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A SERVICE PUBLICATION OF LOCKHEED AERONAUTICAL SYSTEMS COMPANY-GEORGIA

service news

ENGINE OIL LOSS

Lockheed

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Vol. 15, No. 2, April-June 1988

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Cover: Hercules aircraft from five **of** the more than **50 nations that operate the world's premier aircraft are featured** in our cover photographs: Sweden (front cover), and (back cover, clockwise from upper left) Indonesia, Norway, Algeria, and Japan.

LASC PRODUCT SUPPORT-A COMMITMENT TO EXCELLENCE

Bill Bernstein

Regular readers of Lockheed Service News have noticed that our masthead has changed. Lockheed-Georgia is now part of Lockheed Aeronautical Systems Company (LASC). The name has changed and there are other changes in progress at Lockheed, but our **primary goal** remains the same: customer satisfaction.

Our new name recognize5 joining the capabilities of Lockheed- Georgia, Lockheed-Califarnia, and Lockheed Aircraft Service organizations into a single company. But we are still the same people, dedicated to personal attention, quality products, and superior service for our customers.

As Vice President of Product Support at LASC, I want to assure you that this consolidation affects each Lockheed customer in a very positive way. LASC comhines the technical expertise and manufacturing know-how necessary to ensure quality support for every current and future operator of Lockheed aircraft. LASC Product Support's consolidation goal is to build on traditional strengths, while retaining the personal commitment **of each** employee to provide quality service, spares, and support for every customer.

Each of us in Product Support is proud of our new company and our products, and we are dedicated to ensuring that every Lockheed customer receives the maximum value for his investment. This is our pledge to you, and we are matching words with action.

Quality and excellence are the commitments Product Support people make every day. Both to you, the customer, and to our co-workers at LASC. As the customer, you judge our success and write our report card. I am interested in hearing of our accomplishments, and equally interested in knowing where we could do better, Please contact your LASC **representative, resident manager, support** manager or me personally. Your perceptions are vitally important to our ability to serve you better.

Sincerely,

B. F. **Bernstein**
Vice President,Product Support
Lockheed Aeronautical Systems Company

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TROUBLESHOOTING ENGINE OIL LOSS

by **Dare1 A. Traylor,** Service Analyst
C-130/Hercules Service Department

For internal lubrication, the 501/T56 power plants that are installed on Hercules aircraft utilize a lubrication system that consists of two essentially independent pressure lubrication and dry-sump scavenge recovery circuits. One provides lubrication for the reduction gearbox assembly, the other for the power section. Both are furnished with oil from a common nacelle-mounted **oil supply** reservoir.

Two independent pressure pumps move the oil from the supply tank and through their rcspcctive **distribution** systems to provide lubrication and cooling to the various internal surfaces. The dry-sump scavenge portion of each circuit routes recovered oil to a common nacelle return system.

On the way to the supply reservoir, the oil is filtered and cooled. When it reaches the supply tank, the lubricant, which at this point is a heavily aerated,foamy mixture. is separated into air and oil. The oil flows to the bottom of the tank and the air escapes through the tank pressurizing valve and out the nacelle drain mast to the atmosphere.

Lubrication System Problems

The engine lubrication system on the 501/T56 engine has proven itself effective and reliable in literally millions of flight hours during more than three decades of service. Like all things mechanical, however, problems can and do occur.

Oil system problems tend to fall into two basic categories: those where the cause is evident. or can he dctcrmined by inspection or a few simple checks, and those where the cause seems quite obscure, and resists normal discovery efforts. Each of these demands its own special troubleshooting philosophy.

External leaks and malfunctions that can be readily picked up on engine instrumentation belong in the first category. These problems are usually comparatively easy to discover and can generally be solved in a straightforward manner.

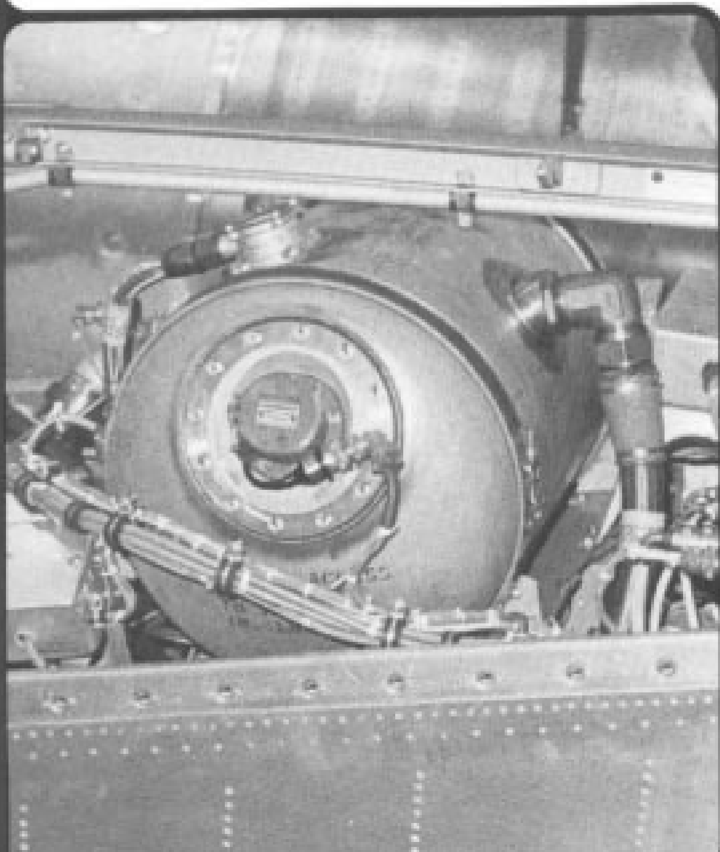
Visual Inspection

When an oil loss problem seems to remain relatively constant regardless of altitude, airspeed, or mission profile, the best place to start troubleshooting is with a thorough visual inspection of the affected power plant.

