FLIGHT SAFETY FOUNDATION

Aviation Mechanics Bulletin

NOVEMBER-DECEMBER 1996

Team of Maintenance Inspectors and Human Factors Researchers Improves Shift-turnover Log

Inspection Shift-turnover Log

Aircraft number:	Date:	Shift (Please Circle): Day Afternoon Night
Inspectors Assigned:		Projected A/C Departure Date:
Problem Workcards		
Card number	Problem	
General Problems		

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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Team of Maintenance Inspectors and Human Factors Researchers Improves Shift-turnover Log

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Robert L. Koenig
Aviation Writer

A maintenance technician was reinstalling a turbine's plugs and covers when a colleague offered to help. The first maintenance technician told the second to go ahead and install the ignitors. "I saw him install the outboard ignitor," the maintenance technician recalled later, adding that his colleague had then moved under the engine as if he were also installing the inboard ignitor. "I did not go back and check his work because I trust the work he does." The first technician signed off on the paperwork, only to learn later that his colleague had not installed the inboard ignitor.

This is one example of the many kinds of human factors, ranging from chronic overwork to poor workplace organization, that can cause problems in aircraft-maintenance facilities.

A research report, "Human Factors Program Development and Implementation," by Colin G. Drury, Ph.D., Caren Levine and Jacqueline L. Reynolds, of the State University of New York (SUNY) at Buffalo, New York, U.S., explains how a human factors program was developed and implemented at one U.S. airline.

The report outlines lessons learned from the program — that, at this facility, accomplishing program goals required focusing on one specific problem that the maintenance department could control, and that distrust of management's motives was an impediment to the program.

When human factors researchers helped develop the human factors program, they found that their initial approach — using a small work force–management team to target improvements related to specific jobs — did not work as well as it had in other industries.

"Our airline partner's specific needs required a different approach, based on involving the maximum number of people, instead of a small task force, and limiting the scope to one issue, such as communication, rather than searching broadly for [human factors] mismatches," the report concluded. "Focusing on communication brought potential solutions under direct control of employees at the site, while still demonstrating potential for improved human-error rates."

If an aircraft maintenance technician forgets to report a rag dropped accidentally into an engine or a maintenance technician has trouble staying awake because of shift changes, those are human factors that can cause maintenance problems. The goal of human factors, also known as ergonomics, research is to find ways to improve employee productivity, maximize the consistent quality of their work and improve the long-term health and safety of workers.

To reach that goal, researchers measure the job demands imposed by the workplace, environment and schedule. Then they compare those demands with the employees' capabilities to complete the tasks consistently and thoroughly. "Where task demands exceed human capabilities, performance will break down, leading to human errors, which can manifest as safety-compromising incidents and/or on-the-job injuries," the report said.

To improve safety and reduce the number of injuries, employers should develop "a better (safer) match between task demands and human capabilities," either by changing the demands — the workplace, the environment or the organization of the work — or by changing the workers' capabilities through better training or placement, the report said.

The airline established a human factors program to redesign its aircraft maintenance technicians' work environments and to prevent on-the-job injuries, the report said. The initial focus of the program was on the airline's maintenance-base inspections department.

The company formed a human factors task force including both management and hangar workers and gave each task-force member a job title, such as inspector or safety manager. Human factors researchers from SUNY-Buffalo were assigned as advisers to the task force. The report said that the initial decision to use a task force as recommended by Burke[1] was made because "a team approach gives the organization maximum input from various people who will be affected by any changes."

The researchers also felt that including "work force representatives in the analysis and redesign of their own jobs makes them more inclined to accept [human factors] solutions" suggested by the task force. "This is because they actively contributed to the solution-development process."

In addition, the university researchers contended that including inspectors on the task force "was critical to its potential for success. Inspectors have unparalleled expertise ... that leads to an understanding of what changes are most necessary and what solutions may or may not work."

The initial objectives of the task force included:

- Developing a process for identifying and addressing human factors issues in the inspection department that would later be used in other departments;
- Reducing the number of on-the-job injuries;
- Finding solutions to human factors problems that could be implemented and whose results could be measured; and,
- Teaching employees about human factors.

The task force followed a number of guidelines concerning the focus ("inspection jobs and tasks in the hangar area"), the time span (one year) and other criteria. The researchers conducted a one-day training seminar for the task force. Then the task force selected the five inspection tasks to be analyzed at the maintenance base: electrical and equipment-compartment inspection; keel inspection; fuel-tank inspection; combustion-chamber inspection; and nose- and forward accessory–compartment inspections.

Using an electronic-audit inspection program developed by SUNY-Buffalo, the task force audited four of the jobs listed above to determine the human factors risks facing the employees.

