FLIGHT SAFETY FOUNDATION
Aviation Mechanics Bulletin

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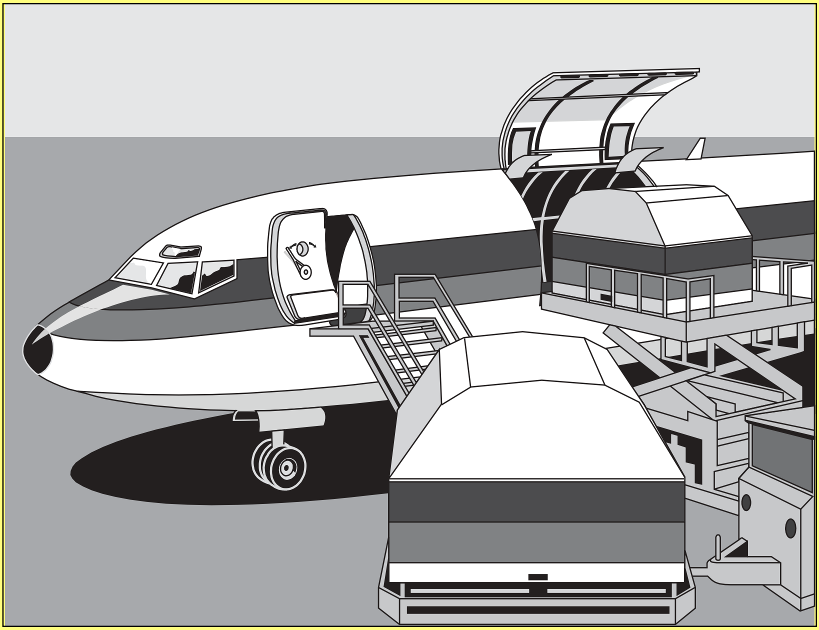
U.S. National Transportation Safety Board Issues "Urgent" Recommendations for Hazardous Cargo



FLIGHT SAFETY FOUNDATION

Aviation Mechanics Bulletin

Dedicated to the aviation mechanic whose knowledge, craftsmanship and integrity form the core of air safety.

Robert A. Feeler, editorial coordinator

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U.S. National Transportation Safety Board Issues "Urgent" Recommendations for Hazardous Cargo

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U.S. National Transportation Safety Board
Washington, D. C.

On May 11, 1996, at about 1415 Eastern Daylight Time, a McDonnell Douglas DC-9-32 crashed into the Everglades swamp shortly after takeoff from Miami (Florida, U.S.) International Airport. The airplane, N904VJ, was operated by ValuJet Airlines Inc. as ValuJet Flight 592. Both pilots, the three flight attendants, and all 105 passengers were killed. Before the accident, the flight crew reported to air traffic control that there was smoke in the cabin and cockpit. Visual meteorological conditions existed in the Miami area at the time of the takeoff. The destination of the flight was Hartsfield International Airport, Atlanta, Georgia, U.S.

Although the accident is still under investigation, the U.S. National Transportation Safety Board (NTSB) has accumulated sufficient factual information to suggest issues needing immediate attention. Preliminary evidence indicates that five cardboard boxes containing as many as 144 chemical oxygen generators, most with unexpended oxidizer cores, and three wheel/tire assemblies had been loaded into the forward cargo compartment shortly before departure. These items were being shipped as company material (COMAT). Additionally, some passenger baggage and U.S. mail were loaded into the forward cargo compartment. The forward compartment of this aircraft was a class D compartment, which had no fire- or smoke-detection system to alert the cockpit crew to a fire in the compartment.

[U.S. Federal Aviation Regulations (FARs), Part 25.857 classifies lower fuselage cargo compartments of large passenger airplanes, i.e., those not accessible to crew members during flight, as either class C or class D. Class C compartments must have "a separate, approved smoke detector or fire-detector system to give warning at the pilot or flight-engineering station" and "an approved, built-in fire-extinguishing system controllable from the pilot or flight-engineer stations." Class D cargo compartments require no fire- or smoke-detection or fire-extinguishing systems. Instead, class D cargo compartments depend on the limited availability of oxygen in the compartment to suppress a fire. This is controlled by compartment-size and leakage-rate requirements found in Part 25.557. Further, class D compartment lining material must pass vertical and 45-degree Bunsen- or Tirrill-burner tests as outlined in Parts 25.853 and 25.855.]

