VOL. 5, NO. 4, OCTOBER – DECEMBER 1978

service news

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

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LOCKHEED-GEORGIA COMPANY
A DIVISION OF
LOCKHEED CORPORATION

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Cover: Two new RAAF Hercules C-l 30Hs fly over Rose Bay, Sydney, Australia, after their maiden flight from America. These airplanes are the first to be delivered of the twelve that will eventually replace the No. 36 Squadron's original A model Hercules.

Vol. 5, No. 4, October – December 1978

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Better service from

Bendix Starters

Starting the engines is always a minor moment of truth for an aircraft mission. Successful starts depend upon the proper operation of a long list of airframe and power plant components, and right at the top of the list must come the starters themselves. We rely on the starters to engage smoothly and drive the engines to a speed which is fast enough for internal combustion to continue the acceleration. Not until each starter has done its vital job and all engines are running at 100% RPM is it likely that the mission will either literally or figuratively get off the ground.

Fortunately, the Bendix starters that equip all current production Hercules aircraft generally perform reliably and well, and are capable of yielding thousands of dependable starts. In fact, operating these starters is so simple, and so little is required by way of routine maintenance for them that it is easy to forget that pneumatic starters, like all other mechanical devices, do require reasonable care and protection from abuse if they are going to be able to perform properly. Let's take a look at starter operation and starter problems and see if we can help you get all of the service that is built into the starters on your aircraft.

Bendix starters have been standard equipment on Hercules aircraft since mid-1972, beginning with aircraft serial LAC 45 15. The starters were originally supplied in two basic versions, model 36E84-16QA, which incorporates an automatic cutout switch and is used in aircraft equipped with push button starter controls, and model 36E84-18QA, which does not have the automatic cutout switch and is installed on aircraft equipped with toggle switch starter controls.

Since these starters were first used on the Hercules, two separate modifications to increase the service life of existing starters have been made available. In each case, the improvements were also introduced into new production units concurrently. The part number suffixes reflect the configuration of both new and retrofitted starters. The original configuration is identified by the letters QA. Those units which incorporate only the first change carry

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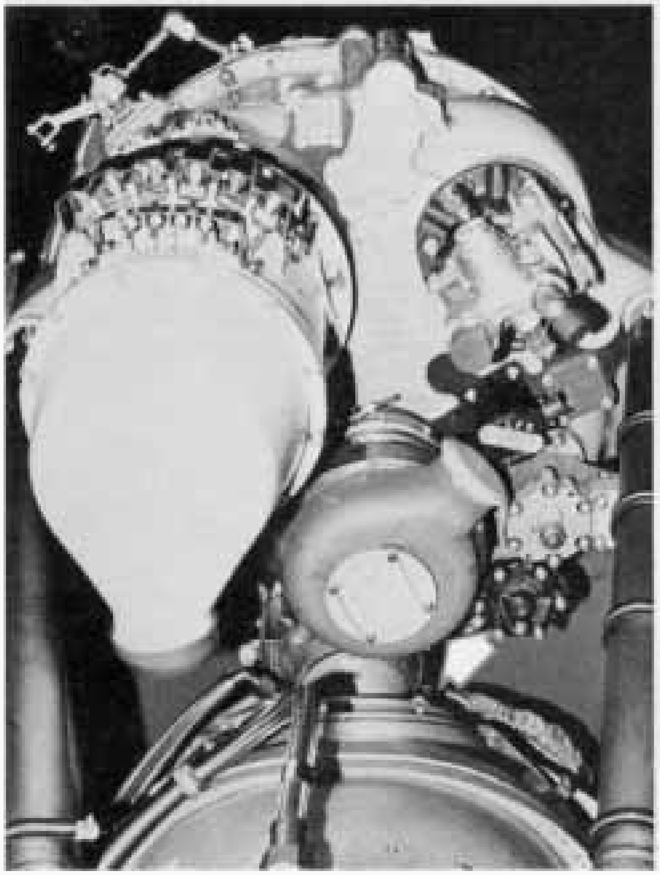

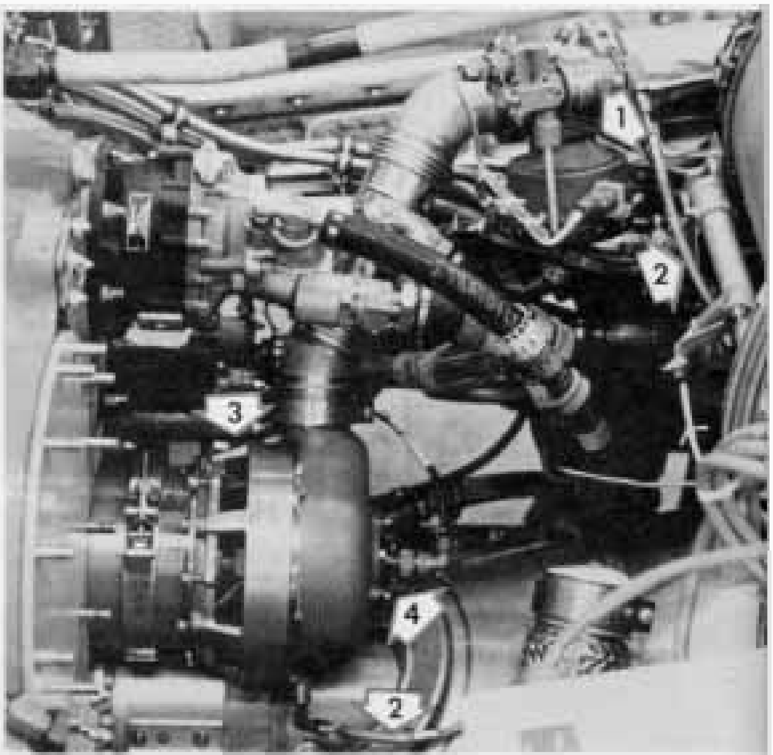

Left: Pneumatic starter location on back of engine reduction gearbox. Above: Starting system components – (1) air control valve (2) pressure sensing line (3) starter (4) speed switch assembly (push button starter controls only).

a QB designation. When both modifications have been made, the unit becomes a QC model. All starters now being installed on current production Hercules aircraft are of the QC configuration.

STARTER OPERATION

The purpose of these improvements and their effect on starter performance can be most easily understood if we first take a brief look at just how the Bendix starter is designed and how it operates.

Essentially, the Bendix pneumatic starter is a specialized type of air turbine motor. Its major components are an inlet assembly, a turbine, reduction gearing, a slip clutch, and an engaging mechanism.

The starter turbine has a titanium wheel which is splined to a steel shaft. It is used to convert air flow from an APU/GTC, an operating engine, or an external air source into torque. A reduction gearing system consisting of a single set of planetary gears is used to convert the high speed and low torque at the turbine to low speed and high torque at the output drive. The overall reduction ratio-is 5.41:l.

