Second Printing December 1986
VOL. 7, NO. 1, JANUARY—MARCH 1980

service news

A SERVICE PUBLICATION OF LOCKHEED-GEORGIA COMPANY, A DIVISION OF LOCKHEED CORPORATION

service news

A SERVICE PUBLICATION OF
LOCKHEED-GEORGIA COMPANY
A DIVISION OF
LOCKHEED CORPORATION

Editor
Don H. Hungate

Associate Editors
Charles I. Gale
James A. Loftin
Arch McCleskey
Patricia A. Thomas

Art Direction & Production
Anne G. Anderson

Vol. 7, No. 1, January – March 1980

CONTENTS

Cover: A new L-100-30 is put through its paces over the Georgia countryside.

Focal Point

We at Lockheed-Georgia believe that the best marketing tool we have is the Hercules aircraft. Its reputation has been earned in 25 years of outstanding service on a truly global scale, and while performing some of the toughest jobs ever to be asked of an airplane.

The Hercules aircraft is now owned and operated by over 45 countries throughout the world. This is an accomplishment that could only have been achieved by a great airplane and a great team of hardworking people.

An important part of our team is the International Marketing organization. The people who work in International Marketing are assigned specific areas of the world. They are specialists in their particular area, familiar with the air routing, market needs, and any problems peculiar to the region. With the assistance of all of us at Lockheed-Georgia, our International Marketing Representatives can study a customer's requirements and offer comprehensive recommendations on how our products can best serve his needs.

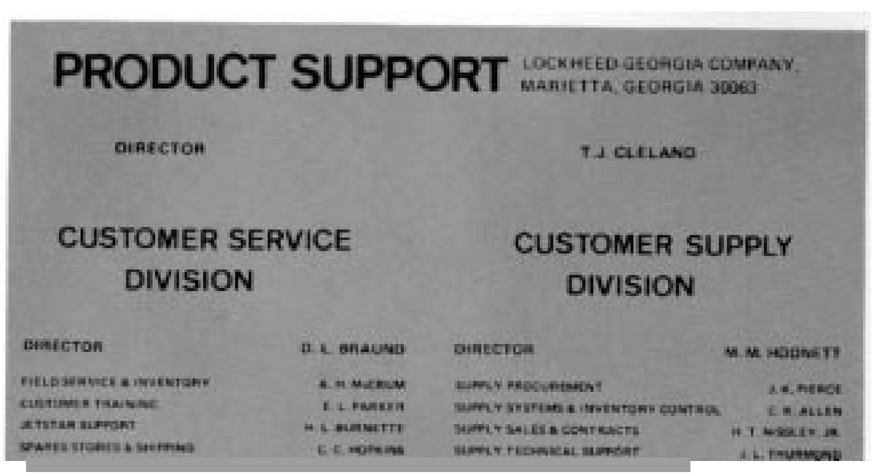
Our reputation is built on the success of our products. The C-130 and L-100 series airplanes have earned their renown as the world's most versatile and successful airlifters. It is our job to maintain that reputation.

On the facing page we are pleased to introduce our International Marketing Representatives. If you would like further information about any of our products, this knowledgeable and experienced team of professionals stands ready to assist you. We would welcome the opportunity to be of service.

Sincerely,

E J Shockley

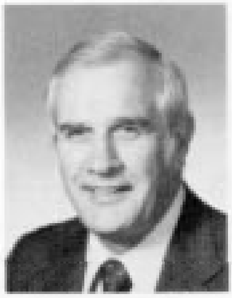
E. J. Shockley,
Vice President Marketing



Lockheed·Georgia

International Marketing Representatives

George Allen
Far East



Bill Cowden
Director
International Sales

Jack Davidson
Director
International Marketing

Joe Morris
Director. International
Market Development

Bill Campbell
Latin America

serving the airlifter needs of the world —

Jim Certich — Manager
Western Hemisphere
and Europe

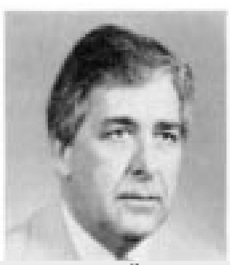
Ben Clay
Europe

Fernando da Costa
Europe

Bob Engelhart — Manager
Far East

Ed Harrison
Far East

Fred Knieriem
Africa



Allen Love
Middle East

Frank Murphy
Far East

Bob McRay
Africa

Bob Parker
Europe

Bill Putnam
Africa

Ned Ridings — Manager
Middle East and Africa

Marty Turner
Far East

Enrique Vizurraga
Latin America

Templeton Walker
Middle East

All of the drains on Hercules aircraft have important functions and should be checked regularly to make sure they are clean and doing their job properly. Of course, some drains are easier to see and get at than others, and occasionally it happens that some of the less accessible ones do not receive their fair share of the attention.

