FLIGHT SAFETY FOUNDATION

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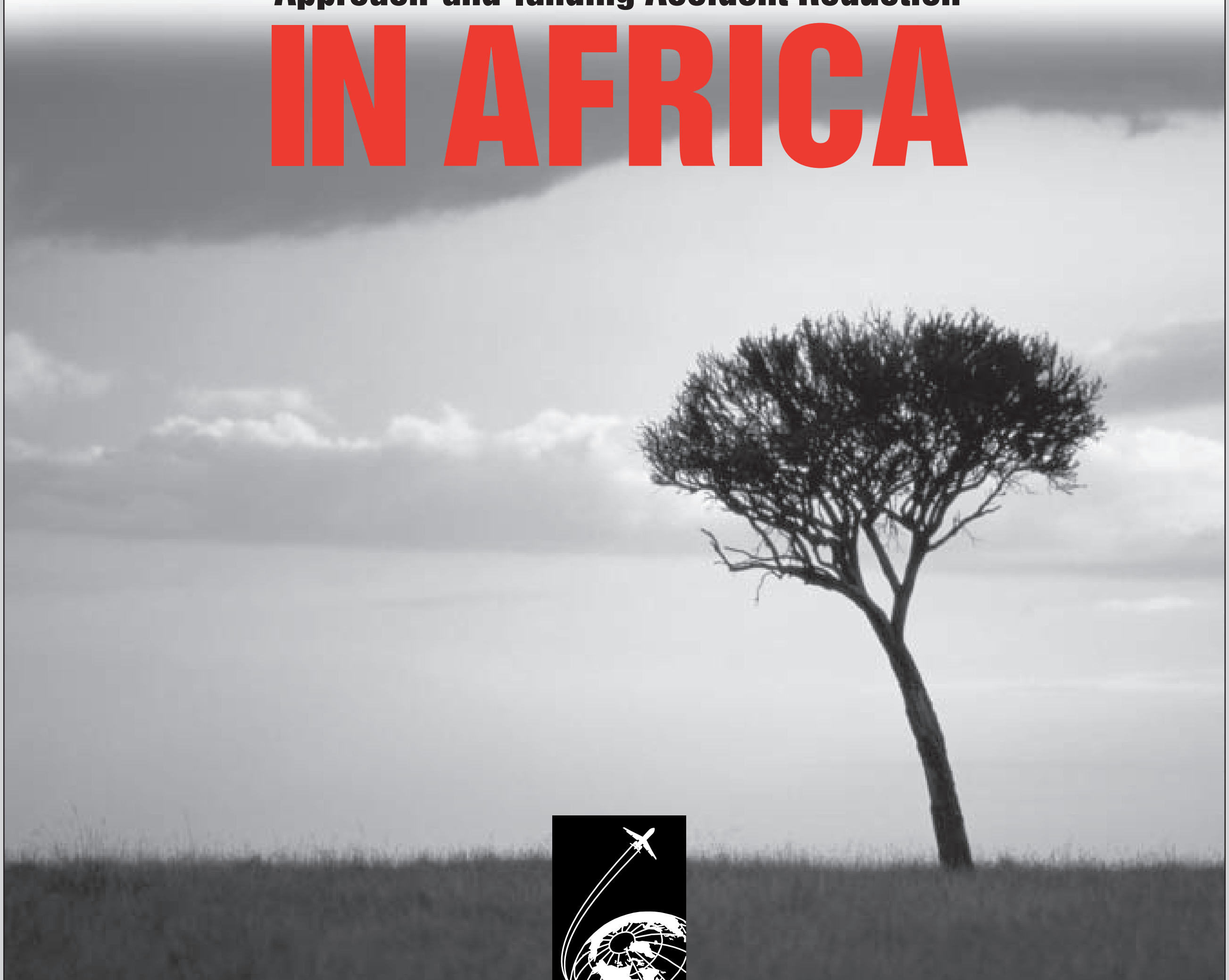
FLIGHT SAFETY DIGEST

ALAR

Approach-and-landing Accident Reduction

IN AFRICA



FLIGHT SAFETY FOUNDATION
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In This Issue

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 850 member organizations in more than 140 countries.

ALAR Regional Implementation Campaign Reaches Key Objective of Introducing Safety Tools in Africa

Foundation workshops on approach-and-landing-accident-reduction (ALAR) strategies based on the FSF* ALAR Tool Kit *will help aviation professionals to tailor preventive measures to Africa, where some safety problems are more severe than in other world regions.

FSF Editorial Staff

Leaders of air transport safety initiatives from several countries in Africa have found compelling reasons to focus their efforts on reducing approach-and-landing accidents (ALAs). Flight Safety Foundation (FSF) presented two approach-and-landing accident reduction (ALAR) workshops in Africa in late November 2001 that encouraged the first steps in implementing ALAR strategies suitable to the needs of Africa, where ALAs are among many problems faced by aircraft operators.

Africa is the world's second-largest continent, behind Asia. The topography and climate vary widely, and the more than 40 countries in the region have diverse political systems, economies, languages and cultures. The aviation-safety problems in Africa are no different than those in other regions, but data show that some problems are more severe (see "AIDS Epidemic Poses Difficult Challenge to Aircraft Operators in Africa," page 2).

Adapting FSF *ALAR Tool Kit*[1] elements to reduce ALAs in Africa was the focus of discussions during the ALAR workshops Nov. 28, 2001, in Nairobi, Kenya, and Nov. 29, 2001, in Johannesburg, South Africa. The workshop in Nairobi was attended by more than 40 aviation professionals and was hosted by Airkenya and Kenya Airways. The workshop in Johannesburg was attended by more than 60 aviation professionals and was hosted by South African Airways.