Shortly before the departure of Flight 592, a driver from the SabreTech Inc. maintenance facility at Miami International Airport delivered the COMAT (the boxes and wheel/tire assemblies) to the ValuJet lead ramp agent for transport to ValuJet facilities in Atlanta. (SabreTech operates a U.S. Federal Aviation Administration [FAA]-approved aircraft repair and maintenance facility at Miami International Airport and had performed renovation work for ValuJet.)

A SabreTech shipping ticket, dated May 10, 1996, for the five boxes of chemical oxygen generators was also offered to the ramp agent. The generators were identified on the shipping ticket as "Oxy Cannisters 'Empty.'"

The ramp agent, who was busy off-loading the aircraft from its previous flight, signed the shipping ticket for the COMAT and instructed the SabreTech driver to place the items on an empty baggage cart. The ramp agent stated that he asked the first officer of Flight 592 for approval to load the COMAT on the aircraft. After the ramp agent and the first officer estimated the weight of the COMAT, the three wheel/tire assemblies and the five boxes containing oxygen generators were loaded into the forward cargo compartment.

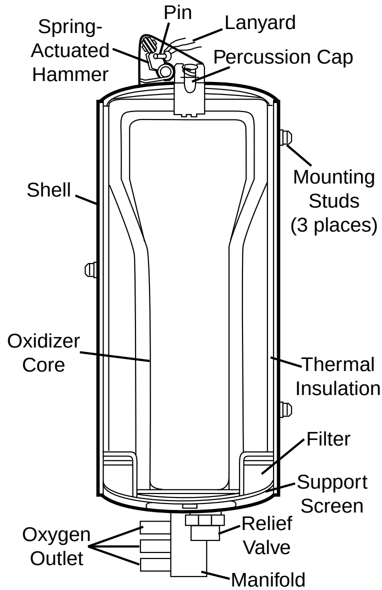
The chemical oxygen generators loaded on Flight 592 had been removed from three McDonnell Douglas MD-80s that were being renovated for ValuJet at SabreTech's Miami facility. These chemical oxygen generators had been installed in overhead compartments on the MD-80s to provide emergency oxygen for passengers but were removed because their 12-year shelf life had expired. Chemical oxygen generators are designed to function safely when properly installed in aircraft. The MD-80 maintenance manual specifies that after a generator is removed from an airplane because it has passed its expiration date, it should be initiated (discharged) and the oxidizer core fully expended. Discharged chemical oxygen generators must be disposed of as hazardous waste.

When a chemical oxygen generator is not installed as equipment on an airplane, a shipping cap must be mounted over the percussion cap to prevent accidental initiation. SabreTech mechanics who placed the generators in cardboard boxes stated that shipping caps were not installed over the percussion caps, and 15 or fewer of the generators had been discharged.

A chemical oxygen generator (Figure 1) is about the size of a can of spray paint (a cylinder 2.75 inches by 6.75 inches [6.99 centimeters by 17.15 centimeters]). The oxidizer core is primarily sodium chlorate mixed with less than 6 percent barium peroxide and potassium perchlorate, and trace amounts of other materials.

The chemical oxygen generators, which were manufactured by Scott Aviation Inc., produce oxygen when a pin is pulled, releasing a spring-loaded firing mechanism that strikes a percussion cap and starts a chemical reaction in the generator's solid oxidizer core. The reaction produces oxygen for at least 15 minutes. The chemical reaction of the oxidizer releases heat, and the heat of reaction can result in external shell temperatures up to 547 degrees F (286 degrees C). (Manufacturer measurements of external shell temperature on oxygen generators during operational testing indicated maximum shell temperatures between 450 degrees F and 500 degrees F [232 degrees C and 260 degrees C].)

Chemical Oxygen Generator, Cut-away View



Source: U.S. National Transportation Safety Board

Figure 1

Chemical oxygen generators, when transported as cargo, are considered a hazardous material. Classified as oxidizers, they are regulated under U.S. Department of Transportation (DOT) hazardous-materials regulations (49 U.S. Code of Federal Regulations, Parts 171–180), which establish packaging, labeling and shipping requirements for their transport.

Although the origin of the in-flight fire on Flight 592 has not been determined, the presence of the chemical oxygen generators in the forward cargo compartment of the aircraft created an extremely dangerous condition. The chemical reaction of an oxidizer such as sodium chlorate in a confined space will generate heat, and the oxygen resulting from the reaction will sustain and intensify a fire. In addition, the ignition temperature of ordinary materials is lowered in an oxygen-rich environment.

