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The Canadian Forces Investigate:
Propeller Low Oil Level Lights

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Cover: A Canadian Forces CC-1 30H(T) is joined by a CF-5 and a CF-18 during a refueling excercise over Alberta.

Back Panel: "Hercs" to the rescue! Canadian Forces CC-1 30s support a host of vital aid programs worldwide.
Photos courtesy of CWO Keith Edgett, Air Transport Group Hdq., Trenton, Ont.

Focal Point

HOC 1994

Joe Parnigoni

In the spring of 1982, forty-eight representatives of 15 Hercules aircraft owners and operators gathered in Marietta, Georgia to inaugurate the international Hercules Operators Conference (HOC). The meeting provided a unique opportunity for both Lockheed and the operators. Lockheed specialists were able to offer the attendees on-the-spot advice on many operational and maintenance questions and supply up-to-date technical information during formal presentations.

The success of this initial operators conference gave the impetus for continuation on a regular basis, and representation has grown to a record level this year. The 1994 HOC will be held in Marietta April 1 1 through 15. To date, almost 250 confirmations of attendance have been received. This number includes representatives of more than 70 operators, Hercules Service Centers, and major vendors.

As the HOC has matured, some changes have been necessary. In 1990, Lockheed formed the Hercules Life Extension Initiatives Working Group (HLEIWG), and the delegates elected three co-chairmen to preside over future meetings. One of the co-chair seats was reserved for an elected representative from among the operators, one was to be appointed by Warner ***/continued on page* 79, column 1)**

The HOC Co-Chairman Comments

Maj. Kightley

As you are by now well aware, the next HOC is scheduled for 11 to 15 April 1994, some 18 months after our successful previous meeting in October of 1992. Among the early priorities after the conclusion of the 1992 conference was the need to set a date for the next meeting. In the ensuing months, there was a great deal of discussion concerning just when the next conference would take place.

These conversations raised two points upon which I would like to comment. Lockheed initially took the position that a return to the earlier practice of holding conferences every two years was in order because of comments made by some operators after the 1992 conference that meetings every year were too much in these times of economic restraint and restrictions.

Based on my discussions with fellow operators and from the results of the 1990 and 1991 conferences, however, I am a firm believer in the concept of the yearly conference. Negotiations resulted in the ***(continued on page 19, column 21***

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The Canadian Forces Investigate:

Propeller Low Oil Level Lights

by **Major Bob Maier** *and* **Captain Dave Nowosad**
Air Command Headquarters, Canadian Forces
Westwin, Manitoba

Propeller low oil light indications have plagued the Canadian Forces (CF) for a number of years. These incidents were of grave concern because in some circumstances, the required procedure for such indications is to shut the engine down in flight. In August of 1991, a decision was made to form a working group to investigate the high rate of propeller low oil light occurrences and make recommendations on how to solve the problem. The purpose of this article is to share our experiences and findings with other Hercules users so that they too may benefit from them.

Working Group

The working group reviewed flight safety data in order to determine if any trends existed. Propeller serial numbers were checked to determine if the problems could be attributed to specific propellers. The resulting analysis showed that this was not the case, and that the majority of problems were due to improper procedures or techniques, with no one predominant cause attributing to the high incident rate. The working group then identified all the factors that appeared to contribute to this problem and made recommendations to rectify them. Each of these factors and suggested solutions will now be discussed in turn.

Flight Incident Reporting

The reporting of propeller low oil level lights through the flight safety net at each user unit was found to be somewhat inconsistent. Steps were immediately taken to standardize flight incident reporting at each user unit in order to ensure that valid history data would be provided.

Standardization of Technical Publications

The technical publications used by the flight engineers and technicians were reviewed for inconsistencies in the procedures. Steps were then taken to standardize all CF publications to the correct procedures laid down by the propeller manufacturer, Hamilton-Standard.

Atmospheric Sump Dipstick

The current design of the dipstick and tube assembly is such that it is possible to get an incorrect fluid level reading if a small amount of residual fluid is retained in the hollow bolt which supports the dipstick tube (Figure 1). We found that this can lead to underservicing of the propeller which may result in a low oil level light indication in flight.

