LOCKHEED MARTIN

VOL. 26, NO. 2, April - June 1999

Service News

A SERVICE PUBLICATION OF LOCKHEED MARTIN AERONAUTICAL SYSTEMS SUPPORT COMPANY

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LOCKHEED MARTIN AERONAUTICAL
SYSTEMS SUPPORT COMPANY

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Vol. 26, No. 2, April - June 1999

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Focal Point

A New Era in Tactical Airlift

Deliveries of the C-130J are well under way, and with those deliveries, a new era in the tactical airlift world has begun. The C-130J, while retaining the same look as the previous Hercules models, is as different as an aircraft can be. The “J” is more advanced than the latest commercial aircraft and is a quantum performance leap ahead of its predecessors. With supportability designed in, the “J” is both easier to maintain and less demanding of maintenance.

The new maintenance system for the C-130J is as advanced as anything on the airplane. As detailed in the accompanying article, the Ground Based Data System, which includes items such as the Ground Maintenance System, Portable Maintenance Aid, and Removable Memory Modules, will make significant improvements not only in the quality of maintenance, but also in the method by which maintenance is performed.

To assure operational Hercules organizations can take full advantage of all the new systems the “J” offers, this new airplane is backed up by a top-notch support organization. This is where the new Customer Operations and Support organization comes into play. As mentioned by Terry Graham in the last issue of *Service News*, Lockheed Martin has reorganized product support functions into Customer Operations and Support. The primary purpose of this organization is to help each of our customers get the most out of their aircraft. This includes not only the new “J”, but also the previous models. In order to make this a reality, Customer Operations and Support has personnel knowledgeable in all facets of each of the Hercules models in operation. Currently, our Field Service Representatives work with customers around the world who operate everything from C-130Bs to C-130Js.

We encourage each operator to contact us anytime we may be of service and take advantage of the expertise that only the Field Service arm of the Original Equipment Manufacturer can offer. The Hercules Support Center can be reached at any time at Tel: 770-431-6569, Fax: 770-431-6556, and E-mail: hercules.support@lmco.com.

Bill Bernstein
Vice President,
Customer Operations and Support

Front Cover: Tony Lutes of Elmendorf Air Force Base, Alaska, photographed these C-130s against the backdrop of Mt. McKinley.
Back Cover: The C-130J and a Honduras Air Force C-130A on the ramp in Tegucigalpa during the Honduran Relief Missions. Photo courtesy of Bob Harper of Lockheed Martin.

Maintenance for a New Hercules

by
Scott Brinegar
Field Service Representative

Technical Assistance by
Dan Budde, Chris Crabb, and Duane Szalwinski

Effective maintenance on aircraft systems has always relied on skilled aviation maintenance technicians correctly identifying the cause of a failure and performing the necessary corrective action to return a system to full functionality. Today's maintenance technicians rely not only on their skill but also on the information provided by complex aircraft systems to restore system operation. Specific design features of Lockheed Martin's C-130J tactical aircraft provide advanced maintenance diagnostic capabilities that combine flight crew reports of problems with detailed system fault information. This enables maintenance technicians to unambiguously identify the cause of system failures and employ the best maintenance strategy to restore system functionality and aircraft availability.

The dual Mission Computers, the heart of the C-130J, are networked to aircraft systems via a MIL-STD-1553B databus to control system operations and monitor system performance. System status is provided to the flight crew via Advisory Caution and Warning System (ACAWS) messages displayed on the flight station Color Multipurpose Display Units (CMDUs). Detected system faults are stored in non-volatile memory of the Mission Computers and are displayed on the CMDU via a selectable maintenance page in the Avionics Management Unit (AMU). System failures are also routed by the Mission Computers to a Dual Slotted Data Transfer System (DSDTS) containing a Removable Memory Module (RMM), which is a standard reformattable Personal Computer Memory Card International Association (PCMCIA) card with 40 MB of memory. The RMM is the transport vehicle of the C-130J Ground Based Data System (GBDS) and provides a variety of tracking and status data recorded during the flight such as faults, trend data, engine usage, and consumable data. The C-130J GBDS consists of a Portable Maintenance Aid (PMA) with Organizational Maintenance System (OMS) software, Ground Maintenance System (GMS) software, and a Mission Planning System (MPS) for each aircraft. Aircraft fault detection, isolation, recording, and maintenance activities are all incorporated into the GBDS.

The PMA, a SUN ULTRA I SPARCstation, and associated connector cables are stored on the aircraft in the underbunk area as loose equipment. The PMA provides the user interface between the maintainer and the C-130J aircraft systems to perform organizational level maintenance on the aircraft. In addition, the PMA provides access to electronic technical manuals, troubleshooting aircraft failures, evaluating status of aircraft systems, checking configuration of aircraft systems, and the

Help with the Acronyms

As with any new system, the C-130J maintenance system comes with a whole new list of acronyms. This list is provided as a quick reference for the most common ones used in this article.