Look for external leaks around fittings, oil lines, gaskets. and for hairline cracks in the cases of all oil-containing engine components. Inspect the engine compressor inlet and turbine exit area for signs of seepage, oil stains, or physical damage.

In particular, check the split **line between** the power section aft side accessory drive case and the air inlet housing. the individual accessory drive seal drain lines, and also the rear turbine bearing scavenge pump cover for evidence of oil loss. Oil stains in the rear turbine area suggest that the rear turbine bearing scavenge pump has failed, or that the return passage back to the main power section sump has become clogged.

Open the clamshell doors of the aft nacelle and examine the 3 o'clock and 9 o'clock turbine strut vents for any unusual oily residue. The inside surfaces of the clamshell doors will also be stained if oil is venting in quantity through these ports. Leakage in this area suggests that oil is passing through the "lighthouse" seals between the turbine inlet casing and the inner combustion casing or inner combustion liner.



Scavenge Oil Leakage

Some areas deserve special attention. A number of occurrences of scavenge oil leakage at the external oil pump outlet tube of the power section accessory drive housing have been reported, and these have generally involved the PN 6784121 aluminum alloy union fitting that is threaded into the magnesium accessory case at that location.

Experience has shown that this fitting is highly susceptible to damage from the application of too much torque during installation. Even slight overtorquing of the union in the accessory case may strip the threads in the magnesium casting and result in oil leakage.

The best way to avoid problems with this fitting is not to take any chances with it. Use a properly calibrated torque wrench and stay within the torque range of 100 to 150 inch-pounds during installation, and be sure to use a wrench to hold the union securely while torquing the scavenge line B-nut.

Repairing Damaged Threads

If the correct torquing techniques are used, it is unlikely that the threads in the accessory case will ever be stripped. But should it nonetheless become necessary to repair a leak at this location because of damaged threads, it is possible to correct the problem by following the instructions and specifications in the Allison *Commercial Engine Bulletin 72-1525* or T.O. 2J-T56-43, Figure 6-140A, page 6-158C, Change 42.

Note that this repair is best accomplished at overhaul because it is difficult to gain access to the area where the union is located while the engine is installed on the aircraft.

The repair procedure consists of reworking the bore as necessary to allow it to accept a PN 6879168 union fitting. This fitting is slightly larger in diameter than the part it replaces and has more threads. This extra thread engagement will reduce the tendency for the accessory case to become damaged. It is advisable, however, to exercise the same care in torquing the new union as is specified for the original.

Unexplained Oil Loss

The second category of lubrication system problems includes troubles whose causes are not clearly evident, and arc for that reason much more difficult to pin down.

Unexplained oil loss, or consumption that has no obvious cause, can test the wits and patience of the most dedicated power plant specialist. Furthermore, so many

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factors could be involved that it is difficult to give advice about solving the problem that will be both general enough to cover all cases and specific enough to be useful. There are, howcvcr, some procedures to try and some things to look for that can help. Let us mention some of the more important ones.

Internal Damage

High oil consumption can often be a sign of internal mechanical damage within the power section or reduction gearbox and the problem should be approached accordingly. Remove the magnetic drain plugs from the sumps in order to make a visual examination of the metal particles that may have been collected.

When doing this, catch the oil that drains from each of the sumps in separate containers and set them aside for the moment. The external scavenge filter element should also be examined for the presence of foreign particles. Note particularly whether any chunks of metal 1/16 inch or larger in diameter are found.

Evaluate the accumulation of particles in accordance with the instructions given in the applicable maintenance manual. If the amount of the accumulation or the nature of the particles is found to be unacceptable, internal damage to the engine is indicated and the engine should be replaced.

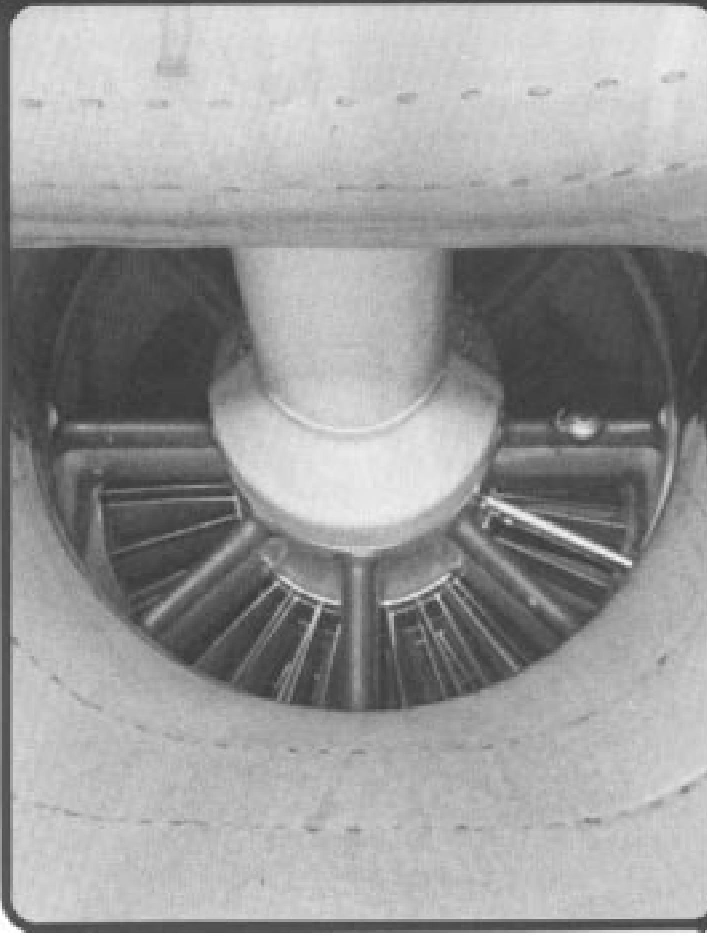
Replacement of an entire engine because of suspected internal damage is one way to solve an oil loss problem. But what if an examination of the magnetic plugs and oil filter elements fails to turn up anything unusual? In this case. it will be necessary to look into the matter a little deeper.

