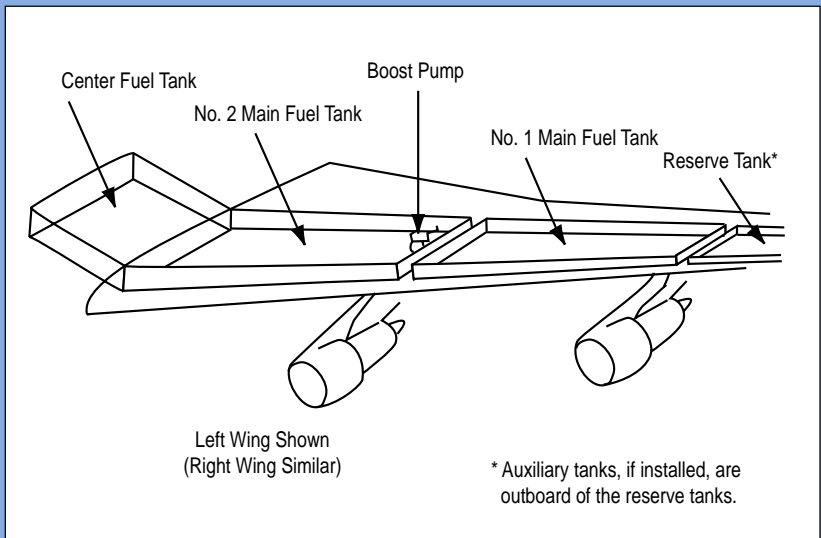




FLIGHT SAFETY FOUNDATION  
**Aviation Mechanics Bulletin**

JANUARY-FEBRUARY 1997

# FAA Airworthiness Directive Requires Inspection of Wiring And Conduits to Boeing 747 Fuel Pumps



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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**AVIATION MECHANICS BULLETIN**

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# FAA Airworthiness Directive Requires Inspection of Wiring And Conduits to Boeing 747 Fuel Pumps

*FSF Editorial Staff*

The U.S. Federal Aviation Administration (FAA) has issued an airworthiness directive (AD), applicable to many Boeing 747 models, to reduce the possibility of frayed wiring causing electrical arcing that could lead to fire or explosion in a fuel tank. The AD announcement described the rule as “an emergency regulation that must be issued immediately to correct an unsafe condition in aircraft ... .”

AD 96-26-06, which went into effect on Jan. 21, 1997, applies to B-747-series airplanes with line numbers through 432. The AD requires “a one-time inspection to detect damage of the sleeving and wire bundles of the boost pumps of the [no.] 1 and [no.] 4 main fuel tanks, and of the auxiliary-tank jettison

pumps (if installed); replacement of any damaged sleeving with new sleeving; and repair or replacement of any damaged wires with new wires.”

The FAA’s AD announcement said that the FAA had determined that “an environment conducive to vibration exists in the conduit and wire bundles of the boost pumps and of the auxiliary-tank jettison pumps, which can cause abrasion of the Teflon® sleeving and subsequent abrasion of the wires in the bundles.”

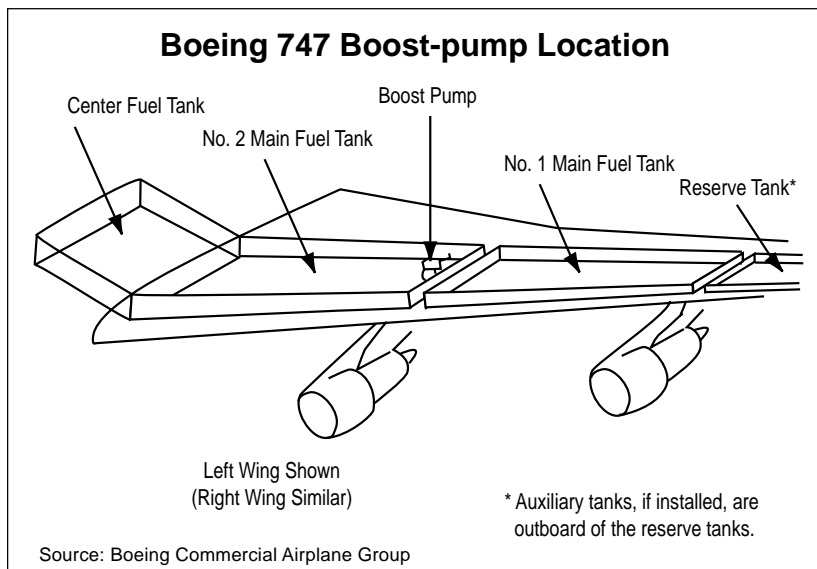
The AD references and incorporates provisions of Boeing alert service bulletin 747-28A2204, dated Dec. 19, 1996, which was reviewed and approved by the FAA.

