How Safe Is The Aircraft's Water?

You have often heard the warning "don't drink the water," especially when traveling to unfamiliar countries. But what about the water you or your passengers drink on the flight to your destination? What about the water that you place in the aircraft's tank or the water storage tank that services the facility?

A good example is the water tank on my travel trailer that is serviced in a similar manner as the water tank installed on an aircraft. We traveled across the United States, Alaska and Canada recently, and added water at campgrounds along the way. After we returned home, I drained the tanks and discovered a loose tank strap had caused chaffing and necessitated removal and replacement of the fiberglass water tank. The tank cracked during removal and exposed the inside of the tank. There were lumps of algae, green to bluish slime, and other brackish matter; it was a repulsive sight, made worse knowing that we had consumed water from that tank.

A toy microscope was on hand, and I examined a specimen of the slime. The lowest power microscope lens revealed prehistoric-size "monsters" on that slide.

Water on my travel trailer passes through a filter system that includes a replaceable cartridge and much ballyhoo about how pure the water is at the faucet. At this point, I don't believe it.

Experienced travelers know that it's a good idea to consume water when in flight to counter the dehydrating effects of jet aircraft travel. I have heard claims that drinking water minimizes jet lag.

How many persons are aware that water served onboard some flights could be unhealthy? Maintenance facilities' water tank inspections may be infrequent, water may be improperly treated with chemical purifiers, and the quality of available water to be treated may be questionable.

Look at your water servicing facility - is it as clean as it should be? Ask a mechanic at an airport about operators who do not systematically clean the water holding tanks of their aircraft at regular intervals. Others may not follow a specific water treatment program.

For example, passengers on an aircraft flying between Los Angeles and New York use half the water supply on that particular aircraft. When that aircraft lands in New York, the remaining water onboard is not drained. Instead, the tanks are topped off with local New York water piped into that airport. The aircraft continues its journey via its routing schedule to Athens. Again, the remaining water in the tanks is not

drained, and additional water is added. This process continues during stops in Cairo, Karachi, Kuala Lumpur and Hong Kong.

By the time the aircraft returns to its originating point, bacteria in those water tanks from improperly treated water could resemble the bar scene from the motion picture *STAR WARS*.

I know that there have been complaints from crews and passengers about the quality and taste of water on board aircraft. One senior airline official (who did not want to be identified) said that . . . . "even when we add the proper chemicals, it still has THAT taste."

Air carriers recognize the need for drinkable water and have a good record in this area. They also are aware that it probably doesn't get the attention it should - it's not a "Go" or "No Go" item.

Some carriers have developed specific guidelines for flight attendants and ground servicing personnel on the subject of onboard water. "We monitor our water usage very carefully," says a spokesman for British Airways. On each British Airways B-747, nearly 200 gallons of drinkable water are available for most flights, and an average of 140 gallons are consumed by the passengers on a typical flight.

It's the quality that counts. I can remember when Pan Am flew the Pacific in the early days of international air travel, it insisted that all water be boiled before it was boarded on its aircraft leaving China; a Pan Am employee supervised the boiling process.

There are a number of carriers, including KLM, SAS and Lufthansa, that do not board boiled water in cities where the basic water quality is considered to be below standards.

The chemical most often used to treat water is a low concentration of chlorine. To further ensure water quality, the water tanks onboard each of KLM's B-747's are cleaned every three months. More important, each KLM station manager around the world is supplied with a field test kit to check the local water supply before it is pumped aboard the aircraft. If the chlorine strength is below the World Health Organization standard of 0.3 mg/liter, chlorine is added. And just to make sure, KLM also regularly flies water samples back to Amsterdam from each KLM destination in Asia, Africa, South America and the Middle East for more extensive laboratory tests at the airline's headquarters.

Just what can you do about this matter? After all, drinking water on airplanes is still a good idea. If in doubt about water quality, ask for bottled water. Just don't drink the water onboard. It's that simple.

You can drink onboard coffee or tea, since that water has been boiled during preparation. Anytime the water is

questionable, so might be the ice. And contrary to some notions, alcoholic beverages mixed with water don't kill all harmful bacteria.

On a recent flight, I sat next to a physician who had a small plastic bottle of mineral water in his attache case. Some pilots and flight attendants carry their private stock of bottled mineral water in their flight bags.

