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Boeing 747 Landing Accident Reveals Flawed Maintenance Procedures

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Robert A. Feeler, editorial coordinator

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Boeing 747 Landing Accident Reveals Flawed Maintenance Procedures

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Robert A. Feeler
Editorial Coordinator

On March 1, 1994, a Northwest Airlines Boeing 747 arriving at New Tokyo International Airport, Narita, Japan, suffered a serious accident on roll-out after landing. The flight, touchdown and initial roll-out were routine. Reverse thrust was selected on all four engines, but when the flight crew moved the engine power levers out of reverse at about 90 knots, the No. 1 engine and pylon sagged, rotating about the midspar pylon-to-wing fittings, allowing the lower forward part of the nose cowl to contact the runway. The aircraft was stopped on a taxiway, with the front of the No. 1 engine contacting the ground (cover photo/U.S. National Transportation Safety Board). A large portion of the lower forward engine nose cowl had been ground away as it was dragged on the runway.

A small fire near the engine was quickly extinguished and passengers were deplaned in an orderly manner via portable loading stairs. There were no injuries to any of the occupants or ground personnel. The accident and the events leading up to it are being investigated by the Japanese Aircraft Accident Investigation Commission

(JAAIC), with assistance from the U.S. National Transportation Safety Board (NTSB). As a result of its findings, the NTSB has issued a Special Investigation Report that addresses the maintenance activity that led to the accident.[1]

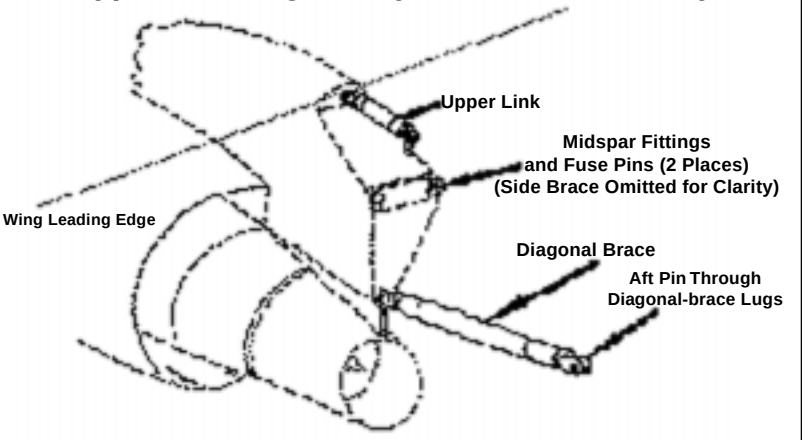
Investigators determined the chain of events leading to this accident and found, as is often the case, that no single failure but rather a series of oversights and errors allowed the accident to occur.

Fuse Pin Had Loosened

On the B-747, each pylon is attached to the wing structure at three points (Figure 1) — an upper link, the midspar fitting and the aft diagonal brace. At an unknown time prior to this landing, the aft fuse pin on the pylon diagonal brace had worked its way out of the fitting. The pin was recovered intact and undamaged, with no evidence of preexisting defects. This hollow pin is normally retained by both a primary and a secondary retention device.

The last failure in the chain of events was the forward upper-link fuse pin in the No. 1 pylon-to-wing attachment structure. This pin failed in static overload, although there was no evidence of preexisting fatigue. When this pin failed, the pylon rotated on the single remaining midspar fitting, allowing the engine to contact the runway surface.