Sleuthing the Sumps

Locate the containers holding the oil that was previously drained from the sump. Measure the quantity in each container. Any amount over about a quart in either sump suggests that an internal problem exists affecting the operation of the scavenge system.

If only one sump is high, the trouble may be a worn scavenge pump in that section of the engine, or restrictions in the lines leading to or from it. If both sumps are high, excessive scavenge system back pressure may be the culprit.

A good way to check the general condition of the scavenge oil system is to measure the back pressure developed in an operating engine. Restore the engine to operable condition and follow the procedures outlined in



TM 382C-2-3, T.O. 2J-T56-26 (for -7 engines), or T.O. 2J-T56-46 (for -15 engines).

In either case, the maximum back pressure measured at the scavenge oil pump outlet should not exceed 30 psi at normal operating temperatures. Note that in aircraft equipped with plate-type oil coolers, the back pressure will ordinarily run a little higher, up to about 3.5 psi. Excessive back pressure is usually caused by restrictions in the fuel heater, oil cooler, or interconnecting lines.

The same restrictions impede the normal flow of oil through these units, resulting in flooding of the sumps at the expense of the main supply tank and loss of oil overboard as the excess oil leaks through the venting system or finds its way into the interior of the engine and is burned.

While the engine is running, it makes good sense to check it carefully for external leaks and signs of excessive venting- particularly from the 3 o'clock and 9 o'clock turbine inlet casing strut vents.

Gravitational Flooding

The reports given by flight crews are often crucial in getting an investigation into unexplained oil loss off to a good start. For instance, if the oil loss appears to be taking place while the aircraft is on the ground-the oil quantity is not noted to be low when the engine is shut down, but reads low hours later--the problem may be gravitational flooding.

Check to see that there arc at least 4 gallons of oil showing on the gage of the affected engine (to provide lubrication) and motor it briefly. If the oil quantity increases significantly, it is likely that an excessive amount of oil has found its way into the sumps and is being scavenged back to the supply tank during the motoring procedure.

The usual cause of this gravitational flooding is an improperly functioning oil retention check valve in the power section filter assembly, the reduction gearbox oil pump assembly, or both.

Gravitational flooding can also result from a defective filter bypass valve in the power section or reduction gear lubrication circuits, or a leaking pressure regulator valve in the main power section pump-or a combination of these problems.

Note that gravitational flooding can be a transient condition caused by a particle of foreign material lodging in the seat of one of the two oil retention check valves. If there is no indication that the engine is a repeat offender, the engine should be run to clear it of the accumulated oil and checked again.

Clearing Oil Fumes

Not surprisingly, an engine whose sumps have been flooded with oil will smoke and vent abnormally during the first few minutes after starting. There is little that can be done to prevent contamination of the outside air in such cases, but a few minor changes in the engine start and run-up procedures can at least help keep oil fumes from getting into the aircraft's air conditioning system and causing discomfort for the crew. The engine start should bc accomplished normally except for the following:

- Allow the engine to stabilize in low-speed ground idle and then immediately close the affected engine's bleed air valve. In low-speed ground idle. the 5th and 10th bleed air valves are open, allowing most of the oil to escape from the compressor through the acceleration bleed manifold.
- Next, shift to high-speed idle, but keep the engine bleed air valve closed as long as possible (a minimum of several minutes) to allow oil residue to dissipate through the engine.
- Opening the bleed air valve at this time should not introduce any oil into the bleed air manifold. and this will usually prevent oily fumes from getting into the aircraft air conditioning system.

Note that a compressor section that has been heavily fouled by oily residues may continue to produce unpleasant odors even after all the raw oil has been cleared. In such cases. washing the compressor using an approved chemical solution liquid cleaner will usually solve the problem. Changing both of the air conditioning water separator "socks" can also help eliminate a persistent oily smell left over from incidents of compressor contamination.

If flooding into the sumps is a persistent problem with a particular engine, the malfunctioning check valve will have to be replaced. Usually it is possible to determine which check valve is at fault by draining the power section accessory drive and reduction gear sumps separately and measuring the quantity of oil removed.

If more than one quart of oil is found in the sumps of either the reduction gear assembly or the power section after the engine has been static for several hours. the offending check valve has been located. If the indication of oil loss is occurring only at high altitudes, a good next step would hc to check the oil supply tank and associated components.

Oil Venting

Over the years problems of exccssivc engine "breathing" or "venting" on Hercules aircraft have been attrihuted to a number of different causes.

