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Robert A. Feeler, editorial coordinator

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Report Recommends Team Inspections, Checklists in Repair Station Oversight

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FSF Editorial Staff

In response to concern about work performed by some holders of repair station certificates, the U.S. General Accounting Office (GAO) conducted a review of the U.S. Federal Aviation Administration's (FAA's) oversight of repair stations and in October 1997 published the results in *Aviation Safety: FAA Oversight of Repair Stations Needs Improvement.*

GAO recommended that the secretary of the U.S. Department of Transportation instruct the administrator of the FAA to:

- "Expand the use of locally based teams for repair station inspections, particularly for repair stations that are large, complex, have higher rates of noncompliance or meet predetermined risk indicators; and develop and use checklists or job aids for inspectors as a way of bringing about more comprehensiveness and standardization;
- "Specify what documentation should be kept in repair station files to record complete inspection results and follow-up actions;
- "Monitor the implementation of the strategy for improving the quality of the data to be used in FAA's new management information system, the Safety Performance Analysis System (SPAS); [and,]
- "Expedite the efforts to update regulations pertaining to the oversight of repair stations, and establish and meet schedules for completing the updates."

Concern, about the quality of work done by independent repair stations that are certified by the FAA to perform

maintenance, preventive maintenance, rebuilding and/or alterations on aircraft and their component parts, has been raised by recent aircraft accidents in which improper work done by independent repair stations was cited in the accident investigations:

- The U.S. National Transportation Safety Board (NTSB) determined that the June 8, 1995, nonfatal engine fire that destroyed a ValuJet Airlines Douglas DC-9 on Runway 27R in Atlanta, Georgia, U.S., was probably caused by an independent repair station's failure to conduct a proper inspection of the engine assembly. There were no fatalities. One flight attendant was seriously injured; a flight attendant and five passengers received minor injuries during the evacuation; the other 57 passengers and crew escaped injury;
- The probable cause of the May 11, 1996, in-flight fire and fatal accident to a ValuJet DC-9-32 near Miami, Florida, U.S., was cited by the NTSB as the failure of a repair station to properly handle unexpended oxygen generators, which are hazardous materials. All 110 passengers and crew died in the accident;
- An accident, on Aug. 21, 1995, occurred after a propeller blade separated from an engine during climb. The Embraer EMB-120 struck terrain during an off-airport landing. The NTSB attributed the accident to a fatigue crack in the propeller blade caused by corrosion pits that were not discovered or properly repaired by the propeller manufacturer's repair station. Eight persons died in the accident, 13 were seriously injured and 29 were unharmed; and,
- A June 17, 1996, engine fire in a Tower Air Boeing 747 was linked by the NTSB to a repair station's overhaul and assembly of a drive unit. The aircraft was descending for landing when the fire started in the engine-accessory gearbox. The aircraft landed without further incident and there were no injuries.

About US$6.5 billion a year is spent currently on maintaining, repairing and renovating some 6,700 U.S.-registered aircraft operated by U.S. air carriers under Federal Aviation Regulations (FARs), Part 121. Among the air carriers, nearly 50 percent of the work is performed by 2,773 FAA-certified independent repair stations. Although there are nearly 5,000 FAA-certified repair stations, the GAO focused its report on the 2,500 U.S. and 273 non-U.S. independent repair stations that perform work on aircraft with 10 or more seats. These repair stations range in size from a few people who repair a