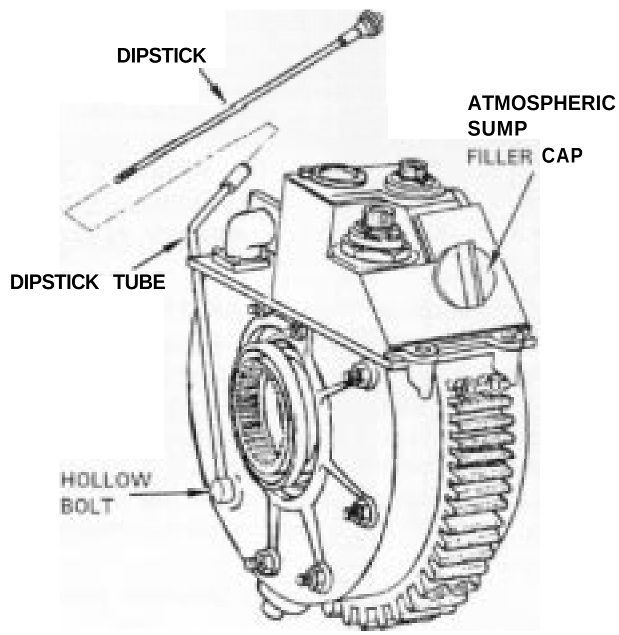

Figure 1. 54H60 propeller control assembly.

An optimum fluid level for the propeller was determined through practical experimentation. For our tests, we made use of a special plexiglass cover for the Hamilton-Standard NSN 16 l0-21 -843-4664 pump housing assembly that had been developed to assist maintenance technicians during desnagging activities and as a training aid. After completion of these tests, authorization was obtained to modify all dipsticks to raise the full mark and indicate an operating level.

Difficulty in reading the dipstick under poor light conditions had also been reported by both technicians and flight engineers. To help remedy this situation, a cross-hatch pattern was etched in all dipsticks to make them easier to read. Figure 2 shows the new design. *Other operators who may be interested in these modifications are cautioned to seek appropriate authorization before making any changes to existing equipment.*

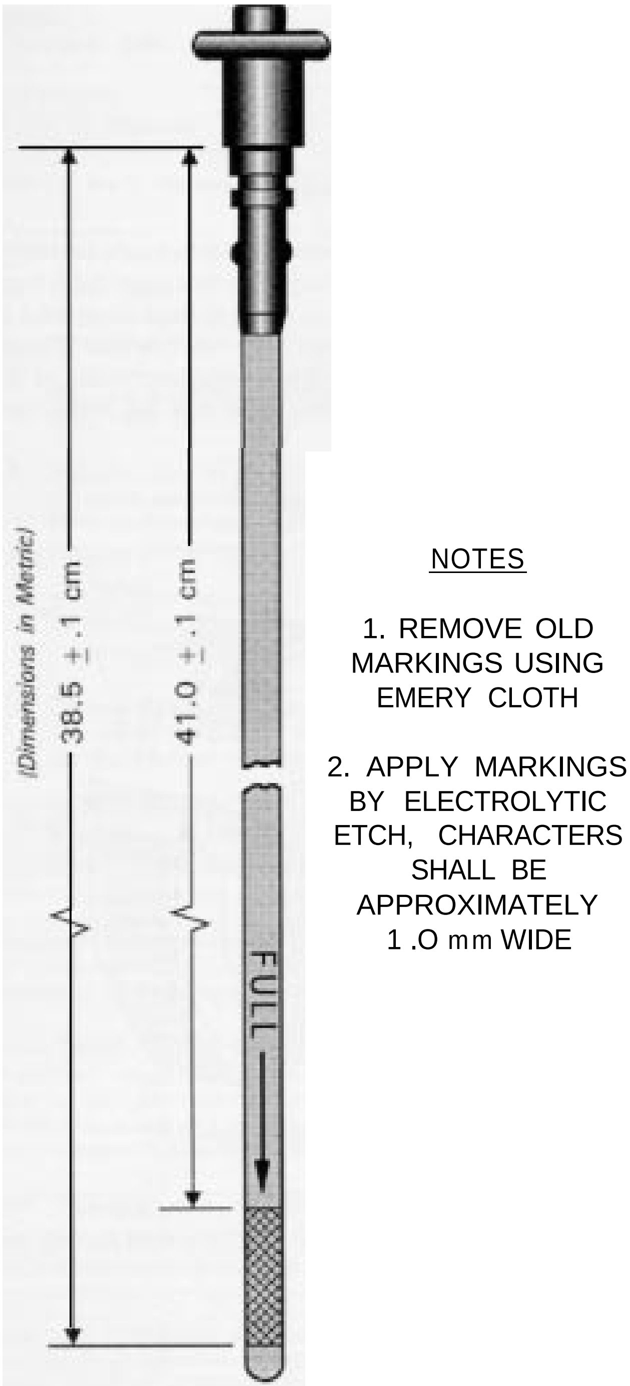

Figure 2. Dipstick rework.

Propeller Oil Level Check

The published procedures for our aircraft state that the propeller oil level check must be carried out within 30 minutes of engine shutdown or overfilling may result. Tests that we performed on the propeller firmly underscored the importance of this point. Even on a warm day, the oil level dropped 1/2 inch on the dipstick after only 45 minutes had elapsed. Therefore, if a technician starts his fluid-level checks 20 minutes after shutdown, and it requires 40 minutes to service all four propellers, the last two propellers could easily end up being overserviced.