The prohlem is usually first noticed in the form of visible vapors being emitted from the nacelle drain mast. Other symptoms are a loss of oil quantity indication, and reduced or fluctuating reduction gear oil pressure, especially at altitude. Some of the loss of oil quantity and fluctuating pressure may seemingly correct itself upon return to lower altitudes.

This particular set of circumstances is frequently caused and cured hy the same thing-a change of engine oil. The root of the problem is the mixing of EMS 53 oils from different vendors in violation of the grouping published in the Detroit Diesel Allison Commercial Service *Letter* (Rev. 3, 18 March 1983).

It is incompatibility among the chemical additives used by different engine oil vendors that induces the foaming. A relatively small quantity of oil can have a dramatic effect on foaming propertics. The problem is particularly common with operators who procure oil by MIL specification. Since MIL-L-23699 oil is produced by many manufacturers, cross-group mixing is such cases can practically he guaranteed.

Excessive foaming caused by incompatible oil additivcs typically results in the following:

- Heavy venting.
- Apparent loss of quantity.
- Fluctuation of reduction gear oil pressure.

When the above symptoms are reported and no obvious mechanical cause can he identified, it is worthwhile to try to solve the problem with an oil change before turning to more drastic measures. First. carefully drain **all the** old oil from the system, including the tank, oil cooler, power section, and reduction gear sumps. Then replace it with new oil, all of which is known to be in the same oil grouping.

Changing engine oil is not a cure for all oil venting complaints, but Hercules aircraft operators can eliminate at least one commonplace.cause of oil venting problems by the judicious selection and use of engine oils.

A good place to start in selecting the right engine oil for your aircraft is with the list of compatible lubricants published by Allison (see Tables 1 and 2), or the MIL-L-23699 oils listed in Qualified Products List 23699 (QPL-23699) published by the U.S. Naval Air Systems Command.

Miscellaneous Causes

Also **keep** in mind that oil loss has occasionally been traced to some quite obscure causes. Here are a few more items that past experience has indicated may he involved when unexplained oil loss has been reported. (continued)

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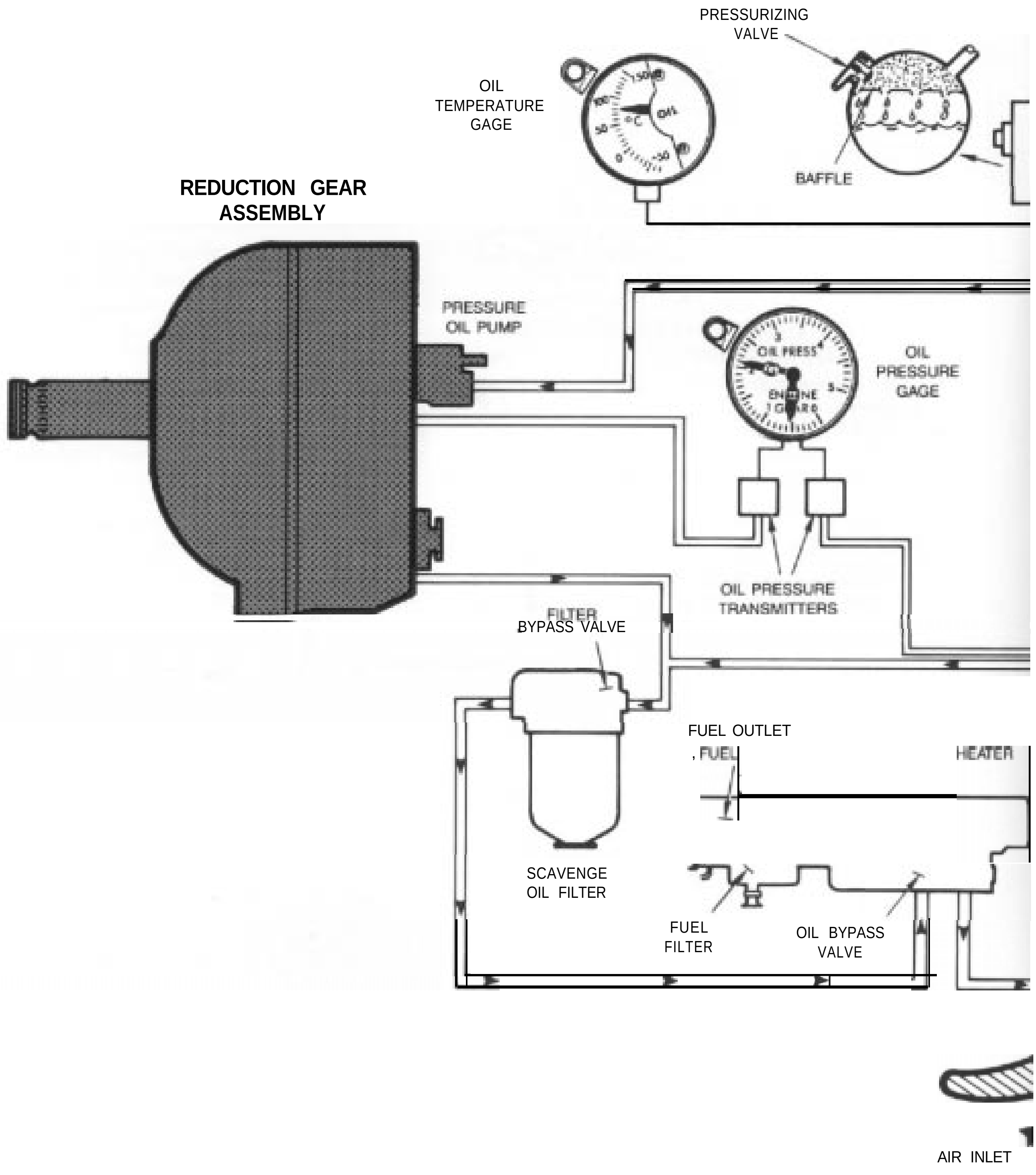

