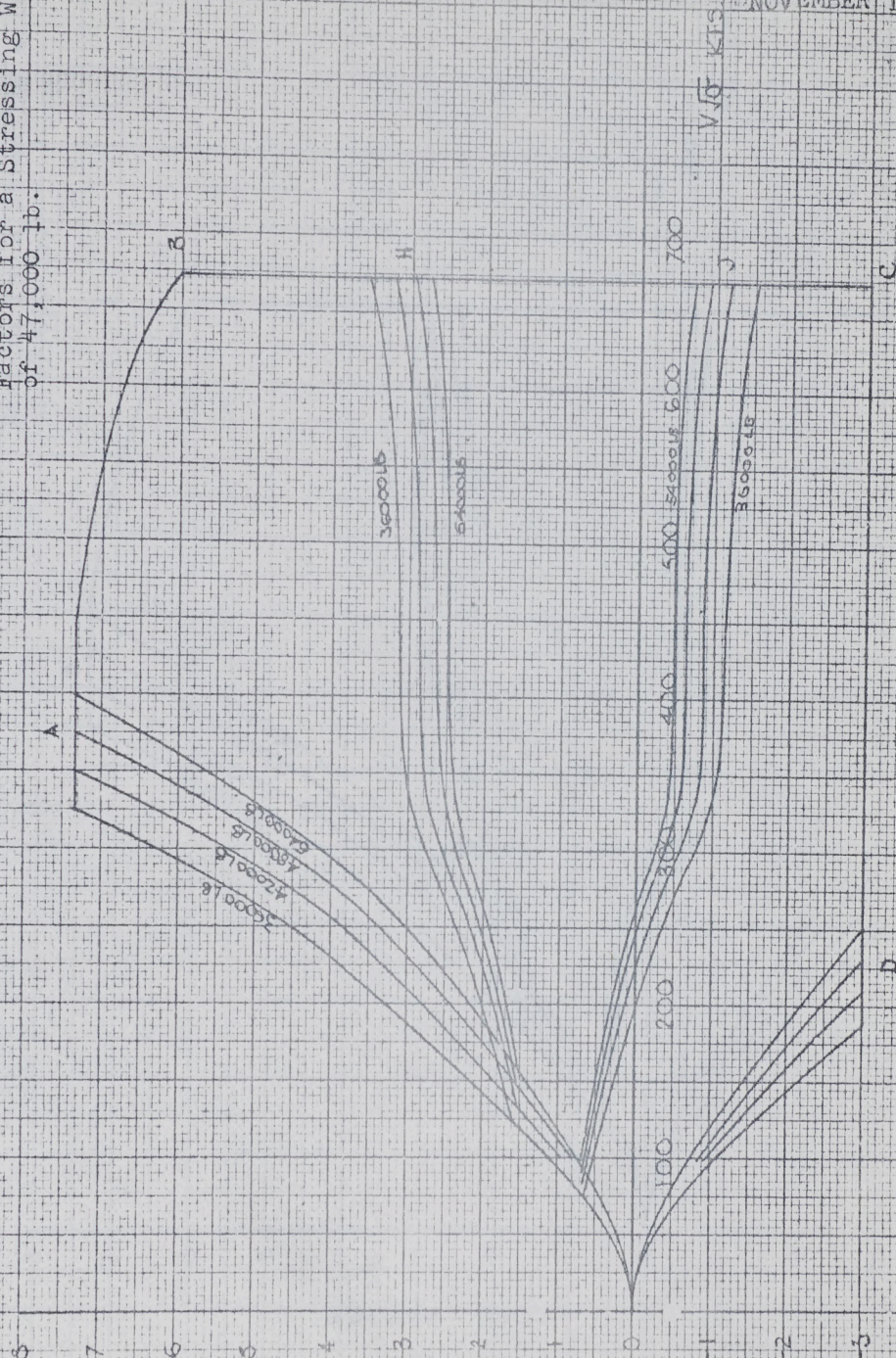
225 (0.75% CAMBER)

TROPO PAUSE

FLIGHT ENVELOPE

$M = 0.003145 V_e$

Structural Limit Maneuver Load
Factors for a Stressing Weight
of 47,000 lb.



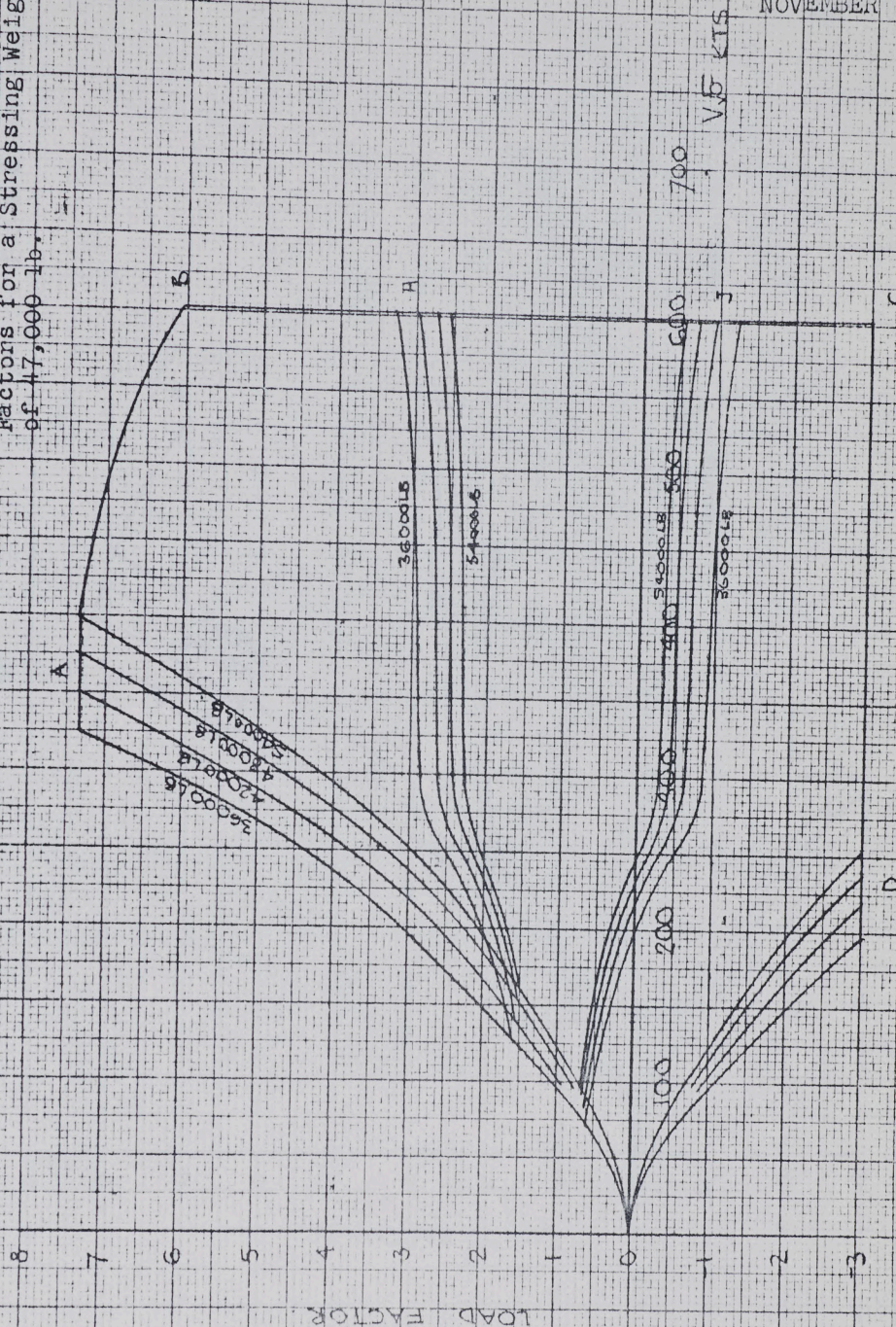
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FORM 1748

40,000 FT

M = 003816 V

Structural Limit Maneuver Load
Factors for a Stressing Weight
of 47,000 lb.



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FIGURE 16

FIGURE 16

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C-105 1725 (075 & 5AMBER) FLIGHT ENVELOPE

50,000 LB

$M = 0.044G \times V_e$

Structural Limit Maneuver Load
Factors for a Stressing Weight
of 47,000 lb.

b.

5

B

36000 lb
34000 lb
32000 lb
30000 lb

H

36000 lb
34000 lb

500

400

300

200

100

V_e KTS

J

C

D

LOAD FACTOR

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FLIGHT ENVELOPE

C105 - 1225 (0.7% CAMBER)

000,000

M- .00 5669 VE

Structural Limit Maneuver Load
Factors for a Stressing Weight
of 47,000 lb.

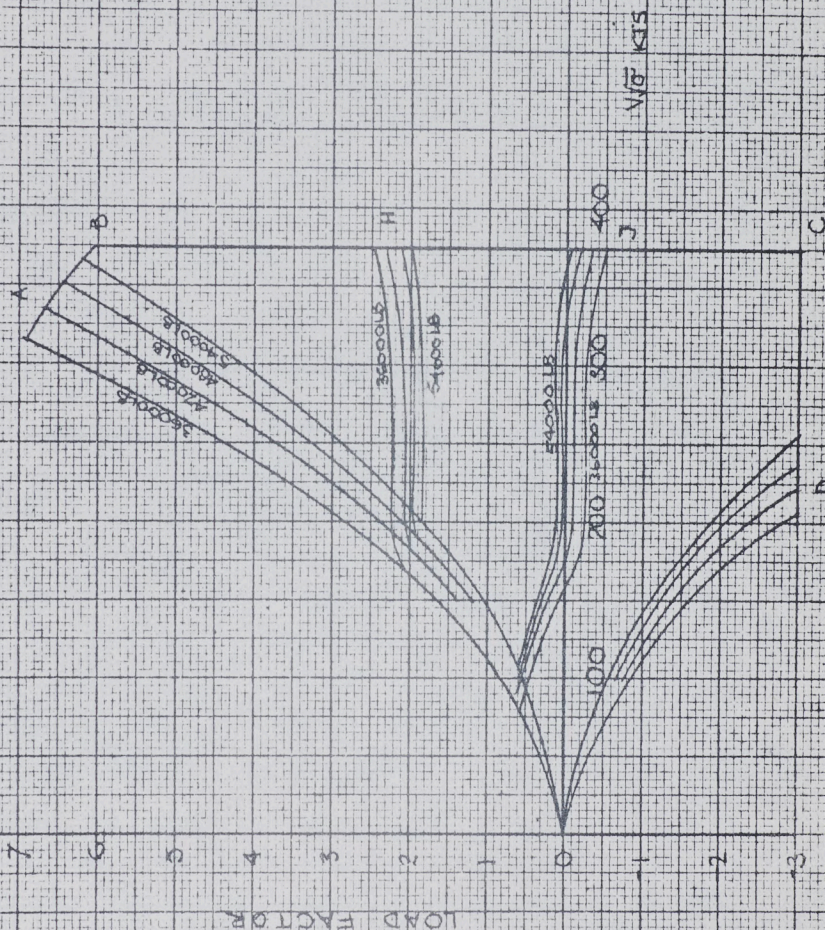


FIGURE 18

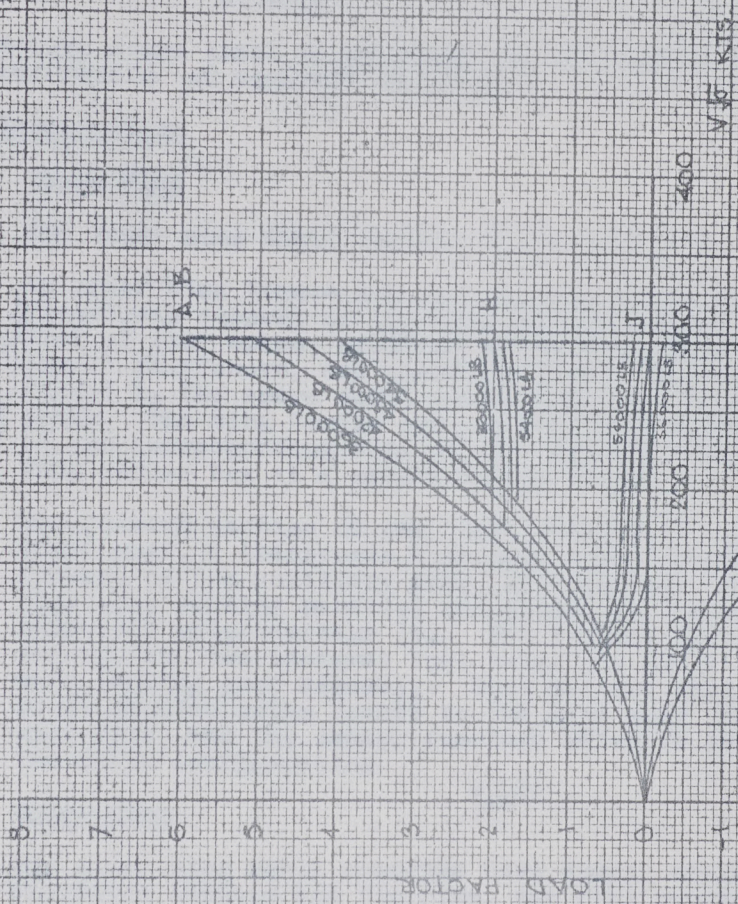
SECRET

C105 - 1225 (0.75% CAMBER) FLIGHT ENVELOPE

70,000 FT

$M = 1.007198 \text{ } \gamma$

Structural Limit Maneuver Load
Factors for A Stressing Weight
of 47,000 lb.



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3.5 Wing Group

3.5.1 Description and Components

The wing shall be a delta type of full cantilever, all metal, stressed skin construction, comprising six main sections on each side of the aircraft center line:

Inner Wing
Outer Wing
Leading Edge
Trailing Edge
Elevator
Aileron

Access doors shall be provided for inspection, maintenance and repair, of aircraft services.

3.5.2 Construction

3.5.2.1 Inner Wing

The inner wing shall consist of two sections.

should include description of elevator control box
An inner wing torque box section shall form the main structural support of the wing assembly and shall consist of four spars, machined skins with spanwise integral stiffeners, and chordwise ribs. The three bays formed by the spars shall constitute four integral fuel tanks. The wing torque box section root shall be attached to the corresponding root of the opposite wing and to a wing center box at a manufacturing joint.

The forward section of the inner wing shall comprise a front spar, a transverse auxiliary spar, chordwise ribs forward of the auxiliary spar, and ribs aft of the auxiliary spar running parallel and normal to the axis of the retracted undercarriage leg. The forward section shall incorporate two integral fuel tanks and shall house the main landing gear assembly. This section shall be attached at manufacturing joints to the main spar, the opposite wing root, and the center fuselage which is indented into the delta configuration.

3.5.2.2 Outer Wing

otherwise for elevator control box
delete
The outer wing shall comprise five spars, stringers, chordwise inboard and tip ribs, and ribs running normal to a wing tangency line. It shall be attached to the inner wing by bolts at a transport joint with loads transmitted to the inner wing through the skin attachment, at a front spar joint, a rear spar joint, and three intermediate vertical shear joints. The outer

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3.5.2.2 Outer Wing (Cont'd)

wing shall house the aileron control unit forward of the rear spar.

3.5.2.3 Leading Edge

The leading edge of the wing shall comprise three sections with structural ribs running normal to the front spar line. As a structural assembly the leading edge shall supplement the structure of the inner and outer wing panels. At the outer chord of the inner wing panel the leading edge shall be slotted 5% of the chord and $6\frac{1}{2}$ " spanwise. The leading edge from outboard of the slot to the wing tip shall be extended forward along the chord line 10% of the chord. The leading edge assembly shall be attached to the inner and outer wing panels at manufacturing joints.

3.5.2.4 Trailing Edge

The trailing edge shall be divided into three sections for the purpose of manufacturing.

An inner trailing edge shall extend outboard from the wing center box to the inboard chordline of the elevator and shall be a manufacturing detail build-up section of six spanwise beams and machined skins bolted at manufacturing joints to the rear spar, the wing center box, and the center trailing edge. The inner trailing edge shall house the elevator control unit.

A center trailing edge shall extend the full span of the elevator and shall comprise an elevator hinge spar and chordwise ribs, six of which shall support the elevator control linkage. The center trailing edge shall be bolted to the inner and outer wing panels and to the outer trailing edge.

An outer trailing edge shall extend the full span of the aileron and shall comprise an aileron hinge spar, and internal ribs at approximately 74° to the spar, seven of which shall support the aileron control linkage. The outer trailing edge shall be attached to the rear spar of the outer wing panel at a manufacturing joint.

3.5.3 Ailerons

The ailerons shall be of stressed skin construction, utilizing aluminum alloy skins, a hinge spar, and ribs running normal to the spar line. Seven main ribs shall connect to

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3.5.3 Ailerons (Cont'd)

the aileron linkage in the outer trailing edge of the outer wing. The aileron shall be hinged to the wing trailing edge by a piano hinge along the topside for the full span of the movable surface and shall be fully shrouded along the underside. (10)

The angular motion of the aileron shall be 19° up and 19° down from the hinge center line. The centroid of the aileron area shall be 19.036 feet from the aircraft center line. The design of the flying control system and its power operation shall obviate the necessity for aerodynamic and static balance.

3.5.4 Aileron Tabs

Not applicable.

3.5.5 Lift and Drag Increasing Devices

Not applicable.

3.5.6 Speed Brakes

Speed brakes installed on fuselage (Reference paragraph 3.7.6). *7422 7.14.1.15, Denison 7*

3.5.7 Elevator

The elevator shall be of stressed skin construction, utilizing aluminum alloy skin, a hinge spar, and ribs running normal to the spar line. Six main ribs shall connect to the elevator linkage in the wing center trailing edge. The elevator shall be hinged to the wing trailing edge by a piano hinge along the top side for the full span of the movable surface and shall be fully shrouded along the underside. The angular motion of the elevator shall be 30° up and 20° down from the hinge center line. The design of the flying control system and its power operation shall obviate the necessity for aerodynamic and static balance. (10)

3.5.8 Elevator Tab

Not applicable.



3.6 Tail Group

3.6.1 Description and Components

The tail group shall comprise a fin and rudder. Due to the delta wing configuration there shall be no horizontal stabilizer and the elevator shall be included as a section of the wing group.

3.6.2 Stabilizer

Not applicable.

3.6.3 Elevator

Elevators installed on wing surface (Reference paragraph 3.5.7).

3.6.4 Elevator Tab

Not applicable.

3.6.5 Fin

The fin shall be of aluminum alloy stressed skin construction and shall consist of two sections, a main structural assembly and an interchangeable rudder control linkage box aft of the rear spar. The main structure shall comprise five spars, spanwise compression ribs, and ribs running normal to the rudder hinge line. Loads shall be transmitted to the wing center box where the fin is attached at a manufacturing joint. A detachable fin tip of fibrous material shall be installed to house radio antennas. The rudder control linkage shall be housed in the control linkage box, with the control unit installed in the fin forward of the main structural assembly rear spar. Access doors shall be provided for inspection, repair, and maintenance of the rudder control unit and aircraft services.

3.6.6 Rudder

The rudder shall be of stressed skin construction and shall comprise a hinge spar, an intermediate spar, and ribs running normal to the hinge spar line. The rudder shall be supported from the fin by seven hinge ribs, five of which connect to the rudder control linkage. The design of the flying control system and its power operation shall obviate the necessity for aerodynamic and static balance.

3.6.7 Rudder Tab

Not applicable.

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3.7 Fuselage

3.7.1 Description

The fuselage shall be arranged below and extend forward of the wing and shall be designed to house two turbo-jet engines, armament, a crew of two, and the major proportion of the aircraft service components. The fuselage shall be of rounded cross-section from the nose probe to the cockpit and engine air intakes where it shall evolve into a slab-sided horizontally oblong cross-section. A pilot's V type windshield and a semicircular cockpit canopy shall protrude above the fuselage lines and shall fair into a dorsal fairing extending aft over the fuselage and wing upper surface to the vertical tail and rear fuselage.

3.7.2 Construction

The fuselage shall comprise a radar nose, nose fuselage, center fuselage, duct bay, engine bay, and rear fuselage, joined at manufacturing joints. The fuselage shall be of stressed skin construction utilizing aluminum alloy and magnesium alloy skins, with vertical bulkheads, frames, and longitudinal stringers in the radar nose, nose fuselage and center fuselage sections, and close pitched frames and longerons in the duct bay, engine bay and rear fuselage. Steel, magnesium, inconel 'X', and titanium shall be utilized in both primary and secondary structure, as required. Loads shall be transmitted between the fuselage and inner wing, by internal center struts between the fuselage main frames and inner wing spars, and through fuselage skin - underwing skin joints.

3.7.3 Crew Stations

The crew stations shall provide for a pilot and radar operator seated in tandem cockpits in the nose fuselage. The cockpits shall be pressurized in accordance with paragraph 3.22.1 and suitable insulation shall be installed to minimize heat transfer from the adjacent skin. A bulkhead shall render the two crew stations incommunicable. The cockpits shall be enclosed by a pilot's windshield and a canopy incorporating a split clamshell type hatch for each cockpit. (77)
(78)

The pilot's windshield and canopy windows shall comprise (12) optically flat panels of electrically heated tempered glass, and the radar operator's canopy windows shall comprise curved panels of tempered glass. Each canopy hatch shall be normally actuated electrically and locked by a manually operated latch. To provide for single crew member operation, access to the latch handle in the radar operator's cockpit shall be gained through a door in the cockpit

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3.7.3 Crew Stations (Cont'd)

separating bulkhead. A canopy actuating switch shall be installed in each cockpit for the respective canopy hatch. A switch for each canopy hatch shall be installed in a location accessible from the aircraft exterior. Emergency opening of the canopy hatches shall be by means of gas pressure from an explosive cartridge. Internal and external hand operated mechanical control for emergency opening shall be provided. *Safety interlocks shall be provided to prevent firing of seat if canopy is closed.*

(11)
(79)

The line of vision from the pilot's cockpit shall be directly forward to a line $12\frac{1}{2}$ degrees below the horizon, aft to 120 degrees on both sides from a line directly forward, and with reasonable pilot movement vertical vision on each side to a line 30 degrees below the horizon. The pilot's cockpit shall provide 25 inches clearance across the normal shoulder location and 36 inches clearance across the normal elbow location.

(80)
(13)

3.7.3.1 Pilot's Cockpit

Manual and automatic flying controls, instruments, warning indicators, and the following items of functional equipment shall be installed in the pilot's cockpit.

Switches

Canopy Opening (Normal)
Air Conditioning
Pressurization Dump Valve
Air Conditioning Defog
Rain Repellant
High Altitude Light
Fire Warning and Extinguishing
Second Shot Fire Extinguishing
Taxi and Landing Lights
Navigation Lights
Engine Starting
Master Electrical
Alternator
External Tank Jettison
Master Warning Test
Master Warning Reset
Artificial Horizon Erection
Engine Relight
Speed Brake
Press-to-transmit
Damping System:
Selector
Emergency Selector
Pitch Axis Re-engage
Roll Axis Re-engage

Controls

Air Conditioning
Cockpit Lighting Intensity
Landing Gear
Power Control (throttle)
Anti-G Valve
Emergency Oxygen Starting
Brake Parachute
Parking Brake
Rudder Pedal Adjustment
J4 Compass
Canopy Opening (Emergency)
Radio Compass AN/ARN-6
Intercom AN/AIC-10
I.F.F. AN/APX-6
Press-to-test Oxygen
Pressure
UHF Radio AN/ARC-34
Seat Raising
Manual Harness Release

*Review
to date*

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3.7.3.1 Pilot's Cockpit (Cont'd)

Switches (cont'd)

UHF Antenna Selector
RMI Function Selector
L-Band Antenna Transfer
Nose Wheel Steering
Elevator, Aileron and Rudder Trim
Missiles Firing Trigger
Armament On-Off
Armament Mode Selector
Master Emergency Jettison

3.7.3.2 Radar Operator Cockpit

To be added.

*define for
mark 1*

3.7.4 Cargo Compartments

Not applicable.

3.7.5 Equipment Compartments

Equipment compartments and bays as listed in the following sub-paragraphs shall be provided for aircraft propulsion, armament, electronics and services equipment and components. Compartments and bays housing equipment and/or components requiring a maintained temperature and/or pressure shall be suitably insulated, sealed, and vented as required. (Reference Section 3.22 Air Conditioning.)

3.7.5.1 Nose Radar Compartments

The radar nose shall comprise two compartments. The forward compartment shall be constructed of plastic bonded fibreglass and shall be detachable. The aft compartment shall comprise the fuselage structural area forward of the pilot's cockpit. Access to the aft compartment shall be provided by two doors, one on either side of the fuselage. Conditioned air shall be supplied to the compartments and equipment housed in the compartments.

3.7.5.2 Nose Wheel Well Compartment

Space in the nose wheel well shall be utilized for the installation of electrical and associated equipment. Conditioned air shall be supplied to maintain the temperature of the forward end of the well. Access shall be gained through the open wheel well door.

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3.7.5.3 Battery Compartment

A battery compartment shall be located in the nose wheel well with access provided to the compartment through the open wheel well door. The compartment shall be provided with conditioned air and shall be suitably treated against corrosion.

3.7.5.4 Forward Fuselage Electronics Bay

The area immediately aft of the nose wheel well shall comprise a forward fuselage electronics bay. Access shall be provided through a panel on the underside of the fuselage.

3.7.5.5 Forward Fuselage Electronics Compartment

Access shall be provided through doors on the underside of the fuselage.

The forward fuselage electronics compartment shall be located between the armament pack bay and the forward fuselage electronics bay. Conditioned air shall be provided to the compartment and installed equipment, with ~~access gained through doors on the underside of the fuselage.~~

(91)

3.7.5.6 Air Conditioning Equipment Bay

An air conditioning equipment bay shall be located immediately aft of the radar operator's cockpit. The bay shall be supplied with conditioned air, and access to the bay shall be provided by removal of a section of the dorsal fairing, an air outlet duct, and a shear panel.

3.7.5.7 Oxygen Bay

The oxygen bay shall comprise the dorsal fairing area immediately aft of the radar operator's cockpit. Conditioned air shall be provided to the bay and installed equipment. Access shall be gained through the same opening as for the air conditioning equipment bay.

3.7.5.8 Armament Pack Bay

The armament pack bay shall comprise a recess in the underside of the fuselage designed to permit the installation of interchangeable missile packs. Conditioned air shall be provided to maintain the internal air temperature of an installed missile pack.

3.7.5.9 Service Bays

The fuselage areas between the left and right hand air intakes and engines shall comprise three service bays. The



3.7.5.9 Service Bays (Cont'd)

forward bay shall primarily house electrical equipment, the center bay shall primarily house fuel system and hydraulic system components, and the aft bay shall house hydraulic system components and aircraft accessories gear boxes. Access doors and panels for the three bays shall be installed on the underside of the fuselage.