In each of the following six areas, the task force listed three risk factors that were the greatest concerns:

- Work cards (card content inaccurate; breaks between cards inappropriate; and card contrast varied);

- Lighting (fixtures dirty; lighting inadequate at the back of the hangar; no preventive-maintenance program for lighting);
- Keel inspection (body positioning; cleaning; lighting);
- Drain-box inspection (body position; nondestructive testing [NDT] equipment; cleaning);
- Electrical and equipment-compartment inspection (lighting, temperature and equipment); and,
- Forward access-compartment inspection (ladder design, ladder control and work planning).

Task-force members decided to concentrate on finding potential improvements for ladder purchase and control, cleaning, task lighting and work-card design.

Despite the clear definition of task force goals, the researchers soon found that the group "was not progressing on developing solutions." After discussing the problems with task-force members, the researchers concluded that the team's work had been hampered by factors such as:

- **Work mandate**. Some task-force members felt that they "had no mandate to pursue their [task-force] assignments as part of their busy schedules";
- **Jurisdiction**. Some solutions, such as redesigning work cards, were functions of another part of the company;
- **Costs**. Solutions such as improving lighting would be expensive; and,
- **Support**. Even though a senior manager had championed the human factors effort, "neither management nor the work force felt a ground swell of support for the task force's activities."

Therefore, the report said, "the task force was disbanded, and the [human factors] efforts were refocused on a different problem that could have broad-based support *and* be entirely under the control at the maintenance base."

The new focus was on communication because "many task-force members recognized communication between shifts as one area in need of improvement." In addition, that problem could be addressed without involving other parts of the airline.

To determine the extent of communication problems, the human factors advisers developed a user-needs analysis questionnaire that was sent to inspectors on all three shifts. Inspectors play a key role because they are the first to examine an aircraft to identify its problems. Inspectors decide which problems maintenance technicians must fix before the aircraft leaves the hangar and which maintenance tasks can be delayed until the next regular maintenance check. Also, inspectors must ensure that maintenance technicians' work was performed properly.

"An inspector must be able to share information with management and other employees so that everyone understands an aircraft's current status," the report said. Depending on the situation, inspectors might have to communicate with other inspectors (on the same shift or on other shifts), maintenance technicians, the lead inspector, the inspection manager, the maintenance manager, engineers, other company management or flight crews. "The inspector must have the communication tools and skills to share information with other members of the organization," the report said.

The SUNY-Buffalo advisers also examined data from outside sources. To find examples of breakdowns in communication, the researchers reviewed 28 maintenance technician's reports from the U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS) data base. Those incidents were reported voluntarily by maintenance technicians at many airlines during a seven-year period, and the report emphasized that they were *not* incidents from the airline for which the human factors program was being developed and implemented.

[Aviation maintenance technicians submit only about 1 percent of the total number of ASRS reports,[2] and because the reports are voluntary they do not represent a statistically valid sample of all aviation maintenance incidents. The numbers, types and percentages of incidents in ASRS records do not represent the numbers, types and percentages of incidents actually occurring, reported or not.

[The only reasonable inference is that the number of incidents of a particular type reported to ASRS is the minimum number that actually occurred. Although the unknowable actual total might be much greater, the number of ASRS reports is often all that decision makers need to determine that a problem exists and requires attention.]

The review of ASRS reports found several typical types of communication problems involving maintenance technicians or inspectors:

- Many incidents were caused by maintenance technicians becoming distracted while performing a task;
- Maintenance technicians often did not write exactly what they did or what parts of a task were uncompleted;

- When a maintenance technician had to allow another maintenance technician to complete a task, it could “lead to difficulties when the second [maintenance technician did] not understand the situation or realize specifically what [remained] to be done”;

- Because one maintenance technician had to sign off on the completion of a task even if others also worked on it, “it [was] difficult to pinpoint who actually worked on the task,” other than the maintenance technician who signed;

- Maintenance technicians were sometimes given false verbal descriptions of discrepancies, or verbal descriptions that differed from the information that was in the logbook; and,

- At times, maintenance technicians were assigned to a task without being given all the accompanying paperwork. “This can lead to the [maintenance technician] making an incorrect diagnosis of the problem and, consequently, taking incorrect action to correct the problem.”

Certain communication failure types were associated with different communication needs in the 28 ASRS reports that the researchers analyzed; and although the ASRS data do not provide a random sample of communication failures, they can be used to identify the different types of failures experienced in the aircraft maintenance environment.

A maintenance technician communicating with himself or herself can have a memory failure. This happened when a mechanic relied on memory rather than a written note or other job aid, such as a checklist.

Maintenance technicians communicating with flight crew were subject to failures of both written and verbal communication. Communication problems from flight crew to maintenance were either failures to communicate at all or a breakdown of the written process. The researchers suggested that this might result “from the widely different background training of flight operations [personnel] and technical operations [personnel] and the lack of opportunities for verbal communication between these groups. Clearly, methods of improving communications between these groups are needed, [for example], extensions of CRM [crew resource management] and MRM [maintenance resource management] to joint training.”