On the B-747, the no. 1 and no. 4 (outboard) main fuel tanks each have two boost pumps that are located in dry bays (for which the slang term is “dog houses”) inside the no. 2 (left inboard, Figure 1) and no. 3 (right inboard) main fuel tanks. Electrical wiring, routed through aluminum conduits inside the no. 2 and no. 3 main fuel tanks, supplies power to the boost pumps. The wire bundles are separated from the conduits by two Teflon sleeves.

Similarly, the auxiliary-tank jettison pumps, if installed, are located in dry bays inside the auxiliary fuel tanks. The auxiliary fuel tanks, installed in a limited number of B-747s, are located outboard of the reserve tanks.

Electrical power for the jettison pumps also travels through wire bundles having Teflon sleeves, inside aluminum conduits within the auxiliary tanks.

The FAA began investigating potential ignition sources in the fuel tanks of B-747s following the TWA Flight 800 accident in July 1996. [While climbing through 13,700 feet (4,180 meters) following takeoff from John F. Kennedy International Airport, New York, New York, U.S., the B-747-100 exploded. It fell into the Atlantic Ocean south of Long Island. None of the 18 crew members and 212 passengers survived. The accident is still under investigation, and the cause has not been determined. It



**Figure 1**

is known that the center fuel tank exploded, although it is unclear whether the fuel-tank explosion caused the accident or resulted from another event.]

“As part of its investigation, the FAA reviewed the actions required by certain existing ADs, and the results of a survey conducted on in-service [B-747s],” the announcement said.

In 1979, the FAA received a report that fuel-pump wires in an aluminum conduit in the auxiliary tank on a B-747 had chafed through their insulation, causing electrical arcing that burned a hole in the conduit. The damage was discovered because fuel leaked through the hole and out of the conduit at the rear spar.

The FAA issued AD 79-05-04, which required discontinuing the use of the auxiliary fuel tanks, draining fuel from those tanks, and opening and collaring the circuit breakers for the auxiliary-tank jettison pumps. Exceptions to the rule were made for airplanes in which Teflon sleeving had been installed on the wire bundles in accordance with Boeing alert service bulletin 747-28A2091, Revision 1, dated Feb. 5, 1979, or if the pumps had been previously deactivated in accordance with Boeing service bulletin 747-28-2067, dated Nov. 11, 1977. “The FAA has been advised that use of the [auxiliary] fuel tanks has been discontinued on

eight of the affected airplanes, and that Teflon sleeving has been installed on the wire bundles of two of the affected airplanes,” the AD announcement said.

“Following the issuance of AD 79-05-04,” the announcement said, “a survey involving an inspection of the wires in the conduits for the [no. 1 and no. 4] fuel-tank pumps was conducted on approximately 26 in-service [B-747s]. The results of that survey revealed that numerous wires in these conduits were chafing against the conduit,” with as much as 80 percent of the insulation thickness worn away, although none of the wires inspected at the time had completely worn through the insulation.

As a result, the FAA issued AD 79-06-02. The AD required an inspection of the wires under consideration and replacement of any chafed wires. In addition, wires were to be tied together every 15.2 centimeters (six inches), and two concentric Teflon sleeves were to be installed over the wire bundle (Figure 2, page 4).