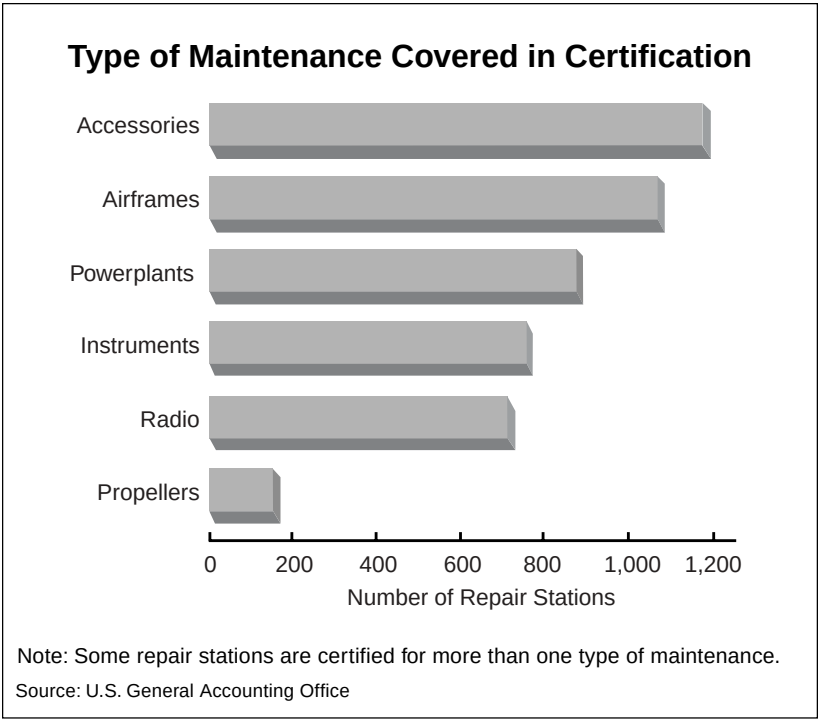


Figure 1

small range of components to thousands of employees who can rebuild entire airframes (Figure 1).

The volume of work performed by repair stations has grown substantially in recent years. Air carriers, especially new carriers, reap some economical benefits by contracting repair stations to perform their maintenance, rather than underwrite their own repair facilities and personnel. In certificating each repair station, the FAA retains the responsibility to monitor performance and ensure that work is performed in accordance with the authorization and limitations of the repair station's certificate.

The FAA's oversight has two facets: certification and surveillance. The certification process begins with a repair station's application for authority to perform specific maintenance tasks on specific aircraft. Certification is granted by the FAA after ensuring that the applicant's proposed procedures are effective and that the applicant's equipment, personnel and material meet FAA requirements.

Certification for a U.S. repair station remains valid until surrendered by the repair station or suspended or revoked by the FAA. Certification for a non-U.S. repair station must be renewed every two years.

In practice, repair station oversight is provided in two ways: by the FAA sending its own inspectors to review repair station operations, and by making air carriers responsible for ensuring that the repair stations that maintain the air carriers' aircraft, powerplants and accessories follow the air carriers' approved maintenance programs and FAA regulations.

"Under [FARs], air carriers share with FAA the responsibility of ensuring that repair stations are conducting works that meets safety standards," said the GAO report.

When contracting for major inspections and maintenance of its aircraft, the air carrier usually conducts an in-depth audit of the proposed subcontractor, prior to initiating the work, and then provides on-site representation and surveillance to ensure that all work is performed in accordance with its approved maintenance program.

For component and accessory overhaul and repair, the air carrier can rely on audits conducted by the Coordinating Agency for Supplier Evaluation (CASE), an international industry organization of airlines, aerospace and marine operators that has established common guidelines and standards for supplier approval and acceptance.

The FAA must inspect each repair station at least once a year. These inspections are conducted by an FAA flight standards district office and determine whether the repair station meets its certification requirements. An inspection reviews a repair station's operation, including the currency of technical data, facilities, calibration of special tooling and equipment and inspection procedures.

Moreover, each year a few facilities are selected by the FAA for special in-depth inspections. Repair stations are chosen for special inspections based on the results of earlier, regular inspections or for such reasons as large size and complexity.

In 1997, the FAA had about 3,000 inspectors, 600 of whom were involved in the inspection of repair stations. Of these 600, about 550 oversee repair stations located in the United States; the remaining 50 inspect non-U.S. repair stations.

The inspection of U.S. repair stations is usually undertaken by individual inspectors, and most inspectors are also responsible for other facilities, including training schools and helicopter operations. For large repair

stations, the inspections may occur over several visits. Figure 2 (page 6) shows what FAA inspectors consider to be barriers to conducting a good inspection.