ACAWS Advisory, Caution, and Warning System

AMU Avionics Management Unit

CMDU Color Multipurpose Display Unit

CNI-SP Communication, Navigation, Identification System Processor

DGMP Deployed Ground Maintenance Program

DSDTS Dual Slot Data Transfer System

EMS Engine Monitoring System

GBDS Ground Based Data System

GMS Ground Maintenance System

MC Mission Computer

MWO Maintenance Work Order

OMP-MC Operational Maintenance Program - Mission Computer

OMS Organizational Maintenance Software

PMA Portable Maintenance Aid

RMM Removable Memory Module

SHM Structural Health Monitoring

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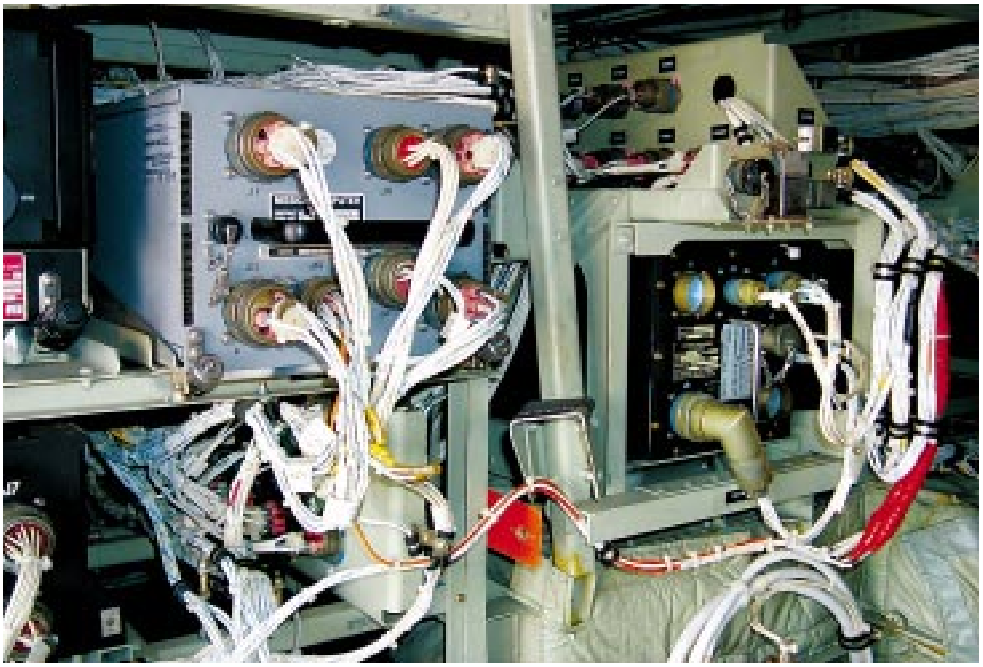


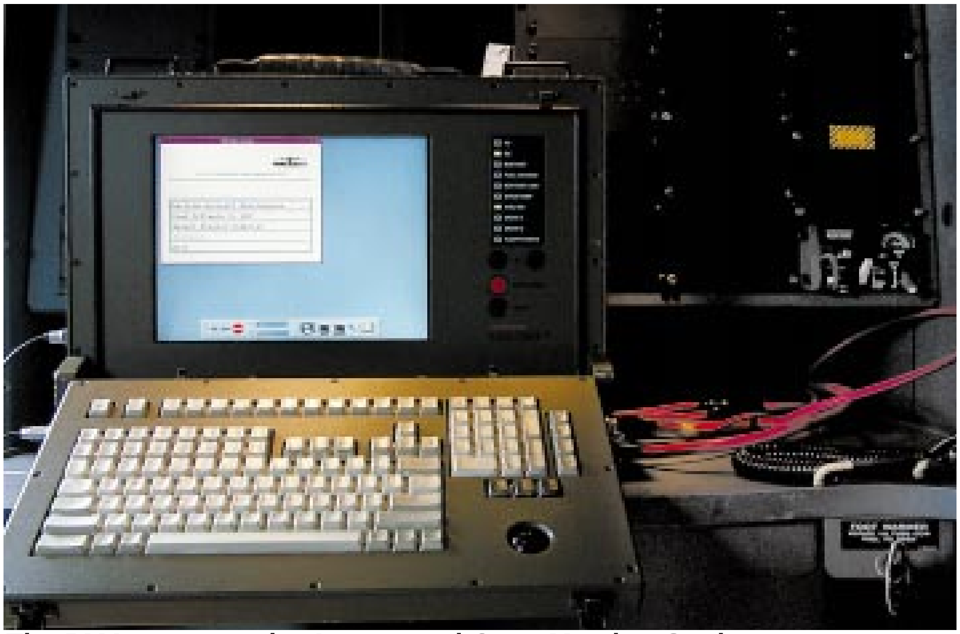
The Mission Computer and other components are located in the under deck racks.

loading/downloading of files to/from the aircraft. The PMA is also used to load the Operational Maintenance Program-Mission Computer (OMP-MC) software into the Mission Computer RAM that is required to run ground maintenance operations. The OMS software that is loaded in the PMA also has an interface with the GMS for maintenance work order processing, user account information, aircraft configuration data, and recording of diagnostics data during maintenance.

The GMS is a ground based computer system that processes the maintenance-related data recorded onboard the C-130J. The GMS hardware is a UNIX based SUN SPARCstation that consists of a keyboard, display, various drives, numerous standard interfaces (peripheral and network), and a separate uninterruptible power supply. Data flows between the aircraft, the PMA, and the GMS via the RMM. The GMS provides an automated flight crew maintenance debrief function and reads the data on the RMM. It then validates the data, runs automatic Fault Isolation (FI) algorithms, calculates health and usage parameters, and raises discrepancies for the aircraft. The GMS processes structural data to monitor component life and supports configuration control and status of the aircraft. The system can be adapted to interface with an external logistics system. The GMS also provides a variety of printed reports to support aircraft maintenance. The GMS includes internal functions such as System Administration, Engineering Control, Reports, Data Management, and Technical Publication presentation that can be validated without the need for aircraft or other OMS data. The GMS workstation acts as the network server and is usually located near the maintenance control facility where management of the fleet is conducted. Additional customer provided terminals, acting as clients to the GMS, are placed at maintenance control and each of the primary work centers. Examples of primary work centers are propulsion shop, avionics shop, hydraulics and mechanical shop, etc. These terminals should also be connected to nearby network printers. Maintenance control terminals are utilized by personnel involved in the daily planning and scheduling of airplane maintenance. Work center terminals are utilized by personnel knowledgeable of airplane systems maintained by that work center.

Below: **The DSDTS is located in the cockpit to the right of the copilot.**

Right: **The RMM loads directly into the DSDTS.**



The PMA set up at the Augmented Crew Member Station.

