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EO 05-200A-1

CANADIAN FORCES

AIRCRAFT OPERATING INSTRUCTIONS
BUFFALO

REVISION
NOTICE

LATEST REVISED PAGES SUPERSEDE
THE SAME PAGES OF PREVIOUS DATE
Insert revised pages into basic publication.
Destroy superseded pages.

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15 AUG 67

Revised 22 Mar 71

LIST OF REVISIONS

DATE	PAGE NO	
27 May 68	88	Ink Amendment
27 May 68	2-4	
27 May 68	2-5	
27 May 68	2-9	
27 May 68	2-10	
27 May 68	2-29	
27 May 68	3-1-1	
27 May 68	3-1-2	
27 May 68	3-1-4	
27 May 68	3-1-5	
26 Sep 68	1-33	
26 Sep 68	1-34	
26 Sep 68	1-34A	
25 Jul 69	1-23	
25 Jul 69	1-25	
25 Jul 69	1-27/1-28	
25 Jul 69	1-74	
25 Jul 69	2-15	
25 Jul 69	2-26	
10 Nov 69	1-45	
10 Nov 69	1-46	
10 Nov 69	1-46A	
10 Nov 69	1-72	
10 Nov 69	2-14	
10 Nov 69	2-15	
10 Nov 69	2-16	
10 Nov 69	2-16A	
10 Nov 69	4-2	
10 Nov 69	4-5	
3 May 70	ii	
3 May 70	x	
3 May 70	xii	
3 May 70	1-15	
3 May 70	1-16	
3 May 70	1-16A	
3 May 70	3-1-3	
3 May 70	3-1-4	
3 May 70	3-1-4A	
22 Mar 71	xii	
22 Mar 71	xiii	
22 Mar 71	xiv	
22 Mar 71	xv	
22 Mar 71	5-1	
22 Mar 71	5-2	

DATE	PAGE NO
22 Mar 71	5-3
22 Mar 71	5-4
22 Mar 71	5-5
22 Mar 71	5-6
22 Mar 71	5-7
22 Mar 71	5-8
22 Mar 71	5-9
22 Mar 71	5-10
22 Mar 71	5-11
22 Mar 71	5-12
22 Mar 71	5-13
22 Mar 71	5-14
22 Mar 71	5-15
22 Mar 71	5-16
22 Mar 71	5-17
22 Mar 71	5-18
22 Mar 71	5-19
22 Mar 71	5-20
22 Mar 71	5-21
22 Mar 71	5-22
22 Mar 71	5-23
22 Mar 71	5-24
22 Mar 71	5-25
22 Mar 71	5-26
22 Mar 71	5-27
22 Mar 71	5-28
22 Mar 71	5-29
22 Mar 71	5-30
22 Mar 71	5-31

NOTE TO USERS

1 This publication is divided into four Parts: Description, Handling, Emergency Handling and Operating Data.

2 PART 1 - DESCRIPTION of the controls and equipment with which the pilot should be acquainted.

3 PART 2 - HANDLING describes the normal handling of the aircraft by the aircrew.

4 PART 3 - EMERGENCY HANDLING describes the emergency handling of the aircraft by the aircrew.

5 PART 4 - OPERATING DATA gives the flying and engine limitations and includes information on fuel consumption, range and endurance under various conditions of flight.

6 These notes are complementary to EO 05-1-1 Aircraft Operating Instructions General and assume a thorough knowledge of its contents.

7 In the text, words written in capital letters indicate actual markings on the controls concerned.

8 Comments and suggestions should be forwarded through the usual channels to CFHQ.

TABLE OF CONTENTS

PART	SECTION	TITLE	PAGE
1		DESCRIPTION	
		INTRODUCTION	
		General	1-1
		Airframe	1-1
		Engines	1-1
		LEADING PARTICULARS	
		Dimensions	1-3
		Weight Limitations	1-3
		Fuel Tank Capacities	1-3
		Oil Tank Capacities	1-5
		FUEL SYSTEM	
		General	1-5
		Fuel Specification	1-5
		Fuel Control Panel	1-8
		Fuel Selector Switch	1-8
		Fuel Flow Levers	1-8
		Fuel Emergency Shutoff Switches	1-9
		Fuel Quantity Indicating System	1-9
		Fuel Quantity Indicators	1-9
		Engine Fuel Pressure Caution Lights	1-9
		Fuel Quantity Test Switch	1-9
		Inner Tank Switches	1-10
		Fuel Flow Indicators	1-10
		Fuel Low Level Caution Lights	1-10
		Booster Pump Fuel Pressure Caution Lights	1-10
		Refuel/Defuel System	1-10
		Fueling Panel	1-10
		Refuel/Defuel Selector Caution Light	1-12
		Doors Unlocked Caution Light	1-12
		OIL SYSTEM	
		General	1-12
		Low Oil Pressure Caution Lights	1-12
		Oil Emergency Shutoff Switches	1-12
		HYDRAULIC SYSTEM	
		General	1-15
		Utility Hydraulic System	1-15
		Utility Pressure to Rudder Actuator	1-15
		Rudder Hydraulic System	1-15
		Utility Pressure to Rudder Switch	1-15
		Emergency Hydraulic Circuits	1-16
		Hydraulic Pressure Indicators	1-16
		Low Pressure Caution Lights	1-18
		Hydraulic Emergency Shutoff Switches	1-18
		ELECTRICAL POWER SYSTEM	
		General	1-18

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
1 (Cont'd)		Power Distribution	1-18
		Electrical Power Controls	1-18
		Electrical Power System Caution Lights	1-21
		Circuit Breakers	1-22
		Variable Frequency AC System	1-22
		400 Cycle AC Power System	1-23
		DC Power System	1-23
		Battery Charger	1-23
		APU Power System	1-26
		External Power System	1-26
		AC and DC Power Receptacles	1-26
		Master Caution System	1-26
		Caution Lights Test Switch	1-26
		Caution Light Circuit Breakers	1-29
		PNEUMATIC SYSTEM	1-29
		POWER CONTROLS	
		General	1-29
		Power Levers	1-29
		Fuel Flow Levers	1-31
		Friction Control Knobs	1-31
		Engine Panel	1-31
		Engine Start Switch	1-31
		Engine Ignition Switch	1-31
		Engine Overspeed Prevention System	1-31
		Engine Overspeed Test Switch	1-31
		Engine Starter Valve Caution Lights	1-32
		ENGINE COMPARTMENT COOLING SYSTEM	1-32
		PROPELLER CONTROLS	
		General	1-32
		Propeller Levers	1-32
		Propeller Feathering Buttons	1-33
		Autofeathering	1-33
		Autofeathering Switch	1-33
		Autofeathering Indicator Lights	1-34
		Autofeathering Test	1-34
		Propeller Fine Pitch Operation	1-34
		Fine Pitch Stop Switch	1-34
		Fine Pitch Stop Indicator Lights	1-34
		Reverse Pitch Operation	1-35
		Unreverse Pitch Operation	1-35
		Rapid Power Provision	1-35
		FLIGHT CONTROLS	
		General	1-35

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
1 (Cont'd)		Control Columns	1-36
		Rudder Pedals	1-36
		Aileron System	1-36
		Aileron Geared Tabs	1-36
		Rudder Aileron Interconnect Tab	1-36
		Aileron Trim Tab	1-37
		Aileron Trim Switch	1-37
		Aileron Trim Tab Position Indicator	1-37
		Elevator System	1-37
		Elevator Spring Tab	1-37
		Elevator Trim Tab	1-37
		Elevator Trim Wheel and Indicator	1-37
		Rudder System	1-38
		Rudder Trim Switch	1-38
		Rudder Trim Indicator	1-38
		Flight Controls Lock Lever	1-38
		Wing Flaps System	1-38
		Wing Flaps Selector Lever	1-39
		Wing Flaps Disengage Knob	1-39
		Wing Flaps Position Indicators	1-40
		Wing Spoilers System	1-40
		Spoilers Landing Arm Switch	1-40
		Spoilers Emergency Close Switch	1-41
		Spoiler Indicator Lights	1-41
		LANDING GEAR SYSTEM	
		General	1-41
		Landing Gear Hydraulic Circuit	1-41
		Landing Gear Selector Lever	1-42
		Landing Gear Indicator Lights	1-42
		Landing Gear Index Marks	1-42
		Landing Gear Warning Horn	1-42
		Hydraulic Emergency Panel	1-43
		Landing Gear Emergency Selector	1-43
		Main Landing Gear Emergency Release Handle	1-43
		Nose Gear Emergency Extension System	1-43
		Nose Gear Emergency Extension Handle	1-43
		Emergency Handpump Lever	1-45
		Emergency Down Recovery Switch	1-45
		NOSEWHEEL STEERING SYSTEM	
		General	1-45
		Nosewheel Steering Switch	1-45
		WHEEL BRAKE SYSTEM	
		General	1-46
		Parking Brake Handle	1-46
		Emergency Brake Lever	1-46

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
1 (Cont'd)		ENVIRONMENTAL CONTROL SYSTEM	
		General	1-46
		ECS Control Panel	1-48
		Refrigeration Unit	1-48
		Temperature Controller Units	1-48
		Temperature Limiter Switches	1-48
		Flight Compartment Heating and Ventilating	1-49
		Flight Compartment Air Conditioning	1-49
		Cabin Heating and Ventilating	1-50
		Cabin Air Conditioning	1-50
		ANTI-ICING AND DEICING SYSTEMS	
		General	1-50
		Icing Detector	1-51
		Engine and Intake Anti-icing	1-51
		Wing and Tail Deicing System	1-52
		Wing and Tail Deicing System Switches	1-52
		Wing and Tail Deicing System Operation	1-52
		Propeller Deicing	1-54
		Propeller Deicing Test Switch	1-54
		Pitot Head Anti-icing	1-54
		Windshield Heating	1-55
		Windshield Heat Switch	1-55
		BLEED AIR SYSTEM	
		General	1-55
		Bleed Air Switches	1-56
		Bleed Air Overheat Caution Lights	1-56
		FLIGHT INSTRUMENTS	
		General	1-56
		Short-field Approach Speed Indicator	1-57
		Pitot-Static System	1-57
		Accessory Control Knobs	1-61
		ENGINE INSTRUMENTS	
		General	1-61
		Torque Indicators	1-61
		Propeller Tachometers	1-61
		Engine Tachometers	1-61
		Turbine Inlet Temperature Indicators	1-61
		Oil Temperature Indicators	1-62
		Engine Oil Pressure Indicators	1-62
		Speed Decreaser Gear Oil Pressure Indicators	1-62
		MISCELLANEOUS INSTRUMENTS	
		Clock	1-62
		Outside Air Temperature Indicator	1-62

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
1 (Cont'd)		Stall Warning System	1-62
		Stall Warning Test Switch	1-63
		APU Indicators	1-63
		LIGHTING SYSTEM	
		General	1-63
		Exterior Lighting	1-63
		Position Lights Switch	1-63
		Anti-Collision Lights Switch	1-64
		Formation Lights Switch	1-64
		Wing and Landing Gear Inspection Lights Switch	1-64
		Landing Lights Switch	1-65
		Taxiing Light Switch	1-65
		Interior Lighting	1-65
		Flight Compartment (Dome) Light Switch	1-65
		Cargo Floor Lights Switch	1-65
		Utility Lights	1-66
		Hydraulic Emergency Panel Switches	1-66
		Secondary Instrument Lights Switch	1-66
		Passenger Warning Signs Switches	1-66
		Cabin (Dome) Lights Switch	1-67
		Ramp Loading Light	1-67
		Navigators Work-Table Light	1-67
		Instrument and Panel Lights	1-67
		Cabin Panel	1-67
		Elevator Trim Pedestal Light Switch	1-69
		Emergency Lighting System	1-69
		Portable Emergency Lights	1-69
		ENTRANCE DOORS	
		General	1-69
		Cabin Doors	1-70
		Flight Compartment Lower Hatch	1-70
		Cabin-Flight Compartment Door	1-70
		Cargo and Ramp Doors	1-70
		Cargo and Ramp Door Control Panels	1-70
		Ramp Door	1-70
		Cargo Door	1-71
		FLIGHT COMPARTMENT EQUIPMENT	
		General	1-72
		Pilot's and Copilot's Seats	1-72
		Flight Technician's Seat	1-72
		Sun Shades	1-72
		Check List	1-73
		Map and Data Cases	1-73

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
1 (Cont'd)		EMERGENCY EQUIPMENT	
		General	1-73
		Fire Detecting and Extinguishing Systems	1-73
		Engine Fire Extinguisher Control Handles	1-73
		Short Discriminator	1-74
		Fire Extinguisher Indicating Discs	1-74
		Fire Detection Test Switch	1-74
		Portable Fire Extinguishers	1-74
		First Aid Kits	1-74
		Emergency Exits	1-74
		Alarm Bell	1-75
		Alarm Bell Switch	1-75
		Crash Axe	1-75
		OXYGEN SYSTEM	
		General	1-76
		Oxygen Regulators	1-77
		Oxygen Shutoff Valve	1-77
		Oxygen Charging Valve and Pressure Gage	1-78
		Oxygen System Check	1-78
		NAVIGATION EQUIPMENT	
		General	1-78
		Horizontal Situation Indicator	1-78
		HSI Control Panel	1-80
		VOR/Glide Slope Indicator	1-80
		Radio Magnetic Indicator	1-80
		TELECOMMUNICATION EQUIPMENT	
		General	1-80
		Intercom and Audio System	1-85
		UHF System	1-85
		VHF System	1-86
		HF System	1-86
		FM System	1-86
		ADF System	1-87
		TACAN System	1-87
		VOR and Glide Slope System	1-87
		Marker Beacon Receiver	1-88
		J-2 Compass System	1-88
		IFF/SIF System	1-88
		Radar Altimeter System	1-89
		CARGO LOADING EQUIPMENT	
		General	1-89
		Fuselage Steady Strut	1-90
		Cargo Winch	1-90
		Pendulum Release	1-90
		Ramp Extensions	1-91
		Tie-Down Devices	1-91

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
1 (Cont'd)		TROOP SEATS AND LITTERS	
		General	1-91
		Troop Seats	1-91
		Litters	1-92
		AERIAL DELIVERY SYSTEM	
		General	1-92
		Aerial Delivery Equipment	1-92
		AUXILIARY POWER UNIT	
		General	1-92
		APU Control Panel	1-93
		Starting APU	1-93
		MISCELLANEOUS EQUIPMENT	
		General	1-93
		Door and Hatch Locks	1-93
		Relief Tubes	1-94
		Access and Exit Ladder	1-94
		Rear Cabin Curtain	1-94
		Blackout Curtains	1-94
		Aircraft Hotcup	1-94
		Windshield Washer System	1-94
		Windshield Washer Switch	1-94
		Windshield Wipers	1-95
2	HANDLING		
		PRELIMINARIES	
		Before Entering Aircraft	2-1
		After Entering Cabin	2-1
		After Entering Flight Compartment	2-1
		Special Check for Night Flights	2-7
		MANAGEMENT OF FUEL SYSTEM	2-7
		STARTING PROCEDURE	
		Before Starting Engines	2-7
		Starting APU	2-7
		Starting Engines	2-9
		Failure to Start	2-10
		Abnormal Conditions After Starting	2-11
		GROUND TEST PROCEDURE	2-12
		TAXIING INSTRUCTIONS	2-14
		ENGINE AND ACCESSORY CHECK	2-15

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
2 (Cont'd)		TAKE-OFF PROCEDURES	
		Vital Actions Before Take-off	2-17
		Take-off	2-17
		After Take-off	2-18
		CLIMB	2-18
		FLIGHT CHARACTERISTICS	
		General	2-19
		Stalls	2-19
		Spins	2-19
		Flight Controls	2-19
		Level Flight	2-21
		Diving	2-21
		SYSTEMS AND EQUIPMENT OPERATION DURING FLIGHT	
		General	2-21
		UHF System	2-21
		VHF System	2-22
		FM System	2-22
		HF System	2-22
		ADF System	2-23
		TACAN System	2-23
		VOR and Glide Slope System	2-24
		Marker Beacon Receiver	2-24
		IFF/SIF System	2-25
		Radar Altimeter System	2-25
		DESCENT	2-25
		LANDING PROCEDURES	
		Pre-landing Check List	2-26
		Final Landing Check List	2-26
		Landing	2-26
		Mislanding	2-27
		After Landing	2-28
		END OF FLIGHT PROCEDURE	
		Post Taxi Check	2-28
		Stopping Engines	2-29
		Before Leaving Aircraft	2-29
		COLD WEATHER OPERATION	
		Before Entering Aircraft	2-29
		After Entering Aircraft	2-30
		Before Starting Engines	2-30
		Starting Engines	2-30
		Warming Up and Ground Test	2-30

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
2 (Cont'd)		Taxiing Instructions	2-30
		Before Take-off	2-30
		Take-off	2-30
		After Take-off	2-30
		During Flight	2-30
		Descent	2-30
		Approach to Pattern	2-31
		Landing	2-31
		Stopping Engines	2-31
		Before Leaving Aircraft	2-31
3		EMERGENCY HANDLING	
	1	NON-CRITICAL EMERGENCIES	
		MAIN SERVICE EMERGENCY OPERATION	
		Landing Gear Emergency Lowering	3-1-1
		Fuel System Emergencies	3-1-2
		Electrical System Emergencies	3-1-2
		Flight Control System Emergencies	3-1-2
		Utility Hydraulic System Failure	3-1-3
		Brake System Emergencies	3-1-3
		ENGINE FAILURE	
		Flight Characteristics Under Partial Power Conditions	3-1-3
		Engine Failure Procedure	3-1-4
		ENGINE FAILURE UNDER SPECIFIC CONDITIONS	
		Engine Failure During Flight	3-1-5
		Maximum Glide	3-1-5
		Landing With One Engine Inoperative	3-1-6
		Go-Around With One Engine Inoperative	3-1-6
		Single Engine Practice Maneuvers	3-1-6
		FIRE	
		Engine Fire	3-1-8
		Fuselage Fire	3-1-9
		Wing Fire	3-1-9
		Electrical Fire	3-1-9
		Smoke Elimination	3-1-9
		LANDING EMERGENCIES	
		General	3-1-10
		Landing With Flat Tire	3-1-10
		Landing With One Gear Retracted	3-1-10
		Wheels-Up Landing	3-1-10
		EMERGENCY ENTRANCE	3-1-11

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
3	1 (Cont'd)	DITCHING	3-1-11
		ABANDONING IN FLIGHT	3-1-15
	2	CRITICAL EMERGENCIES	
		ENGINE FAILURE	
		Engine Failure During Take-off	3-2-1
		Landing With Both Engines Inoperative	3-2-2
		Propeller Failure	3-2-3
4		OPERATING DATA	
		LIMITATIONS	
		Engine	4-1
		Starting	4-1
		Fuel System	4-2
		Oil System	4-2
		Auxiliary Power Unit	4-2
		Speed	4-2
		Flight Load Acceleration	4-3
		Center of Gravity	4-3
		Prohibited Maneuvers	4-7
		Weight and Balance Data	4-7
		PERFORMANCE DATA	
		General	4-7
		Glossary of Terms and Abbreviations	4-7
		STANDARD CHARTS	
		Standard Atmosphere Table	4-8
		Temperature Conversion Chart	4-8
		Density Altitude Chart	4-8
		Compressibility Correction for OAT	4-8
		ENGINE CHARTS	4-9
		PERFORMANCE CHARTS - GENERAL	
		Stalling Speed	4-9
		Position Error Correction to Airspeed	4-10
		Position Error Correction to Altimeter	4-10
		Wind Component Chart	4-10
		Take-off Weight Limitation (FAR Part 25)	4-10
		TAKE-OFF	
		Short-field Take-off	4-11
		Normal Take-off	4-11
		Take-off: Engine Failure (FAR Part 25)	4-12
		Accelerate - Stop Distance (FAR Part 25)	4-12

TABLE OF CONTENTS (Cont'd.)

PART	SECTION	TITLE	PAGE
4 (Cont'd)		CLIMB	
		Enroute Rate of Climb	4-12
		Time, Distance and Fuel in Enroute Climb	4-13
		Service Ceiling	4-13
		CRUISE	
		Cruise Data: Nautical Air Miles Per Pound of Fuel	4-14
		DESCENT	
		Descent Data	4-14
		Landing Weight Limitation (FAR Part 25)	4-14
		LANDING	
		Short-field Landing	4-14
		Normal Landing	4-15
		FAR 25 Landing	4-15
		PERFORMANCE CHART INDEX	4-65
5		FLIGHT TESTING	
		GENERAL	
		Description	5-1
		Method	5-1
		GROUND CHECKS	
		Weight and Balance	5-1
		External Inspection	5-1
		Internal Inspection	5-2
		Pre-Start Checks	5-2
		APU Start	5-2
		Engine Start	5-3
		Systems Checks	5-3
		Pre-Taxi Checks	5-4
		Taxi Checks	5-4
		Pre-Take-Off Checks	5-4
		FLIGHT CHECKS	
		Take-Off	5-4
		Climb to 5,000 Feet ASL	5-4
		Level Flight Checks - 5,000 Feet ASL	5-4
		Climb to 10,000 Feet ASL	5-5
		Stall Checks - 10,000 Feet ASL	5-5
		Climb to 20,000 Feet ASL	5-5
		Engine Relights - 20,000 Feet ASL	5-5
		APU Start - 15,000 Feet ASL	5-6
		Maximum Speed Dive	5-6
		Avionics Systems Checks	5-6
		Landing Gear Checks	5-6
		Landing Checks	5-6
		Post Flight Checks	5-6

LIST OF FIGURES

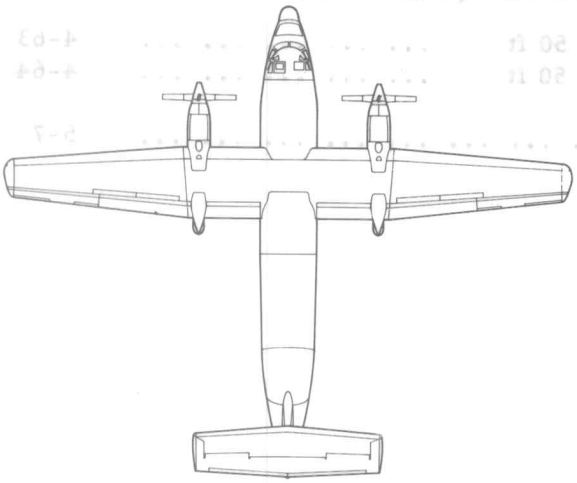
FIGURE	TITLE	PAGE
1-1	General Arrangement	1-2
1-2	Flight Compartment	1-4
1-3	Fuel System - Schematic	1-7
1-4	Fuel Control Panel	1-8
1-5	Fueling Panel	1-11
1-6	Emergency Panel, Side Panels and Caution Lights Panel	1-13
1-7	Oil System - Schematic	1-14
1-8	Hydraulic System - Schematic	1-16A
1-9	Pilot's and Copilot's Pedestals	1-19
1-10	Electrical Control Panel	1-20
1-11	Circuit Breaker Panels and Junction Boxes	1-24
1-12	Electrical System - Schematic	1-27/1-28
1-13	Overhead Console	1-30
1-14	Engine Panel	1-31
1-15	Wing Flap Manual Operation	1-39
1-16	Landing Gear Panel	1-42
1-17	Hydraulic Emergency Panel	1-44
1-18	Landing & Taxi Panel	1-46
1-19	Environmental Control System - Schematic	1-47
1-20	Environmental Control Panel	1-48
1-21	Ice Control Panel	1-51
1-22	Deicing System - Schematic	1-53
1-23	Windshield Panel	1-56
1-24	APU and Bleed Air Panel	1-57
1-25	Pilot's Instrumental Panel	1-58
1-26	Copilot's Instrument Panel	1-59
1-27	Pitot-Static System Schematic	1-60
1-28	Lighting Panel	1-64
1-29	Cabin Lighting Door Control Panel	1-66
1-30	Navigator's Panel	1-68
1-31	Aerial Delivery Panel	1-71
1-32	Oxygen Duration Chart	1-76
1-33	Horizontal Situation Indicator, HSI Control Panel and VOR Glide Slope Indicator	1-79
1-34	Telecommunication Facilities	1-81
1-35	Location of Antennas	1-83
1-36	Radio Console	1-84
1-37	Radar Altimeter	1-89
1-38	Winch Control Panel	1-91
2-1	Exterior Inspection Diagram	2-2
2-2	Stall Chart	2-20
3-1	Miscellaneous Emergency Equipment and Emergency Routes of Escape and Exits	3-1-12
3-2	Ditching Chart	3-1-13
3-3	Caution Lights Panel Summary	3-2-5

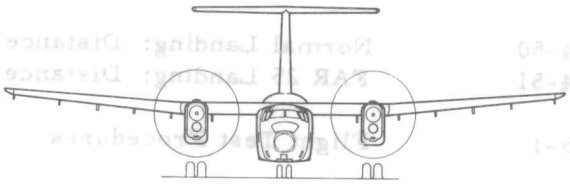
LIST OF FIGURES (Cont'd.)

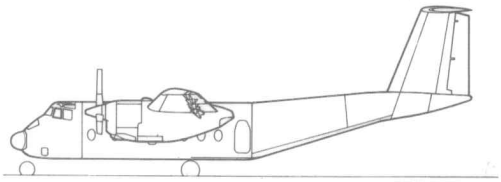
FIGURE	TITLE	PAGE
4-1	Instrument Markings	4-4
4-2	V-G Diagram	4-6
4-3	Standard Atmosphere Table	4-16
4-4	Temperature Conversion Chart	4-17
4-5	Density Altitude Chart	4-18
4-6	Compressibility Correction for OAT	4-19
4-7	Take-off Power Available	4-20
4-8	Normal Rated Power Available	4-21
4-9	Fuel Flow at Take-off Power	4-22
4-10	Fuel Flow at Normal Rated Power	4-23
4-11	Stalling Speed	4-24
4-12	Position Error Correction to Airspeed	4-25
4-13	Position Error Correction to Altimeter - Flap 0°	4-26
4-14	Position Error Correction to Altimeter - Various Configurations	4-27
4-15	Wind Component Chart	4-28
4-16	Take-off Weight Limitation: First Segment	4-29
4-17	Take-off Weight Limitation: Second Segment	4-30
4-18	Take-off Weight Limitation: Final Segment	4-31
4-19	Short Field Take-off: Ground Roll	4-32
4-20	Short Field Take-off: Distance to 50 ft	4-33
4-21	Normal Take-off: Ground Roll	4-34
4-22	Normal Take-off: Distance to 50 ft	4-35
4-23	FAR 25: Take-off Distance to 35 ft	4-36
4-24	FAR 25: Accelerate - Stop Distance	4-37
4-25	Enroute Rate of Climb - Both Engines	4-38
4-26	Enroute Rate of Climb - Single Engine	4-39
4-27	Time, Distance and Fuel in Enroute Climb: Both Engines, ISA	4-40
4-28	Time, Distance and Fuel in Enroute Climb: Both Engines, ISA + 15°C	4-41
4-29	Time, Distance and Fuel in Enroute Climb: Both Engines, ISA + 30°C	4-42
4-30	Time, Distance and Fuel in Enroute Climb: One Engine, ISA	4-43
4-31	Time, Distance and Fuel in Enroute Climb: One Engine, ISA + 15°C	4-44
4-32	Time, Distance and Fuel in Enroute Climb: One Engine, ISA + 30°C	4-45
4-33	Service Ceiling	4-46
4-34	Nautical Air Miles Per Pound of Fuel: Both Engines, Sea Level	4-47
4-35	Nautical Air Miles Per Pound of Fuel: Both Engines, 5000 ft	4-48
4-36	Nautical Air Miles Per Pound of Fuel: Both Engines, 10,000 ft	4-49
4-37	Nautical Air Miles Per Pound of Fuel: Both Engines, 15,000 ft	4-50
4-38	Nautical Air Miles Per Pound of Fuel: Both Engines, 20,000 ft	4-51
4-39	Nautical Air Miles Per Pound of Fuel: Both Engines, 25,000 ft	4-52
4-40	Nautical Air Miles Per Pound of Fuel: One Engine, Sea Level	4-53
4-41	Nautical Air Miles Per Pound of Fuel: One Engine, 5000 ft	4-54
4-42	Nautical Air Miles Per Pound of Fuel: One Engine, 10,000 ft	4-55
4-43	Maximum Range Descent	4-56
4-44	Normal Descent	4-57
4-45	Landing Weight Limitation: Approach Climb	4-58
4-46	Landing Weight Limitation: Balked Landing Climb	4-59
4-47	Short Field Landing: Ground Roll	4-60
4-48	Short Field Landing: Distance from 50 ft	4-61
4-49	Normal Landing: Ground Roll	4-62

LIST OF FIGURES (Cont'd.)

FIGURE		PAGE
4-50	Normal Landing: Distance from 50 ft	4-63
4-51	FAR 25 Landing: Distance from 50 ft	4-64
5-1	Flight Test Procedures	5-7







The Buffalo Aircraft

PART 1

DESCRIPTION

INTRODUCTION

GENERAL

1 The CC 115 Buffalo aircraft manufactured by De Havilland Aircraft of Canada, is an all-metal, high-wing monoplane powered by two General Electric CT64-820-1 turboprop engines driving Hamilton Standard (Model 63E60-17) constant speed, variable and reversible pitch propellers. It is designed for the transportation of troops, supplies, and equipment in tactical situations, under day, night, and all-weather conditions; for ambulance and rescue work and paratroop and supply dropping. It is especially suitable for short-field take-offs and landings from selected unprepared ground. The aircraft has a fully retractable tricycle landing gear and power-operated cargo doors and ramp which in conjunction with the upswept rear fuselage, permit direct cargo loading. The aircraft carries a crew of three: pilot, copilot and flight technician.

AIRFRAME

2 The fuselage is constructed of three main sections, comprising a forward section extending from the nose to the bulkhead dividing the flight compartment from the cargo/troop compartment; a mid section which houses the entire cargo/troop compartment, and a rear section, upswept from the mid section, and accommodating the cargo door and supporting the tail structure. The wings consist of a center section continuous through the fuselage to which are attached the engine nacelles and outer wings. A double-slotted flap-aileron system is installed on the entire wing trailing edge, and hydraulically-operated spoilers are installed on the wing upper surface. The main landing gear, which is supported by the front and rear wing spars, retracts forward into the engine nacelles; the nose landing gear, which is equipped with steering mechanism, retracts rearward into the nose of the aircraft. The empennage consists of a horizontal stabilizer, elevators, vertical stabilizer, and a rudder comprised of a fore section and a trailing section. The horizontal stabilizer and elevators are mounted on the upper extremity of the vertical stabilizer.

3 With the exception of the hydraulically-operated wing flaps, all conventional flight controls are operated by cable systems, with the rudder being powered hydraulically via a cable system. The cargo door and ramp are electrically-operated with provisions for manual operation. A gas turbine auxiliary power unit housed in the left nacelle provides ground and stand-by electrical, hydraulic, and bleed air supply.

ENGINES

4 The two engines are General Electric CT64-820-1, axial flow, free turbine turboprop units, each incorporating a 14 stage compressor, an annular combustion chamber, a gas generator turbine mechanically coupled to the compressor rotor, and a two-stage power turbine mechanically coupled to a speed decreaser gear assembly. An exhaust pipe and a concentric shroud surrounding it are attached to the exhaust frame at the rear of each engine. Each engine is capable of developing 3060 equivalent shaft horsepower at take-off.

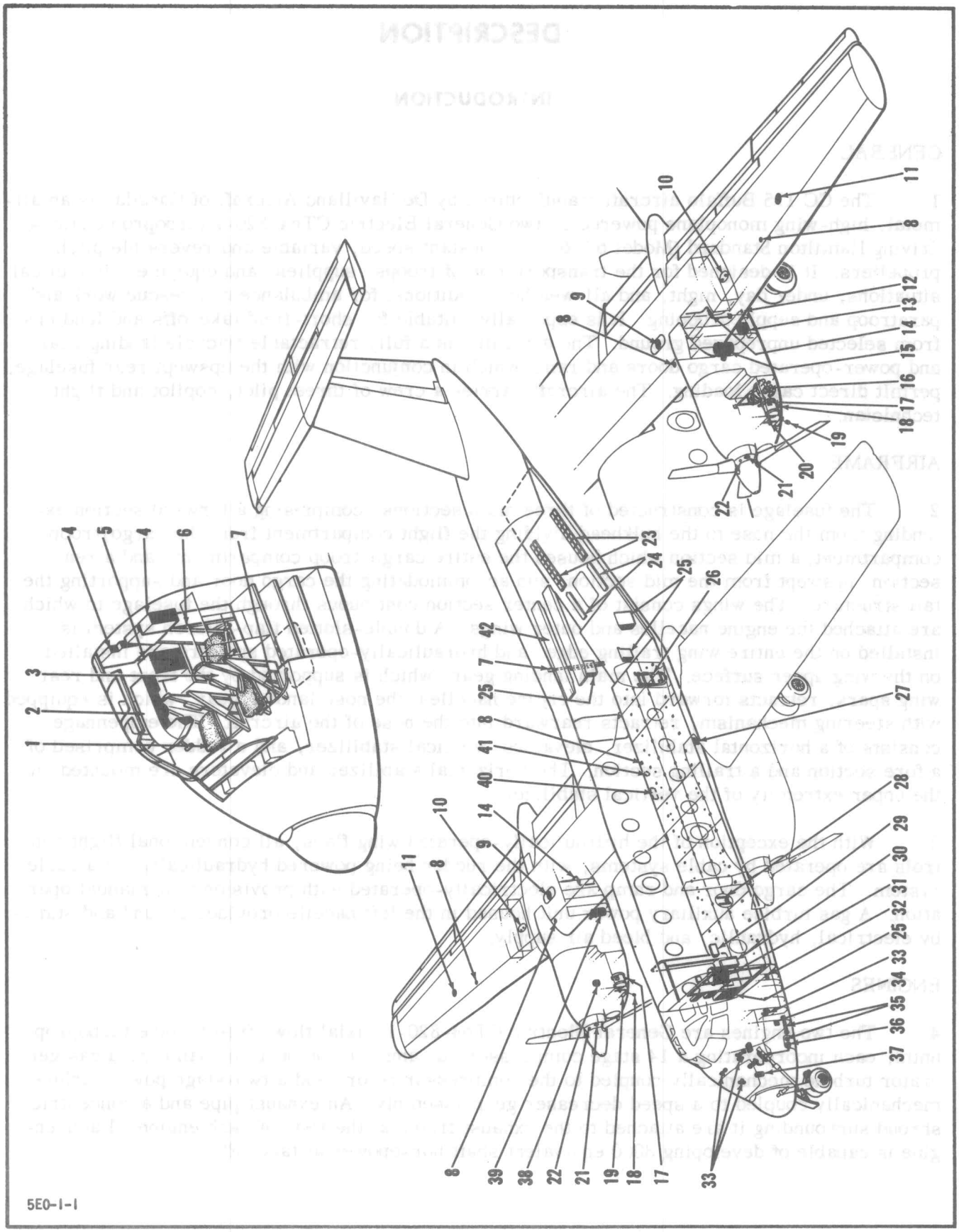


Figure 1-1 General Arrangement

Key to Figure 1-1 General Arrangement

1. Copilot's Seat
2. Overhead Console
3. Pilot's Seat
4. Circuit Breaker Panels
5. Radio Rack (Right)
6. Flight Technician's Seat
7. Relief Tube
8. Grounding Jack
9. Inner Fuel Tank Over Wing Filler Neck
10. Outer Fuel Tank, Booster Pump And Manifold Water Drain Valves
11. Outer Fuel Tank Over Wing Filler Neck
12. External DC Receptacle
13. Battery
14. Inner Fuel Tank Water Drain Valve
15. Utility Hydraulic System Reservoir
16. Auxiliary Power Unit
17. Engine Oil Filler Neck
18. Engine Oil Drain Valve
19. Oil Cooler Drain Plug
20. Fuel System Strainer Drain Valve
21. Propeller Atmospheric Sump Filler
22. Propeller Pressure Sump Filler Plug
23. Roller Conveyor Stowage
24. Removable Side Restraint Rails Stowage
25. Stowage Box
26. Ladder
27. External AC Receptacle
28. Drift Recorder
29. Hot Cup And Timer
30. Navigator's Panel
31. Removable Toilet
32. Oxygen Charging Valve
33. Pitot Static Moisture Traps And Test Points
34. External Intercommunication Receptacle
35. Hydraulic Accumulator And Charging Point
36. Wheel Brakes Emergency Air Bottle Charging Point
37. Windshield Washer Reservoir
38. External Bleed Air Connection
39. Rudder Hydraulic System Reservoir
40. Fueling Panel
41. Fueling Adapter
42. Ramp Extension Stowage

LEADING PARTICULARS

DIMENSIONS

5 The overall dimensions of the aircraft are as follows:

(a)	Wing span	96 ft
(b)	Length	79 ft
(c)	Height	28 ft 8 in.

WEIGHT LIMITATIONS

6 The weight limitations are as follows:

(a)	Maximum take-off gross weight	41,000 lb
(b)	Maximum landing gross weight	39,100 lb
(c)	Maximum zero fuel weight	37,000 lb
(d)	Basic weight (estimated)	24,826 lb

FUEL TANK CAPACITIES

7 The fuel quantities given are for usable fuel. Weights are for JP4 fuel, specific gravity 0.78.

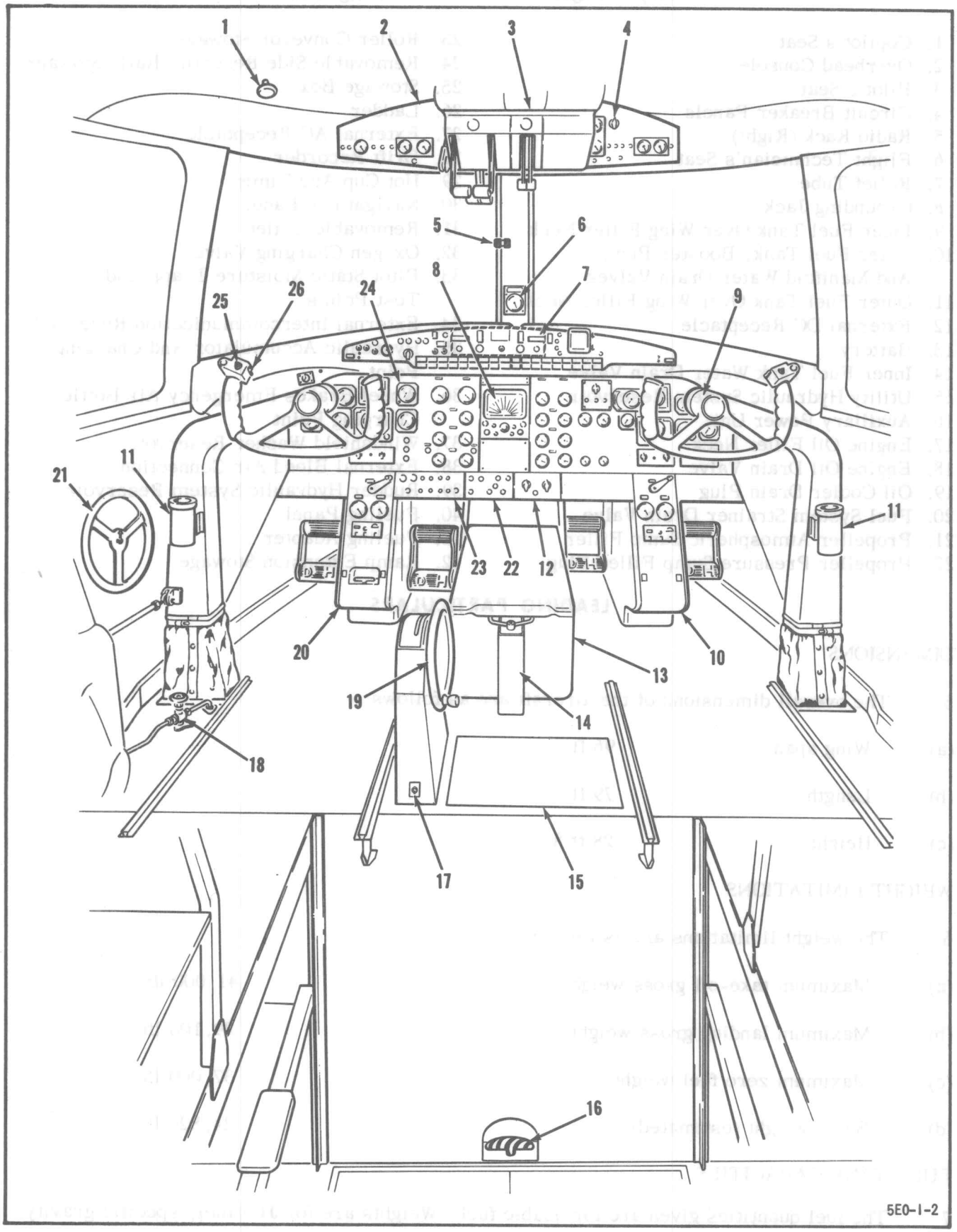


Figure 1-2 (Sheet 1 of 2) Flight Compartment

Key to Figure 1-2 (Sheet 1 of 2) Flight Compartment

1. Outside Air Temperature Gage
2. APU And Bleed Air Panel
3. Overhead Console
4. Electrical Control Panel
5. Wheel Brake Emergency Lever
6. Standby Magnetic Compass
7. Emergency Panel
8. Weather Radar
9. Copilot's Flight Instrument Panel
10. Copilot's Pedestal
11. Ash Tray
12. Windshield Panel
13. Sliding Console
14. Console Latch
15. Hydraulic Emergency Panel
16. Bottom Hatch Jettison Handle
17. Elevator Trim Pedestal Light Switch
18. Oxygen Shutoff Valve
19. Elevator Trim Tab Handwheel
20. Pilot's Pedestal
21. Nosewheel Steering Wheel
22. Landing Gear Panel
23. Ice Control Panel
24. Pilot's Instrument Panel
25. Aileron Trim Tab Switch
26. Microphone Switch

2 Wing Center section tanks	1066 Imp. gal (1280 US gal)	8315 lb
2 Outer Wing tanks	672 Imp. gal (806 US gal)	5241 lb
	1738 Imp. gal (2086 US gal)	13, 556 lb

OIL TANK CAPACITIES

8	2 Tanks	4.75 Imp. gal (5.7 US gal) (each)
		1.66 Imp. gal (2 US gal) air space (each)

FUEL SYSTEM

GENERAL

9 Fuel is contained in four main tanks (Figure 1-3), two of which are integral with the wing center section (each of 533 Imp. gal usable capacity) and two in the outer wing sections (each of 336 Imp. gal usable capacity). The outer wing tanks each comprise ten flexible fuel cells, the inboard five cells of which are self-sealing; all the cells are interconnected by a manifold which extends from the sump of the outboard cell to that of the inboard cell. The fuel system incorporates an automatic internal fuel transfer system which, by means of ejectors motivated by booster pump pressure, transfers fuel from the inner tanks to the outer tanks, the inboard cell of which supplies the engines. Two booster pumps are installed in each outer tank inboard cell one electrically driven and the other air driven by the aircraft bleed air system.

10 The fuel system also embodies a crossfeed system, a pressure fuel suction defuel system with an electrically-operated pre-select fuel tank quantity control, alternative over-wing fueling, a fuel quantity indicating system, and a fuel control panel. Emergency fuel shutoff valves are also included. The auxiliary power unit is supplied with fuel from the left outer wing tank.

FUEL SPECIFICATION

11	Fuel specification	Grade JP-4, Specification 3-GP-22f (MIL-J-5624F) Grade JP-5, Specification 3-GP-24e (MIL-J-5624F) Aviation Gasoline, Specification 3-GP-25e (MIL-G-5572C)

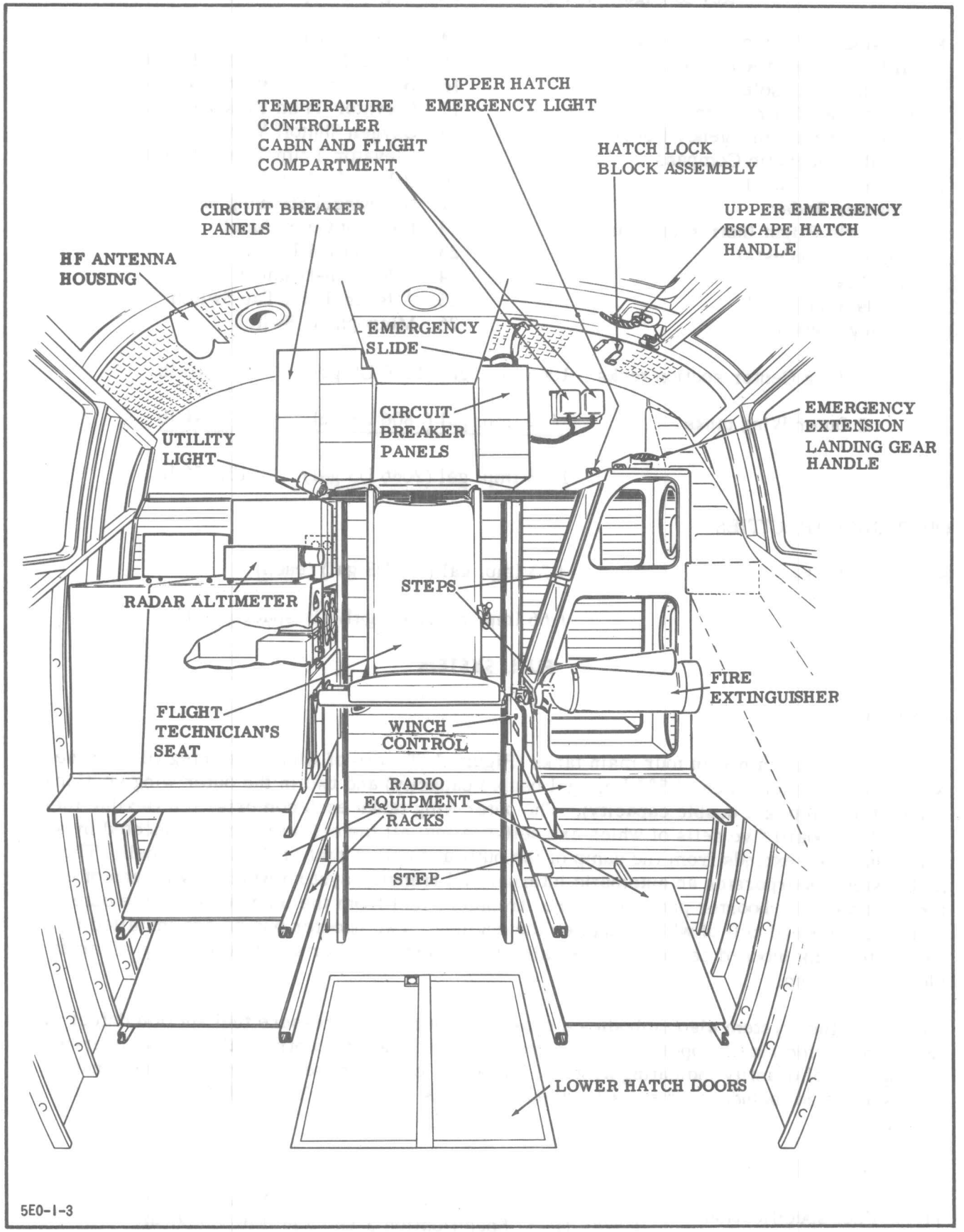


Figure 1-2 (Sheet 2 of 2) Flight Compartment

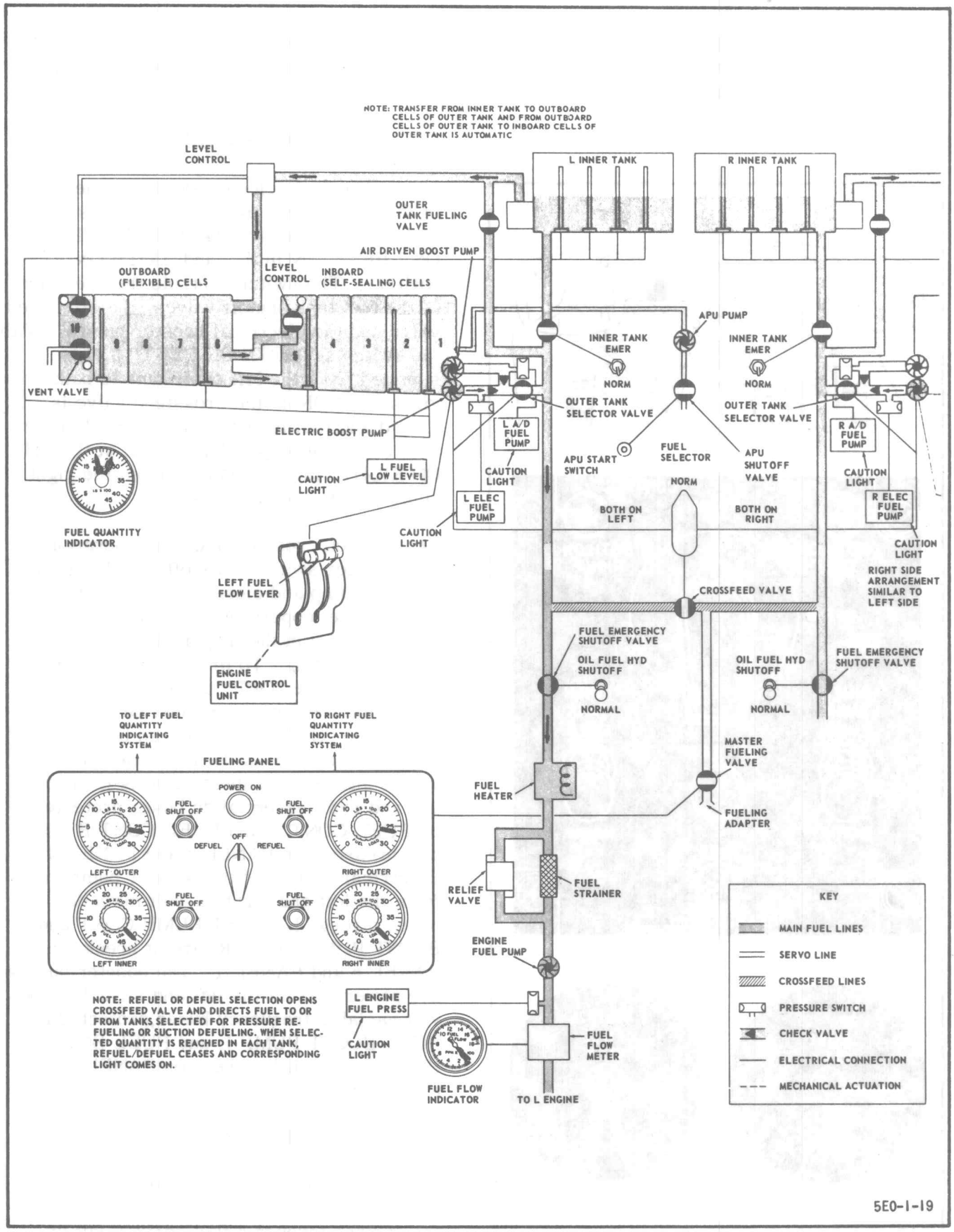


Figure 1-3 Fuel System - Schematic

FUEL CONTROL PANEL

12 The fuel control panel (Figure 1-4) marked FUEL CONTROL, is located on the left side of the copilot's instrument panel. The panel contains a fuel selector switch, two inner tank emergency switches, and a fuel quantity press button test switch.

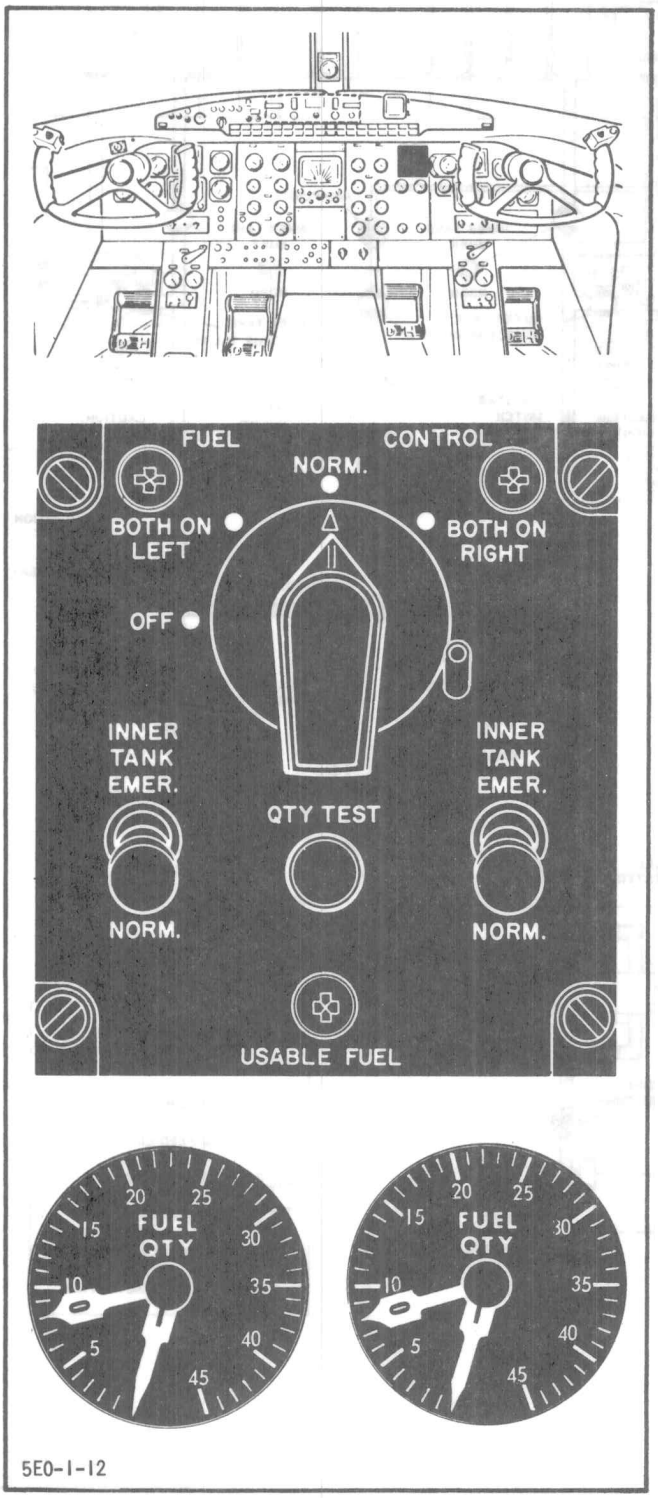


Figure 1-4 Fuel Control Panel

FUEL SELECTOR SWITCH

13 The fuel selector switch on the center of the fuel control panel is a rotary switch with four positions marked "OFF", "BOTH ON LEFT", "NORM", and "BOTH ON RIGHT". The switch controls the operation of the fuel tank shutoff valves, the crossfeed valve and the electrical booster pumps. With the switch at "BOTH ON LEFT" fuel is supplied from the left outer tank to both engines; at "NORM" the crossfeed valve is closed and fuel is supplied from each outer tank to its corresponding engine; at "BOTH ON RIGHT" fuel is supplied from the right outer tank to both engines.

14 When crossfeeding is in operation, the selector switch shuts off the electrical booster pump and closes the fuel shutoff valve of the inoperative tank; the air-driven booster pump in the inoperative tank continues operating. To prevent inadvertent selection to the "OFF" position, a spring detent is provided which must be depressed before the "OFF" selection can be made. Electrical control of the fuel tank shutoff valves and the crossfeed valve is from the left and right essential dc buses protected by FUEL CONT L and FUEL CONT R circuit breakers on PANEL 6 and PANEL 3. Electrical control of the booster pumps is from the left and right 28-volt main dc buses through L BOOST PUMP CONT and BOOST PUMP CONT R circuit breakers on PANEL 6 and PANEL 1. The booster pumps are powered from the left and right 115/200-volt variable frequency buses,protected by FUEL BOOST PUMP L and FUEL BOOST PUMP R circuit breakers on PANEL 7 and PANEL 2.

FUEL FLOW LEVERS

15 Two fuel flow levers on the overhead console (Figure 1-13) control fuel flow to the engines through a fuel control unit on each engine. Electrically-operated fuel

booster pumps are also controlled by the levers, and during normal fuel flow ("NORMAL" selected) are energized in all lever positions except "OFF". The fuel flow levers also control limit switches to shut off the relevant engine and intake anti-ice bleed air (if anti-icing service is selected on) when the fuel flow levers are at the "OFF" position. Each fuel flow lever moves in a slot with positions marked "OFF", "GROUND IDLE" and "NORMAL". Engine speed at "GROUND IDLE" is governed by the fuel flow lever alone through the fuel control unit condition shaft. At "NORMAL", maximum fuel flow is admitted by the condition shaft, but engine speed is governed by the power lever through the power control shaft. During crossfeed fuel flow, the electrical booster pump on the selected side is energized regardless of the position of the fuel flow lever. The selection of crossfeed electrically overrides a fuel flow lever "OFF" selection in the event of one engine being shut down and a fuel requirement from the same side to the live engine.

FUEL EMERGENCY SHUTOFF SWITCHES

16 Two guarded emergency switches, marked OIL FUEL HYD with positions "OFF" and "NORMAL", are located on the emergency panel (Figure 1-6). Each switch is connected to shutoff valves to the oil, fuel, and hydraulic systems of its related engine, so that a single operation only is necessary to isolate all the supply lines in an emergency. The left switch also operates an APU shutoff valve in the fuel line to the APU. The fuel shutoff valve is in the supply line to the engine aft of the firewall and with the switch at "OFF" fuel flow to the engine is prevented. The refuel/defuel switch on the fueling panel also operates the shutoff valve, closing it at "REFUEL" and "DEFUEL", and opening it at "OFF". The electrical circuit for the shutoff valves is powered from the left and right essential dc buses,protected by FUEL & OIL S.O.L. and FUEL & OIL S.O.R. circuit breakers on PANEL 6 and PANEL 3.

FUEL QUANTITY INDICATING SYSTEM

17 The fuel quantity indicating system is of the capacitance type using signals from a quantity indicator, four tank units in each inner tank and five in each outer tank. The inner core and outer case of each tank unit act as the element of a capacitor, while the fuel and air act as the dielectric. The capacitance of each tank unit varies directly with the fuel level it detects and the average capacitance value of all tank units in each tank is expressed as fuel quantity on its relevant fuel quantity indicator in pounds weight.

FUEL QUANTITY INDICATORS

18 Two fuel quantity indicators, one for the left tanks and one for the right tanks are labeled USABLE FUEL and are located below the fuel control panel (Figure 1-4). Each indicator has dual pointers, one marked I for the inner tank and the other marked O for the outer tank. The indicator dials each have scale markings ranging from 0 to 4500 lb. The instruments are powered from the right and left 115/200-volt 400 cycle buses and protected by FUEL QTY R and FUEL QTY L circuit breakers on PANEL 2 and PANEL 7.

ENGINE FUEL PRESSURE CAUTION LIGHTS

19 An amber fuel pressure caution light for each engine is included on the caution lights panel (Figure 1-6). The lights, marked L ENGINE FUEL PRESS and R ENGINE FUEL PRESS are each actuated by a pressure switch in the fuel delivery line on the output side of the engine driven pump, and illuminate at a pressure decrease to 150 psi and go out at a pressure increase to 190 psi.

FUEL QUANTITY TEST SWITCH

20 A press button, fuel quantity test switch, marked QTY TEST, is located on the fuel

control panel (Figure 1-4). As a check on the correct operation of the fuel quantity indicators, when the test switch is pressed (with electrical power on) all indicator pointers should fall to zero, and then return to their former readings when the switch is released.

INNER TANK SWITCHES

21 Two integral lever-lock switches, one for each inner tank, are mounted on the fuel control panel (Figure 1-4); each is labeled INNER TANK with positions "EMER" and "NORM". The purpose of each switch is to enable fuel to be drawn directly from its related inner tank by the engine-driven fuel pump in the event of fuel transfer malfunctions.

FUEL FLOW INDICATORS

22 Two fuel flow indicators, one for each engine, are located on the copilot's instrument panel (Figure 1-26). Each instrument indicates the rate of fuel delivery in pounds per hour. The dials are each marked FUEL FLOW and PPH x 100; and are graduated in increments of 50 lb ranging from 0 to 1800 lb. The fuel flow indicators are powered from the right and left 115/200-volt 400 cycle buses and are protected by FUEL FLOW R and FUEL FLOW L circuit breakers on PANEL 2 and PANEL 7.

FUEL LOW LEVEL CAUTION LIGHTS

23 A fuel low level caution light for each outer fuel tank is located on the caution lights panel (Figure 1-6). The amber lights are marked L FUEL LOW LEVEL and R FUEL LOW LEVEL, and each illuminates when 350 pounds of fuel remains in its outer fuel tank. The caution lights are powered from the left and right 28-volt main dc buses,protected by L LOW FUEL LEVEL and R LOW FUEL LEVEL circuit breakers on PANEL 6 and PANEL 1.

BOOSTER PUMP FUEL PRESSURE CAUTION LIGHTS

24 Four caution lights to indicate low fuel pressure at the booster pumps are located on the caution lights panel (Figure 1-6). Two amber lights represent the electrical booster pumps and are marked L ELEC FUEL PUMP and R ELEC FUEL PUMP, and two represent the air driven booster pumps with markings L A/D FUEL PUMP and R A/D FUEL PUMP. Each light is illuminated by actuation of a pressure switch downstream of its booster pump when pressure decreases to 2 psi; on increasing pressure the light goes out at 5 psi. The caution lights are powered by the left and right 28-volt main dc buses,protected by FUEL & OIL WARN L and FUEL & OIL WARN R circuit breakers on PANEL 1 and PANEL 6.

REFUEL/DEFUEL SYSTEM

25 A single point pressure refueling and defueling system control provides for all tanks to be refueled or defueled simultaneously, independently, or in any combination of the four tanks. Pre-selection of the amount of fuel to be added to or discharged from individual tanks is also possible. Management of refueling or defueling is made at a fueling panel (Figure 1-5) on the right side of the fuselage forward of the fueling adapter. The tank venting system employs float-type valves which vent the tanks to atmosphere. The refuel/defuel system is powered from the left essential dc bus protected by two REFUEL DEFUEL circuit breakers on PANEL 6 when external dc power is used, or powered from the battery if external dc is not used. In either case the BATTERY EXTERNAL DC switch must be set to "ON".

FUELING PANEL

26 The fueling panel (Figure 1-5) contains four load limit controllers, four FUEL SHUTOFF

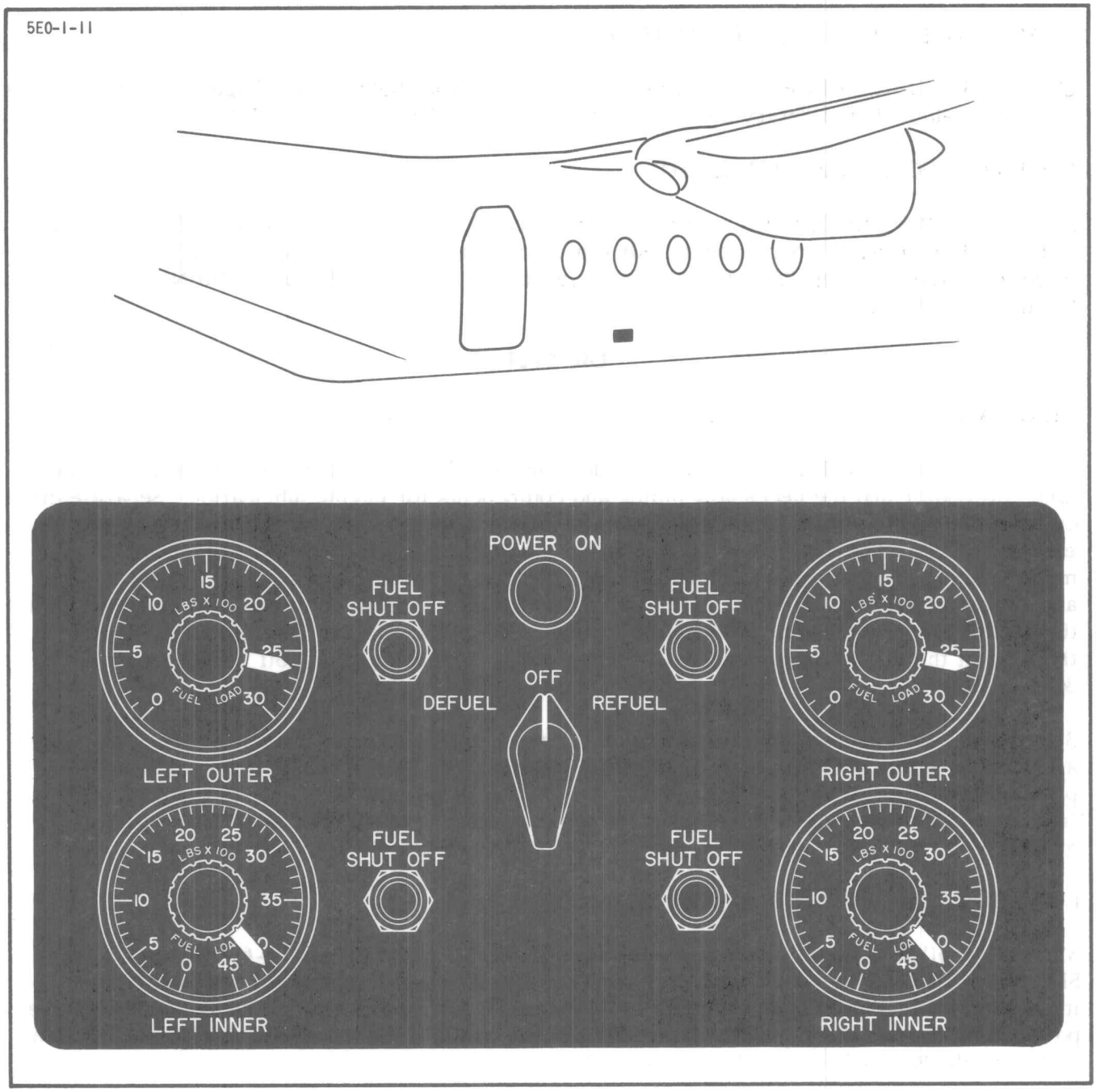


Figure 1-5 Fueling Panel

indicator lights, a POWER ON indicator light and a rotary selector switch with positions "DEFUEL", "OFF", and "REFUEL". Each load limit controller has a selector knob (marked appropriately LEFT OUTER, LEFT INNER, RIGHT OUTER or RIGHT INNER) by which the amount of fuel required in the tank may be dialed, as indicated on a scale graduated in pounds of fuel. The aircraft may be refueled or defueled (after setting the rotary selector switch to "REFUEL" or "DEFUEL") until the relevant refuel/defuel valve closes and its associated FUEL SHUTOFF indicator light illuminates to denote that the required level has been reached.

27 The rotary selector switch operates the POWER ON indicator light on the fueling panel when "REFUEL" or "DEFUEL" is selected. The fueling panel door cannot be closed unless the

rotary selector switch is at "OFF".

REFUEL/DEFUEL SELECTOR CAUTION LIGHT

28 A REFUEL/DEFUEL ON caution light on the caution lights panel (Figure 1-6) illuminates while the refuel/defuel rotary selector switch is at "REFUEL" or "DEFUEL".

DOORS UNLOCKED CAUTION LIGHT

29 A DOORS UNLOCKED caution light on the caution lights panel (Figure 1-6) illuminates while the fueling panel door is open (four other doors are included in the circuit). The circuit is powered from the left 28-volt main dc bus, protected by a DOORS IND & WARN circuit breaker on PANEL 6.

OIL SYSTEM

GENERAL

30 An oil system (Figure 1-7) is provided for each engine and consists primarily of an oil tank, oil cooler and the necessary piping and components for engine lubrication. Separate circuits in the engine power unit and the speed decreaser gearbox are pressurized by a pump on each assembly. The oil tank is located within the engine nacelle in the accessories compartment, and has a capacity of 4.7 Imperial (5.7 US) gallons of oil, specification MIL-L-23699, and approximately 1.6 Imperial (2 US) gallons air space. The oil cooler is also located within the nacelle. A ground adjustable flap is incorporated in the accessories compartment door to the rear of the oil cooler to regulate airflow through the cooler. APU oil specification is 3GP-904A.

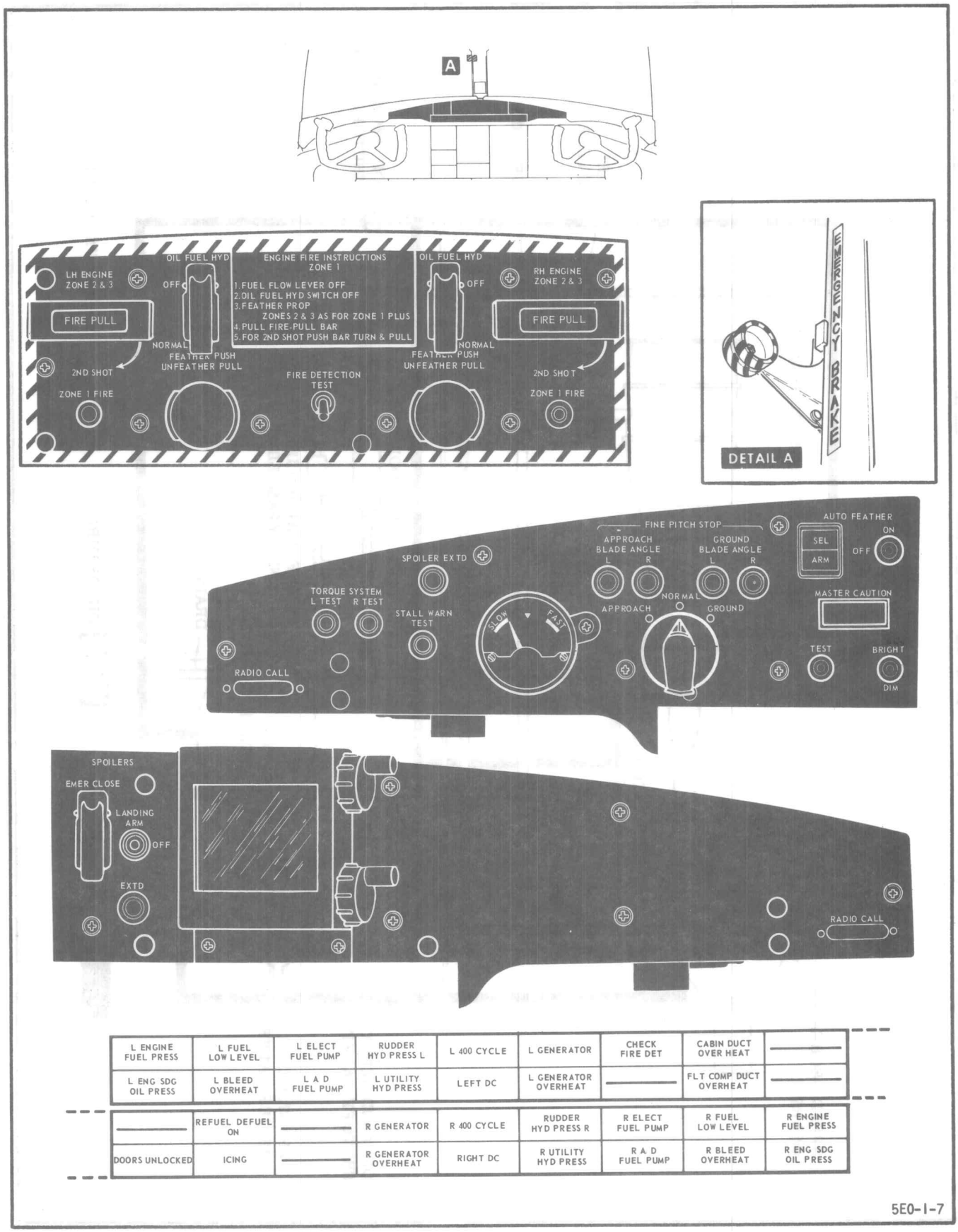
31 Separate indicators to denote engine oil pressure and speed decreaser gear oil pressure are located on the copilot's instrument panel (Figure 1-26), each being connected to its own pressure transmitter in the engine (refer to paragraphs 164 and 165). An oil temperature indicator for each engine is also mounted on the copilot's instrument panel (refer to paragraph 163).

LOW OIL PRESSURE CAUTION LIGHTS

32 Low oil pressure is indicated on the caution lights panel (Figure 1-6) by L and R ENG/SDG OIL PRESS lights, each light registers for both power unit and speed decreaser gear on its respective engine at low pressures of 30 psi and 5 psi respectively. The caution lights are powered by the left and right 28-volt main dc buses and protected by FUEL & OIL WARN L and FUEL & OIL WARN R circuit breakers on PANEL 1 and PANEL 6.

OIL EMERGENCY SHUTOFF SWITCHES

33 Two guarded emergency switches, marked OIL FUEL HYD with positions "OFF" and "NORMAL" are located on the emergency panel (Figure 1-6). Each switch is connected to its shutoff valves in the oil, fuel, and hydraulic systems, so that a single operation only is necessary to isolate all the supply lines in an emergency. Oil system shutoff valves are located on the aft side of each engine firewall, and with the switch at "OFF" oil flow to the engine power unit and speed decreaser gearbox is prevented. Electrical control of the shutoff valves is covered in paragraph 16.



L ENGINE FUEL PRESS	L FUEL LOW LEVEL	L ELECT FUEL PUMP	RUDDER HYD PRESS L	L 400 CYCLE	L GENERATOR	CHECK FIRE DET	CABIN DUCT OVER HEAT	———
L ENG SDG OIL PRESS	L BLEED OVERHEAT	L A D FUEL PUMP	L UTILITY HYD PRESS	LEFT DC	L GENERATOR OVERHEAT	———	FLT COMP DUCT OVERHEAT	———
———	REFUEL DEFUEL ON	———	R GENERATOR	R 400 CYCLE	RUDDER HYD PRESS R	R ELECT FUEL PUMP	R FUEL LOW LEVEL	R ENGINE FUEL PRESS
DOORS UNLOCKED	ICING	———	R GENERATOR OVERHEAT	RIGHT DC	R UTILITY HYD PRESS	R A D FUEL PUMP	R BLEED OVERHEAT	R ENG SDG OIL PRESS

Figure 1-6 Emergency Panel, Side Panels and Caution Lights Panel

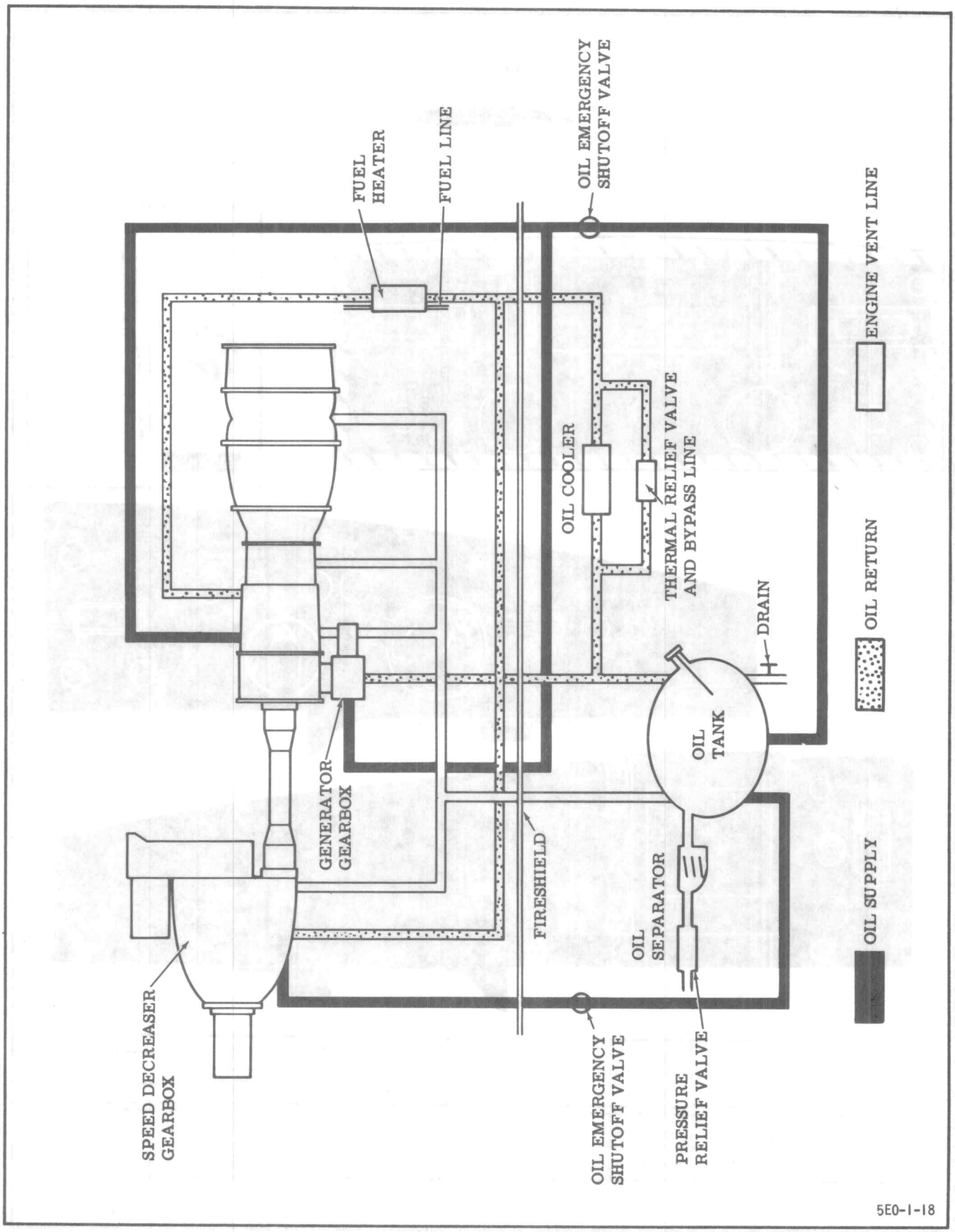


Figure 1-7 Oil System - Schematic

HYDRAULIC SYSTEM

GENERAL

34 Pressure for the utility hydraulic system (Figure 1-8) is supplied by engine-driven pumps to operate the landing gear and its doors, wing flaps, wing spoilers, rudder, nosewheel steering, wheel brakes, and winch. An independent hydraulic system powered by its own engine-driven pumps provides power for rudder operation. This system operates in tandem with the utility system rudder circuit so that if either system fails, rudder operation can still be powered by the other system.

35 Auxiliary hydraulic pressure to the utility system for emergency use in flight and for ground test purposes can be supplied by the auxiliary power unit hydraulic pump. Ground servicing connections are also provided for ground tests. An accumulator is incorporated in the system for emergency braking, and a handpump for emergency lowering of the nose landing gear. Additionally, compressed nitrogen cylinders are provided for emergency lowering of the nose landing gear should the handpump method fail, and for emergency braking.

UTILITY HYDRAULIC SYSTEM

36 The utility hydraulic system (Figure 1-8) includes engine-driven pumps, reservoir, filter, thermal and pressure relief valves, pressure indicators, and low pressure caution lights. Fluid drawn from the reservoir is supplied under pressure by the pumps to the actuators and motors of the various circuits, through a series of filters, selectors and other valves of individual circuits. The pressure is regulated to a nominal 3000 psi. A pressure transmitter connected to an indicator provides utility hydraulic pressure indications, and two pressure switches (one for each pump) control two low pressure caution lights.

UTILITY PRESSURE TO RUDDER ACTUATOR

36A To reduce hydraulic pressure to the rudder actuator during flight with the flaps retracted, a solenoid shut-off valve is incorporated to shut off utility system pressure to the rudder actuator. This valve is activated by a micro-switch mounted on the flap follow-up gear and shuts off utility system pressure to the rudder actuator as the flaps retract through 5°. The valve will open as the flaps extend through 5° providing utility system pressure to the rudder actuator during flight with flaps extended. An ON-OFF indicator is mounted above the UTILITY HYDRAULIC PRESSURE gauge and indicates "ON" when utility system pressure is being delivered to the rudder actuator, and "OFF" when it is not. The indicator is covered with a red flag when there is no AC power to the aircraft. The solenoid valve is powered by the left main DC bus and is protected by a utility Hyd. to rudder circuit breaker on panel 6.

RUDDER HYDRAULIC SYSTEM

37 The rudder hydraulic system (Figure 1-8) operates the rudder actuator independently of the utility system rudder circuit. Two engine-driven pumps deliver pressure to the actuator from a rudder system reservoir. A pressure relief valve, filters and check valves are included in the system. A similar system of hydraulic pressure indication and low pressure caution lights to that of the utility system is incorporated.

UTILITY PRESSURE TO RUDDER SWITCH

37A The UTILITY PRESS TO RUDDER switch is mounted on the aft side of the elevator trim pedestal and is safety-wired in the "OFF" position. Selecting the switch to "ON" will permit the delivery of utility system pressure to the rudder actuator regardless of flap position.

EMERGENCY HYDRAULIC CIRCUITS

38 The emergency operation of some circuits of the hydraulic system (Figure 1-8) are provided for in the event of main pressure failure or mechanical malfunction, by the inclusion of a handpump, reservoir accumulator, compressed nitrogen bottles, emergency selectors and handles. Landing gear, wheel brakes, and wing spoilers each have emergency operating procedures; these are discussed in their descriptions appropriately.

HYDRAULIC PRESSURE INDICATORS

39 Three hydraulic pressure indicators are located in the flight compartment, two on the pilot's pedestal and one on the copilot's pedestal (Figure 1-9). The indicators denote utility system pressure, brake pressure, and rudder system pressure respectively. The utility and brake hydraulic pressure indicators and transmitters are powered from the left 26-volt 400 cycle bus protected by a HYD IND BK/UTILITY circuit breaker on PANEL 7. The rudder hydraulic pressure indicator and transmitter is powered from the right 26-volt 400 cycle bus, protected by a HYD IND RUDDER circuit breaker on PANEL 2.

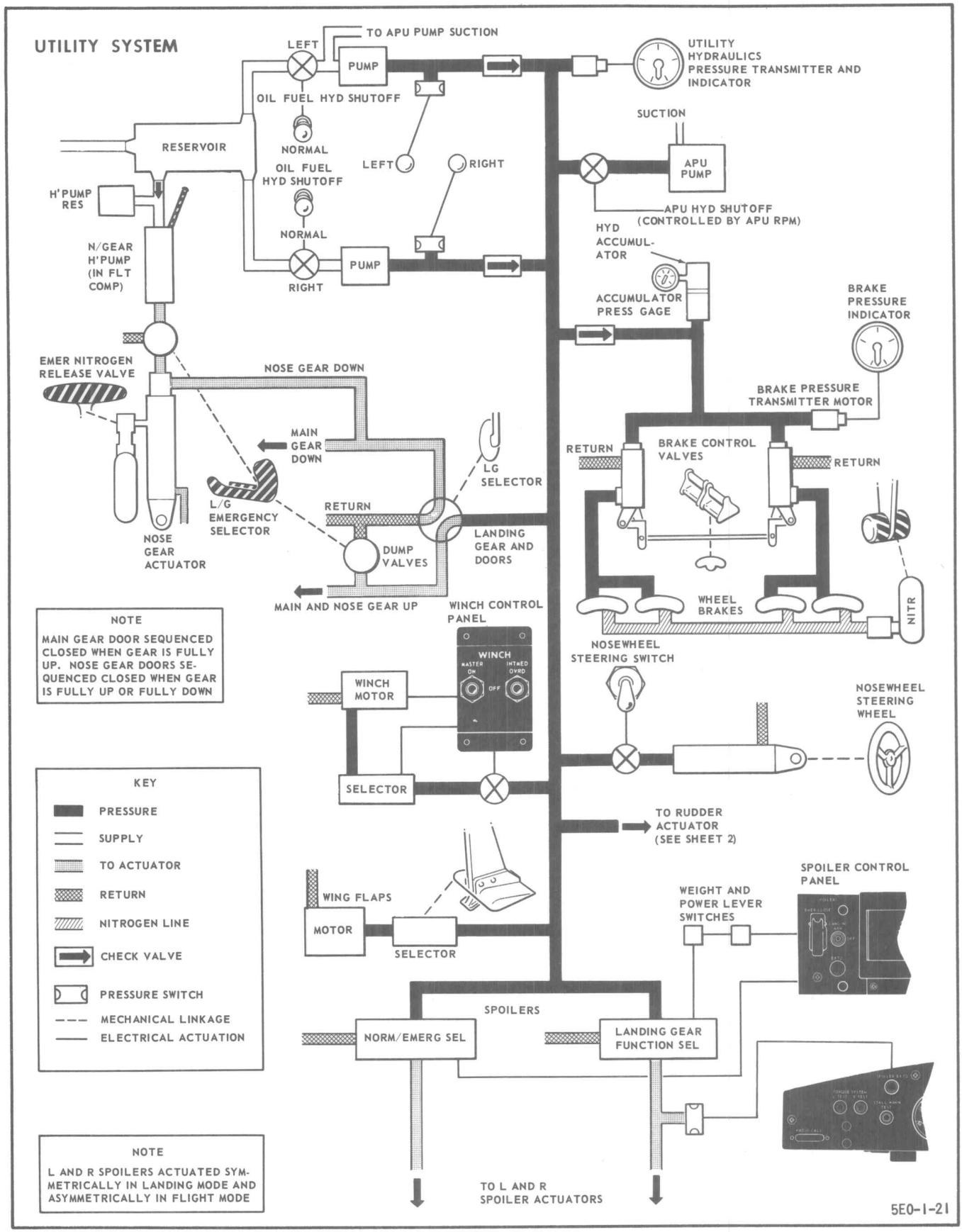


Figure 1-8 (Sheet 1 of 2) Hydraulic System - Schematic

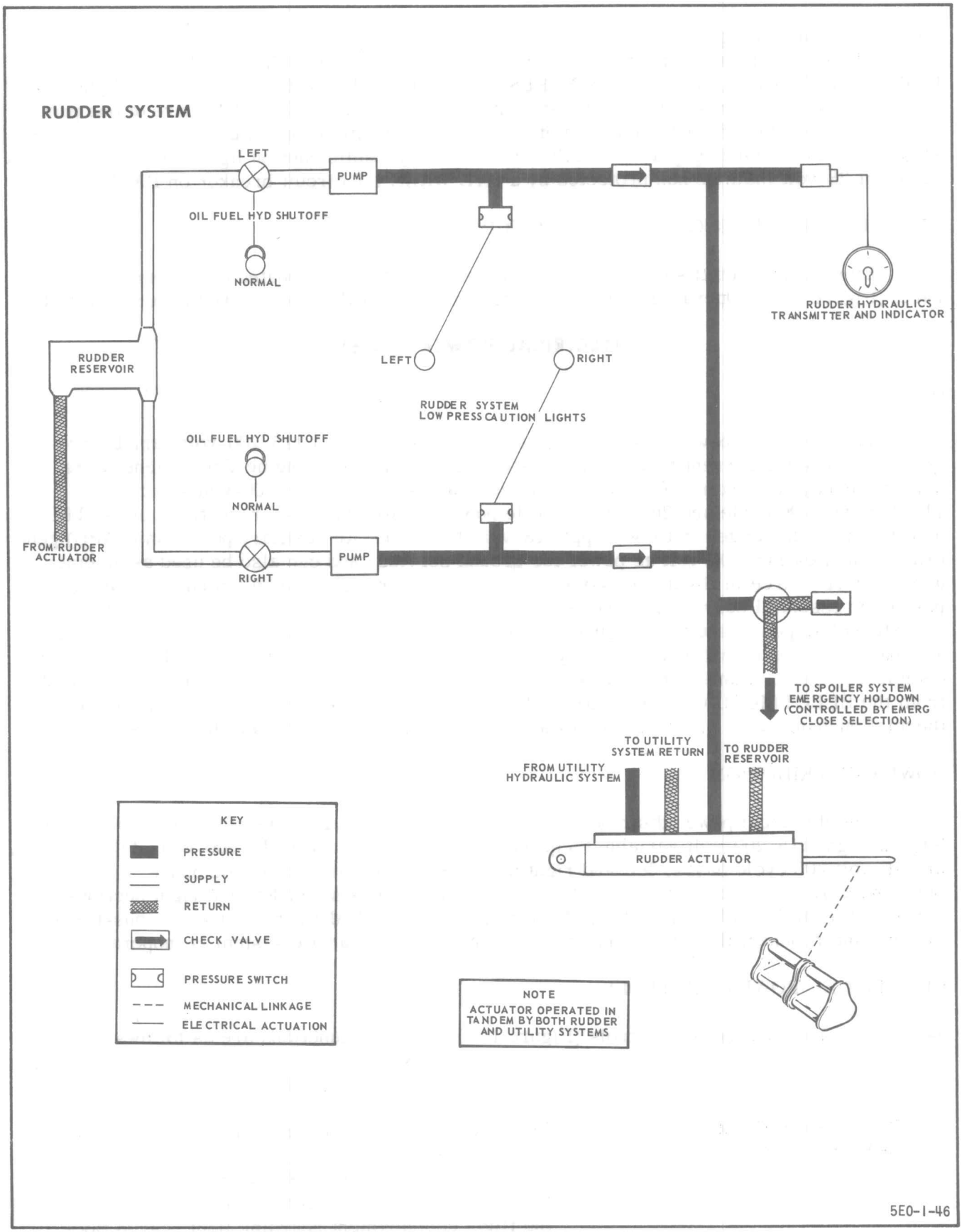


Figure 1-8 (Sheet 2 of 2) Hydraulic System - Schematic

LOW PRESSURE CAUTION LIGHTS

40 Four caution lights on the caution lights panel (Figure 1-6) indicate low hydraulic pressure and the probability of a defective pump. They are marked L UTILITY HYD PRESS, R UTILITY HYD PRESS, RUDDER HYD PRESS L, and RUDDER HYD PRESS R. The lights illuminate when their pumps deliver fluid at a pressure less than 1100 psi. Failure of one pump will not appreciably affect the function of its system; a utility pump failure will cause a very slight increase in landing gear retraction time. The hydraulic caution lights are powered from the right 28-volt main dc bus protected by a HYD WARN LT circuit breaker on PANEL 1.

