OPERATION, MAINTENANCE
and
PARTS MANUAL
for
AC-1 CARIBOU SYSTEMS TRAINERS

THE DE HAVILLAND AIRCRAFT OF CANADA LIMITED

OPERATION AND MAINTENANCE INSTRUCTIONS

AND PARTS LIST

FOR

AC-1 CARIBOU SYSTEMS TRAINER

PART I

R 2000-13 POWER PLANT SYSTEM TRAINER

TABLE OF CONTENTS

PART I - POWER PLANT

PART I

SECTION I

DESCRIPTION

OF

R-2000-13

POWER PLANT TRAINER

PART 1 - R2000-13 POWER PLANT SYSTEM TRAINER

SECTION I - DESCRIPTION

1.1. Introduction

1.1.1. This R-2000 Power Plant Trainer was manufactured from standard Pratt & Whitney engine parts for the U.S. Army Transportation Material Command by the de Havilland Aircraft of Canada, Downsview, Ontario.

1.2. Description

1.2.1. This trainer is for familiarization and maintenance instruction in the operation of the P & W R-2000-13 reciprocating engine used in the de Havilland AC-1 aircraft.

1.2.2. An actual complete engine assembly is attached by four Dynafocal mounts to a reinforced half segment of a standard mount ring supported by a welded stand and two stay braces. The complete welded steel frame is mounted on two hardwood skids fitted with four 4 inch removable rubber casters.

1.2.3. The nose case, crank case, two cylinders (numbers 1 & 11) rear case, and all accessories are sectionalized to permit observance of the internal gears and passages from the left side position. Number 13 cylinder assembly and rod are removed to expose the master rod and link pin assembly. All sectionalized areas having moving parts are covered with clear plastic for safety.

1.2.4. A "Motor Switch" on the control panel (located on the left lower side of the belt cover) actuates the electric motor which in turn drives the engine. A second similar switch marked "Transformer" located beside the motor switch actuates the lighting system which simulates the ignition at each front spark plug. An external electrical outlet is also provided at this point.

1.2.5. The trainer is activated by a 110 volt 60 cycle ½ H.P. electric motor (self lubricated) operating at 1725 r.p.m. A V belt drive to an extension shaft from the starter utilizes its reduction gearing to rotate the crankshaft at 4 r.p.m.

1.2.6. A small transformer (having secondary leads for either 6 or 12 volt 60 cycle power) is mounted on the base beside the motor to supply current for the ignition indicating lights. The lights presently fitted are 12 volt type so the 12 volt leads are utilized, while the neutral wire is capped off for safety purposes.

1.2.7. Power is supplied by means of a 25 foot electric power cable attached to the trainer and stowed on a hook above the driving motor, inside the pulley guard.

1.2.8. A fabric cover is provided for the trainer when not in use.

1.2.9. Additional Data:-

Length	-		81 Inches
Width	-		50 Inches
Height	-	On casters	68 Inches
		On skids	60 Inches
Shipping Weight		-	2550 pounds.

PART

SECTION II

OPERATION

OF

R-2000-13

POWER PLANT TRAINER

PART I - POWER PLANT TRAINER

SECTION II - OPERATION

2.1. General

2.1.1. Remove fabric covers and stow in a dry place.

2.1.2. Check MOTOR switch is "OFF".

2.1.3. For operation of the trainer, the electrical power cord is connected to the 110 volt 60 cycle AC power supply of a minimum 15 amp. capacity.

2.1.4. Check that any tools, rags, etc. are clear of moving parts.

2.1.5. To demonstrate the internal action of the engine, it is merely necessary to place the MOTOR Switch to "ON". The crankshaft will rotate at 4 r.p.m. while the propeller shaft rotates at its normal relative reduction (2:1).

2.2. Internal Gears

2.2.1. The cutaway front case exposes the 2 to 1 reduction gears for the propeller shaft and clearly demonstrates the action between the sun and planetary gears during operation. The high pressure oil supply line for the propeller is exposed as well as the oil scavenge pump for the nose case.

2.2.2. The sectioned cylinders (numbers 1 and 11), permit unobstructed observance of the piston and valve action during the four-stroke cycle. Number 13 cylinder assembly is omitted and a transparent blanking plate permits the student to observe the action of the crankshaft, master rod, and link rods during engine operation.

2.2.3. The operational actions of the rear cam and tappets, as well as the impeller and its drive gear train, are easily observed through the cutaway area of the collector (blower) case. The diffuser vanes and labyrinth seal are also in view.

2.2.4. The intermediate rear and rear cases are cut away, while the oil passages and the oil scavenge and pressure pumps are sectionalized, to allow physical comparison with the lubrication diagram as illustrated in the appropriate P & W R2000 Maintenance Manual.

2.3. Ignition System

2.3.1. To simulate ignition, and as a check for timing, the front spark plugs have been wired to light bulbs which glow momentarily at time of simulated ignition. The power for ignition simulation is controlled by a switch marked "TRANSFORMER" located on the panel beside the Motor Switch.

2.3.2. The action of the breaker assembly and distributor, as well as the construction of the Scintilla SP 14LN-8 magneto, is clearly demonstrated by the sectionalized left magneto mounted on the nose case. The right magneto is not sectionalized, but has been slightly modified to operate the lights connected to the front spark plugs. Due to the low voltage (12V) used in the lighting system, the high voltage rotor brush has been modified by the addition of a spring type wiper which makes positive contact with each spark plug lead terminal in the distributor. The current from the 12 volt transformer supply is fed into the magneto in a single lead through the alternate high tension lead opening and makes connection by a spring loaded contact to the high tension lead. This high tension lead then feeds the current through the rotor brush to the individual front spark plugs which in turn are modified with a wire lead through their shell to the respective indicator light.

2.3.3. To prevent any inadvertent electrical shock from the magnetos, they have been de-activated by removal of the copper connector from the points to the coil.

2.3.4. To facilitate removal if necessary of the right magneto, a quick disconnector is fitted in the electrical lead from the transformer.

2.3.5. Due to the possibility of damaging the modified rotor brush when re-installing the right magneto it is advised that the sectionalized left magneto only be removed for instruction in magneto timing.

2.4. Accessories

2.4.1. The 4G8-1 Governor mounted between the magnetos on the front case, is sectionalized to show the internal oil passages and control mechanism as well as the high pressure pump gears.

2.4.2. The accessories mounted to the intermediate rear and rear cases, namely PD12-F13 Carburettor, Generator, Tachometer Generator, Air Pump, Fuel Pump, and Starter are sectionalized to show their internal construction and the operation of any moving parts.

PART I

SECTION III

MAINTENANCE AND REPAIR

OR

R-2000-13

POWER PLANT TRAINER

SECTION III MAINTENANCE & REPAIR

3.1. Maintenance - General

3.1.1. Since the moving parts are driven at a very low speed (4 r.p.m. for the crankshaft) a minimum of maintenance should be required. Items and intervals for periodic maintenance are given below.

3.2. Cleaning and Inspection - Daily

3.2.1. (1) Check power plant supports for security.

(2) Visually check driving shaft universal joints for serviceability through the transparent cover.

(3) Check driving belt for condition and alignment.

(4) Check electric driving motor for security and the electrical power cord for damage.

(5) Check that no rags, tools, or other foreign objects are left on or in the engine.

(6) Check that all plastic panel guards are clean, clear and in position.

(7) Clean off any traces of oil or dirt with a clean soft cloth and a soft bristle brush.

(8) Connect power cable to electrical supply. Turn Master Switch and Ignition Switch to "ON" and check that trainer operates.

(9) Turn switches "OFF", disconnect power supply and stow cord on appropriate hook.

3.3. Cleaning and Inspection - Monthly.

3.3.1. In addition to the Daily Inspection procedure the following items should be checked:-

(1) Remove plastic covers, spark plugs, and rocker box covers. Warning:- Ensure power supply is disconnected before removing covers.

(2) Lightly lubricate cylinder walls through spark plug holes using Grade 1100 or similar lubrication oil in a pump type oil can.

(3) All accessible frictional moving parts, bearings, and gears in the front centre and rear cases should be similarly lubricated.

(4) Remove rocker box covers and lightly lubricate valves and valve operating mechanism.

(5) Connect power supply and operate trainer through several revolutions, and ensure that the oil is well distributed, re-oiling if necessary. Caution should be used at all times that the engine is clear before operating.

(6) Disconnect power supply and clean off any excess oil.

(7) Replace all rocker box covers, spark plugs and plastic covers.

(8) Since the electric driving motor is self lubricated and the shaft bearing on the universal drive is pre-packed and sealed, no maintenance should be required.

(9) The casters (if fitted) should be checked for smooth operation and repositioned to prevent flap spots. They are "life time" lubricated.

3.4. Repair

3.4.1. The base frame is constructed from welded four inch steel channel and I beam, which should never need repair. The engine mount is constructed of welded steel tubing (2 inch circular) with steel plate web, and the support struts are made from 1½ inch steel tubing with adjustable eye ends.

3.4.2. Any damaged engine units may be replaced by standard engine parts.

3.4.3. Damaged or opaque plastic covers should be replaced at the earliest opportunity.

PART

SECTION IV

PARTS CATALOG

FOR

R-2000-13

POWER PLANT TRAINER

PART NUMBER AC-1-T-1

FSN 6910-M23-0001

PARTS CATALOG FOR POWER PLANT TRAINER

Description	Part Number	Mfg. Code	Quantity Per Assembly
Base structure Assy.	C4-G-1301	DHC	1
Mount Structure Assy.	C4-G-1302	DHC	1
Support Tube Assy.	C4-G-1303	DHC	2
Housing Assembly - Pulleys	C4-G-1304	DHC	1
Skid Hardwood	C4-G-1305	DHC	2
Panel Assy. Plywood	C4-G-1306	DHC	1
Cover Assy. Electric Motor	C4-G-1307	DHC	1
Door Assy. - Belt Cover	C4-G-1308	DHC	1
Caster - Swivel	SCR6-DM-SL-AER6	AER	4
Mounting plate	10164	AER	4
Electric Motor ½ HP Single phase 60 cycle 110/220 V 1725 r.p.m. continuous.	11F757FB2	GE	1
Transformer 115V 60 cycle 55VA 6V & 12V Sec. taps.	1150X60	HAMN	1
Vee Belt - ½" x 68"		DA	1
Vee Pulley -½" x 8" for ½" shaft		DA	1
Vee Pulley ½" x 2½" for 5/8" shaft		DA	1

Description	Part Number	Mfg. Code	Quantity Per Assembly
Universal Coupling	300-8	APX	2
Bearing 1 3/8" OD x 1/2" ID	6202-22	SKF	1
Ignition Indicator light assembly	E451x	DA	14
Bulb - 12V 3cp S.C. bayonet type	#65	DA	14
Lens - red 2 ½"	E446X	DA	14
Spark plugs (Modified for light)	RHB37N	CK	14
Aircraft DC Generator	G-300-4B	JH	1
Air Pump	33E02-5A	BXU	1
Starter	JH6BFSR3	JH	1
Hydraulic Pump Stratopower	66WA200	NABW	1
Fuel Pump	2P-R600-CWX	PE	1
Tachometer Generator	2CM9AAA6	GE	1
Governor (Constant Speed Unit)	4G8-3	HS	1
Carburettor Type FD12F13	121808	ST	1
Magneto SF14LN-8	92403	BXS	2
Dynafocal Mount	MR26SA	LO	4
Mount Bracket	MB46962	PW	4
Temperature Bulb	MS28034-1	MEI	1
Fitting Assembly	C4-PM-1901-1	DHC	1

Description	Part Number	Mfg. Code	Quantity Per Assembly
Carb. Fuel Trans-Line	C4-P-1904	DHC	1
Prop Governor Oil Trans-Line	C4-P-1409	DHC	1
Carb. Fuel Trans-Line	624117-10-0130	AQ	1
Fuel Pressure Line	624100-4-160	AQ	1
Fuel Line - Pump to Carb.	624117-12D-0154	AQ	1
Priming Hose	624100-4-0090	AQ	1
Fuel Priming Line	624100-4-0134	AQ	1
Oil Pressure Line	624100-4-0360	AQ	2
Feathering Oil Line	624300-10-0200	AQ	1
Fabric Dust Cover	2131-0D-2650	DHC	1

All engine parts are standard Pratt & Whitney items (sectionalized in some instances) and part numbers for these can be found in the relative parts manual for the R-2000-13 engine.

CODE	NAME AND ADDRESS OF MANUFACTURER
APX	Apex Tool and Cutter Co. Inc., Shelton, Conn.
AQ	Aeroquip Corp., Jackson, Mich., U.S.A.
BXS	Bendix Aviation Corp., Scintilla Division, Sidney, N.Y.
BXU	Bendix Aviation Corp., Utica Division, Utica, N.Y., U.S.A.
CGE	Canadian General Electric, 940 Lansdowne Ave., Toronto. Ontario, Canada.
CK	Champion Spark Plug Co., Toledo, Ohio.
DA	Dominion Auto Accessories, 420 Keele St., Toronto, Ontario, Canada.
DHC	De Havilland Aircraft of Canada Ltd., Downsview, Ontario, Canada.
GE	General Electric Co., Schenectady N.Y., U.S.A.
HAMN	Hammond Transformers, Edinburgh Rd., Guelph, Ontario, Canada.
HS	Hamilton Standard Prop. Division, United Aircraft Corp., East Hartford, Conn., U.S.A.
JH	Jack and Heintz, Inc., Cleveland, Ohio.
LO	Lord Mfg. Co., Erie PA., U.S.A.

CODE	NAME AND ADDRESS OF MANUFACTURER
MEI	McGraw Edison Co., Instrument Division, West Orange, N.Y., U.S.A.
NABW	The New York Air Brake Co., Watertown, New York, U.S.A.
PE	Pesco Products Division, Borg Warner Corp., Bedford, Ohio.
PW	Pratt & Whitney Aircraft Corp., East Hartford, Conn., U.S.A.
ST	Stromberg Products Division, Bendix Aviation Corp., Detroit, Mich.

OPERATION AND MAINTENANCE INSTRUCTIONS

FOR

AC-1- CARIBOU SYSTEMS TRAINER

PART II

HAMILTON STANDARD

43D50 PROPELLER SYSTEM TRAINER.

PART II - HAMILTON STANDARD 43D50 PROPELLER

PROPELLER SYSTEM TRAINER

SECTION I - DESCRIPTION

1.1. Description (See Photograph)

1.1.1. The Propeller System Trainer consists basically of a standard 43D50 Propeller with amputated blades and a de-icing adapter mounted on a vertical steel shaft. The shaft in turn is welded to a 3 foot diameter steel plate base mounted on four 4 - inch rubber casters.

1.1.2. Number one blade is partially sectioned to exhibit the hollow shank with the lead ballast, cork plug, and blade balancing plug. All blades are shot-peened from the shank root a distance of thirty inches.

1.1.3. The dome and piston are cut away to expose the cam and piston construction arrangement, and operation during the pitch change procedure.

1.1.4. The barrel is sectioned between numbers one and two blades to permit observance of the cam gear and blade butt gear, as well as the blade root bearing, spacer, and seal.

1.1.5. On an appropriate metal support positioned on the base ahead of the propeller, rests a sectionalized distributor valve, showing the internal mechanism and oil passages displayed in colors corresponding to those in the operation diagram of the Propeller Maintenance Manual.

1.1.6. A sectionalized 4G8-1 Governor is mounted beside the distributor valve on a vertical shaft and is also painted in appropriate colors to illustrate operation as described in the relative manual.

2.1. Operation.

2.1.1. The Hamilton Standard 43D50 Propeller System Trainer in non-operational in the normal manner.

2.1.2. In order to illustrate the internal action in the dome mechanism during blade pitch change, the blades may be turned through their normal angular limits by applying a manual twisting movement to one or more of the blades.

2.1.3. The cutaway portion allows observance of the cam action being converted to blade twisting action through the cam gear and blade root segment gear.

2.1.4. For information on the operation of the actual propeller, reference should be made to the applicable Operation and Maintenance Manual for the Hamilton Standard 43D50 Propeller.

3.1. Maintenance.

3.1.1. Since there is very little operational movement, maintenance required is negligible. The plastic guards should be periodically removed and a few drops of oil applied to the bearings, cams, and gear teeth.

3.1.2. The complete assembly should be cleaned externally with a rag dampened with suitable cleaning fluid such as P-S-6 B 1 and dried with a soft cloth. The plastic guards should be cleaned with soap and water using a soft lint free rag and replaced in position.

3.1.3. The sectioned governor and distributor valve displayed on the same stand, need only to be kept clean and dry.

3.2. Repair

3.2.1. Repair to this trainer is considered unnecessary except for polishing out any nicks or scratches.

PART II

SECTION IV

PARTS CATALOG

FOR

HAMILTON STANDARD

43D50 PROPELLER SYSTEM TRAINER

PART I - HAMILTON STANDARD 43D50 PROPELLER

PROPELLER SYSTEM TRAINER

SECTION IV - PARTS CATALOG

4.1. Since the propeller trainer is made up of Hamilton Standard 43D50 Propeller parts sectionalized for instructional purpose, any replacement parts may be found listed in the applicable Propeller Parts Catalog.

OPERATION AND MAINTENANCE GUIDE

&

PARTS LIST

FOR

AC-1- CARIBOU SYSTEMS TRAINER

PART III

COMPOSITE HYDRAULIC

LANDING GEAR

&

FLAPS SYSTEMS TRAINER

PART III

SECTION I

DESCRIPTION

OF

COMPOSITE HYDRAULIC

LANDING GEAR

&

FLAPS SYSTEMS TRAINER

TABLE OF CONTENTS

PART III COMPOSITE HYDRAULIC, LANDING GEAR & FLAP SYSTEMS TRAINER

SECTION I - DESCRIPTION

1.1. Introduction.

1.1.1. This training aid is designed to provide instruction in the operation, maintenance and trouble-shooting of the flap system, the undercarriage and the brake system.

