Foreign Object Damage: Elimination Should Be a Priority to Reduce Risks to Personnel and Equipment

by
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Foreign object damage (FOD) costs the U.S. aviation industry alone more than US$1.25 million in damages each year, but the problem is shared by non-U.S. airlines worldwide.

Contrary to general opinion, FOD is not just a jet engine problem. Turbine jets, turbo-props, reciprocating engine aircraft and rotorcraft are all subject to varying degrees of FOD. If an aircraft has an engine or a propeller, it is susceptible to FOD. Even auxiliary power units (APUs) have been damaged by foreign objects.

One of the classic turboprop FOD events occurred some years ago at what was then Allegheny Airlines. The inaugural flight of the Convair 540, which was to have initiated prop-jet service between Pittsburgh and Philadelphia, Pennsylvania, taxied from the gate with a full load of executive passengers and media representatives when the left prop lifted an improperly secured fueling pit manhole cover, resulting in major damage to prop and

engine. The total length of the inaugural "flight" was about 50 feet.

Damage to turboprop engines is not as common as in jet engines, because the inlets are generally smaller and the propeller serves as a first line of defense. Nevertheless, first-stage impeller nicks and scratches are caused when small stones and debris are picked up from the runway during propeller reverse pitch operation after landing.

FOD Is Rough On Turbines

Turbofan engines are not nearly as forgiving as turboprops. While cases of in-flight engine ingestion are more plentiful, the most serious incidents generally occur on the ground.

The most common in-flight FOD is caused by birds. Hundreds of instances of in-flight bird ingestion have been reported, ranging from a single bird in a single engine to several birds in more than one engine. In some cases, pilots elected to return to the departure airport. Other incidents resulted in an in-flight shut-down of one engine. But in the majority of reports, the flight continued to its normal destination.

Less common, but more dangerous, are the occasional in-flight incidents involving ingestion of parts of the aircraft such as fueling caps and access panels secured improperly. Also hazardous are chunks of ice formed from leaking water service fittings or from in-flight ice buildup that breaks away into the airstream and the "blue ice" buildup that results from leaking lavatory servicing fittings.

A Boeing 727 lost its right engine during flight when the torque resulting from the almost instantaneous freeze-up of the engine, following the ingestion of a large chunk of blue ice, exceeded the shear rating of the engine mounting bolts.

While little can be done to prevent in-flight bird ingestion and the shedding of routine ice buildup, we can improve inspection and maintenance practices regarding fuel caps, access panels, and water and lavatory service panels. Figure 1 (page 3) shows six days' of trash collected during consecutive sweepings on the ramp area of a major airport. It is an assortment typical of what can be found on almost any airport ramp — soft drink cans, a smokeless tobacco can, valet bag hang-up hooks, a wheel from a suitcase, tags, snaps, buckles and straps from luggage items, coat hangers, nuts, bolts, a spoon, cotter keys, safety wire scraps and miscellaneous metallic junk that could destroy an engine or tire.

Figure 2 (page 3) shows some un-

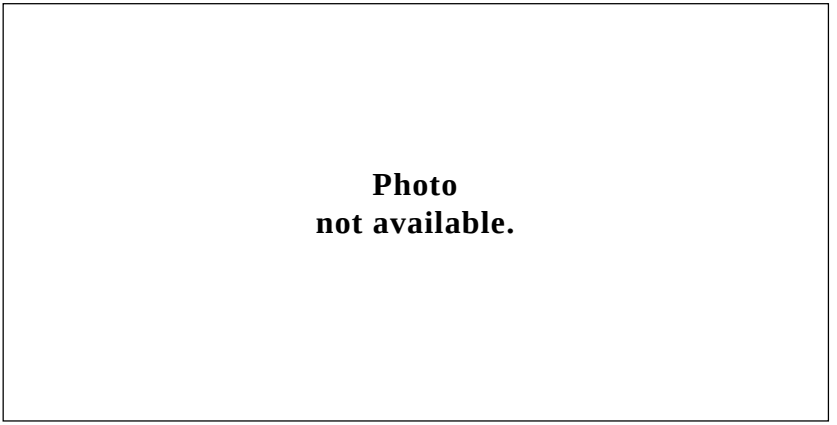


Figure 1

usual trash picked up from the ramp and deposited in an FOD box attached to a tug. The quantity of unsqueezed pop rivets testify to poor FOD awareness and lack of concern for maintenance costs.

The following illustrations demonstrate what these bits of trash can do to the turbine blades of an engine. Figure 3 shows a bolt that has completely pierced the blade. Figures 4 and 5 (page 4) show how extensive fan blades can be damaged by foreign object ingestion. Foreign object debris may come from a number of sources, as the examples show, but one often-overlooked area of potential FOD trouble is sometimes right underfoot — loose blacktop patching.

