Proper Handling of Aviation Turbine Fuel Is Crucial to Safety

by
Robert A. Feeler
Editorial Coordinator

This is the first of two articles focusing on turbine fuel handling. The second article, to appear in the September/October Aviation Mechanics Bulletin, *will discuss receiving fuel deliveries, quality assurance inspections and quality assurance records.*

The proper care and handling of turbine fuel (Jet A-1, or aviation kerosene) is paramount in maintaining safe aircraft operation. Turbine fuel is much more susceptible to contamination problems than aviation gasoline. Although modern technology has developed many devices to minimize contamination problems, these devices must be used properly to maintain clean fuel.

Although the fuel refiner, supplier and delivery agent are all concerned with providing turbine fuel that is free of any contamination, the final responsibility for ensuring that only clean fuel is put into the aircraft rests with the owner/operator. This responsibility is often delegated to the maintenance technician, so it is important to know the methods and procedures to fulfill this responsibility.

In the past, it was common practice for those responsible for aviation turbine fuel handling to learn on-the-job. Information was frequently passed on from one individual to the next, and errors or omissions in this information "hand-down" often resulted in inadequate or improper fuel-handling procedures.

Until recently, very little information was available to train an individual to conduct the various checks, inspections and maintenance functions involved in the safe handling of aviation turbine fuel. Several documents have been published specifying what should be done to maintain fuel quality, how often various checks and inspections should be performed and what devices should be used to filter and check the fuel at various steps along the way from the refiner to the aircraft's fuel tank.

A few major fuel suppliers have produced training aids for their employees and major fixed-based operator (FBO) chains have also created similar training programs. Most of these have been in the form of textbooks or video presentations. At least one company has produced a computer-based training program for personal computers. The program takes the student from identifying the most basic problems associated with aviation turbine fuel to performing the various inspections, checks and maintenance functions of the fuel-handling equipment. This training applies to most of the various methods and equipment available to the technician.

The computer-based format allows the student to progress at his or her own pace. It has quizzes and review steps incorporated into the program, with a more complete test at the completion of each segment or module of the program. The following information is based on this computer-based program by Gulf Publishing Co.

Fuel Standards Apply To Refineries Only

The American Society for Testing and Materials (ASTM) has established a standard for aviation turbine fuel specifications under #D-1655. This standard establishes the precise qualities of the fuel (chemical content) as well as its freedom from contamination. But this standard applies only to the refinery. Freedom from contamination is relatively easy for the refiner to ensure, because the very process of distillation and refining precludes the presence of water or other contaminants in the finished product.

Once the fuel leaves the refinery, opportunities for contamination exist in every step of the process of transportation, storage and delivery to your aircraft.

There are no fixed standards for cleanliness of aviation turbine fuel, although there are generally accepted standards that most suppliers and users of aviation turbine fuel subscribe to.

In the United States, the major airlines, under the auspices of the Air Transport Association of America (ATA), have developed a "Standard for Jet Fuel Quality Control at Airports," ATA Spec. #103. The American Petroleum Institute (API) has also published "Storage and Handling of Aviation Fuels at Airports," API Publication #1500. These documents establish industry-accepted standards for the methods and procedures in ensuring the quality of fuel delivered to the aircraft.

Contaminants Take Many Forms

Turbine fuel can be contaminated by:

- Particulate matter, including dirt, dust, sand, metallic particles, rust, etc.; and,

- Water, which can be in two forms: entrained moisture or free water.

  Entrained (dissolved) moisture is water that has merged with the fuel and is held in suspension. The ability to hold this entrained water in suspension varies with the temperature of the fuel. The warmer the fuel, the more dissolved water it will hold. As a rule, turbine fuel will hold one part per million (ppm) of water per degree F of temperature. When the fuel is cooled, this dissolved water will precipitate and become free water. Because the free water is heavier than fuel, it will always settle to the bottom of the tank.

  Free water can also be introduced through leaks in tank covers or caps, leaks in underground plumbing or condensation from moist air above the fuel in a storage tank; and,

- Microorganisms that can live in the fuel environment. More than 100 different varieties of microorganisms can live in the free water that accumulates in sumps and at the bottoms of storage tanks. Many of these microorganisms are airborne while others are found in the soil, so there are numerous opportunities for these "bugs" to enter the fuel supply; and,

- Aviation gasoline, solvents, industrial fuels, or otherchemicals that may have been introduced through inadequately cleaned vessels or human error at some point in the delivery chain.