3.7.5.10 Dorsal Electronics Compartment

The dorsal electronics compartment shall be located in the dorsal fairing at approximately a mid-wing position. The compartment and equipment shall be supplied with conditioned air and access to the compartment provided by the removal of a section of the dorsal fairing.

3.7.6 Speed Brakes

Two symmetrical speed brakes, of box panel construction of aluminum alloy and magnesium alloy, shall be installed on the underside of the duct bay section of the fuselage. The brakes shall be installed outboard of the frontal area of the nose landing gear fairing. The brakes shall be actuated by a continuous positioning lever powered by the utility hydraulics system, and shall retract into a sealed well recessed into the underside of the fuselage.

3.7.7 Fuselage Power Plant Installation

Reference Section 3.10.

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3.8 Landing Gear

3.8.1 Description

The landing gear shall be an electrically controlled, hydraulically actuated tricycle type. The main landing gear shall retract inward and forward into the inner wing on a line at 50° to the aircraft center line. The nose gear shall be steerable and shall retract forward into the nose fuselage. The hydraulic actuating system shall be designed to retract the gear, including door operation, in 5 seconds (14) at -20°F and 30 seconds at -65°F. When completely retracted the alighting gear shall be enclosed within the faired lines of the wing and front fuselage.

A mechanically releasable and jettisonable drag parachute shall be installed within the faired lines of the rear fuselage.

The landing gear shall be designed in accordance with the requirements of R.C.A.F. Specification AIR 7-4, and ARDCM 80-1, except as stated in Appendix II and as additionally stated herein.

3.8.2 Main Landing Gear

3.8.2.1 Description

Each main landing gear shall comprise a two-wheel tandem bogie pivoted to a shock absorber installed in the lower end of a main strut. A mechanical linkage to draw the shock absorber into the main strut and rotate the bogie, and a telescopic spring strut to position the unloaded bogie in a front wheel down attitude, shall be installed to permit stowage of the retracted gear within a wing wheel well.

The upper end of each main landing gear main strut shall be pivoted between the front and main spars at the outer end of the inner wing. The strut shall be braced by a drag strut in the plane of the pivot line and by a telescopic downlock strut in the plane of retraction.

3.8.2.2 Wheels, Brakes and Brake Controls

The main wheels shall be demountable and fitted with anti-friction bearings and hydraulically operated multiple disc brakes. A skid detector shall be installed in the outer end of each wheel axle to govern a brake anti-skid hydraulic control valve. The hydraulic pressure available for normal brake operation shall be a maximum of 2130 psi, and for emergency operation a maximum of 1500 psi (Reference paragraph 3.14.1.1.4).



3.8.2.2 Wheels, Brakes and Brake Controls (Cont'd)

Metered and differential braking shall be obtainable by operation of toe pedals integral with the rudder pedals. It shall be possible to lock the brakes for parking by full depression of the toe pedals in conjunction with the positioning of a parking lever located at the left side of the pilot's cockpit. After engine shutdown the emergency hydraulic supply available from the accumulator shall permit three full applications of the brakes.

The main wheel brakes shall be applied automatically during the retraction cycle and released automatically during the extension cycle.

3.8.2.3 Tires

Tubeless tires (U.S.A.F. 29 x 7.7 Type VII E.H.P.) rated at 15,500 Lb. static load when inflated to 260 psi shall be installed.

3.8.2.4 Shock Absorbers

The shock absorbers shall be of liquid spring design and shall embody provision for topping up in situ. The shock absorber fluid shall be a blend of silicone oil and hydraulic oil.

3.8.2.5 Retracting, Extending and Locking Systems

3.8.2.5.1 Retraction

Each main landing gear shall be retracted inward and forward by a hydraulic actuator until an uplock is engaged. During the retraction cycle, the gear shall be shortened, and the bogie rotated to lie in the plane of the wing wheel well.

3.8.2.5.2 Extension

Each main landing gear shall be extended outward and aft by gravity and drag until a downlock is engaged. During the extension cycle, the gear shall be lengthened and locked, and the bogie rotated to lie in a plane parallel to the aircraft center line.

3.8.2.5.3 Locking

The downlock and uplock for each main gear shall be designed to engage mechanically and to be released by hydraulic actuators. The shock absorber downlock in the gear main strut shall be designed to lock and unlock mechanically.

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3.8.2.5.4 Controls

A pilot operated landing gear retraction and extension selector shall be installed to control the actuation of both main gears and the nose gear. A lock shall be incorporated in the selector to prevent UP selection until micro-switches have been closed by full extension of the shock absorbers. The actuation of the main gears and the main gear locks shall be hydraulically sequenced in relation to the actuation of the main gear doors and door locks (Reference Section 3.14). It shall be possible to reverse the motion of the landing gear, during the retraction or extension cycle, by reselection. A warning light shall be installed in the knob of the selector to indicate when the landing gear is in motion and not locked up or down, or when both engine throttle levers are retarded to $1/3$ full throttle or less with the landing gear retracted. A three-way landing gear position indicator for each main gear shall be installed near the selector.

3.8.2.5.5 Emergency Retraction

An override push switch for the UP selection prevention lock shall be installed on the landing gear selector. It shall be necessary to continuously depress the override button during operation of the selector lever.

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3.8.2.5.6 Emergency Extension

Operation of a push button shall release a gate and permit the landing gear selector lever to be depressed below the normal DOWN position. This action shall release a pneumatic charge into the landing gear sub-system to release all locks, actuate the doors and permit the main landing gear to extend and automatically lock in the fully extended position.

3.8.2.6 Doors and Fairings

Each retracted main gear shall be faired in conformity with the aircraft skin line by a main door, a fairing attached to the main strut and a door for the pivoted end of the main strut. The main door shall be hinged parallel to the aircraft center line and hydraulically actuated. The pivot door shall be hinged parallel to the main gear pivot line and actuated by a linkage to the main strut. The main door shall be locked in, and unlocked from, the down position by a lock within the door actuator, and locked in the up position by mechanically engaged locks which shall be released by hydraulic actuators.

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3.8.2.6 Doors and Fairings (Cont'd)

The main door and door lock actuation shall be hydraulically sequenced with the main gear and main gear locks (Reference Section 3.14).

3.8.2.7 Inspection and Maintenance

Access doors shall be installed on the underside of each inner wing to provide access to the main landing gear retraction jack.

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3.8.3 Auxiliary Landing Gear (Nose Gear)

3.8.3.1 Description

The steerable nose landing gear shall consist of a Y shaped main strut incorporating a liquid spring shock absorber which shall act in conjunction with a suspension lever carrying a live axle and co-rotating wheels. The two upper arms of the main strut shall be pivoted to the fuselage bulkhead aft of the navigator's cockpit. The strut shall be braced by a folding, lockable drag strut.

A hydraulic self centering actuator shall be installed on the gear main strut and linked to the nose wheel suspension lever to provide for castoring with self centering of the wheels, or for steering when steering is selected. The nose wheels shall castor, or be steerable, up to 55° (93) on either side. Shimmy damping restrictor valves shall be installed in the steering actuator hydraulic circuit to operate when steering is not selected.

3.8.3.2 Wheels

The wheels shall be demountable and retained on the live axle by splines and lockable axle nuts.

3.8.3.3 Tires

A tubeless tire (U.S.A.F. 18 x 5.5 Type VII E.H.P.) rated at 5,050 lb. static load when inflated to 170 psi, shall be installed on each nose wheel.

3.8.3.4 Shock Absorbers

The shock absorbers shall be of liquid spring design with provision for topping up in situ. The shock absorber fluid shall be a blend of silicone oil and hydraulic oil.

3.8.3.5 Retracting, Extending and Locking Systems

3.8.3.5.1 Retraction

The nose landing gear shall be retracted forward and up

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3.8.3.5.1 Retraction (Cont'd)

by a hydraulic actuator until an uplock is engaged.

3.8.3.5.2 Extension

The nose landing gear shall be extended aft by gravity and drag until a downlock is engaged.

3.8.3.5.3 Locking

The uplock and downlock for the nose gear shall engage mechanically and be released by hydraulic actuators. The gear downlock shall be part of the folding drag strut. The actuation of the nose landing gear shall be hydraulically sequenced with the nose landing gear door (Reference Section 3.14).

3.8.3.5.4 Controls

The nose landing gear shall be controlled in conjunction with the main gear (Reference paragraph 3.8.2.5.4). A three-way landing gear position indicator for the nose gear shall be installed in conjunction with the main gear position indicators.

3.8.3.5.5 Emergency Retraction

Emergency retraction of the nose gear shall be effected in conjunction with that of the main gear (Reference paragraph 3.8.2.5.5).

3.8.3.5.6 Emergency Extension

The emergency extension of the nose landing gear shall be effected by the means employed for the main landing gear (Reference paragraph 3.8.2.5.6).

3.8.3.6 Steering Control

Steering selection shall be by continuous pressure on a push button on the pilot's control column. A microswitch shall be installed on the nose gear suspension lever, to prevent selection of steering unless the nose wheels are in a loaded attitude. The rudder pedals shall be mechanically linked to the steering control valve through a hydraulically operated clutch integral with the valve and synchronization of the rudder pedals with the nose wheel deflection shall be necessary to permit the hydraulic clutch to engage. A follow-up type steering control valve shall be installed to permit control of the steering actuator when steering has been selected.

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3.8.3.6 Steering Control (Cont'd)

The steering actuator shall be designed to be self-centering by the action of internal springs and the hydraulic system return pressure.

3.8.3.7 Doors and Fairings

The retracted nose landing gear shall be enclosed within faired lines of the front fuselage by a door and a fairing. The nose gear door shall be hinged to the right hand edge of the nose wheel well and shall be hydraulically actuated; the nose gear fairing shall be hinged to the aft edge of the nose wheel well and actuated by the nose gear. The door shall be locked in, and unlocked from, the down position by a lock within the door actuator, and locked in the up position by mechanically engaged locks which shall be released by a hydraulic actuator.

3.8.3.8 Inspection and Maintenance

Access to the nose landing gear for inspection and maintenance shall be possible when the gear is extended.

3.8.4 Drag Parachute

3.8.4.1 Description

A "fist" type ribbon drag parachute pack, including a spring opened pilot parachute, shall be stowed in a compartment in the top of the tail cone between the two engine jet pipe fairings. The pack shall be retained by two doors which shall maintain the skin line when closed and recede below the skin line when opened.

3.8.4.2 Release Gear

The parachute shall be streamed or jettisoned as required (76) by a mechanical release controlled by the pilot. The parachute shall be attached to the aircraft structure by a shear pin to permit breakaway of the attachment at a predetermined load.

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3.9 Surface Control System

The surface control system shall be a fully powered, hydraulically actuated, irreversible system, and shall be designed (16) to meet the requirements of ARDCM 80-1 except as specified herein and as additionally stated in the deviations (Appendix II).

The primary flight controls shall be powered by two independent (15) hydraulic power circuits with normal Manual Mode control effected through command electro-hydraulic servos, and Emergency Mode control effected through mechanical linkages installed to control the surface actuator valves. Artificial pilot feel systems shall be provided for both the Manual and Emergency Modes of control. Space provision shall be made for an automatic flight control system. An artificial damping system shall be installed to provide flight damping and stabilization about all three axis, turn co-ordination, and spiral stability in the Manual Mode of control; and yaw axis damping and stabilization only in the Emergency Mode of control.

Speed brakes powered by the Utility Hydraulic System shall be installed, ~~for use within the subsonic speed range.~~

3.9.1 Primary Flight Control System

The primary flight control surfaces shall comprise ailerons, elevators, and a rudder with surface displacement controlled by conventional movement of a pilot's control column and rudder pedals.

A selector switch shall be installed in the pilot's cockpit for selection of manual or emergency mode of control. The emergency mode of control shall be in an operable condition at all times when the surface control hydraulic system is charged, and shall automatically become the effective mode of control in the event of failure of the manual mode.

3.9.1.1 Elevators

The control column shall be linked to elevator actuator control valves by bell cranks, quadrants, cables, and push rods with stick force transducers installed in the linkage. In the manual mode of control the transducers (18) shall transmit the pilot's input stick forces as electrical signals through an amplifier to the elevator parallel (command) servo. The parallel servo shall be connected by a mechanical linkage to the control valves of the elevator hydraulic actuators. In the emergency mode of control the parallel servo shall be by-passed, with (19)

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3.9.1.1 Elevators (Cont'd)

the control column movement transmitted through the mechanical linkage direct to the actuator control valves. (17)

3.9.1.2 Ailerons

The control column shall be linked to aileron actuator control valves by bell cranks, quadrants, cables, and push rods with stick force transducers installed in the linkage. In the manual mode of control the transducers shall transmit the pilot's input stick forces as electrical signals through an amplifier to the aileron parallel (command) servo. Stick force command signals shall be limited such that roll rates in excess of 180°/second shall not be transmitted. The parallel servo shall be connected by a mechanical linkage to the control valves of the aileron hydraulic actuators. In the emergency mode of control the parallel servo shall be by-passed, with the control column movement transmitted through the mechanical linkage direct to the actuator control valves. (18)

3.9.1.3 Rudder

Co-ordinated rudder control in the manual mode of control shall be provided by the damping system (Reference paragraph 3.9.4.1). A mechanical linkage comprising bell cranks, quadrants, cables, and push rods shall connect the rudder pedals to the rudder hydraulic actuator control valves for the emergency mode of control, and to permit the pilot to override the damping system rudder co-ordination functions during maneuvers requiring unco-ordinated control. (18) (19)

3.9.1.4 Artificial Feel

3.9.1.4.1 Manual Mode Artificial Feel

Manual mode artificial feel for the elevators and ailerons shall be provided by electronic control of the parallel servos which shall provide feel reaction against control column movement.

3.9.1.4.2 Emergency Mode Artificial Feel

The emergency mode artificial feel units shall comprise positional spring units installed between the control linkage and the aircraft structure with electrical trimming devices incorporated between the feel units and the structure. A bob-weight installed on an elevator control linkage torque tube shall supplement the

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3.9.1.4.2 Emergency Mode Artificial Feel (Cont'd)

elevator feel unit providing additional feel in proportion to the "g" load in the pitching axis. The rudder feel unit shall incorporate an adjustment linkage which shall automatically govern the rudder surface deflection at a given rudder pedal load as a function of the compressible dynamic pressure.

3.9.1.5 Cable Tensioning Devices

Cable tension regulators shall be installed in each control axis cable system at the forward fuselage end of the cable runs with additional aileron control cable tension regulators installed in the aft fuselage inner wing area.

3.9.1.6 Vulnerability and Duplication

Vulnerability of the flying control system to anticipated types of aircraft damage shall be kept to the lowest degree possible by utilization of inherent protection afforded by aircraft structural components. The flying control hydraulic system shall be a duplicate system up to control surface actuators.

3.9.2 Secondary Flight Control System

3.9.2.1 Lift and Drag Increasing Devices

~~Not applicable.~~

1 speed brakes here instead of 3.9.

3.9.2.2 Speed Brakes

Two rectangular speed brake panels shall be installed on the underside of the fuselage, the panels being lowered by hydraulic actuators to present a braking area to the slipstream. The hydraulic actuators shall be controlled by a manually operated switch incorporated in the right hand engine throttle lever in the pilot's cockpit. The switch shall be of the 3 position type with EXTEND, HOLD and RETRACT positions and shall control the jacks through a hydraulic selector valve. The selector valve shall limit speed brake extension to speeds below Mach 1.0 and shall control the degree of deflection in relation to speed brake air loads. (Reference paragraph 3.14.1.1.5).

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at speeds above Mach 1

(75)

3.9.3 Trim Control Systems

Trim for the manual mode of control shall be automatically and continuously supplied by the damping system. Trim adjustment for the emergency mode of control shall be provided by trim devices, integral with the artificial feel units

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3.9.3 Trim Control Systems (Cont'd)

and linkages, which unload the artificial feel springs. A trim selector button shall be installed on the pilot's control column grip.

3.9.4 Automatic Flight Control Systems

3.9.4.1 Automatic Pilot System

Not applicable.

3.9.4.2 Artificial Damping System

The damping system shall operate through the flying control hydraulic system with normal damping operable in conjunction with the Manual Mode of control and emergency damping operable in conjunction with the Emergency Mode of control.

*Electrical power for operation of the damping system shall be provided by the aircraft power supply. A system failure in either the primary flight controls manual mode of control or the damping system normal operation shall automatically transfer the damping system to emergency operation. A STANDBY-OPERATE-OFF switch for control of the entire damping system, a switch for selection of the damping system to normal or emergency operation, and roll and pitch axes cut-out re-engagement switches shall be installed in the pilot's cockpit. A warning light shall be installed in the pilot's cockpit to indicate when the damping system is in emergency operation.

3.9.4.2.1 Normal Damping

Normal operation shall provide automatic damping of short period oscillations about the three axes, turn co-ordination, control of spiral stability so that the amplitude shall not double in less than 20 seconds, and sideslip minimization in any maneuvers up to 6g in pullout, 4g in turns and negatively to -2g.

A rudder pedal force switch shall provide means for disconnecting the damping system automatic co-ordination control of rudder and ailerons, and allow the pilot to produce intentional sideslip. A "g" cut-out switch shall be installed to automatically disengage the pitch

~~*If necessary a separate power supply will be installed for the damping system.~~

delete



3.9.4.2.1 Normal Damping (Cont'd)

axis of the damping system and engage the corresponding trim feel system to prevent the aircraft from exceeding the structural integrity "g" limits about the pitch axis. A roll rate cut-out switch shall be installed to automatically disengage the damping system roll axis channel and engage the aileron trim feel system to prevent the aircraft from exceeding the structural integrity rate of roll limit. It shall be possible to re-engage the roll and pitch axes by means of the re-engagement switches in the pilot's cockpit.

Air data from air sensors, pitot and static systems, etc. (Reference paragraph 3.13.3.4), shall be combined with data from the damping system flight sensing instruments (gyros, accelerometers) for scheduling of aileron, elevator and rudder position control signals. These scheduled signals shall be continuously transmitted by magnetic amplifiers to the appropriate differential servos located on the actuation jacks of the control surfaces. In response to the applied signals the differential servos shall operate the hydraulic valves which control the surface actuation jacks resulting in adjustment of the control surfaces according to the sensed aircraft stability requirements. Mechanical and electrical feedbacks in the system provide closed loop stabilization.

3.9.4.2.2 Emergency Damping

The emergency damping shall consist of a duplication of the normal yaw axis damping channel components, to provide a limited structural integrity protection in the event of normal damping system failure.

*more detail
on when
system goes
to emergency*

3.9.5 Inspection, Maintenance and Repair

for inspection & repair

Means of access to the control systems shall be through panels in the underside of the fuselage and panels provided, where necessary, in the wings and front fuselage. ~~Repair shall be possible by replacement of damaged components.~~

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3.10 Engine Section

3.10.1 Description and Components

The engine bay shall form an integral part of the fuselage structure and shall house two power plants, together with various accessories.

3.10.2 Construction

Construction shall be in accordance with paragraph 3.7.2.

3.10.3 Engine Mounts

The engine mounts shall provide two planes of attachment for securing the engine to the aircraft structure.

The forward engine mounting shall consist of two ball-and-socket joints. A spanwise beam, suspended from the wing structure, shall provide mating attachment points for the inboard mount of each engine. The male half of the inboard mount shall be attached to the pad provided on the engine forward housing. The inboard mounts shall be designed to absorb longitudinal, vertical and side loads, and to permit the engine to pivot about the mounting point. Separate engine supports suspended from the wing structure shall provide attachment points for each outboard engine mount. These supports shall contain the ball and socket joint, which is secured to a conical spigot attached to the pad provided on the engine forward housing. The outboard mounts shall be designed to absorb vertical loads only.

The hangar-type rear engine mount shall have three attachment points, one on the engine vertical center line, and two (one inboard and one outboard) on the horizontal center line. The center point shall be secured to the wing structure by a pinned joint, designed to absorb side loads only. The inboard and outboard mounts shall be secured by hangar linkages to supporting brackets on the wing structure where they are spherically jointed to an interconnecting horizontal member. The hangar linkage shall be designed to accept vertical loads only, and to prevent unacceptable deflections from being transmitted to the engine turbine housing. Provision shall be made in each outboard linkage for vertical adjustment of the engine during installation, with lateral adjustment provided at the center mount.

3.10.4 Vibration Isolation

Not applicable.

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3.10.5 Fire Walls

The engine shrouds and steel liners described in paragraph 3.11.2 shall form the fire walls.

3.10.6 Cowling and Cowl Flaps

Not applicable.

3.10.7 Inspection and Maintenance

Access doors shall be provided for inspection, maintenance, (94) removal and installation of engines and accessories. The fuselage ~~tail~~ ^{aft} section shall be removable for engine change.

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3.11 Propulsion

The propulsion system shall be designed to the requirements of R.C.A.F. Specification AIR 7-4 and ARDCM 80-1 except as stated herein and in Appendix II (Deviations).

3.11.1 Engines

The aircraft shall be powered by two Pratt and Whitney J75 turbojet engines. Each engine shall have a static sea level military thrust rating of 15,500 pounds and a maximum thrust rating, with afterburner, of 23,500 pounds.

3.11.2 Engine Installation

Each engine and afterburner shall be contained in a shroud (95) fabricated from aluminum alloy and titanium. A fireproof, (24) ceramically insulated, stainless steel liner shall be installed in sections around the afterburner and the "hot" (22) region of the engine. (23)

Engine mounts shall be in accordance with paragraph 3.10.3 and the afterburner shall be mounted rigidly to the engine.

All services, except for engine air bleeds, shall enter the engine shrouds in the region of the access doors in the underside of the engine bays, and shall be quickly detachable to facilitate engine removal.

Engine installation and removal shall be carried out using (104) an engine stand. Rails installed from the stand to brackets within the engine shroud, shall, on engine installation, automatically locate the engine in the mounting position. Securing of the engine mounts shall lift the engine sufficiently to permit removal of the rails.

3.11.3 Engine Driven Accessories

3.11.3.1 Description

An alternator, with constant speed hydraulic drive, shall be mounted on the accessories pad at each engine inlet face. The constant speed drive shall consist of a combination hydraulic pump and motor, the fluid for which shall be supplied from the accessories gear box oil system.

One gear box shall be mounted on the accessories drive of each engine beneath the high pressure compressor housing. The starter and generator pads shall be utilized for mounting the gear boxes which shall be driven from the starter pads only. Each gear box shall provide a mounting for the engine starter, and a take-off for an aircraft accessories gear box.

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3.11.3.2 Remote Gear Boxes and Drives

Two aircraft accessories gear boxes shall be located between the engines, each shaft-driven from the adjacent power take-off. Each gear box shall drive three hydraulic pumps and provide a power take-off to drive the fuel booster pump.

A drive shall be provided on each gear box for motoring from a ground power supply for hydraulic system checking.

3.11.4 Air Induction System

3.11.4.1 Description and Components

The air intakes shall be located outboard of the crew stations. They shall be approximately "D" shaped and external compression shall be achieved by a two dimensional ramp with a 12° wedge attached to the side of the fuselage. The duct from inlet to engine shall diffuse from 5.6 square feet at the inlet to 7.1 square feet at 9 feet from the inlet, then hold a constant diameter circular section back to the compressor face. (21)

The boundary layer air of the fuselage shall pass beneath the ramp leaving the "clean" air to approach the intake. This air in turn builds up its own boundary layer which shall be sucked through a porous strip on the ramp parallel to the duct intake face. The air then entering the intake shall have the least possible turbulence therefore the maximum relative speed, i.e. ram pressure.

3.11.4.2 Air Filters

Not applicable.

3.11.4.3 Intercoolers

Not applicable.

3.11.5 Exhaust System

The turbine exhaust shall be forced rearward through a nozzle whose orifice is automatically increased in area when afterburning is selected. To improve cooling air flow and provide an increase in thrust, the steel liner surrounding the nozzle shall form an afterburner ejector.

Thermocouples shall be installed in each jet pipe to provide turbine discharge temperature sensing.

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3.11.5 Exhaust System (Cont'd)

The design of the exhaust system shall permit longitudinal and radial expansion and contraction of the exhaust system components.

3.11.6 Cooling System

3.11.6.1 Engine Cooling

At speeds less than Mach 0.5 ventilating and cooling air shall be drawn through spring loaded, inwardly opening doors at the forward end of the rear engine zone. The air shall be induced through the afterburner section by the main engine nozzle ejector, and through the accessories section by an engine air supplied ejector. (Engine compressor air shall not be supplied to this ejector at speeds in excess of Mach. 0.5).

At speeds in excess of Mach 0.5 cooling shall be provided by air entering the upper segment of a peripheral intake immediately upstream of the compressor face and circulating around the engine and accessories. The flow of air (109) shall be controlled by gills which close at speeds below Mach 0.5.

Engine cooling air shall be exhausted at the circumference of the afterburner tail pipe, and accessories cooling air through an ejector nozzle on the underside of the aircraft.

3.11.6.2 Heat Exchangers

There shall be three air cooled heat exchangers beneath each engine which are cooled by intake air entering the (109) lower segment of the peripheral intake. Additionally, three fuel cooled heat exchangers shall be installed ahead of the front face of each engine. In the case of both the air and fuel cooled exchangers one shall be used for cooling engine oil, supplementing the oil cooling system which is part of the engine, one for cooling flying control hydraulic oil, and one for cooling gear box and constant speed drive oil.

3.11.7 Lubrication System

3.11.7.1 Description and Components

Lubrication of the engine shall be a closed system except for supplementary cooling as described in paragraph 3.11.6.2. Low pressure warning lights shall be installed on the pilot's warning indicator panel.

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3.11.7.1 Description and Components (Cont'd)

For further details of engine lubrication see applicable Pratt and Whitney Engine Specification.

3.11.8 Fuel System

A pressurized fuel system of sufficient capacity to meet engine requirements, shall be installed in the aircraft. (28)

In the event of a single strike not more than 20% of the fuel remaining in the tanks shall be lost, unless a collector tank is ruptured in which case not more than 50% of the remaining fuel shall be lost. (87)

Full fuel flow to the engines during inverted flight shall be provided for 15 seconds at sea level, or for approximately 45 seconds at combat altitude. (85)

3.11.8.1 Description and Components

The fuel system shall be basically divided into left hand and right hand sub-systems. Fuel shall be transferred from the storage tanks of each sub-system to the respective collector tank by pressurization, (Reference paragraph 3.11.8.10) and a 5-way flow proportioner shall maintain the flow from each tank at a predetermined value in order to restrict the aircraft c.g. travel within specified limits.