The 50 inspectors who inspect non-U.S. repair stations generally work in teams, and they have few or no collateral duties because the FAA generally has no regulatory authority over operations that do not directly affect aviation in the United States.

FAA Meets Goal of Annual Inspections

The GAO report said, "FAA's records indicate that the agency is meeting its goal of inspecting every repair station at least once a year."

Among FAA inspectors interviewed for the report, 84 percent said that they believed that repair stations rated good to excellent in their compliance with FAA standards. Nevertheless, more than half of the inspectors said that there were areas of compliance in which the repair stations could improve (Figure 3, page 7).

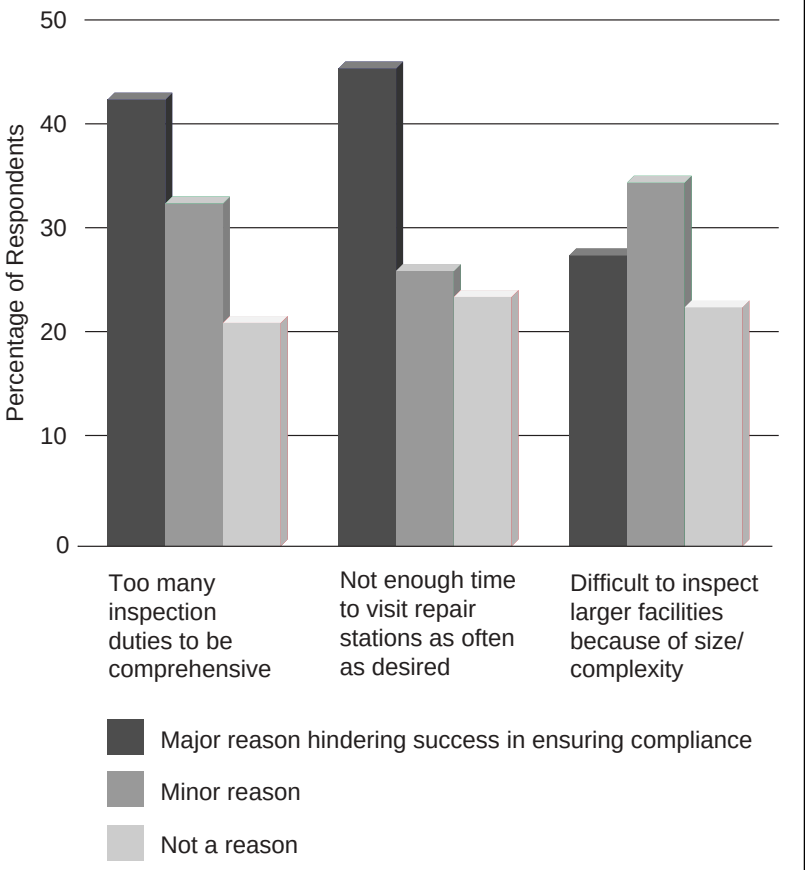
For U.S. repair stations, the FAA relies primarily on individual inspectors.

"Most of FAA's offices use the approach of assigning an individual inspector to a repair station, even one that is large and complex, rather than a team of inspectors," said the report. "When direct comparisons could be made, teams were shown to be more effective than individual inspectors in identifying those areas in which repair stations were not in compliance with FAA's rules and regulations, even if one inspector visited the facility several times and the team visited it just once."

The report said that teams are more likely to use checklists and other aids to be certain that no aspect of the inspection is overlooked. Team inspections help ensure that judgments are more objective, because team members are not likely to have an ongoing relationship with the repair station. The keys to a quality inspection — independence, comprehensiveness, focus and standardization — are found more often among teams and team members than in individual inspectors.

"Individual inspectors generally find far fewer deficiencies than teams do," said the report. "At the FAA offices we reviewed, 16 repair stations routinely inspected by individuals were also inspected by one or more special teams … . These teams found a total of 347 deficiencies, of which only 15 (or 4 percent) had been identified by the individual inspectors in the 12 [months] to 18 months prior to the [team] facility inspections."