On May 24, 1996, the U.S. Research and Special Programs Administration (RSPA) issued an interim final rule[1] that prohibits the transportation of chemical oxygen generators on passenger aircraft until Jan. 1, 1997, and the FAA issued an emergency notice[2] that any person who offers for transportation or transports chemical oxygen generators as cargo aboard passenger aircraft will be subject to swift enforcement action. [The RSPA is a DOT agency whose mission is to "make America's transportation systems more integrated, effective and secure" through research and programs that cut across transportation modes.]

The NTSB supports these actions but believes further action can and should be taken. Because chemical oxygen generators are not reusable and must be discharged before disposal, the NTSB believes that there is no need to transport expired and undepleted chemical oxygen generators as cargo on any passenger or cargo aircraft. Therefore, the NTSB believes that the FAA, in cooperation with the RSPA, should permanently prohibit the transportation of generators as cargo on any passenger or cargo aircraft when the chemical oxygen generators have passed their expiration dates and the oxidizer cores have not been depleted.

The NTSB also believes urgent action is needed to prevent the shipment of undeclared or inappropriately packaged hazardous materials. The failure to properly identify and properly package hazardous materials has resulted in other accidents and incidents.

On Nov. 3, 1973, a Pan American World Airways Boeing 707-321C crashed at Logan International Airport, Boston, Massachusetts, U.S., killing all three crew members. Thirty minutes after this cargo flight departed John F. Kennedy International Airport, New York, New York, U.S., the flight crew reported smoke in the cockpit, and the flight was diverted to Logan, where it crashed short of the runway. The NTSB determined that dense smoke in the cockpit seriously impaired the flight crew's vision and ability to function effectively during the emergency.

Although the source of the smoke could not be established conclusively, the NTSB believed that the accident sequence was initiated by a spontaneous chemical reaction that occurred when nitric acid, a corrosive and oxidizing material, leaked from a container (in which it was improperly packaged and stowed) onto the sawdust packing (which was also improper) around it. A general lack of compliance with existing regulations governing the transportation of hazardous materials and inadequate government surveillance were found to be contributing factors. Further, the NTSB concluded that most of the personnel who handled the hazardous-material shipment were inadequately trained.

On Aug. 10, 1986, a McDonnell Douglas DC-10-40, operating as a nonscheduled flight from Honolulu, Hawaii, U.S., to Chicago, Illinois, U.S., with an en route stop in Los Angeles, California, U.S., arrived without incident at Chicago's O'Hare International Airport. After the passengers and crew had deplaned, a fire, which was found to have started in a cargo compartment, burned through the cabin floor, spread rapidly through the cabin and destroyed the airplane.

The NTSB concluded that the fire had started as a result of improper handling of the chemical oxygen generator associated with a seat back temporarily stored in the compartment. The NTSB learned, as a consequence of this incident, that some air carriers were not aware that chemical oxygen generators were capable of generating high temperatures and were classified as hazardous materials when carried as COMAT in cargo compartments. Consequently, some air carriers were not taking the required precautions when shipping oxygen generators.

Following this incident, the FAA notified all domestic air carriers and foreign airworthiness authorities of the circumstances of the incident and reminded them that oxygen generators are oxidizers and, therefore, are classified as hazardous materials, which should be properly packaged and stowed securely.

On Feb. 3, 1988, American Airlines Flight 132, a DC-9-83, had an in-flight fire while en route to Nashville (Tennessee, U.S.) Metropolitan Airport, from Dallas/Fort Worth (Texas, U.S.) International Airport.[3] As the aircraft was on an instrument landing system approach, a flight attendant and a deadheading first officer notified the cockpit crew of smoke in the passenger cabin. The NTSB found that containers of hydrogen peroxide solution (an oxidizer) and a sodium orthosilicate-based mixture had been shipped in the midcargo compartment of the airplane. The shipment was improperly packaged, and it was not identified as a hazardous material.

After the hydrogen peroxide leaked from its container, a fire started in the class D cargo compartment. The fire eventually breached the cargo compartment, and the passenger cabin floor over the midcargo compartment became hot and soft. The aircraft landed without further incident, and the 120 passengers and six crew members were safely evacuated from the aircraft.

As a result of the fire on American Airlines Flight 132, the NTSB stated that, in addition to proper packaging of hazardous materials, the safe transportation of hazardous materials depends on airlines having sufficient information to identify hazardous materials presented for transportation. Accordingly, the NTSB noted that both shippers and carriers had a responsibility to determine whether materials offered for transportation were hazardous and whether they were packaged properly to ensure safe travel.