In order to ensure that the propeller oil level readings are taken within 30 minutes of engine shutdown, three servicing technicians must be utilized, one located in the flight station while the other two service two props each. An alternate method would be to have one technician take the readings of all four propellers before adding fluid as required. The actual dipstick check itself must also be carried out exactly according to the procedure described for your aircraft. A summary of the method used by the CF is as follows:

> Shut down the engine and connect external electrical power to the aircraft. Position the No. 1 blade at the 12 o'clock position to ensure that the propeller hydraulic system is purged of air and to help prevent static leakage. Use the propeller auxiliary (feather) pump to cycle the propeller blades through the full range of positions from ground idle, to feather, to reverse, and back to ground idle *twice.* Be sure to observe the pump's duty cycle restrictions when carrying out this procedure.
>
> While the pump is still running, remove the atmospheric sump dipstick and wipe it with a lint-free cloth. Insert and lock the dipstick in the tube. Remove it again and check the oil level. Shut off the propeller auxiliary pump after the reading has been obtained.

Leaking Propellers

It was determined that 30% of propellers routed to the shop for maintenance work to repair leaks could have been fixed on the wing. In a number of cases, no fault at all with the propellers could be found.

In reviewing the maintenance records, we discovered that the record sheet then in use did not contain a sufficient amount of information about the propeller to serve as a truly useful desnagging tool. A new record sheet was introduced that included such missing items as fluid amounts added and removed, information on when the propeller is changed, purged, or replenished, and the serial number of the propeller to ensure that the sheet will be used for one specific propeller and that propeller only. Figure 3 shows the newly designed record form.

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PROPELLER FLUID LEVEL RECORD

PROPELLER SER #

*NOTE : ALL FLUID ADDED TO RECTIFY AN UNSERVICEABILITY OR PROP LOW OIL LIGHT MUST BE RECORDED.

PERIODICITY EVERY 50 HRS +/-5

ENTER OIL ADDED OR REMOVED IN QUARTS OR PART QUARTS (IE. l/2 QUART. 1/4 QUART. ETC)

TAIL NO.	POSITION	A/F HRS DUE	A/F HRS DONE	AMOUNT ADDED (+) OR REMOVED (-)	AMOUNT ADDED AFTER FIRST FLIGHT OR MAINTENANCE	UNSERVICE-ABILITY	PROP LOW OIL LIGHT ON AT A/F HRS	NAME/SIGNATURE PLEASE PRINT	LOCATION & TIME OF SERVICING

Figure 3. Propeller servicing record form.

Cold Weather Operations

The procedure used for starting engines during cold weather operations was reviewed and the following procedure for starting engines cold-soaked at temperatures below 0°C (32°F) was implemented:

> Run the engine in low-speed ground idle until the engine oil temperature rises to 10°C. When this temperature has been reached, the engine may be upshifted to normal ground idle. Then run the engine in normal ground idle until the engine oil temperature reaches 6O'C, or has been 50°C or above for five minutes. At no time during this procedure is the blade angle to be changed by throttle movement until all the conditions noted above have been met.

Propeller **Static Position**

The technical orders used by the CF direct that the number one blade of the propellers on static aircraft is to be placed above the horizontal split line or roughly at the 12 o'clock position. It was emphasized to all technicians and flight engineers during training sessions that positioning the propeller as per regulations is essential to prevent oil from draining from the propeller hub through the beta feedback shaft and filling the atmospheric sump, causing static oil leaks.

Clogged Breather

On at least one occasion, an unnoticed clogged propeller oil system breather caused the atmospheric sump to become pressurized and resulted in a propeller leak. The propeller servicing procedures were therefore changed to direct the technicians to place a finger over the dipstick tube briefly during feather pump operation to establish that no back pressure exists. This practice will ensure that the breather is not clogged.

Propeller Servicing Training

It is essential that senior supervisors fully appreciate the time required to properly desnag and service a leaking propeller, and not place undue pressure on the technicians. It is also important that the technician be thoroughly trained with regard to the correct procedures for propeller servicing.

An extensive training package was prepared for all technicians, senior supervisors, and flight engineers. The training was introduced into several basic training courses, and also taught by a special team that went to the major user units in order to get to as many personnel as quickly as possible. The half-day course focused on the proper procedures for the servicing of propellers and was comprised of the following topics.

Photo courtesy of CWO Keith Edgett

THEORY

Basic propeller construction

Hydraulic system operation

Servicing techniques, including:
- Initial installations
- Post-runup servicing
- Post-flight servicing
- Ongoing servicing

All notes and cautions listed in the technical pubs.

Fluid-level servicing sheets

PRACTICAL

Filling procedures

Cycling of the propeller

Reading of the dipstick

Procedure on removal of fluid in event of overservicing.