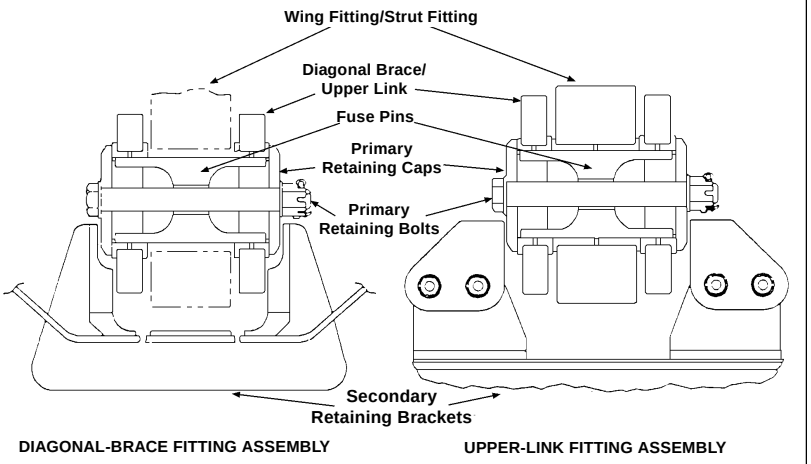
Typical Boeing 747 Pylon-brace Assembly



Source: U.S. National Transportation Safety Board

Figure 1

Diagonal-brace and Upper-link Fitting Assemblies



Source: U.S. National Transportation Safety Board

Figure 2

The primary retainer consists of a large washer on each end that overlaps the pin and bushing. The washers are secured by a retaining bolt passed through the hollow pin, and the castellated nut on the through-bolt is secured by a cotter pin.

A secondary retainer consists of a U-shaped bracket surrounding the washers, keeping them in place over the end of the pin/bushing assembly (Figure 2).

Neither the primary retainer nor the secondary retainer were found in the area of the accident. The aircraft had completed 14 flight cycles since completion of a "C" check at the airline's main maintenance facility eight days earlier. The day following the accident, airline personnel advised the NTSB and the JAAIC that a small cloth bag, containing a set of the diagonal-brace fuse-pin primary retainers and secondary retainers, had been found in the maintenance facility on a work stand that had been used during the aircraft's recent "C" check. lt was later confirmed that these parts were not reinstalled on the aircraft during the check.

This accident identifies several maintenance error causal factors. Although this accident involved a B-747, exposure to these factors exists in every maintenance facility.

Aircraft Underwent NDT Inspection

The B-747 was scheduled for a routine "C" check at the airline's main maintenance base. Along with the check, other special inspections were scheduled. One special inspection was a nondestructive-testing (NDT) inspection of the pylon diagonal-brace legs. The work card that contained the instructions for this inspection called for the removal of the U-shaped secondary retention bracket to facilitate the inspection. The work card did not call for the removal of the primary retention through-bolt and washers, and the technician who removed the secondary retainer and cleaned the fittings stated that he did not remove the through-bolt and washers.

An NDT-qualified inspector later accomplished the ultrasonic inspection of the diagonal-brace attach-point fittings. The inspector said that the primary retention through-bolt and washers were installed at the time he performed the inspection and that he had not requested that they be removed.

The work instruction card next called for the reinstallation of the secondary retention bracket. The NDT inspector stated that he had not recognized that the secondary retainers were required on this airplane and he marked this step "N/A" [not applicable] on the work card.

At some point in the check, it was found that one of the bushings in this pylon upper-link fitting had migrated out of position, and a nonroutine card was generated by the computerized planning and monitoring system with instructions to ream the fitting and install oversize bushings. To accomplish this, it was necessary to remove the engine from the airplane and then remove the pylon upper link to gain access. Because of the weight distribution within the pylon, it was necessary to remove the aft diagonal-brace fuse pin to facilitate the reinstallation of the upper link to the pylon. The technician involved in this operation said that neither the primary retention devices nor the secondary retention devices were in place on the aft diagonal-brace attachment when he removed and subsequently reinstalled the fuse pin at this location. Because the aft pin was only removed for a few minutes, no nonroutine paperwork was initiated, nor was a red cautionary tag generated and attached to this item.

An inspector was later called to perform an "OK to Close" inspection of the pylon area. He performed this check while standing on a scaffold under the wing, leaning under the batwing doors while holding onto the airplane structure with one hand and holding his flashlight in the other hand to illuminate the area. The inspector did not discover that the primary retention devices and the secondary retention devices were

missing from the aft diagonal-brace fuse-pin installation, and the pylon was cleared to be closed.

The airplane was subsequently released to service and 14 cycles later, the aft fuse pin had migrated out, leaving the pylon attached at only the upper and midspar fittings. When the engine went from reverse back to normal-thrust position after landing, the upper link was unable to sustain the stress and failed, allowing the engine to rotate downward and drag along the runway.