HYDRAULIC EMERGENCY SHUTOFF SWITCHES

41 Emergency shutoff switches for the hydraulic system are located on the emergency panel (Figure 1-6). Operation of these switches and their valves is covered in paragraph 16.

ELECTRICAL POWER SYSTEM

GENERAL

42 The electrical power system (Figure 1-12) is primarily a 115/200-volt, variable frequency, alternating current, three-phase system, supplied by two engine-driven generators. Two frequency converters, fed from the ac generators, supply 115/200-volt 400 cycle, 115/115-volt 400 cycle and 26-volt 400 cycle power. Two transformer-rectifier units (TRU), also fed from the ac generators, supply 28-volt dc power. An auxiliary power unit (APU) generator supplies 115/200-volt ac power for ground service, and can also be used as an emergency power source in flight. A 24-volt, 34 ampere-hour nickel-cadmium battery supplies power for essential services. Separate ac and dc external power receptacles are provided. An external ac power source will provide power for the complete system (with dc control). The battery, or external dc and battery, can be used to start the APU to provide power for the complete system, if an external ac power source is not available. The system is controlled from the ELECTRICAL CONTROL panel (Figure 1-10). The power circuits are protected by thermal push-to-reset circuit breakers and current limiters. A battery charger is provided.

POWER DISTRIBUTION

43 The electrical power distribution (Figure 1-12) is through a bus network consisting of left and right 115/200-volt variable frequency buses, left and right 115/200-volt, 115/115-volt, and 26-volt 400 cycle buses, left and right main, essential, and control dc buses, a battery bus, and a battery distribution bus. The dc control bus consists of left and right sections connected by an OUTPUTS BUS PROTN circuit breaker on PANEL 6. Automatic bus-tie relay circuits interconnect the left and right buses, in the event that one system is inoperative.

ELECTRICAL POWER CONTROLS

44 The electrical power controls (Figure 1-10) and their functions are as follows:

Control	Function
BATTERY/EXT DC OFF-ON Switch	In the "ON" position connects battery (or external dc) power to the left and right essential dc buses, the control bus, and the APU start circuit. In the "OFF" position connects the battery bus to the flight compartment boarding light, cargo floor lights and the portable lights reset circuit.

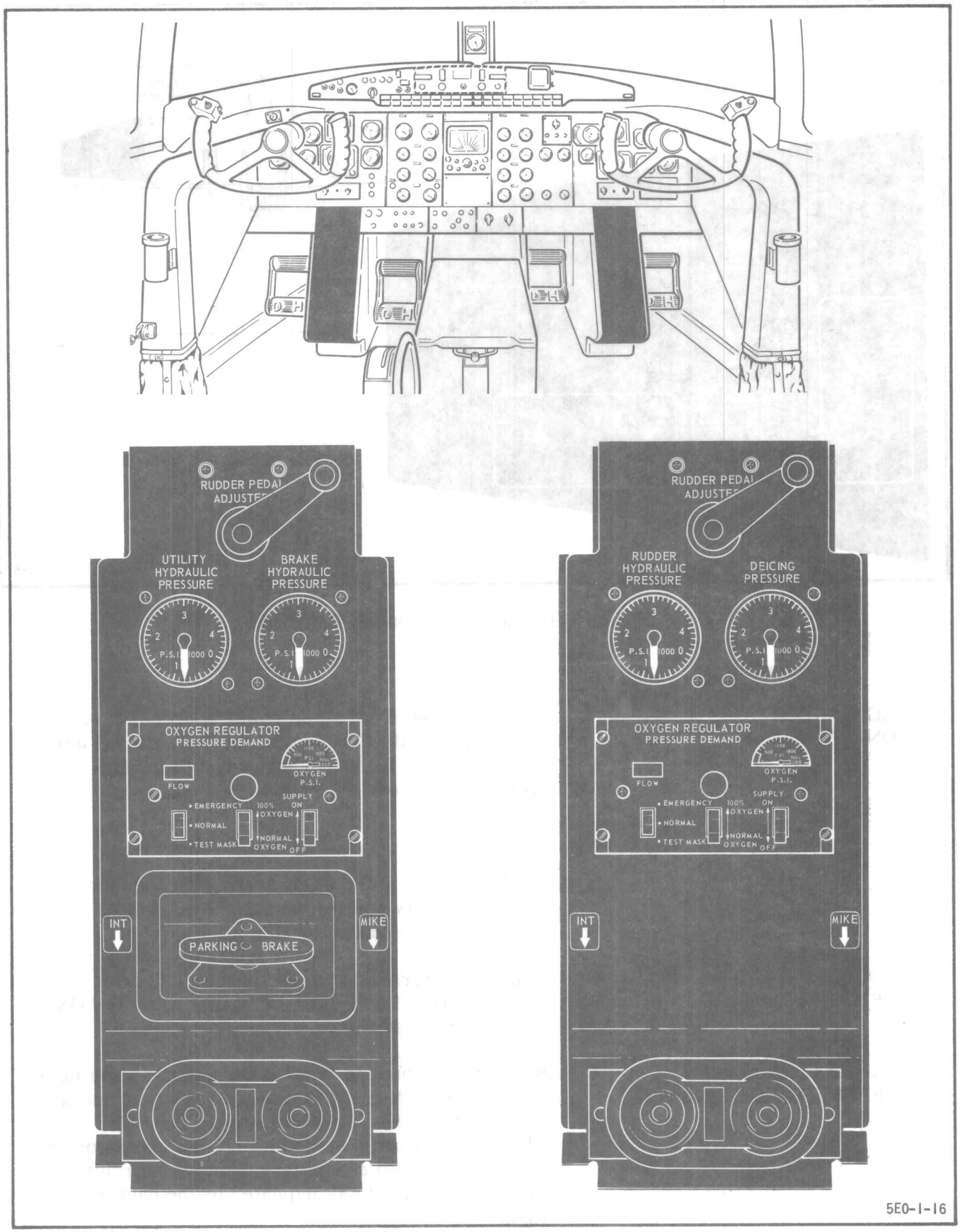


Figure 1-9 Pilot's and Copilot's Pedestals

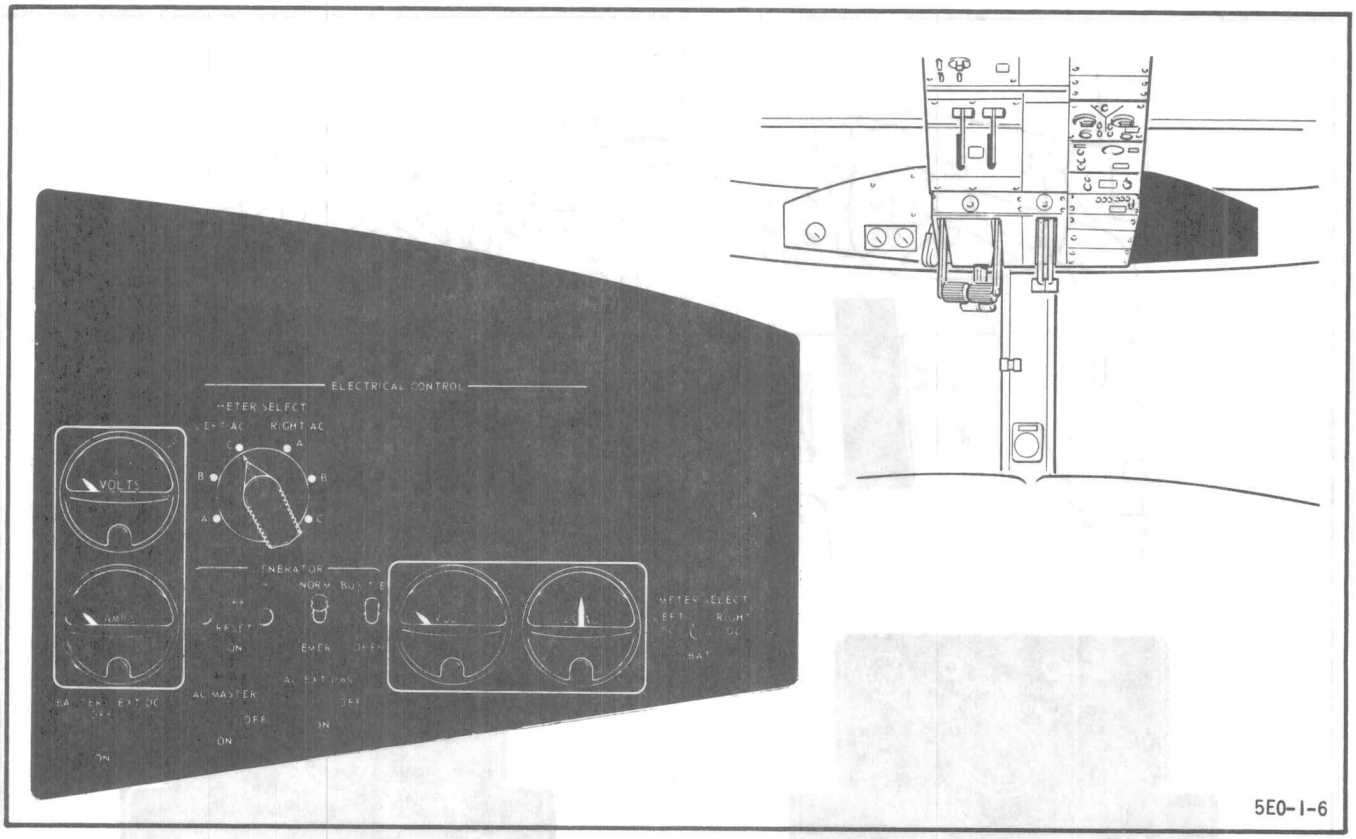


Figure 1-10 Electrical Control Panel

Control	Function
AC MASTER ON-OFF switch	Controls input from all ac power sources, (i.e. left, right, and APU generators, and external ac) to the variable frequency buses and to the frequency converters. NOTE Permanent magnet generator (PMG) output for primary control, and to the dc control bus, is independent of this switch.
AC EXT PWR OFF-ON switch	Connects external ac power source to aircraft system. (BATTERY/EXT DC switch must be "ON" for ac control supply.)
GENERATOR L and R OFF-RESET-ON switches	Normally maintained "ON" to connect the generators to their variable frequency buses when the generator output reaches a pre-set value. The "OFF-RESET" position is used to switch the generator off, or attempt to restore the generator circuit in the event of a fault, as indicated by the caution lights.

Control	Function
NORM-EMER switch	To enable APU power to be connected to the left variable frequency bus in the event of left generator failure together with a right bus fault, (set to "EMER" position). In the event of a right generator failure together with a left bus fault (or both generators inoperative) the switch remains at the "NORM" position. Fault indicated by caution lights.
BUS TIE-OPEN switch	Normally maintained at "BUS TIE" position, with each generator supplying its bus. In the event of one generator failure, both buses are automatically connected together. Also connects both buses together for supply from APU. In the "OPEN" position, isolates left and right buses from each other and prevents automatic bus tie.
METER SELECT LEFT AC - RIGHT AC A - B - C A - B - C	Connects ac voltmeter and ac ammeter to read voltage and current from left or right generator A, B, or C phase as selected. These circuits are protected by three LEFT AC VOLTMETER and three RIGHT AC VOLTMETER circuit breakers located in the variable frequency distribution box in the cabin.
METER SELECT LEFT DC-BAT-RIGHT DC	Connects dc voltmeter and dc loadmeter to read voltage and load from left or right TRU as selected. In the "BAT" (normal) position, with the BATTERY/EXT DC switch at "ON" connects meters to read battery voltage and battery charge or discharge. (With the BATTERY/EXT DC switch at "OFF", the discharge for the boarding and cargo floor lights will not be indicated.) These metering circuits are protected by two LOADMETER and a V-METER circuit breaker in the essential dc bus control box in the cabin.
APU GEN OFF-ON switch (On APU and bleed air control panel)	At "ON" position, connects APU generator to variable frequency buses, when APU reaches 92-94 percent. The "OFF" (reset) position is used to switch off the generator or attempt to restore the generator to the line in the event of a fault.

ELECTRICAL POWER SYSTEM CAUTION LIGHTS

45 The electrical power system caution lights are included in the master caution system (refer to paragraph 54). The caution lights together with the fault and action to be taken in the event of a caution signal are as follows:

Caution Light	Fault and Action to be Taken
L or R GENERATOR (Single fault)	Generator malfunction. Switch "OFF" generator. Left and right variable frequency buses will be automatically connected for supply from one generator.

Caution Light	Fault and Action to be Taken
L or R GEN OVERHEAT (Single fault)	Generator overheating. Switch "OFF" generator. Left and right variable frequency buses will be automatically connected for supply from one generator.
L or R 400-CYCLE (Single fault)	Frequency converter malfunction. Left and right 400-cycle buses will be automatically connected for supply from one frequency converter.
LEFT or RIGHT DC (Single fault)	TRU undervoltage. Left and right main dc buses will be automatically connected for supply from one TRU.
L and R GENERATOR L and R 400-CYCLE LEFT and RIGHT DC (Combined fault)	Left generator failure and right bus fault, or right generator failure and left bus fault or both generators failed. Switch off nonessential loads. Start APU. (a) With APU generator switch "ON", power will be supplied by APU to right bus if fault is right generator failure and left bus fault. R 400-CYCLE and RIGHT DC caution lights go out, remainder stay on. (b) If APU generator starts, then shuts down, fault is left generator failure and right bus fault. Switch "OFF" the APU generator, set NORM-EMER switch to "EMER", then set APU generator switch to "ON". The L 400-CYCLE and LEFT DC caution lights go out, remainder stay on, power supplied by APU generator to left bus.

CIRCUIT BREAKERS

46 Circuit breakers for individual ac and dc circuits, and control bus circuit breakers, are located on the circuit breaker panels on the cabin-flight compartment bulkhead (Figure 1-11 sheet 1). Circuit breakers for ac variable frequency distribution are located on the ac variable frequency distribution box, mounted in the cabin roof aft of the cabin-flight compartment bulkhead (Figure 1-11 sheet 2). Variable frequency circuits between the ac variable frequency distribution box in the cabin and the circuit breaker panels in the flight compartment are protected by three LEFT FWD BUS and three RIGHT FWD BUS circuit breakers located in the variable frequency distribution box. Also located in the cabin roof is the dc power distribution box, and the essential dc bus control box containing dc circuit breakers. The battery-external power transfer distribution box located in the left wheelwell, also contains circuit breakers.

VARIABLE FREQUENCY AC SYSTEM

47 The variable frequency ac system consists of the two main engine-driven 20 KVA generators, which supply 115/200-volt 330/550 cycle three-phase power. Each generator circuit includes a control/voltage regulator panel, voltage limiter, and power relays for automatic control and protection. A permanent magnet generator (PMG) in each main generator produces power for generator field excitation, variable frequency power control, and the dc control bus. The left generator (PMG) provides power to the left control bus,protected by an INPUTS PMG LEFT circuit breaker on PANEL 6,and the right generator (PMG) provides

power to the right control bus, protected by an INPUTS PMG RIGHT circuit breaker on PANEL 3.

400 CYCLE AC POWER SYSTEM

48 The 400 cycle ac power system consists of two frequency converters, with inputs from the variable frequency buses through LEFT FREQ CONVERTER and RIGHT FREQ CONVERTER circuit breakers in the variable frequency distribution box, and outputs of 115/200-volt 400 cycle, 115/115-volt 400 cycle, and 26-volt 400 cycle. Protection and control circuits are contained in the frequency converters, and power relays are included in each circuit for automatic power transfer in event of a fault. Circuit protection is through LEFT BUS and RIGHT BUS 115 VAC 400 CYCLE (LEAD), 115 VAC 400 CYCLE (LAG) and 26 VAC 400 CYCLE circuit breakers on the AC 400 cycle distribution box in the cabin.

DC POWER SYSTEM

49 The dc power system consists of two transformer rectifier units (TRUs) with inputs from the variable frequency buses through LEFT TRU and RIGHT TRU circuit breakers in the variable frequency distribution box, and outputs to the left and right 28-volt main dc buses through DC CONTROL L and R circuit breakers on the main dc power distribution box in the cabin roof. A bus tie relay provides automatic power transfer in event of a fault. The left and right 28-volt main dc buses power the left and right essential buses through ESS BUS L and ESS BUS R circuit breakers on PANELS 6 and 1 with relay control through ESS BUS CONT L and ESS BUS CONT R circuit breakers on PANEL 6 and PANEL 1. The left and right essential buses power the left and right control buses through INPUTS APU PMG & L DC and INPUTS BATT & R DC circuit breakers on PANEL 6 and PANEL 3. A 24-volt, 34 ampere-hour battery supplies power to the portable emergency lights reset circuit, the flight compartment boarding light, and the cargo floor lights. When other power is not available, the battery supplies the left and right essential dc buses, the control bus, and a static inverter. Power from the battery is supplied to the left and right essential buses through the INPUTS APU PMG & L DC and INPUTS BATT & R DC circuit breakers on PANEL 6 and PANEL 3. The battery circuit is protected by a BATTERY SHUNT circuit breaker on the battery external power transfer box in the left wheel well. The essential dc buses supply refueling circuits, APU and engine starting circuits, fire protection circuits, essential lighting, and turn and slip indicators. The static inverter supplies 115-volt 400 cycle ac power for refuel/defuel load limit control, fuel quantity indication and engine temperature indication. The inverter is powered from the right essential bus protected by an INVERTER circuit breaker on PANEL 3. The battery charging relay is energized from a battery charger power relay circuit to connect the regulated charging circuit through the battery relay to the battery. The battery charging relay is controlled by the temperature switches regulating the charge rate. The battery temperature circuit is protected by a TEMP SW circuit breaker on the essential dc bus control box in the cabin.

BATTERY CHARGER

50 The battery charger converts variable frequency ac power to battery dc power, charging automatically through a regulated charging circuit, which is temperature controlled. The battery charger is powered from the left 115/200-volt variable frequency bus protected by three BATTERY CHARGER circuit breakers located in the variable frequency distribution box.

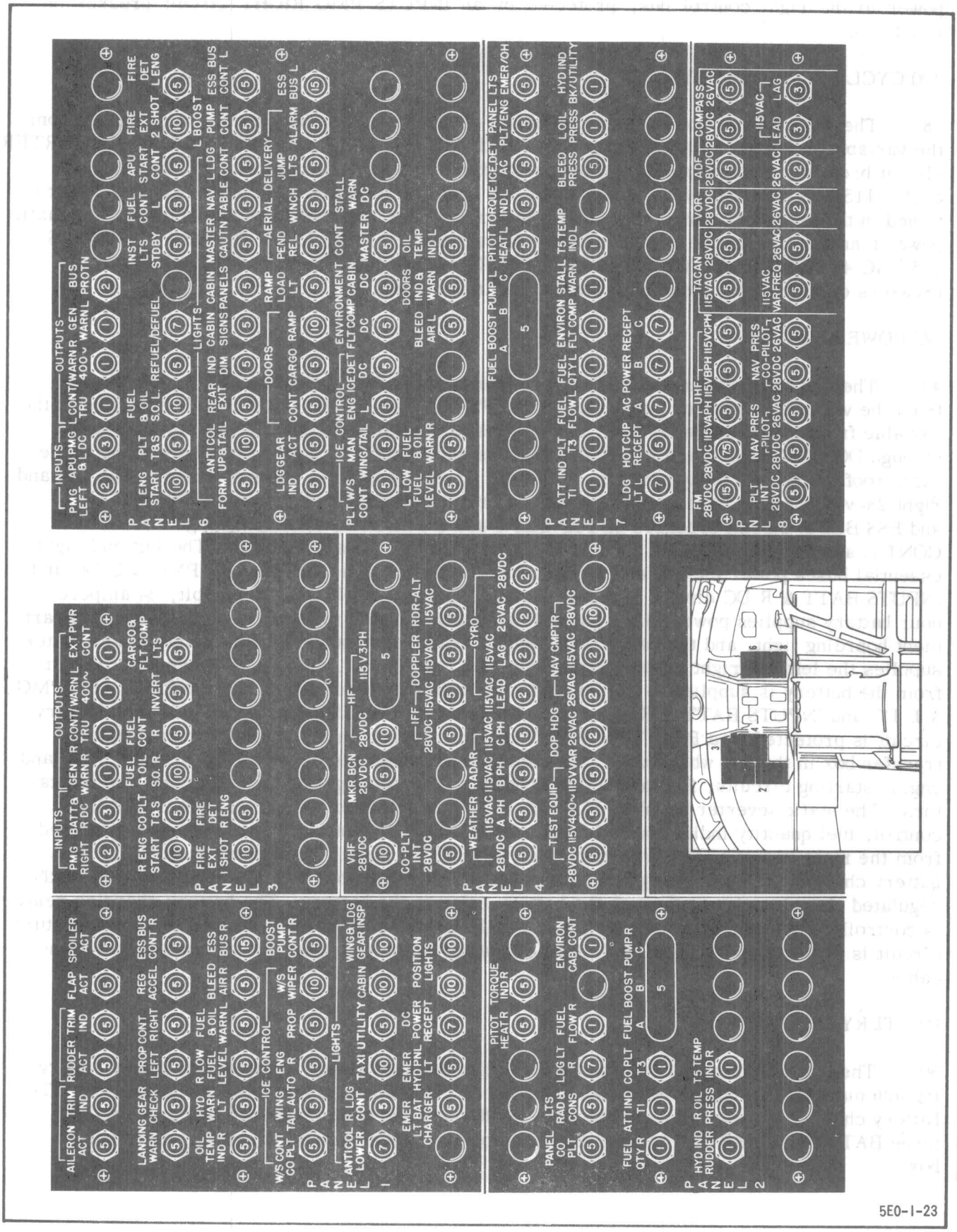


Figure 1-11 (Sheet 1 of 2) Circuit Breaker Panels and Junction Boxes

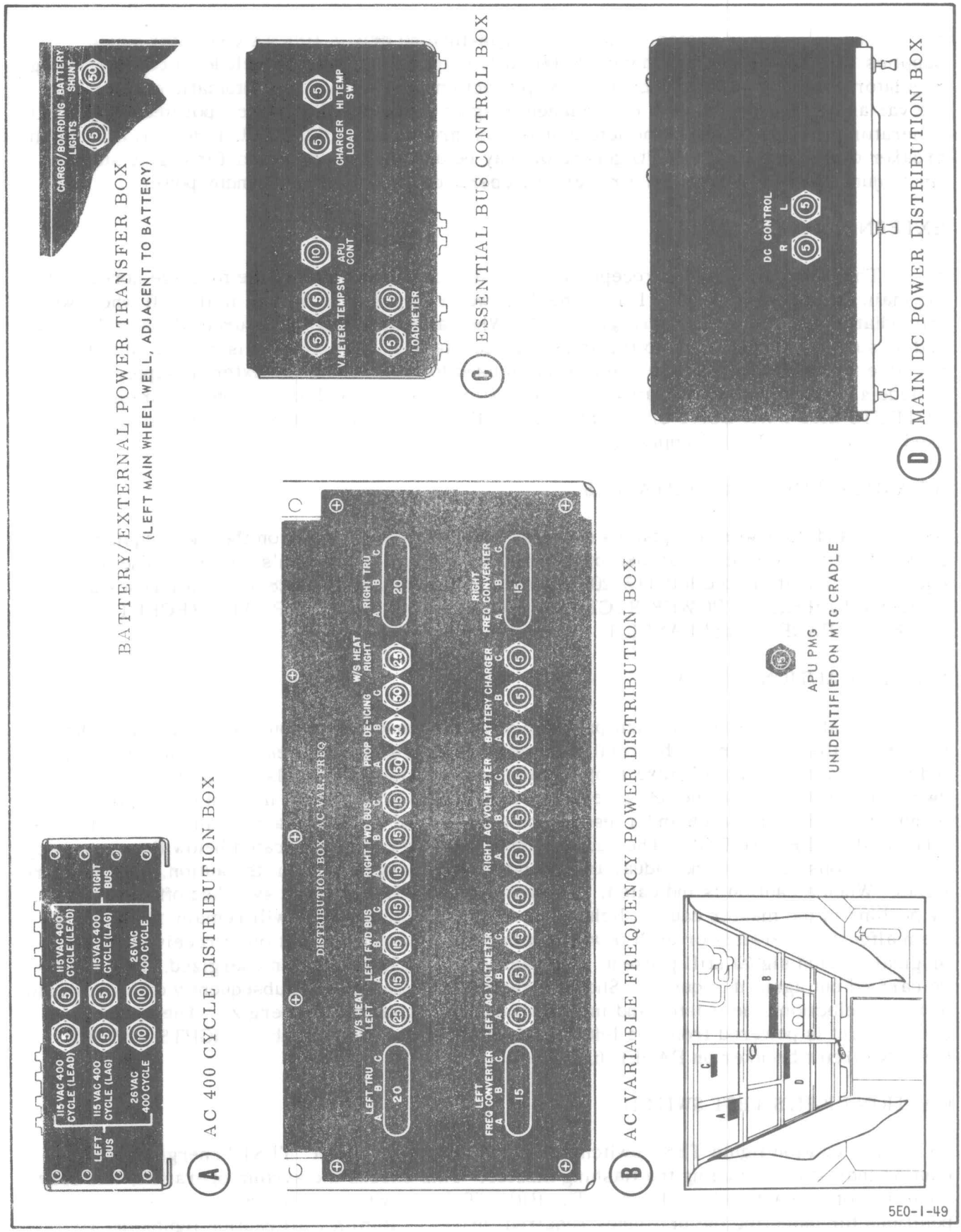


Figure 1-11 (Sheet 2 of 2) (Issue 1) Circuit Breaker Panels and Junction Boxes

APU POWER SYSTEM

51 The APU power system consists of a gas-turbine driven 10 KVA generator which supplies 115/200-volt ac at a nominal 400 cycle output. The system includes a control/voltage regulator panel for automatic control and protection, and a relay for automatic connection to the variable frequency buses. A permanent magnet generator (PMG) incorporated in the APU generator provides power to the left control bus through an INPUTS APU PMG & L DC circuit breaker on PANEL 6. The APU generator may be used to provide power for engine starting (in conjunction with APU bleed air), ground operation, and in-flight standby power.

EXTERNAL POWER SYSTEM

52 The external ac power receptacle is located on the left side of the fuselage abreast of the main landing gear (Figure 1-1). The dc power receptacle is located in the left wheel well immediately aft of the battery (Figure 1-1). When an external power source which includes ac and dc supplies is connected to the ac power receptacles, the ac power is connected to the variable frequency bus and the external dc is used for control. If the external supply does not include a dc supply, the aircraft battery (or external dc) is used for dc control through an OUTPUTS EXT PWR CONT circuit breaker on PANEL 3. An external dc power source can be used to start the APU to supply the system.

AC AND DC POWER RECEPTACLES

53 Ac and dc power receptacles (for test equipment) are located on the radio equipment racks aft of the copilot's seat and to the right of the flight technician's position. The test equipment circuits to the left 115/200 variable frequency and right 28-volt main buses are protected by three AC POWER RECEPT circuit breakers and a DC POWER RECEPT circuit breaker on PANEL 7 and PANEL 1.

MASTER CAUTION SYSTEM

54 The Master Caution system provides a flashing master caution amber light upon detection of a malfunction or an abnormal condition, as identified by a steady light on a panel of individual caution lights (Figure 1-6). The master caution light is also a combination reset switch and is located on the left emergency side panel, immediately in front of the pilot. A bright/dim selector switch and a test switch are grouped with the master caution light and are labeled MASTER CAUTION. The caution lights panel is centrally located below the emergency panel and consists of 30 individual amber lights, each inscribed with its caution, and six spare lights. When a caution is indicated, the master caution light may be switched off, and reset, by pushing in the master caution light. The individual caution light will remain on as long as the malfunction persists or until power is removed. If a second caution is received, with the original caution signal still present, the master caution light is again energized. Reset may be carried out again if required. Should a caution be received and subsequently disappear prior to reset selection, the master and individual caution lights will deenergize. The master caution light is powered from the left 28-volt main dc bus,protected by a LIGHTS MASTER CAUTN circuit breaker on PANEL 6.

CAUTION LIGHTS TEST SWITCH

55 The caution lights TEST switch, when momentarily held at "TEST" energizes all caution indicators including the flashing master. This checks the system operation, and serviceability of all caution light lamps. The BRIGHT/DIM switch has two momentary contact positions for selecting the brilliancy required (bright or dim) for all caution lights and all indication lights and landing gear WARN & UNLOCKED lights. The BRIGHT/DIM switch circuit

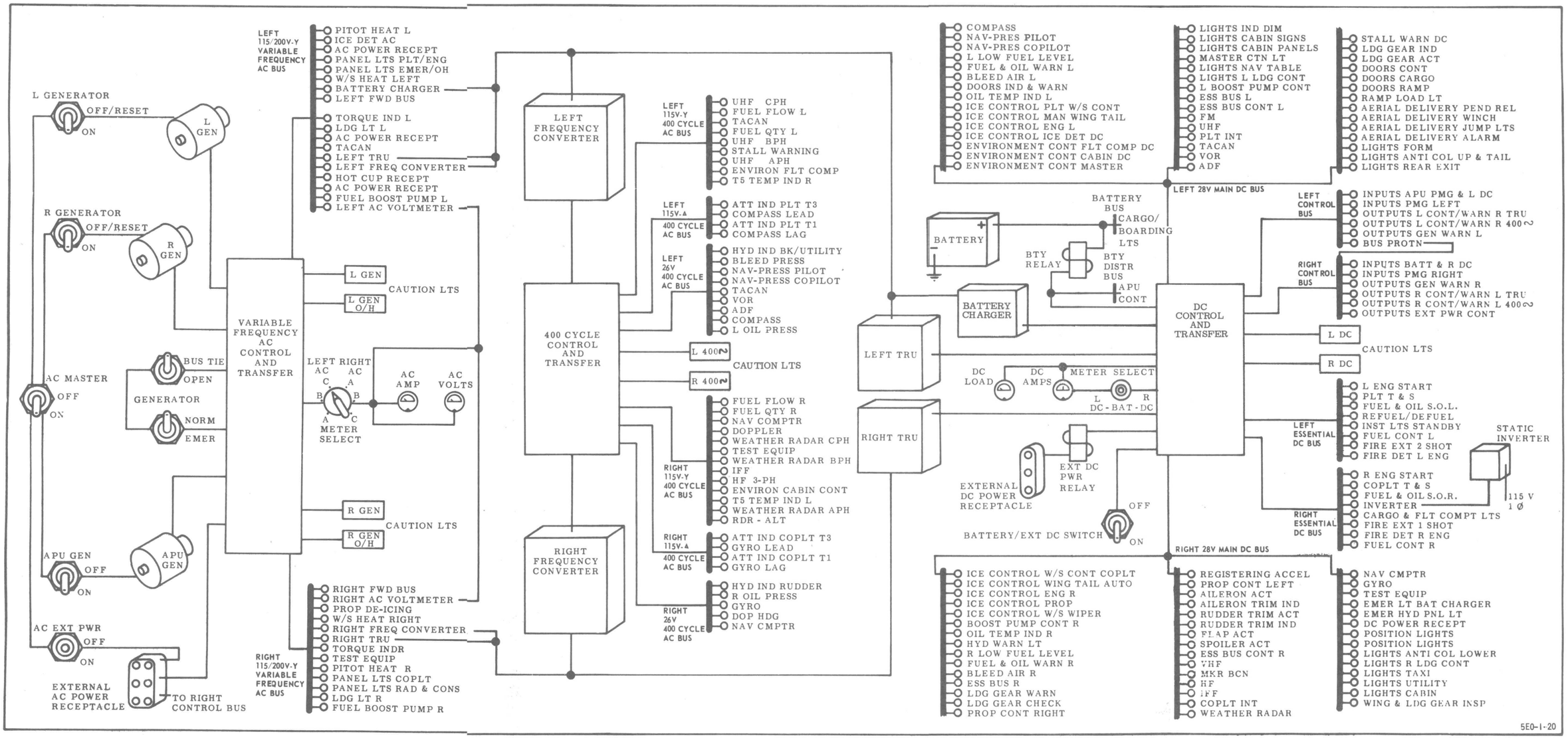


Figure 1-12 (Issue 1) Electrical System - Schematic

is powered from the left 28-volt main dc bus and protected by a LIGHTS IND DIM circuit breaker on PANEL 6.

CAUTION LIGHT CIRCUIT BREAKERS

56 The RIGHT DC caution light is powered from the left control bus and protected by an OUTPUTS L CONT WARN R TRU circuit breaker on PANEL 6. The R 400 CYCLE caution light is powered from the left control bus and protected by an OUTPUTS L CONT WARN R 400 circuit breaker on PANEL 6. The L GENERATOR caution light is powered from the left control bus and protected by an OUTPUTS GEN WARN L circuit breaker on PANEL 6. The R GENERATOR caution light is powered from the right essential bus, protected by an OUTPUTS GEN WARN R circuit breaker on PANEL 3. The LEFT DC caution light is powered from the right control bus, protected by an OUTPUTS R CONT WARN L TRU circuit breaker on PANEL 3. The L 400 CYCLE caution light is powered from the right control bus, protected by an OUTPUTS R CONT WARN L 400 circuit breaker on PANEL 3.

PNEUMATIC SYSTEM

57 Pneumatically-operated equipment in the aircraft consists only of a compressed nitrogen emergency extension system for the nose landing gear and a compressed nitrogen supply for emergency application of the wheel brakes. These are described in paragraphs 118 and 124.

POWER CONTROLS

GENERAL

58 The power controls levers are located in the overhead console (Figure 1-13) and comprise a power lever, fuel lever, and propeller lever for each engine. Each lever moves in a slot with appropriate markings for lever operation. Friction control knobs are installed to retain the power levers and propeller levers at their selected positions. Engine switches are mounted on the ENGINE panel on the overhead console.

POWER LEVERS

59 Dual power levers on the overhead console each move in a slot with the panel between labeled THROTTLE and with lever positions marked "MAX" and "MIN" in the REVERSE range, and "IDLE" and "MAX" in the forward range. The power levers control engine speeds in the forward and reverse pitch ranges of the propellers, and also select reverse pitch. A cable and pulley system and linkage connects each power lever to the power shaft of the fuel control unit and to the propeller controller of its engine. To prevent inadvertent selection of reverse pitch, a gate in each power lever slot is provided and a stop gate mechanism in the power lever allows the gate to be overridden by twisting the grip of the lever. A detent mechanism locates the "MIN" position in the REVERSE range. A subsidiary function of the power levers is the actuation of microswitches at certain power settings to provide simultaneous control of functions in the environmental control, wing spoilers, landing gear warning, and anticipator systems. These functions are described in subsequent paragraphs.

NOTE

The power levers should not be left between "MAX" and "MIN" in the reverse pitch range on engine shutdown.

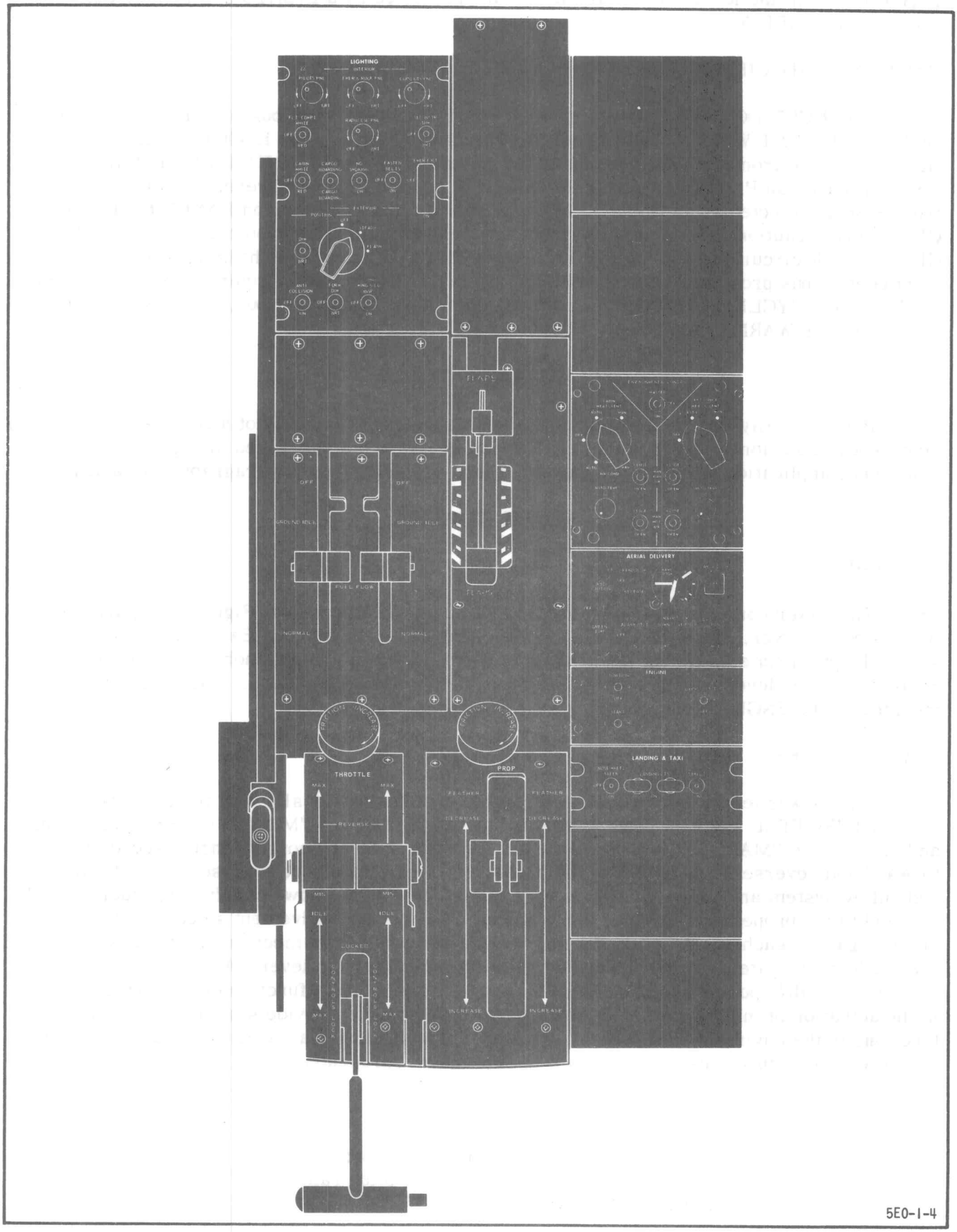


Figure 1-13 Overhead Console

FUEL FLOW LEVERS

60 The fuel flow levers are described in paragraph 15.

FRICTION CONTROL KNOBS

61 Two friction control knobs are mounted on the overhead console at the aft ends of the power lever and propeller lever panels (Figure 1-13). Each knob is marked FRICTION and is arrowed clockwise with the direction INCREASE. The knobs must be rotated in the direction indicated to obtain the desired friction to retain the levers in any selected position without excessive restriction of movement.

ENGINE PANEL

62 The ENGINE panel (Figure 1-14) is located on the overhead console. It is labeled ENGINE and contains the ENGINE START switch, ENGINE IGNITION switch, and ENGINE OVERSPEED TEST switch.

ENGINE START SWITCH

63 The ENGINE START switch on the ENGINE panel is labeled START, and has a center off position and two momentary on positions marked "L" and "R". Operation of the switch to "L" or "R" during engine starting procedure energizes the starter valve of its engine and admits air (ground supply or APU) to rotate the starter. The switch automatically returns to its off position at a preset rpm (approximately 46%) when the starter valve is deenergized.

ENGINE IGNITION SWITCH

64 The ENGINE IGNITION switch on the ENGINE panel (Figure 1-14) is labeled IGNITION and has a center "OFF" position, and two positive contact positions marked "L" or "R" supplies electrical current to the igniters of its engine. The ignition circuit is deenergized simultaneously with the starter valve. The switch is selected "OFF" when engine idle speed is attained.

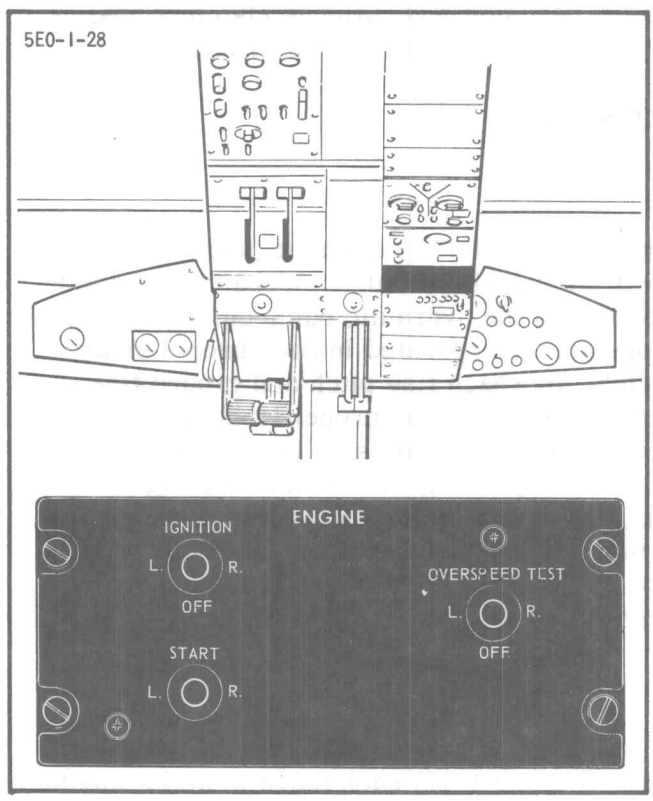


Figure 1-14 Engine Panel

ENGINE OVERSPEED PREVENTION SYSTEM

65 Overspeeding of the power turbine and propeller is prevented by an engine-mounted switch which, by being energized when the propeller rpm reaches 114% signals the fuel control valve to reduce fuel flow and thereby decrease gas generator speed to idle until the propeller rpm falls below 114%. At this point the overspeed switch is automatically deenergized and engine speed reverts to its original operating condition. This cycle will repeat itself until the cause of the malfunction is determined and eliminated.

ENGINE OVERSPEED TEST SWITCH

66 The ENGINE OVERSPEED TEST

switch on the ENGINE panel (Figure 1-14) is a momentary contact type switch and is labeled OVERSPEED TEST; it has a center "OFF" position and two momentary contact positions marked "L" and "R". Operation of the switch to "L" and "R", with the relevant engine running, allows a test of the overspeed prevention system to be carried out at a propeller rpm of approximately 72%. During testing, the overspeed test limit switch governs the signal to the fuel control valve, and simulates an overspeed condition on the engine at a lower speed.

ENGINE STARTER VALVE CAUTION LIGHTS

67 Two press-to-test engine starter valve caution lights, each labeled START ON, are located on the pilot's instrument panel (Figure 1-25). Each light illuminates when its engine starter valve is energized by the START switch, and remains on while the starter is engaged. If a light remains on after a start, the engine should be shut down and rectification carried out. The caution lights, engine start switch, ignition switch and overspeed test switch circuits are all powered from the left and right essential dc buses protected by L ENG START and R ENG START circuit breakers on PANEL 6 and PANEL 3.

ENGINE COMPARTMENT COOLING SYSTEM

68 The engine and its accessories are cooled by ram air. The engine compartment, enclosed by the engine cowlings, is cooled by air entering through the center of the propeller spinner and through airscoops in the bottom front cowling, and exhausted through vents in the rear of the top cowling. The power section compartment and the exhaust pipe are cooled by air drawn into the shroud and circulated around the power section then exhausted to atmosphere through the annular chamber formed by the exhaust pipe and the exhaust pipe shroud. Exhausting of this cooling air is aided by the rapid discharge of exhaust gases from the exhaust pipe causing an area of low pressure at the rear of the chamber. A scoop on the right side of each engine admits air for generator cooling. The accessories compartment utilizes the airflow through the oil cooler for cooling. It is discharged to atmosphere through a ground adjustable flap on the accessories compartment door. An inlet and outlet is also provided in the left engine accessories compartment door for the elimination of APU exhaust gases.

PROPELLER CONTROLS

GENERAL

69 Each propeller is a Hamilton Standard, three-bladed, fully feathering (automatic and manual), reversible, speed governed unit, with hydromatic pitch change mechanism and self-contained hydraulic system. An auxiliary pump augments the hydraulic pump during feathering and reversing operations. Three low pitch stops are incorporated in each propeller and provide for blade angle settings for normal fine pitch, approach fine pitch and ground fine pitch. The normal and approach settings may be overridden and the propeller blades driven into reverse pitch to obtain aerodynamic braking upon landing. Provision is made for the automatic prevention of power turbine and propeller overspeeding. Electrical heating elements are incorporated on the propeller blades, plateaus, and spinners for anti-icing. Electrical control of the propeller is from the right 28-volt main dc bus and the circuit is protected by PROP CONT LEFT and RIGHT circuit breakers on PANEL 1. The feathering motors are powered from the left and right 28-volt main dc buses,protected by current limiters in the main dc distribution box.

PROPELLER LEVERS

70 Two propeller levers on the overhead console (Figure 1-13) each move in a slot labeled PROP, over a range with markings "INCREASE", "DECREASE", and "FEATHER". Each

lever controls the constant speed and feathering ranges of its propeller through a cable and pulley system connected to a propeller controller. A gate is incorporated in each propeller lever slot to prevent inadvertent selection of the feathering position; this may be overridden when required by pushing upward and the pulling backward on the lever knob. This operation mechanically selects propeller feathering and simultaneously actuates a series of limit switches which energize the electrical circuits of the feathering system. The blades are then hydraulically actuated to the feathered position. A safety toggle is incorporated in the propeller lever assembly to prevent both propellers from being feathered simultaneously. During the feathering operation a red light in the associated propeller feathering button on the emergency panel (Figure 1-6) illuminates and the button pulls in. A propeller can only be unfeathered by pulling out the appropriate feathering button after the propeller lever has been moved from the "FEATHER" position.

PROPELLER FEATHERING BUTTONS

71 Two guarded propeller feathering buttons located on the emergency panel (Figure 1-6), are marked FEATHER PUSH UNFEATHER PULL. A feathering cycle is initiated electrically by depression of the appropriate feathering button, and is indicated by illumination of a red light in the button. The light remains on for the duration of the feathering cycle, going out simultaneously with the return of the button to its neutral position. To unfeather, the button must be pulled out and held until the feathering cycle is complete. The propeller blades return to a setting determined by the propeller lever position and the fine pitch stop switch. The propeller lever should be selected to a mid-range position when unfeathering, and the fine pitch stop switch operated to "NORMAL" or "APPROACH" as required. The propeller will then unfeather to the appropriate pitch stop. Unfeathering with the pitch stop selector at GROUND may result in the propeller pitch-locking at 40° or it may feather into reverse. Indications of pitch lock are; failure of the GROUND and APPROACH blade angle lights to illuminate, and unusually low propeller RPM at idle. To regain normal operation the propeller should be refeathered and the unfeathering cycle repeated in NORMAL or APPROACH. If when unfeathering in GROUND the propeller unfeathers into reverse the only indication will be a flight idle propeller RPM of 35% vice 60%. To regain normal operation the pitch stop selector should be moved to NORMAL and propeller RPM allowed to stabilize.

AUTOFEATHERING

72 An autofeathering system is incorporated which automatically feathers the propeller of an underpowered engine if unequal engine torque values are detected within a certain range. Autofeathering is controlled by the torque indicating system of each engine, which initiates a feathering cycle if the torque of one engine decreases to 200 foot-pounds while that of the other engine remains above 550 foot-pounds. The AUTOFEATHER switch is selected "ON" prior to take-off and a green press-to-test light inscribed SEL illuminates. The system is armed for operation when torque on both engine output shafts exceeds 550 foot-pounds, and is indicated by the illumination of an amber indicator light marked ARM.

Autofeathering occurs when torque on one engine decreases to 200 foot-pounds and is indicated by the illumination of its feathering button as it automatically retracts; simultaneously the ARM indicator light goes out. Subsequent autofeathering of the other propeller is prevented by torque meter switching which disarms the autofeathering system. The autofeathering system is also disarmed if the torque values of both propellers are reduced to an intermediate figure. Rearming cannot occur until propeller torque values again rise to arming level.

AUTOFEATHERING SWITCH

73 The autofeathering switch is located on the left emergency side panel (Figure 1-6) under the label AUTO FEATHER. It is a two-position switch with marked "ON" and center "OFF" positions. The switch at "ON" connects electrical power to the autofeathering system as indicated by the illumination of the green SEL indicator light adjacent to it. The autofeathering system is powered from the right 28-volt main dc bus, protected by PROP CONTROL LEFT and RIGHT circuit breakers on PANEL 1.

AUTOFEATHERING INDICATOR LIGHTS

74 Two press-to-test autofeathering indicator lights are located one above the other on the left emergency side panel (Figure 1-6) adjacent to the autofeathering switch. The upper light is green and inscribed SEL; it illuminates when AUTOFEATHERING is selected "ON". The lower light is amber and is inscribed ARM; it illuminates when both propeller torque values exceed 550 foot-pounds and indicates that the system is armed for autofeathering.

AUTOFEATHERING TEST

75 The autofeathering system can be tested by the TORQUE SYSTEM L TEST and R TEST switches located on the left emergency side panel (Figure 1-6). Simultaneous selection of both switches to the "TEST" position with AUTOFEATHER switch selected to "ON" will increase the reading on the TORQUE indicators beyond 550 foot-pounds, and arm the system. Releasing one of the TORQUE SYSTEM TEST switches will decrease the TORQUE indicator reading below 200 foot-pounds, the ARM indicator light will go out, the feathering button automatically retracts and illuminates and the propeller will feather. Complete feathering can be prevented by holding the feathering button out and releasing the other TORQUE SYSTEM TEST switch. Autofeathering of the other propeller can be tested by repeating the above procedure but releasing the other TORQUE SYSTEM TEST switch when the system is armed. The TORQUE SYSTEM L TEST and R TEST switches are electrically connected to a weight switch on the nose gear which deactivates the system in flight.

PROPELLER FINE PITCH OPERATION

76 Each propeller is equipped with three fine pitch stops to facilitate optimum aircraft performance in its various regimes of operation, i.e., take-off, climb, cruise, approach and ground operation. The fine pitch stops each establish a minimum angle to which the propeller blades can be driven, upon selection of the fine pitch stop switch and operation of the propeller lever. The switch has three positions: "APPROACH", "NORMAL" and "GROUND", and controls the fine pitch stops of both propellers. The "APPROACH" setting selects the stop for attaining a zero thrust blade angle of 6.8° during approach and landing. The "NORMAL" setting selects a conventional fine pitch stop for a blade angle of 17.2° for take-off and in-flight usage. The "GROUND" setting selects the stop for achieving a blade angle of -2.2° for ground operation and taxiing. The propeller controller, through operation of the propeller lever, maintains control of blade angles above the selected fine pitch stop. A landing gear weight switch in the electrical circuit prevents engagement of the GROUND stop in flight.

FINE PITCH STOP SWITCH

77 The fine pitch stop switch on the left emergency side panel (Figure 1-6) is a rotary type switch and has three positions marked "APPROACH", "NORMAL", and "GROUND". Selection of any position, under the appropriate condition, adjusts the blade angles of both propellers to the angles given in paragraph 76.

FINE PITCH STOP INDICATOR LIGHTS

78 Fine pitch stop indicator lights on the left emergency side panel (Figure 1-6) consist of four blue press-to-test lights arranged in two pairs; one pair is labeled APPROACH BLADE ANGLE and the other pair GROUND BLADE ANGLE. Of each pair, individual lights are marked L or R. Upon selection of "APPROACH", each APPROACH BLADE ANGLE light illuminates when the NORMAL stop has been overridden and the propeller blades are closing upon the angles determined by the APPROACH stop. When "GROUND" is selected, each GROUND BLADE ANGLE light also illuminates when the APPROACH stop is overridden and the propeller

blades are nearing the angles determined by the GROUND stop. The two or four blade angle lights remain illuminated while operating on the APPROACH or GROUND fine pitch stops respectively. The blade angle lights are also illuminated when the propellers are operating in reverse pitch.

REVERSE PITCH OPERATION

79 To operate the propellers in reverse pitch, the power lever handles must be twisted through 60° to release the stop gates and then the levers moved aft into the REVERSE range. A detent position is reached when full reverse pitch is obtained. Further aft movement of the levers increases reverse thrust engine power. As the propeller blade angles decrease when reverse pitch is selected, the blade angle lights illuminate as their fine pitch stops are approached and overridden. The propeller reversing operation is carried out through an electrical and mechanical linkage between each power lever and its propeller hydraulic valves.

CAUTION

Operation of the power levers into REVERSE range with fine pitch stop switch at "GROUND" will produce momentary forward thrust.

UNREVERSE PITCH OPERATION

80 The propellers are unreversed by advancing the power levers to "IDLE". As the blades unreverse, the fine pitch stops are overridden and the GROUND and APPROACH blade angle lights go out. Regardless of the pitch stop selected, the complete unreversing cycle takes place and the blades coarsen to an angle slightly greater than that set by the NORMAL pitch stop; they then return to the angle set by the selected pitch stop, and to propeller governor control. If APPROACH fine pitch is selected, the APPROACH blade angle lights come on again.

NOTE

If the power levers are advanced out of the REVERSE range with electrical power off, blade unreverse cannot take place until the power levers are again moved to REVERSE with electrical power on.

RAPID POWER PROVISION

81 Anticipator limit switches operated by the power levers are incorporated to provide for rapid power requirements and to prevent propeller overspeeding when operating at "APPROACH" or "GROUND" fine pitch stops. When the power levers are advanced to take-off power, as in a go-around, the anticipator switches are actuated at approximately 2000 shaft horsepower positions, and the propeller blades are driven to increase pitch. The blade angle lights go out as the fine pitch stops are overridden.

FLIGHT CONTROLS

GENERAL

82 The primary flight controls are operable from either the pilot's or copilot's position by means of dual control columns and rudder pedals. Secondary flight controls and the flight con-

trols lock lever are all operable from either pilot's position. Ailerons and elevators are mechanically operated through control cable systems, and the rudder through a cable system-operated hydraulic actuator. An electrically-operated aileron trim tab and a mechanically-operated elevator trim tab (which is also interconnected with the flap mechanism) provide lateral and longitudinal trim control, while directional trim is provided by biasing the rudder through the rudder actuator. A geared tab on each aileron, a rudder-aileron interconnect tab on the left aileron, and a spring tab on the right elevator give aerodynamic assistance to the primary controls. The double-slotted wing flaps are hydraulically and mechanically operated, with provision for hand-operation in the event of malfunction. The wing spoilers which operate in conjunction with the ailerons in flight, and reduce wing lift on landing are controlled electrically and hydraulically. The ailerons and elevators can be positively locked mechanically when centered by operation of a controls lock lever in the flight compartment.

CONTROL COLUMNS

83 Each of the control columns (Figure 1-2 sheet 1) is a one-piece structure mounted on a torque tube below the flight compartment, each on its outboard side of the flight compartment, and with a single yoke carrying the control wheel. Chains and sprockets transmit control wheel movement to the aileron controls beneath the flight compartment floor. A single connecting rod on the left side transmits control column fore-and-aft movement to the elevator controls. The W-type control wheels are each equipped with a microphone-interphone button and an aileron trim switch. A stick-shaker type stall warning device is also attached to each control column.

RUDDER PEDALS

84 The pilot's and copilot's rudder pedals are of conventional design and are connected by push rods to a quadrant beneath the flight compartment floor, from which movement is transmitted to the rudder controls. The rudder pedals are also connected by push rod and bellcrank linkage to the wheel brake system control valves. Brakes are applied by depression of the toe section of each pedal. A mechanism for leg reach adjustment is operated by a handle on the pylon directly in front of each seat.

AILERON SYSTEM

85 The ailerons, one on each wing, are hinged to the outboard fore flaps and are operated through a control cable system and mechanical linkage from the pilot's or copilot's control wheel. The ailerons move with the flaps and their upward range of movement varies with flap position. In flight, the aileron system is engaged with the wing spoiler system, which assists in the lateral control of the aircraft. The left aileron is equipped with a geared tab and a rudder-aileron interconnect tab and the right aileron with a geared tab and an adjustable trim tab.

AILERON GEARED TABS

86 The aileron geared tabs are installed on the inboard ends of both ailerons to aerodynamically assist aileron control by opposite deflection with respect to the ailerons.

RUDDER-AILERON INTERCONNECT TAB

87 The rudder-aileron interconnect tab is hinged to the outboard end of the left aileron and is connected by cables to the rudder control cables. Movement of the rudder in either direction produces proportionate interconnect tab movement (up or down as appropriate) to assist the aileron in coordinating the turn.

AILERON TRIM TAB

88 The electrically-operated trim tab is hinged to the outboard end of the right aileron. An actuator in the aileron is connected to the tab and controls its movement in response to the pilot's or copilot's selected requirements.

AILERON TRIM SWITCH

89 The momentary-contact aileron trim switch on each control wheel (Figure 1-2 sheet 1) has two operating positions marked L/W DWN and R/W DWN. The aileron trim electrical circuit is powered from the right 28-volt main dc bus and is protected by the AILERON TRIM ACT circuit breaker on PANEL 1. The pilot's switch has primary control of the circuit and can override a simultaneous copilot's switch selection.

AILERON TRIM TAB POSITION INDICATOR

90 The aileron trim tab position indicator is located on the left side of the copilot's instrument panel (Figure 1-26). The indicator dial is marked AIL TRIM, and has a scale with graduations above and below a neutral 0 position with the appropriate directions LW UP and LW DN. The instrument responds to electrical signals from a position transmitter adjacent to the trim tab actuator. The indicator circuit is powered from the right 28-volt main dc bus through the AILERON TRIM IND circuit breaker on PANEL 1.

ELEVATOR SYSTEM

91 The elevators are connected to each other and are operated by means of a control cable system and mechanical linkage from either control column, through a torsion spring mechanism in the right elevator in conjunction with a spring tab on the same elevator. A trim tab is installed on the left elevator.

ELEVATOR SPRING TAB

92 The spring tab on the right elevator trailing edge is deflected by the torsion spring mechanism in the elevator. It moves an amount proportional to the pilot effort required to overcome the air loads on the elevators. The greater the air loads on the elevators, the greater the effort required of the pilot to move them and therefore a greater spring tab deflection is achieved. This provides aerodynamic assistance to the elevators and offsets the effect of the air loads, thereby decreasing pilot effort.

ELEVATOR TRIM TAB

93 The elevator trim tab on the left elevator trailing edge is adjustable from the elevator trim wheel in the flight compartment and is also automatically adjusted by the wing flaps system interconnecting mechanism to compensate for changes in aircraft trim when the flaps are lowered or raised.

ELEVATOR TRIM WHEEL AND INDICATOR

94 The elevator trim wheel (Figure 1-2 sheet 1) is mounted on a pedestal to the right of the pilot's seat. The elevator trim position indicator is incorporated in the top of the pedestal, adjacent to the trim wheel. The indicator, which is mechanically operated, consists of a pointer ranging over a graduated scale, with a marked TAKE OFF RANGE, and directions NOSE DOWN and NOSE UP. The indicator is illuminated by internal lighting which is controlled from a switch on the aft side of the pedestal.

RUDDER SYSTEM

95 The rudder is constructed of two sections, the forward of which is hinged to the vertical stabilizer; the rear (or trailing) section is hinged to the forward section. The forward section is powered by a hydraulic actuator in response to rudder pedal movement from either pilot's position, through a control cable system. The trailing section is geared to the forward section by means of a push-pull rod connecting it to the rear fuselage, and which transmits a wider arc of movement to the trailing section, in the same direction. An electrically-operated feel and trim unit connected to the rudder operating lever provides artificial rudder feel, and bias for directional trim. A hydraulic damper is installed between the forward and trailing rudder sections.

RUDDER TRIM SWITCH

96 The rudder trim switch is located on the forward face of a bracket attached to the forward face of the elevator trim pedestal. It is a three-position switch; with left and right momentary-on positions. The switch is labeled (on the upper face of its mounting bracket) RUD TRIM, and is arrowed to "L" or "R" positions. The label lighting is controlled by the switch on the aft face of the elevator trim pedestal. Operation of the switch to "L" or "R" energizes the feel and trim unit actuator, which changes the effective length of the unit and which operates the hydraulic actuator to impose bias on the rudder in the required direction. The actuator electrical circuit is powered from the right 28-volt main dc bus and protected by a RUDDER TRIM ACT circuit breaker on PANEL 1.

RUDDER TRIM INDICATOR

97 The rudder trim indicator is located on the left side of the copilot's instrument panel (Figure 1-26). The indicator dial is marked RUDDER TRIM, and has a scale with graduations to L and R of a NOSE 0 position. The instrument responds to signals from a position transmitter on the rudder feel and trim unit. The indicator circuit is powered from the right 28-volt main dc bus through the RUDDER TRIM IND circuit breaker on PANEL 1.

FLIGHT CONTROLS LOCK LEVER

98 The flight CONTROLS LOCK lever on the overhead console (Figure 1-13) retains the aileron and elevator controls in their neutral positions. The rudder actuator prevents free movement of the rudder. The lever has a "LOCKED" aft position and an unmarked "unlocked" forward position and when the controls are in neutral and the lever moved to the "LOCKED" position the elevators and ailerons are mechanically locked. A press-button must be depressed before the flight CONTROLS LOCK lever can be moved. In the locked position the flight CONTROLS LOCK lever prevents the power levers from being advanced to take-off power settings.

WING FLAPS SYSTEM

99 The wing flaps are of the double-slotted type and consist of root, mid, and outboard fore flaps and root and mid trailing flaps, on each wing. The geometric arrangement provides for the trailing flaps to move over a proportionately greater range than the fore flaps. The fore flaps are hinged to attachment arms on the wing rear spars and the trailing flaps are attached by their own hinge arms to hinge arms on the fore flap. The ailerons are hinged to the outboard fore flaps. The wing flaps are operated by hydraulic pressure supplied by the utility hydraulic system. A pressure driven actuator in the cabin roof transmits rotary movement to three flap screw jacks in each wing (one per flap segment) through torque tubes. Flap actuator motor operation is electrically-controlled from the flap selector lever in the flight

compartment which, through a follow-up mechanism at the selector, provides for the flaps to be selected to any position. The motor also drives a cable drum which is connected by cable to the elevator trim actuator, to provide elevator trim proportionate to flap travel. A sensor unit with integral microswitches is incorporated in the system to detect asymmetric movement between left and right flaps and uncoordination between flap travel and elevator trim travel, and to immediately stop flap movement. Provision is made for manual operation of the flaps, if a malfunction occurs, by engaging the cargo door handcrank with a manual drive shaft on the flap actuator (Figure 1-15) and handcranking them to the desired position. Access to the actuator can be gained by opening the upholstery zippers in the cabin roof at ARM 382.00, left of the centerline, and lowering the plastic drip tray. Handcranking instructions are placarded on the actuator. The wing flaps electrical circuit is powered from the right 28-volt main dc bus, protected by a FLAP ACT circuit breaker on PANEL 1.

CAUTION

No attempt should be made to reposition the flaps manually if asymmetric movement of left and right flaps or uncoordination of flaps and elevator trim travel has caused the sensor to stop flap movement. A manual repositioning attempt under these circumstances could worsen, rather than improve the situation.

WING FLAPS SELECTOR LEVER

100 The wing flaps selector lever on the overhead console (Figure 1-13) is labeled FLAPS and moves in a slot with graduated markings in 5 and 10 degree increments, from 0 to 40. A spring-loaded button inset in the lever handle must be depressed to disengage the lever before it can be moved.

WING FLAPS DISENGAGE KNOB

101 A wing flaps disengage knob on the flap actuator (Figure 1-15) permits the disengage-

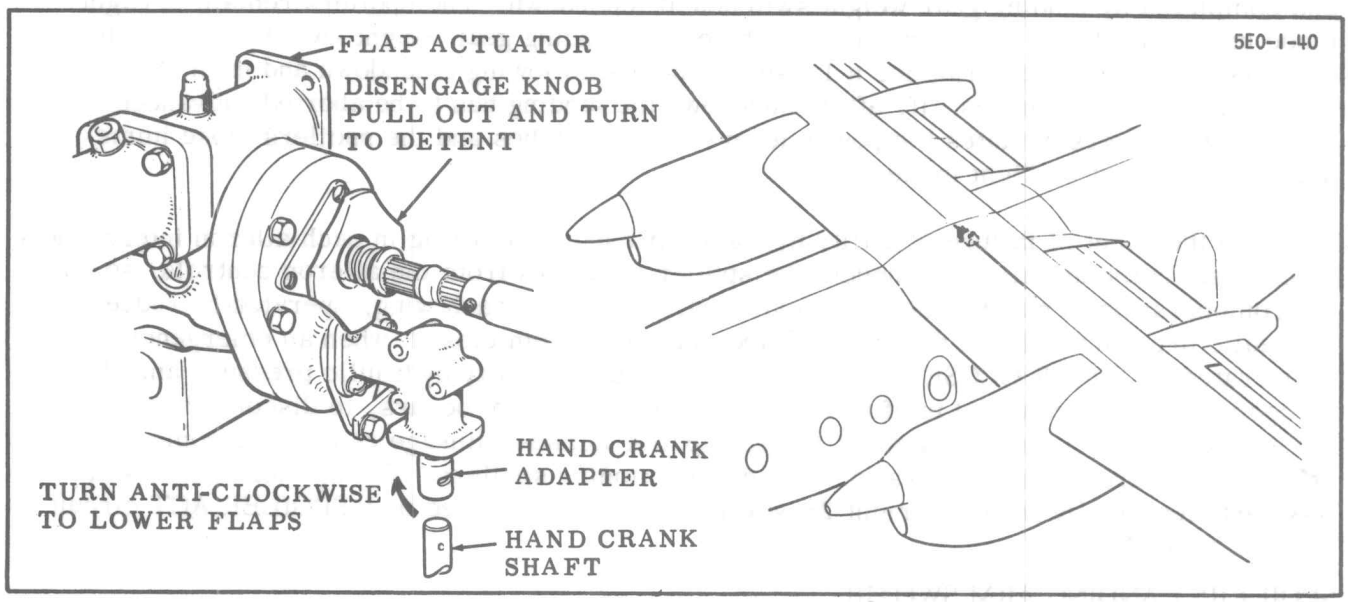


Figure 1-15 Wing Flap Manual Operation

ment of the actuator gears so that the wing flaps can be handcranked to any position. This provides for emergency operation of the flaps in the event of a malfunction in flight (subject to accessibility due to cargo). To manually operate the flaps, the disengage knob on the right side of the actuator must be pulled out and turned into its detent; the ramp door handcrank is then engaged with the actuator vertical drive shaft and wound in the appropriate direction to raise or lower the flaps. If difficulty is encountered in pulling out the disengage knob rotate the handcrank adapter slightly. Approximately 300 turns are required for full flap deflection. To resume normal power operation of the flaps, the disengage knob must be turned and released to its engaged position. To fully re-engage the knob, it may be necessary to rock the adjacent flap torque tube.

WING FLAPS POSITION INDICATORS

102 A wing flaps position indicator (Figure 1-25) is incorporated in the left side of both the pilot's and copilot's airspeed indicator. Each indicator is marked FLAP POSITION and has a scale graduated in 5 and 10 degree increments over a 40 degree range. The indicators are operated mechanically from the flap actuator.

WING SPOILERS SYSTEM

103 Twin spoilers at the trailing edge of each wing upper surface are controlled electrically and operated hydraulically by pressure supplied by the utility hydraulic system to an actuator in each wing. The spoilers are designed to function in flight mode and in landing mode. In flight mode they augment the ailerons in the lateral control of the aircraft, and in landing mode they provide aerodynamic braking and reduced wing lift upon touchdown. In the flight mode, the spoilers operate automatically in conjunction with the ailerons, to whose controls they are interconnected, except for the initial 5 degrees of control wheel movement. Spoilers on the same wing as the upward displaced aileron open proportionately with aileron movement, and the spoilers on the opposite wing remain closed.

104 In the landing mode, the spoilers are disconnected from the aileron controls, and open fully and symmetrically upon touchdown. This is attained through an electrical sequence commencing with the manual selection of an arming switch on landing approach, followed by the automatic operation of microswitches by the power levers when engine power is reduced, and completed by landing gear weight switches at touchdown. The spoilers remain in flight mode until touchdown. A timer, actuated by either landing gear weight switch, retains the spoilers in fully open position for a 15-second period following touchdown and each of any succeeding landing bounces. If, after touchdown the landing has to be aborted, advancement of the power levers actuates the power levers microswitches and the spoilers close immediately and revert to flight mode.

105 In the event of failure of utility hydraulic pressure, a spring in each aileron interconnect mechanism automatically disconnects the spoiler actuators from the aileron controls, so that aileron operation is not impeded. An additional actuator in each wing, operated by rudder hydraulic pressure, closes the spoilers and maintains them closed when an emergency switch is operated to "EMER CLOSE". This switch also dumps utility hydraulic pressure and should be operated if a mechanical malfunction to the spoiler system occurs, to disconnect it from the aileron controls. A spring strut in each spoiler actuator linkage can be overcome by pilot effort and ensures aileron operation with malfunctioning spoilers. The spoiler controls are powered electrically from the right 28-volt main dc bus protected by a SPOILER ACT circuit breaker on PANEL 1.

SPOILERS LANDING ARM SWITCH

106 The spoilers landing arm switch is located on the SPOILERS control panel to the right of

the emergency panel (Figure 1-6). It is a two-position toggle switch with positions "LANDING ARM" and "OFF"; "LANDING ARM" is selected on landing approach and its function is to arm the spoiler electrical circuit for the subsequent automatic operation of the spoilers at touchdown.

SPOILERS EMERGENCY CLOSE SWITCH

107 The spoilers emergency close switch is located on the SPOILERS control panel to the right of the emergency panel (Figure 1-6). It is a guarded switch with a marked "EMER CLOSE" position and an unmarked "normal" position. The switch should be operated to "EMER CLOSE" in the event of utility hydraulic pressure failure or spoiler mechanical malfunction during flight mode only. At all other times the switch must remain at its "normal" position.

SPOILER INDICATOR LIGHTS

108 Two press-to-test, amber indicator lights are included in the wing spoiler system. One indicator light, marked EXTD on the spoilers control panel (Figure 1-6), illuminates when "LANDING ARM" has been selected, the power levers retarded, and either of the landing gear weight switches is operated at touchdown. It indicates that the LANDING ARM signal has been received at the solenoid valve of the landing mode selector. The second indicator light marked SPOILER EXTD, is on the left emergency side panel, and illuminates when hydraulic pressure is sensed by a pressure switch in the line downstream of the landing mode selector, and indicates that the spoilers are extended. The intensity of both indicator lights is controlled by the caution light BRIGHT/DIM switch.

LANDING GEAR SYSTEM

GENERAL

109 The tricycle landing gear comprises retractable main gear units, and a steerable and retractable nose gear unit. Each main gear unit consists of dual wheels with multiple-disc type brakes, a pneudraulic shock strut, a drag strut and an actuator which retracts the gear into the engine nacelle. The main gear doors are operated by independent actuators and sequenced to open and close in conjunction with landing gear extension and retraction. The nose landing gear consists of two wheels in a side-by-side arrangement attached to a pneudraulic shock strut; a steering actuator is attached to the shock strut. The gear is retracted into a well in the aircraft nose by a hydraulic-operated drag strut. The nose gear doors are opened and closed in sequence with the gear by a separate actuator. Hydraulic sequencing provides for the doors to close when the nose gear is both retracted and extended. All three landing gear units and their doors are mechanically locked in both the extended and retracted positions, except the nose gear door which is locked only when retracted.

LANDING GEAR HYDRAULIC CIRCUIT

110 Extension and retraction of the landing gear is effected by hydraulic pressure directed to actuators at each main gear unit and main and nose gear doors, to the nose gear drag strut and to all uplocks and downlocks, through an electrically-operated landing gear selector valve. Sequence valves in the circuit provide for each operating component to function in logical order. The landing gear selector valve is electrically connected to weight switches on each main gear shock strut, which prevent retraction of the landing gear when any of the shock struts is compressed. At the completion of retraction or extension and with all units mechanically locked, the landing gear selector solenoid is deenergized and hydraulic pressure in the circuit is released. The landing gear actuation electrical circuit is powered from the left 28-volt main dc bus protected by the LDG GEAR ACT circuit breaker on PANEL 6.

LANDING GEAR SELECTOR LEVER

111 The landing gear selector lever on the overhead console (Figure 1-13) is labeled L. G. with positions "UP" and "DOWN". The lever is electrically connected to the landing gear selector valve through a two-position switch; it has a wheel-shaped handle and a trigger which must be depressed before the lever can be moved. A red light in the handle illuminates if either or both power levers are retarded to "IDLE" with the landing gear retracted; it also illuminates during retraction or extension, and remains so until the gear is positively locked in its up or down position. The light is included in the landing gear warning circuit which is powered from the right 28-volt main dc bus, protected by the LANDING GEAR WARN circuit breaker on PANEL 1.

LANDING GEAR INDICATOR LIGHTS

112 Landing gear indicator lights are mounted on the LANDING GEAR panel (Figure 1-16) below the main instrument panels. Three green press-to-test indicator lights under the inscription LOCKED DOWN, are individually marked LEFT, NOSE, and RIGHT. Each illuminates when its landing gear unit is locked down. An additional nose gear downlock check is provided in the form of a duplicate green press-to-test light and switch labeled NOSE DOWNLOCK with positions "OFF" and "CHECK". The switch has a momentary-on position, and when selected to "CHECK", the light should illuminate to confirm that the nose gear is locked down. A red press-to-test indicator light marked WARN & UNLOCKED operates parallel to the landing gear selector lever light, and provides warning indications for the conditions given for the selector lever light. The green indicator lights are powered from the left 28-volt main dc bus protected by the LDG GEAR IND circuit breaker on PANEL 6. The nose gear downlock check circuit is connected to the right 28-volt main dc bus protected by the LANDING GEAR CHECK circuit breaker on PANEL 1. The WARN & UNLOCKED light is connected to the landing gear warning circuit which is powered from the right 28-volt main dc bus, protected by the LANDING GEAR WARN circuit breaker on PANEL 1.

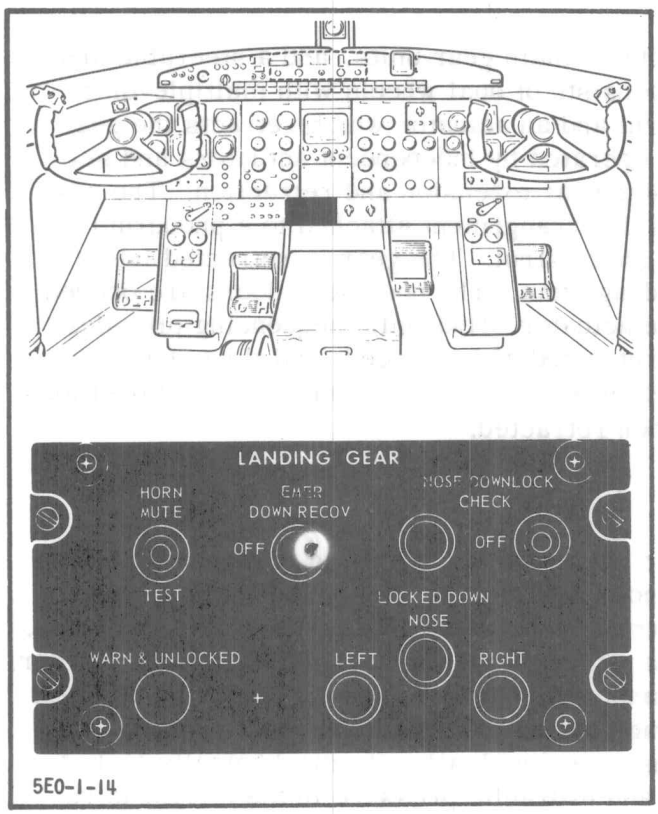


Figure 1-16 Landing Gear Panel

LANDING GEAR INDEX MARKS

113 White/red index marks are located on the inboard side of each main gear downlock mechanism. These marks are visible from the cabin and should be checked for alignment before landing if any doubt exists that the main gear is fully down and locked.

LANDING GEAR WARNING HORN

114 A warning horn in the flight compartment provides audible warning (concurrent with the landing gear selector lever warning light) that the landing gear is not down and locked when either power lever is retarded to "IDLE". A switch marked HORN on the LANDING GEAR panel (Figure 1-16), has two momentary-on positions marked "MUTE" and "TEST". The "MUTE" position may be selected to silence the horn when a warning

is signalled; the horn circuit is deenergized until the landing gear is locked down or the power levers advanced, whereupon the horn circuit is automatically reenergized for any subsequent warning. The "TEST" position is for use in checking horn operation and the simultaneous illumination of the landing gear selector lever warning light. The horn electrical circuit is connected to the landing gear warning circuit which is powered from the right 28-volt main dc bus, protected by the LANDING GEAR WARN circuit breaker on PANEL 1. The circuit breaker must not be pulled to shut off the horn as this will render the entire landing gear warning system inoperative until the circuit breaker is reset.

HYDRAULIC EMERGENCY PANEL

115 The hydraulic emergency panel (Figure 1-17) is recessed in the flight compartment floor between the pilot's and copilot's seats, and covered by a hinged access door. A landing gear emergency selector handle and a nose gear emergency extension handle are mounted on the panel. The instructions for landing gear emergency operation are inscribed on the panel.

LANDING GEAR EMERGENCY SELECTOR

116 The landing gear emergency selector on the hydraulic emergency panel (Figure 1-17) is marked EMERGENCY SELECTOR and is operated in conjunction with the main landing gear emergency release handles. When the emergency selector handle is turned in the direction of the arrow, three dump valves in the hydraulic circuit are actuated to allow fluid from the "up" side of all landing gear actuators and uplocks to bypass the landing gear selector valve and enter the common return line to the reservoir. For any emergency operation of the main or nose landing gear the L. G. lever must be selected "DOWN".

MAIN LANDING GEAR EMERGENCY RELEASE HANDLE

117 The main landing gear release handle (Figure 1-2 sheet 2) is mounted on the left radio rack behind the pilot's seat. The handle, when pulled, releases both main gear uplocks and both main gear door uplocks, and, provided the emergency selector handle has been operated, the main landing gear pushes open the doors and extends under its own weight to the locked down position, assisted by the airflow.

NOSE GEAR EMERGENCY EXTENSION SYSTEM

118 The nose landing gear may be extended in an emergency by means of the emergency hydraulic system, using the handpump to supply pressure, or by means of a compressed nitrogen charge from an emergency bottle. Since the compressed nitrogen system can only be used once in flight, the emergency hydraulic system should be tried first. If the gear will not extend by this method then the compressed nitrogen should be used by operating the nose gear emergency extension handle.

NOSE GEAR EMERGENCY EXTENSION HANDLE

119 The nose landing gear emergency extension handle on the hydraulic emergency panel (Figure 1-17) has labeled instructions on the panel for its operation. The landing gear emergency selector handle overlaps the nose gear emergency extension handle to ensure the correct order of operation. After selection of the emergency landing gear selector to "DOWN", the nose gear emergency extension handle must be turned in the direction of the arrow to release the nose gear door uplock, and then pulled to release the compressed nitrogen charge from the emergency bottle. The gear then pushes open the door and extends. The handle must be held out until the nose gear locks down.

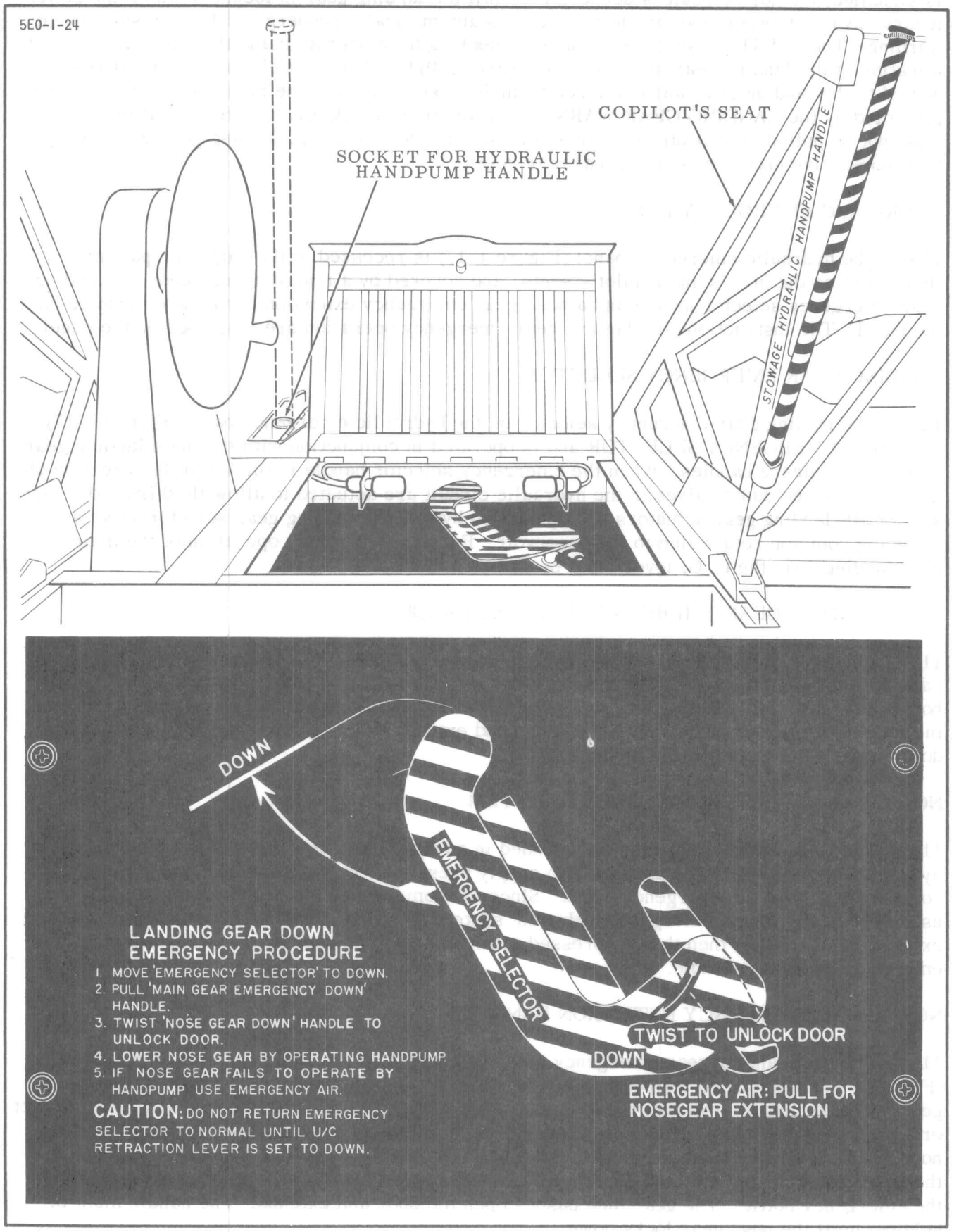


Figure 1-17 Hydraulic Emergency Panel

EMERGENCY HANDPUMP LEVER

120 The emergency handpump lever (Figure 1-17) is stowed in clips on the back of the co-pilot's seat. To operate the handpump, the lever must be inserted in the handpump socket and operated with a fore-and-aft motion. The handpump socket is accessible through the panel marked HYDRAULIC HANDPUMP on the floor to the right of the pilot's seat.

EMERGENCY DOWN RECOVERY SWITCH

121 A two-position, momentary-on switch marked EMER DOWN RECOV on the LANDING GEAR panel (Figure 1-16) is provided for training and test purposes only. It is used to return the landing gear hydraulic circuit to normal operation after an emergency extension (without the use of compressed nitrogen) of the landing gear. As the landing gear doors are not fully opened by the operation, the landing gear cannot be retracted until the full down cycle has been completed. To complete the down cycle, the L. G. selector lever must be set to "DOWN" and the EMER DOWN RECOV switch operated to energize the DOWN solenoid of the landing gear selector valve. The landing gear can subsequently be retracted by a normal "UP" selection.

NOSEWHEEL STEERING SYSTEM

GENERAL

122 The nosewheel is steered by a hydraulically-operated actuator on the nose gear leg, which is controlled through a selector valve integral with the actuator. A cable system connects a hand-operated steering wheel on the left side of the flight compartment (Figure 1-2 sheet 1) to the selector, which directs hydraulic pressure to the up or down side of the actuator appropriately. The actuator extends or retracts accordingly and, through its linkage by torque arms to the wheel axles, swivels the nosewheels to left or right. A nominal steering range of 50 degrees to left and right is attainable. Hydraulic pressure to the steering system is controlled by an electrically-operated shutoff valve, operation of which is by means of a nosewheel steering switch in the flight compartment and a weight switch on the nose gear leg. The weight switch operates to automatically close the shutoff valve when the leg is fully extended. On the ground, with the nose leg compressed and the nosewheel steering switch "ON" the nosewheels are fully steerable from the steering wheel. The steering system is irreversible in operation in that the nosewheels remain in the position set by the steering wheel, and will not self-center. In flight, with the nose gear strut extended and the steering system inoperative, self-centering cams within the shock strut center and retain the nosewheels at the centered position.

NOSEWHEEL STEERING SWITCH

123 The nosewheel steering switch is located on the LANDING & TAXI panel on the overhead console (Figure 1-18). It is a two-position switch marked NOSEWHEEL STEER with "OFF" and "ON" positions. The nosewheel steering electrical circuit is powered from the left 28-volt main dc bus, protected by the LDG GEAR ACT circuit breaker on Panel 6.

CAUTION

With the nosewheel steering selected OFF or inoperative for any reason, restraining the nose steering wheel during ground manouvering will result in loss of fluid from the shimmy damper and loss of nosewheel damping.

NOTE

The situation under which nosewheel steering will be inoperative are:

(a) Steering selected OFF.

(b) Electrical Failure of the nose weight switch.

(c) Hydraulic Failure of the utility system.

(d) When the undercarriage actuation C/B is pulled.

WHEEL BRAKES SYSTEM

GENERAL

124 The wheel brakes system comprises a multiple-disc type brake unit on each main landing gear axle operated hydraulically from the utility hydraulic system by pressure applied to the pilot's or copilot's brake pedals. Hydraulic pressure is supplied to each brake unit through a brake control valve which regulates the supply proportionate to brake pedal depression. A parking brake handle is connected to the brake control valves and when applied retains the pressure in the brake units after the brake pedals have been depressed. An emergency braking system for use in the event of a hydraulic failure, consists of a compressed nitrogen bottle, the contents of which are released through a control valve to the brake units when the EMERGENCY BRAKE lever is operated.

PARKING BRAKE HANDLE

125 The parking brake handle, labeled PARKING BRAKE, is mounted on the pilot's pedestal (Figure 1-9). To apply the parking brake, the brake pedals must be depressed and then the handle pulled fully out and turned 90° clockwise. To release, the pedals must first be depressed and then the handle turned counterclockwise and pushed fully in.