1.1.2. The unit was designed and manufactured for the U.S. Army Transportation Materiel Command by the de Havilland Aircraft of Canada.

1.1.3. The trainer is constructed from welded steel tubing with aluminum base members mounted on 6 inch rubber casters which can be locked at 90° positions, and are easily removable for transportation on the hardwood skids.

1.1.4. To facilitate transport, the trainer is constructed in two sections A and B with some removable and hinged units which are reassembled prior to operation.

1.1.5. The trainer consists of the hydraulic brake system, (for one gear only), the undercarriage retraction system, and the flap control system, all systems being fully operational.

1.2. Description.

1.2.1. A complete hydraulic system is provided including reservoir, controls, regulators, and lines necessary for operation. Power is supplied by a 2 h.p. electric motor driving a hydraulic pump, identical to that employed on the aircraft, the complete unit being shock mounted on the base of the front section.

1.2.2. All the hydraulic components are arranged so that their operations will duplicate as closely as possible those encountered in the actual aircraft. The components with minor exceptions - are actual aircraft parts and as such, adjustments are identical to those on the aircraft. To avoid duplication of systems only one main gear is presented having the piping and door mechanism to simulate the left hand unit. The landing gear is retractable and fully operational.

1.2.3. To simulate the aircraft weight on the nose gear, a hydraulic hand-operated jack is placed immediately below the nose gear and can be operated to compress the nose shock strut. When not required, it is stowed in the indicated position on the frame immediately forward and securely anchored by a heavy chain which also serves as auxiliary ground.

1.2.4. A simulated cockpit seat is incorporated along with a control panel and overhead console, nose-wheel steering control, and single rudder pedal with brake linkage.

1.2.5. The control panel (See Figure 1-1) contains:-

a/ Two hydraulic pressure gauges (electrically operated).
b/ Undercarriage indicator lights.
c/ Low pressure light.
d/ Two emergency oil shut off switches (one dummy).
e/ Triple switch block (master, motor, and rectifier).
f/ Nose wheel steering switch.
g/ Parking brake control handle.
h/ Emergency air brake control.

1.2.6. The flap sections are represented by sectional pieces of plywood positioned on the front side of the trainer in the relative location as on the aircraft.

1.2.7. The trainer is designed to operate from a 220 volt AC 60 cycle source and is equipped with a 25 foot power cable permanently attached to the trainer. The cable is electrically connected to the trainer through a master switch and is stored in a small box on the base of the trainer. A fourth wire in the cable automatically grounds the trainer.

1.2.8. The 28 DC power required to operate the electrical components of the system (solenoid selectors, indicator lights and inverter) is supplied by a rectifier mounted on the base beside the electric motor.

1.2.9. The AC power required to operate the hydraulic pressure gauges is derived from a 26 volt 400 cycle AC inverter mounted near the base of the vertical panel below and to the rear of the cockpit floor.

1.2.10. The trainer is provided with a suitable dust cover fabricated from Weatherbar which is a light-weight, flexible, durable, oil-repellent material.

1.2.11. General Data:

Length -	Section A	105 in.	(8 ft. 9 in.)
	Section B	130 in.	(10 ft. 10 in.)
	Assembled	235 in.	(19 ft. 7 in.)
Height -	Assembled	122 in.	(11 ft. 1 in.)
Width -	Assembled	54 in.	frame plus
		24 in.	for flap assembly and ladder.
Weight -	Section a	1400 lbs.	
	Sections B & B_1	2200 lbs.	

PART III

SECTION II

OPERATION

OF

COMPOSITE HYDRAULIC

LANDING GEAR

&

FLAPS SYSTEMS

TRAINER

PART III COMPOSITE HYDRAULIC, LANDING GEAR & FLAP SYSTEMS TRAINER

SECTION II - OPERATION

2.1. Pre-operating Procedure.

2.1.1. The following procedure should be followed to ready the trainer for operation:

a/ Remove the fabric covers (if installed) and stow in a dry place.

b/ If adapter blocks are not fitted, check that casters are fitted and positioned to prevent inadvertent movement of the trainer.

c/ Check the operator's controls (in the simulated cockpit), as follows:

1. Master switch "OFF".
2. Motor switch "OFF".
3. Rectifier switch "OFF".
4. Emergency Landing Gear Down Selector "OFF".
5. Emergency Brake - "OFF".
6. Landing Gear Selector Lever - "DOWN".
7. Nose Gear Steering Wheel - "NEUTRAL".
8. Flap Lever - "UP".
9. Parking Brakes - "OFF".
10. Nosewheel Down Hand Pump Selector - "OFF".
11. Brake Accumulator Hand Pump Charging - "OFF".
12. Hand Pump Selector - "NORMAL SYSTEM".

13. Hydraulic Pressure Shut Off Valve - "OFF".

14. Emergency Shut-Off Switch - "OFF". Visually check motor actuated gate valve for "OPEN" position. (Located on vertical panel above the motor-driven pump.)

WARNING:- Do not operate hydraulic motor-driven pump with this shut off valve closed since the pump is lubricated by the hydraulic fluid and resultant starvation could cause seizure.

d/ Check hydraulic fluid for correct level (1.52 U.S. gallons) in the sight glass on the reservoir and add fluid if necessary.

e/ Remove external undercarriage locks and stow on the appropriate hook on the trainer.

f/ Uncoil the electric power cord from its stowage below the operators seat, and connect to a 220 volt AC 60 cycle 20 amp power source.

g/ Ensure that all protective covers, tools, and other equipment that could cause damage are removed.

h/ Post suitable warning signs and check that all personnel stay clear of the wheel wells and the paths of the flaps and landing gear.

i/ Remove external control locks and stow.

2.2. Undercarriage Retraction Operation.

2.2.1. Normal Power Operation. (See Fig. 4-1 in TM55-1510-206-20)

Operation of the undercarriage retraction cycle is accomplished in a manner similar to that employed in the AC-1 aircraft. Two additional switches are required in the operating panel of the trainer namely "Motor" and"Rectifier".

2.2.3. For Normal operation of the undercarriage, the following procedure should be followed:-

a. Nosewheel Down Hand Pump Selector "OFF".
b. Nosewheel Steering Wheel - NEUTRAL.
c. Brake Accumulator Hand Pump Charging "OFF".
d. Hand Pump Selector - NORMAL SYSTEM.
e. Place Master, Motor and Rectifier switches (located on the control panel) to "ON".

f. Check System Pressure Gauge for Correct pressure, (3000 p.s.i.).

g. Select Landing Gear "UP" by means of selector lever located on the overhead console.

2.2.4. (See Figure 2-12 and 2-20)

The main gear unit consists basically of a main structure containing an oil and air shock strut capsule, a shortening mechanism (including the down lock), a retraction actuator, a drag strut, a stabilizer and an uplock. The units are housed within the trainer framework and are attached to front and rear members.

2.2.5. When the landing gear lever is selected to the UP position, pressurized hydraulic fluid is fed to the retraction actuator and the shortening mechanism; the latter controls releases the down locks and pulls the stabilizer to initially fold the drag strut. The retraction actuator then extends and starts retracting the main structure which in turn continues folding the drag strut. This causes the shortening mechanism (through the stabilizer) to pivot about its attachment, draw the shock strut capsule upwards, and thus shorten the overall length of the leg. When fully retracted a spring-loaded hook-type uplock automatically locks the gear on contact with the hook, and mechanically operated doors completely enclose the unit.

2.2.6. The undercarriage green indicator lights on the panel should go out when the undercarriage down lock is broken, at which time the red warning light in the selector handle comes on. When the undercarriage is fully up and locked, the red light goes out. This circuit is broken by the microswitches on the up-locks of both the main and nose undercarriages, and both microswitches have to be activated to extinguish the warning light.

2.2.7. To lower the undercarriage, the selector lever is positioned to "DOWN". When the "uplock" is broken the red warning light comes on and is extinguished only when the undercarriage is fully down and locked, at which time the respective green indicator lights come on. If any unit is not locked, the red warning light stays on and the unlocked unit will be indicated by the corresponding green light.

2.3. Emergency Operation (See Figure 4-1 Sheet 2)

2.3.1. To simulate engine driven pump failure, turn "MOTOR" switch to "OFF".

2.3.2. The emergency system consists of a handpump, filter, relief valve, and five selector valves. These valves are installed below the hydraulic emergency panel in the floor to the right of the operators seat and are controlled by four selector levers, two of the valves being interconnected and controlled by one lever. The levers are marked:- HANDPUMP SELECTOR, NOSE WHEEL DOWN HANDPUMP SELECTOR, BRAKE ACCUM'R HANDPUMP CHARGING, and EMERGENCY LANDING GEAR DOWN SELECTOR, and each has two positions. With the handpump selector at NORMAL SYSTEM and the other levers OFF, the handpump can be used to operate any selected circuit. With the HANDPUMP SELECTOR at EMERGENCY SYSTEM and the other levers ON, operation of the handpump will draw fluid from the emergency portion of the reservoir and direct it under pressure to charge the brake accumulator with fluid, and to lower the nose gear. The purpose of the EMERGENCY LANDING GEAR DOWN SELECTOR valve is to by-pass return fluid from the UP side of the landing gear actuators around the landing gear selector valve to the common return line, in the event that the landing gear selector valve is stuck in the UP selection (e.g. electrical failure).

2.4. To use the emergency system to lower the landing gear proceed as follows:-

a. LANDING GEAR SELECTOR LEVER - DOWN.
b. EMERGENCY LANDING GEAR DOWN SELECTOR valve handle - ON.
c. HANDPUMP SELECTOR - EMERGENCY SYSTEM.
d. NOSEWHEEL DOWN HANDPUMP SELECTOR - ON.
e. Insert handpump handle and actuate to lower and lock nose gear down.
f. MAIN GEAR EMERGENCY extension handle - PULL. This action manually releases the main gear up-lock and the weight of the undercarriage will lower and lock it at the full down position.

2.5. A second type of emergency system is incorporated for lowering the nose gear if, for any reason, hydraulic failure should be encountered.

Pulling the handle marked "NOSEWHEEL EMERGENCY DOWN (AIR)", operates a sheathed cable to the control valve.

of a compressed air bottle strapped to the nose gear drag strut (actuator), thus releasing the air into the strut to effect emergency lowering. Because of the overlapping positions of the selectors on the Emergency panel, it is impossible to pull this Emergency control without first operating the Emergency Landing Gear Down Selector.

2.6. For replacement procedure, details of construction, operation, and adjustment of the main gear and nose gear assemblies, including doors, the applicable section of the AC-1 aircraft manual should be consulted.

2.7. Wing Flap Operation.

2.7.1. The wing flaps are operated by hydraulic pressure supplied by a motor-driven pump to an actuator on the simulated wing rear spar, from which movement is transmitted to the flaps through mechanical linkage. The actuator is controlled by a selector lever in the overhead console through an internal follow-up valve which allows the flaps to be positioned at any point within flap range. The circuit is provided with a filter and check valve in the pressure line, and a check valve in the return line. In addition, the rod end of the actuator is vented to atmosphere through a pressure relief valve set at 3250 p.s.i. full flow pressure. Thus, in the event of a plugged return line or port, excessive pressure which would otherwise be built up due to the differential area of the piston is relieved, and the actuator will extend.

2.8. Wing Flaps Actuator.

2.8.1. Wing flaps actuator is pivot-mounted to the simulated wing rear spar on the left side of the trainer and is connected to a large bellcrank from which movement is transmitted to the system push rods. The actuator assembly incorporates a metal-edge filter, inlet valve, selector valve with a follow-up device, rotary shut-off valve and a pressure relief valve. The actuator also includes an up lock which locks the piston in its fully retracted position when the selector lever is a "0".

2.9. Selector Valve.

2.9.1. The selector lever in the control compartment is connected by push rods to a lever on the actuator. This lever

in turn being connected through bevel gears in the actuator head to a rotary spool-type selector valve. This valve consists of an inner core, which is rotated by the bevel gears, and an outer spool which is coupled to a spiralled follow-up shaft extending the length of the actuator cylinder.

2.10. Rotary Shut-Off Valve.

2.10.1. The rotary shut-off valve is a blade-type valve which opens and closes a fluid port connecting the down side of the piston with a pressure relief valve in the actuator head. The valve is keyed to the follow-up shaft so that the fluid port is blanked off from zero to take-off flap settings, and open from take-off to landing flap settings. With the flaps in the latter range, excessive air pressure on the control surfaces would force pressure fluid to operate the relief valve (set at 3250 p.s.i.), allowing the flaps to retract to a point where air loads and actuator thrust are balanced. The flaps will automatically return to their selected position as soon as the overload condition has disappeared.

2.11. Operation.

2.11.1. With the wing flaps selector lever at 0^{o} and flaps fully up, the actuator is locked in its fully retracted position. When the lever is moved away from 0^{o}, the inner core of the selector valve is rotated to the selected position and fluid under pressure enters the actuator through the inlet check valve, passes through the rotary spool and into a port in the inner core to be directed via a restrictor to the down side of the piston. Since the piston is locked, the pressure acts against the spring-loaded lock retainer (the rear side of which is vented to atmosphere) forcing it back to free the locking claws and thus allow piston movement. As the piston travels along the cylinder towards its selected position, the spiralled follow-up rod over which it travels is forced to rotate, carrying with it the rotary spool of the selector valve. When the selected position is reached, the spool pressure port encounters a blank area of the valve inner core, and the flow of pressure fluid (and thus jack movement) is stopped. Return fluid from the up side of the piston flows through a passage drilled down the center of the follow-up rod, through the selector valve inner core and return port of the rotary spool to a point beyond the relief valve and out into the circuit return line. If the wing flaps

selector lever is moved towards 0°, fluid again enters through the inlet check valve but is directed by the selector valve through the follow up rod to the upside of the piston, while return fluid passes through the restrictor and selector valve into the return line.

2.12. Bleeding Wing Flaps Circuit.

2.12.1. The wing flaps circuit is self bleeding and any air trapped in the lines and actuator can be removed by operating the flaps through their full range at least five times. Trapped air is usually indicated by "sponginess" when an attempt is made to move a flap manually against the actuator holding pressure.

2.13. Wheel Brakes System.

2.13.1. Hydraulic pressure for brake actuation is supplied by the motor-driven pump, supplemented by accumulator pressure, and distributed by control valves in proportion to the depression of the brake pedals. The circuit also includes relief valves, check valves, restrictors, a pressure gage and a parking brake handle. The restrictors (shown in Figure 3-1 as safety valves), limit the flow of hydraulic fluid so that in the event of a brake unit failing, fluid will still be available for the other units.

2.14. Brake Pressure Gage.

2.14.1. A bourdon-type pressure gage calibrated from 0 to 5000 p.s.i., is introduced into the pressure supply line to the brake control valves, and is mounted next to the system pressure gage on the operator's control panel.

2.15. Parking Brake.

2.15.1. A mechanically-operated parking brake is controlled from a handle in front of the operator. The parking brake is applied by first depressing the brake pedal and then pulling out the parking brake handle and turning it 90 degrees to the right.

2.16. Bleeding Wheel Brakes Circuit.

2.16.1. Ensure a sufficient supply of fluid in the reservoir and accumulator is fully charged.

Build up the system pressure with the hand pump.

While an operator applies brake pressure to the brake pedal, the bleed screws at the wheel brake units should be opened to allow any trapped air to escape. This procedure should be repeated until no air bubbles are present.

2.17. Nosewheel Steering Unit.

2.17.1. A hand-operated wheel on the left side of the flight compartment is connected by cables to a selector valve mounted on a hydraulically-operated steering actuator. The actuator is attached at one end to the nosewheel structure and at the other end to the upper torque arm. Extension and retraction of the actuator is transmitted through a universal joint between the upper and lower torque arms to the wheel axles to give a nominal left and right steering range of 60 degrees. A solenoid-operated shut-off valve in the hydraulic pressure supply line to the actuator is controlled by an ON/OFF switch in the flight compartment and by a weight switch on the nose gear leg, the latter automatically closes the valve when the weight of the aircraft is removed from the leg. In the trainer the leg is normally in a "no aircraft weight" condition.

2.17.2. In order to operate the nosewheel steering the nose gear shock strut must be compressed to 8½ inches in order to disengage the centering mechanism and also to actuate the weight switch located on the scissors. To accomplish this, the air must be released from valves numbers 1 and 2 and valves removed on the nose shock absorber strut. The strut can then be compressed by hand and sustained in this position by positioning a suitable box or similar platform under the nosewheels.

2.17.3. With the Nose Gear Steering Wheel on "NEUTRAL" position, switch the Nose Wheel Steering Switch to "ON".

2.17.4. Slowly move steering wheel through a full arc in clock-wise direction; nosewheels shall follow, turning to the right.

2.17.5. Move steering wheel through a full arc in counter-clockwise direction; nosewheels shall follow, turning to the left.

2.17.6. Move steering wheel to intermediate positions and wheels should position accordingly.

2.17.7. Apply manual load to nosewheels. It should not be possible to move nosewheels to left or right and steering wheel should not move.

2.17.8. Turn steering wheel through a full arc in clockwise direction. Switch nosewheel steering switch to "OFF" position. Manually turn nosewheels to straight fore and aft position.