"Approach-and-landing accidents are a problem everywhere, but particularly here in Africa," said James Burin, FSF director of technical programs, who conducted the workshops with members of the FSF Controlled Flight Into Terrain (CFIT)/ALAR Action Group (CAAG [see "Workshop Presenters Typify Volunteers for FSF ALAR Efforts," page 3]).

Several workshop participants said that problems of infrastructure and regulatory oversight are especially critical in Africa. At the root of the problems in many parts of the region is a lack of resources, they said.

"The lack of infrastructure, the lack of training of personnel — aircrew, ATC [air traffic control] and regulatory personnel — and nonenforced or nonexistent legislation are the main reasons for the high accident rate in Africa," said Capt. Tesfaye Zewdie, chief safety officer for Ethiopian Airlines.[2] "I believe that we have more problems in Africa regarding flight safety than anywhere else."

"Radar coverage is minimal, and procedural let-downs are the norm in many parts of Africa," said Capt. Bruce Rowan, a senior Boeing 747-400 pilot for South African Airways.[3] "The onus for terrain avoidance and compliance with let-down procedures is passed entirely to the flight crew, with little assistance or backup from ATC.

AIDS Epidemic Poses Difficult Challenge to Aircraft Operators in Africa

A worldwide health problem that is especially severe in Africa is the prevalence of AIDS (acquired immune deficiency syndrome). The effect of AIDS on aviation safety was discussed by Dr. Eric Peters, medical director for South African Airways, during the annual meeting of the Africa Aviation Safety Council in Nairobi, Kenya, Nov. 26–27, 2001.

Peters said that treatment of aircrew affected by AIDS and detection of early symptoms that can be detrimental to aviation safety are challenges facing every airline, but the challenges are particularly difficult in Africa.

"AIDS is an epidemic in Africa," he said. Peters said that in some areas of Africa, the proportion of the population infected with the human immunodeficiency virus (HIV) or afflicted with AIDS — the disease produced by HIV — has increased in the past few years from 20 percent to 30 percent, and that in a few areas, the proportion of the population afflicted with HIV/AIDS is more than 60 percent.

Peters said that there is "no quick fix" for the HIV/AIDS problem in Africa. He said that the Aerospace Medical Association in 1992 recommended removing from flight status pilots infected by HIV; the association in 1997 changed its recommendation to allow HIV-positive pilots on a case-by-case basis to return to flying if they are receiving proper treatment for the virus and are being monitored adequately by the operator.

He said that careful monitoring is critical because the first symptom of infection in 15 percent to 20 percent of HIV victims is subtle neuropsychiatric changes and/or cognitive changes that can be detrimental to flight safety. Therefore, monitoring of HIV-positive pilots must include neuropsychological testing to detect subtle neuropsychiatric problems or subtle cognitive problems, Peters said.♦

"VHF [very-high-frequency radio] coverage is patchy and intermittent, leading to extensive reliance on HF [high-frequency radio communication], which, in turn, results in overcrowded HF frequencies. Landline communication is inadequate, resulting in flight plans and aircraft movements being communicated between ATC centers by HF. The chaos on many African HF ATC frequencies has to be heard to be appreciated."

John Buckley, managing director of Airkenya, said that the aviation industry, particularly in Africa and in other developing regions, "does not necessarily need theories and solutions at the forefront of research and technology. It needs practical, affordable solutions and procedures that are 100 percent applicable to the conditions within which we operate and can be utilized by all our airlines."

Burin said that one of the primary successes of the FSF *ALAR Tool Kit* is to provide tools that can be used readily and can be adapted to meet the needs of different operators for ALAR implementation.

Data presented during the ALAR workshops by CAAG member Capt. David Carbaugh, chief pilot for flight operations safety at Boeing Commercial Airplanes, showed that hull-loss accidents occur in Africa at a rate that is substantially higher than the world average. A hull-loss accident involves airplane damage that is substantial and beyond economic repair, an airplane that remains missing after search for wreckage has been terminated, or an airplane that is substantially damaged and inaccessible.

Carbaugh said that the average worldwide hull-loss accident rate from 1991 through 2000 was 1.2 accidents per million departures. The hull-loss accident rate in Africa during the period was 9.8 accidents per million departures — more than eight times higher than the worldwide average (Figure 1, page 5).

The worldwide data include accidents involving Western-built commercial jet airplanes weighing more than 60,000 pounds (27,216 kilograms), with the exception of the Commonwealth of Independent States, where reliable data are not available.

Carbaugh said that 172 hull-loss accidents, involving 7,184 fatalities, occurred worldwide during the period, and that 69 percent of the accidents and 34 percent of the fatalities occurred during ALAs and CFIT accidents. In Africa, 52 percent of the hull-loss accidents and 12 percent of the fatalities involved ALAs and CFIT.

"When you compare the data for Africa with data for the rest of the world, Africa had 21 percent of the approach-and-landing hull-loss accidents and six percent of the CFIT accidents — while having had only three percent of the worldwide departures," Carbaugh said.

CFIT occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew. This type of accident can occur during most phases of flight, but CFIT is more common during the approach-and-landing phase, which begins when an airworthy aircraft under the control of the flight crew descends below 5,000 feet above ground level (AGL) with the intention to conduct an approach and ends when the landing is complete or the flight crew flies the aircraft above 5,000 feet AGL en route to another airport.

"The accident rates for the regions vary for a number of reasons," Carbaugh said. "Many of them have to do with infrastructure: ATC, navigational aids, airport equipment, etc. In some parts of the world, airlines are challenged to have the infrastructure to provide appropriate training, maintenance and dispatch, and to develop procedures for their aircrews.