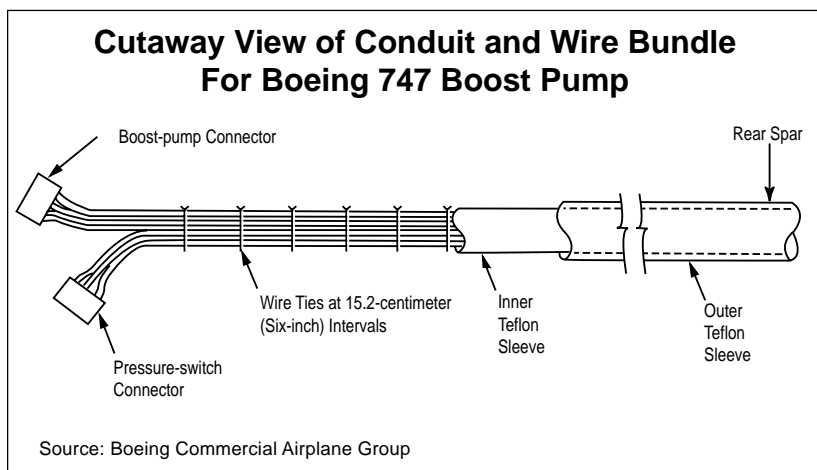
“Vibration of the conduit and wire bundles can cause abrasion of the Teflon sleeving, which could lead to abrasion of the wires in the bundles,” the FAA said. “Such abrasion, if not corrected, could result in electrical arcing between the wires and the aluminum conduit and subsequent fire or explosion of the fuel tank.”

The most recent AD announcement continued: “The FAA finds that an environment conducive to vibration still exists in the conduit and wire bundles of the fuel-boost pumps and the auxiliary-tank jettison pumps (if installed). The FAA has determined that wire chafing has occurred on [B-747s] inside other conduits located outside the main fuel tanks in the vicinity of the conduits addressed in AD 79-06-02. In some cases, chafing through both the Teflon sleeving and the wire insulation has occurred on these airplanes ... . The FAA concludes that follow-on inspections of the Teflon sleeving must be accomplished to determine if the sleeving continues to provide a protective barrier after extended time in service.”

AD-96-26-06 requires, within 120 days after its Jan. 21, 1997, effective

date, an inspection to detect and correct abrasion of the Teflon sleeving and wiring bundles. The AD gives the following directions, in accordance with Boeing alert service bulletin 747-28A2204:

- “If any damaged sleeving is found, prior to further flight, replace the sleeving with new sleeving ... ;
- “If any damaged wire is found, prior to further flight, repair or replace the wire with new wire ... ; [and,]
- “If any burned wire is found, prior to further flight, perform an inspection to detect damage of the conduit ... . If any damage is found, prior to further flight, replace the conduit with a serviceable conduit ... .”



**Figure 2**

The Boeing service bulletin describes the inspection and repair to be performed as follows: “The no. 1 and no. 4 main-tank forward and aft boost pump cover plates are removed. The boost-pump wire bundle is removed from the conduit. The sleeving/wire bundle is inspected for damage. Any damage that is found is repaired. The boost pump cover plates are installed. A test of the boost pumps is done.”

The AD requires that operators submit a report of inspection results to the FAA. The report must include the airplane serial number; the total hours in service accumulated on the airplane; the total number of flight cycles accumulated on the airplane; and a description of any damage found including where the damaged part was located.

The AD also requires that operators submit to the FAA any damaged Teflon sleeving, wires and conduits that are found. The submittal is necessary because “the FAA recognizes that the degree of wear or damage to the parts may be difficult to describe in a written report of inspection results. ... Examination of these parts will enable the FAA to determine whether a need exists to require future replacement of aluminum conduits with stainless steel conduits, and to develop appropriate compliance times based on the extent of wear or damage found.”

Both the AD announcement and the Boeing service bulletin 747-28A2204

noted a variation between earlier and more recent B-747 models. The Boeing service bulletin said that “747 airplanes [having] cumulative line numbers 001–432 have aluminum conduits for the main-tank boost pumps. All other 747 airplanes have stainless-steel conduits. If the boost-pump power wiring shorts to the conduit, it is more likely that the aluminum conduit can melt and make a hole. This could result in a fuel leak, fire or an explosion.”