FAA Inspectors' Responses on Barriers to Comprehensive Inspections



Note: Percentages may not add to 100 because a few respondents said they had no basis to make a judgment.

Source: U.S. General Accounting Office

Figure 2

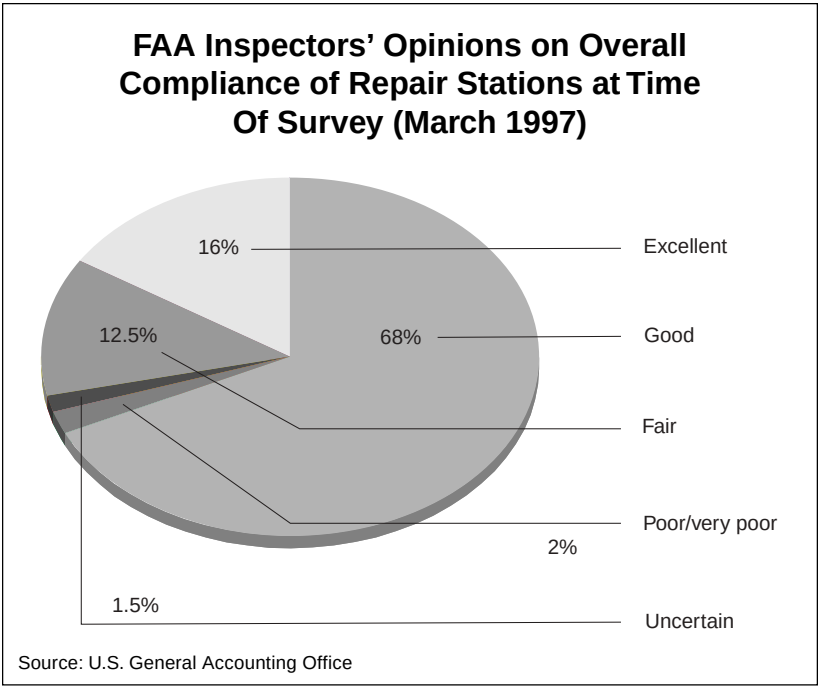


Figure 3

GAO investigators found considerable evidence that checklists (or similar job aids) are essential to a thorough inspection; that they help ensure that the inspection will be made in a structured, consistent manner; and that the results of the inspection will be more useful to the FAA.

"At present, FAA does not require the use of a checklist during a repair station inspection," said the report (Table 1, page 8).

"Officials from FAA, industry and the [U.S.] Department of Defense (which reviews air carriers before awarding defense contracts) told us that they would question the comprehensiveness of any facility inspection that was not done using a job aid or checklist. … They said the scope of the inspection of many repair stations is large enough that it is not difficult to overlook a portion of what must be covered."

Despite the value of checklists, the report said, "We also found that when individual inspectors use a checklist, they tend to use one that is not detailed enough to ensure that compliance with regulations is checked."

Table 1
Characteristics of a Quality Inspection

Characteristic	Definition/explanation
Independence	Inspectors need to be free of complacency regarding the repair station's operation. Inspectors who must inspect a repair station on an ongoing basis can lose their objectivity because they may feel they already know that the repair station's operations are in good order.
Comprehensiveness	Each inspection needs sufficient time to cover all of the elements that are supposed to be covered.
Focus	The inspection needs to be performed without distraction. This means minimizing competing demands, such as responding to repair station employees' questions or concerns about other matters. Too many distractions can prevent inspectors from conducting a thorough inspection.
Standardization	Even though repair stations are different, each one needs to be reviewed for all of the applicable requirements. Use of an agreed-on checklist or job aid helps to ensure that all similar inspections are conducted in a similar fashion.

Source: U.S. General Accounting Office

The GAO could not find documentation to determine how well the FAA was following up repair station inspections, to ensure that steps were being taken to remedy deficiencies found during the inspections.