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Workshop Presenters Typify Volunteers for FSF ALAR Efforts

Participation by hundreds of aviation professionals from around the world is a key factor in the efforts led by Flight Safety Foundation (FSF) to reduce approach-and-landing accidents (ALAs), including those involving controlled flight into terrain (CFIT).

"The specialists who have participated on our various task forces and committees — and those who are helping to spread the ALAR [approach-and-landing accident reduction] message worldwide — are the unsung heroes in the Foundation's efforts to help prevent ALAs and CFIT, which are the two leading causes of aviation fatalities," said Stuart Matthews, FSF president and CEO. "Without their help — and without the resources provided by those who support us —the Foundation could not be doing this work."

CFIT occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew. This type of accident can occur during most phases of flight, but CFIT is more common during the approach-and-landing phase, which begins when an airworthy aircraft under the control of the flight crew descends below 5,000 feet above ground level (AGL) with the intention to conduct an approach and ends when the landing is complete or the flight crew flies the aircraft above 5,000 feet AGL en route to another airport.

The four members of the FSF CFIT/ALAR Action Group (CAAG) who, under the direction of FSF Technical Programs Director James Burin, presented the FSF ALAR workshops in Africa in November 2001 are representative of those who volunteer to participate in Foundation-led safety efforts. Like other volunteers, the CAAG members— David Carbaugh, Andrés Fabre, John Long and Kyle Olsen — have diverse backgrounds and interests that are helping to implement ALAR worldwide.

As an instructor pilot for the U.S. Air Force and later for Boeing Commercial Airplanes, Capt. David Carbaugh helped to integrate crew resource management (CRM) principles in U.S. Air Force and Boeing training programs. As chief pilot for flight operations safety at Boeing since 1994, Carbaugh has been involved in several other safety efforts, including participation as chairman of an industry team that developed a wake turbulence training aid.

"This was my first big exposure to industry safety efforts," he said. "When we finished the wake-turbulence effort in 1994, I was selected by the Foundation to chair the effort to produce the CFIT training aid." The FSF *CFIT Education and Training Aid* is a two-volume package that includes information on CFIT hazards, specific educational material, a model training program, effective CFIT-avoidance strategies and a video that examines a jet transport airplane CFIT accident and how it might have been prevented.

Carbaugh also assisted in the development of materials for the FSF *ALAR Tool Kit*, which provides on compact disc a unique set of pilot briefing notes, videos, presentations, risk-awareness checklists and other tools designed to help prevent ALAs and CFIT. He led the production of *An Approach and Landing Accident: It Could Happen to You*, a 19-minute video included in the tool kit that presents specific data, findings and recommendations generated by FSF ALAR Task Force studies.

"As a CAAG member, I have traveled extensively to support FSF ALAR efforts," Carbaugh said. "I have devoted much of my time to flight safety because I believe that it is an essential element to the success of our industry. I have received good support from Boeing for the FSF activities. What I have gained from these safety activities is the satisfaction of having made a positive difference in our industry and of having saved lives."[1]

For Capt. Andrés Fabre, director of flight operations for MasAir Cargo Airline, the driving force to work with the Foundation is to help bring the ALAR message to small airlines and to show them that ALAR implementation can be accomplished inexpensively and efficiently (see "Small Airline Sets Example for ALAR Implementation," page 9).

A member of the FSF International Advisory Committee, Fabre became a member of the FSF ALAR Task Force Data Acquisition and Analysis Working Group (DAAWG) in 1997 and has continued his ALAR work with the CAAG.

The DAAWG, one of four working groups of the FSF ALAR Task Force, validated accident-prevention strategies based on analyses of 287 fatal ALAs from 1980 to 1996 involving turboprop airplanes and jet airplanes weighing more than 12,500 pounds/5,700 kilograms, detailed case studies of 76 accidents and serious incidents from 1984 to 1997, and assessments of key flight crew behavioral markers identified in the accidents and incidents, and in line observations of 3,300 flights.

Fabre said, "I have devoted a lot of my time to the Foundation because I feel that small, resource-limited operators — the type of airline that statistics show needs the most help — often are left 'out of the loop' in receiving data and information to help make decisions and establish SOPs [standard operating procedures]. I am very happy to be able to prove that money, the size of the airline and the age of the aircraft operated by the airline are not important in achieving a sound safety culture."

Fabre's pride in MasAir's accomplishments in ALAR implementation is shared by his company and by the Mexican civil aviation authority.

Continued on page 4

"Upper management is proud of being first in Mexico to implement ALAR, and I am very happy to be able to share my airline's experiences," he said. "The Mexican DGAC [General Directorate of Civil Aviation] is proud of what our airline has achieved and has used us as an example of what can be done to raise ALAR consciousness in Latin America."[2]

Fabre's sense of fulfillment is shared by many task force members, including Capt. John Long, a member of the Air Line Pilots Association, International (ALPA), and a Boeing 757/767 captain for a major U.S. airline. Like other task force members who have contributed to the vast amount of information that has been gathered on ALAR, Long was instrumental in developing the FSF *Standard Operating Procedures Template*, one of the 19 elements of the FSF *ALAR Tool Kit*.

Long was asked to participate on the FSF ALAR Task Force Operations and Training Working Group (OTWG) in 1996. The OTWG developed eight data-driven conclusions about the major causes of ALAs and how to prevent them.