The reduction gears transmit torque to an output drive coupling through a multiple disk clutch whose purpose is to reduce the impact during engagement and protect the starter and engine mechanism from overloads. The output drive consists of a drive jaw provided with teeth designed to engage the teeth of a driven jaw which is attached to the starter drive of the engine's reduction gearbox through the propeller brake.

Engagement, and then disengagement of the jaws during the starting cycles is accomplished through the action of an automatic jaw advance mechanism. When the starter is operated, compressed air regulated to a pressure of between 36 and 42 PSIG by the starter control valve is admitted to the turbine. As the turbine begins to turn the starter output shaft, helical spline action causes the drive jaw of the starter to advance and engage the driven jaw on the engine. At the same time, exhaust air leaving the turbine wheel is collected by a tube mounted in the planetary gear retainer and then passed into the starter's gearbox. The air pressure rise within the gearbox assists the mechanical jaw advance mechanism during initial engagement.

When the starter cutoff speed of about 8500 RPM is reached and the compressed air supply is cut off at the starter control valve, the turbine loses torque. As the driven jaw on the accelerating engine begins to overrun the drive jaw of the starter, the starter jaw is forced to move backward on its helical splines and out of engage-

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ment. A jaw return spring maintains the separation and, since the air flow has been removed from the turbine, the starter coasts to a stop.

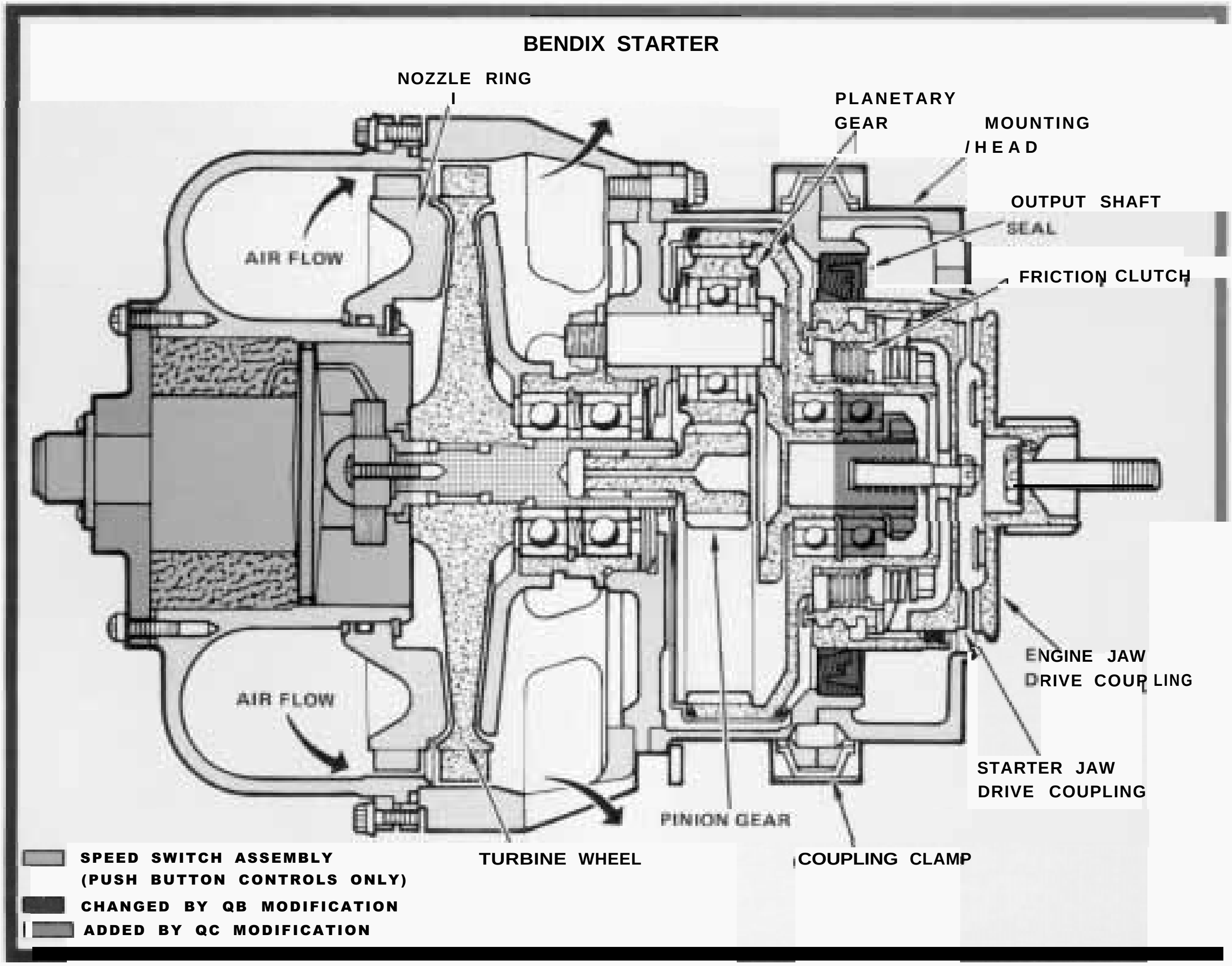
MODIFICATIONS

Soon after Bendix starters were first introduced on the Hercules, some scattered failures were reported from the field. The usual complaint was that a starter was not engaging when the starter button or switch was operated, even though a normal air supply was reaching the unit. Investigation soon traced most of the trouble to a single cause: unexpectedly rapid wear of the output shaft oil seal.

It happens that the integrity of this seal is of key importance in the operation of the starter. Although it is called an oil seal and does act to protect the starter lubricant from contamination by engine oil, the seal must also provide a certain minimum amount of drag on the outer, helically-splined member of the engagement mechanism in order for the jaw to advance toward engagement. If the seal is worn and does not supply the required friction, the jaw will not advance and engagement cannot take place.

While tests under controlled conditions had shown that the seal would usually last for at least 1200 starts, it became evident from field experience that the serviceability of this seal was the main factor tending to limit the potential operating life of the starter. If the wear resistance of the oil seal could be upgraded, it seemed likely that the service life and dependability of the unit could be significantly improved.

The answer to the problem was found in a new seal material called Viton. When output shaft oil seals composed of Viton were tested, it was found that not only would the seals on the average remain serviceable for more starts than those made of the original material, but their performance was much more reliable. Bendix immediately began installing seals made of the new material in new production starters and supplied the Viton seals (P/N 2492193) to the field at no cost for retrofit in existing equipment. All units in which the new seals were installed received the QB designation.