A booster pump submerged in each collector tank, and driven by the airframe accessories gear box, shall supply fuel to the engine feed manifolds via an engine fuel proportioning unit. This unit shall normally equalize the flow of fuel from each sub-system, regardless of throttle setting and consequent engine consumption, thus maintaining the aircraft lateral balance. (83) (89)

In the event of failure of either sub-system and/or either engine, the proportioner shall maintain fuel flow from the operative sub-system(s) to the operative engine(s). (86)

In the event of pump failure, tank pressurization and suction of the engine fuel proportioning unit shall provide fuel flow through a by-pass around the inoperative pump.

Fuel shut-off valves shall be installed adjacent to the engine fire walls to provide for isolation of each engine. Actuation of either engine fire extinguishing system shall automatically close the appropriate valve.

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3.11.8.1 Description and Components (Cont'd)

Switches shall be installed in the nose wheel well for ground control of the shut-off valves.

3.11.8.2 Fuel Specification and Grade

The fuel system shall be designed for the normal use of Aviation Turbine Fuel Type II-3-GP-22 (MIL-F-5624 Grade JP4), and for limited ferry mission use of Aviation Fuel 3-GP-25 (MIL-F-5572).

3.11.8.3 Fuel Tanks

Twelve wing tanks and two fuselage tanks shall constitute the main fuel storage and shall be divided into a left- (84) hand system comprising the left-hand wing tanks and aft fuselage tank, and a right-hand system comprising the right-hand wing tanks and forward fuselage tank. One wing tank in each system shall serve as a collector tank.(31)

The wing tanks shall be fabricated as an integral part of the wing structure and the fuselage tanks shall consist of bladder type cells installed in aluminum alloy shells. (27)

3.11.8.3.1 Tank Capacities

Assuming a specific gravity of .75, and allowing an expansion space of 3% of the normal fuel capacity, the tanks shall have the following capacities:

<u>Tank No.</u>	<u>No. Of Tanks</u>	<u>Gross Capacity of Tank Imp. Gal.</u>	<u>Useable Capacity of Tank Imp. Gal.</u>	<u>Total Useable Fuel Capacity Imp. Gal.</u>
1(Fuselage)	1	308	277	277
2(Fuselage)	1	307	281	281
3	2	165	151	302
4	2	101	90	180
5(Collector)	2	170	146	292
6	2	176	154	308
7	2	322	279	558
8	2	207	173	346
				<hr/> 2544
Auxiliary	1	-	500	<hr/> 500
				<hr/> 3044

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3.11.8.4 Auxiliary Fuel Tank

Structural provision shall be made in the underside of the fuselage for the attachment of a jettisonable tank of 500 Imperial gallons useable fuel capacity.

9000-4
start of
pumpers

3.11.8.5 Piping and Fittings

The piping, couplings and fittings for the fuel and pressurization systems shall be aluminum alloy. Quickly detachable connectors shall be provided in the engine supply lines at the points of connection to the engine.

(111)

3.11.8.6 Valves

Valves and other components of the fuel system shall be designed to function in the presence of air at temperatures between -65°F and $+350^{\circ}\text{F}$, and the fuel designated in paragraph 3.11.8.2 at temperatures between -65°F and $+185^{\circ}\text{F}$.

3.11.8.7 Strainers and Filters

An eight mesh strainer shall be installed in each inlet to the booster pumps. (105)

A two hundred mesh screen filter shall be installed in the pressurization line from the pneumatics system to filter the pressurization air.

9000-4
filter
5/1/55

3.11.8.8 Quantity Gauges, Flowmeters and Indicators

A capacitance type fuel contents system shall be installed in the aircraft. Two quantity gauges, indicating in pounds, the quantity of fuel in each sub-system shall be installed in the front cockpit. (90)

Four warning lights shall be installed in the front cockpit, one to indicate failure of either booster pump, one to indicate failure (by-pass open) of either 5-way flow proportioner, and two, one left hand and one right hand, to indicate low fuel level in the respective collector tank.

3.11.8.9 Purging and Explosion Suppression System

Not applicable.

(25)

3.11.8.10 Pressurization

The fuel system shall be pressurized, using air from the pneumatics system (Reference paragraph 3.15.1.2) to

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3.11.8.10 Pressurization (Cont'd)

transfer fuel, to prevent fuel boiling at altitude and to provide pressure for defueling.

The fuselage tanks shall be maintained at 10 psig and the wing tanks, (except collector tanks) at 25 psi abs. by pressure regulating valves. Pressure relief valves shall be installed in the main pressurization lines to the fuel tanks in the fuselage and each wing to prevent over-pressurization in the event of a regulating valve failure. A negative "g" and low level air admission valve shall be installed at each collector tank inlet to permit the entry of air during final emptying of the tanks and also during periods of negative "g".

Flow limiters shall be installed in each wing pressurization system, and in the fuselage pressurization system to limit the flow of air required to be handled by the pressure relief valves to a value commensurate with initial pressurization build-up requirements. To prevent excess spillage of air in case of tank damage the pressurization lines to individual wing tanks shall be appropriately sized, and flow limiters shall be installed in the line to each fuselage tank.

3.11.8.11 Vent System

In flight venting of the differentially pressurized fuselage tanks shall be accomplished through a differential pressure relief valve installed in each tank. Venting of the wing storage tanks, which are maintained at an absolute pressure, shall be unnecessary.

When the pressure in the collector tanks exceeds that required for negative "g" and low level air admission (Reference paragraph 3.11.8.10), accumulated air shall be vented through a fuel-level-sensitive air release valve installed in each collector tank.

3.11.8.12 Refueling System (Ground)

The refueling system shall provide for pressure refueling (and defueling) of the internal tanks through two pressure fuel servicing adaptors. One adaptor to mate with refueling nozzle Type D1 (MIL-N-5877) shall be installed in each main landing gear well. The system shall permit refueling to the combat radius of action fuel load within five minutes. (88) (29)

From each adaptor fuel shall pass to the respective 5-way proportioner and then along the fuel transfer



3.11.8.12 Refueling System (Ground) (Cont'd)

lines to all tanks except collector tanks. A separate line shall be installed to fill each collector tank, as the transfer lines from the proportioners to the collector tanks will be closed during refueling to prevent overfilling the collector tanks. During full refueling a by-pass on the proportioners shall be opened providing a minimum restriction to filling. A dual shut-off valve, servo controlled by a dual level sensing unit, shall be installed in each tank. During partial refueling the (26) by-pass valve shall be closed and the proportioners shall operate in reverse, controlling the amount of fuel entering each tank so as to maintain the aircraft c.g. within specified limits. The pressurization relief valves shall be opened to provide venting of all storage tanks, with venting of the collector tanks provided through the air release valves.

Controls and indicators located adjacent to the left-hand speed brake and each refueling adaptor, shall provide for selection and indication of the refueling or defueling operation.

3.11.8.13 Refueling System (In Flight)

Not applicable.

3.11.8.14 Drainage

Combination condensate and drain valves shall be installed at the low point in each wing tank, except tank number 4, to permit ground purging of water or drainage of fuel from each tank. Wing tank number 4 and the fuselage tanks shall be provided with condensate drain valves only. (30)

3.11.8.15 Defueling Provisions (Ground)

Defueling shall be accomplished through the two fuel servicing adaptors. Fuel from all internal tanks, except the collector tanks shall be transferred to the adaptors through the normal fuel transfer lines by pressurizing the tanks from a ground service unit (Reference paragraph 3.22.2). Fuel shall be removed from the collector tanks through the lines used for filling, by suction of the ground service unit. All valves shall be appropriately positioned by selection of "defuel" on the selector switch (Reference paragraph 3.11.8.12).

3.11.8.16 Fuel Jettisoning

Applicable to auxiliary fuel tank only. Reference paragraph 3.11.8.4.

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3.11.8.17 Maintenance and Inspection

Hand holes shall be provided for access to the interior of each tank for inspection and maintenance of all equipment requiring such attention.

3.11.9 Water Injection System

Not applicable.

3.11.10 Propulsion System Controls

3.11.10.1 Description and Components

The power plant controls shall comprise a throttle lever for each engine and afterburner, engine starting switches, and engine re-light buttons.

3.11.10.2 Engine Control System

The throttle levers shall be mounted on a quadrant on (98) the left hand console and shall provide for selection of a full range of engine power with positions for "off" "idle" and "military" thrust. Initial movement of the throttle levers shall open the high pressure fuel cocks.

Depression of the throttle levers in any position forward of two-thirds throttle shall operate microswitches for selection of afterburning. Variation of thrust with the afterburners operating shall be achieved by variation of engine power ~~with~~ the afterburners operating at constant power. Rearward movement of the throttle levers to one-third throttle or less shall automatically cut out the afterburners.

The throttle levers shall be connected to the automatic fuel metering controls, provided as part of the engine, by a system of cables and pulleys.

A normal/emergency switch shall be installed so that in the event of failure of the automatic fuel controls on the engine the pilot may have manual control.

3.11.10.3 Induction Air Controls

Not applicable.

3.11.10.4 Starter Controls

Two "start-off-reset" switches shall be installed on the right hand console in the front cockpit to control the electrical power supply to the engine igniter systems, and to the starting external air supply control

(12) moving
the throttles.

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3.11.10.4 Starter Controls (Cont'd)

valves. Centrifugal switches shall be installed in each starter system to complete the circuits to the ignitors when the engines reach 700 rpm and to break the circuits when the engines reach 3000 rpm. Indicator lights adjacent to the starter switches shall be installed to signal the pilot to move the throttles from "off" to "idle" at 700 rpm. (old)

A relight button shall be installed in each throttle lever for the purpose of relighting the engines in flight.

3.11.10.5 Propeller Controls

Not applicable.

3.11.10.6 Cooling Air Controls

Cooling air control shall be a function of Mach No. (Reference paragraph 3.11.6.1).

3.11.10.7 Water Injection Controls

Not applicable.

3.11.11 Starting System

An air turbine starter shall be mounted on each engine, (Reference paragraph 3.11.3.1). The starters shall be powered from a ground source and shall be capable of meeting the scramble requirement of paragraph 3.1.3.1. Automatic quick disconnects shall be provided for the ground air supply.

3.11.12 Propeller

Not applicable.

3.11.13 Rocket Propulsion System

Not applicable.

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3.12 Auxiliary Power Plant

Not applicable.

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3.13 Instruments and Navigational Equipment

Instrument arrangement shall be subject to agreement between the R.C.A.F. and the Company, based on the operational role of the aircraft and on ORI/4-2. Navigational equipment in accordance with the requirements of R.C.A.F. Specification AIR 7-4 shall be installed.

3.13.1 Instruments

3.13.1.1 Pilot's Instruments

3.13.1.1.1 Flight Instruments

Mach Air Speed Indicator
Artificial Horizon Indicator
Rate of Climb Indicator
Turn and Bank Indicator
Pressure Altimeter
Radio Magnetic Indicator (Ref. Para. 3.13.3.1 & 3.17.2.8)
Accelerometer
~~Radio Altimeter (Ref. Para. 3.17.2.2)~~

3.13.1.1.2 Navigational Instruments

Clock
Standby Magnetic Compass
R-Theta DR Repeater (Ref. Para. 3.13.3.2)
Tacan Deviation Indicator (Ref. Para. 3.17.2.8)

3.13.1.1.3 Engine Instruments

Turbine Discharge Temperature Gauge (2) (Ref. Para. 3.11.5)
Turbine Discharge Pressure Ratio Indicator (2) (Ref. Para. 3.11.5)
Fuel Contents Indicator (2) (Ref. Para. 3.11.8.8).

All engine instruments shall be of the electrical remote single indicating type and of 2 inch case size to drawing AND 10412.

3.13.1.1.4 Miscellaneous Instruments

Skin Temperature Gauge
Cabin Pressure Gauge (Ref. Para. 3.22.1.1.1)
Oxygen Pressure Gauge (Ref. Para. 3.21.1.4)
Oxygen Quantity Gauge (Ref. Para. 3.21.1.4)
Landing Gear Position Indicator (Ref. Para. 3.8.2.5.4)

3.13.1.2 Radar Operator's Instruments

To be determined.

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3.13.2 Air Data Sensing Equipment

3.13.2.1 Pitot Static System

To be determined.

3.13.2.2 Relative Wind Sensors

To be determined.

3.13.2.3 Air Temperature Sensors

To be determined.

3.13.2.4 Air Data Scheduling Equipment

To be determined.

3.13.3 Navigational Equipment

3.13.3.1 J-4 Compass

A J-4 type compass system shall be installed to provide indication of the magnetic heading of the aircraft on a radio magnetic indicator in each cockpit and to an R-Theta DR Computer. A controller incorporating the system switches and controls shall be installed in the pilot's cockpit and power for the system shall be supplied from the 115V AC bus and the 27.5V DC bus.

3.13.3.2 R-Theta DR Navigation System

The R-Theta dead reckoning navigation system shall be installed in the aircraft for the purpose of automatically and continually computing the position of the aircraft in relation to a selected datum point. The system shall also provide true airspeed reading, track data and a selection of heading indications.

A pilot's DR repeater shall be installed in the front cockpit and an indicating DR computer and an indicating ground speed computer shall be installed in the rear cockpit.

True airspeed information shall be obtained from the air data sensing equipment and aircraft headings from the J-4 compass system. Wind information shall be fed in manually.

3.13.3.3 Navigation Radio Aids

The navigation radio aids shall be as described in paragraph 3.17.2.

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3.13.4 Installation

The instruments and main instrument panels shall be installed in accordance with the requirements of AIR 7-4 and specifications MIL-I-5997 and MIL-C-6818A as applicable. The connections to the instruments and instrument panels shall be flexible to the extent that free action of the shock absorbers is not restrained. All hoses and electrical leads shall be of sufficient length to permit the instruments to be withdrawn from the panel for disconnection. (32) (97) (96)

3.13.4.1 Instrument Markings

On all contractor furnished instruments the major scale markings and pointers shall be treated with Specification C-28-96 or U.S. Radium R410AB self-luminous compound, and all minor scale markings shall be treated with fluorescent compound to specification AN-L-1A. Range and limit markings shall be applied to all instruments requiring such markings.

3.13.4.2 Inspection and Maintenance

Each ~~All~~ instruments and connections thereto shall be accessible without removal of other instruments or equipment. Four knurled nuts at the mounting brackets shall permit quick removal of the main instrument panel for inspection and maintenance.

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3.14 Hydraulic Systems

3.14.1 Description and Components

Three separate 4000 psi hydraulic systems shall be installed in the aircraft:-

A utility services system, to operate the landing gear, nose wheel steering, wheel brakes, speed brakes and a removable armament pack.

Two flying control systems, each providing sufficient power for limited control of the aircraft in the event of failure of the other.

The systems shall be designed in accordance with the requirements of Specification MIL-H-5440 except as stated in Appendix II (Deviations) and herein. System design shall permit a maximum operating fluid temperature of 250°F, with local rises to 275°F.

Six engine driven hydraulic pumps shall be installed, two in the utility services system power circuits, and two in each flying control system power circuit. Three compensators, one for each system, shall provide fluid reserve, pump inlet pressurization, and system ground pressurization. Hydraulic power for emergency operation of the brakes, and pressurized air for emergency extension of the landing gear shall be provided.

Ground operation for system testing with the engines inoperative shall be effected by use of the aircraft pumps, the aircraft accessories gear boxes being designed to permit use of a mobile plug-in mechanical power unit.

3.14.1.1 Utility Services System

3.14.1.1.1 Utility Services System Power Circuit

Two 4,000 psi variable delivery hydraulic pumps shall be installed, one on each aircraft accessories gear box with the combined output from both pumps utilized to power the utility services and charge an accumulator. The accumulator output shall be reduced to 1,500 psi and utilized for the emergency brake supply, and to pressurize the compensator in each hydraulic system.

Two warning lights shall be installed on the pilot's warning indicator panel, one to indicate when the utility services pressure falls below 1,000 psi and one to indicate when the pressure stored in the accumulator falls below 1,600 psi.

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3.14.1.1.2 Landing Gear Sub-System

The landing gear and landing gear door actuation shall be hydraulically sequenced during retraction and normal extension. Actuation shall be controlled by a selector valve in conjunction with a manually operated selector lever installed in the pilot's cockpit.

Emergency extension shall be by air from a 5000 psi storage bottle with release of the air controlled by the landing gear selector lever (Reference paragraphs 3.8.2.5.6 and 3.8.3.5.6).

3.14.1.1.2.1 Retraction

Up selection shall hydraulically release all gear downlocks and raise the gear until the uplocks engage mechanically. In the last stages of the engagement of each gear uplock, a controllable check valve shall permit hydraulic pressure to release the door downlock and cause the actuator to raise the door until the door uplocks engage mechanically.

3.14.1.1.2.2 Extension

Down selection shall hydraulically release all landing gear door uplocks and lower all doors until the downlocks are engaged. As each door is locked down, a controllable check valve shall permit hydraulic release of the gear uplock, and hydraulically operate a transfer valve. The transfer valve shall release the hydraulic pressure from the landing gear actuator, permitting the gear to fall by gravity and drag forces until a downlock engages mechanically.

3.14.1.1.2.3 Emergency Extension

Emergency down selection shall permit a supply of air from the emergency air storage bottle to enter an emergency extension circuit. The emergency circuit shall permit the compressed air to simultaneously release all gear and door uplocks and operate the door actuators. The landing gear shall extend by gravity and drag, and lock in the down position.

3.14.1.1.3 Nose Wheel Steering Sub-System

A double ended hydraulic actuator shall be installed for nose wheel steering. A selector valve controlled by a push button on the pilot's control column shall be installed for selection or release of hydraulic pressure for steering. A follow-up type steering control



3.14.1.1.3 Nose Wheel Steering Sub-System (Cont'd)

valve shall be mechanically linked to the rudder pedals through a hydraulic clutch to prevent transmission of rudder pedal movement to the valve until rudder pedal deflection has been synchronized with nose wheel deflection. Release of steering hydraulic pressure shall permit a restricted run-around hydraulic circuit to provide shimmy damping and hydraulic assist to nose wheel centering (Reference paragraph 3.8.3.6).

3.14.1.1.4 Wheel Brakes Sub-System

The hydraulic pressure available for normal brake application shall be a maximum of 2130 psi reduced from the 4000 psi utility hydraulic system. Pressure available for emergency brake application shall be a maximum of 1500 psi reduced from a 4000psi accumulator. Two control valves shall be linked, one to each brake pedal, to permit metered differential control of the brakes. Each valve shall incorporate a transfer component for automatic changeover to the emergency brake supply. A solenoid operated valve shall be incorporated in each control valve to permit automatic brake operation during main gear retraction. Locking the brakes for parking shall be achieved by means of a mechanical linkage controlled from the front cockpit.

The normal pressure control outputs shall be conveyed to the wheel brakes through an anti-skid and shuttle valve assembly installed on each main gear and governed by a skid detector installed on each wheel of the associated bogie.

In the event of normal supply pressure failure, the emergency brake pressure shall be routed through an anti-skid return line to the shuttle valve and to the brakes. The anti-skid valve shall be by-passed during emergency actuation of the brakes. (34)

3.14.1.1.5 Speed Brakes Sub-System

is installed 7 Two hydraulic actuators, one for each of the two speed brakes, shall be controlled by a selector valve in conjunction with a three position switch. A relief valve to limit the degree of speed brake extension in relation to speed brake air loads (Reference paragraph 3.9.2.2). A check valve shall be incorporated in the pressure line to prevent excessive back pressures, set up by high hinge moments on the speed brakes, from entering the pressure lines of the utility system. (75)



3.14.1.1.6 Armament Pack Supply

A pressure and a return line shall be installed and shall terminate in a self-sealing half coupling at the aft end of the armament pack bay. The couplings shall correspond with half couplings carried by any armament pack designed to be fitted to the aircraft.

3.14.1.2 Flying Control Systems

3.14.1.2.1 Flying Control Systems Power Circuits

The two flying control hydraulic systems shall comprise (108) an "A" and "B" system, each powered by two 4000 psi variable delivery pumps. One pump of each system shall be installed on each of the two aircraft accessories gear boxes. The output of the two pumps for each system shall be combined and utilized to power control surface actuators and servo units.

Two warning lights, one for each flying control system power circuit shall be installed on the pilot's warning indicator panel to indicate loss of pressure in either power circuit to 1000 psi or less. A red and an amber Master Warning shall indicate failure of both circuits. (Reference paragraph 3.16.11.1).

3.14.1.2.2 Control Actuators and Servo Units

Tandem dual cylinder and piston type actuators shall be installed to permit hydraulic actuation of the control surfaces from the two independent "A" and "B" hydraulic systems. Single differential servo control units shall be installed on the aileron and elevator actuators to permit damping system signalled hydraulic operation from the "B" system. A dual differential servo control unit shall be installed on the rudder actuator to permit rudder damping signalled hydraulic operation from both "A" and "B" systems.

Two command (parallel) servo control units shall be installed and powered from system "B" to permit pilot command signal controlled hydraulic operation of the control valves of the aileron and elevator hydraulic actuators.

3.14.1.2.3 Flying Control Systems Return Circuits

An air cooled heat exchanger and a fuel cooled heat exchanger shall be installed to limit the temperature of hydraulic fluid at the pump inlets to 225°F (approx.).



3.14.1.2.3 Flying Control Systems Return Circuits (Cont'd)

Each heat exchanger shall comprise two sections to permit each flying control hydraulic system to be kept functionally separate.

A compensator designed to pressurize the return fluid at 90-100 psi and to separate air from the fluid, shall be installed. It shall be possible to manually ground bleed the separated air from the compensator.

In each hydraulic system return circuit a self displacing type accumulator shall be installed to damp out surges set up by the continual operation of the control actuators, and reduce return pressure fluctuations in the compensator.

3.14.1.2.4 Compensator Pressure Supplies

The compensator of each flying control system return circuit shall be pressurized by a 1,500 psi supply from the Utility Services System Power Circuit. Emergency pressurization of the compensators, at 1,250 psi shall be automatically available from the respective flying control power circuit.

3.14.1.3 Filters

High and low pressure ten micron filters shall be installed in the main pressure and return lines respectively of all three main hydraulic systems. The filters shall embody pressure differential by-pass valves set at approximately 50 psi.

In-line type filters shall be installed in the pressure line of the nose wheel steering sub-system and in the supply lines to the aileron and rudder control actuators.

3.14.1.4 Inspection and Maintenance

Access panels and doors shall be installed to facilitate inspection and maintenance.

Three separate filling connections, one for each hydraulic system shall be installed on the aircraft. (35)

Provision for disconnecting the aircraft accessories gear box drives from the engine gear boxes shall permit each gear box to be driven independently by a ground power unit



3.14.2 Hydraulic Fluid

The hydraulic systems shall be designed for the use of hydraulic fluid to Specification MIL-O-5606.

3.14.3 Piping and Fittings

High pressure lines shall be of stainless steel. Low pressure lines shall be of aluminum alloy. All piping joints shall be made with flareless fittings to Avro Aircraft Company Standards. The use of flexible rubber hose shall be kept to a minimum. To cater for component motions, expandable and/or swivel type couplings shall be used. (33)

*design
Hi & Lo pressure*

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3.15 Pneumatic System

The pneumatic system shall comprise several sub-systems which shall utilize air pressure from the air conditioning system (Reference Section 3.22). ~~Complete provision shall be included for an air supply to be taken from the heat exchanger input to power a turbine driven generator, when installed, for an integrated electronics system. Structural provision shall be made for an air supply to power a turbine driven generator in a Sparrow missile pack (when fitted).~~ Ground operation of the pneumatic services shall be possible by utilization of air supplied by the ground air conditioning service unit (Reference Section 3.22).

A ground chargeable air storage bottle shall be installed in the aircraft to supply air for emergency extension of the landing gear (Reference Section 3.14).

The system shall be designed in accordance with the requirements of ARDCM 80-1 except as stated in Appendix II (Deviations) or as additionally stated herein.

3.15.1 Description and Components

The sub-systems constituting the pneumatic system shall be as follows:

- (1) A low pressure services sub-system for:-
 - (a) Canopy and windshield seal inflation.
 - (b) Anti-G suit inflation.
 - (c) Radome anti-ice system air supply.
- (2) Fuel tank pressurization air supply.
- (3) Windshield rain repelling system.
- ~~(4) Complete provision for turbine air supply.~~

*Remove this
is ICS volume.*

3.15.1.1 Low Pressure Services Sub-System

Air at 85 psi (max.) pressure from the air conditioning system heat exchanger shall be filtered and utilized to inflate the canopy and windshield seals, anti-G suits, and to operate the radome anti-ice fluid system. The filter shall incorporate a drainable moisture trap.

3.15.1.1.1 Canopy and Windshield Seal Inflation

Air shall be ducted to a solenoid operated, pressure regulating, pressure relieving and check valve. The valve shall be designed to provide seal inflation air reduced at 20 psig pressure, to relieve seal pressure

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3.15.1.1.1 Canopy and Windshield Seal Inflation (Cont'd)

exceeding 25 psig, and to prevent back flow from the seals when the solenoid is energized. When the solenoid is de-energized the valve shall vent seal pressures. The control solenoid shall be electrically linked to the canopy latches of both cockpits.

A male threaded fitting for connecting an external source of pressure for canopy and windshield seal inflation during cockpit leakage tests shall be installed.

3.15.1.1.2 Anti-G Suit Inflation

A branch duct shall convey air from the filter to an (82) anti-G valve in each cockpit. The anti-G valves shall automatically control anti-G suit inflation.

3.15.1.1.3 Radome Anti-Ice System Air Supply

A branch from the anti-G suit inflation air supply ducting shall convey air to a pressure reducing valve which shall reduce the pressure to 10 psi. The reduced pressure air shall be utilized to:-

- (1) Pressurize the radome anti-ice fluid tank through a check valve.
- (2) Provide purging air for the anti-ice fluid distributor supply line at the end of each fluid distribution period.

3.15.1.2 Fuel System Pressurization Supply

Air at 85 psi (max.) shall be ducted from the air conditioning system heat exchanger to a hot air filter. The output from the filter shall be ducted to the pressure reducing valves of the fuel tank pressurizing system (Reference Section 3.11.8.10).

3.15.1.3 Windshield Rain Repelling System

Air shall be ducted from the air conditioning system heat exchanger to a distributor installed outside at the base of the windshield. The duct shall incorporate an electrically operated on-off valve controlled by a switch in the pilot's cockpit and thermostatically controlled to shut off the supply when air temperatures exceed 250°F.

3.15.1.4 Piping and Fittings

Low temperature pipes or ducting shall be of aluminum alloy and high temperature or highly stressed ducting



3.15.1.4 Piping and Fittings (Cont'd)

shall be of stainless steel. Couplings below 1 inch diameter shall be flareless type couplings to Avro Aircraft Company Standards. Couplings of 1 inch and above diameter shall be band type couplings.

*refer
specific
standards*

3.15.1.5 Inspection and Maintenance

Equipment components of the pneumatic system shall be made accessible for inspection and maintenance. (36)

3.15.2 Ground Operation

Air at a pressure of approximately 45 psi shall be available for operation of the pneumatic services from the air conditioning ground air supply.

