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Q-Star Verification Process Provides Safety Assessment Of Aircraft Charter Providers

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Flight Safety Foundation is an international membership organization dedicated to the continuous improvement of aviation safety. Nonprofit and independent, the Foundation was launched officially in 1947 in response to the aviation industry's need for a neutral clearinghouse to disseminate objective safety information, and for a credible and knowledgeable body that would identify threats to safety, analyze the problems and recommend practical solutions to them. Since its beginning, the Foundation has acted in the public interest to produce positive influence on aviation safety. Today, the Foundation provides leadership to more than 830 member organizations in more than 150 countries.

Q-Star Verification Process Provides Safety Assessment of Aircraft Charter Providers

Program helps corporate flight departments to identify U.S. charter providers that operate to safety standards significantly higher than the minimum regulatory requirements.

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FSF Editorial Staff

Companies that charter aircraft to supplement their flight-department resources typically expect charter providers to exceed the minimum safety standards required by the U.S. Federal Aviation Regulations (FARs). Without access to a safety-audit report on a charter provider or first-hand experience with a charter provider, however, a flight department may not find easily information about current safety policies and practices.

Q-Star program administrator Robert Feeler (left) and Q-Star verification specialist Robert McCutchan (center) review company manuals with Charles McLeran, vice president of flight operations and standards for TAG Aviation USA.

The Flight Safety Foundation Q-Star Charter Provider Verification Program is designed to provide to subscribers information about charter providers that meet high safety standards. (The Q-Star program currently is limited to the verification of U.S.-based charter providers, but if user response indicates a need, the program might be expanded to include charter providers based outside the United States.)

Q-Star program subscribers — typically corporate flight departments that pay a US$6,000 annual subscription fee (FSF members receive their first-year Q-Star subscription as a benefit) — access verified information about charter aircraft, pilots and services via the Internet at http://www.qstarcharter.com. The Web site ensures that Q-Star charter provider data are available to subscribers at any time and from any place.

"Our program is not designed for every charter provider, only those that clearly meet the highest standards," said Robert Vandel, FSF executive vice president. "The industry asked the Foundation to provide a pass/fail verification process with no middle ground. We have raised the bar to encourage high safety standards, but not every charter provider will be able to qualify. Even among the leading charter providers, only verified aircraft, identified by registration number, and verified pilots, identified by name as meeting Q-Star standards, will appear in the Q-Star database." (See "Q-Star Standards Reflect Best Practices of Business Flight Operations," page 2.)

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Q-Star Standards Reflect Best Practices of Business Flight Operations

The Flight Safety Foundation (FSF) Q-Star Charter Provider Verification Program standards (see page 4) were developed in consultation with a working group comprising representatives of FSF member companies that use charter services to supplement their in-house flight operations resources, companies that provide charter services, companies that provide aircraft fractional ownership programs, the National Air Transportation Association (NATA) and the National Business Aviation Association (NBAA).

The standards were designed to be reasonable and attainable, and to reflect what company flight operations managers typically require when they entrust charter providers to transport company personnel and materials.

For example, to qualify for participation in the Q-Star program, a charter provider must operate turbine-powered aircraft (multi-engine turbojet or multi-engine turboprop airplanes, or twin-turbine helicopters) and crew the aircraft with two qualified pilots.

Q-Star flight crew minimum flight time standards are based on the typical hiring practices of company flight operations managers consulted by the Foundation. Table 1, Table 2 and Table 3 show that the Q-Star standards are substantially higher than the minimum flight time standards required of charter pilots by the U.S. Federal Aviation Regulations (FARs) Part 61 and Part 135.

The Q-Star program recognizes that the standards may not be met by all aircraft and by all pilots employed by a specific charter provider. A charter provider with aircraft and pilots that meet Q-Star standards also may have some aircraft (e.g., with reciprocating engines) and/or pilots (e.g., newly type-rated and without sufficient experience in type when the Q-Star verification was conducted) that do not meet the standards.

In this case, the Q-Star database will include information only on the multi-engine turbine aircraft operated by the charter provider. The database also will include information on pilots employed by the charter provider, designate their Q-Star status and, where applicable, explain why a pilot does not meet the Q-Star standards.

Information on Q-Star charter providers is available to program subscribers on the Internet at http://www.qstarcharter.com. Subscribers (typically, companies that use charter services to supplement their flight-department resources) access Q-Star information by entering either the name of a specific charter provider; a three-letter airport identification code (e.g., "MIA" for Miami [Florida] International Airport) to search for charter providers or aircraft based at that airport or within approximately 50 miles (80 kilometers) of the airport; or a specific aircraft type and/or model designation to search for charter providers that operate such aircraft.

Information available to Q-Star subscribers includes the following:

- Charter-provider data, including address and telephone numbers, staff contacts, references, contacts for the U.S. Federal Aviation Administration (FAA) office overseeing the charter provider, number of aircraft, training providers, insurance carrier and limits of coverage, and approved areas of operation;

- Aircraft data, including registration number, date of manufacture, total airframe time, dates of last painting

Table 1
Q-Star vs. FARs
Multi-engine Turbojet Airplane Flight Crew Minimum Flight Time Requirements

	Pilot-in-command (flight hours)		Second-in-command (flight hours)[1]	
	Q-Star[2]	FARs[3]	Q-Star	FARs
Total	3,500	1,500	2,500	250
PIC	2,000	250	500	100
PIC multi-engine	500	10	100	10
Multi-engine	1,500	20	500	20
Instrument	300	75	150	40
Turbine	500	NA	100	NA
Aircraft type	100	NA	50	NA

[1]U.S. Federal Aviation Regulations (FARs) data for second-in-command (SIC) are based on requirements for an SIC for multi-engine aircraft instrument flight operations.

[2]Flight Safety Foundation Q-Star Charter Provider Verification Program standards

[3]FARs Part 61 and Part 135

NA = Not addressed

Sources: Flight Safety Foundation, U.S. Federal Aviation Administration and cabin refurbishment, number of passenger seats and equipment (e.g., traffic-alert and collision avoidance system, ground-proximity warning system/ terrain awareness and warning system, in-flight telephone, automated external defibrillator, etc.); and,

- Pilot data, including name, type of FAA certificate held, aircraft qualifications, total flight hours and flight hours in type for the year and the quarter preceding the Q-Star verification.

The Foundation encourages program subscribers to report on their experiences with Q-Star charter providers to Robert Feeler, Q-Star program administrator. This information will be considered during periodic reviews of the program standards.♦

Table 2
Q-Star vs. FARs
Multi-engine Turboprop Airplane Flight Crew Minimum Flight Time Requirements

	Pilot-in-command (flight hours)		Second-in-command (flight hours)[1]	
	Q-Star[2]	FARs[3]	Q-Star	FARs
Total	2,500	1,200	1,000[4]	250
PIC	500	100	250	100
PIC multi-engine	250	10	50	10
Multi-engine	1,000	20	250	20
Instrument	200	75	100	40
Turbine	250	NA	NA	NA
Aircraft type and model	100	NA	25	NA

[1] U.S. Federal Aviation Regulations (FARs) data for second-in-command (SIC) are based on requirements for an SIC for multi-engine aircraft instrument flight operations.

[2] Flight Safety Foundation Q-Star Charter Provider Verification Program standards

[3] FARs Part 61 and Part 135

[4] Total-time requirement may be reduced by 500 flight hours if the pilot has a minimum of 100 flight hours in aircraft type and model.

NA = Not addressed

Sources: Flight Safety Foundation, U.S. Federal Aviation Administration

Table 3
Q-Star vs. FARs
Twin-turbine Helicopter Flight Crew Minimum Flight Time Requirements

	Pilot-in-command (flight hours)		Second-in-command (flight hours)[1]	
	Q-Star[2]	FARs[3]	Q-Star	FARs
Total	2,500, with 1,500 RW	1,200, with 50 RW	1,000, with 300 RW	150, with 50 RW
PIC	1,000 RW	35 RW	NA	35 RW
Multi-engine	NA	NA	200	NA
Instrument	100, with 50 RW	75	50, with 25 RW	40
Turbine	500	NA	100	NA
Aircraft type	100	NA	25	NA

[1] U.S. Federal Aviation Regulations (FARs) data for second-in-command (SIC) are based on requirements for an SIC for multi-engine aircraft instrument flight operations.

[2] Flight Safety Foundation Q-Star Charter Provider Verification Program standards

[3] FARs Part 61 and Part 135

NA = Not addressed RW = Rotary wing

Sources: Flight Safety Foundation, U.S. Federal Aviation Administration

Flight Safety Foundation (FSF) Q-Star Charter Provider Verification Program Standards

Aircraft:

- Multi-engine turbine (turbojet airplane, turboprop airplane and/or twin-turbine helicopter);
- Flown by two qualified pilots; and,
- Emergency equipment adequate for the assigned mission.

Administrative:

- Relevant qualifications and experience of management staff;
- Minimum insurance of US$50 million combined coverage for turbojet airplanes, $35 million for turboprop airplanes and $20 million for helicopters;
- Where appropriate, implementation of Flight Safety Foundation (FSF) Fatigue Countermeasures Task Force recommendations[1];
- No financial problems or legal problems that could adversely affect safe operations;
- Should have no aircraft accidents or U.S. Federal Aviation Administration (FAA) enforcement sanctions within the past five years, or an explanation of any such occurrences must be presented;
- Flight operations manual and revision process with detailed standard operating procedures defining stabilized approach, mandatory go-around policies, pilot-in-command duties and use of automation; and,
- Use of qualified handling agencies in support of international operations.

Safety:

- A proactive, in-house safety program supported by senior management;
- A designated safety coordinator who reports directly to the chief executive officer;
- An incident/hazard reporting program and response process;
- A cabin-emergency-procedures training program for initial training and recurrent training of flight attendants and pilots;
- Ground and in-flight security procedures;
- System to disseminate safety-related information to pilots and flight attendants;
- Detailed emergency response manual; and,
- Implementation of industry safety initiatives to prevent controlled flight into terrain (CFIT) and approach-and-landing accidents.