EMERGENCY BRAKE LEVER

126 The yellow and black striped EMERGENCY BRAKE lever is mounted on the windshield center post (Figure 1-6). To apply the brakes in the event of loss of brake pressure, the lever should be pulled out as necessary to obtain progressive braking of the wheels.

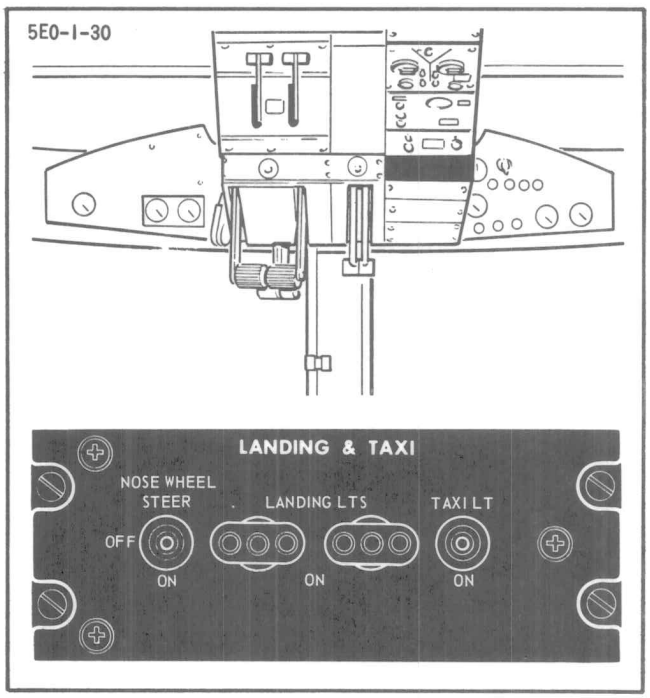


Figure 1-18 Landing & Taxi Panel

CAUTION

The lever must not be pumped or the nitrogen supply will be depleted rapidly.

ENVIRONMENTAL CONTROL SYSTEM

GENERAL

127 The environmental control system (ECS) (Figure 1-19) provides heating, cooling, and ventilation for the flight compartment and cabin either automatically or by manual control, with bleed air from the engines and/or ram air from an intake in the fuselage nose. Alternatively, air may be supplied on the ground by the aircraft auxiliary power unit or by a ground compressor when the engines are not running. Air is obtained at the desired temperature by mixing hot bleed air with cooled air from a refrigeration unit or with ram air, and is

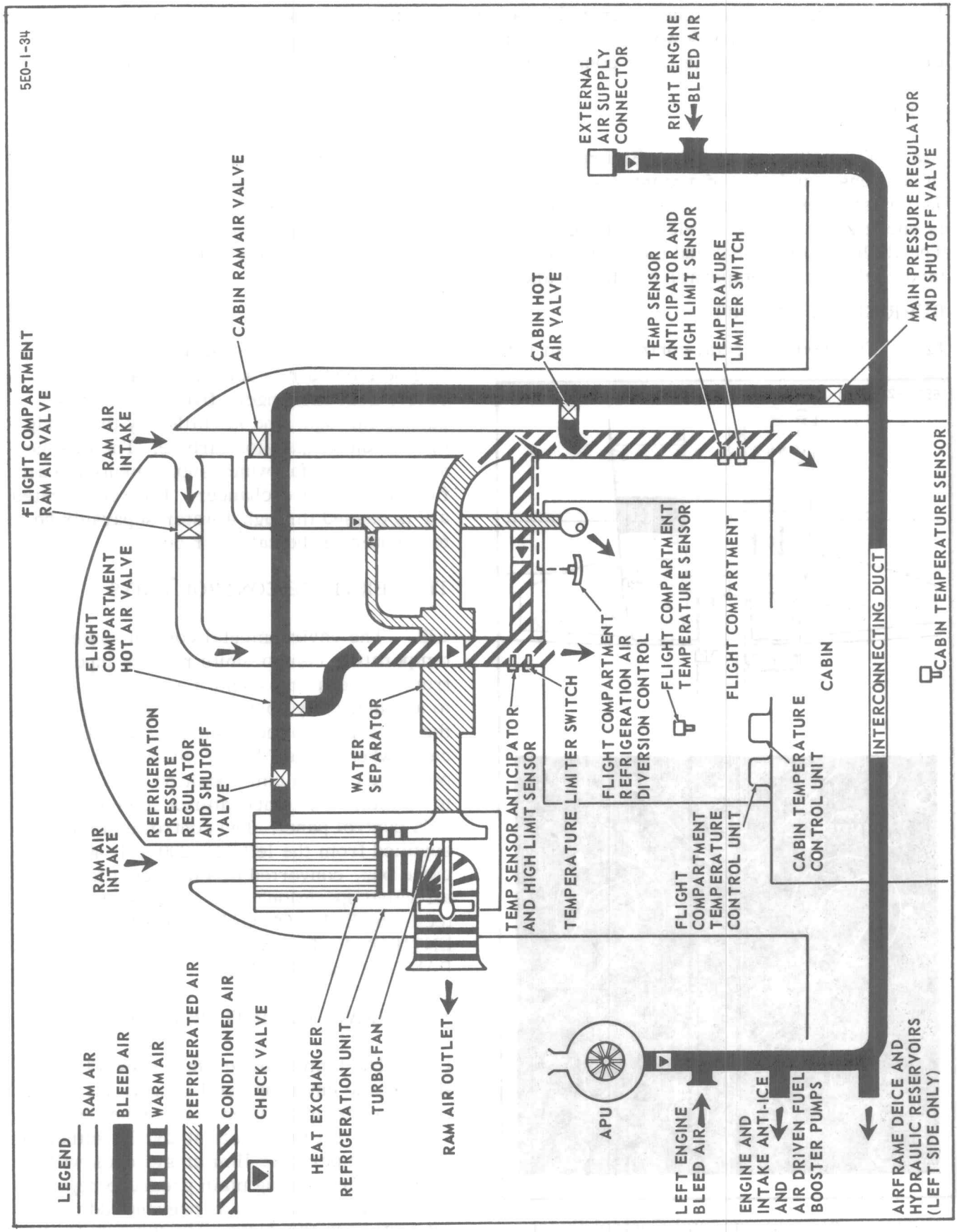


Figure 1-19 Environmental Control System - Schematic

accomplished with electrically-operated airflow control valves and automatic temperature control units or manually-positioned valves. Safety features include air duct temperature limiter switches and switches operated by a reverse pitch selection on the power levers, actuation of which shuts down the ECS and prevents excessive temperature in the ducts, or exhaust gases entering the flight compartment and cabin.

ECS CONTROL PANEL

128 The ECS control panel (Figure 1-20) is marked ENVIRONMENTAL CONTROL and is in sections consisting of a master switch, and flight compartment and cabin control sections. The master switch has two positions, marked "ON" and "OFF"; at "ON" the main system valve is energized open and a relay is energized to power the flight compartment and cabin controls. The flight compartment and the cabin control panel sections are similar in that each has a mode selector, a temperature selector and manual control switches.

REFRIGERATION UNIT

129 The environmental control system refrigeration unit is located in the aircraft nose. Engine bleed air is admitted to a ram air cooled heat exchanger, from where it is passed through, and is chilled by the refrigeration unit expansion turbine. The turbine also powers a fan which supplements the air flow in the heat exchanger. The refrigerated air is passed through a water separator before entering the cabin air duct.

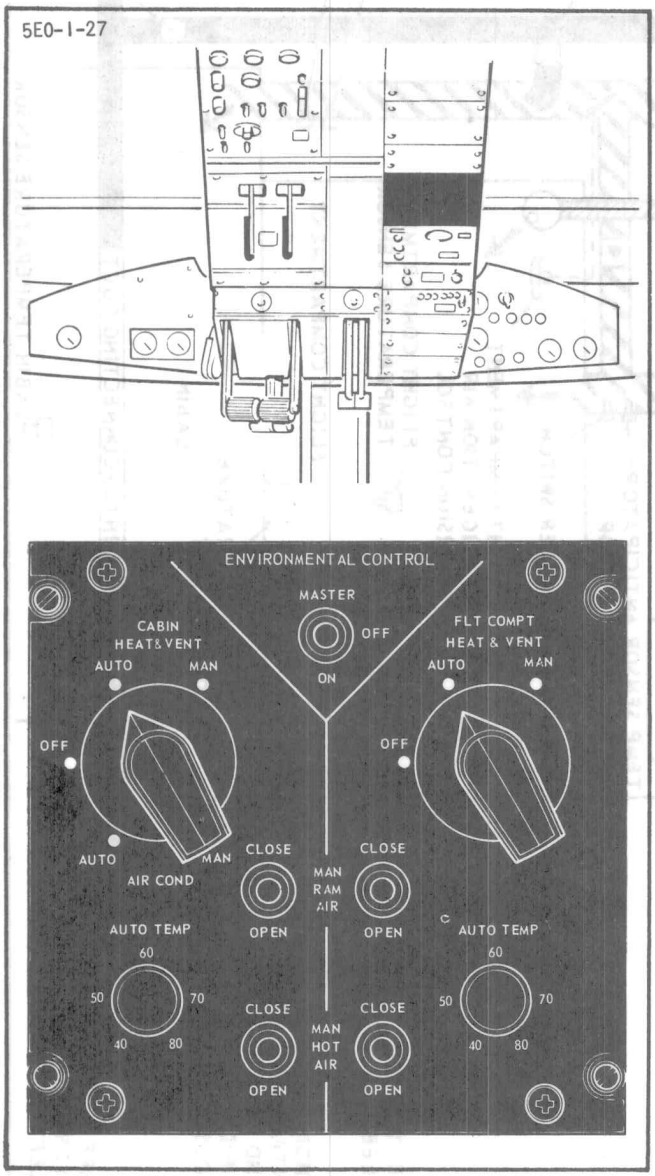


Figure 1-20 Environmental Control Panel

TEMPERATURE CONTROL UNITS

130 The environmental control system temperature control units receive inputs from temperature sensors and anticipators to automatically control the temperature of the air supply to the flight compartment and cabin when in the "AUTO" mode. The temperature control units position the air valves to maintain the temperatures selected on the ECS control panel. The control units are supplied from the left 115/200-volt 400-cycle bus, converted to a dc signal for the air valve operation. The circuits are protected by ENVIRON CABIN CONT and ENVIRON FLT COMP circuit breakers on PANEL 2 and PANEL 7.

TEMPERATURE LIMITER SWITCHES

131 The temperature limiter switches shut off the environmental control system if excessive temperatures are reached in the air ducts. Set to operate at 250°F, either of the two temperature limiter switches will close the fast-acting main pressure regulator and shut off valve and prevent additional hot airflow in the ducts. The master caution

control actuates the flasher, the caution lights marked FLT COMP DUCT OVERHEAT and CABIN DUCT OVERHEAT illuminate and stay on. The environmental control system master switch must be set to "OFF", to reset the circuit. When the excessive temperature condition no longer exists, the warning lights will be extinguished, and the master switch may be returned to "ON". Electrical control of the ECS is from the left 28-volt main dc bus and the circuits are protected by ENVIRONMENT CONT FLT COMP DC, ENVIRONMENT CONT CABIN DC and ENVIRONMENT CONT MASTER circuit breakers on PANEL 6.

FLIGHT COMPARTMENT HEATING AND VENTILATING

132 Heating and ventilating of the flight compartment, with the engines or APU running, is carried out with the bleed air system appropriately selected and the environmental control system master switch at "ON".

(a) For automatic regulation of flight compartment temperature, turn AUTO TEMP control to desired temperature, and mode selector control to HEAT & VENT "AUTO". With this control selection the flight compartment temperature control unit is energized. The flight compartment ram air valve is fully opened and the flight compartment hot air valve is controlled by the sensors and flight compartment temperature control unit in accordance with the temperature selected by the AUTO TEMP control. Should there be insufficient heat after the hot air valve is fully open, the signal is transferred to the opposite side of the ram air valve to progressively close the ram air valve and increase the temperature. The MAN HOT AIR and MAN RAM AIR switches are inoperative with this selection.

(b) For manual HEAT & VENT control of flight compartment temperature, turn mode selector control to "MAN", then control the temperature and rate of airflow into the flight compartment with the MAN HOT AIR and MAN RAM AIR switches. In this mode the temperature control unit is inoperative.

NOTE

The MAN HOT AIR and MAN RAM AIR switches are spring returned to the center position; each must be held to motor its valve the required amount. Full travel of either valve takes 7 to 13 seconds.

(c) In flight, ram air is available through adjustable air outlets in the flight compartment.

(d) To shut down the system turn the flight compartment mode selector control to "OFF". In this position the hot air valve and the ram air valve are closed and the temperature control unit is inoperative.

FLIGHT COMPARTMENT AIR CONDITIONING

133 Air conditioning of the flight compartment with the engines or APU running is obtained with the bleed air system appropriately selected and the environmental control system master switch at "ON". Before any refrigerated air can be made available to the flight compartment the cabin mode selector control must be selected to AIR COND "AUTO" or "MAN".

(a) With the cabin mode selector at AIR COND "AUTO" or "MAN", refrigerated air is available, both on the ground and in the air, through adjustable air outlets in the flight compartment.

(b) Additional refrigerated air can be diverted from the cabin to the flight compartment by pulling up on a manual control knob, located at floor level, outboard of the copilot's seat. This control knob diverts refrigerated air into the flight compartment, which would otherwise go to the cabin.

CABIN HEATING AND VENTILATING

134 Heating and ventilating of the cabin with the engines or APU running is obtained with the bleed air system appropriately selected and the environmental control system master switch at "ON".

(a) For automatic regulation of cabin temperature, turn AUTO TEMP control to desired temperature, and mode selector control to HEAT & VENT "AUTO". With this control selection the cabin temperature is automatically controlled in a similar manner to that described in flight compartment heating and ventilating.

(b) For manual control of cabin temperature, turn mode selector control to HEAT & VENT "MAN", then control the temperature and rate of airflow into the cabin with the MAN HOT AIR and MAN RAM AIR switches. In this mode the temperature control unit is inoperative.

(c) To shut down the system turn the cabin mode selector control to "OFF". In this position the hot air valve and the ram air valve are closed and the temperature control unit is inoperative.

CABIN AIR CONDITIONING

135 Air conditioning of the cabin with the engines or APU running is obtained with the bleed air system appropriately selected and the environmental control system master switch at "ON".

(a) For automatic regulation of cabin temperature using refrigerated air, turn AUTO TEMP control to desired temperature and mode selector control to AIR COND "AUTO". This opens the refrigeration pressure regulator and shut off valve and energizes the cabin temperature control unit. The cabin hot air valve is controlled by the sensors and cabin temperature control unit in accordance with the temperature selected by the AUTO TEMP control. The cabin ram air valve is closed and the MAN HOT AIR and MAN RAM AIR switches are inoperative with this selection.

(b) For manual control of cabin temperature using refrigerated air, turn mode selector control to AIR COND "MAN", then control the temperature of the airflow into the cabin with the MAN HOT AIR switch. In this mode the MAN RAM AIR switch and the temperature controller are inoperative, and the hot air modulating valve is manually controlled by the MAN HOT AIR switch.

ANTI–ICING AND DEICING SYSTEMS

GENERAL

136 Anti-icing and deicing of the aircraft is accomplished by the use of hot bleed air for the engines and intakes, and bleed air pressure for the wings and horizontal stabilizer leading edge boots. Electrically-heated elements are used for propeller, windshield, pitot head, and stall warning lift transducer anti-icing. A caution light on the caution lights panel marked ICING illuminates when icing conditions are detected by an ice detector. Anti-icing and deicing is controlled from the ICE CONTROL panel (Figure 1-21) below the pilot's instrument panel.

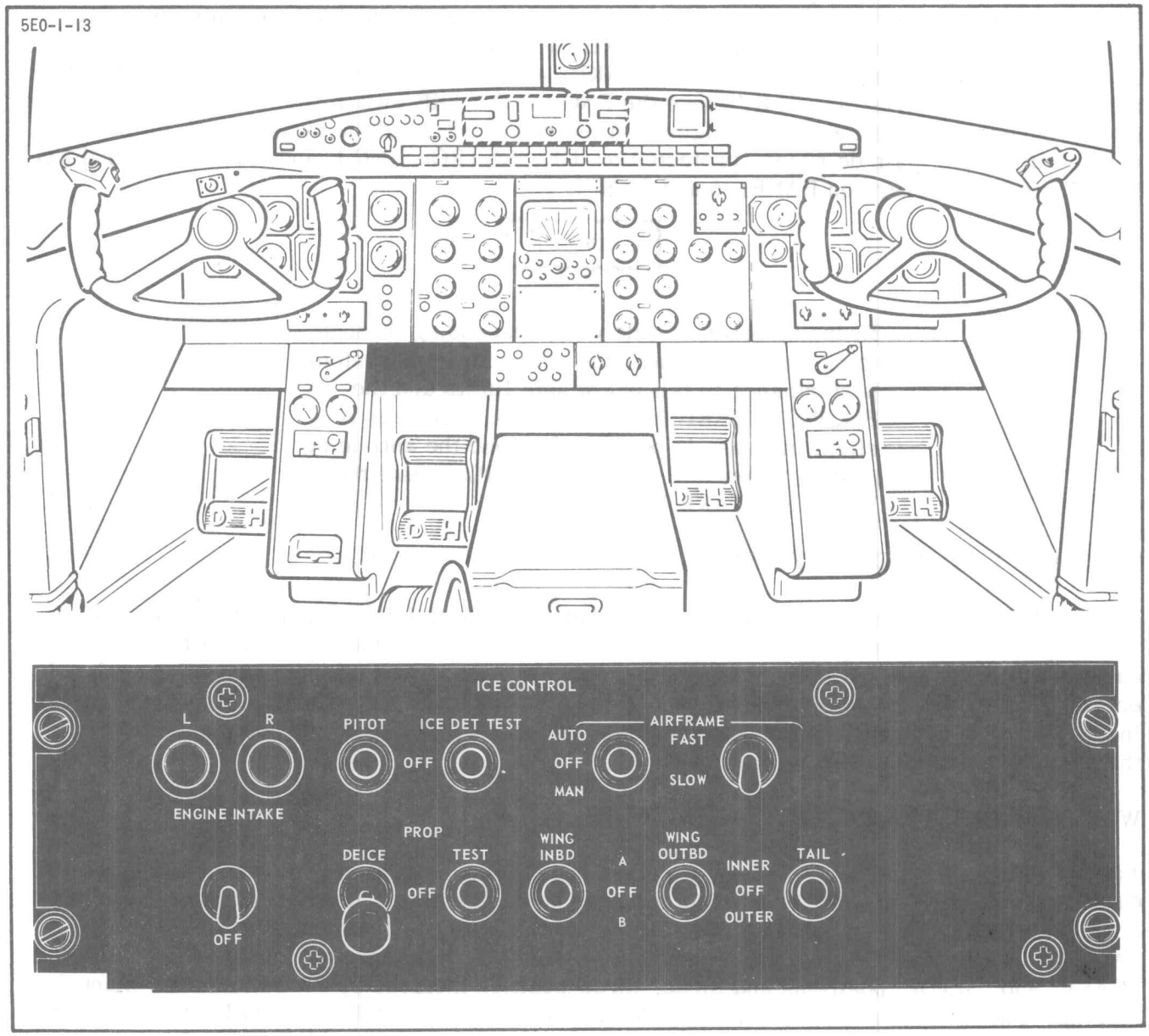


Figure 1-21 Ice Control Panel

ICE DETECTOR

137 The ice detector, located in the flight compartment on the right side, has two probes protruding through the fuselage into the airstream. One probe detects the air temperature and the other the moisture content of the air. If atmospheric icing conditions are present, a signal is supplied to the master caution system by a relay inside the detector unit, which illuminates the MASTER CAUTION light and ICING light on the caution lights panel. A test switch, marked ICE DET TEST, on the ice control panel is used to test the ice detector circuit by illuminating the caution light when the switch is momentarily selected to "ICE DET TEST". The circuit is powered from the left 115/200-volt variable frequency bus and the left 28-volt main dc bus, protected by ICE DET AC and ICE CONTROL ICE DET DC circuit breakers on PANEL 7 and PANEL 6.

ENGINE AND INTAKE ANTI-ICING

138 The engine bleed ports are manifolded together and are connected directly to the engine

intake duct, duct leading edge, and compressor front frame, to prevent the formation of ice. Bleed air flow is controlled by four valves (two in each engine) which are operated by a two-position toggle switch marked ENGINE INTAKE on the ICE CONTROL panel. The switch has up and down positions marked "ENGINE INTAKE" and "OFF". Press-to-test ENGINE INTAKE indicator lights, marked L and R, above the ENGINE INTAKE switch illuminate when anti-icing is in progress to the left and right engines. Electrical control of the system is from the 28-volt left and right main dc buses, protected by ICE CONTROL ENG L and ICE CONTROL ENG RIGHT circuit breakers on PANEL 6 and PANEL 1.

CAUTION

Reducing power to idle when descending through icing conditions may cause the anti-icing system performance to fall below safe limits and the ENGINE INTAKE indicator lights to go out. A slight increase in power will cause the anti-icing system to resume operation and illuminate the ENGINE INTAKE lights.

WING AND TAIL DEICING SYSTEM

139 Inflatable rubber boots on the wing and horizontal stabilizer leading edges are used to break up ice formations (Figure 1-22). Bleed air pressure is supplied to the boots automatically in a slow or fast cycle by means of a timer, or manually by a momentary-on switch selection. The pulsations of the boots break up the forming ice layer, which falls away. Venturi induced suction is applied to the boots between pulsations and to hold the boots deflated when the system is not operating.

WING AND TAIL DEICING SYSTEM SWITCHES

140 Switches for the control of the wing and tail deicing system are located on the ICE CONTROL panel (Figure 1-21) which is mounted below the pilot's instrument panel. The panel contains a three-position deicer mode selector switch with positions marked AIRFRAME "AUTO", "OFF" and "MAN", a two-position AIRFRAME cycle speed selector switch with "FAST" and "SLOW" positions and three, three-position momentary-on switches for manual deicing. The latter switches are labeled WING INBD, WING OUTBD, and TAIL; the wing inbd and wing outbd switch selections are "A", "OFF" and "B", and the tail switch selections are "INNER", "OFF" and "OUTER". A deicing pressure gage on the copilot's pedestal indicates the pressure available to the deicing system.

WING AND TAIL DEICING SYSTEM OPERATION

141 In severe icing conditions when "AUTO" and "FAST" are selected (Figure 1-21), each section of boots is pressurized for 5 seconds of every one-half minute, in a cycle which follows the order; inboard wing (A section), inboard wing (B section), outboard wing (A section), outboard wing (B section), tail inner, and tail outer. Each cycle takes 60 seconds (30 seconds for the cycle plus 30 seconds dwell time). The cycle is repeated for as long as the selection is made.

142 In light to moderate icing conditions with "AUTO" and "SLOW" selected, each boot or boot section is pressurized for 5 seconds in each cycle, but the interval between cycles is 210 seconds, so that each boot or boot section is pressurized for 5 seconds in every 4 minutes. If icing conditions make the manual operation of the system necessary, or in the event of failure

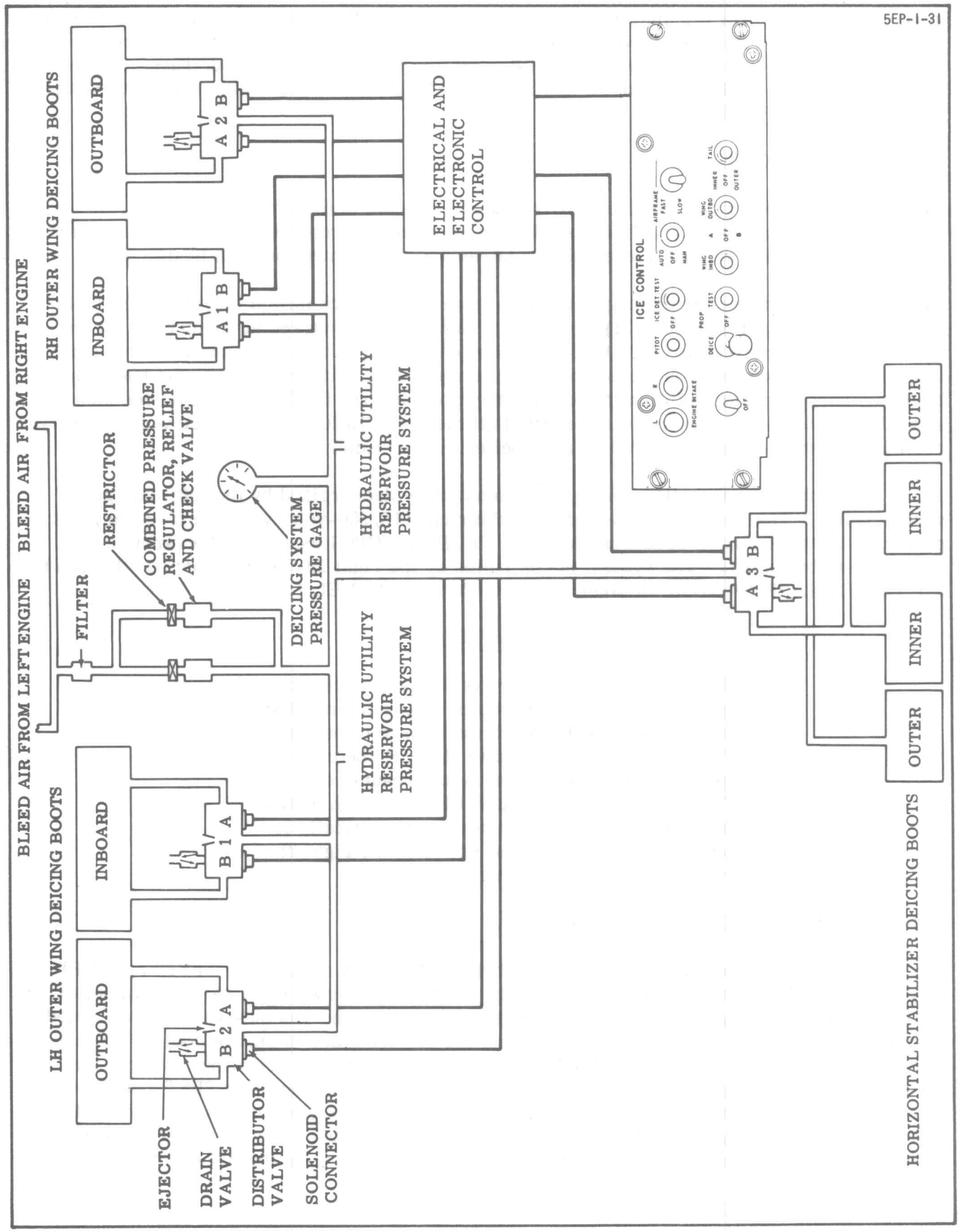


Figure 1-22 Deicing System - Schematic

of the timer, "MAN" is selected on the mode selector. Each boot or boot section is then pressurized by operation of the manual switches, WING INBD, WING OUTBD, and TAIL. Air pressure is applied to a selected INNER A and B or OUTER A and B for the time its switch is held on. Wing and tail deicing is powered from the left and right 28-volt main dc buses, protected by ICE CONTROL WING TAIL AUTO and ICE CONTROL MAN WING TAIL, circuit breakers on PANEL 1 and PANEL 6.

PROPELLER DEICING

143 Propeller deicing is by electrically-heated elements in the propeller spinner, and on the propeller blade plateaus and blades. Power is supplied through slip rings to four elements on the spinner, one element on each blade plateau and one element on each blade.

144 Control of propeller deicing in flight is from a lever lock switch labeled PROP on the ICE CONTROL panel (Figure 1-21); this switch has "DEICE" marked at its up position and "OFF" at its down position. At "DEICE" the switch energizes three spinner elements continuously on each of the propellers; power to the remaining spinner element, the blades and blade plateaus is cycled between the left and right propellers for 30 seconds on one then 30 seconds on the other. This cycle is repeated all the time "DEICE" is selected while the aircraft is airborne and is controlled by a propeller deicing timer.

145 At touchdown, propeller deicing is automatically deenergized by the left main gear weight switch. The system is powered from the right 115/200-volt, variable frequency bus, protected by three circuit breakers identified PROP DE-ICING located in the variable frequency distribution box. The system is controlled by the right 28-volt main dc bus through the ICE CONTROL PROP circuit breaker on circuit breaker PANEL 1.

NOTE

If the propeller deicing system is in operation and power to the right 28-volt dc bus is interrupted, the PROP DEICE switch would have to be set to "OFF", then reselected to "DEICE" beore the propeller deicing system would resume operation. This is because the PROP DEICE switch is electrically locked on and returns automatically to off every time electrical power to the right 28-volt dc bus is interrupted.

PROPELLER DEICING TEST SWITCH

146 The propeller deicing test switch is labeled PROP with selections "TEST" and "OFF" (Figure 1-21). This switch, located next to the PROP DEICE switch, allows the system to be tested on the ground by overriding the main gear weight switch. Engines should be operated during the ground test to prevent overheating of the elements due to lack of cooling airflow. With the PROP DEICE switch at "DEICE", the system is tested by selecting, in turn, the RIGHT AC meter rotary switch to "A", "B" and "C" phases, and with the TEST switch selected to "TEST" and "OFF" for each phase. C-phase should be checked a second time after an interval of 30 seconds in order to register the changeover from one propeller to the other. During the test an ac load of approximately 39-amp will register on the AC AMPS meter.

PITOT HEAD ANTI-ICING

147 The PITOT switch on the ICE CONTROL (Figure 1-21) panel labeled "PITOT" in the

up position and "OFF" in the center position controls the heating elements in the two pitot tubes, one on each side of the fuselage below the side windows. The switch also controls heating elements in the stall warning lift transducer vane and in the vane mounting plate in the leading edge of the left outer wing. The left pitot and stall warning transducer heaters are powered from the left 115/200-volt variable frequency bus, while the right pitot is powered from the right 115/200-volt variable frequency bus. Circuit protection is by two PITOT HEAT L and R circuit breakers on PANEL 7 and PANEL 2.

WINDSHIELD HEATING

148 To prevent windshield icing and misting and to maintain resistance to shattering from the impact of birds, the windshields are heated to a temperature of 100 ± 5°F. A small thermostat, embedded in each windshield, senses the windshield temperature, and controls the automatic energizing and deenergizing of the heating elements, to keep the windshield at a fairly constant temperature.

WINDSHIELD HEAT SWITCH

149 A rotary switch labeled HEAT on the WINDSHIELD panel (Figure 1-23) controls the windshield heating from positions marked "OFF", "WARM UP", and "NORM". The switch should be set to "NORM" at least three minutes before take-off to enable the windshields to reach operating temperature. Under such cold conditions that sudden heat might cause windshield damage, the "WARM UP" position should be selected to permit a gradual warm up of the windshields, after which "NORM" position may be selected. The pilot's and copilot's windshield heaters are powered from left and right 115/200-volt variable frequency buses protected by W/S HEAT LEFT and W/S HEAT RIGHT circuit breakers in the variable frequency distribution box. The windshield heaters are controlled from the left and right 28-volt main dc buses protected by ICE CONTROL PLT W/S CONT and ICE CONTROL W/S CONT COPLT on PANEL 6 and PANEL 1.

BLEED AIR SYSTEM

GENERAL

150 Bleed air, tapped from the engine compressors or supplied by the APU, is used for engine starting, driving the air driven fuel pumps, the environmental control system, wing and tail deicing and engine and intake anti-icing systems, and for pressurizing the utility and rudder hydraulic reservoirs (Figure 1-19). The engine bleed ports are manifolded together and are connected directly to the fuel boost pump and intake anti-ice supply lines. They are also connected, through a pressure regulator and shutoff valve, and a check valve to a flexible duct linking the engine ducting to the airframe ducting. A branch of the engine ducting leads through another pressure regulator and shutoff valve to the air turbine starter.

151 The airframe ducting links the flexible ducts from the left and right engine through the wing center section, and extends on to the APU bleed port (in the left nacelle) and to an external air connection (in the right nacelle). The portion interconnecting the nacelles through the wing center section, supplies the ECS and the wing and tail deicing system; the utility and rudder hydraulic reservoirs are pressurized from the deicing system line. Bleed air is temperature controlled and temperature limiter switches are provided to protect the bleed air system if overheating occurs. The bleed air is controlled from the APU and BLEED AIR panel (Figure 1-24) located to the left of the overhead console. Owing to its limited supply, APU bleed air cannot be used for simultaneous engine starting and environmental control operation. The bleed air pressure indicator is located on the APU and BLEED AIR panel and measures bleed air pressure in psi. The indicator is graduated from 0 to 200 PSI in increments of 10.

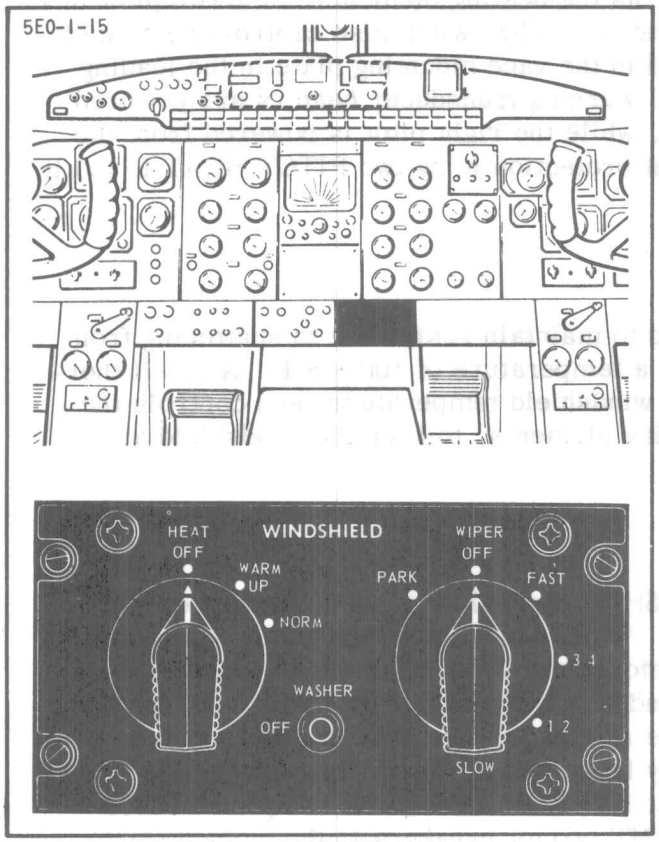


Figure 1-23 Windshield Panel

The bleed air indicator is powered from the left 26-volt 400 cycle bus protected by a BLEED PRESS circuit breaker on PANEL 7. The bleed air valves are powered from the left and right 28-volt main dc buses, protected by BLEED AIR L and BLEED AIR R circuit breakers on PANEL 6 and PANEL 1.

BLEED AIR SWITCHES

152 Two bleed air switches are located on the APU and BLEED AIR panel (Figure 1-24); they are identified L ENG and R ENG with common markings of "OFF" and "ON". The switches provide for selection of bleed air from the left engine and/or right engine, by energizing the engine bleed air valves, thereby providing air as required for its dependent systems. The left and right engine pressure regulator and shutoff valves can be overridden by temperature limiter switches which close the valves upon sensing an overtemperature condition in the duct, or by power lever microswitches which close the valves upon selection of reverse power.

BLEED AIR OVERHEAT CAUTION LIGHTS

153 A temperature limit switch, located in the bleed air manifold at the top of each nacelle, detects an overtemperature condition in the ducts and automatically closes its pressure regulator and shutoff valve. Simultaneously, a caution light on the caution lights panel (Figure 1-6) identified L BLEED OVERHEAT or R BLEED OVERHEAT is illuminated. The MASTER CAUTION flashing light is also energized. When the appropriate bleed air switch is selected "OFF", the caution light remains on as long as the overheat condition exists; the circuit resets when the ducts have cooled sufficiently, and a reselection of bleed air can be made.

FLIGHT INSTRUMENTS

GENERAL

154 A set of flight instruments is installed on the pilot's instrument panel (Figure 1-25) and an identical set on the copilot's instrument panel (Figure 1-26). Each set consists of an airspeed indicator, altimeter, vertical speed indicator, attitude indicator, and a turn-and-slip indicator. A horizontal situation indicator (HSI), HSI control panel, and VOR glide slope indicator is installed on the pilot's and copilot's instrument panels. The attitude indicators are electrically operated, the pilot's being powered from the left 115-volt 400 cycle bus, protected by two ATT IND PLT, T1 and T3 circuit breakers on PANEL 7. The copilot's attitude indicator is powered from the right 115/115-volt 400 cycle bus, protected by two ATT IND COPLT, T1 and T3 circuit breakers on PANEL 2. The turn-and-slip indicators are also electrically operated, the pilot's being powered from the left essential dc bus, protected by a PLT T & S circuit breaker on PANEL 6, and the copilot's from the right essential dc bus

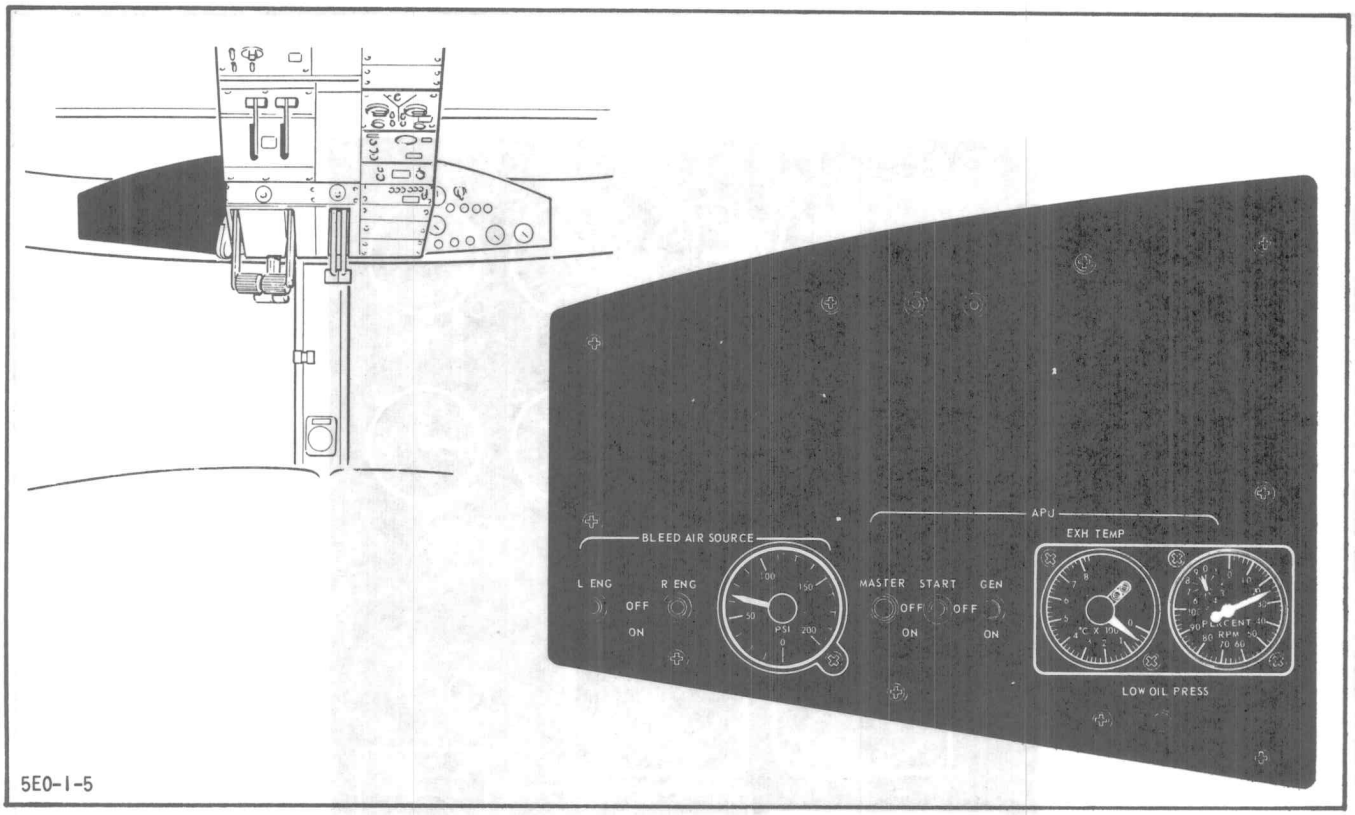


Figure 1-24 APU and Bleed Air Panel

protected by a COPLT T & S circuit breaker on PANEL 3. The remaining flight instruments are operated by the pitot-static system. Additional flight instruments not mounted on the main instrument panels consist of a magnetic standby compass on the windshield center post and a short-field approach speed indicator.

SHORT-FIELD APPROACH SPEED INDICATOR

155 The short-field approach speed indicator, located on the left emergency side panel (Figure 1-6) is operated by the stall warning system. The instrument is calibrated only for the final approach phase of a short-field landing with flaps at 40°. The dial is marked SLOW and FAST on the left and right sides of a triangular index mark. The index mark represents the optimum approach speed and deviations of the indicator pointer to left or right of the mark denote insufficient or excessive speed. An orange OFF flag appears at the bottom of the instrument dial when the electrical circuit is deenergized.

PITOT-STATIC SYSTEM

156 The pitot-static system (Figure 1-27) consists of two electrically-heated pitot heads mounted one on each side of the aircraft nose, with two static vents below each head. The left pitot head is connected to the pilot's airspeed indicator and the right pitot to the copilot's airspeed indicator, each pitot pressure line being independent of the other. The static pressure lines are also independent of each other; the upper static vent on each side supplies the copilot's airspeed indicator, altimeter, and vertical speed indicator, and the lower static vent on each side supplies the equivalent pilot instruments. The copilot's pitot and static lines are also connected to the true airspeed transmitter through accessory control valves.

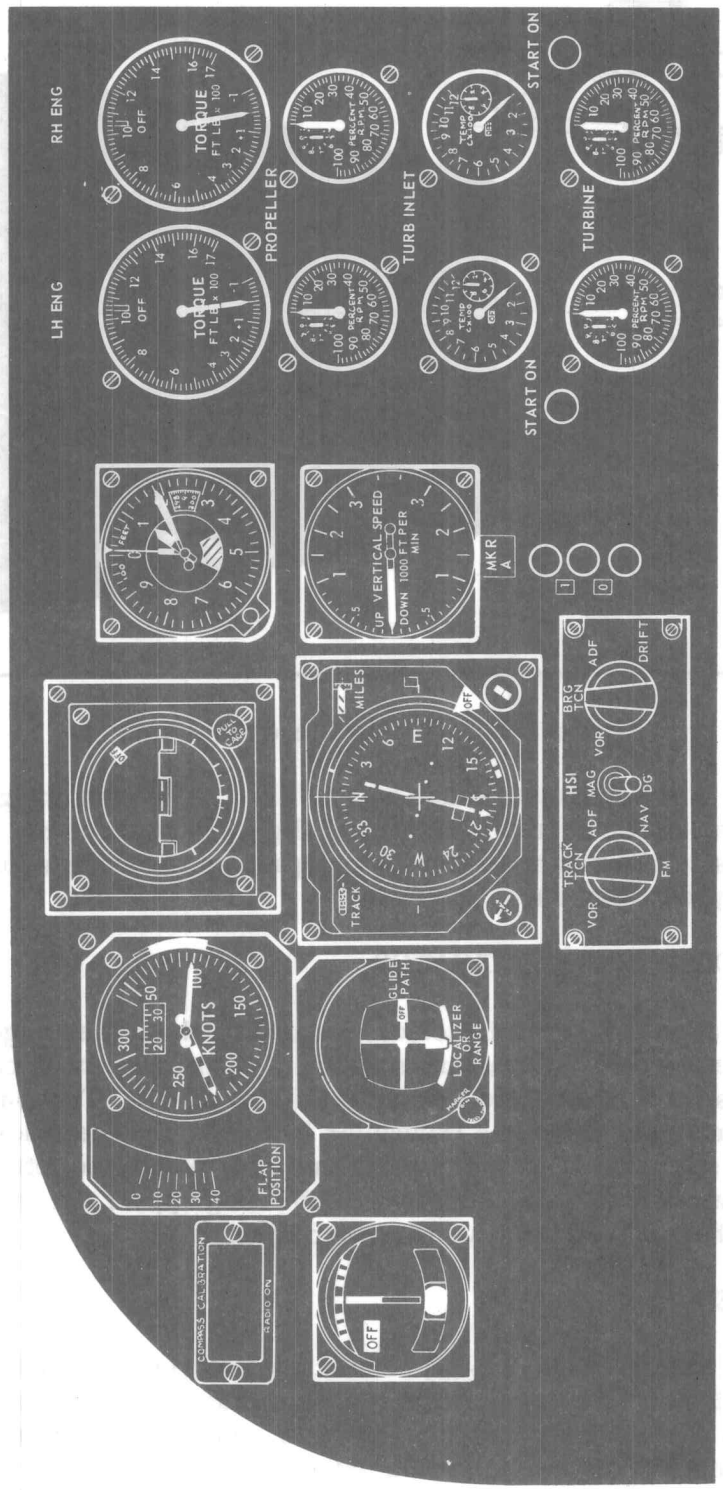


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Figure 1-25 Pilot's Instrument Panel

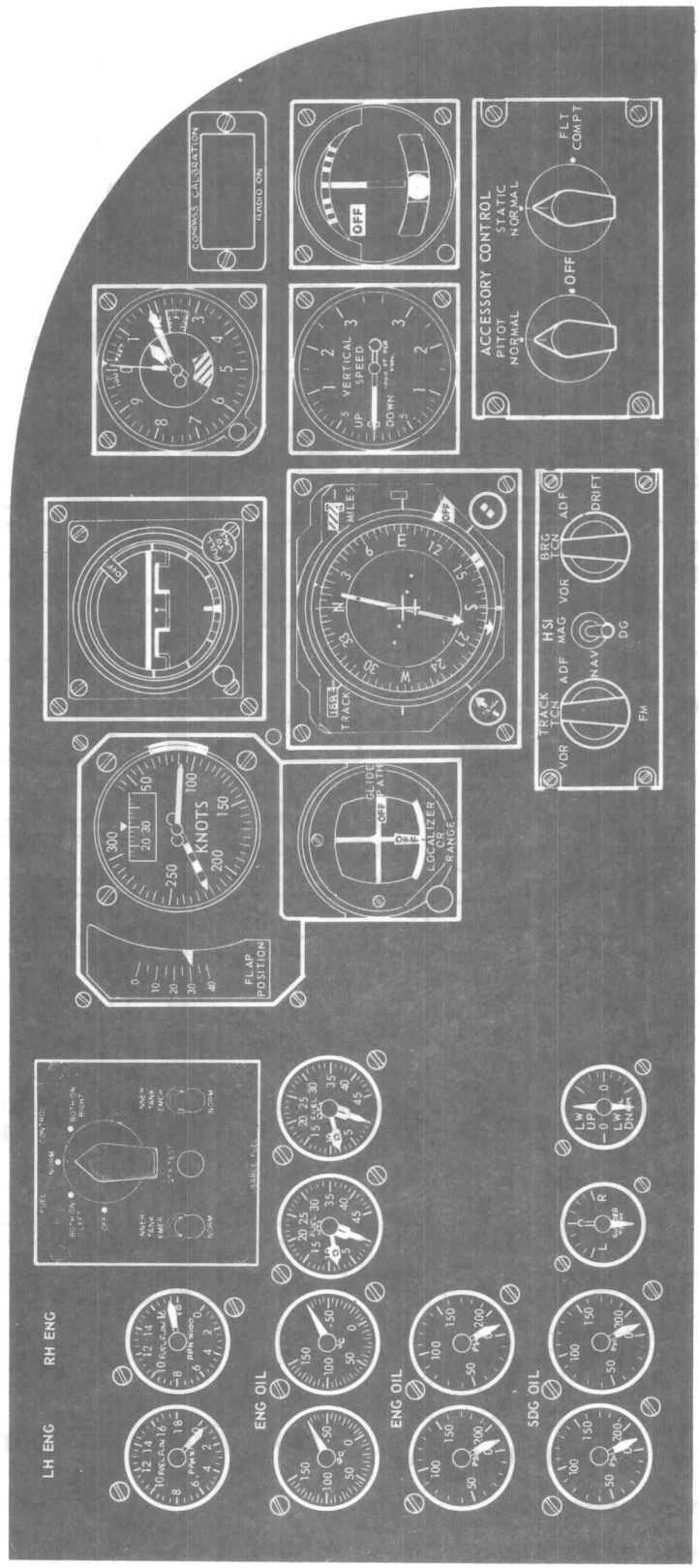

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Figure 1-26 Copilot's Instrument Panel

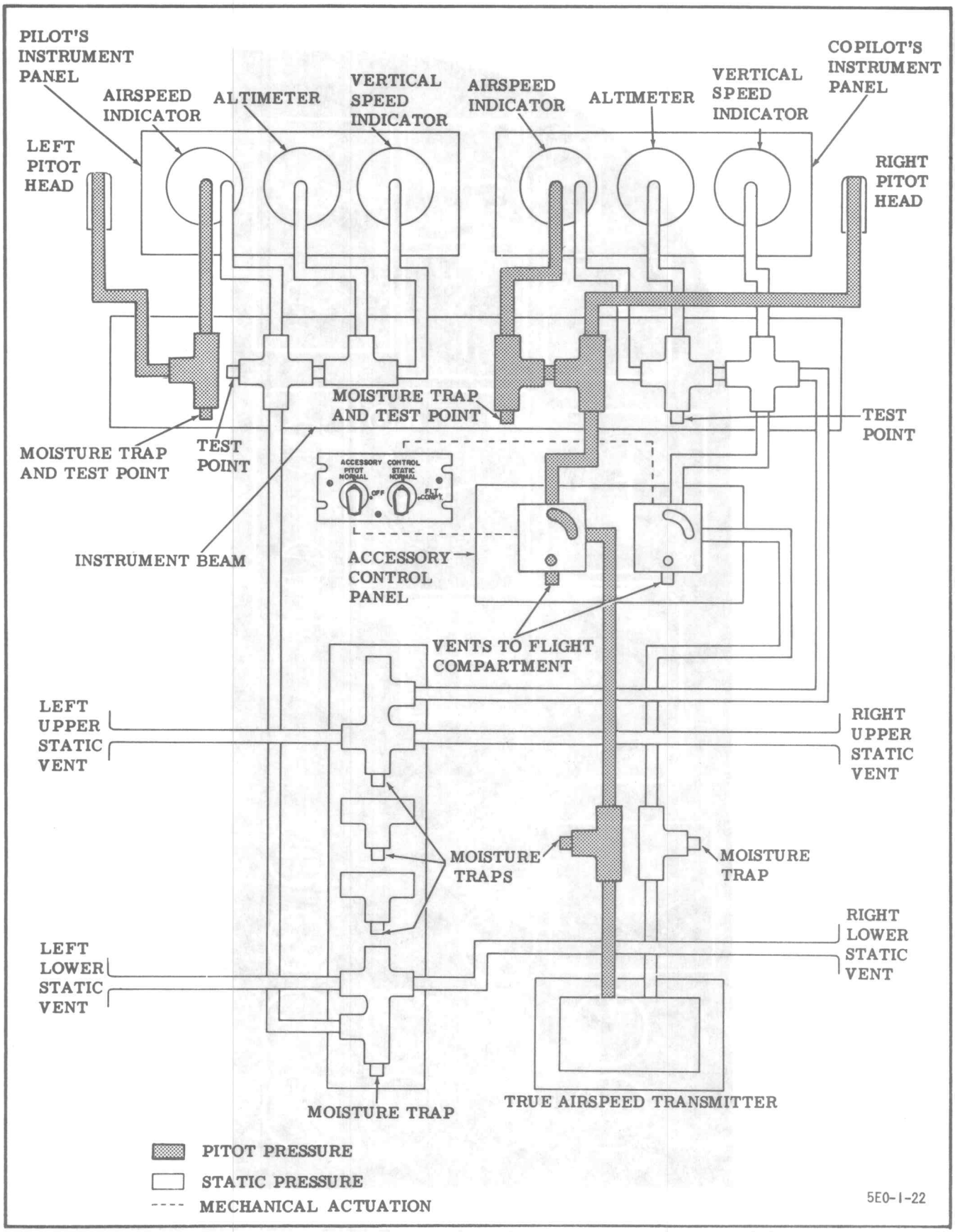


Figure 1-27 Pitot-Static System - Schematic

ACCESSORY CONTROL KNOBS

157 Two accessory control knobs on the ACCESSORY CONTROL PANEL, located on the copilot's instrument panel (Figure 1-26) control pitot and static pressure from the copilot's system to the true airspeed transmitter. Each knob operates a valve which shuts off pitot and normal static pressures to the true airspeed transmitter in the event of malfunction. The left knob is labeled PITOT with two positions marked "NORMAL" and "OFF". The right knob is labeled STATIC with two positions marked "NORMAL" and "FLT COMPT". At the "OFF" and "FLT COMPT" positions, the valves vent the true airspeed transmitter into the flight compartment.

ENGINE INSTRUMENTS

GENERAL

158 The engine instruments are mounted on the right side of the pilot's instrument panel and on the left side of the copilot's instrument panel (Figures 1-25 and 1-26). A set of instrument is installed for each engine. The fuel quantity and fuel flow indicators are described in paragraphs 18 and 22.

TORQUE INDICATORS

159 Two torque indicators are installed on the pilot's instrument panel (Figure 1-25). Each instrument labeled TORQUE, is graduated in foot-pounds, from -100 to + 1700 in 20 foot-pound increments. Torque sensor transducers, mounted on each engine output shaft, transmit a torque signal to its indicator which converts it to a torque reading. The torque indicators can be tested by operation of the TORQUE SYSTEM L TEST and R TEST switches located on the left emergency side panel (Figure 1-6). The torquemeters are powered from the left and right 115/200-volt variable frequency buses protected by TORQUE IND L and TORQUE IND R circuit breakers on PANEL 7 and PANEL 2. An orange flag marked OFF appears in an aperture in each indicator dial when power to the affected instrument is inadequate.

PROPELLER TACHOMETERS

160 The propeller tachometers (rpm indicators) are mounted on the pilot's instrument panel (Figure 1-25) and are labeled PROPELLER. Each instrument dial is marked PERCENT RPM and expresses propeller speed as a percentage. The main scale markings range from 0 to 100 in 2 percent increments. A small dial with a range of 0 to 10 provides for intermediate readings. The instrument mechanism is driven by a tachometer generator on the related engine speed decreaser gearbox. The tachometer generators are self-excited and are not powered from the electrical system.

ENGINE TACHOMETERS

161 Two engine tachometers (rpm indicators) are installed on the pilot's instrument panel (Figure 1-25) and are labeled TURBINE. The instruments are identical to the propeller tachometers and register turbine speed as a percentage. A tachometer generator on each engine accessories gearbox drives the mechanism of its indicator.

TURBINE INLET TEMPERATURE INDICATORS

162 Two turbine inlet temperature indicators are installed on the pilot's instrument panel (Figure 1-25) and are labeled TURB INLET. Each indicator is a servo-operated, potentiometer type, self-balancing unit which responds to signals generated by eight thermocouples

installed in the turbine section of the engine. Each indicator dial is marked TEMP ° C X 100 and its scale is graduated from 100 to 1200 degrees Centigrade in increments of 50. Accurate readings are facilitated by a small dial and pointer which registers 10-degree increments. An orange OFF flag appears in an aperture on the dial when electrical power to the indicator is disconnected. The instruments are powered from the left and right 115/200-volt 400 cycle buses protected by T5 TEMP IND L and T5 TEMP IND R circuit breakers on PANEL 7 and PANEL 2. During engine shut-down, power is supplied by the static inverter.

OIL TEMPERATURE INDICATORS

163 Two oil temperature indicators are installed on the copilot's instrument panel (Figure 1-26) and are labeled ENG OIL. Each instrument denotes the oil temperature in its engine oil inlet line as sensed by a ratio resistance bulb. The indicator dials are marked °C and scaled from -70 to +150 in increments of 5 degrees. The indicating systems are powered from the left and right 28-volt main dc buses protected by OIL TEMP IND L and OIL TEMP IND R circuit breakers on PANEL 6 and PANEL 1.

ENGINE OIL PRESSURE INDICATORS

164 Two engine oil pressure indicators are installed on the copilot's instrument panel (Figure 1-26) and are labeled ENG OIL. Each indicator is marked PSI and graduated in increments of 10 psi from 0 to 200. A pressure transmitter on each engine transmits by electrical signal the pressure sensed to its indicator. The pressure indicating systems are powered from the left and right 26-volt 400-cycle buses,protected by L OIL PRESS and R OIL PRESS circuit breakers on PANEL 7 and PANEL 2.

SPEED DECREASER GEAR OIL PRESSURE INDICATORS

165 Two speed decreaser gear oil pressure indicators are installed on the copilot's instrument panel (Figure 1-26) and are labeled SDG OIL. Each indicator denotes the oil pressure in the speed decreaser gearbox of its related engine. The instruments are identical to the engine oil pressure indicators and have the same scale markings; they also have the same electrical power source and are protected by the L OIL PRESS and R OIL PRESS circuit breakers.

MISCELLANEOUS INSTRUMENTS

CLOCK

166 An ABU5A 8-day elapsed time clock with one hour elapsed time feature and reset is located above and to the left of the pilot's instrument panel. The clock incorporates a sweep second hand. An elapsed time, zero-reset flyback knob and a winding/setting knob are at the top right and bottom left of the clock.

OUTSIDE AIR TEMPERATURE INDICATOR

167 A direct reading outside air temperature indicator is installed in the flight compartment roof (Figure 1-2 sheet 1) above the pilot's seat. It's scale is graduated in degrees Fahrenheit and Centigrade.

STALL WARNING SYSTEM

168 Incorporated in the flight control system is a stick shaker stall warning system, which vibrates the control column to give the pilot and copilot pre-stall warning at approximately 10 percent above the stalling speed with the flaps and landing gear in all the normally used

positions. The short-field approach speed indicator is also operated by the stall warning system. The system comprises a left wing lift transducer, a flap position potentiometer, a signal summing unit, two stick shakers and a test switch. The wing lift transducer vane responds to movement of the airflow stagnation point as the stall is approached and changes the voltage to the signal summing unit. The summing unit compensates this voltage for flap position, detected by the flap position potentiometer, and operates both stick shakers to vibrate the control columns. The lift transducer is heated simultaneously with the pitot heads and is controlled by the ICE CONTROL PITOT switch. The system is powered from the left 28-volt main dc bus protected by the STALL WARN DC circuit breaker on PANEL 6 and the left 115/200-volt 400 cycle bus protected by the STALL WARN circuit breaker on PANEL 7.

STALL WARNING TEST SWITCH

169 A two-position toggle switch located on the left emergency side panel (Figure 1-6) is labeled STALL WARN TEST. The center-off position is unmarked and the up position marked "TEST" is a momentary position which operates the stick shakers.

APU INDICATORS

170 The APU indicators are mounted on the APU and BLEED AIR panel (Figure 1-24) located to the left of the overhead console. The bleed air pressure indicator is described in paragraph 151. The APU tachometer is identical to the propeller tachometers (paragraph 160) and is driven by a generator mounted on the rear of the APU. The APU exhaust temperature indicator is connected to a thermocouple installed in the APU exhaust pipe. The indicator dial is marked °C x 100 and graduated from 0 to 850.

LIGHTING SYSTEM

GENERAL

171 The aircraft lighting system comprises exterior and interior lighting, panel and instrument lighting and emergency exit lighting. Electrical power from the left bus system is connected to part of the lighting and from the right bus system for the remainder of the lighting in each area of the aircraft. The circuits are protected by thermal push-to-reset circuit breakers and controlled by switches.

EXTERIOR LIGHTING

172 The aircraft exterior lights consist of position (navigation), anti-collision, formation, wing and landing gear inspection lights, landing lights, and a taxiing light.

POSITION LIGHTS SWITCH

173 Six position lights are controlled by a three-position rotary selector switch and a two-position toggle type switch which are located on the EXTERIOR portion of the LIGHTING panel (Figure 1-28) on the overhead console. The switches are identified POSITION with selections at "OFF", "STEADY" and "FLASH" for the rotary switch, and "DIM" and "BRT" for the toggle switch. The left and right wing tips house a conventional red and green light and an aft facing white quartz light. Mounted on the tailcone in a single housing is a white and yellow light, the yellow light being mounted on the left. Power is supplied to the position lights from the right 28-volt main dc bus and protected by two POSITION LIGHTS circuit breakers on PANEL 1. With the rotary selector switch at "STEADY" all the lights except the yellow tail light are energized, with the switch selected to "FLASH" a flasher unit incorporated into the system causes the wing tip lights to flash on and off, and the white and yellow lights in the

tailcone to flash alternately. The selection of "DIM" on the toggle switch introduces six dimming circuits into the system.

ANTI-COLLISION LIGHTS SWITCH

174 A two-position anti-collision light switch is located on the LIGHTING panel (Figure 1-28). It is identified ANTI COLLISON with selections at "OFF" and "ON". The three anti-collision lights, operated by the switch, are rotating red beacons and are mounted one on each upper and lower surface of the aircraft fuselage, and one on the tailcone, above and slightly forward of the tail lights installation. All three lights are rotated by 28-volt dc motors within the beacon housings. The upper light and tail light are powered from the left 28-volt main dc bus and are protected by a LIGHTS ANTI COL UP & TAIL circuit breaker on PANEL 6. The lower light is powered from the right 28-volt main dc bus and is protected by a LIGHTS ANTI COL LOWER circuit breaker on PANEL 1.

FORMATION LIGHTS SWITCH

175 A three-position toggle-type switch located on the LIGHTING panel (Figure 1-28) is identified FORM with selections at "DIM", "OFF" and "BRT". The nine formation lights are lunar white in color and are mounted, three along each upper wing surface and three aft along the fuselage. The lights are powered from the left 28-volt main dc bus and are protected by a LIGHTS FORM circuit breaker on PANEL 6.

WING AND LANDING GEAR INSPECTION LIGHTS SWITCH

176 A two-position wing and landing gear inspection lights switch is located on the LIGHTING panel (Figure 1-28). It is identified WING & LG INSP with selections at "OFF" and "ON". The six lights operated by the switch are: left and right inboard and outboard wing inspection lights, located on the fuselage slightly aft of the wing leading edge, and on the outboard side of the engine cowl; and left and right landing gear inspection lights located on the fuselage immediately forward of the cabin doors. Each of the six lights is powered from the right 28-

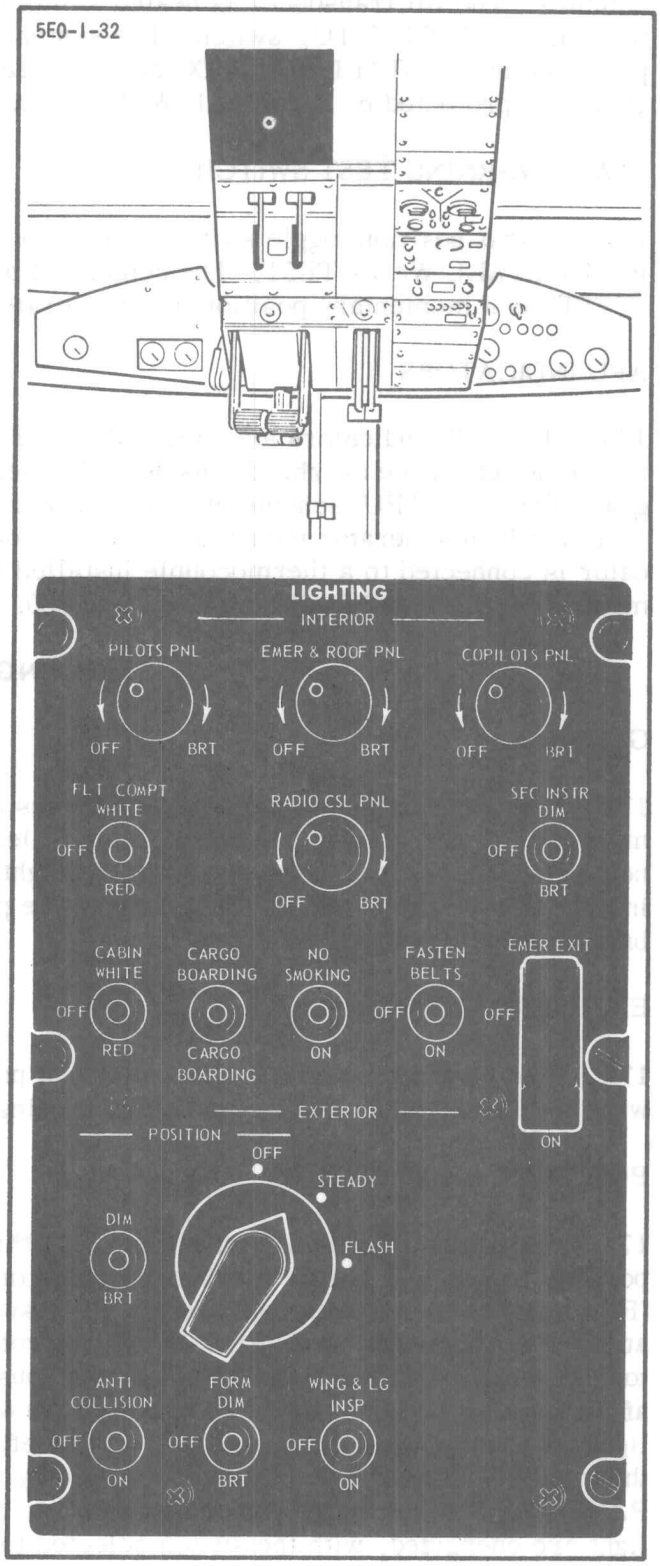


Figure 1-28 Lighting Panel

volt main dc bus and protected by a LIGHTS WING & LDG GEAR INSP circuit breaker on PANEL 1.

LANDING LIGHTS SWITCH

177 The two toggle-type switches located on the LANDING & TAXI panel (Figure 1-18) on the overhead console, are identified LANDING LTS with switch selections at "ON" and "OFF". The two landing lights are set at a fixed angle into each outer wing leading edge. Two separate electrical circuits are used to provide power for each landing light. Control is from the left and right 28-volt dc buses and the lights are powered from the left and right 115/200 volt variable frequency buses. Two circuit breakers identified LIGHTS L LDG CONT and LIGHTS R LDG CONT protect the switch circuits and are located on circuit braker PANEL 6 and PANEL 1. Two circuit breakers identified LDG LT L and LDG LT R protect the landing light circuits and are located on PANEL 7 and PANEL 2.

TAXIING LIGHT SWITCH

178 The taxiing light switch located on the LANDING & TAXI panel (Figure 1-18) on the overhead console is identified TAXI LT with switch selections at "ON" and "OFF". The taxi light is mounted on the nosewheel door fairing. The circuit is powered from the right 28-volt main dc bus and is protected by a LIGHTS TAXI, circuit breaker on PANEL 1.

INTERIOR LIGHTING

179 The interior lighting system comprises a flight compartment (dome) light, cargo floor lights, utility lights, emergency hydraulic panel lights, secondary instrument lights, passenger warning signs, cabin dome lights, a ramp loading light, and a navigator's chart table light.

FLIGHT COMPARTMENT (DOME) LIGHT SWITCH

180 The FLT COMPT (dome) light switch located on the LIGHTING panel (Figure 1-28) has switch selections marked "WHITE", "OFF" and "RED". The switch incorporates a lever lockout mechanism to prevent inadvertent selection of the white lamp. The red/white flight compartment light is powered from the right essential dc bus when the switch is selected to either "WHITE" or "RED" and the BATTERY/EXT DC switch on the ELECTRICAL CONTROL panel (Figure 1-10) is selected to "ON". The circuit is protected by a CARGO & FLT COMP LTS circuit breaker on PANEL 3. The white lamp in the flight compartment light is also controlled by either the flight compartment or the cabin CARGO/BOARDING light switch and powered from the battery bus, when the BATTERY/EXT DC switch is selected "OFF". The battery bus circuit is protected by a CARGO/BOARDING LIGHTS circuit breaker immediately aft of the battery in the left wheel well.

CARGO FLOOR LIGHTS SWITCH

181 Six white cargo floor lights in the cabin roof illuminate the cargo floor. They are controlled by either the flight compartment CARGO/BOARDING light switch located on the LIGHTING panel (Figure 1-28) on the overhead console, or cabin CARGO/BOARDING light switch located on the CABIN LTG DOOR CONTROL panel (Figure 1-29) in the cabin aft of the left passenger door. Both switches are two position toggle type and are identified CARGO BOARDING/CARGO BOARDING on their panels. With the selection of CARGO/BOARDING at either of the two switches, power from the right essential dc bus, when the BATTERY/EXT DC switch (Figure 1-10) is selected "ON", or from the battery bus, when the BATTERY/EXT DC switch is selected "OFF", will illuminate the cargo floor lights. The circuits are protected in a similar manner to the flight compartment (dome) lights. Refer to paragraph 180.

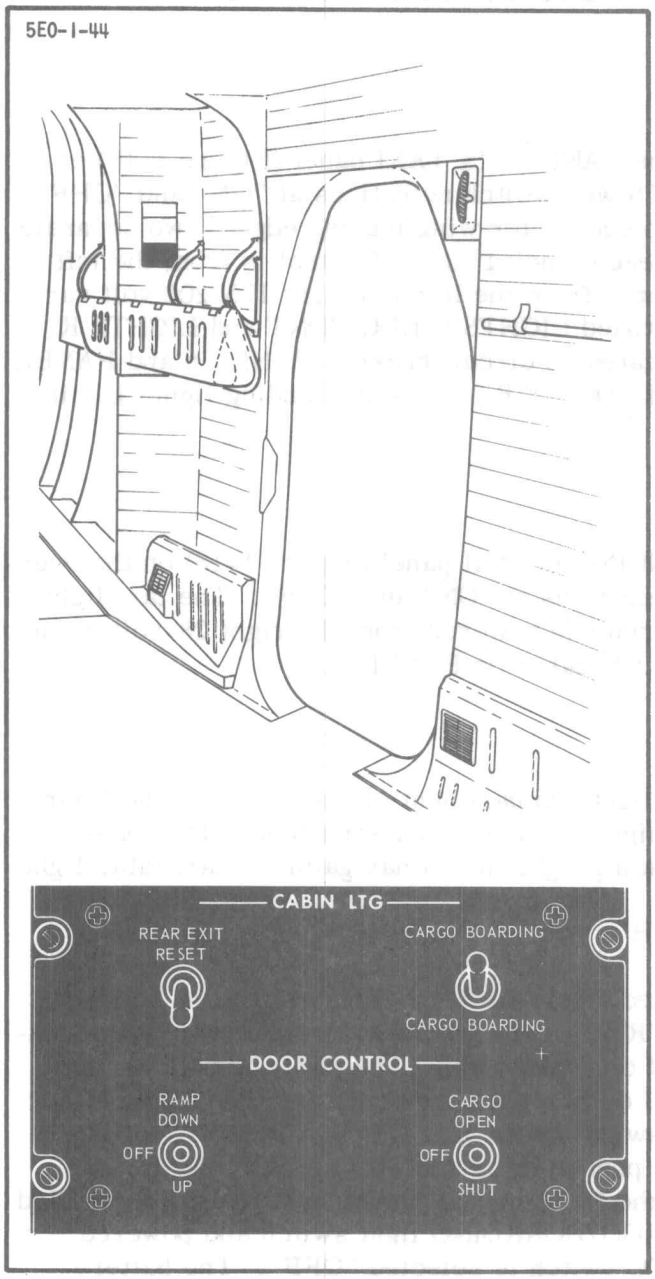


Figure 1-29 Cabin Lighting Door Control Panel

UTILITY LIGHTS

182 Three utility lights are provided in the flight compartment, one each for the pilot and copilot and one on the radio racks (Flight Technician's position), behind the copilot's seat. The pilot's and copilot's lights are mounted on the flight compartment canopy to the left and right of the pilot's and copilot's positions, but may be removed and used as the electrical lead permits. All three lights are controlled by a rheostat type selector which is an integral part of each light. The light cases have markings at "OFF", "DIM", and "BRT" and each contains a rotating front section, which can be set for either red or white on the radio rack light, and red or amber on the other two lights. Each light also has a push button to provide momentary brilliance irrespective of rheostat selection. Power is supplied to the utility lights from the right 28-volt main dc bus; the circuits are protected by a LIGHTS UTILITY circuit breaker on PANEL 1.

HYDRAULIC EMERGENCY PANEL SWITCHES

183 Two red lights for the hydraulic emergency panel (Figure 1-17) are located inside the panel door and are operated by a micro switch which is actuated by the door. Power is supplied to the hydraulic emergency panel lights from the right 28-volt main dc bus, protected by a EMER HYD PNL LT circuit breaker on PANEL 1.

SECONDARY INSTRUMENT LIGHTS SWITCH

184 Five secondary, instrument flood lights are provided, two lights mounted on the caution lights panel structure, two lights on the emergency panel structure, and one light is mounted adjacent to the pilot's clock. The lights are controlled by a SEC INSTR toggle type switch mounted on the LIGHTING panel (Figure 1-28) with selections as "DIM", "OFF", and "BRT". Power is supplied from the left essential dc bus, protected by a INST LTS STDBY circuit breaker on PANEL 6.

PASSENGER WARNING SIGNS SWITCHES

185 A dual passenger warning sign is located in the cabin above the cabin-flight compartment door and reads NO SMOKING and FASTEN BELTS. Two toggle type switches located on the LIGHTING panel (Figure 1-28) are identified NO SMOKING and FASTEN BELTS, with switch selections at "OFF" and "ON" to control the illumination of the signs. The warning signs are powered from the left 28-volt main dc bus and the circuits are protected by the LIGHTS

CABIN SIGNS circuit breaker on PANEL 6.

CABIN (DOME) LIGHTS SWITCH

186 The cabin (dome) lights switch is on the LIGHTING panel (Figure 1-28). It is a three-position, lever lock-out toggle switch identified CABIN, with positions marked "WHITE", "OFF", and "RED"; the switch must be lifted to select the "WHITE" position. At "RED", the switch energizes a relay for the dimming control of the red and green jump lights in the cabin. The cabin (dome) lights are mounted in the cabin roof and each consists of one red and one white lamp; they are staggered in two rows of three, and are powered from the right 28-volt main dc bus and protected by the LIGHTS CABIN circuit breaker on PANEL 1.

RAMP LOADING LIGHT

187 A white spot light, with a mechanically-operated red shutter, is stowed on a mounting in the cabin roof above the left passenger door, and is removable for hand operation. A two position on/off slide switch is incorporated on the side of the light. The light is powered from the left 28-volt main dc bus, and is protected by the RAMP LOAD LT circuit breaker on PANEL 6.

NAVIGATORS WORK-TABLE LIGHT

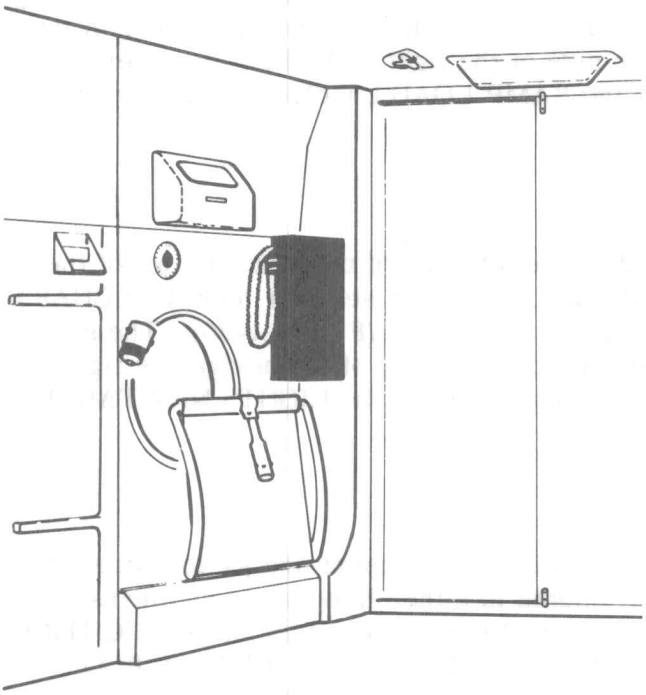
188 The navigator's work-table light is located on the left side of the aircraft, aft of the window behind the cabin-flight compartment bulkhead. A dimming selector identified CHART TABLE is located on the LIGHTING panel on the navigator's panel (Figure 1-30). The selector has panel markings of "OFF" and "BRT" and controls the intensity of the navigators light. Power is supplied from the left 28-volt main dc bus, protected by the LIGHTS NAV TABLE circuit breaker on PANEL 6.

INSTRUMENT AND PANEL LIGHTS

189 Edge lights are installed in the plastic face panels of instrument and switch panels for lighting and panel markings. The lighting of instruments is either integral or by means of eyebrow light fittings. The lights are controlled by four dimming selectors on the LIGHTING panel (Figure 1-28). The dimming selectors are identified PILOTS PNL, EMER & ROOF PNL, COPILOTS PNL and RADIO CSL PNL; they each have an intensity range with limit markings of "OFF" and "BRT". In conjunction with dimming controllers they provide a 28-volt (maximum) ac output for eyebrow and edge lights and 5.5-volt (maximum) ac output for the integrally lit instruments. The controllers for the pilots panel lights and the emergency and overhead panel lights are powered from the left 115/200-volt variable frequency bus protected by the PANEL LTS PLT/ENG and PANEL LTS EMER/OH circuit breakers on PANEL 7. The controllers for the copilot's panel and radio console panel are powered from the right 115/200-volt variable frequency bus protected by the PANEL LTS COPLT and PANEL LTS RAD & CONS circuit breakers on PANEL 2.

CABIN PANEL

190 A dimming selector identified CABIN PANELS is located on the LIGHTING panel on the navigator's panel. The dimming selector has an intensity range with limit markings at "OFF" and "BRT" and controls the panel lighting in the cabin. Power for the lighting of the cabin panels is supplied from the left 28-volt main dc bus protected by the LIGHTS CABIN PANELS circuit breaker on PANEL 6.



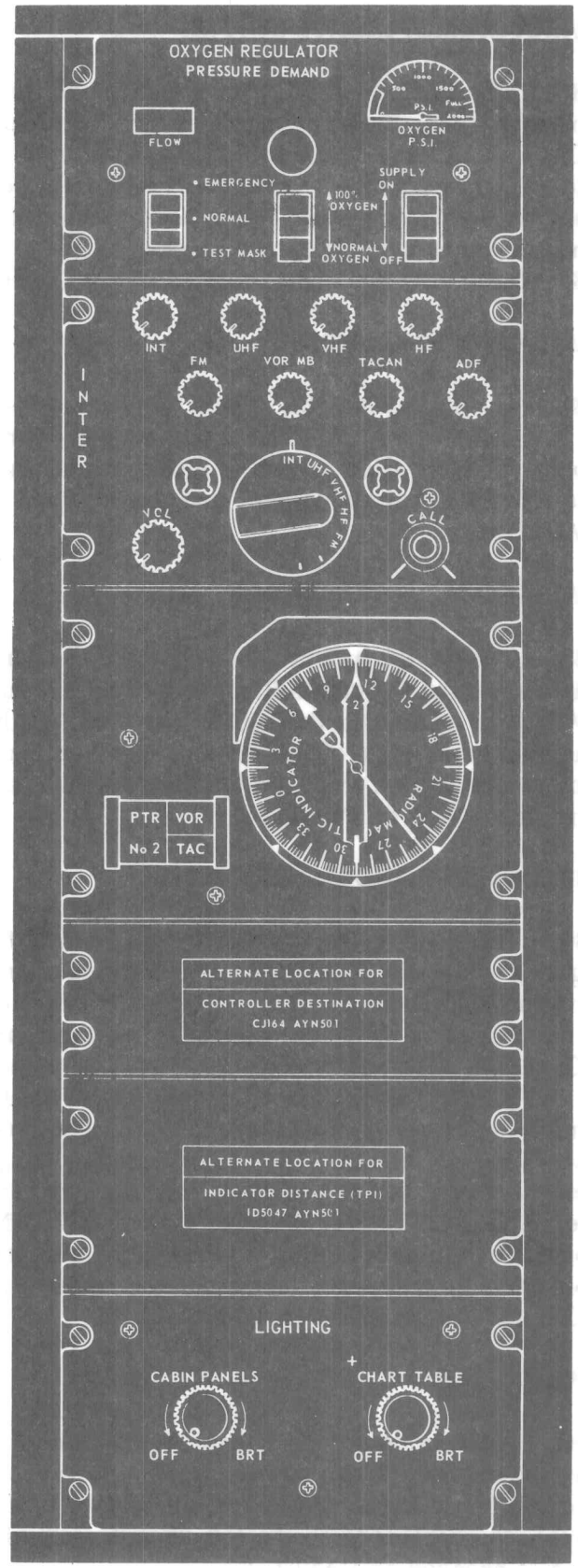


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Figure 1-30 Navigator's Panel

ELEVATOR TRIM PEDESTAL LIGHT SWITCH

191 A two position toggle switch identified PEDESTAL LIGHT, (Figure 1-2 sheet 2) with positions marked "ON" and "OFF", is located on the aft face of the elevator trim pedestal. It controls the lights which illuminate the elevator trim position indicator. Dimming of the lights is controlled by the PILOTS PNL dimming selector on the LIGHTING panel (Figure 1-28).

EMERGENCY LIGHTING SYSTEM

192 An emergency lighting system which operates from a 6-volt nickel-cadmium battery, is provided to illuminate the aircraft emergency exits in the event of a complete electrical failure. The system is manually controlled by a guarded two position toggle switch located on the LIGHTING panel (Figure 1-28) identified EMER EXIT, with selections marked "OFF" and "ON", or automatically controlled by an inertia switch on impact of a crash landing. Lights are provided for both left and right forward emergency exits, left and right of the cargo door, and flight compartment upper and lower hatches. The lower hatch light is not illuminated until a system limit switch is actuated by the floor door as it is opened. A trickle charger, powered from the right 28-volt main dc bus, maintains the emergency lights battery in a fully charged condition. The circuit is protected by the EMER LT BAT CHARGER circuit breaker on PANEL 1.

PORTABLE EMERGENCY LIGHTS

193 Two portable emergency lights are installed in the rear of the cabin above each passenger door. They are battery powered and electrical system operated and may be used individually either attached to or detached from the aircraft. Each light has an integral three position switch marked "ARM", "OFF" and "ON". The switch must be in the "ARM" position to provide automatic function in the event of electrical failure or a crash landing. When installed, the lights ARM circuit is connected to the left 28-volt main dc bus, and in the event of electrical failure that affects the bus, or with normal power shut-down, the portable lights are automatically switched on. They must be switched off if not required by operating the REAR EXIT RESET switch on the CABIN LTG DOOR CONTROL panel (Figure 1-29) aft of the left passenger door, to "REAR EXIT RESET". An inertia switch incorporated in each light will switch the light on in the event of a crash landing. The portable emergency lights 28-volt circuit is protected by the LIGHTS REAR EXT circuit breaker on PANEL 6.

NOTE

On the ground, it is recommended that each portable emergency light be switched to "OFF" after placing the REAR EXIT RESET switch on the CABIN LTG DOOR CONTROL panel (Figure 1-29) to "REAR EXIT RESET"; this avoids operation of the switch each time electrical power is used during ground servicing. On preflight inspection these switches should be placed at "ARM" position.

ENTRANCE DOORS

GENERAL

194 Entrance to the aircraft may be made through either of the two cabin doors, the flight compartment lower hatch, or by the cargo door and ramp. A door is also provided between the cabin and flight compartment.

CABIN DOORS

195 The two cabin doors, located one on each side, are each fitted with a flush type handle which springs out when a button adjacent to the handle is depressed. Each door is equipped with jettison mechanism and a door stay to hold the door open on the ground. The jettison mechanism on each door has a tell-tale indicator, visible through an inspection window on the lower forward door jamb to indicate if the jettison mechanism is properly engaged. A limit switch on each door is connected to the DOORS UNLOCKED caution light (Figure 1-6) to warn against taking off with the doors open.

FLIGHT COMPARTMENT LOWER HATCH

196 The flight compartment lower hatch is located aft of the pilot and copilot seats in the fuselage bottom skin. The hatch hinges forward and downward and has a recessed step in its inner surface. The hatch is opened by a key lock handle similar in operation to the cabin doors and a door stay is incorporated to hold the hatch in the open position. Flight compartment floor doors are located above the hatch and must be pushed upwards to gain access to the flight compartment. The lower hatch can be used as an entrance and exit door in the event that cargo loading prevents normal access and exit. A limit switch on the lower hatch frame is connected to the DOORS UNLOCKED caution light (Figure 1-6) to warn against taking off with lower hatch open.

CABIN-FLIGHT COMPARTMENT DOOR

197 A sliding door separates the flight compartment from the cabin. The door may be opened from either side but locked only from the flight compartment.

CARGO AND RAMP DOORS

198 The cargo and ramp doors are used primarily for loading and unloading cargo, troops or casualties, or for aerial delivery operations. The cargo door and ramp door may be opened or closed independently by electrical or mechanical actuation. Two ramp extensions may be attached to the ramp door in its down position to facilitate loading and unloading wheeled vehicles.

CARGO AND RAMP DOOR CONTROL PANELS

199 Switches for cargo and ramp door operation are located on the AERIAL DELIVERY panel (Figure 1-31) on the overhead console in the flight compartment, and on the CABIN LTG DOOR CONTROL panel (Figure 1-29) on the left cabin wall aft of the passenger door. The AERIAL DELIVERY panel switches are labeled RAMP DOOR "DOWN" and "UP", RAMP DOOR "OVERRIDE" and CARGO DOOR "OPEN" and "SHUT". The panel also incorporates a ramp door position indicator labeled RAMP DOOR UP, 0, -15 and DN and a square window CARGO DOOR POS indicator displaying a roller type dial marked OPEN, PART, SHUT and OFF. OFF is indicated when electrical power to the system is off. The DOOR CONTROL switches on the CABIN LTG DOOR CONTROL panel are labeled RAMP "DOWN", "OFF" and "UP" and CARGO "OPEN", "OFF" and "SHUT". The cargo and ramp door motors are controlled and powered from the left 28-volt main dc bus and protected by DOORS CONT, DOORS CARGO and DOORS RAMP circuit breakers on PANEL 6.

RAMP DOOR

200 The ramp door is hinged to the aft end of the cabin floor and is moved up and down by two screw jacks driven by a motor, through a system of torque tubes, shafts and gears. On

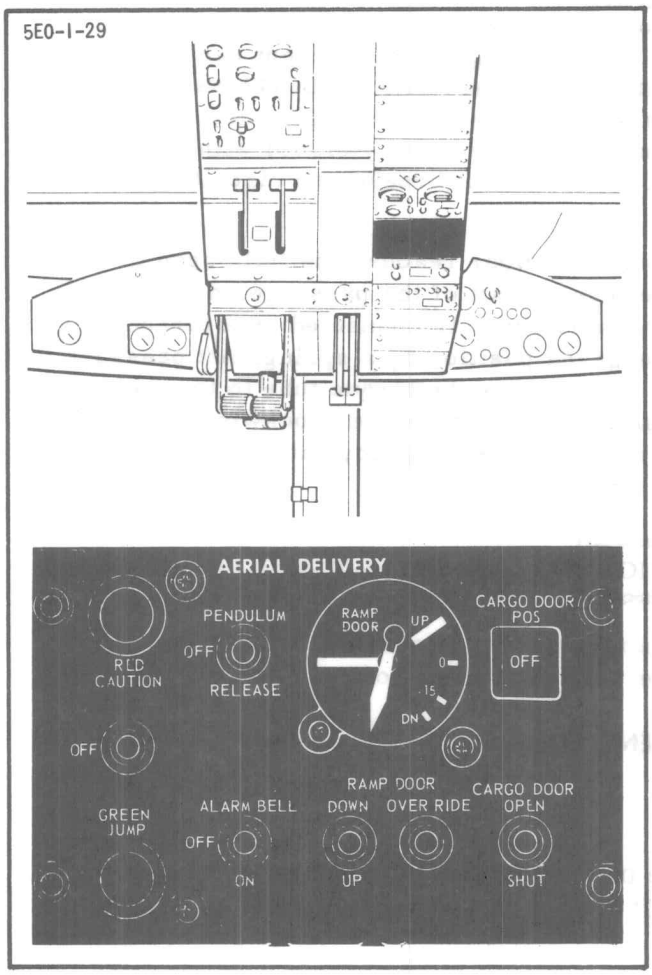

Figure 1-31 Aerial Delivery Panel

the ground, the ramp door may be operated to the UP and DOWN position by holding the RAMP DOOR switch (Figure 1-31) in the flight compartment, or the RAMP switch (Figure 1-29) in the cabin, in the "UP" or "DOWN" position. The ramp door can be stopped in intermediate positions by releasing the switch to the center "OFF" position, or its direction of operation reversed by making an opposite selection. The RAMP DOOR switch in the flight compartment will override a RAMP switch selection in the cabin. In the air a landing gear weight switch in the circuit prevents the ramp door from being operated below the -15° position. A flight compartment switch selection can bypass the weight switch and full down operation may be obtained, in the air, by holding the RAMP DOOR switch at "DOWN" and the RAMP DOOR OVERRIDE switch at "OVERRIDE" simultaneously. A ramp below 0° limit switch activates the master caution system and illuminates a DOORS UNLOCKED light on the caution lights panel (Figure 1-6) when the ramp door is open beyond the 0° position. Limit switches deenergize the ramp door motor when the door reaches the up or down positions on the ground, and the up or -15° positions in the air. When a simultaneous "DOWN" and "OVERRIDE" selection is made in the air the limit switch deenergizes the ramp door motor when the door is fully down. A detachable hand-crank is provided for raising or lowering the ramp door by hand. A label on the right cabin wall aft of the passenger door adjacent to the ramp door hand crank stowage displays instructions for the manual operation of the door. The ramp extensions are stowed in the roof of the cabin between Arm 510.25 and Frame 7 (Figure 1-1).