2.17.9. Remove support from nosewheel. Replace number 2 valve and charge with air to 750 p.s.i.

2.17.10. Allow shock strut to extend fully. Replace number 1 air valve and recharge with air 45-50 p.s.i.

2.18. Bleeding Landing Gear Circuit.

2.18.1. With the exception of the main gear up and down locks the landing gear circuit is self bleeding and air may be eliminated from the system by raising and lowering the gears several times. To bleed the up and down locks proceed as follows:-

a. With wheels clear of ground, disconnect nose gear doors and remove only the nose gear ground lock leaving main gear ground lock in place.

NOTE: Ensure reservoir is full at all times during the bleeding operations and motor switch is "OFF".

b. Move HANDPUMP SELECTOR lever to NORMAL SYSTEM.

c. Select landing gear UP, loosen line connections at the main gear down lock. Operate handpump until all air is expelled and retighten connections.

d. Select landing gear DOWN, loosen line connections at the main gear up lock and operate handpump until all air is expelled. Retighten line connections.

e. Replace nose gear ground lock, and reconnect nose gear doors.

2.19. Post - Operating Procedure.

2.19.1. a/ Release hydraulic pressure by repeatedly operating brake pedal.

b/ Unless the trainer is to be disassembled for shipment, the undercarriage should be left in the extended and locked position.

c/ Master, Motor, and Rectifier switches "OFF".

d/ Check landing gear selector lever "DOWN".

e/ Fit external ground locks.

f/ Disconnect power cord and coil it in the hook provided for its stowage.

g/ Visually inspect the trainer for maintenance items that should be corrected before the next operation of the trainer.

h/ Install fabric covers as required.

PART I II

SECTION III

MAINTENANCE & REPAIR

OF

COMPOSITE HYDRAULIC

LANDING GEAR

&

FLAPS SYSTEMS

TRAINER

COMPOSITE HYDRAULIC LANDING GEAR & FLAP SYSTEMS

TRAINER

PART III SECTION III - MAINTENANCE & REPAIR

3.1. Maintenance.

3.1.1. The trainer should be periodically cleaned, lubricated and checked for proper adjustment. Items and intervals for periodic maintenance are given below:-

3.2. Cleaning & Inspection - Daily:-

3.2.1. (1) Inspect accessible hydraulic lines for obvious damage, leaks, chafing, and security.

(2) Inspect landing gear shock struts for leaks, damage, and security.

(3) Inspect landing gear uplocks, retraction jacks and shortening mechanisms for leaks, damage and security.

(4) Inspect flap actuating cylinder for leaks, damage and security; simulated flap sections for damage.

(5) Check hydraulic system reservoir for quantity, leaks, and check filler cap for security.

(6) Check hydraulic system and emergency air cylinder gauges for correct pressures:-

a. Nose leg emergency air cylinder - 1200 p.s.i.
b. Brake system emergency air cylinder - 1500 p.s.i.
c. Brake system accumulator air charge (hydraulic system pressure released) - 800-850 p.s.i.

(7) Remove any hydraulic fluid from the area of the hydraulic pump, retraction jacks flap actuator, and nose wheel steering actuator. Any excessive seepage would be cause for further inspection to determine serviceability of the effected unit.

3.3. Inspection - Monthly.

3.3.1. (1) Inspect floor panel in flight compartment for cracks, damage and security; operator's seat for security of attachment.

(2) Ball screw and screw jack for security and threads for damage and wear.

(3) Inspect wheel compartments for damage to structure, pipe lines and components.

(4) Inspect wheel compartment doors for damage, and security; operating mechanism for corrosion, wear, damage, security, and freedom of operation.

(5) Inspect main landing gear emergency system cable and pulleys for condition and security.

(6) Thoroughly clean, and inspect main landing gear shock struts, retraction jacks, shortening mechanisms, and up and down lock mechanisms for leaks, damage and security; attachment brackets and surrounding structure for distortion, cracks and security.

(7) Inspect hydraulic lines including brake lines for damage, chafing, leaks, and security.

(8) Inspect hydraulic system emergency shut-off valves for leaks and security.

(9) Thoroughly clean, and inspect nose gear shock strut for leaks, damage, security and specified extension; steering valve and actuating cylinder for leaks, cleanliness and security; scissors for binding, distortion, corrosion, and security.

(10) Inspect nose gear down emergency air cylinder and piping for loose connections, damage and security of attachment; air cylinder for correct pressure (1200 p.s.i.) and gauge for broken faceglass.

(11) Inspect nosewheel steering system pulleys, cables and control wheel for damage, binding and frayed cables, chipped pulleys, and security of attachment; spring - tensioned pulley for weak, corroded or broken spring.

(12) Carry out landing gear retraction tests (normal and emergency systems) and check the indicator lights for proper indication in relation to landing gear position; landing gear doors for free operation, fit, and proper clearance.

(13) Clean all exterior surfaces using a suitable solvent. Federal Specification P-S-661, or equivalent and dry with a soft cloth.

3.4. Inspection Bi-annually.

3.4.1. (1) Remove main wheels; clean, and inspect for corrosion, cracks, and distortion; bearings for wear, corrosion, and roughness. Lubricate and reinstall.

(2) Inspect brake assemblies for signs of leakage and damage; discs for cleanliness.

(3) Remove nose wheels, clean, and inspect for corrosion and cracks, bearings for corrosion, and roughness. Lubricate and reinstall.

3.5. Lubrication.

Lubrication points, type of lubricant, method of application, and periods, are given in the lubrication diagram Figure 1-8.

3.6. Adjustments - Trouble Shooting.

3.6.1. The trainer should rarely require maintenance other than cleaning and lubrication, however, some possible problems that may arise and their correction are given below:-

a. No D.C. Electric Power
   (1) Inspect all power line connectors
   (11) Replace DC Inverter if unit inoperative

b. Indicator lights failure.
   (1) Spare lamps are stored in a receptacle with the Electrical Trainer

c. Nose gear fails to lock up and indicator light in selector lever remains on.
   (1) Microswitch on UP lock incorrectly adjusted.
   (11) UP lock plunger sticking or damaged. Readjust microswitch if necessary and insure plunger has free movement.

d. Indicator lights not indicating correctly. Check adjustment and functioning of relative microswitches.

3.7. Repair.

3.7.1. Since the framework has been constructed from rugged materials and the components are standard aircraft parts, the trainer should give relatively trouble-free service. The hydraulic lines are fabricated to the same specifications as those in the AC-1 aircraft. Should the frame become damaged, it can be repaired by welding since it is constructed of 4130 steel. The base is 6061 aluminum alloy. Any damage or defective component may be replaced or repaired depending on the nature and extent of the damage. Any superficial damage such as skin damage to the main and nose gear doors would merely require the standard sheet metal repair. Any nicks or abrasions to the components could be repaired by blending out and refinishing with applicable primer and paint.

Repair Materials:-

Tubing: Structure 1½ O.D. x .125 - 4130 Steel
Base - 65S-T6 Alum. H Beam 4 x 4
(Die 29001 Alloy Metal Sales Limited)

Hydraulic Tubing:

Size	Material	Heat Treat	Tube En	Fitting
¼ OD x .035	6061 T4	T6	Double Flare	AN818-4D MS20819-4
½ OD x .065	6061-T4	T6	Single Flare	AN818-8D MS20819-8
	(Tested to 4500 psi)			
¼ OD x .035	5052-0	Single Flare	(Hand pump suction)	
	(Tested to 100 psi)			

Sheet: Outer Skin - .025 Alclad 2024 T3
Inner Skin - .032 Alclad 2024 T4
Channel - .032 Alclad 2024 T4

Primer: Zinc chromate MIL-P-6889

Paint: Gray gloss lacquer, colour 512 MIL-L-7178

Special Tools: - (for Hydraulic and Undercarriage Trainer)
SD5501 - Acorn - Nose gear pivot shaft
SD5502 - Lock Pin - Nose gear
SD5503 - Lock - Nose gear
SD5505 - Special Wrench - nose gear pivot
SD5528 - Acorn - Main gear bolts
SD5529 - Acorn - Main gear bolts
SD5539 - Alignment Tool - Main gear drag strut

PART III

SECTION IV

ERECTION

OF

COMPOSITE HYDRAULIC

LANDING GEAR

OF

FLAPS SYSTEMS

TRAINER

PART III: COMPOSITE HYDRAULIC LANDING GEAR & FLAP SYSTEMS TRAINER

SECTION IV - ERECTION

4.1. Erection.

4.2. Under normal conditions the trainer will not be disassembled or require any special procedure other that that stated in Section II to put it in operation. However, when the trainer has been disassembled for transportation, it may be erected in the following manner:-

a/ Remove the fabric covers from the two units.
b/ Hoist Section "B" from shipping position on the base B1 after removing attachment bolts. Attach a four cable sling of two tons capacity to the four lifting eyes on the top of frame B.
c/ Attach base of section A to base B1 with three foot rod and secure with cotter pin.
d/ Hoist top section B high enough to attach forward end to section A at pickup point. Fit the centre post over the stub on the "B" frame and secure by bolt.
e/ Erect crossmembered end section on base B1 and attach to pick up points on rear of section B. Attach the bottom end of the centre post to frame B-1 by four bolts.
f/ Erect and secure operator's hinged control panel, brake pedal, nosewheel steering control, overhead control console and operator's seat. Attach curved members and metal fairing to front of operator's console.
g/ Mount the flap section panel to the centre post and rear frame.
h/ Mount the flap bellcrank assembly to the vertical cross-membered support and secure by applicable bolts. Connect the flap operating linkages between control, bell-crank, and flap section.

i/ Connect hydraulic lines from Section A to Section B at hydraulic panel.

j/ The main and nose gears are in the retracted position for shipping, and may be lowered if desired by following the Emergency procedure outlined in Section II (Operation paragraph 2-7).

WARNING:- Due to the linear dimensions of the main and nose gears, they should not be lowered without casters or adapter blocks fitted to the trainer.

PART III

SECTION V

PARTS LIST

FOR

COMPOSITE HYDRAULIC

LANDING GEAR

&

FLAPS SYSTEMS

TRAINER

COMPOSITE HYDRAULIC LANDING GEAR & FLAPS SYSTEMS TRAINER

PART III SECTION V - PARTS LIST

5.1. Introduction.

5.1.1. Since the nose gear and mainwheel gear assemblies, (including doors) as well as all hydraulic units are standard AC-1 parts, the numbers for replacement of these parts may be found in the applicable section of the TM 55-1510-206-34P manual and will not be included in the Hydraulic Trainer Parts Catalog.

5.2. Parts.

5.2.1. Electrical.

Item	Location & Part Number	Quantity
(1) Cannon Connectors	Uplocks, Downlocks Weight Switches PC06E-10-6S(SR)	6
(2) Cannon Connectors	U/C Selector Valve Hydraulic Pressure Switch MS3106B-10SL-3S	2
(3) Cannon Connector	Nosewheel Steering Valve MS 3106-10SL-4B	1
(4) Cannon Connectors	Hydraulic system & brake transmitters 7 indicators. MS 3106A-14S-2S	4
(5) Cannon Connector	Inverter MS 3106A-12S-3S	1
(6) Circuit Breakers	Hydraulic & Indicating Circuits D7271-1-3	2
(7) Circuit Breaker	D.C. Master Switch D7270-1-5	1
(8) Circuit Breaker (3 amp.)	Inverter Switch D7270-1-3	1
(9) Fuse (3/10 amp.)	AC Fuse 3AG-3/10 312,500	1
(10) Fuse holder	AC Fuse 342001	1
(11) Relay	U/C Control AN3311-2	1
(12) Stand off	For Terminal Strips A2927-11-91	6

(13)	Terminal Strip	Inside Junction Box AN3436-2-10	3
(14)	Transformer	Hammond type 210P	1
(15)	Rectifier	D-26 (Sharkes - Targian)	1
(16)	Resistor	5 ohm - 100W.	

5.2.2. Frame.

	Item	Part Number	Manufacturer	Qty.
(1)	Frame - Section A		DHC	1
(2)	Frame - Section B		DHC	1
(3)	Frame - Section B 1		DHC	1
(4)	Frame - Support		DHC	1
(5)	Casters	SCR-DM-SL-AER6	AER	
(6)	Electric Motor	CS213-F	Century Electric Co. St. Louis.	1
(7)	Hydraulic Pump	60WA200	N.Y.A.B.	1
(8)	Pressure Gauges	AW1817-AC01 11080-2	U.S. Gauge Kenyon Inst. Company	2 2
(9)	Ladder	C4-G-1345-1	DHC	1
(10)	Pulley	3 in. dia. 3 groove	Browning	2
(11)	Retaining Plate	P 11	Browning	1
(12)	A belts	4L480	Sadler	3
(13)	Pulley & Belt Guard	C4G-1342-1	DHC	1
(14)	Seat	C2FF2573	DHC	1
(15)	Hydraulic Quick Disconnectors	TB155-S11-16D T.155-S11-8D		1 1
(16)	Hydraulic Tubing	$\frac{1}{4}$" O.D. x .035" wall 6061-T4 $\frac{1}{2}$" O.D. x .065" wall 6061-T4		as req. " "

(17)	Scotch Tread	gray	Minnesota Mining.	A.R.

5.2.3. Flap System.

(1)	Flap Selector Assembly		C4-G-1343-1
(2)	Push Rod Assemblies		C4-G-1343-31 C4-G-1343-33 C4-G-1343-35
(3)	Idler	C4-	C4-G-1343-11
(4)	Bellcrank Assembly		C4-CM-1578-1
(5)	Flap Actuator Assembly		C4-SC-1009-1
(6)	Pushrod Assembly		C4-G-1343-37
(7)	Bellcrank Assembly		C4-G-1343-39
(8)	Nose flap section		C4-G-1344-15
(9)	Nose flap arm		C4-G-1344-17
(10)	Trailing Flap section		C4-G-1344-11
(11)	Trailing flap arm		C4-G-1344-13
(12)	Interflap connecting rod		C4-G-1344-27

5.2.4. Nosewheel Steering System.

(1)	Control wheel	C4C 1141-5	1
(2)	Cable and chain assembly	C4C 1146-5	1
(3)	Pulley	MS 20219-2	2
(4)	Pulley	AN 219-4	2

OPERATION AND MAINTENANCE GUIDE

AND PARTS LIST

FOR

AC-1 CARIBOU SYSTEMS TRAINER

PART IV

ELECTRICAL TRAINER

TABLE OF CONTENTS

PART IV

SECTION I

DESCRIPTION OF ELECTRICAL TRAINER

1.1. Introduction

1.1.1. This training aid provides operating and maintenance information for the electrical system found in the AC-1 Caribou aircraft. It was fabricated by de Havilland Aircraft of Canada, Limited, Downsview, Ontario, Canada.

1.1.2. Scope of This Manual

The scope of this manual is to describe the operation and functioning of the electrical systems on this training aid. The instructor should use this manual in conjunction with TM55-1510-206-20 and -34 to be fully conversent with the AC-1 Caribou electrical systems, so as to be able to demonstrate to full advantage the systems as displayed on this training aid.

1.2. Description

1.2.1. This training aid consists of five (5) interconnected portable panels, to which is attached the electrical systems of the AC-1 Caribou, either in full (as per aircraft) or animated, where the full system is not practical, due to the dimensional limits of the panels, etc.

The aircraft electrical system as illustrated by the five panels, are interconnected by "Cannon" connectors clearly number coded for positive identification. The complete system's circuit wire coding is similar to that of the aircraft, and is only changed where necessary to accommodate the limitations of the training aid. All codes which have been changed or added will be the same as the aircraft wire code, but will be prefixed with the letter "T". Grounding on all panels is through "L" section aluminum strips mounted along the top and bottom of each panel, to which all grounds are connected.

1.2.2. Panels 1, 3 and 5 are constructed at 60 inches x 56 inches x 0.75 inches plywood, mounted on rectangular sectioned 4 inches x 2 inches aluminum frames with 4 casters for mobility. Panels 2 and 4 are the same as 1, 3 and 5 but built on aluminum frames which are hung on and between 1, 3 and 5 panels by gate hinges. For portability, the panels are disconnected electrically and physically.

1.2.3. The electrical systems for the heaters, instruments and radio are not included in this Training Aid.

1.2.4. The presentation is designed to show the function and the appearance of the systems as much as possible but where the system is animated or simulated it will show the function of the circuit only. Certain components are made in "dummy" form, but will be wired in such a way as to present the normal appearance of the unit.

1.2.5. The trainer contains an Instructor's control panel attached to the left edge of the Number 1 panel and facing the left. Mounted on this panel are certain special switches and controls. These are provided to enable the instructor to activate the Training Aid, and to switch simulated faults into the circuits.

1.2.6. Number 1 panel contains the switches and controls found in the cockpit of the AC-1 aircraft, which control the electrical systems throughout the aircraft. Also mounted on this panel are the circuit breaker and fuse panels and the number one and two junction boxes.

1.2.7. Number 2 panel presents the main power supply sources on the AC-1 and is displayed with the following components:-

No. 4, No. 6, No. 9, No. 10 Junction boxes, Firewall Junction Box, Windshield Heat Relay Panel, and two dummy windshield inverters. External power supply plug and socket. Dummy battery, and two dummy DC generators. Generator control panel, main, and standby inverters. Stall warning wing transducer and two flap position potentiometers.

1.2.8. Panels Number 3, 4 and 5 are mainly the "Working Ends" of the electrical systems. In some cases the actual aircraft component is used and is functioning, in other instances the system is simulated, or a combination of both is used, such as with the cabin lights; i.e. - one cabin light is placed on the board to demonstrate the function of the red and white lights; in addition the position of all the cabin lights in the aircraft are shown by white lights in the appropriate location on the aircraft silhouette on panel number 3.