Maintenance:

- Inspection-and-maintenance program in accordance with manufacturer recommendations;
- Monitoring and control of deferred maintenance and the use of minimum equipment lists (MELs);
- Monitoring and control of life-limited components and time-controlled components;
- Experience requirements:
  - Manager, three years; and,
  - Certificated technicians, three years and aircraft-specific training by a qualified organization;
- Contract-maintenance and vendor-surveillance policies with operator oversight of outside maintenance activities; and,
- Quality control of parts and materials, and periodic audits of parts suppliers.

Flight Crew:

- Minimum experience requirements (flight hours) for pilot-in-command (PIC):

	Turbojet	Turboprop	Helicopter (RW)*
Total time	3,500	2,500	2,500 (1,500 RW)
PIC	2,000	500	1,000 RW
PIC multi-engine	500	250	NA
Multi-engine	1,500	1,000	NA
Instrument	300	200	100 (50 RW)
Turbine	500	250	500
Time in type	100	100 (type and model)	100

* Total aircraft time (rotary-wing time)

- Minimum experience requirements (flight hours) for second-in-command (SIC):

	Turbojet	Turboprop	Helicopter (RW)*
Total time	2,500	1,000	1,000 (300 RW)
PIC	500	250	NA
PIC multi-engine	100	50	NA
Multi-engine	500	250	200
Instrument	150	100	50 (25 RW)
Turbine	100	NA	100
Time in type	50	25 (type and model)	25

* Total aircraft time (rotary-wing time)
** Turboprop SIC total time requirement may be reduced to 500 hours provided the individual has a minimum of 100 hours in type and in model.

- Minimum of 100 flight hours in past year and 50 flight hours in past 90 days;
- Qualifications maintained in no more than two aircraft types;
- Initial training and annual recurrent training conducted in a Level C or Level D airplane simulator[2] or helicopter simulator[3]; if no airplane simulator is approved by the FAA for the aircraft type, training must be conducted in an FAA-approved flight training device[4] of Level 6 or higher; if no helicopter simulator is approved by the FAA for the helicopter type, training must be conducted according to manufacturer-approved training;
- Region-specific training for international operations;
- Crew resource management (CRM) initial training for all pilots, and incorporation of CRM practices in daily operations and recurrent training; and,
- Should have no aircraft accidents or FAA enforcement sanctions within the past five years, or an explanation of any such occurrences must be presented.♦

Reference and Notes

1. Flight Safety Foundation Fatigue Countermeasures Task Force. "Final Report: Principles and Guidelines for Duty and Rest Scheduling in Corporate and Business Aviation." *Flight Safety Digest* Volume 16 (February 1997).

2. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 120-40B, *Airplane Simulator Qualification*, defines *airplane simulator* as "a full-size replica of a specific type or make, model and series airplane cockpit, including the assemblage of equipment and computer programs necessary to represent the airplane in ground and flight operations, a visual system providing an out-of-the-cockpit view and a force-cueing system which provides cues at least equivalent to that of a three-degrees-of-freedom motion system."

3. FAA AC 120-63, *Helicopter Simulator Qualification*, defines *helicopter simulator* as "a full-size replica of a helicopter cockpit representing a specific type or make, model and series. It also includes the assemblage of equipment and computer programs necessary to represent the helicopter in ground and flight operations, a visual system providing a real time out-of-the-cockpit view, a control-force system and a motion system which provides cues that are at least equivalent to that of a three-degrees-of-freedom motion system."

4. FAA AC 120-45A, *Airplane Flight Training Device Qualification*, defines *airplane flight training device* as "a full-size replica of an airplane's instruments, equipment, panels and controls in an open flight deck area or an enclosed cockpit, including the assemblage of equipment and computer software programs necessary to represent the airplane in ground and flight conditions to the extent of the systems installed in the device; does not require a force (motion) cueing or visual system."

The program provides the following benefits for subscribers:

- Convenient access to a database of current information on the verified aircraft and the verified pilots of Q-Star charter providers;
- Assurance that the charter providers have received objective on-site verifications by specialists using established standards and guidelines;
- A significant reduction in cost in terms of staff time and resources expended to conduct individual charter provider verifications or safety audits; and,
- A discount in program fees for FSF members.

Charter providers pay a fee to receive a Q-Star verification. The program provides the following benefits for charter providers:

- Assurance of an objective and practical verification by qualified specialists under a program administered by the Foundation;
- Recognition as a Q-Star charter provider that meets the conservative standards established by industry

representatives and used by corporations that operate their own flight departments (see "Corporate Flight Departments Use Charter Providers for Supplemental Lift");

- A convenient means of assuring prospective clients of the commitment to providing quality charter service; and,
- A reduction in time otherwise expended in responding to repetitive inspections by a variety of independent agencies.

"We want an objective result," said Robert Feeler, Q-Star program administrator. "We developed realistic and objective standards that take out personal opinions. The Q-Star advisory committee reconvenes periodically to review the standards and to reconsider whether the standards represent current best practices.

"We show the standards to the client before the verification begins. We show the client the checklists to be used in the verification process. We also provide, in advance, the Q-Star data-recording forms."

By reviewing the Q-Star data-recording forms before the on-site verification begins, charter providers can identify all sources of required data, clarify definitions and requirements, and assemble essential information, thus ensuring that the on-site verification is as efficient as possible and minimizes demands on staff.

Feeler said that he would expect any charter provider that requests a Q-Star verification to be confident beforehand that

Corporate Flight Departments Use Charter Providers for Supplemental Lift

Many companies operate their own aircraft to transport employees and equipment, or to facilitate visits to company facilities by potential customers or clients. Corporate aircraft often are operated in areas that are not served by the airlines.

One of the greatest benefits of owning an aircraft is saving time, said Douglas Carr, senior manager, government affairs for the National Business Aviation Association (NBAA), which represents about 6,200 aircraft operators. (Carr, former manager, domestic operations for NBAA, participated in the development of the Flight Safety Foundation [FSF] Q-Star Charter Provider Verification Program standards.)

"By saving time, a corporate aircraft allows employees to get more work done," Carr said. "A corporate aircraft also provides the flexibility that allows a company to respond to changes." For example, personnel and/or equipment can be relocated relatively quickly to where they are needed.

Nevertheless, a company's travel requirements often exceed its in-house travel resources. NBAA estimates that about 85 percent of companies that operate turbine aircraft have only one aircraft in their flight departments, Carr said.

"There often is a need for more seats than your aircraft supplies," he said. A corporation, for example, may have a board meeting that requires transportation of many people from various locations. At such times, corporate flight department managers often look to charter providers for "supplemental lift."

Charles S. McLeran, vice president of flight operations and standards for TAG Aviation USA, a Q-Star charter provider, said that a corporation recently chartered six of TAG's aircraft to fly stockholders from various locations in North America to a meeting in Mexico.

Logistics often play a role in the need for supplemental lift. NBAA's Carr gave the following example: A company based in the eastern United States schedules a series of meetings at several locations on the West Coast. The company may decide to use its transcontinental-capable airplane to fly personnel to the West Coast and to use smaller charter aircraft to shuttle the personnel to their meeting sites. Meanwhile, the company airplane is flown back to its home base, to be available for other long-range transportation requirements.

While travel requirements often exceed the seating capacity of the company aircraft, policy sometimes precludes filling all the seats.

"Many companies have policies limiting the number of key company employees that can travel together in any vehicle," Carr said. This ensures that company leadership would not be lost totally in a fatal accident.

Robert Feeler, Q-Star program administrator, said there are many other reasons why a corporate flight department might require supplemental lift.

"The company aircraft may be out of service for scheduled maintenance, equipment upgrades or refurbishment," he said. "Or, a mechanical problem may take the aircraft out of service for unscheduled maintenance. A charter provider could help get the passengers to where they are going and get the crew back to their home base."

A company might have a travel requirement that is beyond the capabilities of its own flight department.

"An overseas trip, for example, might require the services of a charter provider with long-range aircraft, crews that are trained and experienced in operating in the region, and flight-support and ground-handling services by qualified organizations," Feeler said.♦

the Q-Star standards can be met. Regardless of how well any charter provider presents or documents its operations, however, the Q-Star verification specialists maintain the healthy skepticism of detectives as they conduct the verification. This method inherently generates many questions about the presented data and involves the cross-checking and confirmation of data.

In 2000, Feeler and Robert McCutchan, an FSF contract verification specialist, conducted a verification of TAG Aviation USA, an aviation services company, at its headquarters in San Francisco, California, U.S. Senior editors from the FSF Publications Department accompanied the verification specialists to observe the verification process.

The company, created in 1998, is part of TAG Group (TAG is an acronym for Techniques d'Avant Garde), a privately held group of companies headquartered in Geneva, Switzerland, and comprises U.S. companies formerly known as Aeroleasing, Aviation Methods and Wayfarer Aviation. AMI Jet Charter, a U.S. company, holds the FARs Part 135 certificate; U.S. operations are conducted under the familiar TAG name.

TAG Aviation USA (TAG) has four lines of business: aircraft management, aircraft charter, aircraft sales and fractional ownership. At the time of the Q-Star verification, TAG operated 116 airplanes, including 68 airplanes on the company's Part 135 certificate for charter from about 45 bases throughout the United States.

Feeler has been a certified aircraft maintenance technician since 1952 and has served in several senior management positions for two U.S. airlines. He has participated in safety audits throughout his career; as a member of FSF safety audit teams since 1983, he has conducted safety evaluations of airlines, airports, repair stations and corporate aircraft operators (see "Q-Star Verification, Safety Audit Differ in Purpose and Scope," page 8). He served as manager of FSF safety audit programs from 1992 through 1999, when he participated in developing the Q-Star program and was appointed Q-Star administrator.

McCutchan was a U.S. Air Force pilot and later worked 23 years for a major U.S. corporation as a line captain, manager of quality assurance standards and safety, and aviation team leader responsible for hiring and training flight attendants. McCutchan has an airline transport pilot certificate, 15,000 flight hours and type ratings in the Boeing 707 and 727; the Gulfstream II, III and IV; the Falcon 2000; and the Lear 30/50 series aircraft.

Feeler said that all Q-Star verification specialists are experienced aviation safety auditors who have credentials that are widely recognized. All have completed FSF training to verify that a charter provider meets Q-Star standards. Every verification is conducted with a written checklist to verify the

Gary Tongate, chief pilot for TAG Aviation USA, shows Q-Star verification specialist Robert McCutchan the company's written policy regarding stabilized approaches.

company's adherence to Q-Star standards and to ensure consistent and thorough inspections.