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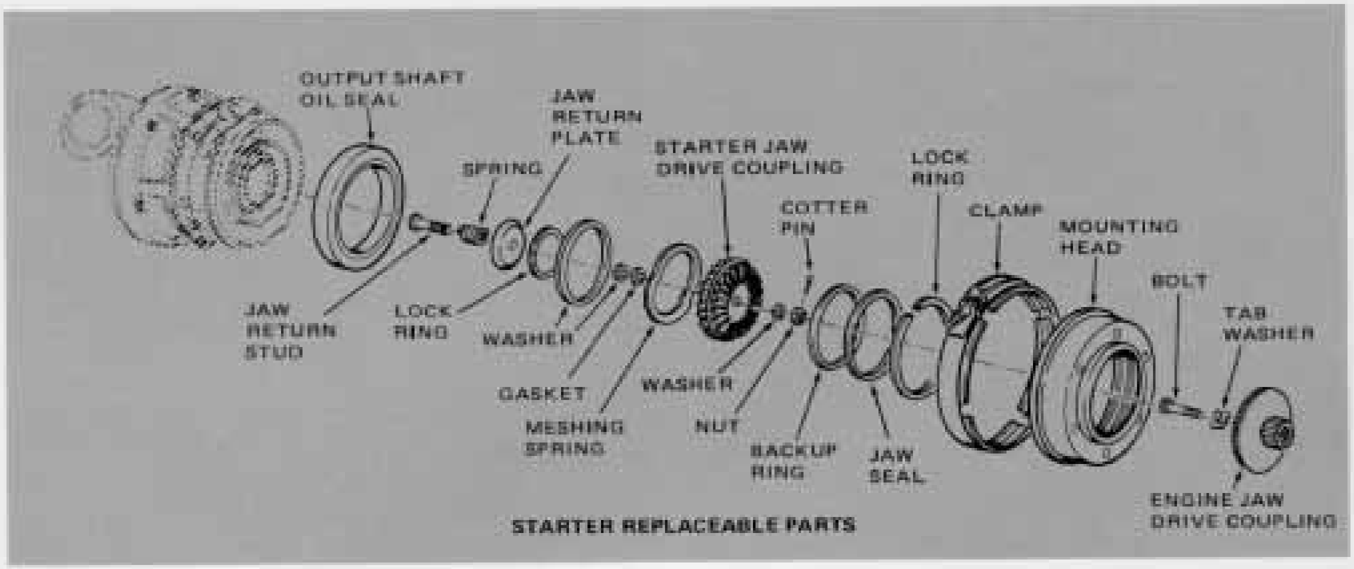

STARTER REPLACEABLE PARTS

The investigations which led to the development of the new seal material subsequently also pointed the way to another improvement which has the potential to extend the service life of Bendix starters still further. In the QA and QB models, the engage-disengage mechanism is supported by a single bearing. At starter cutoff speed, when separation of the starter and engine jaws occurs, the mechanism is fully advanced and rotating at approximately 8500 RPM. When disengagement occurs, it takes about 10 to 20 seconds for the starter to decelerate to rest. The single bearing support allows some degree of eccentric rotation of the engaging mechanism before it comes to a stop. While the eccentric running does not impose unmanageable loads on the bearing, it does tend to cause additional wear on the output shaft oil seal. The new Viton seals are much more resistant to this type of wear than were seals made of the old material, but the cumulative effect can still be significant.

Engineers at Bendix determined that the addition of a second set of ball bearings in the engage-disengage mechanism stabilizes the rotational characteristics of the shaft on which the oil seal rides and significantly reduces the wear it receives. Starters equipped with both the Viton seal and two-bearing support for the engage-disengage mechanism have completed more than 3500 starting cycles before seal replacement was required.

The success of this arrangement led to a second change in the production configuration of new starters, the QC model, which includes both the Viton oil seal and the double output shaft bearing.

By now, most of the QA units will already have been converted to QBs, and some to the QC configuration as well. It is unfortunately not quite as simple to modify a QB model to a QC as it was to modify the QA to the QB. The job must be done in the Bendix factory. The results of the QC modification are well worth the charge that is made for it, however. In terms of the additional trouble-free service that may be expected, it is money in the bank.

STARTER PROBLEMS

By far the most common problem that has been reported in connection with Bendix starters has been that of no engagement. And by far the most common cause of no engagement in the past has been failure of the output shaft oil seal.

Bendix starter with engine jaw coupling and mounting hardware.

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We have seen how the improvements offered by the QB and QC configurations were specifically targeted to extend the life of the seal. To make the possibility of a seal failure in service even more remote, Bendix recommends that the output shaft oil seal be routinely replaced after 1200 starts for QB models, and after 2400 starts for QC units. It is also reasonable to expect that the incidence of seal problems will continue to decrease as older starters are updated and more and more new QC units enter service.

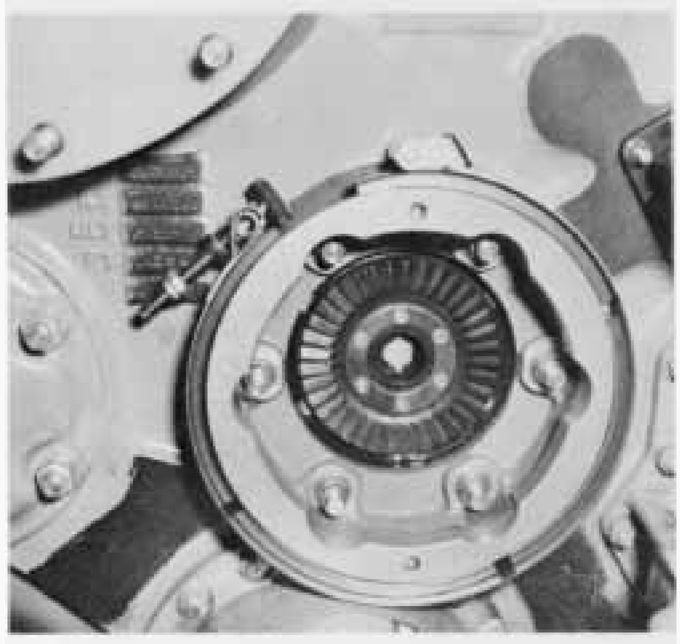
A second major cause of no engagement has been traced to the use of improper or inadequate procedures during installation of the engine jaw drive coupling. Investigation of starters returned to Bendix has indicated that some units were placed into service with the engine jaw drive coupling not properly seated against the mating engine gearbox splines. This can result in the loosening of the bolt which secures the engine jaw coupling to the gearbox shaft. If the bolt backs out, the shaft end and retaining nut of the starter drive jaw will strike the bolt head and prevent the jaws from fully engaging when a start is initiated. The inadequate engagement then leads to broken jaw teeth, excessive wear, and finally, failure to engage.

To avoid such unhappy consequences, it is important that the splines in the starter drive of the engine be carefully inspected and prepared before an attempt is made to tit the parts together. Clean up any high spots or feathered edges, and coat the splines of the engine jaw drive coupling with spline lubricant (MIL-L-25681) prior to slipping it into the gearbox shaft. The coupling should slide into the mating splines freely; it **must not** be force fit. The flat side of the starter jaw should seat firmly against the face of the engine's starter drive shaft.

