72/MS/1 REISSUED

MODEL SPECIFICATION JAN 1959

FOR ARROW 2

AIRFRAME AND GSM INSTALLATIONS

(SERIAL NO 25206)

SECRET

46

A V R O   A I R C R A F T   L I M I T E D

MODEL SPECIFICATION

FOR

ARROW 2 AIRFRAME

AND

GOVERNMENT SUPPLIED MATERIAL INSTALLATIONS

(SERIAL NO. 25206)

S E C R E T

NUMBER OF PAGES 272

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MODEL SPECIFICATION AMENDMENT NOTICE	TO ______ ______ DATE ______
SPECIFICATION TITLE Model Specification for Arrow 2 Airframe and Government Supplied Material Installations	COPY NO. ______ SPEC. NO. 72/MS/1 ISSUE NO. 1

This reissue of the above noted specification incorporates Amendments 1 to 10 and Appendix VI.

Amendments 1 to 10 bring the specification up to date with respect to the current design status of aircraft serial number 25206.

Appendix VI sets forth the acceptance condition of aircraft serial number 25206 as of this date. This Appendix is to be read in conjunction with the relevant paragraphs in the main body of the Model Specification to establish the current definition and limitations applicable to aircraft serial number 25206.

APPROVAL OF REISSUED SPECIFICATION

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MODEL SPECIFICATION

FOR

ARROW 2 AIRFRAME

AND

GOVERNMENT SUPPLIED MATERIAL INSTALLATIONS

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This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

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SECTION 1

APPLICABLE SPECIFICATIONS AND PUBLICATIONS

1.1 Referenced Specifications and Publications

The following specifications and publications of the issue in effect on 23rd April 1954, or the date of first issue, whichever is later, shall form a part of this model specification to the extent stated in this specification. The applicable paragraphs of this model specification shall, in each case, state the extent to which the design complies with the following specifications. Failure to list non-compliance with the requirements of the specifications listed in this paragraph, which, by a reasonable engineering interpretation, apply to this model specification, shall indicate the Contractor's intention to meet all such requirements even though no specific mention is made of the requirement in this model specification. Where the Contractor does not intend to comply with such requirements a deviation shall be raised.

Contractor specifications and publications shall be approved by the RCAF prior to forming a part of this specification.

At the discretion of the Company subsequently dated RCAF approved issues may be used.

*AIR 7-4 (Issue 5)	RCAF Specification for Requirements for the Airframe and GSM Installations for the Arrow 2 Aircraft. 1
PROC 100-4	Identification Marking of RCAF Property.
PROC 100-11 (Issue 3)	Engineering Data, Control Procedures for Production Equipment.
CAP 479	Manual of Aircraft Design Requirements for the Royal Canadian Air Force.
ARDCM 80-1	Handbook of Instructions for Aircraft Designers.
EMS-8 (Issue 2) Dated: Feb. 1958	Preliminary Model Specification - Iroquois 2 Engine
MIL-B-5087A	Bonding, Electrical (for Aircraft)
MIL-W-5088A	Wiring, Aircraft, Installation of

* This specification not yet contractually accepted.

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1.1 Referenced Specifications and Publications (Cont'd)

MIL-I-5099A	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-5572A	Fuel, Aircraft Reciprocating Engine
MIL-O-5606 (2)	Oil, Hydraulic, Aircraft, Petroleum Base
MIL-F-5616	Fuel, Aircraft Engine, Grade JP-1
MIL-F-5624C	Fuel, Aircraft Turbine and Jet Engine, Grades JP-3, JP-4, and JP-5
MIL-S-5700	Stress Analysis Criteria
MIL-S-5702	Structural Criteria, Basic Flight Criteria
MIL-S-5703	Structural Criteria, Piloted Airplane Basic Ground Criteria
MIL-S-5705	Structural Criteria, Piloted Airplanes, Fuselage, Booms, Engine Mounts and Nacelles.
MIL-S-5711	Structural Criteria, Piloted Airplane Structural Test, Flight
MIL-N-5877A	Nozzle, Pressure Fuel Servicing, Locking Type D-1
MIL-I-5997	Instruments and Instrument Panels, Aircraft Installation Of
MIL-I-6051	Interference Limits and Methods Of Measurements, Aircraft Radio and Electronic Installations
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-6818A	Clamp, Mounting, Aircraft Instruments

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1.1 Referenced Specifications and Publications (Continued)

MIL-E-7080 (1)	Electrical Equipment, Installation of Aircraft, General Specification
MIL-E-7563 (1)	Electrical Equipment, Aircraft, Installation 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, Characteristics Of
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	Installation and Test of Electronic Equipment in Aircraft, General Specification for
MIL-J-8711	Jack Pads, Aircraft, Design and Installation
MIL-F-8785	Flying Qualities of Piloted Airplanes
MIL-F-25352	Flutter, Divergence and Reversal of, Aircraft, Prevention of
MIL-F-25467A	Lighting, Integral, Instrument, General Specification For
MIL-R-25572	Regulator, Oxygen, Automatic Pressure Breathing High Altitude, General Specification for
Specification Bulletin ANC-2	Ground Loads
CGSB 3-GP-22b	Aviation Turbine Fuel - Type II
CGSB 3-GP-23b	Fuel, Aviation Turbine, Type I
CGSB 3-GP-25c	Aviation Fuel

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1.1 Referenced Specifications and Publications (Cont'd)

CGSB 3-GP-26A	Oil, Hydraulic, Petroleum Base
MAT 1-2	Luminescent material, Fluorescent, Radio-Active
CS-D-2	Protective Treatment Schedule Landplanes
Avro Report	Periodic Performance Report No. 15A
Avro Report 72/FAR/6	Arrow 2 Aircraft 25206 & 25208 Instrumentation 1
Avro Report QC-E-9	Interchangeability - Working Lists
Avro Report P/AERO DATA/89	Detailed Analysis of Flying Qualities of CF-105
Avro Report GEN/STDS/4	Compliance with ABC Standards
Avro Report 7-0400-82	Weight and C.G. Summary - Arrow 2 A/C 25206 1
Dowcan 200 (Issue 2)	Silicone Based Fluid

1.2 Precedence of Requirements

From the date of RCAF approval of this Model Specification the requirements of this specification shall take precedence over the requirements of all specifications listed herein. In the event of conflict between the requirements of the specifications, publications, and documents referenced in this Model Specification, the order of precedence for compliance shall be as follows:

(a) AIR 7-4 - RCAF Specification for Requirements for the Airframe and GSM Installations for the Arrow 2 Aircraft. 1

(b) CAP 479 - Manual of Aircraft Design Requirements for the Royal Canadian Air Force

(c) ARDCM 80-1- Handbook of Instructions for Aircraft Designers

(d) The remaining specifications referenced in this specification.

1.3 Specification Amendments

Any alteration(s) to this Model Specification, whether or not such alteration results in a physical change to the aircraft, shall be submitted by the Company to the RCAF in the form of a "Specification Amendment".

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

1.4 <u>Deviations</u>

Deviations are set forth in Appendix II and Appendix IV to this document and are indicated throughout the text by the appropriate deviation number encircled in the left hand margin. A definition of "Deviation" appears in paragraph 6.2. From the date of approval by the RCAF of the Model Specification, required additional deviations from the requirements of the specifications listed in paragraph 1.1 shall be submitted in the form of "Specification Amendments".

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SECTION 2

SCOPE

2.1 Terms of Reference

This Model Specification describes the airframe and Government Supplied Material installations of the Arrow 2 aircraft.

The airframe and GSM installations of the Arrow 2 aircraft, Serial Number 25206 and subsequent up to and including Serial 1
Number 25209, shall be defined by this specification together with applicable specification amendments issued in accordance with paragraph 1.3 of this specification. The design detail documents are identified in the effectivity schedule of the Master Record Index referenced in Appendix IIIA to this specification. The requirements of this specification shall apply except as amended and/or limited by the requirements of Appendix VI to this specification.

2.1.1 This specification describes the airframe and GSM installations of the following aircraft.

2.1.1.1 RCAF name and mark number - Arrow 2.

2.1.1.2 RCAF specification number - AIR 7-4 (Issue 5) *. 1

2.1.1.3 Manufacturer's name - Avro Aircraft Limited.

2.1.1.4 Manufacturer's model designation - Arrow 2.

2.1.1.5 Number of engines - Two.

2.1.1 6 RCAF name and mark number of engine - Iroquois.

2.1.1.7 RCAF engine specification number -

2.1.1.8 Engine manufacturer's name - Orenda Engines Limited.

2.1.1.9 Engine manufacturer's model designation - PS 13.

2.1.1.10 Engine specification number - EMS-8 Issue 2. (As amended - see para. 3.11.1 of Specification 72/MS/1).

*Specification not yet contractually accepted. 1

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

2.2 Role

The role of the aircraft shall be that of a flight test vehicle for use in the development and production of the Arrow Weapon System.

2.3 Crew

The crew shall normally consist of a Pilot and an Observer.

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SECTION 3

REQUIREMENTS

3.1 Characteristics

3.1.1 Three-View Drawing

See Figure 1 Page 9

3.1.2 Interior Arrangement Drawing

See Figures 2 and 3, Pages 10 and 11.

3.1.3 Performance

The estimated performance of the aircraft shall be as detailed in Avro Aircraft Ltd Periodic Performance Report No. 15A, assuming the aircraft configuration to be as described by this 1
specification and engine performance to be in accordance with paragraph 3.11.1 of this specification.

3.1.4 Performance Curves

Reference paragraph 3.1.3. 1

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2097-105-4

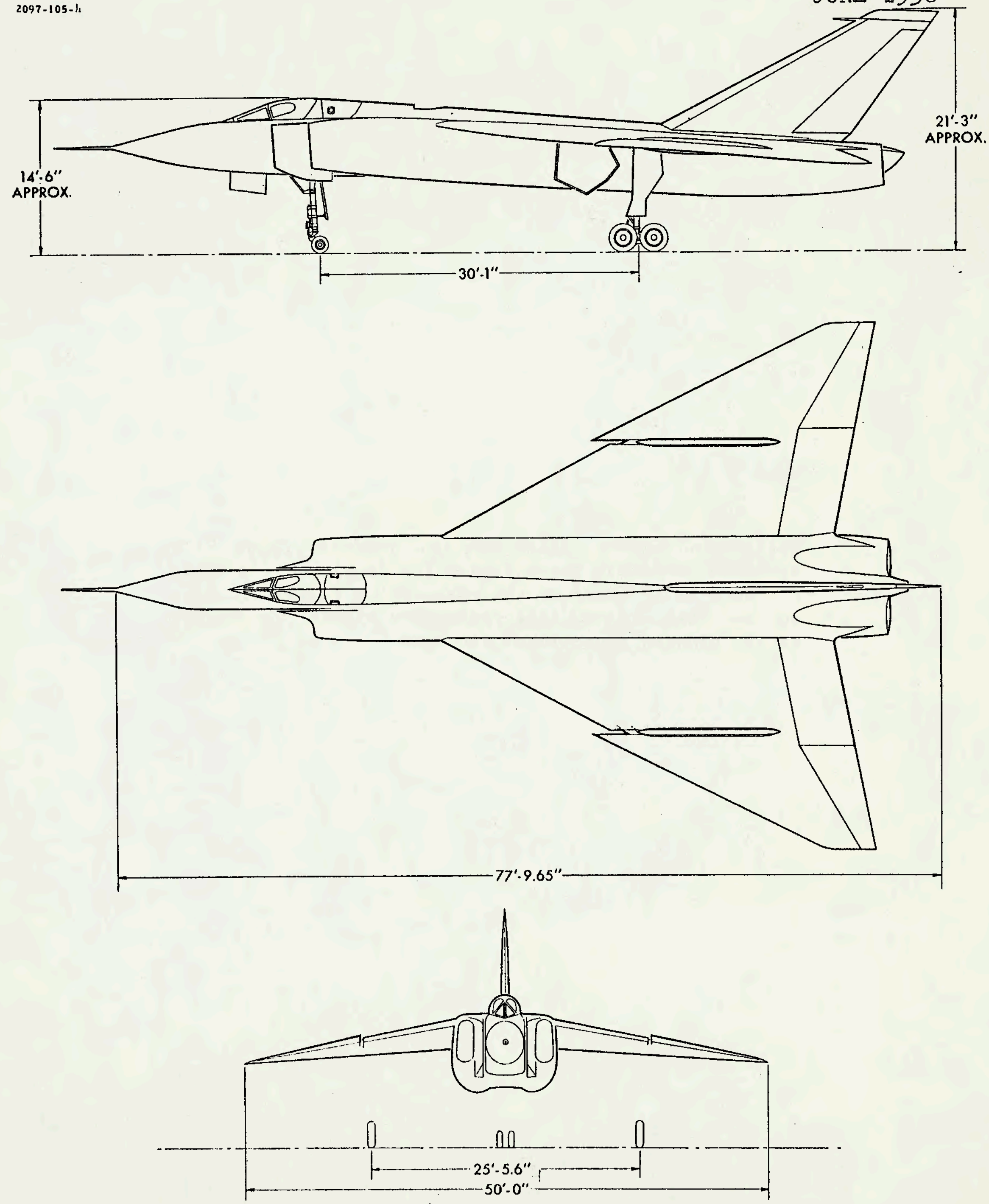

FIG. 1

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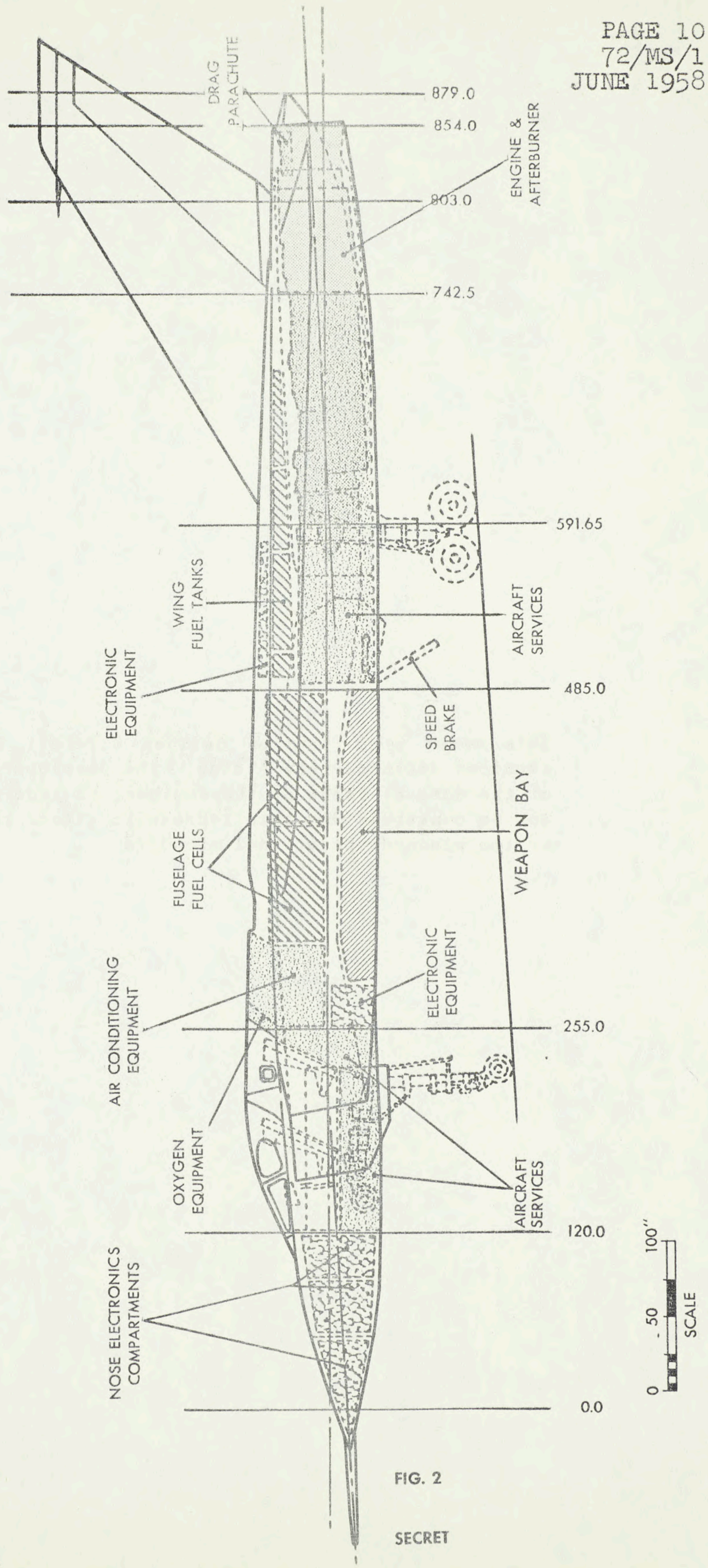
DRAG PARACHUTE
879.0
854.0
ENGINE & AFTERBURNER
803.0
742.5
591.65
WING FUEL TANKS
ELECTRONIC EQUIPMENT
AIRCRAFT SERVICES
485.0
SPEED BRAKE
WEAPON BAY
FUSELAGE FUEL CELLS
AIR CONDITIONING EQUIPMENT
ELECTRONIC EQUIPMENT
255.0
OXYGEN EQUIPMENT
AIRCRAFT SERVICES
120.0
NOSE ELECTRONICS COMPARTMENTS
0.0
0 50 100"
SCALE

FIG. 2

SECRET

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

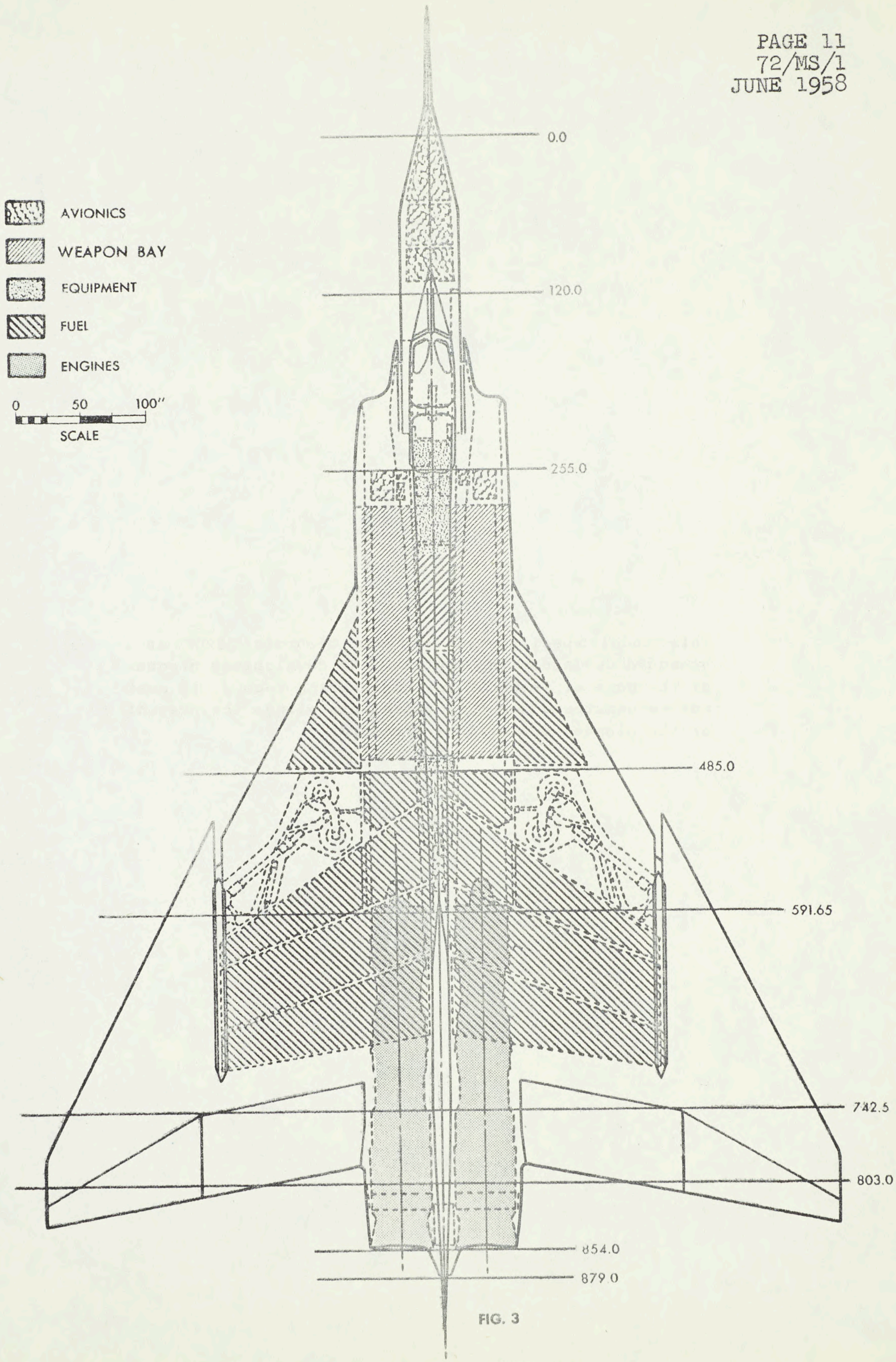
AVIONICS
WEAPON BAY
EQUIPMENT
FUEL
ENGINES
0
50
100"
SCALE
0.0
120.0
255.0
485.0
591.65
742.5
803.0
854.0
879.0

FIG. 3

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3.1.5 Weight and Balance

The estimated weight for the aircraft is as follows (For current weight status refer to latest issue of Avro Aircraft Report No. 7-0400-82).

3.1.5.1 Basic Weight

DESCRIPTION	WEIGHT lb		
STRUCTURE		19,258	
Wing	10,032		
Fin & Rudder	1,031		
Fuselage fwd. Sta. 255"	2,605		
Sta.255" - 485"	1,716		
Sta.485" - 591.65"	1,170		
Sta.591.65" - 742.5"	1,576		
Sta.742.5" Aft.	1,085		
"Marry-up"	43		
LANDING GEAR		2,708	
Main landing gear	2,059		
Main L/G Doors and Fairings	288		
Nose Landing Gear	334		
Nose L/G Door & Fairing	27		
POWER PLANT & SERVICES		11,548	
Engines & Accessories	10,058		
Gear Box & Drives on Fuselage	292		1
Engine Controls	32		
Gear Box & Starter on Engine	153		
Engine Instrumentation	100		
Fire Extinguisher System	74		
Engine Mountings	75		
Fuel System	763		
FLYING CONTROLS GROUP		1,966	
Mechanical Flying Controls	958		
Hydraulic Flying Controls	1,007		
EQUIPMENT GROUP		8,217	
Instruments	35		
Probe	15		
Cockpit Pressure Sealing	5		
Oxygen System	21		
Ejector Seats	343		
Air Conditioning System	874		
Hydraulics Utility System	641		
Cockpit Insulation	14		
Drag Chute	91		
Electrical System	1,237		
Low Pressure Pneumatics	50		
Surface Finish	100		
Intake De-icing Boots	88		
Canopy Actuation	65		
Cockpit Consoles	18		
Damping System	99		
Mechanical Door Stops - Main L/G Doors	3		

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3.1.5.1 Basic Weight (Cont'd)

DESCRIPTION	WEIGHT lb	
EQUIPMENT GROUP (cont'd)		
Electronic System	613	
Emergency Fire Protection	181	
Instrument Pack Structure	692	
Pack Instrumentation	2,408	
Flight Test Installations	624	
BASIC WEIGHT		43,284

3.1.5.2 Normal Gross Weight

BASIC WEIGHT		45,204
Ballast		1,294
Operational Load (less fuel)		1,097
Crew	390	
Oil	162	
Residual Fuel	287	
Oxygen Charge	13	
Fire Extinguisher Fluid	25	
Water for Air-Conditioning	220	
OPERATIONAL WEIGHT EMPTY		46,301 1
Maximum Internal Fuel (2,455 gal. @ 7.8 lb/gal.)		19,146
NORMAL GROSS WEIGHT		65,447

3.1.5.3 One Half Fuel Weight

OPERATIONAL WEIGHT EMPTY	46,331
1/2 Maximum Internal Fuel	9,573
HALF FUEL WEIGHT	55,874

3.1.5.4 Maximum Gross Weight

OPERATIONAL WEIGHT EMPTY	46,301
Maximum Internal Fuel	19,146
Maximum External Fuel (500 gal. @ 7.8 lb/gal and drop tank)	4,242
MAXIMUM GROSS WEIGHT	69,690

3.1.5.5 Unit Weights

(a)	Wing Group (Gross Area 1,225 sq. ft.)	8.190 lb/sq. ft.
(b)	Vertical Tail (Gross Area 158.79 sq. ft.)	6.492 lb/sq. ft.
(c)	Fuel System (Capacity 2,455 Imp. Gal.)	0.311 lb/Imp. Gal.

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3.1.5.6 **Balance**

The C.G. limits of the aircraft are estimated to be:
(Landing Gear Up or Down)

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

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3.1.6 Areas (Not to be used for inspection purposes)

Wing area (including ailerons, elevators, and 390.50 sq. ft. of fuselage, and not including 28.63 sq. ft. of 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).......... 14.37 sq. ft.

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

3.1.7.1 Wings (Reference Figure 14)

Span.................................. 50 ft. 0.00 in.
Chord - Root.......................... 45 ft. 0.00 in.
- Construction Tip.................... 4 ft. 4.98 in.
Mean Aerodynamic Chord................ 30 ft. 2.61 in.
Airfoil Section - Inner Wing
- Profile... .0003.5-6-3.7 (Modified)
- Camber.... .0075 (Modified)
Outer Wing
- Profile... .0003.5-6-3.7 (Modified)
.0003.8-6-3.7 (Modified)
- Camber.... .0075 (Modified)
Incidence - Root...................... 0 degrees
- Construction Tip.................... 0 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

3.1.7.2 Horizontal Tail

Not applicable.

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 Section....................... .0004-6-3.7 (Modified)

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3.1.7.3 Vertical Tail (Cont'd)

Sweep Back - Leading Edge.......................59.34 degrees
- Trailing Edge.......................33.08 degrees
- 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%

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 Airframe

Reference to ground static line (approx)... 21 ft. 3.00 in.

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

Aircraft reference line level........... 77 ft. 9.65 in.

3.1.7.7 Propeller

Not applicable.

3.1.7.8 Landing Gear

Tread....................... 25 ft. 5.6 in.
Wheel Base....................... 30 ft. 1.00 in.

3.1.7.9 Ground Angle

Angle between airframe 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)

		Surface Movement	Control Movement
Ailerons:	up and down	19°	4.98 in.
Elevators:	up	30°	aft 6.63 in.
	down	20°	fwd 4.37 in.
Rudder:	left and right	30°	fwd 3.28 in.
			aft 3.03 in.
Speed Brake		60°	-

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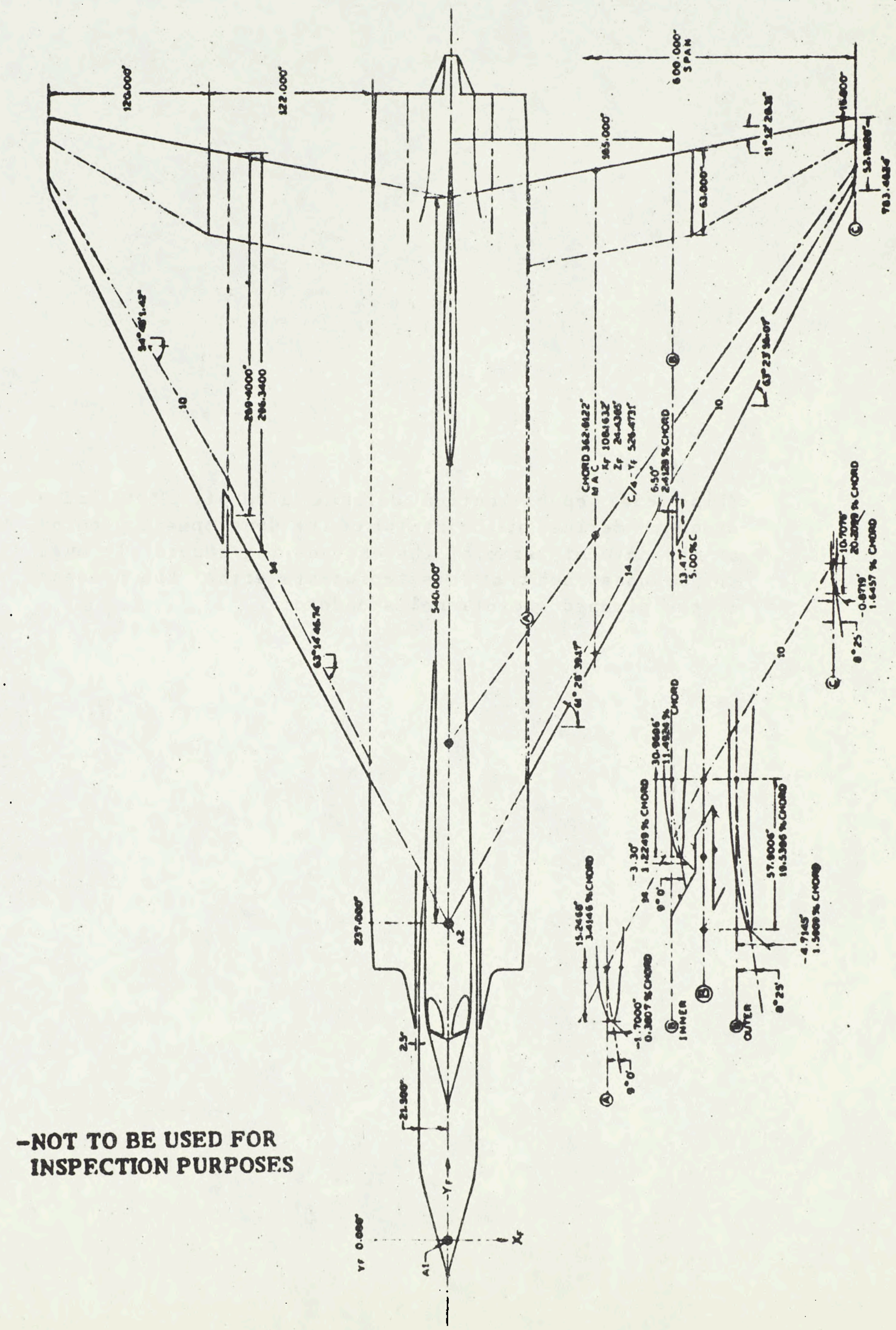
WING PLANFORM AND AIRFOIL DIMENSIONS AND DATA



-NOT TO BE USED FOR
INSPECTION PURPOSES

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

3.2 Construction

3.2.1 General Interior

A pressurized compartment for the accommodation for the crew and incorporating instruments, controls, and stowage as described in the appropriate sections of this specification shall be located in the nose section of the airframe. The front cockpit shall be equipped to accommodate a pilot, and the rear cockpit shall be equipped to accommodate an Observer. It shall be possible for the pilot to perform all the normal and emergency functions required to fly the aircraft without the assistance or presence of the second crew member. The cockpit compartment shall be enclosed by a fixed windshield and two split clamshell type canopies. Equipment and service compartments shall be as described in paragraph 3.7.5.

3.2.2 Materials

The following order of precedence shall apply to materials used in construction of the airframe and contractor furnished equipment:

(a) Requirements issued by DND or approved by the RCAF as covered by CAP 479 Part 5; or

(b) Requirements covered by ARDCM 80-1; or

(c) RCAF approved Company specifications.

3.2.3 Standards

The following order of precedence shall apply to standard parts used in construction of the airframe:

(a) Standards issued or approved by the RCAF, as covered by CAP 479 Part 5; or

(b) ABC Standards to the extent agreed between the RCAF and the Company and as set forth in Avro Report GEN/STDS/4; or

8 (c) Standards covered by ARDCM 80-1; or

(d) RCAF approved Company design standards.

3.2.4 Workmanship

All workmanship and shop practice shall be in accordance with accepted standards of aeronautical engineering practice.

3.2.5 Production, Maintenance, and Repair

The design of the airframe shall be such as to be suitable

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3.2.5 Production, Maintenance, and Repair (Cont'd)

for quantity production. Consideration shall be given during the design to provide access to the airframe and installed equipment to facilitate ease of replacement, maintenance and repair. Maintenance provisions incorporated in the airframe and the equipment installed therein shall conform to:

(a) Requirements covered by CAP 479 or as otherwise agreed between the RCAF and the Company.

(b) Requirements covered by ARDCM 80-1.

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

3.2.6 Climatic Conditions

The airframe shall be designed to meet the environmental conditions given in CAP 479 and ARDCM 80-1, and additionally for operation within the design flight conditions.

All contractor furnished equipment installed in the airframe shall be designed to meet the environmental conditions given in CAP 479 and ARDCM 80-1 and additionally, where the pressure altitude and/or temperature is in excess of that covered by CAP 479 and ARDCM 80-1, the requirements in the Company Equipment Specifications shall govern. 1

3.2.7 Noise and Vibration

The levels of noise and vibration shall be as determined by test. 1

3.2.8 Processes

The following order of precedence shall apply to processes used in construction of the airframe and contractor furnished equipment incorporated in the various systems installed therein.

(a) Requirements issued by DND or approved by the RCAF as covered by CAP 479 Part 5; or

9 35 (b) Requirements covered by ARDCM 80-1.

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3.2.9 Finish

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

3.2.10 Colour Scheme and Identification Markings

3.2.10.1 Colour Scheme

The airframe exterior colour scheme and markings shall conform to (a) CAP 479 Chapter 6; or
(b) Company drawings, where not covered by (a).

The cockpit interior colour scheme shall conform to ARDCM 80-1.

3.2.10.2 Identification Markings

Airframe components and airframe parts shall be marked in accordnance with Specification PROC. 100-4 except as stated in the deviations in Appendix IV.

3.2.11 Pipeline Identification

70 All removable pipeline and electrical conduit in the airframe 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 RCAF and the Company as set forth in Company Reports listed in Appendix III.

3.2.13 Interchangeability

Interchangeability and replaceability shall conform to the requirements of Specification MIL-I-8500A and as set forth in Avro Aircraft Report QC-E-9.

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 ARROW 2 aircraft.

3.2.15 Equipment

The following order of precedence shall apply to contractor furnished equipment incorporated in the various systems installed in the airframe:

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3.2.15 Equipment (Cont'd)

(a) Requirements issued by DND or approved by the RCAF as covered by CAP 479 Part 5; or

(b) Requirements covered by ARDCM 80-1; or

(c) RCAF approved Company Specifications.

Government supplied equipment, specified as a mandatory requirement by the RCAF, shall be installed without modification or adjustment, except to the extent of normal calibration or minor adjustment.

Where a degree of performance to meet the specification requirements is obtainable only by a process of testing and/or selection or selective matching of Government supplied equipment, then such testing or selective process shall not be considered a part of the requirements of this specification. Upon subsequent replacement of one of the components so matched the aircraft performance obtained by such testing and selective process is no longer assured.

Where failure of Government supplied equipment to provide a degree of performance necessary to meet the specification requirements for the aircraft is indicative of a modification requirement of such equipment, then the Company shall notify the RCAF and recommend such modification for such equipment as it may deem necessary, but shall not undertake such a program of modification as part of the requirements of this specification.

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3.3 Aerodynamics

3.3.1 General

The aircraft shall have a delta planform high wing, with 4° 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.

The aircraft shall be designed to possess aerodynamic characteristics such as to permit the accomplishment of the role as defined in RCAF Specification AIR-7-4. 1

3.3.1.1 Special Characteristics

The wing leading edge shall be slotted, extended and drooped (as described in paragraphs 3.1.7 and 3.5.2.4) to alleviate transonic "pitch-up" at high lift coefficients and to produce favourable air-flow conditions.

A maximum camber of 0.75% c (negative) shall be incorporated in the wing design in order to effectively reduce the required elevator deflection at design speed and altitude, thus effectively reducing the trim drag. The elevator trim required at altitudes above 45,000 feet shall be effectively reduced by automatic upward deflection of the ailerons. (Reference paragraph 3.9.1.2).

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.

A boundary layer bleed shall be installed between each fixed ramp and the fuselage, and on each intake ramp face, to prevent boundary air from the forward fuselage and intake ramps from entering the intakes, thus improving 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 for engine cooling.

3.3.1.2 Aerodynamic Data

Aerodynamic data, including lift, moment, drag, yaw, thrust,

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3.3.1.2 Aerodynamic Data (cont'd)

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

The aircraft shall be designed to meet the stability and control requirements of Specification MIL-F-8785 except as stated in Avro Aircraft Report Number P/AERO DATA/89.

3.3.3 Aero-Elasticity

Flutter and divergence calculations shall be computed in accordance with the requirements of Specification MIL-F-25352.

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3.4. Structural Design Criteria

109 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. All weights shall be in accordance with the Definitions stated in Section 6, rounded to the next highest 500 lb. to provide a stabilized value.