Maintenance System Anomalies Found

The airline has a large fleet of B-747s and many years of experience in maintaining them. There is a comprehensive work instruction card procedure and a general policies manual that are intended to provide safeguards and cross-checks to preclude maintenance errors. Nevertheless, in analyzing the sequence of events, the NTSB found several instances when the system did not preclude errors.

The chain of events leading to this accident is summarized under the following subheadings:

Failure to follow procedures. The airline's policy manual calls for a red cautionary tag to be attached to the component or attachment point when a critical part is removed for maintenance. In addition, a nonroutine item card is to be generated, calling for the reinstallation of the subject part. In this instance, the technician removing the secondary retention device did not attach a red tag on the fitting, and the technician later removing the primary retention through-bolt and washers also failed to attach a red tag to the fitting. Neither technician generated a nonroutine card calling for reinstallation of the removed safety devices.

Inadequate training of technicians. When questioned, technicians were found to have different interpretations of the airline's red-tag policy. Most of them thought that the red tag was only required when a major or vital component or system had been compromised. Other technicians said that the red tag was only required when specified on a work instruction card. These responses confirmed that this critical procedure was poorly understood among the maintenance force.

Failure to complete paperwork properly; inadequate work instructions. When completing the NDT check, the inspector had written on the work instruction card "N/A" for steps 8 and 9, which called for corrective action if defects were found. Nevertheless, in this instance, the inspector also wrote "N/A" for step 10, which called for the reinstallation of the secondary retention device. The

inspector had no recollection of this inappropriate action, but the entry was in his handwriting.

In addition, there are different configurations of fuse pins and retention devices. The work instruction card did not clearly illustrate these differences, and technicians not familiar with them might not be aware of the need for a secondary retention device on some installations.

Assumption that someone else had completed a task. The inspector performing the "OK to Close" inspection on the No. 1 pylon indicated that he had examined the work area, found no red tags or any other obvious discrepancies, and had approved the work that had been performed on the pylon. His description of an "OK to Close" inspection was a "quick area inspection for rags and previously identified problem areas." This inspector also performed the "OK to Close" inspection on the No. 4 pylon, and as he was about to approve the area for closing, maintenance personnel found the engine fuse-pin retainers for the No. 4 pylon in a cloth bag hanging on the bat-wing doors. Examination of the No. 4 pylon fittings found that the fuse-pin retainers were missing, and the technicians proceeded to reinstall them. Even after finding these missing retainers, no one took the initiative to double-check the No. l pylon, which had undergone similar work.

Failure to provide adequate tooling and equipment; implied pressure to complete a task; inspector fatigue. When performing the "OK to Close" inspection at 0600 near the end of the night shift, the inspector was working overtime on his sixth day following a regular five-day week. He and one other inspector were inspecting two aircraft in separate hangars and the two inspectors were shifting between the two hangars. Although personnel said that they were not pressured to rush a maintenance action, they were well aware that the airplane was due out at the end of the shift and that the company expected the maintenance to be completed on time.

The inspector's task was further hampered by the working environment. The scaffolding was used frequently in a paint dock and, as a result, the portable fluorescent lights that aimed upward from the floor of the scaffolding were coated with paint overspray, which diminished their brightness. These factors combined to significantly reduce the effectiveness of the inspector's visual examination of the area.

Lack of identification and control of removed parts. The handling of parts removed from an airplane-in-work was found to be inconsistent. The missing retention devices from the No. 1 pylon fuse pins were found eventually in a cloth bag lying behind a wood plank on the scaffolding that

was used at the No. 1 engine position during the "C" check on the accident airplane eight days earlier. Until hearing of the accident, no one connected the bag of parts with the accident airplane. On some work stands, boxes or racks were provided for removed parts. In other instances (such as on the No. 4 pylon of the accident airplane), the removed parts were bagged and attached to a cowling or adjacent structure. Without a defined procedure, technicians had to decide for themselves what to do with removed parts.

Lack of supervision and direction. Completion of the "C" check on the accident airplane took place on the third shift on a weekend. There was activity on two airplanes in separate hangars, the shift had minimal staffing, some of the technicians were working an overtime day and several were relatively inexperienced on the tasks that they had been assigned. These factors combined to create a need for close supervision and direction, yet management had not reinforced the supervision on this shift.

