Lockheed

VOL. 21 NO. 2, APRIL - JUNE 1994

service news

A Service Publication of Lockheed Aeronautical Systems Company

The Hercules In Transition

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A SERVICE PUBLICATION OF LOCKHEED AERONAUTICAL SYSTEMS COMPANY

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Vol. **21, No. 2,** April -June 1994

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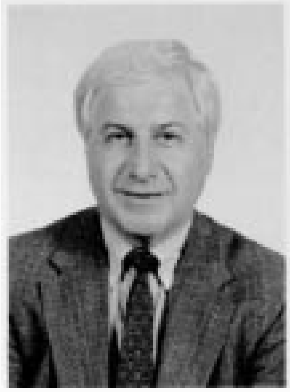
Cover: New C-130Hs being delivered to the North Carolina Air Guard are equipped with a number of advanced systems, including night-vision imaging (NVIS). Back panel: A leased RAF Herc with the Allison AE 2100D3 engine and six-blade Dowty R391 prop that will power the C-130J installed in the No. 2 position.

Cover photos by John Rossino.

Focal Point



John Gaffney

The Lockheed Aeronautical Systems Support Company

The amazing success of Hercules airlifter, now operating in 64 countries throughout the world, has generated a constantly escalating demand for high-quality Hercules support products and services. This has led to the development of a global marketplace for these products that presents the Hercules operator with both risks and opportunities.

In my Focal Point message in Vol. 20, No. 4 of Service News, I stated that LASC Product Support is totally committed to providing the very highest level of service to each of our customers and every one of our airplanes. This verbal commitment is now being backed up by an innovative new approach that will offer every operator of the Hercules aircraft the most comprehensive and cost-effective support package available anywhere.

For the past several Years, the Lockheed Western Export Company (LWEC) has been providing Hercules operators with low-cost, high-quality field support and aircraft field modification services. Based on LWEC's demonstrated success, we have now created a new company which will incorporate LWEC's functions and enlarge upon its role. It gives me great pleasure to announce the formation of the Lockheed Aeronautical Systems Support Company (LASSC).

LASSC offers an expanded product line designed to provide our operators with a one-stop shop for total Hercules support. The new venture greatly simplifies the process of obtaining logistic support, whatever level you may require. We have made it much easier for You to conduct business with Lockheed by consolidating previously separate Hercules support organizations under one company. The resulting efficiencies also make it possible for us to offer extremely competitive pricing for all logistics elements. And the quality of LASSC support is unmatched. Every service we offer, and every spare part we sell-new, used, rebuilt, or exchanged-is fully warranted by Lockheed, the original equipment manufacturer. No other supplier can make that statement, or offer that kind of protection.

When we created LASSC, we listened to the world's best consultants: You, our customers. LASSC has been designed from the ground up to meet Your support needs, based upon the ideas, concerns, and expectations which you have shared with us over the years. We think You will like the result. Welcome aboard!

Sincerely,

John L. Gaffney
President,
LASSC

PRODUCT SUPPORT LOCKHEED AERONAUTICAL SYSTEMS COMPANY

J. L. GAFFNEY – DIRECTOR

FIELD SUPPORT	SUPPLY SUPPORT	TECHNICAL PUBLICATIONS	RM&S DESIGN	CUSTOMER TRAINING
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The Hercules in Transition

by **Lyle H. Schaefer**
Chief Experimental Test Pilot
Flying Operations Department

While the venerable C-130 has retained the external appearance of its heritage through the years, there are a number of improvements now being incorporated into some new production models that will not only improve its operational effectiveness, but will make a positive contribution to flight safety. The purpose of this article is to highlight some of those enhancing features. Many appeared in 1993 deliveries; others will be incorporated incrementally over the next two years.

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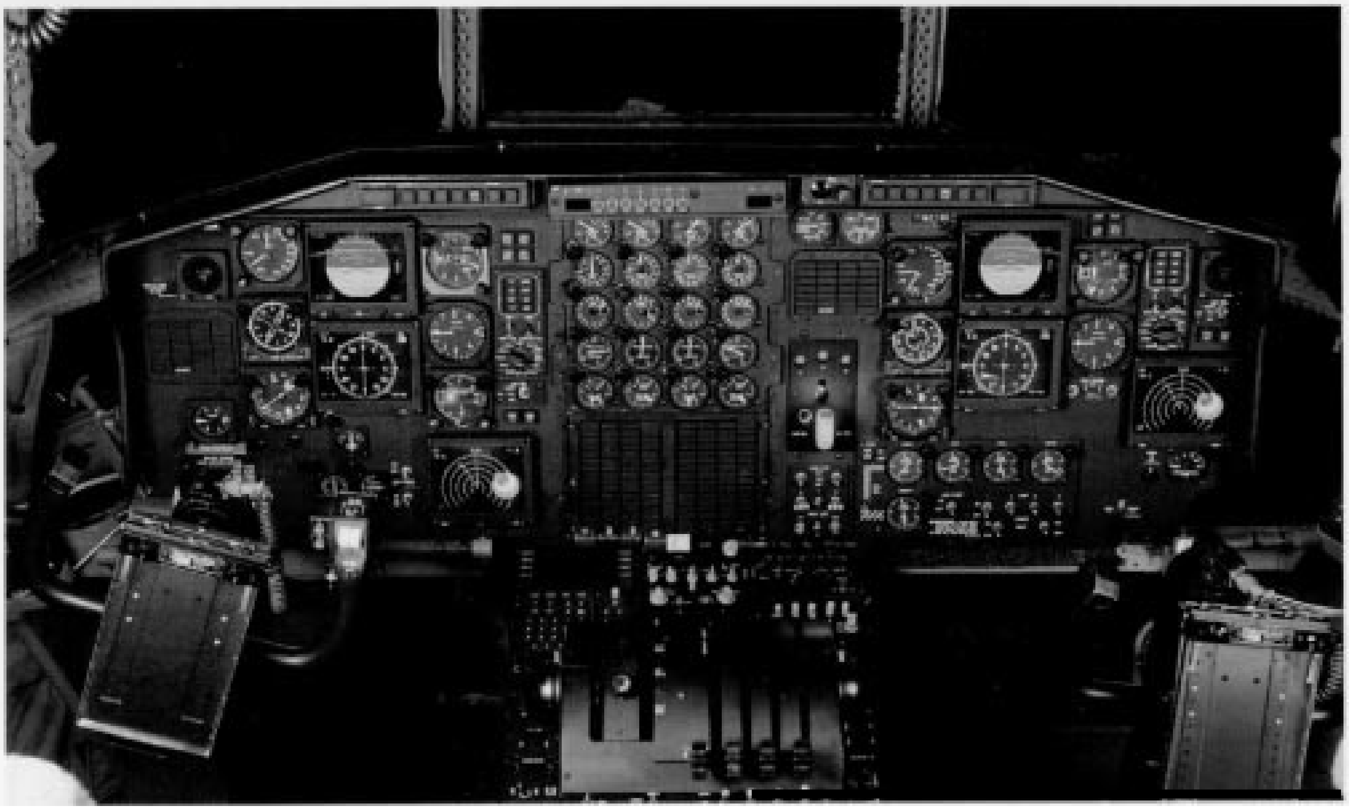


By day: the NVIS-compatible cockpit features a clean new layout, updated instrumentation.

In C-130H deliveries to the U.S. Air Force and Air Reserve Component beginning in 1993, the cockpit of the Herc has a totally new look to it. The most notable feature is the subdued flat black and gray color scheme. This is the first hint that the cockpit has been reconfigured for something quite focused-flying at night! The customer mission requirement to use night-vision imaging systems (NVIS) led Lockheed to initiate a complete redesign of the cockpit in order to ensure NVIS goggle compatibility.