3.4.1 Limit Flight Load Factors

The aircraft shall be designed for limit flight maneuver load factors based on a positive factor of 7.33 and a negative factor of 3.00 at a Stressing Weight of 47,000 lb. At weights 1
greater than 47,000 lb. limit maneuver load factors (n_1) shall be assumed to be the product of the stressing weight load factor and 47,000 lb. divided by the greater weight.

3.4.1.1 Gross Weight for Stress Analysis 56,000 lb.

Maneuver		Clean Configuration
	Positive	+6.15*
	Negative	-2.52
Gust	(55 fps)	
	Positive	+4.67
	Negative	-2.67

3.4.1.2 Maximum Gross Weight 70,000 lb.

Maneuver		Clean Configuration	Aux. Tank Installed #
	Positive	+4.92*	+4.50
	Negative	-2.01	-2.01**
Gust	(55 fps)		
	Positive	+3.93	+3.47
	Negative	-1.93	-1.47

3.4.1.3 Normal Gross Weight and Maximum Landing Gross Weight 66,000 lb.

Maneuver		Clean Configuration
	Positive	+5.22*
	Negative	-2.13
Gust	(55 fps)	
	Positive	+4.11
	Negative	-2.11

*, **, # For notes see following page.

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* The limit load factor shall decrease due to the effect of skin temperature rise as shown on flight envelopes Figure 5 to 8 inclusive.

** Aux. Tank installation negative limit maneuver load factor of -3.00 reduced to the limit maneuver load factor for the airframe clean configuration.

\# Up to a structural speed limitation of Mach .95

3.4.1.4 Normal Landing Gross Weight 51,000 lb.

Maneuver		Clean Configuration
	Positive	+6.75*
	Negative	-2.76
Gust	(55 fps)	
	Positive	+5.02
	Negative	-3.02

* The limit load factor shall decrease due to the effect of skin temperature rise as shown on flight envelopes Figure 5 to 8 inclusive.

3.4.1.5 Flight Envelopes

In addition to the above the limit flight load factors for the aircraft in the clean configuration shall be as shown in the following flight envelopes:

Sea Level	Figure 5	Page 28
10,000 feet:	Figure 6	Page 29
30,000 feet:	Figure 7	Page 30
50,000 feet:	Figure 8	Page 31

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
Line B-C = Limit Dive Speed
Line H = Positive Gust - Vertical Velocity of 55 ft. per second
Line J = Negative Gust - Vertical Velocity of 55 ft. per second.
Line K = Max. Attainable Load Factor, 30° Up Elevator Deflection
Line L = Max. Attainable Load Factor, 20° Down Elevator Deflection
Line M = Elevator Hinge Moment Limitation, Positive
Line N = Elevator Hinge Moment Limitation, Negative

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3.4.1.6 Load Factors in Roll

2 The aircraft shall be designed for limit flight maneuver load factors in roll in accordance with the requirements of MIL-S-5702 except that the maximum load factor in a rolling pull-out shall be 4.89 at 47,000 lb. and $4.89 \times \frac{47,000}{W}$ for weights in excess of 47,000 lb. 1

3.4.1.7 Load Factors in Spin

1 The aircraft shall be designed for limit flight maneuver load factors in spin 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. 1

3.4.1.8 Load Factors for Landing Gear Operation

The aircraft shall be designed for limit load factors for landing gear operation in accordance with the requirements of MIL-S-5700 and MIL-S-5705 except that: 1

4 (a) Landing gear operation shall be limited to limit maneuver load factors between +0.8 and +1.3, over the speed range of 0 to 250 knots EAS.

(b) With the landing gear in any intermediate retraction or extension position, the limit maneuver load factors shall be limited to between 0 and +2.25, over the speed range of 0 to 250 knots EAS.

3.4.2 Limit Ground Load Factors

3.4.2.1 Limit Take-off Load Factors

The aircraft shall be designed for limit take-off load factors in accordance with Specification Bulletin ANC-2 except that: 1

(a) Load factors at Maximum Weight shall be reduced in a manner such that the landing gear reaction is equal to that obtained at a weight of 65,000 lb.

(b) Load factors at Normal Gross Weight shall be reduced in a manner such that the landing gear reaction is equal to that obtained at a weight of 55,000 lb.

3.4.2.2 Limit Landing Load Factors

3 The aircraft shall be designed for limit landing load factors in accordance with Specification Bulletin ANC-2 and Specification MIL-S-5703 except that at Normal Landing Gross Weight the vertical descent velocity shall be limited to 8 ft./sec. 1

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3.4.2.3 Limit Ground Handling Load Factors

105 The aircraft shall be designed for limit ground handling 1
load factors in accordance with Specification Bulletin ANC-2 except as stated in Appendix II (Deviations). The gross weight for jacking (Reference ANC-2 Table 4.2) shall be 56,500 lb.

3.4.3 Limit Speeds

3.4.3.1 Limit Diving Speeds

The aircraft shall be designed for a limit diving speed V_D 1
which shall be the lesser of 700 knots EAS, a speed corresponding to Mach 2.0, or a speed corresponding to a skin temperature of 250°F.

3.4.3.2 Limit Drag Chute Deployment Speed

The aircraft shall be designed for a limit speed for selection 1
of drag chute deployment of 180 knots EAS.

3.4.4 Crash Criteria

3.4.4.1 Ditching Conditions

Not applicable.

3.4.4.2 Emergency Landing Conditions

The seats, seat installations, canopy and canopy actuating mechanisms, and supporting structure for cockpit equipment shall be designed to withstand inertia loads corresponding
31 to ultimate load factors of 25 'g' forward, 4 'g' laterally, or 20 'g' vertically, applied either separately or together.

Under emergency landing conditions as specified above, 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.

3.4.5 Ultimate Loads

All limit loads, except limit ground handling loads, derived from the above criteria shall be multiplied by 1.365 to obtain ultimate loads. Limit ground handling loads shall be multiplied by 1.5 to obtain ultimate loads.

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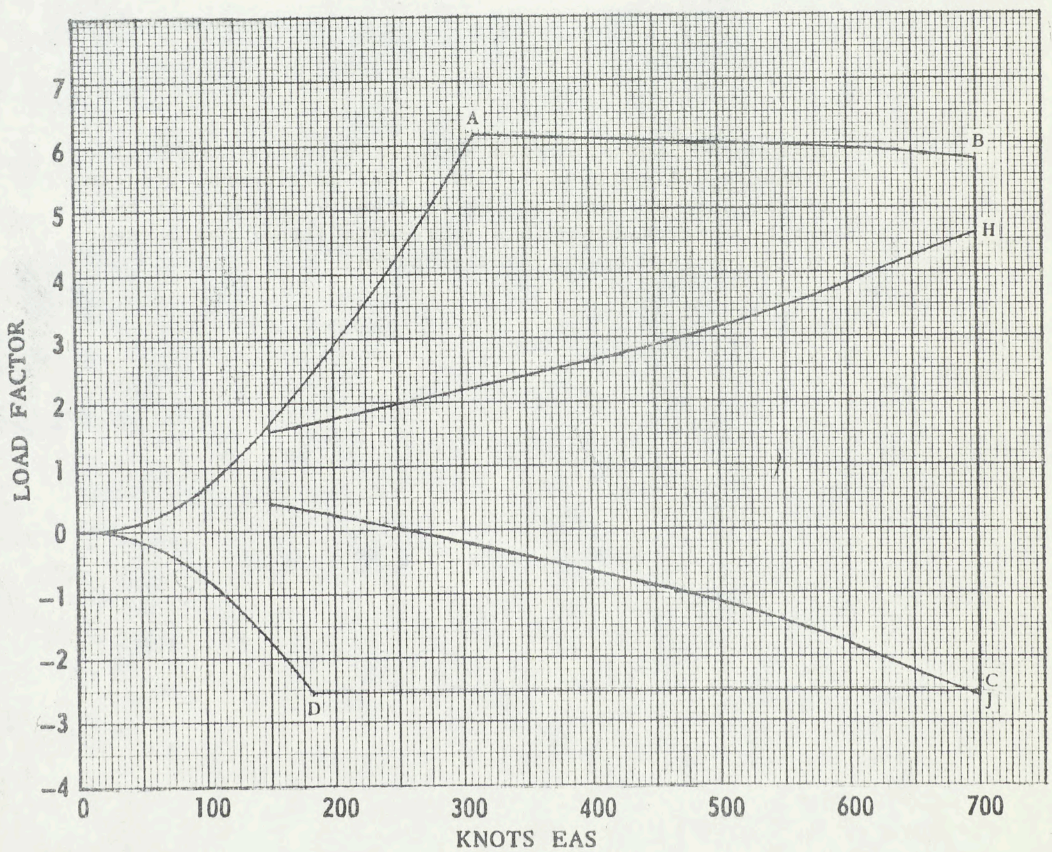
ARROW 2 FLIGHT ENVELOPE

SEA LEVEL

STRUCTURAL LIMIT MANEUVER
LOAD FACTOR FOR A
WEIGHT OF 56,000 LB.
(BASED ON A STRESSING
WEIGHT OF 47,000 LB.)



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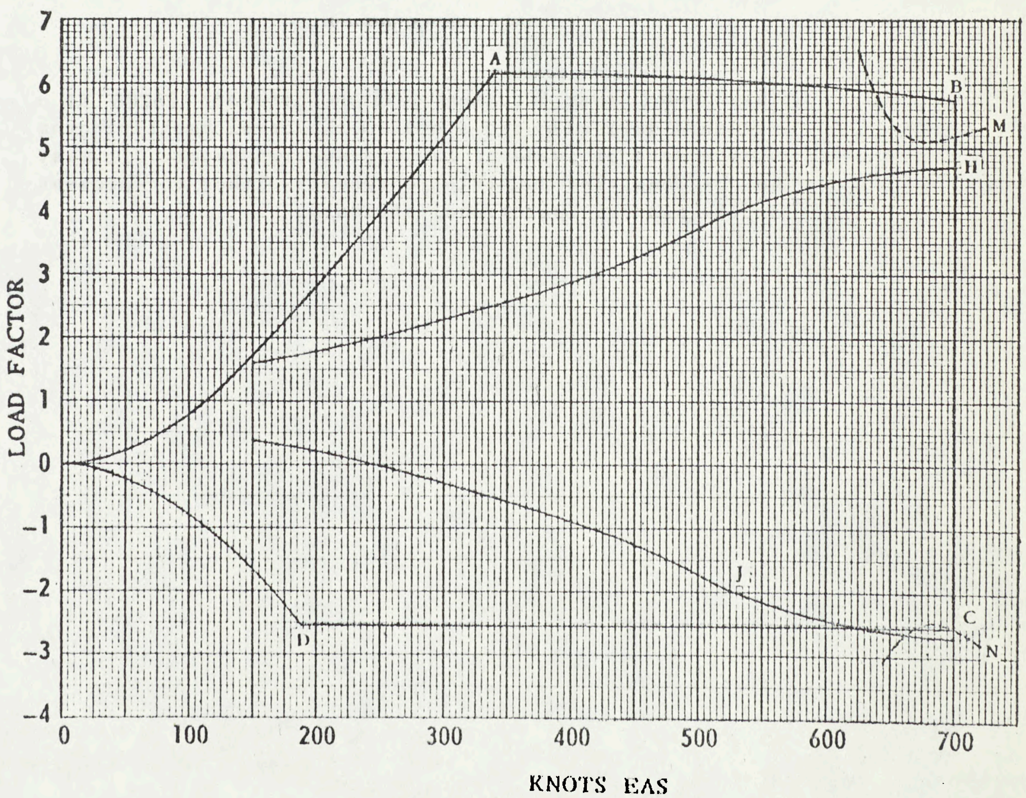
ARROW 2 FLIGHT ENVELOPE

10,000 FEET

STRUCTURAL LIMIT MANEUVER
LOAD FACTOR FOR A
WEIGHT OF 56,000 LB.
(BASED ON A STRESSING
WEIGHT OF 47,000 LB.)



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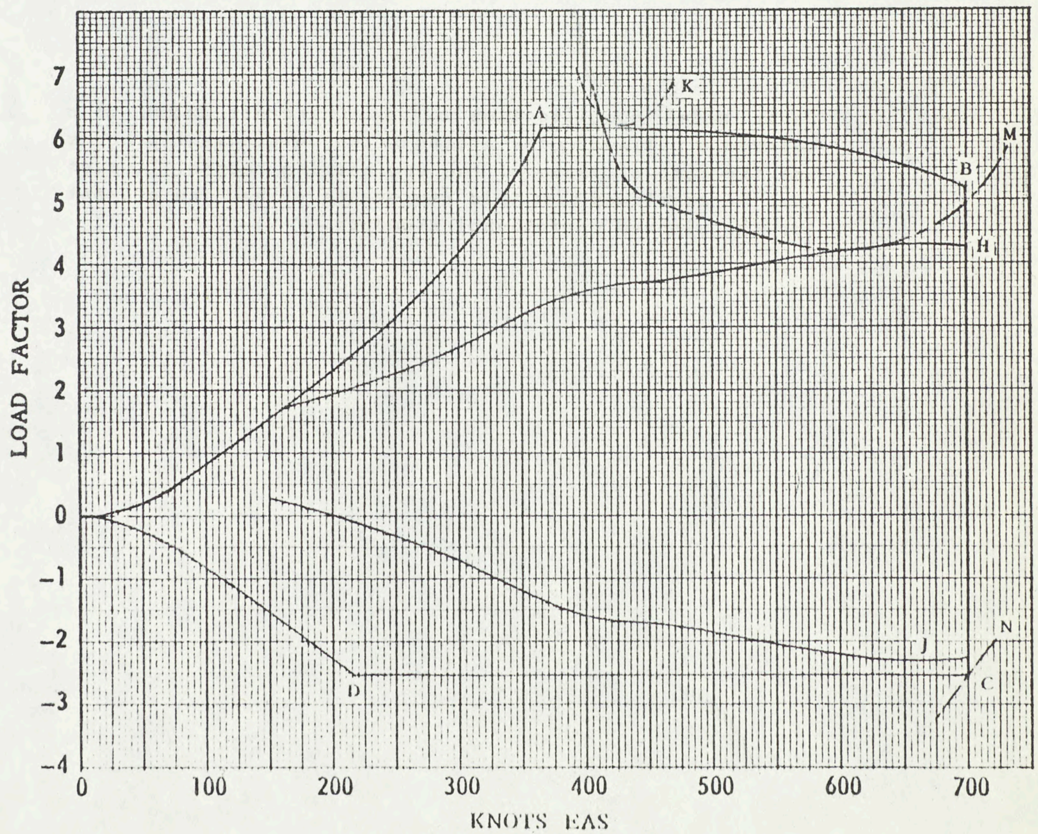
ARROW 2 FLIGHT ENVELOPE

30,000 FEET

STRUCTURAL LIMIT MANEUVER
LOAD FACTOR FOR A
WEIGHT OF 56,000 LB.
(BASED ON A STRESSING
WEIGHT OF 47,000 LB.)



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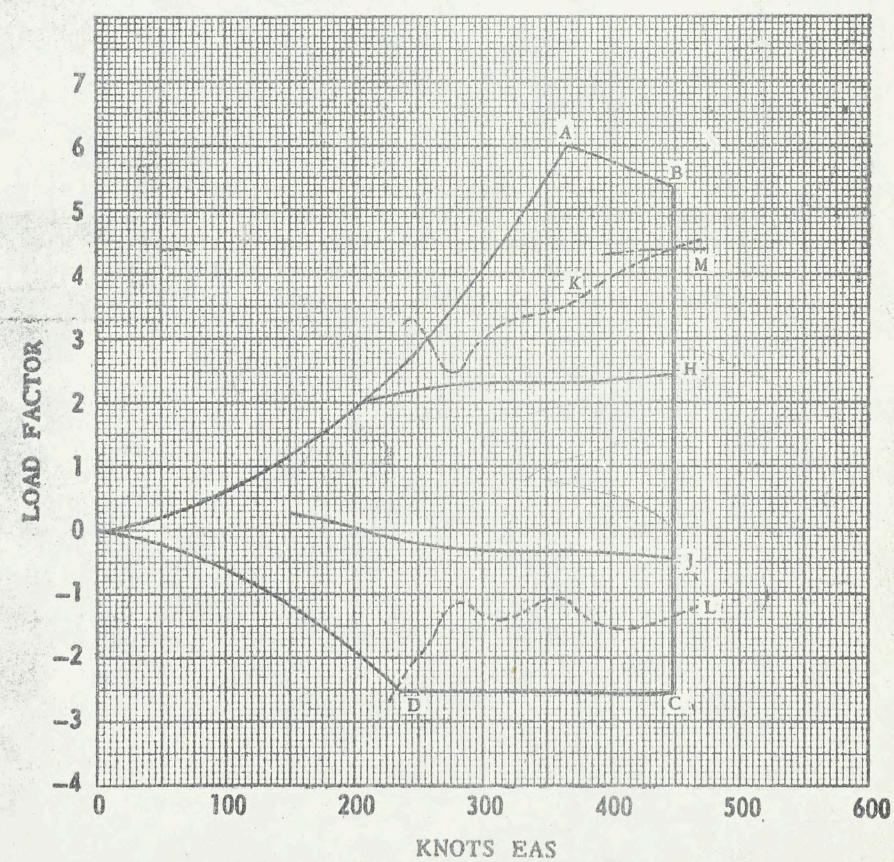
ARROW 2 FLIGHT ENVELOPE

50,000 FEET

STRUCTURAL LIMIT MANEUVER
LOAD FACTOR FOR A
WEIGHT OF 56,000 LB.
(BASED ON 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. The wing shall comprise a wing centre box, and six main sections on each side of the aircraft centre line:

Inner Wing
Outer Wing
Leading Edge
Trailing Edge
Elevator
Aileron

Access doors shall be provided for inspection and maintenance of airframe services.

3.5.2 Construction

3.5.2.1 Wing Centre Box

The wing centre box shall be a load carrying structure of built up box beam, beam, and rib sections and shall include wing spar shear fittings, wing skin panel attachments, shear fittings and attachment points for the fin spars, fin skin panel attachments, fuselage internal centre strut pick-ups, and an elevator hydraulic actuator earthing attachment fitting.

3.5.2.2 Inner Wing

The inner wing shall consist of two sections.

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 the wing centre 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 landing gear 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 centre fuselage which is indented into the delta configuration.

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3.5.2.3 Outer Wing

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 with loads transmitted to the inner wing at a front spar joint, a rear spar joint, three intermediate vertical shear joints, and through the skin attachment. The outer wing shall house the aileron control unit forward of the rear spar.

3.5.2.4 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 61/2" 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.

3.5.2.5 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 centre 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 centre box, and the centre trailing edge. The inner trailing edge section shall house the elevator control unit.

A centre trailing edge, forming an elevator control box, 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 centre trailing edge section shall be bolted to the inner and outer wing panels and to the outer trailing edge.

An outer trailing edge, forming an aileron control box, 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 the ribs shall support the aileron control linkage. The outer trailing edge section 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,

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3.5.3 Ailerons (Cont'd)

utilizing aluminum alloy skins, a hinge spar, and ribs running normal to the spar line. Seven main ribs shall connect to the aileron linkage in the outer trailing edge section of the outer
5 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.

The angular motion of the aileron shall be 19° up and 19° down from the aileron neutral position. The centroid of the aileron area shall be 19.138 feet from the aircraft centre line. The design of the flying control system and its power operation shall obviate the necessity for aerodynamic and static balance.

Each aileron shall be split normal to the hinge spar line at 47.515% of the span. A shear connection shall be provided at the trailing 5
edge and the gap shall be aerodynamically sealed with cover strips.

3.4.5 Aileron Tabs

Not Applicable.

3.5.5 Lift and Drag Increasing Devices (Flaps)

Not Applicable.

3.5.6 Speed Brakes

Speed brakes installed on fuselage (Reference paragraph 3.7.6).

3.5.7 Elevators

The elevators 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 centre trailing edge section. 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.

Each elevator shall be split normal to the hinge spar line at
45.030% of the span. A shear connection shall be provided at 5
the trailing edge and the gap shall be aerodynamically sealed with cover strips.

The angular motion of the elevator shall be 30° up and 20° down from the elevator's neutral position. The design of the flying control system and its power operation shall obviate the necessity for aerodynamic and static balance.

3.5.8 Elevator Tabs

Not applicable.

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3.6 Tail Group

3.6.1 Description and Components

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

3.6.2 Stabilizer

Not applicable.

3.6.3 Elevators

Elevators are installed on the trailing edge of the inner wing (Reference paragraph 3.5.7).

3.6.4 Elevator Tabs

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 a rudder control linkage box.

The main structural assembly shall comprise five spars, spanwise compression ribs, and ribs running normal to the rudder hinge line. Loads shall be transmitted to the wing centré box where the fin is attached at a manufacturing joint. A rudder control unit shall be installed in the fin forward of the main structural assembly rear spar. A detachable fin tip of fibrous material shall be installed to house radio antennas. A pitot static pressure head shall be mounted on the upper portion of the fin leading edge.

The rudder control linkage box shall be a built up assembly comprising machined skins, a rudder hinge spar, a compression spar, and companion rib and support fittings for the rudder control linkage. The control linkage box shall be bolted to the fin rear spar.

Access doors shall be provided for inspection and maintenance of the rudder control unit and aircraft services within the fin.

3.6.6 Rudder

The rudder shall be of stressed skin construction and shall comprise a hingespar, 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

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3.6.6 Rudder (Cont'd)

the rudder control linkage. The angular motion of the rudder shall be 30° either way from the aircraft centre line. The design of the flying control system and its power operation shall obviate the necessity for aerodynamic and static balance.

The rudder shall be split normal to the hinge spar line at
28.328% of the span. A shear connection shall be provided 5
at the trailing edge and the gap shall be aerodynamically
sealed with cover strips.

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, two crew members, and the major proportion of the airframe 1
service components. The fuselage shall be of rounded cross-section from the nose probe to the engine air intakes and cockpit where it shall evolve into a horizontally oblong cross-section. A pilot's V-type wind-shield and a semi-circular cockpit enclosure 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, centre 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 bulkheads, frames and longitudinal stringers in the radar nose, nose fuselage and centre fuselage sections, and longerons and close pitched frames 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 centre struts between the fuselage main frames and inner wing spars, and through piano hinged underwing skin to fuselage skin joints.

Complete provision shall be made in the centre fuselage for the installation of a removable instrumentation pack. 1

3.7.3 Crew Stations

28 The crew stations shall provide for a pilot and an observer seated in tandem cockpits, in the nose fuselage. The cockpits shall be separated by a bulkhead with a transparent panel and a transparent access door installed to provide vision and communication between the two crew stations. 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. The cockpit compartment shall be enclosed by a fixed windshield and two split clamshell type canopies.

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3.7.3 Crew Stations (Cont'd)

30 The pilot's windshield and canopy windows shall comprise optically flat panels of tempered glass. The observer's canopy windows shall comprise curved panels of plastic. All glazing shall incorporate transparent electrical heating elements (Reference paragraph 3.23.4).

A manually operated latch shall be installed in each cockpit to secure the respective canopy in the closed position. With the rear cockpit unoccupied, access for securing the rear cockpit latch shall be gained through the door in the cockpit separating bulkhead.

Each canopy shall be normally actuated by an electrically powered screw jack controlled by two OPEN-OFF-CLOSE switches. One switch for each canopy shall be located on the left hand console of the respective cockpit, and one switch for each canopy shall be located on the fuselage exterior left hand side between the two canopy openings. A micro-switch shall be installed in the canopy securing latch to prevent electrical canopy actuation with the latch in the secured position.

Emergency opening of the canopies shall be as described in paragraph 3.19.1.

25 26 29 The line of vision from the pilot's cockpit shall be directly forward to a line 12-1/2 degrees below the horizontal, 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 horizontal. The pilot's cockpit shall provide 25 inches clearance across the normal shoulder location and 36 inches clearance across the normal elbow location.

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 (Operative)

- Air Conditioning (Normal/ Emergency Air Supply)
- Air Conditioning De-fog
- Engine Air Bleed Shut-Off
- Pressurization Dump
- Air Conditioning Failure
- Canopy Opening (Normal)
- Observer Bail-Out Warning
- Engine Starting or Motoring
- Engine Relight

Controls (Operative)

- Air Conditioning
- Canopy Opening (Emergency)
- Canopy Lock
- Seat Firing
- Seat Firing (Alternative)
- Seat Adjustment 1
- Manual Harness Release
- Harness Reel
- Leg Restraint Disconnect

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3.7.3.1 Pilot's Cockpit (Cont'd)

Switches Operative

Fire Warning and Extinguishing
Second Shot Fire Extinguishing
Fire Extinguishing Crash Switch
Engine Fuel (Normal/Emergency)
Low Pressure Fuel Cocks
Fuel Cross Feed
External Tank Jettison
Master Electrical
Alternator
DC Reset
Taxi and Landing Lights
Navigation Lights
High Altitude Light
Warning Light Intensity
Master Warning Test
Master Warning Reset
Speed Brakes
Rudder Trim
Elevator and Aileron Trim
Flight Control:
    Damping System ON-OFF
    Damping System Engage
    Emergency Damping Engage
    Landing Gear Down Configuration 4
Press-to-transmit
UHF Antenna Selector
UHF Transfer
UHF/IFF Emergency Test
De-ice or Missile Power Supply
Stores Jettison

Switches (Non-Operative)

Nose Wheel Steering
Anti-Skid 2

Controls (Operative)

Anti-g Valve
Emergency Oxygen
    Starting
Power Control (Throttles)
External Tank Manual
    Jettison
Cockpit Lighting ON-OFF
    and Intensity
Rudder Pedal Adjustment
Landing Gear
Drag Parachute
Parking Brake
UHF Radio AN/ARC-52
Intercom AN/AIC-10A
Radio Compass AN/ARN-6
IFF AN/APX-25A
J-4 Compass

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3.7.3.2 Observer's Cockpit

Instruments, warning indicators, and the following items of functional equipment shall be installed in the observer's cockpit.

Switches (Operative)	Controls (Operative)
Canopy Opening (Normal)	Canopy Opening (Emergency)
Press-to-transmit	Canopy Lock
Muting (Communication)	Seat Firing
UHF Transfer	Seat Firing (Alternate)
UHF/L Band Antenna Selector	Seat Adjustment
	Manual Harness Release
	Harness Reel
	Leg Restraint Disconnect
	Anti-g Valve
	Emergency Oxygen Starting
	Cockpit Lighting ON-OFF and Intensity
	UHF Radio AN/ARC-52
	Radio Compass AN/ARN-6
	Intercom AN/AIC-10A

2

3.7.4 Cargo Compartments

Not applicable.

3.7.5 Equipment Compartments (See pages 10 & 11 for diagrams) 1

Compartments and bays listed in the following sub-paragraph shall be provided for the equipment and components of propulsion, armament, electronics, and services systems. 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).

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3.7.5.1 Nose Electronics Compartments

The radar nose shall comprise three compartments for electronic equipment. The forward compartment shall comprise a detachable nose cone and the forward portion of the fuselage structure. Access to the forward compartment shall be provided by removal of the nose cone, and by access doors at the aft end of the forward compartment. The two aft compartments shall comprise the fuselage structure area forward of the pilot's cockpit. Access to the aft compartments 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 airframe services equipment. Conditioned air shall be supplied to the battery and to the forward end of the well. Structure adjacent to the battery shall be suitably treated against corrosion. Access shall be gained by opening the wheel well door.

3.7.5.3 Fuselage Electronics Compartment

6 The fuselage electronics compartment shall be located immediately forward of the arament pack bay. Conditioned air shall be supplied to the compartment and installed equipment. Access shall be provided through hinged doors on the underside and sides of the fuselage.

3.7.5.4 Air Conditioning Equipment Bay

An air conditioning equipment bay shall be located aft of the oxygen equipment bay and forward services bay. The bay shall be supplied with conditioned air. Access to the bay shall be provided by removal of a section of the dorsal fairing, an air outlet duct, and a shear panel.

3.7.5.5 Oxygen Equipment Bay

The oxygen equipment bay shall comprise the dorsal fairing area immediately aft of the rear cockpit. Conditioned air shall be supplied to the installed equipment. Access shall be gained through a door in the dorsal fairing.

3.7.5.6 Weapon Pack Bay

The weapon pack bay shall comprise a recess in the underside of the fuselage designed to permit the installation of a removable instrumentation pack. Conditioned air shall be provided to the weapon pack bay 1

3.7.5.7 Airframe Services Bays

The fuselage area aft of the nose wheel well and the

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3.7.5.7 Airframe Services Bays (Cont'd)

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.

3.7.5.8 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. Access to the compartment shall be provided by removal of a section of the dorsal fairing.

3.7.6 Speed Brakes

Two speed brakes, of aluminum alloy box panel construction, shall be installed on the underside of the duct bay section of the fuselage. Each brake shall be retracted and extended by an actuator powered by the utility hydraulics system. The brakes shall retract into sealed wells 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

7 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 centre line. The nose gear shall retract forward into the nose fuselage. The hydraulic actuating system shall be designed to retract the gear, including door operation, in 10 seconds at -20°F and 30
69 seconds at -65°F. When completely retracted the landing gear shall be enclosed within the faired lines of the wing and front fuselage.

A 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 RCAF Specification AIR 7-4, and ARDCM 80-1, 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 and telescopic spring strut shall be installed to position the gear during retraction.

The upper end of each main landing gear strut shall comprise an integral transverse shaft pivoted at the front and main spars near the outer end of the inner wing. The main strut shall be braced by a drag strut and a telescopic downlock strut.

3.8.2.2 Wheels, Brakes, and Brake Controls

114 The main wheels shall be demountable and fitted with anti-friction bearings and hydraulically operated multiple disc brakes.

63 The hydraulic pressure available for normal brake operation shall be a maximum of 2500 psi, and for emergency operation 1
a nominal maximum of 1500 psi (Reference paragraph 3.14.1.1.3).

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

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

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 an accumulator shall permit at least three full applications of the brakes.

The main wheel brakes shall be applied automatically during the retraction cycle and released automatically when the landing gear is in the locked up position.

3.8.2.3 Tires

Tubeless tires (USAF 29 x 7.7 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, to Specification Dowcan 200.

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, a mechanical linkage shall draw the shock absorber into the main landing gear strut and rotate the bogie, and a telescopic spring strut shall position the unloaded bogie in a front wheel down attitude to permit stowage of the retracted gear within a wing wheel well.

3.8.2.5.2 Extension

Each main landing gear shall be extended outward and aft by gravity and aerodynamic drag until a downlock is engaged.

During the extension cycle, the gear shall be lengthened and locked, and the bogie rotated to lie parallel to the airframe longitudinal axis.

3.8.2.5.3 Locking

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

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3.8.2.5.4 Controls and Indicators

A pilot operated landing gear retraction and extension selector lever 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 actuated by 75% full extension of the main landing gear shock absorbers. The actuation of the landing gear and the landing gear locks shall be sequenced in relation to the actuation of the landing 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 dual purpose red warning light shall be installed in the knob of the selector to indicate that either the landing gear is in motion and not locked up or down, or at altitudes below 10,000 ft., that both engine throttle levers are retarded to 1/3 full throttle or less, and the landing gear is retracted.

An indicator with one green and one red light for each
107 landing gear unit shall be installed. The associated electrical circuit shall be designed to furnish indication as follows:-

(a) An individual green light indication for each landing gear unit when the unit is locked down (tri-light green indication when all three units are locked down).

(b) An individual red light indication for each landing gear unit when the unit is not locked up or down (tri-light red indication when all three units are unlocked).

(c) Red and green lights extinguished when the corresponding landing gear unit is locked in the up position (no-light indication when all units are locked up).

The indicator shall embody a duplicate set of three filament lamps for the green lights with a change-over switch on the indicator face for selection of either set of filament lamps.

3.8.2.5.5 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 nitrogen charge into the landing gear sub-system to release all locks, actuate the doors, and permit the main

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3.8.2.5.5 Emergency Extension (Cont'd)

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 axis end of the main landing gear. The main door shall be hinged parallel to the aircraft centre line and hydraulically actuated. The outer door shall be hinged parallel to the main gear axis line and actuated by a linkage to the main landing gear leg.

The main door shall be locked in, and unlocked from, the down position by a lock within the door actuator. The main door shall be locked in the up position by mechanically engaged locks which shall be releasable by hydraulic actuators.

The main door and door lock actuation shall be 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 actuator.

3.8.3 Auxiliary Landing Gear (Nose Gear)

3.8.3.1 Description

The 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 hinge on shafts supported by fittings projecting forward from the rear cockpit aft bulkhead. The strut shall be braced by a folding, lockable drag strut. A pneumatic spring strut shall be installed to assist shock absorber extension during gear retraction.

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 wheels, and for shimmy damping.

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3.8.3.1 Description (Cont'd)

104 The nose wheels shall castor up to 55° on either side of the airframe centre line. Shimmy damping restrictor valves shall be installed in the steering actuator hydraulic circuit.

3.8.3.2 Wheels

The wheels shall be demountable and shall be retained on a splined live axle by lockable axle nuts.

3.8.3.3 Tires

A tubeless tire (USAF 18 x 5.5 Type VII E.H.P.) rated at 5,050 lb. static load when inflated to 175 psi, shall be installed on each nose wheel.

3.8.3.4 Shock Absorbers

The shock absorber 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, to Specification Dowcan 200.

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 by a hydraulic actuator until an uplock is engaged. During the retraction cycle a telescopic pneumatic spring shall assist the extension of the unloaded liquid spring shock absorber thus assuring positive landing gear positioning in the nose wheel well.

3.8.3.5.2 Extension

The nose landing gear shall be extended aft by gravity and aerodynamic 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.

3.8.3.5.4 Controls and Indicators

The nose landing gear shall be controlled in conjunction with the main gear. The nose landing gear position and warning system shall be as described for the main gear (Reference paragraph 3.8.2.5.4).

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3.8.3.5.5 Emergency Extension

The emergency extension of the nose landing gear shall be effected by the means employed for the main landing gear (Reference paragraph 3.8.2.5.5). With the nose landing gear fully extended a sequence valve shall permit the pressurized nitrogen to close the nose gear door.

3.8.3.6 Steering Control

66 Not applicable. 1

3.8.3.7 Doors and Fairings

The retracted nose landing gear shall be enclosed within the 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. The door shall be locked in the up position by mechanically engaged locks which shall be releasable by a hydraulic actuator.

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

3.8.3.8 Inspection and Maintenance

Access to the nose landing gear for inspection and maintenance shall be possible by ground operation of the wheel well door.

3.8.4 Drag Chute

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 spring loaded latch with a solenoid operated safety catch. The 6
doors shall maintain the skin line when in the closed position and shall retract to a position inside the adjacent skin surface when chute deployment is selected. Visual indication that the latch is engaged shall be provided by a plunger in the rear fuselage skin.

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3.8.4.1 Description (Cont'd)

A press-to-test light shall be installed adjacent to the
left-hand speed brake to provide ground indication that 6
the solenoid catch is engaged.

An indicator flag shall be installed on the underside of the rear fuselage to provide chute non-stowage indication.

3.8.4.2 Release Gear

39 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 6
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 airframe structure by a shear pin which shall permit break-away at a predetermined load.

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3.9 Surface Control System

41 The surface control system shall be a fully powered, hydraulically actuated, irreversible system, and shall be designed to 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
42 hydraulic power circuits. Normal Mode control for the elevators
and ailerons shall be effected through command electro-hydraulic
servos, and Emergency Mode control effected through hydraulically-
boosted mechanical linkages installed to control the surface
actuator valves. Normal and Emergency Mode control for the
rudder shall be effected through the damping system. Pilot 2
artificial feel systems shall be provided for both the Normal
and Emergency Modes of control.

A system shall be installed to provide artificial damping. In the Normal Mode of control the system shall provide damping about all three axes, stability augmentation in yaw, and sideslip minimization in maneuver. In the Emergency Mode of control the system shall provide yaw axis damping and stability augmentation in yaw.

Speed brakes powered by the Utility Hydraulic System shall be installed.

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 in the Normal and Emergency Modes of Control.

Mode and function selection controls shall comprise an ON-OFF
power supply control switch, a Normal Mode engage switch, and
a landing gear down configuration switch, installed on the
pilot's console. An Emergency Mode selection switch shall be 2
installed on the pilot's control column grip.
4

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3.9.1 Primary Flight Control System (Cont'd)

The Emergency Mode of control shall be in an operable configuration at all times when the surface control hydraulic system is suitably pressurized, and either mode has been selected. The Emergency Mode shall automatically become the effective mode of control in the event of failure of the Normal Mode.

The following damper system warning lights shall be installed in the pilot's warning indicator panel:

One to indicate no mode has been selected (damper out).
One to indicate Emergency Mode has been selected.
One to indicate disengagement of the roll and/or
pitch axis of the damping system (Ref. para. 3.9.5). 4

An indicator light shall be installed to indicate when the landing gear and the landing gear configuration of the damping system are not in the same position.

Indication of flying control system hydraulic power failure shall be provided by two warning indicator lights and the Master warning indicator lights (Reference paragraph 3.14.1.2.1).