Conclusions

Since the completion of the working group report and the implementation of their recommendations, there has been a significant reduction in the number of propeller low oil level light illuminations. The incident rate has dropped from a high of 2.93 per 1000 flying hours to a low of 0.94 per 1000 flying hours.

The most meaningful point to remember is that there was no single "magic fix" that led to a solution of our propeller low oil light problem. Rather, it was a combination of improved techniques, tightened procedures, and enhanced training that brought the problem under control.

Major Maier may be contacted at 204-833-5187; Capt. Nowosad at 204-833-5699.

■

Introducing a **NEW** — AUXILIARY POWER UNIT TEST SET

by **Donald A. Coia,**
Field Service Representative,
Electronic Support Equipment
Engineering Department

The interface of various components of the Hercules auxiliary power unit (APU) and gas turbine compressor systems (GTC) is complex, and technicians at the organizational level often find troubleshooting and adjusting these systems difficult and time-consuming.

The Lockheed Aeronautical Systems Company has developed a new, state-of-the art Auxiliary Power Unit Test Set, PN BUS I-103, for checking the APUs and GTCs on C-130E, C-130H, P-3, and CP-140 aircraft. The test set can also be used to check APUs and GTCs on the test stand during intermediate-level repair.

Testing Capability

The test set is engineered for both static and dynamic testing of APU/GTC system components. This includes readings on oil, fuel, and air pressure, as well as exhaust gas temperature (EGT) and RPM.

The APU/GTC components which can be checked by the test set are listed below:

- Fuel holding relay
- Auxiliary start relay
- Overspeed test solenoid
- Load control valve
- Fuel solenoid valve
- Three-way shutoff solenoid valve.
- Ignition exciter and igniter plug.
- Start relay and motor
- Centrifugal speed switch

Precise measurements of APUlGTC parameters by the test set ensures accurate adjustments of the following components:

- Acceleration limiter valve
- Pneumatic thermostat
- Fuel control unit governor.
- Load control valve
- Oil pressure relief valve
- Air pressure regulator

The test set includes all equipment necessary to accomplish a complete system checkout on the C-130H aircraft and equivalent L-100 models. An additional cable assembly is required for testing on the C- 130E and some early C- 130H export models.

For intermediate- level maintenance testing, a cable assembly is required to provide electrical power to the test set. Operating instructions and a maintenance manual for the test set are included. The test set is mounted in a sturdy aluminum case and weighs 32 pounds. The only electrical power required is 28 VDC.

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Test Set Design Characteristics

The test set design incorporates a panel layout that has switches, word indicators, and meters arranged logically and grouped by function. Test modes are chosen with an eight-position, positive-action function select switch. This switch is mechanically guarded to prevent inadvertent actuation.

Lengthy interfacing pressure hoses have been eliminated by the use of pressure transducers which are installed on the APU/GTC pressure lines and ports during testing. This greatly enhances ease of use and improves accuracy. With oil, fuel, and air pressure transducers connected to the test set through an electrical cable assembly, the probability of leaks is reduced and the reliability of the pressure readings is increased.

To improve the test set performance in electrical fault isolation, digital meters and color-coded word indicators have been incorporated. The EGT readings are accurate to +/-2" Celsius. To reduce the possibility of operator error, the meters read in actual aircraft values. APU/GTC tachometer output is selectable in RPM or percent of RPM. No conversion is required.

Standard 0.080-inch tip jacks are used for test points on the test set. Most electrical faults can quickly be isolated by making just one electrical connection into the APU harness and performing an APU component static check. Improved safety measures built into the test set include advanced system protection with a circuit breaker instead of fuses, and an easily accessible, red push-pull emergency stop operation button.

When properly utilized in an organizational level maintenance program, the APU Test Set can dramatically decrease the number of "no fault found" repair actions. Because this test set is portable, easy to work with, and more accurate than previous test sets, it is more likely to be used. This makes it quick and simple to discover faults that previous troubleshooting has overlooked. Testing of the APU has never been easier. Aircraft downtime can be significantly reduced through the use of the APU Test Set.

Further Information

Optional cable assemblies that are not supplied with the Auxiliary Power Unit Test Set can be purchased separately. Cable assemblies for C-130 applications are listed below:

C-130E APU Test Cable Assembly, PN 1311141-101
C-130E Test Stand Cable Assembly, PN 1311152-101
C-130H Test Stand Cable Assembly, PN 1311153-101

For further information concerning operation of the test set, and for ordering information, please contact:

Lockheed Aeronautical Systems Company
Customer Supply Business Management
Dept. 65-l 1
Marietta, GA 30063-0577

Telephone: l-404-494-7529 (U.S. Government)
Telephone: l-404-494-21 16(international; commercial)
Fax: l-404-494-7657

Don Coia can be contacted at 404-916-2687. ■

A New Standard for the USAF:

Converting to JP-8 Fuel

by Jim Pepper, ***Training Specialist***
Customer Training Systems Department

The U.S. Air Force is now in the process of converting from JP-4 to JP-8 as the standard fuel for use in all of its turbine-powered aircraft in the continental United States. The changeover, which is expected to be completed by the fall of 1995, follows by nearly a decade a similar conversion that was carried out by NATO forces in Europe during the 1980s.