New Cockpit Lighting

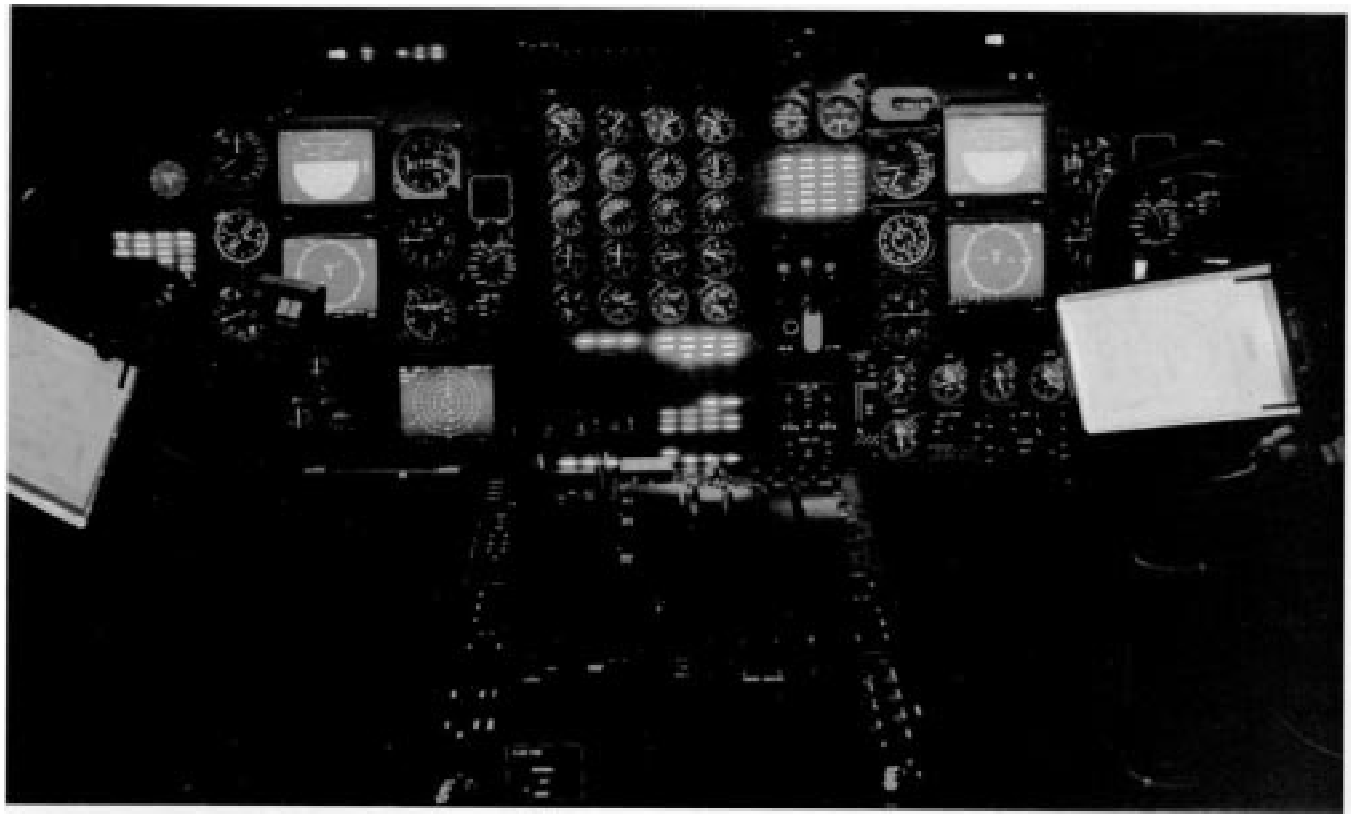
This resulted in a totally new cockpit lighting system, as well as a modified crew alerting scheme to provide a safer environment for the crew when flying on night-vision goggles. In the redesign process, the overriding consideration in all decision-making was flight safety. It was recognized that flying low-level missions at night is in itself a demanding task, and it is even more demanding to fly them with one or more of the crew on night-vision goggles.

Different approaches have been taken to modify C-130 cockpits in an attempt to make them NVIS-compatible, but this is the first time that the C-130 cockpit has been production-configured by the prime contractor to be totally NVIS-compatible. The entire cockpit lighting is new. All of the panel lights are NVIS green, and all the incandescent floodlights have been replaced withgreenelectroluminescent strips. The edge-lit panels with the screw-in bulbs have all been replaced with panels that have NVIS-compatible integrated back lighting.

Many of the panel legends have been abbreviated or eliminated to reduce the overall cockpit luminance. All the instrument post lights have been replaced with new NVIS green lights. The pilot has a master, lever-lock switch that shifts all cockpit lighting to the NVIS mode. This safeguard protects the crew from an inadvertent illumination of a non-NVIS-compatible light during goggle operations. This switch not only shifts all the cockpit lights to a NVIS dim mode, but also converts the electronic displays to a NVIS-compatible color palette.

All of the panel lights have been balanced to give very uniform night lighting. In addition, the side shelves have been modified to include shields that block out reflective light from inside the cockpit on the side windows. Normal night operations in the cockpit have benefited significantly from these improvements, resulting in one of the best-lit and reflection-free night cockpits in existence today. This will make seeing outside the cockpit at night more efficient and will eliminate reflected-light interference with external visibility, thus improving the safety of night operations.

New forward windshields will allow 50% more NVIS frequency-band light to pass through. This will



By night: the normal nighttime lighting mode offers a beautifully illuminated and reflection-free operating environment.

not result in a noticeable change in non-NVIS night viewing, but will significantly improve NVIS goggle effectiveness under comparable lighting conditions, allowing the crew to maximize the viewing utility of the goggles.

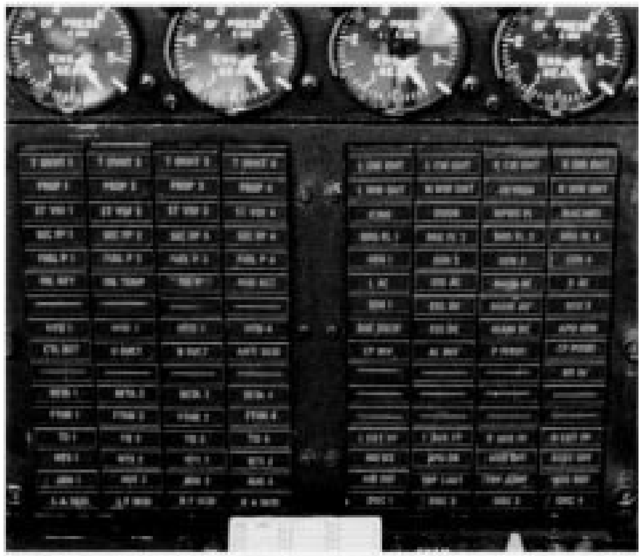
Aircrew Alerting System

When using the NVIS goggles, the pilots' field of view allows them to see the instrument panel by looking underneath the goggles, but restricts their ability to see the overhead or side panels. It was concluded that having warning, caution, and alert lights distributed throughout the cockpit panels would not be acceptable in the night-vision goggle environment.

To solve this problem, the cockpit was modified to conform to MIL-STD-411, Aircrew Alerting Systems, as well as MIL-L-85762, the military specification for NVIS-compatible cockpits. The approach included the incorporation of the Mode Advisory Caution and Warning System (MACAWS). This system ties all caution alerts to two master caution lights that are imbedded in the glareshield, places two sets of warning alert lights in panels directly adjacent to them, and relocates all existing caution and advisory lights to a centrally located panel.