Charles McLeran, vice president of flight operations and standards for TAG, said at the beginning of the on-site visit, "The Q-Star standards are well above Part 135 requirements, in terms of certification. A good example of that is simulator training; there is no requirement for simulator training under the FARs." Simulator training enables flight crews to practice emergency scenarios, operate in unfavorable weather conditions and learn crew resource management techniques, among other benefits. The Q-Star standard requires initial training and annual recurrent training in a full-motion simulator if available for the make and model of aircraft being operated.

A Q-Star verification typically comprises interviews with company management to gauge compliance with Q-Star standards, follow-up meetings, document reviews, checks of selected aircraft, hangars and maintenance facilities, and an exit briefing of company managers. The verification of TAG, which paid a fee for the service, comprised four and a half days.

During the checks, the verification specialists confirm the charter provider's published specifications by comparing the equipment on selected aircraft to the aircraft data sheets; examine emergency equipment, placards, emergency briefing cards and exit markings; and check the minimum equipment

Q-Star Verification, Safety Audit Differ in Purpose and Scope

Flight Safety Foundation (FSF) has conducted audits of aircraft operators as a safety service for more than 40 years. The Foundation in 1999 introduced another safety service, the Q-Star Charter Provider Verification Program. The safety services are similar in providing qualified specialists to evaluate a company's safety procedures, practices and policies, but they differ fundamentally in purpose and scope.

The primary purposes of an FSF operational safety audit are to identify deficiencies and provide recommendations for improvement, and to identify methods by which company personnel can perform their duties and responsibilities more effectively and efficiently.[1]

The purpose of a Q-Star verification is to determine whether or not a company meets standards established for participation in the Q-Star program, which provides information on charter providers to program subscribers (typically, business flight operations managers) that use charter services to supplement their own in-house flight resources.

The scope of an FSF safety audit and a Q-Star verification differ markedly.

"An audit includes all aspects of an operation that pertain to safety," said Robert Feeler, who participated in more than 160 FSF audits before assuming responsibility as Q-Star program administrator in 1999. "We compare the company's operations to its own written policies and procedures, and to accepted industry standards and norms. We also examine the company's compliance with applicable FARs [U.S. Federal Aviation Regulations]."

While an audit measures a company's policies, practices and performance against various benchmarks, a Q-Star verification determines whether or not a charter provider meets specific standards for administration, aircraft, safety, maintenance and flight crews (see "Q-Star Standards Reflect Best Practices of Business Flight Operations," page 2).

"A Q-Star verification compares a charter provider's operations to a very specific and clearly defined set of standards," Feeler said.

A typical FSF safety audit includes the following:[1]

- Evaluation of all manuals and published policies, procedures and practices;
- Evaluation of safety programs, operating procedures and practices;
- On-site inspections of facilities, equipment and working conditions;
- Evaluation of training facilities, curricula, programs and instructor qualifications;
- Review of representative samples of training files and proficiency files; and,
- In-flight observations of flight procedures and practices.

An audit also includes interviews with all company managers and as many other employees as possible. Interviews provide a measure of employee knowledge and practice of company policies and procedures. Interviews also provide insight on morale and how morale may affect safety.

A Q-Star verification includes a review of manuals to determine whether they contain required materials (e.g., standard operating procedures for stabilized approaches), reviews of aircraft records and pilot records, interviews with all managers and with a few staff members, and checks of aircraft and maintenance facilities.

A Q-Star verification does not include determination of compliance with FARs.

"That's FAA's [U.S. Federal Aviation Administration's] business," Feeler said. "To provide charter service, you have to have a [FARs] Part 135 operating certificate, and the FAA is responsible for ensuring that the charter provider complies with the regulations. What we try to look at is those things that we believe need to be higher than the minimum Part 135 requirements."

(FAA does not conduct regular audits of charter providers.[2] Audits are conducted randomly, however, and/or when the FAA has reason to believe that an audit should be conducted. Compliance with FARs typically is monitored by operations inspectors and maintenance inspectors assigned to the FAA district office that holds the charter provider's operating certificate.)

Compared with an FSF safety audit, a Q-Star verification requires fewer personnel and less time. For example, the Foundation in 2000 conducted a Q-Star verification of TAG Aviation USA, a relatively large company that provides charter services, aircraft sales, aircraft management, maintenance services and a fractional-ownership program. The verification of TAG's charter operation was completed by Feeler and another FSF verification specialist, Robert McCutchan, in four and a half days. Feeler said that an audit of TAG Aviation USA might require four auditors and two weeks or three weeks to complete. (Note that although Q-Star verifications are not audits, verifications are conducted by trained and experienced FSF auditors.)

An FSF safety audit concludes with a detailed report to the company of all findings and recommendations. The audit is confidential, and the results are provided only to the company.

A Q-Star verification concludes with the determination that the charter provider meets or does not meet the program's standards. The charter provider also receives a report providing suggestions for improvements in line with Q-Star standards.

Feeler estimates that 98 percent of FSF safety audits are requested by the companies. Few audits are requested by someone outside the company; in such cases, the audit is conducted with the company's permission and cooperation.

"There are many reasons why you [i.e., a corporate aircraft operator] would invite an outside audit," he said. "You believe that you are doing things right but know that it is prudent to occasionally have a third party look over your shoulder. You tend to get tunnel vision and see what you expect to see in your operations. An outside party can review the operation objectively and with no preconceptions.

"Other events that may prompt a request for an audit include: a significant change in the organization, such as a merger or acquisition; a management change; a change in the type of aircraft operated or the type of operation conducted — launching international operations, for example; an accident or a serious incident."

Charter providers request verifications to confirm their qualifications for the Q-Star program. Information about charter providers verified as meeting Q-Star standards is listed on an Internet site, http://www.qstarcharter.com, that can be accessed by program subscribers.♦

References

1. Arbon, E.R.; Mouden, L. Homer; Feeler, Robert A. "The Practice of Aviation Safety: Observations from Flight Safety Foundation Safety Audits." Flight Safety Foundation. Second edition, March 1998.

2. U.S. Federal Aviation Regulations Part 119.59 states: "At any time or place, the Administrator may conduct an inspection or test to determine whether a certificate holder under this part is complying with … regulations, the certificate or the certificate holder's operations specifications." Part 119 prescribes certification requirements for air carriers and commercial operators.

list and the status of deferred maintenance. The checks verify that a selected sample of all aircraft meet Q-Star standards; other aircraft are verified from official documentation.

As they document the Q-Star standards met by the company, the verification specialists increasingly focus on issues for which more information is needed, said Feeler. For example, during the verification of TAG, Feeler and McCutchan determined early in the process that most of the Q-Star standards were being met by the company. Subsequent interaction with company representatives then concentrated on verifying that the remaining standards were being met.

Specialists Compare Operational Procedures to Q-Star Standards

McLeran said, "It is very difficult to raise or heighten interest in safety among our clients — they just expect it. We are committed to maintaining our reputation at all costs. We have made a real hard effort at looking at what we call 'best practices.' Our requirement is to have an airplane ready to go anywhere within 24 hours."

TAG policy is to assign to each aircraft two qualified pilots who meet FARs requirements and company requirements to serve as pilot-in-command (PIC) of that aircraft, he said. Each jet crew is assigned to fly one aircraft; this policy exceeds the Q-Star standard, which requires that pilots be assigned to fly no more than two aircraft types. TAG makes exceptions for some turboprop airplane crews, who may be assigned to fly two turboprop airplane types.

McLeran said that regular charter customers are encouraged to participate in a thorough demonstration of aircraft emergency systems.

"About 10 percent of our customers participate in the demonstrations," said McLeran. "We schedule about 30 minutes for the demonstration, but it usually goes to two hours once they get out to the plane."

Another example of company best practices is the TAG "standards pilots" group, which is responsible for measuring conformance with standard operating procedures (SOPs), observing flight operations and identifying improvements to SOPs and training. The standards pilots conduct operational observations that focus on human factors.

"The standards pilots answer such questions as: How well do the two pilots work together when they are swapping seats [reversing roles as captain and first officer]?" said McLeran. "How well does the pilot commanding the airplane function as a supporting team member when he is in the right seat [first officer]? What kind of support is a pilot able to elicit from other crewmembers? Do they talk to maintenance personnel about the condition of the airplane before they get ready to leave — or just take good maintenance for granted? Do they advise the flight attendant about imminent choppy air over the Rocky Mountains when she is getting ready to serve a meal? Human factors are deeply related to the reduction of incidents and accidents in our industry."

McLeran delivered to Feeler and McCutchan sets of pilot and aircraft information forms from TAG's bases. Using the standards checklist, Feeler asked McLeran to clarify or verify basic facts about the company. Questions included details of changes of ownership, management and reporting relationships, number of employees in all categories, employee turnover, financial condition, aviation insurance coverage, principal training organization, pending litigation, client references, accident history and history of any U.S. Federal Aviation Administration (FAA) investigations in the previous five years.

After the meeting with McLeran, Feeler and McCutchan received from Stephen Schwarz, director of maintenance, a list of the 68 aircraft available for charter. Feeler and McCutchan arranged to check at local airports a Raytheon Hawker, a Bombardier Challenger, a Gulfstream IV and a Raytheon King Air between scheduled aircraft trips. They also planned to inspect a TAG maintenance facility at San Francisco International Airport and another company's maintenance facility at Hayward Executive Airport, which is used for the maintenance of some aircraft used in TAG charter operations.

Feeler and McCutchan familiarized themselves with data sources and made notes about what was needed to verify whether specific Q-Star standards were being met. Schwarz reviewed with Feeler the company's critical-component inspection system and policies for maintenance technicians working alone. Feeler and McCutchan also discussed company policies about attendance of maintenance personnel at manufacturers' operator conferences.

Later, Feeler and McCutchan reviewed the company's manuals. Feeler went to McLeran or Schwarz several times to get missing data or to clarify data.

Gary Tongate, chief pilot, reviewed with McCutchan the record of pilot qualifications, which provides the documentary basis for each management decision to assign a pilot to specific duties. McCutchan and Tongate then went through the Q-Star pilot standards checklist item by item to verify that standards were being met.