At least one air carrier - Air France - takes no chances when it comes to onboard water. Signs in the lavatories inform passengers that the water in the holding tanks is not potable. "Instead, we provide bottled water to all of our passengers for drinking purposes," says an Air France spokesperson. They served more than 3.6 million liters of bottled water to their thirsty passengers in the past year.

Sure, most of the large aircraft drinking water is filtered, but has the filter system, and the tanks themselves been given the careful scrutiny that they deserve? More work has to be done in this matter so that all users of onboard water can be assured that it is fit to consume.

Composite Repair Requires A Thorough Knowledge

There is more to composite repair than just glues and clamps. A recent survey of the training facilities that teach the repair of composites revealed that the repair processes require a basic introduction, coupled with a broad overview of composites, prior to learning the actual repair processes. This information would include description and construction of composites, history of composite development, design characteristics, performance characteristics, applications, manufacturing materials and processes, hazards and safety precautions during repair, lay-up procedures, reference sources and standards.

If you have conquered the items listed above, then you should become thoroughly familiar with the types of damages, repair criteria, repair materials, tools, and finally the repair procedures. These procedures should be learned in a practical workshop so you can become knowledgeable in damage layout, damage removal, scarf repairs, the fabrication of repair patches, fastener hole repairs, trailing edge repairs, mechanically fastened patches and sandwich structure repairs. Damage assessment and classification are two distinctly different but necessary categories in this subject.

Currently active aviation mechanics realize the depth of knowledge that is required to perform normal or routine maintenance. However, composite structures was not included in many curriculums of aviation mechanic schools in past years, although it is being

routinely included in present programs. Mechanics who graduated and obtained their certificates without training in this area, should seriously consider upgrading their knowledge to include advanced composite structure repair. Today's and tomorrow's aircraft will demand the aviation technician who is thoroughly familiar with composites.

Impact Tools Are as Welcome as Adjustable Wrenches

There aren't many mechanics' tool boxes that do not include several sizes of adjustable wrenches that are used as a last resort to remove (and disfigure) a nut or bolt. The same tool boxes also contain their share of adjustable pliers to accomplish the same feat. Both tools are a "must", but their uses should be limited to their intended applications. Can we get along without those adjustable pliers to neatly twist our safety wire installations? That is usage with good common sense. The same cannot be said for the impact tool.

A recent observation of a mechanic removing a stubborn (locked thread) instrument panel mount screw (5/16-18 flat head countersunk machine screw) with an impact tool equipped with the "proper" recj—sed head driver, ended up with the tool cutting through the inner panel and tearing into an instrv·ment housing.

Another incident, in which the mechanic had a firm hold on the landing gear attach bolt, resulted in the tool tearing through the skin fairing to that landing gear. This observation included the fact that it was a cold day on the line, and the mechanic using the tool was wearing a pair of gloves. A second try did free the bolt, at the cost of a fairing.

It all boils down to the application of common sense to overcome the temptation of using quick removal tools such as the "Variable Speed Wrench" (adjustable pliers), the adjustable wrench, and the impact tool - in place of the proper tools.

Do You Work Smart?

People in aviation maintenance don't always work smart, even though they may work hard. According to aviation safety analysts who go out on safety surveys, too many people fail to stop and determine the consequences of maintenance malpractice. Malpractice includes the use of unstable workstands, or working without a hard-hat. They use an incorrect tool or fail to heed warnings placed on servicing equipment.

It appears, from the survey, that these are the same people who do not practice self-discipline or continually fail to refer to the proper manual or set of instructions. These are the same people

who often fail to accomplish a repair or maintenance task, who fall off unstable work stands, and who injure themselves during normal routine assignments. They are also the persons who round-off nuts and bolts and get electrical shocks when they fail to heed electrical hazard warnings. Yet, when questioned about doing these things, they provide a variety of excuses - especially the one where the tempo of the job required would not have allowed completion of the job within the established time period, if they hadn't taken a short cut.

The same survey revealed that those persons who practice "malpractice" during their maintenance duties are the ones who are short-lived both on the job and in this real world. Don't be one of those recent survey figures, and try to advise those who are.

Heat Shrinkable Tubing and Environmental Splices

Aircraft environmental resistant devices and shield terminations reduce corrosion, prevent water and moisture intrusion failures, and are appropriate for routine wiring repairs and installations of changes on aircraft if so approved in the maintenance manual.