These changes put the master caution and warning lights in a position to get the pilots' attention, and allow the pilots to see which alert has triggered them even if the night-vision goggles are being used. All of the lights that are employed in the MACAWS are purposely located in such a way as to ensure that they will be readilv visible to both of the pilots and the flight engineer at all times.

The MACAWS includes installation of a master caution light and a set of alert warning lights in the glareshield directly in front of each pilot.



In the MACAWS, all caution and advisory lights are placed in a centrally located panel below the engine instruments.

Optimizing the Layout

A major design objective was to clear everything off the top of the glareshield, and to optimize the shape of the glareshield to provide an improved external field of view for the pilots. The standby compass is relocated high above the center of the glareshield, installed in an area of reduced magnetic interference just below the eyebrow panel. Here it can be seen by both pilots and provide a more accurate output without obstructing the external field of view.

A caution/advisory panel, organized into eight columns of lights, is now located in the center instrument panel in place of the bottom three rows of engine instruments. The panel is divided into zones; the top zones are reserved for cautions and the bottom zones for advisories. To make room for this panel, the oil temperature, oil quantity, and oil cooler flap gages were moved to the overhead right-hand side of the fuel panel along with the oil cooler flap control switches. The fuel panel was simplified and condensed to make room for these gages and switches.

New alerts to warn of high engine oil temperature, low engine or gearbox oil pressure, or rudder deboost failure have been incorporated. The rudder boost gages have been eliminated from the cockpit, although actual direct reading pressure can still be read in the rudder servo area in the cargo compartment.

The layout of the caution/advisory panel was planned to keep related system lights grouped together. The left four columns of the panel are devoted to engine-related alerts, with the most important cautions at the top of the cautions zone and the most important advisories at the top of the advisory zone. On the right side, other zones for electrical, hydraulic, bleed air, and fuel were established.

The typical aviation yellow for caution lights had to be abandoned in favor of NVIS green in this panel. To assist the crew in identifying a green caution light as a caution indication when it triggers the master caution light, the individual caution light flashes along with the master caution lights. Pressing either master caution light to acknowledge the alert results in the master caution lights going out and the caution light shifting from a flashing to a steady condition.

All the lights that reflect flight director, autopilot, or navigation system modes are aggregated into two mode light panels conveniently placed in the flight instrument cluster on the forward instrument panel. A similar mode panel is located at the navigator's station to reflect navigation and system status. All of these lights conform to a standard that allows a maximum of eight letters, numbers, or spaces; thus maintaining large, easily read alphanumerics of consistent size.

Electronic **Flight Instrument Displays**

Another cockpit feature that is immediately noticeable is the use of electronic flight instruments (EFIs) in the instrument panel. Four of these are color, liquid-crystal, flat-panel displays that replace the conventional electromechanical attitude director indicators (ADIs) and horizontal situation indicators (HSIs), two are radar displays, and two are vertical speed/Traffic Alert and Collision Avoidance System (VSI/TCAS) indicators.

These flat-panel instruments make the best use of color and are very bright and easily readable in direct sunlight, even with sunglasses on. They also are much easier to read in dusk conditions when the other instruments are hard to see in the transition between sun-in-your-eyes and darkness.

The new displays provide improvements over the electromechanical gages they replace and incorporate additional critical data. For instance, a digital readout of radar altitude is presented on the upper left comer of the AD1 in large numerals. This single feature improves situational awareness during low-level work and instrument approaches. In response to customer requests, the combined altitude radar altimeter indicator (CARA) itself has been moved to the left of the HSI, just below the VSI, to a spot more convenient for the pilot's instrument scan.

The EFIs are able to do things that cannot be achieved with electromechanical instruments. One such feature is that EFIs will only display data when it is available. On electromechnical instruments, needles must either be mechanically stowed or they will be left

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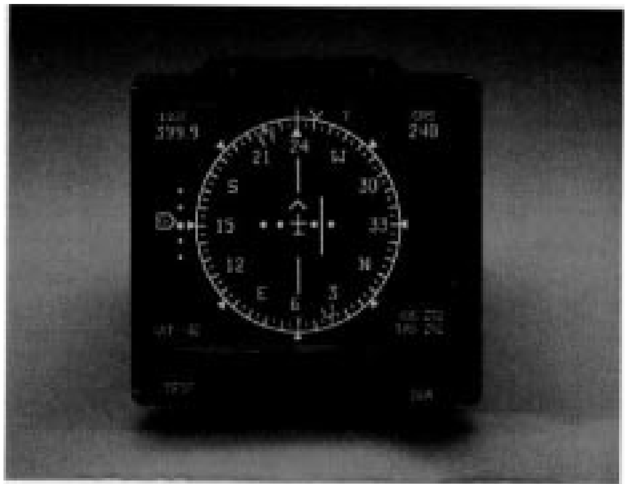

The electronic HSI features large numerals that "ferris-wheel," always remaining vertical as the HSI rotates.

to rotate in a "hunting" mode. An example of this would be selecting a VOR station when no signal is available. On the electronic HSI, no data will be displayed; the conventional indicator would present a searching, rotating needle, which is distracting and disorienting.

Flight director commands are displayed in a standard V-bar format, making it very easy to track commanded roll and pitch commands without having to search for the correct bank angle. The pilot merely matches the aircraft symbol (which is a different color from the command bar) in pitch and roll to fly the commanded track. This reduces pilot workload and reduces deviations from the commanded track. The individual marker beacon lights have been eliminated and are presented in the upper right corner of the ADI. When the marker beacon signal is received, it is presented in a square in the appropriate color with the outer-marker (OM), middle-marker (MM), or inner-marker (IM) letters.

The top of the HSI has a green inverted chevron that displays aircraft course (or track) relative to the heading. Drift angle is measured from the lubber (heading) line to the chevron and provides a simple cue to the pilot for flying approaches or any other precision tracking maneuver that requires compensation for drift. The pilot merely matches the chevron with the bearing needle or desired track and the airplane tracks directly to the station.

Another feature of the HSI is large numerals that "ferris-wheel" as the HSI rotates, i.e. the numerals always remain in the vertical orientation. In the right-hand corner, true airspeed and ground speed are displayed continuously. Static air temperature is shown in the lower left corner, so the need for the large ground speed, true airspeed, static air temperature, and drift angle instruments has been removed.

The need for a separate station-keeping equipment (SKE) range marker has been eliminated by integrating the SKE information into the electronic ADI. When the pilot selects SKE on his mode select panel, the AD1 is configured to include range variations on the vertical flight director needle. An airplane symbol replaces the slow/fast symbol on the right side of the instrument, showing the deviation from the desired tracking interval. This allows the pilot to concentrate on the basic flight instruments and improves his situational awareness of the SKE picture within a much smaller scan pattern.

Digital Low-Power Color Radar

The other two flat-panel displays are used to display the new multimode digital low-power color radar (LPCR), flight plan, and SKE data. Each pilot has his own display and a display controller. The navigator has a monochrome display with a full set of radar controls. The pilots can bring up different displays at the same time. For instance, one pilot can be on SKE, while the other is on weather radar.

Even when seen from an extreme angle, the new EFIs are remarkably easy to read.

Developed especially for the Hercules airlifter by Lockheed and Westinghouse, the LPCR is unique to the Here and a truly state-of-the-art radar. It has the following modes: ground map, weather, air-to-air skin paint, and wind shear. It is fully integrated with the self-contained navigation system (SCNS) via the 1553 data bus and offers a quantum improvement in performance, reliability, and capability. The flight plan mode is available as an overlay to indicate the airplane's planned navigation route relative to weather, obstructions or other displayed features.