Surface active agents, commonly referred to as surfactants, are also a major concern in ensuring the quality of turbine fuel. Surfactants are soap or detergent-like materials that may occur naturally in the fuel, may be introduced into the fuel with certain additives or may be added from vessels and/or pipelines that have not been properly flushed or cleaned after transporting other products.

Each of these groups of contaminants can be detected by various tests and inspections. Moreover, they can be prevented by careful handling of the fuel.

Observe Fuel to Check For Contamination

One of the most basic methods of checking fuel for the presence of contaminants is the "white bucket test." The preferred container is a 9-quart white, porcelain bucket. Before drawing a fuel sample, be sure the drain tap and the bucket are clean. Draw a sample in the bucket to a depth of about 8 inches (20 cm). If the sample is being taken from a filter vessel, the system should be under pressure when the sample is drawn. Then do the following:

1. Let the sample settle for one minute to remove air bubbles;

2. Place the bucket on a level surface and inspect the bottom for water droplets, solid contaminants, a hazy/cloudy condition and/or brown slime;

3. Drop a shiny copper coin into the bucket to aid in evaluating the clarity of the fuel. If the features of the coin can be distinguished, the fuel is neither hazy or cloudy;

4. Swirl the fuel in the bucket to create a vortex in the center. This will concentrate any particulate matter present at the cone of the vortex and make it more visible. No particulate matter will be visible in an acceptable sample;

5. Smell the sample. Turbine fuel has a characteristic odor that should not be sour orfoul-smelling. A sulphurous or "rotten egg" odor indicates contamination by microorganisms. Any odors from gasoline or other solvents are indicative of contamination; and,

6. Inspect the fuel. Clean turbine fuel will be bright and tend to "sparkle."

A hazy appearance may result from fine droplets of moisture dispersed throughout the sample. If this persists after one minute, further tests for water content should be performed. A cloudy appearance may be the result of extremely fine droplets of water dispersed throughout the sample, giving it a milky appearance. This condition should be investigated further before using the fuel.

Look for water in the form of puddles in the bottom of the bucket or drops clinging to the sides. If there is any doubt whether these drops are water or bubbles, a few drops of common food coloring may be added to the sample. The dye will be attracted to any water present and color it. If no water is present, the food coloring will remain in dark drops. Free water can usually be drained from the sumps of the vessel being tested. After no more water is present in subsequent samples, the fuel may be used.

Look for the presence of surfactants. They may appear as slime at thebottom of the bucket, at the fuel/water interface as a dark brown or black layer or as lacy tendrils of material floating in or on the sample.

Use Equipment to Make More Specific Contamination Checks

Several portable devices are available for checking for turbine fuel contamination. In addition, various laboratory analyses may be performed to determine the presence of contaminants.

Particulate Contamination. One of the most common devices in use is the Millipore test unit. This consists of a small cartridge into which a filter membrane is inserted. A 3-gallon sample of fuel is flowed through the cartridge, and the membrane is then removed, dried and compared against a set of standard color samples to evaluate the extent of particulate contamination. Millipore units do not detect water. Fuel suppliers or transporters should be able to show the last Millipore sample disc for the fuel batch or perform a sample test on request.

Water Contamination. In addition to the visual checks for free water contamination, other means are available such as food dye, litmus paste, dipsticks or commercially available water detectors such as Metracator, Hydrokit, Water Detector, etc.

Entrained water detection is more difficult. Laboratory analysis of a sample will determine the exact water content, but this is a time-consuming and costly process. A commonly used device is the Aqua-glo unit. This unit is capable of determining very accurately the water or moisture content of turbine fuel and will indicate water content in parts per million (ppm). The generally accepted maximum limit for entrained water is 30 ppm.

Surfactant Contamination. Any visual indication of the presence of surfactants warrants concern about possible contamination of filter/separator units.

The typical filter/separator uses surface tension to cause the water droplets to coalesce into larger drops so that a second element can separate them from the fuel and allow the water to fall into the sump of the filter/separator container. Surfactants break down this surface tension and thus render the filter/separator ineffective.

An Aqua-glo test of fuel upstream of the filter compared with a test downstream of the filter will confirm the effectiveness of the filter separator.