Upper Nacelle and Wing Dry Bay Plumbing

by Russ C. Payne, ***Design Engineer, Senior***

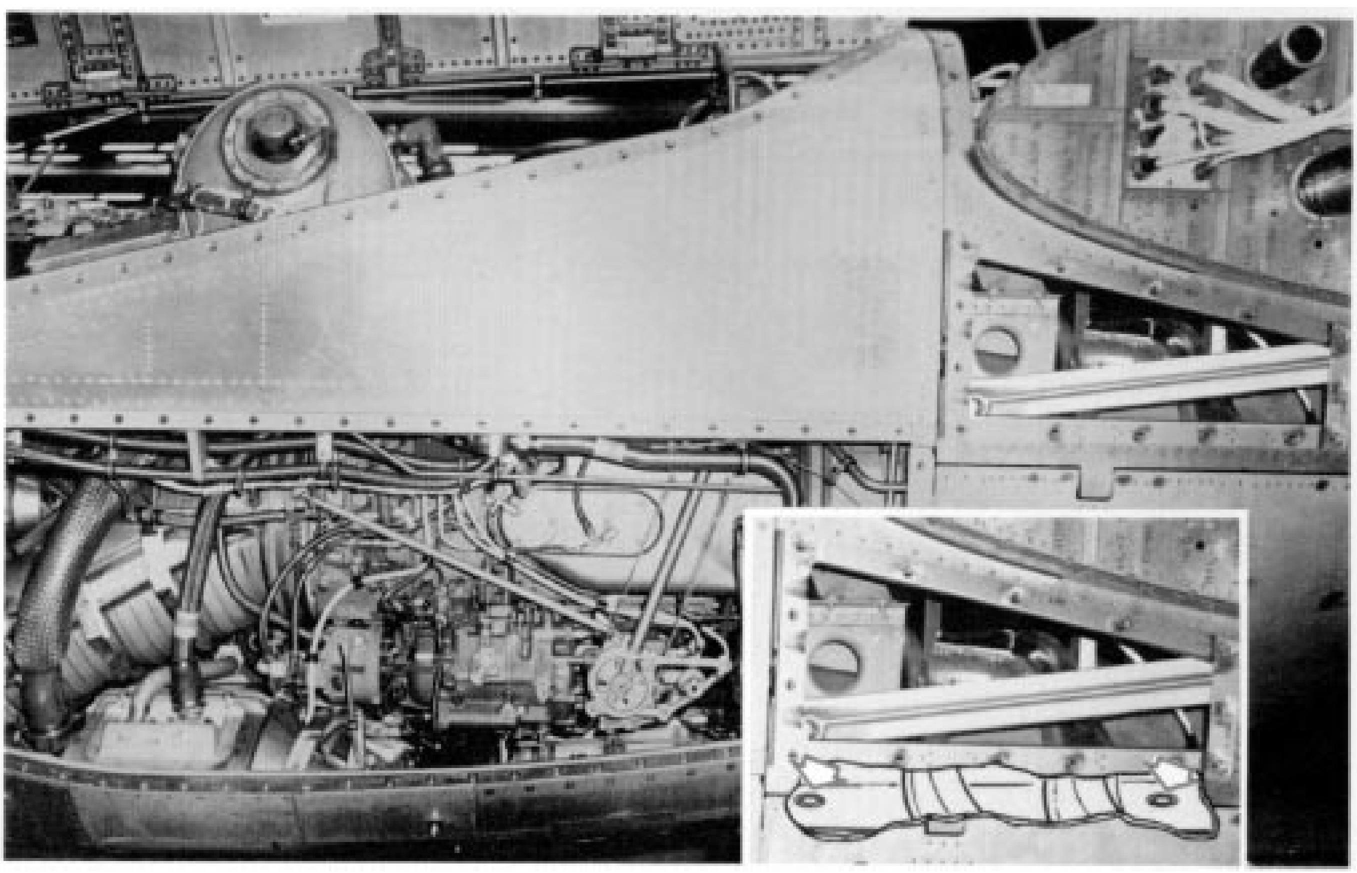
A case in point concerns the drain lines that serve the upper nacelles and the wing dry bays located behind each engine. Because they are generally out of sight, these lines tend to be neglected, and sometimes they become obstructed. Whenever the upper nacelle (horse collar) area and wing dry bays are open, it is a good practice to check the drain plumbing to ensure that it is not clogged or restricted.

The drain lines in these areas have the sole purpose of removing any fuel, hydraulic fluid, or condensate that might collect. An obstructed drain in the upper nacelle can have some particularly unpleasant consequences.

If fuel or hydraulic fluid from a leak in the horse collar area cannot pass out of the drain, it will accumulate and back up into the wing dry bay aft of the engine. The accumulation of fluid may also spill over into the hot section of the nacelle because of leakage around the right- and left-hand access panels.

Recently, after a fire was discovered in the nacelle of a C-130, an investigation revealed that a fuel line had ruptured and sprayed fuel into the horse collar area. The drains were partially clogged at the time. As a result, they released the fuel overboard at a rate which was only about half of their design capacity. It is possible that the fire would have caused less damage if the drains had been clear and allowed the spilled fuel to discharge overboard more rapidly.

Four drain openings serve the upper nacelle area of each engine, two on each side. The enhanced inset shows typical location, left side.