"Starting in late 1998, I also became a member of the CFIT Joint Safety Implementation Team under CAST [U.S. Commercial Aviation Safety Team]," he said. "While working on this project, I wrote the *SOP Template* for CAST, which was used by the FAA [U.S. Federal Aviation Administration] as the basis for AC [Advisory Circular] 120-71 [*Standard Operating Procedures for Flight Deck Crewmembers*]."

Long participated with other ALAR Task Force members in vetting and adapting the AC for the FSF tool kit. He believes that SOPs are critical to flight safety.

"Without usable SOPs that all crewmembers know and understand, CRM cannot exist," he said. "Almost every accident report has at least one statement that says the crew failed to follow procedures, there was no procedure for the crew to use or the procedure the crew followed was inadequate for the situation."

Long also is involved with safety projects led by ALPA. He said that the association encourages and supports his work with the Foundation.

"ALPA is interested in remaining active in the CAAG and other FSF projects," he said. "As a member of the ALPA local safety committee at my airline since 1987, I have participated in two major accident investigations. Working with a committee such as CAAG is a lot more fulfilling than picking up broken and bloody aluminum. I believe that the message of the CAAG is vitally important in the battle to reduce the accident rate."[3]

Kyle Olsen, manager of continued operational safety at FAA, is another example of the aviation professionals who contribute their time and expertise to FSF safety efforts and to other safety efforts worldwide.

Olsen participated in the creation of CAST, a joint effort of industry and FAA to improve commercial aviation safety, and played a key role in developing the data-analysis methodology and processes used by CAST. He also is a member of the Joint Aviation Authorities Safety Strategy Initiative (JSSI), which has similar functions as CAST in Europe. Olsen represents both CAST and JSSI on the CAAG.

"Once CAAG has identified regional team leaders, I provide those team leaders with CAST and JSSI information and other support, if requested," he said. "The past has shown that we — manufacturers, operators, safety organizations and regulators — must work together to achieve our safety goals. The FSF *ALAR Tool Kit* is an important element, and the FAA, which supports my work with the Foundation, is planning to provide a copy of the tool kit to each flight standards inspector."[4]♦

Notes

1. Carbaugh, David. E-mail communication with Lacagnina, Mark. Alexandria, Virginia, U.S. Jan. 4, 2002. Flight Safety Foundation. Alexandria, Virginia, U.S.
2. Fabre, Andrés. E-mail communication with Lacagnina, Mark. Alexandria, Virginia, U.S. Dec. 21, 2001. Dec. 31, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.
3. Long, John. E-mail communication with Lacagnina, Mark. Alexandria, Virginia, U.S. Dec. 20, 2001. Dec. 27, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.
4. Olsen, Kyle. E-mail communication with Lacagnina, Mark. Alexandria, Virginia, U.S. Jan. 6, 2002. Jan. 8, 2002. Flight Safety Foundation. Alexandria, Virginia, U.S.

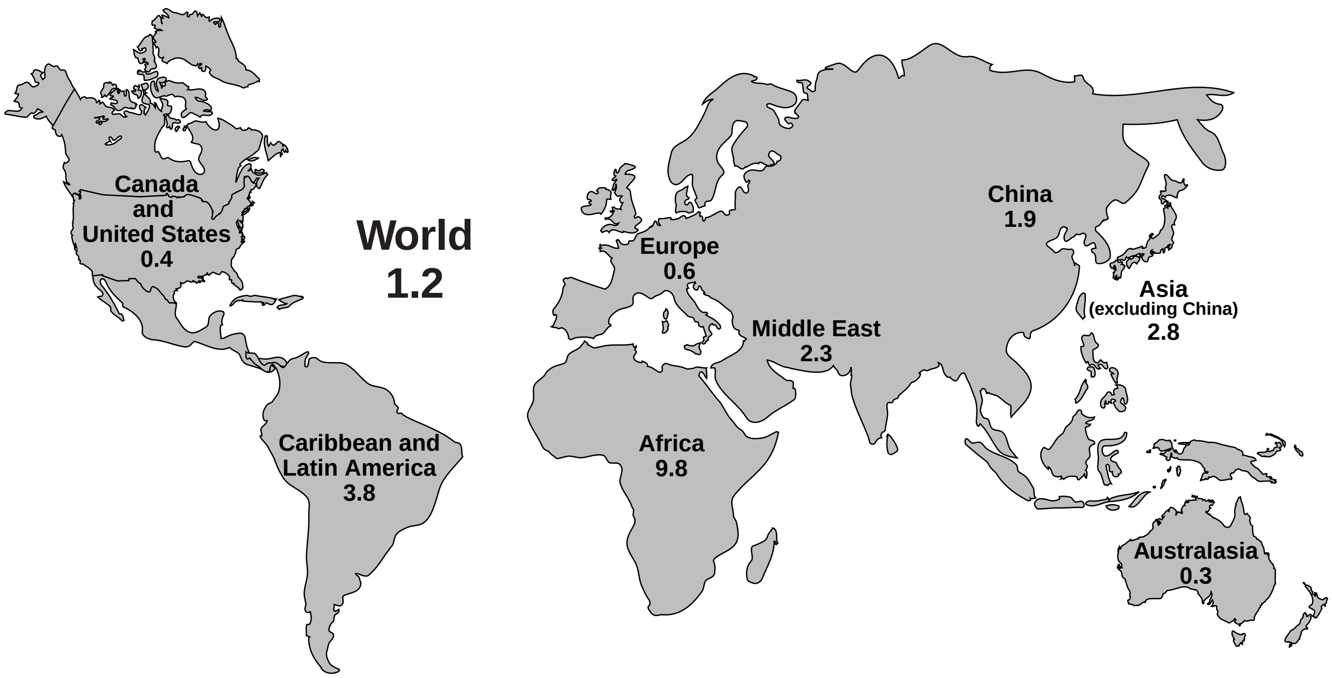
"We also know that some countries lack the ability to provide proper oversight via aviation law, regulation and properly trained personnel. Some countries lack the resources to do these things."