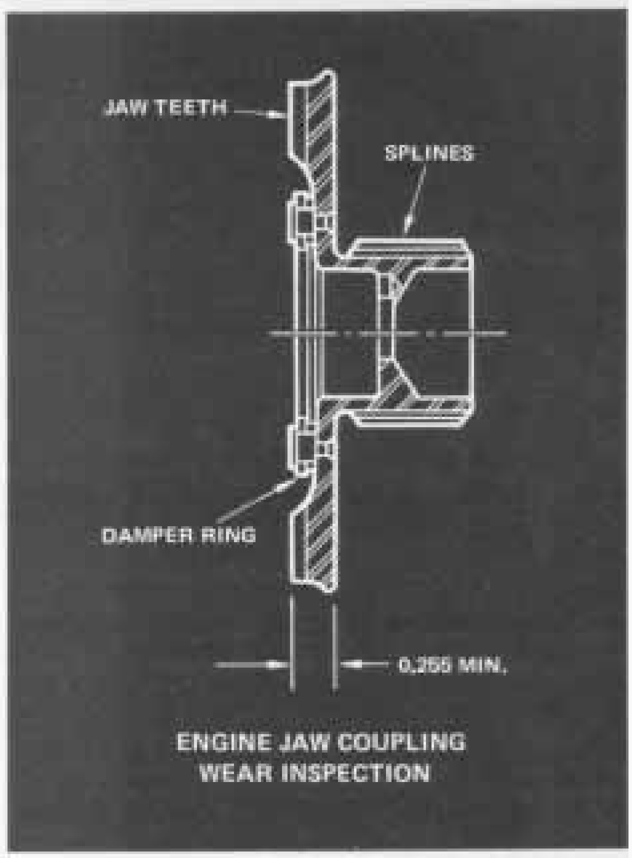
It is worth noting here that the engine jaw drive coupling, together with its attachment hardware, must ordinarily be replaced each time a starter is changed on an engine. An exception is allowed if the engine jaw coupling is to be used again with the same starter and starter jaw coupling. Always use a new locking tab washer under the attachment bolt, but before reinstalling a used engine jaw coupling, inspect it carefully for cracks, broken teeth, or other damage, and measure the jaw for wear (see diagram, page 7). Couplings measuring less than 0.255 inch are to be scrapped.

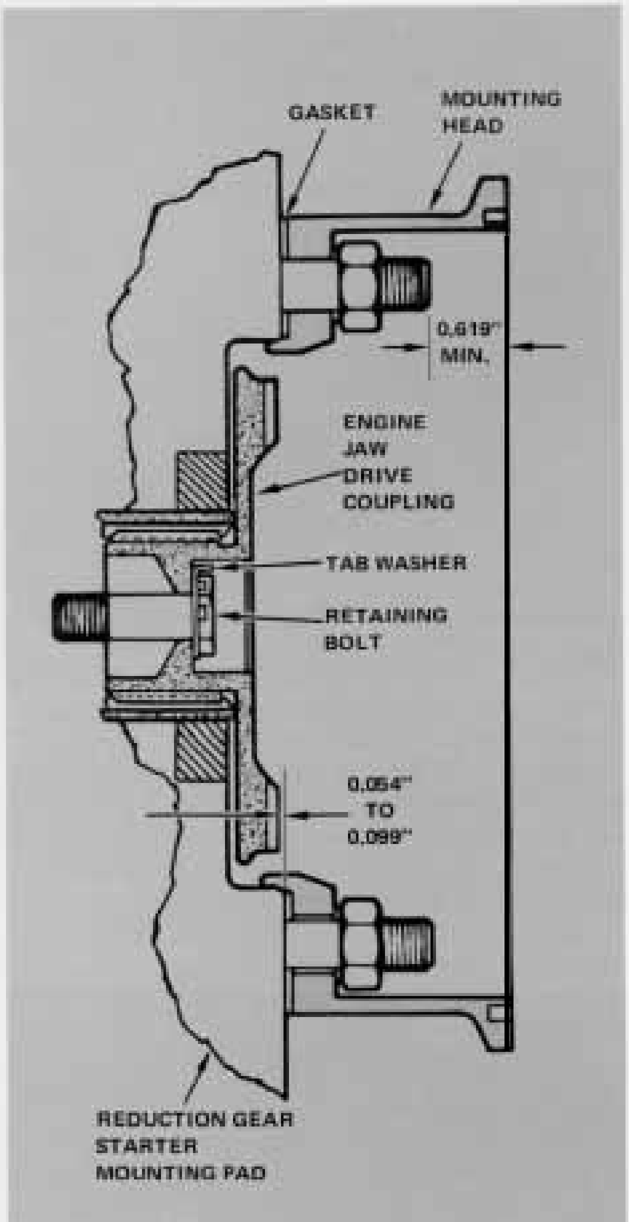
A particularly troublesome point has been failure to properly secure the bolt which attaches the engine jaw drive coupling to the gearbox shaft. During installation, the lock tab of the tab washer must be set into the hole on the engine drive coupling. Bend the other two tabs slightly so that a tool can be inserted to bend the tabs up to the locking position after the bolt has been tightened down.

The bolt should be torqued to between 70 and 7.5 inch-pounds. Be careful to stay within these values while securing the bolt. Too little torque may allow the bolt to loosen, and too much could rotate the washer and pull the lock tab out of the hole in the engine drive coupling or cause the washer to fracture, which would ultimately produce the same result.



Engine jaw coupling, installed.





ENGINE DRIVE COUPLING AND MOUNTING HEAD INSTALLATION

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After the bolt has been torqued, measure the clearance between the teeth of the engine jaw and a straight edge held across the engine mounting pad face (with the gasket removed). The teeth should be within 0.054 to 0.099 inch of the straight edge (see drawing, page 8). It is also very important that in any given installation the clearance between the teeth and the straight edge be the same at all points on the jaw face. In other words, the jaw face should be parallel with the face of the engine mounting pad.

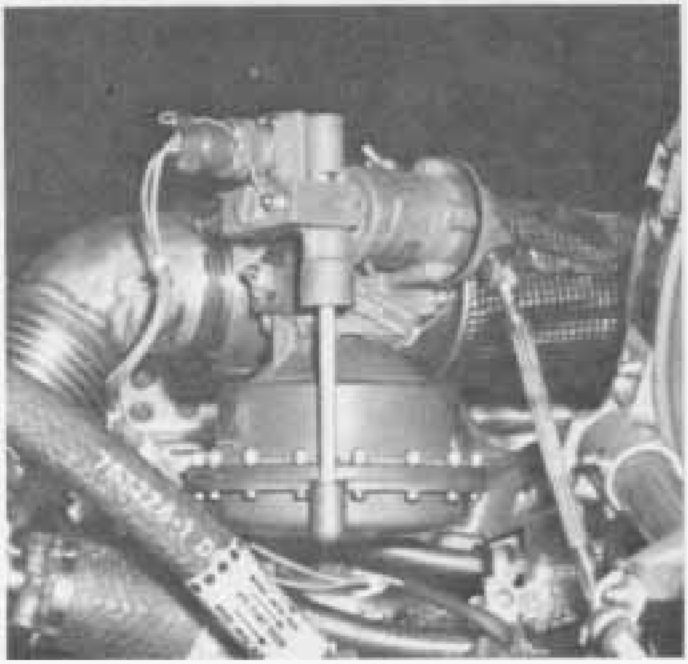
If the measurements are within limits, complete the installation by bending up the two remaining tabs on the tab lock washer so that they are positioned securely against the flats of the bolt head.