Surfactants may be filtered from the fuel by flowing it through a clay treatment unit. This unit contains a specially prepared porous medium made from “attapulgus” clay, which looks somewhat like fine sand. Each particle consists of hundreds of tiny, fiber-like crystals, providing an enormous surface area to absorb the contaminants. One pound of this material provides more than 13 acres of surface area. Although the clay treatment units are effective, they can become saturated and unable to absorb the surfactant contaminants.

The actual presence of surfactants can only be determined by laboratory analysis. However, the effect (and therefore the presence) of surfactants can be determined by measuring the ability to separate the water from the fuel. This characteristic is termed the water separation index measurement test.

The testing unit, called a water separometer or micro-sep, measures the water separation index of a sample. Perfect fuel with no surfactants present will measure 100 on the scale. Turbine fuel that has been treated with corrosion-inhibiting additives may have a slightly lower water separation index rating, but a commonly accepted standard for untreated fuel is an index reading of 90 or higher.

Microbial Contamination. The presence of microorganisms must be suspected any time there are indications of slime, discoloration or foul-smelling odors. A number of commercially available test kits are available to determine the presence of microorganisms.

These test kits typically consist of sealed vials of a nutrient broth and a sterile syringe to draw a water sample from the sump and inject it into the vial. A contaminated sample will change the color of the solution in one to five days.

Any indication of microbial contamination should receive immediate attention; these microorganisms and their by-products can be extremely corrosive to aluminum structure. They also can cause inaccurate readings of fuel quantity indication systems.

Other Contamination. Contamination of turbine fuel with gasoline, solvents or other industrial fuels may be indicated by strange or unusual odors. Anything suspicious should be cause for further investigation.

A test for contamination with other fluids can be conducted by checking the specific gravity of the sample. API gravity readings of 37 through 51, corrected to 60 degrees F, are normally considered acceptable. A supplier should be able to provide certification of the API reading for any batch of fuel. Most suppliers also have the beaker, hydrometer and charts necessary to make on-the-spot API gravity checks.

If contamination by other fluids is suspected, a laboratory analysis is the only means of determining the precise content of a turbine fuel sample.

Defend Against Water Contamination

The primary objective is to prevent the entry of any water into the fuel. Because fuel will absorb moisture from the air, and every tank and storage vessel must be vented, it is almost impossible to prevent all moisture from entering the fuel. But proper maintenance of fuel tank cap seals and storage vessel covers is mandatory to prevent the entry of rainwater or groundwater.

To minimize the possible accumulation of free water, it is imperative to drain daily tank sumps and fuel storage vessel drains. For pressurized filter vessels, the sump must be drained while the system is pressurized and flowing to ensure that any water collected in the filter vessel low point is flushed.

A point-of-use filter has also been developed to minimize the exposure to water in turbine fuel. A special filter cartridge can absorb water from the fuel while also filtering any particulate contaminants. This filter is made of a material that swells as it absorbs water. As it becomes saturated, the filter swells within the casing and restricts the flow of fuel until it will not allow fuel to pass. This feature provides excellent protection against unknowingly accepting fuel with excess water content.

Contact: Gulf Publishing Co., P.O. Box 2608, Houston, TX 77252-2606 U.S. Telephone (713) 529-4301. ♦

NEWS & TIPS

Halon Phaseout Will Affect Aircraft Fire Protection Systems

The stratospheric ozone layer surrounding the planet is essential to protect life from the harmful effects of ultraviolet radiation emitted by the sun. Scientific studies have confirmed a link between the depletion of this ozone layer and the release of chlorofluorocarbons (CFCs) such as Halon. As recently reported in the Aerospace Industries Association (AIA) newsletter, these findings have "spurred an international effort to phase out the manufacture of all ozone-depleting substances (ODS). The Montreal Protocol, amended in 1990, mandates production phaseout of all ODS by the year 2000. The U.S. Clean Air Act specifies a similar phaseout schedule. The increased rate of ozone loss, monitored in the winter of 1991-92, prompted the U.S. government to issue a directive to accelerate the U.S. phaseout of ODS to December 31, 1995." Many experts anticipate that other developed countries will also accelerate their efforts to phase out ODS earlier than the year 2000.