The Hercules is the first operational military aircraft to have a proactive, on-board, wind-shear alerting system. This system marks the wind-shear area ahead of the aircraft, allowing the crew time to take evasive action. The unique features of this radar will make a major new contribution to keeping aircrews out of harm's way.

In the area of ground safety, the new radar operates at such a low power output level that it can be operated on the ground without any restrictions on the proximity of ground personnel. This removes restrictions during operational pre-flights and eliminates the need to set up outside warnings.

Part of the upgrade of the navigation system is the installation of a second inertial system, a Global Positioning System (GPS) receiver. A standby attitude indicator is installed in the instrument panel. Gone is the C-12 compass system and the standby gyros. The second inertial system provides a more accurate attitude source than the gyro it replaces, and the dual heading outputs from the inertial systems exceed the C-12 system in terms of accuracy.

The GPS in combination with the Doppler beam sharpened mode of the radar will provide aircrews with very precise locator information. This opens up all kinds of possibilities in the tactical world, as well as making a vital contribution to navigating precisely to avoid ground obstructions. The radar cursor will couple with the autopilot for airdrops so that position updates can be used to improve drop accuracy right up to the drop point.

Traffic Alert **and Collision Avoidance System**

The TCAS II as installed in airliners is being installed in the Herc. This system includes two new liquid-crystal VSIs, which display both traffic alert information and vertical speed. TCAS information can also be selectively displayed in a larger format on either radar display. Mode "S" is incorporated in the IFF to support TCAS. The system gives the Hercules the same airspace alerts that the airliners have, providing additional protection against mid-air collisions. This will supplement the air-to-air skin paint mode of the radar, which displays digitally processed airborne target information on the radar display.

The new instrument panel incorporates threat warning indicators for both pilots. This will give them an immediate indication of the threat sector without the delay associated with communications from another crew member. The capability should enhance safety in a hostile environment, giving the pilots instantaneous information allowing them to react quicker to a threat alert.

Summary

No single item in this list of improvements can be tagged as making a major contribution to improved flight safety. But taken in aggregate, we believe they will make a positive contribution to the proven safety of the Hercules aircraft. Even with all these design and system improvements, the aircrew member is still the critical common denominator in the safety equation. Proper knowledge of how the aircraft systems work, what their limitations are, and the application of good judgement in their utilization is still necessary for effective and safe mission completion. All the safety improvements in the airplane can only be effective when operated by a well-trained, well-rested, and well-prepared aircrew.

The author and *Service News* gratefully acknowledge the generosity of Dave Didier and Avionic Displays Corporation in providing photographic support for this article.

Lyle Schaefer may be contacted at 404-494-3049.

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A DIGITAL TOOL for Ramp Hook Retainer Identification

by Roy H. Webber, Group Engineer
Reliability and Maintainability Engineering Department

The cargo ramp rigging procedures shown in the authorized maintenance manuals for various models of the Hercules aircraft sometimes differ from one another in a variety of details, but all start out with the basic assumption that the correct hardware is installed in the correct locations on the aircraft. Unfortunately, experience from the field has shown that this assumption is not always justified. Mislocated ramp hook retainers, in other words, retainers that are installed at incorrect stations on the sloping longerons, appear to be a common finding in some parts of the Hercules fleet.

When the hook retainers are not installed at their intended locations, the result can be a host of unexplained discrepancies involving the ramp, and an exercise in frustration for anyone unfortunate enough to be tasked with re-rigging the locking system. An in-depth discussion of the Hercules airlifter's cargo ramp and its locking system was published in Vol. 20, No. 4 (October-December 1993) of ***Service News*** magazine. The article, written by MSgt. Dave Crerar of the Wyoming Air National Guard, includes a complete discussion of the cargo ramp hook retainers and the problems that can arise if a retainer is not located in its intended position.

If you are not already thoroughly familiar with the ramp hook retainers and the ramp locking system, we suggest that you read MSgt. Crerar's article. A copy can be obtained by contacting the ***Service News*** editor if you do not already have the issue in your library.

Identifying the Problem

The key to avoiding mislocation of the ramp hook retainers is having a reliable way of identifying each of the seven different part numbers included in every complete shipset. A second article in the same ***Service***

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The heart of the new rams hook retainer identification tool is the digital protractor, a high-tech "hand" tool now in wide use in civil engineering and the construction industry.

News issue, written by Ben Puckett of the Warner Robins Air Logistics Center, addresses this requirement. Mr. Puckett describes a locally manufactured mechanical measuring device developed by the U.S. Air Force for the purpose of identifying C-130 cargo ramp hook retainers. When constructed with sufficient precision and used with care, this tool provides a useful method of identifying the ramp hook retainers without requiring their removal from the aircraft.

The mechanical tool identifies individual ramp hook retainers by measuring the angles between an individual ramp hook retainer's locking lug and the flat surfaces on the tops of its mounting hole bosses. Mr. Puckett's generosity in providing the prototype tool to Lockheed for evaluation led to an inspired suggestion by two Lockheed engineers, Jim Taylor and Larry Lassiter, who proposed an entirely different approach to the task of measuring the very small angles involved.

The Digital Edge

Their idea makes use of a digital protractor, a high-tech "hand" tool now in wide use in civil engineering applications and the construction industry, to determine the angular difference between a retainer's locking lug and the top surfaces of its mounting hole bosses. This concept yielded excellent results in two prototype hook retainer identification tools built by Lockheed for internal use, and immediate action was taken to make similar devices available to Lockheed customers.

Lockheed support equipment engineers teamed up with one of our commercial suppliers to improve the original concept and develop a low-cost digital hook retainer identification tool using off-the-shelf components. The result of these efforts is now available as the PN 122-000-l Ramp HookRetainer Identification Tool.

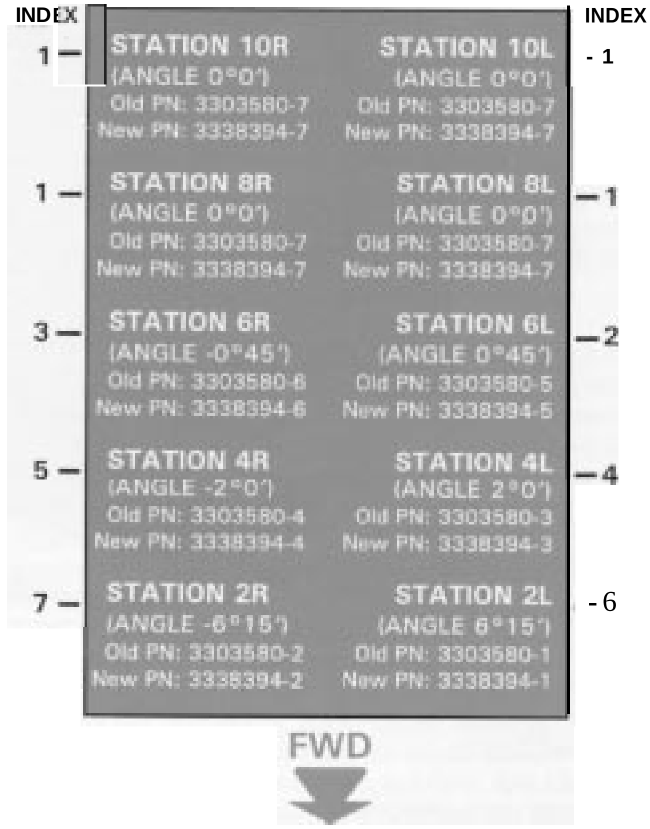
The new tool consists of a digital protractor fastened to a black-anodized, machined aluminum plate. The plate is equipped with tangs at right angles to its main axis that help facilitate making the measurements. A small bubble level is fixed to one of the arms to help ensure that the protractor will not be tilted excessively toward or away from the operator while the measurements are being made.