They discussed a Q-Star requirement for a documented policy prohibiting the pairing of a low-time PIC (with fewer than 100 hours in type) with a low-time second-in-command (SIC; with fewer than 50 hours in type).

Tongate said that a policy on crew-pairing is not included in the company's flight operations manual (FOM) but that such decisions largely are made by the base managers in consultation with company management. The overall experience of each pilot is considered when making crew-pairing decisions.

"Crew-pairing has not been an issue because of the way we operate our aircraft," Tongate said. "Each crew is assigned to a specific airplane, and we make sure in advance that we do not have a low-time SIC and a low-time PIC flying together. If it is a new-airplane assignment — for instance, a crew with substantial experience in one airplane type upgrading to an airplane in which they have no experience — we will have an experienced pilot fly with them as PIC for at least two months. The crew will have well in excess of 100 hours' experience in the new airplane within a few months."

Q-Star standards require a process for incident/hazard reporting. TAG maintains two incident/hazard reporting systems: a "Pilot in Command Use of Emergency Authority/Irregularity" report and a hazard-reporting form that can be submitted anonymously by a crewmember for review only by Charles Johnson, manager of safety standards.

Feeler, McCutchan and McLeran discussed two incidents within the past five years, both involving altitude deviations during operations conducted under FARs Part 91. FAA issued letters of investigation in each incident but took no enforcement action after reviewing the incidents and verifying pilot qualifications, McLeran said.

Q-Star verification specialist Robert McCutchan checks emergency equipment aboard a TAG Aviation USA aircraft.

McLeran said that executives responsible for flight operations management were informed of the incidents and required the involved pilots to receive additional training on SOPs and other subjects. The incidents and subsequent corrective actions also were incorporated into the recurrent training of all pilots, he said.

During their interview with Johnson, who had joined the company early in 2000, the verification specialists asked about the duties of his position and his background. Johnson, a former FAA principal operations inspector, said that his background included training as an FAA accident prevention specialist and completion of a U.S. Navy aviation safety program. Johnson said that he reports directly to J.W.P. "Jake" Cartwright, president and chief executive officer, and that his duties include conducting the safety phases of employee indoctrination, training on the use of U.S. National Aeronautics and Space Administration Form 277 for Aviation Safety Reporting System reports, teaching pilots how to report to FAA a deviation from a regulation, and explaining the use of company forms for reporting irregularities.

Johnson said, with reference to training materials and safety manuals, “There is nothing I have asked for that I have not received.”

Feeler and McCutchan also reviewed the company’s hazard-reporting form and asked Johnson about any accident history in Part 135 operations for the past five years. No accidents had occurred, Johnson said.

Stephen Schwarz (left), director of maintenance for TAG Aviation USA, and Robert Feeler, Q-Star program administrator, discuss the company’s procedures for quality control of aircraft parts.

After the interview, Feeler and McCutchan reviewed their notes and the company’s procedures, and verified that the TAG policy on internal reporting of safety-related occurrences met Q-Star standards.

The verification specialists also discussed the apparent absence from the FOM of information on security procedures. When asked about the discrepancy, Schwarz explained that common industry procedures for aircraft security after arrival — such as the use of security tape, which is used to seal temporarily the edges of access panels and doors so that aircraft tampering will be evident — are followed during TAG charter flights but are not documented in the FOM.

Throughout the verification, Feeler and McCutchan copied required data from TAG forms to Q-Star forms, then compared data samples to other company records to verify the training of pilots and maintenance technicians; data from all TAG bases were provided to the verification specialists.

During his reviews of pilot records, McCutchan asked Tongate about a few apparent discrepancies, including the absence of recent flight data for some pilots. Tongate explained the data-processing limitations of some bases and arranged to have the base managers provide the additional data required for the verification. McCutchan also found that company letters of PIC authorization or letters of SIC authorization were missing from a few pilot records. He said that Q-Star verification and listing of these crewmembers would be withheld until the required documentation was provided.

McCutchan and Feeler discussed the company flight operations specifications and the company’s air carrier manual, including a copy of pending changes.

“Everything is there as required by Q-Star standards,” McCutchan said.

During their inspection of the San Francisco maintenance hangar, Feeler and McCutchan spoke with maintenance supervisors about Q-Star standards and checked the available aircraft. During the check of aircraft at Hayward, McCutchan reviewed carefully the contents of each passenger briefing card and its location, and determined that emergency equipment such as life preservers, first aid kits, fire extinguishers and oxygen equipment was stowed as shown on the placards and briefing cards.

Specialists Examine Maintenance Procedures, Adherence to Policies

During an interview with Feeler, Schwarz said that each base has its own base manager, and that typically one maintenance technician is assigned to each aircraft. The company requires maintenance technicians conducting maintenance on Part 135 aircraft to receive recurrent training at least every two years.

Schwarz said that TAG conducts only line-level maintenance on Part 135 aircraft and generally does not stock parts for them, preferring to use overnight delivery of parts. The company complies with all mandatory and recommended manufacturer service bulletins, he said.

The company conducts quarterly maintenance-control monitoring of flight maintenance logs and maintenance-control logs. These documents are received every month from the bases and quality assurance supervisors review events for the previous month, he said.

Feeler and Roy Seward, supervisor of quality assurance for Part 135 operations, discussed in depth the internal maintenance-monitoring process at TAG. Seward said that he reviews every page of maintenance records submitted from the bases. Seward said that in monitoring the maintenance of each aircraft on the Part 135 certificate for compliance with certificate requirements and company standards, he writes notes about any indicated omission or discrepancy, then contacts the responsible maintenance technicians for confirmation or correction.

"I have seen improvement since we initiated a thorough training program for our maintenance technicians," said Seward. "The paperwork has become tighter and tighter."

Quality assurance supervisors are particularly vigilant for normally expected maintenance activity that does not seem to be occurring, he said.

"If I have an older airplane with no squawks for a month — a red flag goes up for me," said Seward, who works with about 100 TAG maintenance technicians. During indoctrination, he discusses record keeping and other topics such as equipment deficiency/irregularity reports, problems that cannot be duplicated in the shop, procedures for swapping suspected components and appropriate involvement of flight crews in maintenance troubleshooting.

"We alert the pilot whenever major work has been done even though the pilot does not see the work order," Seward said. The company also conducts random inspections of aircraft for compliance with company standards in addition to the inspections required at specified intervals, he said.

Feeler randomly selected and examined the training records of 13 maintenance technicians, then Feeler and Seward discussed employee training records kept at headquarters vs. repair station technician records kept in contractor files, and the oversight of local bases.

"Overall, the selected records show good record-keeping and good training," Feeler later said to McCutchan.

Near the end of the verification, McCutchan checked a Challenger while Feeler, at TAG headquarters, looked at maintenance records for the same Challenger.

Exit Briefing Presents Results of Verification

The Q-Star verification concluded with an exit briefing involving Feeler, McCutchan, Cartwright, McLeran and Schwarz; Tongate was conducting training and could not attend. Feeler and McCutchan reviewed several items needed to complete the final verification report and discussed a variety of minor administrative items. Feeler said that TAG would need to meet two of the Q-Star standards.

J.W.P. "Jake" Cartwright, president and chief executive officer of TAG Aviation USA, makes a point about the company's crew-pairing policy during the Q-Star verification exit briefing.

"The company needs to document thorough ground-security procedures and in-flight security procedures," he said. "And the FOM should document the company's policy for precluding the scheduling of a low-time PIC with a low-time SIC."

The security-related finding concerned the limited contents of the TAG FOM regarding the security of crews, passengers and aircraft.

McLeran said that TAG uses a qualified vendor to brief the company on security measures appropriate for specific flights and to provide security services or arrange for security services when appropriate. Security procedures in the current manual were kept brief and general primarily because of the variations in specific airplanes, security equipment and operating methods, McLeran said. Then he said, "So what do we do now to meet the standard?"

"You need to say in the operations manual how you are doing this," said McCutchan. "We will require an immediate bulletin announcing the manual revision and the manual-change date." McLeran said that more specific policies and procedures would be provided immediately in a bulletin.

During the verification, McCutchan had found that the FOM did not include a crew-pairing policy.

“Everything in the FOM was acceptable except for meeting the Q-Star standard requiring a policy on scheduling low-time PICs with low-time SICs,” McCutchan said. “I can see that you need to delegate those authorities to the local base managers. We must see a policy to give guidance — a minimum standard from headquarters — for whomever is going to schedule pilots so that they are all treating crew-pairing the same.”

McLeran said that TAG had achieved the intent of the Q-Star standard by expecting uniform policy adherence at each base, but that typically, crew-pairing restrictions had been decided on a case-by-case basis with management involvement. He provided an example of a contract pilot with 1,000 hours in type who was hired to fly the first 100 hours with a crew who had just received their type ratings in the airplane.

“The policy must be stated in your FOM,” Feeler said. “We want to see a memo immediately, announcing the pending manual revision.”

TAG agreed to take these actions and upon completion, data on the company’s verified pilots and verified aircraft were published on the Q-Star Web site database.

Client’s Expectations Affect Value of Findings, Suggestions

Cartwright said that the introduction of the Q-Star program was timely for the company, which is experiencing rapid growth — adding aircraft and increasing its management of charter operations. He said that the company was launching a marketing campaign, in which compliance with Q-Star standards would be an important method of demonstrating to clients the company’s commitment to safety.

Cartwright said, “When we stand up in front of a customer, we really get one chance to talk about safety because in selling the program you want to say, ‘Our number one customer service is actually safety.’ Once we are operating the airplane, the customer’s focus on safety disappears — it just becomes a given. But we are not getting paid to put fresh flowers in the airplane, we really are paid to keep our customers safe — to bring them home at night.

“Charter has become a very important revenue piece of our business, with a lot of investment in marketing. We really want to grow. Q-Star is a good standard to volunteer to meet.”♦

For more information about the FSF Q-Star Charter Provider Verification Program, visit the Foundation’s Internet site, http://www.flightsafety.org; contact Joanne Anderson, Technical Assistant, Flight Safety Foundation, 601 Madison Street, Suite 300, Alexandria, VA 22314-1756, telephone: +1 (703) 739-6700 extension 111, fax: +1 (703) 739-6708; or e-mail Robert Feeler, Q-Star program administrator, at admin@qstarcharter.com.