Any of the factors contributing to this accident can exist in another hangar or shop. Eliminating just one of these factors might have prevented this accident. Eliminating all of these contributory factors, wherever found, may prevent another accident.♦

Editorial note: The accident described in this article is discussed in more detail in *Accident Prevention* Volume 52 (March 1995).

Reference

1. U.S. National Transportation Safety Board. *Special Investigation Report: Maintenance Anomaly Resulting in Dragged Engine During Landing Rollout, Northwest Airlines Flight 18, Boeing 747-251B, N637US, New Tokyo International Airport, Narita, Japan, March 1, 1994.* Report No. NTSB/SIR-94/02.

Jeppesen Acquires Aviation Maintenance Publishing Company

Jeppesen Sanderson Inc., the well-known publisher of "Jepp charts," has purchased International Aviation Publishers Inc. (IAP), based in Casper, Wyoming, U.S. IAP publishes maintenance training textbooks and technical data used by aviation technicians throughout the world.

IAP's operations will be combined with Jeppesen Sanderson's training group. The familiar IAP publications will continue to be available to the industry.

Aviation Laboratories Expands Line of Test Products

Aviation Laboratories recently announced an expanded list of testing kits and services for use by aviation technicians. Kits are available for field testing of oils, hydraulic fluids, fuels and water. Field tests can be performed to detect the presence of bacterial and fungal contamination. Other field test kits are available to test anti-icing mix ratios.

In addition to field test kits, the company also provides a wide range of laboratory testing facilities such as spectrographic oil analysis program (SOAP) tests of engine and hydraulic lubricants to assist technicians in evaluating the internal condition of engines and other system components. A full listing of services and products available will be supplied upon request to: Aviation Laboratories, 5401 Mitchelldale B-6, Houston, TX 77092 U.S.

ASNT Conference and Quality Testing Show Scheduled

More than 1,500 nondestructive testing (NDT) professionals from around the world are expected to attend the American Society for Nondestructive Testing (ASNT) 1995 Fall Conference and Quality Testing Show, Oct. 16–20 at Loews Anatole Hotel, Dallas, Texas, U.S. The conference will examine the dominant role that NDT plays in ensuring the safety and reliability of products and assemblies in a variety of applications. Professional program tracks currently under development for the conference include penetrating radiation, international coordination of NDT technologies, infrared/thermal NDT, and general NDT topics and applications. More than 75 technical presentations will be made during the program.

On Oct. 19, ASNT will also host a one-day symposium on "Advances in Ultrasonic Technology." Topics will include flaw detection, sizing and evaluation, past, present and future techniques, codes and standards, data acquisition, analysis and management, and modeling. Nearly 100 NDT equipment manufacturers and service companies are expected to attend and exhibit their products.

For program details and registration information, contact: ASNT Marketing/Membership Department, 1711 Arlington Lane, P.O. Box 28518, Columbus, OH 43228-0518 U.S.

University Professor Works to Make Riveting Less Debilitating

The stress that riveting-equipment operators endure when building and repairing aircraft can result in debilitating hand and wrist injuries. Ergonomic rivet tools developed by John Cherng, University of Michigan–Dearborn (UMD) mechanical engineering professor, aim to reduce the tools' vibrations and prevent such work-related injuries.

Since 1989, Cherng has been involved in a joint research project with U.S. Industrial Tool and Supply Co. in Plymouth, Michigan, U.S., to develop percussive and pneumatic tools that minimize the worker's exposure to high vibration. The company and the state of Michigan's Research and Economic Development Program have supported the project. "Because the rivet hammer's hitting force must be maintained to effectively and efficiently flatten the rivets, the source of the vibration can't be altered," Cherng said. "The challenge was to reduce vibration levels received by the workers by only adding damping to the tool or isolating the vibration with a soft spring."

Cherng's work in the campus's acoustic and vibration laboratory measured the vibration levels in conventional tools and analyzed data that led to changing the position and shape of the rivet hammer's handle, stiffness of the spring and effectiveness of damping devices. Other changes included a damping bucking-bar handle to isolate vibration. This can be accomplished by adding an air chamber, using a recoilless spring or putting polymer-based dampers in the middle of the bucking bar.