CARGO DOOR

201 The cargo door is hinged at its aft end to the rear fuselage, and the forward end moves upward into the fuselage until the door is slightly above horizontal to reach the open position. This provides maximum overhead clearance to permit vehicles to load or unload cargo directly from the ramp or cabin floor. The cargo door is opened and shut by a motor through a chain and cable system. The cargo door may be operated to the OPEN or SHUT position by holding the cabin DOOR CONTROL CARGO switch (Figure 1-29) in the "OPEN" or "SHUT" position. The cargo door can be stopped in intermediate positions by releasing the switch to the center "OFF" position or its direction of operation can be reversed by making an opposite selection. The cargo door may be operated to the OPEN or SHUT position by a momentary selection of the flight compartment CARGO DOOR switch (Figure 1-31) to "OPEN" or "SHUT". The flight compartment CARGO DOOR switch incorporates lock-on relays so that the doors will continue to operate without the switch being held in the "OPEN" or "SHUT" position.

CAUTION

A cargo door "OPEN" selection made in the cabin or flight compartment can be overriden by a "SHUT" selection of the flight compartment CARGO DOOR switch. However, once a "SHUT" selection has been made on the flight compartment CARGO DOOR switch, it cannot be stopped until the door is fully closed without pulling either the DOORS CONT or DOORS CARGO circuit breaker on circuit breaker PANEL 6.

Limit switches deenergize the cargo door motor when the door reaches the fully open or fully shut positions. A hand crank on the left side of the fuselage aft of the passenger door is provided to open or shut the cargo door manually. The hand crank is connected by a torque tube to the cargo door motor and is retained in the disengaged position by a spring. Aft pressure on the hand crank overcomes the spring pressure and engages the torque tube to the motor to permit clockwise rotation of the hand crank to open the door and counterclockwise rotation to shut it. Aft pressure must be maintained while cranking. An emergency hatch is installed in the cargo door for emergency use when the cargo door is closed.

CAUTION

Operating time limits for ramp and cargo door are not to exceed "1" minute "on" and 9 minutes "off".

FLIGHT COMPARTMENT EQUIPMENT

GENERAL

202 Flight compartment equipment includes the pilot's, copilot's and flight technician's seats, flight compartment sun shades, the take-off and landing check list and map and data cases.

PILOT'S AND COPILOT'S SEATS

203 The pilot's and copilot's seats are identical and each is capable of taking a back type parachute and is provided with a lap belt and shoulder harness complete with inertia reels. Each seat can be adjusted horizontally and vertically by means of spring-loaded levers located at the side and front of the seat and can be locked at any desired position. Arm rests are hinged to the seat back side frames, and can be raised when not required.

FLIGHT TECHNICIAN'S SEAT

204 The flight technician's seat (Figure 1-2 sheet 2) is installed between the left and right radio structures with the top of the seat back runners engaging with a channel above the cabin-flight compartment doorway. The seat lateral tubes engage with receptacles on the side of the radio structures. The seat is not adjustable but is equipped with shoulder harness, inertia reel and lap belt. The seat is capable of taking a back type parachute, but for the flight technician's ease of mobility a back cushion is provided and there is stowage provision for a chest pack parachute behind the pilot's seat.

SUNSHADES

205 Vinyl fabric sunshades are installed on each of the 6 overhead windows in the flight compartment. They can be extended to cover the windows or folded, along rod assembly guides, to leave the windows clear. The sun shades are held in the desired position by Velcro tape.

CHECK LIST

206 A take-off and landing check list (Figure 1-6) is located above the copilot's instrument panel. This adjustable check list scroll is backlit with lighting intensity controlled from the EMER & ROOF PNL rotary dimming selector located on the overhead console LIGHTING panel (Figure 1-28).

MAP AND DATA CASES

207 Map and data cases are provided for both pilot and copilot. Each case is made from grey plastic with a vinyl-coated nylon flap and snap fastener. The pilot's case is bonded to a fairing attached to the structure below the pilot's rear window, and the copilot's case is attached directly to the fuselage structure below the copilot's rear window.

EMERGENCY EQUIPMENT

GENERAL

208 Emergency equipment includes the fire detecting and extinguishing system, first aid kits, emergency exits, alarm bell system and crash axe.

FIRE DETECTING AND EXTINGUISHING SYSTEMS

209 Fire detecting and extinguishing systems are installed to give fire warning and to extinguish a fire in either engine nacelle. Each engine nacelle is divided into three zones. Zone 1 being the front part of the engine aft of the main firewall, Zone 2 the compartment forward of the main firewall and above the fireshield, and Zone 3 the wheel well compartment and accessory compartment forward of the wheel well.

210 Fire detecting elements (of the continuous wire type) in each zone are connected to fire warning lights on the emergency panel in the flight compartment. Fire extinguishing agent (Freon - CF_3Br) is stored in two spherical containers located in the cabin roof forward of the rear spar. Pipelines convey the agent to fire Zones 2 and 3 in each engine nacelle. The circuits are powered from the left and right essential dc buses protected by FIRE DET L ENG and FIRE DET R ENG circuit breakers on PANEL 6 and PANEL 3.

211 A fire occurring in Zone 1 will illuminate the appropriate ZONE 1 FIRE warning light on the emergency panel (Figure 1-6). (No extinguisher, however, is provided for this zone.) The procedure to be followed in this event is displayed on the emergency panel under ENGINE FIRE INSTRUCTIONS. Should a fire occur in Zone 2 or 3, warning lights on the appropriate FIRE PULL T-bar handle on the emergency panel will come on. Operation of the handle discharges the extinguishing agent into Zones 2 and 3. If a fire occurs while the APU is being started, the unit must be shut down before pulling the left FIRE PULL T-bar handle. The extinguisher systems are powered by the left and right essential dc buses, protected by FIRE EXT 2 SHOT and FIRE EXT 1 SHOT circuit breakers on PANEL 6 and PANEL 3.

ENGINE FIRE EXTINGUISHER CONTROL HANDLES

212 Two engine fire extinguisher control handles, labeled LH ENGINE ZONE 2 & 3 and RH ENGINE ZONE 2 & 3, are located on the emergency panel (Figure 1-6). The T-bar handles are marked FIRE PULL and have a red warning light at each end of the bar. Pulling either handle fires a cartridge in one extinguisher container, instantly releasing the extinguishing agent to blanket the fire area in Zones 2 and 3. Should a second shot be necessary, the handle

must be pushed in, turned clockwise 90 degrees (handle vertical) and pulled again. This will release the extinguishing agent from the other container.

NOTE

Each container can be discharged once only. Therefore, both can be discharged into one engine, or each can be discharged into its own engine.

SHORT DISCRIMINATOR

213 A short discriminator is incorporated in the fire detecting system to prevent a false fire warning. Should a short occur in the fire detecting system a light on the caution light panel (Figure 1-6) marked CHECK FIRE DET illuminates, together with the MASTER CAUTION Holding the FIRE DETECTION TEST switch (Figure 1-6) momentarily at "TEST" will isolate the defective fire detecting element since the applicable warning light on the emergency panel will not illuminate.

FIRE EXTINGUISHER INDICATING DISCS

214 Two colored discs located on the right side of the fuselage opposite the engine nacelle are provided to indicate the discharge of extinguisher containers. The yellow disc is broken by a pressure operated plunger when the fire extinguisher control handle in the flight compartment is pulled. The red disc is blown out to indicate that a container has been discharged through excessive pressure caused by high temperature. A thermal plug in the container is designed to melt at between 208°F and 220°F, the agent thus released blows out the red disc and exhausts to atmosphere.

FIRE DETECTION TEST SWITCH

215 A FIRE DETECTION TEST switch is located on the emergency panel (Figure 1-6). When held momentarily at "TEST" the warning lights for Zone 1, and the Zone 2 and 3 warning lights in the FIRE PULL T-bar, should illuminate.

PORTABLE FIRE EXTINGUISHERS

216 Three hand-operated fire extinguishers are installed in the aircraft. CO2 type extinguishers are installed, one in the flight compartment (Figure 1-2 sheet 2) behind and below the pilot's seat and on the left side of the rear fuselage at floor level between frames 3 and 4 (Figure 3-1). A glycol type A2O extinguisher is installed in the cabin on the right aft face of the cabin-flight compartment bulkhead (Figure 3-1). Each fire extinguisher is retained in a bracket mounted to the aircraft structure.

FIRST AID KITS

217 Provision is made for three first aid kits, one in the flight compartment on the left radio rack and one on each cabin wall forward of the entry doors (Figure 3-1).

EMERGENCY EXITS

218 Seven emergency exits are provided (Figure 3-1), two in the flight compartment in the form of an upper and lower hatch, two in the cabin located one on each side between Arms 290 and 320, aft of the propeller line, one in the cargo door and both passenger doors (jettisonable).

219 The flight compartment exits consist of a hatch in the roof immediately aft of the pilot's position, and a bottom hatch in the well behind the pilot's and copilot's seats (Figure 3-1). Access to the bottom hatch is gained by opening the two doors in the flight compartment floor (Figure 1-2 sheet 2). When the doors are opened a limit switch is activated and the well illuminated by a lamp recessed in the aft face of the well. The hatch may be jettisoned, if required, by operating a handle (Figure 1-2 sheet 1) located in a recess in the bulkhead above the doors and marked BOTTOM HATCH JETTISON - OPEN INSIDE DOORS BEFORE PULLING HANDLE. The upper doors must be opened first as they would be difficult to open during flight with the lower hatch jettisoned.

220 The upper hatch can be opened from either inside or outside the aircraft by the handle (Figure 1-2 sheet 2) marked EXIT RELEASE - PRESS BUTTON AND TURN HANDLE. The upper hatch is hinged on the right side and is not jettisonable. A webbing strap marked EMERGENCY SLIDE (Figure 1-2 sheet 2) is fitted below the upper hatch,rolled up and retained on top of the left circuit breaker switch box,and is provided to aid escape from the flight compartment. The flight compartment lower hatch may be used for exit during flight,but the upper hatch, because of its proximity to the propellers, is for use on the ground only with the engines stopped.

221 The cabin emergency exits can be jettisoned in flight by lifting a guard and turning the handle; this withdraws the exit retaining pins and allows the exit to be pushed free of the aircraft. Each exit can also be opened on the ground from outside the aircraft by following the instructions on the outside of the exit.

222 The cargo door incorporates an escape hatch (Figure 3-1) near its forward end and is labeled EMERGENCY HATCH. It is hinged at its forward edge and has a hatch release labeled HATCH RELEASE PULL HANDLE with a directional arrow.

223 Both passenger doors can be used as emergency exits and can be opened from either inside or outside the aircraft. The passenger doors are both jettisonable from inside the aircraft by pulling the lightly wire locked jettison handle located at the top forward edge of the door frame. It may be necessary to push the door to initiate its separation from the aircraft.

ALARM BELL

224 An alarm bell is provided on the right wall of the cabin above the emergency exit door (Figure 3-1).

ALARM BELL SWITCH

225 The alarm bell switch is a center off lock switch, located on the AERIAL DELIVERY panel (Figure 1-31) on the overhead console. It is marked ALARM BELL with selections at "OFF" in the center lock position and "ON" in the down position. The alarm bell circuit is powered from the left 28-volt main dc bus, protected by an AERIAL DELIVERY ALARM circuit breaker on PANEL 6.

CRASH AXE

226 A crash axe is stowed in a case assembly in the cabin attached to the cabin-flight compartment bulkhead below the blackout curtains stowage bag, and to the right of the snatch block stowage bag (Figure 3-1).

OXYGEN SYSTEM

GENERAL

227 A diluter demand type oxygen system will provide 4.6 hours supply of oxygen for a crew of three, or 3.5 hours supply for a crew of four at an altitude of 15,000 feet. A supply of gaseous oxygen is stored in two interconnected cylinders on the left side of the cabin-flight compartment bulkhead. The cylinders are recharged through a filler valve in the left side of the fuselage through an access panel (Figure 1-1). Provision is made for the installation of a removable kit to provide extra capacity for four people for 12 1/2 hours at 25,000 feet altitude. Figure 1-32 is the oxygen duration chart.

228 An oxygen cylinder pressure gage indicates the pressure in the cylinders, of which the nominal charging pressure is 1800 ± 50 psi.

229 A shutoff valve is provided on the flight compartment floor to the left of the pilot's seat, (Figure 1-2 sheet 1) and is turned counterclockwise for oxygen flow from the cylinders to an oxygen regulator at each of the crew positions, where the pressure is reduced to a breathable level.

230 An oxygen hose connection for each crew member is located adjacent to the crew member's position. When the system is in operation, and with the diluter switch set at NORMAL OXYGEN, air is drawn into the breathing system and is automatically mixed with oxygen from the supply cylinder to give the total needed oxygen up to approximately 30,000 ft; above this altitude 100% oxygen is delivered automatically.

OXYGEN DURATION IN HOURS-DILUTER DEMAND SYSTEM

CYLINDERS: 2 - TYPE AN 6025 AX 386

THREE CREW MEMBERS						FOUR CREW MEMBERS					
ALTITUDE FEET	GAGE PRESSURE - PSI					ALTITUDE FEET	GAGE PRESSURE - PSI				
	1800	1600	1400	1200	1000		1800	1600	1400	1200	1000
8000	0.8 3.3	0.7 2.9	0.6 2.6	0.5 2.2	0.4 1.8	8000	0.6 2.5	0.5 2.2	0.4 2.0	0.4 1.6	0.3 1.3
10,000	0.8 3.6	0.7 3.2	0.6 2.8	0.6 2.4	0.5 2.0	10,000	0.6 2.7	0.5 2.4	0.4 2.1	0.4 1.8	0.4 1.5
12,000	0.9 4.0	0.8 3.6	0.7 3.1	0.6 2.7	0.5 2.2	12,000	0.7 3.0	0.6 2.7	0.5 2.3	0.4 2.0	0.4 1.6
14,000	1.1 4.4	1.0 3.9	0.9 3.5	0.7 3.0	0.6 2.5	14,000	0.8 3.3	0.7 2.9	0.7 2.6	0.5 2.2	0.4 1.9
15,000	1.2 4.6	1.1 4.1	0.9 3.6	0.8 3.0	0.7 2.5	15,000	0.9 3.4	0.8 3.1	0.7 2.7	0.6 2.2	0.5 1.9
20,000	1.5 4.2	1.3 3.8	1.2 3.3	1.0 2.8	0.8 2.4	20,000	1.1 3.1	1.0 2.8	0.9 2.5	0.7 2.1	0.6 1.8
25,000	2.0 2.4	1.8 2.1	1.6 1.9	1.3 1.6	1.1 1.3	25,000	1.5 1.8	1.3 1.6	1.2 1.4	1.0 1.2	0.8 1.0
30,000	2.6 2.6	2.4 2.4	2.1 2.1	1.8 1.8	1.5 1.5	30,000	2.0 2.0	1.8 1.8	1.6 1.6	1.3 1.3	1.1 1.1

NOTE: UPPER FIGURES DENOTE DURATION WITH DILUTER SWITCH AT "100% OXYGEN"
LOWER FIGURES DENOTE DURATION WITH DILUTER SWITCH AT "NORMAL OXYGEN"

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Figure 1-32 Oxygen Duration Chart

OXYGEN REGULATORS

231 An oxygen regulator, marked OXYGEN REGULATOR, PRESSURE DEMAND, is provided adjacent to each crew member position. The pilot's regulator is located on the pilot's pedestal, (Figure 1-9), the copilot's regulator on the copilot's pedestal, the flight technician's regulator is located on the top shelf of the right radio rack, and the navigator's regulator is on the navigator's panel (Figure 1-30).

232 The four regulators are identical and each has edge type lighting for panel illumination. A gage marked OXYGEN PSI, calibrated from 0 to 2000 psi, with a white arc from 0 to 300 (low level) and FULL at 1800 psi. In addition, a blinker indicator marked FLOW which shows that oxygen is flowing on demand to the user's mask, and three individually colored switches for controlling the oxygen supply flow are provided as follows:

(a) Supply Switch (Green Color). The supply two-position switch on the right of the panel is marked SUPPLY with "ON" and "OFF" at the up and down positions. The switch is used to control the supply of oxygen at each panel.

(b) Diluter Switch (Black Color). The diluter two-position switch on the lower center of the panel is marked "100% OXYGEN" and "NORMAL OXYGEN" at the up and down positions. With the switch at "NORMAL OXYGEN", the oxygen passes through a diluter demand route for normal operation. At "100% OXYGEN", the air valve of the diluter demand route is closed and pure oxygen only is fed to the user's mask; this position should be selected if any doubt exists regarding the oxygen supply.

NOTE

When 100% oxygen is used, the oxygen duration will be reduced.

(c) Pressure Supply Switch (Red Color). The pressure supply three-position switch on the left of the panel is marked "EMERGENCY" and "NORMAL" at the up and center positions, and "TEST MASK" at the down (momentary) position which is selected against a spring tension. The switch should be at "NORMAL" position for routine operation to allow regulated oxygen pressure to be supplied to the user. At "EMERGENCY" position a continuous positive pressure of oxygen is supplied to the user regardless of altitude, to prevent hypoxia or unconsciousness. When the switch is held at "TEST MASK" position, oxygen at positive pressure is supplied to test the user's mask for leaks.

CAUTION

When positive pressures are required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to insure no leakage, the continued use of positive pressure under these conditions will result in the rapid depletion of the oxygen supply.

OXYGEN SHUTOFF VALVE

233 The oxygen shutoff valve on the flight compartment floor to the left of the pilot's seat (Figure 1-2 sheet 1) is used to stop the flow of oxygen from the cylinders to the four oxygen regulator panels. The valve is marked OXYGEN SHUTOFF VALVE and OFF, and arrowed clockwise.

OXYGEN CHARGING VALVE AND PRESSURE GAGE

234 The oxygen charging valve and pressure gage are mounted on a panel on the left side of the nose (Figure 1-1). The gage dial is marked OXYGEN CYLINDER PRESSURE and is graduated from 0 to 2000 psi. A label under the access panel is inscribed CHARGING PRESSURE 1800 ± 50 PSI.

OXYGEN SYSTEM CHECK

235 Before entering the aircraft, check the oxygen cylinder pressure gage reading to insure there is sufficient oxygen for the mission. On entering the flight compartment turn the oxygen shutoff valve fully counterclockwise to allow the oxygen to flow to the oxygen regulators. When seated in position place the regulator supply switch to "ON" and check that the oxygen supply pressure gage reading is within normal supply limits. Fit and connect mask, then check oxygen flow and supply with diluter switch at "100% OXYGEN", then at "NORMAL OXYGEN" with the pressure supply switch at NORMAL. Check supply with the pressure supply switch at "EMERGENCY" and at "TEST MASK". Check should be repeated for each position being used. Move regulator supply switch to "OFF". Before leaving the flight compartment turn the oxygen shutoff valve fully clockwise to OFF, and the regulator pressure supply switch to "NORMAL".

NAVIGATION EQUIPMENT

GENERAL

236 A horizontal situation indicator (HSI) and HSI control panel, and VOR/glide slope cross pointer indicator is installed on both the pilot's and copilot's instrument panel. A radio magnetic indicator (RMI) is installed on the navigator's panel. A J2 compass system provides magnetic heading information to the HSI's and RMI and a standby magnetic compass is installed on the windshield center post. Provision is made for the installation of a MK 2 type drift recorder on a mounting plate installed in the second window aft of the cabin-flight compartment bulkhead on the left side of the cabin. A sextant mount is permanently installed in the cabin roof aft of the cabin-flight compartment bulkhead and to the left of the centerline. This mount can be used to install the Type 1471B-01 periscopic sextant.

HORIZONTAL SITUATION INDICATOR

237 The HSI, type IDS-5-2, displays navigation information as viewed from above the aircraft looking down. It is a combination heading indicator, radio magnetic indicator, track indicator, and range indicator. The HSI may display TACAN, VOR, ADF and FM track information; VOR, TACAN and ADF bearing information and TACAN distance information. The aircraft heading is displayed on a rotating compass card under the heading lubber line (Figure 1-33). There is also a reciprocal lubber line, 90° and 270° markers, and 45° markers. The card is calibrated in 5-degree increments. The bearing pointer indicates the magnetic bearing from the aircraft to the selected ground station (VOR, TACAN or ADF). The bearing pointer has a short reciprocal bearing pointer. The fixed aircraft symbol and lateral deviation bar display the aircraft's position relative to the selected track(TACAN, VOR, ADF or FM). The bar moves at right angles to its length across a 5 dot scale. Each dot represents 5 degrees, giving 10 degrees off-track indication either side of center. The lateral deviation bar rotates with the track arrow and the compass card when track is set, and with the track arrow only when the track knob is rotated. The track arrow has a short reciprocal track arrow.
The heading marker is adjusted to the desired heading by rotating the selector knob in the lower right corner of the instrument. The marker then rotates with the compass card as aircraft heading changes. The to-from station pointer points continuously to the selected radio

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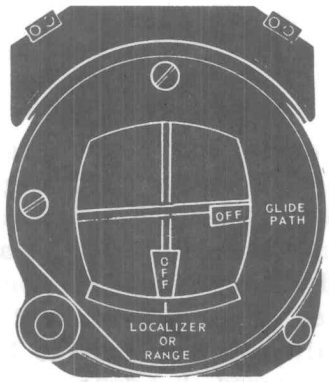
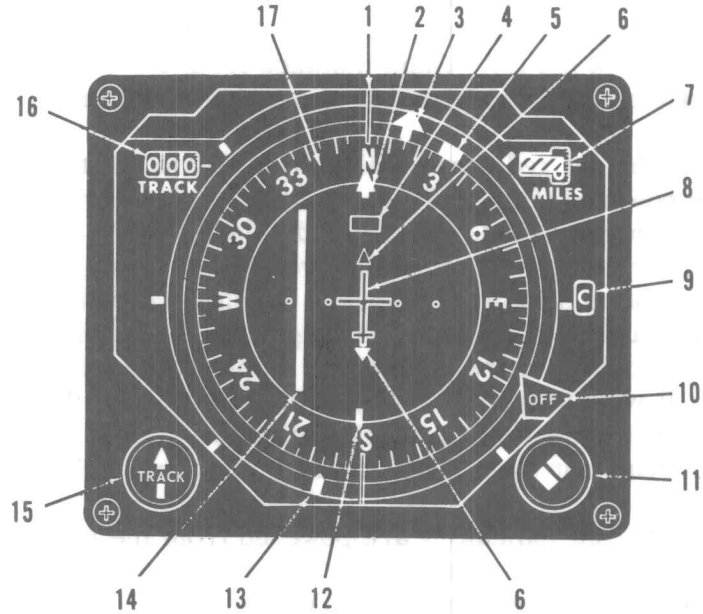
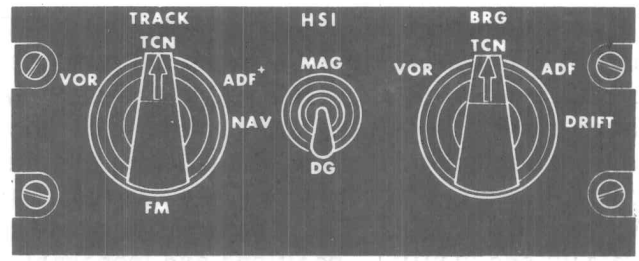


VOR/GLIDE SLOPE INDICATOR



HORIZONTAL SITUATION INDICATOR



HSI CONTROL PANEL

1 LUBBER LINE
2 TRACK ARROW
3 BEARING POINTER
4 DEVIATION FLAG
5 HEADING MARKER
6 TO-FROM INDICATOR
7 DISTANCE WINDOW
8 AIRCRAFT SYMBOL
9 MAGNETIC SYNCHRONIZATION WINDOW
10 POWER FAILURE FLAG
11 HEADING SETTING KNOB
12 RECIPROCAL BEARING POINTER
13 RECIPROCAL TRACK ARROW
14 LATERAL DEVIATION BAR
15 TRACK SETTING KNOB
16 TRACK SELECTOR WINDOW
17 ROTATING COMPASS CARD

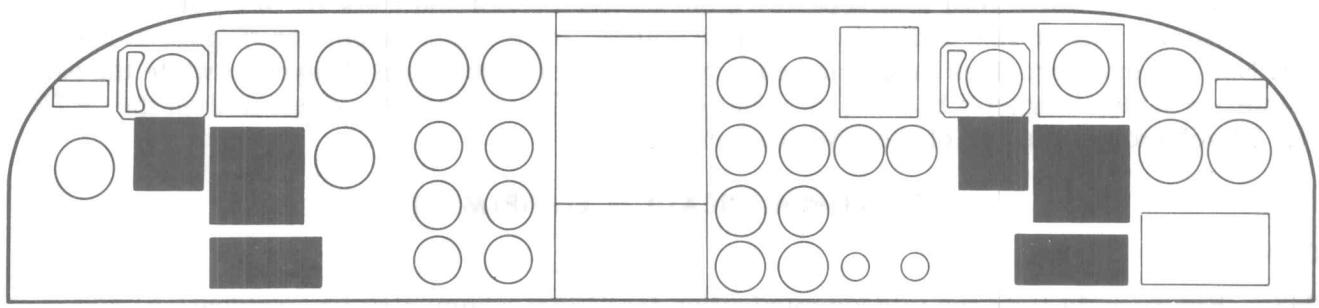


Figure 1-33 Horizontal Situation Indicator, HSI Control Panel and VOR/Glide Slope Indicator

navigation station in the plane of the track arrow. Whether the aircraft is heading towards or away from a station, on or off the selected track, or on a holding pattern, the pilot is presented with a positive correct sense of orientation. The ADF system will not activate the to-from indicators on the HSI. Slant distance from a selected TACAN station is displayed on the digital read out in the upper right corner of the instrument.

238 A bright red power failure flag located just above the heading knob disappears when the HSI is powered (Figure 1-33). A magnetic synchronization display window on the right side of the instrument at the center line displays a "C", "CC", or blank section. If a "C", or "CC" appears synchronization is achieved by depressing and rotating the spring loaded heading knob. This initiates slewing signals and synchronization is achieved when the blank section of the flag appears in the window. A bright red deviation flag between the track arrow and reciprocal track arrow above the center line displays track bar unreliability when selected to TACAN or VOR. It will disappear when selected to ADF, if the ADF is powered, but does not serve an unreliability function. A black and yellow striped shutter falls to partially cover the distance digital read-out when signal reception is unreliable or when interrogating the ground station.

239 The HSI indicators are powered from the left 28-volt main dc and the left 26-volt 400 cycle buses,protected by NAV-PRES PILOT 28 VDC and 26 VAC and NAV-PRES COPILOT 28 VDC and 26 VAC circuit breakers on PANEL 8.

HSI CONTROL PANEL

240 An HSI control panel located below each HSI is used to select the desired presentation on the HSI (Figure 1-33). This panel has two selectors, one for track and one for bearing and a two position switch which can be selected to "MAG" or "DG". In the "MAG" position the HSI is slaved to the J2 compass while in the "DG" position, it provides for free gyro operation in areas where magnetic heading information is unreliable. The MAG DG switch on the copilot's HSI control panel is inoperative. The "TRACK" selector has positions "VOR", "TCN", "ADF", "NAV" and "FM". The "BRG" selector has positions "VOR", "TCN", "ADF" and "DRIFT". The "NAV" and "DRIFT" positions are inoperable pending installation of additional avionics equipment.

VOR/GLIDE SLOPE INDICATOR

241 The VOR/glide slope cross pointer (ID-48) (Figure 1-33) is an interim indicator pending installation of the flight director system. It gives a standard ILS presentation of localizer and glide slope when the NAV receiver on the COMM/NAV control panel is activated and selected to ILS frequencies.

RADIO MAGNETIC INDICATOR

242 The navigator's RMI is a repeater from the pilot's HSI and consists of a rotating compass card and lubber line and a No. 1 narrow pointer and No. 2 wide pointer (Figure 1-30). The No. 1 pointer provides magnetic bearing information from the ADF system while the No. 2 pointer provides magnetic bearing information from VOR or TACAN as selected on the "PTR No. 2" selector to the left of the RMI indicator.

TELECOMMUNICATION EQUIPTMENT

GENERAL

243 Figure 1-34 lists the telecommunication facilities: communication, navigation, and radar, installed in the aircraft. Further details are given in paragraphs 244 to 281. The location of antennas is shown in Figure 1-35.

TELECOMMUNICATION FACILITIES

Type	Designation	Function	Operator	Range	Location Of Controls
Intercom and Audio System	Intercom and Audio System (AN/AIC-18)	Intercommunication between crew members. Facilitate monitoring all communication and navigation reception, and transmission on the selected radio transmitter by pilot, copilot or navigator. Walk-around communication both inside and outside the aircraft.	Pilot, Copilot, Navigator and Flight Technician	Not Applicable	Pilot and Copilot sliding console, flight technician's panel, navigator's panel and aft of left passenger door
UHF Command Communications	Transmitter receiver (AN/ARC-552)	Air-to-air and air-to-ground communication	Pilot, Copilot	Line of sight	Sliding Console
VHF System	618 M-1	Air-to-air and air-to-ground communication	Pilot, Copilot	Line of sight 50 miles at 3000 ft approximately	Sliding Console
HF Radio	AN/ARC-505(V)	Two-way voice communications	Pilot, Copilot	Indefinite	Sliding Console
FM and HOMING System	AN/ARC-54	Air-to-air and air-to-ground communication and FM homing	Pilot, Copilot	Line of sight up to 50 miles	Sliding Console

Figure 1-34 (Sheet 1 of 2) Telecommunication Facilities

TELECOMMUNICATION FACILITIES (Cont'd)

Type	Designation	Function	Operator	Range	Location Of Controls
ADF	Direction finder receiver (AN/ARN-59)	Homing and position fixing, aircraft bearing, radio broadcast receiver	Pilot, Copilot	First class bearing 100 miles	Sliding Console
TACAN	TACAN (AN/ARN-501)	Navigation and approach aid which provides bearing and distance information	Pilot, Copilot	From 75 to 200 miles line of sight, depending on altitude	Sliding Console
VOR and G/S System	AN/ARN-82 and 51V-5	VHF omnidirectional range for navigation and runway localizer and glide slope for approach aid	Pilot, Copilot	Line of sight 50 miles at 3000 ft approximately and approximately 15 miles for glide slope	Sliding Console
Marker Beacon Receiver	Beacon Receiver (MN-53B)	Visual and aural indication of marker beacon passage	Pilot, Copilot	Not Applicable	Sliding Console
IFF/SIF	AN/APX-25	Identification friend or foe, with provision for selective identification feature (SIF)	Pilot, Copilot	Line of sight	Sliding Console
RADAR ALTIMETER SYSTEM	AN/APN-133A	To indicate absolute altitude	Pilot, Copilot	0 - 50,000 ft	Located on set on right radio rack

Figure 1-34 (Sheet 2 of 2) Telecommunication Facilities

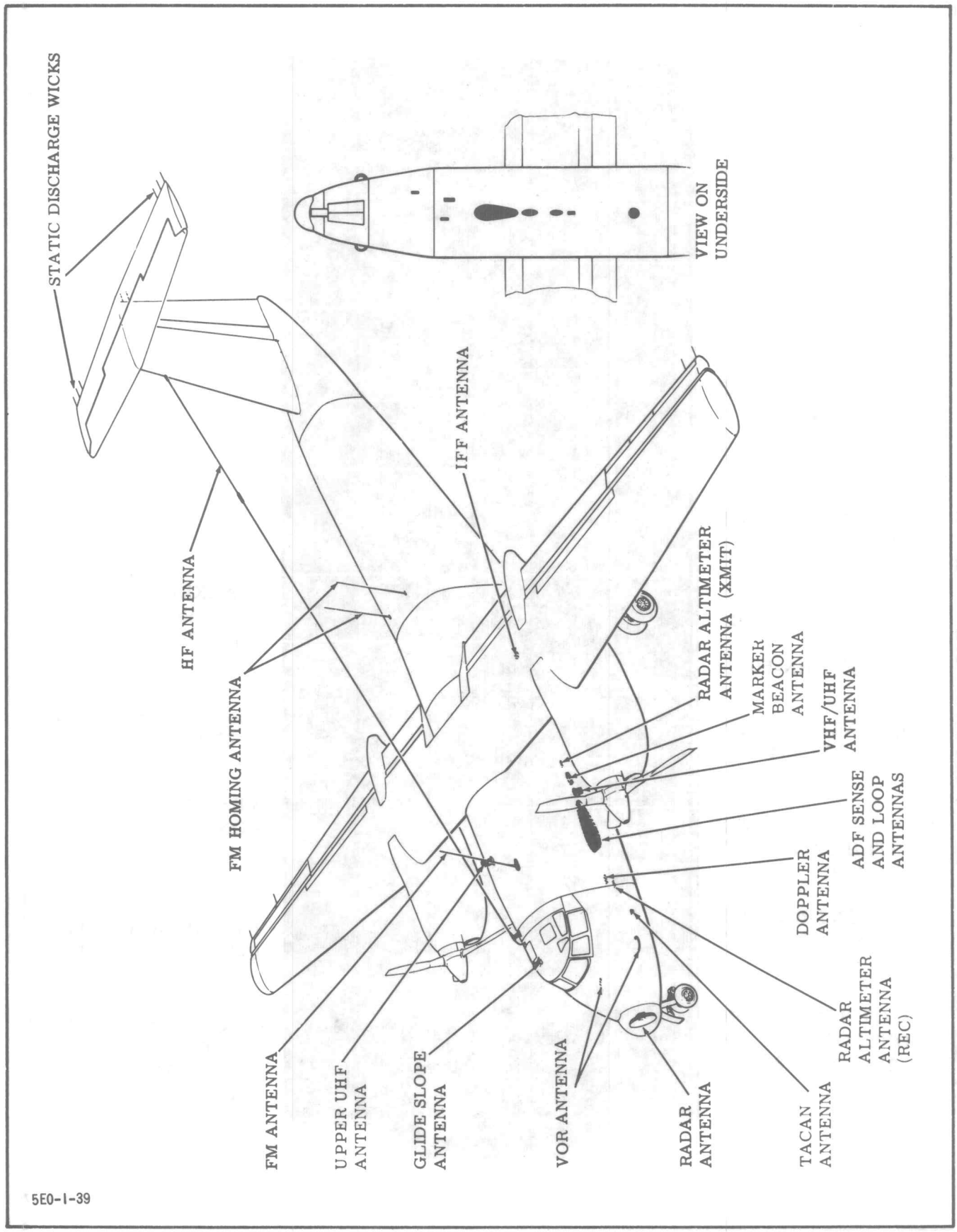


Figure 1-35 Location of Antennas

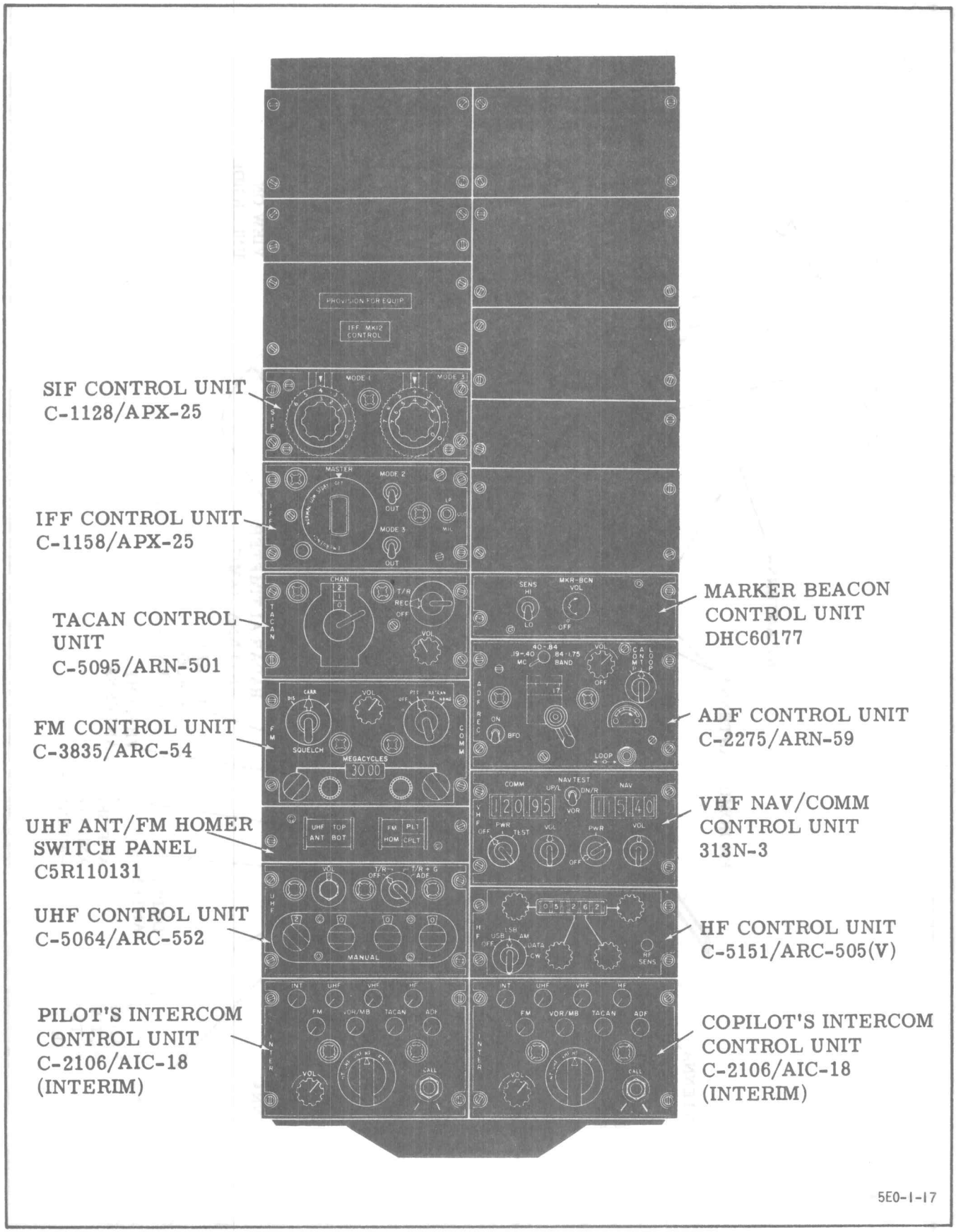


Figure 1-36 Radio Console

INTERCOM AND AUDIO SYSTEM

244 The AN/AIC-18 intercom and audio system provides intercommunication between the pilots and crew members, monitoring of all communication and navigation receivers, and microphone transmission over the selected radio transmitter. Provision is also made, by using the 35 foot extension, for walk around intercom inside the aircraft from the receptacle aft of the left passenger door, or outside the aircraft from external receptacles, one on each side of the fuselage nose.

245 There are five control panels, marked INTER (Figure 1-36): pilot's and copilot's, flight technician's, navigator's and the cargo area panel. Each control panel contains eight combination receiver monitor-switch/volume controls for monitoring and individual audio level adjustment. These are pull "on", push "off" button switches which can be rotated to vary the volume. These switches are labeled INT, UHF, VHF, HF, FM, VOR/MB, TACAN and ADF. The VOR/MB, TACAN, and ADF switches are not connected on the flight technician's and cargo area control panels. The control panels each contain a rotary transmitter selector switch labeled "INT", "VHF", "UHF", and "FM". This selector enables transmission, audio monitoring, and sidetone from the selected equipment. The flight technician's and cargo area control panels have only the "INT" position connected. The control panels also contain VOL controls to adjust signal level to the headphones, and a "CALL" button for emergency call operation.

246 The pilot and copilot each have two combined microphone switches connected in parallel. For each position, one switch marked TX-1C is installed on the control wheel, and the other switch marked MIKE - INPH is foot operated. The microphone switches for the navigator, flight technician, cargo area position, and on the extension cord, are integral with the headset/microphone jacks.

247 The pilot's, navigator's and cargo area control panels are powered from the left 28-volt main dc bus,protected by the PLT INT 28 VDC circuit breaker on PANEL 8,and the copilot's and flight technician's control panels are powered from the right 28-volt main dc bus,protected by the COPLT INT 28 VDC circuit breaker on PANEL 4. The control panels are automatically powered when the main DC buses are powered.

UHF SYSTEM

248 The AN/ARC-552 UHF system provides voice transmission and reception in the frequency range of 225 to 399.9 mcs and continuous monitoring of the guard frequency (243 mcs). Transmission and reception are on the same frequency; 1750 channels are available in steps of one-tenth megacycle. Any one of the 1750 channels can be selected on the control panel located on the sliding console.

249 The control panel marked UHF (Figure 1-36) contains four MANUAL frequency selector knobs for setting up the desired frequency, (the digits of the frequency appear in windows adjacent to the knobs), a volume control, and a function switch. The function switch has positions marked "OFF" which deenergizes the set, "T/R" which energizes the transmitter and receiver on the same frequency, and "T/R & G" which energizes the transmitter and receiver in the same manner as "T/R" but also energizes the guard receiver. The "ADF" position on the function switch is inoperative.

250 Immediately above the UHF control panel is a panel which has a UHF antenna switch marked UHF ANT, and a push-to-select switch marked TOP and BOT. This switch selects the desired antenna, and the switch TOP or BOT position illuminates accordingly.

251 The UHF is powered from the left 28-volt main dc bus protected by the UHF 28 VDC circuit breaker on PANEL 8 and from the left 115/200-volt three phase buses protected by UHF 115 VAPH, 115 VBPH, and 115 VCPH circuit breakers on PANEL 8.

VHF SYSTEM

252 The 618M-1 VHF system provides amplitude modulation (AM) communication in the 118.0 to 135.95 mc frequency range.

253 The control panel marked COMM (Figure 1-36), is the left side of the dual COMM/NAV panel. This control panel has a concentric function selector marked "OFF", "PWR", and "TEST", the lower section of the selector being a frequency selector. It also has a concentric selector marked VOL, the lower section of the selector being a frequency selector. The numerals of the selected frequency appear in a cutaway window on the panel.

254 The VHF system is powered from the right 28-volt main dc bus protected by the VHF 28 VDC circuit breaker on PANEL 4.

HF SYSTEM

255 The AN/ARC-505 (V) HF system provides USB (upper side band), LSB (lower side band), and AM (amplitude modulation) communications in the 2 mc to 30 mc frequency band. Any one of 28,000 preset channels can be selected on the HF control panel.

256 The control panel marked HF (Figure 1-36), has a rotary mode selector switch marked "OFF", "USB", "LSB", "AM", "DATA" and "CW". The "DATA" and "CW" modes are not used. The panel also has four dials to set the frequency, the numerals of which appear in the FREQ window, and an RF SENS control knob. The HF antenna coupler is located on the top right radio rack. Antenna coupler remote amber and green indicator lights are located on the same radio rack below the ground speed and interception computer. After a frequency change, transmissions should be delayed until the amber light goes out (approximately six seconds). Illumination of the green light only, indicates the antenna is tuned to the selected frequency.

257 The HF system is powered from the right 28-volt main dc bus and the right 115/200-volt 400 cycle bus,protected by the HF 28 VDC and 115 V3PH circuit breakers on PANEL 4.

FM SYSTEM

258 The AN/ARC-54 FM system provides frequency modulation (FM) communication and homing facilities in the 30.00 to 69.96 mc band. Transmission and reception are on the same frequency.

259 The control panel marked FM on one side, COMM on the other (Figure 1-36) has a rotary function switch labeled "OFF" "PTT" (press-to-talk) "RETRAN", which is inoperable, and "HOME". There is also a SQUELCH switch with positions labeled "DIS" (disable), and "CARR" (carrier). The volume control is arrowed clockwise for increase. Two frequency selector dials are used to set the desired frequency in the MEGACYCLES window. Immediately below the FM COMM panel is a panel which has a switch marked FM HOM and a push-to-select switch marked PLT and CPLT. This switch selects homer presentation on the desired HSI and either PLT or CPLT illuminates.

260 The FM system is powered from the left 28-volt main dc bus protected by the FM 28 VDC circuit breaker on PANEL 8.

ADF SYSTEM

261 The AN/ARN-59 ADF system provides automatic direction finding, aural null direction finding, automatic or aural null bearing and track information and radio broadcast reception. The system operates in the 190 to 1750 kc frequency range which is covered in three bands, 190 to 400 kcs, 400 to 840 kcs, and 840 to 1750 kcs.

262 The control panel marked ADF REC, (Figure 1-36), contains a frequency band select switch, tuning control, tuning indicator, an arrowed volume control on/"OFF" switch, beat frequency oscillator switch, loop switch and function switch. The function switch, marked "COMP" - "ANT" - "LOOP" selects the operating mode. The "COMP" position is for automatic direction finding, where magnetic bearing information is displayed on the pilot's and copilot's HSI (horizontal situation indicators) and the navigator's RMI (radio magnetic indicator), the "ANT" position for non-directional reception, and the "LOOP" position for manual direction finding in which the loop is rotated by the LOOP switch and magnetic bearing indicated on the HSI's and RMI when an aural null is obtained. ADF track information can also be selected on the HSI's. The ADF system will not activate the to-from indicators on the HSI.

263 The ADF system is powered from the left 28-volt main dc bus protected by the ADF 28 VDC circuit breaker on PANEL 8,and by the left 26-volt single phase bus protected by the ADF 26 VAC circuit breaker on PANEL 8.

TACAN SYSTEM

264 The AN/ARN-501 Tacan system operates in conjunction with a surface beacon to form a radio navigation system which provides beacon identification, bearing, and distance information relative to a selected beacon. The system provides 126 channels at 1 mc spacing to enable the operator to select a desired ground station.

265 The control panel marked TACAN (Figure 1-36), has a CHAN selector, a three position ("OFF", "REC", "T/R") function switch, and a volume control knob. With the function switch at "REC", only bearing information and station identification is received; with the switch in T/R position, bearing, range and identification are received. Magnetic bearing and range information are displayed on the HSI when HSI TRACK and BRG selectors are selected to "TCN", and magnetic bearing information on the navigator's RMI when the PTR NO. 2 switch (Figure 1-31) is pushed to illuminate TAC.

266 The TACAN is powered from the left 28-volt 400 cycle bus and the left 115/200 volt variable frequency bus. These circuits are protected by the TACAN 28 VDC, 115 VAC, 26 VAC and 115 VAC VAR FREQ circuit breakers on PANEL 8.

VOR AND GLIDE SLOPE SYSTEM

267 The AN/ARN-82 and 51V-5 VOR and G/S system provides very-high frequency omnidirectional range, runway localizer and glide slope facilities. VOR signals are received from 108.2 to 117.9 mc. Runway localizer signals are received from 108.1 to 119.9 mc with simultaneous glide slope tuning and reception from 329.3 to 335.0 mc.

268 The control panel marked NAV (Figure 1-36) is the right side of the dual COMM/NAV panel. This control panel has a concentric function selector marked "OFF" and "PWR", the lower section of the selector being a frequency selector. It also has a concentric selector marked VOL, the lower section of the selector being a frequency selector. The numerals of the selected frequency appear in a cutaway window on the panel. A NAV TEST VOR switch, spring-loaded to center, is marked DN/R and UP/L on the right and left side of the switch.

269 VOR bearing information is displayed on the pilot's and copilot's HSI's. Localizer information is displayed on the HSI's and on the interim cross pointer indicators,and glide slope information is displayed on the interim cross pointer indicators. VOR bearing information is also displayed on the navigator's RMI (Figure 1-31) when the PTR NO. 2 switch is pushed to illuminate VOR.

270 The VOR and G/S system is powered from the left 28-volt main dc bus and left 26-volt 400 cycle bus, protected by the VOR 28 VDC and 26 VAC circuit breakers on PANEL 8.

MARKER BEACON RECEIVER

271 The MN-53B marker beacon receiver provides visual and aural indication of aircraft passage over a ground marker beacon system. The receiver operates on a fixed frequency of 75 mc and receives am signals modulated at 400 cps from the outer marker to operate the blue indicator light, 1300 cps from the middle marker to operate the amber light and 3000 cps from the airways marker to operate the white light. The lights are located on the pilot's instrument panel (Figure 1-25).

272 The control panel marked MKR - BCN, (Figure 1-36) contains a directional arrowed VOL control, which also incorporates the power ON/"OFF" switch, and a SENS "HI"/"LO" switch.

273 The marker beacon receiver is powered from the right 28-volt main dc bus protected by the MKR BCN 28 VDC circuit breaker on PANEL 4.

J2 COMPASS SYSTEM

274 The J2 compass system provides magnetic heading information to the compass card on the pilot's HSI and through a repeater amplifier, heading information for the copilot's HSI, and the navigator's RMI. A slaving switch marked "MAG" "DG" on the pilot's HSI control panel provides for free gyro operation in areas where magnetic heading information is unreliable. The switch when set to "DG", operates a relay to isolate the compass transmitter signals from the gyro. A remote compensator located on the left radio rack counteracts distortion originating from aircraft magnetic parts.

275 The J2 compass is powered from the left 28-volt main dc bus, the left 26-volt 400 cycle bus, the left 115/115-volt 400 cycle lead bus, and the left 115/115-volt 400 cycle lag bus,protected by COMPASS 28 VDC, 26 VAC, 115 VAC LEAD and 115 VAC LAG circuit breakers on PANEL 8.

IFF/SIF SYSTEM

276 The AN/APX-25 IFF/SIF system is a pulse type transponder set which provides automatic selective identification of the aircraft in which it is installed to ground recognition stations.

277 Control is from two panels one marked IFF, the other SIF (Figure 1-36). The IFF panel has a rotary selector labeled MASTER and has positions marked "OFF", "STBY", "LOW", "NORMAL" and "EMERGENCY". A red button adjacent to the selector must be depressed before "EMERGENCY" can be selected. The IFF panel also has two, two-position switches marked "MODE 2" and "OUT" and "MODE 3" and "OUT" and a three position switch marked "IP", "OUT" and "MIC". The switch can be held in the "IP" (spring-loaded) position or selected to "OUT" or "MIC" positions. The SIF panel contains two concentric dials labeled MODE 1 and MODE 3. The outer knob of the MODE 1 dial bears the numbers 0 through 7 and

the inner knob from 0 through 3, thus making possible 32 different selected responses. The outer and inner knobs of MODE 3 dial each are numbered 0 through 7 making possible 64 different selected responses.

278 The IFF/SIF is powered from the right 28-volt main dc bus and the right 115/200-volt 400 cycle bus,protected by IFF 28 VDC and 115 VAC circuit breakers on PANEL 4.

RADAR ALTIMETER SYSTEM

279 The AN/APN-133A radar altimeter system, indicates absolute altitude of the aircraft up to 50,000 feet above land or water. Altitude indication is presented on the calibrated face of a cathode ray tube in two ranges, 0 to 5000 ft and 0 to 50,000 feet. The indications are accurate to ± 1% on the low range and ± 2% on the high range.

280 The radar altimeter is located on the right radio rack and the controls are on the set (Figure 1-37). A GAIN control marked "OFF" - "ON" and graduated for gain increase is on the lower left and a graduated CIRCLE SIZE control on the lower right. A SCALE two position switch with markings "TIMES TEN" in the up position and TIMES ONE in the down position is on the upper left. There is also a window above the GAIN control marked ELAPSED TIME REC which displays bobbing dots when the power is on. The altitude scale is marked THOUSANDS OF FEET and is graduated to read 0 to 5000 feet in increments of 50 feet for scale times one and 0 to 50,000 feet in increments of 500 feet for scale times ten. Absolute altitude is read off at the counter clockwise side of the lobe on the green circular trace.

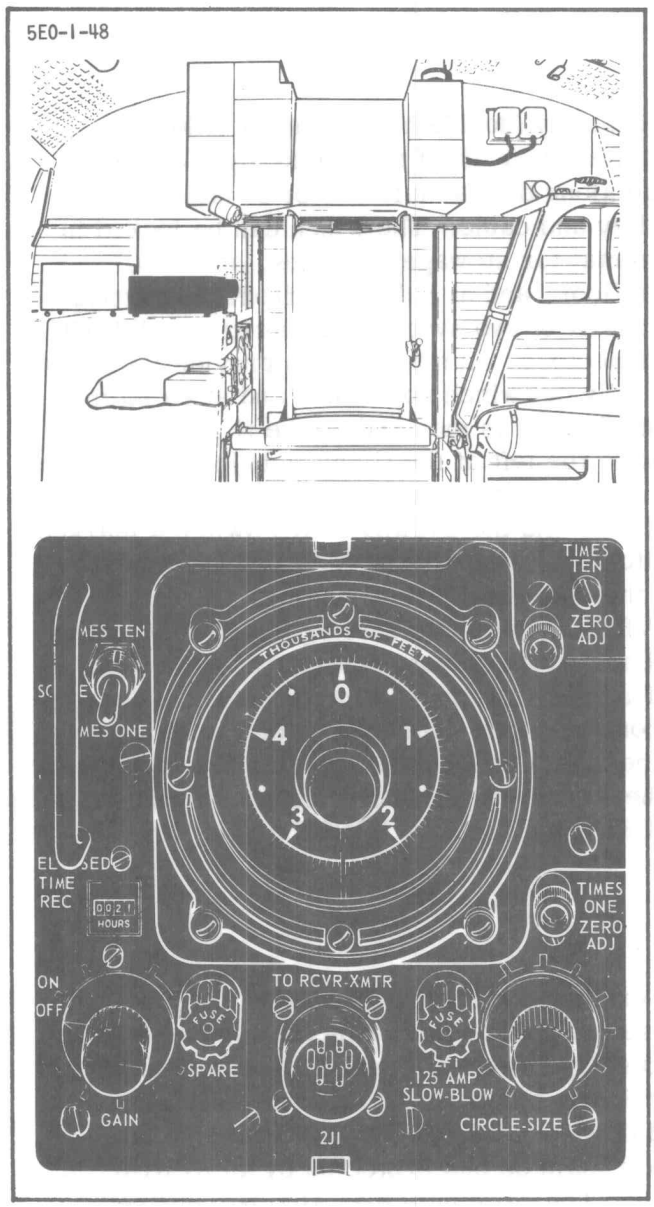


Figure 1-37 Radar Altimeter

281 The radar altimeter is powered from the right 115/200 volt 400 cycle bus,protected by the RDR - ALT 115 VAC circuit breaker on PANEL 4.

CARGO LOADING EQUIPMENT

GENERAL

282 Cargo loading and unloading equipment provided as part of the aircraft equipment are: fuselage steady strut, cargo winch, pendulum release, ramp extensions, roller conveyors, and cargo tie-down devices. For more detailed coverage of cargo loading equipment refer to EO 05-200A-8A CARGO LOADING AND UNLOADING INSTRUCTIONS. The cabin extends from Arm 161.45 to Arm 538.63 and provides 1715 cubic feet of cargo compartment volume. A cargo door, aft of the cabin, consists of a large door hinged at

the rear which opens upward into the fuselage, and a ramp door which is hinged at its forward edge and opens downward, and is an extension of the cabin floor. Refer to paragraphs 198, 199, 200 and 201 for information on cargo and ramp door operation. The cabin floor is of aluminum alloy skin and balsa sandwich construction which will withstand bulk cargo loading of 200 psf anywhere in the area, local foot print pressure of 1000 psf, which at the same time a loading of 1500 lb per running foot must not be exceeded. Vehicle loads on the inboard four inches of the treadways and the full width area aft of Arm 470.0 must not exceed 2000 lb per wheel during loading and unloading, based on a vehicle tire pressure of 50 psi. The treadways outboard of this four inches to Arm 470.0 will withstand loads up to 3000 lb.

FUSELAGE STEADY STRUT

283 An adjustable steady strut is stowed on the aft face of the MB1 stowage box at the cabin-flight compartment bulkhead, where it is secured by a strap and buckle assembly. The steady strut is provided for attachment to the anchor fitting at Arm 510.25 on the fuselage underside forward of the ramp door where it acts as a safety measure against tipping of the aircraft when loading or unloading cargo items weighing 1500 lb or more.

CARGO WINCH

284 An hydraulically-operated winch of 2000 lb capacity (double hauling up to 4000 lb at reduced speeds) is located below the cabin floor immediately aft of the cabin-flight compartment bulkhead. The winch can be used to tow cargo along the cabin floor, or to facilitate operation over the ramp by means of an overhead pulley and cable. The winch can be locked in any one of three positions: 28 degrees below horizontal for stowage purposes, at 9 - 10 degrees above horizontal for towing along the cabin floor, and at 8 degrees from the vertical for use with an overhead pulley. Winch controls consist of two switches mounted on a WINCH control panel (Figure 1-34) and two winch remote selectors. Limit switches provide for automatic shut down of the winch motor at fully in and fully out winch positions, and at an intermediate position when reeling in. The WINCH control panel is mounted on the flight compartment side of the cabin-flight compartment bulkhead to the left of the flight technician's position. The switches are labeled "MASTER" and "INTMD OVRD" (intermediate override). The MASTER switch has marked "ON" and "OFF" positions and the INTMD OVRD switch a marked "OFF" position with "INTMD OVRD" being the switch on position. The MASTER switch when at "ON" connects the winch electrical circuit with the electrical power supply. The intermediate override switch is operated to "INTMD OVRD" to complete reeling in after the safety intermediate limit switch has stopped the winch. Each winch remote selector has positions "OUT" and "IN" with a center stop position. The flight compartment winch selector is located on the left side radio rack adjacent to the WINCH control panel. The cabin winch selector is located just forward of the left passenger door. The detachable control handles are stowable in case assemblies adjacent to their selectors. The winch electrical circuit is powered from the left 28-volt main dc bus and protected by an AERIAL DELIVERY WINCH circuit breaker on PANEL 6.

PENDULUM RELEASE

285 A pendulum release system is provided for extraction or gravity release of cargo loads. The installation consists of an ejector rack, release unit, a mounting bracket, and a pendulum hook, located at the roof centerline between rear fuselage Frames 3 and 4. The extraction (or release) parachute is released from the rack electrically by operation of the PENDULUM RELEASE switch on the AERIAL DELIVERY panel (Figure 1-31) on the overhead console. Power to the circuit is supplied from the left 28-volt main dc bus protected by an AERIAL DELIVERY PEND REL circuit breaker on PANEL 6. The parachute may also be released manually by operation of a handle in the cabin roof at ARM 177.65. The handle is connected by

cable to a release lever on the ejector rack.

RAMP EXTENSIONS

286 Two ramp extensions are provided with the aircraft to facilitate loading and unloading of vehicles or troops. The ramp extensions can be stowed in the aircraft between Arm 510.25 and Frame 7, above the cargo door (Figure 1-1).

TIE-DOWN DEVICES

287 Sixty-nine cargo tie-down rings with an ultimate strength of 5000 lb each, are installed in four longitudinal rows in the cabin floor, eighteen in the left row and seventeen in each of the other rows. Two cargo tie-down rings with an ultimate strength of 10,000 lb each, are installed in the cabin floor, one on each side at Arm 237.00. Each floor tie-down ring is installed in a recessed sheet metal pan, which enables the rings to be stowed below cabin floor surface level. Six tie-down rings with an ultimate strength of 10,000 lb each are installed, three on each cabin wall four inches above floor level at Arms 319.5, 385.2 and 510.3. The wall tie-down rings are not recessed but are detachable. Eight Type MB-1 chain devices and 25 Type MC-1 webbing strap devices are supplied with each aircraft. Stowage boxes for 9 MC-1 and 8 MB-1 devices are located at the lower right side of the cabin-flight compartment bulkhead and 16 MB-1 devices are stowed in two boxes (8 per box), located one on each side of the rear fuselage between Frames 2 and 3.

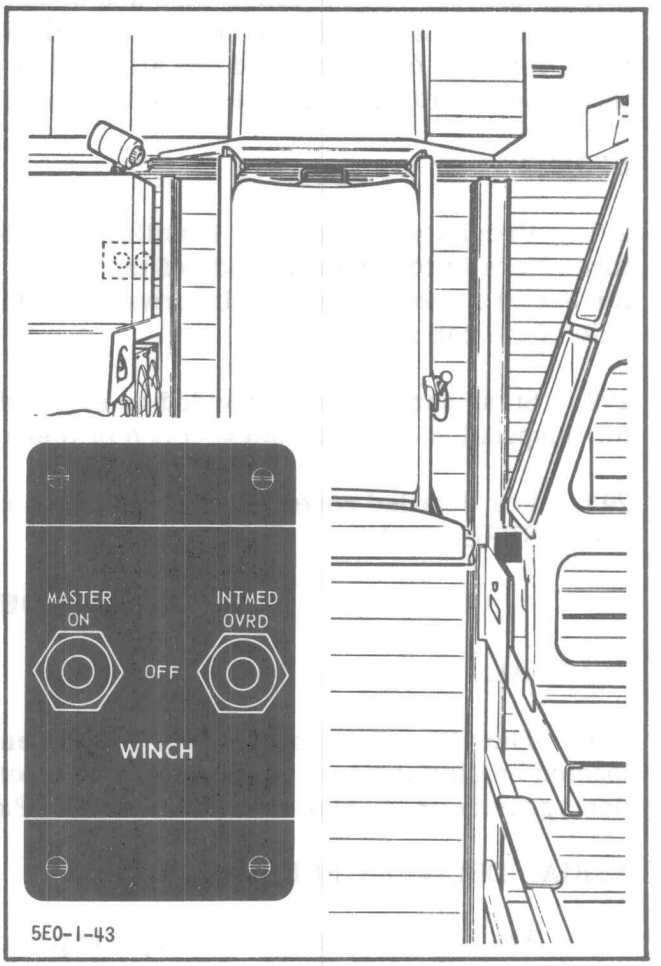


Figure 1-38 Winch Control Panel

TROOP SEATS AND LITTERS

GENERAL

288 Wall type troop seats are provided accommodating 34 troops or 28 paratroops. Seven forward facing one-man seats may be installed on the cabin longitudinal centerline to provide accommodation for an additional seven troops or paratroops. Alternatively, 24 litters and seats for 6 attendants or ambulatory patients may be installed.

TROOP SEATS

289 The troop seats on each side of the cabin are made up of a two-man unit aft of the passenger door, seven two-man units forward of the door and a one-man unit immediately aft of the cabin forward bulkhead. Each of the seven two-man seat units is linked to the adjacent seat by male and female couplings to make one long seat; the back webbing of this long seat is in two sections which are connected together by a slide fastener.

290 Seats may be stowed by folding up against the wall or, for more compact stowage, by

folding the legs and spreader bars and detaching the seat back hooks from the upper support rail. The seats may then be rolled up and secured by the straps provided. Seat belts are provided for each occupant, and are attached by quick-release fasteners to swivel rings bolted to the structure to which the seat lower support rail is attached.

LITTERS

291 Provision is made for installation of 24 standard military or NATO litters, arranged in three tiers of four on each side of the cabin. Sufficient space remains with all litters installed for use of a one-man seat unit forward of, and a two-man seat unit aft of the litters on each side of the cabin.

292 Strap hangers are provided on each cabin wall at Arms 190.50, 283.75, 377.00 and 457.00 for suspension of blood packs. Each of these Arms is labeled with a red cross near the ceiling.

293 For detailed coverage of troop seats and litters refer to EO 05-200A-8A CARGO LOADING INSTRUCTIONS.

AERIAL DELIVERY SYSTEM

GENERAL

294 The aircraft is equipped for aerial delivery of supplies and equipment, with the items located on platforms or in containers. Dispatch of aerial delivery items can be done by extraction, gravity or manual ejection methods. Paratroops may also be dropped from the aircraft.

AERIAL DELIVERY EQUIPMENT

295 The essential aerial delivery equipment, which is either readily removable or stowable, (except troop jump lights) consists of: two anchor line cables, a roller type static line retriever cable for each anchor line, a static line retriever winch, a pendulum release system, 24 roller conveyors (in four rows of six sections), with attached quick-release hold-down pins, cargo side guidance restraint rails system and troop jump lights. Troop jump lights are installed aft of each passenger door and on both sides of the rear fuselage, at Frame 8. Two lights at each position comprise a GREEN JUMP and a RED CAUTION light; each are press-to-test type. All lights are controlled by a three position switch on the AERIAL DELIVERY panel (Figure 1-31) in the flight compartment; the switch has positions marked "RED CAUTION", "OFF", and "GREEN JUMP", with matching red and green indicator lights adjacent to the switch. The circuit is powered from the left 28-volt main dc bus and protected by an AERIAL DELIVERY JUMP LTS circuit breaker on PANEL 6.

296 For more detailed coverage of air delivery equipment refer to EO 05-200A-8A CARGO LOADING INSTRUCTIONS.

AUXILIARY POWER UNIT

GENERAL

297 The auxiliary power unit (APU) is a Williams Research Corporation Model WR9-7C fixed-shaft gas turbine engine with a centrifugal compressor, an annular burner, and two axial turbine stages. It is mounted in the accessory compartment of the left engine nacelle. The APU provides hydraulic pressure to the utility system, an electrical power source, and bleed air for engine starting or environmental control operation. APU fuel is supplied from the left

outer wing tank through an APU electric booster pump and an APU fuel emergency shutoff valve on the left engine firewall. The APU incorporates a start counter and hour meter to record the number of starts and APU running time (APU oil specification 3GP-904A (MIL-L-7808)).

APU CONTROL PANEL

298 The APU control panel (Figure 1-24) located to the left of the overhead console above the pilot's position has three switches, two indicators and a warning light. The control switches are marked APU MASTER "OFF" and "ON", APU START "OFF" and "ON" and APU GEN "OFF" and "ON". The indicators are marked APU EXH TEMP and APU PERCENT RPM and the press-to-test warning light is marked APU LOW OIL PRESS.

STARTING APU

299 The APU can be started by internal battery, or external dc. When starting by battery or external dc the BATTERY/EXT DC switch on the ELECTRICAL CONTROL panel (Figure 1-10) to the right of the overhead console above the copilot's position, should be selected "ON". When starting by battery the starter motor is powered direct from the battery upstream of the battery shunt and is not metered. When starting by external dc the starter motor is powered from the 28-volt external dc power input. APU start control, ignition, and semi-automatic fuel control, are powered from the battery shunt bus protected by the APU START CONT circuit breaker on PANEL 6. The APU emergency fuel shutoff valve is powered from the left essential dc bus and the shutoff valve is controlled by the APU MASTER switch and the left OIL FUEL HYD switch on the emergency panel (Figure 1-6). APU starting procedure is covered in Part 2 paragraph 7.

NOTE

The APU starting motor is supplied at all times from the battery, except when external dc is connected. The control circuits are supplied at all times from the battery.

MISCELLANEOUS EQUIPMENT

GENERAL

300 Miscellaneous equipment includes door and hatch locks, relief tubes, access and exit ladder, rear cabin curtain, blackout curtains, an aircraft hotcup receptacle and timer, and windshield washers and wipers.

DOOR AND HATCH LOCKS

301 The flight compartment lower hatch and left cabin door are provided with key-operated locks. Block assemblies are provided for locking the flight compartment roof hatch, right cabin door, and cabin left and right emergency exit doors. Each block has a length of Velcro tape bonded to one side and is connected by means of a length of cord and a bracket to its door or hatch. The blocks are stowed by attaching the Velcro tape strip on the block to another strip bonded to the door or hatch. When the blocks are installed to prevent the handles from being opened from the outside, access or exit can be gained only through the flight compartment lower hatch or left cabin door which can be key-locked.

RELIEF TUBES

302 The aircraft is provided with three relief tubes, one each on the pilot's and copilot's seats, and one in the right rear of the cabin for passenger use. Provision is also made for the installation of a removable chemical toilet, modesty curtain and toilet paper holder, in the right front of the cabin (Figure 1-1).

ACCESS AND EXIT LADDER

303 A ladder is provided for access to or exit from the cabin and is stowed on the inside of the left cabin door (Figure 1-1). When in use, two locating pins on the top of the ladder engage in two holes in the cabin floor at the doorway; a support on the ladder underside braces it against the fuselage. In the stowed position, the ladder is suspended by its locating pins from two holes in the cabin door and secured by an elastic cord at the bottom.

REAR CABIN CURTAIN

304 Two stowable curtain sections, a left and a right, can be secured to Frame 2 by means of two studs and sockets, and Velcro tape at the top and sides. A zipper at the inner edges of each section secures the curtain sections in the closed position to form a draftproof barrier between the cabin and the rear fuselage. A stowage bag on each side of the fuselage between Frames 1B and 2 holds the folded curtain sections when not in use. A reinforced slit at the upper outboard corner of each curtain section permits installation with the anchor lines in the stowed position.

BLACKOUT CURTAINS

305 The sixteen blackout curtains for the cabin windows are stowed in a canvas bag marked BLACKOUT WINDOW CURTAINS, secured to the aft face of the cabin-flight compartment bulkhead on the right side. The bag is secured with Velcro tape.

AIRCRAFT HOTCUP

306 An aircraft hotcup receptacle and timer is installed on the left forward side of the cabin immediately aft of the navigator's position (Figure 1-1). The aircraft hotcup is powered by the left 115/200 variable frequency bus and protected by a HOTCUP RECEPT circuit breaker on PANEL 7.

WINDSHIELD WASHER SYSTEM

307 The windshield washer system consists of two spray nozzle assemblies, one for each of the pilot's and copilot's windshields situated directly beneath each windshield and connected by means of synthetic rubber hoses to a reservoir and a pump assembly located on the left side of the nose section. Electric current to the dc electric motor in the pump assembly is supplied from the right 28-volt main dc bus through the ICE CONTROL W/S WIPER circuit breaker on PANEL 1 and operation is controlled by the windshield washer switch.

WINDSHIELD WASHER SWITCH

308 The windshield washer switch on the WINDSHIELD panel (Figure 1-23) located below the copilot's instrument panel is labeled WASHER. It is spring-loaded to the "OFF" position and "WASHER" denotes the on position. When the switch is held to the "WASHER" position, the pump motor is energized and washer fluid is pumped through the spray nozzles onto the windshields until the switch is released to the "OFF" position.

WINDSHIELD WIPERS

309 The windshield wiper switch is identified WIPER on the WINDSHIELD panel (Figure 1-23). The switch is of the rotary type with six positions marked "PARK", "OFF", "FAST", "3/4", "1/2", and "SLOW". To park the wiper it is necessary to hold the switch momentarily in the "PARK" position; when released the switch will return to "OFF". Windshield wipers park in the vertical position adjacent to the windshield center post. The windshield wiper motor is supplied from the right 28-volt main dc bus, through the same circuit breaker as protects the windshield washers, identified ICE CONTROL W/S WIPER on PANEL 1.

CAUTION

Do not operate the windshield wiper on a dry windshield as an excessive load will be imposed on the wiper motor; scratching of the windshield surface may also result.

NOTE

If the switch is held in the "PARK" position for a prolonged period, the wipers will oscillate.

PART 2

HANDLING

PRELIMINARIES

BEFORE ENTERING AIRCRAFT

1 Before entering the aircraft, make pre-flight external checks as in Figure 2-1.

AFTER ENTERING CABIN

2 After entering the cabin, complete the following checks:

(a) Portable emergency lights (2) switch - "ARM". (With no external power connected).

(b) Cargo doors - Closed.

(c) Cargo - Correctly loaded and tied down (if applicable).

(d) Ramp extensions - Properly stowed.

(e) Tools and other items not required in cabin - Removed.

(f) Passenger doors - Closed and secure. Latch blocks removed and stowed.

(g) Cabin escape hatches - Closed and secure. Latch blocks removed and stowed.

(h) Safety equipment - Check:

(1) First aid kits (2) - Intact and properly stowed.

(2) Survival kits - Intact and properly stowed.

(3) Hand fire extinguishers (2) - Charged and properly stowed.

(4) Fire axe - Intact and properly stowed.

AFTER ENTERING FLIGHT COMPARTMENT

3 After entering the flight compartment, complete the following checks:

(a) Safety equipment - Check:

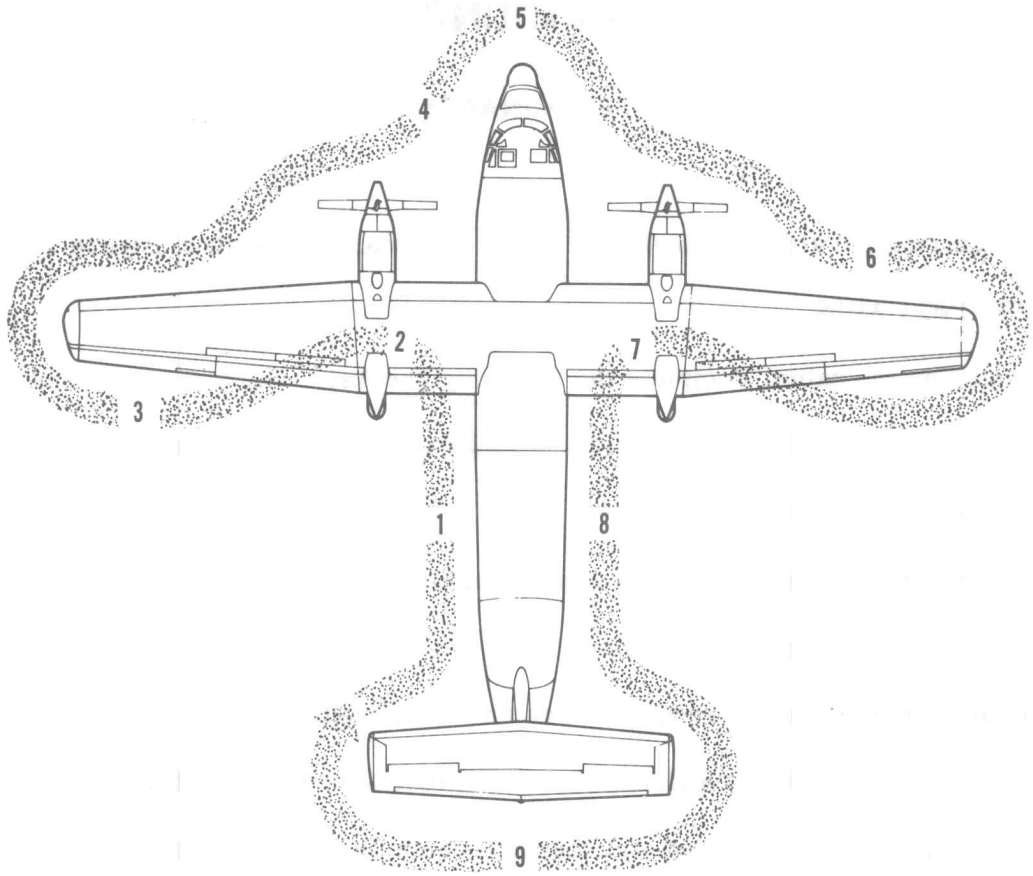
(1) First aid kit - Intact and properly stowed.

(2) Hand fire extinguisher - Charged and properly stowed.

(b) Flight compartment lower hatch and roof hatch - Closed and secure. Latch blocks removed and stowed.

(c) Circuit breakers - Set.

5EO-1-35



1	FUSELAGE LEFT SIDE	
(a)	Passenger door -	Obvious damage and jettison telltale
(b)	Emergency exit -	Obvious damage
(c)	Fuselage skin and windows -	Obvious damage
2	LEFT MAIN LANDING GEAR	
(a)	Doors -	General condition
(b)	Ground safety locks -	Removed
(c)	Hydraulic reservoir -	Fluid level
(d)	Weight switch plug -	Connected
(e)	Shock strut -	Correct extension
(f)	Tires -	Condition
(g)	Brake assembly -	Condition
(h)	Wheel chock -	In place
3	LEFT WING	
(a)	Wing and flight control surfaces -	Condition
(b)	Position light -	Condition
(c)	Landing light -	Condition

Figure 2-1. (Sheet 1 of 2) Exterior Inspection Diagram

3	LEFT WING (Cont'd)	
(d)	Engine inlet -	Condition
(e)	Propeller -	Condition
(f)	APU intake and exhaust -	Clear
4	NOSE LANDING GEAR	
(a)	Ground safety lock -	Removed
(b)	Shock strut -	Correct extension
(c)	Steering disconnect pins -	Installed
(d)	Weight switch plug -	Connected
(e)	Tires -	Condition
(f)	Taxi light -	Condition
(g)	Doors -	Closed
(h)	Brake accumulator and nose gear emergency bottle pressure -	Checked
5	NOSE	
(a)	Heater air intake ducts -	Clear
(b)	Pitot head covers -	Removed
(c)	Static vents -	Unobstructed
(d)	Access panels -	Secure
(e)	Flight compartment lower hatch -	Unlocked and secure
6	RIGHT WING	
(a)	Continue check as under LEFT WING as applicable.	
7	RIGHT MAIN LANDING GEAR	
(a)	Continue check as under LEFT MAIN LANDING GEAR as applicable.	
8	FUSELAGE RIGHT SIDE	
(a)	Engine fire extinguisher indicating discs -	Intact
(b)	Emergency exit -	Obvious damage
(c)	Passenger door -	Obvious damage and jettison telltale
(d)	Fuselage skin and windows -	Obvious damage
(e)	Lower antennas -	Condition
(f)	Lower anti-collision light -	Condition
(g)	Fueling panel -	Selector "OFF" door closed
(h)	Cargo and ramp door -	Obvious damage
9	EMPENNAGE	
(a)	Stabilizers and control surfaces -	Obvious damage
(b)	Tailcone -	Obvious damage
(c)	Anti-collision light and position light -	Condition

Figure 2-2. (Sheet 2 of 2) Exterior Inspection Diagram

(d) Hand slide - Stowed.

(e) Emergency hydraulic panel - Check:

(1) Landing gear EMERGENCY SELECTOR - Normal position.

(2) Nose gear emergency extension handle - Normal position.

(f) Hydraulic handpump handle - Stowed.

(g) Flight compartment seats - Adjust as necessary.

(h) Seat belts and safety harness - Fasten and adjust.

(j) Rudder pedal adjuster - To desired position.

(k) Parking brake - Set, and check brake hydraulic pressure.

(m) Oxygen shutoff valve - Open (if desired). Check 1800 psi.

(n) Pilot's instrument panel - Check.

(p) Clock - Check

(q) Emergency and side panels - Check:

(1) FINE PITCH STOP selector - "GROUND".

(2) AUTO FEATHER switch - "OFF".

(3) FIRE PULL T-bars - In and horizontal.

(4) OIL FUEL HYD switches - "NORMAL".

(5) SPOILERS EMER CLOSE switch - NORMAL.

(6) SPOILERS LANDING ARM switch - "OFF".

(7) Take-off and landing check list.

(r) APU and bleed air panel - Check:

(1) BLEED AIR SOURCE L ENG and R ENG - "~~ON~~". OFF

(2) APU MASTER - "OFF".

(3) APU START - "OFF".

(4) APU GEN - "ON".

NOTE

The generator switch should remain on at all times except when a generator malfunction occurs.

(s) Overhead console - Check:

(1) CONTROLS LOCK lever - "LOCKED".

(2) L.G. lever - "DOWN" and locked.

(3) Power levers - "MIN".

(4) Propeller levers - "INCREASE".

(5) Fuel flow levers - "OFF".

(6) FLAPS selector - "0°".

(7) LIGHTING INTERIOR and EXTERIOR switches - As required.

(8) ENVIRONMENTAL CONTROL MASTER - "OFF".

(9) AERIAL DELIVERY switches - OFF.

(10) ENGINE IGNITION, START, and OVERSPEED TEST switches - "OFF".

(11) NOSE WHEEL STEER switch - "OFF".

(12) LANDING and TAXI LTS - "OFF".

(t) ELECTRICAL CONTROL panel - Check:

(1) BATTERY/EXTERNAL DC switch - "OFF".

(2) AC MASTER switch - "OFF".

(3) AC EXT PWR switch - "OFF".

(4) GENERATOR L and R switches - ~~"ON"~~. OFF

~~NOTE~~

~~The generator switches should remain on at all times except when a generator malfunction occurs.~~

(5) GENERATOR NORM EMER switch - "NORM".

(6) GENERATOR BUS TIE switch - "BUS TIE".

(u) Copilot's instrument panel - Check.

(v) FUEL CONTROL selector - "NORM".

(w) INNER TANK switches - "NORM".

(x) ACCESSORY CONTROL panel - Check:

(1) PITOT selector - "NORMAL".

(2) STATIC selector - "NORMAL".

(y) WINDSHIELD WASHER switch - "OFF".

(z) WINDSHIELD WASHER switch - "OFF".

(aa) LANDING GEAR EMER DOWN RECOV switch - "OFF".

(ab) LANDING GEAR NOSE DOWN LOCK switch - "OFF".

(ac) ICE CONTROL switches - "OFF".

(ad) Radio console switches - "OFF".

(ae) Microphone and headsets - As desired.

(af) With external ground power plugged in and BAT/EXT DC, AC MASTER and AC EXT PWR switches "ON" - Check: (If external ground power is not available see (ag) below.)

(1) All press-to-test lights.

(2) STALL WARN TEST.

(3) MASTER CAUTION TEST.

(4) FIRE DETECTION TEST.

(5) FUEL CONTROL QTY TEST.

(6) LANDING GEAR HORN TEST.

(7) ICE DET TEST.

(8) All electrical instruments.

(9) NO SMOKING, FASTEN BELTS, ALARM BELL and jump lights (if applicable).

(ag) With external ground power not available and BAT/EXT DC and AC MASTER switches "ON", check FIRE DETECTION TEST, start APU (see paragraph 7 for APU start procedure) and - Check:

(1) All press-to-test lights.

(2) STALL WARNING TEST.

(3) MASTER CAUTION TEST.

(4) FUEL CONTROL QTY TEST.

(5) LANDING GEAR HORN TEST.

(6) ICE DET TEST.

(7) All electrical instruments.

(8) NO SMOKING, FASTEN BELTS, ALARM BELL and jump lights (if applicable).

SPECIAL CHECK FOR NIGHT FLIGHTS

4 For flights which may include night flying,additional checks should be carried out, after the aircraft electrical system is powered either by ground power or the APU, as follows:

(a) CARGO/BOARDING lights, switch on CABIN LGT panel aft of left passenger door (can be checked on entering aircraft without ground power or APU).

(b) All lights controlled by switches on LIGHTING panel on overhead console.

(c) TAXI LT and LANDING LTS on LANDING & TAXI panel on overhead console.

(d) Indicator lights BRIGHT DIM intensity on left emergency side panel.

(e) Emergency hydraulic panel light (by opening emergency hydraulic panel door).

(f) Pilot's, copilot's and flight technician's utility lights.

(g) Elevator trim pedestal light, (switch located on the left face of elevator trim pedestal with dimming controlled by PILOT'S PNL switch on overhead console).

(h) Flight compartment lower hatch light (by opening the doors in the flight compartment floor).

(j) CABIN PANELS lights and CHART TABLE lights at navigator's position, if applicable.

(k) Ramp loading light over left passenger door.

MANAGEMENT OF FUEL SYSTEM

5 With engines running, FUEL CONTROL selector at "NORM" and fuel flow levers at "GROUND IDLE" or "NORMAL" the engine driven fuel pumps, electric fuel pumps and air driven fuel pumps are all operating and fuel is transferred automatically from each inner wing tank to the outer wing tank from where it is fed to its left or right engine. No further selection is necessary under normal conditions. Each outer tank fuel quantity indicator should remain almost unchanged until its inner tank indicator registers zero, when the outer tank indicator too will denote decreasing contents. If necessary, fuel can be fed from left wing tanks to right engine or both engines by moving the fuel selector to "BOTH ON LEFT". Similarly, fuel can be fed from right wing tank to right engine or both engines by selecting "BOTH ON RIGHT". The fuel quantity indicator should be monitored during flight for correct fuel sequencing.

STARTING PROCEDURE

BEFORE STARTING ENGINES

6 Fire extinguisher in position. It is normal to use APU for starting the first engine, but if using ground power a 28-volt dc power source or 115-200-volt 400-cycle (nominal) ac power source is required. If using external bleed air a ground rig capable of 40 lbs/min at 40 PSIG, such as Type MA1A, is required.

STARTING APU

NOTE

Power source combinations for APU starting are:

(a) No external power - BATTERY/EXT DC switch "ON" - Starter motor powered direct from battery and is not metered.

(b) External dc - BATTERY/EXT DC switch "ON" - Starter motor is powered from external dc.

(c) External ac - Will not power starter motor, and power for an APU start would be from the battery.

(d) External ac and external dc - BATTERY/EXT DC, AC EXT PWR, and AC MASTER switches "ON" will power aircraft electrical system. Before starting APU select AC EXT PWR switch "OFF", otherwise, TRU relay cuts off dc and starter motor would be powered from battery as in (a).

7 With applicable ELECTRICAL CONTROL panel switches "ON" (depending on power source) and FIRE DETECTION TEST circuit having been checked, proceed as follows:

(a) APU and BLEED AIR panel - Check:

(1) APU MASTER switch - "ON".

(2) APU START switch "ON" to 50%, then released (maximum 10 seconds to light up, maximum 20 seconds to 50% RPM).

(3) Monitor EXH TEMP, PERCENT RPM, and oil pressure.

NOTE

EXH TEMP 675° C maximum or 675° C to 700° C for 2 seconds. If oil pressure light not extinguished by 50% RPM, discontinue start.
PERCENT RPM maximum continuous 103%.

(b) Ensure generator comes on line. (AC EXT PWR switch - "OFF", if in use, and generator is on line if 400-cycle caution lights remain extinguished).

(c) Allow APU rpm to stabilize at 100%.

CAUTION

The APU MASTER switch should be set to "OFF" following any observed overheat condition, or illumination of the Zone 2 and 3 fire warning lights,

or in the event of an automatic shutdown caused by actuation of the overspeed protection system. For action in event of fire on starting, refer to PART 3, paragraph 13 (a).

NOTE

In the event of a false start, set APU MASTER to "OFF" before rpm drops below 20% and wait 3 minutes before attempting restart.

(d) Utility and brake pressure - Check. (3000 psi).

(e) WINDSHIELD HEAT - "WARM UP".

(f) Bleed air pressure - Check (30 psi).

STARTING ENGINES

8 A normal start is one in which the engine lights up and accelerates, within temperature limits, to GROUND IDLE speed. The time taken varies with ambient temperature. Air pressure for the pneumatic starter (air turbine starter) on the engine is obtained either from APU bleed air, bleed air from the other engine if operating, or from an external air supply. Electrical power to buses is obtained from the APU generator, from the other engine generator, if operating, or external power. With applicable ELECTRICAL CONTROL panel switches "ON" (depending on power source), proceed as follows:

(a) Prestart check:

(1) ANTI COLLISION LIGHTS - "ON".

(2) Fuel flow levers - "OFF"

(3) Power levers - "MIN".

(4) ENGINE IGNITION - "OFF".

(5) GENERATOR L and R switches - "~~ON~~". OFF

(6) BLEED AIR PRESS - Check (30 psi).

(7) FINE PITCH STOP selector - "GROUND".

(b) Parking brake - Set and check brake hydraulic pressure.

(c) ENGINE START switch - "L" or "R" (as required).

(d) ENGINE IGNITION switch "L" or "R" (as required) when TURBINE PERCENT RPM reaches 20%.