Faulty installation of the starter mounting head has also been implicated as a cause of engagement troubles in Bendix starters. Here are some points worth special attention in connection with this procedure.

Check first to be sure that the mounting head is correctly oriented. It must be positioned over the engine gearbox studs so that the starter locating pin holes are on a vertical centerline. Then, when the mounting head is ready to be secured to the engine gearbox pad, make certain that there is one, and only one, AN40447-l/MS9136-01 gasket between the mounting head and the face of the gearbox pad. All remaining traces of the old gasket should be removed before the new gasket is installed. The use of shims or more than one gasket will affect the jaw clearance stack-up and **will result** in either no jaw engagement, or inadequate engagement and excessive wear or breakage of the jaw teeth.

There is another crucial dimension that must be checked before the starter is installed. First, secure the mounting head on the engine pad with lock washers and locking nuts and torque the nuts to 265 to 325inch-pounds. Now measure the distance from the ends of the studs to the mounting head's mating surface with the starter. The clearance must be not less than 0.619 inch (see drawing, page 8). Be sure that this dimension is acceptable before proceeding. If the clearance is not sufficient, the studs may interfere with the proper installation of the starter assembly.

Starter (air) control valve with pressure sensing line.



AIRCONTROLVALVEPROBLEMS

Not all engagement problems originate in the starter or in starter mounting procedures. Sometimes faulty starter control valve operation will impose stresses on the starter which set the stage for failures that really should not be blamed on the starter at all.

Unusually rapid jaw wear is the kind of trouble that may indicate leakage through the starter control valve. When a starter control valve does not close fully after an engine has been started, the starter will continue to rotate and the jaws will attempt to remain in contact.

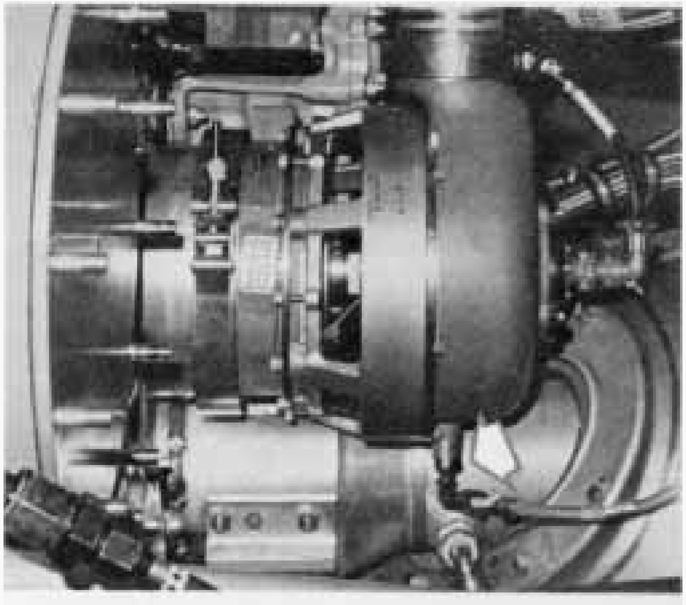
What happens next depends on the amount of air being leaked and the configuration of the airplane. On aircraft with toggle switch starter controls, leakage past the starter control valve will generally be evident immediately because the VALVE OPEN light on the starter control panel will remain illuminated. This should give the flight crew warning in sufficient time to secure the engine and cut off the air supply at the fire wall bleed air valve before any serious damage is done.

On aircraft equipped with push button controls, no such warning system is present, and a malfunctioning starter control valve is harder to detect. If the valve is passing only a small amount of air, contact between the jaw teeth may only be intermittent. The ratcheting will nonetheless sooner or later cause serious wear and failure to engage during a start attempt. If the amount of air passed by the valve is large, the starter will attempt to remain engaged, even after the engine has reached full operating speed. This will quickly result in severe damage to the jaws and the starter bearings. Since the Bendix starter is well protected against spectacular catastrophic failures, the fact that it has been destroyed internally may not be noticed until the next start attempt.

Keeping track of starter control valve operation through periodic testing – and immediate testing if there is a hint of trouble – is probably the best insurance against starter problems which relate to malfunctions of this kind. This is particularly important if your Hercules is not equipped with the VALVE OPEN lights which help monitor starter valve operation.

Bendix suggests that operators tee in a direct reading gage and measure the starter control valve pressure at the "B" check (200 hours of aircraft time), especially if starter problems have been experienced. The tee should be installed at the pressure sensing line port of the starter scroll so that accurate readings of actual starter operating pressures may be obtained.

Starter cutout speeds should also be watched carefully to see that they remain within the proper limits. Overrunning of the starter by the engine when speeds exceed about 60% on the tachometer has been identified as an important cause of starter jaw wear. The push button controls will usually pop out automatically at between 58% and 62% of normal engine speed, but if a button has not released by about 65%, pulling it out manually will help reduce the possibility of unnecessary starter wear. Toggle switch starter controls should always be released when the engine speed reaches 60%.



Operating pressure can be checked at port on starter scroll.

One other potential cause of abnormal starter jaw wear which should be considered is leakage from the pressure sensing line that connects the starter scroll with the starter control valve. The main function of this line is to supply a reference pressure from the starter turbine to the regulator of the control valve. The control valve adjusts the air flow delivered to the starter turbine in response to the pressure applied at the regulator through this line.

If leaks develop in the sensing line, the regulator will sense the reduced pressure and try to compensate by increasing the air flow to the starter. The starter will then be forced to operate at pressures which exceed its design specifications. The result can be worn or fractured jaw teeth, and generally reduced service life.

This kind of trouble can be avoided by checking the sensing hose for leaks every 2000 hours of operating time with this simple test: Remove the hose assembly from the aircraft. Plug one end and apply shop air at 100 PSI to the other. Submerge the pressurized hose assembly in water and watch for bubbles. If any bubbles appear, reject the hose.

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Note that two sections of the pressure sensing line (P/N 755200-l) are used in each nacelle of aircraft equipped with toggle switch starter controls and pressure switches for the starter control panel warning lights; push button systems require only one section of line.

STARTER SAVVY

Good maintenance and good judgement have always been the two key terms that must be added together to get the best possible performance out of any mechanical system. In the case of the Bendix starter, most of the first part of this equation has already been solved for us in advance. The starter requires literally no routine service between overhauls. The second part of the problem, supplying the good judgement and proper handling, is still the responsibility of those of us in the field.