The NTSB noted that, although the American Airlines procedures for accepting packages containing declared hazardous materials were thorough and American would likely have rejected the fiber drum containing the oxidizer had it been properly identified, American Airlines procedures for accepting ordinary freight packages were not adequate. These procedures did not include routine inquiries about the possibility that hazardous materials might be included without being identified as such.

The NTSB urged American Airlines to develop checklist procedures and questions to help freight clerks identify undeclared hazardous materials offered by general freight shippers who are unaware of federal hazardous-materials transportation safety regulations. Further, the NTSB noted that the airline industry had also recognized that undeclared hazardous materials present a problem. The International Air Transport Association dangerous-goods regulations (Section 1.6.3) address precautionary measures against hidden hazards in cargo and baggage. In addition, following a series of misdeclarations of freight, Swissair imposed new requirements on shippers who describe consignments in generic terms — shipping descriptions must include the phrase “not restricted.” Unless the additional description is included with the shipping name, the cargo is assumed to contain hazardous materials.

The NTSB is concerned, based on the facts learned during the ValuJet Flight 592 accident investigation, that the practices, procedures and training of personnel involved in the identification and handling of hazardous materials remain inadequate.

When investigating the fire on American Airlines Flight 132, the NTSB noted that, because the cargo compartment was not equipped with a fire- or smoke-detection system, the cockpit crew had no way of detecting the danger until smoke and fumes reached the passenger cabin. After smoke was detected in the passenger cabin, the cockpit crew had no way to identify the location of the fire. Previously, on Aug. 8, 1984, the FAA had issued a notice of proposed rule-making, Notice 84-11, that addressed the problem of fire containment in cargo compartments by specifying a new test method for determining the flame-penetration resistance of compartment liners.

When the NTSB commented on the rule-making on Oct. 9, 1984, it advised the FAA that, although the proposed flame-penetration tests were more stringent than previous ones, a fire should not be allowed to persist in any state of intensity in an airplane without the knowledge of the flight crew, and a fire-detection system should be required in class D cargo compartments.

On May 16, 1986, the FAA issued a final rule to amend fire-safety standards for cargo or baggage compartments. The final rule adopted more stringent cargo-liner burn-through tests and made class D cargo compartments smaller, but it did not require fire-detection systems in class D cargo compartments.

The FAA cargo compartment fire-protection research and testing did not consider the effect that hazardous materials might have on the ability of the cargo compartment to contain a fire. The FAA concluded in its final rule that the effects of hazardous materials were beyond the scope of its rule-making notice. Nevertheless, the NTSB subsequently noted that the incident aboard American Airlines Flight 132 clearly demonstrated that the possibility of hazardous-materials involvement in a cargo compartment fire must be considered in all cargo compartment fire-penetration safety standards, and hazardous materials that present unacceptable threats should be prohibited.

As a result of the fire on American Airlines Flight 132, the NTSB, on Oct. 24, 1988, urged the FAA to:

- Require fire- or smoke-detection systems for all class D cargo compartments (A-88-122); and,
- Consider the effects of authorized hazardous-materials cargo in fires for all types of cargo

compartments, and require appropriate safety systems to protect the aircraft and occupants (A-88-127).

On Aug. 10, l993, the FAA responded to Safety Recommendation A-88-122 by stating that the FAA did not believe that fire- or smoke-detection systems would provide a significant degree of protection to occupants of airplanes and that the FAA had terminated its rule-making action to require such systems. On Oct. 14, 1993, Safety Recommendation A-88-122 was classified by the NTSB "Closed — Unacceptable Action." On April 19, 1993, after no response to a final follow-up letter to the FAA, Safety Recommendation A-88-127 was classified "Closed — Unacceptable Action."

The NTSB is currently reviewing two other incidents reported by the FAA that involved fires associated with chemical oxygen generators being shipped by air. One incident occurred on Nov. 6, 1992, in Los Angeles, and the other on Sept. 23, 1993, in Oakland, California, U.S. Information obtained to date indicates that neither shipment of oxygen generators was declared to be a hazardous-materials shipment.

These occurrences involved oxidizing materials that were transported as cargo without having been declared or properly packaged as hazardous materials. The NTSB stressed in its report of the American Airlines Flight 132 incident the importance of air carriers having policies, practices and training to effectively screen passenger baggage and freight shipments for undeclared or unauthorized hazardous materials. Nevertheless, acceptance of undeclared and unauthorized shipments of hazardous materials continues to pose a significant threat to passenger and cargo aircraft.