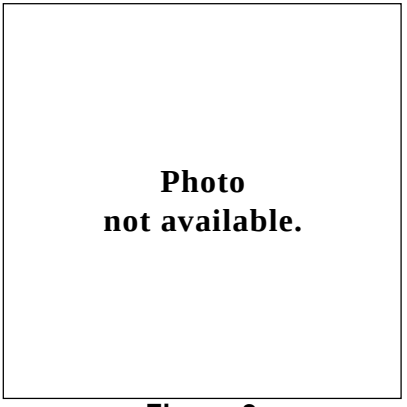


Figure 2

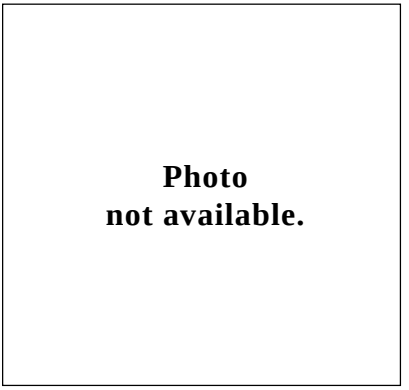


Figure 3

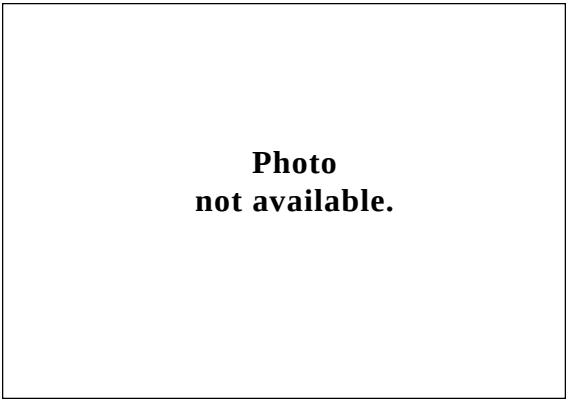


Figure 4

Inspect ramps and taxiways. Check all patches for security and integrity. Check the joints between concrete slabs for loose or bubbled asphalt. It is possible for large chunks of asphalt to stick to tires as heavy jets taxi across joints on a hot summer day. In an incident involving a DC-9, the asphalt came loose and flew into the suction pattern of the engine and was immediately ingested, causing more than $250,000 in damage.

Other common sources of FOD are dumpsters and trash containers placed (with good intentions) on ramps or at gate areas, but later allowed to fill to overflowing because of inadequate pickup schedules.

One need not look far or wait long to find FOD incidents waiting to happen. The ramp area at one airport was frequently strewn with gravel, particularly after strong winds or heavy rains. The source was a poorly stabilized gravel roof on an adjacent building.

Reports indicate that small stones, soil particles and pieces of paving are more prevalent on operational surfaces after a heavy rain or a sustained period of rain. This situation is believed to result from water-loosened debris from surface cracks and grassy areas being forced to the surface where strong winds, jet or prop blasts can blow them onto runways and taxiways.

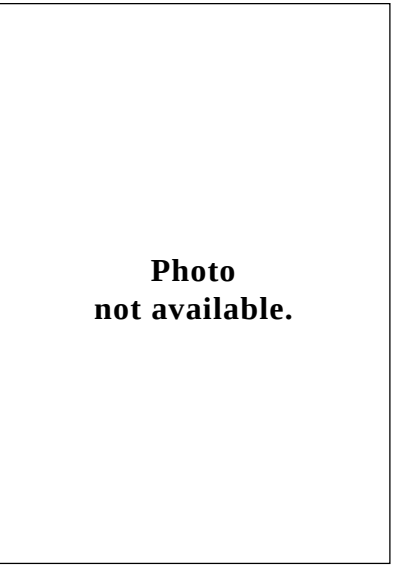


Figure 5

Even a mechanic's uniform jacket (complete with his name patch) was recently retrieved from an active runway. Investigation revealed that he had placed it on the landing gear while working on an aircraft and forgot to remove it before the aircraft departed.

Ground Personnel Also Exposed to Risk

Ground personnel risk being injured by turbofan engines if simple precautions are not followed.

According to Boeing Co. data, 13 instances of ingestions associated with ground personnel were reported for the B-737 aircraft alone in a four-year period. Eight incidents involved personnel while troubleshooting engine oil leaks, three while performing engine trim, one while adjusting engine oil pressure and one during refueling operations.