According to the test results, the ergonomically modified bucking bars reduced the vibration level between 40 percent and 75 percent compared with conventional bars. Vibration reduction for the rivet hammers ranged from 20 percent to 53 percent improvement when recoilless springs and some damping devices were added to the hammers. Two years ago, the ergonomic rivet tools were tested

by riveters at a major military repair facility. This year, U.S. Industrial Tool and Supply will introduce ergonomic rivet hammers and bucking bars into the market, and the company will continue its research and development of tools for the aircraft industry.♦

MAINTENANCE ALERTS

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, press information and other sources. The information may not be entirely accurate.

Battery-powered Equipment Poses Spark Danger

A technician was recently performing a fuel-valve modification that required him to access the fuel tank interior and then remove a cover plate on a component within the fuel tank. The technician was using a cordless (battery-powered) screw gun. It was not explosion-proof. While removing the screws that secured the internal access plate, the motor in the screw gun ignited the fuel vapors inside the tank, causing an explosion that killed the technician and destroyed the aircraft wing.

Technicians should inspect all portable lights and electrical tools to ensure that they are approved for such use before using them in a flammable environment. Supervisors and safety officers should develop a training program to educate all personnel concerning explosion hazards when working in a flammable environment.

Mission Safety International has issued this warning: "Remember: Just because it doesn't have a cord hanging from it doesn't mean it won't create a spark!"

Nonmandatory Service Letter and Service Bulletin Made Subject of Safety Recommendation

In late 1993, a Hiller UH-12E helicopter crashed while attempting to make an emergency landing in the western United States. The pilot, who was the sole occupant, sustained minor injuries

and the helicopter was substantially damaged. Subsequent investigation disclosed that the outboard tension-torsion (TT) bar pin for one of the blades had fractured. The outboard TT bar pin extends from the main rotor-blade root fork and serves as an attachment point for the inboard end of the main rotor-blade drag strut. Forces applied to the pin and drag strut by the main-blade root fork change the pitch of the main rotor blade. Fracture of the TT bar pin causes a main rotor blade to rotate freely about the blade hub, resulting in possible loss of control of the helicopter.

Metallurgical examination at the U.S. National Transportation Safety Board (NTSB) materials laboratory revealed that the head of the outboard TT bar pin (P/N 51452) had separated, with the fracture intersecting the bolt through-hole where the drag strut is attached to the pin. Two fatigue cracks originated from corrosion pits along the surface of the bolt through-hole. The pin had accumulated 369 total hours of operation at the time of the accident, which occurred about 73 hours after a 100-hour inspection of the helicopter. The pin has a retirement life of 643 hours.

Dye-penetrant inspection of similar pins on a second helicopter of the same type disclosed a crack at the bolt through-hole in one of two pins examined. This pin had accumulated 489 hours of use. An analysis of earlier UH-12 series accident reports revealed that a UH-12E had had a similar failure in 1992.

Cracking of the outboard TT bar pin was the subject of a manufacturer's service letter (SL) in 1978. The SL advised owners of UH-12D/E helicopters to perform visual inspections of the main-rotor outboard TT bar pin for proper alignment. If the outboard drag-strut terminal and the blade trailing edge are found misaligned by more than 1/16 inch [1.6 millimeters], the SL recommends that the alignment be corrected by repositioning the TT bar pin. An improperly aligned TT bar pin can cause the drag strut to put a large twisting moment on the head of the TT bar pin and crack the head of the pin. In addition, the SL recommended that the head of the outboard TT bar pin be inspected for cracks by the dye-penetrant method at each No. 3 check (100-hour intervals).

In 1983, a Hiller service bulletin (SB) advised owners of UH-12A through -12E models and OH-23D/F/G, and all Hiller helicopter models converted by supplemental type certificate (STC) 178WE and 177WE, to install shims between the flats of the TT bar-pin head and the clevis of the inboard drag-strut terminal. This SB also called for a dye-penetrant inspection of the TT bar pins. But neither the earlier SL nor the SB were mandatory, and the helicopters involved in the accidents

cited above had not been inspected or modified as recommended. The NTSB believes that if the instructions in the SB had been followed, the dye-penetrant inspection would have been sufficient to detect cracking before the defect became critical.