Communication failures between maintenance technicians, and between maintenance technicians and supervisors, resulted from either a failure to communicate at all or a failure of verbal communication. This also included shift-change communication.

The report said, "Clearly, written communication does not fail; if people use written communication, then this is adequate. The main emphasis for addressing these problems should be ensuring that [maintenance technicians] and supervisors use written communication. Thus, the new focus of this project became redesigning communication forms so [maintenance technicians] and supervisors can use them more easily."

Based on these findings, the researchers concluded that written communication is extremely important in airline maintenance and inspection. "Verbal communication, although often more convenient, is more error-prone, especially when information must be remembered for long periods of time or must be passed sequentially through a number of people," the report said.

Because of the critical importance of communication, the researchers interviewed inspectors at the maintenance base to determine how communication there might be improved. A major focus of the communication user-needs analysis questionnaire was on the shift-turnover log, a bound book with numbered pages. Lead inspectors make entries in the log every day, with information such as who called in sick, who worked overtime and a quick summary of each aircraft's status.

"It is difficult to identify who made an entry in the log, and few entries are ever followed up with another entry describing how the problem was resolved," the report said. "The existing shift-turnover log does not serve as a communication tool, showing the tasks with multishift implications, nor does it provide the information necessary for subsequent shifts to 'pick up' where a previous shift left off."

The researchers questioned inspectors and management in detail. The responses to the user-needs analysis questionnaire revealed that many inspectors did not understand how their tasks fit into the larger picture of airline maintenance. "For example, jobs are often assigned to inspectors in what they perceive as a random manner ... ," the report said. "Many times, there seems to be little consideration of how job scheduling affects the maintenance department."

Follow-up personal interviews with inspectors "generally support[ed] the results from the user-needs analysis," the researchers found, and also provided insight into how to improve communication for inspectors. Some examples follow:

- Inspectors said that they nearly always communicated verbally with their lead inspector and with other airline employees. But most inspectors had not considered the consequences of doing a job correctly but not detailing it in writing. "Even if an inspector did everything correctly, there would be no way to prove this in an investigation," the report said;

- Information resources were better on the weekday-day shift and in the early part of the weekday-afternoon shift, when each department was fully staffed with engineers, management officials and planners. "During the second half of the afternoon shift, on the night shift and on weekends, it [was] difficult and time-consuming to get information from those resources," the report said;

- Inspectors tended to receive only the information from the previous shift that the previous shift's lead inspector passed along. The report warned of a "danger in filtering critical information through the lead inspectors" without communication from others on the shift;

- When inspectors were busy, they tended to fall behind in reading updates to maintenance manuals. Inspectors were supposed to read the updates daily and sign off on any new entries. But no supervisor ever seemed to question inspectors if inspectors fell behind in that task; and,

- Inspectors received a lot of information from maintenance updates and other sources that "they [saw] as irrelevant to their current responsibilities," and wasted time that might have been spent keeping up-to-date on material that did apply to their operations. Thus, if a base serviced only McDonnell Douglas DC-9s but was flooded with information about Boeing 727s and McDonnell Douglas DC-10s, some inspectors feared that they might overlook a relevant update.

In their meetings with airline management officials, the researchers said that communication problems existed and made several recommendations:

- Improve inspectors' communication skills by training them. "Inspectors must learn what is expected, so they understand what information must be communicated and why it is important," the report said;

- Explain the benefits of better communication, to motivate inspectors to improve and to reassure them that the new requirements would not increase their work loads; and,

- Develop better communication tools for passing along information such as management memos and aircraft alerts and for recording detailed problems and necessary follow-up actions at shift turnovers.

  In developing such new tools, the medium of communication — logbooks, verbal messages or blackboards — must be chosen carefully "to provide only the information that inspectors need and not to overload them with unnecessary information," the report said. "Information should be presented in a form that is easy to use and that allows inspectors easily to elicit specific details, as necessary";

- Arrange for input from everyone in the inspection department — including managers, the lead maintenance technician and inspectors — into redesigning the communications system;

- Standardize communication systems so that they can be used by all the inspection groups, such as support shops, engine shops and major maintenance shops. "Such standardization would make it easier for inspectors to move among groups, effectively obtaining necessary information ... ," the report said; and,

- Make it standard practice to use the shift-turnover log to communicate information from the maintenance department's daily morning meeting to other shifts.