In one incident, a mechanic was sucked backwards into an engine but managed to hang on to the nacelle inlet. Although his coat was burned from the friction of the spinner on his back, he emerged from the incident frightened but uninjured.

The McDonnell Douglas Service Magazine reported on the experience of an airline employee who ventured too close to the inlet of a wing-mounted jet engine. According to the report, "the suction force pulled him toward the inlet. His hat and headphones were ingested, but fortunately he was able to save himself by hooking his elbow around the nose cowl lip."

These near tragedies are a reminder that the suction forces of a jet engine constitute a danger to anyone who is present in the area of an operating engine. A lack of awareness or understanding of the invisible forces surrounding the engine inlet fosters complacency among ramp personnel who work in the vicinity of engine inlets while engines are running.

Figure 6 (page 6) illustrates the strength of the pulling forces near the inlet of a wing-mounted engine operating at takeoff thrust. While the forces listed in this chart are based on a DC-10 engine, forces of this magnitude are typical for most wing-mounted engines.

The pulling force felt by a person too close to a jet inlet is the same force felt in a strong wind, except that a wind of 25 mph (40 kilometers per hour) only exerts a force of 20 pounds (9 kg) on a person of average size. By comparison, a force of about 1,000 pounds (450 kg) is exerted on a person standing about a foot in front of a turbine engine operating at takeoff thrust. Even with the engine

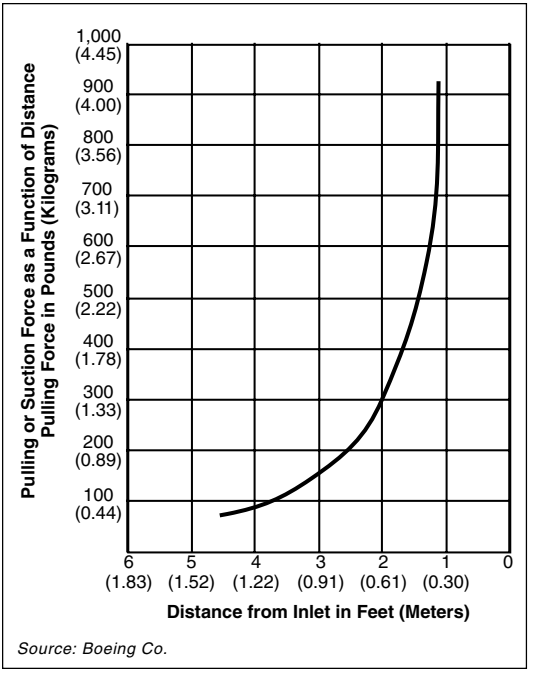


Figure 6

at idle, the pulling force is greater than 300 pounds (135 kg).

Considering that a person with nothing to hold onto can offer only about 95 pounds (42.75 kg) of resistance by skidding on the bottom of his or her shoes, the force of an idling engine is sufficient to pull someone into the spinning compressor blades. It is certainly enough to pull in loose articles of clothing, hats, rags and even small notebooks from shirt or jacket pockets.

As Figure 6 illustrates, the pulling force increases rapidly as the distance between the inlet lip and the object decreases. Moving from a point three feet (91 cm) from the lip to half this distance increases the pulling force from about 150 pounds 67.5 kg) to 600 pounds (267 kg), or four times greater. Merely turning the body from profile to full face can double the force, and standing up from a crouched position can triple the effects.

Not only do the pulling forces increase rapidly as an object moves toward the inlet, but airflow directions change rapidly around the inlet and can cause a body passing through the different directions of airflow to twist and tumble out of control. In addition to these dangers, natural winds and uneven forces caused by sudden gusts can expand the normal danger area. Moreover, buildings, fences, and the aircraft fuselage and wings can create highly localized wind forces and unpredictable shears that will add to the inlet-induced flow field, requiring additional safety margins.

The fact that an engine is small or running at idle is no excuse for a casual attitude. Although the airflow of a smaller engine is less, the suc-

tion forces are just as powerful as those produced by larger engines. Even though engines are not usually run at high thrust in maintenance, ramp or terminal areas, the throttles could be advanced without warning ground personnel.

Never leave an auto throttle system activated while running an aircraft engine on the ground. Pull circuit breakers and install lockout rings, or remove units or connectors and tag the controls with red warning tags. Many acts can cause unintentional throttle advancement.

Every aircraft manufacturer publishes data outlining the dangerous areas around engine inlets. Know these areas for all aircraft that you normally handle or service. Make sure that all personnel with ramp access know and understand these hazards. If you have a normal run-up area, paint wheel locator marks on the ramp and outline the engine hazard areas. Also have personnel oversee visitors or strangers who are on the ramp.