Just about the most destructive thing that can be done to any air turbine motor is to supply it with a large volume of air at high pressure and then allow it to run unloaded, as fast as it will go. No doubt about it, an air turbine motor will go very fast indeed. Given an adequate air supply, it will keep on accelerating until the stresses that are being applied exceed the strength of some critical component, usually a bearing. Then everything comes to abrupt stop, sometimes with the unit still in one piece, but more often separated into many pieces and distributed over a wide area. This is a terrible fate for any piece of precision equipment, to say nothing of the fate of anyone who happens to be within range.

The Bendix starter has excellent containment features, so it is not likely to blow up on you even if it is abused in this manner. But it is an air turbine unit, and it can be made to destroy itself internally if the people it serves don't protect it.

The safe approach is clear: Don't allow your starter to go to free run for any longer than it takes to realize what is happening. If you do not see prop rotation within 5 seconds after you have pressed the starter control, reject the start and investigate. You could have a no-engagement situation on your hands. The squeal of tortured bearings may even have been audible as the starter went to free run.

Try to resist the temptation to give it another go in such cases. Bendix does allow two engagement attempts of 5 seconds each, but there is usually little point in trying again. We have already examined the principal causes of no engagement, and all of them require mechanical repairs to rectify. The chances that the problem will disappear between the first and second attempts are practically nil, but your chances of doing damage to a starter that is not engaging improve dramatically with each start attempt. Although the bearings of a Bendix starter will theoretically withstand 2 minutes of operation at free run speed (approximately 12,500 RPM), it is a very awkward experience to find out what the limits of your particular starter actually were.

Note too that once in a while even new starters may suddenly fail to engage. Repeated start attempts with malfunctioning low-time starters is no more likely to be effective in curing the trouble than with older ones, and in the process you may void the warranty protection on the new unit as well. Losses like that are hard on everyone, particularly because they are so unnecessary.

Strict adherence to good starter care practices very definitely has its own rewards. Starters which are merely worn and have not been subject to abuse can be repaired and put back to work with a minimum of downtime and expense. When a unit has reached its recommended start-cycle limit (1200 for QB models, 2400 for QC models) and is removed from service, the bearings can be checked, and the output shaft seal and starter jaw coupling replaced in your own maintenance facility. The same is true if a starter for some reason experiences premature seal wear and fails to engage -provided the "5-second rule" has been followed and the starter has not been damaged internally by repeated start attempts. Consult the latest technical manual for complete repair instructions.

The current generation of Bendix starters is probably the safest and most reliable starter that has ever been used on the Hercules. When we add its low maintenance requirements to its ruggedness and dependability, it is clear that the Bendix starter is an advanced unit that is capable of doing its job day after day, and month after month, with a bare minimum of care and attention. If we can supply a working knowledge of starter function and starter limitations, and a liberal measure of good judgement, the result is certain to be a winning combination that will get your mission off to a good start every time.

service news

A/C Temperature Control System Checkout

This article presents a simplified method of performing an operational checkout of the air conditioning temperature control system without the necessity of using bleed air. All that is required is electrical power on the aircraft. The procedure described herein is good only on those systems that utilize the new, solid-state components (reference *Service News*, Vol. 5, No. 3, July-September 1978, page 12) and while it does not cover the testing of all the components necessary to the operation of the air conditioning system, it does include those components involved in the majority of air conditioning temperature malfunctions, This procedure can be used successfully over a wide range of ambient temperatures since the effects of different ambient temperatures are taken into account in the analysis of sensor and valve reactions. The same procedure is used to check both the flight station system and the cargo compartment system.

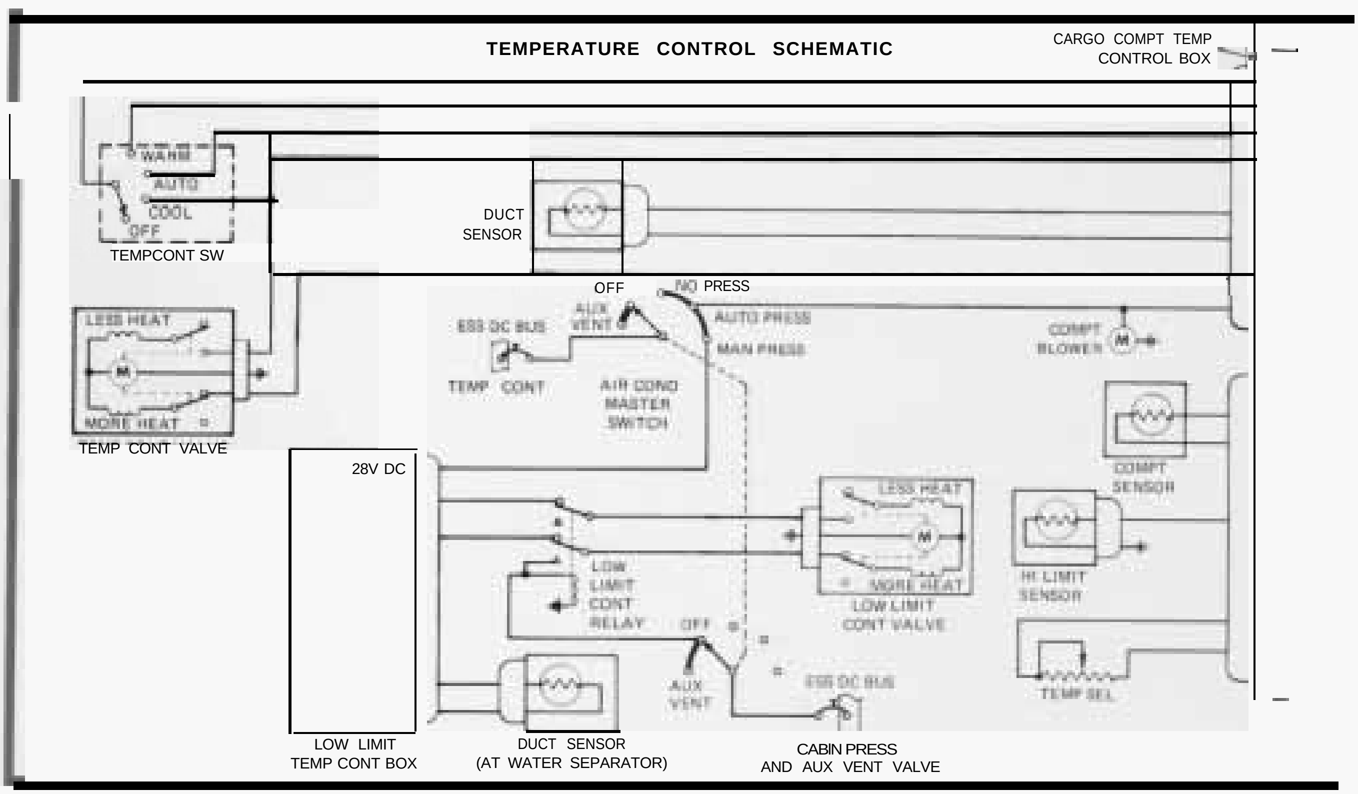
The operation of the valves in the air conditioning system can be observed by watching the movement of the position indicators located on the valves. Thus, the response of any valve is apparent and easily observed when a temperature change occurs or when a temperature change is simulated at a sensor. The rate of opening and closing the valves is controlled by running the valve's electric motor for very short periods of time or in pulses as directed by the temperature control boxes.