Capt. Mike Huson, South-Africa-based partner in Global Aviation Consultants and a former pilot for several aircraft operators in Africa, said that revenues derived from aviation are not being used to improve the aviation infrastructure in many African countries.[4]

"Aviation is a significant source of revenue for some countries," he said. "For instance, going into Dakar, you pay a significant fee just to cross the border [of Senegal]. In the Congo, you get charged for every navigational facility that you fly over, whether they are serviceable or not. That is significant income for these countries and a significant expense for the operator.

"The problem is that [the revenue] is not put back into aviation. Some civil aviation authorities are hamstrung because they

Regional Hull-loss Accident Rates,* 1991–2001



* Rates are expressed as hull-loss accidents per million departures involving Western-built commercial jet airplanes weighing more than 60,000 pounds (27,216 kilograms). A hull-loss accident involves airplane damage that is substantial and beyond economic repair, an airplane that remains missing after search for wreckage has been terminated, or an airplane that is substantially damaged and inaccessible. Reliable data for the Commonwealth of Independent States are not available.

Source: David Carbaugh, chief pilot, Flight Operations Safety, Boeing Commercial Airplanes, and Flight Safety Foundation

Figure 1

have no support — aviation revenues go into the general coffers, not into aviation."

Huson said that the lack of revenues causes many known deficiencies to remain uncorrected or to exist for long periods before they are corrected. Some corrections occur only when aircraft operators say that they will discontinue air service to the affected area.

"For example, the [nondirectional] beacon that serves as the main entry point to Nairobi was off the air for many months because it had been stolen to salvage the copper content," he said. "The point is that the system [in some areas] is that slow in moving — a beacon can be missing for weeks, and it takes the airlines to turn around and say 'if you do not provide the proper facilities, we won't bring in the passengers.'"

Nonexistent or inadequate ATC service, communication and navigational aids regularly are reported to the International Air Transport Association (IATA) by IATA member airlines in the region.

For example, Trevor Fox, IATA's director of regional operations and infrastructure, said that one African airline in July 2001 reported deficiencies in HF radio communication in Angola and Ghana; inadequate navaids, unsafe approach procedures and absence of appropriate notices to airmen in Rwanda; exclusive use of the French language for ATC service in the Congo and the Ivory Coast; a flight crew that was cleared for an instrument landing system (ILS) approach to an airport in Swaziland and received erroneous ILS indications because maintenance was in progress; a flight management system map-shift occurrence caused by publication of inaccurate data in Kenya; a breakdown of VHF communication and no backup HF communication in Harare, Zimbabwe; and inadequate controller proficiency that resulted in lack of adequate separation between aircraft operating in oceanic airspace controlled by Senegal.

Lack of resources is a primary factor in the failure of some African member states of the International Civil Aviation Organization (ICAO) to adequately implement ICAO standards and recommended practices (SARPS), said Negussie Kumelachew, ICAO regional officer for safety oversight.

Kumelachew presented data showing an association between ICAO audit findings and regional accident rates. He said that analysis of 177 interim audit reports showed that 29 percent of the member states audited worldwide lacked effective implementation of SARPS on personnel licensing, aircraft operations and aircraft airworthiness. In Africa, the extent of nonimplementation of SARPS was much higher:

- In the ICAO Eastern and Southern African Region, 42 percent of member states were found to lack effective implementation of SARPS; and,

- In the ICAO Western and Central African Region, 51 percent of member states were found to lack effective implementation of SARPS.

Kumelachew said that in addition to having the highest rates of ineffective implementation of SARPS, these subregions also have the highest accident rates (Figure 2). In 2000, for example, Eastern and Southern African Region operators conducting scheduled international operations and scheduled domestic operations were involved in about 11 accidents per million departures, and Western and Central African Region operators were involved in about 60 accidents per million departures.

To improve aviation safety in Africa, governments must provide greater support to their civil aviation authorities to ensure that proper staffing and resources exist to implement SARPS and to enforce regulations, said Kumelachew.