Halon 1211 and 1301 have become the pre-eminent fire-extinguishing agent in built-in fire-extinguishing systems and in portable fire extinguishers. The excellent fire-extinguishing capabilities of Halon and its low toxicity have resulted in this gaseous agent becoming the almost universal choice for aircraft installations. The phaseout of CFCs will therefore have a profound effect on aircraft fire protection systems.

The actual release of Halon into the atmosphere from aircraft fire-extinguishing systems is very rare, as it only occurs when the system or extinguisher is discharged.

Currently, Halon's use in aircraft fire protection systems is among the essential uses exempted from regulation. This exemption will, however, become meaningless if CFC production is eliminated as planned in the near future.

Manufacturers are therefore working to develop a replacement agent for Halon. Besides being an effective fire suppressant, a potential replacement agent must also not pose any toxicity risks or be harmful to the environment. Aircraft systems pose additional problems because weight and space requirements are critical parameters in the selection of a replacement agent. No suitable replacement for Halon extinguishing agents is yet available.

Development of a suitable replacement agent is expected to take three to five years. With the strong possibility that Halon production will cease before a suitable replacement agent is widely available, the aviation industry faces a crisis. One measure that every operator should adopt is to ensure that repair and servicing agencies used in the inspection and overhaul of Halon fire-extinguishing equipment are equipped to recycle the Halon agent for reuse after inspection and servicing of pressurized containers. Equipment to efficiently recover and purify Halon is in use by many inspection and repair agencies.

Some experts have suggested the creation of a "Halon banking system," whereby Halon recovered from nonessential uses could be saved for use in essential installations such as aircraft fire protection until suitable replacement agents were available. A group called the Halon Alternatives Research Corp. (HARC) has been formed and is sponsoring a study of issues related to recycling and management of existing Halon.

AIA has taken a lead in coordinating efforts on behalf of the aviation community. AIA's presentation to the 1992 International CFC and Halon Alternatives Conference recommended a plan for Halon phaseout and replacement in aviation.

Training Offered in Aging Aircraft

Fatigue Concepts has announced its fall schedule of training courses in aircraft structural fatigue and aging aircraft. The company will conduct two courses designed for engineers and technicians involved in the maintenance and repair of aircraft structures:

- Aging Aircraft Course October 25-29 in Sacramento, Calif., U.S.; November 8-12 in Toyko, Japan

- Fatigue, Fracture Mechanics and Damage Tolerance October 18-22 in Sacramento, Calif., U.S.; November 1-5 in Toyko, Japan

Contact Sam Kanthimathi, 300 Salmon Falls Road, El Dorado, CA 95630-9734 U.S. Telephone: (916) 933-3360. Fax: (916) 933-3361.

ANSI's 1993 Safety And Health Catalog Now Available

The American National Standards Institute (ANSI) is a private, nonprofit membership organization that coordinates the U.S. voluntary standards system. Its membership includes more than 1,300 corporations, 250 organizations and 30 government agencies.

ANSI's latest catalog lists all approved American National Standards for safety and health, including the new and revised standards published since the September 1991 edition.

The standards help safeguard consumers and individuals in the workplace and provide guidelines for everything from agricultural equipment to X-ray machinery.

The 1,230 standards listed in this publication represent a significant portion of the 10,500 approved to date by ANSI. They are listed by subject and ANSI designation numbers and titles.

Free copies can be obtained by contacting ANSI's Customer Service Department, 11 West 42nd Street, New York, NY 10036 U.S. Telephone: (212) 642-4900. ♦

MAINTENANCE ALERTS

Beware of Degradation Of High-heat Treated Steel Parts by Fire-Extinguishing Agents

Technicians are aware of the phenomenon of *hydrogen embrittlement* of high-strength steel parts that have been heat-treated during processing. Any contact with chemicals, fluids, gases or products that have hydrogen in their make-up can result in some of that hydrogen being absorbed into the steel alloy, which may seriously degrade the strength of the part. Thus, be sure not to use certain paint strippers, etc. on such parts.

One of the major airplane manufacturers recently issued a service letter warning operators that some foam agents used in fire-extinguishing compounds may also subject high-strength steel parts to hydrogen embrittlement. Several components of the landing gear on a wide-body aircraft had to be scrapped after the airplane was subjected to an accidental foam agent discharge in a hangar.