With at least several years of operations using JP-8 fuel already logged on most types of USAF aircraft in the European theater, it would be surprising if many unanticipated problems were to arise during the conversion period on the western side of the Atlantic. However, some questions do remain, and a number of C-130 organizations continue to be concerned about how the changeover to a new fuel might impact their overall mission readiness.

In this article we will first take a look at some of the factors involved in the formulation of aircraft fuels in general, and then address several specific points that will be of interest to Hercules organizations as they undertake to make a smooth and trouble-free transition to full-time use of JP-8 fuel.

Fuel Composition

Every aircraft fuel is formulated to satisfy a specification. Fuel specifications, in turn, are based on operational requirements. Among the factors which influence a fuel's ability to meet a specific set of performance requirements are its combustion properties, fluidity, stability, corrosiveness, contamination level, and the additive package which it contains.

Military and commercial fuels intended for use in turbine engines consist of complex mixtures of hydrocarbon compounds. Thanks to the ability of carbon atoms to bind with one another to form many kinds of chained, branched, and cyclic molecules, the variety of hydrocarbons found in petroleum products is almost infinite. It is not surprising to find that the hydrocarbon compounds represented in common aircraft fuels show considerable diversity in their chemical composition.

Typically, four hydrocarbon groups predominate: the paraffins, the cycloparaffins, the aromatics, and the olefins. Saturated paraffins and cycloparaffins are the major components of turbine fuels, constituting up to 75% of the total. They also impart the most desirable characteristics to the fuels. As a group they are stable, clean-burning, and high in energy content.

Aromatic hydrocarbons may comprise up to 25 % of an aircraft turbine fuel. Higher percentages of these unsaturated cyclic carbon compounds are generally avoided because they yield a smoky fuel that causes carbon deposits to form on fuel nozzles and combustion liners. The aromatics may also cause degradation and swelling of some types of sealants and gaskets.

Olefins must be limited to no more than about 5 % of the total in turbine fuels. These compounds are essentially byproducts of the refining process and they are the most reactive of the hydrocarbons found in fuels.

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Although they will bum and produce energy when ignited in an engine, the olefins are also active at room temperatures. They are able to enter into spontaneous chemical reactions with many common substances in the natural environment, including the oxygen in the air.

These reactions can produce varnishes and rubbery residues that are thoroughly unwelcome in any fuel system. The olefins also tend to combine with each other to form high molecular-weight gums and polymers. More than any other factor, it is the presence of olefins that limits the useful life of stored fuels.

The rich assortment of hydrocarbon compounds that constitute over 99% of a typical aircraft turbine fuel is normally augmented by fractional percentages of other compounds whose purpose is to impart specific desired characteristics to the finished product. These additives may include agents that help inhibit corrosion, control static electricity, curb microbial growth, and improve the stability of the fuel.

Physical Properties

As we have noted in the discussion above, the chemical characteristics of a turbine fuel are determined by the percentages of the various hydrocarbon groups present in the mix, plus whatever additive package may be included. But physical properties also play an important role in determining fuel specifications, and it is here that another feature of carbon chemistry comes into play. In nature, hydrocarbon compounds are nearly always found in the form of homologous series; that is, families of molecules that have a similar basic structure and chemical properties but differing molecular weights. This is also true of the ingredients of aircraft fuels.

A good example of a homologous series commonly found in turbine fuels is the paraffin series. The simplest representative of the paraffin series likely to be found in liquid fuels is hexane, whose molecules consist of six carbon atoms and 14 hydrogen atoms. Moving up the scale of increasing molecular weight, the next member of the series is heptane, with seven carbon atoms and 16 hydrogen atoms, followed by octane, which can claim eight carbon atoms and 18 hydrogen atoms.

Hexane, heptane, and octane are light, volatile, flammable liquids that are the principal ingredients of gasoline and similar fuels. Like other members of the paraffin series, these compounds are chemically stable at room temperatures, but bum cleanly and release large amounts of energy when ignited.

Bad News, Good News

While they clearly offer many excellent characteristics for use as fuels, formulations consisting mainly of such light, volatile hydrocarbons also have some distinct disadvantages. Perhaps the most significant is that they have very low flash points, which means that they are extremely flammable, even at room temperatures. This makes fuels like gasoline difficult to handle and store safely, particularly in confined areas such as inside buildings or aboard ship.