To solve communication problems, the researchers considered a number of options, including the following:

- A formal written log (the shift-turnover log), which would be a permanent written record of activities in the inspection department;

- Informal written notes, addressed to either an individual or an entire crew, which would be preferable to verbal communication;

- Tape recordings, which offer a quick way to replace written notes. Some tapes might later be transcribed into a written log;

- Computer software tools, such as e-mail, electronic bulletin boards and electronic turnover logs, which allow more than one person to have access to the same information simultaneously;

- Blackboards or whiteboards, which are useful in displaying information that needs to be seen for only a short time. This can be a good way of communicating with an entire crew;

- Formal crew meetings, which are useful in reaching all inspectors, who then have the opportunity to discuss the information presented;
- Informal verbal communication, a quick but short-lived way to transmit information. During busy times, however, such communications can overtax inspectors' memories; and,
- Nonroutine work cards, which can be used to identify parts of the aircraft that require maintenance and can later be checked to verify that the work was done properly.

In the end, the researchers proposed developing a revised version of the existing shift-turnover log that could improve communication among inspectors on different work shifts. "The present shift-turnover log is used mainly by the lead inspectors and does not contain much information that inspectors can utilize," the report said. "It does not record activities that took place during a shift or help the next shift know what they need to accomplish."

Researchers developed versions of a new log that "is intended for use by all inspectors," the report said. "It allows an inspector to record activities during a shift, leaving a written account of what needs to be accomplished and helping prevent rework," or more than one inspection of the same area of the aircraft. Rework is often caused by miscommunication between two inspectors, especially when an inspection is carried over from one shift to the next shift.

The first draft of the new shift-turnover log was organized into five bound logbooks, each with numbered pages. The first logbook (Figure 1, page 11) was the "general shift-turnover log," which could be used to pass information between shift leads. Information that could be entered into the general shift-turnover log included general problems and personnel information, such as assigned overtime and call-ins of workers.

The other four logbooks were color-coded, each colored logbook corresponding to a color assigned to one of the four hangar bays. A new logbook was used for each aircraft, summarizing the inspection history of the aircraft (Figure 2, page 12). Inspectors assigned to that aircraft were asked to complete the log, which could be filed when the aircraft left the hangar.

A sample group of 17 inspectors was asked to evaluate the proposed shift-turnover log. The inspectors

Inspection Shift-turnover Log (First Draft)

General Shift Information

Date:	To Be Read By:	Morning	Afternoon	Night	Shift
Lead Inspector:	Manager:				
Filled in By: on the		Morning	Afternoon	Night	Shift

Personnel Information

Call-Ins

Name	Reason	Time

Overtime

Name	Reason	Number of Hours

Field Trips

Name	Destination	Departure Time	Return Time

Special Instructions/General Problems

Problem	Needed Action/Alert	Resolution	Date	Time

Source: Colin G. Drury, Ph.D., et al.

Figure 1

were asked to rate the log on a scale of 0 (lowest) to 8 (highest) for 18 aspects of usefulness and ease of use.

Researchers analyzed the inspectors' responses to determine whether the median response for each question was significantly different from the low point (0), midpoint (4) or high point of the rating scale (8). [The median is the midpoint value in a range; that is, the value above which half

Inspection Log: Blue Bay (First Draft)

Aircraft number:	Day:	Shift (Please circle): Morning Afternoon Night
Inspectors Assigned:		
Aircraft Status (Please Circle): Line Initial Shakedown Buyback		
General Information/Notes:		

Long Term Projects

Project	Status	Needed Action/Alert	Inspector

Other Projects/Problems

Insp.	Project/Problem	Needed Action/Alert	Resolution	Date	Time

Source: Colin G. Drury, Ph.D., et al.

Figure 2

the responses fall and below which the other half falls.]

The report said that the analysis showed the following significant findings:

- "Inspectors felt that the use of a separate log for recording personnel issues and general problems was significantly better than 'useful';

- "[Inspectors] ... indicated that they would read the turnover log for the aircraft to which they were assigned more than three times per week;

- "Inspectors ... felt that the proposed turnover log was more useful than the current turnover log; [and],

- Inspectors [indicated] that they would use the proposed turnover log more often than they [used] the current turnover log."

Other general trends, which were not statistically significant, included the following:

- Inspectors found the proposed log easy to understand;

- Inspectors found that the general and aircraft sections contained the right amount of information;

- Inspectors indicated that they would be likely to make an entry in the log only three times per week, not every day, as the log would require;

- Inspectors indicated that the proposed shift-turnover log did not meet their needs for information; and,

- Inspectors did not find the proposed shift-turnover log layout particularly easy to use.

Using a team approach, the researchers met with each inspection shift to discuss ways to improve the log's design. But "only a few" of the 10 inspectors to 15 inspectors at each meeting gave suggestions for redesigning the log. In general, they recommended simplifying the log so that it would require less time to complete.

In contrast to their responses to the "user-needs" questionnaires, many inspectors at the meetings said that they did not like the idea of a new log because it "would require too much time and would place too many additional requirements on the inspectors."