The AD announcement explained that “arcing from the fuel-pump wires to the stainless-steel conduit will result in opening the fuel-pump circuit breaker before sufficient heat is generated to penetrate the stainless-steel conduit. The FAA is considering additional rule making to require replacing the aluminum conduits located in the fuel tanks with stainless-steel conduits following accomplishment of the one-time inspection required by this AD.”

The Boeing service bulletin added that “if an airplane has a non-Boeing modification or repair that affects a component or system also affected by this service bulletin, the operator is responsible for obtaining appropriate regulatory agency approval before incorporating this service bulletin.”

The AD announcement said that because “a situation exists that requires the immediate adoption of this

regulation, it is found that notice and an opportunity for public comment ... are impracticable, and that good cause exists for making this amendment effective in less than 30 days [although the FAA invited interested parties to comment on the rule even as it was being implemented].”

Another recent AD, not directly related to AD 96-26-06, specifies inspection and testing of fuel pumps on B-747s (as well as Boeing 757s, which have fuel pumps of a similar design). AD 97-03-17 requires repetitive visual inspections and testing to identify corrosion of fuel pumps on all B-747 and B-757 aircraft to prevent fuel leaks, and requires insulation-resistance tests of the fuel-pump wiring. The FAA received eight reports of fuel leaks in the vicinity of B-747 fuel pumps, and one

leak resulted in a fire in a wheel well while the airplane was on the ground.

Within 120 days of the effective date of March 14, 1997, visual inspections are to be made to detect discrepancies of the wire-terminal assembly, electrical connector and wire insulation on the fuel pump. The fuel pump is to be replaced if necessary. The repetitive insulation-resistance tests of the fuel-pump wiring include a continuity check of the fuel-pump ground wire.

Inspection and testing are to be performed in accordance with Boeing service bulletin 747-28A2194, revision 1, dated Jan. 18, 1996, for B-747s; and Boeing service bulletin 757-28A0043, revision 1, dated Jan. 18, 1996, for B-757s.♦



### **Video Demonstrates Life-extension Techniques for PT6A Engine**

A program that is said to more than double the time between overhauls (TBO) for the Pratt & Whitney PT6A engine is explained in a 12-minute technical training video offered by the MORE Co. Inc.

“The MORE Program: It’s About Time” looks at the four-step process designed to extend the life of the PT6A from the standard TBO of 3,500 hours to as much as 8,000 hours or 9,500 cycles.

The MORE Program is approved by the U.S. Federal Aviation Administration (FAA).

For more information, contact: MORE Co. Inc., P.O. Box 1059,



*Video for PT6A engine owners and operators*

Minden, NV 89423 U.S. Telephone: (702) 782-3346; Fax: (800) 650-6673 (United States and Canada); (702) 782-3349.

### **MRO '97 Scheduled For April**

The MRO [Maintenance, Repair and Overhaul] '97: Shaping the Future of Aviation Maintenance conference will be held April 13–15, 1997, in Dallas, Texas, U.S. Sponsored by the Aviation Week Group in association with the Canaan Group, the conference and exhibition will include sessions on “The Changing MRO Marketplace Track,” “Acquisition Reform,” “The Technology Revolution Track” and “Managing Outsourced Maintenance Track.”

Keynote speakers will be Harry C. Stonecipher, President and CEO, McDonnell Douglas Corp., and John H. Dasburg, President and CEO, Northwest Airlines.

For more information, contact Aviation Week Group, 1221 Avenue of the Americas, New York, NY 10020 U.S. Telephone: (800) 240-7645 (United States and Canada); (212) 512-3225; Fax: (212) 512-3334.

## **ASNT and AWS Exploring Merging of Nondestructive Examination Certification Programs**

The American Society for Nondestructive Testing (ASNT) and the American Welding Society (AWS)

are exploring the merging of their respective certification programs for nondestructive examination (NDE) Level II personnel, ASNT said.

“The intent is to have a single program that will [ensure] the performance and qualification of Level II NDE personnel who are examining welds,” the organization said.♦

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## **MAINTENANCE ALERTS**

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### **FAA Warns of Unapproved Generator Parts**

During an investigation of the Federal Air Accessories Co. in Hollywood, Florida, U.S., the U.S. Federal Aviation Administration (FAA) Suspected Unapproved Parts Program Office discovered that the facility was producing replacement generator parts for sale. Federal Air Accessories had no FAA parts manufacturer approval.