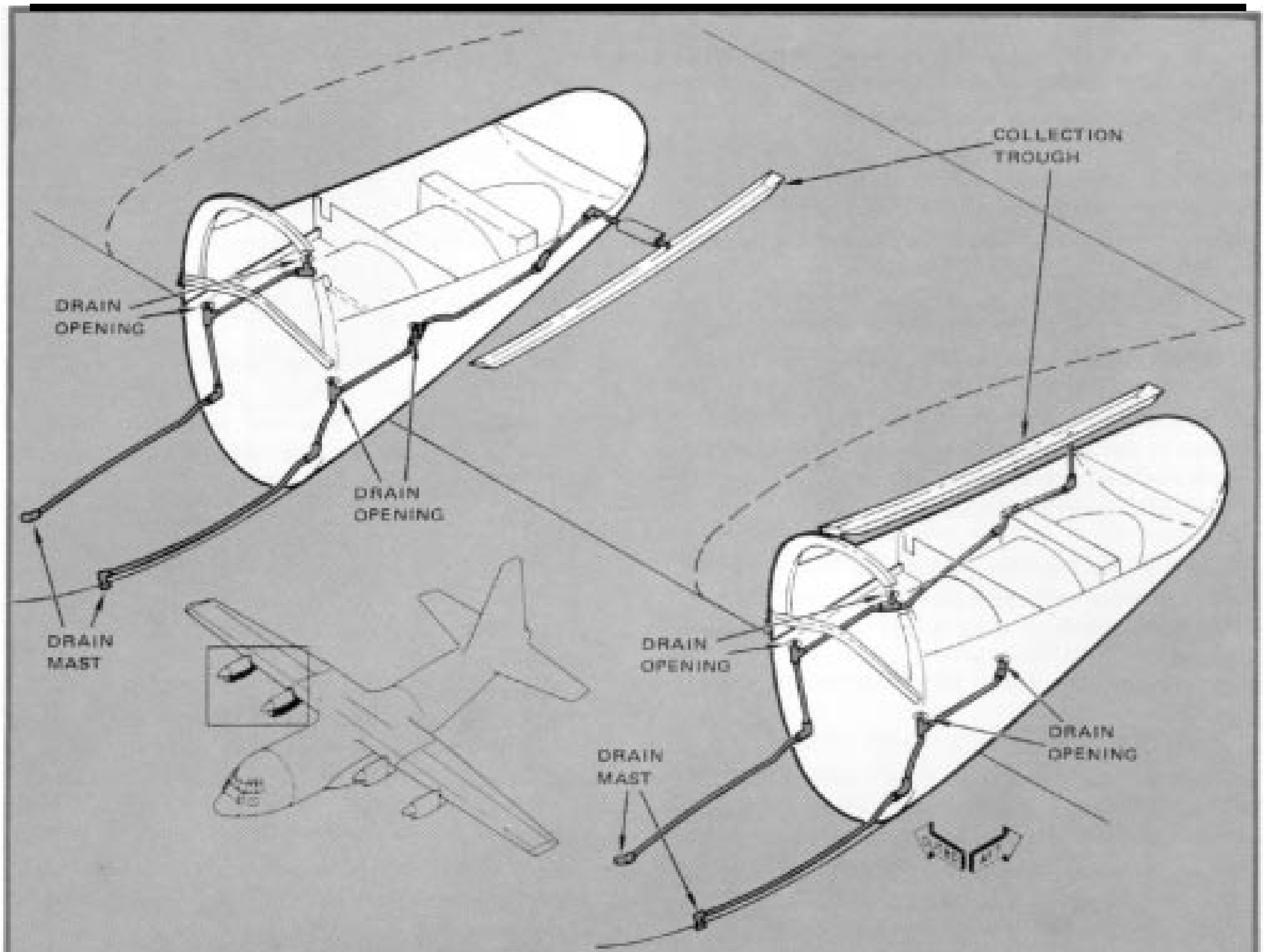


Figure 1, UPPER NACELLE AND WING DRY BAY DRAINAGE SYSTEM

Drain System Check

To check on the condition of the upper nacelle and dry bay drain system of an engine, remove the access panels from both sides of the upper nacelle, open the horse collar top panel and wing dry bay access panel, and locate the four drain openings in the upper nacelle. There are two on each side of the horizontal upper nacelle firewall assembly (the "pan" under the horse collar area – see Figure 1).

Station an observer who has been fitted with safety glasses or goggles near the drain mast on the engine QEC. Now blow compressed air at 65 to 85 psi (448 to 586 kPa) into each of the drain openings, checking one side at a time. Have your observer verify that there is always a free flow of air out of the drain port on the side where the air is being applied.

Also make sure that the drain lines leading to the under-wing collection troughs and the passages from the collection troughs into the dry bays are clear.

There is a line of small holes in the bottom of the wing above the collection troughs, one between each riser. Air flow through these holes should be evident when the compressed air is applied to the drain openings on the outboard side of inboard engines, and the inboard side of outboard engines. If any of the lines proves to be clogged or restricted, disassemble it and clean as required to establish normal drainage.

Clean, properly functioning upper nacelle and wing dry bay drains offer an added margin of safety in case of a fluid leak, but there arc other benefits as well. Good drainage from the dry bays will help prevent an accumulation of water condensate that may form in these spaces with changes of temperature and altitude. Less moisture means less corrosion and lower maintenance costs. All in all, a little extra time invested in keeping the drains clear can pay worthwhile dividends, both in terms of safety, and in longer airframe life.

the Bendix

PPI -1P Weathervision Radar Indicator

by G. T. Strickland, ***Training Specialist***

The PPI-IP Weathervision indicator is part of the Bendix RDR-1E high performance weather and terrain mapping radar system, a system which has been chosen by many commercial Hercules aircraft customers for installation aboard their airplanes.

Since the system is relatively new to some avionics maintenance personnel, and a circuit schematic showing the interactions between the various boards in the indicator has not to our knowledge been published previously, we believe that the material presented here will be helpful to a significant number of Hercules operators.

Please note that for the purposes of this article, the PPI-1P indicator and the model PPI-IN indicator used in the Bendix RDR-IF radar system may be considered identical.

General

First, let us take a brief look at the overall system. The RDR-1E radar has a range coverage of up to 180 nautical miles. Terrain contours and significant weather systems are accurately presented on the PPI-1P indicator, which gives a constant, non-fading display. The indicator uses digital procedures to process the radar data.

The radar set consists of four units: the receiver-transmitter (R-T), the indicator, the radar control, and the antenna. The system requires 115 VAC and 28 VDC electrical power for operation.

The surveillance scan of the antenna is 90 degrees in azimuth on each side of the aircraft center line (180 degrees total sweep angle) and +15 degrees in tilt from the aircraft's longitudinal axis. The antenna scans at a rate of 10 cycles per minute, which yields 20 "looks" per minute at a given target area. Antenna operation is stabilized with pitch and roll information supplied by the airplane's vertical reference system.

Indicator Operation

The indicator receives trigger pulses and video signals from the R-T unit, converts the video to digital information, and stores the information in a memory circuit. Antenna azimuth information in the form of a synchro signal is used to determine the position in memory reserved for each of 192 different positions of the antenna within the 180-degree sector scan. As new data are received, they are compared with previous data from that particular antenna position and used to modify or replace previous data which are significantly different.