Operators who have a hangar foam system in their facilities should review the characteristics of the foam agent(s) to determine if the chemical can expose high-strength steel parts to embrittlement. If any steel parts are flooded with foam agents, they should be rinsed with large quantities of clean water immediately.

Modification and Misuse of Military Surplus Helicopters Cited as Causes of Several Accidents

The U.S. National Transportation Safety Board (NTSB) has investigated 15 accidents since 1986 involving military surplus helicopters certified in the restricted category and operated under U.S. Federal Aviation Regulation (FAR) Part 133 "Rotorcraft External Load Operations." The NTSB has indicated that these helicopters were certified in several different U.S. Federal Aviation Administration (FAA) regions and that they may have been approved for civilian use by personnel without adequate expertise. As a result, it appears that these helicopters may have been approved for operations for which they were never intended and in which their safe operation could not be ensured.

Examples of failures cited included:

- A military surplus Bell TH-1L sustained a drive train failure, resulting in an emergency autorotation landing into a wooded area with substantial damage to the helicopter. It was found that the sprag clutch (free-wheeling unit) located between the engine and main transmission had failed. The clutch was an improper one for the engine/transmission combination and had been installed only 140 hours before the accident.

- A military surplus Bell UH-1B helicopter suffered an engine failure during forest-spraying operations, resulting in a fatal crash. Investigation revealed that the T53-L11D engine had failed because of an axial compressor blade separation just above the blade platforms. Metallurgical examination of the fracture surfaces revealed evidence of high-cycle fatigue on blades in all five compressor stages. Aninvestigation found that the rated performance of the installed engine was different from that of the engine usually installed in this model helicopter, although the operator was using standard engine performance and maintenance information.

- Several Bell UH-1L and TH-1L accidents have been attributed to failures of the 42-degree intermediate gearbox resulting from a fatigue-initiated fracture of an input pinion gear tooth. In each case, the unit had been operated for less than 50 percent of its expected military service life.

- Other external load accidents involved tail-boom cracking to the point of failure, main- and tail-rotor damage and failures of hydraulic components of the flight control system.

The NTSB is concerned that the airworthiness of military surplus helicopters is being compromised because of repetitive loadings that occur during external load operations and that may exceed the intended operating parameters of the military design.

In each instance, the subject helicopters had been certificated for civilian use under the provisions of Supplemental Type Certificate (STC) #1HWE24, which states:

"An applicant is entitled to a type certificate for an aircraft in the restricted category for special purpose operations if he shows compliance with the applicable noise requirements of Part 36 of this chapter, and if he shows that no feature or characteristic of the aircraft makes it unsafe when it is operated under the limitations prescribed for its intended use, and that the aircraft is of a type that has been manufactured in accordance with the requirements of and accepted for use by, an Armed Force of the United States and has been later modified for a special purpose."

When certified under this STC, the helicopter is to be operated and maintained in accordance with the appropriate military technical manuals. The NTSB said the phrase "operated under the limitations prescribed for its intended use" is significant. For example, the UH-1 was intended to meet military requirements for use as a utility vehicle. Such military use did not anticipate frequent or constant use in heavy external load operations. Other military surplus helicopters such as the H-34 and HSS-1 may also be subjected to similar unanticipated uses.

The NTSB found that there are currently 12 different UH-1 and five H-34/HSS-1 STCs for approval of military surplus helicopters under restricted category operations. The further reduction of military forces in the United States is likely to result in additional helicopters being declared surplus, thus increasing exposure to questionable airworthiness under restricted civilian operations. The NTSB therefore recommended that the FAA:

- "Develop a program requiring that all new requests for supplemental type certificate approval of military surplus helicopters submitted to any regional office be directed to the Rotorcraft Standards Office of the FAA, Southwest Region, for action"; and,

- "Review existing supplemental type certificates on the Bell UH-1 and Sikorsky H-34/HSS-1helicopters and, from these, establish standards that must be met for continued operation of these helicopters in the restricted category."

Technicians involved in the maintenance and servicing of helicopters subject to these recommendations should ensure that they are working with the proper technical manuals, parts and materials for the modified helicopter(s).

Caution — Oven Cleaner Attacks Aluminum!

A major air carrier recently circulated a bulletin to technicians warning them to be careful in the use of commercial oven-cleaning products around aircraft structures.