The environmental splice is composed of two parts: a metal crimp barrel with inspection window (for mechanically-spliced wire) and a transparent sealing sleeve with integral wire insulation barriers.

Installation of environmental splices and heat shrinkable tubing requires the use of a hot air heating device. Attention is called to the fact that not every hot air device may be used and approved types are generally specified - especially when working such repairs on fueled aircraft.

Common sense precludes the use of open-flame sources, but it has become apparent that shrinkable devices are being installed with such hazardous materials as cigarette lighters and matches!

Random inspection of wiring repairs have revealed an alarming number of improperly installed environmental splices and other heat-shrinkable devices through the use of open flame heat sources. Signs of using a lighter or match are: discoloration of the device, soot on the device, changing of the device surface, and melted wire insulation or device materials. Basic safety rules preclude the use of such open flame devices on aircraft whether fueled or not.

Permanent damage can result to shrinkable devices and associated wiring should open flame heat be applied. Carbon laden soot from the flame can coat the device, producing a conductive

surface. This has been the case in several reported malfunctions. Because the heat is uncontrolled, the device may overheat and rupture, exposing the wire crimp barrel or sealing barrier. In the case of miniseal splices, the sealing material will spew from the sleeve and burn. Then, the purpose of the device is voided, and an electrical hazard will exist.

The technician performing this type work must be aggressive in preventing the use of open flame heat sources on heat shrinkable devices on aircraft.

A visual check of the plug is mandatory prior to plug-in to avoid what could be a catastrophe.

Mobile Robots To Replace Aviation Technicians?

A vast array of electro-mechanical products are emerging into a new industry that will one day rival the largest industries that we know today — people. That emerging industry is mobile robots.

Even more astounding is the fact that the market for these moving mazes of modern metal will top $3 billion by early in the next century.

These conclusions come from an intelligence firm that tracks worldwide micro and macro technology trends.

Mobile robots is singled out as one of several emerging industries having uncommon potential. These emerging industries are subjects of a series of reports of which one is titled *MOBILE ROBOTS*. Licensing opportunities abound and there is still time for growth-oriented manufacturers to enter this opportunity. The report is a comprehensive study of mobile robot technology, uses and markets. It explores the interplay of several technologies - sensory, feedback, internal motion sensors and geometric reasoning (for example), that make these robots practical.

Consider some of the less obvious applications that will benefit from mobile robots; They start with pipe crawling robots, and quickly expand to military, construction, mining, agricultural, hospital, and firefighting. A few are already on the market, others are actively seeking licenses. This robot could be better than the onboard monitoring and maintenance systems on current aircraft. Better the robots crawl into pressurization systems, landing gear wells, belly bins, than the human mechanic.

It is predicted that mobile robots will not be a monolithic marketlike market like the automobile industry where a handful of companies dominate the industry. Rather, mobile robots will

emerge as a broad-based industry open to numerous firms of varying size. Twenty one broad categories for mobile robots have been found. These range from clean-room applications and office automation to building maintenance and firefighting. Then there are mining applications, handicap assistance, indoor surveillance, and many construction uses. Within each category there can be dozens of different types and models. The result is dozens of products for dozens of markets. One small firm has sold, in the past year, 20 of its mobile robot systems at $250,000 per system, which is just a fraction of what this industry represents.

Many universities are quietly working on robot development and specialized college courses are already on the curriculums with the title boldly carrying the title ROBOTS.

Robots currently in development for the automotive industry couple the computer to give the signal and a robot to perform the mechanical action as a follow-up. If robots can build the cars, then robots can maintain them.

Could this be a possible application to aircraft? With an onboard computer linked to a robot, the maintenance could be accomplished inflight bringing a turn-around ready aircraft into the passenger terminal! Food for thought.

Maintenance of Aircraft Highlighted At Upcoming Hannover Air Show

Somebody has seen the light. It has been announced that a major sector of the Hannover Air Show will be devoted to aircraft maintenance, showcasing scores of exhibits and highlighted by a special maintenance symposium. This International Aerospace Exhibition is scheduled for May 5-12, 1988, in Hannover, West Germany.

"The growing emphasis on safety, specifically due to the increased accidents and incidents, has led to heightened demand for aircraft servicing, repairs and overhaul" stated a manager of the air show. "Maintenance has developed into a major market segment for the international aerospace industry, for aircraft manufacturers and for the airlines themselves."