"Thus, it was impossible to assess how completely or quickly repair stations were bringing themselves into compliance," said the report. "FAA does not tell its inspectors what documentation to keep, and the resulting information gaps lessen the agency's ability to determine how well its inspection activities are working or to identify and react to trends. …

"FAA's guidance is limited in specifying for inspectors what documents pertaining to inspection and follow-up need to be maintained in repair station files. … GAO examined records of 172 instances in which FAA sent deficiency letters to domestic repair stations. The responses from the repair stations were not on file [at the repair stations] in about one-fourth of these instances, and FAA's assessments of the adequacy of the

corrective actions taken by the repair stations were not on file in about three-fourths of the instances."

The purpose of inspecting is not to find and list problems but to resolve them. Good documentation of what action has been taken is a necessary part of showing what problems were found, what was done to correct them and whether all parties agree that the deficiencies have been corrected.

The report said, "We believe — and FAA [officials] agreed — that beyond effective documentation in the repair station files, FAA also needs an effective management information system for capturing this basic information, combining it with information from other activities and synthesizing it in ways that allow management to plan surveillance activities, schedule manpower resources, evaluate accomplishments, analyze results for patterns or trends and modify planned activities.

"FAA's management information tool for its inspection activity is its Program Tracking and Reporting Subsystem (PTRS). … The quality of PTRS data is important because PTRS is expected to provide data for FAA's new [computer-based] information management system, the [SPAS]."

Non-U.S. repair stations had better performance records than U.S. repair stations, perhaps because they are required to renew their FAA certification every two years. GAO interviewed 34 inspectors who conducted inspections of both U.S. and non-U.S. repair stations. They agreed that documentation and follow-up was better and that compliance took place more quickly at the non-U.S. repair stations.

After the May 1996 ValuJet DC-9 accident, the FAA announced new initiatives for upgrading air carriers' oversight of contracted repair stations. The initiatives call for, among other things, stricter oversight of repair stations by air carriers and more FAA review of what air carriers are doing to oversee repair stations.

The report said, "Collectively, these initiatives require that (1) air carriers demonstrate regulatory compliance for each of their contract facilities doing substantial heavy maintenance or repairs; (2) FAA ensure that air carriers list all contractors performing substantial maintenance for them; and (3) air carriers audit repair stations they want to begin using. They could also ask for additional review by FAA inspectors — mainly those who oversee air carriers."

The report noted that the FAA has been struggling with the complexities created by new airlines and deregulation, and acknowledged that additional management attention might be necessary to use FAA's resources effectively.♦

FAA Offers DER Seminars

The following designated engineering representative (DER) seminars will be offered by the U.S. Federal Aviation Administration (FAA) in 1998:

Standardization Seminar. This seminar is offered to all DERs and DER candidates. The seminar covers the history and organization of the FAA, U.S. Federal Aviation Regulations and compliance guidelines, DER authority and responsibilities, certification of aircraft and aircraft products, and continued airworthiness. U.S. seminar locations and dates are: Atlanta, Georgia, June 30–July 1; Long Beach, California, July 14–15; and Seattle, Washington, Sept. 15–16.

Recurrent Seminar. This seminar includes workshops on topics such as structure, systems and equipment. U.S. seminar locations and dates are: Long Beach, California, May 19–20; Chicago, Illinois, May 27–28; Atlanta, Georgia, July 1–2; Fort Lauderdale, Florida, Aug. 11–12; Seattle, Washington, Sept. 16–17; and Long Beach, California, Sept. 23–25.

Contact Kevin Kendall, FAA, Telephone: +(405) 954-7074; Fax: +(405) 954-4104.

Maintenance Human Factors Seminar/ Workshop Set

Transportation Systems Consulting (TSC) Corp. will offer an Aircraft Maintenance Human Factors Seminar/Workshop in Orlando, Florida, U.S., May 12–15. The event is described by TSC as "a comprehensive, up-to-date presentation by maintenance quality and human factors experts" that is "designed for an international audience [and] recognizes that English may not be the first language of some of the attendees."