Therefore, the NTSB recommends that the FAA:

- Immediately evaluate the practices of, and training provided by, all air carriers for accepting passenger baggage and freight shipments (including COMAT) and for identifying undeclared or unauthorized hazardous materials that are offered for transport. This evaluation should apply to the practices and training of any person, including ramp personnel, who accepts baggage or cargo for transport on passenger and cargo aircraft (Class I, Urgent Action) (A-96-25);
- Require all air carriers, based on the evaluation performed under Safety Recommendation A-96-25, to revise as necessary their practices and training for accepting passenger baggage and freight shipments and

for identifying undeclared or unauthorized hazardous materials that are offered for transport (Class I, Urgent Action) (A-96-26);

- In cooperation with the RSPA, permanently prohibit the transportation of chemical oxygen generators as cargo on any passenger or cargo aircraft when the generators have passed their expiration dates and the chemical cores have not been depleted (Class I, Urgent Action) (A-96-27); and,

- In cooperation with the RSPA, prohibit the transportation of oxidizers and oxidizing materials (e.g., nitric acid) in cargo compartments that do not have fire- or smoke-detection systems (Class I, Urgent Action) (A-96-28).♦

References

1. *Temporary Prohibition of Oxygen Generators as Cargo in Passenger Aircraft*, Docket HM-224, at 61 FR 26418 on May 24, 1996.

2. *Emergency Notice of Enforcement Policy* at 61 FR 26422 on May 24, 1996.

3. U.S. National Transportation Safety Board. *In-flight Fire, McDonnell Douglas DC-9-83, N569AA, Nashville Metropolitan Airport, Nashville, Tennessee, February 3, 1988*. Hazardous Materials Incident Report no. NTSB/HZM-88/02. 1988.

NEWS & TIPS

UNC Acquires Garrett Aviation Services

UNC Inc., an aviation services company based in Annapolis, Maryland, U.S., has acquired Garrett Aviation Services. The acquisition was said by a UNC spokesman to establish UNC as the world's largest independent aviation services company.

UNC services include airframe maintenance, modification and retrofitting services; avionics and aircraft interior installations; overhaul and repair of aircraft accessories and engines; aircraft maintenance and pilot-training contract services; and the manufacturing and rebuilding of jet engine and aircraft components. UNC has 5,900 employees at 78 locations in the United States and worldwide.

Garrett Aviation, based in Phoenix, Arizona, U.S., specializes in aircraft, engine and avionics service for business aircraft powered by turbofan and turbojet engines manufactured by AlliedSignal. It has 1,100 employees in the United States.

Dunlop Aircraft Tires Opens New Distribution Center

Dunlop Aircraft Tires USA has opened a new U.S. headquarters and distribution center in Crewe, Virginia. The Crewe facility will also be the base for the Wilkerson Tire Co., an independent aircraft tire retread and distribution company.

Dunlop offers in-house facilities for retreading and dynamic testing of tires up with load capacity up to 135,000 pounds (61,236 kilograms) and takeoff and landing speeds up to 335 miles per hour (539 kilometers per hour).♦

MAINTENANCE ALERTS

Static Electricity and Unstable Oxygen-fuel Mixture Result in Substantial Fire Damage

In February 1995, an Israel Aircraft Industries (IAI) 1124 (Westwind I) business jet sustained substantial fire damage while parked at the ramp at Stapleton International Airport, Denver, Colorado, U.S. The fire occurred during a routine aircraft interior/cockpit preflight check and was caused by a faulty oxygen system. Although no one was injured, the U.S. National Transportation Safety Board (NTSB) is concerned that a recurrence of this type of event, particularly during flight, could result in loss of life and property.

When the copilot turned on the airplane's main oxygen supply valve on the oxygen-system pressure reducer-regulator assembly, he heard a loud hissing sound. A fire erupted almost immediately, and the cockpit was engulfed in flames. The copilot was able to duck under the fireball and evacuate the aircraft uninjured. The pilot, who was outside the aircraft, observed flames coming through the cabin main entry door. The fire melted the oxygen regulator assembly, burned a hole in the right forward side wall of the airplane and caused substantial damage to the cabin interior before the fire was extinguished by ramp personnel.