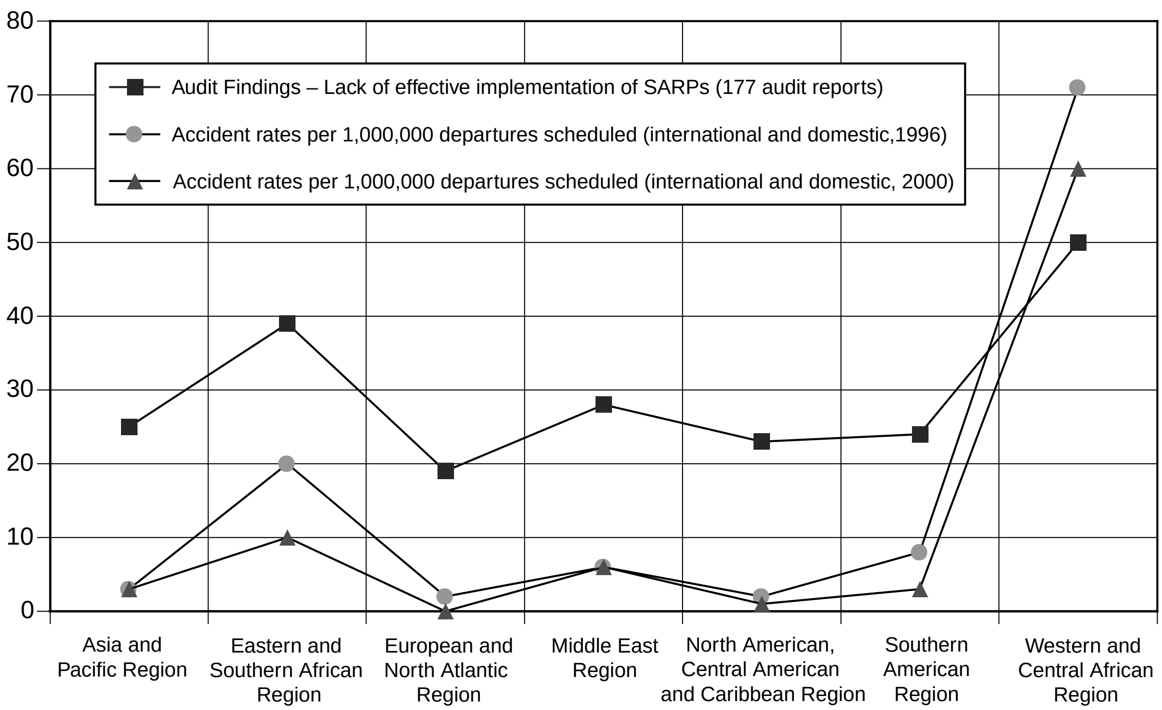
A strong safety culture fostering improvement and compliance with regulations and standard operating procedures (SOPs) is required at all levels of aviation in any region, particularly in Africa, said Bruce Rowan.[5]

"In many parts of Africa, adequate safety systems and procedures are in place, but some pilots ignore them and go their own way," Rowan said. "The attitude is that the rules are not good unless they are their own rules. This might be a result of a lack of enforcement of regulations in many areas.

"In my opinion, flying in Africa requires one to use self-discipline to the utmost in adhering to procedures, because very often one is left totally to one's own devices."

Airkenya's Buckley said that he believes that safety largely is considered an ideal in Africa, not a necessity. He said that this outlook must change before improvement can be achieved.

Association Between International Civil Aviation Organization Audit Findings and Regional Accident Rates



SARPS = Standards and recommended practices

Source: Negussie Kumelachew, regional officer for flight safety oversight, Eastern and Southern African Office, International Civil Aviation Organization

Figure 2

Participants at the FSF approach-and-landing accident reduction workshop in Nairobi, Kenya, Nov. 28, 2002. (FSF photo)

The effect of the terrorist attacks on the public's perception of aviation safety — that is, mixing security issues and safety issues — has clouded the fact that, overall, air travel is very safe. Carbaugh told workshop participants that the worldwide challenge is not only to keep air travel safe but to reduce the accident rate. Reducing ALAs and CFIT accidents is critical to the future of the aviation industry, he said.

"The statistics for the year 2000 show that we flew 1.3 billion people — equivalent to about one-fifth of the world's population," he said. "There were more than 18 million flights, and there were only 11 fatal accidents involving large jet-transport-type airplanes.

"The importance of 'safety' to the commercial well-being of any airline is self-evident," Buckley said. "However, I am concerned that, particularly in Africa, safety still remains a somewhat esoteric subject [that] is not fully integrated into the day-to-day practices of many airlines. … This attitude and situation has to change if further progress is to be made that will enable our industry to maintain the confidence of the traveling public."

The erosion of public confidence in the safety of air travel in the wake of the Sept. 11, 2001, terrorist attacks in the United States has affected the aviation industry worldwide. Global's Huson said that many aircraft operators in Africa have been affected adversely by a decrease in tourists traveling from the United States.

The terrorist attacks in the U.S. — which involved aircraft hijackings and intentional collisions of three aircraft with structures in New York, New York, and Washington, D.C., and a related collision with terrain in Pennsylvania — focused world attention on aviation security. This requires that African operators redouble their efforts to improve security and safety, said Buckley.

"At this time, the safety record of our industry is under scrutiny as never before," he said. "[We] must do our utmost to change attitudes in our companies as necessary and invest time and money as appropriate to ensure that public confidence in our industry is not further eroded. Easy words to say, but a daunting task, particularly at this time when many of us are feeling both the direct and indirect effects of recent tragic events."

Capt. David Carbaugh, FSF CAAG member and chief pilot for flight operations safety at Boeing Commercial Airplanes. (FSF photo)

"We have a very safe industry. The challenge is to keep it safe. What has happened over the years with the evolution of sophisticated simulators and the introduction of improved equipment is that the hull-loss accident rate has gone down and then has remained at a very low rate worldwide. The challenge is that, as the number of departures continues to increase, if we keep the same hull-loss accident rate, we can expect to see the number of accidents increase.

"We know, especially since the terrorist attacks in the United States, that we have a fragile industry whose economic health is affected by our customers' perception of safety. So, we have to constantly strive to improve the accident rate and keep the confidence of the public that flying is safe. We need to focus our efforts where the problems are. Economically, to an airline, that is very important."

Carbaugh said that in every region of the world, there are airlines that are very safe and countries that have had few accidents. One characteristic that distinguishes safe operators is a strong safety culture.

The FSF ALAR Task Force found, for example, that company management failure — including management attitudes fostering deviations from SOPs, inadequate resources allocated to safety, restraint of feedback on safety from line personnel, inadequate crew training and inadequate control of flight operations safety — was a circumstantial factor in 46 percent of the 76 ALAs and serious incidents studied.[6]

"We found that the safety culture of an airline is a major factor in accident prevention," Carbaugh said. "We found that safer operators have certain characteristics. There is emphasis from senior management on aviation safety. There are strong procedural-development programs that are emphasized throughout the structure of the airline and supported by the check pilots, and there is a lot of input from the pilots that influences procedural changes.