Topics will include:

- Human error — true-life events;
- Overview of contributing factors to human error;
- Building a human factors program for aircraft maintenance;
- Key elements of human factors training programs;
- What is required to make a human factors program work; and,
- Measuring the success of human factors training programs.

Contact Transportation Systems Consulting Corp., 35111 U.S. 19 North,

Suite 101, Palm Harbor, FL 34684 U.S. Telephone: +(813) 785-0583; Fax: +(813) 789-1143.

FAA, Aviation Industry Associations Sponsor Maintenance Conference

The U.S. Federal Aviation Administration (FAA) Flight Standards Service and 12 aviation operations, service and supply associations will present the 4th International Aviation Maintenance Conference in Washington, D.C., U.S., July 12–15.

General sessions and workshops will include such topics as:

- Uniqueness of maintenance standards based on application;
- International and domestic repair station program, U.S. Federal Aviation Regulations Part 145;
- Barriers to international certification;
- Evolution of the regional airline industry: transforming from turboprop to jet age;
- Removing the maintenance link from the accident chain; and,
- Standardization and certification of maintenance technicians.

Contact Lee Norvell, FAA, +(202) 267-8616; Fax: +(202) 267-5559; or Joanne Stahling, Professional Aviation Maintenance Association, +(202) 216-2374; Fax: +(202) 216-9224.♦

MAINTENANCE ALERTS

Rudder Travel Restricted on Dassault 900EX

During a flight control check, the crew of a Dassault-Mystère 900EX Falcon three-turbofan-engine executive transport noticed that rudder travel was limited to about half the normal range. When the right rudder pedal was applied, a loud "clunking" noise was heard. The noise came from under the floor in the forward lavatory area. Removal of the forward lavatory floor revealed that the lavatory drain cable, part no. 55-8311-2140, was resting against the rudder torque tube and was causing the rudder travel restriction.

The U.S. Federal Aviation Administration (FAA) suggests that other 900EX operators inspect their aircraft

for a similar condition because of the short time in service for this aircraft.

Evaporator Ruptures With Rapid Cabin Decompression on Beech King Air

A Beech King Air A200 flight crew experienced excessively high cabin temperatures when they were approaching their destination. The crew changed the cabin control operating mode from automatic to manual. While they were "toggling down" the cabin temperature, a loud pop or bang was heard and was followed by rapid cabin decompression. There was mist and a strong smell of oil in the cabin, and smoke emanated from the overhead vents. After declaring an emergency, the crew safely landed the aircraft.

Investigation revealed that the suction and discharge lines running from the condenser were installed in reverse order and that the air-conditioning system evaporator was ruptured in the center area of the capillary/cooling fin. The in-flight incident occurred 4.5 operating hours after a scheduled inspection had been conducted. The air-conditioning system could not be activated for testing after the inspection because ambient and cabin temperatures were too cold.

The U.S. Federal Aviation Administration (FAA) is concerned that a decompression at high altitudes could incapacitate the aircraft's occupants if four kilograms (nine pounds) of freon and compressor oil were injected into the cabin at the same time that the pressurization system closed off all but minimal outflow.

The FAA Flight Standards District Office aviation safety inspector who submitted the report recommended that for the postmaintenance activation of any air-conditioning system, the cabin temperature should be set to a value high enough to cycle the air-conditioning system on when cooling is selected, and then reduce the temperature as needed.

Inspect Embraer EMB-120 Elevator Pitch-trim Command System

Prevention of a potential pitch control problem in Embraer Model EMB-120 series airplanes is addressed by U.S. Federal Aviation Administration (FAA) Airworthiness Directive (AD) 97-26-22. This AD requires a one-time inspection of the movable backstop of the elevator pitch-trim command system to ensure correct installation. If improperly installed, corrective action is required.

The AD also requires installation of a guide to keep the movable backstop in the proper position. These actions

are intended to prevent sudden changes in pitch attitude caused by an autopilot disconnect, which could result in reduced aircraft controllability.