Because of the fire damage, the investigators were unable to effectively examine the oxygen system regulator valve, but the oxygen supply cylinder was removed and examined by the airframe manufacturer. Their examination disclosed that the cylinder contained deposits of phthalates, hydrocarbons, fatty acids and n, n-diethyldithiocarbamate, the latter being a known catalyst. The report prepared by IAI concluded that oil was present in the deposits found in the oxygen supply cylinder.

The advisory alert issued to operators by IAI included this hypothesis of the accident scenario:

"Several known factors may have triggered the ignition. Atmospheric conditions existing at the time of the incident were conducive to high static-charge build-up. Refueling of the aircraft had been completed only minutes before the incident. Refueling of an aircraft can create high static-electrical potential. The crew member's clothing included a leather jacket which, when rubbed across the aircraft's lambskin-covered cockpit seat covers, may have generated a high potential static charge. As this was happening, he reached across the cockpit from the left side to grasp and open the oxygen valve.

"During the brief period oxygen is being introduced at a high rate from a pressure source (storage bottle) to an area of 'ambient' pressure, oxygen is momentarily in its most 'unstable' condition. It is believed the presence of static electricity combined with oxygen fueled by the oil within the oxygen supply caused ignition of the unstable oxygen/fuel mixture within the regulator's cavities of a force adequate to mechanically rupture a component of the regulator. The fire was then free to burn uninhibited in the atmosphere until the fuel source was exhausted."

A review of the oxygen supply cylinder maintenance records indicated that it had been serviced by Tec-Air Service Inc., a certificated repair station in East Northport, New York, U.S., in November 1990, and again at Tec-Air's Macon, Georgia, U.S., facility on Jan. 11, 1994. According to Tec-Air records, the service included removing the cylinder valve, inspecting and cleaning the cylinder interior, testing the cylinder hydrostatically, cleaning and overhauling the cylinder valve, purging/recharging the cylinder and checking it for leakage.

In December 1994, the U.S. Federal Aviation Administration (FAA) had inspected Tec-Air's East Northport facility and found that it was in violation of, or had failed to demonstrate compliance with, 10 sections of the U.S. Federal Aviation Regulations (FARs). The investigation cited numerous occasions on which Tec-Air had approved oxygen-cylinder assemblies and aircraft fire extinguishers for return to service when the equipment was actually unairworthy. Based on the results of this investigation, the FAA suspended Tec-Air's repair station certificate. Tec-Air executives later pleaded guilty to five felony counts of providing substandard equipment to customers.

The FAA issued a notice in Advisory Circular (AC) 43-16, *General Aviation Alerts*, referring to unairworthy emergency equipment and recommending that appropriate action be taken to ensure that any oxygen components serviced by Tec-Air were indeed airworthy. The NTSB does not believe that the detailed service/inspection requirements necessary to ensure continued airworthiness of such equipment, particularly oxygen-supply cylinders and regulator assemblies, have been or will be complied with as a result of this FAA advisory.

In view of the sudden and potentially catastrophic nature of oxygen system failures, as illustrated by this incident on this Westwind I aircraft, the NTSB has issued a Safety Recommendation calling for the FAA to issue an airworthiness directive applicable to all emergency equipment last serviced by Tec-Air Services, requiring detailed inspection, testing and servicing as necessary to ensure its continued airworthiness.

Technicians involved in maintaining and inspecting aircraft with oxygen systems, or other emergency equipment using pressurized containers and associated components, should review the maintenance records and component certification tags to ensure that components subjected to faulty work by Tec-Air facilities are properly identified and inspected. This incident also illustrates that oxygen systems are highly intolerant of carelessness or neglect.

Fuel Contamination Is Primary Cause of Fatal Helicopter Accident

In February 1995, a Eurocopter AS-350B helicopter operated as a public-use aircraft by the Massachusetts (U.S.) State Police (MSP) lost engine power shortly after takeoff and crashed into a boathouse. Both pilots and two passengers were killed, and the aircraft was destroyed.

After takeoff, the helicopter had climbed to about 600 feet (183 meters) above ground level and proceeded over the Charles River. Witnesses on the ground reported observing smoke coming from the engine as the aircraft turned toward the river bank, descending at a steep angle. They also reported that the rotor blades appeared to be turning slowly when the aircraft struck metal structures attached to the boathouse, eventually coming to rest on its roof.

The U.S. National Transportation Safety Board (NTSB) determined that many factors led to the accident, but the primary causal factor was fuel contamination. Investigation by the NTSB revealed that the loss of engine power resulted from contaminated fuel that had clogged the engine fuel-injector ports.