3.9.1.1 Elevators

The control column shall be linked to elevator actuator control valves by bell cranks, quadrants, cables and push rods. The linkage shall include a hydraulic booster
with a damper in parallel with the booster valve. Stick 1
force transducers installed in the control column shall transmit the pilot's input stick forces when in Normal Mode as electrical command signals through an amplifier to the elevator parallel (command) servo. The command
38 signals shall be limited such that "g" load commands are maintained within the operational limitations established for the airframe. The parallel servo shall be connected by a mechanical linkage and a hydraulic booster to the control valves of the elevator hydraulic actuators. In the Emergency Mode of control the parallel servo shall be in idling configuration, with the control column movement transmitted through the mechanical linkage and booster to the actuator control valves.

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3.9.1.2 <u>Ailerons</u>

The control column shall be linked to aileron actuator control valves by bell cranks, quadrants, cables and push rods. The linkage shall include a hydraulic booster with a damper in parallel with the booster valve. Stick 1
force transducers installed in the linkage shall transmit the pilot's input stick forces when in Normal Mode as electrical command signals through an amplifier to the aileron parallel (command) servo. The command signals shall be limited such that roll rates are maintained within the operational limitations established for the airframe. 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 in idling configuration, with the control column movement transmitted through the mechanical linkage and booster to the actuator control valves. Upward deflection of both ailerons at altitudes above approximately 45,000 ft. shall be provided by electrically actuated bias of the aileron control quadrant bell crank linkage, the actuator being controlled by an aneroid switch.

3.9.1.3 <u>Rudder</u>

Co-ordinated rudder control in the Normal Mode and Emergency Mode of control shall be provided by the damping system (Reference paragraph 3.9.5).

A mechanical linkage comprising bell cranks, quadrants, cables, and push rods shall connect the rudder pedals to the rudder hydraulic actuator control valves to permit the pilot to over-ride the damping system rudder co-ordination function during maneuvers requiring unco-ordinated control. A hydraulic damper shall be installed in series with the rudder actuator control valve.

3.9.1.4 <u>Artificial Feel</u>

Artificial feel shall be provided for the Normal Mode and the Emergency Mode of control. The Normal and Emergency Mode systems shall provide landing gear up and landing gear down configurations with appropriate feel. Landing gear configuration and feel shall be selected by operation of the landing gear configuration switch (Reference 3.9.1).

With Normal Mode landing gear up feel the stick force, except for breakout force, to trim the elevators in level flight shall be essentially zero, and the elevator stick force per "g" and the aileron stick force per unit rate of roll shall be essentially constant for all flight conditions.

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3.9.1.4 Artificial Feel (Cont'd)

With Normal Mode landing gear down feel and Emergency Mode feel, the feel characteristics shall be such that the stick forces shall be proportional to control surface deflection, resulting in variable stick forces to trim the elevators in level flight, variable elevator stick forces per 'g', and variable aileron stick force per unit rate of roll.

3.9.1.4.1 Normal Mode Artificial Feel

Normal Mode artificial feel for the elevators shall be provided by feel springs and parallel servo reactions. The feel spring earthing point shall be monitored by the differential pressure across the piston of the parallel servo operating a trim motor such that the feel springs relieve the servo load.

Normal Mode artificial feel for the ailerons shall be provided by the parallel servos which shall provide feel reaction against control column movement.

A rudder feel and trim unit shall be installed and shall incorporate an electrically driven adjustment linkage which shall automatically limit the rudder deflection for
a given rudder pedal load to three preset values. Maximum 1
deflection per unit of rudder pedal load shall be possible with the landing gear extended. Transfer to an intermediate limit of deflection shall be effected by landing gear up selection. Transfer to a minimum limit of deflection shall be effected by a pressure switch actuated by compressible dynamic pressure. A warning light in the front cockpit shall indicate failure of this unit. An override switch shall
permit return to maximum deflection in the event of failure 9
of the unit.

3.9.1.4.2 Emergency Mode Artificial Feel

Elevator and aileron 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 elevator feel unit, providing additional feel in proportion to the 'g' load in the pitch axis. The effect of the bob-weight shall be balanced by a spring at one 'g' loading. The rudder feel shall be as described for the Normal Mode.

3.9.1.5 Cable Tensioning Devices

40 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.

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3.9.1.6 Vulnerability and Duplication

37 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 hydrau-
39 lic 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 (Flaps)

Not applicable.

3.9.2.2 Speed Brakes

Two rectangular speed brake panels shall be installed on the underside of the fuselage, the panels being extended 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 actuators through a hydraulic selector valve. (Reference paragraph 3.14.1.1.4.)

3.9.3 Trim Control Systems

Aircraft trim for both the Normal and Emergency Mode of control shall be effected by the actuation of an elevator and aileron trim selector button installed on the control column grip, and a rudder trim switch installed on the pilot's left hand console. A control surface position indicator shall 1
be installed on the pilot's left hand console.

Elevator and aileron trim adjustment for the Normal Mode of control shall be provided by an electrical trimming unit which shall provide a signal to substitute for the stick force transducer signals with a resultant zero stick force.

Elevator and aileron trim for the Emergency Mode of control shall be provided by trim units repositioning the earthing point of the feel units. Rudder trim for both the Normal and the Emergency Mode shall be provided by the rudder feel and trim unit (Reference paragraph 3.9.1.4.1.).

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3.9.4 Automatic Mode of Control

Not Applicable. 2

3.9.5 Damping System

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

A flying control system failure in the yaw axis shall automatically transfer the damping system to emergency operation.

Damping system warning indication shall be provided by the flying control system indicator lights (Reference paragraph 3.9.1).

Electrical power for operation of the damping system shall be provided by the main airframe system power supply (Reference paragraph 3.16.1.1). In the event of a double AC generator failure, electrical power for emergency damping shall be provided by the emergency AC generator and battery.

3.9.5.1 Normal Damping

Normal operation shall provide automatic damping of short period oscillations about the three axes, control of spiral stability, and sideslip minimization in maneuvers, in conjunction with the Normal Mode of control.

Provision shall be made in the rudder damping circuit to permit the pilot to produce limited intentional sideslip at high speed.

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3.9.5.1 Normal Damping (Cont'd)

For low speed flight provision shall be made for a landing gear down configuration of the damping system. The control characteristics of the landing gear down configuration shall be:

(a) Stick feel shall be proportional to surface position.

(b) The effect of side slip minimization shall be reduced.

To safeguard the aircraft in the event of failure of the normal damping system, duplicate maneuver sensitive pitch axis cut-out switches ("g" limiters), a maneuver sensitive roll axis cut-out switch (roll rate limiter) and duplicate maneuver sensitive yaw axis transfer switches to disengage normal damping and engage the yaw axis emergency damping (rudder monitors) shall be installed. The switches shall be set to function prior to the structural integrity limits of the aircraft being exceeded. It shall be possible to re-engage normal damping by means of the "engage" switch in the pilot's cockpit (Reference paragraph 3.9.1). To prevent structural damage due to inertia-cross-coupling effects at high rolling velocities, the maximum command rate of roll shall be automatically decreased whenever sufficient sideslip occurs to extend approximately half the allowable structural loads.

Air data from pitot and static systems, (Reference paragraph 3.13.2.1), shall be utilized with data from the damping system flight sensing instruments (gyros, accelerometers) for scheduling of aileron, elevator and rudder control signals. These scheduled signals shall be continuously transmitted by amplifier to the appropriate servos operating the control surfaces. In response to the applied signals the servos shall operate the hydraulic valves which control the surface hydraulic jacks resulting in adjustment of the control surfaces according to the sensed aircraft stability requirements, and pilot's commands.

3.9.5.2 Emergency Damping

The emergency damping shall effectively comprise 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.

3.9.6 Inspection, Maintenance and Repair

Means of access to the control system shall be through panels, provided where necessary.

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3.10 Engine Section

3.10.1 Description and Components

The engine bay and rear fuselage shall form an integral part of the fuselage structure and shall house two power plants.

3.10.2 Construction

Construction shall be in accordance with paragraph 3.7.2.

3.10.3 Engine Mounts

The engine mounts of each engine shall provide two planes of attachment for securing the engine to the airframe structure. Two mounts in a forward plane and three mounts in the rear plane shall be designed to carry all engine loads.

The mounts in the forward mounting plane of each engine shall comprise an upper centre spigot designed to accept longitudinal and side loads, and an inboard suspended side support strut designed to carry vertical loads. The upper centre spigot, housed in the wing structure, shall engage a fitting on the engine vertical centre line. The inboard side support strut shall be suspended from an attachment on the wing structure and shall mate with a fitting on the engine horizontal centre line.

The mounts in the rear mounting plane of each engine shall comprise one upper centre lateral strut designed to accept side loads, and two suspended side support struts designed to carry vertical loads. One end of the lateral strut shall attach to a supporting bracket on the wing centre box and the other end shall mate with an attachment on the engine vertical centre line. Each side support strut shall be suspended from fittings located between two beams in the centre trailing edge region and the lower ends of the struts shall pick up on the engine adjacent to the engine horizontal centre line.

The mounting provision for each engine shall be designed to permit all adjustments necessary for correct engine installation and alignment. The mounts shall be designed to permit linear expansion between the front and rear engine mounting planes.

Access openings shall be provided on the wing upper surface to facilitate insertion and removal of all engine mounting struts except the inboard forward mounting strut. The inboard forward mounting strut shall be accessible through an access door on the underside of the fuselage.

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3.10.4 Vibration Isolation

Not applicable.

3.10.5 Fire Walls

Each power plant installation shall be enclosed by a
48 titanium shroud providing isolation of the hot zone
(Zone 2) of the Iroquois engine from the fuselage
45 (Reference paragraph 3.11.2). The wet zone (Zone 1)
of the Iroquois engine shall be isolated from the hot 1
zone (Zone 2) by a shroud integral with the engine.

3.10.6 Cowling and Cowl Flaps

Not applicable.

3.10.7 Inspection and Maintenance

47 Access doors shall be provided for inspection, maintenance, removal and installation of engines and accessories. Additionally the nacelle tail cones and the stinger shall be removable for engine change.

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

3.11.1 Engines
The aircraft shall be powered by two de-rated Iroquois turbo-jet engines, with the installed thrust estimated on the basis of information defined by Orenda Engines Ltd. memo G-50-10-14 dated Nov. 9/58 and the following table contained in Orenda Engines Ltd. memo dated Oct. 9/58.

		See Level Static		Mach 1.5, 50,000 ft.	
		Engine	Engine With A/B	Engine	Engine with A/B
Thrust	(lb.)	17,400	22,900	4,700	8,100
J.P.T.	($^{\circ}$C)	660	660	660	660
S.F.C.	$\left(\frac{\text{lb./hr.}}{\text{lb.}}\right)$	.91	2.25	1.25	2.30
T_4	($^{\circ}$K)	1,180	1,180	1,180	1,180
N_L	(r.p.m.)	5,150	5,150	5,100	5,100
N_H	(r.p.m.)	7,650	7,650	7,650	7,650

1

3.11.2 Engine Installation
Titanium shrouds supported by aluminum formers shall form a tunnel for each engine.

All services shall enter the engine tunnel in the region of the access doors in the underside of the engine bay, and shall be quickly detachable to facilitate engine removal.

Engine mounts shall be in accordance with paragraph 3.10.3.

43 Engine removal and installation, when carried out using suitable ground servicing equipment, and excluding control set-up and synchronization, shall be possible within 30 mins. 1
Each engine shall be guided from the engine stand into the
49 mounting position by means of an engine roller which runs on a longitudinal rail installed on the outboard side in the engine tunnel. Securing of the engine mounts shall lift the engine sufficiently to clear the rail and permit removal of the roller.

3.11.3 Engine Driven Accessories

3.11.3.1 Description
An AC generator, with a constant speed drive, shall be mounted on the accessories pad at each engine inlet face. An oil system for a constant speed drive fluid coupling and generator cooling shall be installed. The oil system shall be pressurized to 9.3 psi (nominal) utilizing air from the pneumatics system (Reference paragraph 3.15.1.2.3). Cooling shall be provided for the system oil by heat exchangers (Reference paragraph 3.11.6.2). The power take-off located on the underside of each engine shall be utilized to power a remote gear box through a drive shaft. The drive shaft to each gear box shall incorporate a quick disconnect at each end.

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3.11.3.2 Remote Gear Boxes and Drives

Two airframe accessories gear boxes shall be installed in the service bay between the engines. Each gear box shall be shaft driven from the adjacent engine power take-off. The two gear boxes shall each drive three hydraulic pumps and provide a power take-off to drive a shaft to a fuel booster pump. The gearbox oil system shall be pressurized to 9.3 psi (nominal) utilizing air from the pneumatics system (Reference paragraph 3.15.1.2.3). Cooling shall be provided for each gear box oil by heat exchangers (Reference paragraph 3.11.6.2).

3.11.4 Air Induction System

3.11.4.1 Description and Components

44

An air intake shall be located outboard on each side of the crew stations. Each shall be approximately "D" shaped and external compression shall be achieved by a 12° wedge shape ramp attached to the side of the fuselage. Each duct shall diverge from 6 square feet at the minimum throat area (approx. 7.5 inches aft of the inlet face) to 7.06 square feet at a station 10.12 feet aft of the minimum throat area, then hold a constant diameter circular section back to the engine compressor face.

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 bled off through a porous strip on the ramp parallel to the duct intake face and discharged through a reverse scoop on the underside of the ramp.

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 with an orifice which automatically increases in area when afterburning is selected. At speeds below Mach 0.5 (approx.) the annular area between the end of the afterburner exhaust nozzle and the engine shroud shall serve to eject cooling air.

At speeds above Mach 0.5 (approx.) the annular area around the afterburner nozzle shall serve as an exit for ram cooling air. Two nozzle area indicators, one left hand and one right hand, shall be installed in the front cockpit to provide positive indication of exhaust nozzle actuation with selection of afterburning. 1
Two jet pipe temperature gauges, one for each engine, shall be installed in the front cockpit to provide indication of turbine outlet exhaust gas temperature .

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3.11.6 Cooling System

3.11.6.1 Engine Cooling

At speeds less than Mach 0.5 (approx.) ventilating and cooling air shall be drawn into the engine bay through inwardly opening doors by the ejector action of the exhaust system annular nozzle (Reference paragraph 3.11.5). The doors shall be installed in the sides and undersides of the fuselage adjacent to the engine compressor and turbine regions. At speeds in excess of Mach 0.5 (approx.), spring loaded gills installed in the tunnel upstream from the forward periphery of the engine shall be opened by the differential pressure between the bypass annulus and the air intake duct to admit ram cooling air. The ram cooling air shall flow around the engine and accessories and leave the engine bay via the exhaust system annular nozzle.

Two warning lights, one left-hand and one right-hand, shall be installed in the front cockpit to indicate engine cooling air overheat.

3.11.6.2 Heat Exchangers

A fuel cooled heat exchanger, comprising eight separate cooling segments, shall be installed in the service bay. Two segments shall be commoned and utilized to cool the utility hydraulic oil, one segment shall be utilized to cool the hydraulic oil of each of the two flying control hydraulic systems, one segment shall be utilized to cool the oil of each of the two constant speed drive and generator cooling oil systems, and one segment shall be utilized for cooling the oil of each of the two airframe accessories gear boxes.

Two composite air cooled heat exchangers, each comprising four separate units, shall be located beneath the respective engine. At speeds above Mach 0.5 (approx.) the heat exchangers shall be cooled by air directed through spring loaded doors installed on the lower surface of each engine intake duct forward of the engine face. The left hand heat exchanger units shall be utilized to cool the hydraulic oil of one of the flying control hydraulic systems, constant speed drive and generator cooling oil, and airframe accessories gear box oil (one unit shall be inoperative). The right hand units shall provide cooling for the second flying control hydraulic system oil, constant speed drive and generator cooling oil, airframe accessories gear box oil, and the utility hydraulic system oil.

3.11.7 Lubrication System

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

3.11.7.1 Description and Components

For details of engine lubrication, see Orenda Engines Ltd. Specification EMS-8.

Low oil pressure warning lights shall be installed in the pilot's warning indicator panel.

3.11.8 Fuel System

62 A pressurized fuel system of sufficient capacity to meet engine requirements shall be installed in the aircraft.

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

61 Full fuel flow to the engines during inverted flight shall be provided for 15 seconds at sea level, or for approximately 45 seconds at 50,000 feet altitude.

3.11.8.1 Description and Components

The fuel system shall be basically divided into left-hand and right-hand sub-systems. One tank in each sub-system shall be utilized as a main (collector) tank.
58 Fuel shall be transferred from auxiliary tanks to main tanks by means of tank pressurization, and from the main tanks to the engine feed manifolds by an engine driven booster pump submerged in each main tank. In the event of pump failure, tank pressurization shall provide fuel flow through a by-pass around the inoperative pump.

An electrical sequencing control system for each fuel sub-system shall comprise a control unit, liquid level sensors, and fuel-no-air valve over-ride solenoids which shall be installed to sequence fuel transfer from the auxiliary tanks to the main tank.

The control unit shall be utilized to establish and maintain the sequence of tank usage. The fuel-no-air valve override solenoids shall be energized by the control unit to maintain the valves in the closed position, with the exception of the fuel-no-air valve override solenoid of the first auxiliary tank in the sequence which shall remain de-energized. The fuel-no-air valve override solenoid of the following auxiliary tanks in sequence shall be de-energized, in turn, by accepting signals from the liquid level sensors of the preceding tank in the sequence.

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3.11.8.1 Description and Components (cont'd)

The fuel content of the collector tank shall be monitored such that if the content is below 90% of the collector tank capacity the solenoid override of the fuel-no-air valves of the next auxiliary tank in sequence shall be de-energized, permitting fuel flow from two tanks simultaneously. If the content of the collector tank is below 70% of capacity, fuel flow shall be provided simultaneously from three consecutive tanks in the sequence.

In the event of power input failure, all fuel-no-air valve override solenoids shall be de-energized permitting fuel transfer from all auxiliary tanks.

59 A manually selected cross-feed shall be installed between the engine feed lines to permit transfer of fuel from either sub-system to both engines, or in the event of single engine operation, from either sub-system to either engine.

Fuel shut-off valves shall be installed adjacent to the engine fire walls to provide for isolation of each engine. Switches shall be installed in the front cockpit for control of the firewall fuel 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 CGSB-3-GP-22b (MIL-F-5624C Grade JP4), limited operations and ferry mission use of Aviation Turbine Fuel Type I CGSB-3-GP-23b (MIL-F-5616 Grade JP1), and for limited ferry mission use of Aviation Fuel CGSB-3-GP-25c (MIL-F-5572A).

3.11.8.3 Fuel Tanks

3.11.8.3.1 Internal Tanks

57 Twelve wing tanks and two fuselage tanks shall constitute the main fuel storage and shall be divided into a left-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 fuse-
64 lage tank. One wing tank in each system shall serve as a main (collector) tank.

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

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3.11.8.3.2 Tank Capacities

Tank design shall be based on the use of fuel with a specific gravity of .75, and shall provide for an expansion space of a minimum of 3% of the normal fuel capacity.

The tanks shall have the following capacities:

Tank No.	Number Of Tanks	Gross Capacity Of Tank Imp. Gal.	Useable Capacity Of Tank Imp. Gal.	Total Useable Fuel Capacity Imp. Gal.
1 (Fuselage)	1	283	252	252
2 (Fuselage)	1	280	254	254
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
				2492
External (Fus.)	1	525	500	500
				2992

3.11.8.4 External Fuel Tank

Complete provision shall be made for the carriage of an external drop tank. When installed, the tank shall be hung from the fuselage lower surface by a forward bomb slip release attachment and an aft release linkage. (Reference paragraph 3.11.8.16). The drop tank shall be braced by two floating compression struts, one attached to the upper arc of each side of the tank. Fuel shall be transferred from the drop tank to the main (collector) tanks through a dry disconnect valve and a spring loaded coupling with fuel transfer effected by pressurized air from the fuel pressurization system.

118 Transfer of fuel shall be controlled by the sequencing control system (Reference paragraph 3.11.8.1), with the drop tank emptying first in sequence. When the drop tank is installed, the sequencing control unit shall close the fuel-no-air valves of the first auxiliary tanks in sequence by energizing the fuel-no-air valve override solenoids. A liquid level sensor shall be installed in the external drop tank to; de-energize

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3.11.8.4 External Fuel Tank (Cont'd)

the fuel-no-air valve override solenoids of the first auxiliary tanks permitting sequence continuation, close the pressurization supply air shut-off valve, and provide cockpit indication when the drop tank is empty.

A fuel filler cap incorporating a manual air release valve, designed to prevent cap removal until tank pressure has been released, shall be installed on the tank forward upper surface.

3.11.8.5 Piping and Fittings

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

3.11.8.6 Valves

Valves and other components of the fuel system shall be designed to withstand the appropriate environment and operating fluid, including air, fuel vapour, and fuels to the specifications designated in paragraph 3.11.8.2.

3.11.8.7 Strainers and Filters

An eight mesh strainer shall be installed at the inlets of each booster pump. A 200 mesh filter shall be installed in the feed line to each engine.

A two hundred mesh screen filter shall be installed in the pressurization line from the pneumatic system to filter the pressurization air. A drain plug shall be provided on the filter.

3.11.8.8 Quantity Gauges, Flowmeters, and Indicators

53 A capacitance type fuel quantity gauging system which utilizes sensors separate from the fuel sequencing system, shall be installed. Two quantity gauges, indicating in pounds the quantity of fuel in each sub-system, shall be installed in the front cockpit.

Five warning lights shall be installed in the front cockpit to provide indication of the following:

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3.11.8.8 Quantity Gauges, Flowmeters, and Indicators (Cont'd)

(a) Low fuel in right-hand main (collector) tank
(b) Low fuel in left-hand main (collector) tank
(c) Engine fuel low pressure right-hand (Reference para. 3.11.10.2)
(d) Engine fuel low pressure - left-hand
(e) Drop tank empty/Drop tank jettison failure

3.11.8.9 Purging and Explosion Suppression System

54 Not applicable.

3.11.8.10 Pressurization

The fuel system shall be pressurized utilizing air from the pneumatics system (Reference paragraph 3.15.1.2) to transfer fuel, to forestall fuel boiling at altitude and to provide pressure for defueling.

All fuel tanks except the main (collector) tanks shall be pressurized at 19 psia (nominal). Pressure regulating valves shall be installed to control tank pressure. An air extractor shall be installed in a vent line from the main tanks to provide a low pressure sink to which air from the main tanks shall be extracted under low altitude high rate transfer conditions. Source of energy for the extractor shall be the pressurization air from the pneumatics system.

Pressure relief valves which vent to atmosphere shall be installed in the main pressurization lines to the fuel tanks to prevent over-pressurization in the event of a pressure regulating valve failure. Flow limiters shall be installed in the main pressurization lines to the fuel tanks to limit the flow of air to the air pressure regulators to within the capabilities of the corresponding air pressure relief valve.

The pressurization lines to individual tanks shall be appropriately sized to forestall excess spillage of air in the event of tank damage.

A negative "g" and low level air admission valve shall be installed at each main tank inlet to permit the entry of pressurization system air during final emptying of the tanks, and also to permit entry of air during periods of negative "g".

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3.11.8.11 Vent System

Outward venting for the auxiliary tanks, and the external drop tank when installed, shall be through the main pressurization line relief valve (Reference para. 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 refueling.

3.11.8.12 Refueling System (Ground)

3.11.8.12.1 Internal Tanks

51 The refueling system shall provide for pressure re-
fueling (and defueling) of internal tanks. Two ad-
aptors, one installed in each main landing gear well
shall mate with refueling nozzles Type D1 (MIL-N-
52 5877A). The adaptor in each main landing gear well
shall connect to the normal fuel transfer lines in
each sub-system. The system shall permit ten minute
refueling to the full internal fuel load specified
in paragraph 3.1.5.3.

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

65 Control selection shall be provided for full refuel, partial refuel 1, and partial refuel 2. With the selection of "full refuel", shut-off valves shall open to permit filling each sub-system to capacity through the respective adaptor. With the selection of "partial refuel 1", shut-off valves shall open to permit filling of all tanks except right-hand tank number 1 and left-hand tank number 7. With the selector switch set at "partial refuel 2" shut-off valves shall open to permit filling of all tanks except right-hand tanks number 1 and 3 and left-hand tanks number 7 and 8.

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3.11.8.12.2 External Tanks

A refueling point shall be provided on the drop tank. Provision shall be made for automatic release of tank pressure prior to removal of the tank filler cap (Reference paragraph 3.11.8.4).

3.11.8.13 Refueling System (In Flight)

Not applicable.

3.11.8.14 Drainage

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

A combination condensate and drain valve shall be provided in the external dropable tank. Each booster pump shall be provided with a seal drain connected to the vent system.

3.11.8.15 Defueling Provisions (Ground)

3.11.8.15.1 Internal Tanks

Defueling shall be accomplished through the two fuel servicing adaptors. Fuel from the internal tanks shall be transferred to the adaptors through the normal fuel transfer lines by pressurizing the tanks from a ground supply. After defueling of the auxiliary tanks is complete, fuel shall be removed from the main tanks by suction of the ground service unit. All valves shall be appropriately positioned by selection of "defuel" on the control panel (Reference paragraph 3.11.8.12.1).

3.11.8.15.2 External Tanks

Defueling shall be accomplished through the drain outlet on the bottom of the tank (Reference paragraph 3.11.8.14).

3.11.8.16 Fuel Jettisoning

3.11.8.16.1 Internal Tanks

Not applicable.

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3.11.8.16.2 External Tank

An external tank jettison switch shall be installed in the front cockpit to electrically release the forward bomb slip attachment, permitting the forward end of the tank to drop. The rear attachment linkage shall be automatically released by downward movement of the tank.

A mechanical release, operated by a control in the front cockpit, shall be installed for release of the bomb slip attachment in the event of failure of the electric release.

The tank shall be automatically jettisoned:

(a) by depression of the stores jettison switch; or

(b) by depression of the missile firing trigger during attack.

Cockpit indication of tank jettison failure shall be provided.

3.11.8.17 Inspection and Maintenance

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 controls for each power plant shall comprise an engine starting switch, an engine relight button, and a throttle lever.

3.11.10.2 Engine and Afterburner Control

The throttle levers shall be mounted on a quadrant on
24 the left-hand console and shall provide for selection
of a full range of powers with positions for "off" 10
89 "idle", "afterburner off", "afterburner on", and "maximum".

Initial movement of the throttle levers shall open the high pressure fuel cocks and complete a ground circuit

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3.11.10.2 <u>Engine and Afterburner Control</u> (Cont'd)

for the engine starting control relay. Forward movement of the throttle levers through a spring gate at approximately 85% throttle travel shall be required for "afterburner on" selection. Rearward movement of the levers through a spring gate at approximately 70% throttle travel shall be required for "afterburner off" selection. Rearward movement of the throttle levers through a spring gate, 10
from the "idle" position, shall be necessary to permit selection of "off".

Variation in afterburner thrust with full engine thrust shall be possible between the "afterburner on" and "maximum" throttle positions. Variation of engine and afterburner thrust, with afterburning selected, shall be possible between the "afterburner on" position and "afterburner off" throttle spring gate. With afterburner selected unrestricted movement shall be permitted between the afterburner off throttle spring gate and the maximum position.

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

A normal/emergency switch shall be installed in the front cockpit to provide the pilot with emergency (manual) control of the engine fuel metering in the event of failure of the engine automatic fuel metering controls. A warning light shall be installed in the front cockpit to indicate that the emergency (manual) fuel control valve has been actuated to the emergency position. Two warning lights, one left-hand and one right-hand, shall be installed in the front cockpit to indicate each of the following:

(a) Low pressure at the engine fuel inlet.

(b) Overspeeding of engine rotors.

(c) Low level in the reservoir of the engine hydraulic system which actuates the afterburner nozzle.

(d) Low pressure in the engine hydraulic system.

Two gauges, one left-hand and one right-hand, shall be installed in the front cockpit to provide indication of fuel
pressure at the engine fuel inlet. 1

Two tachometers for each engine, one to provide indication of low rotor RPM and one to provide indication of high rotor RPM, shall be installed in the front cockpit.

3.11.10.3 <u>Induction Air Controls</u>

Not applicable.

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3.11.10.4 Starter Controls

Two START-OFF-MOTOR switches shall be installed on the right-hand console in the front cockpit. With the throttle levers positioned (Reference paragraph 3.11.10.2), selection of "start" shall permit the electrical power supply circuits to the starting external air supply control valves and to the engine igniter systems to be energized. Centrifugal switches shall be installed in each starter system to complete the circuits to the igniters when the engines reach light-up speed, and to break the circuits when the engines reach cutout speed. Selection of "motor" shall permit use of the ground starting unit, and rotation of the engine without ignition, for ground test.

A relight button shall be installed in each throttle lever to permit relighting the engines in flight within the relight flight envelope.

3.11.10.5 Propeller Controls

Not applicable.

3.11.10.6 Cooling Air Control

(Reference paragraph 3.11.6.1).

3.11.10.7 Water Injection Controls

Not applicable.

3.11.11 Starting System

An air turbine starter, powered from a ground source, shall be installed on each engine. 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 <u>Auxiliary Power Units</u>

Not applicable.

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3.13 Instruments and Navigational Equipment

Instrument arrangement shall be as agreed upon between the RCAF and the Company. 2

3.13.1 Instruments

3.13.1.1 Pilot's Instruments

3.13.1.1.1 Flight Instruments

Mach/Air Speed Indicator 2
Rate of Climb Indicator
Turn and Bank Indicator
Pressure Altimeter
Accelerometer
Sideslip Indicator (Ref. Para 3.13.2.2).
Artificial Horizon 2
Angle of Attack Indicator.

3.13.1.1.2 Navigation Instruments

Clock
Radio Magnetic Indicator 2

3.13.1.1.3 Engine Instruments

Engine Fuel Pressure Gauges
Tachometer High Speed Rotor (2) 1
Tachometer Low Speed Rotor (2)
Jet Pipe Temperature Gauges (2)
Nozzle Area Indicators (2)
Fuel Contents Indicator (2) (Ref. Para. 3.11.8.8).

3.13.1.1.4 Miscellaneous Instruments

Skin Temperature Indicator 2
Cabin Altimeter (Ref. Para. 3.22.1.1.1).
Oxygen Quantity Gauge (Ref. Para 3.21.1.4).
Landing Gear Position Indicator (Ref. Paras. 3.8.2.5.4, and 3.8.3.5.4).
UHF Channel Selection Indicator.
Control Surface Position Indicator. 2

3.13.1.2 Observer's Cockpit

3.13.1.2.1 Navigation and Tactical Navigation Instruments

Clock
Total Fuel Indicator (Complete Provision Only) 2
Oxygen Quantity Gauge.

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3.13.2 Air Data System

An air data system comprising pitot-static, relative wind
sensing, and skin temperature sensing shall be installed to 2
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. A pitot-static probe 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 a fin probe 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 2
system. One nose static pressure source shall supply
the front cockpit altimeter, normal damping system,
and aileron deflection aneroid switch. The second nose
static pressure source shall supply the rate of climb
indicator, indicated airspeed indicator, cockpit pressure
regulators, and cockpit safety valve controller.

Pitot and static pressure from the fin probe shall be supplied to the emergency damping system.

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 to the damping system and 2
the angle of attack indicator, 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 probe shall be installed externally
on the underside of the nose fuselage. Skin temperature
shall be converted to electric signals to be fed to the 2
skin temperature indicator.

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3.13.2.4 Deleted. 2

3.13.3 <u>Navigational Equipment</u>

The navigational radio and radar aids shall be as described in paragraph 3.17.

3.13.3.1 <u>J-4 Compass</u>

A J-4 type compass system shall be installed to provide indication of the magnetic heading of the aircraft on a 2
radio magnetic indicator in the front cockpit. A controller incorporating the system switches and controls shall be installed in the front cockpit.

The system shall operate on 115 volt AC power obtained through a star to delta transformer from the main electronic supply system, and 27.5 volt DC power obtained from the emergency DC bus. In the event of failure of the main AC supply, AC power shall be supplied by the emergency generator through the star to delta transformer.

3.13.4 <u>Installation</u>

22 The instruments and main instrument panels shall be installed in accordance with the requirements of Specifications AIR 7-4, 1
23 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.

3.13.4.1 <u>Instrument Markings</u>

Markings on all contractor furnished integrally lit instruments shall be in accordance with Specification MIL-L-25467A. Contractor furnished instruments other than those integrally lit shall have markings in accordance with RCAF Specification MAT 1-2.

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3.13.4.1 Instruments Markings (Cont'd)

Range and limit markings shall be applied to all instruments requiring such markings.

3.13.4.2 Inspection and Maintenance

All instruments and connections thereto shall be accessible without removal of other instruments or equipment. The main instrument panel shall be designed to permit quick removal for inspection and maintenance.

3.13.5 Test Instrumentation

Test instrumentation shall be installed in accordance with paragraph 4.3.

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3.14 Hydraulic Systems

3.14.1 Description and Components

Three separate 4000 psi main hydraulic systems shall be installed:

A utility services system to operate the landing gear, wheel brakes, speed brakes, and emergency AC generator drive. 1

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

2

The systems shall be designed in accordance with the requirements of Specification MIL-H-5440A 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 circuit, and two in each of the two flying control system power circuits. Three compensators, one for each system, shall provide fluid reserve and pump inlet pressurization.

Hydraulic power shall be provided for emergency operation of the brakes. Pressurized nitrogen shall be provided for emergency extension of the landing gear.

3.14.1.1 Utility Services System

A constant delivery hydraulic pump shall be driven by each of the two airframe accessories gear boxes (Reference paragraph 3.11.3.2). The output from the pumps shall be combined at a pressure regulating and check valve and shall be utilized to power the utility services and charge two accumulators.

The output of one accumulator shall be utilized to maintain power circuit pressure, and the output of the second accumulator shall be reduced to 1,500 psi and utilized for the emergency brake supply and to pressurize three compensators, one in the utility hydraulic system return line, and one on each flying control system hydraulic return line.

The compensator of the utility hydraulic system shall be designed to pressurize the return fluid at 90 psi (nominal) and to separate air from the fluid. It shall be possible to manually ground bleed the separated air from the compensator.

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3.14.1.1 Utility Services System (Cont'd)

Air cooled and fuel cooled heat exchangers shall be installed to limit the temperature of the hydraulic fluid at the pump inlets (Reference paragraph 3.11.6.2).

Two warning lights shall be installed in 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 falls below 1,600 psi in the accumulator utilized for emergency braking.

The utility hydraulic system shall be so designed that in the event of partial failure the following services shall be available under the conditions specified. The term "engine failure" shall denote an engine that has flamed out and is windmilling.

System	One Engine Failed or Equivalent Partial Loss of Power	Double Engine Failure or One Engine Seized One Engine Failed
(a) Undercarriage - Lowering	Available	Available
(b) Speed Brakes - Limited Operation	Available	Available
(c) Wheel Brakes - Limited Operation	Available	Available
(d) Stores jettison-capability	Available	Available

3.14.1.1.1 Landing Gear Sub-System 1

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 lines to the landing gear and door actuators. Normal actuation shall be controlled by solenoid operated selector valves signalled from a manually operated selector lever installed in the front cockpit.

A switch shall be installed for ground operation of the nose wheel well door.

A pneumatic release valve, mechanically linked to the landing gear selector lever, shall be installed to release nitrogen from a 5000 psi storage bottle to effect

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3.14.1.1.1 Landing Gear Sub-System (Cont'd)

landing gear emergency extension.

3.14.1.1.1.1 Retraction

On 'up' selection, a nose landing gear door solenoid operated selector valve shall be energized to open the nose landing gear door. In the fully open position, the door shall actuate a limit switch to energize the landing gear selector valve, which shall hydraulically release all gear downlocks and raise the gear until the uplocks engage mechanically. With the nose landing gear in the locked up position, a limit switch shall energize the nose landing gear door selector valve to permit hydraulic pressure to release the door downlock and raise the door until the door uplock engages mechanically. For the main landing gear, 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. With the complete landing gear in the fully up and locked position, the landing gear selector valves shall be de-energized to vent the landing gear sub-system to the utility services return line.

3.14.1.1.1.2 Extension

'Down' selection shall hydraulically release all landing gear door uplocks and lower the doors until the downlocks are engaged. As each door approaches the fully open position, a controllable check valve shall permit hydraulic release of the gear uplock, and hydraulically operate a transfer valve. The transfer valve shall provide a run-around circuit for the landing gear actuator, permitting the gear to fall by gravity and aerodynamic drag forces until a downlock engages mechanically. With the nose landing gear down, the nose landing gear door selector valve shall be energized to permit hydraulic pressure to release the door downlock and raise the door to the up position.