During operations away from home base, GMS functionality can be taken with the aircraft and operated via the PMA. There are two options for taking the GMS during deployed operations: a GMS-to-GMS transfer of aircraft files from one GMS to another (including PMA) called portable GMS, and deployable GMS. Length of the deployment, number of aircraft, availability of hardware, and the necessity of home base to have visibility to the deployed aircraft are all considered when determining which option is best.

The deployable GMS is intended to be used for short-term deployments. In the deployable GMS scenario, specific data associated with the deployed aircraft is recorded on an RMM from the home station GMS. One RMM is used for each deployed aircraft when operating in this mode. The deployed aircraft's files remain available to the home station GMS throughout the deployment. The PMA's hard drive is used to run the Deployed Ground Maintenance Program (DGMP) during the deployment, so the PMA takes on the role of GMS. There is no need to archive the data off the PMA's hard drive since the data is stored on an RMM prior to shutting down the deployed GMS. When the aircraft returns to home base, the master GMS is updated to reflect the maintenance performed on the aircraft while deployed.

The basic C-130J aircraft Mission Planning System is designed to be compatible with the U.S. Air Force Mission Support System (AFMSS). AFMSS is the standard mission planning station for a number of USAF aircraft including several C-130 variations. Each aircraft variation is supported by a unique Aircraft/Weapons/Equipment (A/W/E) software module within AFMSS. The basic C-130J has a unique A/W/E that was developed by Lockheed Sanders (the prime supplier of AFMSS). The A/W/E allows specific data to be gleaned from the mission plan, formatted, and then loaded to an RMM. The basic C-130J A/W/E data includes the following:

- ◆ Primary Flight Plan
- ◆ Performance initialization data
- ◆ Origin, destination, and waypoint data
- ◆ Hold pattern information
- ◆ Origin departure and arrival data

This is a typical GMS. Components shown include the monitor, keyboard, processor, CD drive, RMM interface, and other peripherals.

The GMS Startup page. Buttons are shown for each of the available functions.

- Computer Air Release Point information
- Search and Rescue information
- Landing Zone and Drop Zone data
- Rendezvous information
- Customized waypoint data
- Take Off and Landing Data (TOLD)
- Chute Ballistic information
- Word-of-the-Day data

Once properly loaded, the RMM is inserted into the aircraft DSDTS. Under Mission Computer control, the mission data is transferred from the RMM to the aircraft Communication, Navigation, Identification System Processor (CNI-SP). The data is then used by the CNI-SP to properly navigate the aircraft through the planned mission. The aircrew has the ability to edit the mission data in the event mission changes are required. However, this system provides a convenient method by which pertinent information can electronically and reliably be entered into the aircraft from a ground-based mission planning system.

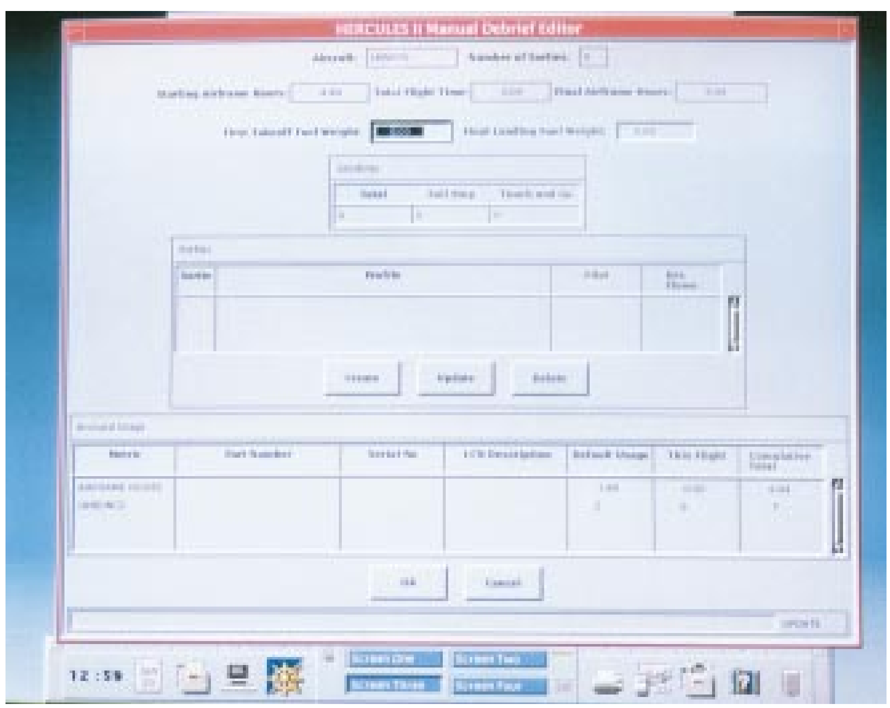
The Ground Based Data System allows the transfer of data from the flight to maintenance control to be expeditious and convenient to everyone involved in the process. Although each customer will operate differently, the following procedure shows a typical flow:

1. The post flight maintenance RMM is taken to the debrief site to be processed by the GMS.

2. The flight crew arrives at the debrief site and reviews the particulars about the flight such as sortie information, flight hours, landings, Engine Monitoring System (EMS) data, Structural Health Monitoring (SHM) data, observable faults (not recorded on the RMM), etc.

3. Engine usage data is verified with flight profiles and, if correct, updated to the GMS. If the data is incorrect, then it is recorded by hand and a manual discrepancy is created to isolate and repair the fault. The engine usage data can be edited manually once the problem has been corrected.