Nacelle Oil System Schematic

501/T56 Engine

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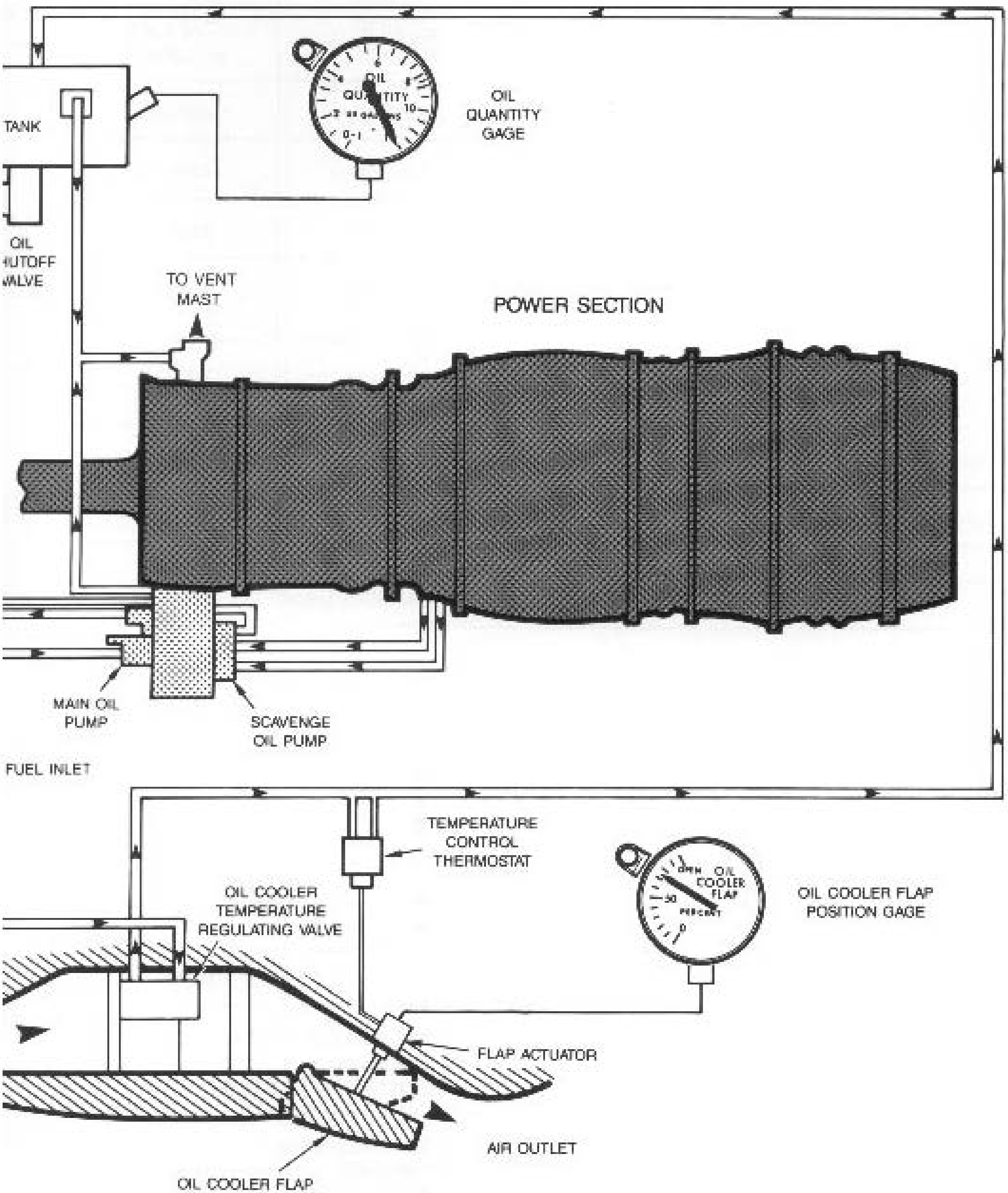
TANK
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SCAVENGE
OIL PUMP
FUEL INLET
TEMPERATURE
CONTROL
THERMOSTAT
OIL COOLER
TEMPERATURE
REGULATING VALVE
OIL COOLER FLAP
POSITION GAGE
FLAP ACTUATOR
AIR OUTLET
OIL COOLER FLAP

Table 1. Allison-Approved Lubricants—Engine Oil System

OIL APPROVED FOR USE IN ENGINE OIL SYSTEM	APPROVED DRAIN PERIOD (HOURS)	ALLISON SPECIFICATION NUMBER
Mobil Jet Oil II (Type II)	1500 ± 50	EMS 53
EXXON Turbo Oil 2380 (Type II)	1500 ± 50	EMS 53
ESSO Turbo Oil 2380 (Type II)	1500 ± 50	EMS 53
Stauffer Jet II (Castrol 205) (Type II)	1500 ± 50	EMS 53
AeroShell Turbine Oil 500 (Type II)	1500 ± 50	EMS 53
Mobil Jet Oil 254	1500 ± 50	EMS 53
Royco Turbine Oil 500	1500 ± 50	EMS 53
All oils meeting U.S. Military Specification MIL-L-23699	600 ± 50 (See NOTE below)	

WARNING: The tri-cresyl phosphate and some of the other organic additives in synthetic oils conforming to specification MIL-L-23699 and EMS 53 are readily absorbed by the skin and are highly toxic. Any part of the body that comes in contact with these oils should be cleaned as soon as possible.