3.14.1.1.1.3 Emergency Extension

Emergency down selection shall permit a supply of nitrogen from the emergency nitrogen storage bottle to enter a landing gear emergency extension circuit. The emergency circuit shall permit the compressed nitrogen to simultaneously release all gear and door uplocks, operate the door actuators, and operate the

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3.14.1.1.1.3 Emergency Extension (Cont'd)

landing gear transfer valves. The landing gear shall extend by gravity and aerodynamic drag, and lock in the down position. In the final stages of travel the nose landing gear shall actuate a valve permitting the compressed nitrogen to close the nose gear door.

3.14.1.1.2 Nose Wheel Shimmy Damping Sub-System

A double ended hydraulic actuator shall be installed for nose wheel shimmy damping. Shimmy damping restrictor valves shall be installed to permit a restricted run-around hydraulic circuit to provide a shimmy damping and hydraulic assist to nose wheel centering (Reference paragraph 3.8.3.6).

3.14.1.1.3 Wheel Brakes Sub-System

The hydraulic pressure available for normal brake application shall be maximum of 2500 psi reduced from the 4000 psi utility hydraulic system. Pressure available for emergency brake application shall be a nominal maximum of 1500 psi reduced from a 4000 psi accumulator. 1

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. On landing gear up selection hydraulic pressure from the landing gear sub-system shall be automatically applied to the wheel brake control valves. With the landing gear in the retracted position the brakes shall be de-pressurized in conjunction with the landing gear sub-system. Locking of the brakes for parking shall be controlled from the front cockpit (Reference paragraph 3.8.2.2). 1

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In the event of normal supply pressure failure, the emergency brake pressure shall be routed to the shuttle valve and to the brakes. 1

3.14.1.1.4 Speed Brakes Sub-System

Two hydraulic actuators, one for each of the two speed brakes, shall be controlled by a selector valve in

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3.14.1.1.4 Speed Brakes Sub-System (Cont'd)

conjunction with a three-position switch. The actuation mechanism shall be designed to limit the degree of speed brake extension in relation to the speed brake design limit hinge moments. A relief valve shall be installed within the selector valve to permit blow back of the speed brakes as a function of limiting hinge moments.

3.14.1.1.5 Emergency AC Generator Drive

The emergency AC generator drive shall comprise a hydraulic motor to drive an AC generator to provide power for essential services during a double engine failure. (Reference paragraph 3.16). When the rotational speed of both engine low pressure compressors reaches a low wind-milling rate the emergency generator drive motor shall automatically become energized.

3.14.1.1.6 Deleted. 1

3.14.1.2 Flying Control Systems

3.14.1.2.1 Flying Control System Power Circuits

The two flying control hydraulic systems shall comprise an "A" system and a "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 (Reference paragraph 3.11.3.2). The output of the two pumps for each system shall be combined and utilized to power control surface actuators and servo units.

An accumulator shall be installed in each system to damp out surges set up by operation of the control actuators.

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

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3.14.1.2.1 Flying Control System Power Circuits (Cont'd)

in either power circuit to 1000 psi or less. 7

The flying control hydraulic system shall be so designed that in the event of partial failure control shall be available to the extent specified under the following conditions:

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One Engine Failed or Equivalent Partial Loss of Power	Double Engine Failure	One Engine Seized One Engine Failed
Sufficient power to provide system operation under normal flight conditions	Sufficient power to maneuver the aircraft toward a suitable ejection area.	Sufficient power to maneuver the aircraft toward a suitable ejection area.

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. Dual boosters shall be installed in the aileron & elevator control linkages, actuated by 500 psi pressure reduced from the pressure in the main power circuits. A dual differential servo control unit shall 1
be installed on the rudder actuator to permit rudder damping signalled hydraulic operation from either the "A" or "B" system.

Two command (parallel) servo control units shall be installed and powered from system "B" to permit 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

Air cooled and fuel cooled heat exchangers shall be installed to limit the temperature of hydraulic fluid at the pump inlets to 225°F (approx.) (Reference paragraph 3.11.6.2).

A compensator designed to pressurize the return fluid

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3.14.1.2.3 Flying Control Systems Return Circuits (Cont'd)

at 90 psi nominal and to separate air from the fluid shall be installed in the return circuit of each of the two flying control systems. Except during engine starting the compensators shall be pressurized 8
through 1,250 psi pressure control valves by the respective flying control power circuit. During engine starting pressurization shall be automatically supplied by the emergency brake accumulator. It shall be possible to manually ground bleed the separated air from each compensator.

3.14.1.2.4 Deleted. 2

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.

Line type filters shall be installed in the pressure lines to the aileron and rudder control actuators. 1

3.14.1.4 Inspection and Maintenance

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

Pressure and return line self-sealing couplings for a hydraulic test stand shall be installed in each system to permit system testing with the engines inoperative. System filling shall be accomplished through the return line couplings.

1

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3.14.2 Hydraulic Fluid

The hydraulic system shall be designed for the use of hydraulic fluid to Specification CGSB-3-GP-269 (MIL-O-5606).

3.14.3 Piping and Fittings

71 All hydraulic lines, with the exception of 3/4 inch and 1 inch diameter low pressure lines, shall be of stainless steel in accordance with specification AVROCAN M-7-14. Low pressure lines of 3/4 inch and 1 inch diameter shall be of aluminum alloy to specification MIL-T-7081.

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3.15 Pneumatic System

94 The low pressure pneumatic system shall comprise two sub-systems which shall utilize pressurized air from the air conditioning system. Ground operation of the pneumatic services shall be possible by utilization of air supplied by a ground service.

A ground chargeable high pressure storage bottle shall be installed in the aircraft to supply nitrogen 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) and as additionally stated herein.

3.15.1 Description and Components

The low pressure pneumatic system shall comprise the following sub-systems:

(1) A services sub-system for:

(a) Canopy seal inflation 1
(b) Anti-G suit inflation
(c) Instrumentation pack seal inflation

(2) A pressurization sub-system for:

(a) Fuel tank pressurization
(b) Fin waveguide pressurization
(c) Constant speed drive and airframe accessories gearbox oil pressurization

3.15.1.1 Services Sub-System

The services sub-system shall utilize air at 65 psig (maximum) tapped from the downstream side of the air conditioning system air cooling water evaporator (Reference paragraph 3.22.1.3.2). A filter, which incorporates a drainable moisture trap, shall be installed in the sub-system supply line.

3.15.1.1.1 Canopy Seal Inflation

Air for canopy 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 and as a pressure relief valve at pressures in excess of 25 psig. A check valve shall be installed to prevent back flow of air from the seals. With the solenoid in the de-energized position, the valve shall vent seal pressures. The control solenoid shall be electrically linked to the canopy latches of both cockpits. Failure of the canopy seal inflation valve shall be indicated by a warning light in the front cockpit. 1

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3.15.1.1.2 Anti-G Suit Inflation

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A branch duct shall convey air from the services sub-system filter to an anti-G suit inflation control valve located on the right-hand side in each cockpit. Each of the two anti-G valves shall automatically control anti-G suit inflation for the occupant of the respective cockpit.

3.15.1.1.3 Deleted. 1

3.15.1.1.4 Instrumentation 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 and as a pressure relief valve at pressures in excess of 25 psig. A check valve shall be installed to prevent back flow of air from the seals. With the solenoid in the de-energized position, the valve shall vent seal pressures.

The control solenoid shall be energized by a microswitch installed on the pack. The microswitch shall be actuated by closing an access door for the pack test panel.

3.15.1.2 Pressurization Sub-System 1

3.15.1.2.1 Fuel System Pressurization Supply

Air at 65 psi (normal maximum) shall be ducted from the downstream side of the air conditioning system heat exchanger through a hot air filter and non-return valve to the fuel tank pressurizing system (Reference paragraph 3.11.8.10).

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.

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3.15.1.2.3 Constant Speed Drive and Gearbox Oil Pressurization

A branch from the fuel system pressurization ducting shall convey air to 9.3 psi (nominal) pressure regulating valves. Air at the regulated pressure shall be utilized for pressurization of the constant speed drive oil system and airframe accessories gearbox oil system.

3.15.1.3 Ground Operation

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

Air at a pressure of approximately 45 psi from a ground supply shall be necessary for ground pressurization of the fuel tanks with the engines not operating. The ground air connection shall be installed on the underside of the fuselage.

During engine starting the constant speed drive oil tank shall be pressurized to 50 psi (maximum) utilizing air from the ground air supply used for engine starting.

3.15.1.4 Inspection and Maintenance

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

3.15.2 Piping and Fittings

Low temperature pipes or ducting shall be of aluminum alloy and high temperature or highly stressed ducting shall be of stainless steel. Couplings below 1 inch diameter shall be flareless type couplings to Avro Aircraft Company Standards. Couplings of 1 inch diameter and above shall be band type couplings.

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3.16 Electrical System

The electrical system prime source of electric power shall be two engine driven 40 KVA, 208/120 volt, 3 phase, 400 cycle AC generators. The aircraft 27.5 volt DC power shall be supplied by means of two AC to DC transformer-rectifier units. The characteristics of the power supply shall be within the limits specified in specification MIL-E-7894. Additionally the voltage with balanced loads shall be within ± 1.5% of the voltage setting at the bus, and with overloads shall be within ± 3.5% of the bus setting. The steady state frequency shall be 400 cps ± 1%, and the transient frequency 400 cps ± 5%. The peak ripple voltage of the DC output shall not exceed 3.0 volts over the output range from no load to 5% full load, and 1.0 volt from 5% load to full load.

The electrical system shall be designed to the requirements of RCAF Specification AIR 7-4 except as stated herein and in Appendix II (Deviations). 1

68 The system shall be designed to supply electric power to the following services under the following emergency conditions as specified. The term "engine failure" shall denote an engine that has flamed out and is windmilling.

System	Single Engine Failure Or Equivalent Loss Of Power	Double Engine Failure Or One Engine Failed And One Engine Seized
Receiver, Transmitter, Interphone	Supplied	Supplied
IFF (Air to Ground)	Supplied	Supplied
Flight Instruments	Supplied	Supplied
Radio Compass	Supplied	Not Supplied (Heading Reference Supplied) 2
Ejection Capability (Bail-Out Warning)	Supplied	Supplied
Re-light Capability	Supplied	Supplied
Stores Jettison Capability	Supplied	Supplied
Windscreen De-Misting	Supplied	Not Supplied
Cockpit and Instrument Lighting	Supplied	Not Supplied (Map Lighting Only Supplied)

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3.16 Electrical System (Cont'd)

System	Single Engine Failure Or Equivalent Loss Of Power	Double Engine Failure Or One Engine Failed And One Engine Seized	
Automatic continuous transmission of UHF and IFF if aircraft abandoned.	Supplied	Supplied	2
Emergency Damping	Supplied	Supplied	2
Engine Emergency Fuel Selection	Supplied	Supplied	
Fire Detection and Extinguishing	Supplied	Supplied	

3.16.1 General Description

3.16.1.1 AC System

The AC system shall be a three phase, four wire, star connected, neutral ground system.

Power drawn from one AC generator shall be utilized for airframe electrical services, and power drawn from the other AC generator shall supply the power requirements of the aircraft electronic systems. Provision shall be made for cockpit indication of power failure, automatic transfer of the primary loads to the operative AC generator, and disconnection of secondary AC services in the event of failure of one AC generator.

3.16.1.2 Emergency AC System

An emergency AC system shall be installed to supply alternating current to the services listed under para. 3.16 in the event of failure of the normal supply due to double engine failure. The power shall be supplied by a hydraulic motor driven emergency AC generator.

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3.16.1.3 DC System

The DC system shall be a single, grounded negative 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 or single transformer-rectifier unit failure.

3.16.1.4 Emergency DC System

A battery shall be installed to supply emergency DC power. Distribution of power to the emergency services shall be 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 of failure of both transformer-rectifier units. With the master switch in the off position, (Reference paragraph 3.16.2.5) the supply of power to the emergency bus shall be discontinued, and only those services connected to the battery bus shall be supplied with power.

3.16.1.5 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 airframe services.

3.16.2 Electrical Power Supply

3.16.2.1 AC Generators

Two 40 KVA, 208/120 volt, 3 phase, 400 cycle, AC generators shall be installed, one in the nose bullet of each engine. Each generator shall be engine driven through a constant speed drive fluid coupling.

Cooling for each AC generator shall be provided by oil from the associated constant speed drive oil system (Reference paragraph 3.11.3.1).

A 1.8 KVA 208/120 volt 3 phase, 400 cycle emergency AC generator driven by a hydraulically operated motor shall be installed in the airframe services bay. 1

3.16.2.2 Battery

116 A 24 volt, 15 amp hour, nickel cadmium storage battery shall be installed in the nose wheel well. The battery connectors shall be to MS 25182. 1

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3.16.2.2 Battery (Cont'd)

The battery shall normally be connected to the battery bus. When engine starting power supply is connected, the battery circuit shall automatically open permitting the DC services on the emergency and battery buses to draw current from the ground source only. Cooling air for the battery shall be supplied by the air conditioning system.

3.16.2.3 Voltage Regulators

Four voltage regulators, part of the control/transformer rectifier units, shall be installed in the airframe services bay to provide voltage regulation of each AC generator output and each transformer rectifier output. Cooling for the control/transformer rectifier panels shall be provided by the air conditioning system.

3.16.2.4 Protective Devices

AC overvoltage, undervoltage, and overcurrent; and DC overvoltage, undervoltage, and reverse current protection shall be provided in accordance with the requirements of MIL-E-7894.

3.16.2.5 Controls

A master ON-OFF power supply switch shall be installed in the front cockpit. Two AC generator failure warning lights, and two TRIP-RESET switches to permit individual control of each generator 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 4.5 Kw transformer rectifiers, one located in each control/transformer rectifier panel, shall provide for the conversion of AC power to 27.5 volt DC power.

3.16.4 Equipment Installation

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

3.16.5 Wiring

(74) to (84) The installation of all wiring in the airframe shall be 1

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3.16.5 Wiring (Cont'd)

in accordance with Specification MIL-W-5088A.

3.16.6 Bonding and Shielding

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

3.16.7 Controls

20 Rheostats, resistors, and switches shall be installed in accordance with the requirements of Specification MIL-E-7563 and/or MIL-E-7080.

Circuit breakers shall be installed in accordance with
the requirements of Specification MIL-E-7614. Damping
32 system circuit breakers shall be located on the left-
hand console in the front cockpit. All other circuit
breakers shall be located on a panel in the nose wheel
well.

Current limiters shall be installed to 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
106 cockpit to provide protection for the cockpit lighting
circuits.

3.16.8 Lighting

3.16.8.1 Interior Lighting

The interior lighting, comprising instrument, console panel, and map lighting, shall be installed in accordance with Specification CAP 479, MIL-P-7788, MIL-L-6503A, and MIL-L-25467A.

3.16.8.1.1 Instrument Lighting

Instruments shall be integrally lit or shall be illuminated by post type red lights.

3.16.8.1.2 Console Panel Lighting

Console panel lighting shall consist of plastic plate
type red lighting and hooded type red flood lights.
Two high altitude white flood lights shall be installed 3
in the front cockpit.

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3.16.8.1.3 Interior Illumination Controls

Three continuously variable transformers shall be installed in the front cockpit to provide illumination control. One transformer shall control the console flood lights, one shall control the plastic plate lighting, and one shall control the integrally lit instruments and post type red lights.

Two continuously variable transformers shall be installed in the rear cockpit. One transformer shall provide illumination control for the plastic plate type red lighting and integrally lit instruments, and the post type red lights, the other transformer shall provide illumination control for the console flood lights.

An ON-OFF switch shall be provided in the front cockpit for the high altitude white flood lights.

3.16.8.1.4 Map Lighting

A combination red and white flood lamp with an integral intensity control shall be installed in each cockpit to provide illumination for map reading. The map lights shall be connected directly to the emergency DC bus for use as emergency lighting.

3.16.8.2 Exterior Lighting

The exterior lighting, comprising navigation lights, taxi light, and landing light, shall be installed in accordance with RCAF Specifications AIR 7-4 and CAP 479. 1

3.16.8.2.1 Navigation Lights

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

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 swivel. 1

3.16.8.2.3 Landing Light

A landing light shall be installed on the nose landing gear assembly.

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3.16.8.2.4 Exterior Lighting Controls

Controls for exterior lighting shall be located in the front cockpit. A STEADY-OFF-FLASHING switch shall be installed for navigation light selection. An OFF-TAXI-LAND switch shall be installed for landing light and taxi light selection. On selection of "land" both the landing and the taxi light circuits shall be energized.

3.16.9 Ignition System

The engine ignition system shall be in accordance with Orenda Specification EMS-8. Switches located in the front cockpit shall provide for selection and control of engine starting.

3.16.9.1 Engine Starting

Two START-OFF-MOTOR switches shall be installed on the right hand console in the front cockpit to provide control of DC power to the relevant engine igniter system and to an 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 Power Receptacles

An external power receptacle for ground supply of AC power shall be installed in accordance with Specification MIL-E-7563. The receptacle shall conform to ABC Standard 12/7 and shall be suitable for mating with an automatic quick disconnect plug. DC power shall be provided through the aircraft transformer rectifier units.

117 An external receptacle suitable for mating with an automatic quick disconnect connector shall be installed for ground supply of DC power during engine starting and for engine starting control. 1

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 ground potential on landing.

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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.

3.16.10.4 Grounding Jack

A grounding jack shall be installed adjacent to the main AC external supply plug to facilitate attachment of a pull-away quick disconnect grounding cable.

3.16.11 Indicators

3.16.11.1 Master Warning Lights

34 One red and one amber master warning light shall be installed on the main instrument panel. Each light assembly shall em - body two bulbs connected in parallel. The red warning light shall indicate fire detection and the amber warning light shall indicate trouble in any of the circuits, (except Engine 7
Emergency Fuel On) designated on a warning indicator panel.

Master warning light illumination intensity shall be controlled in conjunction with the warning indicator panel lights.

3.16.11.2 Warning Indicator Panel

34 A panel with provision for 38 warning indicators shall be installed in the front cockpit to provide, in conjunction with the master warning lights, indication of specific system failure or system malfunction.

The following warning lights shall be incorporated in the panel:

2 Fuel Low Level L.H. and R.H.
1 Engine Emergency Fuel Control Selected.
2 Engine Fuel Pressure L.H. and R.H.
2 Oil Pressure L.H. and R.H.
2 Flying Control Hydraulic Pressure "A" and "B"
1 Utility Hydraulic Pressure
1 Emergency Brake Hydraulic Pressure
2 AC Generator Failure L.H. and R.H.
1 Battery in Use
1 DC Failure L.H. or R.H.
2 Rotor Overspeed L.H. and R.H. 4
1 (Flying Control System) Damping out
1 (Flying Control System) Emergency Damping on
1 Damping System Roll and/or Pitch Axis out
2 Engine Air Bleed Failure 4
1 Air Conditioning Failure

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3.16.11.2 Warning Indicator Panel (Cont'd)

1 Cabin Pressure or Canopy Seal Failure 1
1 Ice Warning
1 External Tank Empty Jettison Failure
1 Airframe Services Bay Overheat
2 Engine Hydraulic Low Level L.H. & R.H.
1 Rudder Feel Unit qc Actuator 1
2 Engine Overheat L.H. and R.H.
2 Engine Hydraulic Low Pressure L.H. & R.H. 1
4 Spare

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 and the master warning lights.

3.16.11.3 Fire Warning

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

3.16.11.4 Landing Gear Position and Warning Lights

A warning light in the landing gear selector lever and a composite landing gear position indicator shall be provided as described in paragraphs 3.8.2.5.4 and 3.8.3.5.4.

3.16.11.5 Bail-Out Warning

A bail-out warning system shall be installed as described in paragraph 3.19.1.4.

3.16.11.6 Landing Gear Configuration Warning

A warning light to indicate that the landing gear and damping system landing gear configuration are not in phase shall be installed on the main instrument panel in the front cockpit. 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 electrical system where necessary. Interference limits and methods of measurement for all installations shall be to the requirements of MIL-I-6051 and MIL-I-6181B.

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3.16.14 Inspection and Maintenance

85 Provision shall be made for the inspection, maintenance,
86 removal, and re-installation of electrical equipment.

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3.17 Electronics Installations

108 The following telecommunication and navigation equipment shall be installed:

Command Set	AN/ARC-52
Interphone	AN/AIC-10A
Radio Compass	AN/ARN-6
Identification Equipment	AN/APX-25A

Structural provision shall be made for the installation of 2
the following equipment: 2

Homing Adaptor	AN/ARA-25

A J-4 Compass system shall be installed (Reference paragraph 3.13.3.1).

The electronics system shall be installed in accordance with the requirements of Specification MIL-I-8700 and MIL-W-5088A except as stated herein and in Appendix II (Paragraph 3.16.5 shows wiring deviations against Specification MIL-W-5088A).

Conditioned air for pressurization and cooling within the electronic compartments shall be supplied by the air conditioning system (Reference Section 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 structure or flush with the skin. The radio controls and selector switches shall be conveniently located in the console panels of the respective cockpits.

3.17.1 Communication Equipment

3.17.1.1 Command Set

An AN/ARC-52 type UHF transceiver shall be installed to provide air-to-air and air-to-ground communication facilities on 1750 channels, any eighteen of which may be preset. The equipment incorporates a guard channel receiver tuned to a preset guard frequency with the main receiver selected to any other frequency. Provisions shall be made in the system for utilization of the AN/ARA-25 UHF homing adaptor (Reference paragraph 3.17.2.6).

A UHF remote control unit for the main transceiver shall be installed in each cockpit to permit selection of any of the

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

3.17.1.1 Command Set (Cont'd)

eighteen preset channels, selection of the guard channel, or selection of a manually set channel. The control unit in the rear cockpit shall also permit manual setting of 1,750 channels. An indicator shall be installed on the pilot's instrument panel to provide indication of the selected preset channel.

Circuits shall be provided to operate the transmitter tone modulated on a single designated distress frequency. These circuits shall be operated by the seat microswitches (Reference Section 3.19.1.6). An override test switch shall be installed in the front cockpit for the purpose of testing the emergency function of the UHF and IFF system.

A press-to-transmit button shall be installed on the inboard throttle grip in the front cockpit. A foot operated press-to-transmit switch and a foot operated muting switch shall be installed in the rear cockpit.

Two antennas to provide omni-directional coverage shall be installed for use with this equipment. A dual purpose antenna incorporating a fan shaped UHF vertical radiator shall be mounted under a fibre-glass fairing at the top of the fin, and a downward facing annular slot type antenna shall be flush mounted in the skin of the fuselage electronics compartment. A selector switch located on the front cockpit right-hand console shall provide means for connection of either antenna to the set.

The system shall normally operate on 200/115 volt AC power obtained from the main electronic supply system and 27.5 volt DC power obtained from the emergency DC bus. In the event of failure of the main AC supply, AC power shall be supplied by the emergency generator.

3.17.1.2 Liaison Set

Not applicable.

3.17.1.3 Interphone

A type AN/AIC-10A interphone system shall be installed to provide intercommunication between the crew members and to provide a means of selection and audio signal level control of the aircraft's communication and navigation radio facilities. The interphone system 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 telescramble 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).

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3.17.1.3 Interphone (Cont'd)

Electrical isolation shall be provided between the aircraft land telephone circuit and ground service circuit.

3.17.1.4 Microphone 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 combination microphone and headphone jack shall be installed on the right-hand side of each ejection seat.

Quick disconnects shall be provided for automatic separation of the microphone and headset cable connections between the crew and the ejection seat, and between the ejection seat and the airframe. (Reference paragraph 3.19.1.3).

3.17.1.5 Filters

87 Radio interference filters of the electronics system shall be integral with electronic units. Radio interference caused by the operation of the installed electronic equipment shall not exceed the limits defined in Specification MIL-I-6051 and MIL-I-6181B.

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 to provide visual bearing indication of a selected radio station on indicators located in the front and rear cockpit instrument panels. Control facilities, which provide for servo-tuning of the receiver, shall be installed in each cockpit.

A non-directional sense antenna shall be installed in the dorsal electronic compartment. A flush type directional loop shall be installed in the centre door of the fuselage electronics compartment. Matching devices shall be installed between the sense antenna and the receiver to compensate for the length of the sense antenna cable.

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

3.17.2.2 Radar Altimeter

Not applicable.

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3.17.2.3 <u>Radio Range Receiver</u>

Not applicable.

3.17.2.4 <u>Marker Beacon Equipment</u>

Not applicable.

3.17.2.5 <u>Instrument Approach Equipment</u>

Not applicable.

3.17.2.6 <u>Homing Adaptor</u>

Structural provision shall be made for the installation of a type AN/ARA-25 UHF homing adaptor with integral antenna to be used in conjunction with the UHF communication receiver to provide a continuous visual indication on two indicators of the direction of a selected UHF signal source (Reference paragraph 3.17.1.1).

3.17.2.7 <u>VHF Navigation Receiver</u>

Not applicable.

3.17.2.8 <u>Distance Measuring Equipment</u>

Not applicable.

3.17.2.9 <u>Arbitrary Course Computer</u>

Not applicable.

3.17.2.10 Deleted. 2

3.17.2.11 Deleted.

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3.17.3.1 Search Equipment

Not applicable.

3.17.3.2 Loran Equipment

Not applicable.

3.17.3.3 Automatic Ground Position Indicating Equipment

Not applicable.

3.17.3.4 Identification Equipment

A radar identification set type AN/APX-25A shall be installed to permit the aircraft to identify itself automatically when interrogated by ground or airborne L-band radars.

A control box for the set shall be installed in the front cockpit. Circuits operated by the seat micro-switches shall be provided to operate the set automatically on emergency mode when the crew seats are ejected (Reference 3.19.1.6).

Antenna requirements shall be furnished by a fan-shaped vertical radiator mounted under a fibre-glass fairing at the top of the fin, and a downward facing annular slot antenna mounted in the skin of an access panel forward of the fuselage electronics compartment.

The system shall operate on 200/115 volt AC power obtained from the main electronic supply system and 27.5 volt DC power obtained from the emergency DC bus. In the event of failure of the main AC supply, AC power shall be supplied by the emergency generator.

119 A dual-horn antenna and waveguide for an air-to-air IFF identification system shall be installed in the fin. 2

3.17.3.5 Interrogation Equipment

Not applicable. 2

3.17.3.6 Radar Beacon

Not applicable.

3.17.4 Electronic Countermeasures

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3.17.4.1 Search Equipment

Not applicable.

3.17.4.2 Analyzing Equipment

Not applicable.

3.17.4.3 Panoramic Receiving Equipment

Not applicable.

3.17.4.4 Panoramic Adaptor

Not applicable.

3.17.4.5 Direction Finding Equipment

Reference paragraph 3.17.2.6 (UHF Homer).

3.17.4.6 Transmitting Equipment

Not applicable.

3.17.4.7 Radar Homer

Not applicable.

3.17.5 Electronic Guidance System

3.17.5.1 Guide Links and System

Not applicable. 2

3.17.5.2 Television and Telemetering Equipment

Test telemetering equipment shall be installed in accordance with paragraph 4.3. 1

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.

SECRET

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3.18 Armament

3.18.1 Description

The weight and space allocated for the provision of an armament installation shall be utilized for the installation of test instrumentation required to carry out the intended role of the aircraft as a flight test vehicle. 1

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R E S E R V E D

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3.19 Equipment and Furnishings

17 18 19 Equipment and furnishings appropriate to the role of the aircraft shall be installed in accordance with the requirements of RCAF Specifications AIR 7-4 and CAP 479 except as stated in Appendix II (Deviations). 1

3.19.1 Crew Escape System

3.19.1.1 Ejection Seats

115 A fully automatic Martin Baker Mark C5 ejection seat with an ejection velocity of 88 feet per second shall be installed for each member of the crew. Each seat shall incorporate leg restraints, and a single harness to serve as a combined seat and parachute harness for the occupant. The harness shall be attached to a reel, controlled by a lever on the left hand side of the seat, to provide freedom of movement for the seat occupant. A leg restraint disconnect shall be located on the right hand side of the seat. Normal firing of the seat shall be by means of a face blind, and an alternative firing handle shall be provided on the seat pan. Provision shall be made in the seat firing mechanism to permit insertion of a safety pin to prevent inadvertent seat firing on the ground.

3.19.1.2 Emergency Oxygen System

An emergency oxygen bottle shall be installed on each ejection seat (Ref. paragraph 3.21.1). The emergency supply shall be selected automatically at bail-out.

3.19.1.3 Services Disconnect

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

Oxygen
Telecommunications
Anti-G suit

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

3.19.1.4 Bail-Out Warning System

A bail-out warning system comprising a green light in the front cockpit, and a red light and warning horn in the rear cockpit shall be installed. Operation of a switch installed in the front cockpit shall illuminate both lights and

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3.19.1.4 Bail-Out Warning System (Cont'd)

sound the horn. When the rear seat is ejected from the airframe the green light in the front cockpit shall be automatically switched off.

3.19.1.5 Emergency Canopy Opening

Emergency release of either canopy securing latch and open-
ing of the canopy shall be by means of a dual gas genera-
27 ting cartridge for each canopy, actuated by one of the
following means:

(a) Automatically, by initiation of seat ejection.

(b) By a handle in each cockpit, cable connected to the sear of the respective canopy actuating cartridge.

(c) For emergency opening from the outside, by a cable connected to the sears of the actuating cartridges of both canopies. Stowage of the exterior end of the cable shall be in an enclosed recess in the fuselage right side, forward of the engine intake ramp.

3.19.1.6 Distress Telecommunication Signals

When the seat is ejected, a micro switch incorporated in each seat installation shall switch the UHF command transmitter to transmit on an emergency frequency, and the air-to-ground IFF transponder to transmit in emergency mode.

3.19.1.7 Survival Equipment

A special pack parachute shall be installed in each ejection seat. Accommodation shall be provided in each ejection seat for a survival kit, packaged in such a way as to be compatible with the seat design.

3.19.2 Miscellaneous Equipment

3.19.2.1 Drinking Water Containers

15 Not applicable.

3.19.2.2 Crew Relief Provisions

14 Not applicable.

3.19.2.3 Compass Deviation Card Holder

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

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3.19.2.4 Pilot's Check List Holder

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

3.19.2.5 Map Stowage

Not applicable.

3.19.3 Windshield Wipers

Not applicable.

3.19.4 Furnishings

10 Insulation shall be installed on the interior of the cockpit compartment to minimize heat transfer from the adjacent skin.

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3.20 **Fire Protection**

The fire protection system shall provide for detecting over-
11 heat conditions, detecting fires, and extinguishing fires in
the airframe services bay and each power plant compartment.
12 The detection system and the extinguishing system shall be in
accordance with Specifications AIR 7-4 and CAP 479 respectively, 1
except as stated herein and Appendix II (Deviations).

3.20.1 **Description and Components**

3.20.1.1 **Detection System**

Continuous wire type fire and overheat detection circuits shall be installed for each power plant and in the airframe services bay. Red and amber warning lights located in the front cockpit shall be connected to the fire and overheat detection circuits respectively.

The fire warning lights shall comprise a master fire warning light and three location warning lights, one for each protected region. Each of the location warning lights shall be combined with a separate extinguishing switch.

Three overheat warning lights, one for each protected region, shall be installed in the pilot's warning indicator panel and shall operate in conjunction with the amber master warning light. (Reference paragraph 3.16.11.1).

3.20.1.2 **Extinguishing System**

Two triple outlet fire extinguisher bottles, each contain-
ing 12 pounds of freon, shall be installed in the airframe
88 services bay. The bottles shall be interconnected to pro-
vide a single charge to any two of the protected regions, or two charges to any one region. The extinguishing agent shall be discharged initially through stainless steel pipes and finally through high rate discharge nozzles in the wet and hot zones of each power plant installation, and in the airframe services bay.

3.20.1.3 **Fire Protection System Controls**

Actuation of the extinguishing switches shall initiate discharge of the extinguishing agent to the associated region. A toggle switch, which shall remain dead until the 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.

A switch shall be installed in the front cockpit to complete a circuit from the battery to discharge the extinguishing agent to all three protected compartments in the event of an emergency or crash landing.

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3.20.1.4 Power Supply

Power for normal operation of the 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

Externally accessible test switches shall provide for detector circuit ground testing. 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 vest operation for both crew mem- 1
bers. 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 here-
in 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, 70 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.

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 (approximately) NTP oxygen, 1
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

13 A high altitude, automatic pressure demand oxygen regulator 1
to Specification MIL-R-25572 shall be installed on each
46 ejection seat. Oxygen shall be supplied to the regulator
through a three part composite quick disconnect
(Reference paragraph 3.19.1.3).

The individual emergency oxygen supply shall feed into the normal system through a combined 70 psi reducing valve and trip valve installed on each ejection seat. The trip valve shall provide for manual selection, or automatic selection at bail-out. A dual check valve shall be installed on each seat to close the normal oxygen supply line and to permit the emergency supply to flow to the regulator.

3.21.1.4 Indicators

A capacitance type oxygen quantity gauge, incorporating an electrical "power off" warning flag, shall be installed in each cockpit to indicate the quantity of liquid oxygen contained in the converter. A switch shall be installed in

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3.21.1.4 Indicators (Cont'd)

the front cockpit for testing both quantity gauges. 1

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.

3.21.1.5 Piping

All low pressure piping 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.

3.21.2 Ground Service

The liquid oxygen supply shall be replenished by the replacement of the oxygen converter assembly with a fully charged unit. The converter assembly shall be installed in the aircraft through an access panel opening 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.

The emergency oxygen bottles shall be rechargeable through a charging valve installed on each ejection seat.

3.21.3 Inspection and Maintenance

Suitable provision 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 conditions of air temperature and/or pressure as specified herein, 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 by "Secondary Conditioning" in the table below.

Primary Conditioned	Minimum Flow lb./min	Secondary Conditioned	
Cockpits	28	Weapon Pack Bay	1
Nose Electronics Equipment Compartment.	46.5	Nose Wheel Well (Forward End)	
Battery	2.0		
Windshield Transformer	2.6		
Oxygen Equipment	4.3	Air Conditioning Bay	
Fuselage Electronics Compartment	19		
Dorsal Electronics Compartment	5		
Stable Platform	1.5		1
Transformer Rectifier Units	27		

Ground air conditioning shall be possible by utilizing conditioned air from a ground service unit connected to the system through two quick disconnects.

Air from the air conditioning system shall be utilized to supply the requirements of the pneumatic services (Reference Section 3.15).

92 The air conditioning and pressurizing system shall be designed to the requirements of RCAF Specification AIR 7-4 and ARDCM 80-1 1
95 except as stated in Appendix II (Deviations) and additionally herein.

3.22.1 In Flight Air Conditioning

Air cooled by successive stages of the system shall be mixed with thermostatically metered hot engine bleed air, to provide conditioned air to the cockpits, equipment 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.

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3.22.1 In Flight Air Conditioning (Cont'd)

Four warning lights shall be installed on the warning indicator panel in the front cockpit. Two, (one left hand and one right hand) shall indicate pressures exceeding 95 psi downstream of the engine bleed pressure reducing valves. One "air conditioning failure" light 1
shall indicate cockpit or equipment overheat, turbine outlet overheat, fuel system pressurization air supply overheat, or expansion turbine overspeed. One light shall indicate that the cockpit altitude has exceeded 31,000 feet, or that the canopy seal pressurization system has failed.

In the event of over pressure downstream of the pressure reducing valve in either engine bleed, the left hand or right hand warning light shall indicate a fault. The appropriate bleed shut-off valve shall then be closed 1
manually by a switch in the front cockpit. System design shall prevent simultaneous shut-off of both engine bleeds.

An air conditioning failure switch shall be installed in the front cockpit for operation in conjunction with the "air conditioning failure" warning light. Operation of the failure switch shall either:

(a) extinguish the failure light (thereby providing indication of cockpit or equipment overheat) and 1
simultaneously shut-off the hot air supply; or

(b) continue failure light indication (thereby providing indication of failure in one of the three remaining system failure warning areas) and simultaneously shut down the air conditioning system and select ram ventilating air.

An air supply selection control shall be installed to permit manual selection of either conditioned air or ram ventilating air.

3.22.1.1 Occupied Compartments

3.22.1.1.1 Cockpits

110 Primary conditioned air shall be supplied to the front and rear cockpits in seat back and floor regions. A manual temperature control shall be installed in the front cockpit to provide for selection of cockpit temperatures within the range of 40°F to 80°F. A de-fog switch shall be installed

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3.22.1.1.1 Cockpits (Cont'd)

112 in the front cockpit to provide selection of inlet air at $90^{o}F$ for fog dispersion.

96 A cockpit pressure regulator shall be installed to provide the following pressure schedule:*

111 (a) A cockpit to atmosphere pressure differential of zero from sea level to 10,000 feet.

(b) A linear increase in cockpit to atmosphere pressure differential from zero at 10,000 feet, to 4.25 ± 0.25 psi, at 50,000 feet.

(c) A constant cockpit to atmosphere pressure differential of 4.25 ± 0.25 psi, at altitudes above 50,000 feet.

A secondary pressure regulator shall be installed for safety operation in the event of failure of the normal regulator. The secondary regulator shall be designed to maintain the following cockpit pressure schedule:*

(a) A cockpit to atmosphere pressure differential of one psi +0, - 0.25 psi from sea level to 10,000 feet.