Digitized video in the memory circuit is converted to analog form and displayed on the cathode ray tube (CRT) screen at a rate of 61 complete scans per second. Internally generated range marks and azimuth marks are also displayed to aid in determining target range and azimuth.

A simplified diagram is shown on pages 8 and 9 ***as*** an aid to understanding data flow within the indicator. Reference numbers on the diagram correspond to paragraph numbers in the following circuit description.

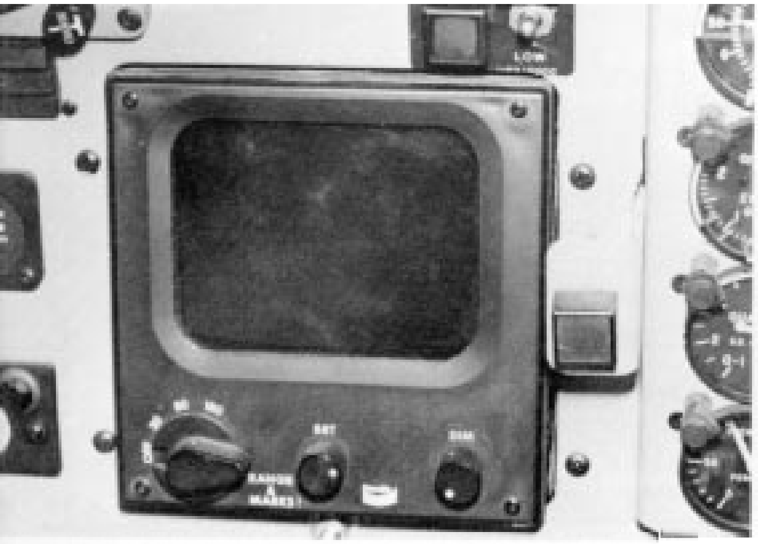
1 Trigger pulses (identified on the diagram as PRF) from the R-T unit, range select information from the range select switch on the indicator front panel, and an internally generated 7.87 MHz signal are used to generate range clock pulses. The range clock frequency is such that 128 pulses occur during the time interval required for the selected range. These pulses are used to divide the incoming video from each PRF into 128 separate bits.

2 The video bits, which vary in amplitude, are sent to the analog-to-digital converter. The analog-to-digital converter converts each video bit to a 3-line digital output representing one of four different signal levels; below minimum discernable signal level (below MDS), minimum discernable signal level (MDS), medium signal level (MID), and highest signal level (HI).

3 A digital decoder circuit converts the 3-line digital information to a 2-bit binary number, MSB and LSB (most significant bit and least significant bit). At this point the incoming video signals from the R-T unit have been digitized in time (128 bits of information for the video received from each radar pulse during the selected range time) and amplitude (4 possible levels for each video bit).

4 The MSB and LSB are clocked into input buffers by the range clock pulses. The input buffers are shift registers capable of storing 128 bits, or one word, in each register. A range clock counter on each buffer counts 128 range clocks and then blocks any further clocks until another trigger pulse occurs. While the MSB and LSB are being clocked into one buffer by the range clocks, information previously stored in the other buffer is clocked out by 1.9 MHz memory clock pulses. On the next trigger pulse, new information is clocked into the buffer that was emptied by the 1.9 MHz clocks while the previously filled buffer is being clocked out. The switching action between buffers repeats for each trigger pulse.

Previous Page Table of Contents Next Page



The PPI-1P radar indicator, installed.

5 The MSB and LSB from the input buffers are gated through multiplex gates to integrator memory. Integrator memory consists of two 1024-bit shift registers, one for MSB and one for LSB. The data in integrator memory consists of information received from eight consecutive radar pulses, or eight 128-bit words.

6 We should now take a look at how signals are synchronized in the indicator. Timing pulses are obtained by taking the signal from a 7.87 MHz crystal-controlled oscillator and counting this frequency down through a series of dividers. The frequencies needed at various points in the indicator circuits are taken from this series of dividers at appropriate points.

7 The control counter is a series of dividers with an input of 3.9 MHz. Timing pulses are taken off at various points along the dividers. The output of the last divider in the control counter goes high when 128 input pulses have been counted, then the counters are all reset to zero when 40 additional pulses have been counted. This output is called “line blank.” Line blank goes to the memory word generator and to various other places for use as a gating and timing signal. During the time that the line blank is low (128 clock pulses), data are displayed on the CRT; sweep retrace takes place during the time that line blank is high (40 clock pulses).

8 The memory word generator requires two line blanks to generate one memory word. The memory word is sent to the memory address counter, which counts 192 words during one complete cycle. The counting cycle occurs at a rate of 61 Hz, which is the scan rate of the indicator presentation.

9 The first three divider outputs from the memory address counter comprise a binary code representing eight consecutive words being fed into the memory counter. These three lines go to three exclusive OR gates where they are compared with the three-line output from the PRF counter. The exclusive OR gate output goes to a NOR gate, the output of which is called word compare. When the memory word count and PRF count agree, the NOR gate output goes high, generating a word compare signal. Word compare goes to the integrator word enable generator to enable radar returns to be entered into integrator memory at the proper location for that PRF.

10 The adder, accumulator, and integrator decoder circuits, controlled by SUM CLEAR, SUM ENABLE and SUM TRANSFER signals and clocked by the 1.9 MHz memory clock, combine the eight words of video from integrator memory into one word. The video at the output of the integrator decoder is an average of the video received from eight consecutive radar pulses, with seven levels of brightness expressed in a 3-bit binary code.