Panel Number 3 as well as containing the aircraft silhouette and showing the location and operation of certain components throughout the aircraft, incorporates the windshield wiper system, aileron trim system, and all the various types of lamps found on the AC-1.

Panel Number 4 shows in simulated form all the aircraft's engine electrical components. These are represented by lights showing location and operation, mounted on a silhouette of the engine and center wing and fuselage. Also on Number 4 Panel is a working model of the upper cowl carburetter air intake doors, using mainly aircraft parts.

Panel Number 5 shows the operation of the doors and landing gear. The operation of the doors is illustrated by the actual aircraft actuating components superimposed over a working model of the aircraft doors.

Landing gear is illustrated by a hand-operated model to illustrate the sequencing of the various micro switches in the landing gear selector systems.

1.2.9. The power supply for this training aid is provided by:-

A mobile rectifier power unit capable of delivering 22 - 32 volts DC and 100 amperes. Input and output cables are supplied with the unit which must be operated from a 220 volt, 3 phase, 60 cycle AC power source.

PART IV

SECTION II

OPERATION

OF

ELECTRICAL TRAINER

SECTION II OPERATION

2.1. General

2.1.1. Pre-positioning

Before using the training aid for instruction, move all switches and controls to the position listed in the following schedule.

Component	Position
Instructor's Panel	
Training Aid Master Switch	Off
All Fault Switches	Normal
Number 1 Panel	
All Switches	Off or Normal
Fuel Control	Off
Throttle Levers	Closed
Landing Gear Handle	Down
All Circuit Breakers	In
Number 2 Panel	
Ground Power Supply	Disconnected
Flap Potentiometer	Up
Battery	Disconnected
Number 3 Panel	
Ramp Loading Light	Off
Number 4 Panel	
NIL	
Number 5 Panel	
Rear Entrance Light	Off
Rear Panel Lights	Off

2.2. General

NOTE:-

This training aid depicts the complete left engine DC power supply only. All faults and trouble shooting will be explained on this system, as the right engine DC power supply of the aircraft is identical.

2.2.1. DC Power Supply System

The 27.5 volt DC power supply system includes two dummy engine driven DC generators wired in such a way as to depict the normal functioning of the units. The generators are controlled by generator control switches located on the electrical control panel, on the Number 1 training aid panel. The generators operate simultanously or can be switched to operate separately to supply the primary source of power for the system. Although only one generator control panel is fitted to the training aid the system is wired so that the bus control relays operate normally.

2.2.2. To activate the training aid connect power supply cable lead to the Type II Junction Box, on the power supply rectifier and switch the Training Aid Master Switch to "ON".

The training aid now depicts the Electrical Systems in a completely inactive and de-energized condition with the battery disconnected.

2.2.3. From this point on the training aid electrical system can be manipulated in the same manner as the aircraft.

2.2.4. Battery and Battery Bus

Connect the battery. The battery bus will be energized. The flight compartment dome light is the only component which uses the battery bus. There is an emergency bus which can be connected to the battery bus, by placing the emergency bus switch located on the circuit breaker panel, to the emergency position. The battery bus is terminal A1 of the battery relay.

2.2.5. Battery Master Switch and Main Bus.

Place the aircraft master switch in the "ON" position, the main bus will be energized.

MAIN BUS:- The main bus found in number 2 junction vox, distributes power to electrical equipment which is considered to be essential to flight safety. The main bus may be energized by either or both generators, the battery, or when on the ground, by an external power source. The generators will energize the main bus through the generator relays, if the output voltage of either or both generators is 0.35 to 0.65 volt greater than battery voltage. The left and right-hand generator relays are controlled by the respective generator control panels and by generator switches located on the electrical power panel. The battery will energize the main bus through the battery relay, if the generators are not operating, or if generator output voltage is less than battery voltage. The battery relay is controlled by the battery master switch located on the engine switch panel. An external power source can be used to energize the main bus through an external power receptacle and relay.

CAUTION:-

The battery master switch must always be at OFF while external power is connected, otherwise the aircraft battery will be paralleled with the external supply. The generator switches must be at OFF while external power is connected, to avoid reverse current through the generator circuit.

2.2.6. Secondary Bus

The secondary bus found in Number 2 junction box, distributes power to electrical equipment that is considered of secondary importance to flight safety. The secondary bus is energized from the main bus via the secondary bus relay, which is normally energized when both generators are producing 0.35 to 0.65 volt greater than the battery voltage. The secondary bus relay is controlled by the left and right hand bus control relays which are wired as an interlocking circuit that will not permit the secondary bus relay to operate unless both bus control relays are energized. The bus control relays are energized by their associated generator control panels.

Each generator control panel senses the output of its associated generator and functions to energize the associated bus control relay when the generator output voltage exceeds the battery voltage, thus the secondary

bus relay can operate only if both generators are producing output voltages 0.35 to 0.65 volts above the battery voltage. Should one generator fail, the associated generators control panel will function to de-energize the related bus control relay. Consequently the secondary bus relay is de-energized and the services dependent on the secondary bus are disconnected from the system. However, if certain services supplied by the secondary bus are required, those services not required can be switched off by pulling the circuit breakers, and by means of the secondary bus override switch, reconnect the secondary bus. When an external power source is connected to the system, a ground test relay is energized which completes a circuit that bypasses the generator control panels and the bus control relays, and energizes the secondary bus relay directly from the external supply source.

2.2.7. The emergency bus found in number 2 junction box, distributes power to the electrical equipment considered necessary for an emergency situation. It is normally powered by the main bus, but in the event of a complete failure of the generator system, the emergency bus can be isolated from the main bus, and receive its power from the battery by selecting the emergency bus switch found on the circuit breaker panel, to EMERG, and the battery master switch to OFF. This action connects the emergency bus, by bus cable, directly to the battery.

2.2.8. Battery

The dummy battery located on Number 2 Training Aid Panel represents a 24 volt 34 ampere hour nickel cadmium storage battery, and is wired to function the same as the normal battery.

CAUTION

Ensure that the battery master switch is selected to OFF, and that the emergency bus switch is selected to NORMAL before disconnecting the battery, as any substantial load on the battery circuit could cause damage to the connector and receptacle pins when removed.

2.2.9. Battery Relay

The battery relay functions to connect the battery to the main bus and is controlled by the battery master switch. The relay is located in number 2 junction box.

2.2.10 Generator System

The generator system consists of two dummy 30 volt, 300 ampere, direct current generators, fitted to Number 2 Panel. Each generator is connected, via a generator relay

and a current limiter, to the main bus. Regulation and control equipment is provided for each generator to stabilize voltage output, control cut-in and cut-out, prevent overloading and to isolate a generator should it develop a fault or draw current from the main bus. The regulation and control equipment for generator includes a generator control panel, (fitted to the left system only), a ground fault detection system, a generator relay, and a bus control relay. The generator control panel maintains the output voltage of the generator at a practically constant level of 27.7 volts, and controls the cut-in and cut-out point of the generator by energizing or de-energizing the generator relay.

The generator relays connect the generators to the main bus, and are energized through the corresponding left or right-hand generator control panel (only left hand systems or training aid) when the voltage output of a generator exceeds the bus voltage. When energized, the generator relay connects the output of the related generator to the main bus via a 325 amp current limiter in Number 2 junction box, and also provides switching that supplies power to energize the associated bus control relay, via the terminal marked IND. and interrupts the ground return of the directly coupled negative ground fault circuit via the terminal marked B3. A control switch, a failure warning light and a voltammeter, are incorporated in each generator system which are located on the electrical control panel on Number 1 Training Aid Panel. The control switch marked ON-OFF-RESET, located in the electrical power panel permits a generator to be isolated from the system by selecting to OFF, or be electrically reconnected to the system by selecting to RESET, when the respective generator field relay has been tripped by a fault. The failure warning, a press-to-test type, red-coloured light, provides a warning by illuminating if the corresponding left or right-hand generator is disconnected from the main bus. Each voltammeter provides an indication of voltage at the main bus, and current drain of the related generator. The circuits for the secondary bus relays, the generator field relays reset, the left and right-hand tickler resistors, which maintain proper polarity of the shunt field, and the generator warning lights are protected by five, 5 ampere, push-to-reset circuit breakers located on the power section of the circuit breaker panel.

2.2.11. Generator Control Panels.

The generator control panel is located on Number 2 Panel and is connected to the left hand generator system. The control panel maintaining a practically constant level of output voltage under varying electrical loads imposed on the generator. The control panel incorporates a carbon

pile, a polarized differential relay, an equalizer relay, a field relay, a ground fault relay, and an overvoltage relay. The carbon pile performs the function of regulating the generator output voltage. It is essentially an automatic rheostat fitted in series with the generator field supply. The differential relay operates to delay the energizing of the generator relay until the generator is delivering sufficient voltage to override the aircraft battery. This prevents the possibility of a flow of reverse current in the generator circuit. The equalizer relays operate in conjunction to spread the load demand equally between the generators. The equalizer is inoperative as only the left system is installed on the training aid.

The field relay functions as a switch that will trip out if overvoltage or a ground fault occurs. The ground fault relay functions in conjunction with the ground fault transformers to trip the field relay should an open or ground of the generator output lines occur. The overvoltage relay functions to sense generator output overvoltage and energizes the field relay trip coil if generator output voltage reaches 31 to 34 volts.

2.2.12. Voltage Regulator

A voltage regulator is installed in the generator control panel. The regulator functions to maintain the voltage output from the generator at a nominal potential adjustment rheostat, a reverse current coil, and test jacks for a portable voltmeter.

CAUTION

Do not adjust the carbon pile

2.2.13. Generator Relays

The generator relays function to connect the generators to the main bus. The left relay is controlled by the generator switch on the electrical control panel.

The relays are located in Number 1 junction box on Number 1 Training Aid Panel.

2.2.14. Current Limiters

Current limiters are fitted in circuit between main and secondary bus boxes and circuit breaker panel, between generator relays and main bus, and between main bus and emergency bus (when emergency bus switch is at NORMAL).

Current limiters are unaffected by momentary surge overload but melt under overload after a duration of time. The current limiters are mounted in Number 2 junction box. If current limiters show excessive discolouration or oxidization they should be replaced.

2.2.15. Secondary Bus Relay

The secondary bus relay, located in Number 2 junction box, functions to connect the main bus to the secondary bus and is controlled normally by two bus control relays which form an interlocking circuit that energizes the secondary bus relay only when both generators are delivering power to the main bus. An override switch, marked SEC.BUS RESET, located on the circuit breaker panel, provides a bypass circuit when selected to RESET, that energizes the secondary bus relay, should services supplied by the secondary bus be required when one generator is inoperative. A ground test relay, which is energized when an external power source is connected to the aircraft, completes a circuit that energizes the secondary bus relay.

2.2.16. Bus Control Relays

The bus control relays, one for each generator circuit, function to control the operation of the secondary bus relay. The two relays are connected by an interlocking circuit that energizes the secondary bus relay, when both generators are delivering power to the main bus. Each control relay is energized when the related generator relay is closed. The bus control relays, marked LH BUS CONTROL and RH BUS CONTROL, are located in Number 2 junction box.

2.2.17. External Power

An external power receptacle is mounted on Number 2 Training Aid Panel and provides a means of connecting an external power source to the electrical system. To simulate an external power source, an external power connector on a short length of heavy lead is stowed in a clip close to the external power receptacle. This can be plugged into the external power receptacle and the ground power will be fully simulated, as being connected to the system.

2.2.18. External Power Relay

The external power relay connects the external power source to the main bus, and is energized through the small pin in the external power receptacle.

2.2.19 Ground Test Relay

The ground test relay, when de-energized, functions to complete the energizing circuit from the bus control relays to the secondary bus relay, and from the secondary bus override switch on the circuit breaker panel. The ground test relay is energized when an external power source is connected to the aircraft electrical system, thus the secondary bus relay is energized from the external power source. The ground test relay, marked GROUND TEST RELAY is located in Number 2 junction box.

2.2.20. Ground Fault Transformers

The ground fault transformers function to detect a current differential in the ground fault detection system; if an open or short circuit occurs in the generator output lines, they then actuate a relay to isolate the faulty system. The ground fault transformers used to detect generator negative line faults are located in the left and right-hand firewall junction boxes. Left hand firewall junction box only is fitted to Number 2 panel of the training aid.

Each ground fault detection system includes two ground fault transformers, and a ground fault relay which is essentially a current differential relay. One ground fault transformer is used with the positive line cable and the other with the negative line cable. Each transformer is coupled to one of the coils of the ground fault relay. The positive line cable and the negative line cable each pass through the center of their respective transformers, thus the cable acts as the transformer primary. With normal loads and fault-free circuits, equal signals are imposed on the two coils of the ground fault relay and this results in zero magnetic force on the relay armature. Should an open or short circuit occur, the current through one coil of the ground fault relay will become greater than the current through the opposing coil, causing the relay to close and complete a circuit to the generator field trip coil in the generator control panel, thus de-energizing the generator relay. An additional circuit, directly connecting the generator D terminal to the negative coil of the ground fault relay, and grounded through the generator relay, will provide a strong signal to the negative coil of the ground fault relay if a fault is present during generator build-up. This would actuate the field trip coil, rendering the generator relay inoperative.

2.2.21. Generator Switches

The generator switches provide control of the generators from the electrical power panel on Number 1 Training Aid Panel, permitting a generator to be isolated from the system by selecting to OFF, or be electrically reconnected to the system by selecting to RESET, when the respective generator field relay has been triggered by a fault.

2.2.22. Generator Warning Lights

The generator warning lights consist of two press-to-test red-coloured panel lights, one for each generator. The lights provide a warning by illuminating if the corresponding left or right-hand generator is disconnected from the main bus. The lights are located on the electrical power panel on Number 1 Training Aid Panel and are controlled by the respective bus control relay. The light circuits are protected by a five ampere push-to-reset circuit breaker marked GEN.WARN.LIGHTS, on the circuit breaker panel.

2.2.23. DC Voltammeters

Two dual DC voltammeters are provided for reading of the DC voltage and amperes. The dual meters are located above the electrical power control panel.

The ammeters are calibrated from 0.450 amperes, and are provided with adjustable "set limit" hands.

The voltammeters are calibrated from 15 to 33 volts and are provided with adjustable "set limit" hands, in addition to a pointer adjustment screw. The voltammeters serve to indicate the voltage of the main bus and the current load of the respective generators.

2.3. AC Power Supply System

2.3.1. General

The AC power supply is provided from the main or standby inverter. An inverter change over relay effects the automatic selection to standby inverter in the event of main inverter malfunction. The inverters derive their input from the aircraft 28 volt AC system, and deliver 115 volts 400 cycles output to those systems requiring this voltage. In addition, a 26 volts 400 cycles supply is provided by a step-down 115/26 volts instrument transformer, which derives its input from the inverter in use. The inverters can be selected manually by an inverter switch on the electrical power panel. The panel also contains the AC failure light, which gives warning of complete AC power failure, and an AC standby inverter light, which comes on when the standby inverter is operating.

2.3.2. AC Power Distribution

The alternating current power supply from the inverters is distributed through a multiple bus network, mounted in Number 10 junction box, located on Number 2 Training Aid Panel. There are three AC main buses supplied with 115 volts 400 cycles power, and three AC instrument buses also supplied with 115 volts 400 cycles. Power to the systems requiring 115 volts 400 cycles AC is distributed from the AC instrument buses through the fuse panel. A 115/26 volts step-down instrument transformer, also mounted in Number 10 junction box, supplies 26 volts 400 cycles AC to those instruments requiring this power. The 26 volt 400 cycles AC power is not used on this training aid.

2.3.3. AC Main Buses

The three AC main buses in the Number 10 junction box are the A-phase, B-phase and C-phase main buses. The B-phase is grounded through the training aid ground strip. The A-phase and C-phase buses receive power directly from the main inverter. These buses are not presently used, but have been provided for possible future installations.

2.3.4. AC Instrument Buses

The three AC instrument buses in the Number 10 junction box are the A-phase, B-phase, and C-phase AC instrument buses. The B-phase is grounded to the B-phase connection of both inverters. Power is distributed from the A-phase and C-phase buses through fuses on the fuse panel. The buses receive power from the main inverter or the standby inverter, through the inverter changeover relay.

2.3.5. Instrument Transformer

The instrument transformer, located in Number 10 junction box, provides 26 volts 400 cycles, single phase AC, for instruments requiring this power. The 115 volts 400 cycles input to the transformer is supplied from the C-phase AC instrument bus, through the INST TRANSF fuse on the fuse panel. The 26 volts 400 cycle single phase AC is not used on this training aid.

2.3.6. Fuse Panel

The AC fuse panel is located with the group of circuit breaker panels on Number 1 Panel. Each fuse is retained in its holder by a screw cap marked FUSE. The current rating of the tubular fuses is marked on the fuses and the fuses are labelled with the name of the systems protected by them.