"We found that safer airlines have a very strong standardization program and that safety-program managers report directly to senior management to get things done.

"When we look at operators with poorer records, we almost invariably find one of these elements missing from its safety culture. The *ALAR Tool Kit* emphasizes these things. There are challenges to the implementation of this tool kit, but the future belongs to those who are successful."

CAAG member Capt. Andrés Fabre, director of flight operations for MasAir Cargo Airline in Mexico City, Mexico, showed workshop participants how his airline is using the tool kit contents to increase ALAR awareness among its pilots and to improve its SOPs and training procedures (see "Small Airline Sets Example for ALAR Implementation," page 9). Fabre said that ALAR implementation at his relatively small airline has not been expensive and that the tool kit elements can be adapted easily by regional aviation professionals to meet the needs of any operator.

During the workshops in Africa, Burin, Carbaugh, Fabre and CAAG members Capt. John Long, a representative of the Air Line Pilots Association, International, and a Boeing 757/767 captain for a major airline, and Kyle Olsen, manager of continued operational safety at the U.S. Federal Aviation Administration, conducted detailed discussions of tool kit elements and how they can be used in implementing ALAR.

Some participants had not known about the Foundation's international ALAR efforts or about the FSF *ALAR Tool Kit*. After the workshops were conducted, several participants said that their organizations plan to implement ALAR awareness and training using the tool kit.

For example, Ngeny Biwott, air safety manager for Kenya Airways and vice chairman of the Africa Aviation Safety Council (AFRASCO), said that he has developed an action plan for applying the tool kit for Kenya Airways pilot training and has identified a "person to steer it to the application level."[7]

Biwott said that he believes the tool kit will be useful in improving safety in Africa "for those who can read, understand and apply it."

Tesfaye Zewdie said that personnel in Ethiopian Airlines' safety office and personnel in the company's operations office are discussing how best to present the information to their pilots.

"In the meantime, my office already has started posting some of the [*ALAR Information Posters*] in the pilots' briefing room and on our safety bulletin board," Zewdie said. "Use of the FSF *ALAR Tool Kit* will have a great impact in improving safety in the region. I believe that the tool kit will be most useful in the African subregions where the pilot shoulders most of the responsibility for flight safety in the absence of reasonable infrastructure and very little help from ATC."

The workshops in Africa furthered the Foundation's ALAR implementation campaign, which already was underway in Asia, the Caribbean, Central America, Iceland, India, Indonesia, Malaysia, Mexico, Myanmar (Burma), South America, and Thailand.

"A key element of this campaign is to identify team leaders in each region who will spread the ALAR message throughout their regions," said Burin. He said that persons or organizations identified as team leaders are native speakers of the predominant regional language who are active in the region's aviation community and who have substantial contacts and credibility within the region.

"We want the regional team leaders to run the implementation program for their region," Burin said. "The Pan American Aviation Safety Team [PAAST], for example, has made great strides in implementing ALAR."

PAAST — which comprises volunteers from nations and territories of the Caribbean, Central America, Mexico and South America — in 2000 began its first major aviation safety campaign with the FSF *ALAR Tool Kit*.[8] Regional team leaders have translated the contents of the tool kit into Portuguese and Spanish, and have added region-specific ALA safety data in presentations to thousands of pilots. As a result of the PAAST efforts, the Mexican aviation authority will require ALAR training for all the country's certificated pilots.

The ALAR workshops in Africa were conducted at the invitation of AFRASCO, which has volunteered to be a team leader for ALAR implementation in Africa and is seeking the participation of other organizations in the region.

Capt. Blessing Kavayi, flight safety officer for Air Zimbabwe and secretary-general of AFRASCO, said, "We are grateful for the commitment of the CAAG, and I can assure you that we will do our level best to ensure that their endeavors will not go in vain. We are the pioneers of this from here. We have a great task to see what is our best way forward. There is no use in just getting the tool kit to decorate our libraries; it must be fully utilized."

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Small Airline Sets Example for ALAR Implementation

Abundant resources and a large safety department are not required to implement an approach-and-landing accident reduction (ALAR) program based on the Flight Safety Foundation (FSF) *ALAR Tool Kit*, says Andrés Fabre, director of flight operations for Mexico-based MasAir Cargo Airline.

Fabre said that his company implemented an ALAR program in early 2001 without a large financial expenditure or a large staff. The program has been proven useful and effective, and has been embraced by the company's pilots.

Fabre is a member of the FSF Controlled-flight-into-terrain/ALAR Action Group (CAAG) and a member of the FSF International Advisory Committee. He presented his company's experience at ALAR workshops presented by the CAAG in Nairobi, Kenya, and Johannesburg, South Africa, in November 2001.

"MasAir is an eight-year-old cargo airline based in Mexico City," Fabre said. "We have two [Mc Donnell Douglas] DC-8-71 freighters and a [Boeing] B-767-300 freighter. We fly scheduled routes in Mexico and into Central America, South America and the United States. We have 39 pilots in the company, including three instructor pilots."

Fabre launched the ALAR implementation program at MasAir by conducting a detailed review of the FSF *ALAR Tool Kit* with the airline's instructor pilots. He showed them two of the five Microsoft PowerPoint presentations and the two videos, and discussed some of the FSF *ALAR Briefing Notes*.