NOTE

If an engine is being started using external air and battery, there will be no ENG and SDG OIL pressure

indication until the generator comes on the line at 51% TURBINE RPM. If external air and external dc are being used for starting, the initial indication of engine and SDG oil pressure will occur when the L or R ENG/SDG OIL PRESS caution lights are extinguished. TURB INLET TEMP will always be available during entire start regardless of the air and electrical starting source used.

(e) Fuel flow lever - "GROUND IDLE".

(f) TURB INLET TEMP - Monitor (Maximum 649°).

(g) TURBINE PERCENT RPM stabilized at ground idle (68% rpm). START ON caution lights out.

CAUTION

Check for positive indication of both ENG and SDG OIL pressure during start. If oil pressures do not rise almost immediately, deenergize start and ignition switches and investigate.

NOTE

If light up does not occur within ten seconds of fuel flow increase, or if fuel flow is not in the range 100 to 175 lb/hr, return fuel flow lever to "OFF", deenergize ignition switch, and continue to motor engine on the starter for one minute to purge the engine of fuel.

(h) ENGINE START and IGNITION switches - "OFF".

(j) Repeat starting procedure for other engine.

(k) AC EXT PWR switch - "OFF" (if applicable).

(m) External power source - Unplugged (if applicable).

(n) APU MASTER - "OFF" or ground air supply - Off (as applicable).

(p) BLEED AIR pressure - Check. (70 psi).

CAUTION

For action in event of fire on starting refer to PART 3, paragraph 13 (b).

FAILURE TO START

9 The procedures required in the event of a cold hang-up or a hot start during engine starting are as follows:

(a) Cold hang-up. During a start the gas generator may fail to accelerate to ground idle speed; this is usually accompanied by a low TURB INLET TEMP. Any attempt to accelerate the engine with the power lever will have no effect. If this occurs, shut down the engine (fuel flow lever - "OFF", ENGINE START and IGNITION switch "OFF") and investigate.

(b) Hot start. If during a start, (before ground idle rpm is reached) the TURB INLET TEMP rises abnormally and its rate of increase appears great enough to carry it to a temperature of 649° C before ground idle rpm is reached, a hot start is imminent and the engine must be shut down immediately. Fuel flow lever - "OFF" and IGNITION - "OFF", and continue motoring the engine for one minute to purge the engine of fuel before attempting a restart.

ABNORMAL CONDITIONS AFTER STARTING

10 Abnormal conditions that may occur after engine start and procedures to be followed, are as follows:

(a) Compressor stall. A compressor stall is caused by an aerodynamic disturbance of the smooth airflow pattern through the compressor. A rapid rise in TURB INLET TEMP and usually an rpm hang-up (sometimes accompanied by a rapid drop in rpm) are indications of a stall. A change in the engine noise level may also be noted. If a compressor stall occurs, proceed as follows:

(1) Shut down the engine immediately (fuel flow lever - "OFF", ENGINE START and IGNITION switches "OFF").

(2) Listen for unusual noises and indications of mechanical failure during coastdown.

(3) Report the condition for investigation.

CAUTION

Do not engage the starter after a stall until unusual noises and mechanical failure have been investigated and rectified.

(b) Starter valve open. A starter valve remaining open after engine start is indicated by continued illumination of the relevant START ON caution light on the pilot's instrument panel. This condition results in loss of bleed air pressure as well as damage to the starter. If the START ON caution light remains on after engine start, the engine must be shut down, the source of air to its starter must be shut off, and the malfunction rectified.

(c) Abnormal vibrations. High vibrations can be caused by poor coupling alignment, loose engine mounts, or other external connections. Report the condition for investigation.

(d) Abnormal oil pressure. Do not operate the engine if the oil pressure limits, either ENG OIL PSI or SDG OIL PSI, are outside the operating limits. Low engine oil pressure for the particular engine and its associated SDG is also indicated by illumination of the respective L or R ENG/SDG OIL PRESS caution light.

NOTE

Extremely high oil pressure, up to 100 psig, can be experienced when starting in cold weather before

the ENG OIL TEMP stabilizes. Under this condition do not exceed GROUND IDLE speed for three minutes, or until oil pressure stabilizes.

(e) Flameout. An engine that flames out will immediately show a decrease in TURB INLET TEMP, rpm, and fuel pressure (L or R ENGINE FUEL PRESS caution light will illuminate). The engine should be shut down (fuel flow lever - "OFF", ENGINE IGNITION switch - "OFF") and then motored for one minute on the starter to purge fuel. If the engine was operating satisfactorily before flameout, a restart may be attempted.

GROUND TEST PROCEDURE

11 Before taxiing, complete the following checks:

NOTE

Under normal conditions no engine warm-up is required (ENG OIL temperature normal operating range is -54° to 107° C).

(a) All trim controls - Operate through full travel and return to neutral.

(b) Hydraulic pressure - Check UTILITY, BRAKE, and RUDDER HYDRAULIC PRESSURE.

(c) DEICING PRESSURE - Check (17 to 19 psi).

(d) WINDSHIELD HEAT - "NORMAL".

(e) PITOT HEAT - "ON".

(f) FUEL CONTROL selector - "NORMAL".

(g) INNER TANK switches - "NORMAL".

(h) FUEL QUANTITY - Check.

(j) Spoilers - Check operation as follows:

(1) SPOILERS EMER CLOSE switch - "NORMAL".

(2) SPOILERS LANDING ARM switch - "ARM". Check amber SPOILERS EXTD and SPOILER EXTD lights illuminate.

(3) CONTROLS LOCK lever-"Unlocked".

(4) Operate aileron controls left and right and check for spoiler disengagement. No UTILITY HYDRAULIC PRESSURE fluctuation should occur.

(5) Fuel flow lever - GROUND IDLE.

(6) Power levers - Advance and retard each lever individually and check SPOILERS EXTD and SPOILER EXTD lights go out as lever is advanced and illuminate as lever is retarded. Check lights go out after 15 seconds.

(7) SPOILERS LANDING ARM switch - "OFF".

(8) Operate aileron controls left and right. Check that UTILITY HYDRAULIC PRESSURE fluctuates.

(9) CONTROLS LOCK lever - LOCKED.

(k) Left/right ac phases - Rotate METER SELECT switch through LEFT AC "A", "B", and "C" and RIGHT AC "A", "B", and "C" and check AC VOLT meter for left and right 115/200 variable frequency buses and check AC AMPS meter for current loads drawn by each phase. AC VOLTS meter (115 VOLTS) AC AMPS meter (increases with load).

(m) If icing conditions are anticipated, check propeller deicing system as follows:

(1) PROPELLER PERCENT RPM - Both propellers, 61% minimum.

(2) METER SELECT switch - RIGHT AC "A" phase.

(3) ICE CONTROL PROP DEICE switch - "DEICE".

CAUTION

Check AC AMPS meter. A rise of approximately 39 amperes before PROP TEST switch is set to "TEST" indicates a faulty weight switch. In this case the ICE CONTROL PROP DEICE switch should be selected immediately to "OFF" to prevent possible damage to the propeller heating elements.

(4) ICE CONTROL PROP TEST switch - "TEST". A rise of approximately 39 amperes should be indicated on the AC AMPS meter.

NOTE

The ICE CONTROL PROP TEST switch should only be held to "TEST" momentarily and released as soon as AC AMPS meter rise is checked, to minimize possible deterioration of the heater elements.

(5) ICE CONTROL PROP TEST switch - Release to "OFF".

(6) Perform similar check with RIGHT AC "B" phase.

(7) Perform similar check with RIGHT AC "C" phase but hold PROP TEST switch at "TEST" for 30 seconds and check flicker on AC AMPS meter indicating that deicer current is cycling to both propellers.

(8) ICE CONTROL PROP DEICE switch - "OFF".

(n) Left and right dc - METER SELECT to "LEFT DC" and "RIGHT DC". Check DC VOLTS. meter and DC LOAD meter for TRU output. Release METER SELECT switch to "BAT".

	L	BAT	R
DC VOLTS Meter	Normal 20-28	Normal 24	Normal 20-28
DC LOAD Meter	(+) increases with load	(-) depending on load (+) normal .2 (+) low battery .7	(+) increases with load

NOTE

1.0 loadmeter reading on BAT equals 50 amps.
1.0 loadmeter reading on L or R (TRU) equals 200 amps.

(p) FLAPS - Check operation and ensure flaps are at "0°".

(q) If icing conditions are anticipated, check airframe deicing system as follows:

(1) ICE CONTROL AIRFRAME switches - "AUTO" and "FAST".

(2) Have an observer outside the aircraft check visually the correct functioning of all the boots. Also check at "MAN".

(3) ICE CONTROL AIRFRAME switches - "OFF".

(r) NO SMOKING and FASTEN BELTS switches - "ON" ((+) increases with load).

(s) DOORS UNLOCKED caution light - Out.

(t) External power disconnected and clear of aircraft.

(u) Parking brakes - Set.

(v) Wheel chocks - Removed.

(w) Avionics equipment - Applicable avionics equipment turned on and checked.

TAXIING INSTRUCTIONS

12 During taxiing, make the following checks:

CAUTION

As strong winds or gusts may affect the aircraft's large control surfaces on the ground, all taxiing should be done with CONTROLS LOCK lever "LOCKED" until the aircraft is headed into wind prior to take-off and limit max NP to 87 percent.

(a) Power levers - "IDLE". Fuel flow levers - "GROUND IDLE".

(b) Parking brake - Release.

(c) NOSE WHEEL STEER switch - "ON".

(d) Release brakes and as aircraft begins to roll, use nosewheel steering wheel to steer aircraft.

(e) Wheel brakes - Check by applying both brakes evenly.

(f) Control taxi speed with brakes and, if necessary, select fuel flow levers to "NORMAL".

NOTE

At GROUND IDLE, fuel flow cannot be controlled by power levers.

NOTE

Use differential braking only when NOSE WHEEL STEER switch is "OFF" and the nosewheel is free to caster.

(g) Flight instruments - Check during taxiing.

NOTE

Reverse maneuvering can be accomplished on the ground by moving the power levers to "REVERSE" with FINE PITCH STOP selector at "NORMAL", "APPROACH", or "GROUND". In "GROUND" momentary forward thrust will result before reverse is obtained.

ENGINE AND ACCESSORY CHECK

13 Before take-off make the following engine and accessory checks, making sure that the aircraft is facing into wind.

(a) Propeller manual feathering system - Check:

(1) FINE PITCH STOP - "NORMAL".

(2) Left engine propeller lever - "FEATHER".

(3) Check left feathering button illuminates and button pulls in.

(4) Note drop in PROPELLER PERCENT RPM; return propeller lever to "INCREASE" and pull button and hold to unfeather propeller. Note button returns to neutral when released.

(5) Repeat procedure for right engine.

(b) Engine overspeed test - Check:

(1) Power levers - "IDLE".

(2) Fuel flow levers - "NORMAL". Check rise in TURBINE PERCENT RPM.

(3) ENGINE OVERSPEED TEST switch - "L".

(4) CONTROLS LOCK lever - "Unlocked".

(5) Power lever (left engine) - Slowly advance lever until the overspeed switch cuts in and reduces PROPELLER PERCENT RPM; this should occur at approximately 72 percent. Note FUEL FLOW decrease.

NOTE

Following overspeed switch cut in, PROPELLER PERCENT RPM and FUEL FLOW will decrease until the low speed contacts in the overspeed switch open. PROPELLER PERCENT RPM and FUEL FLOW will then return to original reading at which contacts close . This cycle will repeat until test switch is reset to "OFF".

(6) ENGINE OVERSPEED TEST switch - "OFF".

(7) Power lever - "IDLE".

(8) Fuel flow lever (left engine) - "GROUND IDLE".

(9) Repeat procedure for right engine.

(10) CONTROLS LOCK lever - "LOCKED".

(c) Auto feather test - Check:

(1) Fine pitch stop - "NORMAL".

(2) AUTO FEATHER switch - "ON". Green SEL light illuminated.

(3) TORQUE SYSTEM L TEST and R TEST switches selected to "L TEST" and "R TEST" simultaneously. Both TORQUE indicators increase beyond 550 foot-pounds and ARM light illuminates at 550 foot-pounds TORQUE.

(4) Release TORQUE SYSTEM L TEST switch. "ARM" light will go out, left feathering button will retract and illuminate simultaneously, and propeller will start to feather.

(5) Release TORQUE SYSTEM R TEST switch.

(6) Unfeather (by holding left feathering button out).

(7) Repeat autofeather test procedure for right engine.

(d) Propeller reverse test - Check:

CAUTION

Limit NQ to 85 percent or below and NP to 80 percent or below.

(1) FINE PITCH STOP selector - "NORMAL" and allow propeller rpm to stabilize.

(2) Left fuel flow lever - "NORMAL".

(3) Left power lever - "REVERSE MIN".

(4) Check that APPROACH and GROUND BLADE ANGLE lights illuminate as their fine pitch stops are overridden.

(5) Move power lever aft slowly and note increase in PROPELLER PERCENT RPM.

(6) Power lever - "IDLE".

(7) APPROACH BLADE ANGLE lights and GROUND BLADE ANGLE lights go out indicating propeller has unreversed.

(8) Repeat reverse test procedure for right engine.

TAKE-OFF PROCEDURES

VITAL ACTIONS BEFORE TAKE-OFF

14 Just prior to take-off, complete the following checks:

(1)	Windows, doors, and hatches -	Locked.
(2)	ECS MASTER -	"OFF".
(3)	TRIMS -	Set.
(4)	FLAPS -	"7°"
(5)	Fuel flow levers -	"NORMAL".
(6)	Propeller levers -	"INCREASE".
(7)	FINE PITCH STOP -	"NORMAL".
(8)	CONTROLS LOCK lever -	"Unlocked".

TAKE-OFF

15 Take-off techniques required to produce the results stated in Part 4 are as follows:

(a) Normal take-off technique:

(1) Nosewheel - Align. Taxi a short distance to line up aircraft with take-off path and to centralize nosewheel. Leave NOSEWHEEL STEER switch "ON".

(2) Advance power levers until AUTOFEATHER ARM light illuminates (approximately 550 foot-pounds TORQUE).

(3) Brakes - Release.

(4) Power levers - Advance smoothly to take-off power.

(5) Maintain directional control through coarse use of rudder in early part of take-off.

(6) Lift-off - Lift aircraft off runway at V_2, (98 kt at 41,000 lbs gross weight).

(b) Short field (STOL) take-off technique:

(1) Position aircraft at extreme threshold of the strip, with nosewheel centered and flaps at 30°

(2) Apply wheel brakes and advance power levers to take-off power.

(3) Release wheel brakes and hold control column slightly forward of neutral until rotation speed is reached. (Premature rotation below rotation speed may result in a prolonged ground roll or in aircraft settling back on the ground after initial lift off). Refer to Figure 4-19 for rotation speeds.

(4) When aircraft is safely airborne, select L.G. "UP" immediately. Delay flap retraction until clear of obstacles.

NOTE

There is little change in trim as wing flaps retract.

(c) Cross wind take-off technique. Refer to Figure 4-15 for headwind and crosswind components for various windspeeds and directions and recommended speed for lift-off.

(d) Night take-off technique. The technique recommended for normal take-off applies.

AFTER TAKE-OFF

16 When safely airborne, proceed as follows:

NOTE

The critical engine failure speed V_1, minimum take-off speed V_2, and take-off rotation speed V_R, are assumed equal (98 kt IAS at 41,000 lb gross weight). (V_{MC} is 80 kt IAS at 7° flaps).

(a) L.G. selector lever - "UP" as soon as aircraft is well clear of runway. Check indicator lights (retraction time - ten seconds).

(b) FLAP selector lever - "0°" and allow airspeed to build to normal climb speed.

CLIMB

17 Climb techniques required to produce the results stated in Part 4 are as follows:

(a) Maintain take-off power until clear of obstacles, and established at desired climb speed.

(b) When established at desired climb speed, reduce power to required climb settings.

CAUTION

When decreasing power reduce engine TORQUE

before reducing PROPELLER PERCENT RPM.

(c) AUTOFEATHER switch - "OFF".

(d) Temperature, pressure, RPM and torque - Monitor.

FLIGHT CHARACTERISTICS

GENERAL

18 The aircraft has no unusual flight characteristics and is stable in all configurations. Handling of the aircraft is unaffected when flying with the ramp horizontal and cargo door open. Control is good over the entire speed range, and with power on and full flap lowered the aircraft is controllable down to very low speeds.

STALLS

19 Aircraft behavior at the stall is docile and recovery is quickly accomplished by relaxing backward pressure, or by gentle forward pressure on the yoke. Minimum height loss can be affected by prompt use of power. Excessive forward pressure on the yoke should be avoided since this can add to the natural pitching motion of the aircraft and produce excessive nose-down attitudes, and resultant loss of height. Airframe buffet provides warning of all stalls but the buffet diminishes as flap angles increase. The stall warning system, however, provides adequate stall warning in all cases. In all configurations, aileron and rudder control remain effective throughout the stall. Although the pitch attitude is somewhat nose-high in clean configuration stalls, and stalls with power on, the nose-high attitude decreases proportionally as flap is lowered and an unaccelerated stall with full flap occurs at a fairly nose-low pitch attitude. Stalls in turns are accompanied by airframe buffet. At the stall, either power on or power off, the aircraft can roll into or out of the turn, depending on pre-stall control handling. The rolling tendancy can be accompanied by a slow nose-down pitch. More elevator can be used in the recovery from turning stalls without producing an extreme nose-down attitude. Refer to Figure 2-2 for stall chart.

SPINS

20 Intentional spins are prohibited. If a spin is entered inadvertently, normal recovery procedure for a two-engine aircraft is recommended, i.e., power levers to "IDLE", apply full opposite rudder and ease the yoke progressively forward until the spin stops. If the spin does not stop apply power to the inner engine.

FLIGHT CONTROLS

21 The elevator is spring-tab assisted and provides light comfortable longitudinal control throughout the speed range. The aircraft does not respond quickly to sharp short-duration control yoke movements. The ailerons are geared-tab assisted, and are augmented by the spoilers. Spoiler response in terms of roll rate, increases with flap angle and as a result, the pilot should guard against a tendency to overcontrol laterally during full flap approaches. The hydraulically operated rudder is very effective and it is quite easy initially to overcontrol on rudder. All trim controls, while quite positive in response, are not oversensitive. Because of the T tail and flap-interlinked elevator tab, longitudinal trim changes when raising or lowering flap are minimal. Similarly, trim changes with landing gear retraction or extension are negligible. In landing configuration, when the FINE PITCH STOP switch is selected from "NORMAL" to "APPROACH" propeller drag increases noticeably and a power increase is usually required to maintain the desired approach path. Slightly exaggerated power lever movement is required

GROSS WEIGHT LB	FLAP SETTING	STALLING SPEED/ANGLE OF BANK (CAS - KNOTS)				
		0°	15°	30°	45°	60°
26,000	CRUISE (0°)	73.5	75.0	79.4	88.5	106.4
	TAKE-OFF (7°)	65.0	66.3	70.2	78.3	93.9
	LANDING (30°)	55.3	56.4	59.8	66.6	80.1
	LANDING (40°)	53.2	54.2	57.5	64.1	77.0
30,000	CRUISE (0°)	79.0	80.5	84.9	94.0	111.9
	TAKE-OFF (7°)	69.7	71.0	74.9	83.0	98.6
	LANDING (30°)	59.7	60.8	64.2	71.0	84.5
	LANDING (40°)	57.3	58.3	61.5	68.1	81.0
41,000	CRUISE (0°)	92.3	94.0	99.1	104.7	130.4
	TAKE-OFF (7°)	81.5	83.0	87.6	97.0	115.1
	LANDING (30°)	69.9	71.2	75.0	83.1	98.8
	LANDING (40°)	66.9	68.1	71.9	79.5	94.5

5E0-1-36

Figure 2-2 Stall Chart

under these conditions as small power lever movements near the "IDLE" position give very slight changes in thrust.

LEVEL FLIGHT

22 The aircraft trims with ease to level flight, and in conditions of turbulence requires very little control movement to maintain the level flight attitude. When trimmed for low speed level flight between 65 kt and 100 kt, slightly more rudder is required when entering and recovering from turns. At higher speeds, approaching 200 kt, less rudder is required, elevator forces increase mildly, and aileron forces become noticeably heavier.

DIVING

23 High speed dives to V_{MO} do not produce any sharp changes in trim as speed is increased. Nose-down trim requirement increases proportionally with airspeed. Left rudder pressure is required with increased airspeed to maintain coordinated flight, but can be comfortably held in typical short duration dives. Aileron forces increase more rapidly with speed than elevator forces. Rudder forces do not change. The rudder actuator is power-limited to prevent large rudder angles at high speed thus preventing airframe damage. Recovery from V_{MO} dives is made by normal use of elevator. If the aircraft is trimmed hands-off in a power-on dive to V_{MO}, recovery can be made with ease with one hand.

SYSTEMS AND EQUIPMENT OPERATION DURING FLIGHT

GENERAL

24 Operation of the environmental control system, anti-icing and deicing systems equipment, flight compartment equipment, emergency equipment, and oxygen equipment is adequately covered in Part 1, Description. For operation of aerial delivery equipment refer to EO 05-200A-8A CARGO LOADING INSTRUCTIONS. Operation of communication, navigation and radar equipment is covered in the following paragraphs. Refer to Figure 1-36 for radio console illustration.

UHF SYSTEM

25 To operate the UHF system proceed as follows:

(a) INTER control panel UHF monitor switch "on".

(b) INTER control panel rotary transmitter selector - "UHF".

(c) Function switch - "TR & G".

(d) UHF ANT switch - "TOP" or "BOT" as desired.

(e) MANUAL frequency knobs set to desired frequency.

(f) Adjust VOL to desired level.

(g) Depress TX or MIKE switch to transmit, release to receive.

(h) Selecting function switch to "OFF" will deenergize the system.

VHF SYSTEM

26 To operate the VHF system, proceed as follows:

(a) INTER control panel VHF monitor switch "on".

(b) INTER control panel rotary transmitter selector - "VHF".

(c) Function selector - "TEST" - Allow one minute for warm-up.

(d) Function selector - "PWR".

(e) Set desired frequency.

(f) Adjust VOL selector as desired.

(g) Depress TX or MIKE switch to transmit; release to receive.

(h) Selecting function switch to "OFF" will deenergize the system.

FM SYSTEM

27 To operate the FM system, proceed as follows:

(a) INTER control panel FM monitor switch - "on".

(b) INTER control panel rotary transmitter selector - "FM".

(c) Function switch - "PTT". Allow one minute for warm-up.

(d) SQUELCH control - "DIS" and check for loud receiver noise; reset to "CARR" and check for sharp reduction in receiver noise.

(e) Required frequency selected.

(f) Depress TX or MIKE switch to transmit; release to receive.

(g) For FM homing facility continue as follows:

(1) FM HOM switch-"PLT" or "COPLT" as desired.

(2) Appropriate HSI selector - "FM".

(3) Function switch - "HOME".

(h) Selecting function switch to "OFF" will deenergize the system.

HF SYSTEM

28 To operate the HF system proceed as follows:

(a) INTER control panel HF monitor switch - "on".

(b) INTER control panel rotary transmitter selector - "HF".

(c) Mode selector switch USB, LSB, or AM, as required; allow five minutes for equipment warm-up.

(d) Required frequency selected.

(e) Turn RF SENS knob fully clockwise; check for receiver background noise in headset; adjust for barely audible background.

(f) Depress TX or MIKE switch to transmit, release to receive.

(g) Selecting mode selector switch to "OFF" will deenergize the system.

NOTE

The HF Antenna coupler is located on the top right radio rack. Antenna coupler remote amber and green indicator lights are located on the same radio rack below the groundspeed and interception computer. After a frequency change, transmissions should be delayed until the amber light goes out (approximately six seconds). Illumination of the green light only indicates the antenna is tuned to the selected frequency.

ADF SYSTEM

29 To operate the ADF receiver proceed as follows:

(a) INTER control panel, ADF monitor switch "on".

(b) HSI BRG selector - "ADF".

(c) HSI TRACK selector - "ADF".

(d) ADF REC control panel:

(1) VOL OFF control - Clockwise to apply power to receiver. Allow 30 seconds for warm-up.

(2) Function switch - "ANT".

(3) Tune desired frequency, use tuning meter if necessary.

(4) Function switch - "COMP" for ADF.

(5) Function switch - "LOOP", BFO switch "ON", and rotate loop with LOOP switch for aural null.

(e) Rotating the VOL - OFF control anticlockwise to "OFF" will deenergize the receiver.

TACAN SYSTEM

30 To operate the TACAN system, proceed as follows:

(a) INT control panel - TACAN monitor switch "on".

(b) Selector switch – "T/R" it takes approximately 90 seconds for the equipment to warm up.

(c) Select the desired channel on the CHAN selector.

(d) Adjust the VOL selector as necessary.

(e) HSI BRG selector - "TCN".

(f) HSI TRACK selector - "TCN".

(g) Navigator PTR No. 2 TAC for RMI indication if desired.

(h) Placing selector switch to "OFF" will deenergize the system.

VOR AND GLIDE SLOPE SYSTEM

31 To operate the VOR and G/S system proceed as follows:

(a) INT control panel - VOR/MB monitor switch "on".

(b) Function selector - "PWR". Allow one minute for warm-up.

(c) Adjust VOL selector as desired.

(e) HSI TRACK and BRG selectors - "VOR". Bearing and course information will be displayed on HSI's. When selected to a localizer frequency localizer and glide slope, information will be displayed on interim cross-pointer indicator.

(f) Navigator PTR No. 2 VOR for RMI indication if desired.

(g) The system can be tested by the NAV TEST VOR selector. With a VOR frequency selected, select TEST switch down; the OFF flag will show and the deviation bar move a full deflection to the right; release the switch and the OFF flag should disappear and deviation bar return to original position. Select test switch up; the OFF flag will show and the deviation bar move a full deflection to the left; release the switch and the OFF flag should disappear and the deviation bar return to original position.

(h) Selecting function selector to "OFF" will deenergize the system.

MARKER BEACON RECEIVER

32 To operate the marker beacon receiver proceed as follows:

(a) INTER control panel - VOR/MB monitor switch "on".

(b) Rotate VOL control clockwise as necessary.

(c) Set SENS switch to "HI" or "LO" as desired.

(d) Press-to-test marker beacon lights on pilot's instrument panel.

(e) Rotation of the VOL control anti-clockwise to "OFF" will deenergize the receiver.

IFF/SIF SYSTEM

33 To operate the IFF/SIF equipment proceed as follows:

(a) MASTER switch - "STBY". The equipment warms up but will not operate until selected to "LOW", "NORMAL", or "EMERGENCY".

(b) MASTER switch - "LOW" or "NORMAL". "LOW" is the same as "NORMAL" but at reduced sensitivity; in "NORMAL" the transponder is fully sensitized and operates with maximum performance.

(c) Follow ground control instructions regarding master switch setting and mode settings.

(d) In the event of emergency depress the red button and select MASTER switch to "EMERGENCY".

(e) Selecting "MASTER" switch to "OFF" will deenergize the equipment.

RADAR ALTIMETER SYSTEM

34 To operate the radar altimeter, proceed as follows: (Figure 1-37)

(a) GAIN control - "ON" (minimum gain). Allow 5 to 10 minutes warm-up period.

(b) ELAPSED TIME REC window - Check for bobbing dot movement.

(c) SCALE switch - "TIMES ONE".

(d) CIRCLE SIZE control - Adjust if necessary to give green circular trace slightly larger than scale circle.

(e) SCALE switch - "TIMES TEN" and green circular trace should decrease to 1/4 inch inside scale circle.

(f) Select desired SCALE switch setting and read absolute altitude off the counter clockwise side of the lobe on the green circular trace.

(g) Selecting GAIN control to "OFF" will deenergize the system.

DESCENT

35 Descent techniques required to produce the results stated in Part 4 are:

(a) Normal descent. Flaps and gear retracted and power adjusted to give desired rate of descent at an airspeed commensurate with turbulance level.

CAUTION

Reducing power to idle when descending through icing conditions may cause the engine anti-icing system performance to fall below safe limits and

the ENGINE INTAKE indicator lights to go out. A slight increase in power will cause the anti-icing system to resume operation and illuminate the ENGINE INTAKE lights.

LANDING PROCEDURES

PRE-LANDING CHECK LIST

36 Carry out pre-landing check list as follows:

(a) Hydraulics - UTILITY, BRAKE and RUDDER pressure - Check.

(b) Landing gear - Down and check:

(1) LANDING GEAR LOCKED DOWN (NOSE, LEFT and RIGHT - Check lights green).

(2) LANDING GEAR NOSE DOWN LOCK CHECK switch - hold to "CHECK" - Check lights green.

(3) Visual check of landing gear index marks, (if applicable).

(c) NOSE WHEEL STEER SWITCH - "ON".

(d) SPOILERS LANDING ARM switch - "LANDING ARM".

WARNING

If on the previous take-off the undercarriage failed to retract, the undercarriage weight switch is suspect and landing should be carried out without spoilers.

(e) FUEL CONTROL SELECTOR - "NORMAL".

(f) INNER TANK switches - "NORMAL".

(g) FUEL QTY - Check.

(h) FLAPS - Approach.

NOTE

Approach flap is maximum flap at which scheduled single engine performance is available.

FINAL LANDING CHECK LIST

37 Carry out final landing check list as follows:

(a) ECS MASTER - "OFF".

(b) FLAPS - Landing.

(c) Propeller levers - "INCREASE".

(d) FINE PITCH STOP - "APPROACH".

LANDING

38 Landing technique required to produce the results stated in PART 4 are as follows:

ADVANCE REVISION

Serial #3 dated 30 Aug 68
(Sheet 1 of 1)

The sheet of this Advance Revision is to be inserted in this EO facing page 2-26.

Part 2, Page 2-26:

Delete Para 36 (d) SPOILERS LANDING ARM switch - "LANDING ARM", and substitute the following:

(d) SPOILERS LANDING ARM SWITCH - "LANDING ARM". Retard power levers to IDLE momentarily and check that spoilers remain closed (SPOILER EXTD and EXTD indicator lights remain out).

CAUTION

To preclude any dangerous effects from a spoiler system malfunction, "LANDING ARM" should be selected with the airplane in level attitude, at least 1500 feet above the surrounding terrain, power on, and flaps up. If, during check, the spoilers extend, immediately advance power levers and select LANDING ARM switch to "OFF". If spoilers fail to retract, operate EMER CLOSE switch.

(a) Normal landing (30° flaps). Touch down on main wheels, power levers - "IDLE", brakes as required when nosewheel lowered to ground, power levers to "REVERSE" detent position, increase power (not above 1000 lb torque) if desired. Return power levers to idle before aircraft stops to prevent aircraft from rolling backwards under reverse power.

(b) Crosswind landing. Normal crosswind technique of wing down or crab method, or a combination of both should be used. Refer to Figure 4-15.

(c) Night landing technique. The technique recommended for a normal landing applies.

(d) Minimum run landing. The technique recommended for a normal landing applies with the following additions:

(1) Select 40° flap on final approach unless wind conditions dictate otherwise.

(2) On final approach, with flaps 40°, reduce airspeed to the following values depending on gross weight:

a.	39,000 lb -	74 kt IAS
b.	35,000 lb -	72 kt IAS
c.	30,000 lb -	64 kt IAS

(3) Assuming a 50 ft high obstacle, cross this at the recommended speed with power just above idle. Maintain this power and airspeed to the flare altitude. The flare should be commenced and power reduced to idle at an altitude from which the rate of descent can be arrested and the aircraft rotated to touch down on the main wheels. A stalled nose high attitude should be avoided. Immediately the main wheels have contacted the ground, full application of reverse power and intermittent maximum braking should be used. Nosewheel should be lowered to the ground and nosewheel steering used for directional control, while copilot holds control column forward for effective steering. Return power levers to "IDLE" before aircraft comes to rest to prevent aircraft rolling backward under reverse power. The most effective braking is obtained by intermittent use of maximum brake for periods of at least one full second, separated by a momentary release period.

NOTE

During turbulent conditions large control movements should be used as required. In addition airspeed should be increased as appropriate to the conditions of wind and turbulence.

MISLANDING

39 Procedure to be followed in the event of an overshoot or mislanding is as follows:

(a) Overshoot from final approach:

(1) Airspeed - 1.3 V_S (88 kt at maximum landing weight, 30° flaps) (85 kt at maximum landing weight, 40° flaps).

(2) Power levers - Take-off power.

(3) FINE PITCH STOP switch - "NORMAL".

(4) Landing gear selector lever - "UP".

(6) Airspeed - Allow to increase to normal climb speed.

(7) SPOILERS LANDING ARM switch - "OFF".

(b) Overshoot after touchdown or if touchdown is imminent.

(1) Power levers - Take-off power.

NOTE

Anticipator switch operation by power levers will drive propeller blade angle from approach fine into a coarser blade angle range and preclude overspeeding.

(2) Airspeed - Initiate climb at 1.3 V_S (88 kt at maximum landing weight,30° flaps) (85 kt at maximum landing weight,40° flaps).

(3) Landing gear selector lever - "UP" when well clear of the ground.

(4) Wing flaps selector lever - "0°".

(5) Airspeed - Allow to increase to normal climb speed.

(6) FINE PITCH STOP selector - "NORMAL".

(7) SPOILERS LANDING ARM switch - "OFF".

AFTER LANDING

40 After landing proceed as follows:

(a) Controls lock - "LOCKED".

(b) SPOILERS LANDING ARM switch - "OFF".

(c) FINE PITCH STOP - "GROUND".

(d) Wing flaps selector - "0°".

(e) Fuel flow levers - "GROUND IDLE".

(f) ICE CONTROL panel switches - "OFF".

(g) WINDSHIELD HEAT - "OFF".

END OF FLIGHT PROCEDURE

POST TAXI CHECK

41 Complete post taxi check as follows:

(a) Nosewheel - Centered and NOSEWHEEL STEER switch - "OFF".

(b) Parking brake - Set.

STOPPING ENGINES

42 To stop the engines proceed as follows:

(a) Allow the engines to stabilize at ground idle power for one minute.

(b) Power levers - "IDLE".

(c) Fuel flow levers - "OFF" (one at a time to check automatic bus tie).

(d) During shutdown, listen for unusual scraping or rubbing noises.

(e) Monitor TURB INLET TEMP.

(f) FUEL CONTROL selector - "OFF".

(g) BATTERY/EXT DC and AC MASTER switches - "OFF".

(h) All switches ~~except GENERATOR switches~~ - "OFF".

BEFORE LEAVING AIRCRAFT

43 Before leaving aircraft proceed as follows:

(a) CABIN LTG REAR EXIT RESET switch select - "REAR EXIT RESET".

(b) Portable emergency lights (2) switch - "OFF".

(c) Doors and windows - Closed.

(d) All door and hatch block assemblies - In place (if necessary).

(e) Flight compartment lower hatch - Locked (if necessary).

(f) Landing gear ground safety locks - In place.

(g) Wheels - Chocked.

COLD WEATHER OPERATION

BEFORE ENTERING AIRCRAFT

44 Check the entire aircraft for freedom from frost, snow and ice. Loss of lift and stalls may result if the aircraft is not adequately cleaned. Brush off all light snow or frost. Remove ice by a direct flow of air from a ground heater. Do not chip or scrape ice, as this may damage the aircraft. Ensure that the fuel vents, two under each wing, and oil vents, on the engine nacelle aft of the firewall, are free of ice. If an external bleed air source and external dc, or APU, are available the ECS can be operated on Manual to start warming the aircraft.

AFTER ENTERING AIRCRAFT

45 No additional cold weather precautions are required after entering the aircraft.

BEFORE STARTING ENGINES

46 External power should be used, if available, to start the APU and/or engines to avoid excessive drain on the aircraft battery. If it is suspected that the engines may be frozen, ground heater units should be used to preheat the engines, particularly at the gearbox and accessory drive area.

STARTING ENGINES

47 ICE CONTROL ENGINE INTAKE anti-icing switch selected to ENGINE INTAKE before starting engines if operating under icing conditions. Normal procedure for starting APU and engines should be used. Maintain fuel flow levers at "GROUND IDLE" and ensure engine oil temperature and pressure and SDG oil pressure are within operating limits before increasing RPM. Check visually for excessive oil leaks from engines and propellers.

WARMING UP and GROUND TESTS

48 Normal operating procedures to be followed. WINDSHIELD HEAT selected to "WARM-UP".

TAXIING INSTRUCTIONS

49 Normal cold weather precautions to be observed. Use nosewheel steering when ice conditions exist. Avoid taxiing in deep snow as taxiing is more difficult and frozen brakes may result. Increase taxiing distance between aircraft at sub-freezing temperatures to ensure safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice from the jet blast of a preceding aircraft.

BEFORE TAKE-OFF

50 Normal procedures to be observed.

TAKE-OFF

51 Normal procedures to be observed.

AFTER TAKE-OFF

52 The landing gear should be operated through several cycles if take-off has been from a slush covered surface. Early operation of ECS should preclude windshield misting and increase crew comfort.

DURING FLIGHT

53 Normal procedures to be observed.

DESCENT

54 Reducing power to idle when descending through icing conditions may cause the engine anti-icing system performance to fall below safe limits and the ENGINE INTAKE indicator

lights to go out. A slight increase in power will cause the anti-icing system to resume operation and illuminate the ENGINE INTAKE lights.

APPROACH TO PATTERN

55 Normal procedures to be observed.

LANDING

56 Normal procedures to be observed. A judicious combination of braking, reverse thrust and nosewheel steering may be required on slippery landing surfaces.

STOPPING ENGINES

57 Normal procedures to be observed.

BEFORE LEAVING AIRCRAFT

58 Normal procedures to be observed. Release parking brakes after wheels are chocked to minimize possibility of brakes freezing. Install covers and plugs, if applicable.

PART 3

EMERGENCY HANDLING

SECTION 1

NON-CRITICAL EMERGENCIES

EMERGENCIES IN THIS SECTION ARE CONSIDERED TO BE OF A NON-CRITICAL NATURE. SUFFICIENT TIME IS AVAILABLE TO CONSULT THE CHECK LIST FOR REMEDIAL ACTION.

MAIN SERVICE EMERGENCIES OPERATION

LANDING GEAR EMERGENCY LOWERING

1 To use the emergency system to lower landing gear proceed as follows: (gear lowering directions are marked on the emergency hydraulic panel).

NOTE

Failure to obtain a locked down indication of the nosewheel may be caused by a faulty microswitch. This may be checked by operating the LANDING GEAR NOSE DOWNLOCK CHECK switch momentarily to "CHECK". If the adjacent green light illuminates the nosewheel is locked down.

(a) L. G. selector lever - "DOWN".

(b) Landing gear EMERGENCY SELECTOR lever rotated to - "DOWN".

(c) Pull main gear emergency release handle, located on bulkhead behind pilot's seat. The main gear door uplocks and gear uplocks will be released and gear should lower by gravity.

(d) Turn nose gear extension handle clockwise to unlock nose gear doors.

(e) Operate handpump to lower nose gear.

(f) If nose gear will not lower by handpump pressure, use emergency nitrogen bottle by pulling nose gear emergency extension handle and holding until the gear locks down. (Since the nitrogen system can only be used once in flight, the emergency hydraulic system should be tried first.)

CAUTION

Before subsequent retraction of the landing gear after an emergency extension, the LANDING GEAR EMER DOWN RECOV switch must be actuated with the L. G. lever at "DOWN". The landing gear may then be retracted by normal "UP" selection.

FUEL SYSTEM EMERGENCIES

2 For fuel system emergencies, proceed as follows:

(a) Fuel transfer failure. Fuel continues to be drawn from the outer tank while the inner tank contents remain unchanged. Equal levels of fuel should be maintained between left and right inner tanks and between left and right outer tanks, and in the event of fuel transfer failure, the contents of the inner tank on the malfunctioning side should be used first to maintain this balance. This is accomplished by selecting the appropriate INNER TANK switch to "EMER". This will enable inner tank fuel to be supplied direct to its engine. Before the fuel quantity gage denotes that the inner tank is empty, the INNER TANK switch must be reselected to "NORM", so that fuel can be drawn from the outer tank for the remainder of the flight. If an INNER TANK switch is selected to "EMER" at high altitude, rough engine operation may be caused through lack of fuel pressure at the engine pump. In this event the INNER TANK switch should be returned to "NORM" and fuel crossfed to the malfunctioning engine while descending to a lower altitude. The fuel selector switch can then be selected to "NORM" and the INNER TANK switch to "EMER" to use the inner tank fuel. "EMER" should not be selected above altitudes of 15,000 feet or with contents of less than 400 lb in the affected inner tank.

CAUTION

As inner tank contents decreases to a low level, the aircraft should be flown straight and level so that air will not be drawn into the engine fuel line.

(b) Outer tank rupture. If an outer tank rupture is detected either visually or by rapid depletion of outer tank contents, loss of inner tank fuel can be prevented by selecting the appropriate INNER TANK switch to "EMER".

(c) Fuel pressure failure. Proceed as for L or R ENG FUEL PRESS, L or R ELEC FUEL PUMP or L or R A/D FUEL PUMP caution light indication in Figure 3-3.

ELECTRICAL SYSTEM EMERGENCIES

3 For electrical system emergencies, refer to Figure 3-3.

FLIGHT CONTROL SYSTEM EMERGENCIES

4 For flight control system emergencies, proceed as follows:

(a) Flaps inoperable because of an electrical or hydraulic malfunction can be rectified by handcranking flaps to desired position. The wing flaps disengage knob on the flap actuator must be pulled out and turned into its detent and the flaps actuated by inserting the ramp door handcrank into the flap actuator vertical drive shaft. Approximately 300 turns of the crank are required for full flap deflection.

(b) Flap malfunction detected by flap sensor, where the flaps become inoperable because of unequal movement between left wing and right wing flaps or out of phase movement between flaps and elevator trim tab. In this event do not attempt to reposition flaps by hand operation. The aircraft should be trimmed for level flight, and engine power should be appropriately adjusted, to obtain maximum controllability. Land as soon as practicable.

(c) Wing spoiler malfunction while in flight mode through utility hydraulic pressure failure

or spoiler malfunction. Select SPOILERS EMER CLOSE switch to "EMER CLOSE". This will disconnect the spoiler actuators from the aileron controls and hold the spoilers closed. The spoilers must remain closed for the remainder of the flight including landing. Because of reduced lateral control available without spoilers, not more than 20° flap should be used for landing unless crosswinds and gusts are negligible and available landing distance dictates the use of more flap.

(d) Aileron trim tab run-away can be caused by a malfunction of the aileron trim system, Physical control of the aircraft is not difficult. Reduce airspeed to relieve wheel force, and if the trim can be reversed, pull the AILERON ACT circuit breaker on PANEL 1 as the trim reaches the neutral position.

(e) In the event of a loss of rudder system hydraulic pressure due to a failure of both rudder hydraulic pumps, or a hydraulic leak in the rudder system, utility system pressure can be delivered to the rudder actuator by selecting UTILITY PRESS TO RUDDER switch "ON".

UTILITY HYDRAULIC SYSTEM FAILURE

5 When the Utility Hydraulic System fails, the following services are inoperative: winch spoilers, normal flap operation, normal gear lowering, normal brakes (after accumulator has emptied) and nosewheel steering. When the Utility Hydraulic System pressure drops below 1100 psi the nosewheel steering should be selected "OFF" to prevent a surprise failure at a critical moment. No attempt should be made to move or restrain the steering wheel while the steering is "OFF". Pilots should anticipate loss of brakes at any time during normal brake application and be prepared to use the emergency brake system to bring the aircraft to a stop. The aircraft should not be taxied since differential braking is not available when using the emergency system and there is no indication when the emergency system pressure will be exhausted.

BRAKE SYSTEM EMERGENCIES

5A Compressed nitrogen is available for progressive braking in the event of a hydraulic system failure. To apply emergency brakes, pull lever labeled EMERGENCY BRAKE (Figure 1-6) on windshield center post. Braking response will be in proportion to lever travel when pulled.

CAUTION

Lever operations should be kept to a minimum to prevent premature depletion of the nitrogen supply.

ENGINE FAILURE

FLIGHT CHARACTERISTICS UNDER PARTIAL POWER CONDITIONS

6 The two most significant factors for consideration while in flight under asymmetric power conditions are minimum control speed and safe, single engine speed. The minimum control speed, (V_{MC}) 80 kt IAS at 41,000 lb, is based on take-off configuration, inoperative engine autofeathered, take-off power on the operative engine and no more than 5° of bank toward the operative engine. Retracting the landing gear will result in an increase in airspeed or an increased rate of climb. Safe single engine speed is attained when the airspeed reaches 98 kt IAS. At this speed a rate of climb of approximately 300 fpm will be possible with the inoperative propeller feathered, landing gear retracted, and flaps at take-off setting. These figures are based on standard day conditions at sea level, and with an increase in ambient temperature or altitude, a deterioration in performance will result. Refer to PART 4 for

variations in minimum control speed and safe single engine speed for different combinations of gross weight, temperature and attitude.

NOTE

Safe single engine speed is based on 1.2 times power off stalling speed with take-off flap setting.

On the take-off ground roll, should an engine become inoperative before take-off speed is attained and the take-off is aborted, the aircraft is easily controllable to a stop by use of rudder and wheel brakes. If an engine becomes inoperative above take-off speed and the take-off is continued, the intiial yawing tendency should be controlled by rudder. A bank angle of 3° to 5° should then be applied toward the operative engine; the resultant side slip creates an angle of attack at the vertical stabilizer sufficient to relieve footloads and assist in directional control

requirements. The aircraft trim controls can then be adjusted and the climb continued. If an engine becomes inoperative while in flight under cruise power, the resultant yaw is not severe and may easily be corrected by rudder, and trim control applied. In addition to the yaw, the inoperative engine can be determined by checking the TORQUE indicators, PROPELLER PERCENT RPM or TURB INLET TEMP indicators. Depending on gross weight, altitude and ambient temperature, engine power should be adjusted to provide satisfactory performance for continued flight.

ENGINE FAILURE PROCEDURE

7 The critical steps necessary to stop an engine and the additional steps required to completely shut down an engine are covered under engine failure under specific conditions. Procedure for restarting an engine in flight varies with circumstances.

(a) For a normal engine restart in flight, proceed as follows:

(1) AUTO FEATHER switch - "OFF".

(2) OIL FUEL HYD switch - "NORMAL".

(3) Power lever - "IDLE".

(4) Propeller lever - "DECREASE".

(5) ENVIRONMENTAL CONTROL MASTER switch - "OFF".

(6) BLEED AIR SOURCE L ENG or R ENG switch - "ON" (live engine).

(7) ENGINE START switch - "L" or "R" (as applicable).

(8) Power on live engine sufficient to produce 20% TURBINE PERCENT RPM on indicator for engine being started.

(9) ENGINE IGNITION switch - "L" or "R" (as applicable).

(10) Fuel flow lever - "NORMAL".

(11) ENGINE START and IGNITION switches - "OFF" when TURBINE PERCENT RPM stabilized.

(12) Propeller feathering button - "UNFEATHER PULL" (if propeller is feathered).

(13) ENG OIL and SDG PSI indicators - Check.

(14) BLEED AIR and GENERATOR switches - "ON".

(b) For a double flameout engine restart in flight, proceed as follows:

(1) Start APU.

(2) AUTO FEATHER switch - "OFF".

(3) OIL FUEL HYD switch - "NORMAL".

(4) Power lever - "IDLE".

(5) Propeller lever - "DECREASE".

(6) ENVIRONMENTAL CONTROL "MASTER" - "OFF".

(7) ENGINE START switch-"L" or "R" (as applicable).

(8) ENGINE IGNITION switch-"L" or "R" (as applicable).

(9) Fuel flow lever - "NORMAL".

(10) ENGINE START and IGNITION switches - "OFF" when TURBINE PERCENT RPM stabilized.

(11) ENG OIL and SDG OIL PSI indicators - Check.

(12) Unfeather propeller (if feathered).

(13) Power lever - As required.

(14) Repeat (2) to (13) above for other engine.

(15) APU MASTER - "OFF".

ENGINE FAILURE UNDER SPECIFIC CONDITIONS

ENGINE FAILURE DURING FLIGHT

8 If engine failure occurs in flight, proceed as follows (as applicable) for failed engine:

(a) Heading - Maintain.

(b) Power on live engine - Increase if necessary, to obtain a safe cruising speed.

(c) L. G. selector lever - "UP".

(d) FLAPS - "0°".

(e) Trims - Adjust.

(f) Fuel flow lever for failed engine - "OFF".

(g) Propeller feathering button for failed engine - "FEATHER". If inoperative, feather with propeller lever.

(h) Power lever for failed engine - "IDLE".

NOTE

Refer to Part 4 for cruise control with one engine inoperative.

MAXIMUM GLIDE

9 In the clean configuration with both propellers feathered the recommended glide speed

to obtain maximum range is 116 kt IAS at 41,000 lb, 112 kt IAS at 38,000 lb, 101 kt IAS at 30,000 lb.

CAUTION

With both engines stopped and propellers feathered the only electrical power source is the battery. The hydraulic system would then be inoperative; rudder and spoilers would be inoperative, flaps inoperative, normal landing gear lowering inoperative and normal wheel brakes inoperative (after accumulator emptied). Consequently the APU would have to be running to provide normal services, or one or both propellers left windmilling to provide hydraulic services.

NOTE

The left OIL FUEL HYD switch must be at "NORMAL" to provide APU fuel.

LANDING WITH ONE ENGINE INOPERATIVE

10 When landing with one engine inoperative, proceed as follows:

(a) Carry out pre-traffic pattern check list.

(b) Carry out traffic pattern check list (do not lower flaps until final approach); maintain 120 kt IAS for all aircraft weights.

(c) Final approach - Flaps 17° airspeed 88 knots for all aircraft weights.

(d) When safe landing is assured and power is no longer required on live engine lower flaps as applicable.

(e) After touchdown apply brakes as required.

GO-AROUND WITH ONE ENGINE INOPERATIVE

11 The decision to go-around on one engine must be made while the flaps are at or below the approach setting. Take-off power should be applied and the landing gear retracted, and when clear of obstacles, the flaps should be set to "0°". Airspeed should be allowed to increase in accordance with gross weight as the flaps retract. When clear of obstacles and established in the climb, the power on the live engine can be reduced as appropriate.

SINGLE ENGINE PRACTICE MANEUVERS

12 The flight characteristics of the aircraft under asymmetric power are described in paragraph 6 and practice of the following procedures will provide thorough familiarization with flight under this condition.

(a) Effect of power and airspeed on trim. For any given weight and/or configuration, the principle factors affecting directional control are airspeed and operative engine power setting.

Either of these effects can be demonstrated in the following manner: Having shut down one engine, trim the aircraft to fly straight and level, "hands and feet off". Gently ease back the power of the operative engine. As the thrust decreases, the aircraft will yaw toward the operative engine and the power will have to be reset or rudder applied to regain directional control. Regain "hands and feet off" condition. Gently increase the power (thrust). The aircraft will immediately yaw toward the inoperative engine, control being regained as before. With a constant power setting commence a gradual climb. As the airspeed decreases, so the effectiveness of the rudder will decrease, and the aircraft will yaw toward the inoperative engine. If the control column is now eased forward, the airspeed will increase, the effectiveness of rudder will increase to counteract the yaw, and directional control will be regained. If a gentle dive is commenced, the increased effectiveness of the rudder will yaw the aircraft toward the operative engine. During any of the exercises, it will be found that a loss of control due to power setting change can be counteracted by a change in airspeed, and vice versa. If the power is constant and the airspeed slowly reduced, it will be found possible to maintain directional control down to exceptionally low speeds by use of rudder control and slight bank toward the operative engine. With one power lever at "IDLE" trim the aircraft to fly "hands and feet off" and vary the pitch lever on the idling engine from "INCREASE" to "FEATHER" and the variation in yaw between these two propeller blade angles will be very obvious.

(b) Simulated engine failure. At a safe altitude in any take-off configuration and at take-off power, both at above and below the take-off speed, retard one power lever to "IDLE" and note the action necessary to maintain control in each case.

NOTE

In the short field take-off flap configuration, particular attention should be paid to the minimum control speed, and any height loss necessary to maintain directional control while cleaning up the aircraft for continued flight. Continuing the take-off when an engine fails during the early stages of a short field take-off is not recommended (see paragraph 33, (c)).

(c) No difficulty should be experienced in doing normal turns both toward and away from an inoperative engine.

(d) Normal stall recovery technique should be used in recovering from a practice asymmetric stall.

(e) Simulated single engine circuits and landings can be practiced at a safe altitude followed by a simulated go-around. In the appropriate approach configuration, open up the operative engine to take-off power. Note the loss of height from the time of starting to increase power until level flight is attained. Follow the same procedure in the appropriate landing configuration; in this instance, the descent will have to be continued while cleaning up the aircraft.

FIRE

NOTE

Refer to Paragraph 209 SHORT DISCRIMINATOR.

ENGINE FIRE

13 In the event of an engine fire, proceed as follows:

(a) APU fire. For an APU fire during APU start on the ground proceed as follows:

(1) APU MASTER - "OFF".

(2) Left FUEL OIL HYD switch - "OFF".

(3) Pull illuminated FIRE PULL T-bar when APU stops.

(4) If fire is not extinguished, push T-bar fully in, turn clockwise through 90° and pull again.

(b) Engine fire on the ground. For an engine fire during engine start, (excessive TURB INLET TEMP), proceed as follows:

(1) Fuel flow lever - "OFF".

(2) Power lever - "IDLE".

(3) FUEL CONTROL selector - "OFF".

(4) Engage starter (without ignition) and motor engine until fire is extinguished.

CAUTION

Do not exceed starter operating limits (one minute duration).

(5) If fire is not extinguished, have ground crew apply a CO_2 hand fire extinguisher to engine inlet, or operate engine fire extinguisher.

(6) When fire is extinguished, shut down APU.

(c) For a post shut down fire as indicated by a constant TURB INLET TEMP of 320°C or higher, proceed as follows:

(1) BATTERY EXT/DC switch - "ON".

(2) Start APU.

(3) Follow steps (4) through (6) of (b) above.

(d) Engine fire during flight. Follow the instructions on the placard on the emergency panel and proceed as follows for the applicable engine:

(1) ZONE 1. If the ENGINE FIRE ZONE 1 warning light illuminates set:

a. Fuel flow lever - "OFF".

b. OIL FUEL HYD switch - "OFF".

c. Propeller lever or feathering button - "FEATHER".

d. Power lever - "IDLE".

(2) ZONE 2 & 3. If a fire warning light in a FIRE PULL T-bar handle illuminates set:

a. Fuel flow lever - "OFF".

b. OIL FUEL HYD switch - "OFF".

c. Propeller lever or feathering button - "FEATHER".

d. Pull illuminated FIRE PULL T-bar when propeller fully feathers.

e. If fire is not extinguished, push T-bar fully in, turn clockwise through 90° and pull again.

f. Power lever - "IDLE".

FUSELAGE FIRE

14 A fuselage fire should be fought with the portable fire extinguishers. The extinguishing agent should not be allowed to contact the skin as it may cause frostbite or low temperature burns. The extinguishers should be discharged one at a time, and with care, in order to reduce inadvertent splashing. Until the fire is extinguished, the flight compartment side windows should be kept shut, the ENVIRONMENTAL CONTROL MASTER switch selected "OFF" and, if necessary, 100% oxygen used by the crew.

WING FIRE

15 Except for an engine fire that spreads to the wing, the possibility of a wing fire is minimal. Any overloaded electrical circuit would open the circuit breaker and preclude the possibility of igniting the noncombustible wing structure. If an engine fire should spread to the wing, sideslipping the aircraft will assist in diverting the fire. If the fire persists or increases, and indications of consequent structural failure are evident, the aircraft should be abandoned, ditched, or landed as soon as practicable, at the discretion of the pilot.

ELECTRICAL FIRE

16 As already mentioned under wing fire, the possibility of an electrical fire is minimal. However, if an electrical fire should occur, it should be dealt with by switching off the service involved, if it can be identified, and by deenergizing the circuit through the use of the appropriate circuit breaker(s). If the fire is in the fuselage, use 100% oxygen and fight the fire with the portable fire extinguishers.

SMOKE ELIMINATION

17 Until the fire is out, no hatches, doors or windows should be opened to relieve the discomfort of the smoke and fumes from a fuselage fire. The ECS should be turned off. By cutting down the fresh air supply to the fire, it will be more readily extinguished. Once the fire is out, the ECS may be switched on and the pilot's side windows and cargo door opened to dissipate the smoke and fumes. Do not remove oxygen masks until considered safe.

LANDING EMERGENCIES

GENERAL

18 Landing with one or both engines inoperative is covered in paragraphs 10 and 34.

LANDING WITH FLAT TIRE

19 Land normally, using nosewheel steering and if necessary asymmetric power to maintain direction. Do not arm spoilers. Use the brakes as little as possible. If a nosewheel tire is involved, hold up the nose as long as possible and lower gently to the runway prior to loss of elevator control. Use nosewheel steering to maintain direction.

LANDING WITH ONE GEAR RETRACTED

20 Should one main gear fail to extend,the landing must be made with both main gears retracted. If the nose gear fails to extend, the landing should be made with the main gear extended. The nose should be held off the ground as long as possible, but before elevator control is lost, it should be gently lowered to the runway. The brakes must not be applied until after the nose is on the runway, and then only gently. As soon as the main wheels have touched down, select fuel flow levers "OFF" and BATTERY/EXT DC "OFF".

WHEELS-UP LANDING

21 For a wheels-up landing, proceed as follows:

NOTE

Select a smooth level grass area where possible.
If a runway must be used have foam laid down.

(a) Fuel - Use up as much as possible, particularly from inner tanks.

(b) Passenger warning signs - NO SMOKING and FASTEN BELTS switches "ON".

(c) Loose items - Secure.

(d) Shoulder harness inertia reels - Locked.

(e) Approach - Normal approach.

(f) Fuelflow levers - "OFF" before touchdown.

(g) BATTERY/EXT DC switch - "OFF" before touchdown.

(h) Touchdown - Slightly nose high. Use rudder to maintain direction as long as possible.

CAUTION

Do not feather both propellers or rudder control will be lost.

(j) Aircraft - Abandon. Release harness and abandon aircraft.

EMERGENCY ENTRANCE

22 In an emergency, the aircraft may be entered via either passenger door, either cabin emergency door, and the flight compartment bottom hatch and roof hatch, all of which may be opened from the outside of the aircraft. A broken yellow line marked CUT HERE FOR EMERGENCY RESCUE on the right side of the fuselage beneath the wing trailing edge (Figure 3-1) marks an area for emergency entrance by means of chopping or cutting.

DITCHING

CAUTION

This aircraft should only be ditched as a last resort. It is recommended that the occupants bail-out rather than ditch, whenever possible. The decision to ditch or bail-out must be made by the pilot in view of the existing circumstances, but should not be delayed until the fuel supply is exhausted since the approach for ditching should be made with power on. (See Figure 3-2 for ditching chart).

23 Scale model ditching tests with similar aircraft indicate that the aircraft may be expected to experience a pronounced nose down pitch after initial touchdown. The front fuselage may be momentarily immersed, resulting in damage to the fuselage structure; which will probably cause rapid flooding of the flight compartment and forward cabin area, up to the level of the wings. The aircraft will probably settle rapidly in a nose down attitude.

24 Preflight preparations - Overwater flight. It is assumed that the crew are familiar with, and practiced in, general ditching procedures. Prior to overwater flights, a complete check must be made of the emergency equipment, with particular attention paid to the location of the life raft or rafts, and that their carrying capacity is adequate for the number of aircraft occupants. The method of releasing the raft must be understood. The raft will normally be strapped to the floor of the cabin, adjacent to the ramps, together with survival kit. When passengers are carried, a preflight briefing should be conducted including instructions on the use of seat belts, life jackets, and ditching procedures. The method of jettisoning the emergency doors and passenger doors must be understood. Preflight planning shall also include a review of the emergency communication frequencies, rescue facilities, and surface vessels that may be available to render assistance in the event of an emergency.

25 Preparation for ditching. The moment a possible ditching emergency arises, the appropriate communications distress procedure and preparations should be initiated. All cargo and equipment, including ramp extensions that can be jettisoned in the time available should be disposed of. If cargo cannot be jettisoned, its security should be checked and additional tie-down devices added. Fuel should be used down to the practical minimum, since the empty cells provide additional buoyancy. Crew and passengers should remove parachute harnesses; back packs may be left in the seats.

26 Sea evaluation. If the ditching is in the open sea, in daylight, the direction of the wind and swell, and the wind speed must be assessed. This should be from two thousand feet or more, if possible. The primary or basic swell can be distinguished from high altitude and will be seen first. It may be hidden beneath another system or surface chop but, from a high altitude the largest and most dangerous system will be the first one recognized. Secondary or

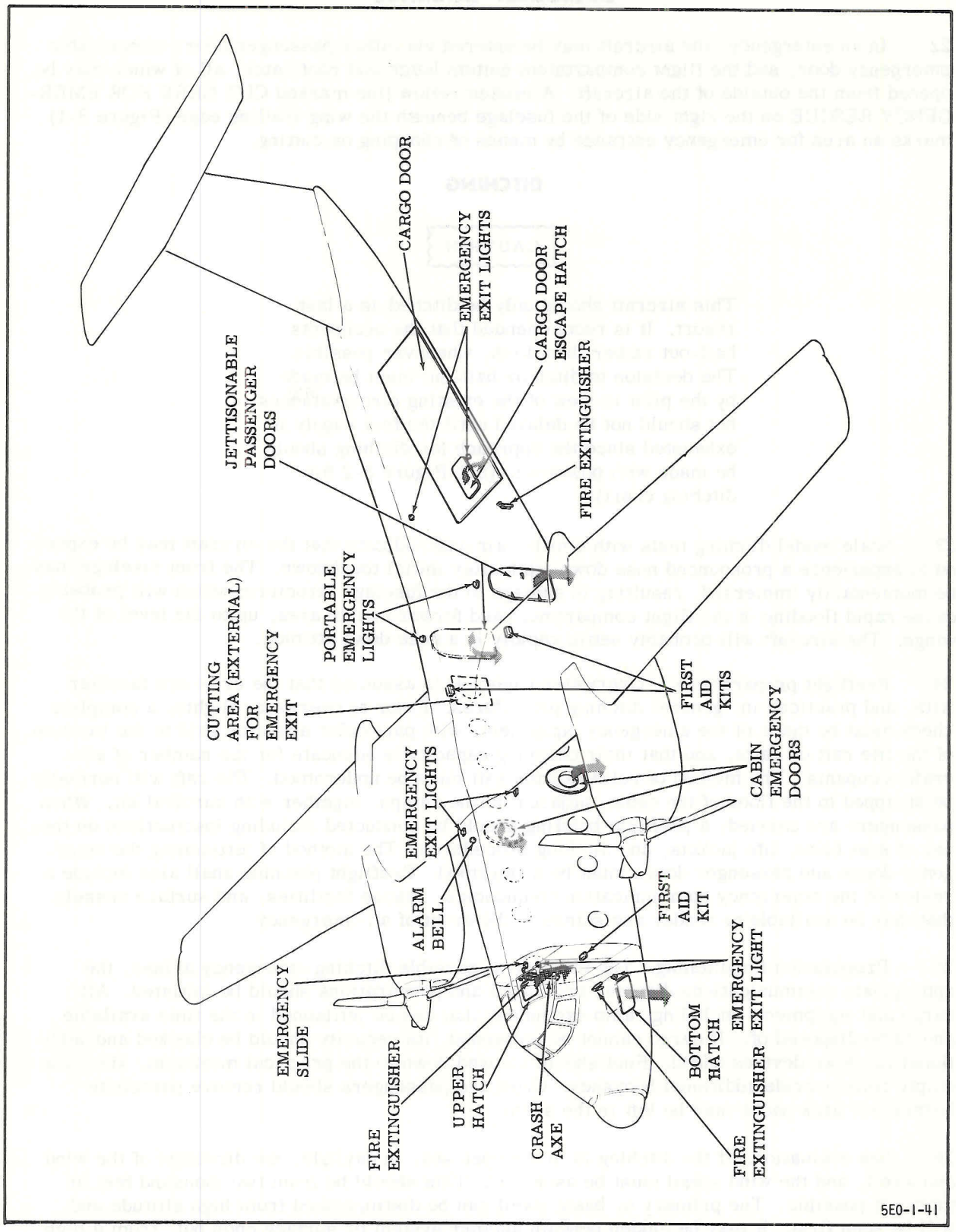


Figure 3-1 Miscellaneous Emergency Equipment and Emergency Routes of Escape and Exits

Personnel	Duty	Provide	Position	Exit
PILOT	Give warning by intercom to crew and passengers to stand-by to ditch. Remove parachute harness, don Mae West, loosen collar and tie and lock safety harness.		Pilot's seat	Flight compartment hatch.
COPILOT	Acknowledge ditching. Assist pilot with control of aircraft. Remove parachute harness, don Mae West, loosen collar and tie and lock safety harness. Give warning to brace for impact. Supervise evacuation of aircraft.		Copilot's seat	Cargo door.
NAVIGATOR	Acknowledge ditching, check aircraft position. Remove parachute harness, don Mae West, loosen collar and tie. Place navigation equipment in satchel. After ditching launch dinghies and assist in evacuation.	Satchel	Aft of main spar	Cargo door.
FLIGHT TECHNICIAN	Acknowledge ditching. Supervise cargo jettison, remove parachute harness, don Mae West. After ditching assist in dinghy launching and passenger evacuation.		Aft of main spar	Cargo door.
PASSENGERS	Remove parachute harness, don Mae West, loosen collar and tie. Secure harness and assume ditching position. After ditching evacuate in orderly manner.		Passenger seat	Emergency exit doors, Passenger doors or Cargo door as briefed.

Figure 3-2 Ditching Chart

minor swells, if present, may not be visible until altitude is decreased, therefore, a continual scanning of the sea is necessary. The wind-driven sea, if any, will be easily recognized by the appearance of whitecaps from which the wind velocity may be assessed as follows:

(a) 4 to 6 kt - Small wavelets, short but pronounced; crests have a glassy appearance but do not break.

(b) 11 to 16 kt - Small waves, becoming longer; fairly frequent whitecaps.

(c) 17 to 21 kt - Moderate waves, taking a more pronounced form; many whitecaps.

(d) 28 to 33 kt - Sea heaps up and white foam from breaking waves begins to be blown in well marked streaks along the direction of the wind.

(e) 41 to 47 kt - High waves. Dense streaks of foam along the direction of the wind. Sea begins to roll.

27 Once the primary and secondary systems are recognized, they should be checked by flying on various headings just above the water. When flying into any system the surface appears steep, fast and rough. When flying down the system the surface appears much more calm. Select the ditching heading in accordance with the following rules:

(a) The best ditching heading is usually parallel to the primary swell system. Attempt to touch down on the falling or back-side, rather than the face of the swell.

(b) Never ditch in the face of a primary swell system unless the winds are extremely high.

(c) In moderately strong winds it may be desirable to compromise the above rules by ditching more into wind and slightly across the swell system.

28 Final preparations. Once the decision to ditch has been made the pilot should warn the passengers and crew, and should turn "ON" the "NO SMOKING" and "FASTEN BELTS" switches. Passengers should be warned to tighten their safety belts and lean towards the nose of the aircraft as far as possible, half turning and resting head on arm, bracing the arm against the next seat occupant.

29 Check the following:

(a) Life raft quickly removable from its straps.

(b) Cargo door fully open.

(c) Draft proof door up and fully secure.

(d) Ramp in fully up position.

(e) All items of equipment remaining in the aircraft - Secured.

30 Last minute preparations should be made at the discretion of the pilot. Among these are transmission of the latest navigational position and assumption of ditching stations by all personnel. Cabin interior lights and emergency exit lights should be turned on at this time if ditching is conducted at night.

31 Ditching procedure. From a suitable height, proceed as follows:

(a) Perform landing check; do not lower the landing gear.

(b) Harness tight and locked.

(c) Flaps - 40° (all weights).

(d) FINE PITCH STOP - "APPROACH".

(e) Final approach at minimum speed consistent with gross weight.

(f) The copilot should signal one long ring on the alarm bell, approximately 5 seconds before touchdown, to warn all personnel to brace. Occupants should not change position until the aircraft has definitely stopped, since more than one shock may occur.

(g) Approach power-on and insure that the aircraft is not brought into contact with the water in a fully stalled attitude. Model tests of similar aircraft have indicated that best results are obtained by ditching in a moderate nose-up attitude. Throttles should be closed just before contact with the water, and all electrical power switched off.

(h) Once the aircraft is completely stopped the life raft should be cast off through the cargo door opening, and an orderly evacuation of the aircraft carried out in the shortest possible time. The emergency doors and passenger doors should be jettisoned if above the water line.

(j) When passengers are clear of the aircraft, exit by the flight compartment roof hatch as rapidly as possible.

ABANDONING IN-FLIGHT

32 Upon the decision to abandon the aircraft in flight, the pilot will alert the crew and passengers over the interphone and by a pre-arranged signal on the alarm bell. During the period taken by the passengers to ready themselves, proceed as follows:

NOTE

The recommended speed for bail-out is 100 knots IAS.

(a) Originate a distress call on the radio and switch IFF to "EMERGENCY".

(b) Open cargo door and jettison passenger doors, cabin emergency doors or cargo door EMERGENCY HATCH (Figure 3-1) as applicable (see Part 1, paragraph 221, 222 and 223). Also, after opening flight compartment bottom hatch inside doors the bottom hatch can be jettisoned in readiness for crew bail-out (see Part 1, paragraph 219).

(c) Execute bail-out order by pre-arranged alarm bell signal.

(d) Trim aircraft for level flight away from populated areas. If time permits before leaving aircraft, the pilot should turn off all electrical services, feather propellers, select fuel flow levers - "OFF", select OIL FUEL HYD switches - "OFF" and select BATTERY/EXT DC switch - "OFF".

SECTION 2

CRITICAL EMERGENCIES

EMERGENCIES IN THIS SECTION ARE CONSIDERED TO BE OF A CRITICAL NATURE. THESE PROCEDURES SHOULD BE PERFORMED IMMEDIATELY AND INSTINCTIVELY, WITHOUT REFERENCE TO WRITTEN CHECK LISTS AND SHOULD BE COMMITTED TO MEMORY.

ENGINE FAILURE

ENGINE FAILURE DURING TAKE-OFF

1 Engine failure during take-off will be covered under engine failure below critical speed and engine failure above critical speed.

NOTE

The critical engine failure speed V_1, minimum safe take-off speed V_2, and the take-off rotation speed V_R are assumed equal (98 kt IAS at 41,000 lb gross weight) (V_{MC} is 80 kt IAS at 7° flaps). If an engine fails during take-off its propeller will feather automatically, provided the AUTO FEATHER switch is selected to "ON".

(a) For engine failure below the critical engine failure speed V_1, proceed as follows:

(1) Power levers - "IDLE".

(2) SPOILERS LANDING ARM switch - "LANDING ARM".

(3) Brakes - Apply.

NOTE

When stopping from a high ground-speed (that is, at high airport altitude, high ambient temperature, high gross weight, and speed near V_2), apply little or no brakes for approximately five seconds and then apply brakes as required.

(b) For engine failure at or above critical engine failure speed V_1, proceed as follows:

(1) Maintain heading with rudder.

(2) Propeller lever or feathering button - "FEATHER" (if propeller does not feather automatically).

(3) Rotate aircraft at V_R (equal to V_2). Maintain V_2 after unstick.

(4) Heading - Keep aircraft straight by lowering the wing on the live engine side a maximum of 5° and applying the necessary rudder.

(5) L. G. selector lever - "UP".

NOTE

Allow the ball of the turn and slip indicator out of center up to half a ball width. This has the effect of allowing the vertical stabilizer to assist the rudder in counteracting yaw.

(6) Trims - Adjust.

(7) Climb - Straight ahead maintaining V_2 and, when clear of obstacles, raise the flaps and allow the airspeed to increase to normal climb speed.

(8) Fuel flow lever for failed engine - "OFF".

(9) Propeller lever for failed engine - "FEATHER".

(10) Power lever for failed engine - "IDLE".

(11) Power for live engine - Adjust to maximum continuous when established in climb.

(c) For engine failure on short field (STOL) take-off, proceed as follows:

(1) If an engine should fail before becoming airborne, the take-off must be aborted. If still groundborne, retard power levers to "IDLE", select SPOILERS LANDING ARM switch to "LANDING ARM" and apply wheel brakes as necessary to stop the aircraft.

(2) In order to provide the high performance take-off capability possessed by this aircraft using take-off flap, single engine performance must be regarded as secondary. As a result, if an engine should fail in the early stages following lift-off, the take-off should be abandoned and the aircraft landed straight ahead, turning only to avoid obstacles.

LANDING WITH BOTH ENGINES INOPERATIVE

2 Depending on the emergency, the situation and conditions can vary to such an extent that it can only be left to the discretion of the pilot to determine the best course of action. Procedures that should be adhered to, subject to time, altitude, and conditions are as follows:

(a) When a forced landing is inevitable, either on or away from an airfield, and structural damage to the aircraft is likely to result, complete the following as warranted by the situation:

(1) Alert the crew.

(2) Start APU to power electrical and hydraulic systems.

(3) NO SMOKING and FASTEN BELTS switches - "ON".

(4) Make radio calls as appropriate.

(b) The descent should be planned with the aim to arrive over the threshold of the landing

area at 1500 feet into wind at 114 kt IAS (at 38,000 lbs), 94 kt IAS (at 26,000 lbs) from this key point, select L. G. "DOWN" and commence turning in a continuous sweep, adjusting the rate of turn to position the aircraft on the approach at 800 feet and approximately one half mile from intended touchdown. When certain of reaching the selected area, commence lowering FLAPS in increments as desired and reduce the airspeed commensurate with gross weight. Select SPOILERS LANDING ARM switch to "LANDING ARM". When landing is assured, lower the remainder of the flaps and reduce to final approach speed for a normal landing. After landing apply brakes as required.

(c) Because of the slow landing speed and short landing roll, it is quite feasible that the aircraft could be forced-landed intact, even when the landing is made off an airfield. If the nature of the terrain confirms this possibility, then it would be advisable to land with the gear down.

(d) Depending on the situation, consideration should be given to stopping the APU, selecting the left OIL FUEL HYD switch to "OFF" and BATTERY/EXT DC switch to "OFF" before touchdown, and abandoning the aircraft the moment it comes to rest.

CAUTION

The APU will provide normal electrical and hydraulic services. Without the APU, even though both inoperative engines are windmilling, the following services would be inoperative: all avionic equipment, normal landing gear lowering, normal flap lowering and spoiler operation. If inoperative engines are feathered and APU not running rudder control would also be lost.

PROPELLER FAILURE

3 In the event of propeller overspeeding, proceed as follows:

(a) Power levers - "IDLE". Flight conditions permitting, reduce airspeed to just above stalling speed.

(b) Propeller lever - "FEATHER".

4 In the event of a propeller runaway, proceed as follows:

(a) If excessive and unchecked overspeeding occurs, reduce the airspeed as quickly as possible and feather the propeller immediately with the propeller lever. Should the propeller refuse to feather, check first the appropriate PROP CONT LEFT or RIGHT circuit breaker on PANEL 1, then if necessary, continue as follows:

(1) Appropriate fuel flow lever - "OFF".

(2) Immediately move passengers away from propeller plane of rotation.

(3) Airspeed - Reduce to just above the stall. If at fairly high altitude, extend landing gear and flaps and descend to a lower altitude.

NOTE

The denser atmosphere at low altitude will assist in reducing overspeeding.

(4) Re-attempt feathering.

(5) If still unable to feather propeller, land as soon as practicable.

WARNING

If a runaway propeller is not brought under control immediately and is overspeeding at a very high RPM, excessive vibration with possible blade failure, could occur.

5 In the event of a FINE PITCH STOP malfunction where one propeller stays at normal fine pitch when selected to "APPROACH" with consequent asymmetric propeller drag on final approach to land, proceed as follows:

(a) Advance both power levers to maximum continuous.

(b) FINE PITCH STOP selector - "NORMAL".

(c) Make subsequent approach and landing with FINE PITCH STOP selector - "NORMAL".

Caution Light Indication (In addition to MASTER)	Probable Cause	Immediate Action In all cases press MASTER caution light to reset, and stop horn.	Remarks Report all abnormal and malfunction conditions upon landing.
L. ENGINE FUEL PRESS	Fuel pressure at engine pump has fallen below 150 psi.	Carry out single engine procedure.	
L. ENG/SDG OIL PRESS	Engine oil pressure has fallen to 30 psi or SD Gear oil pressure has fallen to 5 psi.	Check relevant oil pressure indicator and if low oil pressure confirmed shut down engine: 1. Power lever - "IDLE" 2. Propeller lever - "FEATHER" 3. Fuel flow lever - "OFF" 4. OIL FUEL HYD switch - "OFF" 5. Power on live engine - "INCREASE".	
L. FUEL LOW LEVEL	Left inner tank empty and left outer tank level fallen to 350 pounds.	Check fuel remaining in all tanks. Crossfeed if more fuel remains in opposite wing tanks.	
L. BLEED OVERHEAT	An overheat condition existed in the ducts, and the bleed air valve has automatically closed.	Set L ENG BLEED AIR switch - "OFF". NOTE Unless the switch is set to "OFF" the caution light will not go out.	Reselect bleed air "ON" when caution light goes out.

Figure 3-3 (Sheet 1 of 7) Caution Lights Panel - Summary

Caution Light Indication	Probable Cause	Immediate Action	Remarks
L. ELEC FUEL PUMP	Left outer tank electric pump pressure has fallen below 2 psi.	Monitor L A/D FUEL PUMP caution light. If left and right fuel levels do not remain even equalize by crossfeeding.	Fuel system should function normally unless there is a double booster pump failure on one side.
L A/D FUEL PUMP	Left outer tank A/D pump pressure has fallen below 2 psi.	Monitor L ELEC FUEL PUMP caution light. If left and right fuel levels do not remain even equalize by crossfeeding.	Fuel system should function normally unless there is a double booster pump failure on one side.
L. ELEC FUEL PUMP and L A/D FUEL PUMP (DOUBLE FAILURE)	Left outer tank electric and air driven fuel pump pressure has fallen below 2 psi.	1. Check FUEL CONTROL selector "NORM". 2. If fuel remains in inner tank which is required to complete the mission, switch INNER TANK switch to "EMER". However, do not let this tank run dry. NOTE If engine flames-out on an inner tank selection return INNER TANK switch to "NORM", and crossfeed on relight. Descend to lower altitude. Switch FUEL CONTROL selector to "NORM" and INNER TANK switch to "EMER".	The engine fuel pump draws fuel from the outer tank and maintains engine operation. Inner tank fuel will not transfer to outer tank with double booster pump failure.

Figure 3-3 (Sheet 2 of 7) Caution Lights Panel - Summary

Caution Light Indication	Probable Cause	Immediate Action	Remarks
		3. When inner tank fuel is used select INNER TANK switch to "NORM" and fuel will then be used from outer tank.	
RUDDER HYD PRESS, L.	Rudder hydraulic pressure at left pump has fallen to 1100 psi.	Check for hydraulic fluid leaks.	If due to pump failure right rudder hydraulic pump will supply rudder actuator. If loss of all fluid occurs utility system will continue to supply rudder actuator.
L UTILITY HYD PRESS	Utility hydraulic pressure at left pump has fallen to 1100 psi.	Check for hydraulic fluid leaks.	If due to pump failure right utility hydraulic pump will supply all services.
CHECK FIRE DET	Short in fire detecting system.	Hold FIRE DETECTION TEST switch momentarily at "TEST" and defective fire detecting element will be isolated as applicable emergency panel warning light will not illuminate.	
CABIN DUCT OVERHEAT	Environmental control system ducts overheated (250°C) and pressure regulating shut-off valve has closed automatically.	1. Set ECS MASTER switch to "OFF". 2. Caution light will go out when overheat condition is gone. 3. Set ECS MASTER switch "ON".	

Figure 3-3 (Sheet 3 of 7) Caution Lights Panel - Summary

Caution Light Indication	Probable Cause	Immediate Action	Remarks
FLT COMP DUCT OVERHEAT	Refer to CABIN DUCT OVERHEAT	Caution light.	
DOORS UNLOCKED	Any one of the following doors not properly closed: 1. Flight compartment lower hatch. 2. Right or left passenger doors. 3. Fueling panel door. 4. Ramp door open below 0°.	Check applicable doors.	
REFUEL/DEFUEL ON and DOORS UNLOCKED	Fueling selector not set to "OFF". Panel door not closed.	Set selector to "OFF". Close fueling panel door.	This condition can only occur on the ground with engines stopped, APU running or external power connected. Engines cannot be started with fueling selector "ON".
ICING	Icing conditions exist, as signalled by the ice-detector probes.	1. Set ICE CONTROL ENGINE INTAKE switch to "ENGINE INTAKE". 2. Set ICE CONTROL PROP DEICE switch to "DEICE". 3. Check for ice build-up on wing leading edges and operate ICE CONTROL AIRFRAME deicer system as necessary.	Caution light may illuminate with OAT above freezing. When there is danger of ice in the intake duct.

Figure 3-3 (Sheet 4 of 7) Caution Lights Panel - Summary

Caution Light Indication	Probable Cause	Immediate Action	Remarks
R A/D FUEL PUMP RUDDER HYD PRESS R R UTILITY HYD PRESS R ELECT FUEL PUMP R FUEL LOW LEVEL R BLEED OVERHEAT R ENGINE FUEL PRESS R ENG/SDG OIL PRESS	Refer to equivalent left Caution light and take similar action accordingly.		
L or R GENERATOR (Single fault)	Generator malfunction.	Switch "OFF" generator.	Left and right variable frequency buses will be automatically connected for supply from one generator.

Figure 3-3 (Sheet 5 of 7) Caution Lights Panel - Summary

Caution Light Indication	Probable Cause	Immediate Action	Remarks
L or R GENERATOR OVERHEAT (single fault)	Generator overheating.	Switch "OFF" generator.	Left and right variable frequency buses will be automatically connected for supply from one generator.
LEFT or RIGHT DC (Single fault)	TRU undervoltage.		Left and right main dc buses will be automatically connected for supply from one TRU.
L or R 400 CYCLE (Single fault)	Frequency converter malfunction.		Left and right 400 cycle buses will be automatically connected for supply from one frequency converter.
L and R GENERATOR L and R 400 CYCLE LEFT and RIGHT DC (combined fault)	Left generator failure and right bus fault OR Right generator failure and left bus fault OR Both generators failed	Switch off non-essential loads start APU (a) If L and R 400 CYCLE and LEFT and RIGHT DC caution lights go out both generators have failed OR (b) With APU generator switch "ON", power will be supplied by APU to right bus if fault is right generator failure and left bus fault. R 400 CYCLE and RIGHT DC caution lights go out, remainder stay on.	Continue to operate with non-essential loads switched off. If practicable land as soon as possible. A generator cannot be reset when locked off through a bus fault.

Figure 3-3 (Sheet 6 of 7) Caution Lights Panel - Summary

Caution Light Indication	Probable Cause	Immediate Action	Remarks
		(c) If APU generator starts and then shuts down, fault is left generator failure and right bus fault. Switch "OFF" APU generator, set "NORM EMER" switch to "EMER" then set APU generator switch to "ON". The L 400 CYCLE and LEFT DC caution lights go out, remainder stay on, power supplied by APU generator to left bus.	A generator cannot be reset when locked off through a bus fault.

Figure 3-3 (Sheet 7 of 7) Caution Lights Panel - Summary

PART 4
OPERATING DATA

LIMITATIONS

ENGINE

1 Engine limitations are as follows:

(a)	Gas generator rpm (Ng)	Maximum continuous: 104% (17,800 rpm) Maximum for 10 seconds: 104% to 107% (17,800 to 18,330 rpm) Maximum under any conditions: 107% (18,330 rpm) Maximum in reverse: 104% (17,800 rpm) for 1 minute
(b)	Propeller rpm (Np)	Maximum continuous: 100 ± 1% (1160 rpm) Maximum transient for 5 seconds: 130% (1512 rpm) (speed switch operates at 114%)
(c)	Turbine inlet temperature (T5)	Maximum steady state: 605°C continuous 633°C for 30 minutes 644°C for 5 minutes Maximum transient other than starting (slam acceleration) 670°C for 45 seconds followed by 645°C for 45 seconds Starting transients 566°C to starter cut out (not less than 46% Ng) 649°C to idle
(d)	Torque	Maximum continuous: 1075 ft lb 1670 ft lb transient for 5 ~~minute~~ SEC s maximum

STARTING

2 Starting limitations are as follows:

(a)	Time between starts	2 minutes minimum
(b)	Time to light-up after fuel flow is indicated	10 seconds maximum

(c) Minimum for light-up 20% Ng

FUEL SYSTEM

3 Fuel system limitations are as follows:

(a) Fuel flow range during start (fuel flow lever just selected to GROUND IDLE) 100 to 175 pounds per hour

(b) Maximum fuel flow 1690 pounds per hour

(c) The use of AVGAS specification 3-GP-25e (MIL-G-5572C) as an alternative fuel is restricted to emergency operation for a maximum of 6 hours only. An engine hot-end inspection is then mandatory.

(d) Fuel remaining in a fuel tank when the fuel quantity indicator reaches zero is not usable in flight. All fuel registered on the fuel quantity indicator is usable in any flight attitude.

OIL SYSTEM

4 Oil system limitations are as follows:

(a) Oil temperature -54°C to 110°C maximum

(b) Oil Pressure

(1) Engine

(2) Speed decreaser gear

NOTE

When starting engines in low ambient temperatures, do not exceed IDLE speed for three minutes or until oil pressures stabilize.

AUXILIARY POWER UNIT

5 APU limitations are as follows:

(a) Exhaust temperature 675°C maximum
675°C to 700°C for 2 seconds

(b) Gas generator rpm 103% rpm maximum

(c) Starting cycle 10 seconds on, 3 minutes off.
Repeat 3 times then 30 minutes off

(d) Time to light-up 10 seconds

(e) Time to 50% rpm 20 seconds

SPEED

NOTE

The striped pointer on the ASI indicates maximum operating speed (V_{MO}) at all altitudes, and the white arc in the rim of the ASI indicates flaps extended

operating range appropriate to flap angle selected. The operating range extends from the stalling speed (V_{SI}) at maximum landing weight to the flaps extended speed (V_{FE}).

6 Speed limitations are as follows:

		KNOTS IAS	KNOTS CAS
(a) Maximum operating speed (V_{MO}). The maximum operating speed limit shall not be deliberately exceeded in any regime of flight (climb, cruise, or descent), except where a higher speed is authorized for flight-test or pilot training operations.	S.L.	225	230
	10,000 ft	212	217
	15,000 ft	198	203
	20,000 ft	186	190
	25,000 ft	173	177
(b) Maneuvering speed (V_A). Maximum use of primary flight controls should be confined to speeds below this value.		140	143
(c) Landing gear operating speed (V_{LO}).		137	140
(d) Landing gear extended speed (V_{LE}).		156	160
(e) Flaps extended speed (V_{FE}).	Flaps 0°	122	124
	Flaps 7°	118	120
	Flaps 17°	113	115
	Flaps 30°	105	105
	Flaps 40°	100	100
(f) Cargo door operating and extended speed.		137	140
(g) Turbulent air penetration speed.		147	150

FLIGHT LOAD ACCELERATION

7 Flight load acceleration limitations are as follows:

(a) Flaps up at 41,000 lb - Positive: + 2.5 g; Negative: -1.0 g

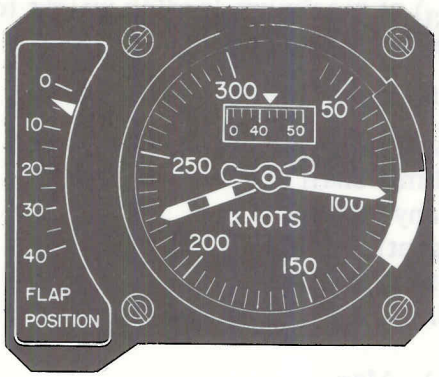
(b) Flaps down at 39,100 lb - Positive: + 2.0 g; Negative: 0

CENTER OF GRAVITY

8 Center of gravity limitations are as follows:

(a) Forward center of gravity limit - landing gear retracted (at all weights and speeds) 25% M.A.C.

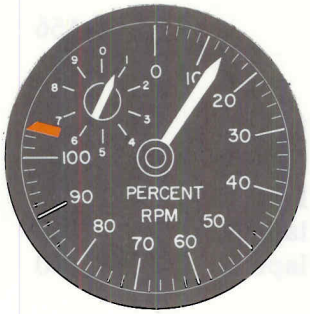
(b) Aft center of gravity limit - landing gear retracted (at all weights and speeds) 40% M.A.C.