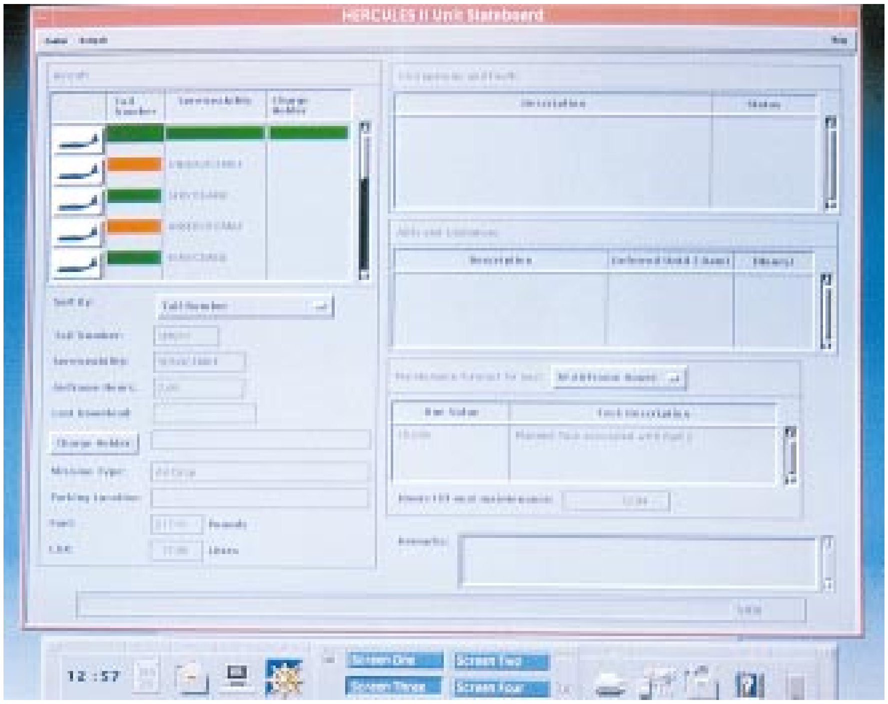
The GMS Manual Debrief screen.



4. The GMS then processes the fault isolation algorithms recorded in flight and displays the aircraft faults. The flight crew and the maintenance controller review the faults for validation. The GMS operator can accept or discard faults, as necessary, based on the flight crew debrief to obtain a true list of discrepancies for the aircraft. Once the debrief is complete, maintenance control accepts the aircraft from the flight crew by changing the chargeholder status in the GMS

In case a post flight RMM is not available, a manual debrief is performed and the SHM and EMS data is updated by the GMS operator based on how the aircrew operated the aircraft. Discrepancies that need to be entered manually will be performed at this time. Once the manual debrief is complete, maintenance control accepts the aircraft from the flight crew by changing the chargeholder status in the GMS.

5. Once the chargeholder status has been changed, maintenance control will review all discrepancies, present and deferred, and assign a Maintenance Work Order (MWO) for each task to be performed. The MWOs are available to each of the work centers for review of the required work.



The GMS Stateboard. This page shows each of the aircraft in the system along with complete status information.

6. The flight RMM is converted to a ground maintenance RMM by erasing the flight data and changing the header file. The MWOs are written to the maintenance RMM by maintenance control.

7. The MWOs are taken to the aircraft electronically via the maintenance RMM. The PMA loads the Operational Maintenance Program (OMP) into the mission computers and maintenance is performed. The maintainer, upon task completion, will enter into the PMA the required information for task completion, i.e.: name, description of work performed, and estimated time of hands-on work. The maintainer with final sign-off authority changes the status of the MWO to "Closed" when the task is complete. The aircraft faults are cleared from the Mission Computer by the PMA once the fault has been corrected.

8. Once all maintenance is complete, the post maintenance RMM is taken to maintenance control. The status of each MWO is transferred to the GMS via the RMM for disposition. Once all the MWOs are downloaded to the GMS, the work center controllers close out MWOs, giving maintenance control visibility into the status of the aircraft.

9. Finally, the maintenance RMM is erased and written with a new header file for the next flight.

The C-130J aircraft Mission Computers monitor and record system operation and faults. This information is vital to the day-to-day operations of the aircraft. The GBDS analyzes and interprets this information for the operator and the maintainer. The GBDS incorporates a smooth operation to everyday procedures involved with flying and maintaining the C-130J. The maintainers and operators will have a common system that will enable good communication and coordination of everyone involved with mission accomplishment. ❐

Problems with your Hercules?

Contact the Hercules Support Center:

24 HOURS

E-mail: hercules.support@lmco.com
Telephone: 770-431-6569
Facsimile: 770-431-6556

Honduras Relief Missions: The C-130J in Action

Hurricane Mitch was the fourth strongest Atlantic storm ever recorded. During the last week of October 1998, Mitch caused terrible damage to many Central American countries. Up to 25 inches of rain fell in the mountainous regions of Honduras, one of the hardest hit nations. The ensuing floods and mudslides caused at least 10,000 deaths. Thousands of homes were destroyed and the transportation infrastructure of roads and bridges was set back decades. Many agricultural crops, the economic mainstay of the region, were decimated. The effects of Hurricane Mitch will be felt for many years to come.

As soon as the storm weakened, relief for the region poured in from around the world. As part of the relief effort, Lockheed Martin operated several C-130J missions to transport much needed Red Cross supplies. A total of three flights transported some 80,000 pounds of supplies to Tegucigalpa, the Honduran capital.

These three missions marked the first time the C-130J was used in an operational role. During these missions, the new C-130J proved itself as the most capable Hercules ever. The increased fuel economy, with its resulting improvements in range, and the Enhanced Cargo Handling System (ECHS) were two of the improvements that were prominent in the Honduran relief effort.

On the first relief flight, which took place on 25 November 1998, the C-130J transported 25,000 pounds of supplies. The amazing part of the flight, however, was that the C-130J flew to Tegucigalpa from Dobbins Air Reserve Base and returned on a single load of fuel. While on the ground in Tegucigalpa, the Auxiliary Power Unit operated for more than two hours. The total round trip distance was over 2,800 nautical miles. Upon its return to Dobbins ARB, the “J” still had 8,000 pounds of fuel onboard.