(b) A linear increase in cockpit to atmosphere pressure differential from one psi at 10,000 feet, to 5.30 ± 0.20 psi, at 28,000 feet.

(c) A constant cockpit to atmosphere pressure differential of 5.30, plus or minus 0.20 psi, at altitudes above 28,000 feet.

93 A solenoid operated dump valve, controlled from a switch in the front cockpit, shall be installed on the secondary pressure regulator. A cockpit air negative pressure relief valve shall be installed.

A cockpit pressure altimeter conforming to Specification MIL-I-5099A shall be installed.

* Assuming NACA Standard Atmosphere

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3.22.1.1.1 Cockpits (Cont'd)

The cockpit leak rate of the installed system shall not exceed 42.5 cubic feet per minute under the following conditions: sea level, 4.75 psi pressure differential, and 60°F temperature.

3.22.1.2 Unoccupied Compartments

3.22.1.2.1 Primary Conditioning Distribution

A system of ducts shall convey conditioned air at 70°F ± 2.5°F to all the primary conditioned equipment and equipment compartments. The air flow shall be sufficient to maintain the internal air temperature of the compartments and the air surrounding the equipment below 140°F, and to prevent the pressure altitude of the fuselage electronic compartment from exceeding 50,000 feet. An air valve, controlled by the ram air selector switch, shall be installed to stop the flow of conditioned air to the nose radar compartments on the selection of ram air.

3.22.1.2.2 Secondary Conditioned Distribution

Air from the cockpits shall be exhausted to the weapon pack bay to maintain the internal air temperature of an installed pack between 0° and 160°F. 1

Exhaust air from the radar nose, and the battery compartment shall be utilized to maintain a cooling air supply at a temperature below 160°F for equipment in the forward end of the nose wheel well. Exhaust air from the forward fuselage electronics compartment and the oxygen equipment bay shall be utilized to maintain the air in the air conditioning bay below 250°F.

3.22.1.3 Conditioning Air Supply System

Air for conditioning shall be bled from a 10th stage bleed port of each engine compressor. The air shall be passed through 60 psi pressure reducing valves and check valves, then ducted to a heat exchanger. Hot bleed air from the input side of the heat exchanger shall by-pass the system cooling components and shall be utilized for temperature control.

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3.22.1.3.1 Air to Air Heat Exchanger

An air to air heat exchanger shall be installed to provide initial cooling of the engine bleed air. On the bleed air output side of the heat exchanger, the major portion of the air shall be ducted to an air cooling water evaporator. The remaining portion of the heat exchanger bleed air output shall be utilized for fuel tank pressurization (Reference paragraph 3.11.8.10).

Cooling air for the heat exchanger shall be ducted from ram air intakes located on each side of the fuselage immediately inboard from the engine intake ramp (Reference paragraph 3.11.4.1). Cooling air, after passing through the heat exchanger, shall be vented to atmosphere.

During conditions of negative pressure in the engine intake tunnel (taxi, engine run-up, and take-off), the negative pressure shall be utilized to draw cooling air in reverse direction through the air to air heat exchanger. A three-way reverse flow valve shall be installed between the ram air duct and engine intake tunnel on each side of the aircraft to block air from the forward section of the ram duct and open a passage into the engine intake tunnel, to provide a path for the reverse flow cooling air.

3.22.1.3.2 Air Cooling Water Evaporator

The air cooling water evaporator shall have a usable capacity of 200 pounds of water and shall be designed to withstand freezing and thawing of its contents. Steam shall be vented to the cooling air duct to the air to air heat exchanger. The vent shall be designed to prevent loss of water during inverted flight or under negative "g" loads of 3g maximum.

The major portion of the air output of the cooling evaporator shall be ducted to an expansion turbine. The remaining portion of the air output shall be utilized for a low pressure pneumatic services sub-system (Reference paragraph 3.15.1).

3.22.1.3.3 Air Cooling Expansion Turbine

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An expansion turbine and compressor, together with associated equipment, shall form an air-cycle refrigeration unit.

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3.22.1.3.3 Air Cooling Expansion Turbine (Cont'd)

The expansion turbine shall dispel heat energy from the engine bleed air by utilizing the turbine's power output to drive a compressor which shall draw air from the engine intake tunnels and exhaust it overboard through a restrictor. The inlet to the expansion turbine shall comprise a variable area nozzle to control air flow in the conditioning system.

3.22.1.3.4 Deleted. 2

3.22.1.4 Ram Air Ventilation

Ram air from the left hand ram air duct (Reference paragraph 3.22.1.3.1) shall be utilized for ventilation of the cockpit and all conditioned compartments and equipment except the nose electronics. On selection of ram air, a ram air shut off valve shall open, a reverse flow valve shall open shutting off ram air to the air to air heat exchanger, the expansion turbine unit shall shut down, and a shut off valve to the nose electronics shall close. A thermostat shall be installed to override ram air selection when the ram air temperature exceeds 100°F.

3.22.2 Ground Air Conditioning

Ground air conditioning shall be possible by utilizing
4.5 psi, 55 to 70°F, conditioned air from a ground service
unit connected to the system through two automatic discon-
nect self-sealing couplings. Ducts shall be installed
90 leading from the automatic disconnect coupling to connections
into the system downstream from the expansion turbine out-
let. From the system connections, ground conditioned air
shall flow downstream through the system ducts to the
equipment compartments, and equipment.

3.22.3 Inspection and Maintenance

A momentary off switch shall be installed to shut off either engine air bleed during power plant checks. Fittings shall be installed to provide for the connection of cockpit leakage test equipment. Access doors and detachable panels shall be installed to facilitate inspection and maintenance.

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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
Air Data Sensing Heads

A power supply selection switch shall be installed in the front cockpit to permit the power supply to the engine and air intake de-icing systems to be discontinued in the event of failure of an AC generator or one transformer rectifier unit during missile firing.

Except as stated in the deviations and as additionally set forth herein, the systems shall be designed in accordance with the requirements of RCAF Specification AIR 7-4. 1

3.23.1 Propeller De-Icing

Not applicable.

3.23.2 Engine Anti-Icing

Each engine, as supplied by the engine manufacturer, shall include an integral hot air return anti-icing system as defined in Orenda Specification EMS-8.

Automatic selection of anti-icing air flow for both engines shall be controlled by icing detectors on the engine air intakes (Reference paragraph 3.23.3.1)

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. A suitably perforated boot of the same type shall be utilized to protect the air bleed area of each ramp. 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 208/120 volt AC system.

The de-icing cycle shall be automatically controlled by icing detectors, installed at the top of the engine air intakes, in conjunction with a de-icing controller which

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3.23.3.1 Engine Air Intakes (Cont'd)

actuates separate shedding distributors for the left hand and right hand intakes. Icing indication shall be provided by a warning light installed in the front cockpit. These components shall operate from the 27.5 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 energized. The boots shall be protected from overheating by thermostats and temperature control relays which override the de-icing controller signals.

3.23.4 Cockpit Transparencies

Anti-icing and anti-misting of the windshield and canopy windows in the front and rear cockpits shall be accomplished by electrically conductive transparent heating elements. These elements, dissipating approximately 5 watts per square inch, shall be bonded between the laminations of each panel. 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 Antenna Masts

Not applicable.

3.23.7 Air Data Sensing Heads

The pitot-static head, the 'alpha' vane, the 'beta' vane, the vane pedestals, and the adjacent areas of the nose boom, and the pitot-static head on the fin shall be anti-iced by integral electric heaters. The heaters shall be powered by the aircraft main AC power supply system and shall be energized by "on" selection of the master electrical switch. The heaters shall be automatically controlled to prevent overheating.

3.23.8 Landing Gear

Not applicable.

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3.23.9 Panels and Doors

Not applicable.

3.23.10 Vents

Not applicable.

3.23.11 Photographic Installations

Not applicable.

3.23.12 Inspection and Maintenance

Provision shall be made for inspection and maintenance of de-icing equipment.

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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. Special type fittings shall be provided at the nose wheel pivot for attachment of a tow bar. The turning angle limitation shall be 55° either side of neutral, thus 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 paragraphs 3.16.10.1 and 3.17.1.3). The intercom system shall provide a warning signal to the tractor driver when the maximum turning angle is approached, and a warning signal to the cockpit occupant if the tow bar shear pin fails. During towing, power to operate the interphone system shall be supplied by the towing vehicle.

103 Towing lugs shall be provided on each main landing gear unit for forward or rearward towing of the aircraft 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.

102 Provision shall be made for jacking the complete aircraft at three points, with the use of a removable jack pad at each jacking point, one on the aircraft centre line aft of the nose landing gear, and one inboard of each outer wing root.

101 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.

3.25.3 Mooring Provisions

99 100 Provision shall be made for the attachment of mooring fittings to the main and nose landing gear.

3.25.4 Hoisting Provisions

Provision shall be made for hoisting the entire aircraft from four points, two on the nose centre fuselage joint, and one on each inner wing panel adjacent to the outer wing root. The wing hoisting points are intended for emergency use only and require removal of structure.

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3.25.5 Leveling

98 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 a four degrees nose up attitude of the longitudinal axis.

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SECTION 4

TESTS

4.1 Ground Tests

Functional ground tests shall be conducted under a program established by the Company and approved by the R.C.A.F. to prove ground functioning of the airframe systems.

4.2 Flight Tests

Commencing with the first flight of the aircraft, functional flight tests shall be conducted under a Flight Test Development Program, established by the Company and approved by the R.C.A.F., to prove in-flight functioning of the airframe systems. 1

4.3 Test Instrumentation

Test instrumentation as detailed in Avro Aircraft Ltd. Report Number 72/FAR/6, necessary for conducting the tests of paragraphs 4.1 and 4.2, shall be installed. An instrumentation pack shall be installed in the weapon pack bay. 1

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SECTION 5

PREPARATION FOR DELIVERY

5.1 Acceptance Procedure

On completion of the first flight, the aircraft shall be officially transferred to and accepted by the R.C.A.F. and immediately returned to the Company on an indefinite loan basis.

5.2 Acceptance Condition

On transfer to the R.C.A.F. for acceptance the aircraft shall be as described by this specification, including all current amendments, except as limited and/or as defined in Appendix VI to this specification. 1

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SECTION 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, electrical wiring, hydraulic lines, etc. will not be required. Space provision does not imply that adequate attaching structure is provided unless otherwise stated.

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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 Specification.

6.2.2.2 Interchangeability

Interchangeability assemblies, components, and parts shall be capable of being readily installed, removed, or replaced without alteration, misalignment, or damage to parts being installed or to adjoining parts. No fabricating operations such as cutting, filing, drilling, reaming, hammering, bending, prying, or forcing shall be required. Only those tools generally available to aircraft mechanics shall be required for installation procedure. This is not intended to preclude the use of special tools, fixtures, and other shop aids during original assembly of the parts into the article.

6.2.2.3 Replaceability

Replaceability applies to parts, the installation of which may require work or operations additional to the applications of the attaching means. In general, such operations include drilling, reaming, cutting, filing, trimming, shimming, or other means normally associated with original assembly into the aircraft or guided missile. Many instances may require match drilling or reaming from the original part or portion of the item. Replaceable parts shall be designed to permit replacement under field maintenance conditions.

6.2.3 Weights

6.2.3.1 Combat Weight (1/2 Full Internal Fuel Weight)

The combat weight shall be the weight of the aircraft fully loaded less 50 percent of the usable internal fuel.

6.2.3.2 Normal Gross Weight

The normal gross weight and the normal weight for take-off shall be the weight of the aircraft fully loaded with full internal fuel.

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6.2.3.3 Gross Weight for Stress Analysis

The gross weight for stress analysis shall not be less than the normal gross weight less fifty per-cent of the combat mission fuel.

6.2.3.4 Maximum Gross Weight

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

6.2.3.5 Maximum Landing Gross Weight

The maximum landing gross weight shall not be less than the maximum gross weight less: assist take-off fuel, droppable 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).

6.2.3.6 Normal Landing Gross Weight

The normal design landing 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 items which must be expended by requirements of the mission; bombs, rockets, missiles and ammunition.

6.2.3.7 Basic Weight

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

6.2.3.8 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.

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6.2.4 **Equipment and Fluids**

6.2.4.1 Fixed Equipment

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

6.2.4.2 Removable Equipment

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

6.2.4.3 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.

6.2.4.4 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).

6.2.5 **Engine Definitions**

6.2.5.1 Maximum Rated Thrust with Augmentation

Maximum rated thrust with augmentation is the maximum thrust which the (engine) contractor specifies the complete engine will deliver with afterburner in operation at standard sea level static conditions for a duration of 5 minutes. In flight, maximum thrust with augmentation will be the thrust developed with the power lever in the "Afterburner Maximum" position. The permissible duration in flight shall be 15 minutes.

6.2.5.2 Maximum Rated Thrust

Maximum rated thrust is the maximum thrust which the (engine) contractor specifies the complete 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. The permissible duration in flight shall be 15 minutes.

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6.2.5.3 Idling Thrust

The idling thrust is the minimum developed thrust at which the (engine) contractor specifies the power unit 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. 10

6.2.6 Performance

To be added.

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APPENDIX I

EQUIPMENT LIST

Issued under separate cover.

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APPENDIX II

DEVIATIONS

1. 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: Stress analysis has been conducted on the basis that a yaw velocity of 3.5 radians per second will not be exceeded.

2. 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 Vn diagram up to and including a load factor of $1 + 2/3\Delta n$ shall be considered - -------.

Arrow requirement where $n = 7.33$ $(\Delta n = n-1)$
$1 + 2/3 \times (7.33-1) = 5.22$

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

Arrow consideration where $n_1 = 7.33$
$2/3 \times 7.33 = 4.89$

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

3. Landing Descent Velocity

Requirement: Specification MIL-S-5703, paragraph 4.2.3

-------- airplanes shall be designed for a limit V_v of 9 ft/sec at W_{L_N} and 5 ft/sec at $W_{L_{Max}}$.

Deviation: The vertical descent velocity at the Normal Landing Gross Weight (W_{L_N}) of 51,000 lb is limited to 8 ft/sec.

Reason for Deviation and Remarks: Landing gear design based on a lower Normal Landing Gross Weight.

4. Landing Gear Door Loads

Requirement: Specification MIL-S-5705, paragraph 4.4

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4. Landing Gear Door Loads (cont'd)

The doors, mechanisms and supporting structure shall be designed for opening at all speeds up to the maximum speed at which the landing gear is to be lowered and for the load factors obtainable at that speed from both a gust and maneuver standpoint. (Arrow Sea Level case; n pos. 5.1, n neg. 3.0 at 250 KT. EAS at 47,000 lb. stressing weight).

Deviation: The doors, mechanisms and supporting structure are designed for operation under acceleration normal to the flight path (up to L.G. design speed) over the range of n pos. 1.3 to n pos. 0.8, and in assymetric flight up to 10° of yaw, and with the fuselage datum up to 50° above the horizontal.

Reason for Deviation and Remarks: The specified requirement is considered unrealistic for an Arrow type aircraft. The above criteria was assessed as being adequate for the design.

5. 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 removable.

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

6. 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.

Reason for Deviation and Remarks: If hinged along the forward edge this door could not be opened with the nose jack in position.

7. 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.

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7. Tail Skid (cont'd)

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.

8. 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.

9. Anodizing

Requirement: Specification MIL-A-8625A, paragraph 3.3.5

(Type 1 - Chromic Acid Coating).

Type 1 coatings shall not be applied to alloys with nominal copper content in excess of 5.0 percent or when the total content of alloying elements exceeds 7.5 percent.

Deviation: Chromic acid anodizing processes are used on 2024 and 7075 Aluminum Alloys having alloying element contents above the maximum stated in the requirement.

Reason for Deviation and Remarks: Satisfactory results have been obtained for approximately ten years of processing using chromic acid anodizing.

10. 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.

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10. Thermal Radiation Protection (Cont'd)

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: Lack of firm directive from the RCAF on what is required.

11. 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.

12. Fire Axe

Requirement: Specification CAP 479, paragraph 23.100.

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

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".

13. 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 observer's ejection seat.

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 CF-105 Oxygen System Sub-Panel Meeting I.A.M., 23 September 1954, Item 3, paragraph 7 (a).

14. Crew Relief Provisions

Requirement: Specification CAP 479, paragraph 42.30.

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

14. Crew Relief Provisions

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.

15. 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.

16. 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: RCAF letter S1038CF105-16 (ACE) dated 9 December 1954, required mounting on right-hand side of seat.

17. 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: Stowage provision for pilot's operating instructions at present not intended.

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

18. Stowage(s) in Rear Cockpit

Requirement: Specification CAP 479, paragraph 20.62

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

18. Stowage(s) in Rear Cockpit (cont'd)

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

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

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

19. 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.

Reason for Deviation and Remarks: The RCAF 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.

20. 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.

21. 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.

22. Instrument Installation

Requirement: Specification AIR 7-4, paragraph 4.1.5 1

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

22. Instrument Installation (cont'd)

All pneumatic lines and electrical leads shall be flexible and fitted with quick disconnects and shall be of sufficient length to allow easy instrument removal.

Deviation: Instrument pneumatic lines are not fitted with quick disconnects.

Reason for Deviation and Remarks: Space and weight limitations prevent installation of quick disconnects on pneumatic lines.

23. 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 windscreen panel.

24. Power Plant Controls Identification

Requirement: Specification ARDCM 80-1, paragraphs 6A.14 and 6A.140

(1) Power plant control 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.

25. 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 12 1/2 degrees below the horizontal.

Reason for Deviation and Remarks: Windshield configuration dictated by performance requirements. Cockpit approved 15th meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33.

26. Visibility of Wing Tips 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.

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

27. 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 canopies shall be openable, but not jettisonable in flight.

Reason for Deviation and Remarks: A non-jettisonable canopy is compatible with the requirements for crew escape which are contained in RCAF Specification AIR 7-4. 1

28. 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 incorporates 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. Cockpit approved at 15th Meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33.

29. Cockpit Head Room

Requirement: Specification CAP 479, paragraph 20.21

No part of the canopy roof or canopy shall be within 8 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 1/2 inches (approximately).

Reason for Deviation and Remarks: Aerodynamic canopy contour.

29. Cockpit Head Room (Cont'd)

requirement. Cockpit approved at 15th Meeting of Co-ordinating Committee, 19th January, Item XVI, paragraph 33.

30. 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.

31. 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 25 g.

Reason for Deviation and Remarks: Recommended as design case by RCAF (Reference letter S1038-105-16 (ACE) dated 25th Jan. 1955). Complies with CAP 479 requirement para. 33.01.

32. 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: Circuit breakers, other than those in damping system circuits, are located on circuit breaker panels in the nose wheel bay. Damping system circuit breakers are located on the left-hand console in the front cockpit.

Reason for Deviation and Remarks: Limitation of space precludes the installation of all circuit breakers in the cockpit and necessitates location of damping system circuit breakers in left-hand console. (Reference RCAF letter S-1038-105-10 (ACE 9th Nov. 1956).

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.

33. Emergency Hydraulic Power

Requirement: Specification AIR 7-4 paragraph 4.11.3 1

The flight control hydraulic system shall be designed such that the following reduced engine power system requirement can be achieved:-

Double Engine Failure Sufficient power to provide adequate control of the aircraft until landing is effected.

Deviation: In the event of double engine failure the flying control hydraulic system will provide sufficient power to maneuver the aircraft toward a suitable ejection area.

Reason for Deviation and Remarks: Insufficient hydraulic power available in the event of double engine failure..

34. 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: Two master indicator lights are installed, one red and one amber. The caution indicators are amber in color.

Reason for Deviation and Remarks: The warning light system proposed by Avro was approved by the RCAF. Reference letter S1038-105-4 (ACE-1) dated 13 August 1955.

35. Flush Head Rivets

Requirement: ARDCM 80-1, paragraph 8.200

The process of shaving the heads of flush rivets to obtain maximum flushness of surface is satisfactory provided the reduction in head diameter does not exceed 5 per cent.

Deviation: The shaving of flush rivet heads with reduction in head diameter in excess of five per cent is carried out.

Reason for Deviation and Remarks: When special shallow head blind rivets are required, full head standard type rivets are installed and shaved to the shallow head dimensions.

36. 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.

36. Brake Parachute Control (Cont'd)

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. RCAF approval of parabrake control lever action or movement is contained in letter S1038-105-16 (ACE-1) dated 11 March, 1957.

37. 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.

38. Elevator Interconnection

Requirement: Specification ARDCM 80-1, paragraph 9.210 (a)

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.

39. 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.

(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.

40. 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.

41. 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.

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.

42. 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.

43. Power Plant Change

Requirement: Specification ARDCM 80-1, paragraph 15.261 (a)

No special tools, other than a power-unit sling, shall be required for power plant change.

43. Power Plant Change (Cont'd)

Deviation: A special tool is required for attaching and detaching the forward top mount on the Iroquois engine installation.

Reason for Deviation and Remarks: To simplify and speed up installation and removal procedures.

44. Engine Air Intake Screens

Requirement: Specification ARDCM 80-1, paragraph 16.625.

Where retractable inlet screens are not provided with axial flow engine, 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.

45. 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 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 rupture of either feed or return lines should occur, the whole system would be drained before the fault could be detected and shut-off valves operated. Design is based on ARDCM 80-1 requirements which are considered to be more realistic.

46. Oxygen Outlets

Requirement: Specification AIR 7-4, paragraph 4.3.5

A high altitude automatic pressure demand dual outlet oxygen regulator shall be installed on each ejection seat. The second outlets shall provide pressure to inflate the crew's pressure suits when required. 1

Deviation: The oxygen regulators installed are to Specification MIL-R-25572, modified to have only one outlet.

Reason for Deviation and Remarks: Personal equipment prescribed by the RCAF for use in the Arrow requires only one oxygen outlet for both breathing and pressure vest inflation supply.

47. 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 Nozzle

(Note: This requirement refers to engine fuel nozzles).

Deviation: The fuel nozzles are not accessible for removal, or replacement, with the engine installed.

Reason for Deviation and Remarks: Access not possible due to engine location under wing.

48. 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.

Deviation: Titanium used in place of stainless steel.

Reason for Deviation and Remarks: Weight

49. 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

49. Interchangeability of Power Plants (Cont'd)

following are handed:

(1) Front side mount, rear center mount, and engine roller.
(2) Air conditioning bleed valve.
(3) Throttle linkage. (Positioning only)
(4) Power take-off. (Positioning only)

Reason for Deviation and Remarks: Engine design dictates the necessity for handling the above items to permit an economical structure design.

50. Fuel Drain Valves

Requirement: Specification ARDCM 80-1, paragraph 15.432

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, and are not suitable for flush installation in an integral tank.

51. Refueling Connection

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

Refueling shall be accomplished through the use of a single adaptor 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.

52. Location of Refueling Adaptors

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

The ground servicing adaptor shall be located such that servicing personnel shall require no ladders, supports or elevating devices to insert the nozzle.

Deviations: Elevating devices are required to couple refueling nozzles to the two adaptors.

Reason for Deviation and Remarks: (1) RCAF requested two refueling points and accessibility to them for defueling with the aircraft resting on the bottom of the fuselage.

(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. Reference

52. Location of Refueling Adaptors (cont'd)

Minutes of 18th Meeting of Co-ordinating Committee, Item 20c.

53 Fuel Flow Meters

Requirements: Specification ARDCM 80-1, paragraph 19.241

Flow meters are required on all jet propelled aircraft-------------.

Deviation: Fuel flow meters 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

54. 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: 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.

55. 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:

Flareless type fittings to Company Specifications are used in some applications.

Reason for Deviation and Remarks:

Flareless type fittings are used in accordance with latest design practice to give a higher vibration life than may be achieved with AN type flared fittings.

56. 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 cowling or access panels. No dis-assembly of structural parts shall be required.

Deviation: Structural tie tubes must be removed to remove and install fuselage fuel cells.

56. Installation or Removal of Fuel Tanks (Cont'd)

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

RCAF approved at Co-ordinating Committee Meeting - 14 December 1955.

57. 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, right and left are located partly over the engines.

Reason for Deviation and Remarks: The aircraft layout makes the present fuel tank locations a necessity.

58. 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 large diameter pipes.

Reason for Deviation and Remarks: Inlet pipes are required to ensure flow under extreme aircraft attitudes, such as inverted flight.

59. 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.

60. Fuel System - Strike Loss

Requirement: Specification AIR 7-4, paragraph 4.8.2 1

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 then 20% of the total fuel in the tanks shall be lost or made unavailable to the engine.

60. Fuel System - Strike Loss (Cont'd)

Deviation: 50% of the fuel will be lost, if a strike is made on a main (collector) tank.

Reason for Deviation and Remarks: All fuel in each sub-system passes through the respective collector tank. Reference deviation No. 59.

61. 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)---------- .

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 main tank. Requirement not compatible with the performance of the aircraft at maximum power.

62. Fuel System Component Identification

Requirement: Specification MIL-F-8615, paragraph 3.5.

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

Deviation: No color marking will be made on fuel system components.

Reason for Deviation and Remarks: Authorized by CF-105 Co-ordinating Committee at the 23rd Meeting held 23rd November 1955.

63. Anti-Skid Brakes

Requirement: Specification AIR 7-4, paragraph 4.10.4.4. Anti-skid brakes shall be fitted.

Deviation: No provision is made for an anti-skid installation. 1

Reason for Deviation and Remarks: Anti-skid installation not yet finalized.

64. Collector Tank Outlets

Requirement: Specification ARDCM 80-1, paragraph 15.431
----a removable cover plate containing both the booster pump flange and the fuel tank sump or an inspection plate arrangement containing all units and fittings of the tank as described---------.

64. Collector Tank Outlets (Cont'd)

Deviation: The booster pumps are not mounted on removalbe cover plates.

Reason for Deviation and Remarks: Aircraft configuration dictates that the mountings, fuel outlets, and drives be on the bottom of the tanks. Structural strength requires a minimum size mounting hole. An inspection hand hole is located on the top surface of each tank.

65. Tank Selection - Refueling

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

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

Deviation: Two alternative groups of tanks can be filled, but selective individual tank filling is not provided.

Reason for Deviation and Remarks: Automatic cg control is provided by means of emptying tanks in a set sequence. Use of selective tank filling would act directly against the object of providing automatic control of cg position. (It is possible to avoid filling a battle damaged tank by disconnecting the electrical lead to the appropriate refueling servo control valve).

66. Nose Wheel Steering

Requirement: Specification AIR 7-4, paragraph 4.10.3.1 1

A fully retractable, power operated landing gear, with the nose wheel steerable, shall be fitted.

Deviation: No provision is made for nose wheel steering. 1

Reason for Deviation and Remarks: Original steering system design inadequate. Redesign in work.

67. Moisture Traps - Hydraulic System

Requirement: Specification CAP 479, paragraph 24.45

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

Deviation: No traps are provided in the hydraulic systems.

67. Moisture Traps - Hydraulic System (Cont'd)

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.

68. Emergency Electrical Power

Requirement: Specification AIR 7-4, paragraph 4.5.5 1

The electrical system shall be designed such that the following reduced engine power requirements can be achieved.

	System	Double Engine Failure
(d)	Radio Compass	Required
(h)	Windscreen de-misting	Required
(i)	Cockpit and Instrument Lighting	Required

Deviation:

(d)	Radio Compass	Not Supplied
(h)	Windscreen de-misting	Not Supplied
(i)	Cockpit and Instrument Lighting	Map Lighting only supplied.

Reason for Deviation and Remarks:

(d) Heading reference provided from flux-valve.
(h) Emergency system of sufficient capacity to provide for this requirement is not practical. Due to the configuration of the air conditioning system cockpit fogging under this emergency condition is not anticipated.
(i) Not within the capacity of present system. The other emergency requirements were assessed as taking priority.

69. 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°F range.

Deviation: Design based on a retraction time of 10 seconds at -20°F and 30 seconds at -65°F.

69. Landing Gear Retraction Time (Cont'd)

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 CF-105 Development Co-ordinating Committee's 20th Meeting, 22nd June 1955).

70. Marking of Pipe Lines and Conduits

Requirement: Specification CAP 479, paragraph 6.02

All pipe lines and electrical conduits in aircraft shall be marked in accordance with RCAF Engineering Order 05-1-2Y, Pipeline Identification, together with such additional markings as may be required by the specification governing each system.

Deviation: Fuel immersed pipes and conduits are not identified

Reason for Deviation and Remarks: No satisfactory fuel immersible tapes are available.

RCAF authorization to omit identification markings on fuel lines immersed in fuel is contained in letter S1038-105 (ACE-1) dated 15th February 57.

71. 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.

Deviation: (1) All connections shall be flareless type in accordance with Company standards.

(2) Hydraulic high pressure lines and some low pressure lines will be of stainless steel to Company specification M-7-14.

Reason for Deviation and Remarks: (1) Flareless type connections to Company Standards incorporate better sealing and strength features.

(2) Approved tubing for 4,000 psi suitable for application to Arrow design is not available.

72. 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.

Deviation: The emergency braking system is powered by an accumulator charged by the utility services main hydraulic power circuit.

Reason for Deviation and Remarks: Failure of the normal brake pressure piping in this design will not prevent operation of brakes from the emergency supply; however, failure of the emergency pressure piping up to the brake control valve will depressurize the entire utility hydraulic system. (This is similar in principle to the CF-100).

73. 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, persuant to Specification MIL-E-7563.

Deviation: 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 necessary, explosion proof type components and connectors and fuel submersible wiring are installed to avoid possible arcing and fire hazards.

The following electrically operated fuel system components and associated electrical cables are located inside the fuel tanks; tank capacitance units, fuel-no-air valves, tank shut-off valve switches, level sensing valves and level sensors.

74. Cable Grouping

Requirement: Specification MIL-W-5088A, paragraph 3.7.3.4

Unprotected wires and cables of the primary electrical power system shall not be bundled or grouped with distribution circuit wires and

74. Cable Grouping (Cont'd)

cables.

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

Reason for Deviation and Remarks: Space limitations prevent segregation of cables in certain locations. Although the runs are separated for the greater portion of their length, the main and distribution cables pass through a large conduit in the fuselage to get from the armament bay to the nose landing gear compartment. Also, to get through the bulkhead at station 485, the cables run through a hole in the bulkhead. See also Deviation number 75.

75. Cable Routing

Requirement: Specification MIL-W-5088A, paragraph 3.7.3.5

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

Main AC power cables are separate from emergency AC. Main AC power cables mainly isolated from remaining cables. Emergency AC cables are light wiring and run with distribution cabling.

Main DC cables mainly isolated from all others.
Emergency DC cables to services run with main DC lines.

Normal and emergency wiring must come together at transfer point.

For normal or emergency, control lines must run together to selector switch.

76. Pressurized Connectors

Requirement: Specification MIL-W-5088A, paragraph 3.6.6.6

Pressurized connectors shall be installed with the flange on the high pressure side.

Deviation: Pressurized connectors in cockpit are installed with flange on low pressure side.

Reason for Deviation and Remarks: Wiring installation is such that compliance with the above requirement could only have been achieved by the use of an additional connector.

77. Terminal Block Identification

Requirement: Specification MIL-W-5088A, paragraph 3.6.5.1

The identification shall be of a "permanent" nature affixed to the aircraft,---------------.

Deviation: Identification strip attached to terminal block.

Reason for Deviation and Remarks: See Company letter 5737/02B/J dated 1 December 1955 (paragraphs 33 and 34).

Identification is visible with wiring run couplers in place.

78. Wires for High Temperature

Requirement: Specification MIL-W-5088A, paragraph 3.5.1.3

In areas where the wire temperature exceeds 212°F, but does not exceed 400°F, wires in accordance with Specification MIL-W-7139 shall be installed.

Deviation: Wire to MIL-W-8777 is used.

Reason for Deviation and Remarks: Wire to MIL-W-8777 will satisfy temperature requirements up to 250°F and is less expensive and easier to print than Teflon insulated wire to MIL-W-7139.

(Note: Wire to MIL-W-8777 is not suitable for immersion in fuel and wire to AVROCAN Specification M-11-8 is used for these applications).

79. Shielded Wires

Requirement: Specification MIL-W-5088A, paragraph 3.4.1

Unless otherwise specified by the detail installation specification for the equipment involved, shielded wires shall have the shields grounded at each end to the aircraft structure.

Deviation: Shielded wires grounded at one point only.

Reason for Deviation and Remarks: To avoid electrical interference by the formation of ground loops, as for example as specified for the installation of the AN/AIC-10 equipment.

80. Conduit Fittings

Requirement: Specification MIL-W-5088A, paragraph 3.10.1.3

The use of conduit fittings shall be in accordance with Drawing AND 10380, or other applicable drawings.

Deviation: Bulkhead fittings and joints are replaced by flanges welded on conduit.

Reason for Deviation and Remarks: Standard fittings are not suitable for this application.

81. Practical Diagrams

Requirement: Specification MIL-W-5088A, paragraph 3.11.2.

Practical wiring diagrams shall be placed on junction box covers or adjacent to junction centers. 1

Deviation: No wiring diagrams are provided on junction boxes.

Reason for Deviation - Remarks: The RCAF agree that this requirement is impractical. (Reference RCAF letter S36-38-105-9 (APO-1) dated 27 November 1958.)

82. Wires and Cables - Under 600 Volts

Requirement: Specification MIL-W-5088A, paragraph 3.5.1.1.

For applications under 600 volts, wires and cables shall be in accordance with Specifications MIL-W-5086, MIL-W-7072 and MIL-C-7078.

Deviation: (1) Wire to Specification MIL-W-8777 is issued in place of wire to Specification MIL-W-5086.
(2) Cable to Specification AVROCAN M-11-9 is used in place of cable to Specification MIL-C-7078.

Reason for Deviation and Remarks: (1) MIL-W-8777 exceeds MIL-W-5086 with regard to maximum ambient working temperature.
(2) M-11-9 exceeds MIL-C-7078 with regard to maximum ambient working temperature.

83. Co-axial Connectors

Requirement: Specification MIL-W-5088A, paragraph 3.6.6.5

Connectors for co-axial cables shall be in accordance with Specifications MIL-C-71, MIL-C-3607, MIL-C-3608, MIL-C-3650 or MIL-C-3655 unless otherwise specified by the procuring activity.

Deviation: Co-axial connectors to MIL specifications are used except on aluminum sheath cable to AVROCAN Specification M-11-10 (Avro Drawing CS-C-162) where co-axial connectors to AVROCAN Specification E-413 are used.

Reason for Deviation and Remarks: Connectors must be specially constructed for use with this cable (Reference Deviation 84).

84. Co-axial Cables

Requirement: Specification MIL-W-5088A, paragraph 3.5.1.4

Co-axial cables suitable for the application shall conform to Specification JAN-C-17 ------------ .

84. Co-axial Cables (Cont'd)

Deviation: Co-axial cables to JAN-C-17 supplemented by cables to AVROCAN Specification M-11-10.

Reason for Deviation and Remarks: The cable run up the fin is of considerable length. If used, conventional cables of reasonable diameter and weight would give excessive attenuation.

85. Alternators and Drives Accessibility

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

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 constant speed drive 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.

86. 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 required 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.

87. 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-10A shall

87. Interference Limits and Methods of Measurement (Cont'd)

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-10A amplifier will give an incorrect measure of the noise content of the particular system under test due to the high gain of the AN/AIC-10A compared to the equipment around which MIL-I-6051 was written. 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.

88. Fire Extinguishing System

Requirement: Specification CAP 479, paragraph 23.72

Separate extinguishing systems shall be provided for each power plant.

Deviation: The power plant extinguishing systems are not separate from the service bay extinguishing system.

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

89. Throttle Lever Movement

Requirement: Specification ARDCM 80-1, paragraph 6A.140.b1

The lever travel shall have not less than 90 degrees nor more than 110 degrees angular movement.

Deviation: The throttle lever travel is 60 degrees.

Reason for Deviation and Remarks: The radius of the throttle lever is of sufficient length to provide adequate movement over an arc of 60 degrees.

90. Ground Air Disconnects

Requirement: Specification ARDCM 80-1, paragraph 8.5.2

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: Two 3-1/4 in. quick disconnect air conditioning system couplings are installed.

Reason for Deviation and Remarks: The type and size of the coupling installed is compatible with the duct sizes. Confirmed by RCAF letter S1038-105-11 (ACE-1) dated 22 August 1955.

91. Air Conditioning - Water Separator

Requirement: Specification ARDCM 80-1, paragraph 12.445

91. Air Conditioning - Water Separator (Cont'd)

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, space, and system performance penalty.
(2) Effective water separator not available (Provision is made for pilot to select 90°F inlet temperature to disperse cockpit fog).
(3) Air Conditioning system approved in principle at 15th Co-ordinating Committee Meeting, 19 January 1955.

92. 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: Design of the system is predicated on a large pressure drop across the refrigeration turbine.

93. 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.

94. Moisture Elimination - Pneumatic System

Requirement: Specification CAP 479, paragraph 24.32 and 24.45

94. Moisture Elimination - Pneumatic System (Cont'd)

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

Deviation: A dehydrating device is fitted in fin waveguide pressurization system only. A moisture 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 is fitted to the low pressure sub-system.