2.3.7. Inverters

Two inverters are provided, a main inverter and a standby inverter for use in event of failure of the main inverter. Both inverters are located on Number 2 Panel. Each inverter will deliver 115 volts 400 cycles, at 250 volt-amperes, when supplied with 26 to 29 volts DC. The input supply for the standby inverter is taken from the emergency DC bus via a 25 amp push-to-reset type circuit breaker, marked STANDBY INVERTER and the supply for the main inverter is taken from the secondary bus via a 25 amp circuit breaker marked MAIN INVERTER. The supply is completed via relays marked MAIN INVERTER RELAY AND STANDBY INVERTER RELAY, respectively, located on Number 6 junction box on Number 2 Training Aid Panel. The DC supply to the main inverter relay coil is provided from the secondary bus, via a 5 amp push-to-reset type circuit breaker marked MAIN INVERTER RELAY. The supply to the standby inverter relay is provided from the emergency bus via a 5 amp push-to-reset circuit breaker marked STANDBY INVERTER RELAY AND "ON" LIGHT. An automatic changeover function is provided by changeover relays, located on Number 6 junction box. Manual control of inverter selection is provided through a switch marked MAIN - OFF - STANDBY, on the electrical power panel located on Number 1 Training Aid Panel.

2.3.8. Inverter Changeover Relays

The inverter changeover relays are contained in a box mounted on Number 6 junction box. The changeover relays function to control main and standby inverter operation as follows:-

a. With only the emergency bus energized the standby inverter operates with the inverter switch on the electrical power panel selected to the STANDBY or MAIN positions.

b. With the emergency bus and the secondary bus both energized, the standby inverter only operates with the inverter switch selected to STANDBY.

c. With the emergency bus and the secondary bus both energized, the main inverter operates with the inverter switch selected to MAIN until the AC voltage from the main inverter fails below 90 volts, at which time the main inverter switches off and the standby inverter switches on automatically.

2.3.9. AC Failure Light

The AC failure light is a red-coloured edge light, mounted on the electrical power panel, and marked AC FAIL. The light will come on when AC power output ceases. The intensity of the light is controlled by the WARN LIGHT DIM SWITCH on the electrical switch panel. The circuit is protected by a 3 amp push-to-reset circuit breaker marked AC FAIL WARN LIGHT and supplied from the emergency bus. When relay E in the inverter changeover relay box is de-energized, the circuit is completed.

2.3.10. AC Standby Inverter Light

The AC standby inverter light is an amber-coloured edge light, mounted on the electrical power panel and marked STANDBY "ON" LIGHT. The light will glow when the standby inverter is operating, as long as the emergency bus remains energized. The intensity of the light is controlled by the WARN LIGHTS DIM SW on the electrical switch panel. The circuit is protected by a 5 amp push-to-reset circuit breaker and is supplied from the emergency bus. With the inverter switch selected to STANDBY the circuit is completed.

2.4. Lighting System.

2.4.1. General

The lighting system may be divided into three groups, namely, interior lighting, external lighting, and panel and warning lighting. All groups operate from the aircraft power supply. The individual circuits are protected by push-to-reset circuit breakers, mounted on circuit breaker panels located on number 1 Training Aid Panel. Lights considered essential to aircraft safety are supplied from the emergency bus, and the remaining circuits except the cabin dome light, are supplied from the main bus. The cabin dome light is supplied from the battery bus. An emergency lighting system, which operates independently of the aircraft electrical system, is provided to illuminate the aircraft exits in the event of a complete electrical failure.

2.4.2. Interior Lighting General.

The interior lighting system comprises ramp loading light, rear entrance light, flight compartment lower entrance light, pilot's utility light, flight compartment come light, cabin dome lights, and passenger warning sign lights. The ramp loading light, rear entrance light, passenger warning sign lights and cabin dome lights, are supplied from the main bus, the pilot utility light is supplied from the emergency bus, and the flight compartment dome light is supplied from the battery bus.

2.4.3. Ramp Loading Light.

The ramp loading light is mounted on number 3 training aid panel. This is a clear spotlight, which can be changed to red by a mechanical shutter, operated by a lever on the front of the lamp housing. The light assembly box is attached to a pivot shaft, which is inserted into a groove on the pivot shaft. The light assembly can be pivoted downwards and sideways or it can be removed from the bracket and used as a hand held lamp. The ramp loading light switch is mounted on the side of the light assembly. A coiled cable 50 inches long is attached to the lamp. The circuit is protected by a 5 amp circuit breaker marked CARGO, which also protects the rear entrance light,

and is supplied from the main bus. (On the AC-1 Caribou aircraft the light is mounted in a recess in the cabin roof near the left passenger entrance door).

2.4.4. Rear Entrance Light.

The rear entrance light is a flush-mounted dome light, mounted in the cabin roof between the two passenger doors and depicted by a white press to test light on the aircraft silhouette on Number 3 training aid panel. The light is controlled by a toggle switch, marked REAR ENTRANCE LIGHT, on the rear control panel, mounted on Number 5 training aid panel. The light fixture is identical with the cabin dome lights but only the clear bulb is connected. The circuit is protected by a 5 amp circuit breaker marked CARGO, which also protects the ramp loading light, and is supplied from the main bus.

2.4.5. Utility Lights.

Three utility lights are provided, one each for pilot and co-pilot, in the flight compartment, and one for the radio equipment rack. Only one is fitted on the training aid and this is located on Number 1 panel. The light is fixed to the mounting bracket by a ball and spring fixture which engages a groove in a shaft attached to the light assembly. When required for use, the light is pulled from the mounting brackets, and a flexible coiled cable permits movement to the desired position. The front section of the light assembly can be rotated to four positions, to give spotlight of diffused light in either of two colours. A spring catch on the side of the light must be pulled back to change from red to amber, but the spring catch is automatically overridden to change from amber to red. The light intensity is controlled by a rheostat marked OFF-DIM-BRIGHT on the rear of the light assembly. A push-button on the rear of the light assembly permits momentary operation. The utility light is supplied from the emergency bus via a 5 amp circuit breaker marked UTILITY LIGHTS. This circuit breaker also protects the flight compartment lower entrance light.

2.4.6. Flight Compartment Lower Entrance Light.

The flight compartment lower entrance light is a red-coloured light, located on Number 5 training aid panel. A microswitch, located on the lower hatch door, is actuated when the hatch door is open and switches the light on. The circuit is protected by a 5 amp circuit breaker marked UTILITY LIGHTS, which also protects the

utility light, and is supplied from the emergency bus. The entrance light is switched off by the microswitch when the lower hatch door is closed.

2.4.7. Flight Compartment Dome Light & Cabin Dome Lights

The flight compartment dome light is flush mounted on the center panel of number 1 training aid panel. The dome light contains a red and a clear bulb within a single enclosure. The bulbs are selected and operated by a three position toggle switch marked WHITE-OFF-RED, located beside the light. The WHITE position is guarded. The circuit is protected by a 5 amp push-to-reset circuit breaker marked COCKPIT LIGHTS and is supplied from the battery bus.

Seven cabin dome lights are provided in two rows on either side of the monorail in the cabin roof, and are shown on the Number 3 Training Aid Panel as white lights on the aircraft silhouette and one dome light mounted on top of the panel. The dome light contains a red and a clear lamp in a single enclosure. The lamps are selected and operated by a three position toggle switch marked CABIN LIGHTS, WHT-OFF-RED, mounted on the cabin lights switch panel on the bottom of the circuit breaker panel on the Number 1 Training Aid Panel. The WHT position is guarded. The circuit is protected by a 15 amp circuit breaker, marked CABIN LIGHTS, which also protects the passenger warning sign lights, and is supplied from the main bus.

2.4.8. Passenger Warning Sign Lights.

A red warning sign reading NO SMOKING and FASTEN BELTS is mounted on the top of Number 3 Training Aid Panel. The sign consists of a fiberglass box assembly divided by a partition in the center. Each half contains five lamps connected in parallel and mounted in bayonet holders which are screwed to the box assembly. The front face of each half of the box assembly is fitted with a translucent insert, through which the lamps illuminate the signs. The lights are controlled by switches marked NO SMOKING and FASTEN BELTS, respectively, located on the cabin lights switch panel assembly on No.1 Training Aid Panel. The circuit is protected by a 15 amp circuit breaker marked CABIN LIGHTS, which also protects the cabin dome lights circuit, and is supplied from the main bus.

2.4.9. External Lighting

The external lighting system comprises navigation

lights, ice inspection lights, anti-collision lights, landing lights, and taxiing light. All lights are supplied from the main bus via push-to-reset circuit breaker panel. The navigation lights, ice inspection lights and anti-collision lights are controlled by switches on the electrical switch panel, the taxiing light and the landing lights from switches on the center panel on Number 1 Training Aid Panel.

2.4.10. Navigation Lights.

The navigation lights are the conventional red, green and white lights located on wing tips and tail on the aircraft silhouette on Number 3 Training Aid Panel. The lights are operated by an ON-OFF TOGGLE SWITCH MARKED WING & TAIL located to the right of the electrical switch panel. The circuit is protected by a 5 amp circuit breaker marked WING & TAIL and is supplied from the main bus.

2.4.11. Ice Inspection Lights.

Ice Inspection lights are mounted on the outboard side of each engine top cowl. The lights are the sealed-beam type and are adjusted to shine along the leading-edge of the wings to inspect for icing. These are simulated by two white lights on the aircraft silhouette on Number 3 panel. The lights are controlled by a toggle switch marked WING INSPECT LIGHT SWITCH located on the electrical switch panel on Number 1 Training Aid Panel. The circuit is protected by a push-to-reset circuit breaker marked WING INSPECT LT and supplied from the main bus.

2.4.12. Anti-Collision Lights.

Two anti-collision lights are provided, one on the underside of the fuselage and one on the top of the rudder. Each light assembly contains two lamps. The lights are rotating red beacons, each of which is rotated by a 28 volt dc motor, mounted within the light housing. Both beacon lights and motors are actuated by an ON-OFF toggle switch, marked ANTI-AOLL, located ro the right of the electrical switch panel. The circuits are protected by two 5 amp circuit breakers marked ANTI COLL LIGHT UPPER and ANTI COLL LIGHT LOWER, respectively and are supplied from the main bus. The position of these lights are shown by two red lights on the aircraft silhouette and one anti-collision light is mounted on Number 3 Training Aid Panel.

2.4.13. Landing Light.

A 250 watt sealed-beam landing light is mounted on Number 3 Training Aid Panel, and the location of the landing light is shown by two white lights near the leading edge of the wings of the aircraft silhouette. The lights are operated by two T handle ON-OFF toggle switches on the center panel on Number 1 Training Aid Panel. The landing light circuits are protected by two 10 amp push-to-reset circuit breakers marked LANDING LIGHT LEFT and LANDING LIGHT RIGHT, respectively. The landing light switches complete the ground return to the coils of left and right hand landing light relays mounted in Number 2 junction box, which complete the supply to the landing light filaments. The circuits are supplied from the main bus.

CAUTION:-

The landing light should only be switched on for very short periods due to heating.

2.4.14. Taxiing Light.

The Taxiing light is a sealed-beam light mounted to a bracket attached to the top of Number 3 Training Aid Panel. The light is controlled by an OFF-ON toggle switch marked TAXI LIGHT, located on the centre panel of Number 1 Training Aid Panel. The location of this light is shown by a white light on the aircraft silhouette. The circuit is protected by a 7 amp push-to-reset circuit breaker, marked TAXI LIGHT, and is supplied from the main bus.

2.4.15. Panel and Warning Lights.

Eyebrow lighting is provided to illuminate pilot's and co-pilot's flight instruments and engine instruments; Edge lighting is provided to illuminate all switch panels and consoles, and panel lights are provided in warning and indication circuits. The various panel and console lighting systems are simulated by six eyebrow lights with illuminating labels denoting which system is being controlled. These are located on the centre panel of Number 1 Training Aid Panel. The intensity of the eye-brow lighting and edge lighting is controlled by four panel lights rheostat switches on the electrical switch panel, each having a range marked OFF to BRT. The panel light rheostat switches are marked, Pilot & ENGINE, SW. EMERG & UPPER, RADIO CONSOLE, and CO-PILOT, respectively. The intensity of the warning and indication panel lights is controlled through a system of dimming relays. The circuits controlled by the four rheostat switches are protected by four 3 amp push-to-reset circuit breakers, marked to correlate with the panel lights

rheostat switch markings, and supplied by the main bus. The PILOT & ENGINE PANEL LIGHTS rheostat switch, controls edge lighting of the engine switch panel (not shown on Training Aid)electrical power panel, dc voltmeter panel, and fuel panel; and eyebrow lighting of the pilot's flight instrument panel, engine instrument panel, fuel panel, the LH pylon, and the de-icing panel. The magnetic standby compass light is also controlled by this rheostat switch when the standby compass emergency and FLIGHR INST LT SW on the electrical switch panel is selected to the NORM position. The SW EMERG & UPPER panel lights rheostat switch, controls edge-lighting of the electrical switch panel, overhead console, and emergency panel. The RADIO CONSOLE panel lights rheostat switch controls edge lighting of all radio control panels in the sliding console. The CO-PILOT panel lights rheostat switch controls eyebrow lighting of the co-pilot's flight instrument panel.

2.4.16. Rear Control Panel Lighting.

Two panels marked REAR CONTROL PANEL and INT CARGO DOOR CONT PNL are mounted together on Number 5 Training Aid Panel. Each of these panels is lighted by two edge lights controlled by a panel lights rheostat switch on the rear control panel similar to those on the electrical switch panel. The circuit is protected by a 3 amp push-to-reset circuit breaker marked REAR CONTROL LIGHT, supplied from the main bus.

2.4.17. Panel Lights Rheostat Switches

Rheostat switches are provided on the electrical switch panel and on the rear control panel, to control the intensity of panel lighting. The panels are illuminated by edge-lights and incorporate a facing panel, which is a plastic panel, painted matt black except where it is desired to permit light to show through. The facing panel is attached to a metal backing panel to which the rheostat switches are mounted. It is necessary to remove the facing panel to gain access to remove the rheostat switches and other panel mounted units.

2.4.18. Eyebrow Lighting Fixtures

Eyebrow lighting fixtures are fitted to the centre panel of the Number 1 Training Aid Panel and are labelled to show which instrument lighting system they represent. The fixtures consist of a rear plate and a hinged cover plate. The rear plate holds two red lamps which are fixed to a hinged contact at one end, and clipped into position by spring contacts at the other end. The rear plate is attached to the instrument panel by two of

the instrument mounting screws which are hidden when the lights are in place. A cable attached to the lights is fed through a hole above the instrument to a connecting terminal strip behind the instrument panel. The cover plate is hinged to the sides of the rear plate and clipped to the top, so that light is reflected downwards onto the face of the instrument.

2.4.19. Edge Lights

Edge lights procide soft diffused lighting of control panel markings; an edge light assembly consists of a rear portion which is mounted on the panel, and a lens cap assembly, which holds the lamp and screws into the rear portion. A control panel to which edge lighting is fitted, consists of a facing panel and a backing panel. The facing panel is of plastic material, painted matt black except where it is desired to permit light to show through. This is attached by screws to the metal backing panel to which the edge-lights are mounted.

2.4.20. Warning and Indication Panel Lights

Warning and indication panel lights are provided with or without a press-to-test facility and may be amber, red, or green coloured according to the requirement of the system in which they are used. The light assembly consists of a lamp holder which is attached to the panel, and a lens cap which screws into the holder. The lamp is held in place against a spring contact in the holder by the lens cap.

2.4.21. Warning Lights Intensity Switch & Dimming Relays

All panel warning lights, except those used for engine fire warning and propeller feathering are controlled by a toggle switch marked WARM LT DIM SW on the electrical switch panel. The toggle switch is marked DIM-BRT, providing two intensities of lighting. The dimming circuits are energized through a dimming control relay in Number 2 junction box, which controls six dimming relays plugged into receptacles on the side of Number 2 junction box. The relays are supplied from the main bus via a 5 amp circuit breaker marked WARM LT DIM RLY. When the relays are de-energized, resistors are inserted in the circuit to dim the light. The resistors are short-circuited by the relay contacts when the relays are energized so that the lights glow with full intensity. The relays are de-energized when the power source is switched off, and the warning lights will be bright when the power source

is switched on again, regardless of the setting of the DIM-BRT switch. To dim the lights it is then necessary to recycle the dimming relays by switching to BRT and then back to DIM.

2.4.22. Doors Unlocked Light

A press-to-test, amber-coloured, panel warning light, marked DOORS UNLOCKED, is located on the emergency panel. The light will come on if the flight compartment lower entrance hatch, the passenger doors, the cargo doors, or the ramp door are not closed and locked. The intensity of the light is controlled by the WARM LT DIM SW on the electrical switch panel. The circuit is protected by a 5 amp circuit breaker marked DOORS WARN and is supplied from the battery bus. If any of the above mentioned doors are open, a ground return to the warning lamp is completed via the normally closed contacts of a microswitch, actuated when the door is open, and the light will come on.

2.4.23. Standby Compass Light

The standby compass light is an edge-light type, integral with the standby compass. The light is controlled by a toggle switch, marked COMPASS LT SW with positions marked NORM and EMERG located on the electrical switch panel. When selected to the NORM position the compass light is controlled by the PILOT & ENGINE panel light rheostat switch on the electrical switch panel, supplied by the main bus, and protected by the 3 amp PILOT & ENGINE circuit breaker. When selected on the EMERG position the compass light is supplied from the emergency bus and protected by a 3 amp circuit breaker, marked STD-BY COMPASS LIGHT.

2.4.24. Emergency Lighting System

An emergency lighting system, operating independently of the aircraft electrical system is provided to illuminate the aircraft exits in the event of complete electrical failure. The system consists of a control unit, which contains a battery and an intertia switch, and white exit lights beamed at the flight compartment ditching hatch, cabin emergency door, the passenger doors and the cargo ramp. These locations are shown by white lights on the aircraft silhouette on Number 3 Training Aid Panel. The system is normally controlled by a guarded EXIT LTS toggle switch on the cabin lights switch panel on Number 1 Training Aid Panel

but the inertia switch in the control unit operates automatically on crash-landing to switch on the exit lights. The control unit is mounted on Number 3 Training Aid Panel. In addition to the inertia switch and the 6.6 volt, 4 ampere-hour, sealed nickel-cadnium battery, the control unit contains a terminal strip to which the exit light cables are connected. The battery will operate the light for at least one hour.