The Departmento de Aviação Civil (DAC), Brazil's airworthiness authority, has received reports of uncommanded reversal of the elevator trim tab during descent when the autopilot descent mode is engaged. Autopilot disconnect, caused by the movable backstop being out of proper position, resulted in sudden pitch-attitude change.

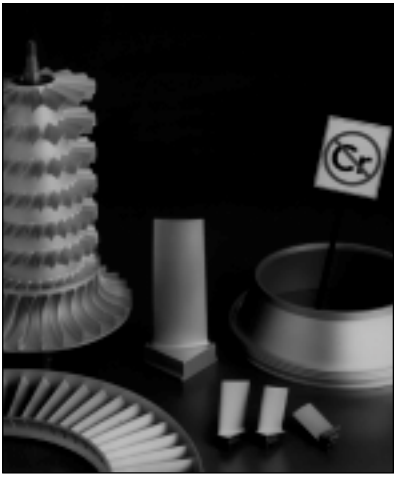
In October 1997, Embraer Alert Service Bulletin 120-27-A081 addressed this problem, and the DAC issued an emergency AD making compliance with the alert service bulletin mandatory. The FAA AD also makes the actions specified in the alert service bulletin mandatory.♦

NEW PRODUCTS

Chrome-free Coatings Protect Flight Turbomachinery Components

Chrome-free protective coatings for application to turbomachinery components such as blades, spacers, casings, shafts and hubs are available from Sermatech Technical Services. The SermeTel® Process 2000 coating system is said to protect ferrous alloys, titanium alloys and nickel against corrosion, erosion and fouling, while providing an improved aerodynamic finish.

The coatings contain no chromium compounds or other hazardous or toxic materials. An aluminum-filled ceramic base coat redirects corrosion "by sacrificing itself to protect the component," according to the manufacturer. The system also includes a chemically inert, glassy ceramic topcoat that produces a smooth, sealed finish to further resist corrosion and fouling.



SermeTel® Process 2000 Coating System

Contact Sermatech Technical Services, 155 South Limerick Road, Limerick, PA 19468 U.S. Telephone: +(610) 948-5100; Fax: +(610) 948-2771.

Single-drawer Release Secures Storage Cabinets

Stanley Storage Systems offers an optional, single-drawer release feature in its Vidmar® cabinets that prevents the unsafe opening of more than one drawer. According to the manufacturer, this feature prevents multiple open drawers from tipping a heavy storage cabinet and allows modular drawers to be fully extended for visibility and accessibility.

Contact Stanley Storage Systems, 11 Grammes Road, P.O. Box 1151, Allentown, PA 18105-1151 U.S. Telephone: +(610) 797-6600; Fax: +(610) 776-3895.

Vacuum Cleaner Filters Out Hazardous Dust

Nilfisk of America Inc.'s GB 833 vacuum cleaner, used with multiple orbital sanders, is said to reduce dust levels during aircraft repainting and refurbishing, and prevent employees from breathing in harmful dust particles.

During aircraft refurbishing, sanders create debris and dust that can cause respiratory problems for maintenance personnel. The GB 833 collects the bulk of the debris in an 68-liter (18–U.S. gallon) capacity vacuum tank. When the tank is equipped with a high-efficiency particulate air (HEPA) filter, the vacuum retains 99.97 percent of the particles down to 0.3 micron (a micron is one millionth of a meter). According to the manufacturer, this vacuum prevents ultrafine dust particles from escaping through the unit's exhaust and prevents exposure to hazardous dust particles below U.S. Occupational Safety and Health Administration required standards.

Contact Nilfisk of America Inc., 300 Technology Drive, Malvern, PA 19355 U.S. Telephone: (800) NIL-FISK (United States and Canada) or +(610) 647-6420.

Lock Secures Light Switches at "On" or "Off" Position

D&G Sign and Label's Light Switch Lockout secures standard workplace light switches in the "on" or "off" position. The company produces a line of products to aid in compliance with Occupational Safety and Health Administration lockout rulings.