11 Digitized video from the integrator decoder is sent to the scan-to-scan decoder where it is compared with MSB and LSB already in memory at the address reserved for that particular word. If the video levels are significantly different, main memory is updated to a new level. The scan-to-scan decoder aids in smoothing out rapid changes in video levels as seen on the CRT screen.

12 Main memory consists of recirculating shift registers capable of storing 192 words of video. The words are stored in “even-bit” and “odd-bit” shift registers, each word at an address corresponding to a specific azimuth position of the antenna.

13 Antenna azimuth position is found by using pulses from the control counter to generate azimuth clock pulses and using synchro data from the antenna to gate a certain number of these pulses to an azimuth clock counter. The number of pulses gated and counted varies from zero when the antenna is at 90 degrees left to 191 when the antenna is at 90 degrees right. Therefore, antenna azimuth position at one instant of time is represented by a specific count corresponding to a position in memory reserved for that count.

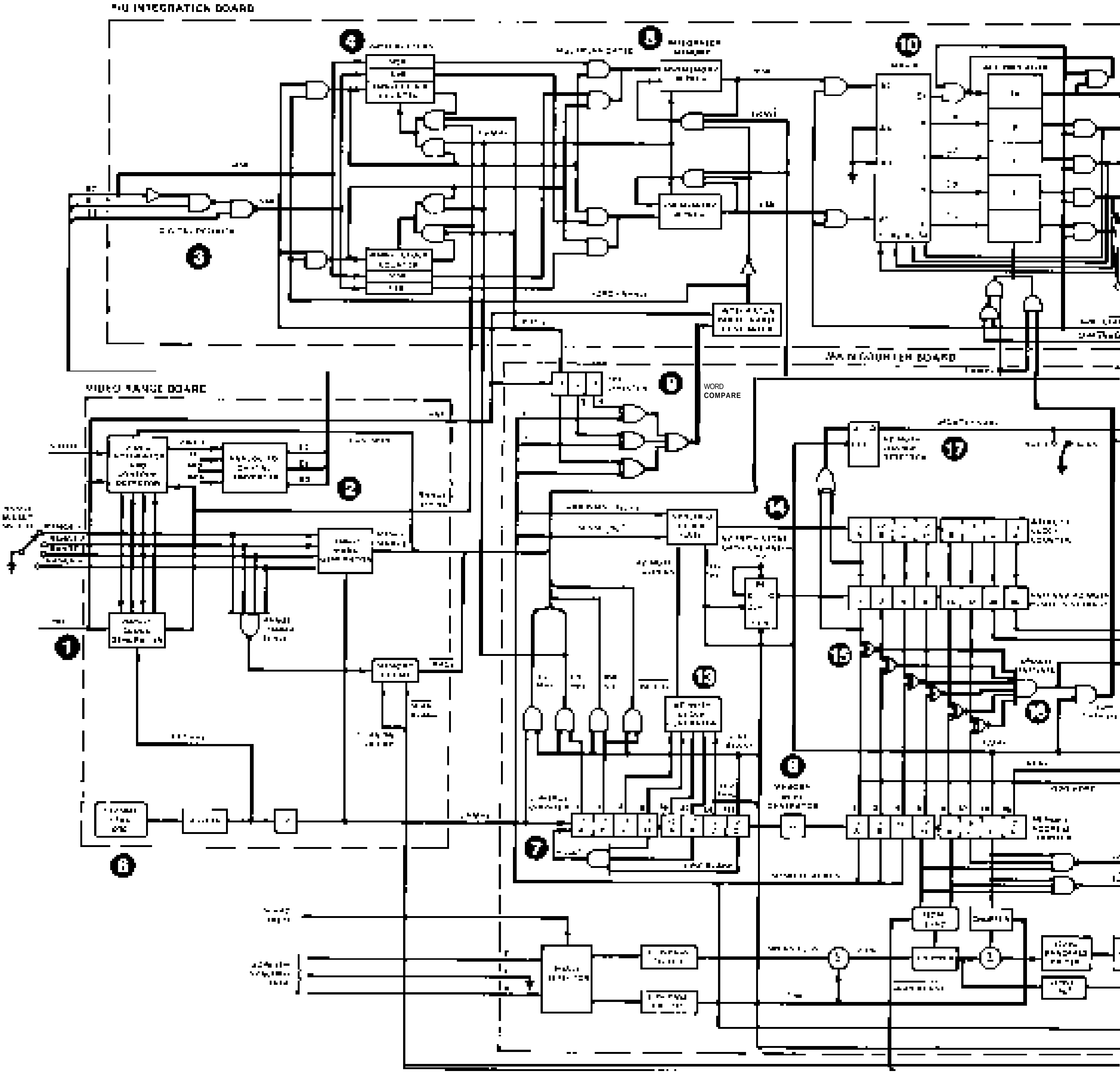
14 A signal from the azimuth store/load generator causes the number of azimuth clocks counted to be loaded into the antenna azimuth position storage register.

15 The antenna azimuth position is compared with the memory address counter outputs by exclusive OR gates. When the two counts agree, an update initiate signal is generated.

16 The update initiate signal is used to generate a sum transfer signal, which along with counts “48” and “96” from antenna azimuth position storage and the 61 Hz signal from memory address counter, is used to generate an entry point signal at one of four entry points. This signal enables video to be entered into main memory at the address reserved for that particular antenna position.