Although many inspectors said that they liked the idea of a dedicated log for the aircraft to which they were assigned, they suggested that the logs be designed for the lead inspectors rather than the inspection crews. The researchers described that attitude as "troubling" because the ASRS reports indicated that "it is critical for inspectors working on an aircraft to have a good understanding of the problems the previous shifts encountered."

In probing the inspectors' preferences concerning the logbook, the researchers said that there was "a large mismatch between the inspectors' needs for information and the effort they are willing to make to obtain it. ... Inspectors seem to want to receive information from the previous shifts, but not to provide information to the next shift."

The roots of communication problems went deeper than procedural questions, the report suggested. More fundamentally, they resulted from an atmosphere of distrust between inspectors and management. Responses by 17 inspectors to the user-needs analysis questionnaire identified "a general problem with inspectors' job satisfaction," the report said. "Many inspectors report having difficulty obtaining information they need to perform the job. ... The shift-turnover log is seen as a managerial tool, not as a way to communicate."

The report added that "this reluctance to communicate is a serious problem and must be addressed if inspection productivity is to be improved."

Even though written communication is far more accurate, it also made some inspectors or maintenance technicians uncomfortable because they feared that it would be used as an investigative tool to examine actions taken or not taken by maintenance crews, the report said.

"There is an understandable reluctance in all branches of the airline industry to write anything not specifically required to be committed to paper," the report said. "[Inspectors] do not want to record additional information in a log which could be used against them in an investigation; they do not realize that information in a written log could protect them in an investigation ... .

"Many inspectors seem unwilling to make an effort to improve the communication process. They are unhappy with how management treats them and, thus, have little motivation to improve the situation. Most simply want to perform their jobs and take on as little responsibility as possible. Inspectors are distrustful of management and do not believe that management wants to aid the inspectors by trying to improve communication. ... Even individual inspectors who want to improve their jobs do not want to appear sympathetic to management's needs or wants."

The researchers contended that problems between management and inspectors "must be resolved before any proposed shift-turnover log can meet information needs of both groups. As is true of many human factors issues in aircraft maintenance and inspection, searching for a consensus solution to a technical problem reveals broad social issues when it is time for implementation."

Beyond attitudinal issues, the communication systems had problems, and the report said: "Inspectors do not

Inspection Shift-turnover Log (Second Draft)

Aircraft number:	Date:	Shift (Please Circle): Day Afternoon Night
Inspectors Assigned:		Projected A/C Departure Date:

Problem Workcards

Card number	Problem

General Problems

Source: Colin G. Drury, Ph.D., et al.

Figure 3

use the shift-turnover log regularly, almost always need to search for more information after being assigned a job, have experienced on-the-job problems caused by miscommunication and deal with each other almost always verbally."

Concluding, nevertheless, that "inspectors approve of the idea of developing a new format for the shift-turnover log and will utilize an improved log," the researchers developed a simplified color-coded shift-turnover log in which inspectors would record information about individual aircraft, considerably reducing the detail required (Figure 3).

The researchers found that "inspectors rated the second draft significantly higher in both information content and format," and many indicated that it was more useful. In the end, the new shift-turnover log met more communication needs than the original log and was generally accepted by inspectors. "The specific choice of the shift-turnover log showed how involvement of both human factors professionals and the inspection work force can produce a practical, refined job aid," the report said.

In an effort to improve communications, the airline introduced a bulletin board for posting company news and announcements at the maintenance-base inspections department, and scheduled more meetings between management and inspectors.

Like the researchers, inspectors suggested allowing each inspector to carry a small tape recorder and using a blackboard or whiteboard to record information that might be useful on a short-term basis to all inspectors.

Other possibilities suggested by inspectors to improve communication included a shift-turnover log in the form of a simple checklist, allowing for quick completion, and using one-on-one shift turnovers in which incoming inspectors walk through the hangar with outgoing inspectors to discuss important information.♦

Editorial note: This article was adapted from "Human Factors Program Development and Implementation," by Colin G. Drury, Ph.D., Caren Levine and Jacqueline L. Reynolds, of the State University of New York at Buffalo. The report was included as Chapter 6 in *Human Factors in Aviation Maintenance — Phase Five Progress Report*, U.S. Federal Aviation Administration (FAA) Report no. DOT/FAA/AM-96/2. The 35-page report includes tables, figures, references and an appendix that details "Ergonomic Audits of Inspections Tasks," "Ergonomic Risk Factors" and "General Communication User Needs Analysis."

References

1. Burke, M. *Applied Ergonomics Handbook*. Boca Raton, Florida, United States: Lewis Publishers, 1992.

2. U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS). "ASRS Database Statistics." *ASRS Directline* Issue no. 8 (June 1996).