Fuel samples from the 6,000-(U.S.) gallon (22,710-liter) storage tank from which the helicopter had been fueled disclosed that the fuel had degraded thermal properties and contained iron oxide (rust) and water. The water content of samples taken from the storage tank ranged from five times to 800 times the maximum allowable.

In reviewing MSP policies and procedures for maintenance and quality control of the fuel facility, the NTSB found that:

- The tank had not been maintained or inspected in 14 years;
- The filter was a 25-micron separator element, normally used in diesel fuel applications (the filter manufacturer recommended a one-micron element for use with jet fuel); and,
- The MSP had no written or verbal maintenance procedures for the fuel storage and dispensing system.

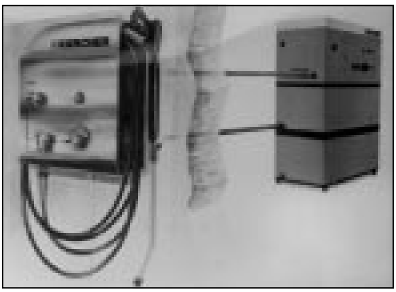
The NTSB found many other deficiencies in the MSP public-use helicopter operation, such as lack of structured training, lack of published operations procedures, lack of flotation equipment for the helicopter, lack of personal flotation devices for passengers and crew and lack of survival training.

This accident illustrates the importance of having a fuel-quality control program to avoid allowing contaminated fuel to enter an aircraft fuel tank.

Maintenance technicians should monitor fuel storage and dispensing facilities used in servicing their aircraft. Even though another section of the operation (or a commercial dealer) may have direct responsibility for fuel facilities, technicians should provide oversight to ensure that fuel dispensed into aircraft under their care is free of contamination. A well-documented, periodic inspection and maintenance program is critical to ensuring that aviation fuel facilities provide clean, uncontaminated fuel at all times.♦

High-pressure Cleaning System Offers Flexibility for Multiple Locations

Alfred Kärcher Inc. has announced the availability of high-pressure facility-cleaning systems that supply water through multiple stations, each programmed to provide water at the appropriate pressure and volume, soap and chemicals. The systems feature microprocessor control, low-oil shutoff switches and temperature-safety switches.



High-pressure cleaning system

Hot-water versions, which use either a built-in heater or the building water-heating system, are available.

For information, contact: Alfred Kärcher Inc. Telephone: (908) 356-1199. Internet World Wide Web: http://www.Karcher.com/akus.

"Bumpy Bar Codes" Aid Tracking of Aircraft Tires

A "bumpy bar code" system for permanently bar coding aircraft tires has been developed for Goodyear Tire & Rubber Co. The raised bar codes will be used on all aircraft tires produced at the company's factory at Danville, Virginia, U.S.

Bar codes printed on gummed labels were introduced on retail products about 20 years ago, but bar codes have previously been unsuccessful in tire applications because they were susceptible to damage or were rubbed off in routine operations.

Bumpy bar codes

Now, through a procedure created by Sensis Corp. of DeWitt, New York, U.S., the bar code is molded into the tire sidewall using an embossing process during the tire curing process. The resulting bar code can help aviation operators and regulatory agencies monitor tire use. An aviation tire can be retreaded as many as 10 times during its service life, according to a Goodyear spokesman, but the bumpy bar code can be read on a tire throughout its lifespan.

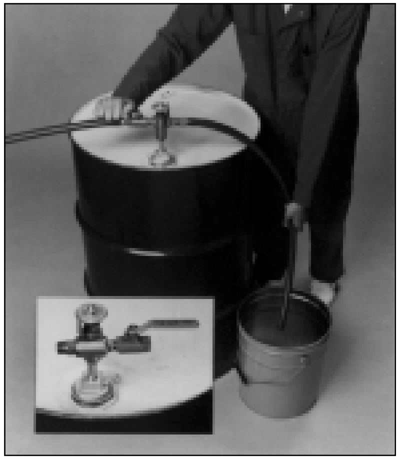
The patented bumpy bar code readers also read bar codes created through photochemical etching or laser engraving, in addition to those created by embossing and molding.

For information, contact: Goodyear Tire & Rubber Co. Telephone: (216) 796-4994.

Mixer Produces Uniform Parts-cleaning Detergent

Force-Flo Inc. has introduced a detergent mixer that automatically blends detergent and water to create a uniform emulsion in any proportion, using only water-line pressure.