Previous Page Table of Contents Next Page

Bendix PPI -1P Weathervision Radar Indicator



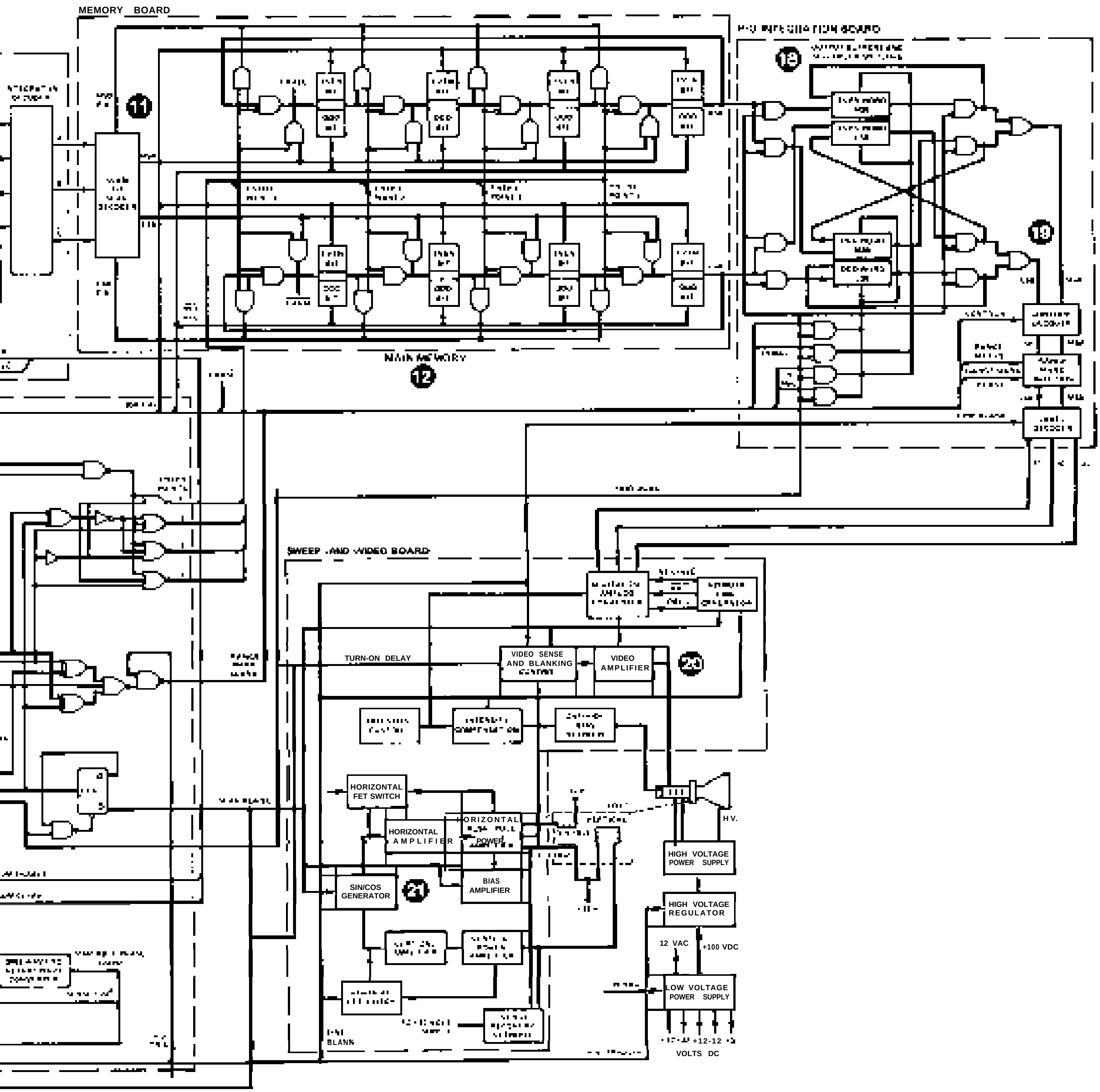
17 The entry point signal will not be generated unless the antenna has changed position since the previous update, as determined by the azimuth change detector, or if the SCAN/HOLD switch is in the HOLD position. This prevents any update of data in main memory. The SCAN/HOLD switch is an optional feature available on some indicators. Switching from SCAN to HOLD then back to SCAN allows evaluation of storm cell movement during the HOLD period.

18 The digital video is continuously circulated through main memory; it is also fed out of main memory through "even-word" and "odd-word" output buffers and multiplex switches. Each word is fed out twice, so that 384 lines (2 x 192) of video are displayed on the CRT.

19 MSB and LSB information from the output buffers is changed to a 3-line digital form by the level decoder, then to analog form by the digital-to-analog converter.

20 The analog video signals are amplified and sent to the grid of the CRT to generate a display on the face of the CRT.

Previous Page Table of Contents Next Page



21 The CRT sweep is generated by taking sine and cosine signals from a sin/cos generator and processing the two signals to produce vertical and horizontal sweep voltages. Sine and cosine sweep amplitudes determine where the CRT trace appears. The sweep voltages occur at a rate that produces 61 complete scans each second. The CRT sweeps are synchronized with the memory circuits by scan blank and line blank signals.

We hope that this description of the features and operation of the PPI-IN indicator will make it easier for the service technician to analyze the unit's circuitry. We also hope that the circuit diagram will prove useful. It's been our experience that this diagram is an excellent guide to understanding how the various circuits in th.e indicator relate to one another and an indispensible tool in carrying out maintenance activities.

Index by Subject – VOL. 1, N0.1 through VOL. 6, N0.4

1974 · 1979

ELECTRICAL AND ELECTRONICS

ENGINES AND PROPELLERS

ENGINES AND PROPELLERS (cont'd)

FUEL SYSTEM

Previous Page Table of Contents Next Page

GENERAL AIRFRAME

GENERAL AIRFRAME (cont'd)

GROUND OPERATIONS

HYDRAULICS

HYDRAULICS (cont'd)

LANDING GEAR

LANDING GEAR (cont'd)

MISCELLANEOUS

PNEUMATICS AND ENVIRONMENTAL

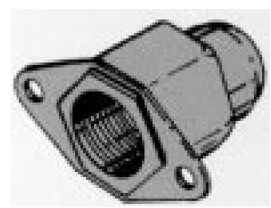
nose jack pad nut plate

by Chuck Austin, ***Service Analyst***

We've heard from several operators who have been looking for the part numbers of the nut plates used to attach the nose jack pad fittings to their Hercules aircraft. Here is some information we think will help.