Get Airworthiness Alerts on the Internet

Advisory Circular (AC) 43-16, *General Aviation Airworthiness Alerts*, issued periodically by the U.S. Federal Aviation Administration, is now available on the Internet. To access AC 43-16, use the following address: http://www.fedworld.gov/ftp.htm.

Keying in that address will open the FedWorld File Transfer Protocol Search and Retrieve Service screen. Select the heading "Federal Aviation Administration" followed by "FAA-ASI." The AC 43-16 file names begin with ALT, followed by three letters for the month, followed by two digits for the year. Files can be viewed onscreen or downloaded.

PAMA Reschedules Annual Meeting

The Professional Aviation Maintenance Association (PAMA) has announced that its Annual Symposium and Trade Show, originally planned for May 14–16, 1997, has been rescheduled. To avoid a conflict with another association's convention, PAMA has changed the dates of the Annual Symposium and Trade Show to May 20–22, 1997. The location will be the Fort Worth/Tarrant County (Texas, U.S.) Convention Center.

Advisory Circular Describes Distributor Accreditation Program

The U.S. Federal Aviation Administration (FAA) has issued an Advisory Circular (AC) that describes a voluntary system, which is based on industry oversight, for the accreditation of civil aircraft parts distributors. The FAA believes that "such programs will assist in alleviating lack of documentation and will improve traceability," according to the AC.

AC 00-56, *Voluntary Industry Distributor Accreditation Program*, lists "quality systems" to ensure that documentation provided by distributors along with parts shipments contains the information necessary to determine whether the parts are acceptable; lists organizations that have existing quality standards considered appropriate for distributors; describes procedures for auditing distributors; describes accreditation procedures; and includes sample certification statement language.

There are about 2,500 civil aviation parts distributors in the United

States, the AC says, and they are not directly regulated by the FAA. “Parts from ... ‘accredited distributors’ will convey an assurance to the purchaser that the [parts are of] the quality stated and that the appropriate documentation is on file at the distributor’s place of business.”

Gas Turbine Exposition Scheduled

Commercial and military aircraft engines will be among the applications for gas turbines to be featured in the Turbo Expo ’97 Congress, sponsored by the American Society of Mechanical Engineers (ASME) International. The exposition will take place June 2–5, 1997, in Orlando, Florida, U.S.

The Congress will include four full days of technical sessions featuring more than 500 presentations. The 1997 Gas Turbine Users Symposium, which will run concurrently with the Congress, will include a “feature session” on important issues in aircraft engine applications, among other areas.

For more information, contact: International Gas Turbine Institute, ASME International, P.O. Box 422029, Atlanta, GA 30342 U.S. Telephone: (404) 847-0072; Fax: (404) 847-0151 or (404) 843-2517.♦

MAINTENANCE ALERTS

New Corrosion Inspection Requirements Issued for DHC-6

A de Havilland Canada DHC-6 Twin Otter floatplane experienced a failure of the down elevator control cable while climbing after takeoff from Port Hardy, British Columbia, Canada, on Sept. 17, 1994. The aircraft stalled and impacted the water, killing the first officer and the two passengers and seriously injuring the captain.

The cable failure, caused by corrosion, occurred at station 376. It was the fifth reported DHC-6 cable failure, all at station 376.

The maintenance required by the de Havilland Equal Maintenance for Maximum Availability (EMMA) work card directs: “ ... [Inspect] control cables for fraying, broken strands, flattening, corrosion and security of turnbuckles and cable ends; plastic sheathing, where applicable, for cracking and deterioration. NOTE: It is important to operate controls through the full range so that cables move away from pulleys and all portions of cables are exposed for inspection."

The Transportation Safety Board of Canada (TSB) determined that the elevator control cable failure resulted from gradual deterioration in an area that contacted the lowermost pulley of the pulley cluster. It appeared that individual wires and strands had failed before the complete failure.

EMMA requires the DHC-6 elevator control cable to be inspected every 800 hours for an aircraft in normal service and every 400 hours for an aircraft that regularly transports livestock or corrosive materials. The Port Hardy accident occurred 68 service hours after the last inspection.

Three of the cable failures occurred on aircraft operating in a salt water environment. Bombardier Regional Aircraft Division, which supports the DHC-6, has accelerated the required maintenance schedule for aircraft operating in marine areas or where there is a high salt concentration. Formerly, cables were required to be replaced only as necessary. Now, the control cables must be replaced every 12 months.

In another occurrence, the corrosion failure was believed to be caused by corrosive cargos leaking onto the pulley area. Bombardier now requires the replacement of the elevator and rudder control cables below the cargo compartment if there is spillage.

Bulkhead Structural Cracks Found in Beechcraft Bonanza

During a scheduled inspection of a Beechcraft A36 Bonanza, a crack was found in a bulkhead doubler (part number 002-440000-29), in an area that is part of the reinforcement for the attachment point of the rear spar for the vertical stabilizer.