The parts include drive splines and spindles for certain Westinghouse Sundstrand generators. The generators are normally installed in engines or auxiliary power units (APUs) on the Boeing 707, 727 and 737; McDonnell Douglas DC-9 and MD-80; Convair 580; and British Aerospace 1-11. The unauthorized parts are numbered 910C605-1, 959C881-1 and 945B527-1.

Aircraft operators and maintenance facilities should determine if they have received or installed any such unapproved parts from Federal Air Accessories and if so, remove them from stock or take action to remove them from aircraft.

For further information, contact the FAA Suspected Unapproved Parts Program Office. Telephone: (703) 661-0581; Fax: (703) 661-0113.

### **Hidden Corrosion Found on Eurocopter Landing-gear Cross Tubes**

Severe corrosion was discovered under the chafing strips on the forward-and-aft landing-gear cross tubes of an American Eurocopter AS-350B1, the U.S. Federal Aviation Administration (FAA) reported.

Minor corrosion was first found adjacent to the cross-tube attachments. When the attachments were removed, severe corrosion under the chafing strips was exposed. Both cross tubes required replacement.

Corrosion of the cross tubes under the cross-tube attachment and chafing strips is unlikely to be detected without removing the cross-tube attachment. Any sign of corrosion adjacent to the cross-tube attachment should be investigated by removal of the fitting and chafing strips.

## **Suspect Fuel-pump Gears and Anti-ice Shutoff Valves Found**

The U.S. Federal Aviation Administration (FAA) has warned that certain main fuel-pump gears and anti-ice shutoff valves should be suspected of being improperly maintained until further evaluation is performed.

In an investigation of Aerosource Inc., a certificated repair station in Somerset, New Jersey, U.S., the FAA discovered that some components that had been returned to service following maintenance did not meet the manufacturer's specifications.

The suspect components are:

- **Main fuel-pump gears.** The parts affected include TRW Inc. and Argo-Tech model numbers 243600, 358200, 371900 and 378200, including part numbers 243601 (all dash numbers), 358201 (all dash numbers), 371901 (all dash numbers) and 378201 (all dash numbers); and,
- **Anti-ice shutoff valve.** The part affected is Whittaker part number 320115, installed on, among other aircraft, the McDonnell Douglas DC-9, McDonnell Douglas MD-80, Boeing 727 and Lockheed Martin L-1011.

The FAA is concerned that other aircraft components may not have been properly maintained by Aerosource Inc. Any component identified as being maintained by Aerosource Inc. should be inspected to ensure that it meets all applicable requirements.

For further information, contact the FAA Flight Standards District Office in Allentown, PA, U.S. Telephone: (610) 264-2888; Fax: (610) 264-3179.♦

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## NEW PRODUCTS

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### **New Locking Wrenches Offer Wide Range of Adjustment**

American Tool Companies Inc. has introduced a line of locking wrenches, each of which is said to be able to replace more than 16 standard and metric wrenches. VISE-GRIP® Locking Wrenches feature a jaw that locks onto three sides of a hex fastener, and the manufacturer says that a great force can be applied without marring or rounding the fastener's surfaces.

WISE-GRIP locking wrenches are available in three sizes. The model 4LW™ includes a wrench-size range from seven millimeters to 14 millimeters (0.25 inch to 0.56 inch). The model 7LW™ includes a wrench-size range from 11 millimeters to 19 millimeters (0.44 inch to 0.75 inch). The model 10LW™ includes a wrench-size range from seven millimeters to 28 millimeters (0.25 inch to 1.1 inches).

The VISE-GRIP locking wrenches are said to be constructed of high-grade steel and to include an adjusting screw that easily sizes the screw to the fastener and a release-trigger guard that prevents accidental unlocking.

For more information, contact: American Tool Companies Inc., 8400

Lake View Parkway, Suite 400, Kenosha, WI 53142 U.S. Telephone: (414) 947-2440; Fax: (414) 947-2441.