Two types of nut plates are used for these fittings. A dome nut plate, P/N 4600H-064 (NSN 5310-00-557.8294). is used in the pressurized cabin area. A low-height corner nut plate, also called the "Mickey Mouse" plate because of its shape, is used in the un-pressurized nose wheel well area. Its part number is MS21055-6 (NSN 5310-00-779-3517). The illustrations below will aid in identifying the two different types.

P/N MS21055-6



P/N 46OOH-064

Anniversaries

We at Lockheed-Georgia extend our congratulations and our thanks to the following operators of Hercules aircraft:

20 years

Indonesian Air Force
U.S. Coast Guard
U.S. Marine Corps

10 years

Transamerica Airlines

Previous Page Table of Contents Next Page


service news

VOL. 1, NO. 1, JANUARY-MARCH 1974

3 FLARELESS FITTINGS
Treated Properly a Better Fitting

STARTIPS
5 Hercules Engine Tachometer System
9 JetStar Nose Steering System

10 OXYGEN SAFETY
An Article Applicable to any Aircraft with an Oxygen System

14 HERCULES FUEL VENT SYSTEM
Keep the Vents Open


service news

VOL. 1, NO. 2, APRIL-JUNE 1974

3 HERCULES PROPELLER CONTROL OIL LEVEL CHECK
Using the Atmospheric Sump Dipstick

7 THE STANDARDIZED LOGISTICS MANAGEMENT SYSTEM
A Better Way to Maintain Any High Technology Product

9 HERCULES WIRE IDENTIFICATION
Including a Cross Reference Chart

12 STEEL CYLINDERS FOR THE JETSTAR MLG ACTUATORS
You Can Install These Preferred Spares

STARTIPS
8 A Quick Way to Drain Hercules Aux Tanks
11 How to Bleed A Hercules Hydraulic Pump and Keep It Clean


service news

VOL. 1, NO. 3, JULY-SEPTEMBER 1974

HERCULES FUEL QUANTITY INDICATING SYSTEM

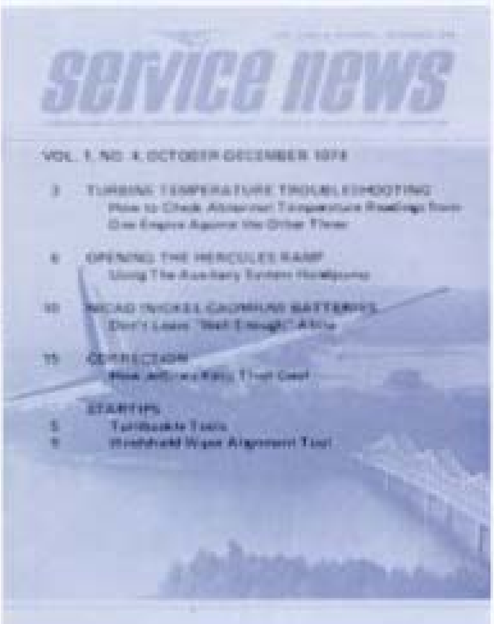
2 TROUBLESHOOTING
6 Tank Units – Part Numbers and Capacitance
10 Troubleshooting Chart
15 Fuel Weight To Capacitance

16 CONNECTORS
Part Number Cross-Reference and Important Details on Assembly

19 DELAYED MAINTENANCE — CAN GIVE YOU A BLAST

20 HOW JETSTARS KEEP THEIR COOL
Maintenance of Turbine-Fan, Air Conditioning Refrigeration Units

STARTIPS
15 Two Different Hercules Engine Driven Hydraulic Pumps
23 How the JetStar FCS Licked a Turbine Problem


service news

VOL. 1, NO. 4, OCTOBER-DECEMBER 1974

3 TURBINE TEMPERATURE TROUBLESHOOTING
How to Check Abnormal Temperature Readings from One Engine Against the Other Three

6 OPENING THE HERCULES RAMP
Using The Auxiliary System Handpump

10 NICAD (NICKEL CADMIUM) BATTERIES
Don't Leave "Well Enough" Alone

15 CORRECTION
How JetStars Keep Their Cool

STARTIPS
5 Turnbuckle Tools
9 Windshield Wiper Alignment Tool

INDEX

1974

THROUGH

1975


service news

VOL. 2, NO. 1, JANUARY-MARCH 1975

2 FLIGHT LINE OBSTACLE COURSE
Caution During Taxiing or Towing

4 HOW TO MOVE AN INCOMPLETE HERCULES
Ballast, Counterbalance, and Removable Load Bearing Components Taken into Consideration

9 POLYTETRAFLUOROETHYLENE (TEFLON)
Lining for Oxygen Servicing Hoses

10 HERCULES HIGH ENERGY BRAKES
Single Disc Versus Multi-Disc

12 NEW ALLOY
For JetStar Landing Gear Shock Struts

14 NEW FILTER ELEMENTS
For Hercules Hydraulic Systems

13 STARTIPS
Hercules Crew Entrance DOOR OPEN Warning Light Switch Adjustment

14


service news

VOL. 2, NO. 2, APRIL-JUNE 1975

3 STARTING FOR A LONGER ENGINE LIFE
Understanding Engine Starting Events for a Professional Approach Toward Extending Engine Life

7 THE EXTERNAL SCAVENGE OIL FILTER
Extends Service Life of Hercules Power Plant — Checklist for Oil Venting and Differential Pressure Symptoms