Forty-three Fatal Accidents Reported Among Eastern-built Jets From 1990 to 1999

Data compiled by the U.K. Civil Aviation Authority show decreases in the number of jet accidents and fatalities every year since 1996.

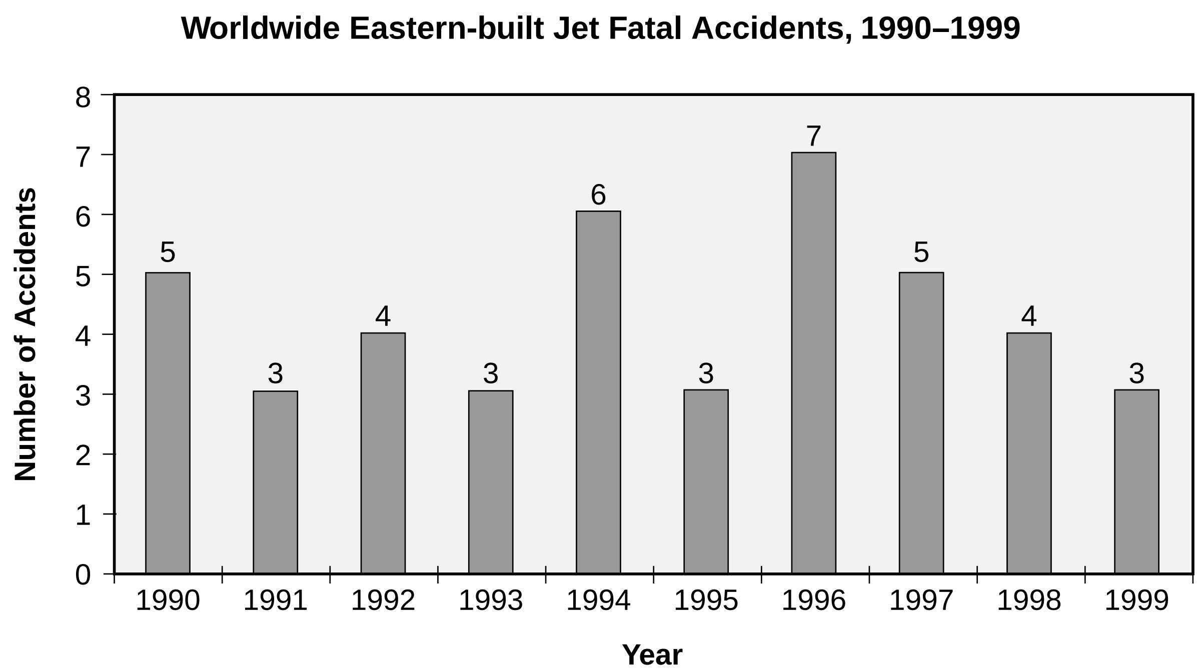
FSF Editorial Staff

Forty-three fatal accidents occurred worldwide among Eastern-built jet airplanes from 1990 to 1999, the U.K. Civil Aviation Authority (CAA) said in its report, *Aviation Safety Review, 1990–1999* (Figure 1). Three fatal accidents were recorded in 1999, the third consecutive year in which the number of fatal accidents decreased. The highest number of fatal accidents in a single year during the 10-year period was seven, recorded in 1996. The lowest was three, recorded in 1991, 1993, 1995 and 1999.

The 43 fatal accidents resulted in 1,832 fatalities, CAA said (Figure 2). Eighty-five fatalities were recorded in 1999, the lowest number since 1991, when there were 68 fatalities. The highest number of fatalities occurred in 1994, when there were six fatal accidents and 355 fatalities. Two accidents, both involving Tupolev 154s, accounted for a total of 285 of the 355 fatalities. In one accident in China, an autopilot failure resulted in excessive vibration and the in-flight break-up of the airplane. In the second accident, an engine fire after takeoff from an airport in Russia resulted in the pilots' loss of control of the airplane.

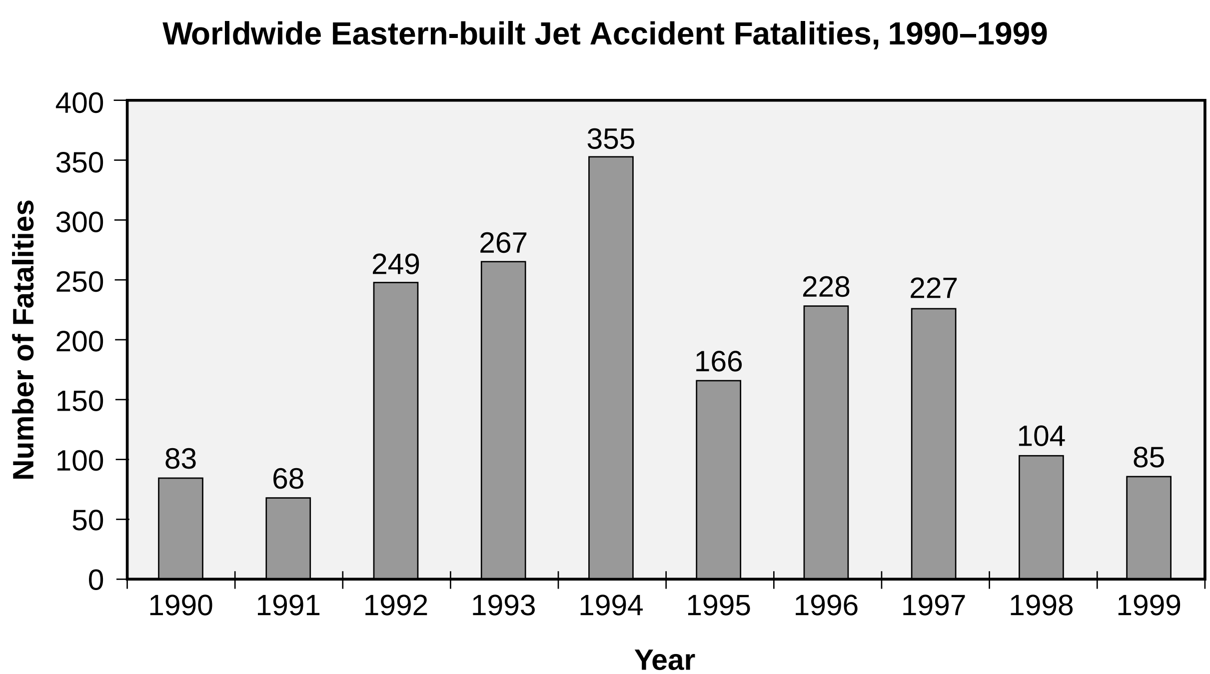
Fifty fatal accidents occurred worldwide among Eastern-built turboprop airplanes from 1990 to 1999, CAA said (Figure 3, page 16). Five fatal accidents occurred in 1999, compared with seven the previous year. The highest number of fatal accidents in a single year during the 10-year period was nine, recorded in 1992. The lowest number of fatal accidents was three, recorded three times during the 10-year period — in 1990, 1994 and 1997.

The 50 fatal accidents resulted in 1,084 fatalities, an average of 108 per year (Figure 4, page 16). Fifty-three fatalities were recorded in 1999, the lowest number since 1994, when there were 44 fatalities. The lowest single-year total during the 10-year period was 14 fatalities, recorded in 1990. The highest was 372 fatalities in 1996, including 297 people killed on the ground when an Antonov 32 overran the runway and came to a stop in a market during an attempted takeoff from Kinshasa, Zaire. The number of fatalities in accidents involving Eastern-built turboprop aircraft has decreased every year since 1996.♦