The logic circuits of the solid-state temperature control system have been designed so that most system malfunctions will cause the valves to drive toward the closed position (less heat).

A simplified schematic of the wiring for the temperature control components is provided for reference. All switches and valves are shown in the OFF position. You will have to interpolate and visualize the various switch and valve positions as you proceed through the troubleshooting steps.

Please note that the result of each step in the following procedures states what should occur as a consequence of the action taken in the step. If you do not obtain the stated result, it will be necessary to complete a more definitive checkout of the system and/or components. Refer to the appropriate maintenance manuals.

Note: Steps 1 and 2 should be deleted from this procedure if your aircraft are equipped with the "dual butterfly" temperature control valves (P/N 695305-l) flight deck unit, and P/N 695316-l) cargo compartment unit). 11



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STEP 1. Place the air conditioning master switch in the OFF position and move the air conditioning shutoff switch for the system being checked to the NORMAL position.

Result: The low limit temperature control valve will drive to the full OPEN position.

STEP 2. Place the air conditioning master switch in the NO PRESS position. Note that the position of the temperature control switch is irrelevant at this point.

Result: A. The low limit control valve will drive to the CLOSED position if the ambient temperature is around 40 degrees F (4.4 degrees C) or higher.

B. The low limit control valve will remain open if the ambient temperature is around 32 degrees F (0 degrees C) or lower.

C. A high temperature can be simulated by removing the electrical connector from the duct low limit sensor at the water separator. The valve will close under these conditions.

D. A low temperature can be simulated at the duct sensor by placing the sensor in an ice bath. The valve will open when the sensor is placed in the ice bath,

STEP 3. Move the temperature control switch to WARM.

Result: The temperature control valve will open.

STEP 4. Move the temperature control switch to COOL.

Result: The temperature control valve will close.

STEP 5. Place the appropriate temperature control switch to AUTO and move the temperature selector rheostat to the maximum WARM position. Note that this step cannot be accomplished if the ambient temperature is 85 degrees F (29.4 degrees C) or higher.

Result: The temperature control valve will drive open.

STEP 6. Move the temperature selector rheostat to the maximum position. Note that this step cannot be accomplished if the ambient temperature is 60 degrees F (15.6 degrees C) or lower.

Result: The temperature control valve will drive closed.

STEP 7. A. Place the temperature selector to the maximum WARM position and assure that the temperature control valve is open. Note that STEP 7 cannot be completed if the ambient temperature is 85 degrees F (29.4 degrees C) or higher unless an ice bath is used on the sensor.

B. Remove the electrical connector from the appropriate compartment temperature sensor.

Result: The temperature control valve will move to the closed position when the electrical connector is removed and will return to the open position when the connector is reinstalled.

Note: STEP 7 is repeated for the overheat sensor (STEP 8) and the duct anticipator sensor (STEP 9). The results should be the same except that the ambient temperature is not a factor.

STEP 8. A. Place the temperature selector at maximum WARM and assure that the temperature control valve is open.

B. Remove the electrical connector from the overheat sensor.

Result: The temperature control valve will drive closed when the electrical connector is removed and it will return to the open position when the connector is reinstalled.

STEP 9. A. Place the temperature selector at maximum WARM and assure that the temperature control valve is open.

B. Remove the electrical connector from the duct anticipator sensor.

Result: The temperature control valve will move to the closed position when the electrical connector is removed and it will return to the open position when the connector is reinstalled.

Complete coverage of the air conditioning systems can be found in your maintenance manuals. Also, articles with brief descriptions of the Hercules air conditioning systems have appeared in previous issues of the Service News: Vol. 3, No. 2, April-June 1974; Vol. 3, No. 3, July-September 1976; Vol. 5, No. 3, July-September 1978.

An analyzer is available for performing a more complete and thorough checkout of the temperature control system. The identity is as follows: Air Conditioning System Temperature Control Analyzer Assembly, Part Number 3402247-1, NSN 4920-01-007-0010. If you desire further information on this analyzer, contact :

Supply Sales & Contracts Dept.
Department 65-l 1, Zone 287
Lockneed-Georgia company
86 S. Cobb Drive
Marietta, Georgia 30063

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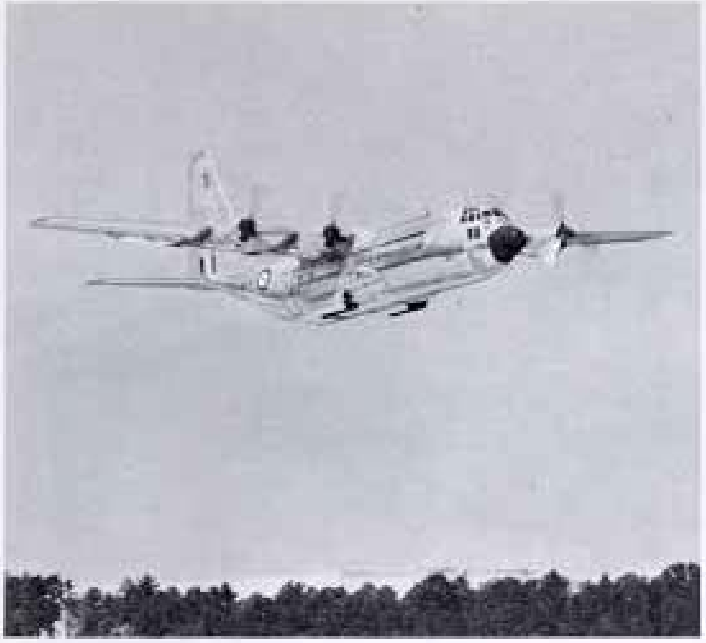

ROYAL AUSTRALIAN AIR FORCE

20 YEAR ANNIVERSARY OF HERCULES WITH THE RAAF

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RAAF and the Hercules

Over 1500 C-130 Hercules have been built and delivered to users within the United States and to 42 different countries outside the United States. We at the Lockheed-Georgia Company are proud of each of the Hercules built and sold, and appreciate all of our customers; however, we have a special feeling for the Royal Australian Air Force. Twenty years ago Australia became the first nation outside the United States to put the C-130 Hercules into service, thus playing a vital role in helping us launch the Hercules into its present position as the world's most successful and versatile cargo aircraft.