One of the crippling effects of Hurricane Mitch was the destruction of support facilities at the Honduran airports. Many airports lacked the ability to refuel aircraft during the days immediately following the storm. The C-130J shines in these circumstances by being able to deliver 25,000 pounds of cargo to a destination more than 1,000 nautical miles away and return without refueling.

A component of the payload/range equation is the fact that the basic weight of the C-130J is less than that of many older Hercules aircraft. The new aircraft lost weight through the new engines and propellers as well as the elimination of many of the fuel valves and much of the electrical wiring. Because of improvements in powerplant efficiency, the basic C-130J now has more range than the “H” models, even though the “J” does not use external fuel tanks. All of these factors work together to provide the C-130J operator with more options when making range/payload decisions.

The Enhanced Cargo Handling System (ECHS) was another prominent feature of the C-130J relief missions. The ECHS represents the first significant improvement to the cargo compartment in the history of the Hercules. Steven Judd, the loadmaster on each of the flights to Honduras, pointed out that the three-person crew of the “J” is actually more efficient than the larger crews of the older Hercules aircraft. The ECHS enhances the capability of the cargo system through the ease of on- and off-load, improved locks, and automation of the weight and balance functions. Steve estimates that weight and balance calculations now take approximately one-fifth of the time that they did in the older Hercules models.

The greatest benefit of the ECHS during the Honduran relief effort, however, was the increased safety level. The loadmaster is no longer confined to a particular area; he can control the locks from positions alongside the pallets. This allows much closer supervision of personnel during the loading/unloading process. During each of the relief flights, the loadmaster worked with local personnel to off-load the supplies. Various people participated in the off-loading process including local police, firefighters, embassy personnel, and Red Cross workers. In many cases, the loadmaster could not communicate verbally with them due to language barriers, and most of them had no formal training on C-130 cargo operations. After the cargo had been unloaded on the last flight (approximately 30,000 pounds) in only a few minutes, an Atlanta newspaper reporter who had accompanied the crew commented to the loadmaster how fortunate he was to have such a well trained crew to help him unload the cargo! The reporter had assumed that everyone was formally trained since the process went so smoothly and quickly.

During the three flights to Honduras, the C-130J logged approximately 27 flight hours with no significant squawks. The simplified, reliable design of the new C-130J translates into a minimum amount of required maintenance. As Steve Judd put it, “Just reload, refuel, and go!”

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Photos

Top Left: The view over the Gulf of Mexico on the way to Honduras.

Top Right: Inside shot of the off-loading process in Tegucigalpa.

Bottom Left: The “J” on the ramp in Honduras while the supplies were off-loaded.

Bottom Right: The Digital Moving Map dramatically improves the ease of navigation in the “J”.

C-130/Hercules Aircraft and Y2K

by
Ed Carroll
C-130 Analysis and Integration Manager

Lockheed Martin has completed a comprehensive Year 2000 (Y2K) evaluation of the C-130 aircraft and has good news for C-130 operators. With the exception of a couple of caveats, C-130 aircraft are Y2K compliant and ready to operate in the new Millennium.

In 1997, the Lockheed Martin Corporation undertook a Y2K initiative to examine its products and business systems for Y2K readiness. The so-called Y2K bug, or Millennium bug, could occur in software or firmware systems that use the last two digits of the calendar year to represent the year (for example, using 99 for 1999 or 00 for 2000). The use of 00 could cause problems when date calculations using 00 are used. In addition, calendar year 2000 is a leap year; century years are not leap years unless they are divisible by 400; of course, the year 2000 is a leap year.

As part of this initiative in early 1998 Lockheed Martin focused on the C-130, which has been in production since 1955. Lockheed Martin performed a systematic, comprehensive assessment of the C-130 aircraft and systems for Y2K compliance. The overall assessment consisted of two separate evaluations: one for the C-130J and one for C-130H and previous models.

Lockheed Martin's role in this evaluation was to assess the C-130's Y2K compliance and indicate to our customers the possible impacts of non-compliance and potential fixes or workarounds. Although C-130A through C-130H contracts did not contain any Y2K specification or statement of work contract requirements, Lockheed Martin has made a conscientious effort to determine if there are any potential Y2K problems.

C-130J Assessment

The C-130J is a highly integrated digital avionics based aircraft. It uses a number of Central Processing Units (CPUs) as well as many software programs. Because of this, a separate assessment was needed.

After the full assessment of the C-130J, it was found to be Y2K compliant. It was thoroughly examined including all the software systems, as well as integrated circuits, on the aircraft and no problems associated with Year 2000 date use were found. Information from the suppliers was obtained, an evaluation of the Mission Computer and Bus Interface Units was accomplished, and an on-aircraft test of the integrated systems was performed. Without exception, all of these showed Y2K compliance.

In addition, the software and hardware in the C-130J's unique new computer-based Ground Based Maintenance System (GBDS) and computer based Training System, as well as normal Support Equipment was examined and tested. Again, all these systems are Y2K compliant.

Therefore, the C-130J and its associated Support Systems are Y2K compliant and ready to operate into the new Millennium.

C-130H/Previous Assessment

The Y2K assessment of C-130H and previous models was as comprehensive as the C-130J, but a different approach had to be taken, as the previous models are out of production. In addition, Lockheed Martin has sold well over 2,000 aircraft in hundreds of different versions. Lockheed Martin's objective was to obtain as complete an analysis as possible, given the complexity of the task.

First, a list of criteria was established. The criteria included these items:

◆ Models of aircraft to be covered:
- C-130A
- C-130B
- C-130E
- C-130H
- L-100

"Year 2000 Readiness Disclosure"

◆ Equipment to be covered: The as-built configuration of the aircraft, i.e. customer furnished equipment or customer changes in equipment since delivery was not covered.