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3.16 Electrical System

The aircraft electrical system shall consist of a 208/120 volt 400 cycle, 3 phase AC system and a 27.5 volt DC system. Two engine driven alternators shall be the prime source of electrical power with provision for the conversion of AC to DC power by means of two transformer-rectifiers.

The electrical system shall be designed to the requirements of R.C.A.F. Specification AIR 7-4 except as stated herein and in Appendix II (Deviations).

3.16.1 General Description

3.16.1.1 AC System

The AC system shall be a three wire, star connected, neutral grounded system. The primary and secondary AC loads shall normally be connected to the right and left alternator systems respectively. Provision shall be made for cockpit indication of power failure and automatic transfer of the primary load to the left alternator and for disconnection of the secondary AC services in the event of the right alternator failure.

3.16.1.2 DC System

The DC system shall be a single wire, negative ground return system. The DC loads shall be distributed among the main, shedding, emergency and battery buses. Provision shall be made in the system for discontinuing the power supply to the shedding bus in the event of a single engine failure.

3.16.1.3 Emergency DC System

A battery shall be installed to supply the emergency DC power, with distribution of power to the emergency services through the emergency and battery buses.

Provision shall be made in the system for the isolation of the battery and emergency buses from the main DC bus in the event both transformer-rectifiers fail.

3.16.1.4 Distribution

An electrical power junction box, containing bus bars, relays and protective devices shall be installed in the electrical equipment compartment for interconnection and distribution of AC and DC power to the various aircraft services.

NAVJAG 100-10000
100-10000
100-10000

Electrical System (Continued)

The aircraft is equipped with a 400 volt AC power system. Two engines are electrically powered. The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system.

Electrical System (Continued)

The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system.

Electrical System (Continued)

The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system.

3.16.1.2- Emergency A/C System

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Electrical

The aircraft is equipped with a 400 volt AC power system. Two engines are electrically powered. The aircraft is equipped with a 400 volt AC power system.

The electrical system of R.C.A. and in A.

16.1 General

16.1.1 AC

The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system.

16.1.2 DC

The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system.

16.1.3 Emergency

The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system.

16.1.4

The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system. The aircraft is equipped with a 400 volt AC power system.



3.16.2 Electrical Power Supply

3.16.2.1 Alternators

A 20 KVA 208/120 volt 3 phase, 400 cycle alternator driven by a constant speed regulating mechanism shall be installed in the nose bullet of each engine. Cooling for the alternators shall be provided by ram air. 20KVA

3.16.2.2 Voltage Regulators

Two voltage regulators, part of the control/transformer rectifier panels, shall be installed in the electrical equipment compartment to provide voltage regulation of each alternator output. Cooling of the control/transformer-rectifier panels shall be provided by the air conditioning system (Reference paragraph 3.22.1.2.1).

3.16.2.3 Controls

A master ON-OFF power supply switch shall be installed in the front cockpit. Two alternator failure warning lights, and two ON-RESET-OFF switches to permit individual control of each alternator output shall be installed in the front cockpit. Two DC failure warning lights, and a DC RESET switch to permit restoration of DC power output in the event of short duration failures due to transient faults shall be located in the front cockpit.

3.16.3 Electrical Power Conversion

3.16.3.1 Transformer Rectifier Units

Two 3KW transformer rectifiers, one located in each control/transformer-rectifier panel, shall provide for the conversion of AC power to 27.5 volt DC power.

3.16.3.2 Protective Devices

Over voltage and reverse current protection shall be provided in accordance with the requirements of MIL-E-7894.

3.16.3.3 Battery

A 24 volt, 15 amp hr., nickel cadmium, hermetically sealed storage battery, shall be installed in the nose wheel well. The battery shall normally be connected to the battery bus with provisions for automatic disconnection when external DC power is used. Cooling for the battery shall be supplied by the air conditioning system.



3.16.4 Equipment Installation

The electrical equipment shall be installed in accordance with the requirements of specifications MIL-E-7563, MIL-E-7080 and MIL-E-7614. (72)

3.16.5 Wiring

The installation of all aircraft wiring shall be in accordance with specification MIL-W-5088A. (39)
(40)
(41)
(42)

3.16.6 Bonding and Shielding

Bonding and ground returns shall be installed in accordance with specification MIL-B-5087. Shielded wire shall be used where required.

3.16.7 Controls

Rheostats, resistors and switches shall be installed in accordance with the requirements of specifications MIL-E-7563 and/or MIL-E-7080. (38)

Circuit breakers shall be installed in accordance with the requirements of specification MIL-E-7614 and located on a circuit breaker panel in the nose wheel well. *reverse*

Current limiters shall provide circuit protection in locations where high ambient temperatures preclude the use of circuit breakers.

Fuses shall be installed in the console panel of each cockpit to provide protection for the cockpit lighting circuits.

3.16.8 Lighting

3.16.8.1 Interior Lighting

The interior lighting comprising instrument panel, console panel and map lighting, shall be installed in accordance with specifications CAP 479, MIL-P-7788 and MIL-L-6503.

3.16.8.1.1 Instrument Panel Lighting

The instrument panel lighting shall consist of red edge panel lights and post type flood lights.

3.16.8.1.2 Console Panel Lighting

The console panel lighting shall consist of red edge panel lights and hooded type red flood lights. Wiring



3.16.8.1.2 Console Panel Lighting (Cont'd)

provisions shall be made for installation of high altitude white flood lighting.

3.16.8.1.3 Interior Illumination Controls

Three continuously variable transformers (0-27.5 volts) shall be installed in each cockpit to provide illumination control of post-type red flood lights, red edge lights, and the console flood lights respectively. An ON/OFF switch shall be provided in each cockpit for high altitude white flood lights.

3.16.8.1.4 Map Lighting

An amber flood lamp with an integral intensity control shall be installed in each cockpit to provide illumination for map reading. These lights shall be connected directly to the emergency DC bus and may be used for emergency lighting purposes.

3.16.8.2 Exterior Lighting

The exterior lighting comprising the navigation, taxi, and landing lights, shall be installed in accordance with R.C.A.F. specifications AIR 7-4 and CAP 479.

3.16.8.2.1 Navigation Lights

Navigation lights shall consist of a red port wing tip light, green starboard wing tip light, and one red and one white light in the trailing edge of the fin. A flasher unit shall be installed in accordance with Specification MIL-L-6503.

3.16.8.2.2 Taxi Light

A taxi light shall be installed on the nose landing gear assembly such that it will follow the direction of the nose wheel steering.

3.16.8.2.3 Landing Light

A landing light shall be installed on the nose landing gear main strut.

3.16.8.2.4 Exterior Lighting Controls

Exterior lighting controls shall be located in the pilot's cockpit. The control for the navigation lights shall provide for selection of steady, off or flashing.

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3.16.8.2.4 Exterior Lighting Controls (Cont'd)

A switch shall be installed to provide for selection of the landing and/or taxi light.

3.16.9 Ignition System

The engine ignition system shall be in accordance with Engine Model Specification No. PWA 2611. Switches, located in the front cockpit, shall provide for selection and control of engine starting.

3.16.9.1 Engine Starting

Two START-OFF-RESET switches shall be installed on the (106) right hand console in the pilot's cockpit to provide control of the DC power to the relevant engine igniter system and to the external air control valve for engine starting.

3.16.9.2 Engine Relight

A relight button shall be provided in each throttle lever for the purpose of relighting the engines in flight.

3.16.10 Receptacles

3.16.10.1 External Receptacles

automatic quick disconnect
An external power receptacle conforming to the outline of AN 3114, and suitable for mating with ~~an lanyard operated self-ejecting plug~~, shall be installed in accordance with specification MIL-E-7563 to provide for a ground supply of AC power.

automatic
A receptacle suitable for mating with an external ~~lanyard release~~ quick disconnect connector shall be installed to facilitate cable connection for engine starting control and cockpit to ground intercommunication.

3.16.10.2 Static Ground

A whisker type static grounding device shall be installed on each main landing gear to automatically bring the aircraft to a ground potential on landing.

3.16.10.3 Fuel Nozzle Grounding

An electrical ground receptacle for grounding the refueling nozzle shall be installed adjacent to each refueling adaptor in accordance with the requirements of ARDCM 80-1.

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3.16.10.4 Grounding Jack

A grounding stud located on the underside of the rear fuselage shall facilitate attachment of a grounding cable incorporating a pull-away quick disconnect.

3.16.11 Indicators

3.16.11.1 Master Warning Lights

One red and one amber master warning light shall be installed at the top center of the main instrument panel. Each light assembly shall embody two bulbs which are connected in parallel. The red warning light shall indicate fire detection and the amber warning light shall indicate trouble in any of the circuits designated on a warning indicator panel. Both red and amber warning lights illuminate in the event of loss of pressure in the power circuits of both flying control hydraulic systems. (44)

3.16.11.2 Warning Indicator Panel

A panel with provision for 20 warning indicators shall be installed in the front cockpit to provide, in conjunction with the master warning lights, indication of specific system failure. (44)

The following warning lights shall be incorporated in the panel:

- 2 Fuel Low Level L.H. and R.H.
- 1 Fuel Proportioner L.H. or R.H.
- 1 Fuel Pump Differential Pressure L.H. or R.H.
- 1 Engine Fuel
- 2 Engine Fuel Pressure L.H. and R.H.
- 2 Oil Pressure L.H. and R.H.
- 2 Flying Control Hydraulic A and B
- 1 Utility Hydraulic
- 1 Emergency Brake Hydraulic
- 2 Alternator Failure L.H. and R.H.
- 2 DC Failure L.H. and R.H.
- 2 Low Rotor Overspeed L.H. and R.H.
- 1 Damping System

Two switches shall be installed on the indicator panel for testing the indicator bulbs and resetting the master warning lights. A two position dimming control shall permit illumination intensity control of the warning panel indicators.

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3.16.11.3 Fire Warning

A fire warning light, to operate in conjunction with the master warning light, shall be incorporated in each of the fire extinguisher buttons.

3.16.11.4 Landing Gear Position and Warning Lights

~~Three~~ ^A landing gear position indicators and a red warning light shall be provided as described in paragraph 3.8.2.5.4.

3.16.12 Electric Drives

Electric drives (canopy actuators, motor operated fuel valves etc.) shall be installed in accordance with specification MIL-E-7080 and MIL-E-7614.

3.16.13 Filters

Radio interference filters shall be installed in the aircraft where necessary. Interference limits and methods of measurement for all installations shall be to the requirements of MIL-I-6051.

3.16.14 Emergency Operation

To be determined.

fill in.

3.16.15 Inspection and Maintenance

Suitable provisions shall be made in the aircraft for the inspection, maintenance, removal and re-installation of electrical equipment. (37)
(43)
(107)

Section 3.17 to be
rewritten using format and
definitions in an 7-6. Existing
amendments to be included.

~~See also~~



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3.17 Electronics - (Interim System)

An interim system as defined in Appendix "A" to R.C.A.F. Specification AIR 7-4 shall be installed to the requirements of Specification MIL-I-8700 (ASG), except as stated herein and in Appendix II (Deviations).

The interim electronic system shall comprise the following:

Command Set	AN/ARC-34 ✓
Interphone	AN/AIC-10 ✓
Radio Compass	AN/ARN-6 ✓
Homing Adaptor	AN/ARA-25 ✓
Distance Measuring Equipment	AN/ARN-21
Identification Equipment	AN/APX-6 ✓

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In addition to the above, complete provision shall be made for the installation of a radar altimeter type STR-30 and a radar beacon type RBX-1, and space provision for the installation of automatic ground position indicating equipment (Doppler).

Temperature and pressure within the electronic compartments shall be limited by the air conditioning system (Reference paragraph 3.22). Junction boxes and panels shall be provided to facilitate interconnection of wiring for related systems. All antennas shall be installed internally, either within the aircraft structure or flush with the aircraft skin. The radio controls and selector switches shall be conveniently located in the console panels of the respective cockpits. A micro-switch incorporated in each seat installation shall provide a means for switching the UHF communication transmitter and the IFF transponder to transmit on the distress frequency when the seat is ejected. An override test switch shall be installed in the front cockpit for the purpose of testing the emergency function of the UHF and IFF systems.

3.17.1 Communication Equipment

3.17.1.1 Command Set

An AN/ARC-34 type UHF transceiver shall provide air-to-air and air-to-ground communication facilities on 1750 channels, twenty of which can be preset. This equipment incorporates a guard channel receiver sub-assembly which is tuned to a preset emergency frequency while the main receiver is selected to any other frequency. Provision shall be made in the system for connection of the receiver portion of the UHF homing adaptor (Reference paragraph 3.17.2.6). A UHF remote control unit shall be installed in the front cockpit.



3.17.1.1 Command Set (Cont'd)

The pilot's and the radar operator's press-to-transmit buttons shall be installed in the inboard throttle grip, and on the left hand console switch panel of the rear cockpit, respectively.

Two omni-directional antennas shall be provided for use with this equipment. A fan shaped vertical radiator shall be mounted under a fiberglass fairing at the top of the fin and a downward facing annular slot type antenna shall be mounted flush with the skin under the electronics bay on the right hand side of the access door. A selector switch located on the front cockpit right hand console shall provide means for connection of either antenna to the set. An indicator located on the rear cockpit right hand console shall indicate which UHF antenna is in use.

The system shall operate on 27.5 volt DC obtained from the emergency DC bus.

3.17.1.2 Liaison Set

Not applicable.

3.17.1.3 Interphone

A type AN/AIC-10 interphone system shall be installed to provide intercommunication between the crew members and a means of selection and audio signal level control of the aircraft's communication and navigational radio facilities. The interphone amplifier shall obtain power from the emergency 27.5 volt DC bus.

Ground operation of the interphone shall provide intercommunication between the crew stations and ground service personnel stations, and between the crew stations and a telescrumble land telephone line. Connections for ground operating power and for the land telephone line shall be provided through the external receptacle (Reference paragraph 3.16.10.1). Electrical isolation shall be provided between the aircraft land telephone circuit and ground service circuit.

3.17.1.4 Microphones and Headsets

Complete provision for the use of a type M-32/AIC microphone and a type H-75/AIC headset, or equivalent, shall be provided for each crew member.

A mating combination microphone and headphone jack shall be installed on the right hand side of each ejection seat.



3.17.1.4 Microphones and Headsets (Cont'd)

Quick disconnects shall be provided for automatic separation of the aircrew's microphone and headset cable connections from the aircraft to seat, and from the seat to man (Reference paragraph 3.19.1).

3.17.1.5 Filters

Radio filters shall not be required. Radio interference (46) caused by the operation of the electronic equipment installed in the aircraft shall not exceed the limits defined in Specification MIL-I-6051.

3.17.1.6 Recording Equipment

Not applicable.

3.17.2 Navigation Equipment

3.17.2.1 Radio Compass

A type AN/ARN-6 LF-MF radio compass system shall be installed with control facilities in each cockpit. The system shall provide visual bearing indication of a selected radio station on the radio magnetic indicators located on the front and rear cockpit instrument panels.

A non-directional sense antenna and a flush type directional loop shall be fitted.

3.17.2.2 Radar Altimeter

Complete provision shall be made for the installation of a type STR-30 radar altimeter system which shall be installed to provide continuous indication of the aircraft height above terrain within the range of 0-500 feet.

3.17.2.3 Radio Range Receiver

Not applicable.

3.17.2.4 Marker Beacon Equipment

Not applicable.

3.17.2.5 Instrument Approach Equipment

Not applicable.

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3.17.2.6 Homing Adaptor

A type AN/ARA-25 UHF homing adaptor shall be installed in the aircraft. This equipment shall be used in conjunction with the UHF communication receiver to provide a continuous visual indication, on the two radio magnetic indicators, of the direction of a selected UHF signal source.

A directional antenna assembly shall be mounted in the nose radar compartment and a solenoid relay, controlled by the function selector on the UHF controller, shall permit selection of either UHF communication antenna, or the homer directional antenna.

3.17.2.7 UHF Navigation Equipment

Not applicable.

3.17.2.8 Distance Measuring Equipment

Type AN/ARN-21 (TACAN), air navigational equipment shall be installed to provide continuous indication of distance and direction of the aircraft ~~from~~ a selected L-band ground beacon station. *to*

A cross pointer (course deviation) indicator shall be located on the pilot's main instrument panel. A distance indicator and a control box shall be located in the rear cockpit. An RMI needle indication selector switch located in each cockpit shall provide a means of connecting either the UHF homer or the Tacan system to the radio magnetic indicators.

Two L-band antennas shall be installed, a fan shaped dipole located at the top of the fin and an annular slot type located in the electronic power equipment bay door, either one of which can be connected to the Tacan transmitter-receiver. A transfer switch located in the rear cockpit shall provide a means for transferring the connection of the two antennas alternately to the Tacan and the IPF systems.

3.17.2.9 Arbitrary Course Computer

Not applicable.

3.17.3 Radar

3.17.3.1 Search Equipment

~~Not applicable.~~

*space provision for equipment
demanded by Air 7-6 shall be provided*

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3.17.3.2 Loran Equipment

Not applicable.

3.17.3.3 Automatic Ground Position Indicating Equipment

Space provision shall be made for installation of the Doppler true ground speed and ground track measuring equipment to DRB Specification EL 5040-1.

3.17.3.4 Identification Equipment

A radar identification set, type AN/APX-6, shall be installed to permit the aircraft to identify itself automatically when interrogated by a ground or airborne L-band radar. The IFF control box shall be installed in the front cockpit.

Antenna requirements shall be furnished by the L-band antenna installation used with the Tacan system (Reference paragraph 3.17.2.8). The L-band antenna transfer switch in the rear cockpit shall permit connection of either antenna to the set. This system shall obtain the DC power from the 27.5 volt DC emergency bus and the AC power from the 115 volt AC bus.

3.17.3.5 Interrogation Equipment

Not applicable.

3.17.3.6 Radar Beacon

Complete provisions shall be made for the installation of an X-band radar beacon, type RBX-1. When installed, this equipment shall provide the means for checking an X-band antenna installed in the fin. The system shall provide a reply pulse in the manner of an IFF transponder when triggered by an X-band AI system. Switching of power to the equipment shall be accomplished by closing the appropriate circuit breaker in the electronics bay before flight. A dual horn antenna, waveguide coupled to the transmitter-receiver unit, shall be installed in the fin.

3.17.4 Electronic Countermeasures

3.17.4.1 Search Equipment

Not applicable.

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3.17.4.2 Analyzing Equipment

Not applicable.

3.17.4.3 Panoramic Receiving Equipment

Not applicable.

3.17.4.4 Direction Finding Equipment

UHF

(Homer)

Reference paragraph 3.17.2.8.

3.17.4.5 Transmitting Equipment

Not applicable.

3.17.4.6 *Space transmitters etc as per the Ref Memo*

3.17.5 Electronic Guidance System

3.17.5.1 Guide Links and System

Not applicable.

3.17.5.2 Television and Telemetry Equipment

Not applicable.

3.17.6 Static Dischargers

Not applicable.

3.17.7 Emergency Rescue Transmitter

Not applicable.

3.17.8 Inspection and Maintenance

Doors and panels shall be installed to provide quick access into electronic equipment compartments and at antenna installation areas. Equipment shall be mounted so that removal or installation of any unit can be made without need for removal of adjacent equipment.

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3.18 Armament

- 3.18.1 Weight and space provision shall be made for the installation of air-to-air guided missiles. A fairing shall be installed to close the opening provided to accommodate a missile package.

3.18.1 what is in it & by equipment

3.18.2. show maneuvers as per air 7-4

controls and safety harness, shall be installed for each member of the crew. Action to fire the seat shall also clear the ejection path.

A composite quick disconnect located on the right hand side of each seat shall provide connections for the following services:

Oxygen
Capstan type pressure suit
Visor demisting
Telecommunications
Anti-g suit

The assembly shall provide for automatic (or manual ejection) or individual manual disconnect of these services between the crew and the ejection seat, and between the seat and the aircraft.

3.19 Essential Equipment

3.19.2.1 Drinking Water Containers

Not applicable. (49)

3.19.2.2 Crew Rest Provisions

Not applicable. (48)

3.19.2.3 Compass Deviation Card Holder

A compass deviation card holder shall be installed in each cockpit.

3.19.2.4 Pilot's Check List Holder

Provision shall be made in the front cockpit for a pilot's check list.



3.19 Equipment and Furnishings

Equipment and furnishings appropriate to the primary role of the aircraft shall be installed in accordance with the requirements of CAP 479 and R.C.A.F. Specification AIR 7-4 except as stated in Appendix II (Deviations). (51)
(71)
(52)

3.19.1 Personnel Accommodation

A fully automatic ejection seat with an ejection velocity of 80 feet per second, and incorporating the necessary controls and safety harness, shall be installed for each member of the crew. Action to fire the seat shall also clear the ejection path.

A composite quick disconnect located on the right hand side of each seat shall provide connections for the following services: (47)

Oxygen
Capstan type pressure suit
Visor demisting
Telecommunications
Anti-g suit

*believe
disconnect
is separate*

The assembly shall provide for automatic, (on seat ejection) or individual manual disconnect of these services between the crew and the ejection seat, and between the seat and the aircraft.

3.19.2 Miscellaneous Equipment

3.19.2.1 Drinking Water Containers

Not applicable.

(49)

3.19.2.2 Crew Relief Provisions

Not applicable.

(48)

3.19.2.3 Compass Deviation Card Holder

A compass deviation card holder shall be installed in each cockpit.

3.19.2.4 Pilot's Check List Holder

Provision shall be made in the front cockpit for a pilot's check list.

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3.19.2.5 Map Stowage

A map stowage shall be located on the right hand side of (53) the front cockpit.

3.19.3 Windshield Wipers

A rain repeller shall be provided in accordance with paragraph 3.15.1.3.

3.19.4 Furnishings

Insulation shall be installed on the interior of the cockpit (50) pit to minimize heat transfer from the adjacent skin.

3.19.5 Emergency Equipment

Accommodation for a special pack parachute and a seat pack emergency kit (14 x 15 x 5.5 inches) shall be provided in each ejection seat.

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3.20 Fire Protection

The fire protection system shall provide for detecting and extinguishing fires in the hydraulics bay and each engine compartment. The detection system and the extinguishing system shall be in accordance with specification AIR 7-4 and CAP 479 respectively, except as stated herein and Appendix II (Deviations). (55)
(57)
(58)

3.20.1 Description and Components

3.20.1.1 Detection System

Continuous wire type fire detector circuits shall be installed in each of the three regions and connected to both a master warning light on the pilot's main instrument panel, and three corresponding compartment warning lights each combined with an extinguishing switch. All fire warning lights shall be red. On receipt of a signal from any of the detector circuits, the affected fire detection control unit shall illuminate the master warning light and the light in the appropriate extinguishing switch.

3.20.1.2 Extinguishing System

Two twelve pound, triple outlet fire extinguisher bottles shall be installed in the hydraulics compartment. The bottles shall be interconnected to provide a single charge to any two of the protected regions, or two charges to any one region. The extinguishing agent shall be discharged through high rate discharge nozzles in the fore and aft zones of each engine compartment, and in the hydraulics bay. (54)

3.20.1.3 Operation

On pressing the illuminated switch, in the case of an engine compartment fire warning, a time delay unit shall provide time for the circuit to automatically close the low pressure fuel valve thus cutting off the supply of fuel to the respective engine before discharging one charge of fluid into the compartment. Operation of the system for the hydraulics compartment shall be similar but without the time delay and fuel shut-off features.

A toggle switch, which shall remain dead until an extinguishing switch has been depressed, shall be installed adjacent to the extinguishing switches to provide for discharge of a second charge to the previously selected zone without further operation of the extinguishing switch.



3.20.1.3 Operation (Cont'd)

Relays in the circuit shall ensure that if the same extinguishing switch is pressed a second time, a second charge will not be discharged into the same zone.

In the event of a crash landing, an inertia switch shall complete a circuit from the battery to automatically discharge the extinguishing agent to both engine compartments. (56)

3.20.1.4 Power Supply

Power for normal operation of the fire detection and extinguishing circuits shall be provided from the main DC supply. In case of failure of the main DC supply, power for the detector and second charge circuits shall be supplied from the emergency DC bus, and power for the fire extinguishing circuits shall be supplied from the battery bus.

3.20.1.5 Inspection and Maintenance

Test switches in the nose wheel well shall provide for detector circuit testing on the ground. Quick disconnects in the detector circuits and extinguisher lines shall provide for uncoupling these services for engine removal.

A pressure gauge shall be installed on each fire extinguisher bottle and shall be accessible for inspection. The bottles shall be removable for recharging.

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3.21 Oxygen System

A liquid oxygen system shall be installed to provide oxygen for breathing and pressure suit operation for both crew members. A compressed gas emergency system shall be installed to provide oxygen in the event of ~~normal~~ system failure or bail-out of the crew. The oxygen systems shall be designed to meet the requirements of ARDCM 80-1 except as stated herein and in the Deviations given in Appendix II.

3.21.1 Description and Components

3.21.1.1 Normal System

The normal oxygen supply shall be stored in a 5 litre, portable type, 300 psig, liquid oxygen converter. The converter capacity shall be sufficient to supply the required oxygen to both crew members for one maximum ferry mission. All components required for the oxygen conversion process and maintenance of system pressure shall be an integral part of the detachable converter assembly. The mounting and locking of the converter in the aircraft shall automatically put the system in an operable condition.

3.21.1.2 Emergency System

The emergency oxygen supply shall be stored in two oxygen bottles, one bottle installed on each ejection seat. Each bottle shall contain 100 litres NTP oxygen, stored at 1800 psig. This supply shall be sufficient for approximately twenty minutes of normal breathing and pressure suit operation for each crew member.

3.21.1.3 Distribution

A high altitude, automatic pressure demand, dual pressure, dual outlet oxygen regulator shall be installed on (70) each ejection seat. The regulator performance shall conform to R.C.A.F. Specification INST 11-1. Normal system oxygen shall be supplied to the regulator through a three part composite quick disconnect (Reference paragraph 3.19.1)

The individual emergency oxygen supply shall feed into the normal system through a trip valve installed on each ejection seat and may be selected manually or automatically at bail-out. A dual check valve shall be installed on each seat to block the normal oxygen supply line and to permit the emergency supply to flow to the regulator.

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3.21.1.4 Indicators

A capacitance type oxygen quantity gauge shall be installed in the pilot's cockpit to indicate the quantity of liquid oxygen contained in the converter. ~~An oxygen pressure gauge shall be installed in the pilot's cockpit to indicate the gaseous oxygen pressure in the normal system.~~

A pressure gauge shall be installed adjacent to each emergency oxygen bottle, and shall be so located as to be easily observable from the normal cockpit entrance path and from the normal seated position.