NOTE: The above-listed EMS 53 oils MAY or MAY NOT appear in U.S. Military Qualified Products List MIL-L-23699; however, only the commercial EMS 53 oils listed above are approved for the drain period of 1500 ± 50 hours.

Table 2. Addresses of Allison-Approved Oil Vendors

GROUP NO.	OIL BRAND NAME	VENDOR ADDRESS
9	EXXON Turbo Oil 2380	EXXON Company U.S.A. P.O. Box 2180 Houston, Texas 77001 USA
9	ESSO Turbo Oil 2380	EXXON International Co. Avenue of the Americas New York, N.Y. 10020 USA Tel. (212) 398-5604

Table 2. Addresses of Allison-Approved Oil Vendors (cont)

GROUP NO.	OIL BRAND NAME	VENDOR ADDRESS
5 5	Mobil Jet Oil II Mobil RM 254	Mobil Oil Corporation USD Aviat. & Gov. Sales 3225 Gallows Road Fairfax, VA 22037 USA
6	AeroShell Turbine Oil 500	Shell Oil Company Commercial Sales Dept. 2 Shell Plaza P.O. Box 2105 Houston, Texas 77001 USA
		Operators based in Canada may contact: Shell of Canada, Ltd. Aviation Sales P.O. Box 400, Term. "A" Toronto M5W 1E1 Ontario, Canada
		Operators based outside North America may contact: Shell International Petroleum Company Ltd. International Aviation Sales Division Shell Centre London, SE1 7NA England
7	Stauffer Jet II (Castrol 205)	Stauffer Chemical Co. Specialty Chemical Div. Westport, CN 06881 USA Tel. (203) 222-2168
6	Royco Turbine Oil 500	Royal Lubricants 101 Eisenhower Parkway Roseland, NJ 07068 USA
	MIL-L-23699	Refer to the latest U.S. Military Qualified Products List (QPL MIL-L-23699)

CAUTION: This listing includes the group number of each specific vendor brand name. Oils in any one group may be mixed, but must not be mixed with oils from another group.

A faulty tank pressurizing valve, a defective seal at the oil tank filler cap, or simply a crack in the upper portion of the oil tank, can prevent the tank from pressurizing, or cause the pressure to leak down enough to permit excessive foaming at altitude. Make sure that all of these components are in good condition before moving on to the next step.

On older engines, a vent screen at the II o'clock position on the air inlet housing may emit an oil mist into the nacelle area. Oil leakage from this vent is generally caused by contamination of the labyrinth seal assembly vent cavity. This problem can sometimes be cleared as follows:

- Remove the vent plug assembly and clean the screen with alcohol (MIL-A-6091).
- Remove the magnetic drain plug and inject four to six ounces of alcohol into the vent passage of the air inlet housing.
- Apply compressed air into the passage in order to create an agitating action that will wash the oily residue from the knives and grooves of the rotor outer seal.
- Reinstall the vent plug and the magnetic drain plug and recheck the engine. If leakage recurs, the engine should be replaced.

Oil loss has been known to be caused by an improperly mated front turbine scavenge oil tube at the diffuser. This area is particularly suspect if the hot section of the affected engine has recently been disassembled.

On at least one occasion, a cracked internal diffuser scavenge tube was found to be responsible for an unexplained loss of oil. Replacement of the damaged part corrected the trouble.

The information we have presented here is by no means an exhaustive discussion of all possible approaches to solving the problem of unexplained oil loss; we hope, however, that these pointers will prove helpful.

In the final analysis, the know-how and ingenuity of maintenance personnel are what it takes to tip the scales in favor of a solution to any complex maintenance problem. An open mind and a keen eye will go a long way toward finding the cause of unexplained loss of oil from a 501/T56 power plant.

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LIGHTNING and AIRCRAFT

The Nature of Lightning

A lightning bolt is a very long electrical spark which extends from a center of electrical charge in a cloud to a center of opposite charge in the ground, in another cloud, or sometimes even in the same cloud.

The estimated electrical potential difference required to produce a flash of lightning to the earth is on the order of 100 to 200 million volts. The electric currents in the return strikes to the cloud are the major components of the strike, and the peak values of these currents range from 5000 to 500,000 amperes.

A lightning strike may have many return strokes, occurring so quickly that they give the impression of a flickering discharge. However, the average number of return strokes is four. Flashes of lightning within a cloud or between adjacent clouds occur more frequently in most thunderstorms than do flashes of earth-associated lightning.

Lightning bolts range from 1000 feet to 100 miles in length, with the most common type about a mile long. The energy content of a typical strike is about 400 million horsepower. The return stroke, the visible part of the lightning flash, travels at 10,000 meters per second and has a temperature of 50,000 degrees F, or five times hotter than the surface of the sun.

Lightning Strikes on Aircraft

Although the question of why aircraft are struck by lightning has not yet been fully explained, most experts agree that aircraft are struck only when they happen to pass near the natural strike path of lightning.

As an aircraft flies near a charge center, such as that found in thunderstorm cells, the electrical field induced around the aircraft may be intense enough for streamers (electrical charges of opposite polarity) to form and travel out toward the charge center. As the aircraft field increases in intensity, an ionized conductive path of air advances toward the aircraft and joins the streamer emanating from an aircraft extremity.