◆ Non-USAF aircraft - since the U.S. Air Force has its own Y2K initiative, the assessment only looked at non-USAF C-130 systems.

◆ Prioritization of Systems - systems that contained electronic equipment were the focus of the assessment; purely mechanical or structural systems were not included.

Engineering personnel assembled a list of systems, by supplier, that were used on aircraft back to the C-130A. The list contained the system type of equipment (High Frequency radio, for example), system identification (ARC-190, for example), and suppliers of that system. A total of 77 different systems were evaluated, with multiple system identifications within each one.

A comprehensive questionnaire was sent to each of those suppliers inquiring about the Y2K compliance of each system. Letters were received from the majority of suppliers indicating that their systems are Y2K compliant; most systems contain no software or firmware and a few are obsolete, such as the Omega Navigation System. In some cases, suppliers had gone out of business or merged with another company, and technical records were not available. In those cases, Lockheed Martin technical experts examined each system to determine if the equipment is Y2K compliant.

Of the 77 systems, 71 of them are indeed Y2K compliant. The list of those systems is shown on the following page. The list shows 43 systems because different suppliers manufactured the same system. Y2K compliance information was received from all of the suppliers, but the list is summarized at the system level.

Of the other systems, here is a rundown of Y2K status:

Two systems have been replaced or redesigned: the AN/URT-26(V) Crash Position Indicator and the AN/ASH-20(V) Recording Set. According to sources within the U.S. Air Force, these systems have been removed from all C-130s due to inadvertent airfoil release from the aircraft. No information was available on these systems from the supplier.

The following systems were indeterminate as to Y2K compliance: the INS-61B Inertial Navigation System, and Flight Director Systems FD-103 and MA-1, which are considered obsolete by the supplier and are no longer supported. No information was obtained on their Y2K compliance.

In addition, the following special cases could require action for the Year 2000: the LTN-72RL and LTN-92 Inertial Navigation Systems and the ARC-164 Radio.

◆ LTN-72RL and LTN-92 Inertial Navigation Systems- according to the supplier (Litton Aeroproducts), these units may not be Y2K compliant, depending on the software installed. Modified software that is Y2K compliant is available. Users should contact Litton to determine if their unit's software is compliant. Other Inertial Navigation Systems, as noted in the table, are Y2K compliant.

◆ ARC-164 Radio - this unit requires special procedural handling in order to address the Y2K issue. The supplier has stated that the ARC-164 is Y2K compliant. The Have Quick algorithm is also Y2K compliant, but will require special handling in the way that the Word of the Day (WOD) is retrieved for the leap year, specifically during the 28 to 29 February 2000 transition. This is procedural handling only and is not a problem with the components or software. For more information on this procedure, contact Mary Lewis of Raytheon System Company in Fort Wayne, Indiana, USA at Telephone: 219-429-5852.

This information, with caveats noted, indicates that the C-130 systems in this assessment are ready for the new Millennium. For information on items in this report, please contact:

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"Year 2000 Readiness Disclosure"

System	System Identification
AF Standard Flight Director	AF STD
ATC Transponder	621A-3, 621A-6, 621A-6A, TRA-62A
Automatic Direction Finder	AD-306B, ADF-73, AN/ARN-6, AN/ARN-19, AN/ARN-83, AN/ARC-149, DF-202, DF-206, DF-206(F).
Autopilot	AP-105V, E-4
Crash Position Indicator	AN/URT-26(V) (Replaced)
Direction Finder	AN/ARA-25, AN/ARN-50, DF-301E
DME System	DME-40, 860E-2, 860E-5
Doppler Computer	AN/ASN 35
Doppler Drift Attachment	AN/APA-52
Doppler System	AN/APN-147, AN/APN-218E
Emergency Keyer System	AN/ARA-26
Flight Data Recorder	109C, 109D, 209F, 5424-501
Flight Director Computer	CPU-27, CPU-65
Flight Director System	FD-103 (Obsolete), FD-108, FD-109, MA-1 (Obsolete)
Glide Slope Receiver	AN/ARN-18, AN/ARN-31, AN/ARN-67, 51V-4
Ground Proximity Warning System	Mark II, Mark VII
Gyrocompass	C-12, N-1
HF Radio System	618S-1, 618T-1, 628T-2, AN/ARC-132, AN/ARN-190, HF-102
IFF	AN/APX-101
IFF Interrogator	AN/APX-76
IFF Transponder	AN/APX-25, AN/APX-72, AN/APX-100(V), Cossor IFF, EMD2900B
Inertial Navigation System	Carousel IV, INS-61B (Obsolete), LTN-51, LTN-72, LTN-72R
Intercommunication System	AN/AIC-10, AN/AIC-18, AN/AIC-25, G610-11
LORAN	AN/APN-70, AN/APN-70A
Marker Beacon Receiver	AN/ARN-12, AN/ARN-32, 51Z-4
Omega Navigation System (No Longer In Use)	AN/ARN-99, AN/ARN-131, CMA-740, CMA-770, CMA-771, LTN-211
Public Address System	AN/AIC-13, MI-36A
Radar Altimeter	ACR-718, AN/APN-22, AN/APN-133A, AN/APN-232
Radar Set	AN/APN-59, AN/APN-128, AN/APN-133, AN/APN-133(V)3, AN/APN-215, AN/APQ-122(V)5, AN/APS-42A, RDR-1E, RDR-1F, RDR-1FB, RDR-1FB(M), WP-103G
Radio Altimeter	AL-101, AN/APN-150, AN/APN-171, AN/APN-184, AN/APN-194
Radio Compass	AN/ARN-89
Receiving Decoding Group	AN/ARA-63
Recording Set	AN/ASH-20(V) (Replaced)
SelCal Decoder	NA135, NA1335
Station Keeping Equipment	AN/APN-169A/B/C
TACAN System	AN/ARN-21, AN/ARN-52, AN/ARN-72, AN/ARN-84, AN/ARN-118(V), AN/ARN-130, AN/ARN-139
UHF Communication Radio	AN/ARC-34, AN/ARC-51BX, AN/ARC-109, AN/ARC-134, AN/ARC-138, AN/ARC-159, AN/ARC-164(V)
VHF Communication Radio	AN/ARC-3, AN/ARC-49, AN/ARC-131, AN/ARC-186(V), AN/ARC-513, AMR-207, VHF-20A, VHF-101, ER4-671B, 618M-2B, 618M-2D, 618M-3A
VHF Navigation System	AN/ARN-123, AN/ARN-126, AN/ARN-127, AN/ARN-147
VHF/UHF Radio System	AN/ARC-182
VOR/ILS Radio	AN/ARN-14, RNA-26C
VOR System	51RV-1, 51RV-4B, 51RV-4D, VOR-101
Voice Recorder	A-100, A-100A