3.21.1.5 Piping

All low pressure piping *no spec* and fittings in the oxygen system up to the regulator shall be aluminum alloy, and all high pressure piping and fittings up to the regulator shall be stainless steel. *no spec*

*de line
Lock
Pressure*

3.21.2 Ground Service

The liquid oxygen supply shall be replenished by the replacement of the oxygen converter with a fully charged unit. The converter shall be installed in the airplane through an access panel opening and shall automatically couple into the system supply line, overboard vent line, and quantity gauge coupling electrical leads, with the supply line quick disconnect self sealing when disengaged. The converter shall lock into the aircraft by a positive lock on the converter mounting tray.

The emergency oxygen bottles shall be rechargeable through a quick disconnect charging valve installed on each ejection seat and so located as to be readily accessible for ground service.

3.21.3 Inspection and Maintenance

Suitable provisions shall be made for the inspection, maintenance, removal and re-installation of the oxygen equipment.

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3.22 Air Conditioning

The air conditioning system shall be of the engine compressor bleed type and shall be designed to maintain specified conditions of air temperature and/or pressure in the cockpits and equipment compartments, and to equipment. Conditioned air exhausted from the cockpit, equipment compartments and equipment shall be utilized to condition other compartments as indicated in the table below:

Primary Conditioned	Secondary Conditioned
- Cockpits	- Armament Pack Bay
- Nose Radar Equipment - Battery Compartment	- Nose Wheel Well (forward end)
- Oxygen Converter - Forward Fuselage Electronics Compartment	- Air Conditioning Bay
- Dorsal Electronics Com- partment	
- Alternator Control/Trans- former Rectifier Box	

Complete provision shall be installed to supply conditioned air for a stabilization platform of an integrated electronics system.

Ground air conditioning shall be possible by the use of a ground servicing unit which shall supply both high and low pressure air for the system through quick disconnects.

Air from the air conditioning system shall be utilized during both in-flight and ground operation to supply the requirements of the pneumatic services (Section 3.15).

The air conditioning and pressurizing system shall be designed to meet the requirements of R.C.A.F. Specification AIR 7-4 and ARDCM 80-1 except as stated in Appendix II (Deviations) and additionally herein. (59)
(60)

3.22.1 In-Flight Air Conditioning

Supplies of air, cooled by successive stages of the system shall be mixed to provide conditioned air for the cockpit compartments and equipment. The system shall be designed to automatically pressurize the cockpits above an ambient pressure altitude of 10,000 feet and shall incorporate limited manual control of cockpit temperature.



3.22.1 In-Flight Air Conditioning (Cont'd)

An air supply selection control shall be installed to permit either complete shut-down of the system, or utilization of ram air to ventilate unoccupied compartments (Reference paragraph 3.22.1.4), in the event of system malfunction or failure.

3.22.1.1 Occupied Compartments

3.22.1.1.1 Cockpits

A control system shall be installed to permit the pilot to select a cockpit temperature in the range of +40°F to +80°F. As a preventative against formation of fog in the cockpit, the lower temperature of the air admitted to the cockpit shall be automatically limited to a minimum of +55°F below 20,000 feet ambient pressure altitude. To disperse cockpit fog, it shall be possible for the pilot to select a cockpit temperature of +90°F.

Automatic cabin pressure control equipment shall be installed to provide:

- (a) A cockpit pressure differential of zero up to an ambient pressure altitude of 10,000 feet.
- (b) A linear increase in cockpit pressure differential to a maximum of 4.5 plus 0.5 minus 0 psi as the ambient pressure altitude increases from 10,000 to 60,000 feet.
- (c) A constant cockpit pressure differential of 4.5 plus 0.5 minus 0 psi at ambient pressure altitudes exceeding 60,000 feet.

The cabin leak rate shall be less than two-thirds of the maximum quantity of air available for pressurization at the absolute ceiling of the aircraft

An electrically operated dump valve, controlled by a switch in the pilot's cockpit, and incorporating components to provide automatic outward and inward relief of cockpit pressure shall be installed. A cockpit altimeter conforming to Specification MIL-I-5099, and the air supply selection control shall be installed in the pilot's cockpit. (69)



3.22.1.2 Unoccupied Compartments

3.22.1.2.1 Primary Conditioning Distribution

A system of ducting incorporating restrictors to provide for control of air distribution shall convey conditioned air at $80^{\circ}\text{F} \pm 5^{\circ}\text{F}$ to all the primary conditioned equipment compartments and equipment to maintain the internal air temperature of each below $+160^{\circ}\text{F}$. The three radar compartments shall be fitted with restricted vents to prevent the internal pressure of the compartments falling below the equivalent of ~~55,000~~ ^{50,000} feet pressure altitude. An air valve, controlled by pressure sensing switches, shall be installed to stop the flow of conditioned air to the nose radar compartment in the event of a drop in supply pressure, from either engine compressor, below the system minimum requirements. Failure of the power output from either transformer-rectifier unit shall provide for the diversion of the flow of conditioning air to the box of the remaining operable unit.

3.22.1.2.2 Secondary Conditioning Distribution

The exhaust air from the cockpits shall be ducted to the armament pack bay to maintain the internal air temperature between 0 and $+130^{\circ}\text{F}$.

Exhaust air from the nose radar and battery compartments shall be utilized to maintain a cooling air supply, at a temperature below 160°F , for the equipment in the forward end of the nose wheel well.

The air vented from the forward fuselage electronics compartment and from the oxygen converter shall be utilized to maintain the air in the air conditioning equipment bay below 250°F .

3.22.1.3 Cooling Sub-System

3.22.1.3.1 Air-to-Air Heat Exchanger

Air for conditioning shall be bled from the two upper bleed ports of each engine through a pressure reducing and check valve set at 85 psi, and ducted to a heat exchanger.

Ducting shall be installed to convey cooling air to the heat exchanger from two sources as follows:

- (1) Ramp air, drawn from each engine air intake ramp air bleed by the turbine driven fan.



3.22.1.3.1 Air-to-Air Heat Exchanger (Cont'd)

- (2) Ram air, provided by the boundary layer air bleed between each engine air intake and the fuselage wall.

Both cooling air supplies shall be vented to atmosphere. The air conditioning output from the heat exchanger shall be ducted to the air cooling water evaporator.

3.22.1.3.2 Air Cooling Water Evaporator

The air cooling water evaporator shall have a nominal capacity of 125 pounds of water and shall be designed to withstand freezing and thawing of its contents under all conditions of operation. Steam generated in the evaporator shall be vented to atmosphere.

The main air conditioning output of the cooling evaporator shall be ducted to the cooling expansion turbine. The remaining output shall be utilized for quantity and temperature control.

3.22.1.3.3 Air Cooling Expansion Turbine

engine duct

The turbine shall cool the conditioned air by expansion (81) and shall power the fan to draw ~~ram~~ air through the heat exchanger (Reference paragraph 3.22.1.3.1).

3.22.1.4 Ram Air Ventilation

Selection of ram air shall permit air from the ram air duct (Reference paragraph 3.22.1.3.1) to be utilized for ventilation of all the conditioned compartments excepting the cockpits, nose radar compartment and armament pack. (62)

3.22.2 Ground Air Conditioning

Two automatic disconnect ground air conditioning couplings, (61) each embodying a check valve, shall be installed to utilize ground service air supplies as follows:

- (1) Air at a pressure of 3.5 psi and at a temperature within the range of 55 to 80°F. Ducting shall be installed to permit the air supply to enter the aircraft system at the output side of the expansion turbine, and be utilized to condition the cockpit, equipment compartments, and equipment.



3.22.2 Ground Air Conditioning (Cont'd)

- (2) Air at a pressure of 45 psi and at a temperature of 350°F or less. Ducting shall be installed to permit the air supply to enter the aircraft system upstream of the heat exchanger, and be utilized to provide temperature control air for the system, and air for the ground requirements of the pneumatic system (Reference Section 3.15).

3.22.3 Inspection and Maintenance

Provision for connecting cockpit leakage test equipment shall be installed. Access doors and detachable panels shall be installed to facilitate inspection and maintenance.

3.23.1 Access Doors

Not applicable.

3.23.2 Carburettor Anti-Icing and De-Icing

Not applicable.

3.23.3 Air Intakes

3.23.3.1 Engine Air Intakes

The outer surface of the shock wings and the leading edges and inner surfaces of the engine air intakes shall be protected from excessive ice accretion by electrically heated de-icing boots. The de-icing boots covering the leading edge of each ramp shall include a protective covering of stainless steel and a suitably perforated mesh of the same type shall be used to protect the main air bleed area. The boots shall incorporate heating elements to prevent ice from forming on the outer surface which would prohibit opening. Power for heating the boots shall be supplied by the 115 volt AC system.

The de-icing cycle shall be automatically controlled by an icing detector, installed at the top of the right hand air intake. In conjunction with a de-icing controller which actuates appropriate switching distributors for the left-hand and right hand intakes. These components shall operate from the 115 volt AC supply.

During the de-icing period the porting valves shall close to allow the air to flow through the de-icing boots. The boots shall be protected from the effects of the de-icing controller signals.

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3.23 Anti-Icing and De-Icing Systems

Fully automatic anti-icing and de-icing systems shall be provided for the following areas:

- Engine Air Intakes
- Engine and Accessories
- Cockpit Transparencies
- Pressure Heads
- Radome

Except as stated in the Deviations and as additionally set forth herein, the systems shall be designed in accordance with the requirements of R.C.A.F. Specification AIR 7-4.

3.23.1 Propeller De-Icing

Not applicable.

3.23.2 Carburettor Anti-Icing and De-Icing

Not applicable.

3.23.3 Air Intakes

3.23.3.1 Engine Air Intakes

The outer surface of the shock ramps and the leading edges and inner surfaces of the engine air intakes shall be protected from excessive ice accretion by electro-thermal de-icing boots. The de-icing boots covering the leading edge of each ramp shall include a protective covering of stainless steel and a suitably perforated boot of the same type shall be used to protect the ramp air bleed area. The boots shall incorporate parting strips to prevent ice from forming an unbroken cap which would prohibit shedding. Power for heating the boots shall be supplied by the 120 volt AC system.

The de-icing cycle shall be automatically controlled by an icing detector, installed at the top of the right hand air intake, in conjunction with a de-icing controller which actuates separate shedding distributors for the left hand and right hand intakes. These components shall operate from the 28 volt DC supply.

During the cyclic period the parting strips shall dissipate 20 watts per square inch continuously, and the shedding areas 12 watts per square inch when they are energized. The boots shall be protected from overheating by thermostats and temperature control relays which override the de-icing controller signals.



3.23.3.1 Engine Air Intakes (Cont'd)

To prevent operation of the de-icing boots during engine runup the DC circuit on which the control equipment operates shall include a scissors switch mounted on the main landing gear.

3.23.3.2 Engine and Accessories

Each engine, as supplied by the engine manufacturer, shall include an integral hot air return anti-icing system, as defined in Pratt and Whitney Engine Specification PWA 2611.

Automatic selection of anti-icing air flow for both engines shall normally be controlled by the icing detector on the right hand engine air intake (Reference paragraph 3.23.3.1). An icing detector shall be installed in the left intake to protect the left hand engine during ground operation, when the right hand engine is not running.

3.23.4 Cockpit Transparencies

Anti-icing and anti-misting of the windshield and canopy windows in the forward cockpit only shall be accomplished (63) by electrically conductive transparent heating elements. These elements, dissipating approximately 5 watts per square inch, shall be applied to the inner surface of the outer ply of each panel during manufacture. Temperature sensing units embedded in the vinyl interlayer adjacent to the heating elements shall permit temperature control for each circuit.

The temperature control shall be automatic, and in order to overcome thermal lag, power shall be applied to the circuit at all times when the aircraft is operating or in a state of immediate readiness.

3.23.5 Main Plane, Stabilizer and Fins

Not applicable.

3.23.6 Antennae Masts

Not applicable.

3.23.7 Pressure Heads

An air data sensing boom, including pitot pressure heads, alpha and beta angle sensors shall be protected from the formation of ice by means of built-in electrical heaters.



3.23.7 Pressure Heads (Cont'd)

The circuit shall be of the constant heat type protected by an overheat thermostat.

3.23.8 Undercarriage

Not applicable.

3.23.9 Panels and Doors

Not applicable.

3.23.10 Vents

Not applicable.

3.23.11 Photographic Installations

Not applicable.

3.23.12 Radome

A freezing point depressant fluid (glycol and water solution), for application to the radome as a protection against the formation of ice, shall be stored in a 2.75 Imperial Gallon pressurized tank. The solution shall be sprayed from a distributor mounted near the base of the nose boom and pneumatic system air, (Reference paragraph 3.15.1.1.3) shall provide power to pressurize the tank and operate the distributor. An ice detector, operating from the 27.5 volt DC supply and located on the underside of the radome, shall control operation of the system.

3.23.13 Inspection and Maintenance

Provision shall be made for inspection and maintenance of de-icing equipment. A ground test switch, to override the landing gear scissors switch and permit testing of the de-icing boots, shall be installed on the panel adjacent to the left hand speed brake.



3.24 Photographic Equipment

Not applicable.

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3.25 Auxiliary Gear

3.25.1 Towing Provisions

Towing provisions shall conform to the requirements of Specification MIL-T-7935. Lugs shall be provided at the nose wheel pivot for attachment of a tow bar. The turning angle will be limited to 55° either side of neutral permitting the aircraft to be turned in a 21 foot radius. Provision shall be made for interconnection between the AN/AIC-10 interphone system and the towing vehicle with connection made at the same point as for ground intercommunication (Reference paragraph 3.16.10.1). A micro-switch on the tow bar shall initiate a warning through the intercom to the tractor driver when the maximum turning angle is approached. During towing, power to operate the interphone system shall be supplied by the towing vehicle.

Towing lugs shall be provided on each main landing gear unit for forward or rearward towing of the airplane by means of a towing bridle.

3.25.2 Jacking Provisions

Jacking provisions, and the design of jack pads shall conform to the requirements of MIL-J-8711, except in the case of the nose landing gear.

Provision shall be made for jacking the complete airplane at three points, one on the airplane center line aft of the nose landing gear, and one inboard of each outer wing root. A removable jack pad shall be provided for each (65) jacking point.

Each main landing gear unit shall incorporate an integral jack pad. The nose landing gear shall incorporate provisions for jacking, using a special bar with a jack pad conforming to MIL-J-8711. (64)

3.25.3 Mooring Provisions

Provision shall be made for the attachment of mooring fittings to the main landing gear towing lugs and a mooring lug on the nose landing gear leg. (66)
(67)

3.25.4 Hoisting Provisions

Provision shall be made for hoisting the entire aircraft from three points, one on the aircraft center line at the nose center fuselage joint, and one on each inner wing panel adjacent to the outer wing root.



3.25.5 Leveling

Provision shall be made in the nose wheel well for the attachment of a special fixture for use in leveling the aircraft. The fixture shall indicate a level attitude of the lateral axis and 4° 4' nose up attitude of the longitudinal axis. (68)

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4. Tests

4.1 Ground Tests

Functional ground test shall be conducted under a program established by the Company to prove ground functioning of the aircraft systems and installed equipment.

Structural integrity tests shall be demonstrated under a static test program based on the requirements of Specification MIL-S-5710 and as agreed upon by the R.C.A.F. and the Company (110) ~~and as set forth in Avro Reports~~

4.2 Flight Tests

Functional flight tests shall be conducted under a program established by the Company to prove in-flight functioning of the aircraft systems and installed equipment.

Structural flight tests shall be conducted under a program based on the requirements of AIR 7-4 (Issue 3) and MIL-S-5711 (110) as agreed upon by the R.C.A.F. and the Company, ~~and as set forth in Avro Report~~

Production
4.3 ~~Acceptance~~ *Flight tests*
as agreed to by RCAF and
Company.

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5. Preparation for Delivery

To be determined.

6.2 Definitions

6.2.1 Provisions

6.2.1.1 Complete Provision

"Complete provision" is a specific item of equipment, or assembly of equipment, which may include, but is not limited to, structural, electrical, wiring, and other components and parts which are required for the equipment to be delivered in the specified condition. It may include, but is not limited to, the equipment itself, and the parts and components which are required for the equipment to be delivered in the specified condition. It may also include, but is not limited to, the equipment itself, and the parts and components which are required for the equipment to be delivered in the specified condition.

6.2.1.2 Structural Provision

"Structural provision" is a specific item of equipment, or assembly of equipment, which may include, but is not limited to, structural, electrical, wiring, and other components and parts which are required for the equipment to be delivered in the specified condition. It may include, but is not limited to, the equipment itself, and the parts and components which are required for the equipment to be delivered in the specified condition. It may also include, but is not limited to, the equipment itself, and the parts and components which are required for the equipment to be delivered in the specified condition.

6.2.1.3 Space Provision

"Space provision" is a specific item of equipment, or assembly of equipment, which may include, but is not limited to, structural, electrical, wiring, and other components and parts which are required for the equipment to be delivered in the specified condition. It may include, but is not limited to, the equipment itself, and the parts and components which are required for the equipment to be delivered in the specified condition. It may also include, but is not limited to, the equipment itself, and the parts and components which are required for the equipment to be delivered in the specified condition.

6.2.2 Statements

6.2.2.1 Deviation

A deviation is the difference between a requirement of the S.C.A.F. Type Specification (and any subsequent amendment thereto), and the structure actually fitted by

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6. Notes

6.1 Explanatory Information

Not applicable.

6.2 Definitions

6.2.1 Provisions

6.2.1.1 Complete Provision

"Complete provision for" a specific item of equipment, or assembly or installation, shall mean that all supports, brackets, tubes and fittings, electrical wiring, hydraulic lines etc. have been installed and adequate weight and space allocated so that the equipment can be installed without alteration to the specified equipment or the aircraft, and that no additional parts are required for the installation other than the item itself. Standard stock items such as nuts, bolts, cotter pins, etc. need not be furnished.

6.2.1.2 Structural Provision

"Structural provision for" a specific installation shall mean that the primary structure shall be structurally adequate for the installation, but that brackets, bolt holes, electrical wiring, hydraulic lines etc. will not be required. Structural provisions also include weight of the equipment involved as an element of alternate weight.

6.2.1.3 Space Provision

"Space provision for" a specific installation shall mean that space only shall be allocated for the installation, and that brackets, bolt holes, electric wiring, hydraulic lines etc. will not be required. Space provision does not imply that adequate attaching structure is provided unless otherwise stated.

6.2.2 Statements

6.2.2.1 Deviation

A deviation is the difference between a requirement of the R.C.A.F. Type Specification (and specifications incident thereto), and the airplane design *as defined by*

this Model Spec

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6.2.2.2 Interchangeability

Interchangeability means the capability of replacing parts, components or accessories by others made to the same drawings or specifications, without further work being done on them or on the parts to which they are assembled.

Replace by MIL 8500A definitions

6.2.2.3 Replaceable

Replaceable parts, components, and accessories are those that can be replaced by others made to the same drawings or specifications, but that require minor operations to be performed on them or on the parts to which they are assembled to effect replacement.

6.2.3 Performance

6.2.3.1 Combat Load Factor

Combat load factor is the maximum load factor that can be sustained in a steady turn without loss of speed or altitude.

6.2.3.2 Combat Speed

Combat speed is the constant speed at which the aircraft is flying during the turn in which the combat load factor is developed.

6.2.3.3 Combat Altitude

Combat altitude is the constant altitude at which the aircraft is flying during the turn in which the combat load factor is developed.

6.2.3.4 Combat Climb and Acceleration Time

Combat climb and acceleration time is the elapsed time taken to reach combat speed and combat altitude from the time the aircraft becomes airborne during take-off at normal gross weight under sea level conditions.

6.2.3.5 Combat Ceiling

Combat ceiling is the altitude where the sustained rate of climb has fallen to 500 feet per minute.

6.2.4 Weights

6.2.4.1 Combat Weight

The combat weight shall be the weight of the aircraft fully loaded with 50 percent of the fuel required for the combat mission.

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6.2.4.2 Normal Gross Weight

The normal gross weight and the normal weight for take-off shall be the weight of the aircraft fully loaded with primary armament and fuel for the combat mission.

6.2.4.3 Gross Weight for Stress Analysis

The gross weight for stress analysis (stressing weight) shall not be less than the normal gross weight less fifty percent of the combat mission fuel.

6.2.4.4 Maximum Gross Weight

The maximum gross weight and the maximum weight for take-off shall be the weight of the aircraft fully loaded with primary armament, fuel internal fuel, and external fuel for the overload range mission.

6.2.4.5 Maximum Landing Gross Weight

The maximum landing gross weight shall not be less than the maximum gross weight less; assist take-off fuel, drop-pable fuel and tanks, dumpable fuel and any other items normally expended during or immediately after take-off (except bombs, rockets, missiles, and ammunition shall be retained).

6.2.4.6 Normal Design Landing Gross Weight

The normal design landing gross weight shall not be less than the applicable take-off weight less; 75% of fuel (internal and external) carried in the basic mission, oil expended consistent with fuel expended, any external fuel tanks which must be dropped by requirements of the mission, any other item which must be expended by the requirements of the mission, and bombs, rockets, missiles, and ammunition.

6.2.4.7 Weight Empty

The weight empty shall be the weight of airframe, power plant, and fixed equipment.

6.2.4.8 Basic Weight

The weight of an aircraft with fixed and removable equipment installed for the purpose of performing a specific role. The term "Basic Weight" shall be qualified as to role when referred to an aircraft in which various items of removable equipment may be installed for different roles. It includes airframe, power plant, accessories,



6.2.4.8 Basic Weight (Cont'd)

trapped fuel and oil, and non-expendable fluid systems (hydraulic, coolant) filled to capacity, but without expendable items.

6.2.4.9 Operational Load

Operational load includes crew, passengers, parachutes, baggage, cargo, personal safety equipment, expendable items (fuel, oil, de-icing fluid, water injection fluid, catering provisions, ammunition, rockets and bombs), and residual fuel.

6.2.5 Equipment and Fluids

6.2.5.1 Fixed Equipment

Equipment installed in an aircraft and not intended to be removed for any specific role.

6.2.5.2 Removable Equipment

Readily removable equipment installed in an aircraft for the purpose of performing a specific role.

6.2.5.3 Trapped Fuel and Oil

The fuel and oil remaining in the aircraft fuel and oil systems after they have been filled and then drained by means of the tank drains, with the aircraft in the normal ground position.

6.2.5.4 Residual Fuel

Residual fuel is fuel, in excess of trapped fuel, that cannot be consumed in flight, but that can be drained by means of the tank drains (i.e. does not include trapped fuel, and is not included in Basic Weight).

6.2.6 Engine Definitions

6.2.6.1 Maximum Rated Thrust

Maximum rated thrust is the maximum thrust which the contractor specifies the engine will deliver at standard sea level static conditions for a duration of 5 minutes. In flight, maximum thrust will be the thrust developed with the power lever in the "Maximum" position. If maximum thrust is greater than military thrust, its permissible duration in flight shall be 15 minutes.

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6.2.6.2 Military Rated Thrust

Military rated thrust is the maximum thrust which the contractor specifies the engine will deliver without augmentation at standard sea level static conditions for a duration of 30 minutes. In flight, military thrust will be the thrust developed with the power lever in the "military" position.

6.2.6.3 Normal Rated Thrust

Normal rated thrust is the maximum thrust which the contractor specifies the engine will deliver at standard sea level static conditions for continuous operation. In flight, normal thrust will be the thrust developed with the power lever in the "normal" position.

6.2.6.4 Idling Thrust

The idling thrust is the minimum developed thrust at which the contractor specifies the engine may be operated at standard sea level static conditions. In flight, idling thrust will be the thrust developed with the power lever in the "idle" position.

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Nil

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Nil

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APPENDIX I

EQUIPMENT CATALOGUE

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APPENDIX II

DEVIATIONS

1. Role

Requirement: Specification AIR 7-4, Paragraph 2.2.1 and 2.2.2

The ----- role of the aircraft shall be high altitude, all weather, night and day interception ----- etc.

Deviation: The aircraft will not, in effect, utilize its maximum potential under adverse weather conditions.

Reason for Deviation and Remarks: No radome material as yet developed will withstand heavy rain impingement at supersonic speeds.

2. Detail Design Spotfacing

Requirement: Specification ARDCM 80-1, paragraph 8.10(b)1

Bosses or extra material shall be provided on surfaces to be spotfaced.

Deviation: Bosses or extra material will not always be provided on surfaces to be spotfaced.

Reason for Deviation and Remarks: Weight saving. Bosses will be omitted on surfaces to be spotfaced where it can be shown that adequate strength qualities exist.

3. Detail Design, Castings

Requirement: ARDCM 80-1, paragraph 3.260

In the design of magnesium alloy castings, wall thickness shall not be less than $5/32$ (0.15625) inch, -----.

Deviation: Minimum wall thickness of magnesium castings may be taken to 0.13 inch in certain limited areas of the castings.

Reason for Deviation and Remarks: To save weight in the more lightly stressed portions of castings.

4. Combat Load Factor

Requirement: AIR 7-4, paragraph 3.3.1

The combat performance at combat weight shall not be less than a



4. Combat Load Factor (Cont'd)

Requirement: (Cont'd)

combat load factor of 2 at a combat speed of Mach 1.5 and at a combat altitude of 50,000 feet.

Deviation: Combat load factor at combat speed of Mach 1.5, combat altitude of 50,000 feet, and combat weight, is 1.5.

Reason for Deviation and Remarks: J-75 engine performance does not permit the above requirement to be attained (Reference AIR 7-4 paragraph 4.1.2).

5. Take-Off Distance

Requirement: Specification AIR 7-4, paragraph 3.9.1

The aircraft shall be capable of taking off safely in still air at maximum gross weight from 6,000 ft. runways at sea level and at a standard summer temperature of 38°C.

Deviation: Take-off distance in still air at maximum gross weight (67,730 lb.) at sea level and standard summer temperature of 38°C, to clear a 50 ft. obstacle with maximum thrust (afterburners operating) is 6,300 ft.

Reason for Deviation and Remarks: J-75 engine performance does not permit the above requirement to be attained (Reference AIR 7-4 paragraph 4.1.2).

6. Combat Ceiling

Requirement: Specification AIR 7-4, paragraph 3.8.1

The combat ceiling at combat weight shall not be less than 60,000 ft.

Deviation: The combat ceiling at combat weight is 57,200 ft.

Reason for Deviation and Remarks: J-75 engine performance does not permit the above requirement to be attained (Reference AIR 7-4 paragraph 4.1.2).

7. Limit Ground Loads

Requirement: Bulletin ANC-2a, Table 4-1



7. Limit Ground Loads (Cont'd)

Requirement: (Cont'd)

The design requirements specified by ANC-2 call for a 12,000 pound load straight ahead and a 6,000 pound load inclined at 45° to the aircraft longitudinal axis.

Deviation: The aircraft is designed for a 10,000 pound load straight ahead and 6,000 pounds at 45° . ok

Reason for Deviation and Remarks: These loads were established at the 17th meeting of the Co-ordinating Committee, 2 March 1955, Item No. 9 and confirmed by letter S1038-105-11 (ACE-1) dated 22 August 1955.