2.4.25. Emergency Light Battery

The battery should be regularly checked and should be regarded as discharged if the voltage reads below 6.3 volts. It should be recharged at a constant current of 300 milliamps for a period of 15 to 17 hours. The temperature of the battery will remain constant until fully charged and then increase. This increase indicates that the battery is charged. Immediately after charging, the battery voltage will read 7.15 to 7.25 volts, but will stabilize and decrease to 6.6 volts (1.32 volts per cell) within two or three hours.

2.4.26. Utility Receptacles.

The Training Aid is provided with two utility receptacles on Number 1 panel and one on the rear control panel on Number 5 Training Aid Panel. The receptacles are marked UTILITY OUTLET -24 volts DC and are covered by a screw cap, which has a safety chain attached. The circuits are protected by two push-to-reset circuit breakers marked UTILITY RECEPTACLES FRONT and REAR respectively. The REAR circuit breaker (20 amp) protects the circuits of the rear control panel utility receptacles, and is supplied from the secondary bus. The FRONT (10 amp) circuit breaker protects the flight compartment utility receptacles on Number 1 panel and is supplied from the main bus.

2.4.27. Emergency Alarm System

An alarm bell is provided for emergency purposes. The system is controlled by a guarded ON/OFF switch, on the circuit breaker panel, marked EMERG ALARM on Number 1 Training Aid Panel. The circuit is protected by a 3 amp circuit breaker marked EMERG ALARM and is supplied by the emergency bus. The bell is mounted on Number 3 Training Aid Panel.

2.4.28. Pitot-head & Stall Warning Lift Transducer Heaters

Six pitot heads and two stall warning lift transducers are fitted to the aircraft. All incorporate electrical heating elements which are simulated by amber lights on the aircraft silhouette on Number 3 panel and are controlled by the pitot heater switch on the deicing panel. The power supply is fed through two relays marked RIGHT PITOT RELAY and LEFT PITOT RELAY, located in Number 2 junction box. The pitot heater switch completes a ground return to the relay coils, which are supplied from the emergency bus via 15 amp circuit breakers marked PITOT INST RIGHT and PITOT INST LEFT. The heater inlet duct anti-icing system is also supplied via these circuit breakers. Separate pitotheads are provided for the pilot's and co-pilot's instruments. These are located one on each side of the aircraft nose. The circuit to the right-hand pitot-head heater is supplied from the emergency box via the PITOT INST RIGHT circuit breaker, through the contacts of the right pitot relay, and grounded at the right pitot-head. From the same relay contacts, a circuit is taken to the 24 volt heating element in the right-hand stall warning lift transducer located in the right wing. The circuit to the left-hand pitot-head heater is supplied from the emergency bus, via the PITOT INST LEFT circuit breaker, through the contacts of the left pitot relay, and grounded at the left pitot-head. From the same relay contacts, a circuit is taken to the 24 volt heating element in the left-hand stall warning lift transducer located in the left wing. Four pitot-heads, each of which incorporates a 12 volt heater, are provided one on each side of the top and bottom cowling on each engine which are simulated by amber lights with 12 volt bulbs on the aircraft silhouette on Number 3 panel. The outer pitot-head heaters are connected in series. The circuit to the outer heaters is supplied from the secondary bus via the 10 amp PITOT ENGINE OUTER circuit breaker. The circuit is fed via contacts on the left pitot relay through the left hand outer pitot-head heater to the right hand outer pitot-head light, and grounded at the right-hand outer pitot-head light. The circuit to the inner heaters is supplied from the secondary bus via the 10 amp PITOT ENGINE INNER circuit breaker. The circuit is fed via contacts on the right pitot relay, through the left hand pitot-head light to the right-hand inner pitot-head light, and grounded at the right-hand inner pitot-head light.

2.4.29. Junction Boxes & Junction Panels

Junction boxes and junction panels are fitted to Number 1 and 2 Training Aid Panels to interconnect electrical systems and power supplied and to mount switching components and relays associated with the systems. Plug-in cable connectors are fitted to the junction boxes and panels, to facilitate equipment removal and to route cable assemblies through the boxes. Terminal strips are mounted inside the boxes and panels for interconnecting the cables. The terminal strips are numbered, and the terminals on each strip are numbered. This method of identification enables the terminals, referenced on the wiring diagrams, to be easily located by giving the strip number and the terminal number as a reference, i.e:- 2-3 denotes terminal strip 2 terminal 3. If more than four connections are required at one point, two or more terminals are joined together to form a bus.

2.4.30. Number 1 Junction Box

Number 1 junction box is mounted on Number 1 Training Aid Panel. The junction box contains the external power relay, propeller feathering relays, both generator relays, ground fault transformers, and starter relays and inter-connection to Number 2 junction box.

2.4.31. Number 2 Junction Box

Number 2 junction box is the main electrical junction box, and contains the main secondary, emergency bus-bar, current limiters, dimming relays, landing light relays, cargo door relay, auxiliary fuel boost pump relays, pitot-head heater relays, bus control relays, stall warning relays, landing gear control relay, automatic propeller feathering blocking relay, and ground test relay; in addition to terminal strips and plug-in cable connectors. The junction bix is located on Number 1 Training Aid Panel adjacent to Number 1 junction box. The dimming relays are plugged into receptacles on the side of the junction box, and the remaining relays are mounted on a platform which is attached to brackets and fitted over the terminal strips. The platform is hinged at the forward end and swings downwards to provide access to the terminal strips, and to facilitate removal of components.

2.4.32. Number 4 Junction Box.

Number 4 junction box is mounted on Number 2 Training Aid Panel. It inter-connects the windshield heat system components, and houses the windshield heat control relay.

2.4.33. Number 6 Junction Box

Number 6 Junction box houses main and standby inverter relays, and inverter changeover relay. The panel is mounted on Number 2 Training Aid Panel.

2.4.34. Number 9 Junction Box

Number 9 junction box is located on Number 2 Training Aid Panel and interconnects electrical components in the rear section of the fuselage as represented by Number 5 Training Aid Panel. It contains cargo doors open and close relays, ramp door open and close relays, and terminal strips.

2.4.35. Number 10 Junction Box

Number 10 junction box is located on Number 2 Training Aid Panel. It contains terminal strips used for interconnection of AC supplies, the 115/26 volt instrument transformer, and the AC main and AC instrument buses.

2.4.36. Firewall Junction Boxes

One firewall junction box is provided and is located on Number 2 Training Aid Panel. This junction box interconnects generator and starter circuits and houses ground fault transformers and ammeter shunts.

2.5. Starter - Primer - Vibrator

2.5.1. The starter, primer and vibrator systems are controlled by three spring-loaded-to-off double throw switches located on the engine switch panel on Number 1 Training Aid Panel. These switches are pressed to the right for the right engine system and to the left for the left engine.

2.5.2. The starter, primer and vibrator are simulated by lights on the engine and center wing section silhouette on Number 4 Training Aid Panel. Example: When the starter switch is pressed to the left the light simulating the left engine starter will illuminate, showing the approximate location of the starter on the aircraft and that the starter circuit is activated.

2.5.3. Right and left starters, primers and vibrators are illustrated in the same manner.

2.6. Fuel Oil & Hydraulic Pressure Warning Systems

As there are no Fuel Oil & Hydraulic systems on this training aid, these systems are actuated by push buttons located in the appropriate positions on the Engine and center wing section silhouette on Number 4 Training Aid Panel. The power for these systems is obtained from the main bus.

2.6.1. Fuel Pressure Warning

To simulate low fuel pressure press push button labelled Fuel Warning on the center section silhouette on Number 4 Training Aid Panel. This will illuminate the appropriate fuel pressure warning light on the fuel management panel on Number 1 Training Aid Panel, showing the fuel pressure has dropped below 15 p.s.i.

2.6.2. Oil Pressure Warning

To simulate low oil pressure press push button labelled Oil Pressure Warning on the center section silhouette on Number 4 Training Aid Panel. This will illuminate the appropriate oil pressure warning light, on the center panel of the Number 1 Training Aid Panel showing the oil pressure has dropped below 45 p.s.i.

2.6.3. Hydraulic Pressure Warning

To simulate low hydraulic pressure press push button labelled Hydraulic Low Pressure on center section silhouette. This will illuminate the appropriate hydraulic low pressure warning light on the center panel of the Number 1 Training Aid Panel, showing that the Hydraulic pressure has dropped below 1100 p.s.i.

2.7. Windshield Wipers

The windshield wipers are operated by 28 volt DC obtained from the main bus through a 10 amp circuit breaker on the circuit breaker panel. The rotary type control switch is located on the switch panel on the Number 1 Training Aid Panel. A set of windshield wiper equipment is mounted on Number 3 Training Aid Panel.

2.7.1. Windshield Wiper Switch

The windshield wiper switch is located on the switch panel on Number 1 Training Aid Panel labelled WIPER. It is a 6 position rotary switch marked PARK OFF FAST 3/4 1/2 and SLOW. To park wiper it is necessary to hold the switch in the PARK position; when released the switch will return to OFF as it is spring loaded between these two positions.

NOTE:-

If the switch is held in the PARK position for a prolonged period, the wiper will start to oscillate.

2.7.2. Windshield Wiper

Mounted on Number 3 Training Aid Panel is a set of windshield wiper equipment consisting of Motor, Resistor, Torque converter, and Arm. This system will operate in the normal manner when controlled by the windshield wiper switch, on the switch panel on Number 1 Training Aid Panel.

NOTE:-

The aircraft system will have two interconnected torque converters, driven by the one motor. The wiper blade is not shown on this training aid.

2.8. Windshield Heaters

The AC-1 Caribou windshields are heated for defrosting and birdproofing by two laminated transparent panels powered by two static AC inverters. As it is not practical to show these items, they are simulated by lights and dummy inverters on this training aid, to demonstrate the operation and failure procedures of the system. Power is supplied from the secondary bus through two 5 amp circuit breakers. (on the aircraft the system is protected by two 70 amp circuit breakers).

2.8.1. Windshields

The electrically-heated windshield panels are simulated by two white lights in the appropriate positions on the aircraft silhouette on Number 3 Training Aid Panel, and will be illuminated when the windshield heat is switched ON.

2.8.2. Windshield Inverters

The windshield heat power supply is simulated by two dummy static AC inverters mounted on Number 2 Training Aid Panel. These have been wired in such a way so to simulate normal operation.

2.8.3. Windshield Heat Switch

The windshield heat switch is grouped with the windshield wiper switch on the switch panel under the heading WINDSCREEN. The switch is labelled HEAT and has three marked positions:- NORM OFF and EMERG.

2.8.4. Windshield Power Failure Lights

Two windshield power failure lights are mounted on the center switch panel below the heater switch and are labelled FAILUE PILOTS COPILOTS. Illumination of either light indicates failure of the respective windshield inverter.

2.8.5. Operation of Windshield Heat System

To operate the windshield heat the switch is set to normal. This will switch on both windshields (simulated by white lights on aircraft silhouette). In the event of power failure to the pilot's windshield as indicated by the pilot's windshield power failure light, the switch should be turned to emergency. The pilot's windshield will then be supplied from the co-pilot's power source, and the co-pilot's windshield will cease to operate.

If both power supplies should fail this will be indicated by the illumination of both power failure warning lights.

2.9. Engine Fire Detection & Extinguisher System

Fire detection for the engines consists of four Fenwal Continuous Fire Detection systems covering three zones on each engine. Zone One is the area in front of the auxiliary firewall, and is covered by one detection system. Zone Two and Three is the auxiliary compartment behind the auxiliary firewall, and the wheel well behind the main firewall. This also is covered by one detection system. The engine fire warning lights are located on the emergency panel, on Number 1 Training Aid Panel.

Zone One area is indicated by a red light labelled ZONE ONE. Zone Two and Three fire warning is indicated by red lights located in the Tee handle of the fire extinguisher control labelled ZONE 2 and 3. The fire extinguisher control handles control the "double shot" extinguisher system.

As all four fire detections systems are electrically identical only one complete system is installed on this training aid. This is connected to Zones Two and Three of the left hand side. However all fire warning lights are wired to illuminate when the fire warning test switch is pressed.

2.9.1. Detector Element

The fire detector element is fitted to the Number 4 Training Aid Panel and a section of it is routed in the approximate area of Zones Two and Three on the engine and center section silhouette.

2.9.2. Control Unit

The Magnetic Amplifier Control Unit is mounted over the engine switch panel on Number 1 Training Aid Panel.

2.9.3. Test Switch

The test switch is located in the lower center of the emergency panel. It is a single throw switch spring loaded to the OFF position.

2.9.4. Operation of Fire Warning System

For the fire detection system operation AC power is required. The AC switch on the electrical control panel must be placed to MAIN or STANDBY position. The circuit is protected by a 2 amp fuse, located on the circuit breaker panel on Number 1 Training Aid Panel and labelled ENGINE FIRE DETECTOR.

To test the system, press the FIRE DETECTION TEST switch located on the emergency panel to test. All engine fire zone detector lights will illuminate.

NOTE:-

As there is only one complete fire detection system installed on this training aid, only the left hand Zone Two and Three will operate in the normal manner, i.e:- The AC system has to be switched on before the fire warning light will illuminate when the test switch is pressed. The other fire zone warning lights will illuminate with DC only, and their purpose is to show the location of the warning lights.

2.9.5. Fire Extinguisher System

The fire extinguisher system is of the "two shot" type. Each extinguisher is simulated by two lights located on the engine and wing center section silhouette on Number 4 Training Aid Panel. The lights are labelled FIRE EXTINGUISHER 1st SHOT and 2nd SHOT

2.9.6. Fire Extinguisher Controls

The fire extinguishers are controlled by two tee handles engraved with FIRE PULL, located on the Emergency Panel on Number 1 Training Aid Panel. The handles are illuminated by the Zone Two and Three fire warning lights. These handles when operated actuate two micro switches which select 1st and 2nd extinguisher shots into Zones Two and Three for the side on which the handle is situated. By pulling a control straight out, the extinguisher of the side pulled discharges in Zone Two and Three, of that side. For a second shot, push the control handle in, turn handle 90° counter-clockwise and pull out. This will discharge the extinguisher from the opposite side into the Zones Two and Three, of the side on which the handle is situated.

2.10. Landing Gear

The landing gear is simulated by a hand operated model on Number 5 Training Aid Panel, and a landing gear selector handle on the center panel on Number 1 Training Aid Panel. Its purpose is to demonstrate the electrical functions of the landing gear selector and the safety and indicator circuits.

2.10.1. Landing Gear Selector

The landing gear selector is mounted on the center panel of Number 1 Training Aid Panel. It is the standard aircraft handle with a translucent plastic knob, which houses the gear "in transit" warning light.

2.10.2. Landing Gear Hydraulic Selector

The landing gear hydraulic selector is simulated by two lights on Number 5 Training Aid Panel. The lights are labelled LANDING GEAR, UP and DOWN.'

2.10.3. Landing Gear

The landing gear is a hand-operated model showing the two main and nose landing gears, complete with microswitches, to represent the weight switches, up lock switches and down lock switches.

To simulate weight on and off the wheels, a platform beneath the wheels is raised or lowered. The shortening mechanism on the main landing gear is also fully illustrated.

2.10.4. Warning Horn

The landing gear warning horn is mounted over the engine switch panel on Number 1 Training Aid Panel.

2.10.5. Throttle Levers

Two throttle levers are mounted on the center panel of Number 1 Training Aid Panel. These levers actuate the micro switches which activate the landing gear up warning horn, and selector handle warning light circuits.

2.10.6. Landing Gear Down & Locked Lights

Three green "press-to-test" lights, mounted on the main switch panel on the Number 1 Training Aid Panel, when illuminated indicate the landing gear is down and locked.

2.10.7. Landing Gear Sequence of Operation

Place the landing gear selector handle and the hand-operated landing gear model in the down position. The weight-on-wheels platform in the up position and the throttle levers in the closed position. The three landing gear LOCKED DOWN lights will be illuminated.

Move the landing gear selector handle to the Up position, the warning light in the handle will illuminate. The Up light in the hydraulic selector will not light.

Move the weight-on-wheels platform to the down position, the Up light in the hydraulic selector will illuminate.

Move the throttle levers to OPEN, and move the hand-operated landing gear partly up. The LOCKED DOWN lights will be extinguished. The warning light in the selector handle will be illuminated. Move the hand-operated landing gear to the fully up and locked position. The warning light in the landing gear selector, and hydraulic selector will be extinguished.

At this stage the landing gear is fully up and locked. Move back throttles to the CLOSED position, the warning horn will sound and the warning light in the landing gear selector handle will illuminate. Move one throttle to OPEN the warning horn will stop sounding and the selector lever warning light will go out. This will demonstrate that the throttle micro-switches are wired in series and that both throttles have to be closed to cause the warning horn to sound, when the landing gear is up. Move back throttles in the OPEN position. Select the landing gear DOWN. The selector handle warning light and the down light on the hydraulic selector will illuminate. Move the hand-operated landing gear to the fully down position, the three landing gear LOCKED DOWN lights will illuminate. The selector handle warning light and the hydraulic selector light will go out. Move the weight-on-wheels platform up.