The operator inspected the remainder of its fleet and found five similar defects. The total times for the defective parts ranged from 2,300 hours to 2,600 hours.

The crack that first alerted the operator originated in the radius cutout area of the bulkhead doubler on the left side. This is a difficult location to inspect, requiring a mirror and flashlight. Access to the area is through the inspection panel on the left rear of the fuselage.

Piper Aztec Heater Fuel Leak Reported

The pilot of a Piper PA-23 Aztec reported fuel fumes in the cockpit after the engines and heater were turned on. An investigation found that fuel was leaking from the heater's fuel-strainer assembly (part number 460-755), which is mounted above the heater in the airplane nose.

Corrosion and a crack were found in the fuel-strainer assembly sediment bowl. According to maintenance records, the fuel screen had been cleaned during the last annual inspection. The corrosion in the bowl had apparently contributed to the bowl being crushed during the inspection.

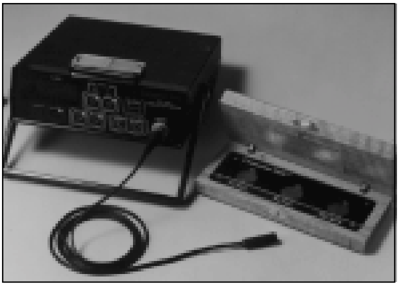
Maintenance technicians working on the Piper PA-23 should check the condition of the fuel-strainer assembly sediment bowl when the fuel screen is cleaned during annual inspections.♦

NEW PRODUCTS

Microprocessor-based Conductivity Tester Performs with New Level of Accuracy

A microprocessor-based conductivity tester that is said to offer up to four times greater accuracy than conventional testers has been introduced by Centurion NDT. The FM-140XL Digital Conductivity Tester measures the conductivity of most nonferrous metals and alloys, including aluminum, copper and brass. As the operator scans a test piece with the FM-140XL's probe tip, conductivity readings are displayed on a seven-segment light-emitting diode (LED) screen. Although conventional testers are typically accurate within plus or minus 2 percent, the FM-140XL is accurate to within 0.5 percent, according to the company. A multiadjustable handle enables the operator to lock the unit into position to achieve the easiest viewing angle.

For quick sorting applications, the tester allows the operator to pre-set a range of acceptable readings. A green light flashes when a reading is within the acceptable range; a red light signals a reading that is outside the selected range. The FM-140XL is also useful for measuring small changes in conductivity that can take place during engineering processes such as hardening, annealing and heat treating, or that can occur naturally with age or from corrosion.



FM-140XL Digital Conductivity Tester from Centurion NDT

Measuring seven centimeters high by 22 centimeters wide by 23 centimeters deep (2.75 inches by 8.5 inches by nine inches), and weighing only two kilograms (five pounds), the FM-140XL is portable, yet its rugged build enables it to withstand a rough shop environment, the manufacturer claims. The unit is powered by a rechargeable nickel-cadmium battery pack that provides up to 10 hours of continuous operation on a single charge. Custom probes and a carrying case are also available. For more information, contact: Centurion NDT Inc., 707 Remington Road, Suite 9, Schaumburg, IL 60173 U.S. Telephone: (847) 884-4949; Fax: (847) 884-8772.

Laser-aimed Portable Infrared Thermometer Helps Troubleshooting

Leaks in pneumatic systems or refrigerant systems, electrical problems associated with overheating, or bearing problems resulting in a temperature increase are detectable with a sensitive temperature-measuring device. With the advent of portable infrared (IR) measurement devices, relatively small temperature differences can be accurately pinpointed and documented.

The new PT-3 Series pocket-size non-contact IR thermometer from CAPINTEC Inc. is intended for use in maintenance and troubleshooting. This ultracompact portable instrument features a built-in laser to pinpoint targets of interest.

PT-3 Series IR thermometer from CAPINTEC Inc.

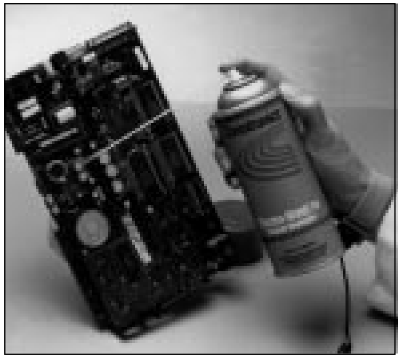
The PT-3 operates in the eight-micrometer (µm) to 14-µm spectral band and covers a temperature range from -20 degrees C to 400 degrees C (-4 degrees F to 752 degrees F). The liquid crystal display (LCD) offers one-degree resolution and includes automatic backlighting for taking measurements in dark areas. Response time is one second. The unit is operated by two AA batteries, which are said to yield 100 hours of operation. The device weighs 198 grams (seven ounces) and comes in a soft carrying pouch.