8. Yaw Velocity in Flat Spins

Requirement: Specification MIL-S-5702, paragraph 4.3.2.1

Flat Spins: The yawing velocity (in this condition) shall be 5.0 radians per second for fighters and pilot trainers -----.

Deviation: The yawing velocity in a flat spin shall be taken as 3.5 radians per second.

Reason for Deviation and Remarks: On the basis of all available data it is not considered that a yaw velocity of 3.5 radians per second can be exceeded. *why? structure? or not logical impossibility?*

9. Load Factors in Rolling Pull-Out

Requirement: Specification MIL-S-5702, paragraph 4.2.1.1

Rolling Pull-Out - For this condition, all points within the positive V_n diagram up to and including a load factor of $1 + \frac{2}{3} \Delta n$ shall be considered ----

$$\begin{aligned} \text{CF-105 requirement where } n &= 7.33 \\ (\Delta n &= n-1) \\ 1 + \frac{2}{3} \times (7.33-1) &= 5.22 \end{aligned}$$

Deviation: The positive load factors to be considered for a rolling pull-out will be based on $\frac{2}{3} n_1$

$$\begin{aligned} \text{CF-105 consideration where } n_1 &= 7.33 \\ \frac{2}{3} \times 7.33 &= 4.89 \end{aligned}$$

Reason for Deviation and Remarks: Requirement of superseded specification 1803 (original contractual specification) used prior to the introduction of MIL-S-5702.

Show in Spec List



10. Piano Hinge Pins

Requirement: Specification ARDCM 80-1, paragraph 5.451

Where the removal of the control surface is accomplished by removal of the hinge pin (piano type hinge) the continuous length of pin shall not exceed 48 inches.

Deviation: The aileron hinge pins exceed this length and are intended to be removeable.

Reason for Deviation and Remarks: Established assembly and removal practice permits handling of the long hinge pins.

Produce this

11. Canopy Jettison

Requirement: Specification CAP 479, paragraph 22.30 (1)

Canopies in single and tandem cockpit aircraft ----- and shall be jettisonable in flight -----.

Deviation: The canopy hatches shall be openable but not jettisonable in flight.

Reason for Deviation and Remarks: A non-jettisonable canopy provides enhanced crew safety, elimination of possible damage to airframe structure, and ability to ground test.

*would
to show prime reason*

12. Windshield Angle

Requirement: Specification ARDCM 80-1, paragraph 6.21

Flat panels in those areas used for vision in taking-off, flying ----- should be placed at an angle of incidence no greater than 55° -----.

Deviation: The angle of incidence of the windshield shall be 65°.

Reason for Deviation and Remarks: Aerodynamic requirement.

13. Visibility of Wing Tip to Pilot

Requirement: Specification CAP 479, paragraph 20.22

The pilot should be able to see both wing tips in fighters - for formation flying.

Deviation: Wing tips not visible to pilot.



13. Visibility of Wing Tip to Pilot (Cont'd)

Reason for Deviation and Remarks: Impossible to achieve with accepted aircraft configuration and limitations on pilot movement imposed by required accoutrements.

14. Landing Gear Retraction Time

Requirement: Specification ARDCM 80-1, paragraph 7.60

The time of operation of the landing gear at temperatures between -65°F to -20°F shall not exceed a value which is double the fastest time selected for the -20°F to $+120^{\circ}\text{F}$ range.

Deviation: Design based on a retraction time of 5 seconds at -20°F and 30 seconds at -65°F .

Note: ARDCM 80-1 requirement for retraction time:- 10 seconds (Reference paragraph 7.601).

Reason for Deviation and Remarks: The above criteria adopted as basis for design to save weight imposed by larger piping (Refer to Item 4 of the Minutes of the CF105 Development Co-ordinating Committee's 20th Meeting, 22nd June 1955).

15. Emergency Flying Controls

Requirement: Specification ARDCM 80-1, paragraph 9.205

Where power boost or power control systems are employed, an emergency manual or power means shall be provided -----.

Deviation: Two separate hydraulic power circuits are used. Both are normally in use, but either system alone will provide sufficient power for adequate control of the aircraft.

Reason for Deviation and Remarks: The two separate hydraulic power circuits, with each being capable of automatically carrying on when the other has failed, provide a better emergency means of operation than a specific emergency source of power. Two pumps are installed in each power circuit.

16. Flying Controls Rigidity and Balance

Requirement: Specification ARDCM 80-1, paragraph 9.206

----- When power control systems are used, the rigidity and balance of the control surfaces shall be such as to preclude flutter or undesirable oscillations if the actuator or any one of the actuators used is disconnected for any reason, including battle damage.



16. Flying Controls Rigidity and Balance (Cont'd)

Deviation: The rigidity of each control surface is dependent on multiple connections to the control tube. The control surfaces are not balanced.

Reason for Deviation and Remarks: This requirement is not compatible with the design aims of a fully powered, irreversible flying control system and, if it were met, it would involve prohibitive weight penalties.

17. Elevator Interconnectors

Requirement: Specification ARDCM 80-1, paragraph 9.210a

Elevators shall be rigidly interconnected or consist of a continuous structure.

Deviation: Each elevator is linked to a separate corresponding actuator and is not connected to the other elevator.

Reason for Deviation and Remarks: Space requirements dictate use of two actuators. This requirement is not met due to the difficulty of achieving the necessary degree of synchronization between two actuators when connected to a single surface and used in a stability augmented system.

18. Cable Guards

Requirement: Specification ARDCM 80-1, paragraph 8.315.1

All pulleys and quadrants shall be provided with stationary guards fitting close to the points of tangency of the control cables.

Deviation: Tension regulating quadrants are equipped with cable guards attached to the quadrants themselves.

Reason for Deviation and Remarks: The above guards move with their respective quadrants and are much simpler and lighter than normal fixed guards. The moveable guards provide ample protection against cables jumping the cable grooves on the quadrants.

19. Control Cable Duplication

Requirement: Specification ARDCM 80-1, paragraph 9.210 a and b

- (a) ----- the direct (elevator control) system shall be duplicated from the base of the ----- control column to the elevator spars.



19. Control Cable Duplication (Cont'd)

Requirement: (Cont'd)

- (b) Where cables are used for the rudder control on aircraft equipped with a single rudder, duplicate cables shall be provided from each rudder pedal to the rudder mast.

Deviation: Single mechanical control linkages are installed between all control surface actuator valves and the pilot's controls.

Reason for Deviation and Remarks: Complexity and space reasons.

20. Control Cable Spacing

Requirement: Specification ARDCM 80-1, paragraph 9.207

Cables of any one control surface shall be separated by at least three inches, preferably more.

Deviation: In a few places, notably where the two cables for a particular control surface change direction at pulleys, the cables are not spaced according to the above requirement.

Reason for Deviation and Remarks: Space restriction. Fairleads or guide tubes are installed where necessary.

*define exactly where
and extent of deviation*

21. Engine Air Intake Screens

Requirement: Specification ARDCM 80-1, paragraph 16.625

Where retractable inlet screens are not provided with axial flow engines, the airframe manufacturer shall mount a retractable screen in the inlet duct of the aircraft.

Deviation: Screens not provided.

Reason for Deviation and Remarks: Penalty to performance and weight does not justify complexity required for very doubtful protection. High location of air inlets is considered adequate protection.

22. Engine Isolation

Requirement: Specification ARDCM 80-1, paragraph 15.620

All engines of (multi-engine) aircraft, which are located adjacent to one another in the fuselage or in nacelles shall be isolated from one another by a stainless steel firewall. This firewall shall be as liquid and gas-tight as possible.

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22. Engine Isolation (Cont'd)

Deviation: A composite structure has been used to fulfill the conditions quoted. An aluminum shroud effectively forms an air tight barrier between Zone 2 and the fuselage bay. Insulation blankets attached to the aluminum shroud to provide flame resistance.

Reason for Deviation and Remarks: Weight

23. Engine Isolation

Requirement: Specification ARDCM 80-1, paragraph 15.620

Each engine installation of all aircraft, regardless of the number or relative position of the engines, shall incorporate a stainless steel diaphragm that separates the burner and tail pipe section from the accessory and compressor section.

Deviation: Titanium is used to separate the burner and tail pipe section from the accessory and afterburner section.

Reason for Deviation and Remarks: Weight

24. Firewall and Shut-Off Valves

Requirement: Specification CAP 479, paragraph 23.22

Firewall shut-off valves shall be incorporated in fuel, oil, and hydraulic fluid lines which pass through the firewall, in all twin and multi-engine aircraft. The shut-off valves shall be located as near as possible to the firewall and yet still be in a location not liable to be swept by a nacelle fire. Valves already provided in these systems can be used to perform the functions of firewall shut-off valves if the controls are convenient to the pilot, second pilot or flight engineer in an emergency, or are automatically closed by operation of the fire fighting controls.

Deviation: Shut-off cocks not installed for engine and accessories oil systems. Hydraulic system does not enter engine compartment - i.e. does not pass through firewall.

Reason for Deviation and Remarks: Shut-off cocks are not provided in engine oil and accessories oil systems since both are high rate of flow systems with small total capacity. If leakage of either feed or return lines should occur, almost the whole system would be drained before the fault could be detected and shut-off valves operated.

SECRET

prove no
fast acting detectors
& valves available

investigate x file



25. Purging of Fuel Tanks

Requirement: Specification ARDCM 80-1, paragraph 16.400

----- A purging system shall be provided for all combat aircraft.

Deviation: A purging system is not provided.

Reason for Deviation and Remarks: All purging systems at present available would be ineffective in this system. Requirements for purging deleted from AIR 7-4 at Issue 2, implying not required. This was agreed at 7th Co-ordinating Meeting, 14 July 1954, Item 39.

26. Tank Selection - Refueling

Requirement: Specification ARDCM 80-1, paragraph 14.323 (j)

It shall be possible to select any tanks for filling, and conversely, to avoid filling any tanks. This is necessary for either c.g. control, selective fuel loading or to avoid the filling of battle damaged tanks or tanks with inoperative fuel booster pumps.

Deviation: Selective tank filling is not provided.

Reason for Deviation and Remarks: Automatic c.g. control is provided by means of the fuel proportioners. Use of selective tank filling would act directly against the object of providing automatic control of c.g. position.

27. Installation or Removal of Fuel Tanks

Requirement: Specification ARDCM 80-1, paragraph 13.421 (c)

It shall be possible to remove tanks without removing any other part of the aircraft, except cowlings or access panels. No disassembly of structural parts shall be required.

Deviation: Structural tie tubes must be removed (~~in sequence~~) to remove and install fuselage fuel cells.

Reason for Deviation and Remarks: Permits an "economical" fuselage structure.

R.C.A.F. approved at Co-ordinating Committee Meeting - 14 December 1955.

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28. Fuel System Component Identification

Requirement: Specification MIL-F-8615, paragraph 3.5

Each fuel system component shall be marked by a red colour in conformance with Army-Navy Aircraft Color Standard Code No. 509.

Deviation: ~~No colour marking will be made on fuel system components.~~ Only the piping shall be colour coded

Reason for Deviation and Remarks: Authorized by C105 Co-ordinating Committee at the 23rd Meeting held 23rd November 1955.

29. Refueling Connection

Requirement: Specification ARDCM 80-1, paragraph 16.323(14.323b)

Refueling shall be accomplished through the use of a single adaptor or unless otherwise specified -----.

Deviation: Two refueling adaptors are installed.

Reason for Deviation and Remarks: To permit refueling within the specified time. Agreed at 18th Meeting of CF105 Development Co-ordinating Committee.

30. Fuel Drain Valves

Requirement: Specification ARDCM 80-1, paragraph 15.432 (13.432)

The sump shall be provided with ----- an approved (Specification 28208) self-locking drain valve.

Deviation: Combination service and condensate drain valves, to Company Specification E-368 are installed.

Reason for Deviation and Remarks: Drain valves to Specification 28208 will not meet temperature requirements. why?

31. Collector Tank Outlets

Requirement: Specification ARDCM 80-1, paragraph 15.431

The fuel outlet fitting from all tanks ----- shall be of a booster pump flange conforming with AN 4135, AN 4130-10 or AN 4128 -----.

Deviation: Booster pump mounting does not conform to the above requirement.

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31. Collector Tank Outlets (Cont'd)

Reason for Deviation and Remarks: Structural strength requires minimum size mounting holes in the tank base.

32. Instrument Mounting

Requirement: Specification ARDCM 80-1, paragraph 19.00

A minimum clearance of 10 inches shall be provided behind the instrument board to accommodate the instruments and connections when installed.

Deviation: The clearance at the top corners of the instrument panel is less than 10 inches.

Reason for Deviation and Remarks: The clearance at the top corners of the instrument panel is reduced by the inboard slope of the wind-screen panel.

33. Hydraulic Fittings

Requirement: Specification ARDCM 80-1, paragraph 10.21

Standard approved hydraulic components as indexed in specification MIL-H-5440, related specifications and ANA Bulletins shall always be used where applicable.

Approved which?
Deviation: All connections shall be flareless type in accordance with Company standards. The hydraulic connecting pipes for the flying controls parallel servos and control surface actuators will be of 4130 seamless steel tubing to Specification MIL-T-6736.

Reason for Deviation and Remarks: Flareless type connections to Company Standards incorporate better sealing and strength features. Flexible tubing designed for 4,000 psi is not available and use of swivel type fittings is precluded by space and weight considerations.

34. Emergency Wheel Brakes

Requirement: Specification MIL-H-5440A, paragraph 3.10.1

All hydraulically operated services which are essential to safety in flight or landing, except types I and IV brake systems, shall be provided with emergency devices ----- . The emergency system shall be completely independent of the main systems up to, but not necessarily including the shuttle valve, the actuating cylinder or the motor.

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34. Emergency Wheel Brakes (Cont'd)

Deviation: The emergency braking system makes use of the normal braking anti-skid return lines and is physically interconnected in brake valve, transfer valve and anti-skid valve.

Reason for Deviation and Remarks: (1) The above deviation obviates the necessity of installing another hydraulic pipe run on the main landing gear main struts.
(2) Failure of the normal brake pressure piping in this design will not prevent operation of brakes from the emergency supply.

35. Moisture Traps - Hydraulic System

Requirement: Specification CAP 479, paragraph 24.45

Traps shall be provided to collect the drain off moisture from the ----- hydraulic systems.

Deviation: No traps are provided in the hydraulic systems.

Reason for Deviation and Remarks: The hydraulic systems are of the airless type and are sealed from contact with the atmosphere which would otherwise be the main cause of moisture entering the systems.

36. Moisture Elimination - Pneumatic System

Requirement: Specification CAP 479, paragraph 24.32 and 24.45

Pneumatic systems shall incorporate a dehydrating device. Traps shall be provided to collect and drain off moisture from the pneumatic ----- systems.

Deviation: No dehydrating device is fitted. A trap is provided only in the low pressure services sub-systems.

Reason for Deviation and Remarks: The air supplied to the sub-systems is too hot for effective dehydration except in the case of the low pressure services sub-system. A filter which incorporates a drainable moisture trap will be fitted to the low pressure sub-system.

37. Alternators and Drives Accessability

Requirement: Specification MIL-E-7614, paragraph 3.5.2 and 3.6.1



37. Alternators and Drives Accessibility

Requirement: (Cont'd)

The generator shall be accessible for inspection of all brushes, commutators and slip rings while installed.
The constant speed drive and flexible shaft shall be accessible for inspection and servicing while installed and for removal for servicing without requiring the removal of other accessories except the generator.

Deviation: The alternators and constant speed drives shall be accessible for inspection, servicing and/or removal only when the engines are removed.

Reason for Deviation and Remarks: This is precluded by the engine installation.

38. Switches - Space Provisions

Requirement: Specification MIL-E-7080, paragraph 3.4.1.4

Space shall be provided on each switch panel containing four or more switches, for subsequent installation of one spare switch conforming to Drawing AN 3022 and one switch conforming to Drawing AN 3023.

Deviation: No space provided for spare switches.

Reason for Deviation and Remarks: Space limitations on switch panels prevent installation of additional switches.

*Not acceptable
give warning
for 1st All*

✓ 39. Cable Grouping

Requirement: Specification MIL-W-5088, paragraph 3.7.3

Cable groups shall contain no more than 26 cables unless all of the wiring is pertinent to a single item of equipment.

Deviation: More than 26 cables are used in a single group in some instances.

Reason for Deviation and Remarks: Space limitations and the number of services provided in the airplane occasionally require the use of more than 26 cables in a single group.

*This may not be
necessary beyond MIL-5088AGC*



40. Cable Routing

Requirement: Specification MIL-W-5088, paragraph 3.7.3.5

Cables to each equipment which must operate to maintain flight of the aircraft under normal or emergency conditions shall be separately routed from other cables.

Deviation: Cables essential to maintain flight under normal and emergency conditions are not separated from other cables.

Reason for Deviation and Remarks: Space limitations prevent separate routing of cables essential to maintain flight.

be specific

41. Cable Spacing

Requirement: Specification MIL-W-5088, paragraph 3.7.4.1

Cables shall be routed separately and not closer than six inches to fluid and gas lines. A minimum of one half inch separation shall be provided when the cables and oxygen lines and associated equipment are rigidly clipped and the cables are covered with approved insulating material; a separation of less than one half inch will not be acceptable.

Deviation: Some cables are less than one half inch from fluid and gas lines.

Reason for Deviation and Remarks: Space limitations.

specific details

✓ 42. Cable Grouping

Requirement: Specification MIL-W-5088, paragraph 3.7.3.4

Cables of the primary electrical power system shall not be bundled or grouped with distribution circuit cables.

Deviation: Power source cables are bundled with distribution cables in some instances.

Reason for Deviation and Remarks: Space limitations prevent segregation of cables.

specific details

43. Batteries Disconnect

Requirement: Specification CAP 479, paragraph 70.05 (3)

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43. Batteries Disconnect (Cont'd)

Requirement: (Cont'd)

Disconnect - A quick disconnect device shall be provided at the battery terminals to disconnect the battery from the electrical system.

Deviation: No quick disconnect device shall be provided at the battery terminals. Nut-type terminals are used with a cover provided for terminal insulation, corona barrier and high creepage protection.

Reason for Deviation and Remarks: Weight saving factor and reliability of a hermetically sealed nickel cadmium battery preclude the necessity for quick disconnect devices.

*delete
use waivers*

44. Warning Lights

Requirement: Specification ARDCM 80-1, paragraph 6A.172 (b)

The caution indicator system shall consist of a master indicator light and an indicator panel. The master light shall be red in color and shall be labelled "Master Caution" -----.

----- The caution indicator panel ----- shall provide a suitable visual indication, red in color -----.

Deviation: One master warning light and the caution indicators are amber in color.

Reason for Deviation and Remarks: The warning light system proposed by Avro was approved by the R.C.A.F. Reference letter S1038-105-4(ACE-1) dated 23 August 1955.

45. Circuit Breakers

Requirement: Specification CAP 479, paragraph 21.62 (1)

In single or tandem pilot aircraft, the circuit breakers shall be located forward on the inboard face of the right console.

Deviation: The circuit breakers shall be located on a circuit breaker panel in the nose wheel bay.

Reason for Deviation and Remarks: Limitation of space precludes the installation of circuit breakers in the cockpit.

Circuit breakers are used for protection only and not as combination protection and switch. Trip free breakers are used which cannot be closed when a fault in the circuit exists.

*delete
use waivers*



46. Interference Limits and Methods of Measurement

Requirement: Specification MIL-I-6051, paragraph 4.2.3.5

----- accomplished. Where in an electronic system any receiver output is normally fed into a radio interphone amplifier, the headset and output meter shall be connected in the amplifier output circuit. The controls for the radio-interphone amplifier shall be adjusted for the conditions of normal system operation.

Deviation: The controls for radio interphone system AN/AIC-10 shall not be set as required for normal operation, but as required for the emergency mode.

Reason for Deviation and Remarks: When the output is measured with the interphone system selected for normal operation, the gain and the inherent noise of the AN/AIC-10 amplifier will give an incorrect measure of the noise content of the particular system under test. When the interphone system is set to emergency mode of operation the input to the amplifier is directly connected to the output circuit resulting in no noise being introduced or amplified by the interphone system.

delete

47. Quick Disconnects - Crew Services

Requirement: Specification CAP 479, paragraph 21.83

The quick disconnect assembly receptacle, which incorporates the oxygen connection, micro-telephone lead, anti "g" connector, etc., shall be located on the left-hand side of the seat.

Deviation: The quick disconnect assembly is located on the right-hand side of the seat.

Reason for Deviation and Remarks: R.C.A.F. letter S1038CF105-16 (ACE) dated 9 December 1954, permits mounting on right-hand side of seat.

48. Crew Relief Provisions

Requirement: Specification CAP 479, paragraph 42.30

Relief horns shall be installed in all aircraft having an endurance of more than three hours.

Deviation: Relief horns are not installed.

Reason for Deviation and Remarks: This requirement arises only as a result of a secondary role, and as weight prejudices primary role performance, relief horns are not installed.

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49. Drinking Liquid Containers

Requirement: Specification CAP 479, paragraph 42.20

Aircraft having an endurance of more than three hours shall have installed, insulated drinking liquid containers of sufficient capacity to provide one pint of liquid per occupant.

Deviation: Drinking liquid containers are not installed.

Reason for Deviation and Remarks: The requirement arises only as a result of a secondary role, and as weight prejudices primary role performance, drinking liquid containers are not installed.

50. Thermal Radiation Protection

Requirement: Specification ARDCM 80-1, paragraph 23.137

All combat fighter, bomber and reconnaissance aircraft shall provide stowable hoods, curtains, or other devices incorporating 14.77 ounce bleached white cotton duck fabric conforming to specification MIL-D-10861, Type II, for protection of the following items from thermal radiation caused by the explosion of nuclear weapons:

- (a) All aircrew members
- (b) Crew members' personal equipment
- (c) Exposed wiring.

These devices shall preclude any light rays originating outside the aircraft from striking any of the above items in the aircraft when the devices are in the unstowed or protecting position. The pilot's protective device shall be operable and stowable in 20 seconds or less. Protective devices for other members of the aircrew must be operable and stowable in 4 minutes or less.

Deviation: Protection from thermal radiation is not installed.

Reason for Deviation and Remarks:

51. Baggage and Tool Compartment

Requirement: Specification CAP 479, paragraph 41.04

All aircraft shall be equipped with a baggage and tool compartment or locker, provided with suitable door locks.

Deviation: Provision of a baggage and tool compartment at present not intended.



51. Baggage and Tool Compartment (Cont'd)

Reason for Deviation and Remarks: The R.C.A.F. has no requirement at the present time for any ground handling or servicing equipment to be stowed aboard the aircraft. Reference letter S1032-105-11 (ACE-1), dated 26 July 1955.

52. Stowage(s) in Radar Operators Cockpit

Requirement: Specification CAP 479, paragraph 20.62

A convenient stowage shall be provided for writing pads, logbook, maintenance manuals, spare fuses and tools.

Deviation: The above stowage(s) are not provided.

Reason for Deviation and Remarks: Not compatible with operational role of the aircraft.

53. Flashlight Stowage in Cockpits

Requirement: Specification CAP 479, paragraph 20.24

Map stowage shall include provision for stowage of a flashlight.

Deviation: Flash light stowage not provided.

Reason for Deviation and Remarks: Space at a premium.

54. Fire Extinguishing System

Requirement: Specification CAP 479, paragraph 23.72 and 23.73

Separate extinguishing systems shall be provided for each power plant.

Separate extinguishing distribution systems shall be provided for all potential fire zones other than power plant compartments.

Deviation: The extinguishing systems are not separate

Reason for Deviation and Remarks: To comply with these requirements would involve an increase from two to three bottles with a consequent increase in weight.

55. Fire Axe

Requirement: Specification CAP 479, paragraph 23.100

Stowage shall be provided for a fire axe in all cabin type aircraft.



55. Fire Axe (Cont'd)

Deviation: Fire axe is not installed.

Reason for Deviation and Remarks: Twenty first meeting of Co-ordinating Committee, 20 July 1955, Item XV, Minute 42(j) states: "axes are not required in either cockpit".

56. Crash Fire Extinguishing

Requirement: Specification CAP 479, paragraph 23.74

The automatic system shall provide one discharge of agent to each power plant, and one discharge of agent to each potential fire zone other than cargo compartments.

Deviation: No discharge to hydraulics bay in crash case.

Reason for Deviation and Remarks: To comply with these requirements would involve an increase from two to three bottles with a consequent increase in weight. *delete*

57. Hand Fire Extinguisher

Requirement: Specification CAP 479, paragraph 23.75

All aircraft, except single seat types, shall have at least one hand fire extinguisher in each crew compartment.

Deviation: Hand fire extinguishers are not installed.

Reason for Deviation and Remarks: Seventeenth meeting of Co-ordinating Committee, 2 March 1955, Item 19 cancels requirement for cockpit fire extinguishers.

58. Overheat Detection - Turbojet Engine Installations

Requirement: Specification CAP 479, paragraph 23.61

Overheat Detection System - An overheat detection system of approved type shall be installed in all turbojet ----- propelled aircraft.

Deviation: No specific overheat detection system is installed.

Reason for Deviation and Remarks: Fire warning system is based on overheat temperature and additional overheat protection would, therefore, be duplication. *query.*



59. Duct Pressure Drop

Requirement: Specification ARDCM 80-1, paragraph 12.443

Total duct pressure drop, including bends and elbows, shall not exceed 3 in Hg. from engine or cabin supercharger air manifold ----- to cabin pressure level.

Deviation: Total duct pressure drop will exceed the above requirement.

Reason for Deviation and Remarks: System design is predicated on a large pressure drop through the system (Volume and cooling).

60. Ducting Alignment

Requirement: Specification ARDCM 80-1, paragraph 12.444

At least 6 in. of flexible duct shall be provided immediately adjacent to each fitting on one fitting side only in order to provide for rapid alignment of the tubing during fitting connections. At least 6 in. of flexible ducting shall also be provided in the turbine discharge fitting of the cabin cooling unit, to minimize the effect of aircraft and duct vibration upon turbine wheel vibration characteristics.

Deviation:

- (1) Not complied with at some connections.
- (2) The expansion cooling turbine and outlet ducting will constitute a firm assembly which will be rigidly installed.

Reason for Deviation and Remarks: Non-compliance only where impracticable or a different design approach is rendered necessary by the basic design of the aircraft as a whole.

61. Ground Air Disconnects

Requirement: Specification ARDCM 80-1, paragraph 8.52

Connections shall be provided on the aircraft, at applicable stations for air conditioning on the ground. These connections shall have a nominal diameter of either 5 in. or 8 in. and shall be in accordance with NAS 400 or NAS 401.

Deviation: One 2½ in. and one 3 in. quick disconnect air conditioning system coupling shall be installed for hot high pressure air and cool low pressure air respectively.