The aircraft will not absorb the electrical charge, but becomes a link in the conductive path as a greatly intensified electrical field causes streamers of positive ions to spring from trees or other projections on the ground and travel upwards to meet the downcoming ionized path. As the two make contact, the downcoming path is neutralized, and the current flows back to the storm cloud in a return stroke.

It is this return stroke that is responsible for the noise and flash associated with a lightning strike. Rapid expansion of the lightning channel in the atmosphere during the return stroke is the source of thunder, while the magnitude of current flow determines the light intensity of the flash.

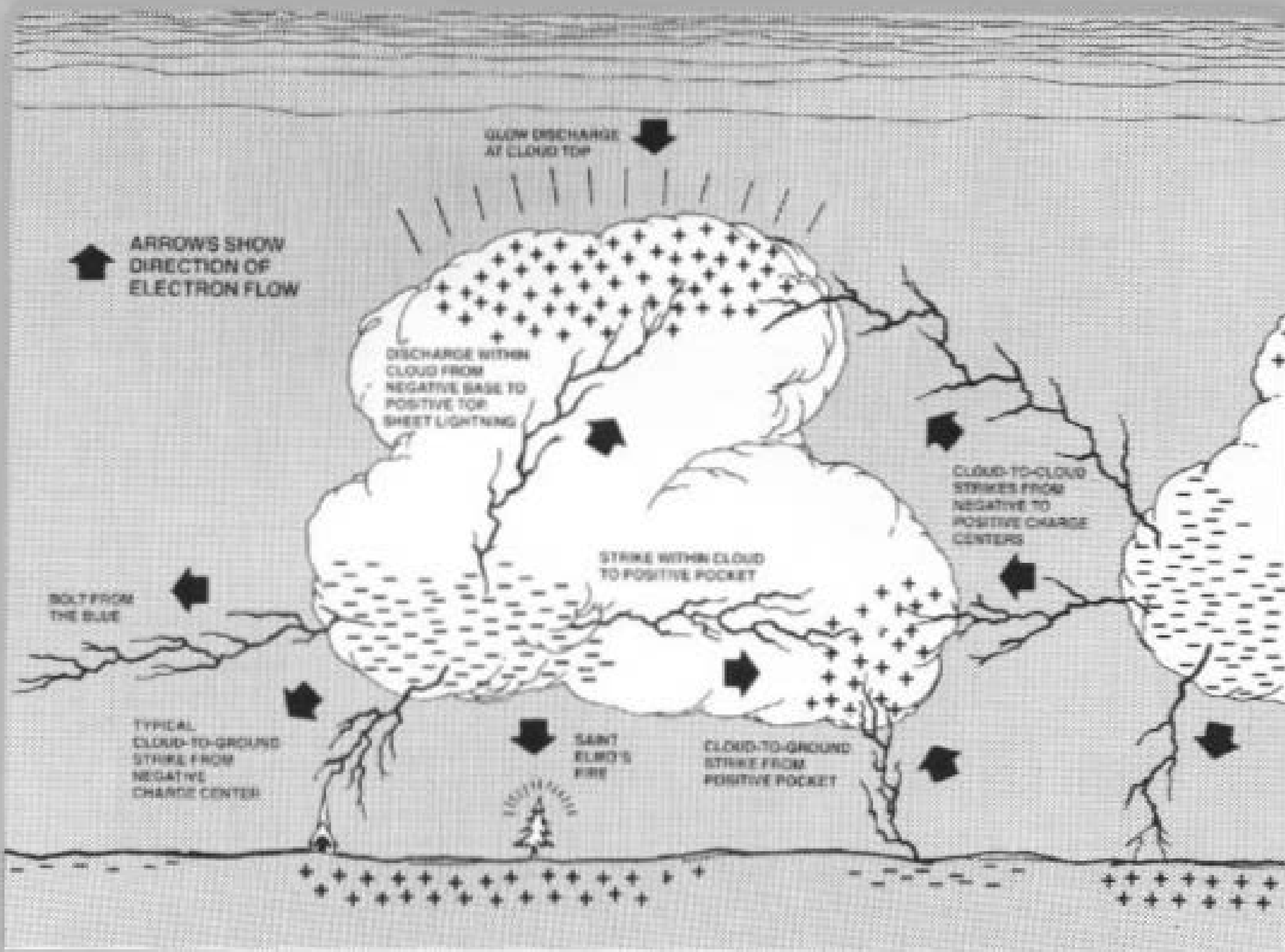
Aircraft Damage

Due to its short duration, no longer than a fraction of a second, the current (as high as 200,000 amperes) flows through the aircraft between the entry and exit points, usually resulting in little noticeable damage because most of the current remains in the skin of the aircraft.

Unfortunately, however, aircraft are not perfect metal shells. The extremities, the parts of an aircraft most likely to serve as electrodes for a lightning strike, are often fitted with nonmetallic structures such as radomes. Moreover, antennas of various shapes and sizes frequently project beyond the shield of the metal shell.

Pointed structures, such as control surfaces and the tips of propellers, are also vulnerable because of their shape and location. These are the components that are most often damaged by lightning strikes, as shown in the pie chart on page 15.

Small pits, marks, or holes melted in the skin may occur in the area of the lightning attachment points. In areas such as trailing edges, where the flash can hang on for a



longer period, there is the possibility of a hole being melted. There may also be some crimping or deformation of metal skin caused by the intense magnetic fields generated by strike currents.