Source: U.K. Civil Aviation Authority

Figure 1



Source: U.K. Civil Aviation Authority

Figure 2

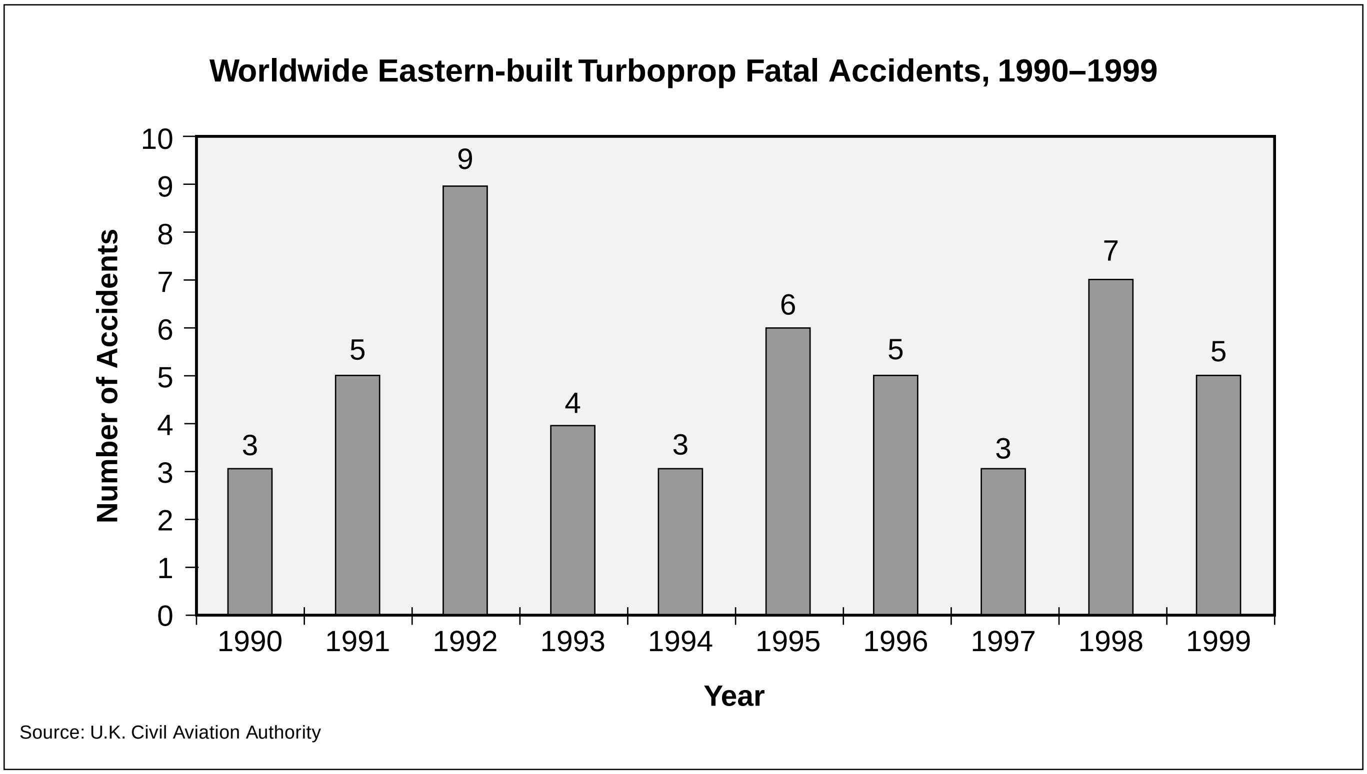


Figure 3

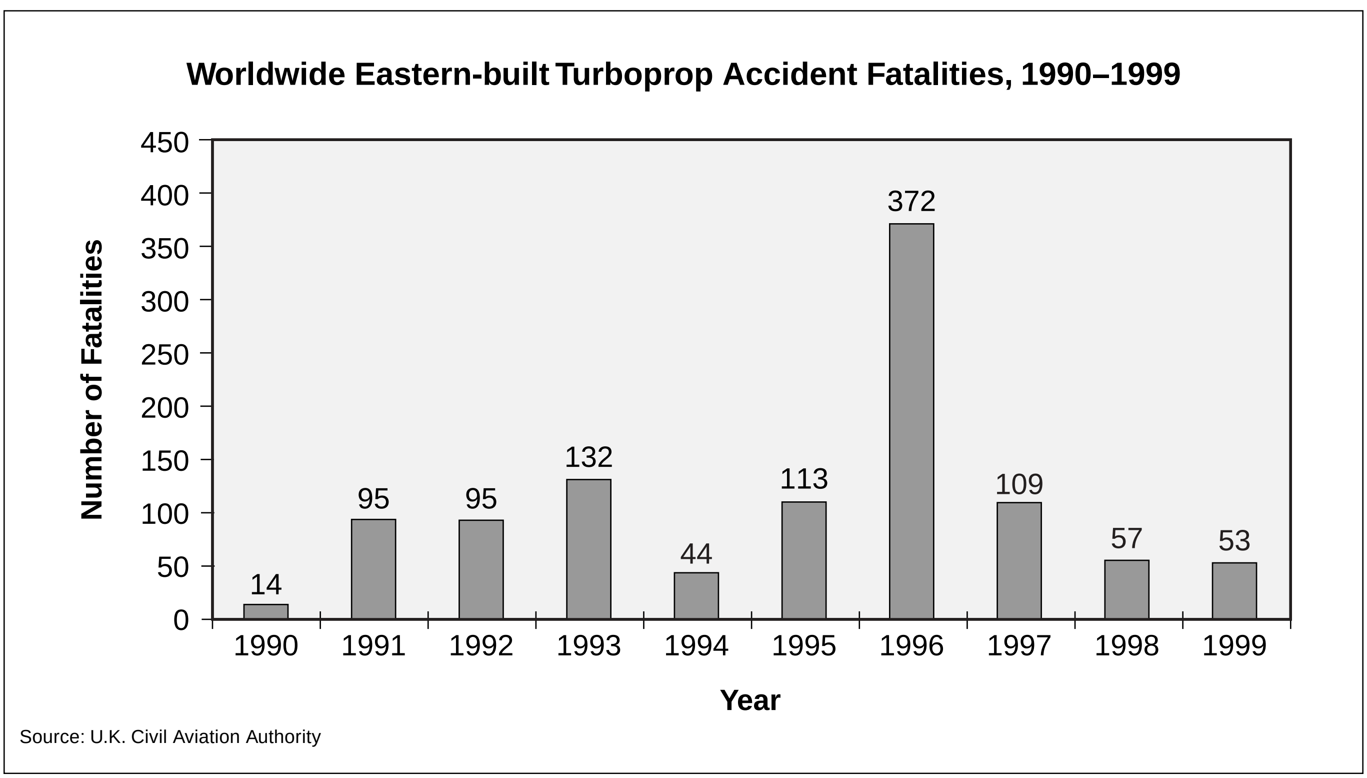


Figure 4

Publications Received at FSF Jerry Lederer Aviation Safety Library

FAA Advisory Circular Provides Information on Airworthiness Certification Of Products Imported to U.S.

The document describes FAA objectives, regulations and general practices for U.S. acceptance of civil aeronautical products manufactured in other countries.

Advisory Circulars

Airworthiness Certification of Civil Aircraft, Engines, Propellers, and Related Products Imported to the United States. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 21-23A. Oct. 20, 2000. 62 pp. Figures, appendixes. Available through GPO.*

FAA is responsible for issuing standard airworthiness certificates and granting airworthiness approvals for aeronautical products manufactured in countries that have technical cooperation agreements with the United States. This AC is a reference guide for the most common situations encountered in the design approval process leading to FAA type certification or a letter of issuance of technical standard order design approval. The AC also provides guidance about obtaining FAA airworthiness certification or approval of civil aeronautical products for import into the United States. Included are FAA objectives, regulations and general practices.

This AC cancels AC 21-23, *Airworthiness Certification of Civil Aircraft, Engines, Propellers, and Related Products Imported to the United States*, dated July 7, 1987.

Recommended Method for FAA Approval of Aircraft Fire Extinguishing System Components. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 20-144. Sept. 22, 2000. 15 pp. Figure, table. Available through GPO.*

This AC provides guidance to companies seeking FAA approval of fire-extinguishing system components. The document describes critical parameters for the design, production, testing, approval process and methods that demonstrate compliance with system requirements. Parameters described apply to the following components: explosive firing cartridges, precision burst discs, fill fittings, pressure indicators and discharge heads. The AC does not address aircraft systems installations or airframe installation requirements.

Airport Design. U.S. Federal Aviation Administration Advisory Circular (AC) 150/5300-13. "Change 6." Sept. 30, 2000. 57 pp. Figures, tables, appendixes. Available through GPO.*

"Change 6" expands previously issued guidelines to include new approach procedures and new flight standards requirements. Principle changes to AC 150/5300-13 involve the following topics: runway protection zone, precision object-free area, runway safety area width, threshold siting criteria and a new instrument approach category (approach procedure with vertical guidance).

Reports

Distribution of Butalbital in Biological Fluids and Tissues. Lewis, Russell J. U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine. DOT/FAA/AM-00/29. August 2000. 4 pp. Tables. Available through NTIS.**

As part of the investigation of fatal U.S. aviation accidents, postmortem blood samples and tissue samples from pilots and copilots are submitted to the FAA Civil Aeromedical Institute for toxicological analysis. In accidents in which the recovery of bodies has been delayed or in which the bodies have been damaged severely, there are no blood samples. In such cases, investigators and toxicologists must be able to estimate drug concentrations from recovered body tissue. This report is based on a study showing that concentrations of the drug butalbital can be determined from muscle tissue and from tissue from kidneys, lungs, spleens, brains, livers and hearts. Butalbital is a short-acting barbiturate prescribed for tension headaches and is found in combination with other drugs such as acetaminophen, aspirin, codeine and caffeine. Some of the side effects of butalbital, such as drowsiness, sedation, dizziness and a feeling of intoxication, could affect pilot performance and could be factors in an accident.

Galactic Cosmic Radiation Exposure of Pregnant Aircrew Members II. Nicholas, Joyce S.; Copeland, Kyle; Duke, Frances E.; Friedberg, Wallace; O'Brien, Keran III. U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine. DOT/FAA/AM-00/33. October 2000. 6 pp. Tables. Available through NTIS.**

The International Commission on Radiological Protection (ICRP) considers aircrews to be occupationally exposed to cosmic radiation. In 1990, the commission issued a recommendation regarding occupational exposure during pregnancy. The recommendation assumed that a dose of cosmic radiation to a pregnant woman's abdomen would be reduced by half as the radiation traversed the woman's body to the conceptus (embryo or fetus and its extraembryonic membranes). This report tested and disproved the commission's assumption. Researchers compared equivalent doses of radiation received by human tissue at high altitudes and low altitudes, on two different air carriers, on domestic flights and overseas flights. Findings showed that, with uniform whole-body exposure, the equivalent dose of radiation to each tissue or organ was the same as the effective dose to the whole person. Therefore, the pregnant woman's body does not shield the conceptus. The amount of galactic radiation to the mother is a valid estimate of the equivalent dose to the conceptus. To comply with recommendations from ICRP and regulatory agencies such as FAA, pregnant crewmembers can reduce occupational exposure to galactic radiation by working on short, low-altitude, low-latitude flights.

Books

Combat Aircraft Since 1945. Wilson, Stewart. Fyshwick, Australia: Aerospace Publications, 2000. 154 pp.

This single-volume directory is a collection of photographs and background information describing 260 combat aircraft that have been used in armed forces worldwide from 1945 to the present. The opening section focuses on milestones achieved by combat aircraft since 1945. The remainder of the directory is devoted to major combat aircraft of the postwar era, and to other aircraft, including prototypes that never reached production and never were placed in service. Each entry includes a photo and data on the country of origin, the type of aircraft, the powerplant, dimensions of the aircraft, weights, armament, performance, and production totals. Details also are included regarding design, development, testing and manufacturing of the aircraft, as well as their unique characteristics and their roles in military encounters. (Contains a glossary and an index.)

Disaster in the Air. Haine, Edgar A. Cranbury, New Jersey, U.S., and London, England, U.K.: Cornwall Books, 2000. 394 pp.

The book contains summaries of 89 of the world's most serious (in numbers of lives lost) airplane accidents from 1927 to 1998. The summaries describe each accident, news accounts and investigations. The author includes recommendations by investigative authorities, lessons learned and actions taken following the accidents. The book begins with a chapter on the history of the development of aviation safety and accident investigation in the United States. Appendixes contain summaries of safety documents, airplane data and U.S. aviation statistics. (Contains tables, appendixes, a bibliography and an index.)♦

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* Superintendent of Documents
U.S. Government Printing Office (GPO)
Washington, DC 20402 U.S.
Internet: http://www.access.gpo.gov

** National Technical Information Service (NTIS)
Springfield, VA 22161 U.S.
Internet: http://www.ntis.org

Accident/Incident Briefs

Engine Cowlings Separate From Airplane In Cruise Flight

The flight crew heard a bang and felt the DC-8 shake; the airplane lost cabin pressure, and a subsequent inspection revealed a hole in the fuselage.