The Force-Flo detergent mixer is inserted into a 55-(U.S.) gallon (208-liter) drum of parts-cleaning detergent, and the detergent-to-water ratio is regulated by a fingertip adjustment setting. Models include brass, nickel-plated and stainless-steel units, in three-gallons-per-minute and 10-gallons-per-minute (11.3 liters-per- minute and 37.9 liters-per-minute) capacities.



Detergent mixer

For information, contact: Force-Flo Inc. Telephone: (216) 431-7270; Fax: (216) 292-5957.

Bird-repellent Device Emits Varied Ultrasonic Sounds

Bird-repellent devices to keep birds out of hangars have included stuffed owls, plastic hawks, sticky goos and various sound devices. Bird-X Inc. has introduced its UX-4 ultrasonic sound generator, which the company claims is more effective than other devices.

The system uses four piezo-ceramic speakers to project powerful ultrasonic sound waves in a pattern of overlapping "fans," which Bird-X says provides 360-degree coverage in a building. The broadcast is said to be harsh and irritating to birds, but too high-pitched for humans to hear. Adjustable variations in speaker sequencing, frequency and warble rate are said to make it possible to tailor the system to end each bird infestation problem.

The constantly changing sounds are intended to make it difficult for birds to become acclimated to any sound pattern. The unit has no moving parts, is easily mounted and can be provided in 110-volt or 220-volt versions. For more information, contact: Bird-X Inc. Telephone: (312) 226-2473; Fax: (312) 226-2480.

Security Chests Protect Tools from Theft and Weather

Power Team has announced a new line of job-site and maintenance security chests to help protect valuable tools and equipment from theft and weather. Constructed of 16-gauge steel, the chests are built with arc-welded seams for extra strength. Full-length hinges securing chest covers

Security chest

to bodies are said to provide increased theft protection.

Single- or double-latch tabs allow padlock protection, and the chests include mechanical cover supports and two 1.5-inch (3.8-centimeter) skids. Each chest is drilled for optional casters, and fold-down handles on the ends are provided for carrying.

The security chests are available in sizes ranging from five cubic feet (1.5 cubic meters) to 25 cubic feet (7.6 cubic meters). For information, contact: Power Team, 2121 W. Bridge Street, Owatonna, MN 55060-0993. Telephone: (800) 541-1418 (United States and Canada); (507) 455-7100; Fax: (800) 288-7031 (United States and Canada); (507) 455-7122.♦

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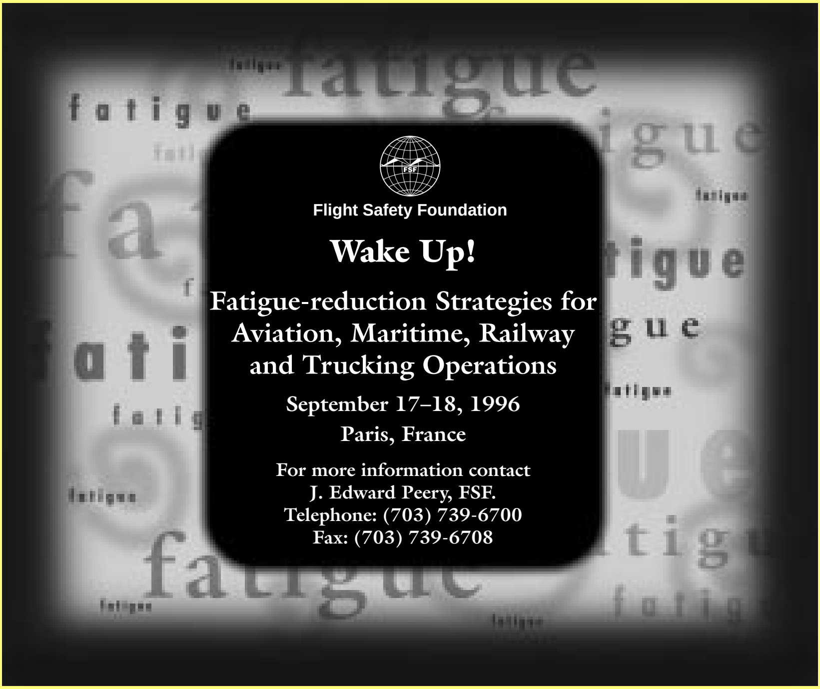
Flight Safety Foundation
Wake Up!
Fatigue-reduction Strategies for Aviation, Maritime, Railway and Trucking Operations
September 17–18, 1996
Paris, France
For more information contact
J. Edward Peery, FSF.
Telephone: (703) 739-6700
Fax: (703) 739-6708