In some cases, the channel of ionized air through which the lighting strike progresses, if it is in the vicinity of a jet engine intake, has caused sufficient changes in air pressure to induce compressor stalls or flameouts. The most likely entry or exit points on an aircraft for lightning-induced electrical current are the extremities such as the nose, wing tips, horizontal or vertical stabilizer tips, tail cones, and antennas.

Electronic equipment is often damaged when a navigation light is struck and the globe broken, allowing a portion of the lightning current into the aircraft's electric power distribution system. It has recently been found that the electromagnetic fields which accompany lightning strike currents may find their way inside the aircraft, where they induce transient voltages and currents in the aircraft's electrical wiring and cause sensitive electronic equipment to malfunction.

Nearby lightning can be hazardous even though it does not strike the aircraft. It can induce a permanent error in the reading of the magnetic compass. It can distract or blind a pilot momentarily and interfere with his control of the aircraft. The loud blast of radio static produced by a lightning flash affects radio receivers on low and medium frequencies even when the flash occurs miles away.

Fortunately, however, there is almost no danger of an aircraft occupant being electrocuted during a lightning strike. At most, some pilots have reported receiving a mild electric shock, which in many cases is nothing more than a startled reaction to the loud noise accompanying the strike.

Avoiding Lightning

The best way to avoid lightning strikes is to avoid thunderstorms. Most strikes occur in the clouds, but they have in some cases been reported as "bolts from the blue," in clear air, miles from any cloud formation. Most strikes occur between 5000 and 15,000 feet, but they also have been reported from as low as 1000 feet to as high as 37,000 feet. Many lightning strikes occur below the cloud level, in the vicinity of a developing thunderstorm.

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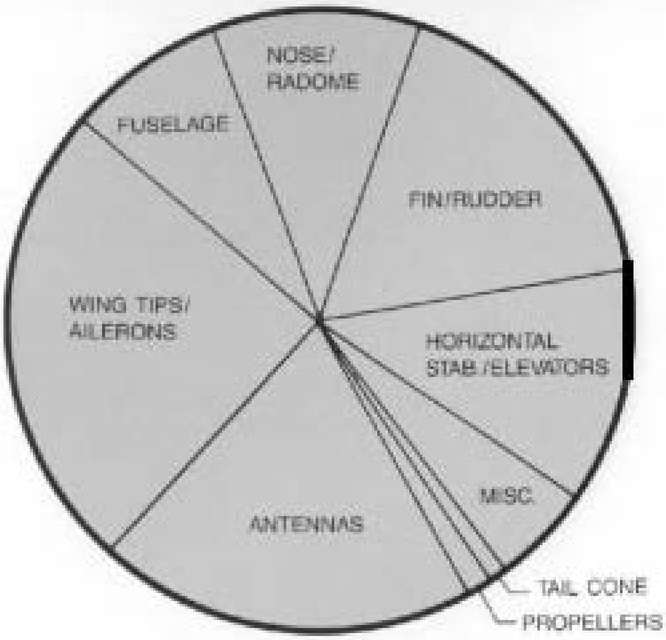

TYPICAL DISTRIBUTION OF LIGHTNING STRIKE LOCATIONS

Nature sometimes provides an early warning system that can alert the crew that the aircraft is passing through a charged environment where lightning strikes are possible. St. Elmo's fire, a visible electrical discharge or corona which appears around aircraft surfaces, is in itself harmless, but its presence may portend a lightning strike. St. Elmo's fire also occurs around solid objects on the ground, and a related phenomenon causes the glow discharge which may be seen near thunderstorm cloud tops at night.

There is a strong tendency for lightning strikes to occur at a level where the outside air temperature (OAT) is at or near 0 degrees C. It is believed that this is because the negative charge center is not located at a single point but is spread out with varying densities over a large area.

Lightning discharges tend to travel horizontally through much of this area before turning up or down. An aircraft flying near the freezing level is more likely to intercept a strike than one operating well above or below the 0-degree C isotherm.

The typical aircraft lightning strike, therefore, occurs between 5000 and 15,000 feet to an aircraft flying within a cloud or on the thunderstorm's edge, experiencing light rain and light turbulence when the OAT is at or near 0 degrees C.

Inspecting for Lightning Damage

If you have reason to believe that your Hercules aircraft has been subjected to a lightning strike, the airplane should be inspected as soon as possible after the suspected occurrence. SMP 515C work card SP-147 describes the specific inspection procedures that should be followed in assessing possible damage. The inspection directs particular attention to three key areas: avionics, propellers, and the aircraft structure.

In the avionics area, the physical condition of the radome and all antennas should be checked for burns or other evidence of damage, and this should be followed by a thorough operational check of all instrument, navigation, communication, and lighting systems.

Propellers can also be damaged by lightning, and sometimes the damage is not at all obvious. For this reason, each blade must be inspected closely and carefully. This means using appropriate work stands to get to the props, and examining all blade surfaces for evidence of burns, cracks, resolidified metal, or other damage.

Suspect areas should be examined with a magnifying glass to determine the nature of the problem. Propeller blades showing evidence of a lightning strike can be repaired according to the normal Hamilton-Standard rework procedures, but blades damaged beyond repair limits must be replaced.

Checking the airframe for lightning damage consists of a complete visual inspection of all exterior surfaces of the aircraft, particularly the control surfaces and their exposed attaching parts, for evidence of burning, pitting, arcing, erosion, or loose or missing fasteners. The visual inspection must then be followed up by a thorough operational checkout of the flight control systems.

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