Although FOD is never funny (only expensive and frightening), some of the FOD reports are indeed bizarre. If it is movable and hangs around an airport, chances are that it has tried to go through an engine — with varying degrees of success. The numbers of flight bags, valet bags, flight and maintenance manuals, work stands, ladders, tools, tool boxes, portable lights, power units and radio test sets ingested are well known to most ground personnel. Consider the following:

- An aircraft from Argentina required extensive repairs following a collision with a horse. The engine manufacturer's local representative said in his report that the engine had ingested parts of the animal and a "large quantity of pre-processed hay."

- In another incident, a turbo-prop aircraft tangled with a pheasant. The remains of the bird passed through the propeller and both impellers and wedged between the turbine plenum and the combustor, causing a flameout. The aircraft landed safely and the engine was removed and sent to the manufacturer for repair. But it sat in its sealed shipping container for a couple of weeks in 110-degree F (43.3-degree C) weather. When the container was opened no one could get near enough to disassemble it until it had aired for another few weeks.

Rotorcraft Are Not Immune from FOD Events

"Foreign object damage? Not on rotorcraft! It's the downwash, you

know. Blows all the junk off the pad. We don't have the problem fixed-wing aircraft do. Those wing-mounted engines in particular are just big vacuum cleaners!"

That is what many helicopter operators believe about FOD and rotorcraft.

Helicopter turbine inlets are higher off the ground and many have inlet screens. Tail rotors are generally much higher than fixed-wing props. Movement on the ground at speeds high enough for tires to pick up debris and fling it into inlets or rotors is very rare.

Nevertheless, helicopters do encounter FOD problems. They are different from the problems experienced by fixed-wing machines, but still a problem.

Engine manufacturers and repair agencies say they see damage from the ingestion of nuts and bolts, bits of safety wire and an occasional tool — most left inadvertently in the inlets or ducts during maintenance.

Airframe manufacturers all have active FOD programs. Boeing Helicopters considers the elimination of FOD to be a factor in job security and maintains a FOD hotline. In the manufacturing area and on the flight-test line, Boeing employees have bright orange bags clipped to belts or worn over the shoulders. These bags provide a constant reminder and a convenient receptacle for debris and are periodically emptied into bright red FOD trash cans located conveniently around work areas.

Winter also poses potentially serious FOD problems. At an airport just after a heavy snowfall, the highways had been plowed and salted, and the airport roadways were plowed and sanded. In front of a corporate hanger, a helicopter was picking up several passengers. A large limousine drove onto the pad and parked close to the entry door. While it was parked there, all four fender wells deposited large globs of snow and slush (well laced with highway salt) onto the tarmac, where it continued to melt.

The limousine departed, driving much of the snow into a thin layer of slush. The passengers and the flight crew walked through this mess and boarded the aircraft. At takeoff, the downwash kicked up a lot of salt-laden moisture that drifted across the ramp and settled on two corporate jets. After the departure, someone dutifully brushed up the residue and shoveled it onto a snow bank beside the ramp where it continued to melt and run across the ramp. Three aircraft were immediately contaminated with corrosion-producing salts and more were exposed to salt contamination until rain had diluted the salts and washed them away. All

this happened because no one had thought to restrict the limousine from entering the air operations area.

If snow is forecast, ensure that the ramp areas are free of debris and not trapped or buried under the snow. Ramp taxiway and runway expansion strips that were loosened during the summer may be pushed up and out when water collects underneath, which expands when frozen.

Ramp vehicles with tire chains that have broken links are especially dangerous. Inspect chains carefully when installing them and during use.

Where multiple rotorcraft are operating close to each other, the cleanliness of the ramps and pads is extremely important because the downwash from one aircraft can pick up trash that can enter inlets and can cause rotor damage or erosion to nearby machines.

What can be done to prevent FOD? The process of eliminating or reducing foreign object debris that causes damage begins with all employees, regardless of job or title. If you work at an airport or heliport, you can help. No matter where you are, keep an eye out for debris on the ramp, pad, hangar and shop floors. If you see something, pick it up. It is good exercise and there will be one less hazard.

In addition, consider a FOD elimination program for your airport or facility. Airline maintenance supervisors usually have a program to control FOD problems and usually share their information with other operators. Talk to airport operators or supervisors. Schedule a walk on the ramp to collect trash. Call a session with other operators at your field and schedule a cleanup, then display the results at a seminar on FOD. When everyone sees the collected debris piled on a table, they will realize the seriousness of the problem. Call your engine manufacturer or overhaul agencies. They are generally very cooperative and can often provide damaged parts, posters, films and videotapes for your seminar.