"Year 2000 Readiness Disclosure"

Improved Bleed Air Overheat Detection System for the C-130

by
Jeff Osterlund
Senior Engineer,
Airlift Derivative Programs

Lockheed Martin incorporates many improvements into the baseline C-130 design which can be adapted for retrofit on in-service aircraft. One such modification, applicable to C-130B, E, and H models, is the installation of an improved bleed air overheat detection system (ODS). In addition to providing more complete coverage of the high pressure bleed air ducts, the system will isolate the failure area during maintenance to reduce aircraft down-time and crew workload.

This improved ODS has been in service on commercial aircraft for the last 15 years. The ODS equipment is certified to applicable U.S. Federal Aviation Administration standards. The system is a dual microprocessor based unit with input of up to 12 zones with 6 alarm outputs to a special C-130 control panel in the overhead flight station. The control unit is mounted in a side rack in the cargo compartment on the right side of the aircraft between Fuselage Station 245 and 497, depending on the customer's configuration. The control unit is mounted in a quick-release ARINC 600 tray with shock isolators along with a system relay panel. The control unit has a built-in-test (BIT) capability to test the integrity of the system's logic and to localize failures to a specific zone for maintenance personnel.

The unique C-130 control panel is mounted in the overhead flight station area in direct line of sight for the flight engineer. The panel is dual mode lighting with night vision goggle (NVG) compatibility, and incorporates a horn silence button and a test mode switch for the control unit. The overheat detection system interfaces with the existing warning horn in the aircraft used for flap and landing gear indication. A unique pulsing tone is sounded when an overheat detection is activated along with zone illumination on the panel. This allows the flight engineer to take the appropriate action in removing the bleed air from the detected zone. The BIT can be performed by activation of the lockout, spring-loaded switch by the flight engineer during preflight checkout.

The detection elements are attached directly to the ducts and are routed on all of the high pressure ducts in the wings, transfuselage, forward and aft fuselage, Fuselage Station 245 bulkhead to the flight station air conditioner, APU/ATM, and cargo compartment air conditioning areas. The areas inside the fuselage are preset for a detection at 255 degrees Fahrenheit and the other areas are preset for a detection at 310 degrees Fahrenheit. The routing is a single, double loop covering the top and bottom of the ducts with a 180-degree separation. This method provides complete duct coverage. The element's corresponding zone will continue to operate with a single break in the zone element sensor.

The improved bleed air overheat detection system offers an additional safety awareness to the crew and a convenient, easily serviced system with minimal aircraft modification.

For more information concerning this modification, please contact:

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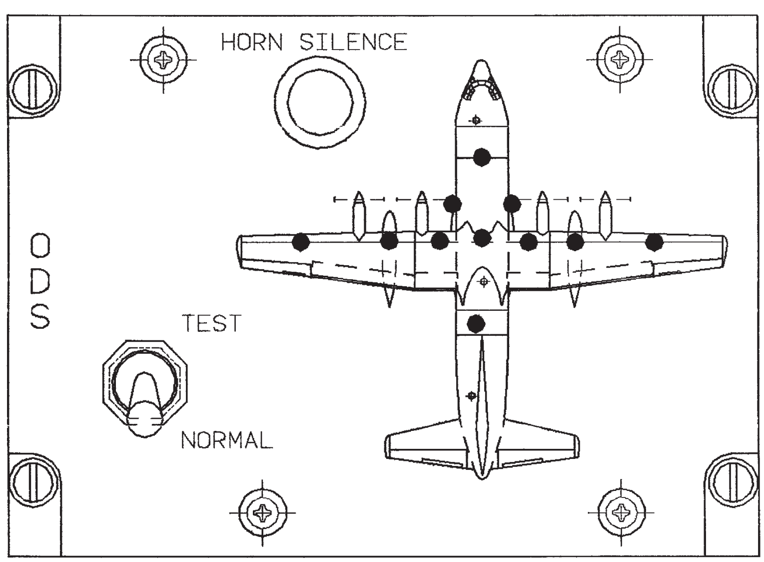

Preventing Fuel Spills When Performing Maintenance on External Tanks

Article, photo, and diagram by
Jerry Greenwood
Field Service Representative

The design of the external fuel tank is unlike the other fuel tanks on the Hercules in that only one fuel line is used for refuel, fuel transfer, and dump operations. This design is efficient and, when everything is functioning properly, provides delivery of fuel to the desired location. After passing into the tank, the single fuel line branches off to the level control and shutoff valve near the top of the tank and to twin fuel pumps located at the bottom of the tank.

Because the external tank is lower than the wing tanks, a path for fuel to siphon from the wing tank dump pumps to the external fuel tank exists. This does not happen because the normally closed wing fuel tank dump valves prevent any fuel from exiting the wing tanks. Fuel flow into the external tank is blocked by the closed external tank level control valve and the two check valves at the fuel pumps.