2.10.8. Nose Wheel Steering

The nose wheel steering on the AC-1 is hydraulically operated and electrically selected. The system is simulated on this training aid by a switch marked NOSE WHEEL STEERING mounted on the center panel of the Number 1 Training Aid Panel, and a light on Number 5 Training Aid Panel represents the nose wheel steering hydraulic selector valve.

2.10.9. Nose Wheel Steering Sequence of Operation

With the model landing gear down and the weight-on-wheels platform in the up position, select nose wheel steering by placing Nose Wheel Steering switch on the center panel of Number 1 Training Aid Panel to ON. The hydraulic selector light will illuminate. Place the weight-on wheels platform in the down position and the light on the hydraulic selector will go out.

This will demonstrate the function of the nose wheel weight switch in relation to the nose wheel steering system. Place the weight-on-wheels platform in the Up position, the light on the hydraulic selector will re-light.

Place the nose wheel steering switch to the OFF position. Hydraulic selector light will extinguish.

2.11. Carburettor Air Actuator

To control the sources of carburettor air, the upper cowling is equipped with two actuators which operate two doors, and these are controlled by a three position switch, which is labelled CARB AIR RAM FILTER ALTERNATE.

A full scale model of a sectioned upper cowling is mounted on Number 4 Training Aid Panel, which shows the operation of the two doors and their sequence of operation. The ram air door has been made of a transparent material so that the operation of the alternate air door can be easily seen.

2.11.1. Carburettor Air Switch

This is a three position switch mounted on the center panel of the Number 1 Training Aid Panel, and is labelled CARB AIR RAM FILTER ALTERNATE.

2.11.2. Carburettor Air Actuators & Door Mechanism

A sectioned model of the upper engine cowling shows in actual size and arrangement the two actuators and the two doors. One actuator operates the ram air door and the other the alternate air door. The operation of the alternate air door can be seen through the transparent ram air door. The filters are shown by arrows pointing in the direction of the filter in the openings labelled Oil Cooler Air.

2.11.3. Carburettor Air Door Sequence of Operation

Place the three position Carburettor Air Switch on Number 1 Training Aid Panel to RAM. Ram air door on model on Number 4 Training Aid Panel will open, and the alternate air door will close.

Place switch to ALTERNATE, the alternate air door will open. This can be seen through the transparent ram air door, which will remain closed.

The carburettor will now receive its air supply from inside the cowling in front of the cylinders.

The normal position for this mechanism is in the ram air position.

2.12 Wing & Tail Deicing

Due to the dimensional limitations of this training aid only the electrical section of the wing and tail deicer system is presented.

This consists of the deicing switch panel on Number 1 Training Aid Panel, electronic timer on Number 3 Panel, and blue indicator lights near the leading edge of the aircraft silhouette wing and tail to simulate the deicer boots.

2.12.1. Deicer Switch Panel

The deicer switch panel is located on Number 1 Training Aid, and is labelled DEICING. There are seven switches, five to control the modes and sequences of the wing and tail deicers, one for pitot heat and one for propeller deicing.

2.12.2. Electronic Timer

The electronic timer is mounted on Number 3 Training Aid Panel. Its purpose is to regulate the sequence of operation when the wing and tail deicers are selected to automatic.

2.12.3. Wing & Tail Deicing Sequence of Operation

Place WING & TAIL switch to AUTO. After a 20 second delay for electronic timer warm-up, the lights on the aircraft silhouette labelled deicer combination unit will illuminate, after a further 5 second delay the lights on the leading edge of the wing and test will illuminate in the following sequence:-

1st	Left	&	right	wing	inner	inner	deicer	boots	for	4	seconds.
2nd	"	"	"	"	inner	outer	"	"	"	4	"
3rd	"	"	"	"	outer	inner	"	"	"	4	"
4th	"	"	"	"	outer	outer	"	"	"	4	"
5th	Stabilizer				inner		"	"	"	4	"
6th	"				outer		"	"	"	4	"

Before the above sequence repeats there will be a dwell period of 31 seconds if the FAST SLOW switch is in the FAST POSITION, and a dwell of 211 seconds for SLOW position selector.

Total time for FAST (heavy icing) cycle is 60 seconds
" " " SLOW (light icing) " " 240 "

When wing and tail switch is moved from AUTO to OFF, the electronic timer will automatically recycle itself and thus will always start in the sequence mentioned above.

Place the WING AND TAIL deicing switch to MANUAL.

The deicer boots can now be operated manually by moving the three spring-loaded-to-OFF Switches on the deicer switch panel, UP for all inner sections of the deicer boots, or DOWN for all outer section of the deicer boots, as indicated by the blue indicator lights on the aircraft silhouette on Number 3 Training Aid Panel.

2.13 Propeller De-icing

Propeller de-icing is simulated on this training aid by blue lights located in the approximate position of the de-icer fluid pumps on the aircraft silhouette on Number 3 Training Aid Panel.

Place the propeller de-icer switch to ON.

The lights simulating the propeller deicer fluid pumps and labelled PROP DEICER located on the aircraft silhouette will illuminate.

2.14. Aileron Trim Actuator & Indicator

The aileron trim system is presented in full showing the pilot's trim button, on the dummy control wheel, and the aileron trim position indicator mounted on the center panel of the Number 1 Training Aid Panel. The aileron trim actuator and position indicator transmitter are mounted on Number 3 Training Aid Panel and are connected by push-rods to a dummy trim tab.

2.14.1. Aileron Trim Switch

The aileron trim switch is located in the left horn of the dummy pilot's control wheel mounted on the Number 1 Training Aid Panel. Its movement is right and left, and spring loaded to the center OFF position.

2.14.2. Aileron Trim Indicator

The aileron trim indicator is mounted on the center panel of the Number 1 Training Aid Panel. It indicates the movement and direction of trim that has been added, in degrees. It is calibrated in four increments to 30°, left and right.

2.14.3. Aileron Trim Tab Actuator

The aileron trim actuator is mounted on Number 3 Training Aid Panel and is interconnected by levers and push rods to the position transmitter and to a dummy trim tab.

It is a limited travel reversible actuator; the travel limits are adjusted by the adjustment screws.

2.14.4. Aileron Trim Tab Position Transmitter

The position transmitter is connected by pushrod to the trim tab actuator, the angular movement of which is then transmitted to the trim tab indicator through the instrument selsyn system.

2.14.5. Aileron Trim Tab Operation

Press trim tab switch on the dummy control wheel to the left, trim actuator will run and dummy tab will go up. Indicator will indicate to the left.

Press trim tab switch to the right, dummy tab will travel down. Indicator will indicate towards the right.

Adjust actuator travel so that indicator indicates equal travel in both directions. Adjustments are made by first centering the actuator travel, then adjust position transmitter and indicator to read zero, by loosening the clamp screw on the transmitter drive shaft, rotating the drive shaft by placing a screw driver in the slotted shaft end, and tightening clamp screw. Adjust for equal travel on the actuator travel limit screws, so that indicator shows equal travel in both directions.

2.15. Stall Warning System

The AC-1 Caribou has three stall warning systems, one lightweight and two heavyweight. The Training Aid will present a single composite system showing one lightweight stall warning system with stickshaker and one heavyweight stall warning system, simulated by a lightweight stickshaker.

The purpose of this composite system is to demonstrate the stall warning systems and components and the different settings of the light and heavy systems.

2.15.1. Stall Warning Lift Transducer

The Lift Transducer is fitted to Number 2 Training Aid Panel and on this panel is lever operated. The 4 gram and 9 gram settings can be shown, one for the lightweight system and the other for the heavyweight system.

2.15.2. Stall Warning Flap Potentiometer

The stall warning flap potentiometer is actuated by lever and push rod from the dummy flap mounted on Number 2 Training Aid Panel. Its purpose is to compensate the stall warning computer for varying flap settings.

2.15.3. Stall Warning Life Computer

The stall warning lift computer is mounted on Number 1 Training Aid Panel. It detects the settings of the lift transducer and the flap potentiometer and computes the information to give warning of an impending stall by activating the stickshakers.

2.15.4. Stick Shaker

Two stick shakers are mounted in two different places on the dummy control wheel mounting panel on Number 1 Training Aid Panel. These are motor-driven eccentrically-weighted flywheels which vibrate the control column when operated. The lightweight unit is mounted horizontally below the wheel. The heavy stickshaker is simulated by the unit mounted vertically above the control wheel. It has a section cut away in the flywheel casing so its operation can be observed.

2.15.5. Test Switch

A stall warning test switch is located on the center panel of Number 1 Training Aid Panel, labelled STALL WARNING, TEST SW LEFT and RIGHT. It is a double throw spring-loaded-to-center-OFF type switch.

2.15.6. Stall Warning Micro Switches

Three micro switches are used in the stall warning system, two in conjunction with the throttle levers and one with the flap. The purpose of these switches is to prevent the heavy stall warning stickshaker from operating with throttles closed (15" hg. Manifold Pressure or less) and with certain flap settings (19° or less).

NOTE:-

One micro switch is used in conjunction with the transducer vane lever, this is a training aid unit and not used in the aircraft installation.

2.15.7. Stall Warning Sequence of Operation

AC power is required for the operation of this system. Place the AC switch in MAIN or STANDBY. Move the stall warning test switch to the right, the lightweight stickshaker will operate. Move test switch to the left, throttles OPEN, flaps to 19° or below. Heavyweight stickshaker will operate. Release switch; stickshaker will stop operating after a second's delay. Place lift transducer operating lever to the 4 grams position, lightweight stickshaker will operate. Move lift transducer operating lever to the 9 grams position. Heavyweight stickshaker, simulated by the small stickshaker with a cutaway case, will operate.

Both stickshakers will stop operation after about a second's delay when the left transducer operating lever is moved to the zero position.

2.16 Propeller Feathering

The AC-1 Caribou is equipped with automatic propeller feathering equipment as a safeguard during engine failure at take-off. It is an integral part of the propeller feathering system, operated by the action of a differential pressure switch, which is connected to the four slipstream thrust pitot heads.

Only the electrical portion of the propeller feathering system is presented on this training aid.

The purpose is to demonstrate the operation and functioning of the feathering and auto feathering system.

2.16.1. Feathering Switch

The feathering switches are located on the emergency switch panel on Number 1 Training Aid Panel.

The two hooded push-pull type switches are labelled FEATHER PUSH-UNFEATHER HOLD IN. The translucent switch handle houses a light which illuminates when the feathering system is in operation.

2.16.2. Differential Pressure Switch

The differential pressure switch is simulated by two mercury switches mounted on a movable beam which is hand operated over two calibrated scales, calibrated in percentage of thrust. This is an integral part of the engine and center section silhouette mounted on Number 4 Training Aid Panel.

2.16.3. Blocking Relay, Auto Feathering Switch & Indicator Light

The blocking relay housed in Number 2 junction box, prevents inadvertent automatic feathering of the two propellers. It is energized through the differential pressure switch, and once energized no further automatic feathering can take place. To clear the relay the auto feathering switch has to be cycled to OFF and back to ON. An auto feathering indicator light is mounted adjacent to the auto feathering switch on the emergency switch panel. It indicates the condition of the blocking relay.

(a) With the auto feathering switch ON and the green warning light illuminated, the auto feathering system is in the "ready" condition.

(b) With the auto feathering switch ON and the green warning light not glowing, the auto feathering switch must be cycled to OFF and back to ON, to clear the blocking relay. Illuminate the indicator light, and return the auto feathering system to the "ready" condition.

2.16.4. Feathering Relays

Two feathering pump relays are located in Number 1 junction box on Number 1 Training Aid Panel.

2.16.5. Feathering Pump

The feathering pumps are simulated by two lights labelled FEATHERING PUMP in the appropriate position on the engine and wing center section silhouette on Number 4 Training Aid Panel.

2.16.6. Governor Pressure Cut-out Switch

The governor pressure cut-out switch is simulated by a push button switch located in the appropriate position on the engine and wing center section silhouette on Number 4 Training Aid Panel.

When pressed, this switch interrupts the feathering holding circuit and releases the feathering button when pressed to FEATHER.

2.16.7. Feathering & Auto Feathering Sequence of Operation

(a) To feather, push feathering switch. Feathering switch handle will illuminate and switch will be held in by the solenoid until the holding circuit is broken by the pressure cut-out switch. This is simulated on the engine and wing center section by a push button switch labelled GOVERNOR PRESS CUT-OUT.

(b) To unfeather, press and hold GOVERNOR PRESS CUT-OUT switch to simulate the governor condition for fully feathered condition.

Press and hold the feathering switch, the handle light will illuminate as long as the switch is held in. Release feathering switch, light in handle will extinguish. Release governor pressure cut-out switch.

NOTE:-

If the governor pressure cut-out switch is released before the

feathering switch, the holding circuit will then hold the feathering switch in. This would be the same condition as holding the feathering switch too long in an unfeathering cycle.

(c) Automatic Feathering

Place the AUTO FEATHER SWITCH to ON. The auto feather warning light will illuminate.

Move the Differential Pressure Switch handle over the calibrated scales until there is a differential of 45% between Right and Left scale. The feathering button of the same side as the lower scale reading will be pulled in by the solenoid and the handle light will illuminate. The auto feathering indicator light will extinguish.

(d) Unfeathering after Automatic Feathering

Unfeathering after automatic feathering is the same as described in sub paragraph (b). However, the auto feather indicator light will remain extinguished after the unfeathering as the blocking relay will be in the condition to prevent any further automatic feathering until it is reset.

(e) Re-setting the Blocking Relay

To reset the blocking relay move the AUTO FEATHER switch from ON to OFF and back to ON.

The blocking relay will be re-set for automatic feathering as indicated by the illumination of the AUTO FEATHER indicator light.

2.17. Fuel Controls and Low Level Warning

The fuel tank selector is located on the fuel management panel on Number 1 Training Aid Panel. It is a four-position rotary switch marked FUEL SELECTOR. The fuel management panel is diagrammatic of the fuel system, and contains the fuel boost pump switches, low fuel level warning lights and the low fuel pressure warning lights. The fuel selector is connected electrically to two motor-driven selector valves and a motor-driven crossfeed valve. These valves are simulated by three sets of double lights on the engine and wing center section silhouette on Number 4 Training Aid Panel. The low fuel pressure warning system is described in paragraph 2.6.1. of this manual. The low fuel level warning lights are connected to four push buttons labelled low fuel level Cell Number 1 and Cell Number 2 on the engine and wing center section silhouette on Number 4 Training Aid Panel. These push buttons represent the low fuel level thermistors which are normally situated in number 1 and 2 fuel cells. One thermistor is mounted for display purposes on Number 4 Training Aid.

2.17.1. Fuel Tank Selector

The tank selector is a rotary switch having four positions marked OFF, BOTH ON R.H. TANK, NORMAL, and BOTH ON L.H. TANK. A spring-loaded detent must be depressed before the selector can be moved to the OFF position.

2.17.2. Motor-Driven Control Valve

The motor-driven control valves are simulated by two lights, one green for OPEN, one red for CLOSED, and are labelled R.H. TANK CONTROL VALVE, L.H. TANK CONTROL VALVE and CROSSFEED VALVE. These are mounted in the appropriate position on the engine and wing center section silhouette on Number 4 Training Aid Panel.

2.17.3. Fuel Selector Sequence of Operation

(a) With the fuel selector in the OFF position, the two control valves and the crossfeed valve will indicate closed by the illumination of the red (CLOSED) lights, on the engine and wing center section silhouette.

(b) Place the fuel selector to BOTH ON R.H. TANK.

The right hand tank control valve and the crossfeed valve simulator green (OPEN) lights will illuminate. The left

hand tank control valve simulator light will remain red (CLOSED).

(c) Place the fuel selector to NORMAL. Both left hand and right hand tank control valve simulator green (OPEN) lights will illuminate and the crossfeed control valve simulator red (CLOSED) will also illuminate.

(d) Place the fuel selector to BOTH ON L.H. TANK

The left hand tank control valve and the cross-feed valve simulator green (OPEN) lights will illuminate. The right hand tank control valve simulator lights will change from green (OPEN) to red (CLOSED).

2.17.4. Fuel Low Level Warning System

The fuel low level warning lights are situated on the fuel management panel, and are labelled LOW LEVEL. The thermistors are simulated by push buttons mounted in the appropriate positions on the engine and wing center section silhouette on Number 4 Training Aid. There are two thermistors in each tank system, and both have to be exposed (above the fuel) to cause a low level indication; to simulate this condition the push buttons are wired in series and therefore both have to be pressed to illuminate the low level warning light.

2.17.5. Fuel Low Level Warning Sequence of Operation

Press the push button marked CELL NO. 1; the low level warning light will not illuminate. Press the push buttons marked CELL NO. 1 and CELL NO. 2. Fuel low level warning light will illuminate. This sequence will be carried out for both right hand and left hand sides.

2.18. Cargo and Ramp Doors & Door Indicator System

The cargo and ramp doors are the electrically-operated rear facing doors of the aircraft. These are presented in model form, but are actuated by the aircraft door actuating mechanisms. These are mounted on Number 5 Training Aid Panel. The door indicator light is an amber-coloured warning light located on the right hand side of the emergency switch panel, and is labelled DOORS UNLOCKED. This light is switched by micro switches, which are wired in series and connected to all door locks, and will illuminate if one or more doors are not fully closed and locked.

2.18.1. Ramp & Cargo Door Switch Panel

The ramp and cargo doors are operated from a switch panel labelled CARGO DOORS. It contains two double throw switches, spring-loaded to the center OFF position, and two circuit breakers.

The cargo door is operated by the switch in the sub panel, marked CARGO DOOR, with the switch labelled CLOSED and OPEN. The circuit is protected by a 15 amp circuit breaker, located below and to the right of the switch.