95. Ducting Alignment

Requirement: Specification ARDCM 80-1, paragraph 12.444

(1) 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.
(2) At least 6 inch 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, suitable allowance being made for vibration and misalignment in ducting leading to and from the turbine.

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.

Flex ducting not considered suitable because of high pressure loss characteristic and sharp bends required.

96. Cabin Air Safety Valves

Requirement: Specification ARDCM 80-1, paragraph 12.460

A combined pressure relief and dump valve in conformance with Specification MIL-V-5379 shall be installed to perform the triple function defined herein.

(a) Positive pressure relief......
(b) Negative pressure relief......
(c) Emergency pressure relief.....

Deviation: A combined valve to MIL-V-5379 is not fitted.

Reason for Deviation and Remarks: An arrangement utilizing two cabin

96. Cabin Air Safety Valves (Cont'd)

pressure regulators and a separate inward relief valve gives the required protection and permits a lower blow-off pressure, thus reducing the design pressurization loads at low altitude.

97. Air Bleeds

Requirement: Specification ARDCM 80-1, paragraph 12.43

In order to regulate the quantity of air bleed from the high pressure air source so as to ensure that the quantity of air bleed is not so great as to result in loss of engine power -----, a flow limiting nozzle substantially in accordance with Drawing 44D20311 shall be installed.

Deviation: Flow limiter 44D20311 is not installed.

Reason for Deviation and Remarks: The limiting nozzle as recommended would introduce a pressure drop which would adversely affect system performance.

Flow is limited by a variable nozzle on the refrigerating turbine, by pressure reducing valves, and by a leak detector system coupled to a shut-off valve.

98. Leveling Provisions

Requirement: Specification ARDCM 80-1, paragraph 8.53

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

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

Reason for Deviation and Remarks: The method used is considered to be more suitable for the Arrow.

99. 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, are 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.

100. 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 RCAF 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.

101 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 CF-105 Co-ordinating Committee, 1st December 1954, Item 22, Minute 49a.

102. Jack Pads - Stowage

Requirement: Specification MIL-J-8711, paragraph 3.5

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

Deviation: No provision made for stowing jack pads.

Reason for Deviation and Remarks: The RCAF 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.

103. Tow Rings, Main Gear

Requirement: Specification MIL-T-7935, paragraph 4.1.3.1.2

Main gear tow rings or other suitable fittings, for attaching the tow bar, shall have a clear opening of pi (π) square inches area, with the minor axis of the opening being not less than 1 inch.

Deviation: The tow rings on the main gear are not suitable for attaching the tow bar, and have a minor axis of .75 inch.

103. Tow Rings, Main Gear (Cont'd)

Reason for Deviation and Remarks: Space does not permit a larger ring. It is not intended to tow the aircraft from the main gear utilizing a tow bar. A towing bridle will be used (Normal towing is from the nose gear).

104. 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: Turning about one wheel is not possible.

Reason for Deviation and Remarks: Bogie arrangement precludes compliance with the above requirement.

105. Limit Ground Loads

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

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°.

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

106. Fuses

Requirement: Specification CAP 479, paragraph 70.24 (1)

Fuses ---------- shall only be used where specially approved by the RCAF.

Deviation: Fuses are used in cockpit lighting circuits, where current demand is less than 5 amperes.

Reason for Deviation and Remarks: Circuit breakers are not available for less than 5 amperes.

107. Landing Gear Indication System

Requirement: Specification MIL-E-7614, paragraph 3.19

A landing gear indication system shall be installed in accordance with Specification MIL-I-6339, paragraph 3.2.

107. Landing Gear Indication System (Cont'd)

The landing gear position indicator shall conform to Drawing AN 5839.

Deviation: "Dowty" indicator type Q 1416 is installed.

Reason for Deviation and Remarks: "Dowty" indicator is installed in accordance with RCAF instructions (Reference letter S22-1-4 (ACE-1) dated 29th January 1957.)

108. Integrated Electronics Installation

Requirement: Specification AIR 7-4, paragraph 4.15.1

An MA-1C electronics system ---------- shall be installed.

Deviation: Electronic system installation shall comprise the items specified in this specification. 2

Reason for Deviation and Remarks: Allocation requirement of overall program.

109. Limit Maneuver Load Factors

Requirement: Specification AIR 7-4, paragraph 3.2.2

At the gross weight for stress analysis the limit load factors as defined in USAF Specification MIL-S-5700 shall not be less than 7.33 and -3.0.

Deviation:

(a) At a gross weight for stress analysis of 56,000 lb. (Reference paragraph 3.4) the positive limit maneuver load factor is 6.15 and the negative limit maneuver load factor is 2.52.

(b) Additionally, the positive limit load factor decreases from 6.15 as skin temperature increases.

Reason for Deviation and Remarks:

(a) Limit load factors of plus 7.33 and minus 3.00 were established for a stressing weight of 47,000 lb. at an early stage of the design. Consequent aircraft weight growth has therefore resulted in reduced load factors at the higher weight.

(b) Weakening of structure due to temperature rise. This reduction does not take into account the effect of thermal stresses which is the subject of further study. The extent of Avro studies on this subject will be dependent upon information obtained from other sources.

110. Safety Limits of Pressurization

Requirement: Specification ARDCM 80-1, paragraph 12.22.

The relative expansion of integral gases (RGE)..........

$$RGE\ (max) = 17.0t + 2.1$$

where t is the time of decompression in seconds.

For all operational conditions in combat areas, RGE (Calc) must never be greater than RGE (Max.).

Deviation: The cockpit pressure schedule does not comply with the limits of RGE (Max.).

Reason for Deviation and Remarks: The above requirement is not compatible with Institute of Aviation Medicine recommendations for cockpit pressure altitudes.

111. Cockpit Pressurization

Requirement: Specification AIR 7-4, paragraph 4.7.1.1 1

The cabin shall be pressurized to increase linearly to a differential of 4.5 psi + 0.5 psi - 0 psi to 60,000 ft., and remain constant at 4.5 psi + 0.5 psi - 0 psi above 60,000 ft.

Deviation: The cockpit to atmosphere pressure differential at 50,000 feet and above is 4.25 ± 0.25 psi.

Reason for Deviation and Remarks: To provide for most effective use of system cooling while maintaining Institute of Aviation Medicine recommendations for cockpit altitudes. Approved by 34th meeting of Co-ordinating Committee, 19th June 1957, Item 38 (b) (ii) (a).

112. Temperature Distribution - Cockpits

Requirement: Specification ARDCM 80-1, paragraph 12.474

The difference in temperature between any two points in a compartment shall not be greater than 10°F.

Deviation: The cockpit temperature difference between air inlet and outlet does not meet this requirement (actual difference to be determined by test).

Reason for Deviation and Remarks: To maintain a 10°F differential between cockpit inlet and outlet is not practicable due to the high air flows which would be required to maintain this differential at high altitudes.

113. Engineering Data

Requirement: Specification CAP 479, paragraph 2.02.

113. Engineering Data (Cont'd)

--------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.
(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.

114. Brake Energy Credits

Requirement: Specification MIL-W-5013C Table 1

Type Of Aircraft	No. of Dynamometer Stops	Energy Credit Drag Chute
Land Based...	45	No
Fighter	5	Yes
	1	Yes

114. <u>Brake Energy Credits</u> (Cont'd)

<u>Deviation</u>: Brake energy credits are calculated on the basis of the following revised tabulation:

Type of Aircraft	No. of Dynamometer Stops	Energy Credit Drag Chute
Land Based Fighter..	45	Yes
	5	No
	1	No

<u>Reason for Deviation and Remarks</u>: Use of drag chute is normal landing procedure.

<u>Note</u>: This Deviation also contravenes Specification AIR 7-4, para. 4.10.4.2. 1

115. <u>Crew Escape</u>

<u>Requirement</u>: Specification AIR 7-4, paragraph 4.6.2 1

For emergency use, crew members shall be provided with a fully automatic and safe means of ejecting from the aircraft, decelerating, descending from altitude and alighting upon the ground. The provision must be operable throughout all speeds, altitudes, and acceleration conditions of which the aircraft is capable or is able to withstand structurally.

<u>Deviation</u>: Safe ejection is estimated to be possible throughout the flight envelope except for conditions corresponding to major limitations imposed by:

(a) Speeds greater than 500 knots EAS or a speed corresponding to Mach 2.0, whichever is the lesser.

(b) Level inverted flight at altitudes below 500 feet.

(c) A pitch angle of 45 degrees at a speed of 500 knots EAS at altitudes below 800 feet.

(d) Aircraft maneuver load factors greater than +4.0 'g'.

(e) Speeds below 90 knots EAS at ground level.

<u>Reason for Deviation - Remarks</u>: Limited by the present "state of the art". Expanding the above limitations is the subject of a development program. This deviation is dependent upon the definition of the word "safe" which is to be supplied by the Department.

116. Battery

Requirement: Specification AIR 7-4, paragraph 4.5.3

The battery shall be to standard AN configuration and meet the specific requirements of MIL-B-6146 or MIL-B-26220. 1

Deviation: The Arrow battery is not to standard AN configuration and meets the requirements of MIL-B-8565.

Reason for Deviation and Remarks: Use of the Arrow type battery results in weight and space saving. Arrow battery agreed to by RCAF letter Ref: S36-38-105-5 (ACE-1) 31 July 1957.

117. External Power Receptacles

Requirement: Specification AIR 7-4, paragraph 4.5.4

Alternating and direct current external power receptacles as required shall be installed in accordance with ABC Air Standards 12/6 and 12/7. 1, 2

Deviation: External DC power receptacles do not conform to ABC Standard 12/6.

Reason for Deviation and Remarks: ABC Standard receptacles are unsuitable for small external DC power required for Arrow. Primary source of DC power on ground is aircraft transformer-rectifier units.

118. Fuel Transfer Indication - External Tank

Requirement: Specification AIR 7-4 paragraph 4.8.3 1

Equipment shall be installed to give the pilot positive indication that fuel is being transferred from the external fuel tanks to the internal fuel system.

Deviation: Indication of fuel transfer from the external tank is provided by the fuel gauges for the internal tanks which indicate, by remaining constant, that fuel is being transferred from the external tank. 1

Reason for Deviation and Remarks: This has been assessed as providing adequate indication of fuel transfer.

119. Waveguides

Requirement: Specification MIL-W-9053, paragraph 3.6

119. Waveguides (Cont'd)

Rigid waveguide lengths in increments of 6 inches should be used up to and including 72 inches.

Deviation: Waveguide in straight lengths exceeding 72 inches is used.

Reason for Deviation and Remarks: The X-band fin antenna is more than 72 inches away from the equipment and losses must be kept to a minimum, consequently the number of joints is kept to a minimum. Also, space is at a premium and precludes the use of joints in many locations.

Appendix III

Engineering Data

Appendix IIIA Drawings

Drawings shall be prepared in accordance with the requirements of RCAF Specification PROC-100-11 Issue 3 except as stated in Appendix IV to this specification.

Detail design documents are listed in the following Master Record Index:

MRI-CA-Arrow 2

Appendix IIIB Reports

Reports covering engineering data shall be listed in a report
113 index and shall be supplied as agreed between the RCAF and the
Company.

Appendix IIIC Additional Publications

The following descriptive reports have been produced as Mock-Up Brochures and are listed herein as reference documents only:

Engine Installation	72/AIREQ 25/1	2
Electrical System	72/System 11/27	
Air Conditioning System	72/System 22/48	
Low Pressure Pneumatics System	72/System 18/29	
Fire Protection System	72/System 23/31	
Protection against Ice	72/System 20/51	
Fuel System	72/System 16/21	
Hydraulics - Utility	72/System 19/26	
- F/Controls	72/System 32/25	
Flying Controls System	72/System 15/28	1
Oxygen System	72/System 21/30	
Escape System	72/Eng Pub/2	

Appendix IIID Novel Features

To be added.

APPENDIX IV

DEVIATIONS FROM PROC-100-11

Issued under separate cover.

APPENDIX V

AMENDMENTS

AVRO AIRCRAFT

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE	CONTRACT	AMENDMENT NO. 1
Arrow 2	B69-12-44 Serial 2-B-5-309 SO 4877	E.C.P. –
SUBJECT		MOD. NO. –
REASON FOR CHANGE To incorporate changes required to reflect existing design status and release, and to incorporate minor miscellaneous changes and corrections.		EFFECTIVITY 25206 to 25209
		RETROFIT –

EFFECT ON PERFORMANCE	Noted		
WEIGHT CHANGE	–	EFFECT ON BALANCE	–

AMENDMENT

PARAGRAPH PAGE

In the following paragraphs and deviations "WSC 1-2" is deleted and replaced by "AIR 7-4".

PARAGRAPH	PAGE	DEVIATION	PAGE
1.2	4	22	150
3.3.1	22	27	152
3.8.1	43	33	154
3.11.	59	60	161
3.13.4	75	66	163
3.16	88	68	164
3.16.8.2	93	109	177
3.20	109	111	178
3.22	113	115	180
3.23	119	118	181

PARAGRAPH 1.1 PAGE 1

Referenced Specifications and Publications

Delete: "WSC 1-2"

Replace By: "AIR 7-4 Issue 5"

Delete: Deviation Number 46

PAGE 4

Delete:

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

Amendment No. 1

PAGE 4 (Cont'd)

"Avrocan E-266" and title
"Avro Report 7-0400-62 Weight and C.G. Summary - CF-105
with Iroquois Engines"

Add:

"Avro Report	Periodic Performance Report No. 15A
Avro Report 72/FAR/6	Arrow 2 Aircraft 25206 & 25208 Instrumentation
Avro Report 7-0400-82	Weight & C.G. Summary - Arrow 2 Aircraft 25206"

PARAGRAPH 2.1 PAGE 6

Terms of Reference

Delete second paragraph:

"The airframe and GSM installations of the Arrow 2 aircraft, Serial Number 25206 and subsequent up to Serial Number 25210, shall be defined by this Specification together with applicable Specification Amendments issued in accordance with paragraph 1.3 of this Specification. The design detail documents are identified in the effectivity schedule of the Master Record Index referenced in Appendix IIIA of this Specification."

Replace By:

"The airframe and GSM installations of the Arrow 2 aircraft, Serial Number 25206 and subsequent up to and including Serial Number 25209, shall be defined by this specification together with applicable specification amendments issued in accordance with paragraph 1.3 of this specification. The design detail documents are identified in the effectivity schedule of the Master Record Index referenced in Appendix IIIA to this specification. The requirements of this Specifi-specification shall apply except as amended and/or limited by the requirements of Appendix VI to this specification."

PARAGRAPH 2.1.1.2 PAGE 6

Delete:

"WSC 1-2 (Issue 1)""

Replace By:

"AIR 7-4 (Issue 5)*"
After "EMS-8 Issue-2", add "(as amended - see para. 3.11.1 of Specification 72/MS/1)"

Add at bottom of page:

"*This specification not yet contractually accepted."

PARAGRAPH 3.1.3 PAGE 8

Delete paragraph:

"Performance will be added after receipt of new issue of RCAF Specification WSC 1-2 containing performance requirements."

Amendment No. 1

PARAGRAPH 3.1.3 PAGE 8 (Cont'd)

Replace By:

"The estimated performance of the aircraft shall be as detailed in Avro Aircraft Ltd. Periodic Performance Report No. 15A, assuming the aircraft configuration to be as described by this specification and engine performance to be in accordance with paragraph 3.11.1 of this specification."

PARAGRAPH 3.1.4 PAGE 8

Performance Curves

Delete:

"To be added (Reference paragraph 3.1.3)."

Replace By:

"Reference paragraph 3.1.3."

PARAGRAPH 3.1.5 PAGE 12

Delete present sub-sections to end at 3.1.5.5

"3.1.5 Weight and Balance

The estimated weight for the aircraft is as follows (For current weight status refer to latest issue of Avro Aircraft Report No. 7-0400-62).

3.1.5.1 Basic Weight

DESCRIPTION	WEIGHT lb	
STRUCTURE		19,175
Wing	10,030	
Fin & Rudder	1,028	
Fuselage fwd. Sta. 255"	2,609	
Sta. 255" - 485"	701	
Sta. 485" - 591.65"	1,161	
Sta. 591.65" - 742.5"	1,574	
Sta. 742.5" Aft.	1,030	
"Marry-up"	42	
LANDING GEAR		2,638
Main Landing Gear	1,989	
Main L/G Doors and Fairings	288	
Nose Landing Gear	334	
Nose L/G Door & Fairing	27	
POWER PLANT & SERVICES		10,811
Engines and Accessories	9,187	

Amendment No. 1

3.1.5.1 Basic Weight

DESCRIPTION	WEIGHT lb	
POWER PLANT & SERVICES (Cont'd)		
Gear Box & Drives on Fuselage	282	
Engine Controls	32	
Gear Box, Starter & Drives on Engine	325	
Engine Nose Bullet	70	
Fire Extinguisher System	66	
Engine Mountings	132	
Fuel System	717	
FLYING CONTROLS GROUP		1,927
Mechanical Flying Controls	953	
Hydraulic Flying Controls	974	
EQUIPMENT GROUP		9,846
Instruments	46	
Probe	15	
Cockpit Pressure Sealing	5	
Oxygen System	26	
Ejector Seats	343	
Air Conditioning System	875	
Hydraulics Utility System	707	
Cabin Insulation	14	
Drag Chute	91	
Electrical System	1,268	
Low Pressure Pneumatics	57	
Surface Finish	100	
Intake De-icing Boots	88	
Canopy Actuation	65	
Cabin Consoles	17	
Damping System	185	
Electronic System	647	
Emergency Fire Protection	160	
Instrument Pack Structure	687	
Pack Instrumentation	3,000	
Flight Test Installations	1,450	
BASIC WEIGHT		44,397

3.1.5.2 Normal Gross Weight

BASIC WEIGHT		44,397
Ballast		655
Operational Load (less fuel)		1,005
Crew	390	
Oil	139	
Residual Fuel	218	
Oxygen Charge	13	
Fire Extinguisher Fluid	25	
Water for Air-Conditioning	220	

Amendment No. 1

3.1.5.2 Basic Weight (Cont'd)

DESCRIPTION	WEIGHT lb
OPERATIONAL WEIGHT EMPTY	46,057
Maximum Internal Fuel (2,492 gal @ 7.8 lb/gal.)	19,438
NORMAL GROSS WEIGHT	65,495

3.1.5.3 One Half Fuel Weight

OPERATIONAL WEIGHT EMPTY	46,057
½ Maximum Internal Fuel	9,719
HALF FUEL WEIGHT	55,776

3.1.5.4 Maximum Gross Weight

OPERATIONAL WEIGHT EMPTY	46,057
Maximum Internal Fuel	19,438
Maximum External Fuel (500 gal. @ 7.8 lb/gal and drop tank)	4,242
MAXIMUM GROSS WEIGHT	69,737

3.1.5.5 Unit Weights

(a) Wing Group
(Gross Area 1,225 sq. ft.) 8.187 lb/sq. ft.

(b) Vertical Tail
(Gross Area 158.79 sq. ft.) 6.450 lb/sq. ft.

(c) Fuel System
(Capacity 2,492 Imp. Gal.) 0.287 lb/Imp. Gal."

Replace by new sub-sections to end of 3.1.5.5 as follows:

" 3.1.5 Weight And Balance

The estimated weight for the aircraft is as follows (For current weight status refer to latest issue of Avro Aircraft Report No. 7-0400-82).

3.1.5.1 Basic Weight

DESCRIPTION	WEIGHT lb	
STRUCTURE		19,258
Wing	10,032	
Fin & Rudder	1,031	
Fuselage fwd. Sta. 255"	2,605	
Sta. 255" - 485"	1,716	
Sta. 485" - 591.65"	1,170	
Sta. 591.65 - 742.5"	1,576	

MODEL SPECIFICATION AMENDMENT

Amendment No. 1

3.1.5.1 Basic Weight (Cont'd)

DESCRIPTION	WEIGHT lb	
STRUCTURE (Cont'd)		
Sta. 742.5" Aft.	1,085	
"Marry-up"	43	
LANDING GEAR		2,708
Main landing gear	2,059	
Main L/G Doors and Fairings	288	
Nose Landing Gear	334	
Nose L/G Door & Fairing	27	
POWER PLANT & SERVICES		11,548
Engines & Accessories	10,058	
Gear Box & Drives on Fuselage	292	
Engine Controls	32	
Gear Box & Starter on Engine	153	
Engine Instrumentation	100	
Fire Extinguisher System	74	
Engine Mountings	75	
Fuel System	763	
FLYING CONTROLS GROUP		1,966
Mechanical Flying Controls	958	
Hydraulic Flying Controls	1,007	
EQUIPMENT GROUP		8,217
Instruments	35	
Probe	15	
Cockpit Pressure Sealing	5	
Oxygen System	21	
Ejector Seats	343	
Air Conditioning System	874	
Hydraulics Utility System	641	
Cockpit Insulation	14	
Drag Chute	91	
Electrical System	1,237	
Low Pressure Pneumatics	50	
Surface Finish	100	
Intake De-icing Boots	88	
Canopy Actuation	65	
Cockpit Consoles	18	
Damping System	99	
Mechanical Door Stops - Main L/G Doors	3	
Electronic System	613	
Emergency Fire Protection	181	
Instrument Pack Structure	692	
Pack Instrumentation	2,408	
Flight Test Installations	624	
BASIC WEIGHT		43,284

3.1.5.2 Normal Gross Weight

BASIC WEIGHT		45,204
Ballast		1,294
Operational Load (less fuel)		1,097
Crew	390	
Oil	162	
Residual Fuel	287	
Oxygen Charge	13	
Fire Extinguisher Fluid	25	
Water for Air-Conditioning	220	
OPERATIONAL WEIGHT EMPTY		46,301
Maximum Internal Fuel (2,455 gal. @ 7.8 lb/gal.)		19,146
NORMAL GROSS WEIGHT		65,447

3.1.5.3 One Half Fuel Weight

OPERATIONAL WEIGHT EMPTY	46,301
1/2 Maximum Internal Fuel	9,573
HALF FUEL WEIGHT	55,874

3.1.5.4 Maximum Gross Weight

OPERATIONAL WEIGHT EMPTY	46,301
Maximum Internal Fuel	19,146
Maximum External Fuel (500 gal. @ 7.8 lb/gal and drop tank)	4,242
MAXIMUM GROSS WEIGHT	69,690

3.1.5.5 Unit Weights

(a) Wing Group
(Gross Area 1,225 sq. ft.) 8.190 lb/sq. ft.

(b) Vertical Tail
(Gross Area 158.79 sq. ft.) 6.492 lb/sq. ft.

(c) Fuel System
(Capacity 2,455 Imp. Gal.) 0.311 lb/Imp. Gal."

Amendment No. 1

PARAGRAPH 3.2.6 PAGE 19

Climatic Conditions

Delete both paragraphs:

"The airframe 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 airframe 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."

Replace By:

"The airframe shall be designed to meet the environmental conditions given in CAP 479 and ARDCM 80-1, and additionally for operation within the design flight conditions.

All contractor furnished equipment installed in the airframe shall be designed to meet the environmental conditions given in CAP 479 and ARDCM 80-1 and additionally, where the pressure altitude and/or temperature is in excess of that covered by CAP 479 and ARDCM 80-1, the requirements in the Company Equipment Specifications shall govern."

PARAGRAPH 3.2.7 PAGE 19

Noise & Vibration

Delete both paragraphs:

"Insofar as practicable, the airframe shall be free from objectionable vibration which might lead to malfunctioning of controls or equipment.

Noise levels at the head positions 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."

Replace By:

"The levels of noise and vibration shall be as determined by test."

Amendment No. 1

PARAGRAPH 3.4.1 PAGE 24

Limit Flight Load Factors

Delete:

"Limit flight maneuver load factors shall be based on a positive factor of 7.33 and a negative factor of ------."

Replace By:

"The aircraft shall be designed for limit flight maneuver load factors based on a positive factor of 7.33 and a negative factor of --------."

PARAGRAPH 3.4.1.6 PAGE 2

Load Factors In Roll

Delete:

"The limit flight maneuver load factors in roll shall be in accordance with ----------."

Replace By:

"The aircraft shall be designed for limit flight maneuver load factors in roll in accordance with ------------."

PARAGRAPH 3.4.1.7 PAGE 2

Load Factors In Spin

Delete:

"The limit flight maneuver load factors shall be in accordance with ----------."

Replace By:

"The aircraft shall be designed for limit flight maneuver load factors in accordance with ---------."

PARAGRAPH 3.4.1.8 PAGE 26

Load Factors For Landing Gear Operation

Delete:

"The limit load factors for landing gear operation shall be in accordance with ----------."

Amendment No. 1

PARAGRAPH 3.4.1.8 Page 62 (Cont'd)

Replace By:

"The aircraft shall be designed for limit load factors for landing gear operation in accordance with ------."

PARAGRAPH 3.4.2.1 PAGE 26

Limit Take-Off Load Factors

Delete:

"The limit take-off load factors shall be in accordance with -----."

Replace By:

"The aircraft shall be designed for limit take-off load factors in accordance with -----------."

PARAGRAPH 3.4.2.2 PAGE 26

Limit Landing Load Factors

Delete:

"The limit landing load factors shall be in accordance with ------."

Replace By:

"The aircraft shall be designed for limit landing load factors in accordance with ---------."

PARAGRAPH 3.4.2.7 PAGE 27

Limit Ground Handling Load Factors

Delete:

"The limit ground handling load factors shall be in accordance with ---------."

Replace By:

"The aircraft shall be designed for limit ground handling load factors in accordance with---------."

PARAGRAPH 3.4.3.1 PAGE 27

Limit Diving Speeds

Delete:

"The limit diving speed V_D shall be the lesser of ------------."

Replace By:

"The aircraft shall be designed for a limit diving speed V_D which shall be the lesser of ----------."

Amendment No. 1

PARAGRAPH 3.4.3.2 PAGE 27

Limit Drag Chute Deployment Speed

Delete:

"The limit speed for selection of drag chute deployment shall be 180 knots EAS."

Replace By:

"The aircraft shall be designed for a limit speed for selection of drag chute deployment of 180 knots EAS."

PARAGRAPH 3.7.1 PAGE 37

Description

Delete in third line:

"armament"

PARAGRAPH 3.7.2 PAGE 37

Construction

Delete 3rd paragraph:

"Complete provision shall be made in the centre fuselage for the installation of a removable interchangeable weapon pack or instrumentation pack."

Add new 3rd paragraph:

"Complete provision shall be made in the centre fuselage for the installation of a removable instrumentation pack."

PARAGRAPH 3.7.3.1 PAGE 38

Pilot's Cockpit

Add in list of Switches (Operative), after "Pressurization Dump":

"Air Conditioning Failure"

PARAGRAPH 3.7.5 PAGE 40

Add after title "Equipment Compartments":

"(See pages 10 and 11 for diagrams)"

Amendment No. 1

PARAGRAPH 3.7.5.6 PAGE 41

Weapon Pack Bay

Delete paragraph:

"The weapon pack bay shall comprise a recess in the underside of the fuselage designed to permit the installation of interchangeable weapon packs or instrumentation packs. Conditioned air shall be provided to the armament pack bay."

Replace By:

"The weapon pack bay shall comprise a recess in the underside of the fuselage designed to permit the installation of a removable instrumentation pack. Conditioned air shall be provided to the weapon pack bay."

PARAGRAPH 3.8.1 PAGE 43

Landing Gear

Delete: Deviation Number 116

PARAGRAPH 3.8.2.2 PAGE 43

Wheels, Brakes, and Brake Controls

Delete in second paragraph:

"Structural provision shall be made for the installation of an anti-skid system."

Delete:

"A nominal 1500 psi."

Replace By:

"A nominal maximum of 1500 psi."

PARAGRAPH 3.8.3.6 PAGE 48

Steering Control

Delete:

"Structural provision shall be made for nose wheel steering."

Replace By:

"Not applicable."

Amendment No. 1

PARAGRAPH 3.9.1.1 PAGE 51

Elevators

Delete second sentence:

"The linkage shall include a hydraulic booster with a damper in series with the booster valve."

Replace By:

"The linkage shall include a hydraulic booster with a damper in parallel with the booster valve."

PARAGRAPH 3.9.1.2 PAGE 52

Ailerons

Delete second sentence:

"The linkage shall include a hydraulic booster with a damper in series with the booster valve."

Replace By:

"The linkage shall include a hydraulic booster with a damper in parallel with the booster valve."

PARAGRAPH 3.9.1.4.1 PAGE 53

Normal Mode Artificial Feel

Delete:

"three prese valves"

Replace By:

"three preset values"

PARAGRAPH 3.9.3 PAGE 54

Trim Control System

Delete from first paragraph, fourth line, after "rudder trim switch":

"and an emergency elevator trim disengage switch"

Delete last sentence from first paragraph:

"A "G" trimming indicator shall be installed in the main instrument panel."

Amendment No. 1

PARAGRAPH 3.10.5 PAGE 58

Fire Walls

Delete from second sentence:
"titanium" before "shroud".

PARAGRAPH 3.11.1 PAGE 59

Engines

Delete paragraph:

"The aircraft shall be powered by two Iroquois turbo-jet engines, each engine having the following static sea level thrust ratings in accordance with Orenda Engines Ltd. Specification EMS-8: a maximum thrust rating of 19,250 pounds and a maximum thrust with augmentation rating of 26,000 pounds."

Replace By new paragraph:

"The aircraft shall be powered by two de-rated Iroquois turbo-jet engines, with the installed thrust estimated on the basis of information defined by Orenda Engines Ltd. memo. G-50-10-14 dated Nov. 9/58 and the following table contained in Orenda Engines Ltd. memo dated Oct. 9/58.

		Sea Level Static		Mach 1.5, 50,000 ft.	
		Engine	Engine With A/B	Engine	Engine With A/B
Thrust	(lb.)	17,400	22,900	4,700	8,100
J.P.T.	(°C)	660	660	660	660
S.F.C.	(lb./hr.)/(lb.)	.91	2.25	1.25	2.30
T_4	(°K)	1,180	1,180	1,180	1,180
N_L	(r.p.m.)	5,150	5,150	5,100	5,100
N_H	(r.p.m.)	7,650	7,650	7,650	7,650

PARAGRAPH 3.11.2 PAGE 59

Engine Installation

Delete:

"Engine removal and installation shall be carried out using suitable Ground Service Equipment, and excluding------."

Replace By:

"Engine removal and installation, when carried out using suitable ground servicing equipment, and excluding------."

Amendment No. 1

PARAGRAPH 3.11.5 PAGE 60

Exhaust System

Add new paragraphs:

"Two nozzle area indicators, one left hand and one right hand, shall be installed in the front cockpit to provide positive indication of exhaust nozzle actuation with selection of after-burning.

Two jet pipe temperature gauges, one for each engine, shall be installed in the front cockpit to provide indication of turbine outlet exhaust gas temperature."

PARAGRAPH 3.11.10.2 PAGE 70

Add at end of paragraph:

"(d) Low pressure in the engine hydraulic system.

Two gauges, one left hand and one right hand, shall be installed in the front cockpit to provide indication of fuel pressure at the engine fuel inlet.

Two tachometers for each engine, one to provide indication of low rotor RPM and one to provide indication of high rotor RPM, shall be installed in the front cockpit."

PARAGRAPH 3.13.1.1.3 PAGE 73

Engine Instruments

Delete:

"Combined Percentage Engine Thrust, Afterburner Thrust, and Exhaust Temperature Indicator (2) (Complete Provision only)"

Add:

"Engine Fuel Pressure Gauges (2)
Tachometer High Speed Rotor (2)
Tachometer Low Speed Rotor (2)
Jet Pipe Temperature Gauges (2)
Nozzle Area Indicators (2)"

PARAGRAPH 3.14.1 PAGE 77

Description and Components - Hydraulic System

Amendment No. 1

PARAGRAPH 3.14.1 PAGE 77 (Cont'd)

Delete:

"A utility services system to operate the landing gear, wheel brakes, speed brakes, emergency AC generator drive and missile extension gear of a removable armament pack."

Replace By:

"A utility services system to operate the landing gear, wheel brakes, speed brakes and emergency AC generator drive."

PARAGRAPH 3.14.1.1 PAGE 78

Utility Services System

Delete in table:

"(e)	Capability of firing missiles in final stages of attack	Available	Not Available

PARAGRAPH 3.14.1.1.3 PAGE 80

Wheel Brakes Sub-System

In first paragraph, fourth line,

Delete:

"a nominal 1500 psi"

Replace By:

"a nominal maximum of 1500 psi"

In second paragraph, third sentence,

Delete:

"-----applied to the wheel brakes."

Amendment No. 1

PARAGRAPH 3.14.1.1.3 PAGE 80 (Cont'd)

Replace By:

"--------applied to the wheel brake control valves".

Delete last paragraph:

"Structural provision shall be made for the installation of an anti-skid system".

PARAGRAPH 3.14.1.1.6 PAGE 81

Weapon Pack Sub-System

Delete paragraph:

"Complete provision shall be made for the installation of a removable interchangeable weapon pack. A hydraulic pressure line and return line terminating in self-sealing half-couplings shall be installed to supply the hydraulic requirements of an installed pack. When installed the armament pack shall contain all other hydraulic components of the sub-system as an integral part of the pack".

PARAGRAPH 3.14.1.2.2 PAGE 82

Control Actuators and Servo Units

Add in first paragraph, after second sentence, new sentence:

"Dual boosters shall be installed in the aileron and elevator control linkage, actuated by 500 psi pressure reduced from the pressure in the main power circuits".

PARAGRAPH 3.14.1.3 PAGE 83

Filters

Delete second paragraph:

"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".

Replace By:

"Line type filters shall be installed in the pressure lines to the aileron and rudder control actuators".

PARAGRAPH 3.14.1.4 PAGE 83

Inspection & Maintenance

Delete third paragraph:

"Separate ground testing of the armament pack, when not installed, shall be possible by the use of the pressure and return line half couplings installed in the armament pack. (Reference paragraph 3.14.1.1.6).

Amendment No. 1

PARAGRAPH 3.15.1 PAGE 85

Pneumatic System - Description & Components

Change: "(1) A sub-system for:"
to read "(1) A services sub-system for:"

Change: "(2) A sub-system for:"
to read "(2) A pressurization sub-system for:"

Delete:

"(c) Nose Radar pressurization air supply
(d) Weapon (Instrument) pack seal inflation"

Replace By:

"(c) Instrumentation pack seal inflation"

PARAGRAPH 3.15.1.1.1 PAGE 85

Canopy Seal Inflation

Add new sentence:

"Failure of the canopy seal inflation valve shall be indicated by a warning light in the front cockpit."

PARAGRAPH 3.15.1.1.3 PAGE 86

Delete paragraph:

"Radar Pressurization Air Supply

Air for a nose radar pressurization system integral with electronics system installations shall be ducted from the services sub-system filter. The air supply shall be a nominal .1 lb/min at pressures between 14 and 80 psia."

PARAGRAPH 3.15.1.1.4 PAGE 86

Change title: "Weapon (Instrument) Pack Seal Inflation"
to "Instrumentation Pack Seal Inflation"

Delete second paragraph:

"The control solenoid shall be energized by a microswitch installed on the interchangeable pack. The microswitch shall be actuated by closing an access door for the weapon pack test panel."

Amendment No. 1

PARAGRAPH 3.15.1.1.4 PAGE 86 (Cont'd)

Replace By:

"The control solenoid shall be energized by a microswitch installed on the pack. The microswitch shall be actuated by closing an access door for the pack test panel."

PARAGRAPH 3.15.1.2 PAGE 86

Delete title:

"Fuel System Pressurization and Fin Wave-Guide Pressurization Supply."

Replace By:

"Pressurization Sub-System"

PARAGRAPH 3.16.2.1 PAGE 90

Delete from third paragraph:

"A 1.57 KVA ------- generator."

Replace By:

"A 1.8 KVA ------- generator."

PARAGRAPH 3.16.2.2. PAGE 90

Add Deviation number 116

PARAGRAPH 3.16.5 PAGE 91

Add Deviation number 81
Deviations 83, 86, 87 renumbered 82, 83, 84

PARAGRAPH 3.16.8.2.2 PAGE 93

Taxi Light

Change "steering" to "swivel"

PARAGRAPH 3.16.10.1 PAGE 94

Add Deviation number 117

PARAGRAPH 3.16.11.2 PAGE 96

Warning Indicator Panel

Add in list of warning lights, after "1 Cabin Pressure": "or Canopy Seal Failure"

Delete: "1 Rudder Trim Unit Failure"

Replace By: "1 Rudder Feel Unit (q_c actuator) Failure"
"2 Engine Hydraulic Low Pressure, L.H. & R.H."

Amendment No. 1

PARAGRAPH 3.17.5.2 PAGE 103

Television & Telemetering Equipment

Delete:

"Not applicable"

Replace By:

"Test telemetering equipment shall be installed in accordance with paragraph 4.3."