If, on the other hand, a wing tank dump valve had failed to close and the external tank fuel pumps or the level control valve were removed, fuel would flow into the tank as it siphoned up though the dump pump, past the not closed dump valve, into the refuel manifold, and down into the external tank. The next stop for the fuel would be the ground. Stopping the flow requires determining the location of the discrepant dump valve and then manually closing it. This can take quite some time as the dump valves cannot be reached unless the dry bay panels are removed.

To ensure that fuel will not siphon from wing tanks into an external tank when an external tank pump or level control valve is removed, follow these steps:

1. Transfer or drain all fuel out of the external tank that will be serviced.

2. Open the external tank refuel valve (level control valve), using the Single Point Refueling (SPR) controls as if to transfer fuel into the tank, but with all aircraft transfer pumps off.

3. Any trapped fuel in the manifold higher than the level control valve will now drain into the tank. This can be seen by looking at the level control valve through the tank filler cap. This flow will stop as trapped fuel in the refuel manifold is exhausted. All trapped fuel that is lower than the level control valve will remain in the line and cannot be removed until the fuel pump assembly is removed.

4. A continuous flow of fuel indicates that one of the wing tank dump valves is not closed. This condition must be corrected prior to removal of the external tank pump assembly.

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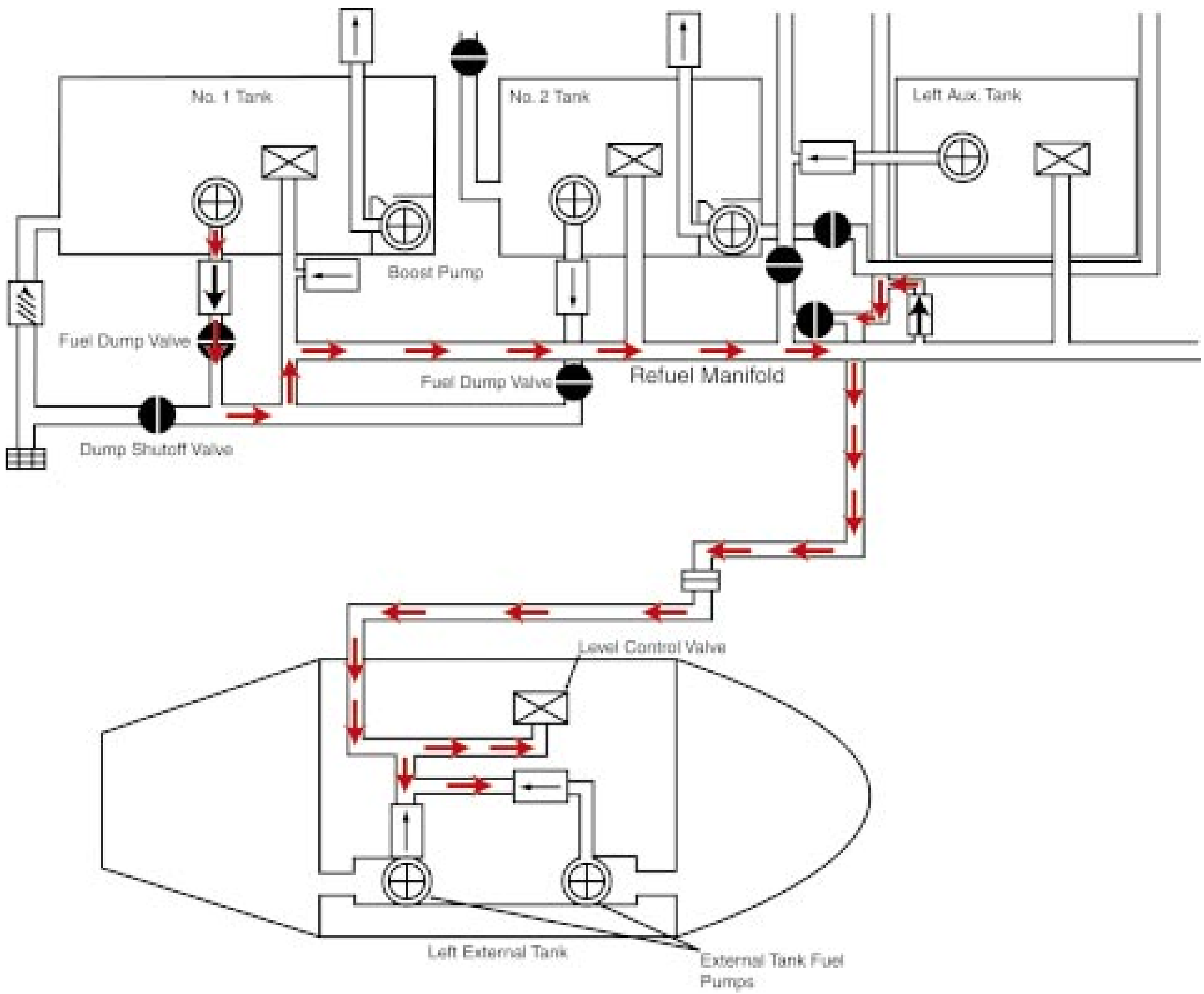

1998 Hercules Operators Conference Action Items

During the 1998 Hercules Operators Conference, two Action Items concerning the Corrosion Control Manual were identified. These two Action Items are presented below along with the responses.

Action Item: The Corrosion Control Manual does not presently include dehumidification information.

> ***Response:*** Lockheed Martin recognizes that dehumidification of aircraft structure will minimize corrosion. An attempt will be made to include a recommendation on dehumidification in the next revision of the manual.

Action Item: The Corrosion Control Manual does not include the Auxiliary Power Unit compartment in corrosion prone areas for electrical components.

> ***Response:*** The Action Item was only applicable to USAF Technical Order 1C-130A-23, which is maintained exclusively by the USAF. However, SMP 515-B, which is written and maintained by Lockheed Martin, addresses protection of electrical components within Chapter 20, "Standard Practices." Currently, neither manual specifically lists the APU compartment as a corrosion prone area.

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