AIRSPEED INDICATOR

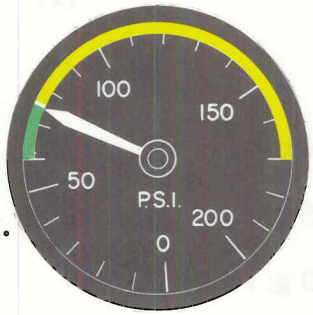
MOVEABLE MARKINGS:
MAX. SAFE SPEED POINTER: 225 KT AT SEA LEVEL TO 164 KT AT 30,000 FT.
FLAP OPERATION: FLAPS EXTENDED SPEED RANGE APPROPRIATE TO FLAP ANGLE SELECTED

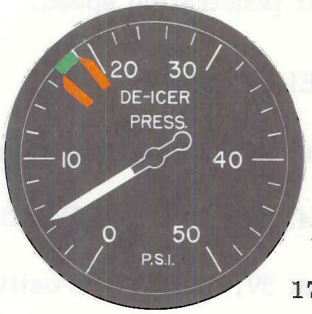
A.P.U. PERCENT R.P.M.
MAXIMUM AT 105%



A.P.U. EXHAUST TEMPERATURE
MAXIMUM AT 675°C

BLEED AIR PRESSURE
CONTINUOUS OPERATION
60 P.S.I. TO 75 P.S.I.
CAUTION 75 P.S.I. TO 170 P.S.I.





DE-ICER PRESSURE
CONTINUOUS OPERATION
17 P.S.I. TO 19 P.S.I.
MIN. AND MAX. AT 17 P.S.I. AND 19 P.S.I.

DANGER MINIMUM AND/OR MAXIMUM LIMITS

CONTINUOUS OPERATION

CAUTION DANGER MAY EXIST UNDER CERTAIN CONDITIONS

FLAPS OPERATING RANGE

5EO-1-42

Figure 4-1 (Sheet 1 of 2) Instrument Markings

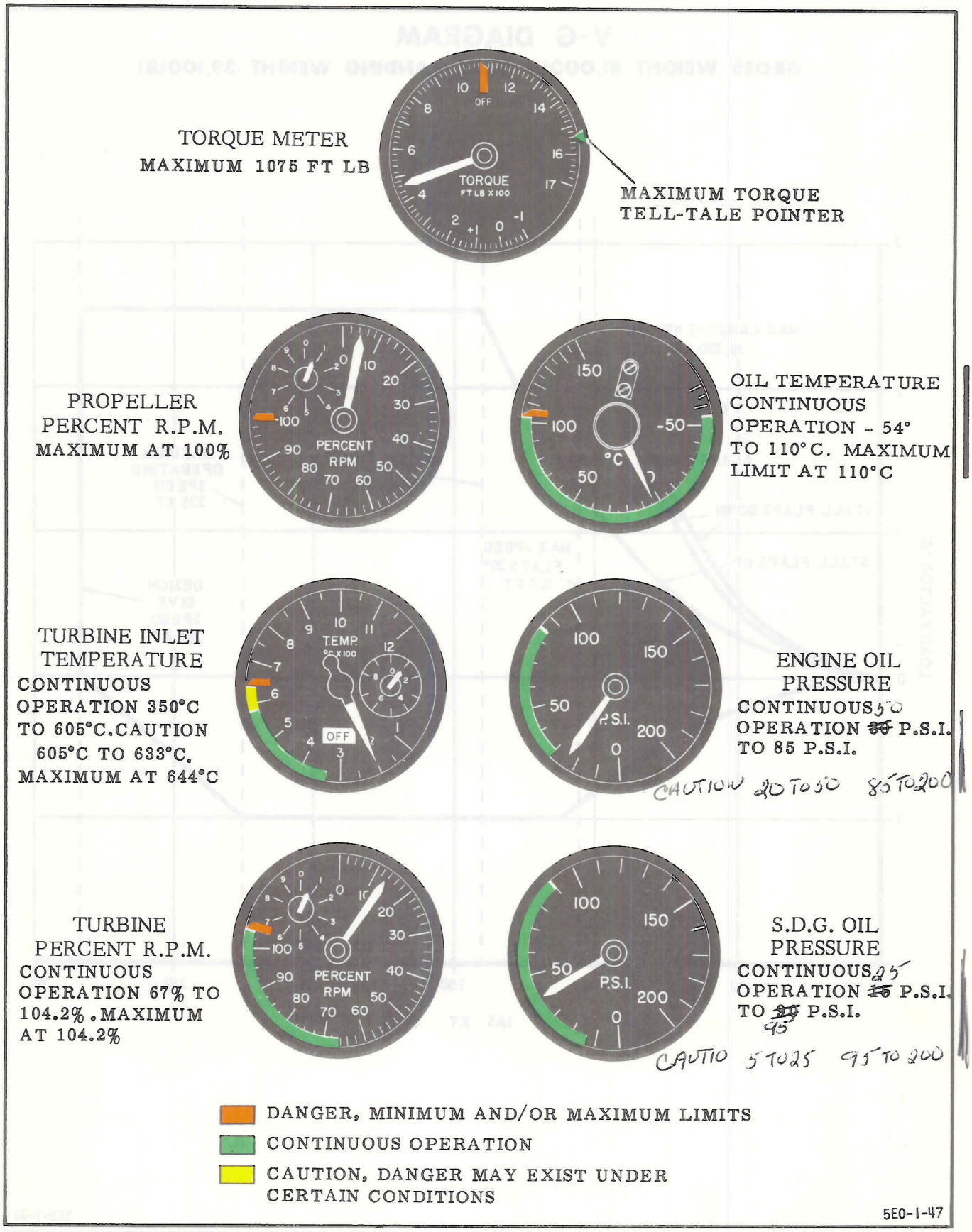


Figure 4-1 (Sheet 2 of 2) (Issue 1) Instrument Markings

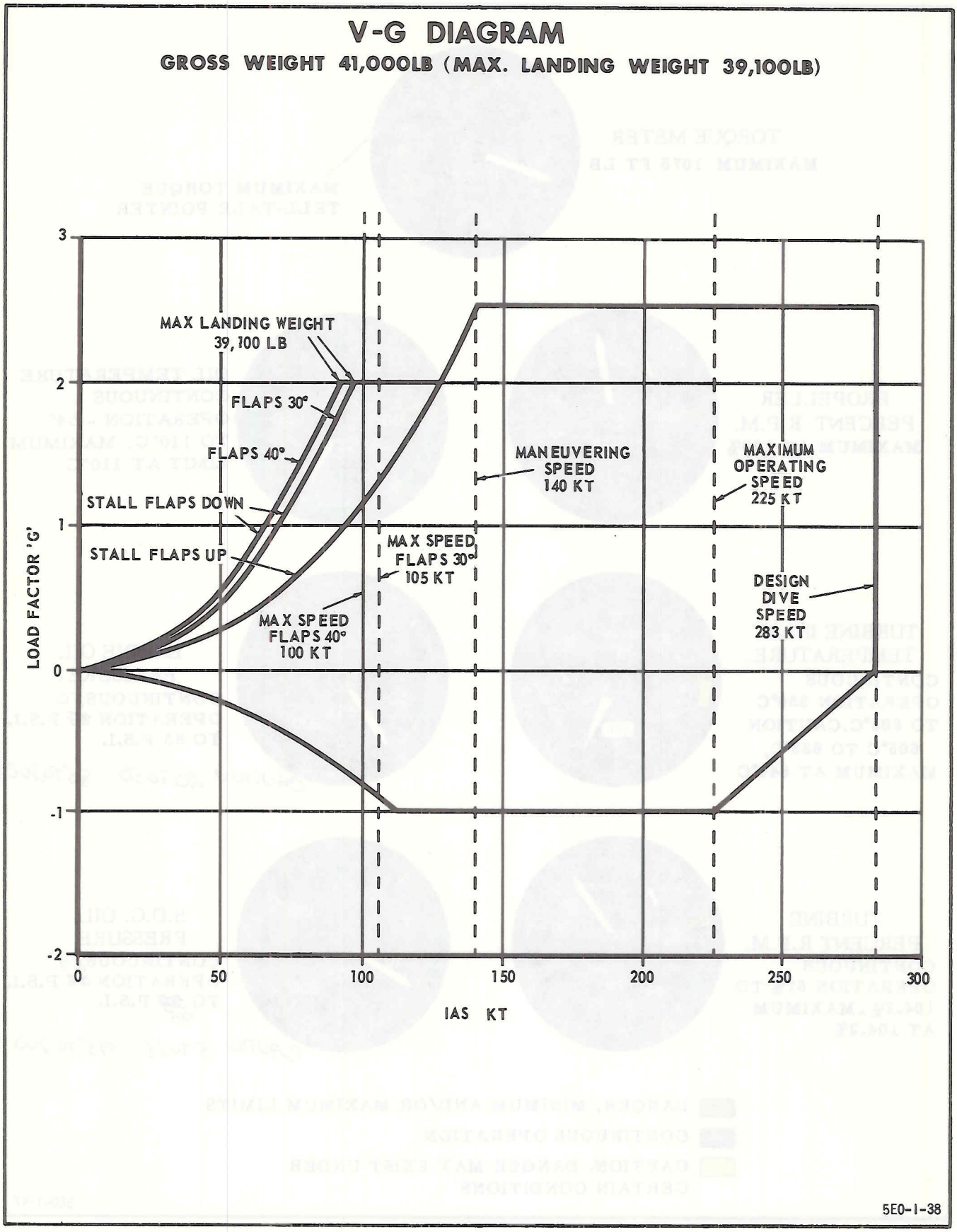


Figure 4-2 V-G Diagram

PROHIBITED MANEUVERS

9 Aerobatic maneuvers, spins or steep turns in excess of 60° of bank.

WEIGHT AND BALANCE DATA

10 Refer to EO 05-200A-8 for weight and balance data.

PERFORMANCE DATA

GENERAL

11 Performance data and charts necessary for preflight and in-flight mission planning, and explanatory text on the use of the data is provided. The information contained on the charts is consistent with the limitations, recommended operating procedures and techniques set forth in Parts 2 and 3 of this manual. All the take-off and landing distances are given with the aircraft center of gravity in the forward position.

12 The flap settings used for the performance configurations are as follows:

Normal and FAR 25 Take-off	7°
Enroute climb	0°
Approach	17°
Normal and FAR 25 Landing	30°
Short field take-off	30°
Short field landing	40°

GLOSSARY OF TERMS AND ABBREVIATIONS

13 Terms and abbreviations used in this manual are as follows:

(a) IAS — Indicated airspeed. Airspeed indicator reading corrected for instrument error.

(b) CAS — Calibrated airspeed. Indicated airspeed corrected for position error.

(c) EAS — Equivalent airspeed. Calibrated airspeed corrected for compressibility. (Due to negligible effect of compressibility in the operating range of speed and altitude for the CC115 aircraft CAS = EAS)

(d) TAS — True airspeed. Equivalent airspeed corrected for density = EAS $\frac{1}{\sqrt{\sigma}}$ = CAS $\frac{1}{\sqrt{\sigma}}$ for CC115.

(e) OAT — Outside air temperature.

(f) SHP — Shaft horsepower.

(g) RPM — Revolutions per minute.

(h) NRP — Normal rated power.

(j) MCP — Maximum continuous power (For the CC115, MCP = NRP)

(k)	T.O. Power	Take-off power.
(m)	ISA	International Standard Atmosphere.
(n)	NM/lb	Nautical miles per pound of fuel.
(p)	STOL	Short field take-off and landing.
(q)	σ	Density ratio.
(r)	FAR PART 25	Federal Aviation Requirements, Part 25, Airworthiness Standards; Transport Category Airplanes (U.S.A.)

STANDARD CHARTS

STANDARD ATMOSPHERE TABLE

14 Figure 4-3 is provided to show standard values of the atmosphere. The table provides data such as temperature in both degrees Fahrenheit and Centigrade, density and pressure ratios etc. for every thousand feet increment in altitude from sea level to 30,000 ft.

TEMPERATURE CONVERSION CHART

15 The temperature conversion chart (Figure 4-4) provides quick means of converting degrees Centigrade to degrees Fahrenheit or vice versa.

DENSITY ALTITUDE CHART

16 The density altitude chart (Figure 4-5) provides a means of determining density altitude, density ratio for a given temperature and pressure altitude. Alternatively for a given temperature and density altitude a pressure altitude can be determined from the chart. An illustrative example is given on the chart.

COMPRESSIBILITY CORRECTION FOR OAT

17 The indicated temperature from the OAT gage during flight will show higher reading than the true outside air temperature. Figure 4-6 provides a means of obtaining the true OAT from indicated OAT reading.

- EXAMPLE -

Given:	Airspeed = 200 kt CAS Indicated OAT = 15°C Pressure altitude = 10,000 ft
Find:	True OAT
Procedure:	Enter Figure 4-6 at 200 kt CAS on the horizontal scale. Move vertically to intersect the 10,000 ft pressure altitude line; move horizontally to the left and read on the vertical scale: Correction to indicated OAT = -5.7°C True OAT = Indicated OAT + Correction = 15°C - 5.7°C = 9.3°C

ENGINE CHARTS

18 The engine data presented in Figures 4-7 through 4-10 give power available and fuel flow at take-off and the maximum continuous power settings. All the data is based on the engine manufacturer's specification corrected for calculated power extraction, bleed air, ram efficiency, and installation duct losses.

In the use of the charts the limitations specified in previous paragraphs in this Part must be observed.

The torque and shaft horsepower relationship is given by:

$$\text{Indicated torque} = \frac{391 \times (SHP)_G}{\text{Prop. rpm}}$$

Where $(SHP)_G$ = Gross shaft horsepower

$(SHP)_N$ = Net shaft horsepower

= $(SHP)_G$ - Shaft horsepower loss in gear box

The use of the charts is shown by the following example.

- EXAMPLE -

Given:	Pressure altitude = 5000 ft OAT = 30°C CAS = 150 kt
Find:	Indicated torque, net SHP and fuel flow at the MCP rating.
Procedure:	Enter Figure 4-8 at 30°C on the horizontal scale. Move vertically up to intersect the 5000 ft pressure altitude line. Move horizontally right to the speed REF LINE and then vertically up to meet 150 kt line. Move horizontally and read on the vertical scale: Indicated torque = 667 lb ft Move horizontally left to meet the torque/SHP conversion line and then read vertically below: Net SHP = 1690 at 1015 RPM

Using Figure 4-10 follow the same procedure and read: Fuel flow = 970 lb/hr.

PERFORMANCE CHARTS-GENERAL

STALLING SPEED

19 The stalling speeds with power for zero thrust are given in Figure 4-11 in calibrated airspeed at the forward center of gravity limit and for wing flap deflection at various angles. On the same chart a table is provided giving the stalling speeds at various angles of bank.

POSITION ERROR CORRECTION TO AIRSPEED

20 Figure 4-12 gives the inflight position error correction (CAS - IAS) versus indicated airspeed. The data is applicable to both the pilot's and copilot's instruments.

POSITION ERROR CORRECTION TO ALTIMETER

21 Figures 4-13 and 4-14 provide the position error correction to be applied to the altimeter reading. The data is given for various flap deflections and is applicable to both the pilot's and copilot's instruments.

WIND COMPONENT CHART

22 Figure 4-15 provides the crosswind and headwind components for a given wind speed and direction. To find the crosswind component, the chart is entered with the maximum gust velocity of the wind relative to the runway. The headwind component is found by entering the chart with the steady wind velocity and wind angle relative to the runway.

- EXAMPLE -

Given:	Wind velocity = 30 kt Wind direction = 40°
Find:	Crosswind and headwind component
Procedure:	From the point of intersection of wind velocity of 30 kt and direction of 40°, read vertically below and horizontally left: Crosswind component = 19 kt Headwind component = 23 kt

TAKE-OFF WEIGHT LIMITATION (FAR PART 25)

23 Figures 4-16 through 4-18 provide one engine inoperative climb gradients in various segments of take-off flight path. In addition in each figure the take-off weight limitation chart is provided. These are based on the one engine inoperative climb requirements of FAR PART 25. These requirements are summarized below.

Take-off Segment	*Power on Operative Engine	Gear	Flaps	Requirement Required Gradient
First	Take-off	Extended	Take-off (7°)	Positive
Second	Take-off	Retracted	Take-off (7°)	2.4 percent
Final	MCP	Retracted	Retracted	1.2 percent

(* propeller of inoperative engine feathered)

- EXAMPLE -

(a) Find climb gradient in first segment of take-off at a gross weight of 38,000 lb,

5000 ft pressure altitude and ISA conditions. Enter Figure 4-16 at 5000 ft pressure altitude on the vertical scale. Move horizontally right to intersect the 38,000 lb line in ISA section of chart. Move vertically below and read: Climb gradient = 3.4 percent.

(b) Find the maximum take-off weight in the first segment of take-off at 5000 ft pressure altitude, ISA + 30°C. Enter Figure 4-16 at 5000 ft pressure altitude in sub-chart labeled as the maximum take-off gross weight. Move horizontally to intersect the ISA + 30°C line and then move vertically down and read: Maximum take-off weight = 39,500 lb.

TAKE-OFF

SHORT FIELD TAKE-OFF

24 Figures 4-19 and 4-20 present the short field take-off ground run and the total distance to 50 ft height at various temperatures, altitudes, gross weights and wind conditions. The short field take-off distances are given with the maximum performance technique and may be achieved under fairly ideal conditions by an experienced pilot - conversant with the aircraft's flying qualities. The flap setting and the configuration of the short field take-off is summarized as follows:

Flaps:	30°
Power:	Both engines at take-off power
Lift-off speed:	Power off stall speed

The use of the charts is shown by the following example:

Given:	Airfield pressure altitude	= 2000 ft
	Airfield temperature	= 18°C
	Take-off weight	= 38,000 lb
	Headwind	= 10 kt
Find:	Take-off ground run and total distance to 50 ft	
Procedure:	Enter Figures 4-19 and 4-20 at 18°C on the left horizontal scale and move vertically up to intersect the 2000 ft pressure altitude line. Move horizontally right to the weight REF LINE and then parallel to the guide lines to meet the 38,000 lb line. Move horizontally right to the wind REF LINE and then parallel to the guide lines to intersect the 10 kt headwind line. Move horizontally right and read on the vertical scale:	
	Ground run	= 775 ft (Fig. 4-19)
	Total distance to 50 ft	= 1190 ft (Fig. 4-20)

NORMAL TAKE-OFF

25 Figures 4-21 and 4-22 provide the normal take-off ground run and total distance to 50 ft at various temperatures, altitudes, gross weights and wind conditions. The normal take-off distances are given with the flap setting and configuration noted below and may be achieved with average piloting technique.

Flaps:	7°
Power:	Both engines at take-off power
Lift off speed:	Greater of 1.2 times power off stalling speed or 1.1 times the minimum control speed

The use of the charts is shown by the same example as in the previous paragraph.

TAKE-OFF: ENGINE FAILURE (FAR PART 25)

26 The procedure and the configuration used in calculating the take-off distance is the same as specified in FAR PART 25. For simplicity, the critical engine failure speed (V_1) is taken as the lift-off speed ($V_{L\ off}$).

Flaps:	7°
Power:	Both engines at take-off power up to the critical engine failure speed (V_1) after which the critical engine is inoperative, its propeller feathered.
Lift-off speed:	Greater of 1.2 times power off stalling speed or 1.1 times the minimum control speed.
Critical Engine Failure speed:	Assumed as the lift-off speed.

The take-off ground run to the engine failure speed (lift-off speed) is the same as in Figure 4-21. The total distance to 35 ft is given in Figure 4-23 at various temperatures, altitudes, gross weights and wind speeds. The use of the chart is shown by the same example as in paragraph 23.

ACCELERATE-STOP DISTANCE (FAR PART 25)

27 The accelerate-stop distance is defined as the distance from the brake release point to the engine failure speed plus the stopping distance from this speed by means of wheel brakes. A pilot's reaction time of three (3) seconds has been allowed for recognition of the engine failure and closing both throttles before applying brakes.

The configuration and the flap setting are the same as the FAR Part 25 take-off. The accelerate-stop distance is given in Figure 4-23 for various temperatures, altitudes, gross weights and wind speeds. The use of the chart is shown by the same example as in paragraph 23.

CLIMB

ENROUTE RATE OF CLIMB

28 Figures 4-25 and 4-26 provide the enroute rates of climb with both engines operating and one engine inoperative respectively for various gross weights and temperatures.

TIME, DISTANCE AND FUEL IN ENROUTE CLIMB

29 Figures 4-27 through 4-29 provide the time, distance and fuel in enroute climb with both engines operating. Similar data with one engine inoperative is given in Figures 4-30 through 4-32. Use of the chart is shown by the following examples:

(a) Given: Climb gross weight = 38,000 lb
Temperature = ISA + 15°C

Find: Time, distance and fuel in one engine inoperative climb from sea level to 8000 ft pressure altitude.

Procedure: Enter Figure 4-31 at 8000 ft pressure altitude on the vertical scale and move horizontally right to meet the 38,000 lb gross weight line. Read vertically below:

Time in climb from sea level to 8000 ft	=	29 minutes
Distance in climb from sea level to 8000 ft	=	58 n m
Fuel in climb from sea level to 8000 ft	=	490 lb

(b) Given: Climb Gross Weight = 38,000 lb
Temperature = ISA

Find: Time, distance and fuel in climb from 10,000 ft to 20,000 ft pressure altitudes, both engines operating.

Procedure: Enter Figure 4-27 at 10,000 ft and 20,000 ft pressure altitude on the vertical scale, and move horizontally right to meet the 38,000 lb weight line. Read vertically below:

(1) Time in climb from sea level to 20,000 ft	=	12 min
(2) Distance in climb from sea level to 20,000 ft	=	29 n m
(3) Fuel in climb from sea level to 20,000 ft	=	395 lb
(4) Time in climb from sea level to 10,000 ft	=	5 min
(5) Distance in climb from sea level to 10,000 ft	=	11 n m
(6) Fuel in climb from sea level to 10,000 ft	=	190 lb
(7) Time in climb from 10,000 ft to 20,000 ft	=	(1) - (4) = 7 min
(8) Distance in climb from 10,000 ft to 20,000 ft	=	(2) - (5) = 18 n m
(9) Fuel in climb from 10,000 ft to 20,000 ft	=	(3) - (6) = 205 lb

SERVICE CEILING

30 The service ceiling is the pressure altitude at which the rate of climb of 100 feet per minute is maintained at a given weight and temperature. The service ceiling versus gross weight chart is shown in Figure 4-33 for both engines operating and one engine inoperative.

CRUISE

CRUISE DATA: NAUTICAL AIR MILES PER POUND OF FUEL

31 Figures 4-34 through 4-39 provide the nautical air miles per pound of fuel with both engines operating at various altitudes, temperatures and weights. Similar data with one engine inoperative is given in Figure 4-40 through 4-42. The recommended long range and maximum endurance conditions are shown on each chart together with a table of recommended settings of torque, propeller rpm and fuel flow.

DESCENT

DESCENT DATA

32 Figure 4-43 provides the time, distance and fuel used in descent with engines at idle and propeller feathered, flaps and gear retracted. The data is calculated at the maximum lift/drag ratio. This type of descent will provide maximum range at minimum fuel in glide.

Figure 4-44 provides the time, distance and fuel in descent with flaps and gear retracted and power adjusted to give 600 feet per minute rate of descent at the specified speeds. Use of the chart is shown by the same example as in the enroute climb chart (paragraph 28).

LANDING WEIGHT LIMITATION (FAR PART 25)

33 Figures 4-45 and 4-46 provide the climb gradients for the approach climb and balked landing climb. In addition, in each figure the landing weight limitation chart is provided. These are based on the climb requirements of FAR Part 25. The requirements are summarized below.

	* Power on Operative Engine	Gear	Flaps	Requirement Required Gradient
Approach	Take-off	Retracted	Approach (17°)	2.1%
	Take-off (both engines operating)	Extended	Landing (30°)	3.2%

(* propeller of inoperative engine feathered)

The use of the charts is shown by the same example as in paragraph 22.

LANDING

SHORT FIELD LANDING

34 Figure 4-47 and 4-48 present the short field landing ground run and total distance from 50 ft height at various temperatures, altitudes, gross weights and wind conditions. The short field landing distances are given with the maximum performance technique and may be achieved under fairly ideal conditions by an experienced pilot conversant with the aircraft's flying qualities. The flap setting and the configuration of the short field landing is summarized as follows:

Flaps:	40°
Propeller:	Fine pitch stop "APPROACH" (7°) during approach. Full reverse during ground roll.
Speed at 50 ft:	1.13 times the power-off stalling speed.

The use of the charts is shown by the same example as in paragraph 23.

NORMAL LANDING

35 Figures 4-49 and 4-50 present the normal landing ground run and total distance from 50 ft at various temperatures, altitudes, gross weights and wind conditions. The normal landing distances are given with the flap setting and configuration following and may be achieved with average piloting technique.

Flaps:	30°
Propeller:	Fine pitch stop "APPROACH" (7°) during approach. Full reverse thrust during ground run.
Speed at 50 ft:	1.3 times power-off stalling speed.

The use of the charts is shown by the same example as in paragraph 23.

FAR 25 LANDING

36 Figure 4-51 presents the FAR landing distance from 50 ft at various temperatures, altitudes, gross weight and wind conditions. The distance is given with the flap setting and configuration following and may be achieved with average piloting technique.

Flaps:	30°
Propeller:	Fine pitch stop "NORMAL" (17°) during approach. No reverse thrust during ground run.
Speed at 50 ft:	1.3 times power-off stalling speed.

The use of the chart is shown by the same example as in paragraph 23.

STANDARD ATMOSPHERE TABLE

STANDARD S L CONDITIONS:

TEMPERATURE 15°C (59°F)
PRESSURE 29.921 IN. Hg 2116.216 LB/SQ FT
DENSITY .0023769 SLUGS/CU FT
SPEED OF SOUND 1116.89 FT/SEC 661.7 KNOTS

CONVERSION FACTORS:

1 IN. Hg 70.727 LB/SQ FT
1 IN. Hg 0.49116 LB/SQ IN.
1 KNOT 1.151 M P H
1 KNOT 1.688 FT/SEC

ALTITUDE FEET	DENSITY RATIO σ	$\sigma^{-1/2}$ $\frac{1}{\sqrt{\sigma}}$	TEMPERATURE °C	TEMPERATURE °F	SPEED OF SOUND KNOTS	PRESSURE IN. Hg	PRESSURE RATIO δ
0	1.0000	1.0000	15.000	59.000	661.7	29.921	1.0000
1000	.9711	1.0148	13.019	55.434	659.5	28.856	.9644
2000	.9428	1.0299	11.038	51.868	657.2	27.821	.9298
3000	.9151	1.0454	9.056	48.302	654.9	26.817	.8962
4000	.8881	1.0611	7.076	44.735	652.6	25.842	.8637
5000	.8617	1.0773	5.094	41.169	650.3	24.896	.8320
6000	.8359	1.0938	3.113	37.603	648.7	23.978	.8014
7000	.8106	1.1107	1.132	34.037	645.6	23.088	.7716
8000	.7860	1.1279	-0.850	30.471	643.3	22.225	.7428
9000	.7620	1.1456	-2.831	26.905	640.9	21.388	.7148
10,000	.7385	1.1637	-4.812	23.338	638.6	20.577	.6877
11,000	.7155	1.1822	-6.793	19.772	636.2	19.791	.6614
12,000	.6932	1.2011	-8.774	16.206	633.9	19.029	.6360
13,000	.6713	1.2205	-10.756	12.640	631.5	18.292	.6113
14,000	.6500	1.2403	-12.737	9.074	629.0	17.577	.5875
15,000	.6292	1.2606	-14.718	5.508	626.6	16.886	.5643
16,000	.6090	1.2815	-16.699	1.941	624.2	16.216	.5420
17,000	.5892	1.3028	-18.680	-1.625	621.8	15.569	.5203
18,000	.5699	1.3246	-20.662	-5.191	619.4	14.942	.4994
19,000	.5511	1.3470	-22.643	-8.757	617.0	14.336	.4791
20,000	.5328	1.3700	-24.624	-12.323	614.6	13.750	.4595
21,000	.5150	1.3935	-26.605	-15.889	612.1	13.184	.4406
22,000	.4976	1.4176	-28.587	-19.456	609.6	12.636	.4223
23,000	.4806	1.4424	-30.568	-23.022	607.1	12.107	.4046
24,000	.4642	1.4678	-22.549	-26.588	604.6	11.597	.3876
25,000	.4481	1.4938	-34.530	-30.154	602.1	11.103	.3711
26,000	.4325	1.5206	-36.511	-33.720	599.6	10.627	.3552
27,000	.4173	1.5480	-38.492	-37.286	597.1	10.168	.3398
28,000	.4025	1.5762	-40.474	-40.852	594.6	9.725	.3250
29,000	.3881	1.6052	-42.455	-44.419	592.1	9.297	.3107
30,000	.3741	1.6349	-44.436	-47.985	589.5	8.885	.2970

Figure 4-3 Standard Atmosphere Table

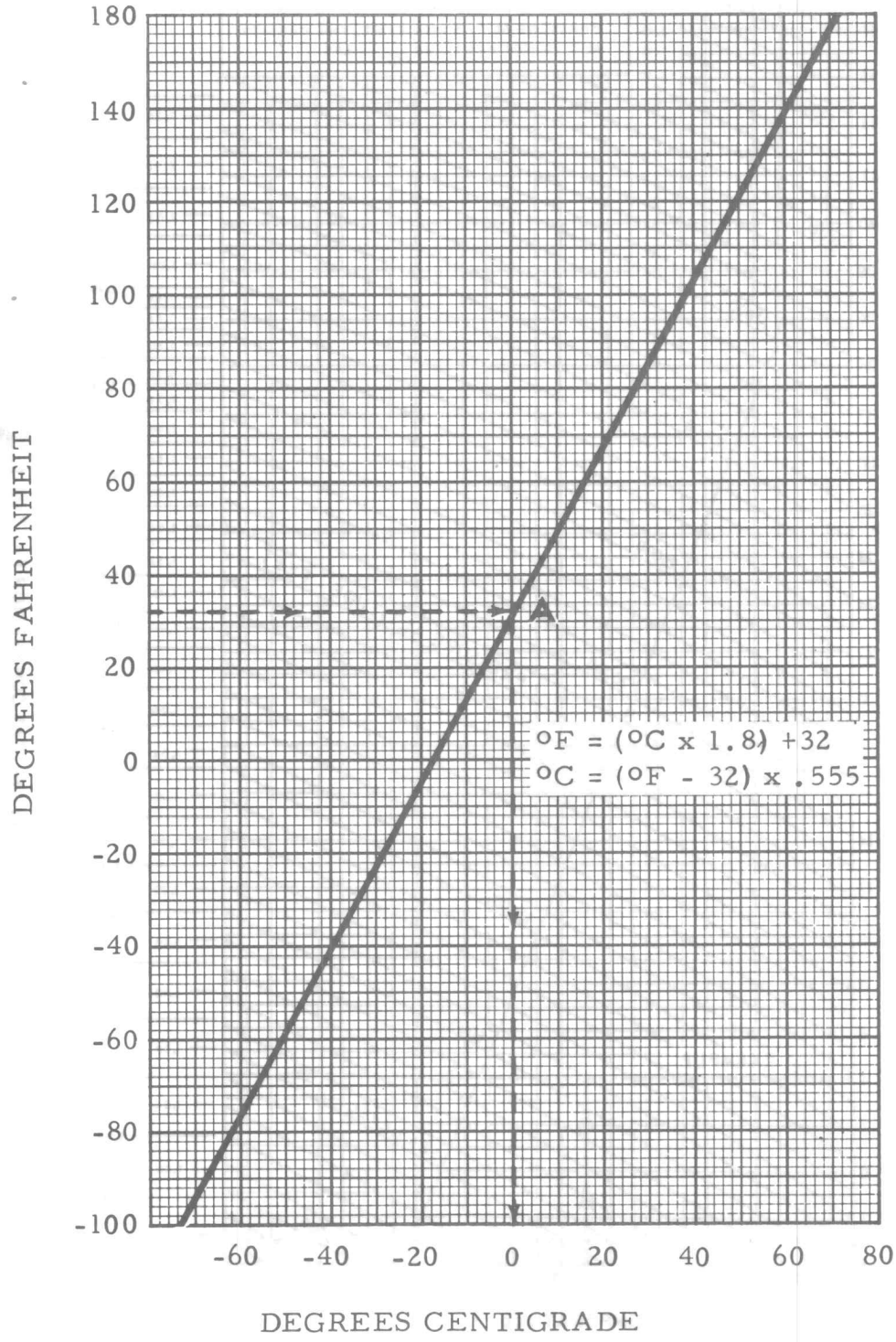


Figure 4-4 Temperature Conversion Chart

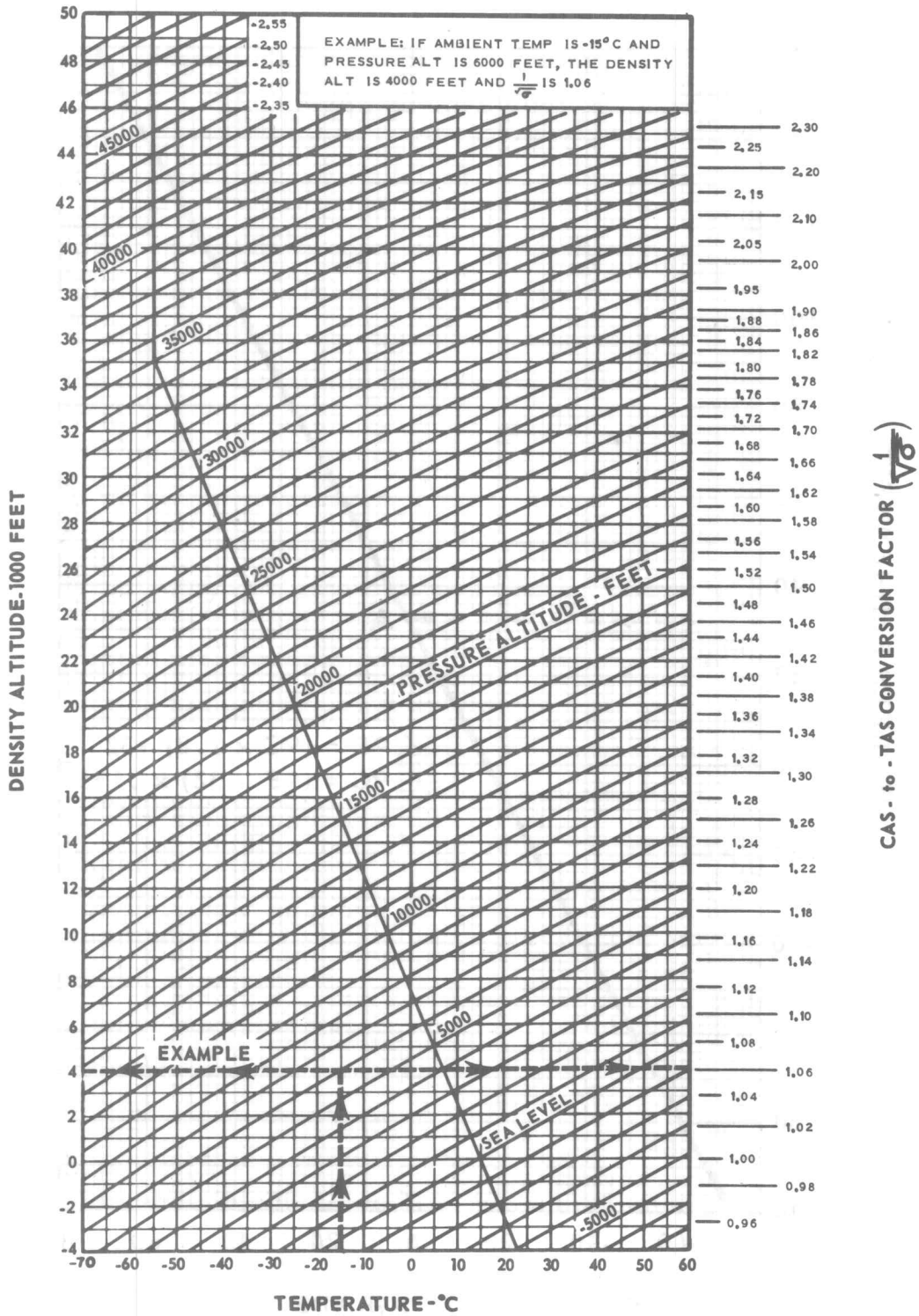


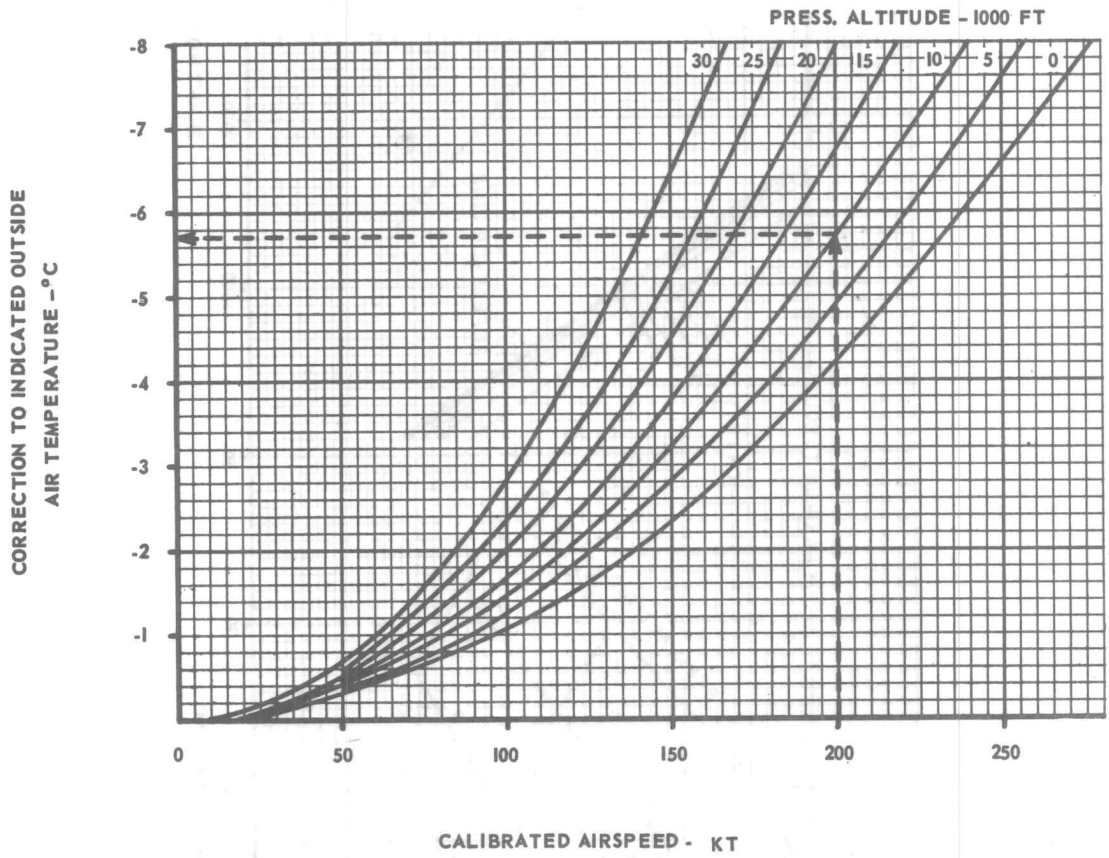
Figure 4-5 Density Altitude Chart

COMPRESSIBILITY CORRECTION FOR OUTSIDE AIR TEMPERATURE

MODEL: CC 115

ENGINES (2): CT64-820-1

NOTE: RECOVERY FACTOR = 0.80



DATA AS OF: JUNE 1967
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP4
FUEL DENSITY: 7.8 LB/GAL

Figure 4-6 Compressibility Correction for OAT

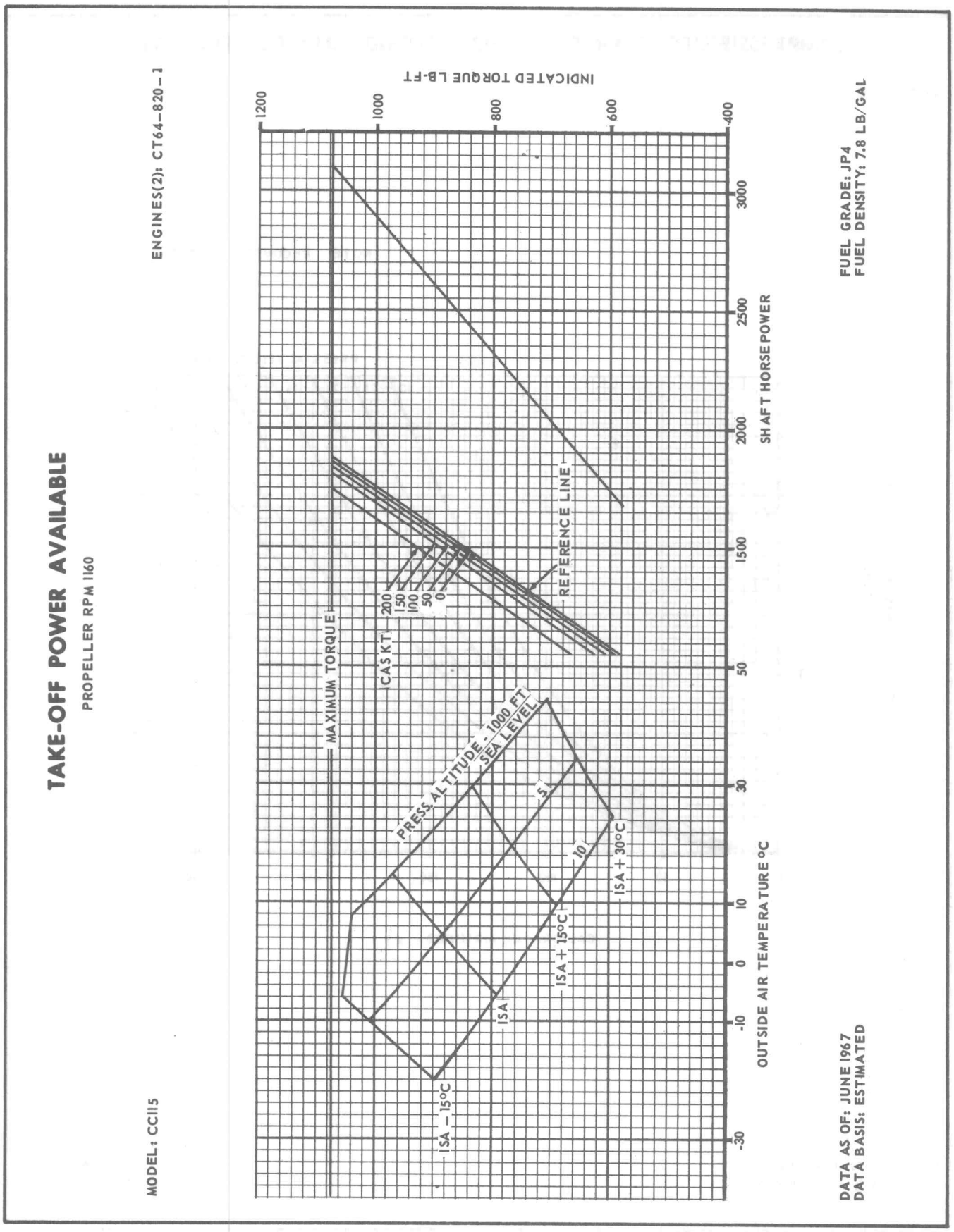


Figure 4-7 Take-off Power Available

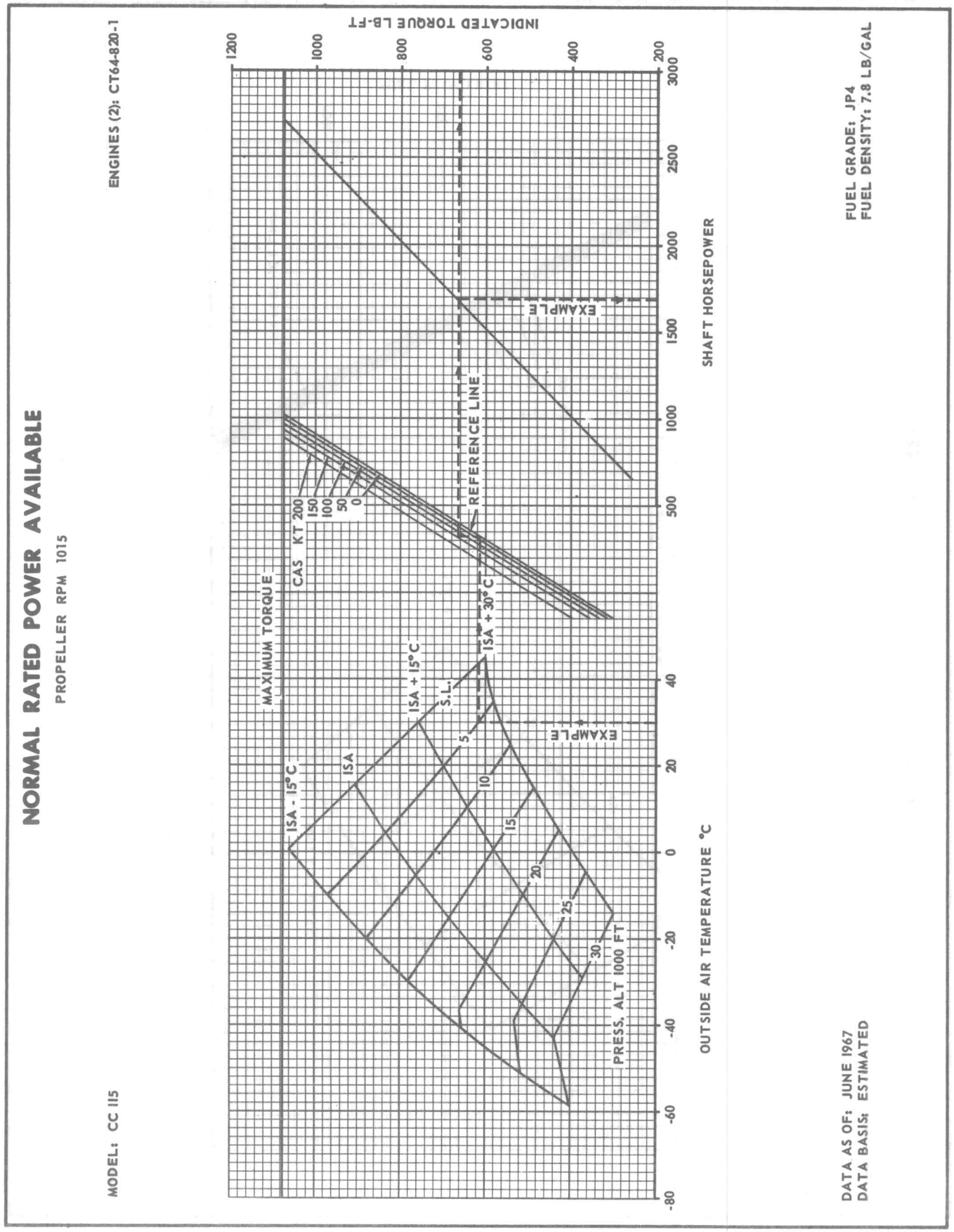


Figure 4-8 Normal Rated Power Available

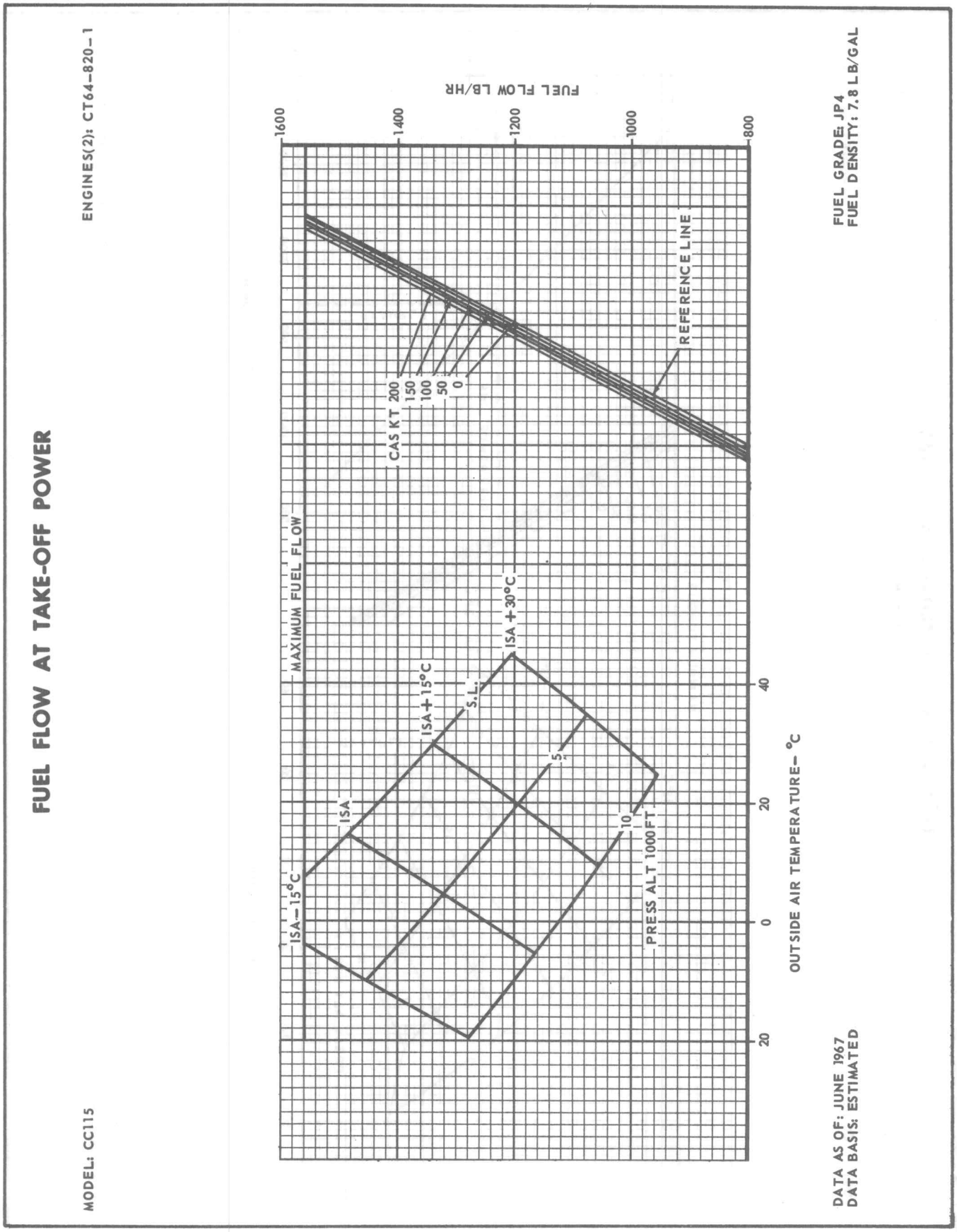


Figure 4-9 Fuel Flow at Take-off Power

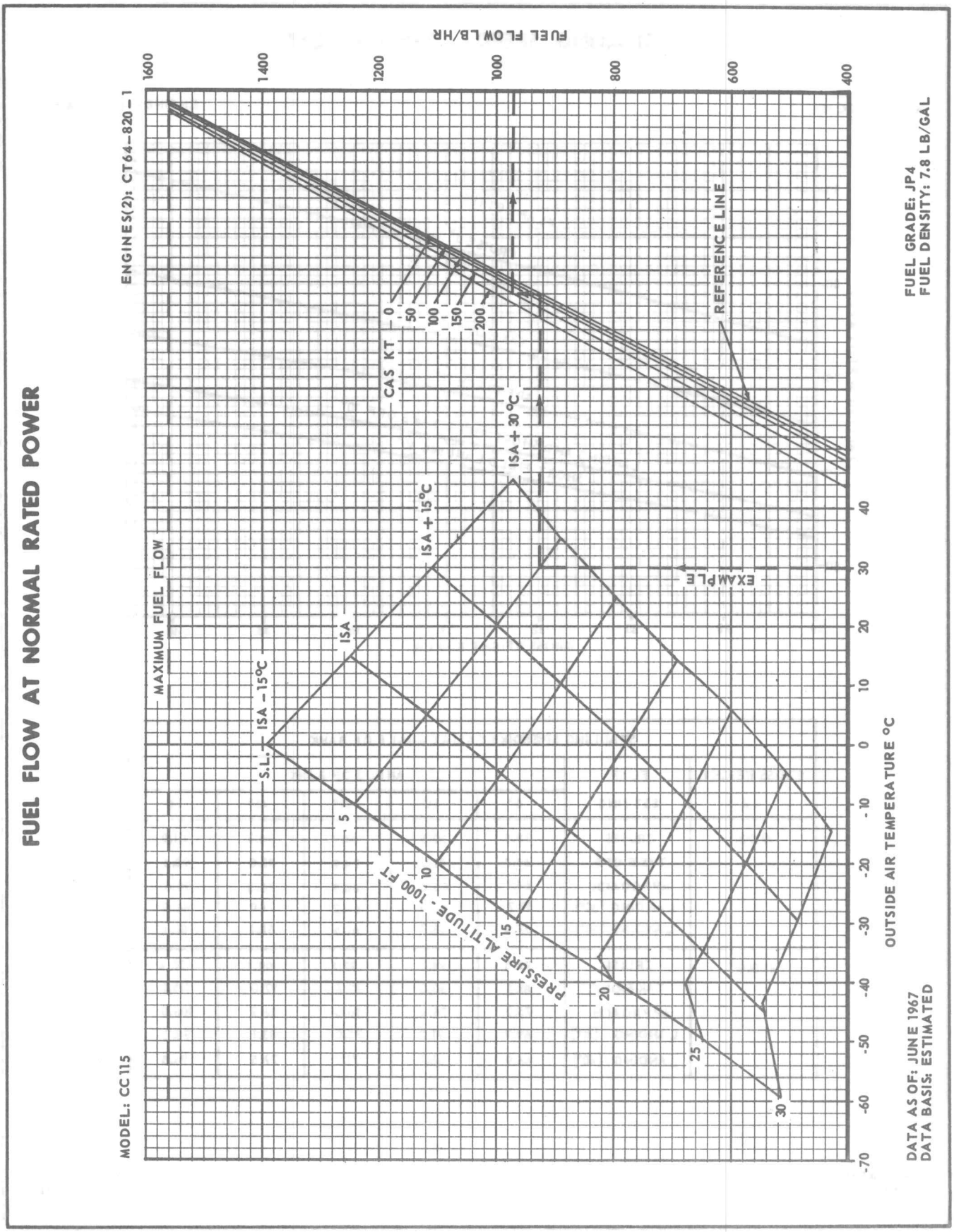


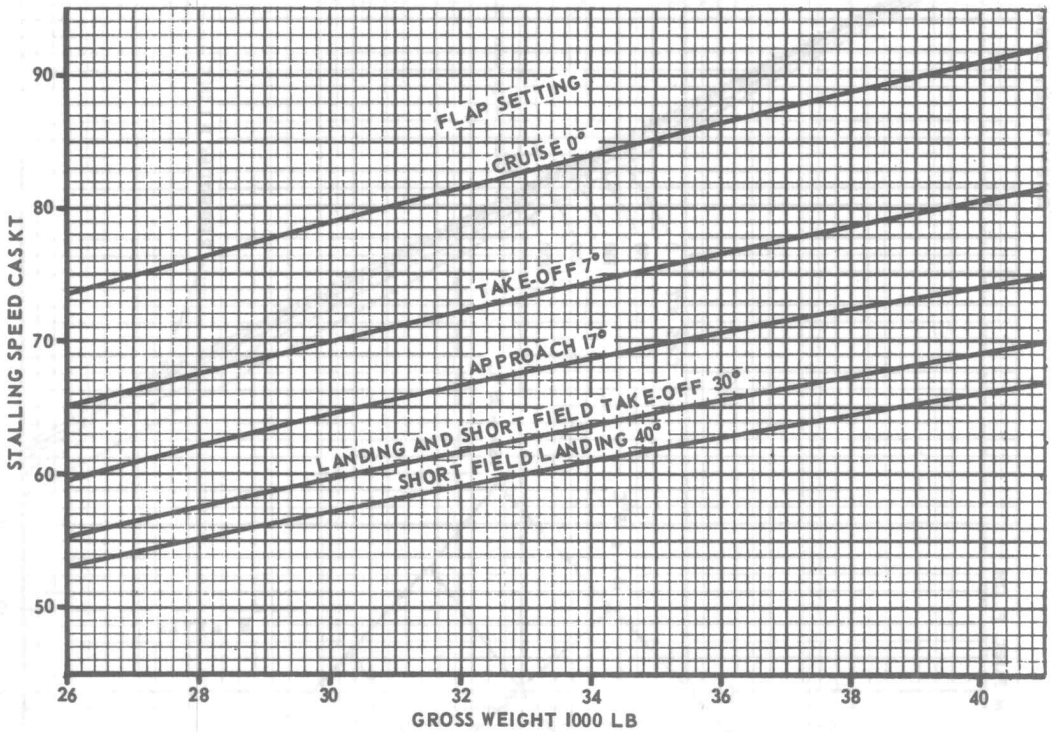
Figure 4-10 Fuel Flow at Normal Rated Power

STALLING SPEED - ZERO THRUST

CG FORWARD

MODEL: CC 115

ENGINES (2): CT64-820-1



STALLING SPEED(KT CAS) AT ANGLE OF BANK						
GROSS WEIGHT LB	FLAP SETTING	ANGLE OF BANK				
		0°	15°	30°	45°	60°
30,000	CRUISE	79.0	80.5	84.9	94.0	111.9
	TAKE-OFF	69.7	71.0	74.9	83.0	98.6
	APPROACH	64.1	65.3	68.9	76.3	90.6
	LANDING (30°)	59.7	60.8	64.2	71.0	84.5
	LANDING (40°)	57.3	58.3	61.5	68.1	81.0
41,000	CRUISE	92.3	94.0	99.1	109.7	130.4
	TAKE-OFF	81.5	83.0	87.6	97.0	115.1
	APPROACH	75.0	76.4	80.5	89.2	106.0
	LANDING (30°)	69.9	71.2	75.0	83.1	98.8
	LANDING (40°)	66.9	68.1	71.9	79.5	94.5

DATA AS OF: JUNE 1967
DATA BASIS: ESTIMATED

FUEL GRADE: JP4
FUEL DENSITY: 7.8 LB/GAL

Figure 4-11 Stalling Speed

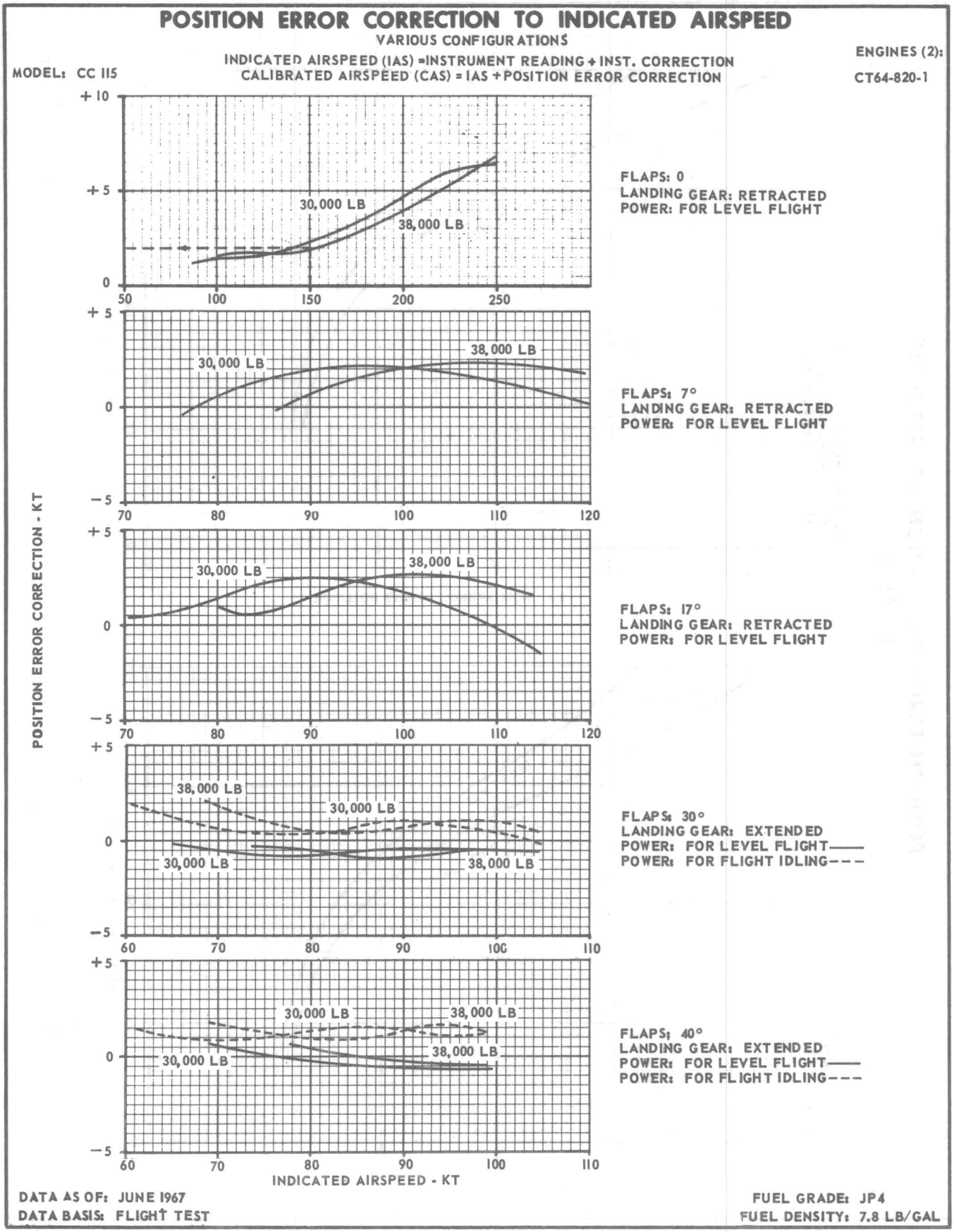


Figure 4-12 Position Error Correction to Airspeed

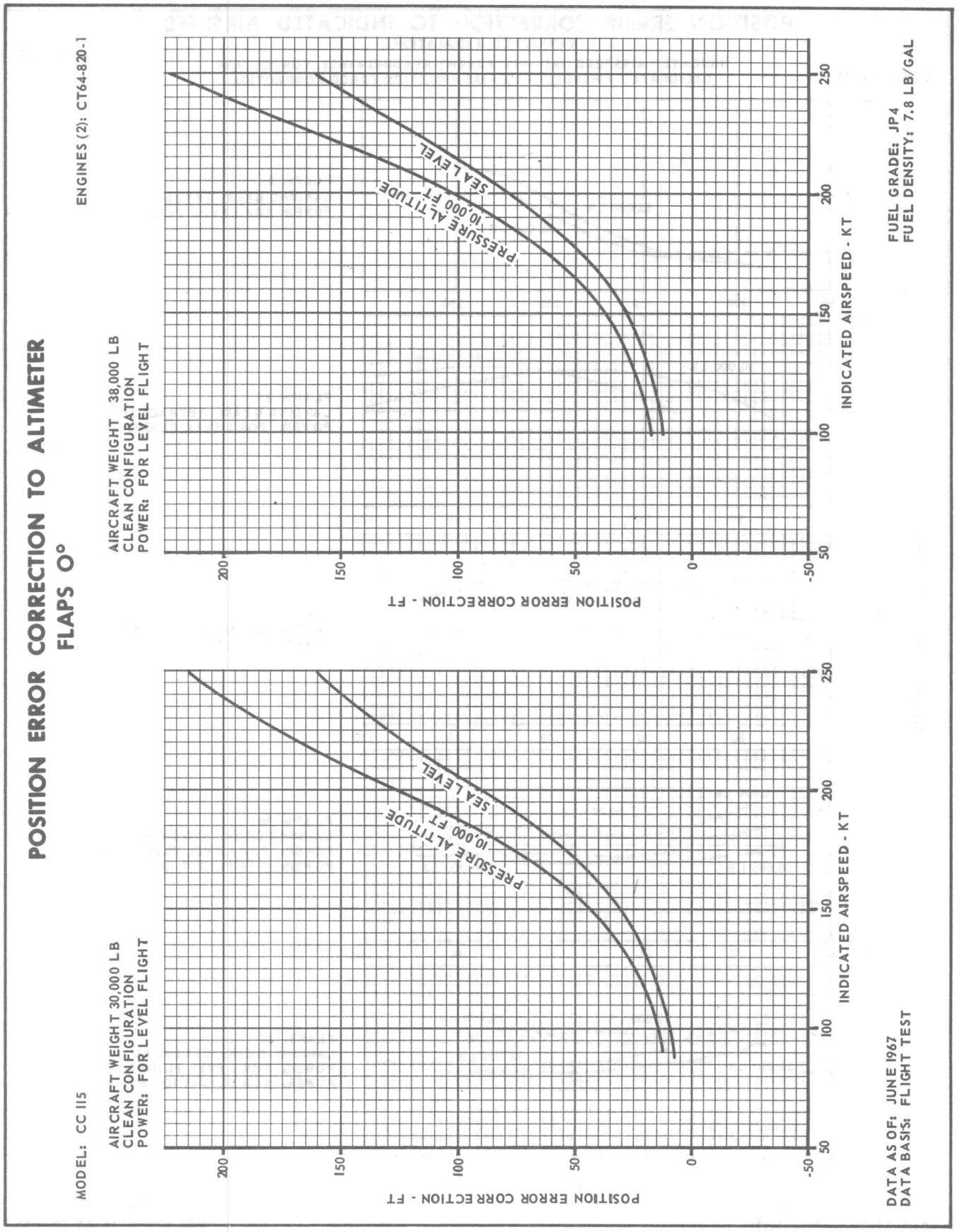


Figure 4-13 Position Error Correction to Altimeter - Flap 0°

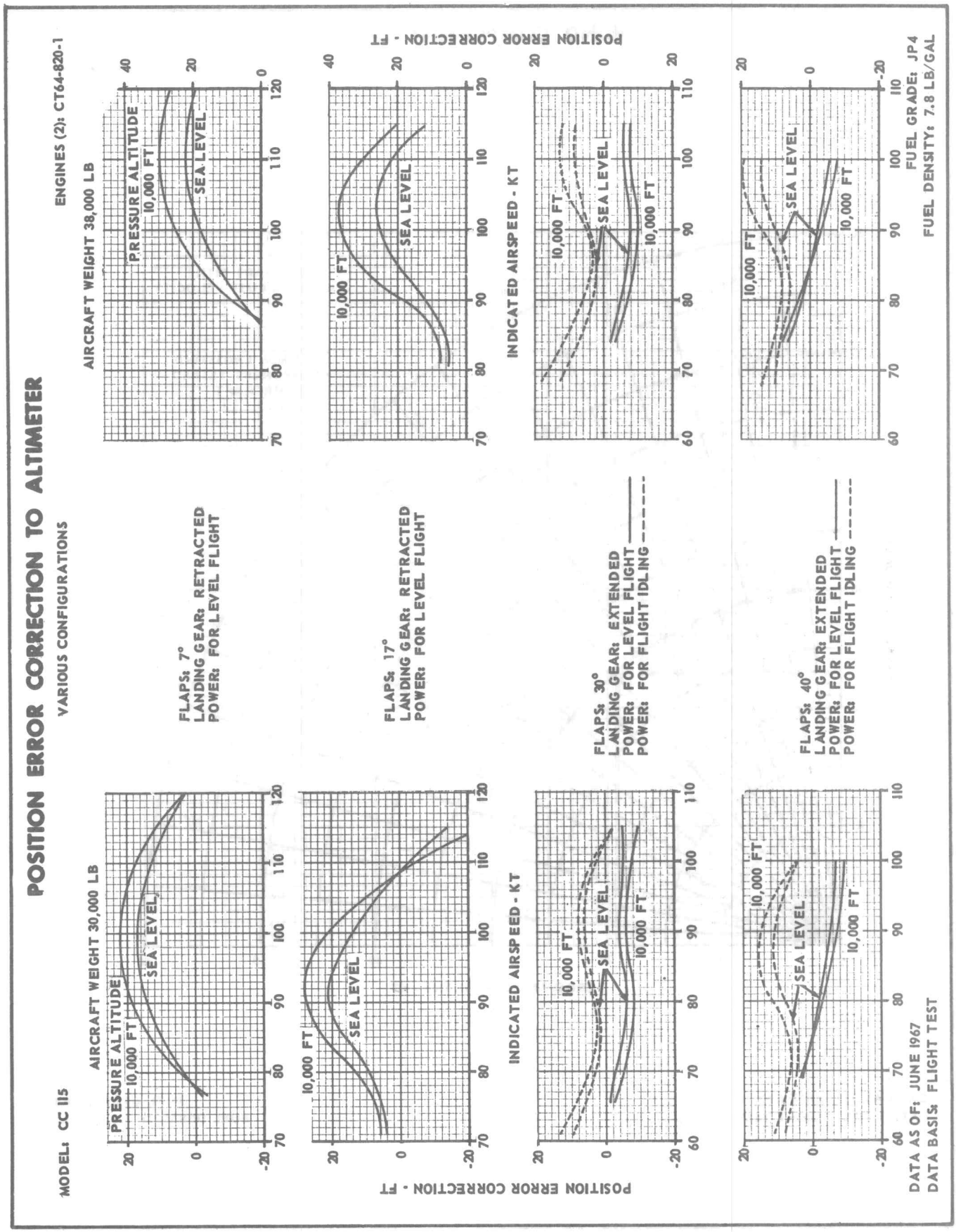
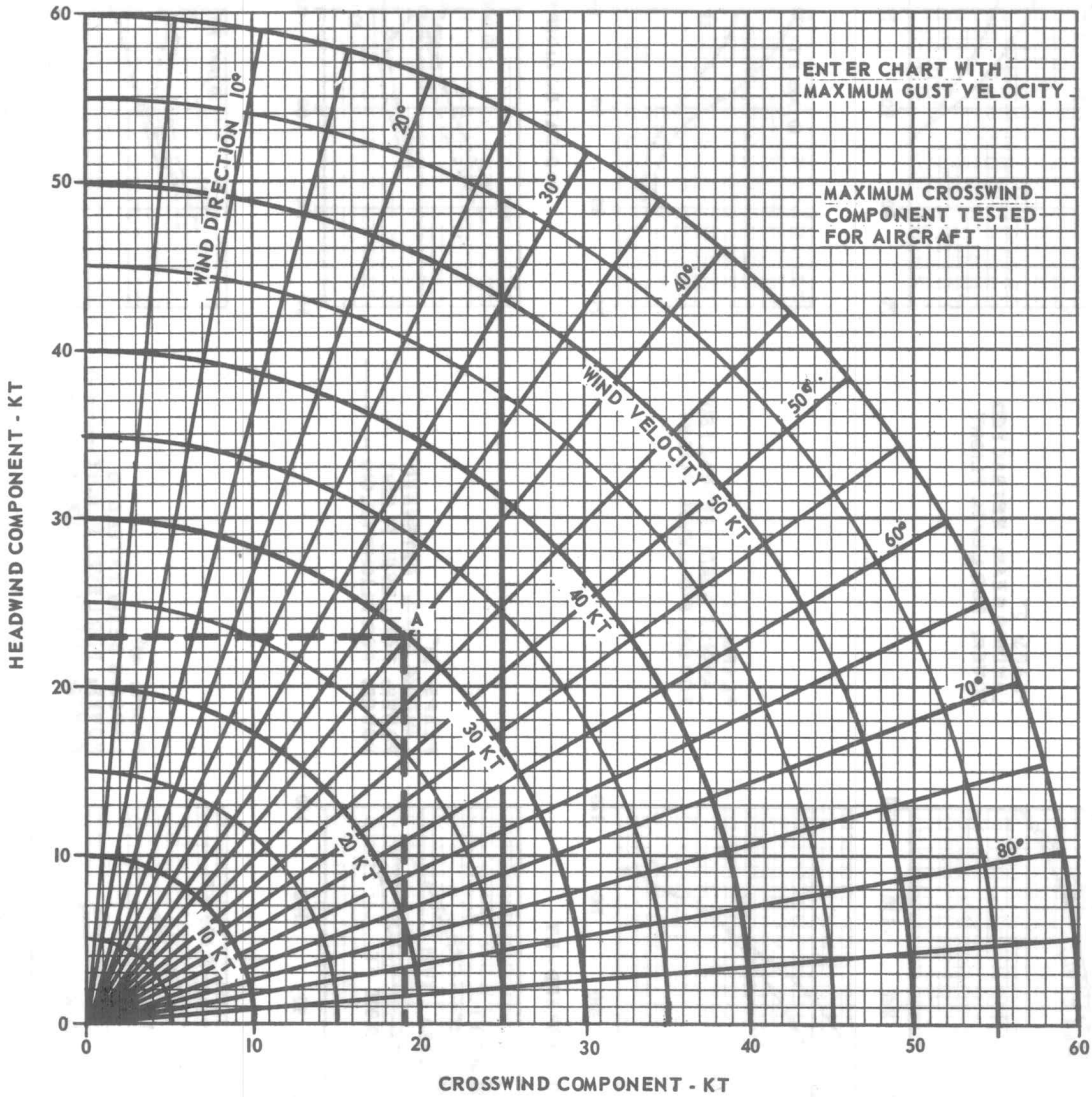