FSF Editorial Staff

The following information provides an awareness of problems through which such occurrences may be prevented in the future. Accident/incident briefs are based on preliminary information from government agencies, aviation organizations, press information and other sources. This information may not be entirely accurate.

Air Carrier

Over-pressurization Suspected In Loss of Engine Cowlings

Douglas DC-8. Substantial damage. No injuries.

Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed for the night cargo flight in the United States.

During cruise flight at Flight Level 370 (37,000 feet), the flight crew heard a bang, felt the airplane shake and observed a loss of cabin pressurization. Instruments showed a loss of power from the no. 2 engine, and the crew pulled the no. 2 emergency "T" handle. The crew donned oxygen masks, began a descent and landed.

An inspection of the no. 2 engine nacelle showed that the inboard main-engine cowling and the outboard main-engine cowling had separated from the nacelle. There was no evidence of an engine fire or of a fire in the nacelle. The fuselage behind the left wing had an 18-inch by 16-inch (45.7-centimeter by 40.6-centimeter) hole. The left horizontal stabilizer also was damaged. The high-pressure bleed-air duct, which was four inches (10.2 centimeters) in diameter, had separated from the high-pressure relief valve; a connecting clamp was not found. The wire bundle, which transmitted no. 2 engine-monitoring data to the flight deck, was cut.

The report quoted the aircraft operator as saying, "When the clamp assembly failed, high-pressure bleed air from the four-inch-diameter duct dumped into the area inside of the engine cowlings. The sudden over-pressurization probably expanded the main engine cowlings into the airstream, leading to the loss of the cowlings. The amount of airflow from the high-pressurization bleed-air duct far exceeds the air discharge capacities of the cowling blowout panels."

Engine Damaged by Separation of First-stage Turbine Blades

BAE SYSTEMS 146. Minor damage. No injuries.

Early in the takeoff roll at an airport in Australia, the flight crew heard a noise, then observed indications of a loss of power and a decrease in revolutions per minute on the no. 2 engine. The crew rejected the takeoff and taxied the airplane back to the gate.

The aircraft operator's examination of the engine showed that the engine-fan assembly was not rotating. Subsequent examination by the engine manufacturer revealed that the engine had been damaged substantially when two first-stage turbine blades separated because of fatigue cracks from the blade trailing edges near the blade platform.

The engine manufacturer said that action had been developed to correct fatigue failure of first-stage turbine blades, as described in Service Bulletin ALF/FL 502/507 72-1043, which was issued in January 1999 and revised in September 1999. The manufacturer had recommended compliance with the service bulletin during the next access to the first-stage turbine.

The first-stage turbine was accessible in February 1999 during a hot-section inspection conducted by the engine manufacturer. The incident report said that there was no record that the service bulletin was complied with during that inspection.

Takeoff Rejected After Uncontained Engine Failure

McDonnell Douglas DC-10. Minor damage. No injuries.

Visual meteorological conditions prevailed for the afternoon takeoff from an airport in the Netherlands. During the takeoff roll, between 50 knots and 60 knots, an “ENGINE FAIL” warning light illuminated. The crew rejected the takeoff and taxied the airplane to the gate, where passengers deplaned normally.

An inspection showed that there had been an uncontained failure of the no. 1 engine and a tear in the plane of the stage 2 low-pressure turbine nozzles. The engine cowling also had been torn where material from the nozzles separated from the engine.

Wind Topples Mobile Passenger Stairs

Boeing 737. Minor damage. One serious injury; one minor injury.

After a late-afternoon arrival at an airport in Canada, the airplane was parked, and passengers began deplaning on mobile passenger stairs. A woman and two children were deplaning when the mobile passenger stairs were toppled by wind.

Winds at the time of the occurrence were from the southwest at 40 knots, with gusts to 54 knots.

Examination of the airplane showed an eight-inch (20.3-centimeter) dent and a tear in the no. 1 engine cowling.

After Hydraulic System Failure, No Directional Control During Landing

Airbus A340. Minor damage. No injuries.

About 90 minutes before their scheduled midday arrival at an airport in Australia, the flight crew observed an alert on the electronic centralized aircraft monitor (ECAM) hydraulic page that indicated low fluid quantity in the “green” hydraulic system. The flight crew performed the “hydraulic green system leak” procedure published in the quick reference handbook and shut down the green hydraulic system’s engine-driven pump and the electric pump. The ECAM then indicated stable fluid quantity.

When the flight crew reactivated the green-hydraulic-system pumps before attempting to extend the landing gear, they observed no system pressure. When the landing-gear lever was moved to the “down” position, the landing gear did not extend.

The landing gear was extended by using the alternate gravity-extension system. The flight crew described the landing as normal and said that, after touchdown, they used the rudder to maintain directional control. Because of the loss of the green hydraulic system, the no. 1 and no. 4 thrust reversers were inoperative, and there was a “loss of some ground spoiler functionality,” the occurrence report said.

As the airplane slowed, the first officer experienced difficulty maintaining directional control. The captain took control of the airplane, but he was unable to maintain directional control. Full manual braking was applied to stop the airplane, which yawed to the right and stopped with the nose wheels in soft ground next to the runway.

Air Taxi Commuter

Wheel Assembly Separates During Takeoff

Beech 1900. Minor damage. No injuries.

During the late afternoon takeoff roll from an airport in Canada, the left-outboard main-wheel assembly separated from the airplane. The flight crew was unaware of the problem, but the separation of the wheel assembly was observed by witnesses on the ground. Air traffic control contacted the crew, who returned to the airport for a normal landing.

Maintenance personnel found the main-wheel assembly, inspected the airplane’s axle assembly and determined that the left-outer wheel bearing had failed.

The accident report said that inspection and repacking of the wheel bearing are required at each tire change and that the wheel and tire assembly had been in service for more than 300 hours.

Captain's Windshield Shatters During Cruise Flight

Canadair CL-600-2B19. Minor damage. No injuries.

The aircraft was in cruise at Flight Level 270 (27,000 feet) on a flight from the United States to the Bahamas when the captain's windshield shattered. The flight crew declared an emergency and began an emergency descent to the destination airport, where they conducted a normal landing.

The cracked windshield was the second replacement windshield to be installed in the airplane. The original windshield, which was installed when the airplane was manufactured in 1996, cracked during a takeoff roll July 2, 1999, after 6,879 hours in service and 6,565 cycles. The first replacement windshield cracked during cruise flight Dec. 13, 1999, after 1,236 hours in service and 1,068 cycles. The second replacement windshield cracked after 899 hours in service and 803 cycles.

The incident report said that U.S. Federal Aviation Administration service difficulty reports from 1990 through Feb. 9, 2000, showed that 83 cracked or shattered windows had been reported on Canadair CL600 series airplanes.

Improper Airspeed Control Blamed for Hard Landing

Beech 200. Substantial damage. One minor injury.

Darkness and instrument meteorological conditions prevailed as the air ambulance crew flew the airplane on a nondirectional beacon-distance measuring equipment (NDB-DME) approach to an airport in Sweden. The flight crew was late in establishing the airplane on the final approach course and conducted a missed approach.

The accident report said, "The second approach was then established on the approach centerline. The crew extended the landing gear and selected the flaps to the first detent before descending towards the minimum descent altitude for the approach."

During descent through 2,400 feet, the airplane drifted right. As the first officer (the pilot flying) corrected for the drift, the flight crew saw the runway. The first officer observed that the airplane was too low and increased the pitch attitude, causing airspeed to decrease.

"Shortly before passing the runway threshold, the [captain] noticed that landing flap[s] had not been selected, whereby he extended the flaps to the correct position," the report said. "The [first officer] attempted to correct for the trim change caused by extending the landing flaps by abruptly lowering the aircraft nose from a few meters height. The [captain] attempted to counteract the increased sink rate by increasing thrust on the engines. The aircraft made a hard landing."

Before shutting down the engines, the crew activated the airplane's deicing boots to remove six millimeters to seven millimeters (0.23 inch to 0.27 inch) of ice from the wing leading edges.

A subsequent examination of the airplane showed damage to the left-engine mount and the left wing.

The report said that the accident was caused by "improper speed control during the landing, which was carried out in difficult weather conditions. The [captain's] lack of supervision during the approach and landing, combined with the [first officer's] inexperience with night flying, were also contributing factors." The report said that the first officer had a total of 588 flight hours, including 40 flight hours at night.

Corporate Business

Pilot Blamed for Hard Landing In Adverse Wind Conditions

Gulfstream American 690C. Substantial damage. No injuries.

Visual meteorological conditions prevailed and an instrument flight rules (IFR) flight plan had been filed for the morning flight in the United States. The pilot canceled the IFR flight plan before entering the traffic pattern on the left base leg for Runway 24.

The pilot increased approach airspeed by five knots to 105 knots because of turbulence. (Winds four minutes after the accident were from 280 degrees at 26 knots, gusting to 31 knots.) The pilot said that the airplane touched down "not particularly hard, within the first third of the runway and on the right-main landing gear." He also said that, after the left-main landing gear touched down, the airplane traveled about 100 feet (30.5 meters) before the left-main landing gear collapsed. The airplane then skidded left and stopped partially off the runway.

Witnesses said that the airplane touched down first on the left-main landing gear. One witness saw smoke immediately after touchdown and saw the landing gear collapse. Other witnesses said that the airplane bounced, touched down on the right-main landing gear and "finally settled down on the left propeller and fuselage."

An investigation showed skid marks on the 5,601-foot (1,708-meter) runway beginning about 3,100 feet (946 meters) from the threshold and left of the centerline.

The accident report said, "About 200 feet [61 meters] further along, there was a skid mark that correlated to the right-main landing gear, and about 300 feet [92 meters] beyond that, skid marks correlated to the left propeller and fuselage. The marks continued an additional 1,100 feet [336 meters] and ended just past the 1,000-foot [305-meter] remaining marker."