The digitally based tool performs the same function as the mechanical tool, but it is easier to use and more accurate. In many cases, the digital tool will also turn out to be less expensive to acquire than the locally fabricated mechanical tool, which requires precision machine shop equipment and the services of an experienced machinist for its construction.

Using the Tool

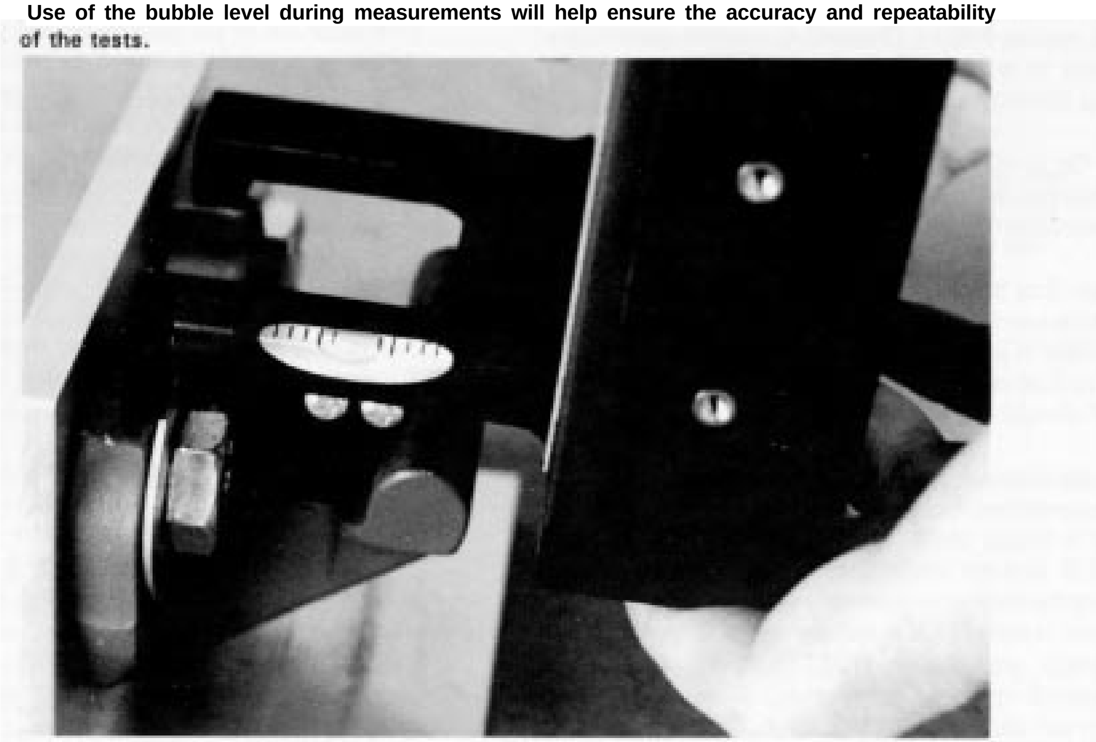
Complete instructions and a protective carrying case are provided with the new tool. A simplified instruction plate containing all of the information necessary to operate the tool and interpret the results is attached to the back of the digital protractor. The basic steps required to measure a ramp hook retainer are listed below:

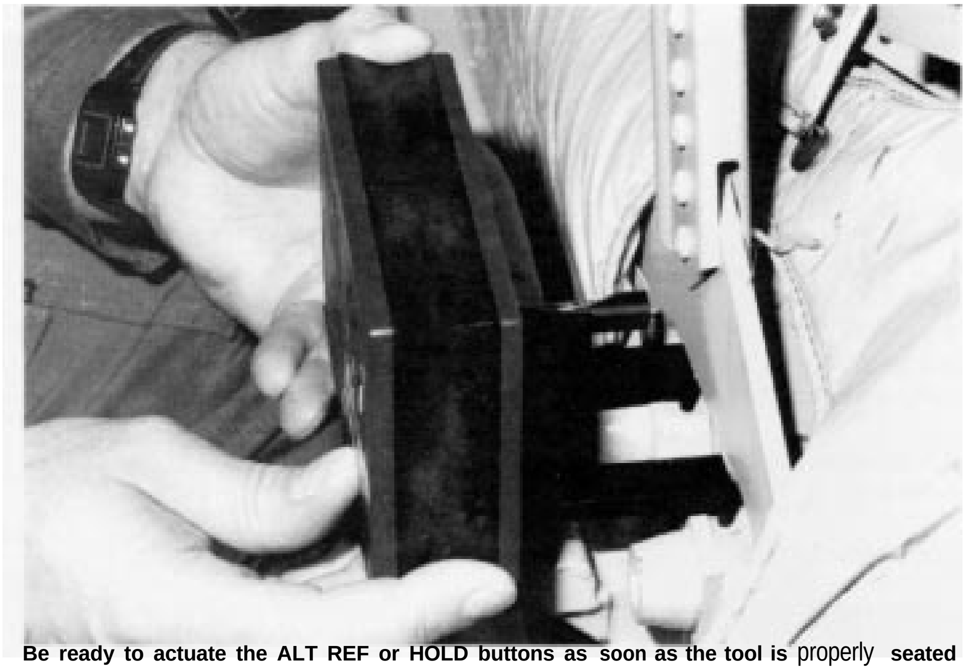
1. Remove dirt and sealant from the tops of the mounting hole bosses.
2. Turn on the digital protractor.
3. Place the tangs on the flat surfaces of the mounting hole bosses.
4. Level the tool and press the ALT REF button to zero the indicator.
5. Relocate the arms to the top of the locking lug. Level the tool and press the HOLD button.
6. Remove the tool. Note the reading and compare it with the table below (or the one provided on the back of the tool).
7. Press HOLD and the ALT REF to return the display to normal.



Cargo ramp hook retainer layout, including index numbers and part numbers. Note that the 2R 4R. and 6R positions will show negative angles when measured with the digital tool.

Use of the bubble level during measurements will help ensure the accuracy and repeatability of the tests.





Be ready to actuate the ALT REF or HOLD buttons as soon as the tool is properly seated on the retainer and level.

Hints and Tips

During our evaluation of the PN 122-000-l Ramp Hook Retainer Identification Tool, we learned a few things about using it that will interest all potential users.