For more information, contact: CAP-INTEC Inc., 6 Arrow Road, Ramsey, NJ 07446 U.S. Telephone: (800) 631-3826 (United States and Canada); Fax: (201) 825-1336.

Nonflammable Cleaner/Degreaser for Electronic and Energized Equipment Contains no CFCs

Since the international phaseout of chlorofluorocarbons (CFCs), production, repair and rework shops have been faced with trade-offs among cleaning performance, plastics compatibility, flammability and drying time in selecting cleaning and degreasing agents. To solve this problem, Chemtronics® has introduced Electro-Wash® PSN Cleaner Degreaser, a spray-on detergent that removes encrusted dirt, oils, grease, oxides, flux residues and acrylic conformal coatings from generators, motors, machines and precision devices.

The product has a low-odor formula that is nonflammable, contains no CFCs, does contain hydrochlorofluorcarbons (HCFCs) and is specifically engineered to clean and degrease energized equipment and electronics without damaging surrounding plastics, the manufacturer says.



Electro-Wash® PSN Cleaner Degreaser from Chemtronics®

Electro-Wash PSN Cleaner Degreaser is said to dry quickly and have excellent wetting and penetrating action that flushes even tight-tolerance areas clean. The product is available in a 340-gram (12-ounce) aerosol container that sprays at any angle, even upside down. For more information, contact: Chemtronics, 8125 Cobb Center Drive, Kennesaw, GA 30152-3486 U.S. Telephone: (770) 423-0748; Fax: (770) 423-0748.

Cushioning Protects Wires, Hoses Against Abrasion by Metal

Device Technologies Inc. has introduced a line of soft polymer cushion materials to protect cables, wires and hoses from abrasion caused by rough edges in sheet metal or other installations. Originally developed for sensitive fiber-optic cable telecommunications applications, the Spring-Fast® Cushion Grommets are said to be ideal for airframe installations as well.

Spring-Fast® Cushion Grommets from Device Technologies Inc.

The cushion grommets are made of nylon-coated stainless steel, with a soft polymer cushion to provide maximum protection from abrasion or cutting. The manufacturer says that the material is durable, strong and flexible and has the ability to conform to any two-axis contour. The grommet edging snaps on, and the unique spring gripping fingers hold it in place. No tooling is required for the installation, and no adhesive is needed to hold it securely.

The Spring-Fast grommet edging is available in several sizes to accommodate sheet metal thicknesses from 0.06 centimeter to 0.6 centimeter (0.025 inch to 0.250 inch). The material is available in precut lengths and in 7.625-meter (25-foot) and 61-meter (200-foot) rolls. To request a free sample or for more information, contact: Device Technologies Inc., 3 Brigham Street, Marlborough, MA 01752-3140 U.S. Telephone: (800) 669-9682 (United States and Canada) or (508) 229-2000; Fax: (508) 229-2622.

Convertible Flashlight Can Be Hand Held Or Worn

Streamlight Inc. has developed a convertible flashlight that can be held in the hands or worn, as the occasion demands. Called WOW™, the light is said to offer the advantages of a rugged hand-held light combined with those of a hands-free lamp that can be worn around the head, hung around the neck or suspended above a work area.

As a hand-held flashlight, WOW is a compact unit weighing 159 grams (5.6 ounces). When hands-free operation is required, the unit's handles rotate open and the adjustable elastic strap can be used to fasten the light around a maintenance technician's head or suspend it around the neck or from a nearby fixture.

For more information, contact: Streamlight Inc., 1030 West Germantown Pike, Norristown, PA 19403 U.S. Telephone: (215) 631-0600; Fax: (215) 631-0712.

WOW™ from Streamlight Inc.

Teflon® tubing from M.M. Newman Corp.

Flexible Tubing Improves Safety of Handling Hot Liquids and Gases

M.M. Newman Corp. has introduced a full line of Teflon® tubing for handling very hot liquids and gases. The tubing, which is nonflammable and chemically inert, is said to be capable of operating at continuous temperatures of up to 232 degrees C (450 degrees F). In addition, the tubing is unaffected by acids, alkalis and other corrosive media, making it suitable for a wide range of fluid-transfer applications, according to the manufacturer.

Plain styles are available in sizes ranging from 0.25 millimeter to 32 millimeters (0.01 inch to 1.25 inches) internal diameter, with varying wall thicknesses. Corrugated and convoluted (screw-thread) styles come in sizes from six millimeters to 25 millimeters (0.25 inch to one inch) internal diameter.

Priced according to type, size and quantity, the tubing is supplied in random-length coils or cut to length. For more information, contact: M.M. Newman Corp., 24 Tioga Way, Marblehead, MA 01945 U.S. Telephone: (617) 631-7100; Fax: (617) 631-8887.♦

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