Although these spray-on oven cleaning chemicals are very effective for cleaning spills and burned-on food residue from galley ovens, they contain caustic material that is very damaging to aluminum and its alloys.

It is suggested that such products be used on the ovens only when they are outside the aircraft to minimize the possibility of the caustic cleaner being sprayed onto adjacent aluminum components. Oven cleaners should not be used for anything other than the interiors of ovens, and appropriate protective measures should be followed as directed on the product label.

EFIS Units Damaged in Hot, Humid Weather

An air carrier that operates electronic flight instrument system (EFIS) equipped aircraft reported a number of premature removals of EFIS cockpit display units because moisture condensation within the units resulted in component malfunction.

During periods of hot, humid weather, air-conditioning systems were being operated while routine overnight activities were performed. When the work was complete, all systems were switched off and the aircraft doors were left open. The combination of high humidity and rapid heating of the cockpit apparently resulted in condensation within the EFIS display units.

The airframe manufacturer recommends that all aircraft doors and windows be closed immediately after switching off the air-conditioning system. This will inhibit the influx of hot, humid air and allow the aircraft to warm gradually.

Pushback Injuries Prompt NTSB Safety Recommendation

As a result of yet another injury to a ground service worker during a pushback operation of an airline aircraft, the U.S. National Transportation Safety Board (NTSB) has issued Safety Recommendation #A-93-77.

This recommendation follows an earlier recommendation issued by the International Air Transport Section (IARTEX) of the U.S.-based National Safety Council, which calls for revised procedures in pushback operations (*Aviation Mechanics Bulletin* May/June 1993).

The NTSB and IARTEX notices recommend that all operators revise pushback procedures to eliminate the need for ground service personnel to be near the airplane landing gear while the airplane is in motion. The IARTEX release recommends that the communication person be physically located on the pushback vehicle. This would eliminate the need for anyone to walk in the danger zone — the area near the aircraft while it is in motion — during pushback.

It is also suggested that operators use cordless headset systems. In the interim, it is strongly recommended that operators modify existing communication equipment to provide longer cords or connection points on the pushback vehicle so that the signalman need not walk near the aircraft or vehicle while it is in motion.

In the accident cited in the NTSB notice, five ground service personnel were assigned to perform the pushback. The signalman, who was communicating with the cockpit crew by an interphone headset, received clearance to begin the pushback and signaled the vehicle driver to start. The aircraft had moved about 200 feet (61 meters) when the tug driver observed the signalman moving toward a position near the nosegear and under the fuselage. Believing the signalman to be clear of the airplane, the driver initiated a slow turn in the signalman's direction.

A few moments later, the driver saw the signalman's head move back and his right leg contact the nosewheel. He then saw the man fall forward, and his right foot appeared to go under the nosewheel. Although the aircraft was moving slowly, it took about 15 feet (4 meters) to stop the movement, and the signalman was dragged along the ground. The signalman suffered seven bone fractures in his right foot and a compound fracture above the right ankle.

Well-known Carburetor Problem Still Causing Accidents

In 1978, the manufacturer of a carburetor commonly used on light aircraft reciprocating engines recognized a potential problem that could result in excessive wear of the mixture control assembly and subsequent loss of engine power. A service bulletin (SB) was issued to modify existing units, and newly manufactured assemblies were redesigned shortly thereafter.

The subject HA-6 series of carburetors was manufactured from mid-1971 through 1978 at the rate of approximately 1,500 units per year. In September 1978, the manufacturer issued SB A1-78, which called for installation of a spring retainer to counteract end-play wear on the rotary mixture control assembly and retaining screw because of vibration.

In December 1978, Avco Lycoming issued Service Instruction #1370, recommending that the spring retainer be installed on all HA-6 carburetors with rotary mixture controls at the next overhaul or sooner, at the owner's discretion.

Even though this problem has been known for more than 15 years, many operators and technicians have not modified the carburetor, and accidents are continuing to occur. Following its investigation of an accident in August 1992, the U.S. National Transportation Safety Board (NTSB) issued a safety recommendation calling for the U.S. Federal Aviation Administration (FAA) to:

"Issue an airworthiness directive applicable to all Marvel-Schebler Model HA-6 carburetors manufactured prior to February 1978 requiring the installation of rotary mixture control spring retainers, unless previously accomplished, in accordance with Marvel-Schebler/

Tillotson Service Bulletin No. A1-78. Compliance should occur at the next 100-hour or annual inspection, whichever occurs first."