- Read and save the separate sheet of instructions that covers the operation of the digital protractor itself. The protractor is the heart of this piece of equipment and must be handled properly if accurate measurements are to be expected.
- Best results will be obtained if another person is present to hold a flashlight on the hook retainer being checked and to record the data.
- Use the bubble level to hold the tool level during measurements. This will improve the accuracy and repeatability of the results.
- When first turning on the protractor, and before starting any measurement sequence, make sure the indicator is in the normal mode. The display should not be flashing (i.e. not in HOLD mode), and ALT REF should not be shown on the screen.
- It is not necessary to look at the display when taking measurements. Better results will be obtained if you hold a finger ready to actuate the ALT REF or HOLD buttons while watching the bubble level. When the bubble is centered, press the appropriate button crisply. If the measurement is performed properly, pressing the HOLD button will lock the measured value on the display, allowing it to be observed and recorded at leisure.
- Note that properly positioned ramp hook retainers in the 2L, 4L, and 6L positions will show positive angles when using the digital tester: no minus sign will be shown on the display. However, the retainers in the 2R, 4R, and 6R positions will show negative angles. In these cases, a minus sign will be shown on the protractor's display.
- After recording the data on the first hook retainer measured, press the HOLD button to take the protractor out of the hold mode and press the ALT REF button to take it out of the ALT REF mode. This returns the protractor to the normal mode for the next measurement. Also perform these two steps prior to turning the protractor off. If you fail to do this at shutdown, the next time the protractor is used it will still be in the same mode it was left in.
- When actuating the ALT REF and HOLD buttons, a quick press and release like a clicking motion works best. If the button is held down more than a fraction of a second, the instrument will not remain in the mode selected.
- One common discrepancy often found is a hook retainer mislabeled by the supplier; i.e., showing the wrong dash number. Another is a correctly labeled part in the wrong location. A third is an out-of-tolerance part. If the parts have been repainted and the part numbers are painted over (the usual situation), you will not be able to distinguish between mislabeling or mislocation if the correct angle is not obtained.

Tolerances

Tests conducted at Lockheed and the Wyoming Air National Guard confirmed that the PN 122-000-l Ramp Hook Retainer Identification Tool is dependable, easy to use, and accurate. It is particularly useful for identifying the 2” and 6” 15’ retainers. Because of tolerance buildups in the parts and inherent measurement inaccuracies, it may not always be possible to distinguish between the 0” retainers and the O'45’ retainers. This is due to the following factors:

- The manufacturing tolerance of the lug angle specified on the part drawing is +0.33', as measured from the bottom surface of the retainer forging. However, since the measurements made with this tool are based on the top surfaces of the mounting hole bosses, any divergence from a perfectly parallel condition between the bottom and the top surfaces of the forging will further affect the accuracy of the results.
- Sealant, uneven paint, or dirt accumulations on the top of the mounting hole bosses will also affect the reliability of the readings.
- The accuracy of the digital protractor is +/-O.1 °
- O'45’ is an extremely small angle to measure in the field, even under the best of circumstances.

As a practical matter, it is unlikely that a ramp rigging problem would result even if it does not prove possible to distinguish between the 0” and O'45’ retainers in all situations. The difference in angle is very small, and could easily be masked by other variables in the rigging system.

Digits and Decimals

In using the digital tester to identify the ramp hook retainers, it is important to keep in mind that the angle data shown in Figure 1 and the authorized documentation are expressed in degrees and minutes. The digital protractor, on the other hand, displays angles in degrees and tenths of a degree. This means that a little calculation is required to convert the applicable values from one scale to the other. Recalling that 1 degree contains 60 minutes, we find that O'45’ becomes 0.75”; 2” 00’ is 2.00”; and 6'15’ equals 6.25”.

Battery Life

The tester is designed to be powered by a 9-volt *industrial* alkaline battery. According to the manufacturer, a service life of approximately 100 hours can be expected when a battery of the specified type is installed. Standard 9-volt alkaline batteries may also be used, but their service life will be shorter.

Special circuitry is included in the digital protractor to protect the battery in case the unit is left on by mistake. If it is turned on and unused for a period of about 6 to 15 minutes, the digital protractor will automatically turn itself off. It should be noted, however, that the current drain on the battery is about 1.15 milliamps when the unit has been allowed to time itself out in this manner. By contrast, the measured battery drain when the unit is turned off normally is only 7 microamps.

It makes good sense, therefore, always to use the OFF-ON button to turn the unit off between testing sessions, and not depend on the automatic shutoff feature to protect the battery. As with other test equipment, the technician may wish to remove the battery entirely if the unit is to be left unused for a significant period of time. This helps protect the digital protractor from the possibility of internal damage in case the battery leaks.

Availability

The PN 122-000-l Ramp Hook Retainer Identification Tool is available from the manufacturer, KWD Manufacturing, Inc., 7847 Fortune Drive, San Antonio, TX 78250; telephone 210-523-2014; fax 210-523-0475. It may also be ordered through Lockheed by contacting Customer Supply Business Management, Dept. 65- 11, Lockheed-LASC, Marietta, GA 30063-0577; telephone 404-494-4214; fax 404-494-7657; telex 804263 LOC CUST SUPPL.

The author and *Service News* wish to express special thanks to MSgt. Dave Crerar and photographer TSgt. Bob Watkins of the Wyoming Air National Guard for their valued assistance in the preparation of this article.

Conducted by Dave Holcomb,
Service Analyst
Lockheed Aeronautical Systems Service Company

DELETION OF RADOME ANTI-ICING and REDESIGN OF NOSE RADOME

Extensive testing of in-service aircraft has indicated that anti-icing is not required on the C-l 30 nose radome. This discovery has led to a decision to disable the system on all USAF C-l 30 aircraft.

A substantial testing program involving some fifty C-l 30s of various types with the radome anti-icing systems disabled revealed no adverse effects, even though particular was attention paid to radar performance. A decision was therefore made to issue TCTO 1 C-l 30-l 294, which requires that all nose radome anti-icing systems in USAF aircraft be deactivated.

At the same time, it was suggested that Lockheed redesign the nose radome to remove the anti-icing provisions and introduce this change into new production aircraft. In response to this initiative, a new radome incorporating this and other modifications has been developed and is currently in testing. Its specifications are being prepared for full qualification testing in accordance with USAF and FAA requirements. Initial production of the new radome will be used for support of USAF needs to comply with the recently issued TCTO. However, other customers will receive a Design Change Notice later this year to provide for retrofit to the preferred spare radome. New production aircraft with Lockheed serial number LAC 5389 and subsequent will have the new radome installed during assembly.

Features of the new radome include:

- **Incorporation of lightning diverter strips.**
- **Retrofit capability for C-l 30B aircraft and up.**
- **New radome wall construction, offering better radome transmissivity and allowing a larger “window” in order to accommodate a great variety of radar antennas.**
- **Lighter weight.**
- **Simpler repairs, allowing the use of standard materials and procedures.**
- **Physically interchangeable with existing radomes.**

The radome change will also be effective for FAA certificated (commercial) aircraft, and has been submitted to the FAA for approval. As a matter of information, the FAA has previously approved removal of the nose radome anti-icing from the Hercules aircraft in a separate case.

The new radome will become the preferred spare for the existing radome. Items presently maintained in supply stocks for the radome anti-icing system should be removed at the incorporation of the radome change.

In summary, the PN 389154-l radome will be discontinued. The new PN 3333921-l radome, which omits anti-icing provisions, will be the preferred spare for aircraft bearing Lockheed serial number 5389 and subsequent. TCTO 1 C-l 30-l 294 has been issued by the U.S. Air Force to delete the radome anti-icing system on USAF C-l 30s. All C-l 30B and later aircraft are candidates for retrofit to the new, preferred-spare radome. For more information on this subject, FMS and U.S. military customers should contact cognizant ALC or NARF personnel. Other customers may contact the following:

Technical Information:

Lockheed - LASC
Airlift Derivative Programs
Dept. 93-20
Marietta, GA 30063-0492
Tel. 404-494-2793
Fax 404-494-7784

Procurement Information:

Lockheed - LASC
Cust. Supply Bus. Management
Dept. 65-l 1
Marietta, GA 30063-0577
Tel 404-494-7529 (U.S. gov't.)
Tel 404-494-2 1 16 (other)

HOC 1994

Lockheed is very pleased to have hosted the 1994 Hercules Operators Conference this spring in Marietta. The meetings, which attracted the highest HOC attendance ever, brought together commercial and military operators of C-l 30 and L-l 00 aircraft from all over the world. The gathering took place between April 1 1 th and April 15th at the Atlanta Marriott Northwest Hotel.