If your airport has a sweeper, vacuum and/or a magnetic pickup device, see when and where it is scheduled to be operated. If its use is not frequent enough, discuss the problem with airport management.

Commercial magnetic pick-up devices are relatively expensive, but I saw a Jeep with a large electro-magnet hung from the snow plow support that operates satisfactorily. The magnet was constructed of two three-foot diameter, half-inch soft iron plates, with the coil wound from a couple of surplus power cords from a 28-volt direct current (DC) aircraft power unit, powered by a 100-amp aircraft generator, and driven by the Jeep engine.

Another approach is to install magnets on the bottoms of frequently used ramp vehicles. Check your local avionics shop for defunct magnetrons from the older radars (have them take the tubes out) and you will have a powerful pickup device that works every time you cross the ramp.

When conducting runway and taxiway inspections, take a can of fluorescent spray paint and outline any areas of bad sealant, spalled or cracked areas, etc. This will alert flight crews and assist maintenance crews in locating areas in need of repair.

Tool kits that have a molded cutout for each tool make an inventory of all tools at the end of a job extremely simple and increases safety. One mechanic outlined all of his tools on sheets of 1/4-inch plywood cut to fit the drawers of his tool box. He then cut out the outlines on a scroll saw, stained and varnished the plywood and secured the sheets to the drawer bottoms with double faced tape. The red bottom of the drawer shows through the cutout if a tool is not in its proper place. It is convenient, attractive, efficient and, above all, a big contribution to safety.

FOD problems can be avoided by:

- Stressing the importance of the problem;
- Providing a flow of FOD information and communication;
- Organizing an FOD program or becoming an active participant if such a program is in place;
- Involving your own personnel;
- Training all employees exposed to areas where FOD exists or can occur;
- Setting an example, by being visible and by picking up debris;
- Holding employees and supervisors responsible for their areas;
- Providing adequate receptacles for trash and debris and assuring timely pickup;
- Appointing a supervisor for a daily check of ramp, hangar, maintenance areas and taxiways; and
- Preventing vehicles that have been operated on off-airport highways from driving onto an air operations area.

If you decide that FOD prevention is not your job, chances are FOD will not be prevented. A good FOD program can save thousands of dollars, reduce delays, cancellations,

expensive down time, and protects jobs and lives. ♦

About the Author

John F. O'Neill Jr. is president of JAYFON Enterprises, an aviation consulting company. O'Neill was employed for 28 years at USAir, where he served in a variety of positions, including director of development engineering and manager of avionics, systems and equipment engineering. He is a frequent contributor to technical aviation publications and is a U.S. Federal Aviation Administration-designated engineering representative.

ANSI Standard to Be Made Available via CD-ROM

All standards published by the American National Standards Institute (ANSI) are now available in CD-ROM (compact disc-read only memory) format. A contractor has scanned ANSI standards cover-to-cover and integrated the standards with the latest CD-ROM technology and high-speed search and retrieval software. This service will allow users with personal computers with CD-ROM capability to locate ANSI standards within seconds. Bulky and time-consuming paper files of ANSI standards can be eliminated.

In announcing this service, ANSI President Manuel Peralta said: "In the past, ANSI members have expressed the desire to gain quick and easy access to American National Standards. Keeping pace with the ever-changing world of high technology is a continuing challenge for the Institute and the standards community. This service will allow the business community to use CD-ROM technology in research, strategic planning and standards operations."

Individuals interested in this service should contact ANSI's Customer Service Department at (212) 642-4900.

Industrywide Standards for Piston-powered Aircraft Engine Oils Issued by SAE

The Society of Automotive Engineers (SAE) recently published the first industrywide standards for piston-powered aircraft engine oils. The new standards define specifications for all grades of oil, including multiviscosity oils. These new standards are a result of five years of work by representatives from SAE, the U.S. Navy, various aircraft engine manufacturers, research labs, testing facilities and oil suppliers.

Dennis Boggs, lubricants technical director for Phillips 66, said: "The industry needed a standardized approval system that would include every oil on the market today and would encourage development of new oils." Boggs added: "Standards for aviation oil really haven't changed much since the 1940s, but

the oil chemistry has."

Pilots and technicians will not see any major differences in the oils. However, they should be aware of the new terminology that will appear on labels and in literature.

Old	New
Mil-L-6082	SAE J 1966 (This specification now includes aviation grades 65 and 100.)
Mil-L-22851	SAE J 1899 (This specification includes ashless oils, as well as multigrade oils.)