Figure 4-14 Position Error Correction to Altimeter - Various Configurations

WIND COMPONENT CHART

MODEL: CC 115

ENGINES (2): CT64-820-1



DATA AS OF: JUNE 1967
DATA BASIS: FLIGHT TEST

FUEL GRADE: JP4
FUEL DENSITY: 7.8 LB/GAL

Figure 4-15 Wind Component Chart

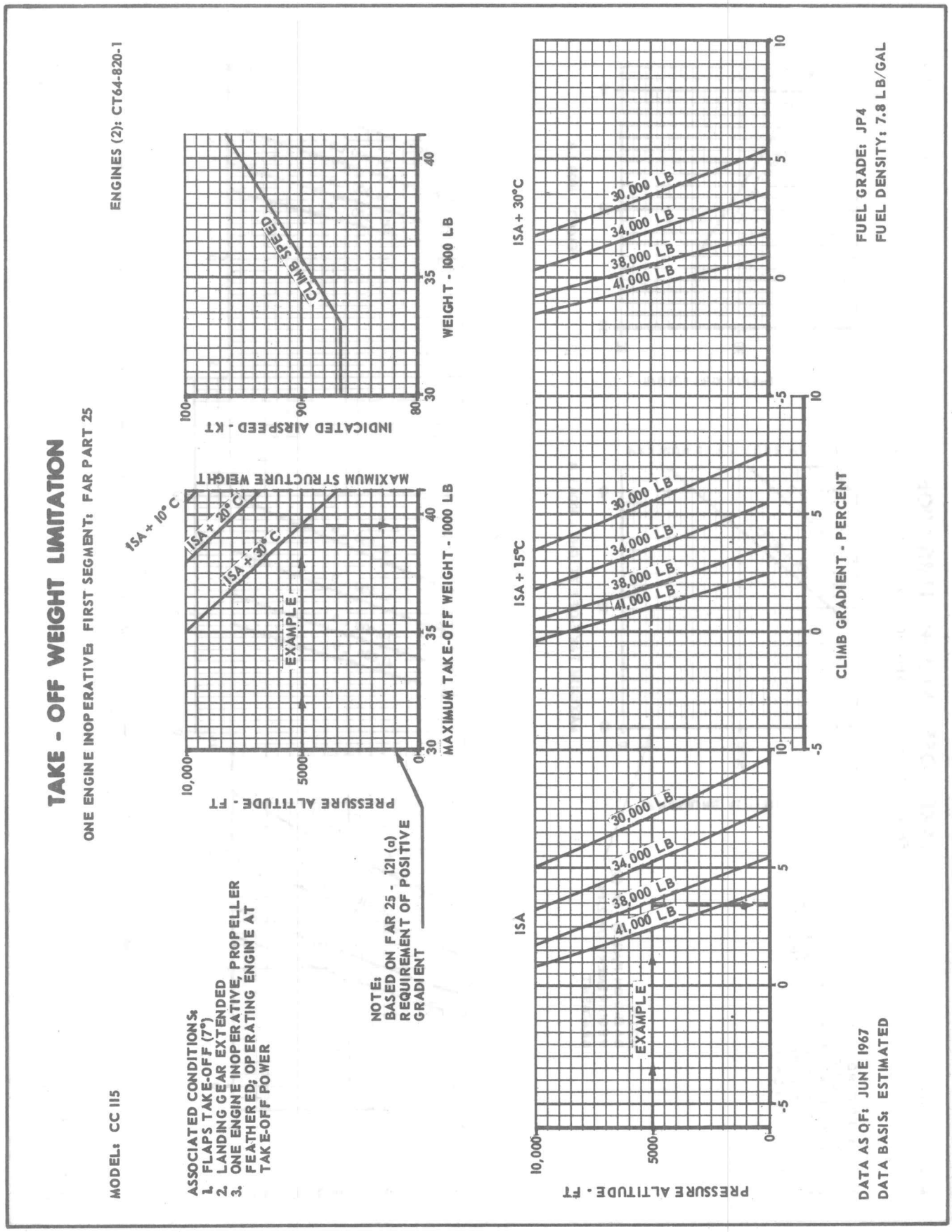


Figure 4-16 Take-off Weight Limitation: First Segment

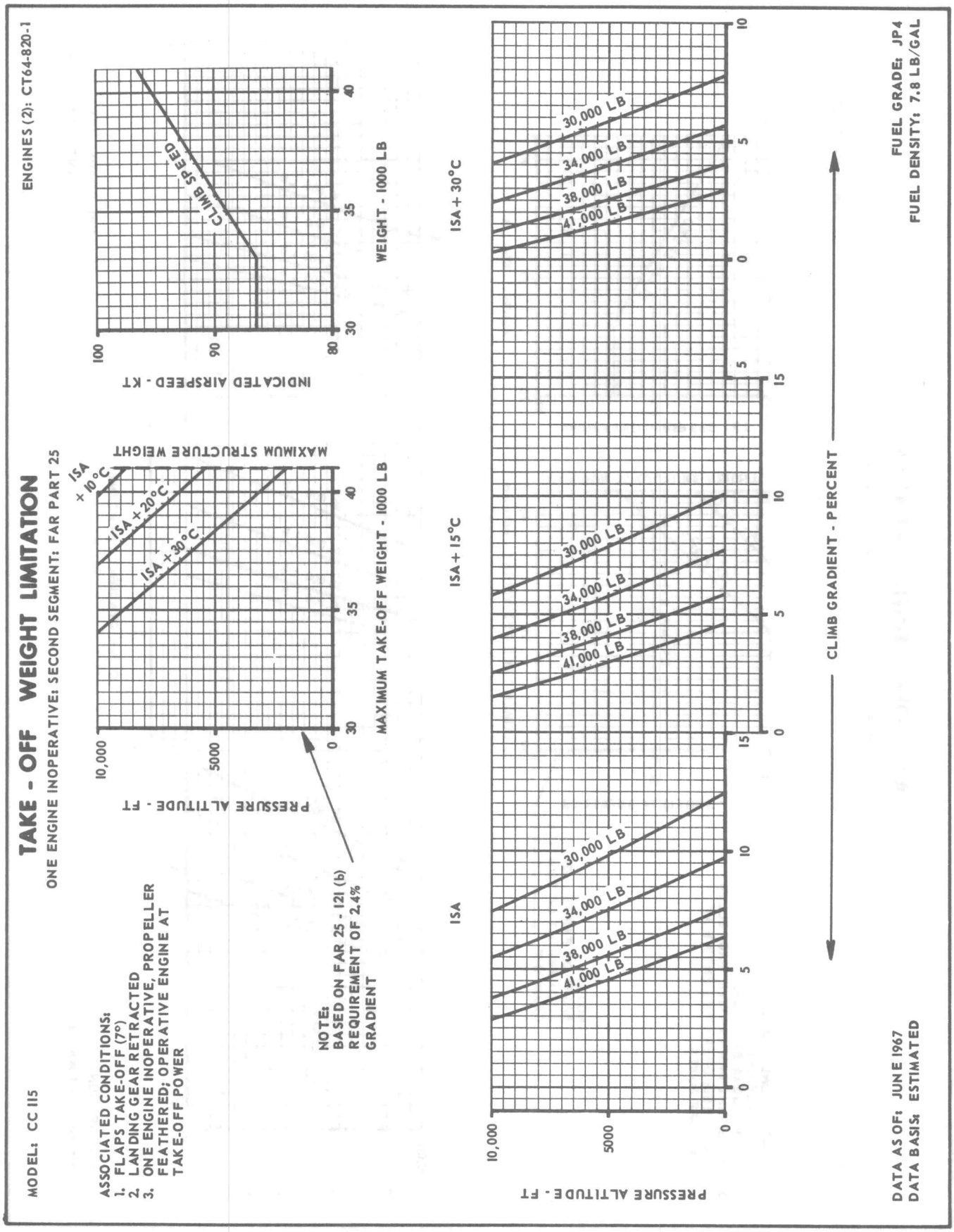


Figure 4-17 Take-off Weight Limitation: Second Segment

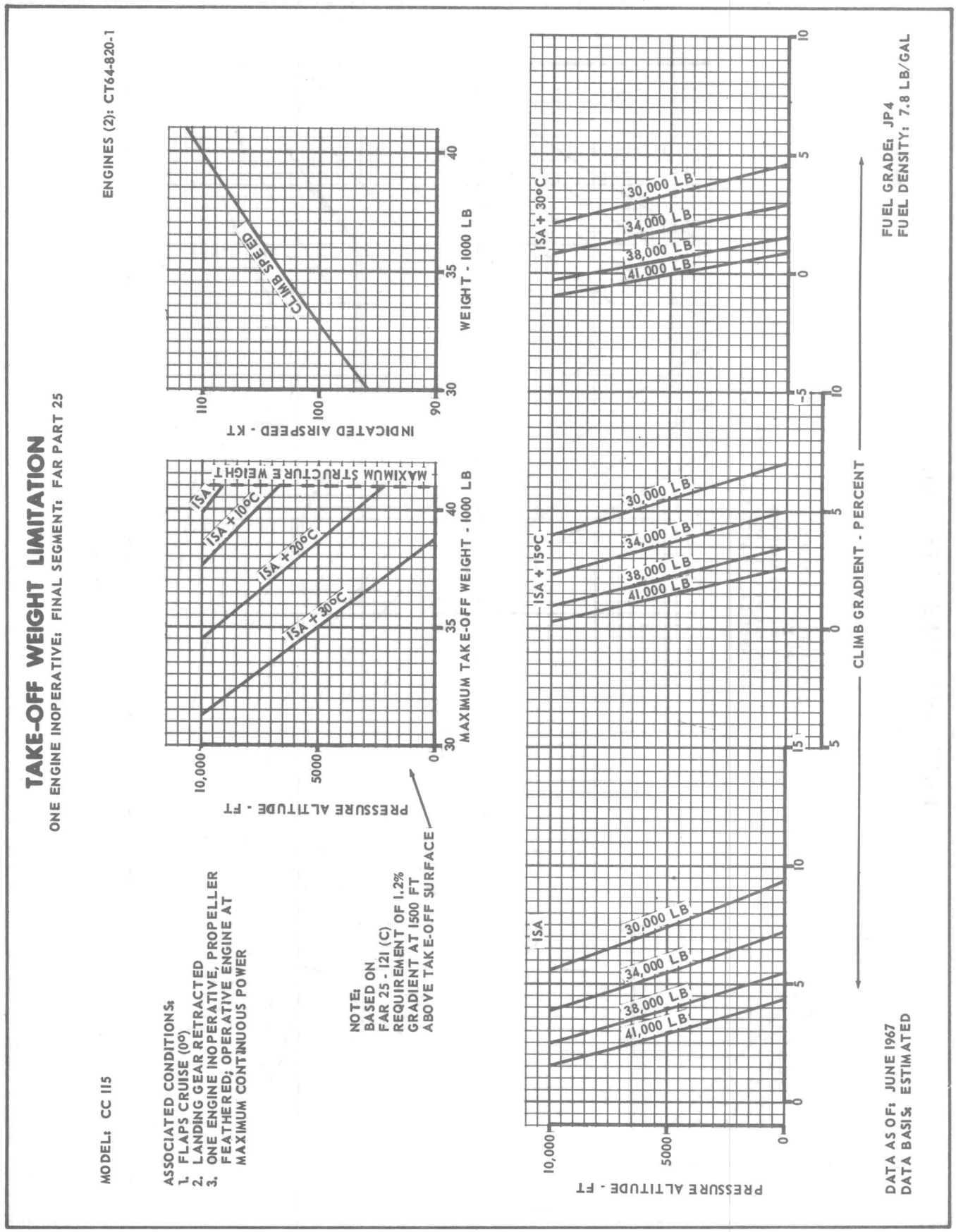


Figure 4-18 Take-off Weight Limitation: Final Segment

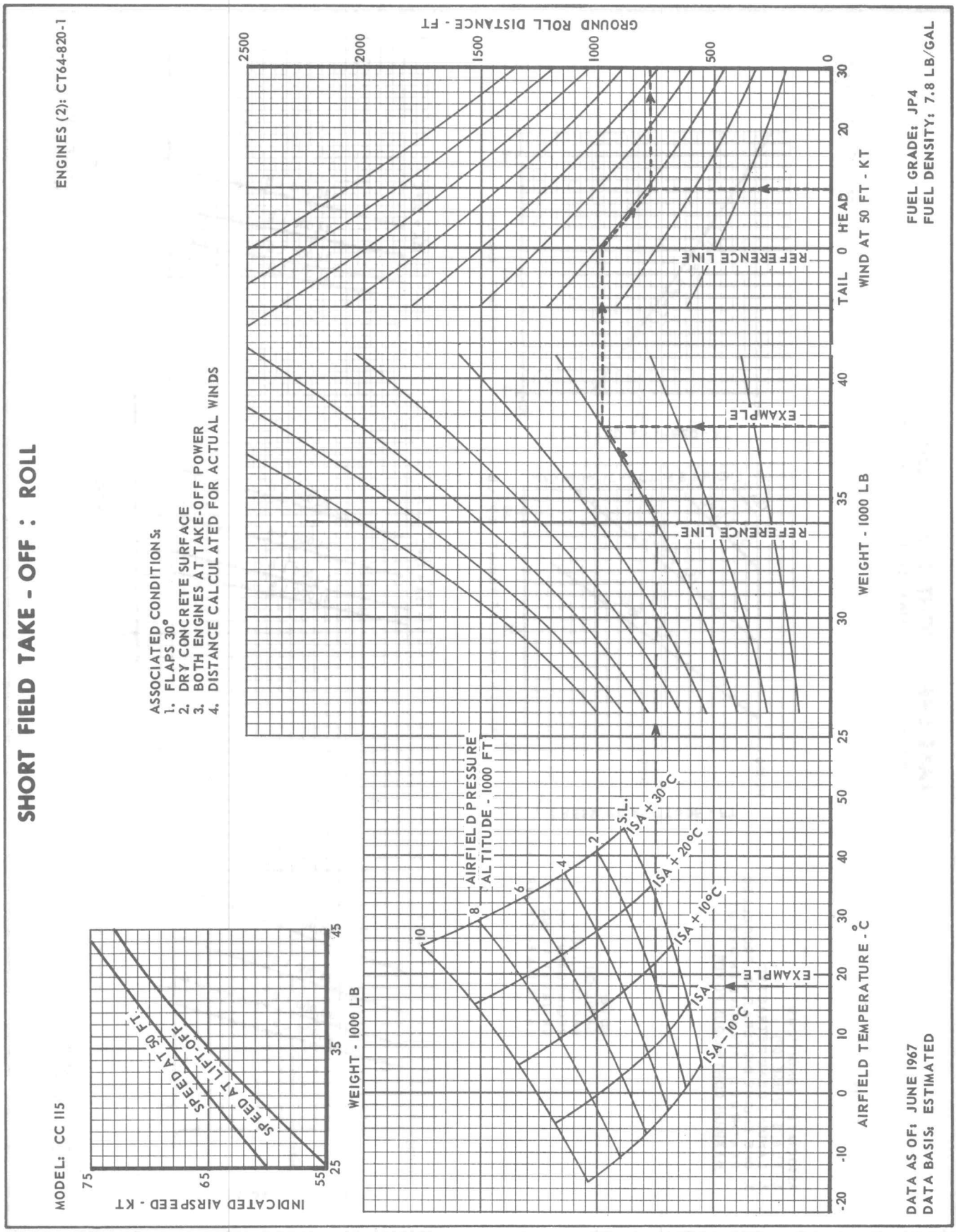


Figure 4-19 Short Field Take-off: Ground Roll

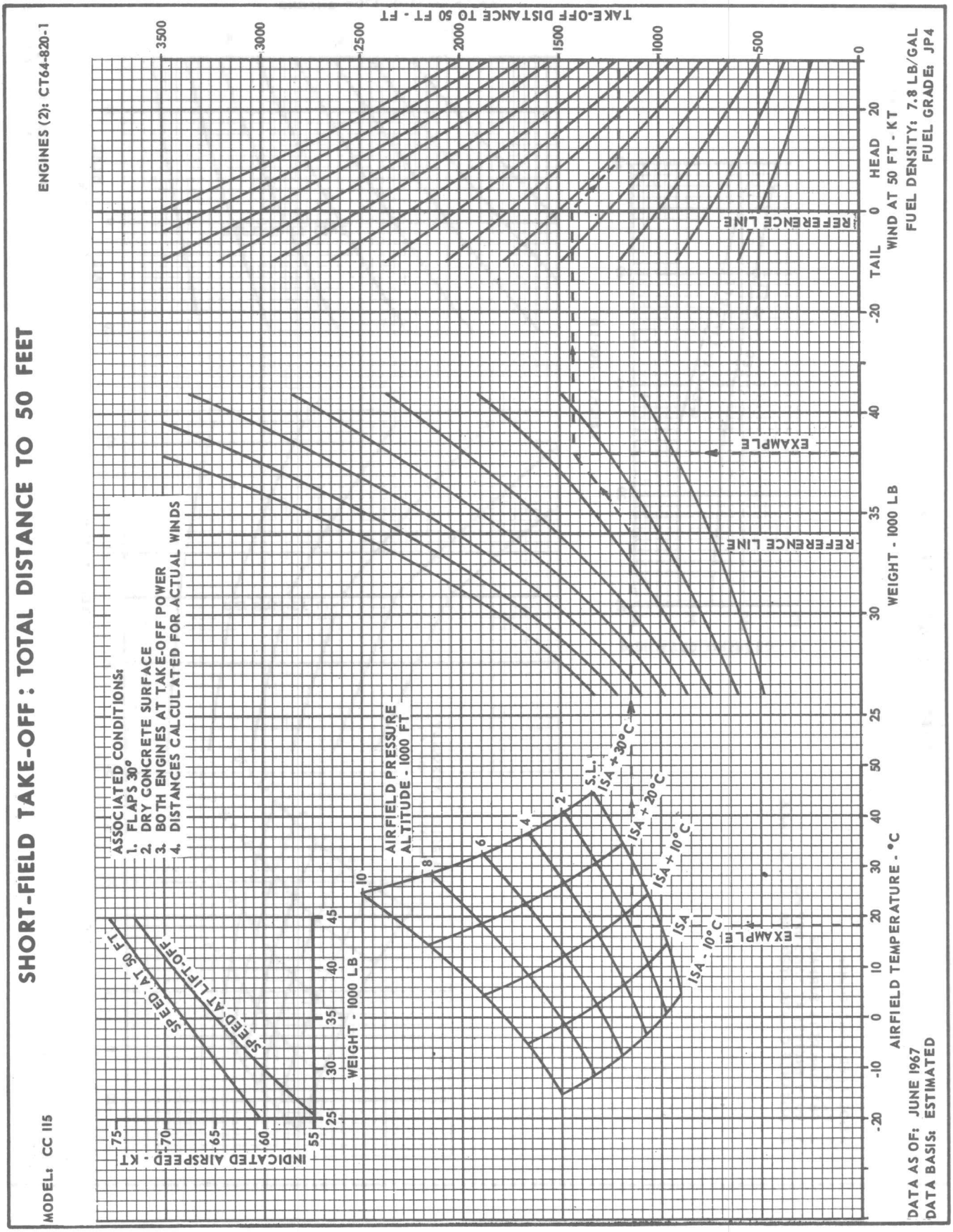


Figure 4-20 Short Field Take-off: Distance to 50 ft

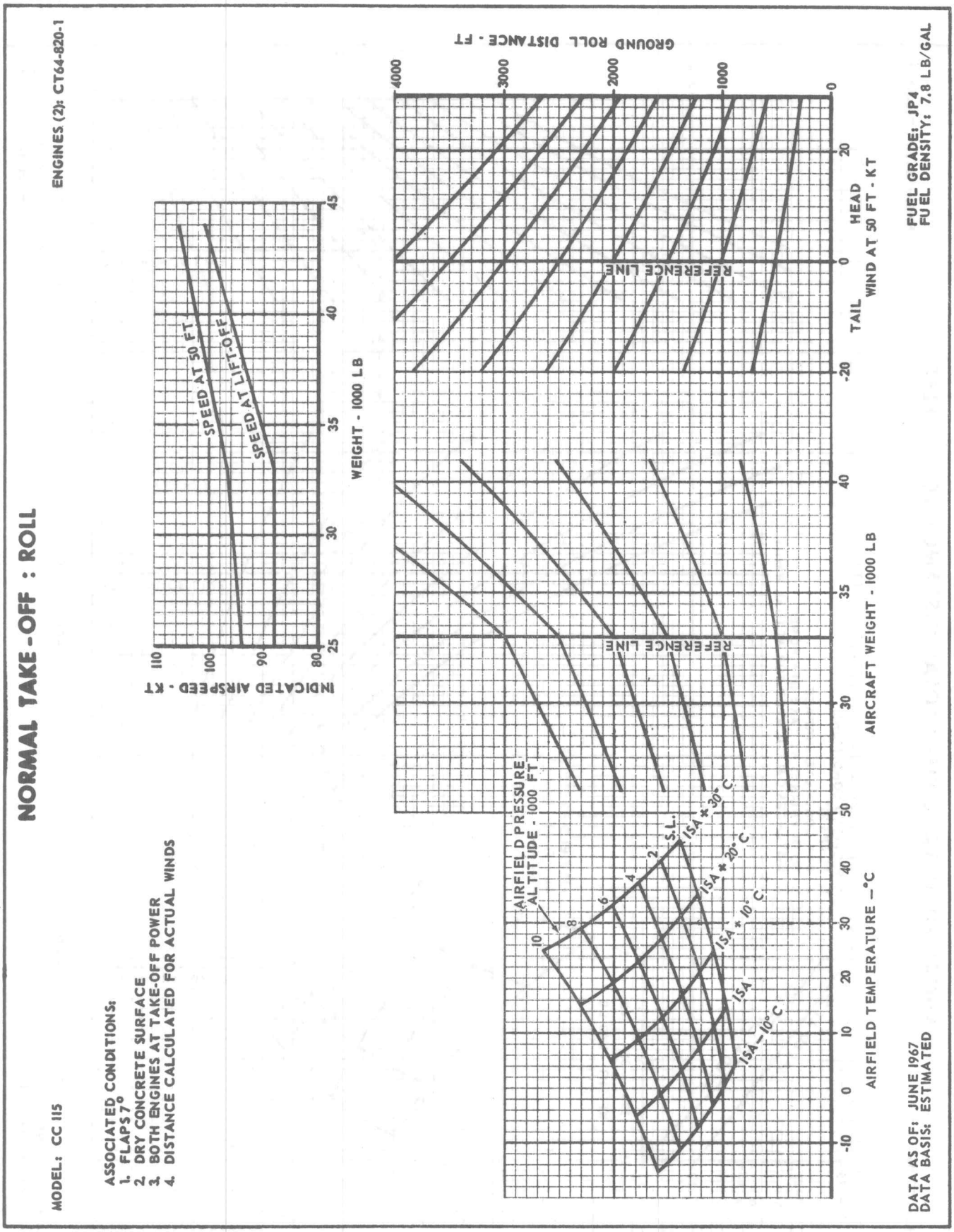


Figure 4-21 Normal Take-off: Ground Roll

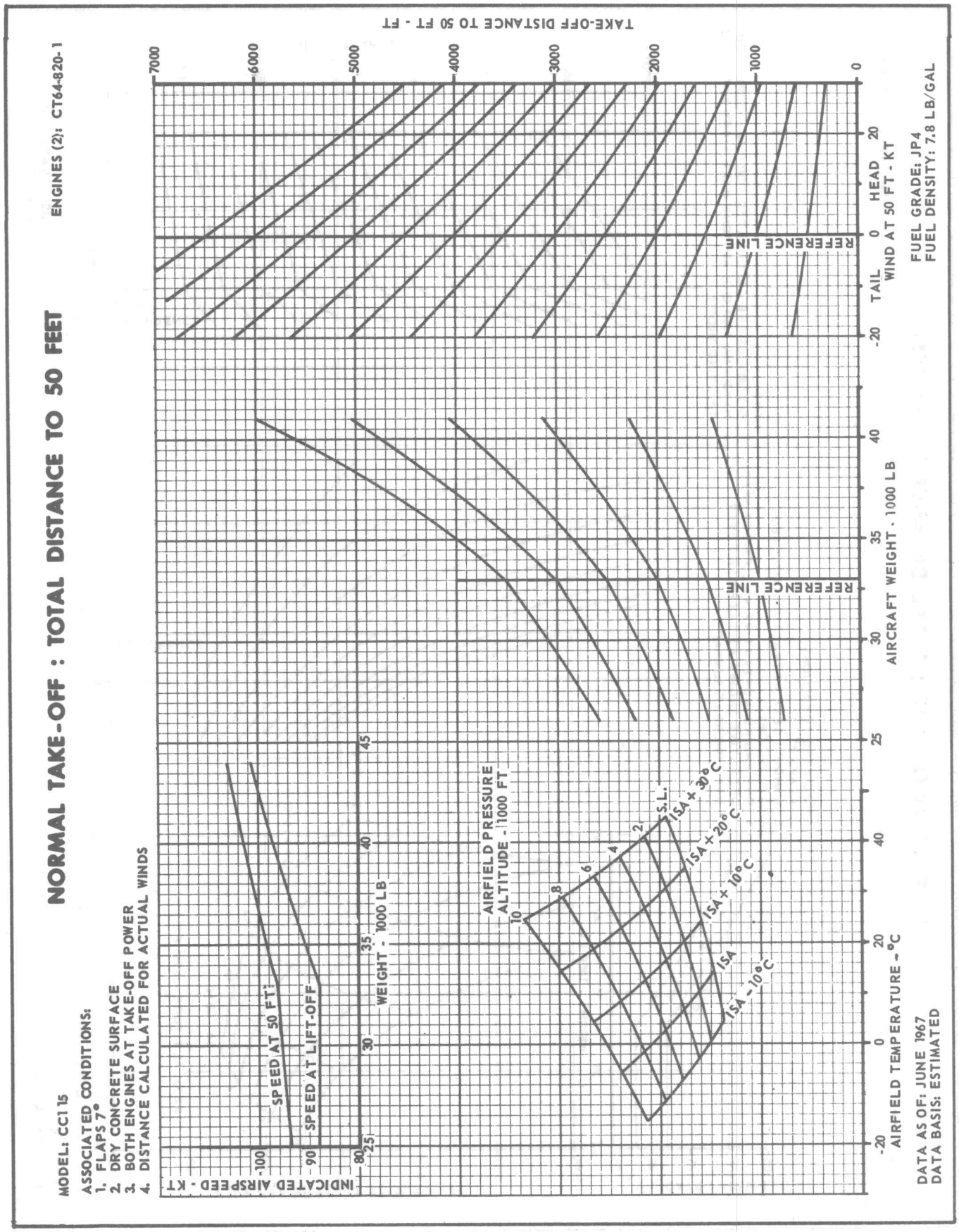


Figure 4-22 Normal Take-off: Distance to 50 ft

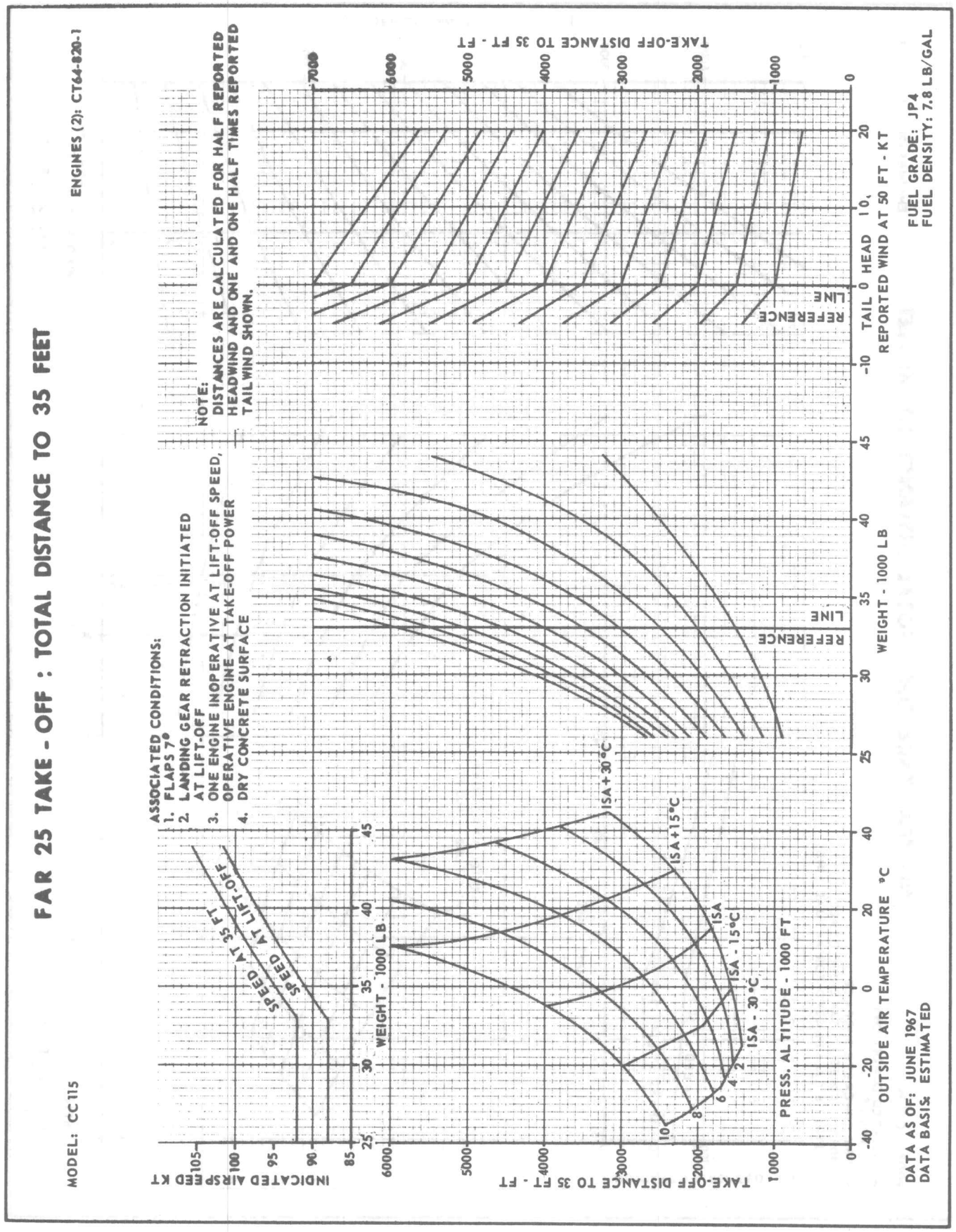


Figure 4-23 FAR 25 Take-off : Distance to 35 ft

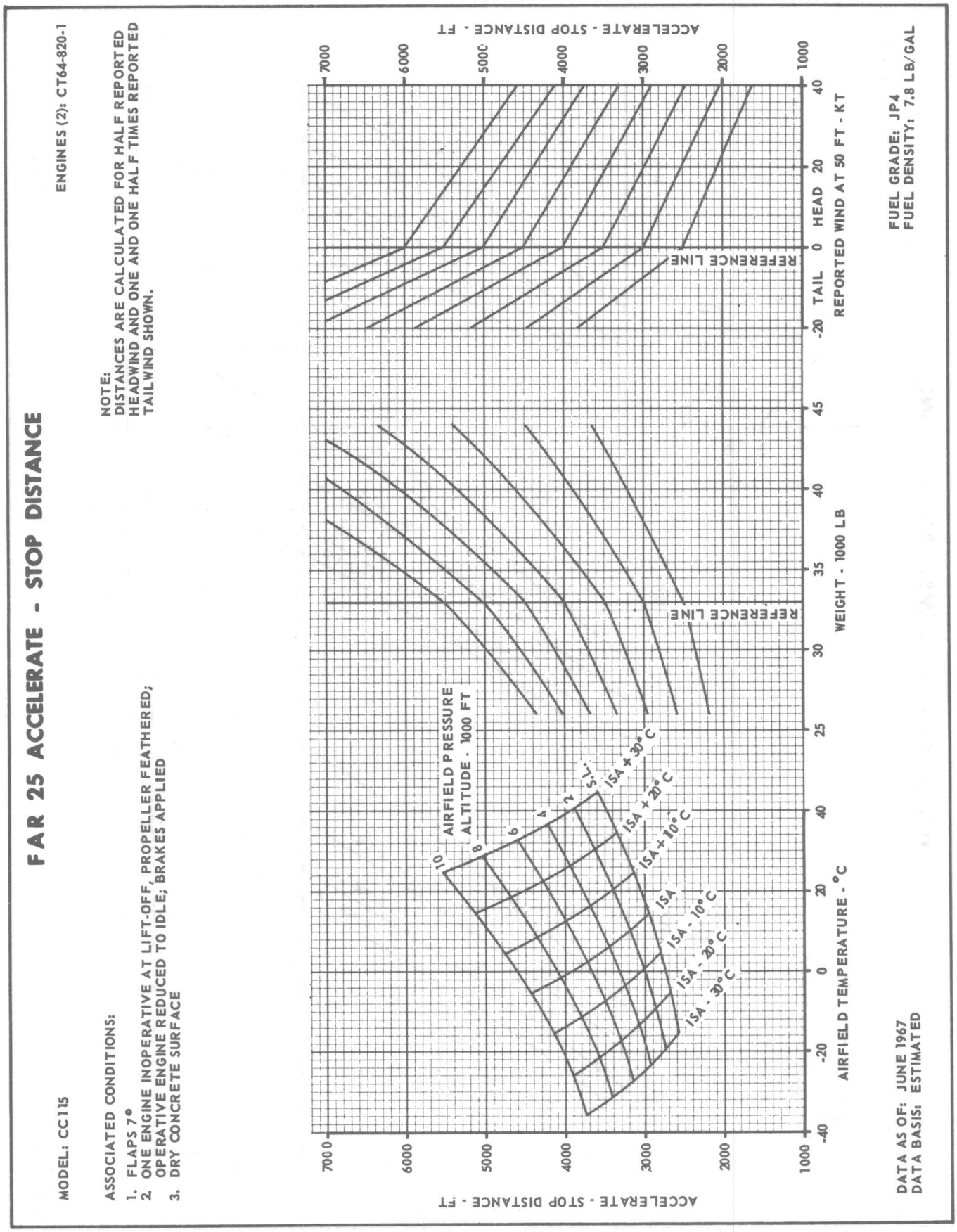


Figure 4-24 FAR 25 Accelerate - Stop Distance

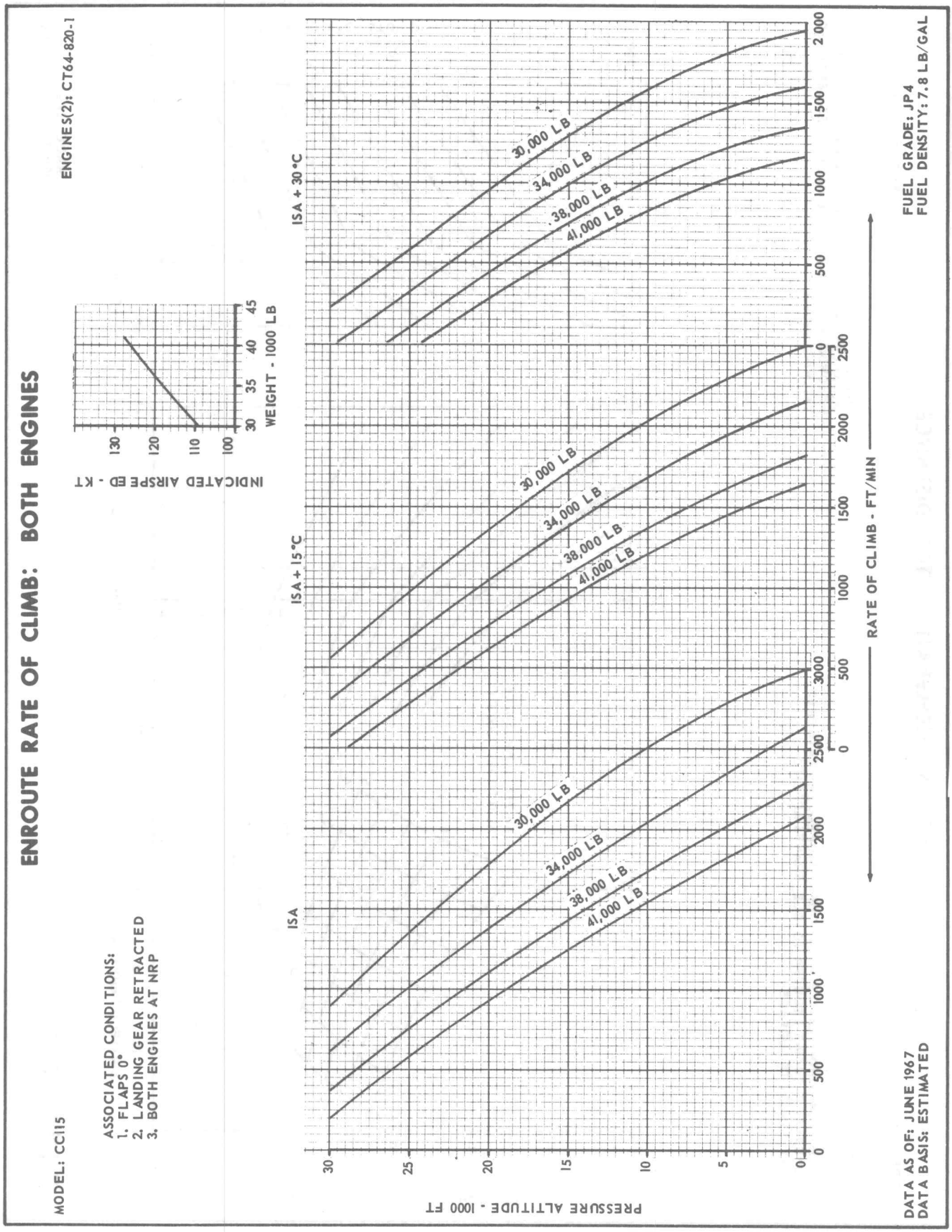


Figure 4-25 Enroute Rate of Climb - Both Engines

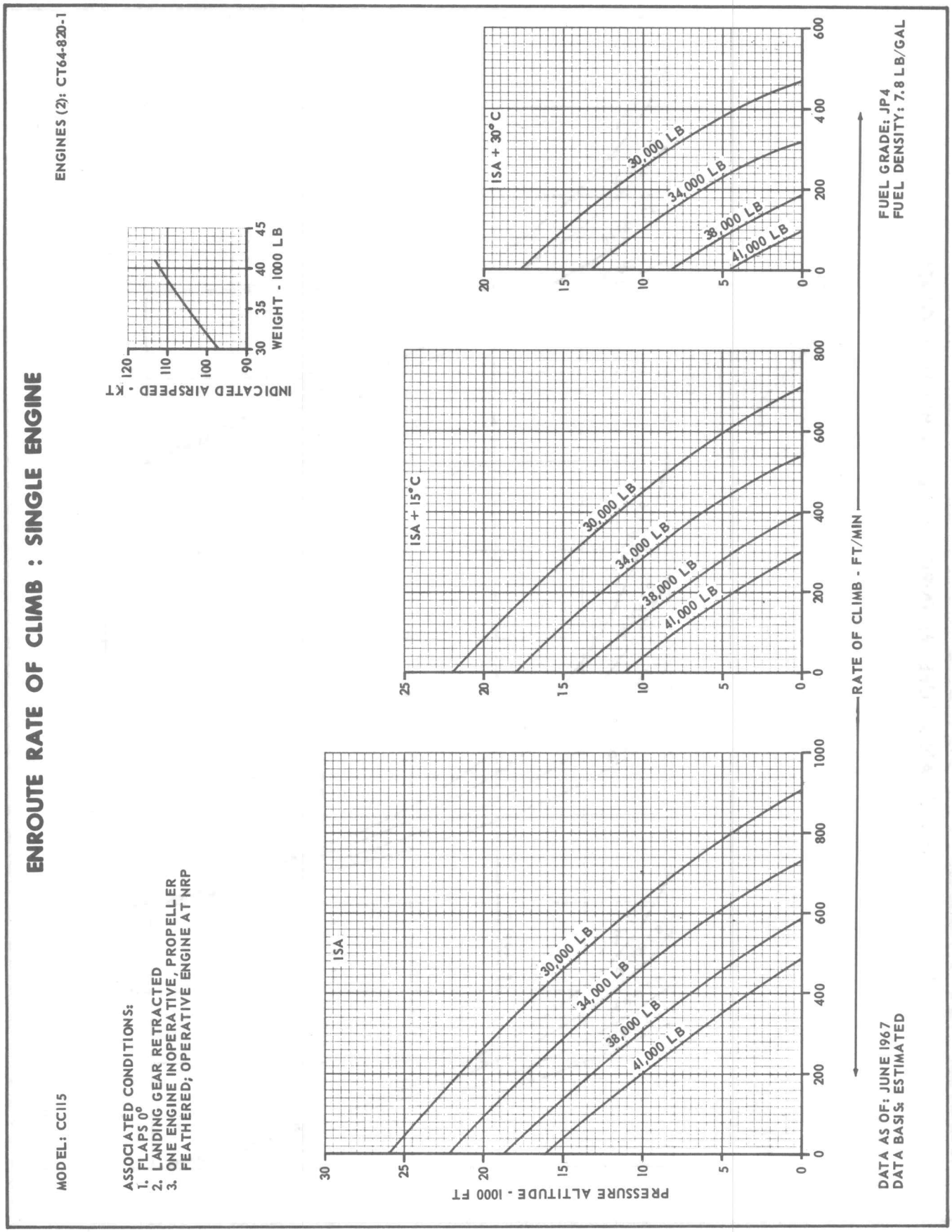


Figure 4-26 Enroute Rate of Climb - Single Engine

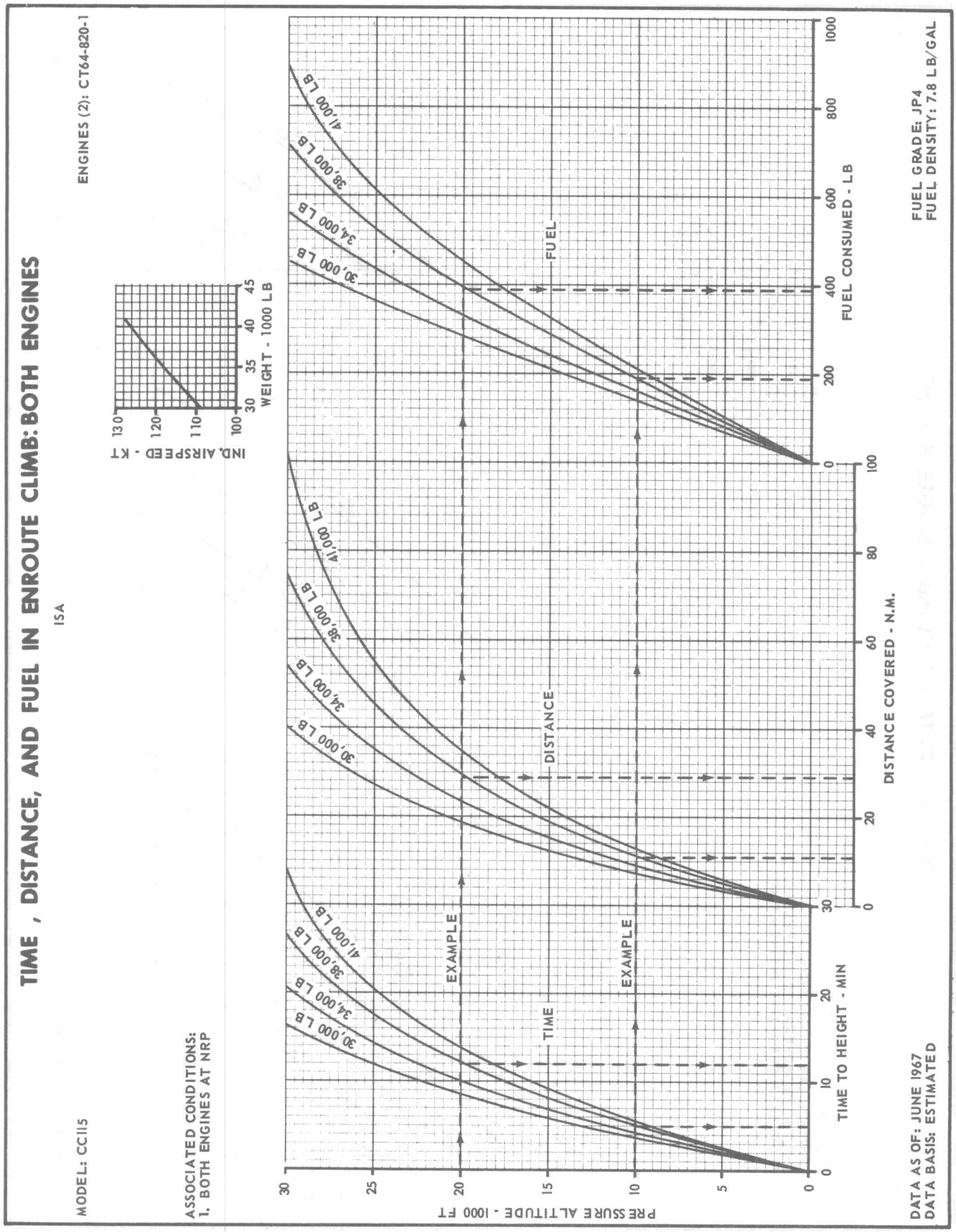


Figure 4-27 Time, Distance and Fuel in Enroute Climb: Both Engines-ISA

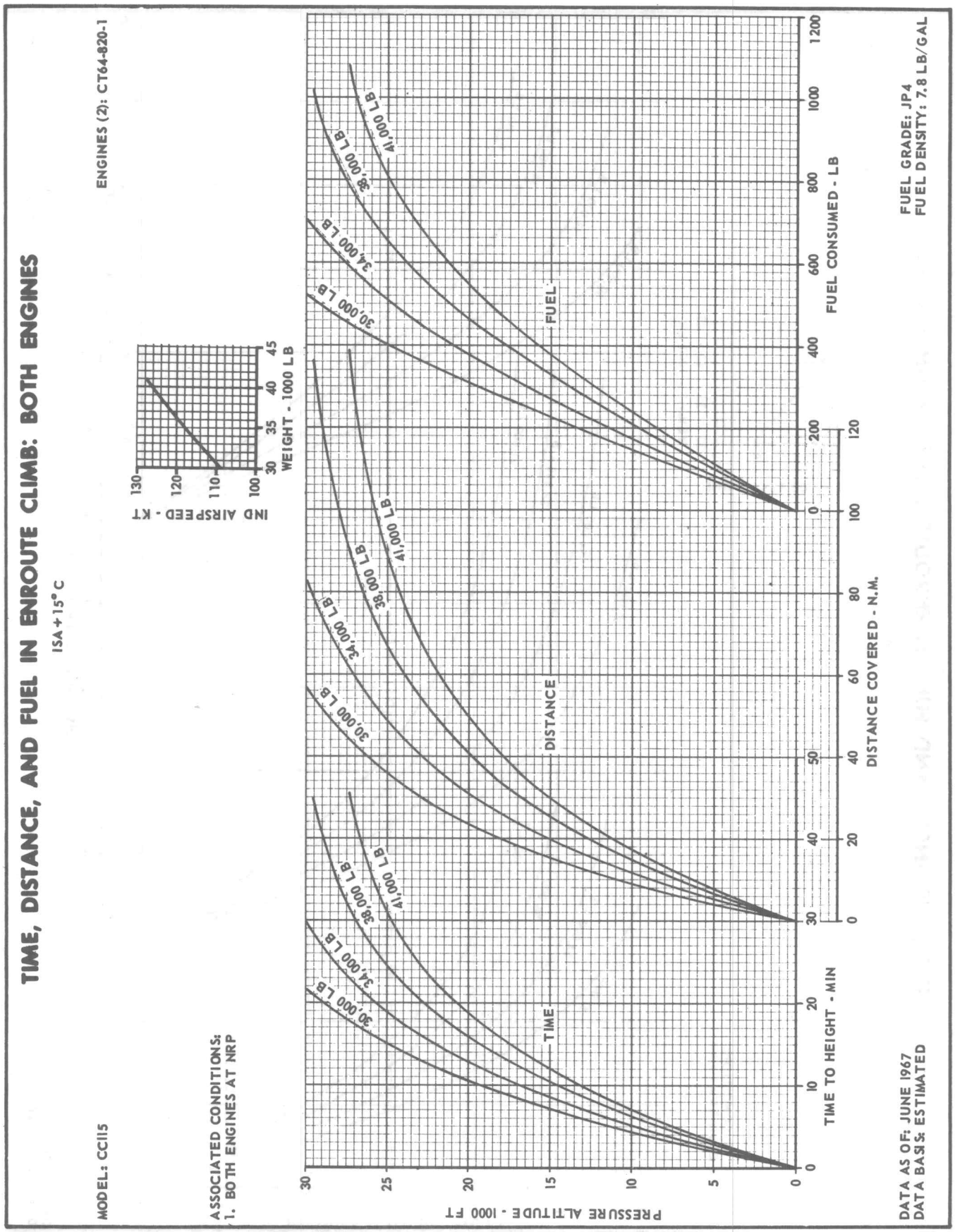


Figure 4-28 Time, Distance and Fuel in Enroute Climb: Both Engines-ISA + 15°C

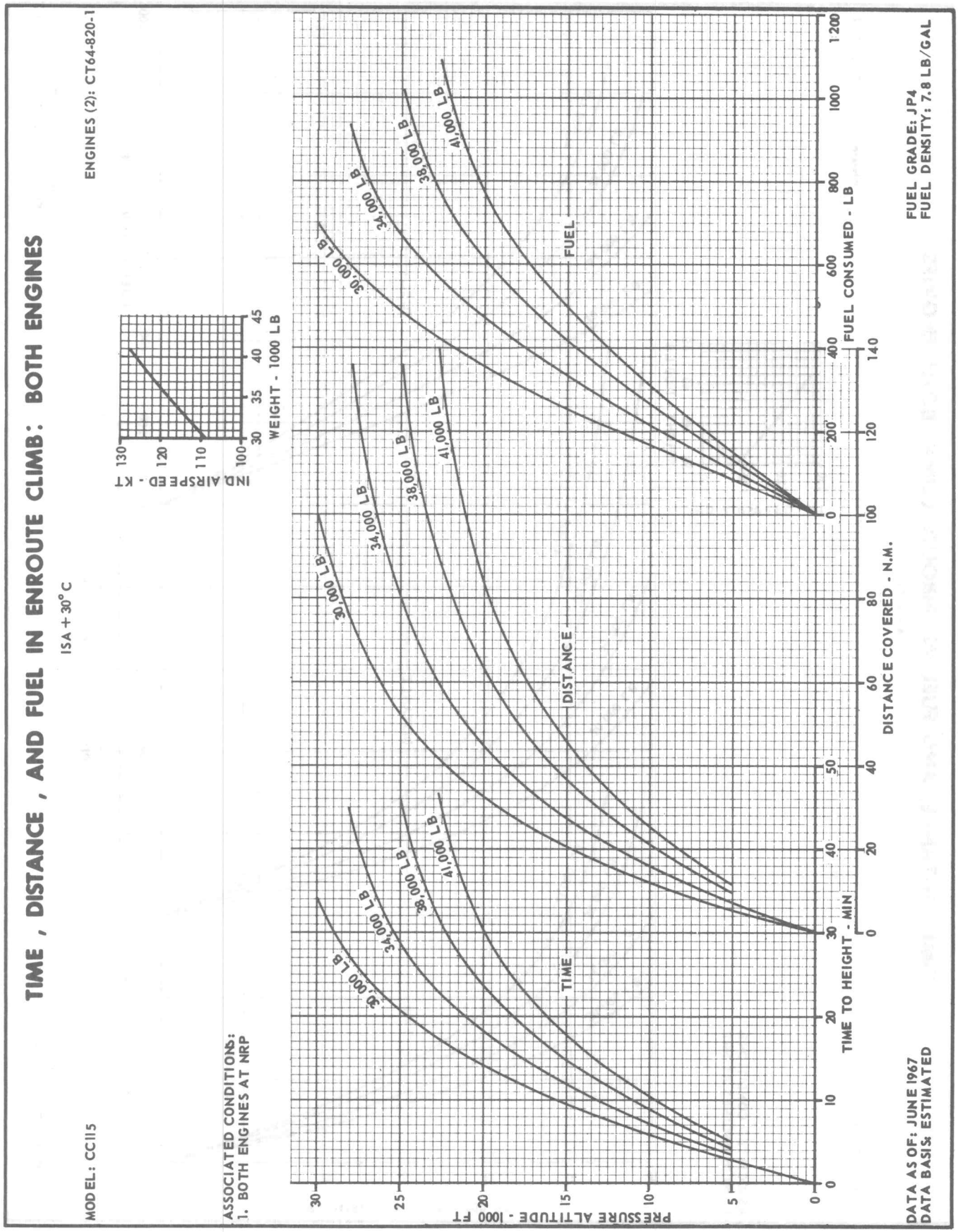


Figure 4-29 Time, Distance and Fuel in Enroute Climb: Both Engines-ISA + 30°C

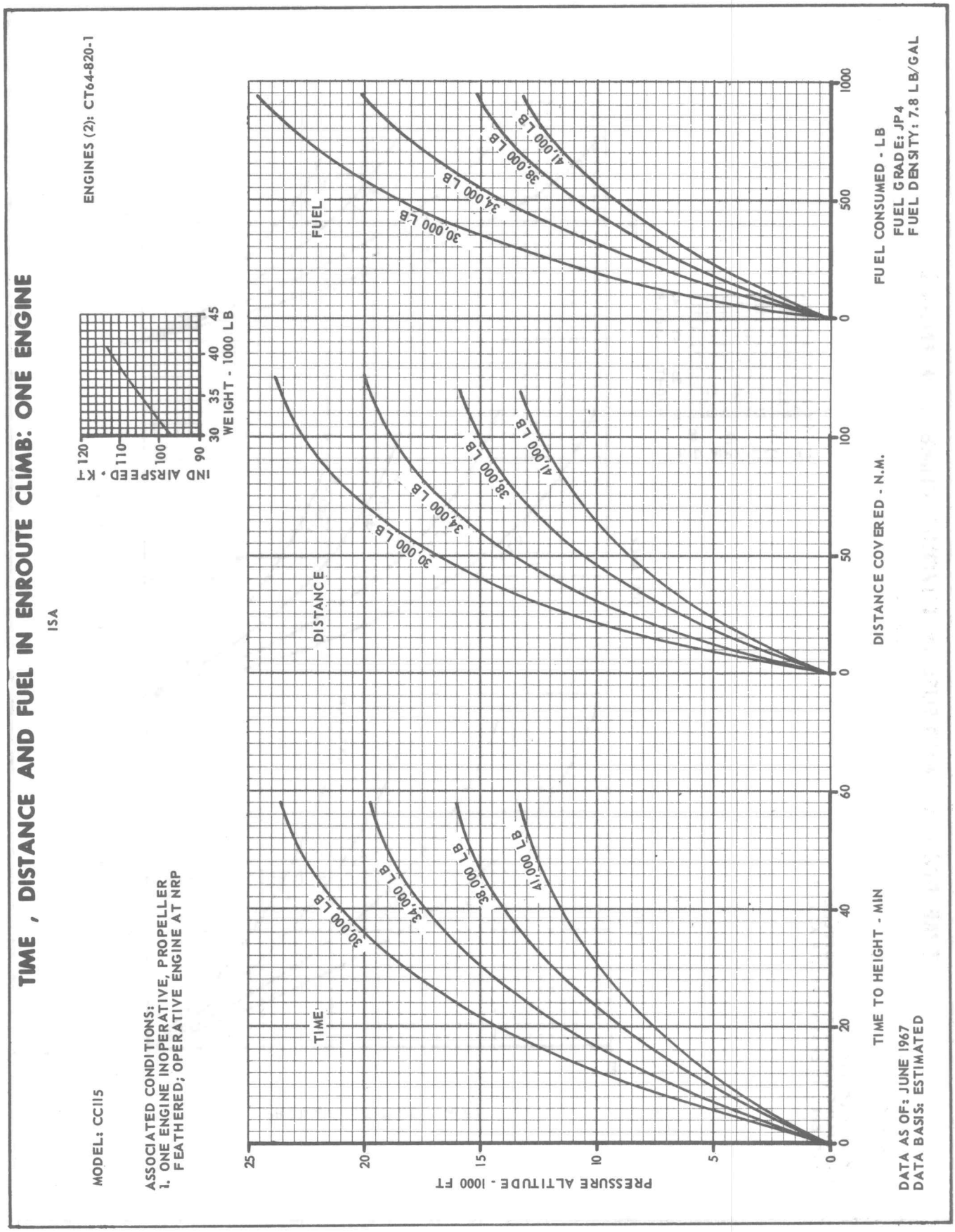


Figure 4-30 Time, Distance and Fuel in Enroute Climb: One Engine-ISA

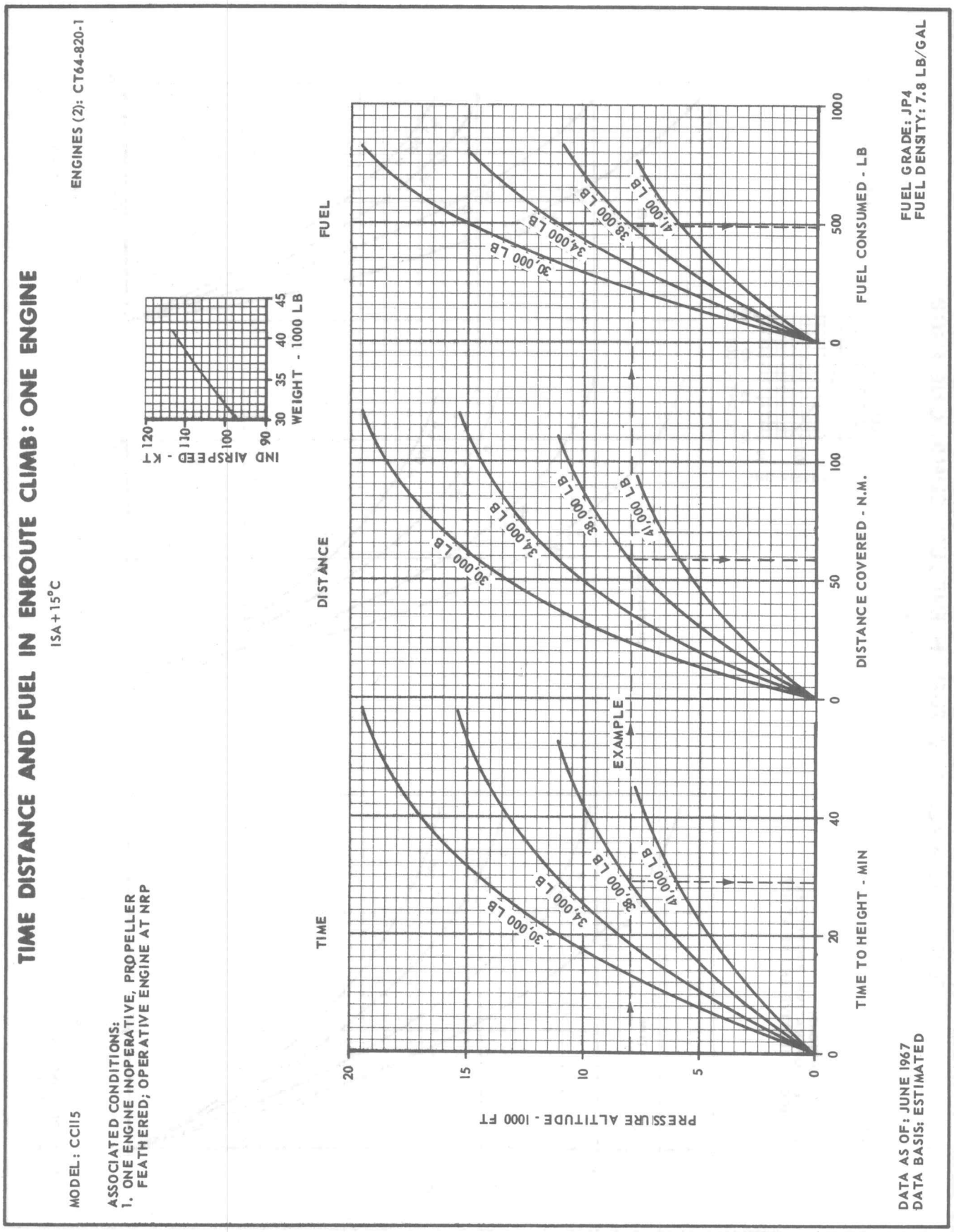


Figure 4-31 Time, Distance and Fuel in Enroute Climb: One Engine-ISA + 15°C

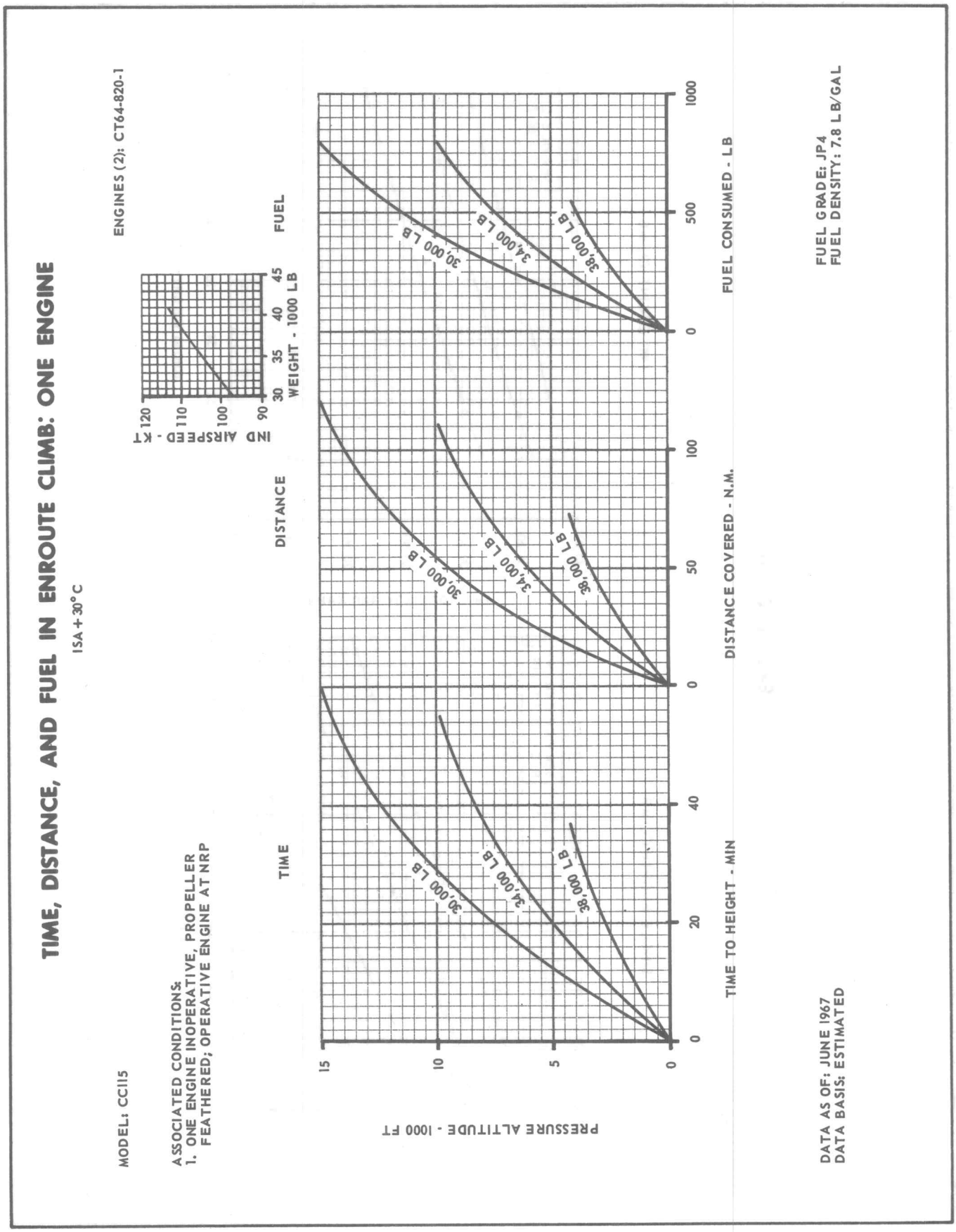


Figure 4-32 Time, Distance and Fuel in Enroute Climb: One Engine-ISA + 30°C

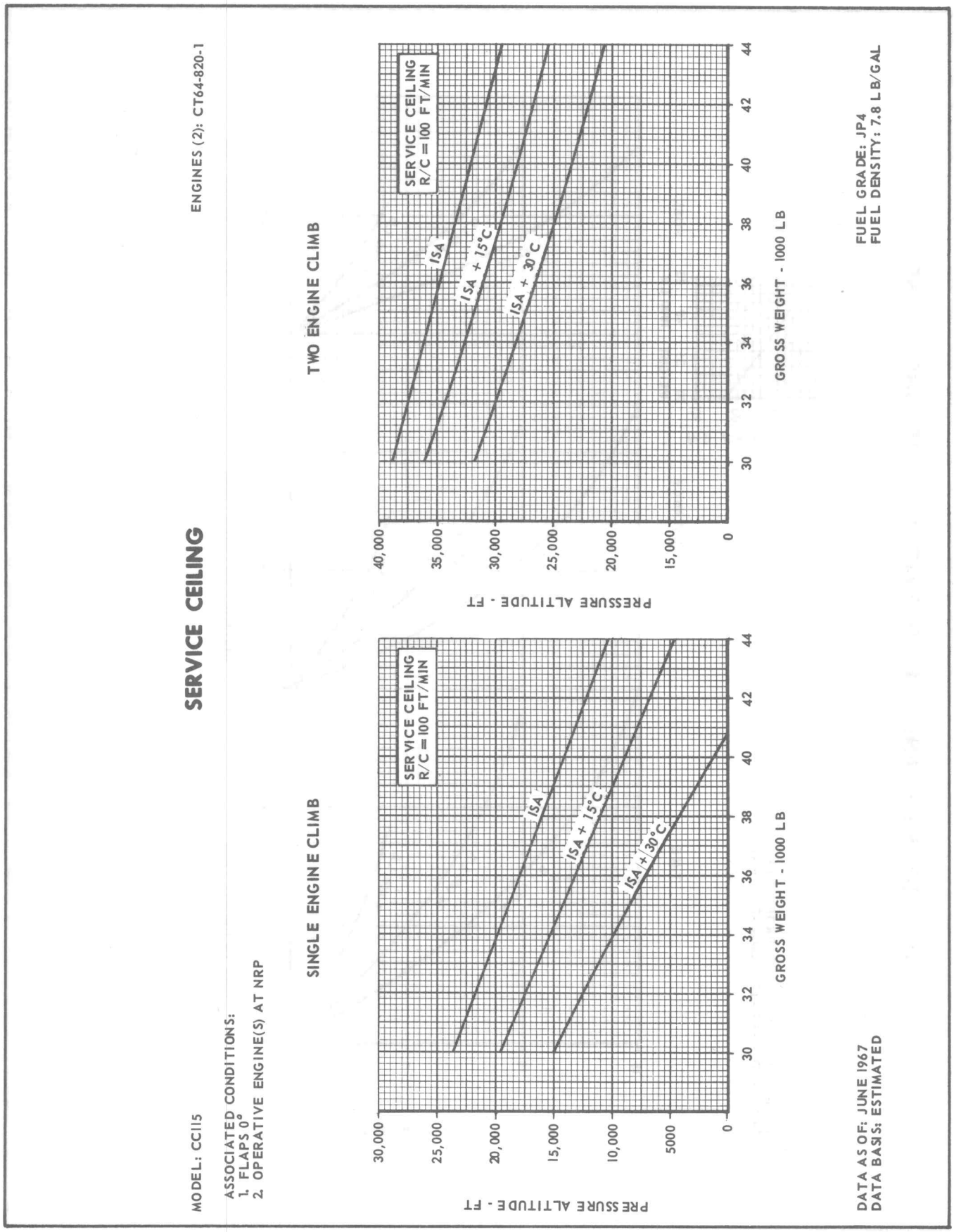


Figure 4-33 Service Ceiling

NAUTICAL AIR MILES PER POUND OF FUEL

BOTH ENGINES OPERATING PRESSURE ALTITUDE - SEA LEVEL

ENGINES (2): CT64-820-1

MODEL: CC115
ASSOCIATED CONDITIONS:
1. ZERO WIND

ISA

% NRP	100	90	80	70	60	50	40	30
SHP	2450	2205	1960	1715	1470	1225	980	735
RPM	1015	990	965	932	900	865	850	850
TORQUE FT-LB	960	890	810	735	650	566	460	348
FUEL FLOW LB/HR	1305	1200	1100	1005	905	811	715	620

ISA+15°C

% NRP	100	90	80	70	60	50	40	30
SHP	1980	1780	1585	1388	1190	990	794	595
RPM	1015	1015	1000	945	905	870	850	850
TORQUE FT-LB	785	700	634	586	525	457	375	282
FUEL FLOW LB/HR/ENG	1130	1050	970	890	810	731	656	580

ISA+30°C

% NRP	100	90	80.	70	60	50	40	30
SHP	1560	1400	1250	1090	935	780	624	468
RPM	1015	1015	1015	955	905	875	853	850
TORQUE FT-LB	615	550	494	458	415	358	295	222
FUEL FLOW LB/HR/ENG	992	925	860	795	728	664	600	536

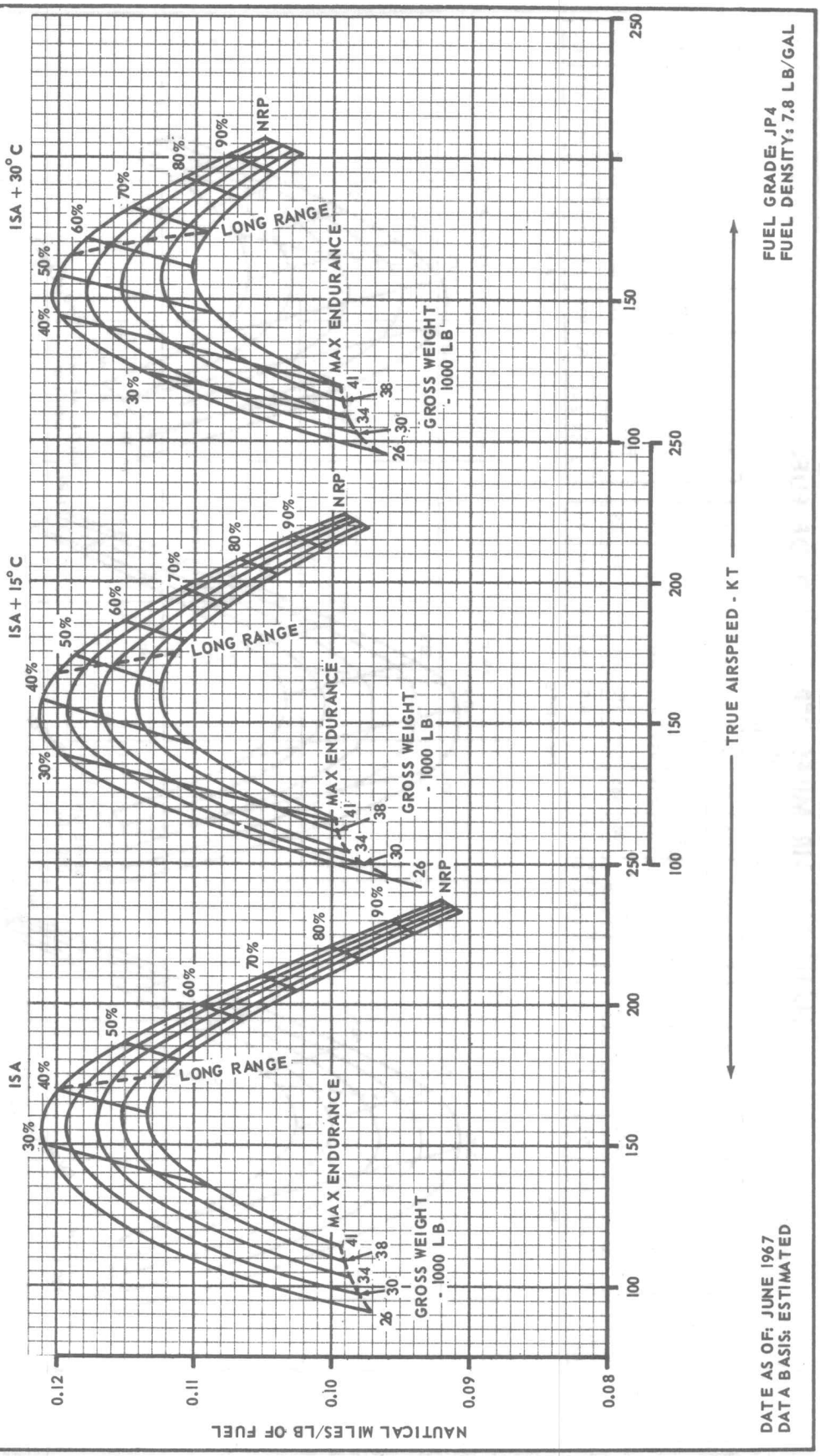


Figure 4-34 Nautical Air Miles Per Pound of Fuel: Both Engines-Sea Level

MODEL CC115
ASSOCIATED CONDITIONS
1. ZERO WIND

NAUTICAL AIR MILES PER POUND OF FUEL

BOTH ENGINES OPERATING
PRESSURE ALTITUDE - 5000 FEET

ENGINES (2): CT64-820-1

ISA

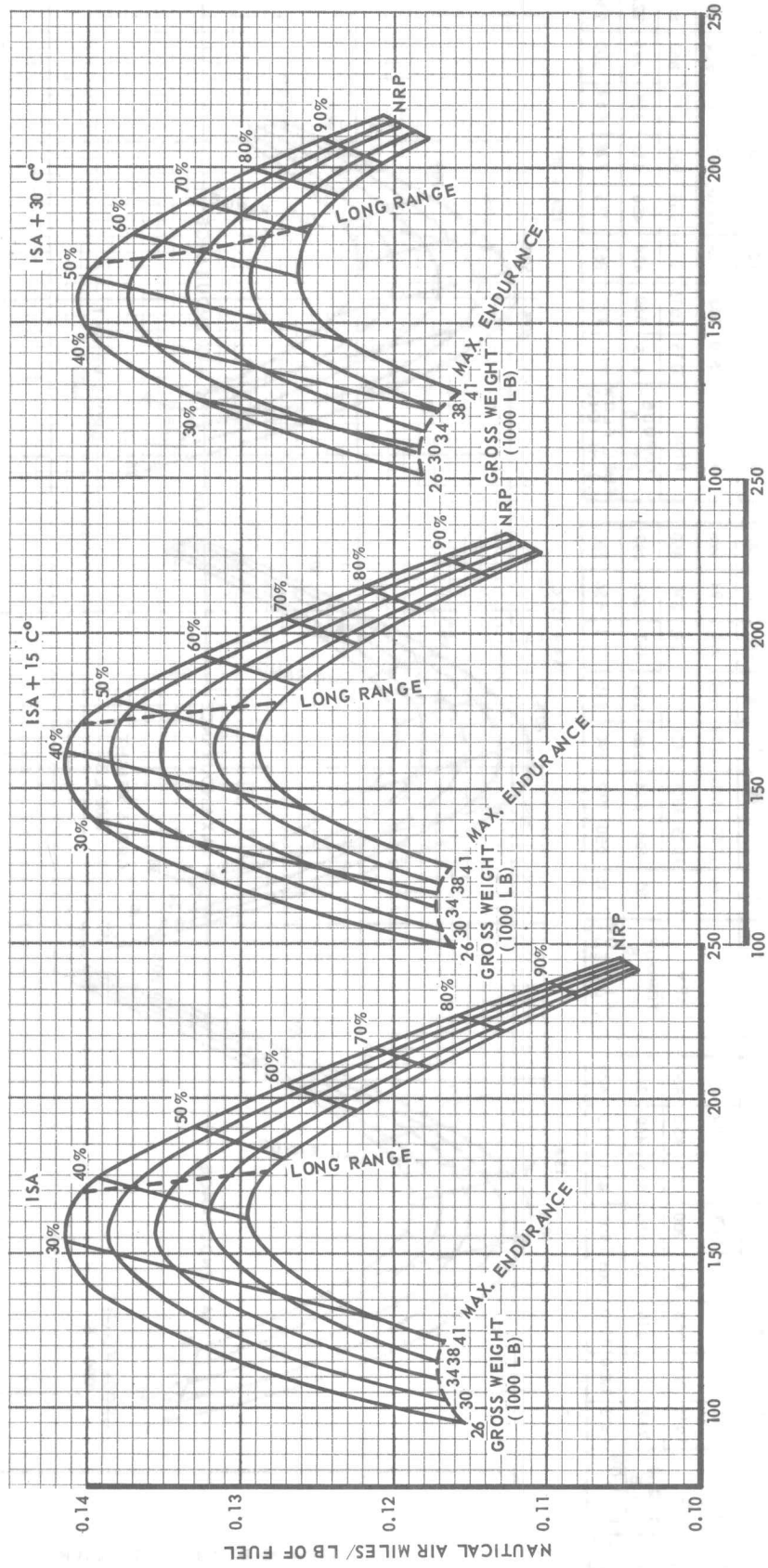
% NRP	100	90	80	70	60	50	40	30
SHP	2260	2030	1810	1580	1355	1130	905	680
RPM	1015	985	955	920	885	850	850	850
TORQUE FT-LB	886	822	755	685	612	530	428	284
FUEL FLOW LB/HR/ENG	1225	1070	980	885	795	710	625	545

ISA + 15° C

% NRP	100	90	80	70	60	50	40	30
SHP	1880	1690	1505	1320	1130	940	750	565
RPM	1015	1015	955	930	900	870	850	850
TORQUE FT-LB	738	665	630	570	500	434	355	269
FUEL FLOW LB/HR/ENG	1030	950	874	800	726	650	580	510

ISA + 30° C

% NRP	100	90	80	70	60	50	40	30
SHP	1505	1355	1205	1055	905	755	600	450
RPM	1015	1015	1005	950	900	875	850	850
TORQUE FT-LB	595	535	480	445	405	348	286	215
FUEL FLOW LB/HR/ENG	900	838	775	717	655	592	530	472



DATA AS OF: JUNE 1967
DATA BASIS: ESTIMATED

FUEL GRADE: JP4
FUEL DENSITY: 7.8 LB/GAL

Figure 4-35 Nautical Air Miles Per Pound of Fuel: Both Engines-5000 ft

NAUTICAL AIR MILES PER POUND OF FUEL

BOTH ENGINES OPERATING

PRESSURE ALTITUDE - 10,000 FEET

MODEL: CC115

ENGINES (2): CT64-820-1

ASSOCIATED CONDITIONS:
1. ZERO WIND

ISA

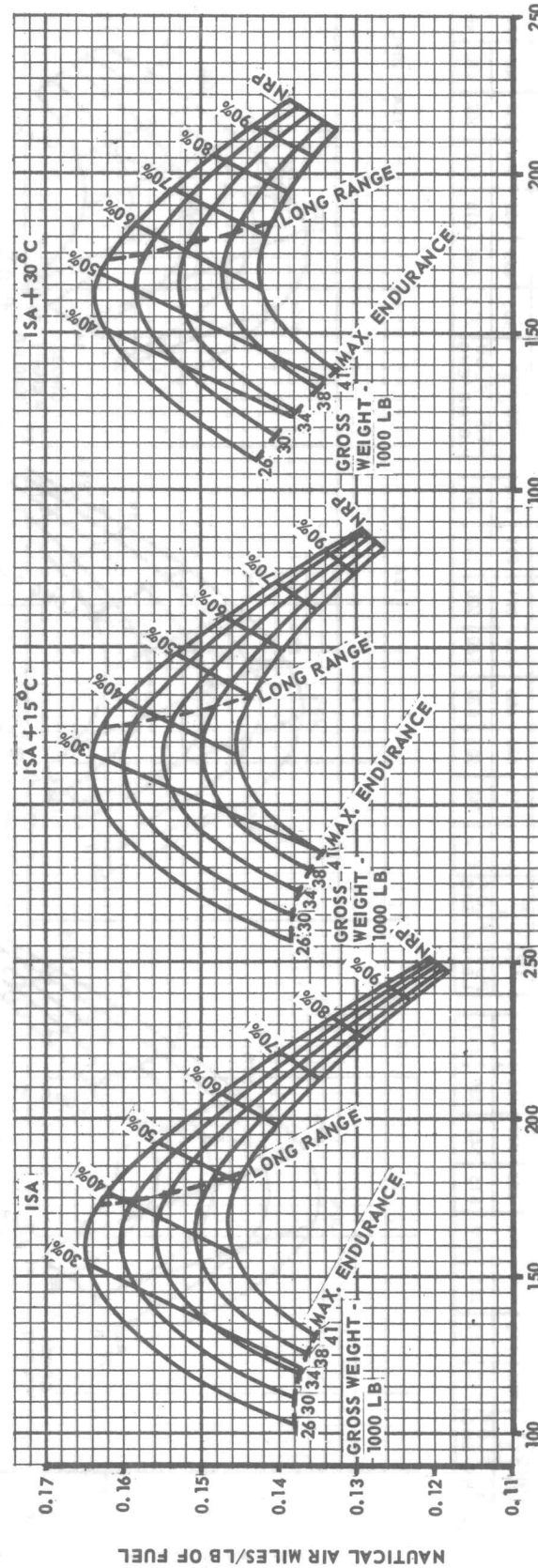
% NRP	100	90	80	70	60	50	40	30
SHP	2080	1870	1665	1455	1250	1040	832	625
RPM	1015	970	930	900	875	850	850	850
TORQUE FT-LB	817	770	715	645	570	490	393	296
FUEL FLOW LB/HR/ENG	1085	945	865	775	700	620	545	475

ISA+15°C

% NRP	100	90	80	70	60	50	40	30
SHP	1740	1565	1390	1220	1045	870	695	522
RPM	1015	1015	970	925	890	865	850	850
TORQUE FT-LB	685	615	574	530	470	405	330	248
FUEL FLOW LB/HR/ENG	978	845	775	710	640	575	508	440

ISA+30°C

% RPM	100	90	80	70	60	50	40
SHP	1415	1275	1130	990	850	710	565
RPM	1015	1015	990	935	895	865	850
TORQUE FT-LB	560	500	458	425	382	330	269
FUEL FLOW LB/HR/ENG	812	756	695	637	580	522	462



FUEL GRADE: JP4
FUEL DENSITY: 7.8 LB/GAL

DATA AS OF: JUNE 1967
DATA BASIS: ESTIMATED

Figure 4-36 Nautical Air Miles Per Pound of Fuel: Both Engines-10,000 ft

NAUTICAL AIR MILES PER POUND OF FUEL

BOTH ENGINES OPERATING

PRESSURE ALTITUDE - 15,000 FEET

MODEL: CC 115

ENGINES (2): CT64-820-1

ISA

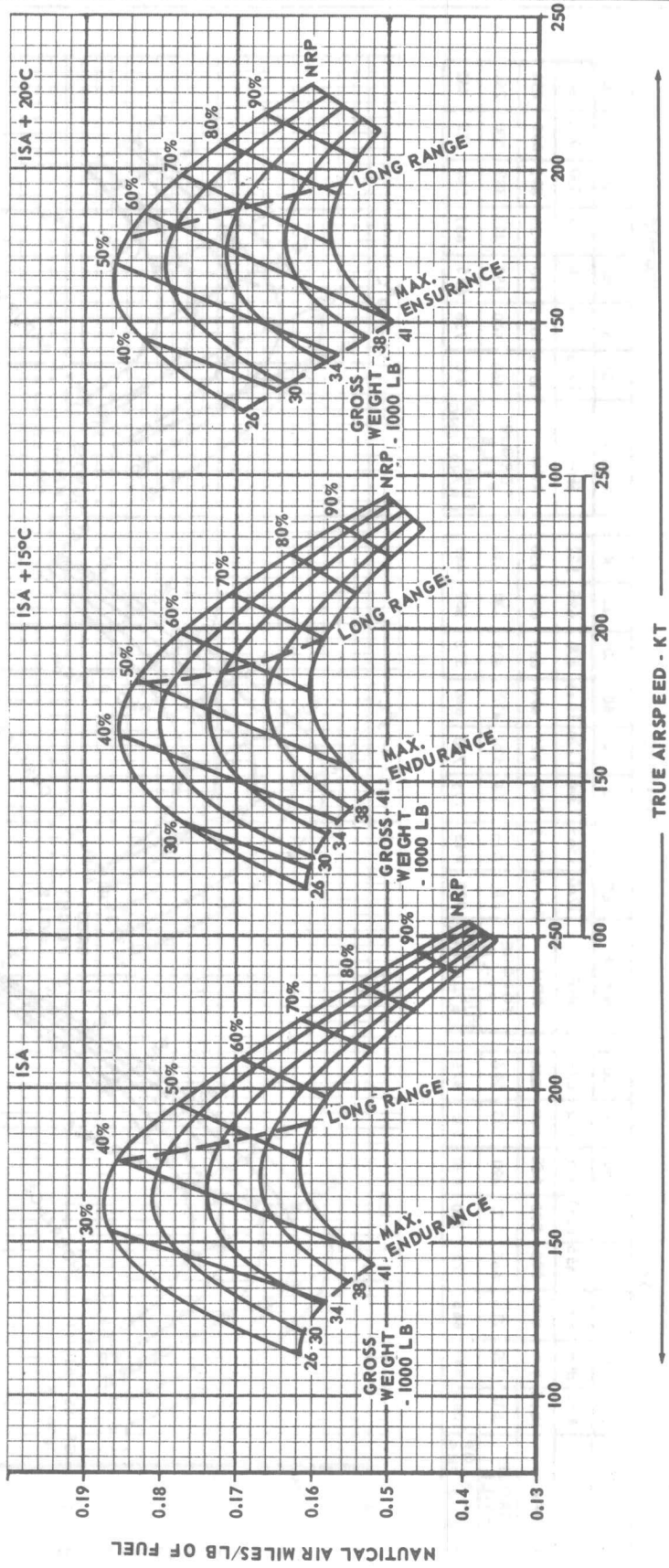
% NRP	100	90	80	70	60	50	40	30
SHP	1875	1690	1500	1310	1125	940	750	560
RPM	1015	950	910	880	855	850	850	850
TORQUE FT-LB	700	710	600	595	525	377	355	312
FUEL FLOW LB/HR/ENG	910	840	765	690	615	545	480	410

ISA +15°C

% NRP	100	90	80	70	60	50	40	30
SHP	1575	1415	1260	1100	945	785	630	470
RPM	1015	980	940	905	875	850	850	850
TORQUE FT-LB	620	575	536	486	434	371	299	224
FUEL FLOW LB/HR/ENG	815	748	685	620	560	500	440	380

ISA + 20°C

% NRP	100	90	80	70	60	50	40
SHP	1280	1150	1025	895	770	640	510
RPM	1015	1015	955	910	880	860	850
TORQUE FT-LB	505	455	432	394	352	300	243
FUEL FLOW LB/HR/ENG	715	660	610	560	508	470	403



FUEL GRADE: JP4
FUEL DENSITY: 7.8 LB/GAL

DATA AS OF: JUNE 1967
DATA BASIS: ESTIMATED

Figure 4-37 Nautical Air Miles Per Pound of Fuel: Both Engines-15,000 ft

MODEL: CC115

NAUTICAL AIR MILES PER POUND OF FUEL

BOTH ENGINES OPERATING PRESSURE ALTITUDE - 20,000 FEET

ENGINES (2): CT64-820-1

ISA

% NRP	100	90	80	70	60	50	40	30
SHP	1650	1485	1320	1155	990	825	660	495
RPM	1015	945	895	850	850	850	850	850
TORQUE FT-LB	650	627	590	545	466	390	312	236
FUEL FLOW LB/HR/ENG	820	730	665	600	538	475	420	362

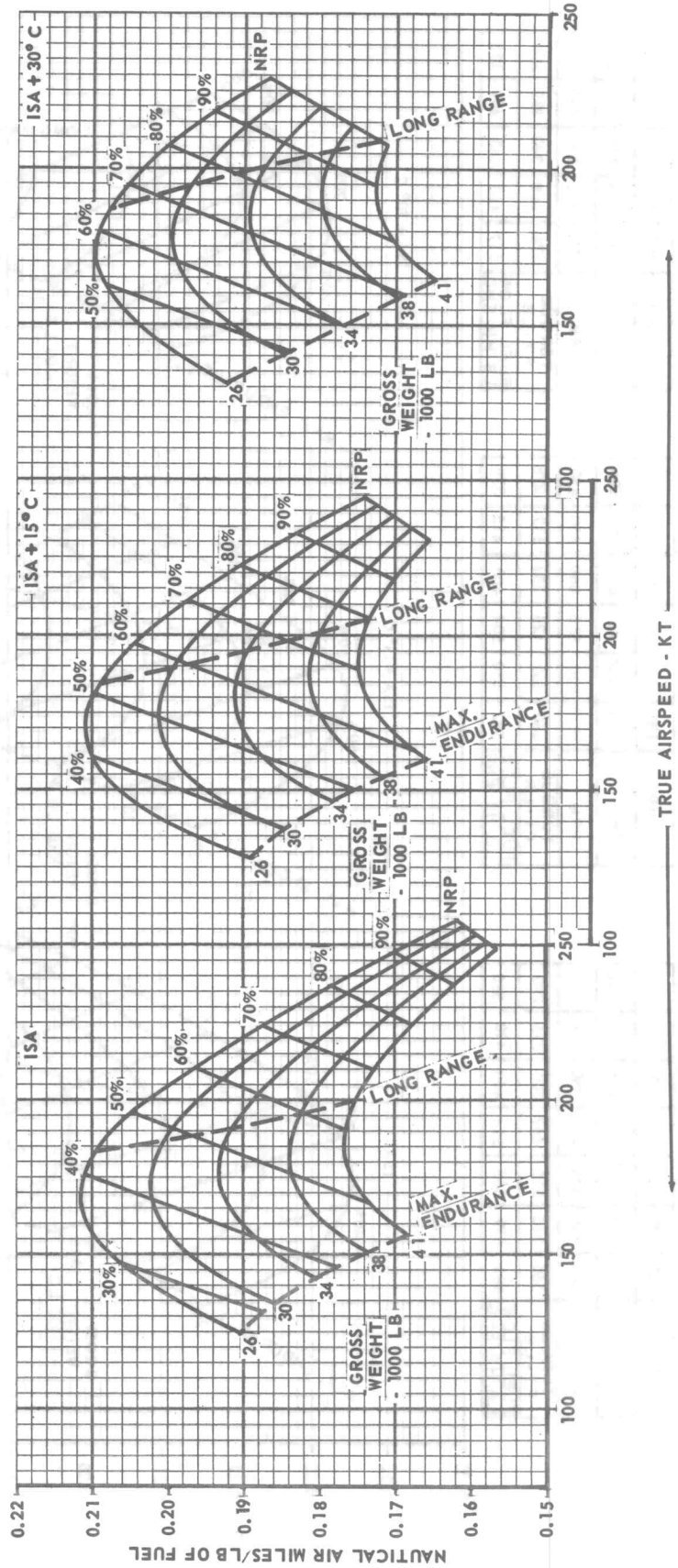
ISA+15°C

% NRP	100	90	80	70	60	50	40
SHP	1370	1230	1095	960	820	685	550
RPM	1015	935	905	880	860	850	850
TORQUE FT-LB	540	526	485	440	389	325	262
FUEL FLOW LB/HR/ENG	700	645	590	538	485	433	383

ISA+30°C

% NRP	100	90	80	70	60	50
SHP	1115	1000	890	780	670	557
RPM	1015	955	920	890	865	850
TORQUE FT-LB	440	420	390	352	312	264
FUEL FLOW LB/HR/ENG	615	570	525	482	440	395

ASSOCIATED CONDITIONS:
1. ZERO WIND



FUEL GRADE: JP4
FUEL DENSITY: 7.8 LB/GAL

DATA AS OF: JUNE 1967
DATA BASIS: ESTIMATED

Figure 4-38 Nautical Air Miles Per Pound of Fuel: Both Engines-20,000 ft

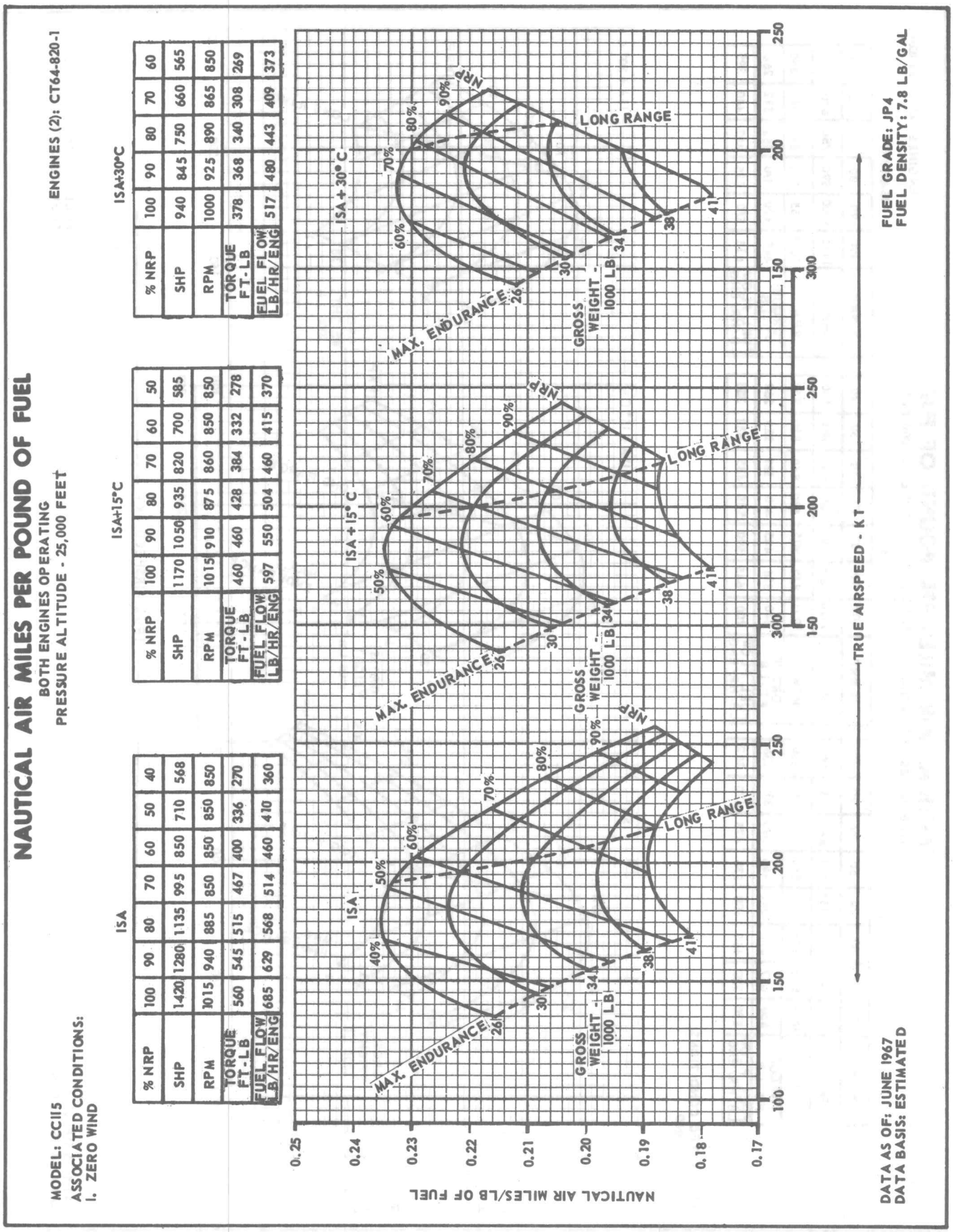
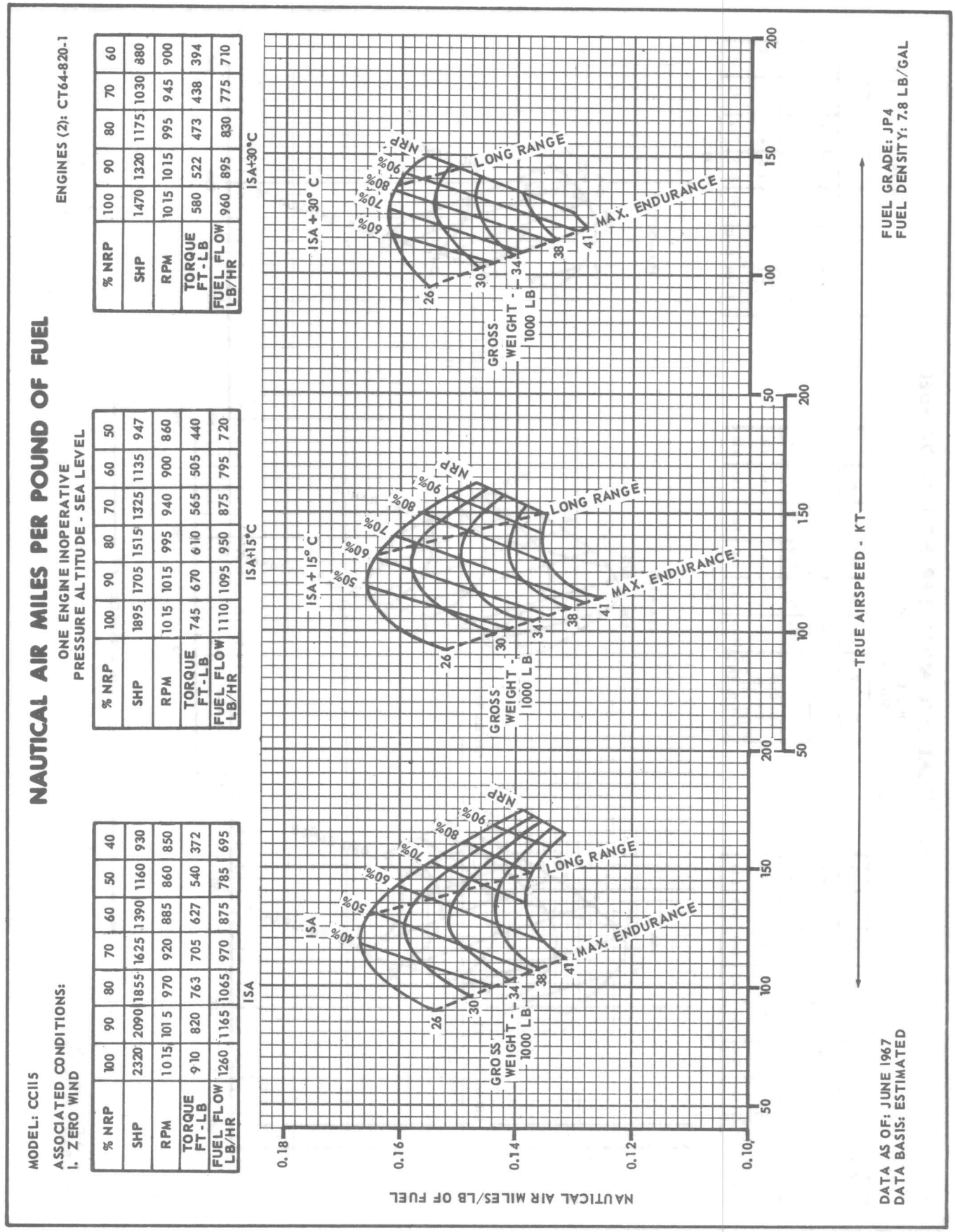


Figure 4-39 Nautical Air Miles Per Pound of Fuel: Both Engines-25,000 ft



% NRP	100	90	80	70	60	50	40
SHP	2320	2090	1855	1625	1390	1160	930
RPM	1015	1015	970	920	885	860	850
TORQUE FT-LB	910	820	763	705	627	540	372
FUEL FLOW LB/HR	1260	1165	1065	970	875	785	695

% NRP	100	90	80	70	60	50
SHP	1895	1705	1515	1325	1135	947
RPM	1015	1015	995	940	900	860
TORQUE FT-LB	745	670	610	565	505	440
FUEL FLOW LB/HR	1110	1095	950	875	795	720

% NRP	100	90	80	70	60
SHP	1470	1320	1175	1030	880
RPM	1015	1015	995	945	900
TORQUE FT-LB	580	522	473	438	394
FUEL FLOW LB/HR	960	895	830	775	710