Reason for Deviation and Remarks: The type and size of couplings which are installed are compatible with the duct sizes. Confirmed by R.C.A.F. letter S1038-105-11 (ACE-1) dated 22 August 1955.

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62. Air Conditioning

Requirement: Specification ARDCM 80-1, paragraph 12.442

A ram air duct shall be installed so as to provide for ingress of ram ventilating air into the cabin when air from the pressure source is not used.

Deviation: Ram air is not provided for ventilating the cockpit.

Reason for Deviation and Remarks: The pressure suits worn by the crew render the supply of ventilation air unnecessary. The ram air supply can be most advantageously used to provide some degree of cooling for equipment vitally necessary for flight, at moderate speeds only.

clarity

63. De-Frosting - Transparent Areas

Requirement: Specification CAP 479, paragraph 26.06

Means shall also be provided for preventing the fogging and frosting of all transparent areas provided for the use of the crew.

Deviation: No such provision for rear cockpit windows.

Reason for Deviation and Remarks: Not compatible with operational role of aircraft.

deleted

64. Jack Pad Installation

Requirement: Specification MIL-J-8711, paragraph 3.3.4.2

Axle jack pads installed on main and nose alighting gear must be integral with or permanently attached to the alighting gear, unless deviation is specifically granted by the procuring activity.

Deviation: The nose gear axle jack pads are not integral with or permanently attached to the nose gear. A special bar is required.

Reason for Deviation and Remarks: Configuration of nose landing gear precludes use of integral jack pad.

Confirmed at 13th Meeting of CF105 Co-ordinating Committee, 1st December 1954, Item 22, Minute 49a.

65. Jack Pads - Stowage

Requirement: Specification MIL-J-8711, paragraph 3.5

Provision shall be made to stow all removable jack pads within the aircraft.

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65. Jack Pads - Stowage (Cont'd)

Deviation: No provision made for stowing jack pads.

Reason for Deviation and Remarks: The R.C.A.F. has no requirement at the present time for any ground handling or servicing equipment to be stowed aboard the aircraft. Reference letter S1032-105-11 (ACE-1) dated 26 July 1955.

66. Mooring Fittings

Requirement: Specification ARDCM 80-1, paragraph 8.521

When detachable fittings are furnished, they shall be securely fastened in the baggage or tool compartment.

Deviation: No provision made for stowing mooring fittings.

Reason for Deviation and Remarks: The R.C.A.F. has no requirement for any ground handling or servicing equipment to be stowed aboard the aircraft. Reference letter S1032-105-11 (ACE-1) dated 26 July 1955.

67. Mooring Points

Requirement: Specification ARDCM 80-1, paragraph 8.521

A mooring fitting shall be provided ----- near the (aircraft) tail. In the case of a nosewheel installation, an additional fitting shall be provided near the nose wheel ----- two wing mooring points on each side of the plane of symmetry shall be provided.

Deviation: Three mooring points, one on each landing gear, shall be provided.

Reason for Deviation and Remarks: (1) The configuration and weight distribution in the aircraft make the provision of three mooring points, one on each landing gear, a most practicable arrangement.

(2) The distance between the landing gears coupled with the small amount of weight outside the triangle formed by the landing gears will furnish good stability when the aircraft is moored.

68. Leveling Provisions

Requirement: Specification ARDCM 80-1, paragraph 8.53

Provisions for measuring and leveling shall be in accordance with Specification MIL-M-6756.



68. Leveling Provisions (Cont'd)

Deviation: A special fixture is used for harmonizing armament and "leveling" the aircraft in a 4° 4' nose up attitude.

Reason for Deviation and Remarks: The method used is considered to be more suitable for the CF105 and was agreed at the third meeting of the Maintenance Sub-Committee, 30 November 1954 (Reference paragraph 11(b)).

not a legal reference

69. Air Conditioning, Controls, Interconnection

Requirement: Specification ARDCM 80-1, paragraph 12.442

A valve in the ram air line shall be mechanically or electrically linked with both the emergency pressurized air shut-off valve (in the cabin air duct) and the cabin air dump valve. The linkage shall provide for positive operation of the three valves when operating personnel desire to operate any one of the three.

Deviation: (1) No emergency, pressurized air shut-off valve will be installed in the cabin air duct.

(2) The ram air shut-off valve is not linked to the dump valve.

Reason for Deviation and Remarks: (1) A normal system ON-OFF valve which will shut off the flow of conditioning air from the heat exchanger to all conditioned compartments is fitted.

(2) Individual control of the dump valve and the ram air valve will permit control more suited to the system.

(3) Air conditioning system approved in principle at 15th Co-ordinating Committee Meeting, 7 January 1955.

70. Oxygen Regulator

Requirement: Specification CAP 479, paragraph 21.80

In single pilot aircraft the oxygen regulator, oxygen pressure gauge and oxygen flow indicator shall be located forward on the left or right hand console, readily visible and accessible to the pilot with his shoulder harness locked.

Deviation: Separate pressure demand regulators are mounted on the pilot's and radar operator's ejection seats.

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70. Oxygen Regulator (Cont'd)

Reason for Deviation and Remarks: The above requirement cannot be met on aircraft equipped with pressure demand, high altitude, bail out oxygen equipment in conjunction with ejector seats. (Reference CF105 Oxygen System Sub-Panel Meeting I.A.M., 23 September 1954, Item 3, paragraph 7a)

71. Pilot's Operating Instructions, Stowage

Requirement: Specification CAP 479, paragraph 41.03(1)

A stowage shall be provided in all aircraft for the pilot's operating instructions, within reach of the pilot with his shoulder harness locked.

Deviation: Storage provision for pilot's operating instructions at present not intended.

Reason for Deviation and Remarks: Requirement not compatible with the role of the aircraft.

72. Isolation of Electrical Equipment

Requirement: Specification ARDCM 80-1, paragraph 13.615

Electrical equipment and fuel should be isolated to prevent ignition of the fuel by arcing of broken electrical and fuel lines resulting from battle damage, accidental breaking or normal arcing. ----- Fuel, oil and hydraulic lines and equipment shall never be located in a position where leaking fluid will come in contact with electrical equipment through either the effect of gravity, air flow or battle damage, and hydraulic lines will be routed below electrical equipment and wires whenever they cross paths, pursuant to specification MIL-E-7563.

Deviation: Electrically operated fuel control valves and associated electrical cables are located inside the fuel tanks.

Fuel and hydraulic lines and electrical cables are located in close proximity in the fuselage under the wing and aft of station 485.

Reason for Deviation and Remarks: The fuel tanks in the wing sections are integral with the wing structure and space limitations in other sections of the airplane preclude possibilities for wider separation of electrical components and cables from fuel and hydraulic lines. Where possible, adequate insulation and explosion proof type components and connectors are installed to avoid possible arcing and fire hazards.

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More details required.



73. Circuit Breaker - Space Provisions

Requirement: Specification CAP 479, paragraph 70.24 (6)

Space shall be provided on the circuit breaker panels for the installation of at least one additional circuit breaker for each group of six breakers.

Deviation: Space is not provided for an additional circuit breaker for each group of six circuit breakers.

Reason for Deviation and Remarks: Space limitation on the panel prevents the fulfillment of the requirement.

*de l'axe
use usages*

74. Afterburner Controls

Requirement: Specification CAP 479, paragraph 21.591 (3)

The afterburner control shall be actuated by movement of the power control lever through a detent or gate in the direction of increased thrust.

Deviation: The afterburners are switched on by depression of the power control lever knobs.

Reason for Deviation and Remarks: On the J75 Model JT4A-23 engine the afterburner is operable at constant power over a range of engine power to give a power range between the Military and Maximum Thrust Ratings. It is therefore, necessary to "bring in" the afterburner by micro-switch operation and use part of the power lever movement for variation of the augmented engine power (Approved by R.C.A.F., Reference letter S1038-105-19 (ACE-1) 25 October 1955).

75. Speed Brakes

Requirement: Specification AIR 7-4, paragraph 4.4.1

Actuation of the speed brakes shall have a minimum effect on the trim or attitude of the aircraft throughout the speed range of the aircraft.

Deviation: A pitch-up condition will occur when the speed brakes are opened at speeds in excess of Mach 1.0.

Reason for Deviation and Remarks: Use of the speed brakes at speeds in excess of Mach 1.0 will not be required to fulfill the intended role of the aircraft.

*1.0
this
sentence*

In the manual mode of control the damping system will automatically counteract the pitch-up condition, and in the emergency mode the change of trim required will be within the trim range.

The pitch-up condition may be used to advantage in diving recovery.

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76. Brake Parachute Control

Requirement: Specification CAP 479, paragraph 21.32

The (Brake Parachute Control) actuating motion shall be to pull backward or downward ----- to deploy the parachute and upward or forward to jettison the parachute.

Deviation: Motion is downward to deploy and inboard and down to jettison.

Reason for Deviation and Remarks: Design of control motion dictated by the nature of the release mechanism in the rear fuselage. (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19th January 1955, Item XVI, paragraph 33.)

77. Cockpit Head Room

Requirement: Specification CAP 479, paragraph 20.21

No part of the canopy roof or canopy shall be within $8\frac{1}{2}$ " of the pilot's eye-line, within a distance extending forward 21 inches from the intersection of the eye line and the seat back line, or the forward face of the pilot's headrest.

Deviation: The clearance at the pilot's eye-line, 21 inches ahead of the forward face of the pilot's headrest is $6\frac{1}{2}$ inches (approximately).

Reason for Deviation and Remarks: Aerodynamic canopy contour requirement (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33.)

78. Canopy Structure

Requirement: Specification CAP 479, paragraph 20.21

There should be no rigid member immediately above the pilot's head in any position in which the cabin roof can be locked.

Deviation: The canopy hatches incorporate rigid structure over the pilot's head when in the closed and locked position.

Reason for Deviation and Remarks: Rigid structure required to strengthen canopy hatches (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33).



79. Canopy Opening

Requirement: Specification ARDCM 80-1, paragraph 6A.102

Provision must be made for instant opening of cockpit enclosures at any flight speed.

Deviation: The maximum speed for canopy opening shall be 420 knots EAS at any load factor within the flight envelope.

Reason for Deviation and Remarks: The cockpit and canopy structure have been designed to cover emergency opening of the canopy up to 420 knots EAS with 25° of yaw. Indications are that in normal flight attitude with zero yaw emergency opening of the canopy up to 720 knots EAS will be permissible (Reference letter 3801/08/J, September 16th 1955 to R.C.A.F.).

*delete
start
accumulation*

80. Vision

Requirement: Specification CAP 479, paragraph 20.22

The view downward and directly forward shall not be less than 15 degrees below the horizontal.

Deviation: The view downward and directly forward shall be 12½ degrees below the horizontal.

Reason for Deviation and Remarks: Windscreen configuration dictated by performance requirements (Cockpit approved 15th meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33).

*check
for
new
make*

81. Air Conditioning - Water Separator

Requirement: Specification ARDCM 80-1, paragraph 12.445

When an expansion turbine is used for cooling air, a water separator shall be provided to remove condensed moisture.

Deviation: Water separator is not provided.

Reason for Deviation and Remarks: (1) Weight and space penalty.
(2) Effective water separator not available (Cabin inlet temperature is maintained at 55°F min. below 20,000 feet to reduce fogging. Provision is made for pilot to select 95°F inlet temperature if fogging should occur).
(3) Air conditioning system approved in principle at 15th Co-ordinating Committee Meeting, 19 January 1955.

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82. Anti-G Suit Control Valves

Requirement: Specification CAP 479, paragraph 21.82

The anti-G suit control shall be located on the left hand side of the cockpit adjacent to the seat.

Deviation: In each cockpit the valve shall be installed on the right side of the seat.

Reason for Deviation and Remarks: The seat adjustment handle for each crew seat is on the left side, leaving little space for other equipment (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33).

83. Booster Pump Inlets

Requirement: Specification ARDCM 80-1, paragraph 16.331(b)

Booster Pumps

----- There shall be no obstructions (not even short lengths of lines) between the tank and the pump inlet.

Deviation: Each booster pump has two longitudinal pipes.

Reason for Deviation and Remarks: Inlet pipes are required to insure flow under extreme aircraft attitudes, such as inverted flight.

84. Fuel Tank Locations

Requirement: Specification ARDCM 80-1, paragraph 15.421(a)

----- No fuel tanks shall be located in or over the engine compartment or over the tail pipe or afterburner section.

Deviation: Tanks No. 5, 7 and 8, R and L, are located partly over the engines.

Reason for Deviation and Remarks: The aircraft layout makes the present fuel tank locations a necessity.

85. Inverted Flight Fuel Supply

Requirement: Specification ARDCM 80-1, paragraph 16.311

----- design shall be such as to provide for full continuous fuel flow from the tank to the engine for at least 1 minute during inverted flight for jet fighter (aircraft) -----.

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85. Inverted Flight Fuel Supply (Cont'd)

Deviation: Provision is made for 15 seconds inverted flight at sea level and approximately 45 seconds at combat altitude with maximum power.

Reason for Deviation and Remarks: It is not possible to provide sufficient inverted flight capacity for 1 minute at all engine and afterburner fuel flows without installing a prohibitively large collector tank. Requirement not compatible with the performance of the aircraft at maximum power.

86. Engine Fuel Feed

Requirement: Specification ARDCM 80-1, paragraph 16.320

-----, the fuel system must be designed so that fuel from each tank can be made directly available to the engine(s) in case of boost pump failure or in the event of a damaged main tank.

Deviation: Fuel from each tank will not be directly available to either engine.

Reason for Deviation and Remarks: To provide fuel from each tank directly to the engine(s) would involve considerable penalties in weight and system complexity.

87. Fuel System - Strike Loss

Requirement: Specification AIR 7-4, paragraph 6.4.2

The fuel system shall be designed ----- and shall be such that in the event of a single strike the maximum amount of fuel is retained but in any case not more than 20% of the fuel in the tanks shall be lost or made unavailable to the engine.

Deviation: 50% of the fuel will be lost, if a strike is made on a collector tank.

Reason for Deviation and Remarks: The pressurized fuel system used on the CF105 requires the use of a collector tank, the loss under these conditions being unavoidable. *quote authority*

88. Location of Refueling Adaptors

Requirement: Specification ARDCM 80-1, paragraph 16.323(14.323g)

The ground servicing adaptor shall be located such that servicing personnel shall require no ladders, supports or elevating devices to insert the nozzle.



88. Location of Refueling Adaptors (Cont'd)

Deviation: Elevating devices are required to couple refueling nozzles to the two adaptors.

Reason for Deviation and Remarks: (1) R.C.A.F. requested two refueling points and accessibility to them with the aircraft resting on the bottom of the fuselage. *state reference*

(2) Location away from the bottom of the fuselage is an overriding requirement for simultaneous re-arming and other system checks during turn-around time.

89. Layout of Fuel System

Requirement: Specification ARDCM 80-1, paragraph 16.322(14.322)

During normal operation each engine ----- (shall receive) fuel from its main tank.

Deviation: During normal operation, fuel is fed from both collector (main) tanks to both engines. *deleted*

Reason for Deviation and Remarks: The engine fuel proportioning unit drains equal flows of fuel from each sub-system and provides an outlet to each engine from a single manifold, according to the demand of each engine. This is to maintain aircraft lateral balance during operation of the fuel system.

90. Fuel Flow Meters

Requirement: Specification ARDCM 80-1, paragraph 19.241

Flowmeters are required on all jet propelled aircraft -----.

Deviation: Fuel flowmeters are not installed.

Reason for Deviation and Remarks: The specific requirement was deleted when Specification AIR 7-4 was raised from issue 1 to issue 2.

91. Hinged Doors

Requirement: Specification ARDCM 80-1, paragraph 8.6.2

If hinged doors are used, the hinges shall be located so that the air stream tends to keep them closed, -----.

Deviation: The forward fuselage electronics compartment door is hinged along its aft edge.

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91. Hinged Doors (Cont'd)

Reason for Deviation and Remarks: If hinged along the forward edge this door could not be opened with the nose jack in position.

92. Tail Skid

Requirement: Specification ARDCM 80-1, paragraph 7.10

Any aircraft equipped with a tricycle landing gear shall be provided with a tail skid or buffer which will adequately protect the control surfaces and the rear portion of the structure from damage and which will provide clearance between the ground and all parts of the structure in the event of a tail down landing.

Deviation: Neither a tail skid nor buffer is installed.

Reason for Deviation and Remarks: Requirement waived by Co-ordinating Committee in the interests of weight saving.

93. Turning Radius

Requirement: Specification ARDCM 80-1, paragraph 7.300

The nose wheel shall swivel through an angle which will permit turns to be made about one wheel as a pivot.

Deviation: Nose wheel swivel will be limited to 55° each way to limit the inner bogie to a described circle of approximately 8.5 ft. radius at maximum turn rate.

Reason for Deviation and Remarks: Minimum safe turning circle of the landing gear bogies is estimated to be 8.5 ft. radius and is accepted by the Co-ordinating Committee.

refer to authorization

94. Removal and Replacement of Fuel Nozzles

Requirement: Specification ARDCM 80-1, paragraph 15.241

The following (components) shall be readily removable and replaceable without removing the engine, tanks, or important parts of the aircraft structure:-

Fuel Nozzles.

Deviation: The fuel nozzles are not accessible for removal, or replacement, with the engines installed.

Reason for Deviation and Remarks: Prohibitive weight penalties do not justify the provision of access.

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which fuel nozzles



91. Hinged Doors (Cont'd)

Reason for Deviation and Remarks: If hinged along the forward edge this door could not be opened with the nose jack in position.

92. Tail Skid

Requirement: Specification ARDCM 80-1, paragraph 7.10

Any aircraft equipped with a tricycle landing gear shall be provided with a tail skid or buffer which will adequately protect the control surfaces and the rear portion of the structure from damage and which will provide clearance between the ground and all parts of the structure in the event of a tail down landing.

Deviation: Neither a tail skid nor buffer is installed.

Reason for Deviation and Remarks: Requirement waived by Co-ordinating Committee in the interests of weight saving.

93. Turning Radius

Requirement: Specification ARDCM 80-1, paragraph 7.300

The nose wheel shall swivel through an angle which will permit turns to be made about one wheel as a pivot.

Deviation: Nose wheel swivel will be limited to 55° each way to limit the inner bogie to a described circle of approximately 8.5 ft. radius at maximum turn rate.

Reason for Deviation and Remarks: Minimum safe turning circle of the landing gear bogies is estimated to be 8.5 ft. radius and is accepted by the Co-ordinating Committee.

refer to authorization

94. Removal and Replacement of Fuel Nozzles

Requirement: Specification ARDCM 80-1, paragraph 15.241

The following (components) shall be readily removable and replaceable without removing the engine, tanks, or important parts of the aircraft structure:-

Fuel Nozzles.

Deviation: The fuel nozzles are not accessible for removal, or replacement, with the engines installed.

Reason for Deviation and Remarks: Prohibitive weight penalties do not justify the provision of access.

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91. Hinged Doors (Cont'd)

Reason for Deviation and Remarks: If hinged along the forward edge this door could not be opened with the nose jack in position.

92. Tail Skid

Requirement: Specification ARDCM 80-1, paragraph 7.10

Any aircraft equipped with a tricycle landing gear shall be provided with a tail skid or buffer which will adequately protect the control surfaces and the rear portion of the structure from damage and which will provide clearance between the ground and all parts of the structure in the event of a tail down landing.

Deviation: Neither a tail skid nor buffer is installed.

Reason for Deviation and Remarks: Requirement waived by Co-ordinating Committee in the interests of weight saving.

93. Turning Radius

Requirement: Specification ARDCM 80-1, paragraph 7.300

The nose wheel shall swivel through an angle which will permit turns to be made about one wheel as a pivot.

Deviation: Nose wheel swivel will be limited to 55° each way to limit the inner bogie to a described circle of approximately 8.5 ft. radius at maximum turn rate.

Reason for Deviation and Remarks: Minimum safe turning circle of the landing gear bogies is estimated to be 8.5 ft. radius and is accepted by the Co-ordinating Committee.

refer to authorization

94. Removal and Replacement of Fuel Nozzles

Requirement: Specification ARDCM 80-1, paragraph 15.241

The following (components) shall be readily removable and replaceable without removing the engine, tanks, or important parts of the aircraft structure:-

Fuel Nozzles.

Deviation: The fuel nozzles are not accessible for removal, or replacement, with the engines installed.

Reason for Deviation and Remarks: Prohibitive weight penalties do not justify the provision of access.

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95. Interchangeability of Power Plants

Requirement: Specification ARDCM 80-1, paragraph 15.25

The power plant installations of multi-engine aircraft shall be identical, permitting complete interchangeability.

Deviation: The complete power plants are not interchangeable as the following are handed:

- (1) Front and rear engine mount attachments
- (2) Heat exchanger duct
- (3) Starter motor and accessories gearbox take-off
- (4) Compressor bleed valve outlets
- (5) High pressure air take-off

Reason for Deviation and Remarks: Engine design dictates the necessity for handing items (1) to (4).

Item (5) is handed from weight considerations.

96. Instrument Installation

Requirement: Specification AIR 7-4, paragraph 8.2.4

All air lines and electrical leads shall be flexible and fitted with quick disconnects and shall be of sufficient length to allow easy instrument removal.

Deviation: Air lines are not fitted with quick disconnects

Reason for Deviation and Remarks: Space and weight limitations prevent installation of quick disconnects on air lines.

97. Panel Space Provision

Requirement: Specification AIR 7-4, paragraph 8.2.3

Panel space shall be provided for 5 x 5 $\frac{1}{4}$ inches case size for the directional indicator and the artificial horizon.

Deviation: Space for 5 x 5 $\frac{1}{4}$ inches case size for artificial horizon and directional indicator shall not be provided.

Reason for Deviation and Remarks: Interim R.C.A.F. requirements for artificial horizon and directional indicator override this requirement.

every 10
case sizes of future instruments

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98. Power Plant Controls Identification

Requirement: Specification ARDCM 80-1, paragraph 6A.14 and 6A.140

- (1) Power plant controls for each engine shall be located and identified in accordance with MIL-STD-203.
- (2) All power plant controls shall be clearly marked in accordance with Specification 98-24105.

Deviation: Power plant controls (throttles) are not identified.

Reason for Deviation and Remarks: Because of location and orientation, it is impossible to confuse the throttles with other controls.

99. Limit Flight Loads

Requirement: Specification AIR 7-4, paragraph 5.2.2.1

At the gross weight for stress analysis, the limit load factor as defined in Specification MIL-S-5700 shall not be less than +7.33 and -3.0.

Deviation: The positive limit load factor decreased from 7.33 as skin temperature increases. ~~2.0 g's at 100,000 ft~~ *to ---*

Reason for Deviation and Remarks: Weakening of structure due to temperature rise.

100. Weight for Stress Analysis

Requirement: Specification AIR 7-4, paragraph 5.2.1.2

The gross weight for stress analysis shall not be less than the normal gross weight less 50% of the combat mission fuel.

Deviation: The gross weight for stress analysis is 47,000 lb.

Reason for Deviation and Remarks: It is in the interest of the primary role of the aircraft to accept lower load factors at low altitude rather than add weight.

101. Normal Gross Weight

Requirement: Specification AIR 7-4, paragraph 5.2.1.1

The normal gross weight and the normal weight for take-off shall be the weight of the aircraft fully loaded with primary armament and fuel for the combat mission.

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*more detail
required.
Also need
corrections
relative to J75
and ambient
selection of
stress weight.*

*also
104,103*



101. Normal Gross Weight (Cont'd)

Deviation: A normal take-off weight of 55,000 pounds used for stress analysis.

Reason for Deviation and Remarks: Of necessity, the weights to be used for stressing were established in the early stages of design.

102. Maximum Gross Weight

Requirement: Specification AIR 7-4, paragraph 5.2.1.3

The maximum gross weight and the maximum weight for take-off shall be the weight of the aircraft fully loaded with primary armament, full internal fuel, and external fuel for the overload range mission.

Deviation: A maximum take-off weight of 65,000 pounds used for stress analysis.

Reason for Deviation and Remarks: Of necessity, the weights to be used for stressing were established in the early stages of design.

103. Landing Weights

Requirement: Specification MIL-S-5701, paragraph 3.2.2.10 and 3.2.2.11

"----- the normal design landing weight shall not be less than the applicable take-off weight less the following items; 75% of fuel (internal and external) carried in the basic mission for fighters (and) bombs, rockets, missiles and ammunition."

"----- the maximum design landing weight shall not be less than the maximum take-off weight less the following items; assist take-off fuel, droppable fuel and tanks, dumpable fuel, any other items normally expended during or immediately after take-off (except bombs, rockets, missiles, and ammunition shall be retained)."

Deviation: A normal landing gross weight of 45,000 lb. used for stress analysis. A maximum landing gross weight of 55,000 lb. used for stress analysis.

Reason for Deviation and Remarks: Of necessity, the weights to be used for stressing were established in the early stages of design.

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104. Engine Change

Requirement: Specification AIR 7-4, paragraph 6.1.3

The engine and afterburner installation shall be designed so that the complete unit in operating condition may be removed and another installed and ready for running in not more than thirty minutes. This shall be accomplished with no special tools other than an engine sling and an engine hoist or suitable trolley. The thirty minute period shall not include time required to set up or synchronize the engine controls.

Deviation: It is not known whether or not this requirement will be met.

Reason for Deviation and Remarks: Engine change time has yet to be determined.

*delete.
Answer if necessary*

105. Fuel Strainers

Requirement: Specification ARDCM 80-1, paragraph 16.333

The aircraft fuel system shall incorporate the necessary strainers or filters to ensure that the particle size of contaminants in the fuel delivered to the engine(s) is within the limits set forth in the applicable engine Model Specifications.

Since engine specifications MIL-E-5007 and MIL-E-8593 require engines to be capable of satisfactory performance on fuel strained to 200 mesh, strainers shall be utilized and shall be the responsibility of the aircraft manufacturer.

Deviation: An 8 mesh strainer is fitted at each booster pump inlet. *gud*

Reason for Deviation and Remarks: The size of 200 mesh strainers capable of handling high performance engine and afterburner fuel flow requirements with low pressure loss is prohibitive. There are no manual fuel filler openings for ingress of foreign matter. Filtered fuel is supplied from pressure refueling ground equipment and the tank pressurization air is strained by 200 mesh air filters.

106. Ignition Circuit

Requirement: Specification ARDCM 80-1, paragraph 9.522

Single and twin engine aircraft shall utilize ignition systems with dual circuitry, each circuit being separately fused. The dual circuitry shall extend back to the power source.

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106. Ignition Circuit (Cont'd)

Deviation: Single wire circuitry is installed for the ignition system.

Reason for Deviation and Remarks: The part of the system supplied on the engine has a single ignition circuit.

Weight economy measure.

Engine relight in the air is accommodated by means of a separate circuit which is connected to the common ignition point on each engine.