Examination of the airplane revealed a fracture in the left-main landing-gear inboard-retract cylinder clevis, just below the attaching bolt hole, and a crack in the center of the upper drag brace in the webbing where the landing-gear door-actuating mechanism was attached. The crack at the center of the upper drag brace progressed through a manufactured hole with small fatigue crack regions on both sides of the hole and crack initiation from multiple locations within the hole. There was no evidence of pre-existing mechanical damage.

The report said that the probable cause of the accident was "a hard landing due to the pilot's inadequate compensation for the wind conditions."

Inadequate Greasing Was Likely Cause of Loss of Aileron Control

Learjet 35A. No damage. No injuries.

The airplane was taxied along wet taxiways at an airport in Canada onto a runway that also was wet because of heavy rain earlier in the day.

During the climb through Flight Level 290 (29,000 feet), the captain, who was the pilot flying, observed that the airplane was turning right with five degrees of bank. The autopilot was engaged, and there was no apparent reason for the turn. At FL 300, the captain disengaged the autopilot and attempted to regain control of the airplane by using a variety of control inputs, including rudder and differential power, but the bank angle increased to about 20 degrees. The flight crew observed no fuel imbalance.

The crew informed air traffic control of their problem with the flight controls and then began the control malfunction checklist.

The incident report said, "The crew attempted several applications of aileron input. After four or five attempts, they felt a small movement and saw a reduction of five degrees of bank. Continuing applications of force to the ailerons resulted in further movement until full aileron control returned. By this time, the aircraft had turned approximately 215 degrees to the right."

The crew returned to the departure airport and conducted a normal descent, approach and landing.

An inspection determined that frozen brush seals between the wings and the ailerons may have interfered with movement of the ailerons. The report said that the brush seals had not been greased adequately. Since the incident, the operator has increased the frequency of greasing from every 300 hours to every 100 hours and has acted to ensure that pilots can assess grease levels during their preflight inspections.

Landing Gear Damaged When Airplane Strikes Power Line

Cessna 310. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the night flight from a private airstrip in the United States.

The pilot said that, shortly after takeoff, he realized that he had forgotten his wallet, which contained his pilot credentials. He flew the airplane back to the private airstrip.

The report said that, during the approach, the pilot flew into "a sudden wind change or downdraft," and the nose landing gear struck an electric power line. The pilot abandoned the approach and flew to a nearby airport, where airport employees told him that the nose landing gear was "twisted 90 degrees to the left and was pushed back and dangling." He then flew to another airport, where air traffic control confirmed the position of the nose landing gear. The pilot circled the area for an hour to use fuel, then landed at the airport that had the control tower. As the airplane landed, the nose landing gear caused the airplane to veer to the left, and the airplane stopped in the grass next to the runway.

Other General Aviation

Electrical Short Circuit Ignites Insulation During Training Flight

Cessna 172P. Minor damage. No injuries.

The pilot was on a training flight when he smelled fumes. He landed as soon as possible at an airport in Canada. During the landing roll, smoke filled the cockpit, and the pilot observed flames in the passenger-side firewall. The pilot stopped the airplane on a taxiway and used a fire extinguisher to extinguish the fire.

Inspection of the airplane showed that the firewall insulation had been ignited when the electrical power wire for the Hobbs meter (engine-time recorder) shorted on the radio rack.

Loose Fuel-line Connection Suspected in Loss of Power

Rans RV-3. Substantial damage. One fatal injury.

The pilot was flying a single-seat experimental aircraft to and from a fly-in at an airport in Australia on behalf of the owner. He had five flight hours in the aircraft type; to re-familiarize himself with the airplane, he had flown it the previous day.

On the flight to the airport, the engine operated roughly, and the pilot landed to clear what he thought was a fouled spark plug. The subsequent takeoff, flight and landing at the fly-in appeared to be normal.

After takeoff from the fly-in, the engine suddenly lost power as the airplane reached 200 feet. Witnesses saw the airplane's pitch attitude decrease and heard the engine regain power. The airplane began a left turn and climbed slightly before the engine lost power again. The airplane then descended and struck a playing field.

Examination of the airplane showed that there had been adequate fuel in both wing fuel tanks, that there was a loose connection in a fuel line between the fuel filter and the engine-driven fuel pump and that the carburetor fuel level had been low while the airplane was in operation. Both the engine-driven fuel pump and the electric auxiliary fuel pump were tested and operated normally. The spark plugs were in a condition "consistent with operating in a lean mixture immediately prior to the engine stopping," the accident report said.

"The loose fuel-line connection could have allowed air to enter the carburetor," the report said. "This may have been prevented had the electric pump been selected 'on,' as it would have provided fuel pressure to the engine-driven pump. The investigation could not determine whether the electric fuel pump had been selected 'on' for the takeoff. The aircraft owner said that he had never used the electric pump for takeoff."

Airplane Strikes Terrain During Spin-awareness Training

Cessna 152. Airplane destroyed. Two serious injuries.

Visual meteorological conditions prevailed for the training flight in England, and the forecast was for visibility of six kilometers (3.7 miles) in haze and scattered clouds at 4,000 feet.

The flight lesson was part of the required training for a basic commercial pilot license and was to include stall-spin awareness, although the instructor said before the flight that the cloud base might be too low to allow for spin training. (The flight-training organization said that spins must be entered above 4,000 feet above ground level (AGL) and that recoveries must be completed before descending through 3,000 feet AGL.) After conducting several stall recoveries, the student was asked to put the aircraft into a spin and did so. The instructor said that, after he asked the student to recover from the spin, the student initially took no action, so the instructor closed the throttle. The instructor again asked the student to recover from the spin, but there was no response.

"At this stage," the accident report said, "the instructor described experiencing shock at the fact that there was no recovery, as in his previous experience, the aircraft had always recovered easily. Full corrective control inputs did not appear to be effective, so he returned the controls to the neutral position, checked the flap and throttle positions and reapplied the opposite-rudder and control-column-forward inputs. The aircraft still did not recover, so he experimented with other control column positions and power settings. The aircraft broke out of the spin suddenly, and he was able to level the wings and get the nose just above the horizon before the aircraft hit the ground."

The airplane struck the surface in a level attitude, bounced and broke apart.

The instructor said that the aircraft had been just below the cloud base before the spin was begun. Radar showed that the airplane reached 3,600 feet above mean sea level (MSL) before entering a steep descent. The elevation of the accident site was 970 feet MSL.

The report said that, when the correct recovery technique is used, Cessna 152 aircraft typically recover easily from spins. Nevertheless, the report said, "Factors that may delay or prevent the recovery are a lateral imbalance, an adverse [center of gravity] position, power remaining on, an incorrect recovery technique or recovering from a spin after a large number of turns."

Rotorcraft

Helicopter Strikes Wires During Approach to Field

Bolkow 105DB. Minor damage. No injuries.

The helicopter, an emergency medical service aircraft, was being flown to assist an injured child in England. As the helicopter approached the child's location, the crew observed an ambulance-service marshaller in a large field surrounded by trees.

The helicopter crew had no radio contact with anyone on the ground, and the pilot overflew the field at 300 feet to search for possible obstructions; he saw none and began an approach. At 100 feet, he began to reduce airspeed, then observed power lines immediately ahead. The helicopter struck the power lines. One power line appeared to break on contact with the helicopter, just below the cockpit bubble, but the pilot had to maneuver the helicopter to break free; a second wire contacted the helicopter's automatic direction finder (ADF) antenna, and the ADF antenna separated from the helicopter. One of the power lines started a fire on the field, but the helicopter was landed normally.

The pilot said that the power lines were hidden and that, if wire cutters had been installed on the helicopter, they might have resulted in a clean cut of the wires. The accident report said that wire cutters are not required and that the best method of avoiding power lines during low-level helicopter operations is "effective air and/or ground reconnaissance."

Helicopter Sinks After Precautionary Landing in Pacific

Hughes 369HS. Helicopter destroyed. No injuries.

The helicopter was being flown on a fish-spotting mission over the Pacific Ocean about 500 miles (805 kilometers) north of Papua, New Guinea. The pilot heard grinding noises in the cyclic control, followed by a bang, and then conducted a precautionary landing on the water near the fishing vessel from which the helicopter had taken off. The helicopter was engulfed in a large ocean swell and sank. The pilot and observer-passenger were rescued from the water by fishing-vessel personnel.

Helicopter Impacts River During External-load Operation

Bell 206B. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the late-afternoon external-load flight in Costa Rica. The helicopter had taken off from a research ship anchored in a bay near the accident site, and the pilot was attempting to pick up expedition equipment and production equipment from a sand bar.

The pilot said that the load demand might have exceeded the available engine power and that "the tension on the cargo hook caused the helicopter to yaw right and roll to the left." The helicopter struck the river and rolled upside down. The main-rotor mast was severed in the accident, and the tail boom separated from the aircraft.

Helicopter Strikes Terrain After Low-rotor RPM Descent

Robinson R-22. Substantial damage. One serious injury; one minor injury.

Visual meteorological conditions prevailed for an afternoon aerial photography flight in the United States. The photographer, who also was a student helicopter pilot, said that he had completed photographing one site and that the helicopter was being flown just above trees at a slow forward speed.

"Our height above the ground was between 100 [feet] and 200 feet," the photographer said. "We got extremely slow, and the helicopter started shaking and wobbled with a high descent rate to the ground. While descending, I remember seeing the pilot out of the corner of my eye, and he was making a lot of control movements. The low-rotor RPM [revolutions per minute] warning horn and light stayed on from the time the helicopter started shaking all the way to the ground."

The pilot said that his memory of the accident was vague and that he did not recall vibrations or noises before the helicopter impacted terrain on residential property.

The impact caused the helicopter's left skid to collapse. The drive belts were disconnected but not broken, and the rotor blades were bent but not broken.

A weight-and-balance review showed that the helicopter weighed about 1,362 pounds (617.8 kilograms) when the accident occurred; the pilot operating handbook (POH) said that the maximum gross weight was 1,370 pounds (621.4 kilograms).

The pilot said that the helicopter had no mechanical deficiencies. The helicopter's main fuel tank was almost full, and the auxiliary fuel tank was about half full.

The POH said that activation of the low-rotor RPM warning light and warning horn indicate rotor RPM at 95 percent or less. Minimum rotor speed with power on is 97 percent.♦

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