Figure 4-40 Nautical Air Miles Per Pound of Fuel: One Engine-Sea Level

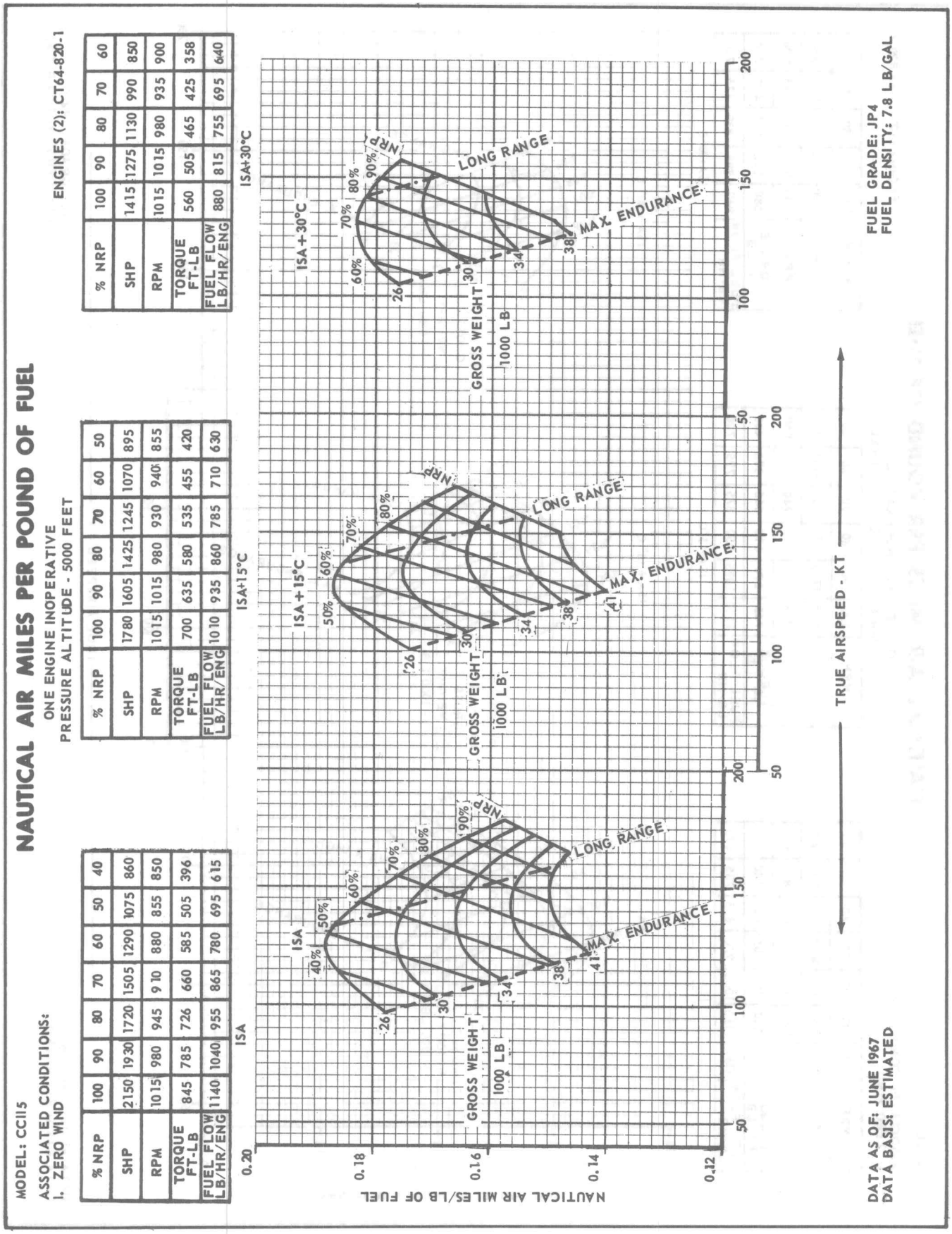


Figure 4-41 Nautical Air Miles Per Pound of Fuel: One Engine-5000 ft

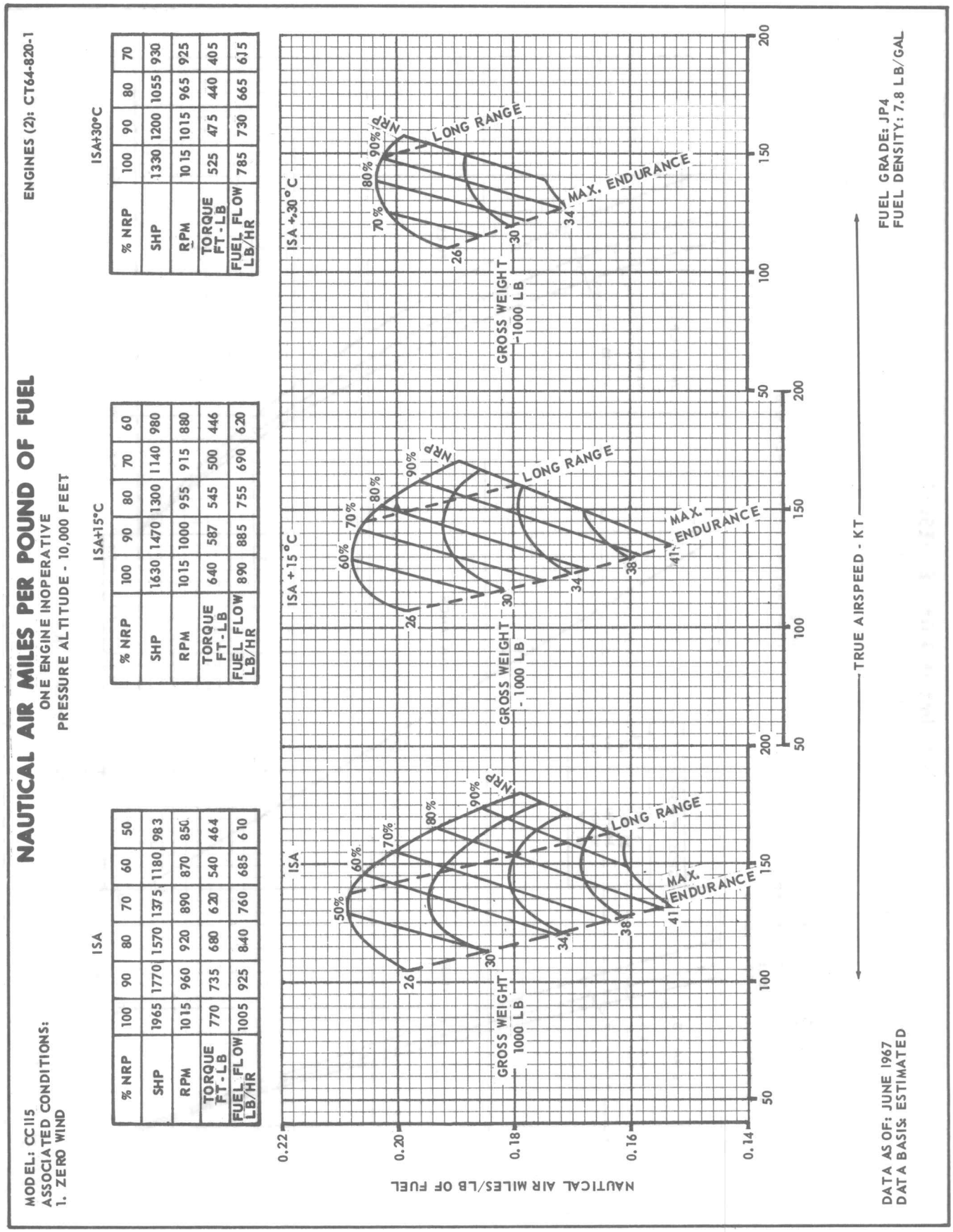


Figure 4-42 Nautical Air Miles Per Pound of Fuel: One Engine-10,000 ft

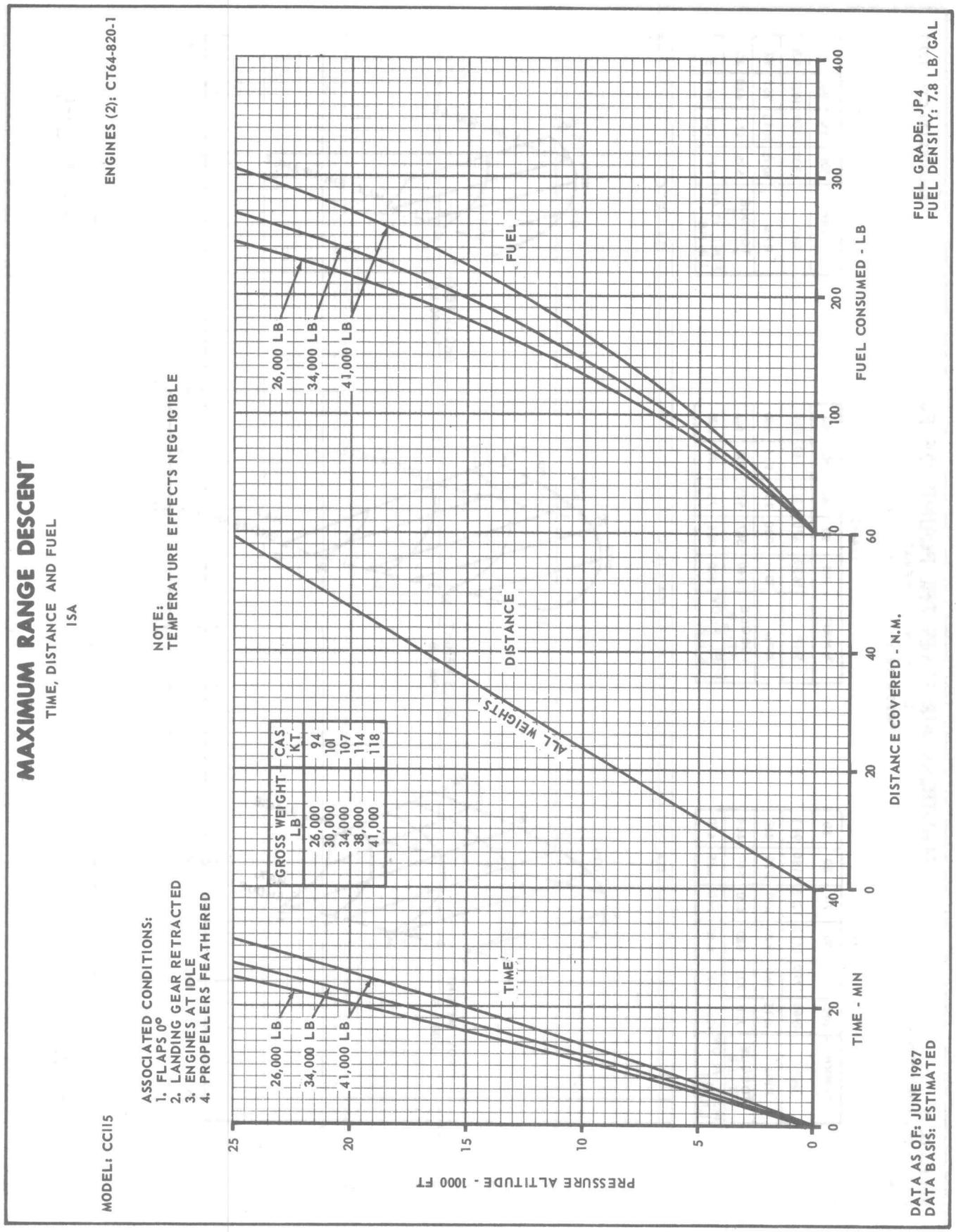


Figure 4-43 Maximum Range Descent

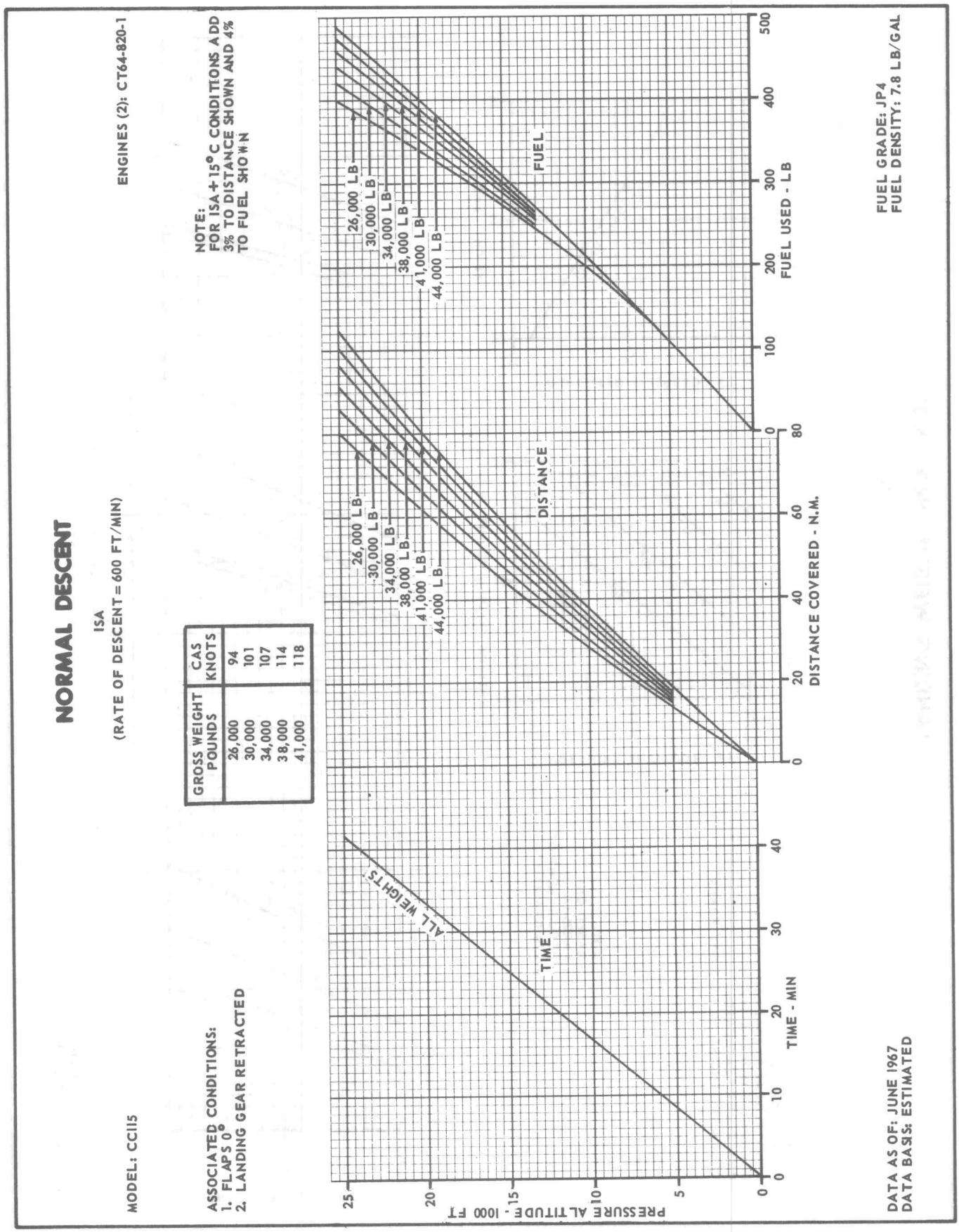


Figure 4-44 Normal Descent

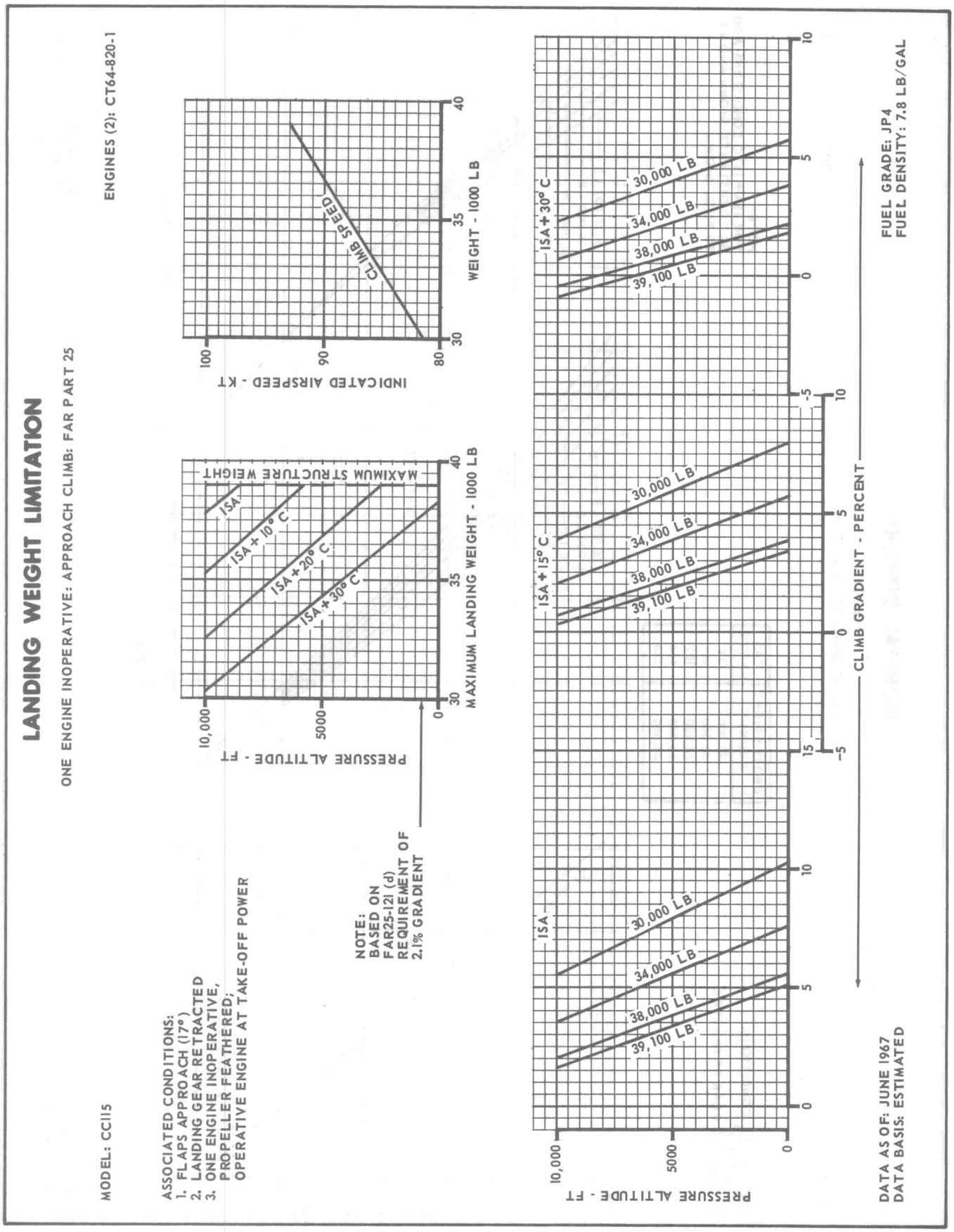


Figure 4-45 Landing Weight Limitation: Approach Climb

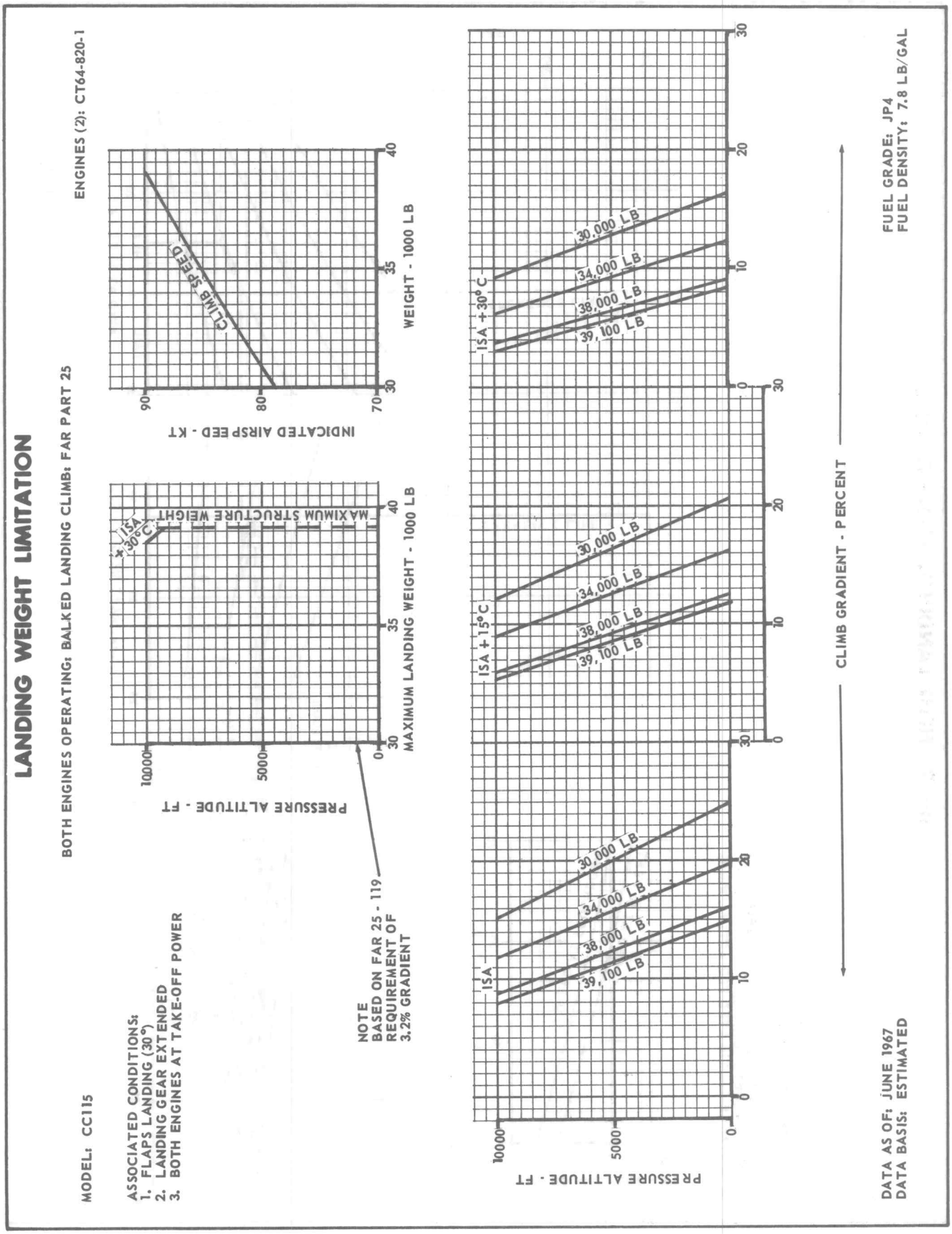


Figure 4-46 Landing Weight Limitation: Balked Landing Climb

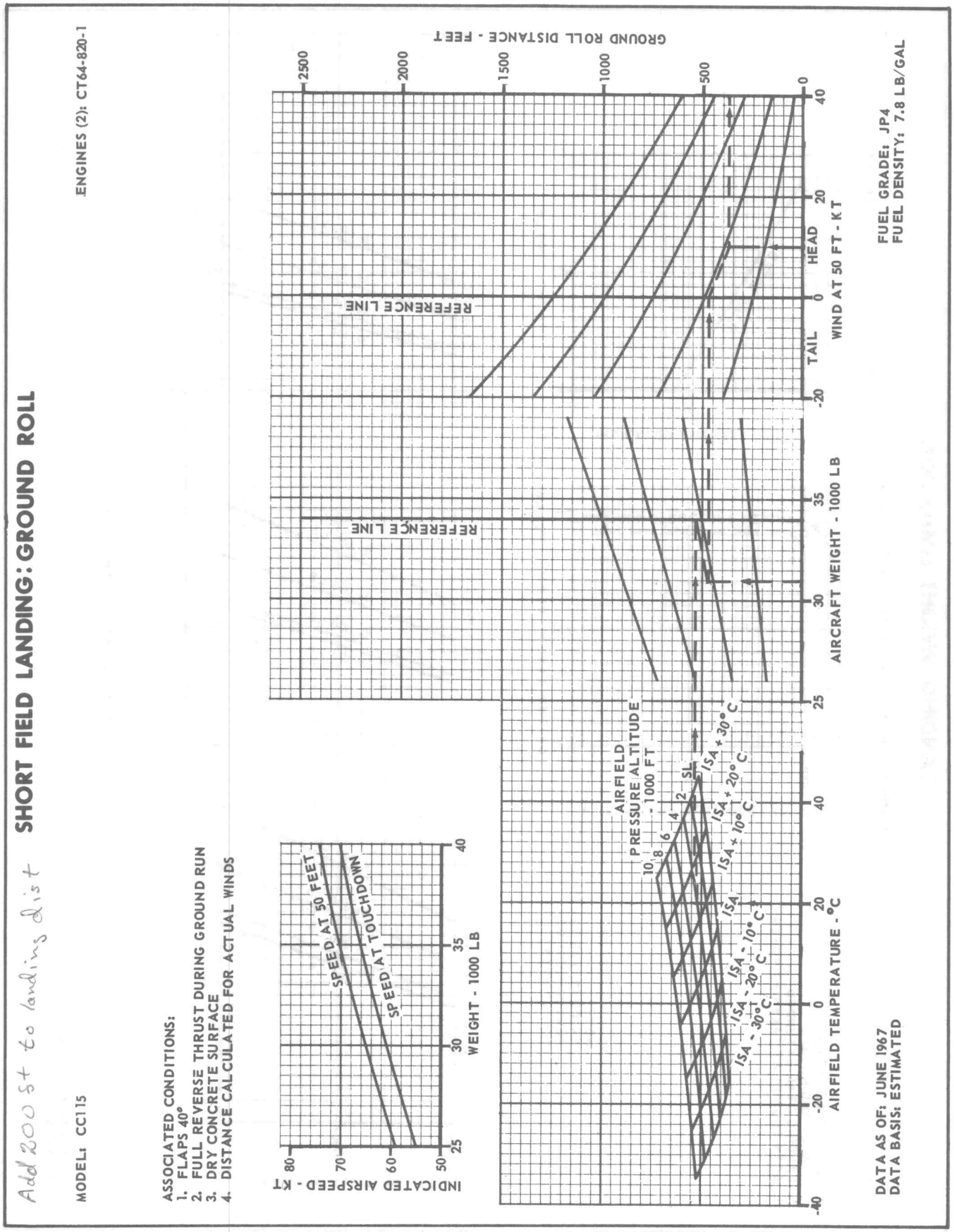


Figure 4-47 Short Field Landing: Ground Roll

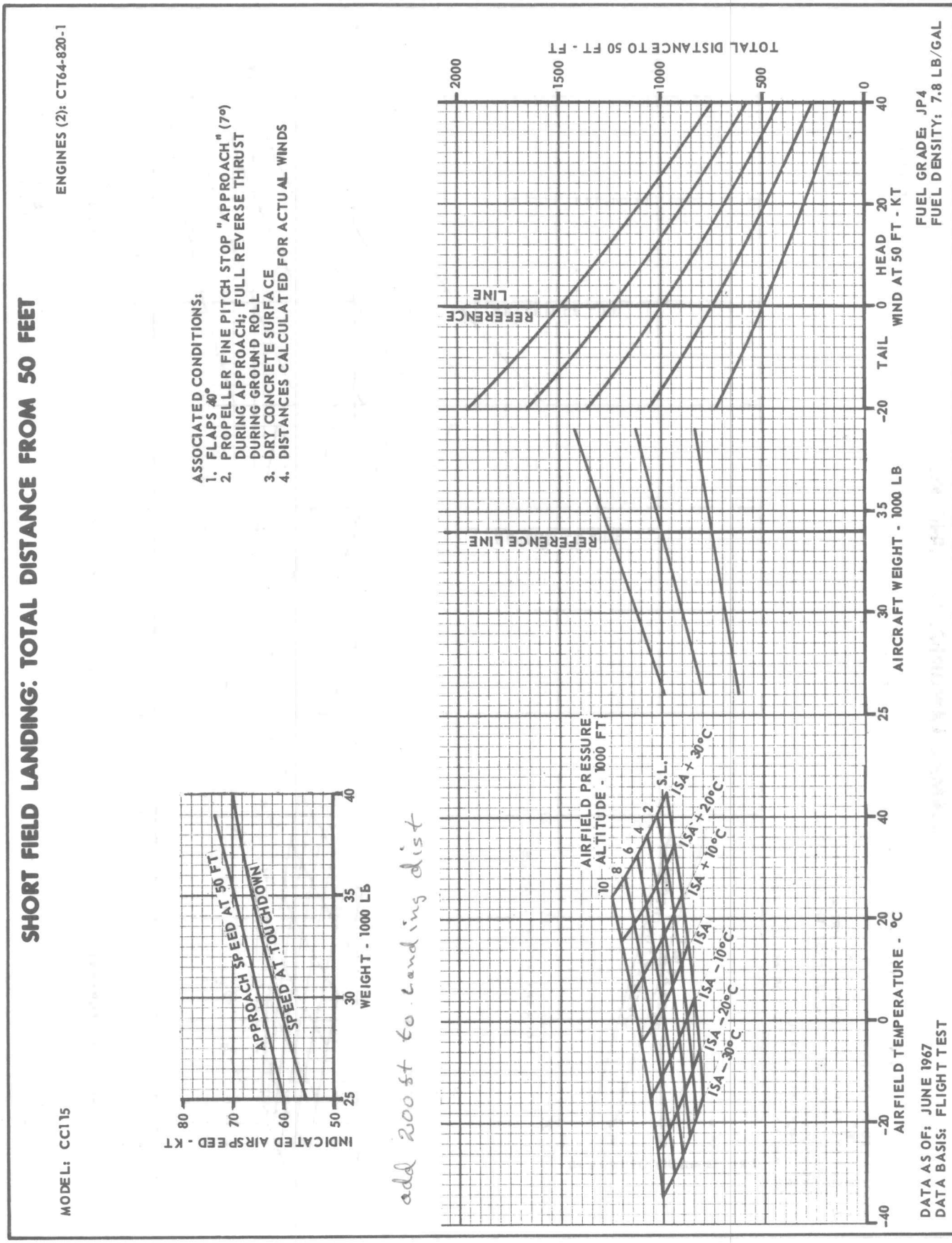


Figure 4-48 Short Field Landing: Distance from 50 ft

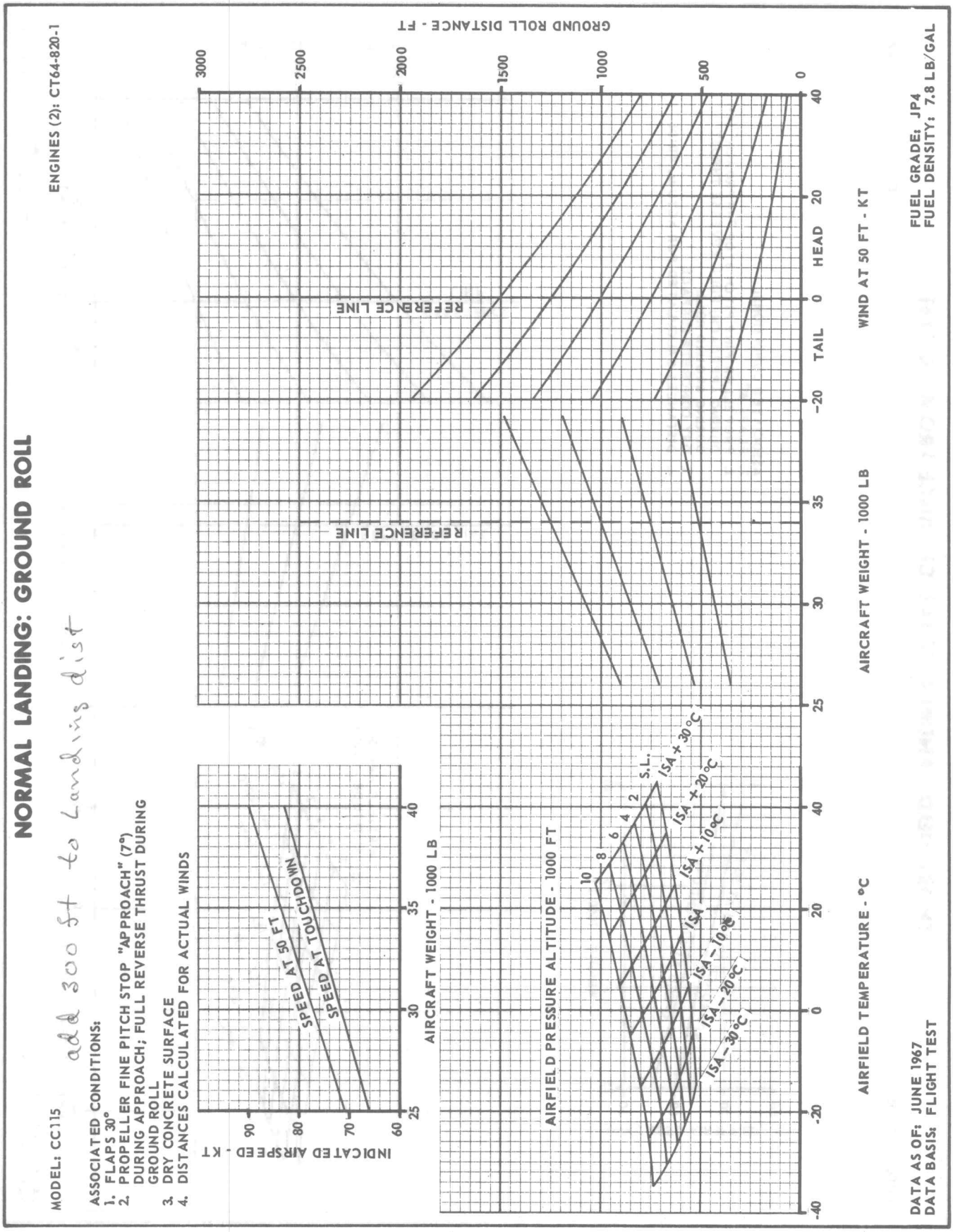


Figure 4-49 Normal Landing: Ground Roll

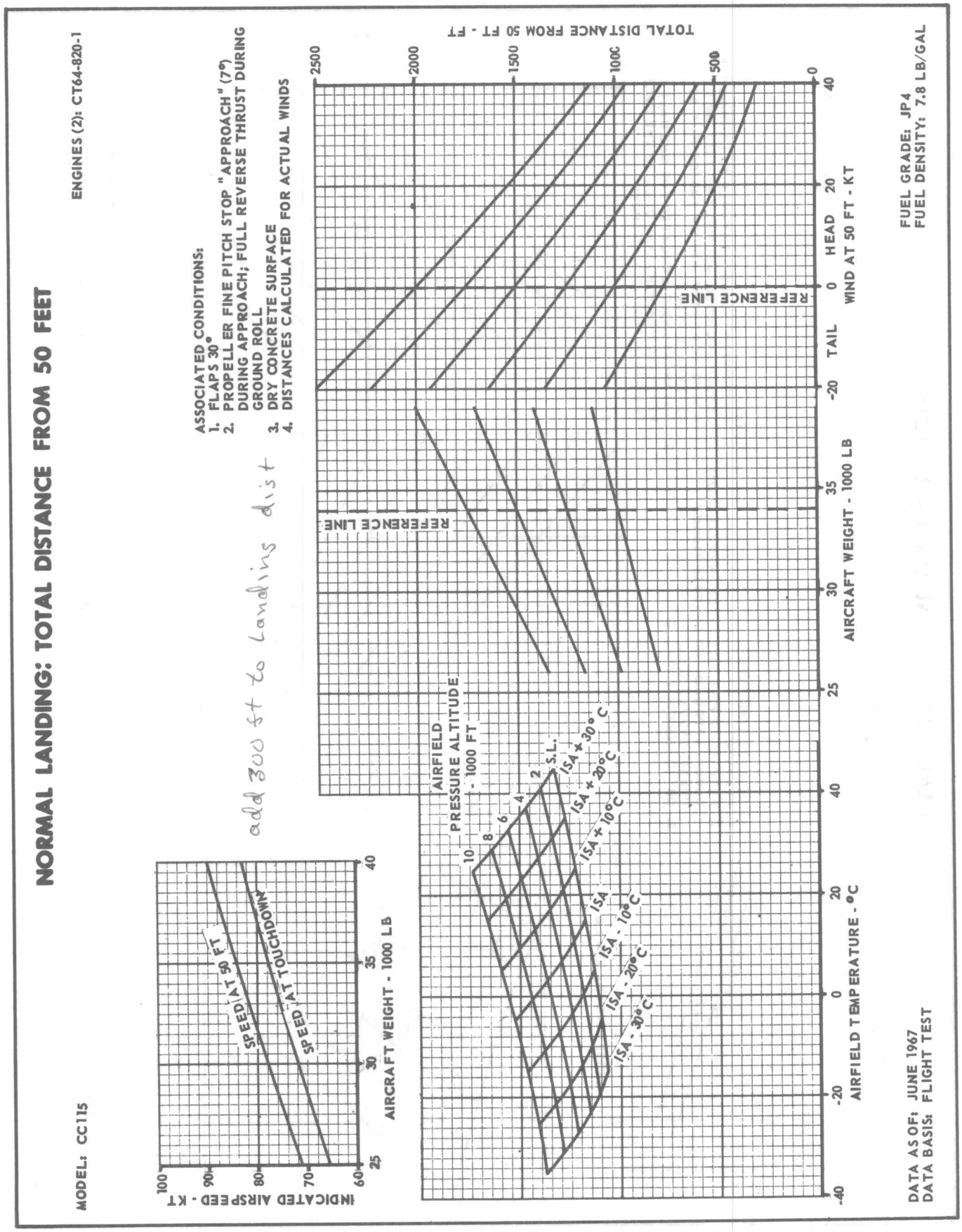
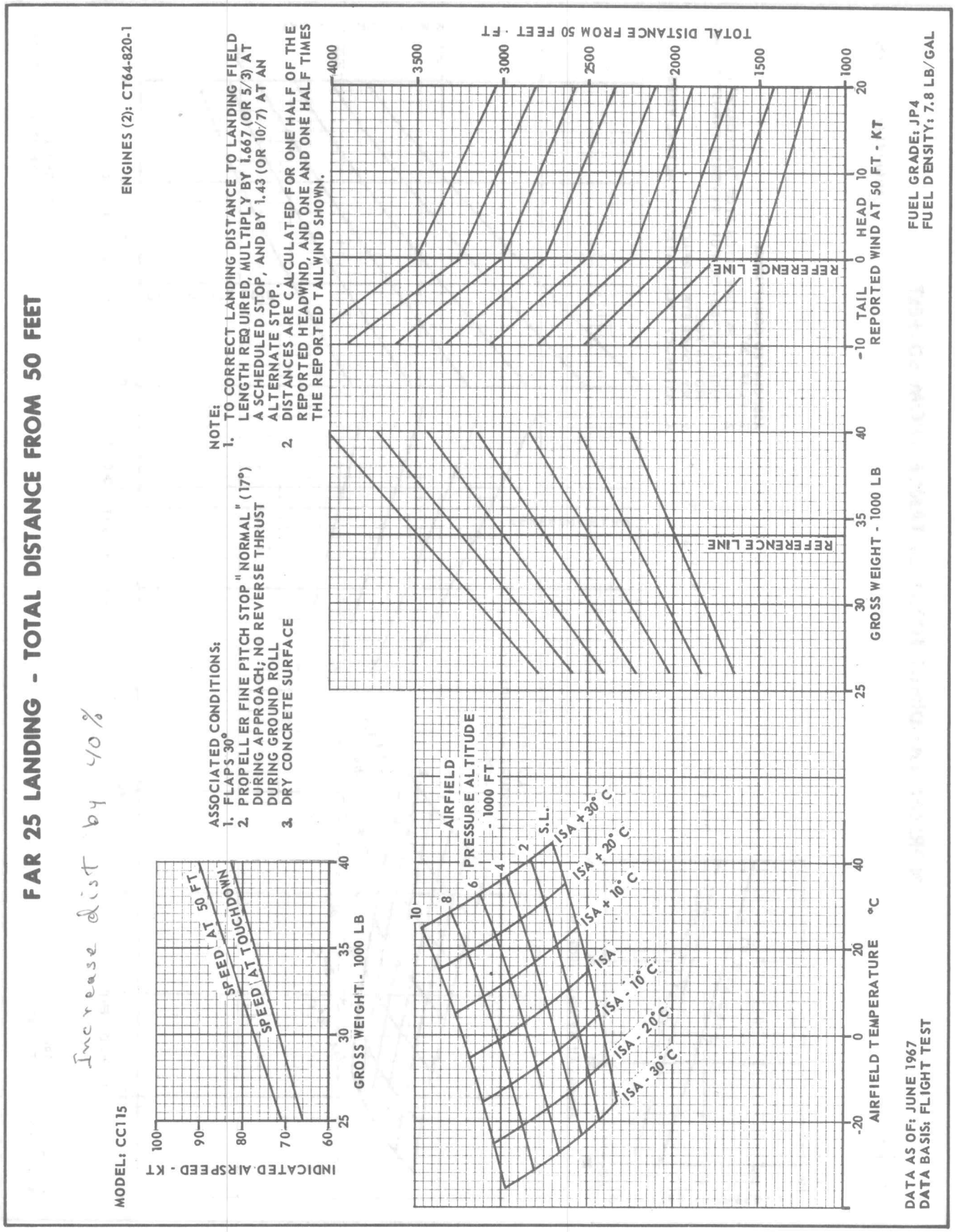


Figure 4-50 Normal Landing: Distance from 50 ft



Increase dist by 40%

Figure 4-51 FAR 25 Landing: Distance from 50 ft

PERFORMANCE CHART INDEX

FIGURE	TITLE	PAGE
	STANDARD CHARTS	
4-3	Standard Atmosphere Table	4-16
4-4	Temperature Conversion Chart	4-17
4-5	Density Altitude Chart	4-18
4-6	Compressibility Correction for OAT	4-19
	ENGINE CHARTS	
4-7	Take-off Power Available	4-20
4-8	Normal Rated Power Available	4-21
4-9	Fuel Flow at Take-off Power	4-22
4-10	Fuel Flow at Normal Rated Power	4-23
	PERFORMANCE CHARTS: GENERAL	
4-11	Stalling Speed	4-24
4-12	Position Error Correction to Airspeed	4-25
4-13	Position Error Correction to Altimeter - Flap 0°	4-26
4-14	Position Error Correction to Altimeter - Various Configurations	4-27
4-15	Wind Component Chart	4-28
	TAKE-OFF WEIGHT LIMIT CHARTS	
4-16	Take-off Weight Limitation: First Segment	4-29
4-17	Take-off Weight Limitation: Second Segment	4-30
4-18	Take-off Weight Limitation: Final Segment	4-31
	TAKE-OFF CHARTS	
4-19	Short Field Take-off: Ground Roll	4-32
4-20	Short Field Take-off: Distance to 50 ft	4-33
4-21	Normal Take-off: Ground Roll	4-34
4-22	Normal Take-off: Distance to 50 ft	4-35
	TAKE-OFF: ENGINE FAILURE	
4-23	FAR 25: Take-off Distance to 35 ft	4-36
4-24	FAR 25: Accelerate - Stop Distance	4-37
	ENROUTE CLIMB CHARTS	
4-25	Enroute Rate of Climb - Both Engines	4-38
4-26	Enroute Rate of Climb - Single Engine	4-39
4-27	Time, Distance and Fuel in Enroute Climb: Both Engines ISA	4-40
4-28	Time, Distance and Fuel in Enroute Climb: Both Engines ISA + 15°C	4-41
4-29	Time, Distance and Fuel in Enroute Climb: Both Engines ISA + 30°C	4-42

PERFORMANCE CHART INDEX (Cont'd)

FIGURE	TITLE	PAGE
	ENROUTE CLIMB CHARTS (Cont'd)	
4-30	Time, Distance and Fuel in Enroute Climb: One Engine ISA	4-43
4-31	Time, Distance and Fuel in Enroute Climb: One Engine ISA + 15°C	4-44
4-32	Time, Distance and Fuel in Enroute Climb: One Engine ISA + 30°C	4-45
4-33	Service Ceiling	4-46
	CRUISE CHARTS	
4-34	Nautical Air Miles Per Pound of Fuel: Both Engines Sea Level	4-47
4-35	Nautical Air Miles Per Pound of Fuel: Both Engines 5000 ft	4-48
4-36	Nautical Air Miles Per Pound of Fuel: Both Engines 10,000 ft	4-49
4-37	Nautical Air Miles Per Pound of Fuel: Both Engines 15,000 ft	4-50
4-38	Nautical Air Miles Per Pound of Fuel: Both Engines 20,000 ft	4-51
4-39	Nautical Air Miles Per Pound of Fuel: Both Engines 25,000 ft	4-52
4-40	Nautical Air Miles Per Pound of Fuel: One Engine Sea Level	4-53
4-41	Nautical Air Miles Per Pound of Fuel: One Engine 5000 ft	4-54
4-42	Nautical Air Miles Per Pound of Fuel: One Engine 10,000 ft	4-55
	DESCENT CHARTS	
4-43	Maximum Range Descent	4-56
4-44	Normal Descent...	4-57
	LANDING WEIGHT LIMITATION CHARTS	
4-45	Landing Weight Limitation: Approach Climb	4-58
4-46	Landing Weight Limitation: Balked Landing Climb	4-59
	LANDING CHARTS	
4-47	Short Field Landing: Ground Roll	4-60
4-48	Short Field Landing: Distance from 50 ft	4-61
4-49	Normal Landing: Ground Roll	4-62
4-50	Normal Landing: Distance from 50 ft	4-63
4-51	FAR 25 Landing: Distance from 50 ft	4-64

PART 5
FLIGHT TESTING
GENERAL

DESCRIPTION

1 The flight test procedures and specifications presented in this part shall serve as a standard for pilots and engineering staff in evaluating the condition, performance and airworthiness of the Buffalo aircraft for its designated role.

METHOD

2 All Buffalo aircraft shall be flight tested in accordance with CFP 100 Article 232, EO 00-50-20 Parts 3 or 4, and EO 05-200A-1 Part 5.

3 The Test procedures detailed below do not relieve the test pilot from complying with the procedures and checks outlined in Parts 1 to 4 of this EO, nor with relevant command and unit instructions. Items that are checked in normal operation are not detailed in this part unless amplification is required.

4 The flight test profile and the actual sequencing of tests are left to the discretion of the test pilot as dictated by local weather and air traffic conditions.

5 To assist the test pilot and engineering staffs in evaluating the aircraft under test, all pertinent data shall be recorded on a test card. These data should be retained for future comparisons with data obtained on subsequent test flights. A sample test card is presented in Figure 1 and is to be reproduced locally. Where instrument readings are required, they shall be recorded from the left-hand instrument panel.

GROUND CHECKS

WEIGHT AND BALANCE

6 Check that a weight and balance report has been completed in accordance with EO 05-200A-8 and that the CG is within the limits of 26.5 to 41.5% MAC (337.83 to 356.35 inches aft of datum).

EXTERNAL INSPECTION (Figure 5-1, para. 1)

7 Carry out a pre-flight external inspection as detailed in the test card, recording data as required. Carefully examine the aircraft for cracks, leaks, loose rivets, poorly fitted panels or doors, and for condition of paint and markings. Special attention should be given to the following:

(a) Landing gear shock strut extension - 8 to 10 inches;

(b) Brake accumulator pressure - 1,500 $\pm$ 50 psi;

(c) Emergency brake air reservoir pressure - 1,500 psi;

(d) Emergency nose gear lowering bottle pressure - 1400 - 1600 psi at 70°F; and

(e) Rudder flutter damper failure flag - not visible.

8 The external checks cannot be completed fully until electric and hydraulic power is available. After the APU is started an external observer will be required to check the following:

(a) Operation of controls and trim tabs ensuring full movement and correct deflection;

(b) Heat output from pitot heaters (2);

(c) Operation of anti-collision, position, inspection, landing and taxi lights; and

(d) Operation of ramp and cargo doors using cabin switches.

INTERNAL INSPECTION (Figure 5-1, para. 2)

9 Carry out a pre-flight internal inspection as outlined in the flight test card. In addition check the following:

(a) General condition and cleanliness of the aircraft interior; and

(b) Condition and proper replacement of placards, decals and instrument markings.

PRE-START CHECKS (Figure 5-1, para. 3)

10 Carry out the pre-start checks as outlined in the flight test card. Ensure that the following items are checked after the Battery/External DC switch is turned on:

(a) Battery voltage - 24 volts;

(b) "Off" flags not visible on Turn and Slip indicators and Turbine Inlet Temperature indicators;

(c) Fuel quantity gauges deflect towards zero when test button depressed;

(d) Operation of the five secondary instrument lights and the flight compartment red/white dome light; and

(e) Fire detection test and illumination of T-handle and Zone 1 fire warning lights.

APU START (Figure 5-1, para. 4)

11 Carry out a normal APU start and check the following items:

(a) Time to light-up - 10 seconds (15 seconds when OAT below -31°C);

(b) Time to 50% - 20 seconds (30 seconds when OAT below -31°C);

(c) Max EGT - 675° to 700°C two second transient, 675°C max continuous; and

(d) Generator cut in - nominal 92%.

12 After the APU has been started carry out the following checks:

(a) Check that the AC voltages are 115v on all phases;

(b) Select the Bus Tie switch to "Open" and check that the left AC phases are zero and the right phases remain at 115v. Return the switch to "Bus Tie" and check 115v restored to the left phases;

(c) Select Norm-Emerg switch to "Emerg" and check that the right AC phases read zero and the left phases remain at 115v. Return the switch to "Norm" and check 115v restored to the right phases;

(d) Check DC voltages are 28 ± .5v on Left, Right and Battery selections;

(e) Check that the DC Loadmeter reading does not exceed 0.7. An initial high reading of up to 0.7 is acceptable; however, the reading should decrease to 0.2 or less before take-off;

(f) Record the following parameters:

- Bleed pressure (30 psi minimum);
- APU egt (675°C max continuous); and
- APU rpm (103% max continuous);

(g) Check that the utility and brake hydraulic pressures stabilize at 3,000 psi within one minute of APU start. If pressures do not reach 3,000 psi, shut down the APU to avoid possible hydraulic pump overheating; and

(h) Complete the external checks which require electrical and hydraulic power. These checks are listed in the flight test card.

ENGINE START (Figure 5-1, para. 5)

13 Carry out a normal engine start. Check the following parameters are within the specified limits:

(a) Minimum fuel flow during start - 100 to 175 pph;

(b) Time to light - 10 seconds maximum;

(c) Starter cut-out speed - 45 to 50% rpm; and

(d) Maximum turbine inlet temperature - 566°C to starter cut-out, then 649°C to idle.

14 After both engines are running and both bleed switches are "On", check that the bleed pressure remains constant when each bleed switch is individually selected "Off". Also check that the bleed pressure drops to zero when both bleed switches are selected "Off".

SYSTEMS CHECKS (Figure 5-1, para. 6)

15 Systems checks are outlined in the flight test card. Items requiring amplification are listed below:

(a) Flaps. Operate the flaps through their full range of travel. Check that the selected flap lever position and the indicated flap position agree within ±3 at the 0°, 17° and 40° positions. Ensure Hyd O/R cuts in as flaps lower through 5°.

(b) Propeller Feathering. Feather each propeller using the propeller levers and the auto-feather system. Depending on conditions, the auto-feather system can be checked by running-up the engines or using the torque test switches.

(c) De-icer Boots. Operate the boots on both the manual and automatic systems. Visually check that the boots fully inflate, then fully deflate at the end of each cycle.

(d) Propeller De-icers. With the propeller de-icers selected on, momentarily select the test switch on and check a 39-amp increase on the right A and B AC phases. While monitoring the right C phase, hold the test switch on and check that a 39-amp fluctuation occurs after 30 seconds, indicating that power is cycling from one propeller to the other.

(e) Spoilers. Visually check the operation of the spoilers from the upper flight compartment hatch. With the spoiler switch "Off" check that the spoilers operate in conjunction with aileron movement, i. e. right spoiler up with right aileron and left spoiler up with left aileron. Select the spoiler switch to "Arm" and check that both spoilers extend and do not operate in conjunction with the ailerons. Also check that the spoilers retract when each power level is individually moved forward. While both spoilers are extended, select "Emergency Close" and check that the spoilers retract. Return the "Emergency Close" switch to "Normal" and check that the spoilers extend, then retract automatically. Select the spoiler switch "Off".

PRE-TAXI CHECKS (Figure 5-1, para. 7)

16 Carry out the pre-taxi checks as outlined in the flight test card.

TAXI CHECKS (Figure 5-1, para. 8)

17 Carry out the taxi checks outlined on the flight test card. While checking the nosewheel steering ensure that the turning radii in both directions are equal and that the aircraft tracks straightforward when the steering wheel is centred.

PRE-TAKE-OFF CHECKS (Figure 5-1, para. 9)

18 Complete the pre-take-off checks and record the fuel state and outside air temperature.

FLIGHT CHECKS

TAKE-OFF (Figure 5-1, para. 10)

19 Carry out a normal take-off checking that the brakes hold to 850 ft-lb torque prior to the take-off roll. During the take-off, check for adequate directional control, nosewheel shimmy, propeller synchronization, and any unusual control forces or trim changes. Record the parameters listed on the test card and perform the post take-off checks.

CLIMB TO 5,000 FEET ASL (Figure 5-1, para. 12)

20 Establish a climb at Normal Rates Power. While passing through 4,000 feet, record the parameters listed on the test card.

LEVEL FLIGHT CHECKS - 5,000 FEET ASL (Figure 5-1, para. 13)

21 Carry out the checks as listed on the test card. Items requiring amplification are listed below:

(a) Fuel Flow Checks. Trim the aircraft for level flight at 150 KIAS and 5,000 feet. Use minimum governing propeller rpm and power as required. When stable, record engine fuel flows. Check that the total fuel is within ± 100 pounds per hour of calculated fuel flow using the Cruise Performance Charts of Part 4.

(b) Control Check. Maintain a trim speed of 150 KIAS. Individually displace the aileron, rudder and elevator controls approximately 1/4 of full deflection in each direction. Check that the controls self-centre when released. Throughout the flight check that control forces and response are normal.

(c) Directional Stability Check. At 150 KIAS with wings level, apply half-rudder deflection to the right then release the rudder pedals. Check that the resulting aircraft directional oscillations damp out within 1-1/2 cycles. Repeat this check to the left.

CLIMB TO 10,000 FEET ASL (Figure 5-1, para. 14)

22 Establish a climb at Military Rated Power. While passing through 9,000 feet record the parameters listed on the test card.

STALL CHECKS - 10,000 FEET ASL (Figure 5-1, para. 15)

23 Prior to conducting stall tests, the pilot should be satisfied that the aircraft handling and performance characteristics are normal. Also, the aircraft gross weight should be determined as accurately as possible. Carry out clean and full flap stalls. Trim the aircraft at the specified speed, then reduce power smoothly to achieve an airspeed bleed rate of one knot per second. Ensure that power is at idle before the stall is reached. As the stall is approached lateral control becomes more difficult, and at the stall, application of some rudder may be necessary to assist the ailerons when correcting for a wing drop. Do not hold the aircraft in the stall as otherwise a steep nose/wing down attitude may be reached and the aircraft could be overstressed during the recovery. Record shaker, pyramid and stall speeds, as applicable, and note any unusual handling characteristics.

24 While changing configurations for the different stalls, record gear and flap extension and retraction times as specified on the test card.

~~CLIMB TO 20,000 FEET ASL (Figure 5-1, para. 16)~~

25 ~~Pre-mod 10B-20C-6A/3 and 6A/9 engines, relights to be carried out at 9000 feet. Climb to 20,000 feet using Normal Rated Power.~~ Carry out the checks listed on the flight test card.
Figure 5-1 para 16

CAUTION

Ensure that the "Inner Tank" checks are completed below 15,000 feet. Also ensure that fuel contents in each inner tank exceeds 400 lb.

Engine Relight 10,000 Feet ASL (Figure 5-1 para. 17)
~~ENGINE RELIGHTS - 20,000 FEET ASL (Figure 5-1, para. 17)~~

26 Shut-down and restart each engine at a minimum alt of 10,000 ~~20,000~~ feet. During restart carefully monitor engine parameters to ensure that limits are not exceeded. In the event of a compressor stall and a hang-up, the start should be aborted and a re-light attempted at a lower altitude. Details of the malfunction should be recorded for maintenance action. Engines should satisfactorily relight between 10,000 + 20,000 ASL

APU START - ~~15,000 FEET ASL~~ (Figure 5-1, para. 18)

27 Start the APU at ~~15,000 feet~~. Check that it operates satisfactorily within limits and then shut it down.

MAXIMUM SPEED DIVE (Figure 5-1, para. 19)

28 Set Normal Rated Power and dive the aircraft to its maximum operating speed (Vmo) avoiding turbulent air. Since Vmo varies with altitude, ensure that the dive speed corresponds to the Vmo limit specified in Part 4 for the particular altitude at which this test is conducted. Check for any unusual control forces, vibrations or trim changes. If any unusual characteristics are experienced, slow the aircraft immediately and return for landing. Also check that the maximum speed pointer of the airspeed indicator corresponds to Vmo. After the dive, carry out a visual check of the aircraft from the cockpit and cabin to ensure that no panels have opened or broken loose.

AVIONICS SYSTEMS CHECKS (Figure 5-1, para. 20)

29 Navigation and communications equipment tests are detailed on the test card and should be carried out as required.

LANDING GEAR CHECKS (Figure 5-1, para. 21)

30 Carry out an emergency gear lowering using the hydraulic handpump. Ensure that the hydraulic circuits are returned to normal before making any subsequent gear selections.

LANDING CHECKS (Figure 5-1, para. 22-24)

31 Carry out normal pre-landing, landing and post landing checks.

POST FLIGHT CHECKS (Figure 5-1, para. 25)

32 Carry out the normal shutdown checks and complete a thorough external inspection.

CC115 BUFFALO FLIGHT TEST PROCEDURES

EO 05-200A-1

Aircraft No.	_____	Date	_____
Basic Wt.	_____	Pilot	_____
Fuel Wt.	_____	Start Flight	_____
Gross Wt.	_____	End Flight	_____
C of G	_____	Flight Time	_____
A/C Accepted	_____	Reflight Req'd	_____

Signature _____
(Test Pilot)

Figure 5-1 (Sheet 1 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
1	EXTERNAL INSPECTION				
	Fuselage Left Side				
	Passenger door _____	Condition	___		
	_____	Secure	___		
	Emergency exit _____	Condition	___		
	Fuselage skin and windows ___	Condition	___		
	Inboard inspection light ____	Condition	___		
	Left Wing, Nacelle and Gear				
	Inboard flaps _____	Condition	___		
	_____	Hinges	___		
	_____	Bonding wires	___		
	_____	Clearance from fuselage and nacelle ___	___	No sign of interference	
	Inboard wing vents _____	Clear	___		
	Aft nacelle and tailpipe ____	Condition	___		
	Gear doors _____	Condition	___		
	Ground safety lock _____	Removed	___		
	Uplock roller _____	Free			
	Oleo safety gauge _____	Pressure _____	___	1800 psi	
	Shock strut _____	Extension _____	___	8 to 10 inches	
	Weight switch connector ____	Secure	___		
	Tires _____	Condition	___		
	Brake assembly _____	Condition	___		
	Outboard flaps _____	Condition	___		
	_____	Hinges	___		
	_____	Bonding wires	___		
	_____	Clearance from nacelle _____	___	No sign of interference	
	Aileron _____	Condition	___		
	_____	Hinges	___		
	_____	Bonding wires	___		
	Outboard wing vents _____	Clear	___		
	Undersurface of wing _____	Panels	___		
	_____	Leaks	___		

Figure 5-1 (Sheet 2 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Position light _____	Condition	___		
	De-icer boots _____	Condition	___		
	Stall warning vane _____	Condition	___		
	Landing light _____	Condition	___		
	Wing outboard inspection light _____	Condition	___		
	Engine Inlet _____	Clear	___		
	Propeller _____	Condition	___		
	_____	Leaks	___		
	APU exhaust _____	Secure	___		
	Cowlings _____	Secure	___		
	Hydraulic reservoir _____	Fluid level	___		
	Wheel well _____	Condition	___		
	_____	Tailpipe	___		
	_____	Uplatch	___		
	Battery _____	Secure	___		
	_____	Connected	___		
	Nose				
	Brake accumulator _____	Pressure _____	___	1500 ± 50 psi	
	Emergency brake reservoir _____	Pressure _____	___	1500 psi	
	Access panels _____	Secure	___		
	Left static vents _____	Clear	___		
	Left pitot head _____	Cover removed	___		
	_____	Condition	___		
	Nose gear doors _____	Connected	___		
	_____	Secure	___		
	Ground safety lock _____	Removed	___		
	Shock strut _____	Extension _____	___	8 to 10 inches	
	Weight switch plug _____	Connected	___		
	Steering disconnect pins _____	Installed	___		
	Tires _____	Condition	___		
	Taxi lights _____	Condition	___		
	ECS ducts _____	Clear	___		
	Radome _____	Secure	___		

Figure 5-1 (Sheet 3 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Emergency nose gear lowering bottle _____	Pressure _____	___	1400 to 1600 psi at 70°F	
	Access panels _____	Secure	___		
	Right static vents _____	Clear	___		
	Right pitot head _____	Condition	___		
	Ice detector probes _____	Condition	___		
	Flight compt lower hatch _____	Secure	___		
	_____	Unlocked	___		
	Right Wing, Nacelle and Gear				
	Propeller _____	Condition	___		
	_____	Leaks	___		
	Engine inlet _____	Clear	___		
	Cowlings _____	Secure	___		
	Wheel well _____	Condition	___		
	_____	Tail pipe	___		
	_____	Uplatch	___		
	Hydraulic reservoir _____	Fluid level	___		
	Wing outboard inspection light _____	Condition	___		
	Landing light _____	Condition	___		
	De-icer boots _____	Condition	___		
	Position light _____	Condition	___		
	Aileron _____	Condition	___		
	_____	Hinges	___		
	_____	Bonding wires	___		
	Outboard wing vents _____	Clear	___		
	Undersurface of wing _____	Panels	___		
	_____	Leaks	___		
	Outboard flaps _____	Condition	___		
	_____	Hinges	___		
	_____	Bonding wires	___		
	_____	Clearance from nacelle _____	___	No sign of interference	
	Aft nacelle and tailpipe _____	Condition	___		
	Gear doors _____	Condition	___		

Figure 5-1 (Sheet 4 of 25) Flight Test Procedures

CC-115 BUFFALO

Para	Item	Check	✓	Limits	Snag
	Ground safety lock _____	Removed	___		
	Uplock roller _____	Free	___		
	Oleo safety gauge _____	Pressure _____	___	1800 psi	
	Shock strut _____	Extension _____	___	8 to 10 inches	
	Weight switch connector _____	Secure	___		
	Tires _____	Condition	___		
	Brake Assembly _____	Condition	___		
	Inboard wing vents _____	Clear	___		
	Inboard flap _____	Condition	___		
	_____	Hinges	___		
	_____	Bonding wires	___		
	_____	Clearance from fuselage and nacelle ___	___	No sign of interference	
	Fuselage Right Side				
	Fire extinguisher discs _____	Red and yellow	___		
	Inboard inspection light _____	Condition	___		
	Emergency exit _____	Condition	___		
	Fuselage skin and windows ___	Condition	___		
	Refuelling panel _____	Selector "Off"	___		
	_____	Cover closed	___		
	Lower antennae _____	Condition	___		
	Lower anti-collision light ___	Condition	___		
	Ramp door _____	Condition	___		
	_____	Fit	___		
	_____	Seals	___		
	Cargo door _____	Condition	___		
	_____	Fit	___		
	_____	Seals	___		
	_____	Hatch secure	___		
	Steady strut _____	Stowed	___		
	Empennage				
	Stabilizers and control Surfaces _____	Condition	___		
	De-Icer boots _____	Condition	___		

Figure 5-1 (Sheet 5 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Tailcone	Condition			
	Anti-collision light	Condition			
	Position lights	Condition			
	Rudder warning flag	Not visible			
	Upper Fuselage and Wing				
	Skin surfaces	Condition			
	Panels	Secure			
	Fuel caps	Secure			
	Upper antennae	Condition			
2	INTERNAL INSPECTION				
	Bat/Ext DC switch	Off			
	Portable lights (2)	Operation when selected "On"			
	Boarding light switch (cabin)	On			
		Cargo floor lights "On"			
		Flt. Compt. white dome light "On"			
	Boarding light switch (Flt Compt)	Off			
		Lights off			
	Emergency exit light switch	On			
		Following lights "On":			
		- Flt. Compt. upper hatch			
		- Flt. Compt. lower hatch (inner doors open)			
		- Cabin emergency lights (two forward and two aft)			
		Off			
	Ramp and cargo doors	Manual operation			
		Closed			
	Ramp extensions	Secure			
	Loose equipment	Stowed			

Figure 5-1 (Sheet 6 of 25) Flight Test Procedures

CC-115 BUFFALO

Para	Item	Check	✓	Limits	Snag
	Cargo handling and aerial delivery equip.	Functional check (by loadmaster)			
		- anchor cables			
		- retriever cables			
		- pendulum release system			
		- tie-downs			
		- restraint rails			
		- cargo restraint controls			
		- winch			
	Passenger doors	Closed			
		Latch blocks removed			
	Safety equipment	Checked and Stowed			
		- first aid kits (3)			
		- fire extinguishers (4)			
		- axe (1)			
		- survival kit			
	Engine fire-ext bottles	Pressure		350 psi at 80°F - 150 psi at 0°F	
	Cabin seats and belts	Condition			
	Circuit breakers (cabin ceiling and flt comp panels)	In			
	Cabin and flt comp emergency hatches	Secure			
		Latch blocks stowed			
	Hand slide	Stowed			
	Radio racks	Secure			
		Connected			
	Hydraulic hand pump handle	Stowed			
	Emergency hydraulic panel	Normal			
	Flt comp seats and harness	Condition			
		Freedom of movement			
	Sliding windows	Freedom of movement			
	Rudder pedal adjusters	Full travel			
	Oxygen	Shut-off valve open			
		Pressure		1800 ± 50 psi	

Figure 5-1 (Sheet 7 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Flight controls lock	Operation			
	Power and prop levers	Operation			
		Friction adjustment			
	Altimeters	Field barometric		±50 ft of field elevation	
	Airspeed indicators	Max speed pointer		225K at SL	
		Flap operating band		88 to 123K with 0° flap	
3	PRE-START				
	Parking brake	On			
	Ice control	Off			
	Oil-Fuel-Hyd	Normal			
	Fire T-bars	In and horizontal			
	Landing gear handle	Down			
	Electrical panel				
	generators	Off			
	gen emerg	Normal			
	gen bus-tie	Bus-tie			
	AC ext pwr	Off			
	AC master	On			
	Batt Ext DC	On			
	Battery voltage	Check		24V	
	Turn and bank indicators	"Off" flags not visible			
	EGT indicators	"Off" flags not visible			
	Fuel gauges	Operating - press to test			
	Secondary instrument lights	Operating (5 lights)			
	Flt Comp red/white dome light	Operation			
	Nose wheel steering	Off			
	Avionics	Off			
	ECS master	Off			
	Fire detection	Test		Two Zone 1, Two T-bar lights	
	Bleed air switches	Off			

Figure 5-1 (Sheet 8 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Anti-collision lights _____	On	___		
	Seat belt, no smoking _____	On	___		
	External lights _____	AR	___		
	Fuel levers _____	Off	___		
	Power levers _____	Idle	___		
	Prop levers _____	Increase	___		
	Ignition _____	Off	___		
	Pitch stop _____	Ground	___		
4	APU START				
	APU generator switch _____	On	___		
	APU master switch _____	On	___		
	APU start switch _____	On _____	___	10 sec light-up, 20 sec to 50%, 675° (700° 2 sec), Below -31°C 15 sec light-up and 30 sec to 50%	
	APU generator _____	Cut-in approx 92%	___		
	Utility and brake press _____	Check _____	___	3000 psi within 1 min	
	Windshield heat _____	Warm-up	___		
	Bleed press _____	Check _____	___	min 30 psi	
	Cockpit check _____	Complete	___		
	Bus-tie switch _____	Open - check left AC phases zero	___		
	_____	Bus-tie - check left AC phases 115V	___		
	Gen emerg switch _____	Emerg - check right AC phases zero	___		
	_____	Norm - check right AC phases 115V	___		
	DC Voltmeter _____	Check _____	___	28 ± .5V	
	DC Loadmaster _____	Check _____	___	.7 max reducing to .2 or less before take-off	
	Record _____	Bleed press ____ _____	___	min 30 psi	
	_____	APU EGT ____ _____	___	675° max continuous	
	_____	APU RPM ____ _____	___	103% max continuous	

Figure 5-1 (Sheet 9 of 25) Flight Test Procedures

Para	Item	Check		Limits	Snag
		Utility Press _____ _____	____	3000 psi nominal	
		Brake Press _____ _____	____	3000 psi nominal	
	External checks (external observer to confirm operation)				
	Flight controls _____	Operating and correct deflection	____		
	Trims _____	Operating and correct deflection	____		
	Pitot heaters _____	Heating	____		
	Anti-collision lights _____	Check (upper and lower)	____		
	Position lights _____	Check (wing tips and tail)	____		
	Wing inspection lights _____	Check (inboard and outboard each wing)	____		
	Landing lights _____	Check	____		
	Taxi light _____	Check	____		
	Ramp and cargo doors _____	Check operating using cabin switches	____		
5	<u>ENGINE START</u>				
	Ground Crew _____	Clear to start	____		
	Start Engines _____	Ignition and fuel levers on at 20%	____		
	_____	Fuel flow _____	____	100 to 175 pph	
	_____	Light up _____	____	Within 10 sec	
	_____	Starter cut-out _____	____	45 to 50% Ng	
	_____	Max EGT _____	____	566° at starter cut-out, 649° to idle	
		Oil pressures _____	____	Indicating	
		Generators on at 68%	____		
	Ignition _____	Off	____		
	APU master _____	Off	____		
	Bleed switches _____	On. Check constant press from both sides	____		
	Avionics _____	On	____		

Figure 5-1 (Sheet 10 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
6	SYSTEMS CHECKS	Quantity Checked			
	Fuel system	Crossfeed (3 min each side)			
		Inner tank emergency (3 min each side)			
	Flaps	Operation 0° to 40°			
		Selected and indicated positions agree		±3°	
		"Utility Press to Rudder" shows "On" as flaps lower through 5°			
	Torque system test	Torque increase to approx 900 ft-lb			
	Stall warning test	Stick shakers			
		Approach indicator deflects			
	Master caution test	All lights illuminate			
		Bright/dim operation			
	Pitch stop	Normal (no blue lights)			
	Fuel levers	Normal			
	Feather	Manual (with prop levers)			
		Auto-feather			
	Pitch stop	Ground (4 blue lights on)			
	Engine overspeed	Test		Operate above 72% Np	
	Windscreen Heat	Normal		Check cycling 15-amp current on left A and right C phases	
	De-icer boots	Visually check operation			
		Manual			
		Auto fast		Continuous 30-sec cycles	
		Auto slow		30-sec cycles, 210 sec between cycles	
	Propeller de-icers	Test at 65% Np		39-amp increase on right AC phases. Check transfer on right C phase	
	Electrical panel	AC voltage		115V	
		AC loads balanced			
		DC voltages		28V ± .5V	
		DC load		max .7 reducing to .2 or less before take-off	

Figure 5-1 (Sheet 11 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Fuel levers	Ground Idle			
	Controls	Unlocked			
	Spoilers	Arm			
		Visually check operation			
		Power lever microswitches		Spoilers retract when levers advanced	
		Emergency close			
		Automatic retraction		after 15 sec extended	
		Off			
	Controls	Locked			
	Prop reverse	Check (4 blue lights on)			
7	PRE-TAXI CHECKS				
	Hydraulic press	Check (Utility, brake and rudder)		3000 psi	
	De-icing press	Check		17 to 19 psi	
	Windshield heat	Normal			
	Nosewheel steering	On			
	Doors and steady strut	Closed/Secure			
8	TAXI CHECKS				
	Brakes	Checked			
	Flight instruments	Checked			
	Avionics	Checked			
	Nosewheel steering	Turns both directions			
	Nosewheel castoring	Nosewheel steering "Off"			
		Check castoring with differential braking			
		Nosewheel steering "On"			
9	PRE-TAKE OFF CHECKS				
	Hot mike	On			
	Windows, doors and hatches	Secure			

Figure 5-1 (Sheet 12 of 25) Flight Test Procedures

CC-115 BUFFALO

Para	Item	Check	✓	Limits	Snag
	Trims	Set			
	Tension	Set			
	Flaps	AR			
	Prop levers	Full increase			
	Auto Feather	On			
	Spoilers	Off			
	Ice control panel	Set			
	Pitot heat	On			
	Radios	AR			
	Transponder	AR			
	Take-off briefing				
	ECS	AR			
	Seat belt and harness	Secure			
	Fuel panel	3 Normal			
	Pitch stop	Normal			
	Fuel levers	Normal			
	Controls	Unlocked, free			
	Fuel state	LO			
		LI			
		RO			
		RI			
	OAT				
10	TAKE-OFF				
	Brakes	Hold to 850 ft-lb torque			
	Auto-feather arm light	On		At 550 ft-lb torque	
	Nosewheel shimmy	Check			
	Prop synchronization	Check for excessive out-of-synch noise			
	Record engine parameters	L R			
		Torque		1075 ft-lb	
		Np		100%	
		EGT		644°C	
		Ng		104%	

Figure 5-1 (Sheet 13 of 25) Flight Test Procedures

Para	Item	Check			✓	Limits	Snag
11	POST TAKE-OFF CHECKS						
	Landing Gear _____	Up			____		
	Flaps _____	Up			____		
	Auto Feather _____	Off			____		
	Seat Belt, No Smoking _____	Off					
	Cargo Comp, Wing Check _____	Secure, no leaks			____		
	ECS _____	AR			____		
	Hot Mike _____	Off			____		
12	CLIMB TO 5000 FT ASL						
	Power and Speed _____	NRP, 120 KIAS			____		
	Through 4000 ft record _____		L	R	____		
	_____	Torque	_____	_____	____	1075 ft-lb	
	_____	Np	_____	_____	____	87.5%	
	_____	EGT	_____	_____	____	605°C	
	_____	Ng	_____	_____	____	104%	
	_____	Fuel Flow	_____	_____	____		
	_____	Oil Temp	_____	_____	____	110°C	
	_____	Eng Oil P	_____	_____	____	85 psi	
	_____	SDG Oil P	_____	_____	____	90 psi	
	_____	Altitude _____			____		
	_____	IAS _____			____		
	_____	OAT _____			____		
13	LEVEL FLIGHT CHECKS - 5000 FT ASL						
	Speed and Altitude _____	150 KIAS and 5000 ft.			____		
	Prop RPM _____	Min Governing			____		
	Power Levers _____	AR			____		
	Engine Parameters _____	Check Normal			____	Fuel Flow Data	
	Stabilize and Record _____	OAT _____			____	ISA (5°C) and 5000 ft.	

Figure 5-1 (Sheet 14 of 25) Flight Test Procedures

CC-115 BUFFALO

Para	Item	Check	✓	Limits	Snag
	_____	Fuel flow Left _____ Right _____ Total _____		Fuel flow as per EO: 30,000# wt - 1255 pph 34,000# wt - 1275 pph 38,000# wt - 1310 pph	
	Engine/Prop Controls _____	Check alignment of power levers and prop levers at 500 torque with min governing, 87.5% and 100% prop rpm _____	_____	Max displacement 3/8 inch	
	Airspeed Indicators _____	Compare pilots and co-pilots _____	_____	Max differential 5K	
	Altimeters _____	Compare pilots and co-pilots _____	_____	Max differential 150 ft	
	Standby Compass _____	Check against gyrosyn _____	_____	Within $\pm 5^{o}$ of gyrosyn on four cardinal headings	
	Attitude Indicators _____	Functional check throughout flight			
	Turn and bank indicators _____	Carry out a rate one turn (22° of bank) left and right through 180° at 150 KIAS	_____	180 ± 10° turn after one minute	
	Vertical Speed Indicators _____	Calibrate against altimeter during a timed climb through 500 ft. _____	_____	$\pm$ 100 fpm max error	
	Trims (3) _____	Functional check at 150 KIAS _____	_____	1/2 division max aileron and rudder trim deflection for straight and level flight	
	Controls _____	At 150 KIAS check that elevator, rudder and aileron controls self-centre from small displacements	_____		
		Check that forces and response are normal	_____		
	Directional Stability _____	At 150 KIAS apply half-rudder deflection to the right then release and check that resulting oscillation damps quickly. Repeat to the left _____	_____	Max 1-1/2 cycles to damp	
	Ramp and Cargo Doors _____	At 135 KIAS operate doors using Flt Compt switches. Check:			
		1. Indicators	_____		
		2. Doors Unlocked caution light "On"	_____		
		3. Max ramp travel -15°	_____		

Figure 5-1 (Sheet 15 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	ECS System _____	Heat and Vent Manual			
		1. ECS Master - On			
		2. Rotary Selectors - Heat and Vent Man			
		3. Ram Air Switches - Open			
		4. Check flow of ambient air into cabin and Flt Comp	___		
		5. Hot Air Switches - Open			
		6. Check air temp increases			
	_____	Heat and Vent Auto	___		
		1. Rotary Selectors - Heat & Vent Auto			
		2. Temp Selectors - 40°F			
		3. Check flow of cold air into cabin and Flt Comp	___		
		4. Temp Selectors - 80°F			
		5. Check flow of hot air into cabin and Flt Comp	___		
		Air Conditioning			
		1. Cabin Rotary Selector - Air Cond Auto			
		2. Cabin Temp Selector - 40°F			
		3. Check refrigeration unit starts up and operates without cycling	___		
		4. Check operation of eyeball vents in Flt Comp	___		
		5. Check that refrigerated air is diverted to Flt Comp when diverter valve is pulled out	___		
	Oxygen System _____	Pressure	___		
	_____	Functional check (all stations)	___		
14	CLIMB TO 10,000 FT ASL				
	Power and speed _____	MRP, 120 KIAS	___		

Figure 5-1 (Sheet 16 of 25) Flight Test Procedures

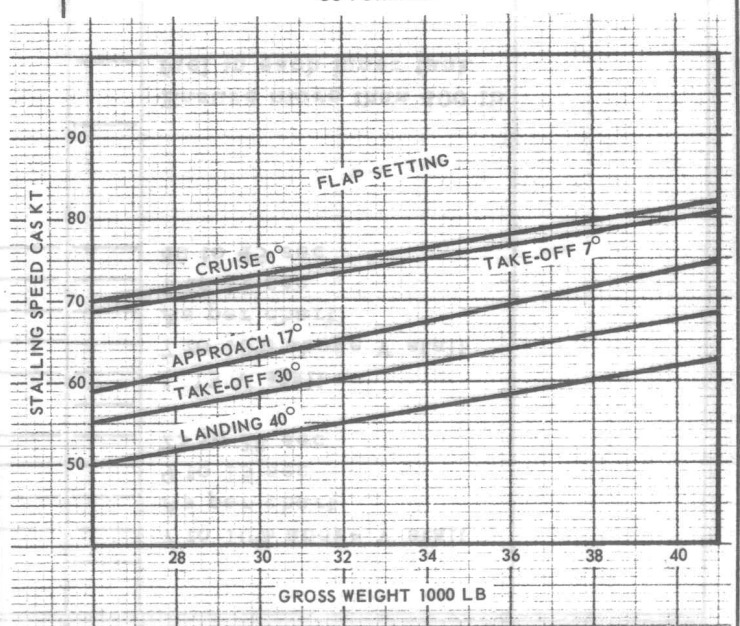
Para	Item	Check	✓	Limits	Snag
	Through 9000 ft record _____	L R			
	_____	Torque _____ _____	___	1075 ft-lb	
	_____	Np _____ _____	___	100%	
	_____	EGT _____ _____	___	633°C	
	_____	Ng _____ _____	___	104%	
		Altitude _____	___		
		IAS _____	___		
		OAT _____	___		
15	STALL CHECKS - 10,000 FT ASL				
	Fuel State	LO _____			
		LI _____			
		RO _____			
		RI _____			
	Gross Weight _____	_____			
	Stall the aircraft in the following configurations and record the speeds as required. Also record gear and flap extension and retraction times when changing configurations	Before each stall trim the aircraft for straight and level flight at the specified speed. Reduce power to idle and allow airspeed to bleed off at one knot per second. As the stall is approached lateral control becomes more difficult. Application of some rudder may be necessary to assist the ailerons when correcting for a wing drop. Note any unusual handling characteristics as the stall is approached and during recovery		STALLING SPEED - ZERO THRUST CG FORWARD  	

Figure 5-1 (Sheet 17 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Clean Stall _____	Trim 100 KIAS	___		
	_____	V shaker _____ _____	___	7 to 10% above V stall	
	_____	V stall _____ _____	___	As per chart	
	Full flap stall _____	Gear down - time _____ _____	___	9 to 15 sec	
	_____	Flaps 40° - time _____ _____	___	23 to 28 sec	
	_____	Trim 90 KIAS	___		
	_____	V pyramid _____ _____	___	1.13 V stall	
	_____	V shaker _____ _____	___	7 to 10% above V stall	
	_____	V stall _____ _____	___	As per chart	
	_____	Gear up - time _____ _____	___	7 to 11 sec	
	_____	Flaps up - time _____ _____	___	40 to 45 sec	
16	~~CLIMB TO 20,000 FT ASL~~				
	Power _____	NRP	___		
	Inner tank feed _____	Conduct inner tank check below 15,000 ft	___	Ensure more than 400 lb fuel in each inner tank	
	_____	Fuel control selector - Normal			
	_____	Left inner tank switch - Emergency			
	_____	Check satisfactory operation and return to Normal	___		
	_____	Right inner tank switch - Emergency			
	_____	Check as per left side	___		
	Fuel Crossfeed _____	Both on left (1 minute)			
	_____	Check "R Elect Fuel Pump" light "On"	___		
	_____	Both on right (1 minute)			
	_____	Check "L Elect Fuel Pump" light "On"	___		
	Ice detector _____	Select "Test"			
	_____	Check that caution light illuminates	___		
	Windshield heat _____	Normal			
	_____	Windshields warm to touch	___		
	_____	Evenly heated	___		

Figure 5-1 (Sheet 18 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	Engine intake anti-ice	Select ON (check torque drop)			
		Lights On	___		
		Select OFF			
		Lights Out	___		
17	ENGINE RELIGHTS - ~~20,000 FT~~ 10 000 FT ~~ASL~~ ASL Minimum			Pre-mod 10B-20C-6A/3 and 6A/9, engine re-lights to be carried out at 9,000 feet	
	Right Engine				
	Gen switch ___	Off	___		
	Bleed switch ___	Off	___		
	Throttle ___	Min	___		
	Fuel lever ___	Ground Idle	___		
	Prop Lever ___	Feather	___		
	Fuel lever ___	Off	___		
	___	Wait 2 minutes	___		
	___	Maintain at least 110 KIAS	___		
	Start Switch ___	On	___		
	Ignition ___	On (at 20% Ng)	___		
	Fuel lever ___	Normal	___		
	___	Check engine parameters and carefully monitor any hang-up tendencies at starter cut-out or between 55 and 60% Ng	___	EGT limits 566° at start cut-out 649° at idle	
	Start and Ignition switch	Off	___		
	Prop lever ___	Min			
	Feather button ___	Unfeather	___		
	Prop and Power levers ___	Set as Req'd	___		
	Gen switch ___	On	___		
	Bleed Switch ___	On	___		
	Left Engine				
	As per right ___		___		

Figure 5-1 (Sheet 19 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
18	APU START - ~~15,000 FT ASL~~				
	APU generator _____	On	___		
	APU Master _____	On	___		
	Start APU _____	Check satisfactory operation within limits _____	___	103% max RPM 675°C max EGT	
	APU Master _____	Off	___		
19	MAX SPEED DIVE				
	Set Normal Rated Power and dive the aircraft to Vmo	Check for any unusual control forces, vibrations or trim changes. Also check that the max speed pointer indicates correctly	___	Altitude / Vmo(IAS) ~~15,000~~ / ~~198~~ 10,000 / 212 S. L / 225	
20	AVIONICS SYSTEMS CHECKS				
	Nav System				
	Doppler _____	Select to "Land" check locked on	___		
	Command Track Unit (CTU)	Select Stage 1 track to aircraft track as indicated by ground velocity Indicator	___		
		Select Stage 2 track to aircraft track plus 90°	___		
	Track Position Indicator (TPI)	Zero "along" and "across" track counters	___		
	CTU _____	Manually select Stage 1. Check that "Along Track" counter on TPI is increasing and "Across Track" counter is stationary. Manually select Stage II. Check that "Along Track" counter is stationary and "Across Track" counter is increasing "left"	___		
	GSIC _____	Check that TAS read-out on GSIC agrees within ±5K of TAS calculated from known IAS, altitude and OAT. Adjust TAS trim if necessary	___		
	_____	Compute track and ground speed from GSIC TAS and wind velocity			

Figure 5-1 (Sheet 20 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
		Check computed values are within ±5K and +5° of ground velocity indicator readings	___		
	Doppler_____	Select to standby and check that amber light on Ground Velocity Indicator illuminates	___		
	Radar Altimeter_____	Check radar altimeter height corresponds to barometric altitude minus terrain height	___		
	Weather Radar				
	Range switch_____	Standby	___		
	Power switch_____	On (allow at least 3 mins for warm-up)	___		
	Tilt_____	3° up or more	___		
	Range switch_____	Select each range scale and check range markings as follows:			
		1. First 5-20 NM - variable control - 2 NM range marks	___		
		2. Second 5-20 NM - variable control - 5 MN range markers	___		
		3. 75 NM - fixed range - 25 NM range marks	___		
		4. 175 NM - fixed range - 50 NM range marks	___		
	Tilt_____	Check operation from 15° up to 15° down			
	Function switch_____	MAP - check radar display against terrain			
		Check operation of Manual Gain and Contrast	___		
	_____	MAN - check as per MAP mode	___		
	_____	WEA - attempt to get weather display Manual gain is inoperative in this mode			

Figure 5-1 (Sheet 21 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
	_____	Check contrast control	___		
		CONTOUR - check that cloud areas with high precipitation rates are blacked out	___		
	Stabilization _____	Check that radar display does not partially disappear in turns with less than 20° bank	___		
	IFF/SIF_____	Check with ground station. Ensure that the emergency and I/P modes are satisfactory	___		
	Tacan _____	Over a known geographical position tune in a tacan station and check the following:			
		1. Ident signal and bearing.	___		
		2. Track bar on HSI moves smoothly.	___		
		3. With track bar centred, check that track read-out and bearing pointer agree. _____	___	±2°	
		4. "To-From" indicators operate correctly when flying towards and away from station.	___		
		5. DME read-out correct.	___		
	VOR _____	Same checks as for Tacan except for DME check. Also check UP/L and DN/R positions on VOR NAV TEST switch	___		
	ADF_____	Carry out a functional check of the ADF on each frequency band. In particular check:			
		1. CW - Voice Switch	___		
		2. Volume control	___		
		3. Comp - Ant-Loop functions	___		

Figure 5-1 (Sheet 22 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
		4. Left-right switch, and	___		
		5. Station passage characteristics when passing outer marker during ILS approach at end of mission.	___		
	FM _____	Carry out a functional check of the communications and homing facilities of the system	___		
	UHF, VHF, HF _____	Ensure that satisfactory two way communications can be established with suitable ground stations. Check that the various controls function satisfactorily	___		
	ILS & Marker Beacon Receiver _____	Carry out an ILS approach and check that the Localizer and Glideslope needles indicate accurately and do not hunt. Also check the marker beacon lights and audio signal	___		
21	LANDING GEAR CHECKS				
	Gear Warning Horn _____	Reduce each power lever to Min and check that warning horn sounds	___		
	Emergency Gear Lowering ___	1. LG selector lever - Up	___		
		2. Emergency selector lever - rotate to down	___		
		3. Pull main gear emergency release handle behind pilot to lower main gear by gravity	___		
		4. Turn nose gear extension handle to unlock to unlock nose gear down	___		
		5. Operate handpump to lower nose gear	___		

Figure 5-1 (Sheet 23 of 25) Flight Test Procedures

Para	Item	Check		Limits	Snag
		6. Check 3 gear down and locked and 3 green lights on.	____		
		CAUTION To return gear circuits to normal carry out the following:			
		1. L. G. selector lever - Down	____		
		2. Check main gear emergency release handle behind pilot is pushed fully in.	____		
		3. Rotate emergency selector to normal.	____		
		4. Select gear emergency down recovery switch and hold for 5 to 10 seconds before releasing.	____		
		5. Check 3 green lights on.	____		
		6. The gear can now be retracted or left in the down position as req'd.	____		
22	PRE-LANDING CHECKS				
	Hot Mike ____	On	____		
	Seat Belt, No Smoking ____	On	____		
	Fuel control panel ____	Checked	____		
	Spoilers ____	Armed	____		
	Ldg data & briefing ____	AR	____		
	Hyd pressures ____	3000 psi	____		
	Landing gear ____	Down	____		
	Nose wheel steering ____	On	____		
	Doppler ____	Off	____		
	Radar ____	Standby, Stab off	____		
	Seat belt & harness ____	Secure	____		
	Flaps ____	AR	____		

Figure 5-1 (Sheet 24 of 25) Flight Test Procedures

Para	Item	Check	✓	Limits	Snag
23	FINAL LANDING CHECKS				
	Landing gear	Down			
	Prop levers	Increase			
	Pitch stop	Approach, check approach lights on			
	Spoilers	Check spoilers extend on touchdown			
24	POST LANDING CHECKS				
	Controls	Locked			
	Spoilers	Off			
	Flaps	Up			
	Ice control panel	Off			
	Windshield heat	Off			
	Radios & Radar	Off as req'd			
25	SHUT DOWN AND POST FLIGHT CHECKS				
	Parking brake	On			
	Nosewheel steering	Off			
	ECS panel	Off			
	Anti collision light	Off			
	Radios	Off			
	Bleed air and generators	Off			
	Fuel levers	Off			
	AC master and Bat/Ext DC	Off			
	External check	Do an external walk-around and check for any leaks or loose panels			

Figure 5-1 (Sheet 25 of 25) Flight Test Procedures

		Not any leaks or loose parts			
	Exit check	Do an exhaust, air,k-around and check			
	AC inverter and Bat/Ext DC	OK			
	Emer power	OK			
	Bleed air and Ejectors	OK			
	Engine	OK			
	Anti collision light	OK			
	ECS panel	OK			
	Noseweel steering	OK			
	Parking brake	OK			
	CHECKS				
24	SHUT DOWN AND POST FLIGHT				
	Radios & panel	OK			
	Windshield heat				
	Ice control panel				
	Flaps				
	Spoilers				
	Throttle	Forward			
25	POST MAINTENANCE CHECKS				
	Gear	Check stop [illegible]			
	Fuel sys	Whenever [illegible]			
	Oil system	Pressure			
	Inspect fire	Clear			
26	FINAL PARKING CHECKS				
Page	Item	CP	V	IN	