107 Reverse Current Cut-Outs - Accessibility

Requirement: Specification CAP 479, paragraph 70.26 (1)

The reverse current cut-out(s) shall be accessible for unhampered inspection and maintenance while the engines are running with the aircraft on the ground.

Deviation: The reverse current cut-outs are not accessible for unhampered inspection and maintenance when installed.

Reason for Deviation and Remarks: The reverse current protection devices require an air conditioned location and are therefore installed in the transformer rectifier unit and alternator controls box. These protection devices are accessible only when the transformer rectifier unit and alternator controls box is removed from the aircraft (~~Resetting of these units is accomplished, on observation of DC failure warning light, by means of a switch located in the pilot's cockpit).~~

108. Flying Controls Hydraulic Circuits

Requirement: Specification AIR 7-4, paragraph 4.7.3.2

- (1) The aircraft shall be capable of meeting the scramble requirement of paragraph 3.4.1 under all climatic conditions when housed in a readiness hangar (32°F inside at -40° outside).

Specification AIR 7-4, paragraph 4.7.3.3

- (2) The aircraft shall be capable of meeting the scramble requirement of paragraph 3.4.1, with a delay of not more than one minute, when dispersed in the open. Details of the environmental conditions involved in this case will be provided to the Department.

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108. Flying Controls Hydraulic Circuits (Cont'd)

Requirement: (Cont'd)

Specification ARDCM 80-1, paragraph 10.02

- (3) Flight controls system shall be designed for operation at temperatures between +160°F and -65°F. After the initial break-away, the increase in force required to operate the control system at -65°F shall not exceed 150% of the force required at +70°F.

Deviation:

- (1) Conformity cannot be guaranteed below -40°F ambient (See (1) and (2) below).
- (2) & (3) The design of the Flying Control Hydraulic System will permit full operation from 0°F to 250°F. Adequate control with limited maneuverability will be available down to -20°F. At environmental temperatures below -20°F, a delay of over 1 minute will be required for the necessary control exercising to warm the system up to -20°F. At -65°F this will require a delay of about 5 minutes (estimated).

Reason for Deviation and Remarks:

- (1) Temperature conditions within readiness hangars are not available for ambient temperatures below -40°.
- (2) & (3) It is necessary to cater for temperatures as high as 250°F present during flights. The weight penalty for installing piping of adequate size to permit full control operation down to -65°F would not be justified since the hydraulic fluid would be above 0°F with the aircraft airborne. The fluid must be at a minimum temperature of -20°F before take-off.

109. Oil Cooler Air Flaps

Requirement: Specification ARDCM 80-1, paragraph 15.530

Oil cooler air exit flaps shall be employed whenever an air-to-oil cooler is utilized in a turbine installation. The flaps shall be thermostatically controlled and shall control the engine oil inlet temperature so as not to exceed the value specified in the engine model specification.

Deviation: Oil cooler inlet flaps are used, with two positions only.

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109. Oil Cooler Air Flaps (Cont'd)

Reason for Deviation and Remarks: Inlet flaps are used to maintain high engine inlet efficiency. This air to oil cooler is supplementary to the main cooling system at high speed and high altitude.

110. Structural Tests

Requirement: Specification MIL-S-5700, paragraph 5.2 and 5.3

Para. 5.2 Structural Tests - Static The structural tests required for approval of the airplane strength shall be as outlined in MIL-S-5710.

Para. 5.3 Structural Tests - Flight The flight tests required for approval of the airplane strength shall be in accordance with MIL-S-5711.

Deviation: Structural ground and flight tests will be conducted under a program based on the requirements of MIL-S-5710 and MIL-S-5711 with some requirements deleted, added, or amended as agreed upon by the R.C.A.F. and the Company.

Reason for Deviation and Remarks: To permit a program which is compatible to the aircraft configuration and R.C.A.F. requirements to be established.

111. Piping Connections - Fuel System

Requirement: Specification ARDCM 80-1, paragraph 13.322

All fittings ----- shall conform to Air Force-Navy or U.S. Air Force Standards.

Deviation:

- (1) Flexible couplings to Company Specification are used.
- (2) Flareless type fittings to Company Specifications are used.

Reason for Deviation and Remarks:

- (1) Special flexible couplings required to meet temperature requirement.
- (2) Flareless type fittings are used in accordance with latest design practice to give a higher vibration life than may be achieved with AN flared type fittings.



APPENDIX III

ENGINEERING DATA

To be added.

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PAGE 196
AAMS-105/1
FEBRUARY 1958

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE Arrow 1	CONTRACT B69-12-44 Serial 2-B-5-309 SO 4877	AMENDMENT NO. 2 (Prelim)
SUBJECT -		E.C.P. -
		MOD. NO. -
REASON FOR CHANGE To incorporate technical changes and additional deviations (Ref. RCAF letter S36-38-105 (OC) dated 9 Dec 57).		EFFECTIVITY 25201
		RETROPIT Nil
EFFECT ON PERFORMANCE -		
WEIGHT CHANGE - EFFECT ON BALANCE -		

AMENDMENT EXAMINATION

NOTE

This amendment is a preliminary issue and in some cases does not include completely revised wording. Formal amendments replacing this amendment, together with revised pages, will be issued in due course.

- 1.1 Delete: "Specification 98-24105-5"
Delete: "Avro Report SR-4"
Replace by: "Avro Report 70/STDS/1"
Delete: "Dowcan 200 (Issue 1)"
Replace by: "Dowcan 200 (Issue 2)"
- 3.1.5 Delete: "Avro Aircraft Report No. 7-0400-05"
Replace by: "Avro Aircraft Report No. 7-0400-44"
- 3.1.7.1 Delete: "Reference Figure 13"
Replace by: "Reference Figure 11"
- 3.1.7.3 Delete: "Rudder - Chord 30.00 in."
Replace by: "Rudder - Chord 30.00%"

Engineering Approval	Contracts Approval	UNCLASSIFIED
<i>[Signature]</i> Date 11 Feb 58	<i>[Signature]</i> Date 11 Feb 58	

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PAGE 1 of 18



MODEL SPECIFICATION AMENDMENT

PAGE 197
AAMS-105/1
FEBRUARY 1958
Amendment No. 2
(Prelim)

- 1.1.7.8 Delete: "Tread: 25 ft. 1.56 in."
Replace by: "Tread: 25 ft. 5.6 in."
- 3.2.3 Delete: "Avro Report SR-4"
Replace by: "Avro Report 70/STDS/1"
- 3.2.10.2 Delete: "... and Specification 98-24105-5"
- 3.3.2 Delete: "Aero Data 89"
Replace by: "P/AERO DATA/89"
- 3.4.4 Delete: paragraph
Replace by:

3.4.4 Crash Criteria

3.4.4.1 Ditching Conditions

Not applicable.

3.4.4.2 Emergency Landing Conditions

Under emergency landing conditions as specified below permanent deformations shall be permissible provided there shall be no tearing loose of seats or other structural components which might cause injury to occupants, or provided that crew egress is not prevented.

The seats, seat installations, canopy and canopy actuating mechanisms, and supporting structure for cockpit equipment shall be designed to withstand inertia loads corresponding to ultimate load factors of 25 'g' forward, 4 'g' laterally or 20 'g' vertically, applied either separately or together.

(123)

- 3.7.3.1 Delete from switches operative column:

"Press-to-Test Oxygen Pressure"
"Automatic Flying Control System
Disconnect"

Delete from controls operative column:

"Anti 'g' valve"

Add to controls operative column:

"Press-to-Test Oxygen Pressure"
"Press-to-Test Anti 'g' valve"

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3.7.3.1

(Cont'd)

Add to switches operative column:

"Damper Test (L/G up mode)"
"Engine Bleed Air"
"Temperature Control Emergency Off"
"Fuel Shut-Off"

Add to switches non-operative column:

"Automatic Flying Control System
Disconnect"

3.7.5.3

Delete: paragraph
Change subsequent paragraph numbers, 3.7.5.3 through
3.7.5.8.

3.7.5.6

Delete: "... interchangeable ... of an installed
missile pack."

(was 3.7.5.7)

Add: "... interchangeable instrumentation
packs. Conditioned air shall be
provided to the armament pack bay."

3.7.5.7

(was 3.7.5.8)

Delete: paragraph
Replace by:

3.7.5.7 Aircraft Services Bays

The fuselage area aft of the nose wheel well and the cockpit rear bulkhead shall comprise a forward service bay. Access shall be provided through a panel on the underside of the fuselage.

The fuselage area between the left and right hand air intake floating ducts and engines shall comprise a service bay. The forward region of the bay shall primarily house electrical equipment, and the aft region shall primarily house hydraulic equipment, airframe accessories gearboxes, and fire extinguisher bottles.

Access doors and panels for the bay shall be installed on the underside of the fuselage. Sections of the engine shroud shall be removable to provide additional access with engines removed.

3.8.1

Delete from 2nd sub-paragraph "mechanically releasable and jettisonable"

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3.8.2.2

Delete: "2130 psi"
Replace by: "2500 psi"

Delete: "a maximum of 1500 psi"
Replace by: "a nominal of 1500 psi"

Delete in 3rd sub-paragraph: "during the extension cycle"

Replace by: "when the landing gear is in the locked up position"

3.8.2.5.4

Delete from 5th line: "full"

Delete: "both engine throttle levers are retarded"

Replace by: "either engine throttle lever is retarded"

3.8.3.1

Delete from 2nd sub-paragraph, 1st line:

"self centering"

3.8.3.7

Landing Gear Sub-System

This paragraph to be revised to cover nose door retraction with nose L/G extended. (Detailed revision will be included in formal issue of amendment).

3.8.4.1

Delete: paragraph
Replace by:

3.8.4.1 Description

A FIST Ribbon Canopy drag chute, complete with deployment bag and pilot chute, shall be stowed in a compartment in the top of the fuselage stinger between the two engine jet pipe fairings. The chute pack shall be retained by two spring loaded doors, locked by a mechanically operated latch, with a solenoid operated safety catch, which shall maintain the skin line when in the closed position. The doors shall retract to a position inside the adjacent skin surface when chute deployment is selected.

A press-to-test light shall be installed adjacent to the left-hand speed brake to provide ground indication that the solenoid catch is engaged.

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3.8.4.2

Delete: paragraph
Replace by:

3.8.4.2 Release Gear

(69)

Deployment and jettison of the drag chute shall be controlled through a selector lever installed in the front cockpit. Selection of "Stream" shall unlock the solenoid operated catch and mechanically release the spring loaded chute retaining doors. Selection of "Jettison" shall disconnect the drag chute attachment cable.

The drag chute attachment cable shall be secured to the aircraft structure by a shear pin, which shall permit breakaway at a predetermined load.

3.9

3.9.1.1

3.9.1.2

These paragraphs to be revised to cover the installation of flying control system boosters. (Detailed revision will be included in formal issue of amendment)

3.9.2.2

Delete last sentence.

3.11.8.1

Delete last two sub-paragraphs.
Replace by:

"Two fuel shut-off valves shall be installed, one adjacent to each engine firewall, to provide for engine isolation. A switch for control of each firewall fuel shut-off valve shall be installed in the front cockpit.

3.11.8.3.1

Delete: "277" (twice)
Replace by: "271"

Delete: "281" (twice)
Replace by: "265"

Delete: "2544"
Replace by: "2522"

3.11.8.7

Delete: Deviation (95) (in margin)

Add to 1st sub-paragraph: "A 200 mesh filter, incorporating a drain valve and by-pass, shall be installed in the feed line to each engine."

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3.11.8.11

Delete: paragraph
Replace by:

3.11.8.11 Vent System

Outward venting for the auxiliary tanks shall be through the main pressurization line relief valves (Reference paragraph 3.11.8.10).

A fuel-level-sensitive air release valve shall be installed in each main (collector) tank to vent accumulated air admitted by the required function of negative 'g' and low level air admission valves (Reference paragraph 3.11.8.10).

It shall be possible to connect ground equipment at the overboard vent orifice to provide for vapor removal during re-fueling.

3.11.8.14

Add to paragraph:

"Each booster pump shall be provided with a seal drain connected to the vent system."

3.11.10.4

Delete last sentence from 1st sub-paragraph:

"Indicator lights ... light up speed."

Replace by:

"Selection of "reset" shall permit use of the ground starting unit and rotation of the engine without ignition, for ground test."

Delete from 2nd sub-paragraph:

"for the purpose ... flight"

Replace by:

"to permit relighting the engines in flight within the relight flight envelope."

3.13.1.1.2

Delete: "R-Theta DR Repeater (Reference paragraph 3.13.3.2)"

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- 13.1.1.3 Add: "Tachometer (2)" and Deviation notation
"124" in margin.
- 13.1.2 Add: "Oxygen Quantity Gauge"
- Delete: "Ground Speed and Interception Computer"
"R-Theta Indicator"
- 13.2 Delete paragraph and sub-paragraphs (3.13.2.1 to
3.13.2.4)

Replace by:

3.13.2 Air Data System

An air data system comprising pitot-static, relative wind sensing, and skin temperature sensing shall be installed to provide air data information for the damping system and for cockpit presentation.

A probe to provide for the installation of a pitot-static head, an 'Alpha' (Pitch) vane and a 'Beta' (yaw) vane shall be installed on the radar nose. Two pitot-static probes shall be installed on the fin upper leading edge.

3.13.2.1 Pitot-Static System

A pitot-static system comprising a nose boom providing one source of pitot pressure and two sources of static pressure, and two fin probes providing pitot and static pressure shall be installed.

Pitot pressure from the nose probe shall be supplied to the indicated airspeed indicator and normal damping system. One nose static pressure source shall supply the front cockpit altimeter and normal damping system. The second nose static pressure source shall supply the rate of climb indicator, indicated airspeed indicator, rear cockpit altimeter, and cockpit pressure regulators.

Pitot and static pressure from the upper fin probe shall be supplied to the emergency damping system.

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3.2.2

(Cont'd)

3.13.2.2 Relative Wind Sensors

Two relative wind sensors shall be installed on the nose boom probe, an 'Alpha' (pitch) vane sensor to provide angle of attack information, and a 'Beta' (yaw) sensor vane to provide yaw information to the pilot's sideslip indicator, and the damping system. A dummy vane pedestal shall be mounted horizontally on the nose probe to provide for a greater degree of symmetrical flow about the 'Beta' vane.

3.13.2.3 Skin Temperature Sensor

A skin temperature sensor shall be installed externally on the underside of the nose fuselage. Skin temperature shall be converted to electric signals to be fed to the skin temperature indicator.

3.13.3.1

Delete: "and to an R-Theta DR computer"

3.13.3.2

Delete: paragraph
Replace by: "Complete provision shall be made for the installation of an R-Theta dead reckoning navigation system."

3.14.1

Delete from 1st sub-paragraph: "and one including a sub-system for operation of a radar scanner drive."

3.14.1.1

Delete: first sentence
Replace by: "Two constant delivery hydraulic pumps shall be installed, one on each aircraft accessories gear box, with the output of both pumps combined at a 4000 psi pressure regulating and check valve and utilized to power the utility services and charge three accumulators."

Delete in first sub-paragraph:

"the second accumulator"

Replace by:

"the two remaining accumulators"



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14.1.1

(Cont'd)

Add to 1st sub-paragraph: "An accumulator shall be installed in the system return line to compensate for changes in return line pressure."

14.1.1.1

Landing Gear Sub-System

This paragraph to be revised to cover nose door retraction with nose L/G extended. (Detailed revision will be included in formal issue of amendment)

Delete 1st sentence of 1st paragraph.

Replace by: "The landing gear and landing gear door actuation shall be sequenced during retraction and normal extension. Sequencing valves, operated by landing gear and door movement during retraction and extension, shall be installed in the hydraulic pressure lines to the landing gear and door actuators."

3.14.1.1.3

Delete: "2130 psi"
Replace by: "2500 psi"

Delete: "a maximum of 1500 psi reduced from a 4000 psi accumulator"
Replace by: "1500 psi (nominal) reduced from two 4000 psi accumulators"

Description of anti-skid will be revised to be compatible with the type of system selected for installation.

3.14.1.1.4

Delete last sentence.

3.14.1.2.1

Delete from 1st sub-paragraph: "with the output ... scanner drive system."

Add to 1st sub-paragraph:

"A self displacing type accumulator shall be installed in each system power circuit"

Add in 2nd sub-paragraph: "(Nominal)" after 1000 psi.

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14.1.2.3 Delete last sub-paragraph

Replace by: "An accumulator shall be installed in each system return circuit to compensate for changes in return line pressure."

14.1.4 Delete 2nd sub-paragraph.

Add to 3rd sub-paragraph: "System filling shall be accomplished through the return line couplings."

14.3 Delete paragraph.

Replace by: "High and low pressure lines of less than 3/4" dia. with the exception of 1/4" and 3/8" dia. shall be of stainless steel in accordance with AVROCAN Specification M-7-6. 1/4 and 3/8" dia. lines which include lines subject to flexing shall be stainless steel in accordance with Specification MIL-T-6845.

Low pressure lines of above 3/4" dia. shall be of aluminum alloy to Specification MIL-T-7081.

15.1 Delete: "(c) Radome anti-ice system air supply."

Replace by: "(c) Armament (Instrument) pack seal inflation."

Add after (2) Fuel tank pressurization: "and fin wave-guide pressurization"

15.1.1 Delete: "and to operate the radome anti-ice fluid system"

15.1.1.3 Delete: paragraph

Replace by:

3.15.1.1.3 Armament (Instrument) Pack Seal Inflation

Air for pack seal inflation shall be ducted from the services sub-system filter to a solenoid operated valve. With the solenoid in the energized position, the valve shall be designed to act as a 20 psig pressure regulator, as a pressure relief valve at pressures in excess of 25 psig, and as a check valve to prevent back flow of air



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15.1.1.3

(Cont'd)

3.15.1.1.3 Armament (Instrument) Pack Seal Inflation
(Cont'd)

from the seals. With the solenoid in the de-energized position the valve shall vent seal pressure.

The control solenoid shall be energized on take-off by the scissors switch in the right-hand main landing gear.

15.1.2

Delete: paragraph

Replace by:

3.15.1.2 Fuel System Pressurization and Fin Wave-Guide Pressurization Supply

3.15.1.2.1 Fuel System Pressurization Supply

Air at 85 psi (max.) shall be ducted from the air conditioning system heat exchanger to a hot air filter. The output from the filter shall be ducted to the pressure regulating valves of the fuel tank pressurization system. (Ref. para. 3.11.8.10).

A non-return valve shall be installed in the pressurization supply line, upstream of the pressure regulating valves, to prevent fuel vapour from entering the air conditioning system.

3.15.1.2.2 Fin Wave-Guide Pressurization Supply

A branch from the fuel system pressurization ducting shall convey air to a 10 psi pressure regulating valve. Air at the regulated pressure shall be utilized to pressurize the wave-guide installed in the fin.

16.2.5

Delete: "Two DC failure warning lights"

Replace by: "One DC failure warning light"

Add: "A light shall be installed in the front cockpit to indicate when the battery is in use."

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- 16.11.2 1st sub-paragraph, last line: change "of" to "or"
Delete from 2nd sub-paragraph: '2 DC Failure L.H. and R.H."
Replace by: "1 DC Failure L.H. or R.H."
Delete: "No present warning function"
Add: "1 Battery Use"
"1 Equipment overheat (air conditioning)"
Add last sub-paragraph:
"Two air conditioning over temperature/over pressure warning lights shall be installed on the right-hand console of the front cockpit (Reference paragraph 3.22.1.3.1). Testing and dimming shall be controlled in conjunction with the warning indicator panel lights."
- 18.1 Delete: "A fairing shall be installed ... package"
Add sub-paragraph:
"An instrument pack shall be installed in the armament pack bay"
- 19.1 Delete in 1st sub-paragraph: "80 feet per second"
Replace by: "83 feet per second"
Delete: "right-hand side of the seat"
Replace by: "left-hand side of the seat"
Delete: "Capstan type pressure suit"
- 20 Delete: "hydraulics bay"
Replace by: "services bays"
- 20.1.2 Delete (in two places): "hydraulics bay"
Replace by: "services bays"

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- 20.1.3 Delete 1st sub-paragraph:
- Replace by: "Selection of the extinguishing switch shall discharge one shot of an extinguishing agent to the appropriate engine zone or services bays."
- Delete last sub-paragraph.
- 21.1.1 Delete: "300 psig"
Replace by: "70 psig"
- Delete last sentence:
- "The mounting ... operable condition"
- 21.1.3 Delete 1st sub-paragraph:
- Replace by: "A high altitude, automatic pressure demand, single outlet oxygen regulator to Specification MIL-R-25572 shall be installed on each ejection seat. Oxygen shall be supplied to the regulator through a 70 psi reducing valve and a three-part composite quick disconnect (Reference paragraph 3.19.1)."
- 21.1.4 Delete: "the pilot's"
Replace by: "each"
- 21.2 Delete: "and shall automatically couple .. mounting tray."
- Replace by: "and shall lock into the aircraft by a positive lock on the converter mounting tray. Quick disconnects shall be provided for the system supply line, overboard vent line, and quantity gauge coupling electrical leads. The supply line quick disconnects shall be self sealing."
- 3.22 Delete in 1st sub-paragraph: "Compartment" after Battery.
- Add: "Windshield Transformer" beneath Battery.

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22.1

Add to paragraph: "An emergency temperature control switch shall be installed to permit shut-off of hot air by-passing the expansion turbine. (Reference paragraph 3.22.1.3.2).

22.1.2.1

Add new sub-paragraph:

"A warning light in the pilot's cockpit shall indicate a temperature in excess of 100°F (nominal) in the ducting system leading to the equipment compartments."

22.1.3.1

Delete: "A pressure switch downstream ... from both engine bleeds."

Replace by:

"Two warning lights shall be installed, one left-hand and one right-hand, to indicate pressures exceeding 120 psi downstream of the engine bleed pressure reducing valves, or to indicate leakage sensed by overtemperature at duct joints. A three-position selector switch shall be installed in the front cockpit to permit either engine bleed shut-off valve to be closed."

22.1.3.2

Add to 1st sub-paragraph:

"through a steam vent designed to prevent spillage of water in extreme aircraft attitudes and under conditions of negative 'g'.

Delete last sentence, 2nd sub-paragraph.

Replace by: "The remaining output shall by-pass the expansion turbine and be utilized for quantity and temperature control.

23

Delete in 1st sub-paragraph: "Radome"

23.7

Delete: paragraph
Replace by:

3.23.7 Air Data Sensing Heads

The pitot-static head, the 'alpha' vane, the 'beta' vane, and the two pitot-static heads on the fin shall be anti-iced by integral self-regulating electric heaters. The heaters shall be powered by the aircraft main AC power supply system and shall be energized when power is applied to the AC buses.



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23.12

Delete: paragraph
Replace by: "Not applicable".

Deviation 29

Delete in the Deviation: item (1)

Delete in the Reason for Deviation and Remarks: item (1),
and (from item 2):

"Investigation on the use of fuses is
being carried out"

Deviation 54

Delete: "3 in. quick disconnect"
Replace by: 3 1/2 in. quick disconnect"

Deviation 62

Add in Reason for Deviation and Remarks Item 2,
after ram air valve: ", and a hot air by-pass shut-
off valve"

Deviation 95

Delete this Deviation

Deviation 117

Delete: "Range of n pos. 1.3 to n neg. 0.8"
Replace by: "Range of n pos. 1.3 to n pos. 0.8"

Add Deviation 121 (add notation (121) to margin of paragraph 3.1.5)

Weighing

Requirement: Specification CAP 479, paragraph 30.03(5)

.... The first aircraft of a new or converted type
shall be weighed in the "dry" condition.

Deviation

The first Arrow aircraft will not be weighed in the
"dry" condition.

Reason for Deviation and Remarks

To expedite test program.

Add Deviation 122 (add notation (122) to margin of paragraph 3.20)

Crash Landing Switch

Requirement: CAP 479, Paragraph 23.74

The fire extinguishing system shall be operated.

(b) automatically, by a switch which will be
actuated by a crash landing.

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Deviation 122

(Cont'd)

Deviation: A crash landing switch is not installed.

Reason for Deviation and Remarks

A switch compatible with the deceleration rates of Arrow aircraft is not presently available.

Deviation 123 (add notation (123) to margin of paragraph 3.4.4.2)

Emergency Landing Loads

Requirement: Specification MIL-S-5705, paragraph 4.5.1.1.2.

(Emergency landing loads) shall not be less than those listed below

Fighter ----- 32g Forward -----

Deviation: Design has been based on an ultimate forward load factor of 25g.

Reason for Deviation and Remarks: Design meets the requirements of CAP 479 and is recommended as design case by RCAF (Reference letter S1038-105-16 (ACE) dated 25 Jan 1955).

Deviation 124 (add notation (124) to margin of paragraph 3.13.1.1.3)

Tachometers

Requirement: Operational Requirements No. ORI/2-5

The instruments are to be calibrated and marked up to 125%.

Deviation: The instruments are calibrated and marked up to 110%.

Reason for Deviation and Remarks: Instruments calibrated to 125% are not presently available.

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Add Deviation 125 (add notation (125) to margin of App. IIIB)

Engineering Data

Requirement: Specification AIR 7-4, paragraph 14.1

..... reports shall be submitted by the Contractor as detailed in CAP 479.

CAP 479, paragraph 2.02

..... The following data are required:

- (b) Wind Tunnel Test Reports;
- (d) Performance Calculations;
- (e) Stress Analysis;
- (f) Structural Strength Test Reports;
- (p) Aircraft Ground and Flight Test Reports;
- (s) Functional Type Test Reports;
- (t) Vendor's Report;

Deviation:

- (b) Wind Tunnel Test Reports: Data without explanatory text will be submitted if it is needed to fill a specific need.
- (d) Performance Calculations: Requests for performance calculations will be complied with by the issue of reports termed Periodic Reports which will be drawn up to contain the specific data requested.
- (e) Stress Analysis: An index to preliminary stress reports will be submitted. Stress reports requested will be submitted in preliminary form, not certified as to accuracy.
- (f) Structural Strength Test Reports: Structural strength test reports compiled in support of stress analysis and/or as proof of complete airworthiness of structure will be available upon request.
- (p) Aircraft Ground and Flight Test Reports: Flight test data will be included with the Performance Calculations in Periodic Reports on specific request.
- (s) Functional Type Test Reports: On satisfactory completion of tests to Avrocan equipment specifications, Approval Statement will be issued to the RCAF. Supporting data will be available in Avro Engineering Central Files.

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Add Deviation 125

(Cont'd)

- (t) Vendor's Reports: Vendor's reports will be available in Avro Engineering Central Files.

Reason for Deviation and Remarks: The procedures outlined appear to have adequately met RCAF needs in the past and provide for the most economical use of manpower and funds.

Appendix III

Drawings

Delete: "MRI-CA-C105/1"
Replace by: "MRI-CA-Arrow 1"

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