International Air Transport Association (IATA) carriers spend approximately $12 billion annually on aircraft maintenance. West Germany alone accounts for three billion German marks in this market. It is known that every airline that services its own aircraft is in a position to provide maintenance services for others. For example, Lufthansa has turned over 800 million marks in maintenance busi-

ness for aircraft other than the company's own.

The Association of Independent Airlines (AIA) that was recently founded, will be on hand to discuss its members' opportunity to offer more cost-effective aircraft maintenance and servicing. This could eventually parallel the similar services offered by larger carriers.

The show exhibits will demonstrate why a higher degree of specialization will be required in the maintenance sector, partially due to the wide range of new structural materials used in airframes and propulsion systems, and also due to the use of increasingly complex electronic systems and avionics.

Simple, Highly Accurate Method For Predictive Maintenance/Trouble Shooting

A new Ultrasonic Inspection System (Ultraprobe 2000) is a multi-use portable instrument based on the technology of air-borne ultrasound. This unit will pinpoint leakage in fuel cells and cabin pressure. In addition, it detects a variety of pressure and vacuum leaks including nitrogen, pneumatic, pitot-static, and oxygen.

Other applications include, monitoring bearings, detecting cavitation in pumps, locating problems in hydraulic valves and checking tires. This portable metered pistol unit heterodynes a narrow range of ultrasound into the audible range which provides accurate sound recognition. The monitored sounds are heard through headphones and observed as intensity on a meter. The Ultraprobe includes interchangeable plug-in modules for scanning mode and for contact (stethoscope) mode operation. Features such as frequency tuning allows users to highlight problem sounds while minimizing interference from competing ultrasounds. Meter mode selection allows for adjustment from real time analysis (as in leak detection) to averaging (for bearing monitoring).

A powerful ultrasonic transmitter produces a warble ultrasound and is used as a sound source for detecting leakage in cabin pressure or fuel cells. The Ultraprobe 2000, by U.E. Systems, is rated Intrinsically Safe, Class One, Division One, Groups A,B,C, & D, by Factory Mutual, a standards company.

Alerts

DC-10 Engine Core Cowl Doors Open In Flight

The flight crew felt high vibration in the airframe and a slight yaw during climb. A second officer travelling as a passenger reported that he had observed the forward portion of the number one en-

gine inboard core cowl to be slightly open. Approximately two minutes after the vibration started, number one engine oil quantity indication dropped to zero. Other engine parameters were normal. The number one engine was shut down and the vibration ceased; indicated oil quantity was four qts. The aircraft continued to its destination and landed without further incident.

Ground inspection revealed the forward half of the number one engine outboard core cowl door had broken off, peeling the entire outboard core cowl door skin off. A wing leading edge access panel was found damaged as was the lower skin adjacent to the outboard side of the pylon and the pylon outboard skin. The number one engine cooling tubes on the outboard side and the sump (D) oil scavenge line were crushed by the impact of the door. There were several dents in the fixed exhaust nozzle.

Prior to this flight, the forward latch hook had been found broken, and permanent corrective action had been deferred to the next station.

B-747 Rapid Rise In Cabin Altitude

One operator reported several occurrences on one airplane of the cabin vertical speed indicator climbing at 1500 ft/min. and the auto fail light illuminating. In one instance, the cabin rate of descent was reported as being uncontrollable in both the auto and manual modes. Three cabin pressure controllers, three cabin pressure selector panels and two vertical speed indicators were replaced without success. Subsequently, the outflow valve actuator was replaced. No further cabin pressure control difficulties had been reported.

The removed actuator had been installed on the airplane for approximately five years with no record of any maintenance action. It was suspected that the outflow valve feedback potentiometer may have become worn in one spot so as to cause erroneous inputs to the cabin pressure controller.

B-747 Flight Deck Overhead Escape Hatch Jammed

On the first maintenance check after the aircraft returned from a modification program by a contractor, a check of the hatch operation proved that it could not be opened as it was fouling the surrounding trim. Investigation found excessive sealant between the trim panels and the structure which, after removal, restored operation to normal..

DC-10 Generator Reset(s) Can Cause Damage

When a generator is repeatedly reset during an inflight abnormal procedure

or during electrical system troubleshooting, it can result in extensive damage to electrical system wiring and adjacent components.

In a recent incident on an MD80 where there were some loose connections, investigation revealed that the right hand generator control switch had been reset several times during previous flights. The aircraft suffered burned terminals and power feeder cables.