Free Textbook on Remote Visual Inspection Offered

The Olympus Corp., one of the leading manufacturers of remote visual inspection (RVI) equipment used in the aviation industry, is offering a free copy of a textbook, "The Science of Remote Visual Inspection," to technicians who respond to a questionnaire included in one of Olympus' recent mailings.

To maximize customer satisfaction and exchange information to improve RVI, Olympus has published a brief six-question mail-in card for user response. The free textbook is offered in return for completing the questionnaire.

Technicians interested in receiving the questionnaire may contact Olympus Corp., Industrial Fiberoptics Division, 4 Nevada Drive, Lake Success, NY 11042-1179 U.S.

Training Offered in the Human Element in Aviation for Maintenance Managers

Richardson Management Associates Ltd., which has its head offices in Montreal, Canada, has announced a training session designed to increase skills in managing people, conflict, authority, safety and performance for maintenance managers and supervisors.

Courses are scheduled May 18-21, 1993, in London, England, and June 7-11, 1993 in Montreal, Quebec, Canada.

For information contact: Richardson Management Associates Ltd., 2054 Sherbrooke Street West, Suite 102, Montreal, Quebec, Canada H3H 1G5. Telephone (514) 935-2593 or Fax (514) 935-1852. ♦

This information is intended to provide an awareness of safety problems so that they may be prevented in the future. Maintenance alerts are based upon preliminary information from government agencies, aviation organizations, the press and other sources. The information may not be entirely accurate.

NTSB Reports Incident Similar to Fatal Continental Express Accident

Investigators from the U.S. National Transportation Safety Board (NTSB) have reported that a maintenance error, similar to that which resulted in a 1991 crash of a Continental Express EMB-120, forced a flight operated by the same carrier to return to the airport after takeoff on Dec. 9, 1992. The pilots reported that vibrations were noted in the control column shortly after takeoff. The flight returned to the airport 12 minutes later. There were no injuries and no additional damage was found on the aircraft.

NTSB investigators found that 12 screws had been left out of the left aileron following maintenance in that area. Airline officials stated, "This incident did not affect the airworthiness of the aircraft in any way. It stemmed from the failure of two individuals to perform their duties properly." The mechanic and an inspector responsible for the work were discharged, according to an airline spokesman.

Investigators were particularly concerned about this incident because of its similarity to a maintenance error in 1991 when a number of screws were left out of the horizontal stabilizer leading edge, causing a crash that killed all 14 people on board. In both cases, someone at the commuter airline's Houston base had failed to reinsert fasteners after performing maintenance.

Faulty Wiring of Cockpit Voice Recorders Found in Several Commuter And Charter Airplanes

While investigating several small jet and turboprop aircraft accidents, the U.S. National Transportation Safety Board (NTSB) found that the

recorded information on the cockpit voice recorder (CVR) was nearly useless in three instances.

All CVRs use a continuous tape that records the last 30 minutes (or 15 minutes in some cases) of communications and conversation in the cockpit. The continuous loop tape is erased just prior to passing over the recording head. In several of the accidents and incidents under investigation, the tape had not been erased and the recording was overwritten on the previous recordings. The CVRs were installed on aircraft such as the BAe Jetstream 3101 and the Learjet series. All the CVRs were manufactured by B+D Instruments and Avionics.

Analysis of the installation disclosed that the circuit that should have enabled erasure of the tape under normal operation had not been properly connected. As a result, the erase function was disabled and the tape was being constantly overwritten. Because of a peculiarity in this particular unit, this fault is not recognized in the normal self-test of the CVR system.

On Feb. 8, 1993, the NTSB recommended that the U.S. Federal Aviation Administration (FAA):

"Require a one-time inspection of all aircraft equipped with a cockpit voice recorder manufactured by B+D Instruments and Avionics to ensure that the erase-enable jumper is properly installed. This inspection should be completed within 120 days of the recommendation.

"Require B+D Instruments and Avionics to modify the self-test circuitry in its cockpit voice recorders (CVRs) so that the CVRs will fail the internal self-test if the erase-enable jumper is not installed. This modification should be accomplished at the next unit overhaul or within two years, whichever comes first.

"Require B+D Instruments and Avionics to revise the procedures contained in its approved installation manual to include a test or tests that will detect a cockpit voice recorder installation with an inadequate erase-enable jumper placement."

Lack of Lubrication Cause of DC-8 Landing Gear Bogie Beam Failure

A DC-8-71F aircraft operated by a package carrier recently experienced a failure of the swivel bogie beam assembly of the left main landing gear bogie beam while taxiing for takeoff. The main landing gear was severely damaged. However, there were no injuries to the crew and no structural damage outside of the gear.