Technicians involved in the inspection and maintenance of any aircraft equipped with this carburetor should be alert to this potential problem. Owner/operators are encouraged to incorporate the modification regardless of whether the FAA issues the airworthiness directive recommended by the NTSB. ♦

NEW PRODUCTS

Electronic Noise-Cancellation Headsets Protect Hearing

Working in high ambient noise environments has always posed a hearing hazard for technicians. Various means of protecting hearing by wearing plugs, protective cups, etc. have been in use for many years; all of them rely on physically blocking the sound from entering the user's hearing system.

Photograph not available.

Active Noise Reduction (ANR) technology, which electronically senses harmful frequencies and reacts by producing anti-noise sound waves that are identical in frequency but differ in phase (timing), is now available for individual worker protection. When the incoming sound and anti-noise waves collide, they cancel one another while substantially reducing the volume of the potentially harmful sound.

Sennheiser Electronic Corp. has introduced a line of ANR hearing protection and headsets that are specifically designed for use in the aviation field. According to the manufacturer, these lightweight Noisegard headsets provide outstanding noise reduction while, at the same time, ensuring clear and intelligible communications for the user. These headsets are available in portable battery-powered units and units that are powered by the aircraft electrical system. Contact: Sennheiser Electronic Corp., 6 Vista Drive, Old Lyme, CT 06371 U.S.

Telephone: (203) 434-9190. Fax: (203) 434-1759.

Cable/Hose Protectors Designed to Improve Hangar Safety

In any maintenance hangar, hoses and wires that are necessary to support work in process have always posed a problem. The trip and fall hazards for personnel working in the area and the potential damage to cables and hoses from movement of tugs, etc. have too often been considered acceptable risks.

Photograph not available.

A system of temporary protection crossovers recently developed by McManus Enterprises now claims to reduce or eliminate these problems. This line (called Yellow Jacket) of protective crossovers consists of three foot-long modular units that interlock to provide any length of crossover desired. Each section comes with a hinged lid that stays open for easy installation by one person, and also offers the ability to add or remove a line without disturbing the entire installation. The system provides channels for one, three, four or five cables or hoses; 45-degree turn units are also available.

When installed, the crossovers provide complete protection from damage by tugs and by ground equipment driving over, according to the manufacturer. A yellow and black color scheme ensures good visibility for pedestrian and vehicular traffic, thus enhancing safety in the workplace. The manufacturer states that these crossovers help meet the requirements of Occupational Safety and Health Act (OSHA), National Electrical Code (NEC) and building codes.

Contact: McManus Enterprises, 111 Union Avenue, Bala Cynwyd, PA 19004 U.S. Telephone: (215) 884-9502. Fax: (215) 664-4234.

Technology Streamlines Nondestructive Engine Wear Detection

Nondestructive testing of particulate matter filtered from engine oil samples or captured on magnetic sump plugs has long been recognized as an excellent means of assessing the health of operating engines.

Photograph not available.

In the past, however, such testing was only available by sending the collected samples to a qualified agency. With the development of new technology and the miniaturization of test equipment and computers, an analysis can now be performed in-house.

Oxford Instruments Inc., a U.K.-based company with offices in the United States, has developed an analysis unit, coupled with a self-standing computer, that provides larger operators with the capability to perform particulate analysis in-house. The XR400 unit is an energy-dispersive X-ray fluorescence spectrometer that can easily handle solid, liquid and powder samples. This non-destructive technique permits the simultaneous analysis of elements at concentrations from low parts per million (ppm) to high weight percentage levels in the same sample. According to the manufacturer, this makes the unit ideal for identifying the various metal and alloy types that may be present in the sample.

The manufacturer says that particulate samples taken from magnetic sump plugs or filtered from oil screen debris can be analyzed quickly to determine the type and amount of each element present. Indications of bearing wear or other internal faults that generate metallic particles into the engine lubricating oil system can then be assessed for severity and potential problem locations. No sample preparation is necessary, and operator training is not extensive. Results are available within minutes, thus enabling engine health assessment to be completed while the aircraft is still undergoing service.