PARAGRAPH 3.18.1 PAGE 104

Delete first paragraph:

"Structural provision shall be made for the installation of an air-to-air fire control system and a missile armament system providing for the semi-submerged carriage, in an interchangeable weapon pack, of four Sparrow 2 MK. 1 missiles suitable for carriage, launch, and effective operation up to the point of initiation of guided flight, under conditions compatible with Arrow 2 performance."

PARAGRAPH 3.19 PAGE 106

Equipment & Furnishings

Delete from first paragraph:

"Equipment & furnishings -------- shall be installed in accordance with the requirements of RCAF Specifications WSC-1, WSC 1-2 and CAP 479 ------."

Replace By:

"Equipment & furnishings ----- shall be installed in accordance with the requirements of RCAF Specifications AIR 7-4 and CAP 479 -------." 1

PARAGRAPH 3.21 PAGE 111

Oxygen System

In second line, change "breathing and pressure suit operation"
to "breathing and pressure vest operation"

PARAGRAPH 3.21.1.2 PAGE 111

Emergency System

In third line, Add:

"(approx.) after "100 litres"

Amendment No. 1

PARAGRAPH 3.21.1.3 PAGE 111

Distribution

In first line, Delete:
", dual outlet" before "oxygen regulator".
Add Deviation number 46

PARAGRAPH 3.21.1.4 PAGE 112

Indicators

Delete:

"-----for testing the quantity gauge."

Replace By:

"------for testing both quantity gauges."

PARAGRAPH 3.22 PAGE 113

Air Conditioning

Delete in table, top section:

"Missile Auxiliaries Compartment" below "Cockpits" and "7.5" below "28"

Add:

"Bay" after "Weapon Pack"

In second section, Add:

"Compartment" after "Equipment"

In third section, Add:

"Compartment" after "Electronics"

In bottom section, after "Dorsal", Delete:

"Radar"

Replace By:

"Electronics Compartment"

Amendment No. 1

PARAGRAPH 3.22.1 PAGE 114

In Flight Air Conditioning

In first paragraph, fourth line, Delete:

"pressures exceeding 75 psi"

Replace By:

"pressures exceeding 95 psi"

Delete entire second paragraph:

"In the event of over pressure downstream of the pressure reducing valve in either engine bleed, the engine bleed shut-off valve shall then be automatically closed and appropriate warning light indication provided. System design shall prevent simultaneous automatic shut-off of both engine bleeds. A reset switch shall be installed in the front cockpit to enable the pilot to reset the engine bleed shut-off valves."

Replace By:

"In the event of over pressure downstream of the pressure reducing valve in either engine bleed, the left hand or right hand warning light shall indicate a fault. The appropriate bleed shut-off valve shall then be closed manually by a switch in the front cockpit. System design shall prevent simultaneous shut-off of both engine bleeds."

In third paragraph, sub-paragraph (a), second line Add "or" between "cockpit" and "equipment".

PARAGRAPH 3.22.1.2.2 PAGE 116

Secondary Conditioned Distribution

In first paragraphs delete "and missile auxiliaries" after "Air from the cockpits".

PARAGRAPH 4.2 PAGE 125

Flight Tests

Delete paragraph:

"After aircraft acceptance, as set forth in paragraph 5.1, functional flight tests shall be conducted under a program established by the Company and approved by the R.C.A.F. to prove in-flight functioning of the airframe systems."

Amendment No. 1

PARAGRAPH 4.2 PAGE 125 (Cont'd)

Replace By:

"Commencing with the first flight of the aircraft, functional flight tests shall be conducted under a Flight Test Development Program established by the Company and approved by the RCAF to prove in-flight functioning of the airframe systems".

PARAGRAPH 4.3 PAGE 125

Test Instrumentation

Delete first sentence:

"Test instrumentation necessary for conducting the tests of paragraph 4.1 and 4.3 shall be installed."

Replace By:

"Test instrumentation as detailed in Avro Aircraft Ltd. Report Number 72/FAR/6, necessary for conducting the tests of paragraphs 4.1 and 4.2, shall be installed."

PARAGRAPH 5.1 PAGE 126

Acceptance Procedure

Delete after "indefinite loan basis":

"to carry out the various phases of a Flight Test Development Program."

Add new paragraph:

"5.2 Acceptance Condition

On transfer to the RCAF for acceptance the aircraft shall be as described by this specification, including all current amendments, except as limited and/or as defined in Appendix VI to this specification."

DEVIATION 46 PAGE 157

Delete entire deviation:

"Applicable Specifications (Reference: Specification WSC 1-2)

(1) The following specifications, publications and drawings, where applicable, including those called up therein, of the issue in effect on the date of first issue of this specification or the date of the first issue, whichever is the later (except when listed otherwise), shall be considered to form a part of this specification

Amendment No. 1

DEVIATION 46 PAGE 157 (Cont'd)

except as otherwise stated herein. Later issues of individual specifications may be used at the discretion of the contractor.

(2) MIL-C-6818
AND 10412
AND 10413"

Deviation:

(1) The effective date of issue of subsidiary specifications is 23 April 1954, except where at the discretion of the Company subsequently dated issues are used.

(2) Specification MIL-C-6818, and Drawings AND 10412 and AND 10413 are not used.

Reason for Deviation and Remarks:

(1) The effective date of issue of subsidiary specifications is established as the first date of issue of AIR 7-4 which preceded WSC 1-2.

(2) These documents are not called up in the body of WSC 1-2 and conflict with the requirements of WSC 1-2 para. 4.1.4."

Replace By new deviation as follows:

"Oxygen Outlets

Requirement: Specification AIR 7-4, paragraph 4.3.5

A high altitude automatic pressure demand dual outlet oxygen regulator shall be installed on each ejection seat. The second outlets shall provide pressure to inflate the crew's pressure suits when required.

Deviation: The oxygen regulators installed are to Specification MIL-R-25572, modified to have only one outlet.

Reason for Deviation and Remarks: Personal equipment prescribed by the RCAF for use in the Arrow requires only one oxygen outlet for both breathing and pressure vest inflation supply.

DEVIATION 63 PAGE 162

Anti-Skid Brakes

Delete in Requirement: "WSC 1-2, paragraph 4.10.3.4"

Replace By: "AIR 7-4, paragraph 4.10.4.4"

Amendment No. 1

DEVIATION 63 PAGE 162 (Cont'd)

Delete:

"Deviation: Structural provision only is made for anti-skid installation.

Reason for Deviation and Remarks: Type of anti-skid installation not yet established."

Replace By:

"Deviation: No provision is made for an anti-skid installation.

Reason for Deviation and Remarks: Anti-skid installation not yet finalized."

DEVIATION 66 PAGE 163

Nose Wheel Steering

Delete:

"Structural provision only is made for nose wheel steering."

Replace By:

"No provision is made for nose wheel steering."

DEVIATION 81 PAGE 169

Add new Deviation 81:

"Practical Diagrams

Requirement: Specification MIL-W-5088A, paragraph 3.11.2

Practical wiring diagrams shall be placed on junction box covers or adjacent to junction centers.

Deviation: No wiring diagrams are provided on junction boxes.

Reason for Deviation - Remarks: The RCAF agree that this requirement is impractical. (Reference RCAF letter S36-38-105-9 (APO-1) dated 27 November 1958.)

DEVIATION 114 PAGE 180

Add note:

"This deviation also contravenes Specification AIR 7-4, para. 4.10.4.2."

Amendment No. 1

DEVIATION 116 PAGE 181

Delete entire deviation:

"Landing Barriers

Requirement: Specification WSC 1-2, paragraph 4.10.3.3

Design of the airframe must make provision for incorporation of anciliary devices to enable the aircraft to be compatible with requirements for emergency barrier arrests either on take-off or landing with minimum damage. A further consideration is that the aircraft must be capable of barrier arrests with carriage of all planned external stores.

Deviation: No airframe provision has been made for barrier arrests.

Reason for Deviation and Remarks: Barrier arrests by means other than nylon net deemed impractical. No airframe provision required by nylon net barrier arrests.

Replace By:

"Battery

Requirement: Specification AIR 7-4, paragraph 4.5.3

The battery shall be to standard AN configuration and meet the specific requirements of MIL-B-6146 or MIL-B-26220.

Deviation: The Arrow battery is not to standard AN configuration, and meets the requirements of MIL-B-8565.

Reason for Deviation and Remarks: Use of the Arrow type battery results in weight and space saving. Arrow battery agreed to by RCAF letter Ref: S36-38-105-5 (ACE-1) 31 July 1957."

Amendment No. 1

DEVIATION 117 PAGE 181

Add new Deviation (replacing that deleted by Amendment 2):

"External Power Receptacles

Requirement: Specification AIR 7-4, paragraph 4.5.4

Alternating and direct current external power receptacles as required shall be installed in accordance with ABC Air Standards 12/6 and 12/7.

Deviation: External DC power receptacles do not conform to ABC Standard 12/6.

Reason for Deviation and Remarks: ABC Standard receptacles are unsuitable for small external DC power required for Arrow. Primary source of DC power on ground is aircraft transformer rectifier units."

DEVIATION 118 PAGE 181

Fuel Transfer Indication

In Deviation, second line, Delete:

"----fuel gauges for the external tanks-----"

Replace By:

"----fuel gauges for the internal tanks-----"

APPENDIX IIIC PAGE 183

Delete:

"Hydraulics-Armament 72/System 19/40"
"Armament System 72/System 26/8"

APPENDIX VI PAGE VI-I

Paragraph 3.2.6

Delete:

"-----temperatures exceed 20°F"

Replace By:

"------temperature is not lower than -20°F."

AVRO AIRCRAFT

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE	CONTRACT	AMENDMENT NO. 2
Arrow 2	B69-12-44 Serial 2-B-5-309 SO 4877	E.C.P. –
SUBJECT: Electronics System		MOD. NO. X74-035
REASON FOR CHANGE: Cancellation of Astra Electronic System.		EFFECTIVITY: 25206 to 25209
		RETROFIT –

EFFECT ON PERFORMANCE –	
WEIGHT CHANGE –	EFFECT ON BALANCE –

AMENDMENT

PARAGRAPH 3.7.3.1 **PAGE** 39

Pilot's Cockpit

Delete from list of switches (Non-Operative):

"Flight Control:
    Automatic Mode Disengage"

Delete from list of switches (Provision for):

"Flight Control:
    Automatic Mode Selector
    Automatic Mode Function Selector
    Automatic Mode Mach/Altitude Hold
 Armament:
    Missile Firing Trigger
    Missile Safe Arm
    Missile Mode Selector
    Missile Selector
    Launcher Retract
    Launcher Extend"

Amendment No. 2

PARAGRAPH 3.7.3.1 PAGE 39 (Cont'd)

Delete from list of Controls (Provision for):

"Flight Indicator (Controls)"

PARAGRAPH 3.7.3.2 PAGE 40

Observer's Cockpit

Delete from list of Controls (Provision for)":

"Data Link AN/ARR-48, IFF AN/APX-26 and 27, Dead Reckoning"

PARAGRAPH 3.9 PAGE 50

Surface Control System

Delete in second paragraph, second and third sentences:

"Space provision shall be made for components required to provide an Automatic Mode of Control with inputs to the flying control system from manual, navigation and fire control command signals. The Automatic Mode shall operate through components of the Normal Mode and the damping system."

PARAGRAPH 3.9.1 PAGE 50

Primary Flight Control System

Delete from second paragraph:

"Structural provision shall be made for an Automatic Mode Selector switch, an ATTACK-NAVIGATION function selector, and a three-position ALTITUDE-OFF-MACH hold switch. An Emergency Mode selection switch and an automatic mode disengage switch shall be installed on the pilot's control column grip."

Replace By:

"An Emergency Mode selection switch shall be installed on the pilot's control column grip."

PARAGRAPH 3.9.4 PAGE 55

Automatic Mode of Control

Delete:

"Space provision shall be made for the installation of an automatic flight control system. When installed, the system shall provide an Automatic Mode of control operable in conjunction with the normal

Amendment No. 2

PARAGRAPH 3.9.4 PAGE 55 (Cont'd)

damping system. The automatic mode shall utilize components of the Normal Mode of control. The system shall provide for heading hold, attitude pitch and roll hold, and for pilot selection of either Mach hold or Altitude hold. Pilot selection of either Mach hold or Altitude hold shall disengage the pitch attitude hold. The Automatic Mode shall accept command inputs from the following:--

(a) Dead Reckoning System (Reference paragraph 3.17.2.10) and/ or UHF Data link AN/ARR-48 (Reference paragraph 3.17.5.1).

(b) Fire Control System (Reference paragraph 3.18.3.1).

Replace By:

"Not applicable."

PARAGRAPH 3.13 PAGE 73

Instruments & Navigational Equipment

Delete:

"Instrument arrangement shall be as agreed upon by the RCAF, the Radio Corporation of America, and the Company."

Replace By:

"Instrument arrangement shall be as agreed upon between the RCAF and the Company."

PARAGRAPH 3.13.1.1.1 PAGE 73

Flight Instruments

Delete:

"Mach Meter (Limit, Command, Actual) Air Speed Indicator
Air Speed Indicator
Flight Director Attitude Indicator"

Add:

"Mach/Air Speed Indicator
Artificial Horizon
Angle of Attack Indicator"

PARAGRAPH 3.13.1.1.2 PAGE 73

Navigation Instruments

Amendment No. 2

PARAGRAPH 3.13.1.1.2 PAGE 73 (Cont'd)

Delete:

"Integrated Destination Display"

Replace By:

"Radio Magnetic Indicator"

PARAGRAPH 3.13.1.1.4 PAGE 73

Miscellaneous Instruments

Add:

"Skin Temperature Indicator
Control Surface Position Indicator"

PARAGRAPH 3.13.1.2.1 PAGE 73

Navigation And Tactical Navigation Instruments

Delete:

"Integrated Destination Display"

PARAGRAPH 3.13.2 PAGE 74

Air Data System

Delete first paragraph:

"An air data system comprising pitot-static, relative wind sensing, total temperature sensing, and air data computation facilities shall be installed to provide air data information for a fire control system, an Automatic Mode of control, the damping system and for cockpit presentation."

Replace By:

"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."

PARAGRAPH 3.13.2.1 PAGE 74

Pitot-Static System

Delete second paragraph:

Amendment No. 2

PARAGRAPH 3.13.2.1 PAGE 74 (Cont'd)

"Pitot pressure shall be supplied to the air data computer, indicated airspeed indicator, and normal damping system. One nose static pressure source shall supply the air data computer, front cockpit altimeter, normal damping system, and aileron deflection aneroid switch. The second nose static pressure source shall supply the rate of climb indicator, indicated airspeed indicator, rear cockpit altitude data computer, cockpit pressure regulators, and cockpit safety valve controller."

Replace By:

"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, normal damping system, and aileron deflection aneroid switch. The second nose static pressure source shall supply the rate of climb indicator, indicated airspeed indicator, cockpit pressure regulators, and cockpit safety valve controller."

PARAGRAPH 3.13.2.2 PAGE 74

Relative Wind Sensors

Delete first four lines:

"Two relative wind sensors shall be installed on the nose boom probe, and "Alpha" (pitch) vane sensor to provide angle of attack information to a central air data computer and a "Beta" (yaw) sensor vane to provide yaw information..."

Add new first four lines:

"Two relative wind sensors shall be installed on the nose boom probe, an "Alpha" (pitch) vane sensor to provide angle of attack information to the damping system and the angle of attack indicator, and a "Beta" (yaw)......."

PARAGRAPH 3.13.2.3 PAGE 74

Delete present paragraph:

"Air Temperature Sensor

A total temperature probe, containing an air temperature sensor, shall be installed externally on the underside of the nose fuselage. Total temperature shall be converted to electric signals to be fed into the central air data computer."

Amendment No. 2

PARAGRAPH 3.13.2.3 PAGE 74 (Cont'd)

Replace By:

"Skin Temperature Sensor

A skin temperature probe 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."

PARAGRAPH 3.13.2.4 PAGE 75

Delete whole paragraph and title:

"Central Air Data Computer

A central air data computer shall be installed to provide functions of total and static pressure to an Automatic Mode of control system; true angle of attack, altitude, static pressure and true airspeed, to a fire control system; and air data to a flight director/attitude indicator, Mach meter, and true airspeed counter.

The computer shall receive data from the pilot static system, the "Alpha" wind sensor, and from the air temperature sensor."

PARAGRAPH 3.13.3.1 PAGE 75

J-4 Compass

Delete first sentence:

"A J-4 type compass system shall be installed to provide indication of the magnetic heading of the aircraft on an Integrated Destination Display in each cockpit."

Replace By:

"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 the front cockpit."

PARAGRAPH 3.14.1 PAGE 77

Hydraulic Systems - Description & Components

Delete:

"Structural provision shall be made for the installation of a closed sub-system for radar antenna drive", and encircled number 117.

Amendment No. 2

PARAGRAPH 3.14.1.2.4 PAGE 83

Delete:

"Radar Antenna Drive Sub-System

Structural provision shall be made for the installation of a closed sub-system for radar antenna drive."

PARAGRAPH 3.16 PAGE 88

Electrical System

In right hand column of table under "Double Engine Failure or one Engine Failed and one Engine Seized",

Delete "(IDD)" after "Heading Reference"

PARAGRAPH 3.16 PAGE 89

Electrical System

Delete from table:

"Override of AFCS by pilot	Supplied	Supplied"
"Capability of firing the missiles if in the final stages of attack.	Supplied	Not Supplied"

PARAGRAPH 3.17 PAGE 98

Electronics Installations

Delete from list of telecommunication and navigation equipment to be installed:

"Air Data Computer (Ref. para. 3.13.2)"

Delete from list of equipment for which structural provision shall be made:

"Data Link Equipment AN/ARR-48
Identification Equipment AN/APX-27
Interrogation Equipment AN/APX-26
Dead Reckoning System
Vertical Heading & Reference System"

Amendment No. 2

PARAGRAPH 3.17.2.10 PAGE 101
3.17.2.11

<u>Delete</u>:

"3.17.2.10 <u>Dead Reckoning System</u>

Structural provision shall be made for the installation of a dead reckoning system to provide aircraft position with respect to:

(a) base
(b) an arbitrary reference point
(c) a destination
(d) a target
(e) a target offset point

3.17.2.11 <u>Vertical and Heading Reference System</u>

Structural provision shall be made for the installation of a vertical and heading reference system to establish earth reference in three planes from which the aircraft heading, pitch angle, and roll angle is derived for supply to the automatic flying control system, the fire control system, and dead reckoning system, and to indicators in the front and rear cockpits."

PARAGRAPH 3.17.3.4 PAGE 102

<u>Identification Equipment</u>

<u>Delete</u> last sub-paragraph:

"Structural provision shall be made for the installation of an identification set AN/APX-27 for response to airborne X-band interrogation. A dual-horn antenna and waveguide for the AN/APX-27 shall be installed in the fin."

<u>Replace By</u>:

"A dual-horn antenna and wave-guide for an air-to-air IFF identification system shall be installed in the fin."

PARAGRAPH 3.17.3.5 PAGE 102

<u>Interrogation Equipment</u>

<u>Delete</u> paragraph:

"Structural provision shall be made for the installation of an interrogation set, type AN/APX-26 to interrogate any target illuminated by airborne interception radar (Reference paragraph 3.18.3.1.2)."

Amendment No. 2

PARAGRAPH 3.17.3.5 PAGE 102 (Cont'd)

Replace By:

"Not applicable."

PARAGRAPH 3.17.5.1 PAGE 103

Guide Links and System

Delete paragraph:

"Structural provision shall be made for the installation of type AN/ARR-48 data link equipment to receive coded information of target position and velocity from ground controlled interception."

Replace By:

"Not applicable."

PARAGRAPH 3.22.1.3.4 PAGE 118

Delete:

"Air to Oil Heat Exchanger

Cooling air shall be supplied to a heat exchanger utilized to cool radar magnetron coolant fluid and radar antenna drive hydraulic fluid."

DEVIATION 108 PAGE 177

Delete entire deviation:

"Integrated Electronics Installation

Requirement: Specification AIR 7-4 paragraph 4.15.1

An electronics system consisting of equipment selected and contracted to the requirements of the RCAF approved electronic system model specification shall be installed.

Deviation: Electronic system installation shall comprise the the items specified in this specification.

Reason for Deviation and Remarks: An approved model specification covering equipment which will be available for installation, is not available at this time.

Amendment No. 2

DEVIATION 108 PAGE 177 (Cont'd)

Replace By:

"Integrated Electronics Installation

Requirement: Specification AIR 7-4, paragraph 4.15.1

An MA-1C electronics system - - - shall be installed.

Deviation: Electronic system installation shall comprise the items specified in this specification.

Reason for Deviation and Remarks: Allocation requirement of overall program.

DEVIATION 117 PAGE 181

Delete entire deviation:

"Flight Control Hydraulic System

Requirement: Specification WSC 1.2, paragraph 4.11.1

It shall be a design principle that the flight control hydraulic system shall be reserved for the sole purpose of powering the flight controls.

Deviation: Structural provision will be made for intended use of the flying control hydraulic system to drive a hydraulic motor for operation of the radar antenna drive sub-system.

Reason for Deviation and Remarks: This has been agreed to by the RCAF. Reference letter S36-38-105-10-2 dated May 13th, 1958."

APPENDIX IIIC PAGE 183

Additional Publications

Delete:

"The ASTRA I system 72/SYSTEM 13/7"

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE	CONTRACT	AMENDMENT NO. 3
Arrow 2	B69-12-44 Serial 2-B-5-309 SO 4877	E.C.P. –
SUBJECT: Cockpit Lighting		MOD. NO. X74-111
REASON FOR CHANGE: Statement of Work 3.1.3-H. To provide adequate lighting in front cockpit.		EFFECTIVITY: 25206 To 25209
		RETROFIT: –

EFFECT ON PERFORMANCE	–		
WEIGHT CHANGE	–	EFFECT ON BALANCE	–

AMENDMENT

PARAGRAPH **PAGE**

3.16.8.1.2 Page 92 Console Panel Lighting

Delete: second sentence

"A high altitude white flood light shall be installed in the front cockpit."

Replace By: "Two high altitude white flood lights shall be installed in the front cockpit."

AVRO AIRCRAFT

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE Arrow 2	CONTRACT B69-12-44 Serial 2-B-5-309 S04877	AMENDMENT NO. 4
		E.C.P. —
SUBJECT Installation Of Development Damper		MOD. NO. X74-117
REASON FOR CHANGE Statement of Work Paragraph 3.1.3; Mock-Up Change Request A62 & A63; RCAF Letter S36-38-105-10-2 (APO 1) Dated Jan. 20th, 1958		EFFECTIVITY 25206 To 25208
		RETROFIT —

EFFECT ON PERFORMANCE —	
WEIGHT CHANGE —	EFFECT ON BALANCE —

AMENDMENT PARAGRAPH		PAGE	
3.7.3.1	Page 39	Pilot's Cockpit	
		Delete:	from list of Switches (Operative) "Damper Test (L/G Up Mode)"
3.9.1	Page 50	Primary Flight Control System	
		Delete:	last sentence, second paragraph "Complete provision shall be made for the installation of a spring-loaded switch to check the landing gear up configuration with the gear extended."
	Page 51	Delete:	from list of damper system warning lights "One to indicate failure of the system to transfer to landing gear down configuration."

3.16.11.2	Page 95	<u>Warning Indicator Panel</u>	
		<u>Delete</u>:	
			"1 (Flying Control System) L/G Down Configuration Failure."
	Page 95	<u>Delete</u>:	from table
			"1 Landing Gear and Damping System L/G Configuration not in phase."
3.16.11.6	Page 96	<u>Add</u>:	new paragraph
			"<u>Landing Gear Configuration Warning</u>
			A warning light to indicate that the landing gear and damping system landing gear configuration are not in phase shall be installed on the main instrument panel in the front cockpit."

AVRO AIRCRAFT

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE	CONTRACT	AMENDMENT NO. 5
Arrow 2	B69-12-44 Serial 2-B-5-309 SO 4877	E.C.P.
SUBJECT Aileron, Elevator and Rudder		MOD. NO. X74-340
REASON FOR CHANGE To alleviate effect of control surface operation under deflection conditions.		EFFECTIVITY 25206 & subs. RETROFIT

EFFECT ON PERFORMANCE	
WEIGHT CHANGE	EFFECT ON BALANCE

AMENDMENT PARAGRAPH	PAGE	
3.5.3	Page 34	**Ailerons** Add third sub-paragraph: "Each aileron shall be split normal to the hinge spar line at 47.515% of the span. A shear connection shall be provided at the trailing edge and the gap shall be aerodynamically sealed with cover strips".
3.5.7	Page 34	**Elevators** Add new sub-paragraph after seventh line, ".....fully shrouded along the underside", as follows: "Each elevator shall be split normal to the hinge spar line at 45.030% of the span. A shear connection shall be provided at the trailing edge and the gap shall be aerodynamically sealed with cover strips". Remainder of former paragraph 3.5.7, "The angular motion..... balance" to follow as third sub-paragraph.

Amendment No. 5

3.6.6 Page 36 Rudder

Add second sub-paragraph:

"The rudder shall be split normal to the hinge spar line at 28.328% of the span. A shear connection shall be provided at the trailing edge and the gap shall be aerodynamically sealed with cover strips".

AVRO AIRCRAFT

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE	CONTRACT	
Arrow 2	B69-12-44 Serial 2-B-5-309 SO 4877	AMENDMENT NO. 6
SUBJECT Deceleration Parachute Door Lock Position Indicator		E.C.P. -
		MOD. NO. X74-4075
REASON FOR CHANGE To provide positive indication of door lock position.		EFFECTIVITY 25206 & subs.
		RETROFIT -

EFFECT ON PERFORMANCE	-		
WEIGHT CHANGE	-	EFFECT ON BALANCE	-

AMENDMENT

PARAGRAPH 3.8.4.1 PAGE 48

Drag Chute - Description

Delete second and third sentences:

"The chute pack shall be retained by two spring loaded doors, locked by a spring loaded latch, 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."

Replace by:

"The chute pack shall be retained by two spring loaded doors locked by a spring loaded latch with a solenoid operated safety catch. The doors shall maintain the skin line when in the closed position and shall retract to a position inside the adjacent skin surface when chute deployment is selected. Visual indication that the latch is engaged shall be provided by a plunger in the rear fuselage skin.

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.

Amendment No. 6

PARAGRAPH 3.8.4.2 PAGE 49

Delete second sentence:

"Selection of "Stream" shall mechanically release the spring loaded chute retaining doors, and selection of "Jettison" shall disconnect the drag chute attachment."

Replace by:

"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."

Add in second paragraph:

"cable", after "attachment"

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE	CONTRACT	AMENDMENT NO. 7
Arrow 2	B69-12-44 Serial 2-B-5-309 SO 4877	E.C.P. -
SUBJECT Master Warning Control Unit - Electrical System		MOD. NO. X74-4137
REASON FOR CHANGE Statement Of Work Paragraph 3.1.2-G		EFFECTIVITY 25206 & Subs.
		RETROFIT -

EFFECT ON PERFORMANCE -	
WEIGHT CHANGE -	EFFECT ON BALANCE -

AMENDMENT PARAGRAPH	PAGE	
3.14.1.2.1	Page 82	<u>Flying Control System Power Circuits</u> <u>Delete</u>: at top of page "A red and an amber Master Warning shall indicate failure of both circuits."
3.16.11.1	Page 95	<u>Master Warning Lights</u> <u>Delete</u>: last sentence in first paragraph "Both red and amber warning lights illuminate in the event of loss of pressure in the power circuits of both flying control hydraulic systems. (Reference paragraph 3.16.11.1)."

AVRO AIRCRAFT

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE Arrow 2	CONTRACT B69-12-44 Serial 2-B-5-309 S04877	AMENDMENT NO. 8
SUBJECT Stop Valve - Flying Controls Hydraulics		E.C.P. -
		MOD. NO. X74-4266
REASON FOR CHANGE Statement of Work Paragraph 3.1.2-Q. To prevent flattening of emergency brake accumulator due to control surface actuation in event of loss of utility hydraulic system pressure.		EFFECTIVITY 25206 & Subs.
		RETROFIT -

EFFECT ON PERFORMANCE -	
WEIGHT CHANGE -	EFFECT ON BALANCE -

AMENDMENT
PARAGRAPH 3.14.1.2.3 PAGE 83

Delete:

"The compensators 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."

Replace by:

"Except during engine starting the compensators shall be pressurized through 1,250 psi pressure control valves by the respective flying control power circuit. During engine starting pressurization shall be automatically supplied by the emergency brake accumulator."

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE	CONTRACT	
Arrow 2	B69-12-44 Serial 2-B-5-309 SO 4877	AMENDMENT NO. 9
SUBJECT Rudder Feel and Trim Unit (Qc Actuator)		E.C.P.
		MOD. NO. X74-4048
REASON FOR CHANGE Statement of Work Paragraph 3.1.2-L Arrow 1 Flight Test Experience		EFFECTIVITY
		RETROFIT

EFFECT ON PERFORMANCE	
WEIGHT CHANGE	EFFECT ON BALANCE

AMENDMENT

PARAGRAPH 3.9.1.4.1 **PAGE** 53

Add new sentence to third paragraph:

"An override switch shall permit return to maximum deflection in the event of failure of the unit."

AVRO AIRCRAFT

MODEL SPECIFICATION AMENDMENT

AIRCRAFT TYPE Arrow 2	CONTRACT B69-12-44 Serial 2-B-5-309 S04877	AMENDMENT NO. 10
SUBJECT Alteration to Engine and Afterburner Control		E.C.P. –
		MOD. NO. X74-4278
REASON FOR CHANGE Ground idle position no longer required.		EFFECTIVITY 25206 & sub.
		RETROFIT –

EFFECT ON PERFORMANCE –	
WEIGHT CHANGE –	EFFECT ON BALANCE –

AMENDMENT

PARAGRAPH 3.11.10.2 PAGE 69

Delete from first paragraph:

".......with positions for "off", "ground idle", "flight idle", "afterburner off"......."

Replace by:

".....with positions for "off", "idle", "afterburner off"....."

PARAGRAPH 3.11.10.2 PAGE 70

Delete last sentence in first paragraph:

"Rearward movement of the throttle levers through a detent, from the "flight idle" position, shall be necessary to permit selection of "ground idle".

Replace by:

"Rearward movement of the throttle levers through a spring gate, from the "idle" position, shall be necessary to permit selection of "off".

PARAGRAPH 6.2.5.3 PAGE 131

Delete in last two lines:

Amendment No. 10

PARAGRAPH 6.2.5.3 PAGE 131 (Cont'd)

".....with the power lever in the "Flight Idle" position."

Replace by:

".....with the power lever in the "Idle" position."

APPENDIX VI

ACCEPTANCE CONDITION

This model specification defines aircraft 25206 at a standard defined by the status of the development program at the date of issue of the engineering record. It must not be construed that this represents either the present or the planned operational standard.

ARROW 2 ACCEPTANCE CONDITION

This appendix, which forms a part of, and shall be read in conjunction with, Model Specification for Arrow 2 Airframe and Government Supplied Material Installations No. 72/MS/1 dated June 1958, including all applicable amendments, sets forth the acceptance condition of Arrow 2 Airframe and GSM installations constructed to the requirements of this Specification.

Insofar as Section 3 of this specification states the design requirements for the airframe and GSM installations, and insofar as at the date of this Appendix, as amended from time to time, certain equipments have not been fully qualified and/or have been substituted, and insofar as the Company has not fully established compliance with the system and airframe design requirements of Section 3 of the specification, the following paragraphs of Section 3 are amended to establish the definitions of, and/or limitations applicable to, the airframe and GSM installations at the time of acceptance.

3.2.6 Climatic Conditions

The aircraft shall be limited to operation where the
ground environmental temperature is not lower than 1
-20°F.

3.2.15 Equipment

The extent of qualification of contractor furnished equipment, to the requirements established by this paragraph, shall be as itemized in paragraph 3.27 of this Appendix.

Certain items of contractor furnished equipment, as itemized in paragraph 3.27 of this Appendix, have been substituted as a manufacturing expediency.

3.3.2 Stability And Control

The aircraft shall be cleared for maneuvers which have been adequately demonstrated by flight test. Specifically, the following maneuver limitations shall be imposed:

(a) The aircraft shall not be stalled intentionally.
(b) The aircraft shall not be spun intentionally.
(c) The aircraft shall be limited to intentional angles of bank not exceeding 60 degrees.
(d) The aircraft shall be limited to intentional rates of roll not exceeding 30 degrees per second.
(e) The aircraft shall be limited to angles of attack not exceeding 14 degrees (indicated).
(f) The aircraft shall be limited to flight at altitudes not exceeding 50,000 ft.

3.4.1 Limit Flight Load Factors

Clearance throughout the flight envelopes established by this paragraph shall be limited to values determined by flight test as specifically stated in the following sub-paragraphs.

3.4.1.1 Gross Weight For Stress Analysis 56,000 lb.

- including weights below 56,000 lb.

Clean Configuration

Maneuver	Subsonic	Supersonic
Positive	+ 4.0	+ 3.0
Negative	- 1.0	0

Gust		
Positive	+ 3.3	*
Negative	*	*

*The aircraft shall be cleared for a gust factor equal to the corresponding limit maneuver load factor at an appropriately reduced gust velocity.

3.4.1.2 Weights In Excess Of 56,000 lb.

In the clean configuration and at weights in excess of 56,000 lb., the limit load factor shall be:

Maneuver $n_1 = \frac{56,000\ n}{W}$

Gust The lesser of

(a) $n_G = \frac{(n-1)\ 56,000}{W} + 1$

(b) The corresponding limit maneuver load factor at an appropriately reduced gust velocity.

3.4.1.5 Flight Envelopes

In addition to the above, the limit flight load factors for the aircraft in the clean configuration shall be as shown in the following flight envelopes:

Sea Level	Figure 5A
10,000 feet	Figure 6A
30,000 feet	Figure 7A
50,000 feet	Figure 8A

3.4.1.6 Load Factors In Roll

The aircraft shall not be cleared for intentional rolling pull-out maneuvers.

The maximum permissible rate of roll shall be as limited by paragraph 3.3.2 of this appendix.

3.4.1.7 Load Factors In Spin

The aircraft shall not be spun intentionally (Ref. paragraph 3.3.2 of this appendix.).

3.4.1.8 Load Factors For Landing Gear Operation

(a) During landing gear retraction the aircraft shall be limited to flight within the bracket of normal acceleration of 0.8 g positive to 1.8 g positive, gust effect included; the longitudinal acceleration shall not exceed 0.3 g, the angle of sideslip shall not exceed 5 degrees, and the speed shall not exceed 250 knots E.A.S.

(b) During landing gear extension the aircraft shall be limited to flight within the bracket of normal acceleration of 1.0 g positive to 1.8 g positive, gust effect included; the longitudinal acceleration shall not exceed 0.3 g, the angle of sideslip shall not exceed 5 degrees, and the speed shall not exceed 200 knots E.A.S.

3.4.2.1 Limit Take-Off Load Factors

The maximum permissible cross-wind components for take-off shall be 15 knots.

3.4.2.2 Limit Landing Load Factors

The maximum permissible cross-wind component for landing shall be 15 knots.

3.4.3.1 Limit Diving Speed

The aircraft shall be limited to 375 knots E.A.S. subsonic, and the lesser of 450 knots E.A.S. or 2.0 Mach number supersonic.

3.4.3.3 Minimum Flying Speed

The aircraft shall be limited to a minimum flying speed of 150 knots E.A.S.

ARROW 2 FLIGHT ENVELOPE

SEA LEVEL

STRUCTURAL LIMIT MANEUVER
LOAD FACTOR FOR A
WEIGHT OF 56,000 LB.
(BASED ON A STRESSING
WEIGHT OF 47,000 LB.)