One way to reduce the danger of fire and explosion from liquid hydrocarbon fuels is to change to formulations which are less volatile and offer higher flash points. Increasing the number of carbon atoms in members of the paraffin series or other common hydrocarbon families yields heavier, denser, and less volatile compounds that still retain many desirable chemical properties for fuel use. Blends in which these heavier molecules predominate are in widespread use today in both turbine and reciprocating (diesel) engines. We usually categorize these formulations as light fuel oils or kerosene.

The term kerosene was originally a trade name applied to a type of illuminating oil, but it is now used to refer to generic petroleum-based fuels made up of hydrocarbon compounds whose molecular structure contains about 10 to 16 carbon atoms. JP-8 turbine fuel falls into this category, and JP-8 is often referred to as a kerosene-type fuel.

Classifying Turbine **Fuels**

The aircraft turbine fuels currently in use are commonly classified as belonging to one of three types: wide-cut, kerosene, and high flash-point. The information we have just reviewed about the chemical and physical properties of aircraft fuels can help shed some light on what is behind this special nomenclature.

JP-4 and Jet B are typical examples of wide-cut fuels. These fuels are essentially identical, with one tailored for military, the other for commercial use. Military and commercial versions of similar fuels are formulated to meet separate specifications, but differ mainly in the details of the testing procedures required and the additive packages used in the finished fuel.

As the term suggests, a wide-cut blend like JP-4 contains a broad selection, or “wide cut,” of hydrocarbons of various molecular weights. Light compounds like heptane are included, as are heavier components typically associated with kerosene. The result is a comparatively light, volatile fuel that has high energy content per unit of weight and good cold-weather performance characteristics (see Table 1).

JP-8, Jet A, and Jet A-l are classified as kerosene-type fuels. These fuels are also a mixture of many different hydrocarbon compounds, but the average molecular weight of the constituents is significantly higher. As Table 1 shows, this results in a kerosene-like

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Table I.
Physical Properties-Common Military Fuels

Property	JP-4	JP-5	JP-8
Density, pounds/gallon	6.5	6.8	6.8*
Flash point, °C (°F)	-29 (-20)	60 (140)	38 (100)
Freezing Point, C (F)	-58 (-72)	-46 (-51)	-50 (-58)
BTUs per gallon	119.600	124.440	125.120
BTUs per pound	18,400	18,300	18,400

*See discussion under Refueling Tables, below.

blend with reduced volatility, a higher flash point, and higher energy per unit volume than wide-cut fuels.

High flash-point fuels, of which J-5 is the principal example, are essentially subsets of the kerosene-type fuels. JP-5 is specially formulated to exclude some of the lighter molecular-weight components that would otherwise be included in a kerosene-type product. This has the effect of raising the flash point still further, which results in a safer fuel for use on board ship or other hazardous situations.

Setting New Standards

For many years, JP-4 has been the primary turbine fuel used by the USAF. JP-4 has a number of attractive properties, including low cost and good cold-weather performance characteristics, but it also has the significant disadvantage of a low flash point. This is the primary reason the U.S. Navy has long used the much safer JP-5 for its carrier operations.

Another disadvantage with JP-4 is that it is exclusively an aircraft fuel. It usually cannot be used in power carts, generators, tugs, and most of the support vehicles that are required around airports and air bases,

The introduction of JP-8 as the USAF's standard aircraft turbine fuel is intended to meet most of these objections. JP-8 is a general-purpose kerosene-type fuel that can be used in a wide variety of turbine and reciprocating engines. It is less volatile than JP-4 and has a significantly higher flash point, but retains acceptable cold-weather performance characteristics. At about 6.8 pounds per gallon, JP-8 is similar in weight to JP-5, and similar refueling data can be applied.

JP-8 Operational Notes

Prior to the initiation of the conversion to JP-8, an effort was made to identify any possible adverse effects on the aircraft or its propulsion system. For the C-130 aircraft the adverse effects are minimal and are identified as follows:

Fuel Nozzle Coking: Coking or carboning of the fuel nozzles has been reported as a problem after conversion to JP-8 fuel. As a result of this coking problem, most operators who use JP-8 have reduced the fuel nozzle inspection or replacement interval by as much as 600 hours.

Fuel Seal Leakage: Fuel seal leakage has been linked to the mixed operation of JP-4 and JP-8; in other words alternating between the use of JP-4 and JP-8. Packings swell more in JP-4 and take on a compression set. When exposed to JP-8 after previously being exposed to JP-4, the packings de-swell but do not decompress. This leads to insufficient sealing of the packing and results in leaks. If either fuel is used exclusively, leaks of this type are not a problem. A more reliable and resilient seal design has been proposed.

APU/GTC Problems: Small gas turbine engines are affected by coking and fuel leakage in the same manner as the main engines. A note will also be added to the flight manual stating that slow or difficult starting is possible when using JP-8 fuel below -26.1 'C (-15" F).