10 CONTROLLING MICROBIAL GROWTH
In Aircraft Fuel Tanks

14 LOCATING LEAKS
In Hercules Fuel Tanks By Color

18 LOCKHEED AIRCRAFT SERIAL NUMBERS
Identifies Production Sequence Only

20 JETSTAR II
Advanced Data On New Configuration

22 FIRST FLIGHT OF MODIFIED JETSTAR

STARTIP
19 Propeller Valve Housing Installation


service news

VOL. 2, NO. 3, JULY-SEPTEMBER 1975

3 NUTS, BOLTS, SCREWS
7 Bolt Identification Chart
8 Screw Identification Chart
9 Nut Identification Chart

12 NEW HYDRAULIC PUMP
Limits Temperature

14 WHERE DID THE OIL GO?
Troubleshooting Engine Oil Losses – Replacement of An Accessory Housing Oil Seal


service news

VOL. 2, NO. 4, OCTOBER-DECEMBER 1975

3 WASHING THE HERCULES
Emphasis Placed on The Value of Thorough Cleaning for Extended Service Life of an Airplane

HYDRAULICS
10 Hercules Hydraulic System Interconnect Valve Positioning Procedure
12 Pressure Indicator Lag

15 DELAMINATION OF WHEEL WELL DOORS

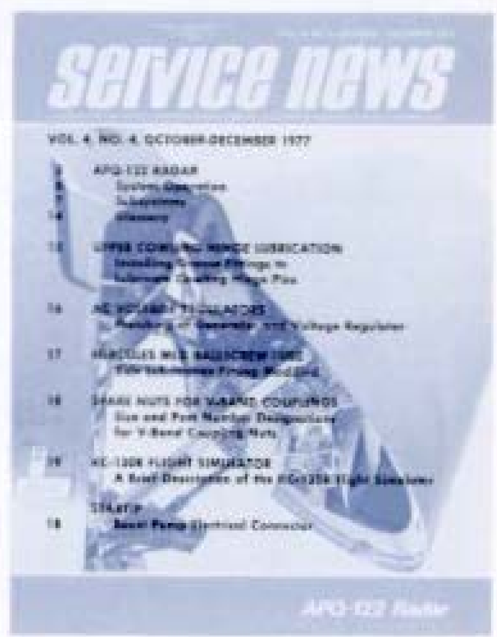
STARTIPS
9 Preservation of T-56 Engines
14 The Forgotten Screen

INDEX

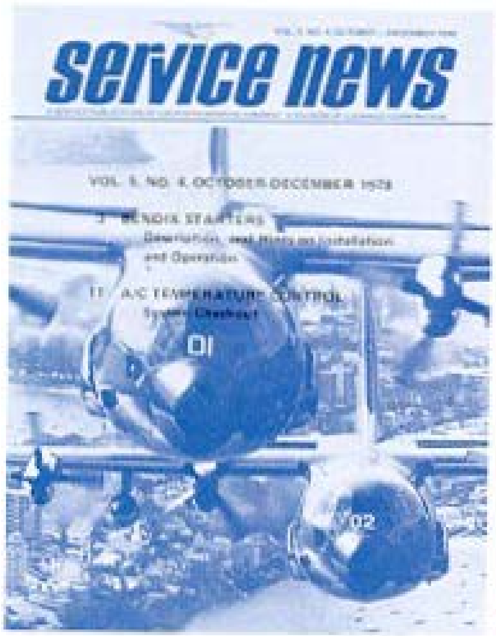
1976

THROUGH

1977



CUSTOMER SERVICE DIVISION
LOCKHEED-GEORGIA COMPANY
A DIVISION OF LOCKHEED CORPORATION
MARIETTA, GEORGIA, 30063

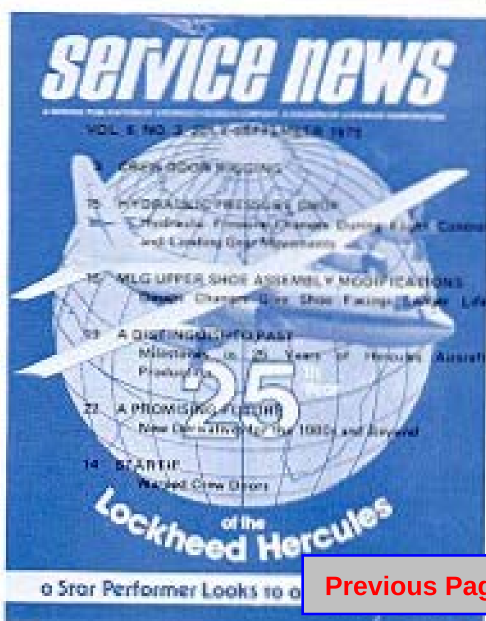


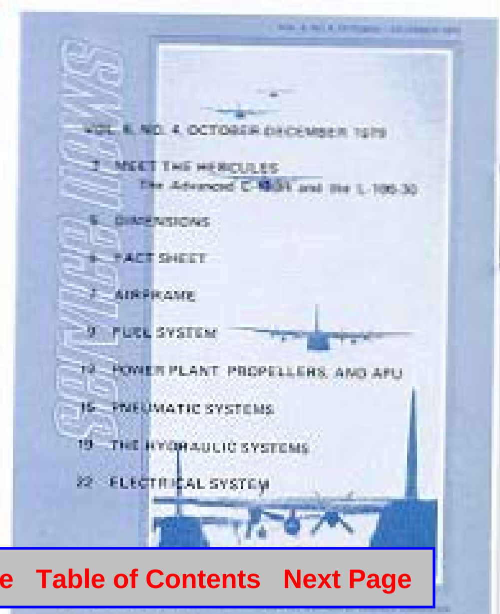
INDEX

1978

THROUGH

1979





Previous Page Table of Contents Next Page