The swiveling bogie beam assembly is incorporated in the design of the main landing gears of the DC-8 series 20, 30, 40, 50, 60 and 70 airplanes. The swiveling bogie beams connect the forward set of wheels to the aft set of wheels, permitting sharper turn angles during taxiing than could be achieved without the swivel feature. The primary components of the swivel bogie beam assembly are the aft and the forward bogie beams, which are assembled together by a swivel pin through two lugs on the forward beam and two lugs on the aft beam.

A U.S. National Transportation Safety Board (NTSB) investigation of this incident disclosed that a separation of the bogie beam assembly occurred in the upper and lower swivel pin lugs of the forward bogie beam. Metallurgical examinations of the failed lugs disclosed that the upper lugs fractured because of overstress; however, the lower lug fractures stemmed from two small areas of stress corrosion cracking. Extensive pitting corrosion was found in both origin areas.

Although the lugs are equipped with grease fittings, there was little, if any, lubricating grease evident in the swivel joint. Since 1969, there have been 22 service difficulty reports (SDRs) of swivel bogie beam failures. All these failures were attributed to stress corrosion or excess wear because of insufficient lubrication.

The current manufacturer's maintenance manual calls for lubrication of the bogie beam swivel joint(s) every 350 to 400 flight hours. It was discovered, however, that the on-aircraft maintenance planning (OAMP) document for the 70 series DC-8 does not include a specific task card to lubricate these points.

On May 17, 1990, as the result of a failure in the swivel joint, the manufacturer published a service letter alerting operators of DC-8-50/60/70 airplanes to the importance of proper lubrication of this assembly and reiterated the recommendation to lubricate these swivel joints each 350 to 400 flight hours. On May 9, 1991, as a result of another bogie beam failure, the manufacturer issued a revision to this letter calling for the lubrication interval to be reduced to 75 flight hours. No action was taken to require that the lubrication period be included in the operator's routine maintenance program. During the investigation of the incident that occurred on August 21, 1992, the NTSB alerted the manufacturer to the omission of the lubrication task from the OAMP and a change was subsequently proposed calling for this lubrication at a 75-hour interval.

Because lubrication of the swivel pin joint in the bogie beam assembly has not been included in the OAMP document, the NTSB is concerned that other operators of the DC-8 may

not have lubricated these joints on a regular or sufficiently frequent basis. Consequently, the NTSB has recommended that the U.S. Federal Aviation Administration (FAA):

"Require operators of DC-8 airplanes to lubricate the main landing gear bogie beam swivel joints at an appropriate interval.

"Issue an Airworthiness Directive to require, within a reasonable time, a one-time inspection for evidence of excessive wear, pitting corrosion, and stress corrosion cracking in the swivel joints of bogie beams of all main landing gears of DC-8 airplanes that incorporate a swivel bogie beam configuration. During this inspection, special attention should be given to examination of inside diameter surface and unpainted areas of the upper and the lower swivel pin lugs in the forward and aft bogie beams."♦

NEW PRODUCTS

Low-cost Device Detects Leaks

A non-invasive leak detection instrument, the Leakcheck Contact Probe, has been introduced by ICC Federated. The unit is designed to identify changes in the amplitude of the ultrasonic signal emitted by any movement within a mechanical system.

The manufacturer claims that the unit can be used to detect leakage through a check valve or shut-off valve. The liquid or gas flow emits a steady rushing sound. A properly seated valve should emit no sound.

The ultrasonic signal is sensed by the instrument's probe and transmitted to a piezo-ceramic transducer that converts the mechanical vibration to an electrical signal. This signal is processed and amplified by the unit's electronics and is heard through

Photo not available.

headphones.

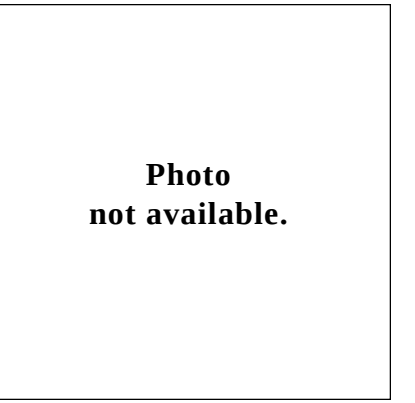
Mechanical problems in gearboxes and other rotating components also can be detected by this system, according to the manufacturer of the unit.

For more information, contact: ICC Federated, 2200 South Street, Racine, Wisconsin 53404 U.S. Telephone (414) 639-6770.