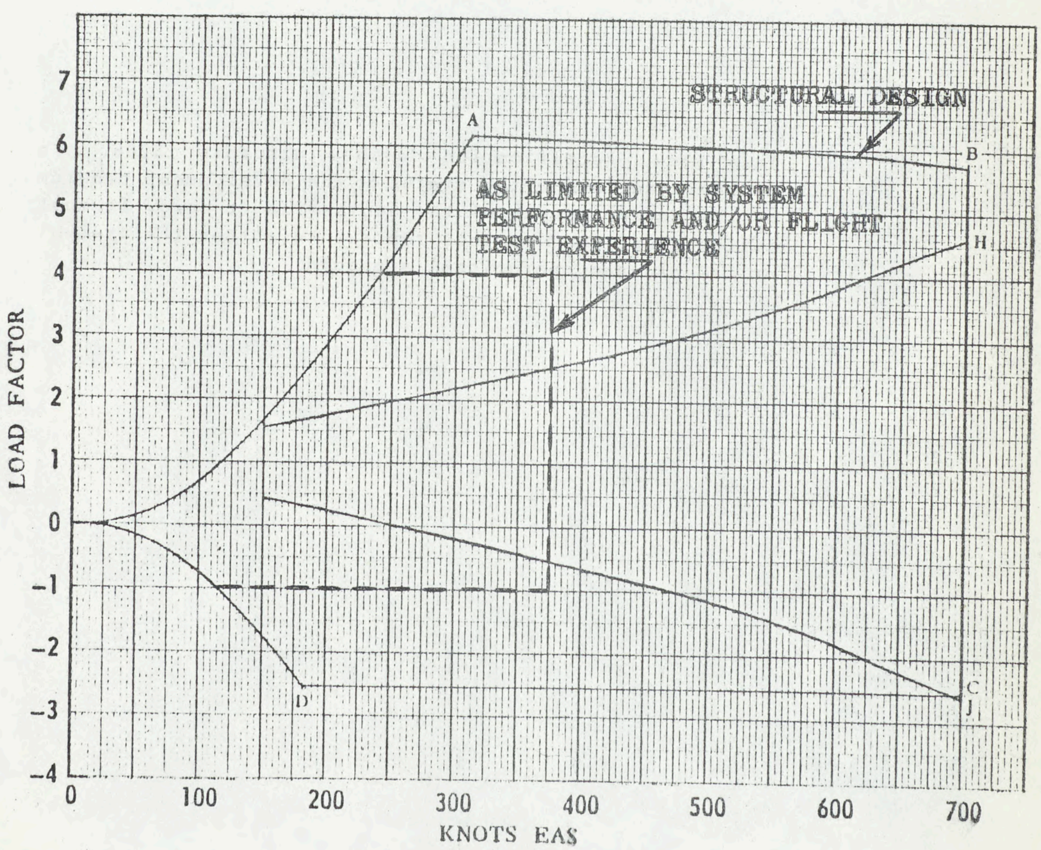
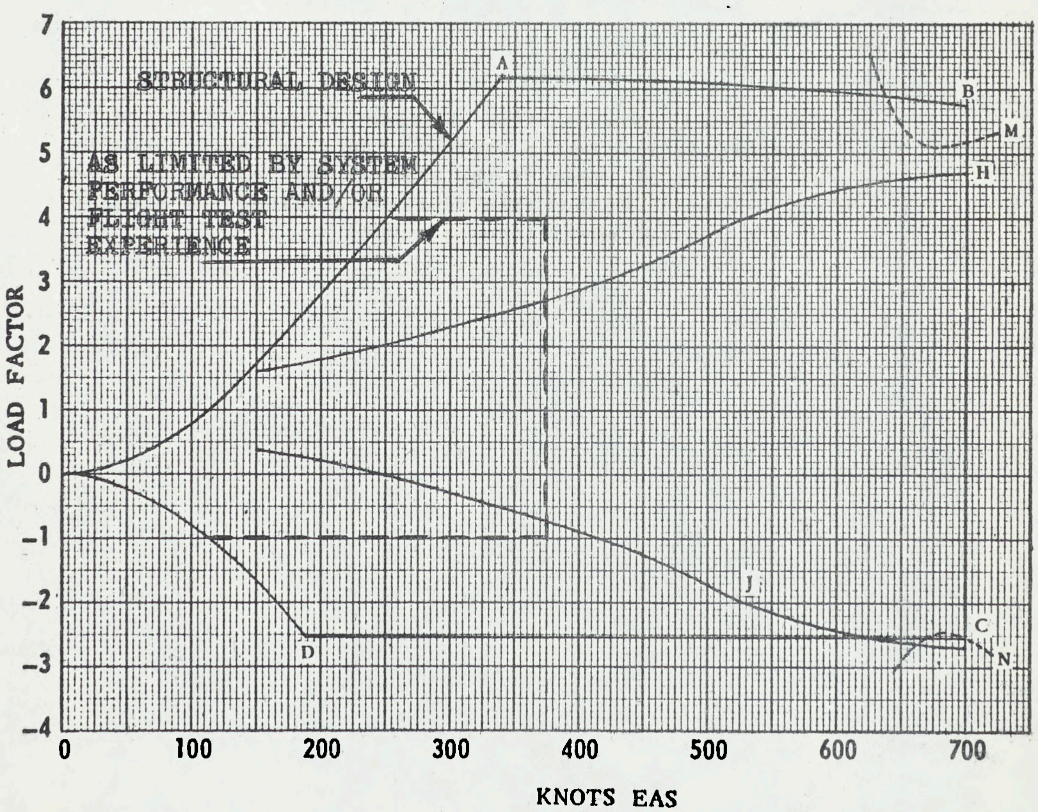


FIGURE 5A

ARROW 2 FLIGHT ENVELOPE

10,000 FEET

STRUCTURAL LIMIT MANEUVER LOAD FACTOR FOR A WEIGHT OF 56,000 LB. (BASED ON A STRESSING WEIGHT OF 47,000 LB.)



ARROW 2 FLIGHT ENVELOPE

30,000 FEET

STRUCTURAL LIMIT MANEUVER LOAD FACTOR FOR A WEIGHT OF 56,000 LB. (BASED ON A STRESSING WEIGHT OF 47,000 LB.)

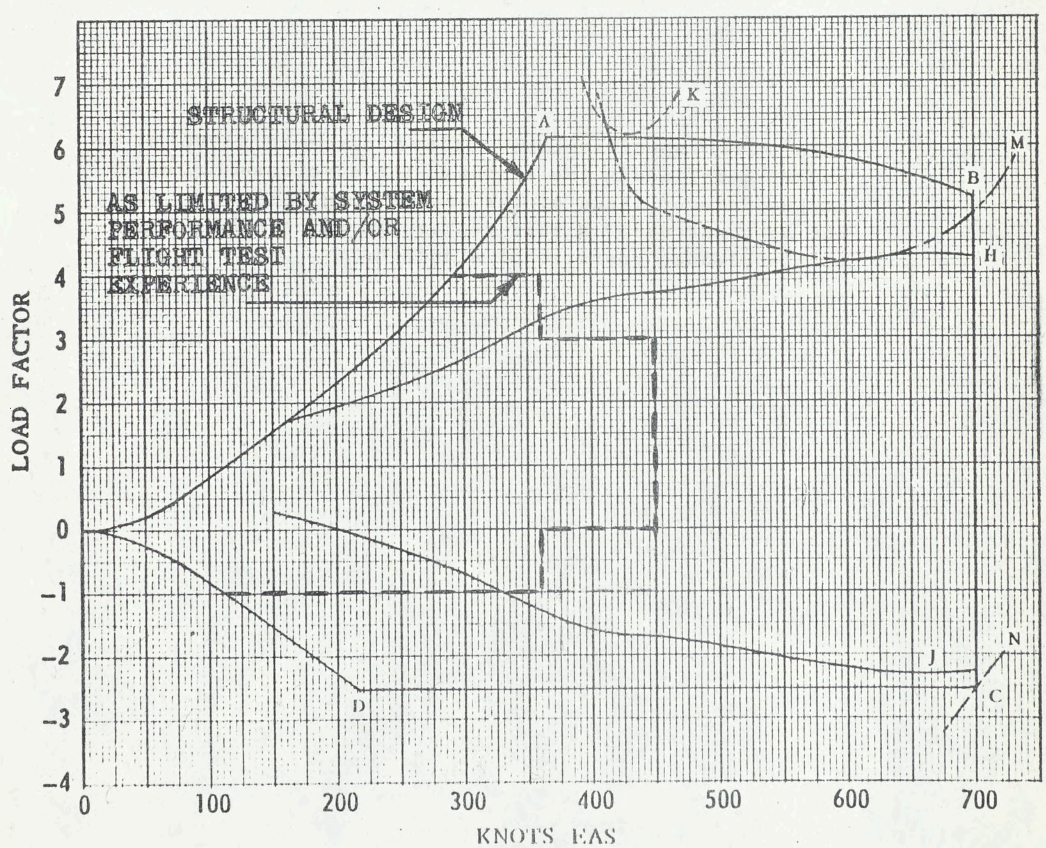
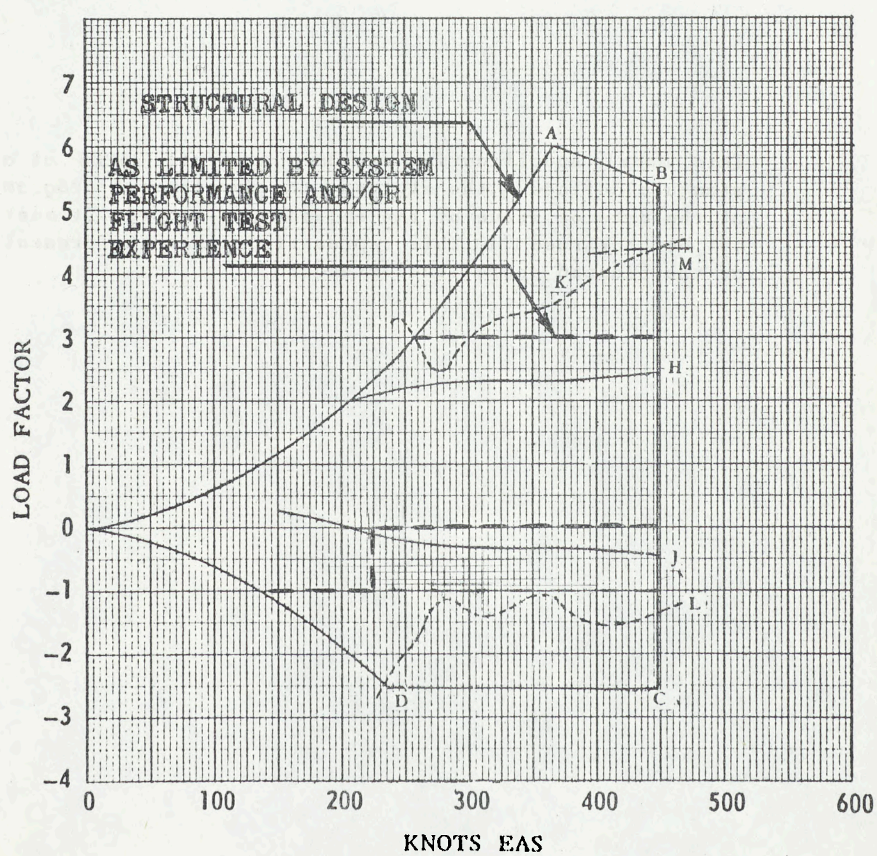


FIGURE 7A

ARROW 2 FLIGHT ENVELOPE

50,000 FEET

STRUCTURAL LIMIT MANEUVER
LOAD FACTOR FOR A
WEIGHT OF 56,000 LB.
(BASED ON A STRESSING
WEIGHT OF 47,000 LB.)



3.8 LANDING GEAR

3.8.1 Description

The hydraulic actuating system shall be designed to retract the gear, including door operation, in 13 seconds at -20°F.

3.9 SURFACE CONTROL SYSTEM (including all applicable sub-paragraphs)

All references to the operation of the Normal Mode of Control for the elevators and ailerons shall be considered as deleted, the Emergency Mode of Control only in the roll and pitch axes will be operative. Normal and Emergency Mode damping will be operable in the yaw axis.

3.11.8.3.2 Tank Capacities

3.11.8.4 External Fuel Tank

(and all applicable subsequent paragraphs).

All references to carriage of an external drop tank shall be considered as deleted. The aircraft shall be limited to flight without a drop tank installed.

3.14.1.1 Utility Services System

Delete stores jettison capability from tabulation. Carriage of drop tank prohibited.

3.16 Electrical System

Delete stores jettison capability from tabulation. Carriage of drop tank prohibited.

3.16.8.2.2 Taxi Light

A taxi light shall not be installed.

3.16.8.2.3 Landing Light

A landing light shall not be installed.

3.20.1.2 Extinguishing System

Three fire extinguisher bottles, each containing 22 pounds of freon, shall be installed to provide additional fire protection. Each bottle shall provide a single charge, one to the airframe services bay, and one to each power plant region.

3.23 Anti-Icing And De-Icing System

The aircraft shall not be flown in icing conditions intentionally.

3.23.3.1 Engine Air Intakes

The engine air intake de-icing system shall be inoperative.

3.27 CONTRACTOR FURNISHED EQUIPMENT QUALIFICATION STATUS

The following items of Contractor furnished equipment have not yet been fully qualified to the requirements of the governing procurement Specification:
Certain items, as indicated, have been substituted as a manufacturing expediency.

PART NO.	DESCRIPTION	REMARKS
7-1052-1037	Jack, Canopy Emergency	
7-1052-1038	Valve, Latch Jack Sequence	
7-1052-6589	Recuperator, Jack Damping	
7-1052-6601	Firing Unit, Canopy Cartridge	
7-1052-1387	Panel, Windscreen L.H.	
7-1052-1388	Panel, Windscreen R.H.	
7-1053-211	Panel, Pilot's Canopy, L.H.	
7-1053-212	Panel, Pilot's Canopy, R.H.	
7-1053-15161	Window Navigator's Canopy L.H.	
7-1053-15162	Window Navigator's Canopy R.H.	
7-1053-15185	Seal, Pilot's Canopy L.H.	
7-1053-15186	Seal, Pilot's Canopy R.H.	
7-1053-15187	Seal, Navigator's Canopy L.H.	
7-1053-15188	Seal, Navigator's Canopy R.H.	
7-1058-25131	Blanket, Sta. 729.86 to 742.5 Inboard	
7-1058-25132	Blanket, Sta. 729.86 to 742.5 Inboard	
7-1058-25133	Blanket, Sta. 698 to 729.86 Inboard	

PART NO.	DESCRIPTION	REMARKS
7-1058-25134	Blanket, Sta. 698 to 729.86 Inboard	
7-1058-25135	Blanket, Sta. 682 to 698 Inboard	
7-1058-25136	Blanket, Sta. 682 to 698 Inboard	
7-1058-25137	Blanket, Sta. 682 to 742.5 Outboard	
7-1058-25138	Blanket, Sta. 682 to 742.5 Outboard	
7-1059-19673	Blanket, Sta. 773 to 743	
7-1059-19674	Blanket, Sta. 773 to 743	
7-1059-19675	Blanket, Sta. 803 to 778	
7-1059-19676	Blanket, Sta. 803 to 778	
7-1059-19683	Blanket, Sta. 778 to 753 Outboard	
7-1059-19684	Blanket, Sta. 778 to 753 Outboard	
7-1059-19685	Blanket, Sta. 778 to 753 Inboard	
7-1059-19686	Blanket, Sta. 778 to 753 Inboard	
7-1059-19687	Blanket, Sta. 803 to 778 Outboard	
7-1059-19688	Blanket, Sta. 803 to 778 Outboard	
7-1059-19691	Blanket, Sta. 803 to 778 Inboard	
7-1059-19692	Blanket, Sta. 803 to 778 Inboard	
7-1059-20421	Blanket, Sta. 803 to 854	
7-1059-20422	Blanket, Sta. 803 to 854	
7-1091-303	Wheel, complete, nose landing gear.	Item used on initial flights only.
7-1091-15003	Nose Undercarriage Leg	
7-1091-15007	Spring, Liquid, Complete	
7-1091-15011	Strut, Drag.	

PART NO.	DESCRIPTION	REMARKS
7-1091-15025	Wheel, Complete	7-1091-303 will be used on initial flights.
7-1091-15027	Tire, High Speed, Tubeless Nose Landing Gear	RCAF 43311 will be used on initial flights.
7-1092-237	Brake, Main Landing Gear Wheel	Item used on initial flights only.
7-1092-305	Side Stay, Main Landing Gear L.H.	
7-1092-306	Side Stay, Main Landing Gear R.H.	
7-1092-15073	Brake, Main Landing Gear Wheel	7-1092-237 will be used on initial flights.
7-1092-15075	Tire, Main Landing Gear	RCAF 43312 will be used on initial flights
7-1092-15203	Main Undercarriage Leg, L.H.	
7-1092-15204	Main Undercarriage Leg, R.H.	
7-1152-15011	Battery	
7-1152-15043	Control Box, Master Warning Sys.	
7-1152-15093	Switch, Altitude	
7-1154-153	Anti-Skid Control Box	
7-1154-15097	Control Unit, Fire Detection L.H.	
7-1154-15098	Control Unit, Fire Detection R.H.	
7-1156-15083	Contactor Power Transfer	
7-1156-15363	Generator Control and Transformer Rectifier	
7-1156-15373	Current Transformer	
7-1158-15057	Transformer, Differential Current	
7-1158-15061	Generator, A.C., 40 KVA	
7-1164-11	Potentiometer, Rectilinear, Triple Element.	

PART NO.	DESCRIPTION	REMARKS
7-1183-11	Tip Light, Fin	
7-1183-12	Tip Light, Fin	
7-1252-15108	Master Warning Panel	
7-1252-15142	Indicator, Control Surface	
7-1252-15181	Indicator, Fuel Quantity	
7-1252-15251	Indicator, Engine Performance	
7-1352-15461	Relay, Electronic Time Delay	
7-1354-337	Accelerometer, Normal G.	
7-1354-343	Calibrator, G Limiter	
7-1354-15011	U.H.F. Antenna, Lower	
7-1354-15113	Cover Panel Equipment Bay L.H.	
7-1356-15301	Command Signal Converter	
7-1362-295	Shock Mount Assembly, Damping System	
7-1362-15145	Rate Gyro Mount	
7-1362-15157	Flex Waveguide	
7-1362-15159	Twisted Waveguide	
7-1362-15161	Gyro, Yaw	
7-1362-15163	Gyro, Pitch	
7-1362-15165	Gyro, Roll	
7-1362-15275	Switch, Differential Pressure (Qc System)	
7-1452-15066	Throttle Box	
7-1458-15129	Ball Joint, Universal	
7-1500-21	Bearing, Flying Controls	

PART NO.	DESCRIPTION	REMARKS
7-1552-341	Feel and Trim Unit, Aileron	
7-1552-521	Feel and Trim Unit, Elevator	**Item** will be used on initial flights only
7-1552-15125	Feel and Trim Unit, Twin Motor, Elevator	7-1552-521 will be used on initial flights.
7-1552-15135	Stick-Grip Transducer, Complete with Quick Disconnect	
7-1562-607	Bearing, Self Aligning, Lever No.1	
7-1562-611	Bearing, Self Aligning, Lever No.1	
7-1562-613	Bearing, Link	
7-1562-615	Bearing, Self Aligning, Link	
7-1562-621	Bearing, Outer T/E	
7-1564-575	Rod Bearing, Lever No.1	
7-1564-577	Bearing, Pivot No. 1	
7-1564-585	Bearing, Self Aligning, Pivot No. 2	
7-1564-587	Bearing, Self Aligning, Link No. 2 and 3.	
7-1564-593	Bearing, Pivot, Lever No. 3	
7-1564-595	Bearing, Jack End, Lever No. 3	
7-1564-597	Bearing, Rod No's. 2 and 4	
7-1564-601	Bearing, Non Self Aligning, Pivot No. 4	
7-1564-603	Bearing, Link No. 4	
7-1564-605	Bearing, Rod End No. 5	
7-1564-607	Bearing, Pivot No. 5	
7-1564-611	Bearing, Link No. 5	

PART NO.	DESCRIPTION	REMARKS
7-1564-613	Bearing, Rod Lever No. 6 and 7.	
7-1564-615	Bearing, Pivot No. 6 and 7	
7-1564-647	Bearing, Control Rod at Lever No. 3	
7-1564-15037	Link No. 7 Bearing	
7-1564-15063	Link No. 1 Bearing	
7-1564-15065	Link No. 2 Bearing	
7-1564-15067	Link No. 3 Bearing	
7-1564-15071	Link No. 4 Bearing	
7-1564-15073	Link No. 5 Bearing	
7-1564-15075	Link No. 6 Bearing	
7-1583-63	Trim Actuator and Quadrant Assy. Rudder Feel and Trim.	
7-1583-243	Bearing, Rod End, Levers No. 1, 2 4 and 5	
7-1583-247	Bearing, Self Aligning, Lever No.3	
7-1583-251	Bearing, Link No. 3	
7-1583-253	Bearing, Link No. 3	
7-1583-361	Bearing, Pivot, Lever No. 4 and 5	
7-1583-362	Bearing, Pivot, Lever No. 3	
7-1583-363	Bearing, Self Aligning, Pivot Lever No. 1	
7-1583-364	Bearing, Pivot, Lever No. 2	
7-1583-435	Bearing, Self Aligning, Actuator Jack End and Lever No. 3	
7-1583-437	Linear Q Actuator	

PART NO.	DESCRIPTION	REMARKS
7-1600-11	Valve, Tank Shut Off, Pressure Fuel Servicing.	
7-1600-15027	Valve, Fuel No Air	
7-1600-15035	Check Valve, Fuel, Residual Flow	
7-1600-15036	Check Valve, Fuel, Residual Flow	
7-1654-15201	Capacitor Unit, Tank No. 1 Fwd.	
7-1654-15203	Capacitor Unit, Tank No. 1 Aft.	
7-1654-15205	Capacitor Unit, Tank No. 2 Fwd.	
7-1654-15207	Capacitor Unit Tank No. 2 Aft.	
7-1654-15231	Sequence Control Unit	
7-1654-15232	Sequence Control Unit	
7-1654-15257	Valve, Non-return	
7-1656-8	Valve, Condensate Drain, Tank No. 1 and 2	
7-1656-15029	Valve-Air Pressure Relief	
7-1656-15263	Filter, Fuel	
7-1658-15093	Regulator, Air Absolute pressure	
7-1662-12	Valve, Drain, Fuel and Condensate Tanks No. 6, 7 and 8	
7-1662-183	Valve, Drain, Fuel and Condensate Tank No. 3	
7-1662-185	Valve, Drain, Fuel and Condensate, Tank No. 5	
7-1662-186	Valve, Drain, Fuel and Condensate, Tank No. 5	
7-1662-189	Valve, Condensate Drain, Tank No. 4	

PART NO.	DESCRIPTION	REMARKS
7-1662-605	Tank Unit, Tank No. 7, Centre Aft.	
7-1662-607	Tank Unit, Tank No. 7 Outboard	
7-1662-611	Tank Unit, Tank No. 7 Inboard	
7-1662-635	Tank Unit, Tank No. 8 Outboard	
7-1662-637	Tank Unit, Tank No. 3 Aft.	
7-1662-641	Tank Unit, Tank No. 3 Fwd.	
7-1662-803	Tank Unit, Tank No. 4 Aft.	
7-1662-805	Tank Unit, Tank No. 4 Fwd.	
7-1662-807	Tank Unit, Compensator, Tank No. 5 Outboard	
7-1662-811	Tank Unit, Tank No. 5, Inboard	
7-1662-813	Tank Unit, Tank No. 6, Outboard	
7-1662-815	Tank Unit, Tank No. 6, Centre	
7-1662-817	Tank Unit, Tank No. 6, Inboard	
7-1662-821	Tank Unit, Tank No. 8, Inboard	
7-1662-825	Tank Unit, Tank No. 3 Centre	
7-1662-827	Tank Unit, Tank No. 7, Centre Fwd.	
7-1662-981	Sensor, Low Level Warning	
7-1662-985	Tank Unit, Tank No. 8, Centre	
7-1662-1007	Tank Unit No. 1, Fuel Management System	
7-1662-1011	Tank Unit No. 6, Fuel Management System	
7-1662-1013	Tank Unit No. 3A, Fuel Management System	
7-1662-1017	Tank Unit No. 5, Fuel Management System	

PART NO.	DESCRIPTION	REMARKS
7-1662-16015	2.5" Gate Valve Manually Operated.	
7-1662-15017	Valve, Transfer and Refueling Shut off.	
7-1662-15555	Valve, Air Release	
7-1662-15581	Fuel Booster Pump	7-1662-583 will be used on initial flights.
7-1662-15582	Fuel Booster Pump	7-1662-584 will be used on initial flights.
7-1852-15133	Switch, Pressure	
7-1854-21	Seal, Pneumatic Armament Pack, Front	
7-1894-11	Seal, Pneumatic, Armament Pack, Side.	
7-1952-12	Jack, Nose Gear Door Operating	
7-1952-21	Jack, Nose Landing Gear Operating	
7-1952-31	Valve, Pneumatic Relief (5,000psi)	
7-1952-483	Valve,Fixed Orifice Restrictor	
7-1952-15037	Uplock, Nose Landing Gear.	
7-1952-15061	Valve, Restrictor (Nitrogen)	
7-1952-15067	Valve, Pneumatic	
7-1954-443	Valve, Anti Skid Control	
7-1954-15163	Manual Dump Valve	
7-1956-7	Jack, Speed Brake	
7-1956-12	Valve, Landing Gear Selector	
7-1956-35	Coupling, Expansion 3/8" O.D.	
7-1956-37	Compensator, Single Pressurized Type	Item will be used on initial flights only.

PART NO.	DESCRIPTION	REMARKS
7-1956-353	Valve, Bypass control	
7-1956-383	Valve, Thermal Bypass	
7-1956-15011	Valve, Landing Gear Selector and Bypass	Selector valve 7-1956-12 and bypass valve 7-1956-21 will be used on initial flights.
7-1956-15105	Compensator, Utility Hydraulics	7-1956-37 will be used on initial flights.
7-1956-15371	Emergency A.C. Generator	
7-1956-15377	Filter 40 G.P.M., Single Outlet	
7-1958-14	Valve, Pressure Control, Utility Hydraulics	
7-1958-51	Regulator, Pressure, 40 G.P.M.	
7-1958-185	Accumulator, 5" diameter	
7-1958-15021	Pressure Control Valve	Pressure control valve 7-1958-14 and relief valve 7-1958-16 will be used on initial flights.
7-1962-17	Jack, Main Landing Gear	
7-1962-18	Jack, Main Landing Gear	
7-1962-23	Jack Main Landing Gear Door.	
7-1962-63	Swivel, Main Gear Sidestay Down-lock Release	
7-1962-421	Fuse, Wheel Brake Circuit	
7-1962-435	Jack, Door Uplock Release	7-1962-15023 will be used on initial flight.
7-1962-15023	Jack, Main Gear Uplock Release	
7-1962-15025	Jack, Main Gear Door Uplock Release	
7-1962-15027	Brake Gauge.	

PART NO.	DESCRIPTION	REMARKS
7-1962-15161	Valve, Restrictor (Nitrogen)	
7-1991-17	Jack, Nose Gear Steering	
7-2052-15011	Windscreen Temperature Control	
7-2055-175	Boot No. 1, Ramp De-icing L.H.	
7-2055-176	Boot No. 1, Ramp De-icing R.H.	
7-2055-183	Boot No. 4, Intake De-icing L.H.	
7-2055-184	Boot No. 4, Intake De-icing R.H.	
7-2055-185	Boot No. 5, Intake De-icing L.H.	
7-2055-186	Boot No. 5, Intake De-icing R.H.	
7-2055-193	Filter Radio Noise, Ice Detector	
7-2055-15021	Boot No. 2 Complete, Ramp De-icing L.H.	
7-2055-15022	Boot No. 2 Complete, Ramp De-icing R.H.	
7-2055-15025	Boot No. 3, Intake De-icing L.H.	
7-2055-15026	Boot No. 3, Intake De-icing R.H.	
7-2055-15031	Boot No. 6, Intake De-icing L.H.	
7-2055-15032	Boot No. 6, Intake De-icing R.H.	
7-2055-15035	Boot No. 7, Ramp De-icing L.H.	
7-2055-15036	Boot No. 7, Ramp De-icing R.H.	
7-2152-15023	Converter-Liquid Oxygen	
7-2152-15025	Tray, Converter Mount	
7-2152-15027	Emergency Bottle Assembly	
7-2152-15031	Disconnect Complete, Leads Man, Part A	

PART NO.	DESCRIPTION	REMARKS
7-2152-15032	Disconnect Complete, Leads Seat, Part B.	
7-2152-15033	Disconnect Complete, Leads Aircraft Part C	
7-2152-15067	Bottle, Emergency	
7-2152-15071	Valve, Oxygen Charging	
7-2152-15073	Valve, Oxygen Starting and pressure reducing	
7-2250-15083	Thermostat.	
7-2252-328	Valve, Safety, Cabin Air Pressure	
7-2252-329	Controller, Safety, Cabin Air Pressure.	
7-2252-403	Valve, Inward Relief	
7-2252-15103	Elbow, Flexible	
7-2252-15193	Valve, Shut off and Non-return	
7-2252-15203	Valve, Radar Nose Shut-off	
7-2252-15733	Thermostat.	
7-2252-15735	Controller, Cockpit Temperature	
7-2252-15737	Controller, Equipment Temperature	
7-2252-15863	Power Unit	
7-2254-349	Pick-up, Duct Temperature	
7-2254-1001	Heat Exchanger	
7-2254-1002	Turbine and Fan	
7-2254-1003	Water Evaporator	
7-2254-15611	Valve, Actuator Reverse Flow	
7-2254-15612	Valve, Actuator Reverse Flow	

PART NO.	DESCRIPTION	REMARKS
7-2254-15617	Valve, Inward Relief	
7-2254-15618	Valve, System Relief	
7-2254-16005	Valve, Non-return	
7-2254-16013	Valve, System Shut-off	
7-2254-18183	Valve, Cockpit Temperature	
7-2254-18187	Valve, Equipment Temperature	
7-2254-15053	Coupling, Ground Service	
7-2256-15021	Pressure Switch-Engine Bleed	
7-2256-15023	Pressure Reducing Valve	
7-2256-15335	Fuel Pressurization Overheat Thermostat.	
7-2295-15013	Valve, Engine Air Bleed Shut-off L.H.	
7-2295-15014	Valve, Engine Air Bleed Shut-off R.H.	
7-2358-15025	Valve, Double Check Tee, Fire Protection	
7-2852-12	Seat, Ejection	
7-2956-15011	Heat Exchanger, Air-Oil, Gear Box	
7-2956-15025	Heat Exchanger, Air-Oil	
7-2956-15245	Regulator, Air Pressure C.S.Drive and Gear Box System.	
7-2958-11	Bearing, Drive Shaft Support	
7-2958-173	Drive Shaft, Forward Horizontal	
7-2958-175	Drive Shaft, Aft Horizontal	
7-2958-15011	Gear Box, Accessories Input	

PART NO.	DESCRIPTION	REMARKS
7-2958-15013	Drive Shaft, Engine to Airframe	
7-2958-15017	Filter, Oil	
7-2958-15018	Filter, Oil	
7-2958-15023	Vertical Drive shaft	
7-2958-15025	Accessories Gear Box (Main)	
7-2958-15026	Accessories Gear Box (Main)	
7-2958-15031	Filter - Oil	
7-2958-15057	Relief Valve, Accessories Drive System	
7-2958-15108	Relief Valve, Constant Speed Drive and Accessories Drive System	
7-2958-15123	All Attitude Tank L.H.	
7-2958-15124	All Attitude Tank R.H.	
7-2958-15125	Fuel Booster Pump Gear Box	
7-2958-15126	Fuel Booster Pump Gear Box	
7-2958-15155	Shuttle Valve	
7-2958-15275	Coupling, Engine to Accessories Drive Shaft.	
7-2962-15021	Gear Box, Top Corner	
7-2995-15011	Engine Starter	
7-2995-15021	Constant Speed Drive, Axial Piston Type.	
7-2995-15047	Valve, Check, Oil.	
7-3159-15085	Parachute-Deceleration	7-3159-171 will be used on initial flights.
7-3252-3	Booster, Elevator and Aileron Circuit.	

PART NO.	DESCRIPTION	REMARKS
7-3252-153	Damper Valve Assembly	
7-3252-235	Accumulator 12 cu. in.	
7-3252-713	Servo, Parallel, Aileron	
7-3252-715	Servo, Parallel, Elevator	
7-3252-15255	Valve, Pressure Reducing	
7-3252-15257	Valve, Pressure Reducing	
7-3252-15355	Gauge, Booster, 500 psi.	
7-3256-15011	Heat Exchanger, Air-Oil	
7-3256-15012	Heat Exchanger, Air-Oil	
7-3256-15013	Heat Exchanger, Oil-Fuel	
7-3256-15014	Heat Exchanger, Oil-Fuel	
7-3258-14	Valve, Pressure Control	
7-3258-37	Compensator Dual Pressurized Type	Item will be used on initial flights only.
7-3258-15027	Switch, Pressure Warning Type 1	
7-3258-15033	Pump, Variable Delivery	
7-3258-15081	Compensator, 475 cu. in.	7-3258-37 will be used on initial flights.
7-3258-15193	Switch, Pressure Warning Type 3	
7-3258-15333	Filter, 40 G.P.M., Multi-outlet	
7-3258-15341	Element, Filter, 40 G.P.M.	
7-3260-11	Differential Servo, Elevator and Aileron	
7-3260-13	Differential Servo, Elevator and Aileron	
7-3262-15	Jack, Elevator L.H.	Item will be used on initial flights. only.

PART NO.	DESCRIPTION	REMARKS
7-3262-16	Coupling, Expansion $\frac{1}{2}$" O.D. 4000 psi.	
7-3262-18	Jack, Elevator R.H.	Item will be used on initial flights only.
7-3262-33	Valve, Elevator Control	
7-3262-165	Parallel Servo, Elevator	
7-3262-167	Parallel Servo, Aileron	
7-3262-343	Damper, Elevator	
7-3262-15123	Jack, Elevator L.H.	7-3262-15 will be used on initial flights.
7-3262-15124	Jack, Elevator R.H.	7-3262-18 will be used on initial flights.
7-3264-12	Valve, Aileron Control	
7-3264-23	Jack, Aileron L.H.	Item will be used on initial flights, only.
7-3264-24	Jack, Aileron R.H.	Item will be used on initial flights, only.
7-3264-181	Damper, Aileron	
7-3264-231	Filter, Complete	
7-3264-232	Filter, Complete	
7-3264-233	Filter, Complete	
7-3264-234	Filter, Complete	
7-3264-15095	Jack, Aileron L.H.	7-3264-23 will be used on initial flights.
7-3264-15096	Jack, Aileron R.H.	7-3264-24 will be used on initial flights.
7-3283-5	Jack, Rudder	Item will be used on initial flights only.
7-3283-7	Double Differential Servo	

PART NO.	DESCRIPTION	REMARKS
7-3283-8	Rudder Jack Control Valve Body	
7-3283-193	Damper, Rudder	
7-3283-237	Filter, Complete	
7-3283-297	Differential Servo, Complete	
7-3283-333	Jack Valve Damper	
7-3283-15097	Jack, Rudder	7-3283-5 will be used on initial flights.
7-3292-11	Detector, Skid Control System	

PART NO.	DESCRIPTION	REMARKS
CS-C-06HR-22-14	Connector, Straight Electrical Plug, 550°F.	
CS-C-06KE-10SL-3S	Connector, Straight Electrical Plug, 400°F.	
CS-C-149-16	Coupling Half, Hydraulic, Self Sealing, 1000 psi.	
CS-C-152-16	Coupling Half (Fixed), Hydraulic, Self Sealing 4000 psi.	
CS-C-154-12	Coupling Half (Fixed), Hydraulic Self Sealing, 4000 psi.	
CS-C-172-28	Coupling, Flexible Boss, L.P.Fuel	
CS-C-174-16-1	Cap, Sealing 1000 psi.	
CS-C-175-12-1	Cap, Sealing 4000 psi.	
CS-C-200-12	Coupling Half, Self Aligning Swivel Boss, 4000 psi	Item not required on initial flights.
CS-C-201-16	Coupling Half, Self Aligning Swivel Boss 1000 psi	Item not required on initial flights.
CS-C-208-1	Connector-Quick Disconnect Lanyard Release	
CS-C-3108E-22-14S	Connector, 90° Angle Electrical Plug	
CS-F-106	Flasher Unit	
CS-F-215-4-6-6	Steel Tee, Special Reducer, Flareless Tube and Boss.	
CS-F-535-8	Al Alloy 45° Elbow, Flareless Tube and Universal.	
CS-F-548-4	Al Alloy 4 Way, Wig-o-flex and Female Boss, Flareless Tube	
CS-F-556-10-4-10	Al Alloy Tee, Bulkhead Reducer Flareless Tube.	

PART NO.	DESCRIPTION	REMARKS
CS-F-559-6	Al Alloy Union, Bulkhead and Universal	
CS-F-564-4-4	Al Alloy 90° Elbow, Flareless to Flared	
CS-F-565-4-4-4	Al Alloy Tee, Bulkhead and End on Run, Flareless to Flared.	
CS-H-139-329-32	Hose, Flexible Metal 85 psi, 950°F.	
CS-H-139-615-64	Hose, Flexible Metal 85 psi, 950°F.	
CS-J-107	Joint, Flexible Metal Hose, Universal 2.00"	
CS-J-108	Joint, Flexible Metal Hose, Universal 4.00"	
CS-J-109	Joint, Flexible Metal Hose, Universal 4.50"	
CS-J-110	Joint Flexible Metal Hose, Universal 4.50"	
CS-R-130	Relay 50 Amp. Class A	
CS-V-108-4	Hydraulic Check Valve 4000 psi	
CS-V-110	Valve and Pressure Gauge Air Charging 750 psi.	
CS-V-111	Valve and Pressure Gauge Air Charging 1500 psi.	