Contact D&G Sign and Label, Department JF, P.O. Box 157, Northford, CT 06472 U.S. Telephone:

Light Switch Lockout
by D&G Sign and Label

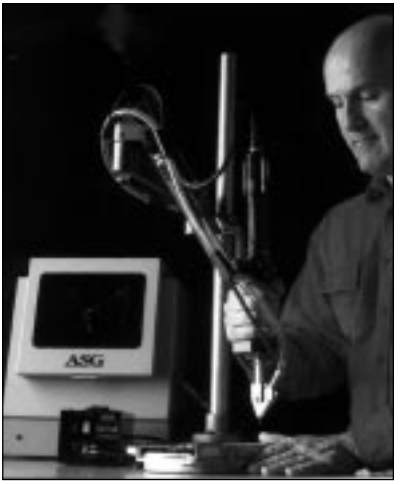
(800) 356-9269 (United States and Canada); +(203) 488-4770; Fax: +(203) 488-4770.

Automated Screwfeed And Screwdriver System Aids Assembly Productivity

ASG has announced the availability of an automated screwfeed and electric screwdriver workstation that is said to provide rapid screw insertion and precise torque control. The unit combines a vibratory bowl screwfeeder with a precision-torque screwdriver to create a "highly productive assembly workstation," according to the manufacturer.

Screws are fed, at a rate of less than one per second, to a hand-held presenter through a flexible tube. Narrow jaws allow access to "tight-quarters" assembly areas. The operator pushes the handpiece down to start the screwdriver. The driver's precision clutch automatically stops rotation when a preset torque is reached, eliminating over- or under-tightening. An ergonomic design requires minimal grasping pressure, and the torque-reaction tool holder and foam-coated handpiece are designed to reduce operator fatigue.

Contact ASG, 19520 Nottingham Road, Cleveland, OH 44110 U.S. Telephone: +(216) 486-6163; Fax: +(216) 481-4519.



Automated Screwfeed and Electric Screwdriver System by ASG

ANDSCAN®
by Krautkramer Branson

Portable Scanning System Inspects Critical Areas

A portable scanning, data analysis and documentation system for the generation of images of critical aircraft areas is available from Krautkramer Branson. ANDSCAN® can be used to check aircraft fuselage panels for corrosion, carbon-fiber composite structures for impact damage and delamination, pipeline welds for subsurface defects, and pipeline tube walls for remaining thickness.

ANDSCAN is compatible with ultrasonic, eddy current and bond-testing instruments. It collects and displays ultrasonic time-of-flight and amplitude, impedance-plane and mechanical-impedance data. Multiple channels of data can be collected and updated simultaneously.

The system software has Windows™-based, point-and-click features and results are displayed as C-scan, dual axis B-scan and operator-rotatable, three-dimensional images. The system's two scanning arms are rugged, with magnetic feet and positive action connectors (for use in plant and offshore environments). A lightweight, precision aerospace arm with suction feet allows easy articulation around complex shapes and radiused areas.

Contact Krautkramer Branson, 50 Industrial Park Road, Lewistown, PA 17044 U.S. Telephone: +(717) 242-0327; Fax: +(717) 242-2606.♦

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Disaster Response Planning Workshop for Business Aviation

June 18–19, 1998
Atlanta Airport Hilton and Towers
Atlanta, Georgia, U.S.

Who Should Attend?

- Department managers (flight, maintenance, scheduling and administration);
- Flight safety managers;
- Corporate safety/disaster response managers;
- Corporate security managers;
- Human resource/personnel managers;
- Public relations/communications managers;
- Risk/insurance and financial managers; and,
- Administrative managers.

Why Should You Attend?

- Develop your own disaster response plan—now!;
- Update your current disaster response plan (at least every other year);
- Increase the number of people in your department with skills and expertise in disaster response (one or two aren't enough);
- Improve corporate managers' understanding of the unique issues involved in an aviation-related disaster (you'll want all the help you can get); and,
- Help your department's staff after a nonaviation disaster (automobile accident, fire or act of violence).

For more information, contact: Joan Perrin, Flight Safety Foundation
Telephone: +(703) 739-6700, ext. 109 • Fax: +(703) 739-6708

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