The ramp door is operated by the switch in the sub panel marked RAMP DOOR with the switch labelled CLOSED and OPEN. The circuit is protected by a 10 amp circuit breaker, located below and to the right of the switch. The cargo door switch panel is mounted on Number 5 Training Aid Panel.

2.18.2. Cargo Door Master Switch

The cargo door master switch is located on the switch panel beneath the circuit breaker panel on Number 1 Training Aid Panel.

2.18.3. Cargo Door Actuator

The cargo door actuator is mounted on Number 5 Training Aid Panel. This drives the cargo door operating mechanism, and is mechanically connected to operate the cargo door on the model. It also drives the cable which contains the travel limit micro switch actuator.

2.18.4. Ramp Door Actuator

The ramp door actuator and travel limiting micro switch drive mechanism is mounted on Number 5 Training Aid Panel. It is mechanically connected to operate the ramp door of the model.

2.18.5. Sequence of Operation for Ramp & Cargo Doors

(a) Cargo Door

Place the Cargo Door Master switch to the ON position. With the 15 amp circuit breaker IN press CARGO DOOR switch down to OPEN. The actuator will run until cargo door is fully open and the micro switch actuator contacts the doors open travel limit micro switch. Press CARGO DOOR up to CLOSED. The actuator will run until the cargo door is fully closed and the micro switch actuator contacts the door closed travel limit micro switch.

(b) Ramp Door Ground Operation

Place the weight-on-wheels platform in the UP position (weight on wheels).

With the 10 amp circuit breaker IN, press the RAMP DOOR switch down to OPEN. The actuator will run until the ramp door is fully down. This will be to an angle of approximately 45° from the horizontal. The ramp door full open limit micro switch will now be made. Press the RAMP DOOR switch up to CLOSED. The actuator will run until the ramp door is fully closed. The ramp door closed limit and indicator micro switches will not be made.

(c) Ramp Door Flight Operation.

Place the weight -on-wheels platform in the down position (weight off wheels). Press the RAMP DOOR switch down to OPEN. The actuator will run until ramp door is 15° below the horizontal. The ramp door in-flight travel is limited by the operation of the ramp door flight limit micro switch in conjunction with the nose wheel weight switch.

2.18.6. Door Indicator Light Operation

The door indicator light indicates that one or more of the doors are not fully closed and locked.

(a) Close all doors and indicator light will extinguish.

(b) Open flight compartment entrance door. Indicator light will illuminate indicating DOOR UNLOCKED. Close door, indicator light will extinguish.

(c) Open rear passenger door, indicator light will extinguish.

(d) Open cargo door. Indicator light will illuminate indicating DOOR UNLOCKED. Close door, indicator light will extinguish.

(e) Open ramp door, indicator light will illuminate indicating DOOR UNLOCKED. Close door, indicator light will extinguish.

(f) Open all doors, indicator light will illuminate indicating DOOR UNLOCKED. Close all doors indicator light will extinguish.

2.19. Instructor's Control Panel.

2.19.1. General:-

The Instructor's Control Panel is attached to the left edge of the number 1 panel. Mounted on the Instructors Control Panel are the following items:-

Trainer Master ON-OFF Switch.
" " 70 Ampere Circuit Breaker.
" " Power Relay.
Trainer Simulator Light 5 ampere circuit breaker.
13"Simulated Fault" Switches.

2.19.2. Operation:-

Power to the Training Aid is controlled by the Master ON-OFF switch through the adjacent 70 ampere circuit breaker.

With the circuit breaker closed and the Master switch in the ON position, the 28V D.C. from the Type II junction box is fed through the Master Power Relay to the Dummy Battery of the Trainer.

The Training Aid now depicts the Electrical Systems in a completely inactive and de-energized condition. From this point on the Training Aid Electrical systems may be supplied through the Generators, External Power or Dummy Battery.

The Training Aid simulator lights are protected by the 5 ampere circuit breaker for the "press to test" function of these lights.

Mounted above the Master switch are the 13 "Simulate Fault" switches.

NOTE:- The Fault switches must be in the down position when simulated fault conditions are not desired. The Fault switches are numbered 1 to 13 and when selected to up position introduces faults into the respective circuits as follows:-

Switch #1 Right-hand Generator Failure, opens the ground return of the right-hand bus control relay.

Switch #2 Main Inverter, D.C. Power Failure, opens the ground return of the Main inverter relay.

Switch #3 Main Inverter A.C. Power Failure, opens up A phase between Main Inverter change-over relay.

Switch #4 Left Low Fuel Level Warning, activates warning light with fuel selector in NORMAL position.

Switch #5 Left Low Fuel Pressure Warning, activates warning light with left-hand boost pump in high position.

NOTE:- The Fuel Low Level simulator buttons must not be depressed while the fault switch is in UP position, and the left-hand Booster pump switch is in high, as this will cause release of the circuit breaker.

Switch #6 Fire Warning Fault Number 1 activates right-hand zone 2 and 3 warning light when the right-hand Fire Pull handle is in number 1 shot OFF position.

Switch #7 Fire Warning Fault Number 2, activates right-hand zone 2 and 3 warning light when the right-hand Fire Pull handle is in number 2 shot OFF position.

Switch #8 Under-Carriage Weight Switch, breaks 28 volt power supply to the weight switches to prevent UP selection of the gear as simulated by the failure of the green UP light to illuminate.

Switch #9 Under-Carriage Up-Lock, supplies a ground return to landing gear warning light as indicated by the red light in the handle remaining on, after the right-hand gear is in UP and LOCKED position.

Switch #10 Under-Carriage Down-Lock, same as switch #9 except the light is on in DOWN and LOCKED position.

Switch #11 Auto De-Icing, breaks power from auto circuit breaker to De-Icer Timer.

Switch #12 Dimming Relay (#4), opens ground return to Dimming Relay, preventing DIM action.

Switch #13 Windscreen Heat, activates Pilot's failure light when the Windscreen selector is in NORMAL position. Switch to EMERGENCY and warning light will go out as power is supplied from co-pilot's Windscreen Inverter.

The Fault circuits are protected by the circuit breakers of the systems into which they introduce the simulated fault.

PART IV

SECTION III

MAINTENANCE & REPAIR

OF

ELECTRICAL TRAINER

MAINTENANCE & REPAIR

SECTION III

3.1. Maintenance.

3.1.1. Since the electrical panels have very few moving parts or items subject to wear there is very little maintenance required.

3.1.2. The Trainer should be periodically checked as follows:-

(1) Complete trainer for cleanliness.

(2) Cannon plug couplings for security and damage.

(3) Actuators for free and adequate operation.

(4) All lights for serviceability.

(5) All circuits for correct simulated indication.

(6) All brackets and clamps for looseness and damage.

(7) All labels and placards for legibility.

(8) All moving and hinged parts for damage.

(9) All pulleys and cables for damage.

(10) Visible signs of chafing and deterioration of the electrical wiring.

(11) Lubrication of hinges controls etc. where necessary.

3.2. Repair.

3.2.1. No repair is anticipated to the Trainer except for replacement of unserviceable units or damaged electrical wire.

3.2.2. If any touching up is required to the paint, the type used on the Trainer is:- Federal Spec. 512 Grey.

PART IV

SECTION IV

PARTS LIST

FOR

AC - 1

ELECTRICAL SYSTEMS

TRAINER

AC-1 Electrical Systems

Trainer Parts List

Part IV Section IV

4.1. General

	Item	Part Number	Manufacturer	Qty.
(1)	Casters	SCR5-AIR4-AEK-11725	Aerol	12
(2)	Tubing	2.00 x 4.00 Rectangular Aluminum Tubing		A.R.
(3)	Plywood	3/4 Fir - Spec NNP-530		A.R.
(4)	Aluminum Alloy Trim	3/4 x 3/4 Aluminum Alloy Angle		A.R.
(5)	Hinge Installation	C4-G-1355		8
(6)	Wood Screws	10/32 x 3/4 Csk.		A.R.

4.2. Panel 1 (Ref. Drawing C4G-1371)

	Item	Part Number	Manufacturer	Qty.
(1)	Toggle Switches			
a)	Fault Panel	On-Off AN3022-4B		13
b)	Cabin Lights	Three position MS25016-3		4
c)	Landing Light	On-Off AN3022-4B		2
d)	Taxi Light	On-Off AN3021-2		1
e)	Nose wheel Steering	On-Off AN3021-2		1
f)	Carburettor Air	Three position MS25016-3		1
g)	Stall Warning	Three position 406		1
h)	De-icing	On-Off AN3021-2		2
i)	Boost Pump	Three position MS25016-3		2
j)	Oil Dilution	Momentary AN3021-8		2
k)	Battery Master	On-Off AN3021-2		1
l)	Start	Momentary AN3021-8		3
m)	Horn Test	Momentary AN 3021-8		1
n)	Lights	Two position AN 3021-2		1
(2)				
a)	Micro Switches	1 SM-1	Honeywell	A.R.
b)	Actuator	JS-5	Honeywell	A.R.
(3)				
a)	Ignition Switch	10-126600-1	Bendix	1

(4)	Lights			
a)	Dome Light	B-2281B-1-24	Grimes	1
b)	Eyebrow Lights	B-4855	Grimes	8
c)	Indicator Lights			
		Blue VM911M-11A	(Dialco)	A.R.
		Amber MS-25041-8		A.R.
		Red MS-25041-6		A.R.
		White MS-25041-5		A.R.
(5)	Inverter	12142-1A	Bendix	2
(6)	Wheel Assembly	C4-C-10036		1
(7)	Control Shaker	C-72502		2
(8)	Lord Mounts	156 P-16	Lord Mfg. Co.	4
(9)	Panels			
a)	Emergency Switch	C4F-1535-9		1
b)	Volt Amp.	C4-F 1519-17		1
c)	AC-DC	C4F 1532-7		1
d)	De-icing	C4F 10042-3		1
e)	Fuel Selector	C4F 1413-5		1
f)	Centre Switch	C4F 1385-35		1
g)	L.H. Switch	C4F 1543-5		
(10)	Receptacles			
a)	"	SK-L3-32SL		2
b)	"	MS 3100A-28-6S		1
c)	"	MS 3100A-36-7S		1
d)	"	MS 3100E 36-10S		4
e)	"	MS 3100A 22-14S		1
f)	"	MS 3100A 28-21S		1
g)	"	MS 3100A 22-14SW		1
(11)	Plugs			
a)	"	MS 3106B 22-14W		1
b)	"	MS 3106B 22-14P		1
c)	"	MS 3106B 28-21P		1
d)	"	MS 3106B 22-14PW		1
e)	"	MS 3106B 32-6P		1
f)	"	MS 3106B 32-6PW		1
g)	"	MS 3106B 32-7P		1
h)	"	MS 3106B 40-9P		1
i)	"	MS 3106B 28-11P		1
j)	"	MS 3106B 16S-1P		1

(12)	Undercarriage Selector Lever	C4U1514-3		1

4.3. Panel 2 (Ref. Drawing C4G1372)

(1)	Junction boxes			
a)	Number 9	C4E1088-1		1
b)	Number 10	C4E-1090-1		1
c)	Number 4	C4E-1087-3		1
d)	Number 6	C4E-1199-1		1
e)	Firewall	C4E-1094-1		1
(2)	Plugs			
a)	"	MS 3106B 28-11S		1
b)	"	Cannon 11612		1
c)	"	SK L3-		2
d)	"	MS 3106B 28-6P		1
e)	"	MS 3106B 36-7P		1
f)	"	MS 3106 E 36-10P		4
g)	"	MS 3108B 18-1P		2
h)	"	MS 3108B 24-12S		2
i)	"	MS 3108B 12S-3P		
j)	"	MS 3108B 12S-3PX		1
k)	"	MS 25182		1
l)	"	MS 3106B 20-18S		1
m)	"	MS 3106A 16S-1P		1
n)	"	MS 3106B 20-18S		1
o)	"	MS 3106B 14S-6P		1
p)	"	MS 3108B 20-4S		1
q)	"	MS 3106B 28-21P		1
(3)	Receptacles			
a)		MS 3101A 16S-1S		1
		MS 3100E 36-10S		5
(4)	External Power Socket	AN 2552-3A		1
(5)	External Power Plug	AN 2551		1
(6)	Voltage Regulator	GC 34-2		1
(7)	Inverters	12142-1A	Bendix	2

(8)	Flap Potentiometer	C72309	Safe Flight Inspection Corp.	A.R.
(9)	Microswitch	AN 3234-1	Honeywell	A.R.
(10)	Actuator	JV5	"	

4.5. Panel 4 (Ref. Drawing C4-G-1374 & C4-G-1357)

(1)	Gate Valve	AV16B 1282B	General Controls	1
(2)	Fuel Probe	38 4301-001	Simmonds Aerocessories	1
(3)	Low Oil Press. Warn. Switch.	3140-1-C-450	Bendix	1
(4)	Low Hyd. Press. Warn. Switch.	AL58D1105A30	General Controls	1
(5)	Low Fuel Press. Warn. Switch.	1171-1	Parmatic Eng. Co.	1
(6)	Differential Press Switch.	P 904-5-2		
(7)	Fire Detector Element	35608-4-575	Fenwal	1
(8)	Ram Air Actuator	30982	Airesearch	2
(9)	Indicator Lights	(See Panel 1)		
(10)	Plugs			
a)	"	MS 3106E 36-10P		3
b)	"	MS 3106B 14S-6S		1
c)	"	MS 3106B 14S-7S		2
(11)	Receptacles			
a)	"	MS-3100E 36-10S		
(12)	Junction Box - Carb. Air -	C4E1083-3		1
(13)	Mercury Switch	5MP1-1		2
(14)	Soldering Iron	24V 100W	Am. Elect. Htr. Co.	1

4.4. Panel 3 (Ref. Drawing C4G-1373)

(1)	Lights			
a)	Landing	AN 3129-4523		
b)	Navigation	AN 3032 -6 & 7 AN 3158-7		1
c)	Taxi light	B-4150B-24		1
d)	Ramp Loading	31590-7079A	Grimes	1
e)	Emergency	C4E 1919		1
f)	Cabin	B-2281B 21-24	Grimes	1
g)	Indicator	(See Panel 1)		
h)	Anti-collision	G-8400-24-24		1

(2)	Emergency Light Control Unit	C4E 1697-11		1
(3)	Windscreen Wiper Motor	C298324-4	Marquette	1
(4)	Windscreen Wiper Converter	A2 16877	Marquette	1
(5)	Windscreen Wiper Resistor	C297957-10	Marquette	1
(6)	De-icer Timer	42E 06 -16A	Bendix	1
(7)	Aileron Trim tab actuator	34636-2	Airesearch	1
(8)	Tab Position Transmitter	8TJ9PFF-44	General Electric	1
(9)	Alarm Bell Type J-3	168-2	Edwards	1
(10)	De-icing Relay	AN 3311-1		
(11)	Plugs			
a)	"	MS 3106E 36-10P		5
b)	"	MS 3106B 14S-2S		
c)	"	MS s106B 22-14S		1
d)	"	MS 3108B 10SL-3S		1
(12)	Receptacles			
a)	"	MS 3100A-14S-2S		1
b)	"	MS 3100E 36-10S		3
(13)	Terminal Strips			
a)	"	MS 25123-1-4		1
b)	"	MS 25123-1-7		1
(14)	Strip Covers			
a)	"	394-4	Henry Eng.	1
b)	"	394-7	Henry Eng.	1

4.6. Panel 5 (Ref. Drawing C4G 1375)

(1)	Interior Lighting Panel.	C4E-1200		1
(2)	Cargo Door Operating Panel	C4E-1170		1
(3)	Micro Switches			
a)	"	AN 3234-1	Honeywell	A.R.
b)	"	2VB2	"	
c)	"	IHS6	"	
(4)	Micro Switch Actuator	JV5	Honeywell	
(5)	Cable & Chain Assembly	C4B1587		1
(6)	Airborne Actuator	R-6112	Airborne	1
(7)	Bevel Gear Assembly	R-310	Airborne	1
(8)	Plugs	MS 3106E 36 10P		2
(9)	Indicator Lights	Green MS 25041		3
(10)	Pulleys			
a)	"	AN 220-3		3
b)	"	AN 221-1		3

PART IV

SECTION V

ERECTION

OF

ELECTRICAL TRAINER

5.1. Erection.

5.1.2. The panels are numbered in consecutive order 1 to 5 and are crated in individual boxes. Since panels 2 and 4 have no base, their boxes are smaller. The casters remain on numbers 1, 3, and 5 during shipment. Panels 2 and 4 hang between and are attached to panels 1 and 3, 3 and 5 respectively by means of a slip-on gate type of hinge.

5.1.3. To reduce overall size for crating, the identification boards mounted at the top of each panel are hinged and folded down. The fault circuit panel (operator's panel) is also hinged flat on the rear of number 1 panel. When the panels are uncrated these items should be secured into correct position.

5.1.4. After attaching the panels together mechanically in consecutive order left to right the electrical connections should then be coupled together in their respective positions.

4.1.5. The 'Stavolt' D.C. Power Supply unit should be connected to a three phase 220 volt A.C. power supply. Adjust output voltage to 27.5 volts and connect to Type 11 Junction box which in turn is connected to the Trainer.

5.2. Dismantling.

5.2.1. To dismantle, reverse the above procedure of assembly.

5.2.2. All inter-panel electrical cannon connectors should be wrapped with a plastic cover to prevent ingress of dirt and moisture.

5.2.3. When not in use the Trainer should be covered with the zippered weatherbar cloth covers provided.