In another incident on a DC-10, it was estimated that the number one engine generator had been reset as many as 17 times during all the troubleshooting. Additionally, due to differential current protection (DP) trips during the troubleshooting, the DP circuit was disconnected, resulting in a much longer than normal delay before the generator relay tripped. The four power feeder cables in the pylon were damaged. A 12-inch section of the cables was completely missing (vaporized), and adjacent wire bundles and supports were damaged.

Molten material melted a 1/2 inch hole in the pylon lower forward apron. It must be realized that when a fault exists in the generator feeder portion of the circuit, there is a finite time after resetting the generator before the protective circuitry opens the generator field. During this time, full voltage is applied to the fault and considerable damage may occur if the generator is repeatedly reset. In fact, if a generator trips after reset, additional reset attempts should not be made and the fault should be determined by other means. If a protective function operates to disconnect the system, it must not be assumed that it is a nuisance trip; often there is a real fault which may cause significant damage if not fixed.

B-737 VHF Static Noise A Simple Cure

The number one VHF receiver on a B-737 was reported as being unusable due to noise (static) especially in areas of precipitation. Action taken to fix the problem included replacement of the number one VHF receiver, nav-comm panel and audio panel, each several times. The number one coax cable was tested also with the time domain reflectometer and checked out OK.

The number one antenna was replaced twice due to stripped nuts. The noise however, persisted. Since it occurred inflight and especially in precipitation, a “high resistance” discharge path was suspected. All static dischargers were replaced and the problem has not reoccurred. Note that several of the dischargers removed showed evidence of lightning strike damage.

DC-9 Installation of Diode in Recirculation Fan Relay Unit

Several operators have reported instances where the air conditioning re-

circulation fan did not shut off when the fan thermal protection switches were opened during ground check-out. Investigation revealed that the wire length from a 0.5 sec. time delay relay to the fan created a capacitance effect which kept the relay latched when the fan thermal switches were opened. The fan relay remained energized and provided electrical power to the recirculation fan. To cope with this problem, a diode can be installed in the recirculation fan relay circuits.

DC-9 Replacement/AC Emergency Power Transfer Relay

Several operators have reported instances where the AC emergency bus voltage dropped below a usable level. Subsequently, the AC Emergency Power Transfer Relay (AEPTR) did not operate to transfer the bus to an available usable power source. The reduced voltage has been attributed to an open phase "A" on the left hand AC Bus. Transformer action of three-phase loads connected to the left hand AC Bus prevented the phase "A" voltage from falling below the AEPTR drop-out value. To provide for a positive bus transfer at a voltage below the usable level, the existing AEPTR relay can be replaced by a voltage sensitive type.

Cessna Cutlass RG Downlock Pin (PN 1280209-1)

The downlock pin broke inside the bearing end, permitting the downlock pin to drift out, contact the nut, and prevent the nose gear from fully extending and locking down. The gear unsafe horn was operational and warned of the condition. The nosegear collapsed during rollout after landing. The submitter suggests inspection for proper clearance between the pin and nut during each annual inspection. (Aircraft time - 1,300 hours).

Note: This article was published in FAA Alert No. 99 dated October, 1986. There was a recent report of finding the right side lock pin broken but still in place on a C-182RG aircraft. The submitter advised that the pins should be physically checked to determine if they are broken.

SA-226-TC Worn Cables

Worn cable was found in the aileron/rubber inter-connect system. An aileron cable in the forward section on the co-pilot's side was found worn where the cable direction is changed by pulleys. An aft elevator up cable was found worn at the rear pressure seal. All worn cables required replacement. Airworthiness Directive 97-02-02 pertains to inspecting the cables.

Mobile Power Unit Cord Fire

While performing maintenance on an aircraft parked on the line at the terminal, a food service operator noticed that the external power cord from a ground power unit was smouldering. Power to the aircraft was immediately stopped and the smouldering fire was extinguished.

An inspection of the cable configuration revealed that the power plug was inadvertently installed backwards! This is hard to do since the connect plug is “polarized”.

The power plug had four large and two small female receptacles that provide a “Murphy Proof” one-way installation. However, on this particular plug, the two small receptacles were elongated to a degree that allowed the power plug to be installed backwards. When the power was supplied to the aircraft, 115 VAC was applied to the ground pin, causing the ground wire to heat up and smoulder.