The NTSB has recommended that the U.S. Federal Aviation Administration (FAA) issue an airworthiness directive (AD) that would require dye-penetrant inspection of the TT bar pins at 100-hour intervals. It also recommended that the AD require checking and adjusting the alignment between the drag strut and the TT bar pins, as well as installing shims at the inboard drag-strut terminal location in accordance with the 1983 SB.♦

NEW PRODUCTS

UltraTech International Introduces 'Target' Funnel

UltraTech International Inc. has introduced a 25-inch (63.5-centimeter) diameter "target" funnel for pouring waste products into drums. Overspills and the mess associated with the use of smaller, conical funnels are said to be eliminated. The channeled surface diffuses splashing and allows filters or partially drained containers to be inverted for complete draining without spilling over the edge. The octagon shape of the unit fits both closed- and open-head drums of either 55-gallon (208-liter) or 30-gallon (113-liter) capacity. A hinged, lockable cover is also available to control unauthorized use of the drain container.

A second safety-related product is a "hard-top" cover for outside storage of drums of hazardous or toxic products. The P4 SpillPallet features a hinged, lockable, gull-wing cover that provides a weather-resistant container with built-in spill protection and containment to meet current U.S. Environmental Protection Agency (EPA) regulations and Uniform Fire Code Spill Containment Regulations. Units are available for two- or four-drum storage.

The Ultra-Funnel™ from UltraTech International Inc.

For more information, contact: UltraTech International Inc., 11711-2 Phillips Highway, Jacksonville, FL 32256 U.S. Telephone: (904) 292-1611.

Storage and Inventory System for Nuts and Bolts Offered

Intromark Inc. has introduced Size Master, a rack and dispenser system for storing nuts and bolts. The product is intended to reduce time spent in taking inventory and reordering stock, and to reduce the possibility of mixing up sizes when hardware is stored loosely in bins or compartments.

The Size Master™ from Intromark Inc.

The Size Master units are said to provide ample storage space and can be expanded easily when additional space is required. The racks are made of injection-molded, high-impact plastic and can be installed easily on any vertical surface. Bars are color-coded with removable labels to identify the bolts and nuts stocked in each row. For more information, contact: Intromark Inc., 217 Ninth Street, Pittsburgh, PA 15222-3506. Fax: (412) 288-1354.

New Welder-protection System Is Available

Hornell Speedglas Inc. has introduced a complete welder-protection system that is said to offer unique safety and comfort features for technicians operating welding and plasma-spray equipment. This system provides:

- Auto-darkening lens mounted in a Zytel welding hood with two side-window peripheral lenses that increase the user's field of view;
- A hard hat that meets American National Standards Institute (ANSI) Z89.1 Class A standards; and,
- A filtered powered-air respirator that can be operated from a

The Welder Protection System by Hornell Speedglas Inc.

rechargeable battery pack capable of eight hours use between charges, or with typical "shop air" filtered to U.S. Occupational Safety and Health Administration (OSHA) and International Organization for Standardization (ISO) standards.

For more information, contact: Hornell Speedglas Inc., 2374 Edison Blvd., Twinsburg, OH 44087 U.S. Fax: (216) 425-4576.

FluxClean System Combines Flux Remover with Brush

Chemtronics has introduced a flux removal system for use in electronic component repair that is said to have several advantages over previously used materials. The CFC Free Flux Off 2000 FluxClean Brush System uses a flux remover delivered by an aerosol container, and contains no ozone-depleting compounds. Included with the system is the FluxClean brush, a spray nozzle and an extension tube.

CFC Free Flux Off® 2000 from Chemtronics®

The manufacturer claims that the system allows the user to precisely apply solvent only where it is needed to gently loosen and to remove synthetic and no-clean fluxes. The solvent is said to dry rapidly, to leave no residue and to offer excellent material compatibility. The cleaner removes oils, greases and ionic and nonionic soils. The flux remover is noncorrosive, safe for most surfaces and requires no rinsing. Recommended applications include surface-mounted device pads, plugs, sockets, heat sinks, switches and relays, and printed circuit boards.

For more information, contact: Chemtronics, 8125 Cobb Center Drive, Kennesaw, GA 30144 U.S. Telephone: (404) 424-4888.