Expandable Plastic Cable Wrap Eases Line Application

The M.M. Newman Co. produces a full line of spirally cut cable wrap and abrasion protective wrap that it says can be easily applied without tools. The flexibility and ease of application make this product especially useful to the line technician making repairs or modifications to existing installations because the wrap can be installed without disconnecting terminal connectors or harnesses, the company said.

According to the manufacturer, Heli-Tube® Spirally Cut Cable wrap is Underwriters Labs (UL)-approved and is available in clear or colored polyethylene, UV-resistant polyethylene and fire-resistant white or black polyethylene. Natural and black nylon or Teflon®-based materials are also available.



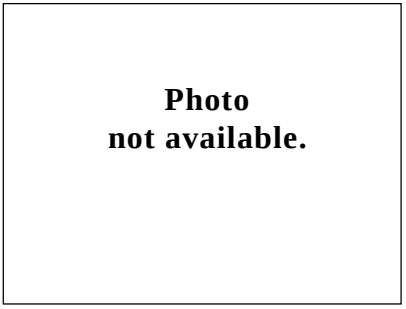
The spiral wrap makes the product especially useful for protecting wiring bundles while allowing for ease of break-outs and/or re-routing of wiring. The product is said to resist abrasion and dampen vibration of wiring and plumbing installations. For more information, contact: M.M. Newman Corp., 24 Tioga Way, Marblehead, Massachusetts 01945 U.S. Telephone (617) 631-7100.

Replacement Power Unit Alternative to AD Inspections

Aerospace Lighting Corp. has recently introduced a replacement power unit for aircraft interior fluorescent lighting systems that are subject to the repetitive inspection of

U.S. Airworthiness Directive (AD) 90-14-06. Repetitive inspections of affected installations are required by this AD to prevent overheating or fire if there is a faulty or broken connector.

The manufacturer states that the U.S. Federal Aviation Administration (FAA) has approved the use of its protected power units as a direct replacement for the original units that are subject to the repetitive inspections. The unit is said to provide a unique fault-sensing capability instantly shuts the unit down in the event of open or short circuits, broken output wires, improperly installed or broken lamp connectors and a variety of excessive voltage conditions including arcing.



The installations are used in a wide variety of airline and corporate interior installations and the manufacturer claims that this part has received FAA approval as a terminating action to the repetitive inspections of this AD. For more information, contact: Aerospace Lighting Corp., 101-8 Colin Drive, Holbrook, New York 11741 U.S. Telephone (516) 563-6400 or Fax (516) 563-8781.

Ansul Announces Environment-friendly Fire Extinguishing Gas

Halon fire extinguishers have proven to be very effective and are widely used. Halon is, however, a member of the freon family of chemicals and has been found to be harmful to the environment because of its ozone-layer depleting characteristics. The industry now plans to phase out production of halon. U.S. industry intends to ban production of halon by December 1995, and sources indicate that a future international meeting may suggest a worldwide ban as early as 1994.

With the introduction of a new agent labeled "INERGEN," Ansul now claims to have "the environment-friendly halon replacement." According to Ansul, INERGEN is a mixture of three inert gases: approximately 52 percent nitrogen, 40 percent argon, and eight percent carbon dioxide. As a gaseous extinguishing agent, the manufacturer claims it is well suited for the protection of sensitive electronic equipment.

Ansul plans to introduce a Underwriters Laboratory (UL)-listed and Factory Mutual-approved INERGEN fire suppression system for the North American market this year. INERGEN systems are already approved and in use in some European countries, according to the maker.

For more information, contact: Ansul Fire Protection, One Stanton Street, Marinette, Wisconsin 54143-2542 U.S. Telephone (715) 735-7411.

New Type Caplug Protects Sealing Area As Well as Opening

The Caplugs Division of Protective Closures Co. has recently introduced a series of threaded plastic plugs that, according to the manufacturer, provide a unique double-sealing feature.

When screwed into a standard Society of Automotive Engineers (SAE) straight-threaded port, an integral "O-ring-type bead" on the plug fits snugly into the bevel of the threaded opening, preventing oil or fluid leakage. At the same time, according to Caplugs, a lip on the flange of the plug compresses against the boss recess, providing a positive seal that keeps paints and/or other contaminants from the sealing surface.

The RPO Series of Caplugs is described on product sheet RPO 991 and is available with a sample kit of new plugs. The design is said to be very cost-effective because it eliminates the need for a separate O-ring seal and the added labor to install it. The plugs have a serrated top for hand installation as well as a slot for screwdriver tightening and a 12-point head for socket wrench use.

For a free sample kit and further information contact: Caplugs Division, Protective Closures Co., 2150 Elmwood Avenue, Buffalo, New York 14207 U.S. Telephone (716) 876-9855. ♦