### **Sensor/Display Unit Automatically Monitors Deicing Fluid Application**

TDG Aerospace Inc. has introduced FreezePointer 100™, a product designed to improve the safety of airline operations during winter conditions. FreezePointer 100 comprises a sensor and a light-emitting diode (LED) display. The sensor is installed directly in the dispensing line of a deicing truck, and the display is mounted on the truck's dashboard. The display continuously provides the deicing crew with the freezing point of the fluid being applied to the aircraft.

The unit measures and displays the concentration of Type I, Type II and Ultra deicing fluids as they are pumped through the nozzle and onto the aircraft.

The manufacturer says that, with the FreezePointer 100 installed just ahead of the ground equipment's deicing-fluid dispenser, any mixing errors can be easily identified before application on the aircraft, thereby increasing the overall safety of the deicing. The FreezePointer unit is said to be

self-calibrating and easily installed into any 3.8-centimeter (1.5-inch) or larger standard pipe fitting. It does not affect fluid flow.

For more information, contact: TDG Aerospace, 6900 Koll Center Parkway, Mail Drop 413, Pleasanton, CA 94566-3107 U.S. Telephone: (510) 417-0910; Fax: (510) 417-0913.

## **Digital Borescope Detects and Measures Hidden Flaws**

A new remote visual inspection system that allows fast detection and measurement of defects inside turbines, compressors, airframe interiors and other difficult-to-access locations has been introduced by Olympus America Inc.

The Digital Measuring Borescope System (DMBS) includes a swing prism with a 50-degree field of view (FOV) for quickly scanning an area to locate the defect. When the defect is located, the 20-degree FOV, high-magnification digital measuring borescope is used to measure and visually inspect the defects located with the swing prism scope.

The manufacturer says that the DMBS needs no calibration. The user focuses on the defect, regardless of the contour of the underlying surface, and freezes the image. Measurements

are performed by moving a cursor on a video monitor to which the DMBS is coupled. Distance, size and depth of the defect can be measured and displayed on the monitor.



*Olympus digital measuring borescope inserted in a gas-turbine access port*

For more information, contact: Olympus America Inc., Industrial Products Group, Two Corporate Park Drive, Melville, NY 11747 U.S. Telephone: (800) 446-5260 (United States and Canada); (516) 844-5888.

## **Small, Versatile Floor Scrubber Useful for Hangars and Aircraft**

Many commercially available floor scrubbers are too large or unwieldy for use in cramped aircraft-interior or maintenance-facility spaces. Alfred Kärcher Inc. has introduced a small automatic floor scrubber and polisher

that is designed to clean both hard surfaces and carpeting, and has a working width of 43.2 centimeters (17 inches).

The model BR 400 can reach under bench tops or furniture in shop and office areas. The unit is equipped with two quick-change, counter-rotating roller brushes and a two-chamber, removable water-solution and water-recovery system. The BR 400 features a forward-and-reverse vacuum squeegee assembly that makes the unit bidirectional.



*BR 400 automatic floor scrubber and polisher from Alfred Kärcher Inc.*

The unit can be fitted with four types of brush to adapt to various kinds of hard surface and carpeting.

For more information, contact: Alfred Kärcher Inc., P.O. Box 6510, Somerset, NJ 08875-9948 U.S. Telephone: (908) 356-1199.

## **Labels Protect Important Information**

Seaton Identification Products' Self-Laminating Write-on Labels are said to protect important information from tampering, spills, soils and abrasion. The labels, 4.45 centimeters by 1.6 centimeters (1.75 inches by 0.6 inch), are made of 2-mil (0.002 inch/0.005 centimeter) polyester with a 2-mil clear polyester flap on a release liner and can be applied to any smooth surface, according to the manufacturer.

The user simply writes label information with a pen, pencil or marker; removes the liner; presses down the overlaminates; and applies the label to a smooth surface to keep information legible and tamper-resistant.

For more information, contact: Seton Identification Products, Department ZRW, P.O. Box 819, Branford, CT 06405-0819 U.S. Telephone: (800) 243-6624 (U.S. and Canada); (203) 488-8059; Fax: (800) 345-7819 (U.S. and Canada); (203) 488-0939. ♦

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**PHOENIX, ARIZONA, U.S.    APRIL 30 - MAY 1, 1997**

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