Headset Is Designed For Use in Deicing Operations

CeoTronics Inc. now offers a special headset for use by ground personnel in aircraft deicing operations. The manufacturer says that the headset offers:

- A water-resistant microphone and speakers;
- A noise-canceling electret microphone for clear transmission;
- A heavy-duty coiled cord, tested to 40,000 bending movements; and,

- Compatibility with deicer truck/unit systems.

For more information, contact the distributor: Aviation Excellence, 3312 Shorecrest Drive, Dallas, TX 75235-2015 U.S. Telephone: (214) 902-9300.

Borescope with Video Image Offers Lower Cost Alternative

Borescopes have long been recognized as valuable inspection devices, and with the advent of video technology, their applications have been greatly expanded. Sophisticated borescopes having video capability, however, have been too costly for widespread use in smaller shops and maintenance facilities. With the introduction of their video adapter unit, Titan Tool Supply Co. Inc. claims to have overcome this cost barrier with the Series F Borescope.

Series F Borescope from Titan Tool Supply Co. Inc.

The basic Series F Borescope, which is normally supplied with a flashlight handle for complete portability, includes an adjustable focusable eyepiece and a 5/16-inch (7.9-millimeter) diameter, 24-inch (60.9-centimeter) long flexible viewing tube with straight and 90-degree vision fields. With the addition of its video adapter, Titan claims that its borescope is one of the lowest priced inspection scopes on the market and should be within the price range of all shops where quality control and part inspections are critical. The manufacturer further says that the video adapter option is so designed that it can be used with 95 percent of all competitive borescopes on the market.

For more information, contact: Titan Tool Supply Co. Inc., P.O. Box 569, Buffalo, NY 14207-0569 U.S. Telephone: (716) 873-9907.

Shipping Labels Meet DOT Requirements

U.S. Department of Transportation (DOT) regulations now have very specific requirements for labeling of shipping containers that include hazardous materials. D & G Sign and Label now offers a series of shipping labels for hazard classes 1 through 9. According to the manufacturer, these labels contain the required wording to meet DOT regulations and are available in magnetic, self-stick

vinyl, flexible plastic or rigid plastic to suit any need.

D & G also offers other products to help users comply with U.S. Occupational Safety and Health Administration (OSHA) and U.S. National Fire Prevention Association (NFPA) regulations. For a free catalog and sample products, contact: D & G Sign and Label, P.O. Box GAC-157, Northford, CT 06472 U.S.

New Gasket Material Reduces Corrosion at Antenna Mountings

Raychem Corp. recently introduced a new conductive gel gasket that is said to provide a more reliable, cost-effective means of preventing corrosion at avionic antenna mounting pads. According to the manufacturer, the GelTek conductive gasket will reduce the time and cost associated with replacing antennas and lead to longer antenna life and reduced aircraft downtime caused by corrosion under such mountings.

Rather than using corrosion-resistant coatings, the GelTek conductive gasket utilizes an aluminum wire cloth embedded in a high-performance, nonhazardous, cross-linked flourosilicone gel sealant. The gasket is said to resist contamination from fuel and other liquids that can create corrosive environments. Unlike anticorrosion coatings that might require special tooling or curing time, the gasket's plastic backing can be peeled away and applied to the antenna base of the fuselage mounting area in a single step. When it becomes necessary to remove the antenna, the maker says, the GelTek gasket minimizes the risk of damage to the skin and antenna. The gasket may simply be peeled away and replaced prior to reinstalling the new antenna without the need to scrape or clean the fuselage, as is frequently necessary with other materials.

In its compressed state, the gasket is approximately 22 mils (0.0022 inch) in thickness. The gasket provides excellent electrical grounding of the antenna base to the structure to dissipate static and conduct away any lightning strikes. Electrical bonding values between the antenna base and the aircraft skin are claimed to be significantly less than the 25 milliohm requirement typical of original equipment manufacturer grounding specifications. Gaskets are available in precut shapes that can be locally cut to fit any antenna configuration.

For more information, contact: Kathy Kelly, Raychem Corp., 300 Constitution Drive, MS 110/7568, Menlo Park, CA 94025 U.S.♦

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