On 28 July 1978, almost 20 years after the first C-130A entered service with the RAAF, the first of 12 new C-130H Hercules was delivered to the RAAF's No. 36 Squadron at RAAF Base Richmond, New South Wales, Australia. In ceremonies at RAAF Base Richmond, Lockheed-Georgia President, Robert B. Ormsby, formally presented the new Hercules to the RAAF, and praised the Australians for the outstanding performance, maintenance, and safety records their two squadrons of Hercules have earned.

The Royal Australian Air Force Chief of Air Staff, Air Marshal Sir James Rowland, KBE, DFC, AFC, paid tribute to the outstanding records attained by Hercules throughout the world, and particularly in the hands of the RAAF. "The Hercules have certainly done the RAAF proud", Sir James said. "They are a remarkable aircraft with a remarkable record."

In 1958, twelve C-130As were accepted and put into service with RAAF's No. 36 Squadron. Since that time the squadron has logged more than 145,000 accident-free flying hours in the Hercules; a world record for the C-l 30A.

In 1966, twelve more Hercules (this time C-130E models) were delivered to RAAF Transport Squadron 37. Since acquiring the C-130E, they have accumulated more than 100,000 accident-free flying hours.

Both squadrons, 36 and 37, are stationed at RAAF Base Richmond. No. 36 Squadron has operated in the Vietnam conflict, in flood relief, in the evacuation and resupply of Darwin after Cyclone Tracey, and in resupply and airdrop operations within Australia, New Guinea, New Zealand, Indonesia, Malaysia, and Singapore.

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No. 37 Squadron operates its C-130E Hercules in and out of marginally acceptable landing fields throughout the southern hemisphere. They were the first to arrive at devastated Darwin airport after Cyclone Tracey, landing by the light of kerosene flares. They have flown scores of mercy missions with complete RAAF medical crews who performed airborne surgery during flights to places as far away as Fiji, Noumea, and Christmas Island. The squadron has also flown resupply and support missions to Australian United Nations forces in Pakistan and Egypt, and has flown priceless archaeological exhibits from the People's Republic of China and back.

From the C-130A to the present C-130H, the Hercules payload has increased by 26%, service life expectancy by 100% range by 52%, and its speed by 11%. As the C-130 Hercules has progressed through successive models to the current advanced C-130H configuration, virtually every part of every system has been strengthened, modernized or otherwise improved. These include components such as the fuselage skin, wing panels, wing structure, landing gear, engines, propellers, avionics, radios, and instruments as well as the hydraulic, electrical, environmental and fuel systems. The C-130H model Hercules incorporates more powerful Allison propjet engines with both higher takeoff ratings and higher cruise settings which make possible better short field performance and increased speeds and altitudes. Improvements to the Hercules have provided greater reliability and reduced maintenance and operating costs. The C-130H Hercules is a worthy addition to the RAAF. We at Lockheed-Georgia wish them good luck and good flying in the future.

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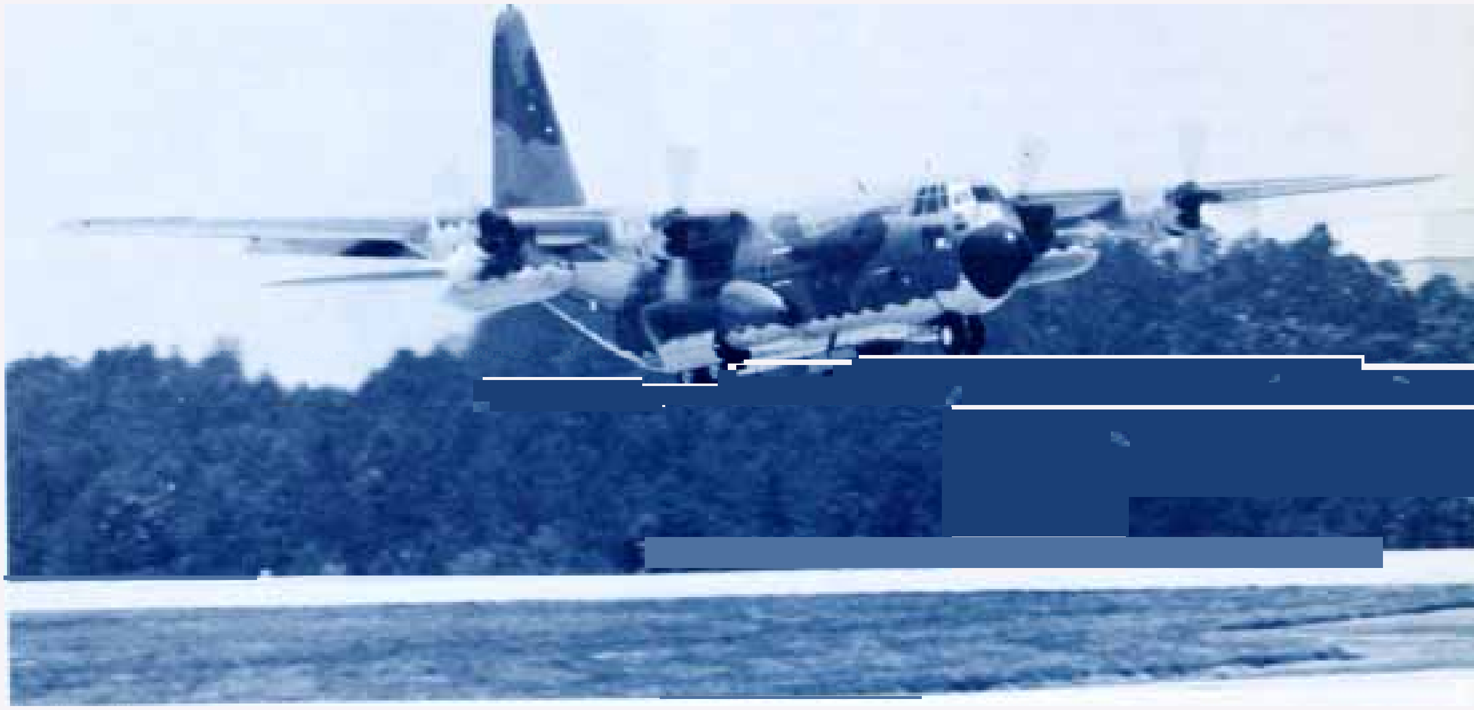

Top left: To mark delivery of the first RAAF C-130H Hercules, Lockheed-Georgia Company President Bob Ormsby presents a Hercules model to Col. Don Ayres, AFPRO, who in turn presents it to Air Commodore Roy Collison, Air Attache with the Australian Embasy in Washington, D. C.

Top right: Squadron Leader Hugo Dreimanis (left) of the RAAF discusses the new Hercules with Lockheed's Director of Flying Operations, Walt Hensleigh.

Above: Number 01, the first of the new C-130H Hercules to be delivered to the Royal Australian Air Force, takes off on its maiden flight.

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