Contact: Oxford Instruments Inc., Analytical Systems Division, 130A Baker Avenue Extension, Concord, MA 01742 U.S. Telephone: (508) 371-9009. Fax: (508) 371-0204.

Clamp for Shielding Security

With the proliferation of electronic equipment in every area of the modern aircraft, the need for reliable shielding to protect wiring from electromagnetic interference (EMI), electromagnetic pulses (EMPs) and

Photograph not available.

radio frequency interference (RFI) is more critical than ever before. One of the problems has been to ensure that shielding installed on wire runs is properly secured to the end connector or shell of the termination.

The IBEX Corp. has introduced an improved clamping system called Tie-Dex. The line includes hand-operated units as well as pneumatic and bench-mounted units to install metallic clamps of any size that will reliably secure the shielding to the end connector. According to the manufacturer, the patented Tie-Dex system provides quick, easy, permanent shield terminations on any backshell, regardless of configuration. No welding, soldering, crimping or magna forming is required. The exposure to wiring and/or backshell damage is therefore eliminated, IBEX says.

For the line technician, a convenient pocket-size hand tool is available that is said to reliably tension the Tie-Dex band to a preset level. It features one-hand operation with a ratchet fixture and a cut-off blade for ease of use.

Contact: Barnhart Sales Co., 314 Lakeshore Drive, Atco, NJ 08004 U.S. Telephone: (609) 767-8014. ♦

Follow up …

In the May/June 40th anniversary issue of the *Aviation Mechanics Bulletin*, long-time editor Joe Chase was erroneously credited with authoring the “Mechanic’s Creed.” The creed was originally written in 1941 by Jerome Lederer, Flight Safety Foundation founder and president emeritus.

The anniversary issue also noted Chase’s adaptation of the now internationally known “Murphy’s Law” to aviation. Some readers have asked for additional information about Murphy’s Law, which is printed below.

According to several reference sources, Murphy’s Law was said to have been invented by George Nichols in 1949 when Nichols was a project manager working for Northrop Corp. in California. He is said to have developed the maxim from a remark made by a colleague, Capt. E. Murphy, of the Wright Field Aircraft Laboratory.

Nichols is quoted in the *Oxford Dictionary of Modern Quotations* as giving the following account of the origin of Murphy’s Law:

“I was project manager at Edwards Air Force Base during … J.P. Stapp’s experimental crash research testing on the track at North Base. The law’s namesake was Capt. Ed Murphy — a development engineer from Wright aircraft lab. Frustration with a strap transducer which was malfunctioning due to an error by a lab technician in the wiring of the strain gauge bridges caused Murphy to remark: ‘If there’s any way to do it wrong, he will!’ I assigned Murphy’s Law to the statement and the associated variations.”

The magazine *People Weekly* published a different version of the events in a 1983 article.

“One day back in 1949, during the wild, wacky ‘Right Stuff’ days when the Air Force was testing its weird new rocketry, Maj. John Paul Stapp was blasted out across California’s Mojave Desert in a rocket sled. Stapp was a guinea pig in a test at Edwards Air Force Base to see just how much pressure the human body could withstand before it turned into Jell-O. He had already handled 31 Gs — 31 times the force of gravity — but on this fateful day Stapp shot beyond that into the outer limits of human endurance. ... After that hairy ride, he stepped from the sled with just one question: ‘What was the G reading?’ There was none. Something had gone wrong. ‘Zero, sir,’ a technician said sheepishly.

“Stapp, who had just risked his hide for nothing, called on troubleshooter Capt. Edward Murphy Jr. to find out what had gone wrong. Murphy discovered that somebody had installed each of six G-measuring devices backward. ‘If there’s more than one way to do a job and one of those ways will end in disaster,’ Murphy remarked, ‘then somebody will do it that way.’ ‘That,’ replied Stapp, ‘is Murphy’s Law.’”

The article says Stapp later gave the maxim a new twist when he defined it for a reporter as “If something can go wrong, it will.” According to the article, Murphy later said Stapp’s interpretation was too pessimistic. “My original statement was to warn people to be sure that they cover all the bases, because if you haven’t, you’re in trouble,” the article quoted Murphy.

Joe Chase’s adaption, “If an aircraft part can be installed incorrectly, someone will install it that way,” first appeared in the *AMB* in the 1955 May/June issue.♦