Refueling Tables

The following tables offer helpful refueling information for JP-4, JP-5, and JP-8 that is applicable to most common configurations of the Hercules aircraft. Note that the actual density of JP-8 falls between 6.7 and 6.8 pounds per gallon. The value 6.8 pounds per gallon is used by Lockheed engineering and has been applied throughout this presentation.

The full-fuel weights shown in the table for JP-4 (6.5 pounds per gallon) also define the structural-limit fuel weights for aircraft equipped with hard main landing gear struts. Similarly, the full-fuel weights shown for JP-8 and JP-5 are the structural-limit fuel weights for Hercules airlifters equipped with soft struts.

Jim Pepper may be contacted at 404-494-4147.

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TABLE 2.

FUEL CAPACITIES-HERCULES AIRCRAFT WITHOUT REFUELING PODS, NO FOAM

IN POUNDS **Fuel weights based on 6.5 lbs. per gallon for JP-4; 6.8 lbs. per gallon for JP-8 (or JP-5).**

TANK	TOTALS		UNUSABLE				USABLE			
			USAF		OTHER		USAF		OTHER	
	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8
1	8450	8840	65	68	78	82	8385	8772	8372	8758
2	7800	8160	65	68	91	95	7735	8092	7709	8065
3	7800	8160	65	68	91	95	7735	8092	7709	8065
4	8450	8840	65	68	78	82	8385	8772	8372	8758
MAIN	**32,500**	**34,000**	**260**	**272**	**338**	**354**	**32,240**	**33,728**	**32,162**	**33,646**
L AUX	5915	6188	0	0	59	61	5915	6188	5856	6127
R AUX	5915	6188	0	0	59	61	5915	6188	5856	6127
INTERNAL	**44,330**	**46,376**	**260**	**272**	**456**	**476**	**44,070**	**46,104**	**43,874**	**45,900**
L EXT	9100	9520	260	272	137	143	8840	9248	8963	9377
R EXT	9100	9520	260	272	137	143	8840	9248	8963	9377
TOTAL	**62,530**	**65,416**	**780**	**816**	**730**	**762**	**61,750**	**64,600**	**61,800**	**64,654**

TABLE 3.

FUEL CAPACITIES-HERCULES AIRCRAFT WITH REFUELING PODS, NO FOAM

IN POUNDS **Fuel weights based on 6.5 lbs. per gallon for JP-4; 6.8 lbs. per gallon for JP-8 (or JP-5).**

TANK	TOTALS		UNUSABLE				USABLE			
			USAF		OTHER		USAF		OTHER	
	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8
1	6988	7310	65	68	78	82	6923	7242	6910	7228
2	7800	8160	65	68	91	95	7735	8092	7709	8065
3	7800	8160	65	68	91	95	7735	8092	7709	8065
4	6988	7310	65	68	78	82	6923	7242	6910	7228
MAIN	**29,576**	**30,940**	**260**	**272**	**338**	**354**	**29,316**	**30,668**	**29,238**	**30,586**
L AUX	5915	6188	0	0	59	61	5915	6188	5856	6127
R AUX	5915	6188	0	0	59	61	5915	6188	5856	6127
INTERNAL	**41,406**	**43,316**	**260**	**272**	**456**	**476**	**41,146**	**43,044**	**40,950**	**42,840**
L EXT	9100	9520	260	272	137	143	8840	9248	8963	9377
R EXT	9100	9520	260	272	137	143	8840	9248	8963	9377
TOTAL	**59,606**	**62,356**	**780**	**816**	**730**	**762**	**58,826**	**61,540**	**58,876**	**61594**

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TABLE 4.

FUEL CAPACITIES – USAF C-130 AIRCRAFT WITHOUT REFUELING PODS, WITH FOAM

IN POUNDS Fuel weights based on 6.5 lbs. per gallon for JP-4; 6.8 lbs. per gallon for JP-8 (or JP-5).

TANK	TOTAL		UNUSABLE		FOAM RETENTION		USABLE	
	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8	JP - 4	JP - 8
1	8235	8615	65	68	214	224	7956	8323
2	7605	7956	65	68	195	204	7345	7684
3	7605	7956	65	68	195	204	7345	7684
4	8235	8615	65	68	214	224	7956	8323
MAIN	**31,680**	**33,142**	**260**	**272**	**818**	**856**	**30,602**	**32,014**
L AUX	5765	6031	0	0	149	156	5616	5875
R AUX	5765	6031	0	0	149	156	5616	5875
INTERNAL	**43,210**	**45,204**	**260**	**272**	**1116**	**1168**	**41,834**	**43,764**
L EXT	8872	9282	260	272	227	238	8385	8772
R EXT	8872	9282	260	272	227	238	8385	8772
TOTAL	**60,954**	**63,768**	**780**	**816**	**1570**	**1644**	**58,604**	**61,308**

TABLE 5.