The conference included technical data interchange and discussions of matters relating to aircraft systems and the inspection, repair, and replacement of C-l 30 and L-l 00 airframe structural components. The following groups were represented at the meetings:

- 45 customer operators
- 10 service centers
- 7 LASC affiliates
- 22 vendors and other agencies.

We continued the highly successful format that was established during previous conferences, which relied heavily upon operator input to define the subject matter and promote detailed discussions of operator concerns. The presentations were therefore for the most part conceived, developed, and presented by customer operator personnel. LASC technical specialists were present to take part in the discussions and to provide updates of significant items. The direction of the conference was determined principally by the operators in attendance under the guidance of an experienced panel of co-chairmen. They were as follows:

The HOC Team: Archie Stanley, LASC Program Manager, Hercules International Programs (center), presents Major Jim Kightley with an award recognizing his contributions as HOC co-chairman. Also pictured (left to right) Lockheed's Dave Holcomb, Jack Grosko, and Darrell Eubanks.

- Major Jim Kightley of the Canadian Forces completed another outstanding year as the co-chairman representing the operators. This conference represented Jim's final year in his tenure as co-chairman. We are most appreciative for Major Kightley's contributions during his co-chairmanship and he will be greatly missed in that capacity. Jim presented a timely challenge to the group as a whole to participate more actively and more directly in all facets of the HOC. He affirmed that the conference is totally dependent on each participant's contributions.

- The USAF co-chairman, Mr. Ray Waldbusser, was unable to attend this year's conference due to a schedule conflict. Ray was gracious enough to ask Mr. Britt Covington to assume his post. Britt was a great contributor to the conference and we are most appreciative for his efforts.

- Jack Grosko, who represented LASC as host and catalyst for the technical interchange, added his technical expertise to the conference proceedings.

On Wednesday, 13 April 1994, **a** co-chairman election was held to replace Jim Kightley as the co-chairman representing the operators. Squadron Leader Tony Trew, technical liaison officer from the Royal Australian Air Force, was nominated and unanimously elected to the post. Tony has graciously agreed to fill the office in the tradition of **his predecessor. We congratulate Tony on this new position and wish him the best in his efforts.**

There were 12 action items specifically assigned during the conference. Three were referred to LASC **and nine were assigned to operators. Some of these action items will be addressed in this section of future issues of *Service News* magazine; others will be discussed at the next HOC conference. The next international Hercules Operators Conference is tentatively scheduled for April of** 1995 **in Marietta. More information about next year's meetings will be forwarded to Lockheed customers and previous HOC participants when the schedules and other particulars are established.**

Dave Holcomb may be reached at Lockheed Aeronautical Systems Support Company, P. 0. Box I2 1, Marietta, GA 3006 1. The voice telephone number is 404-43 l-6549. The fax number is 404-43 l-6556.

THE... VAST

Video Animated Systems Trainer

by **Frank G. Nevelle,**
Training Equipment Specialist
Customer Training Systems Department

The Lockheed Video Animated Systems Trainer (VAST), a widely acclaimed C-130 systems and part-task trainer, has recently been updated. The trainer is now even more effective in providing realistic, hands-on training in cockpit familiarization, systems operation, fault reporting, fault isolation, and normal and emergency procedures for both flight crews and ground personnel.

The VAST is a *part-task* trainer and a *systems* trainer that is suitable for initial, advanced, and recurring training of both flight crew and maintenance personnel. Cockpit familiarization training for pilots and flight engineers in the VAST can reduce the training time required in more expensive simulators. This permits greater use of those simulators for complex cockpit procedures and check rides.

Maintenance teams can use the VAST for engine-run training, emergency and normal procedures, and operation of many systems including the fuel, electrical, air conditioning, and hydraulic systems. The VAST also

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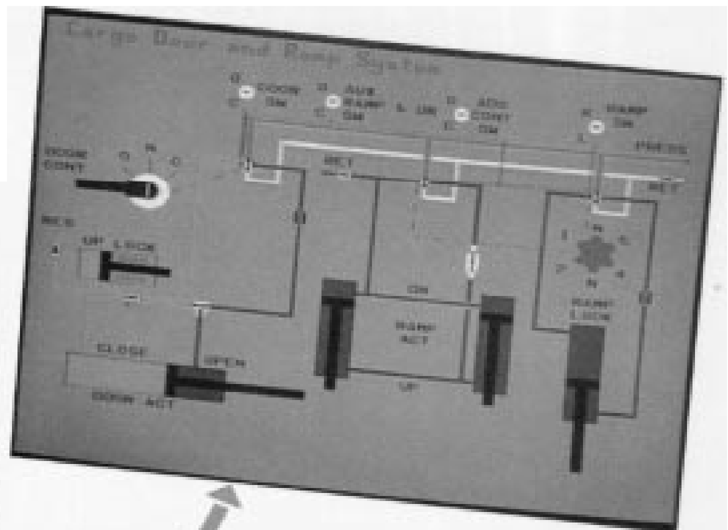
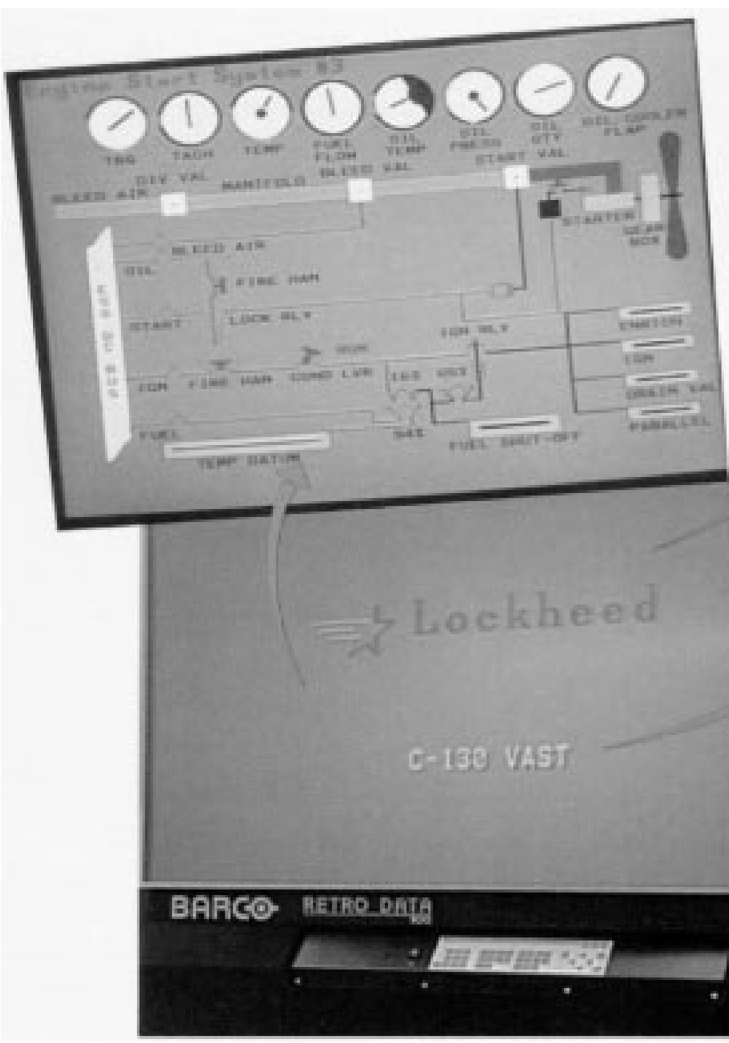
supports procedural training in the operation of feathering, pitchlock, prop governing and engine limiting operation systems. Each system on the aircraft can be taught not only to specialists, but also to other maintenance personnel whose systems interface with it. These multiple uses make the VAST an affordable and effective training device.