FUEL CAPACITIES – USAF C-130 AIRCRAFT WITH REFUELING PODS AND FOAM

IN POUNDS Fuel weights based on 6.5 lbs. per gallon for JP-4; 6.8 lbs. per gallon for JP-8 (or JP-5).

TANK	TOTAL		UNUSABLE		FOAM RETENTION		USABLE	
	JP - 4	JP - 4	JP - 4	JP - 5	JP - 4	JP - 5	JP - 4	JP - 5
1	6812	7126	65	68	175	183	6572	6875
2	7605	7956	65	68	195	204	7345	7684
3	7605	7956	65	68	195	204	7345	7684
4	6812	7126	65	68	175	183	6572	6875
MAIN	**28,834**	**30,164**	**260**	**272**	**740**	**774**	**27,834**	**29,118**
L AUX	5765	6031	0	0	149	156	5616	5875
R AUX	5765	6031	0	0	149	156	5616	5875
INTERNAL	**40,364**	**42,226**	**260**	**272**	**1038**	**1086**	**39,066**	**40,868**
L EXT	8872	9282	260	272	227	238	8385	8772
R EXT	8872	9282	260	272	227	238	8385	8772
TOTAL	**58,108**	**60,790**	**780**	**816**	**1492**	**1562**	**55,836**	**58,412**

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HOC 1994 *(continued from page 2)*

Robins Air Logistics Center, and one was to be appointed by Lockheed.

After analyzing the content of the initial HLEIWG meeting in 1991, Lockheed realized that similar topics had been covered at the HOC of 1990, and that the two conferences could be efficiently merged. The HELIWG and the international HOC meetings were therefore combined, and the Hercules Operators Conference title retained.

In recent conferences, the agenda has been expanded to include presentations by operators, authorized Hercules Service Centers, and major vendors. These discussions cover a wide variety of special maintenance and operational situations which may not have yet been encountered by all operators, and provide an ideal platform in which suggestions and possible solutions may be offered.

The useful and effective concept of the three co-chairmen, first used in the 1991 HLEIWG meeting, has been continued, and three co-chairmen still preside over HOC gatherings. For the 1994 HOC, the elected co-chairman representing Hercules operators is Major Jim Kightley, whose remarks appear as part of this Focal Point article. Mr. Ray Waldbusser is the co-chairman representing Warner Robins Air Logistics Center, and Jack Grosko represents Lockheed.

In little more than a decade, the Hercules Operators Conference has grown from a modest gathering of people with a common interest to a full-fledged Hercules symposium in which the manufacturer, owners, operators, and support organizations from all over the world can sit down together to share information and solve problems. Once again this year, Lockheed is pleased and proud to host the HOC. We look forward to meeting each of you at HOC 1994.

Sincerely,

J. F. Parnigoni, Manager
Airlift Field Service Department

COMMENTS *(continued from page 2)*

April 1994 dates and an indication by Lockheed that this item could be discussed at the 1994 conference in order to resolve what operators wanted and needed. With this background, I would like each operator to give some thought as to their position on the future arrangements for the conference and be prepared to articulate those ideas at the 1994 meeting.

The second point which was a cause of concern to the conference administrators at Lockheed was the perception of a lack of participation on the part of the operators at the last meeting. Only a few countries actually made presentations, and some of those were pulled together at the last minute to fill gaps in the schedule.

I would like to emphasize that these conferences are intended to be *by* operators, *for* operators. Each of you has a vast amount of knowledge to share with other users because of the areas in which you have operated, or the problems you have encountered. If the 30-minute blocks are too long for you to fill, we'll make a shorter opening. If you need help in other ways in order to make a presentation, just tell 'us in advance and we'll try to help. But please, become involved in the process so we can all learn from your experiences.

This will be my last conference as co-chairman, as I am anticipating a posting to one of our Hercules operating bases during the summer of 1994. It has been a true pleasure and a challenge to be your chairman during the formative years of the HOC, and I hope that these meetings will continue to grow and become stronger. As a group, we have the collective knowledge of the Hercules and we need to share it with each other and with Lockheed.

After all, Lockheed builds the aircraft, but it is we who have made it the legend!

Sincerely,

Maj. Jim Kightley, Canadian Forces
HOC Co-Chairman

Food supplies being loaded aboard a Canadian Forces CC-130 in Italy for airlift to Sarajevo.

A CC-130 taking off from Sarajevo Airport after delivering vitally needed humanitarian aid.

Flares being released to protect against missile attack as a CC-130 climbs out from Sarajevo.

A CC-130 Hercules unloading an ambulance in Guatemala as part of an aid package.

Canada's leadership role in peacekeeping and humanitarian aid activities is renowned throughout the world. At the heart of many of these efforts are the CC-130 airlifters, ready and able to deliver the goods wherever they are needed.

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