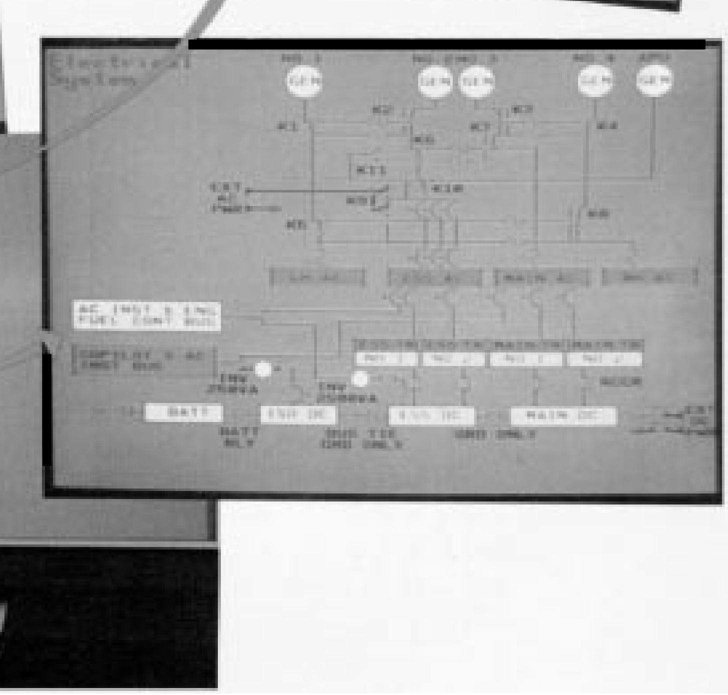
Fault recognition and fault isolation training can also be performed using the VAST for both flight crews and maintainers. The malfunctions can easily be inserted from the instructor's control unit, and flight crew recovery procedures or maintenance fault isolation procedures can be practiced and evaluated.

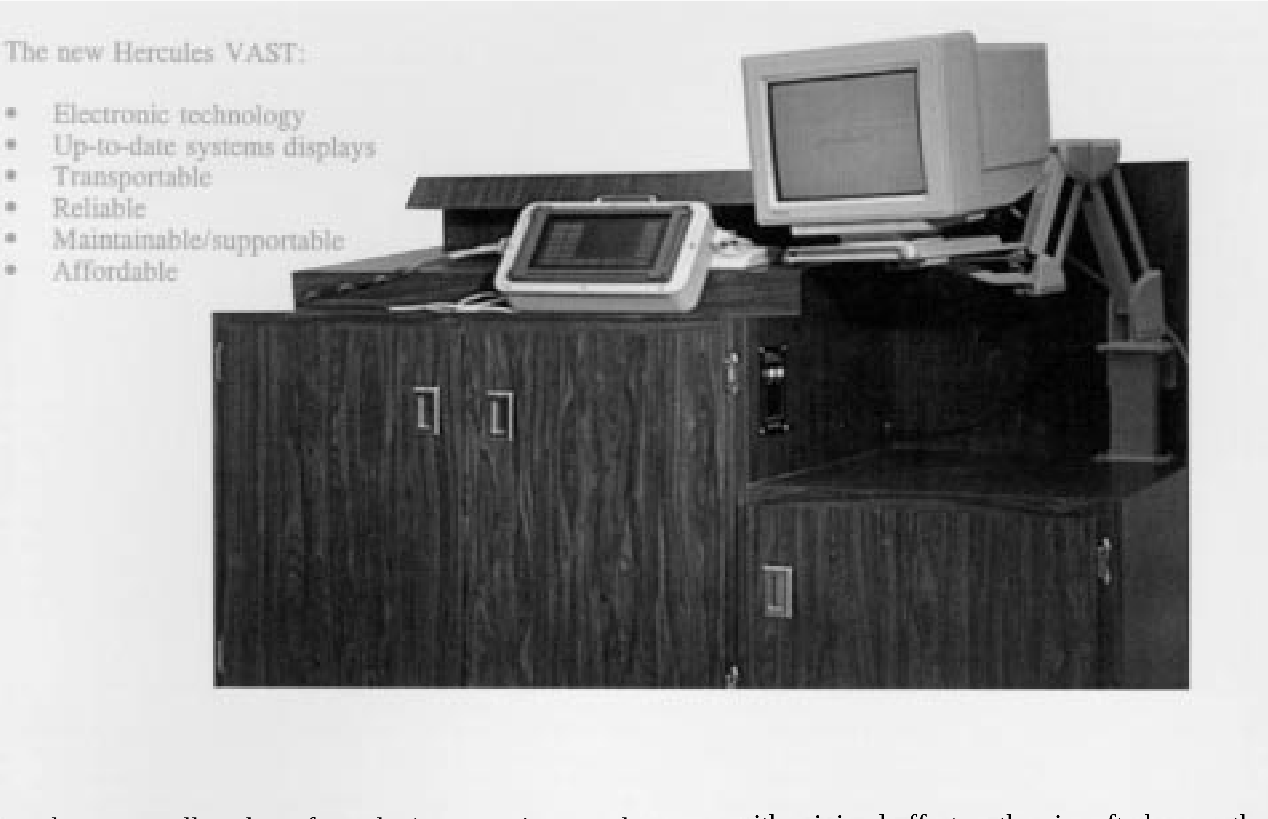
The VAST consists of a Hercules instrument panel, overhead panel, center console, both side panels and circuit breaker panels, a visual display unit, and an instructor's control unit. The overhead panel and the center console rotate out of their normal positions so they can be made visible to an entire class. The instructor can also move the side panels to increase visibility or student access. The trainer is an accurate representation of a Hercules pilot/engineer cockpit station and uses simulated components to maintain reliability and affordability. Included with the VAST are a complement of spares and on-site training instruction.

An improved display, and updated computer and instructional systems are among the most noticeable enhancements to the VAST. The graphics display has been upgraded to a stand-alone unit consisting of a 67-inch diagonal measure rear-projection television system. The display presents bright, full-color, animated schematic diagrams of the aircraft's mechanical and electronic systems in normal room light. These diagrams dynamically illustrate system responses and interaction with cockpit settings and control movements made by the









students, as well as those from the instructor's control unit. This interaction serves as a powerful reinforcement to the learning achieved in the classroom.

Control of the VAST is provided by a commercial, off-the-shelf Motorola 68030-based computer system. All peripherals are readily accessible in a dedicated cabinet mounted behind the engine instrument panel. Complete operating software supporting the graphics, trainer hardware, training functions, and system control and management is included.

The instructor's control unit is separate from the trainer and can be moved about the room to the most convenient location. The removable control monitor features a touch screen with programmed multi-functional buttons and switches that control the lesson, the trainer, graphics display, and malfunction insertion. A separate monitor that repeats the same information as the main display is provided for the instructor's use.

The VAST is configured to a single aircraft which is chosen by the customer and is representative of their aircraft. This way, the trainer can be kept up to date with minimal effort as the aircraft changes through its life span. The VAST has proven to be an effective training tool in the Hercules Flight Training Center and in Lockheed's Customer Training Systems Department.

For further information about the VAST, please contact:

Lockheed-LASC
Customer Training Systems Department
Dept. 66-14
Marietta, GA 30063-0308
Tel. 404-494-4625
Fax 404-494-1017

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