"The presentations on data [*Approach-and-landing Accident Data Overview*] and on operations [*Flight Operations and Training*] especially were useful in getting the instructors to understand why ALAR is important," he said. "Some of them are old-fashioned, and it is not easy to bring to them new techniques or ways of thinking. Data in the tool kit really helped in this matter."

Fabre and the instructor pilots used tool kit information to help revise the company's operations manual. The revisions emphasized the importance of conducting a go-around when required by conditions such as weather or an unstabilized approach.

"We defined a 'go-around-without-consequences' policy and redefined our stabilized-approach criteria using the elements recommended by the Foundation," he said. "We clearly defined our go-around policies — when a pilot must go around — and we removed a requirement that said pilots must write a very complicated report for the chief pilot after conducting a go-around.

"This was a very important change in perception regarding the 'good' pilot and the 'bad' pilot. We emphasized that the good pilot is the one who goes around when required, not the pilot who was the 'hero' for landing successfully after an unstabilized approach."

Simulator-training procedures were modified to introduce situations requiring a go-around and to observe how the pilots react to the situations. Fabre said that the simulator instructors were very receptive to the procedures and found them easy to implement.

"We told the simulator instructors to destabilize the pilot's approach — by introducing wind shear, a late runway change or whatever," he said. "If the pilot executes a go-around, it is the correct and expected response. If the pilot continues to land, it is not the correct response. The simulator instructors were told to discuss with the pilots why they continued the approach or executed a go-around."

MasAir also used procedures recommended in the tool kit to improve several company standard operating procedures, including those involving the duties of the pilot flying and the pilot not flying during abnormal situations, flight crew briefings and instrument cross-checks.[1]

After effecting these changes, Fabre and the instructor pilots conducted a meeting with the company's line pilots. The meeting began with a detailed discussion of approach-and-landing accidents.

"We showed a presentation that we assembled from the tool kit presentations on operations and data; it was very easy to use the tool kit to create a presentation with the information we wanted to show our pilots," Fabre said, "We showed the videos and conducted a quick review of all 19 tool kit elements to let the pilots know what is included."

Each pilot was given a navigational-chart-binder insert that incorporates the FSF *Approach-and-Landing Risk Awareness Tool* and the Foundation's recommended elements of a stabilized approach.

MasAir developed a procedure for distributing printed copies of the FSF *ALAR Briefing Notes* to the pilots. The airline decided not to distribute all 34 briefing notes in a single package.

"Nobody would read 200 pages if they were received all at one time," Fabre said. "We gave each pilot a nice binder with the ALAR logo on it, and every two to three weeks, we issue two briefing notes. That way, the pilot will have only a few pages to read at one time."

Besides encouraging the pilots to read the briefing notes, the periodic distribution of the briefing notes helps to maintain the pilots' interest, which was high when implementation of the ALAR program began.

"Every two or three weeks, the pilot receives information that keeps alive his or her awareness of ALAR," Fabre said.

The first distribution of briefing notes included a bulletin from the company's safety manager explaining the reasons for the ALAR program and requesting feedback from the pilots. The company prepared methods for reviewing the information received from pilots and for responding to it.

"We want the pilots to tell us how to improve our manuals and to tell us what policy changes might be necessary," Fabre said. "If you ask pilots for feedback, you have to be

Continued on page 10

prepared to receive it and respond to it. We have received a lot of feedback from our pilots, and it has resulted in changes to our written standard operating procedures. Not all of the suggestions have resulted in changes, however, and it is difficult to tell a pilot why his suggestion was not accepted. You have to be prepared for that."

MasAir purchased a laptop personal computer (PC) and installed the PC in the pilots' room at the company's headquarters so that the pilots can use the FSF *ALAR Tool Kit*. Although use of the tool kit initially was discretionary, the company currently is developing a requirement for all pilots to use the tool kit.

"We could not buy a tool kit for every pilot; we do not have the money for that," Fabre said. "We decided to have a PC available for the pilots to freely navigate through the tool kit. We found that some pilots liked to spend hours with the tool kit and that a few pilots never used the PC for a tool kit review. So, we are going to make it a requirement that each pilot spend a specific minimum amount of time with the tool kit. We will not tell the pilots what to look at, however."

MasAir's ALAR program generally has been received well by the pilots, and implementation of the program has resulted in a closer relationship between pilots and management, Fabre said.

He said that while the MasAir experience serves as an example for other small airlines with limited resources, it is not the only way to implement an ALAR program; other small airlines might require different methods to implement ALAR.

"You can implement an ALAR program in many ways," he said. "The tool kit is easily adapted to set up your own program based on the needs and culture of your company."

While implementing the ALAR program at MasAir, Fabre also worked with the support of his company to spread the ALAR message to other small airlines and aircraft operators in Mexico.[2] He believes that communication among small operators is important to the ALAR effort worldwide.

"Besides showing people how to implement ALAR, I want to influence them to believe in what they can do outside their own organization," he said. "MasAir could have done only its own ALAR implementation program and then relaxed, but we want to make sure that other small operators are not left out.

"Our experience shows that small airlines also have the power to gather people together and to get out the ALAR message. They may have to beg and lobby a little. They may have to go to the offices of larger organizations and convince them to help. But it is important for ALAR to be explained by small operators to other small operators, not by those whose resources and needs are much different."♦

Notes

1. Fabre, Andrés. E-mail correspondence with Lacagnina, Mark. Alexandria, Virginia, U.S. Dec. 14, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

2. Fabre. Interview with Rosenkrans, Wayne. Athens, Greece. Nov. 7, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

Dries Wehmeyer, senior manager of aviation safety for South African Airways, vice chairman of AFRASCO and a member of the FSF International Advisory Committee, said, "We cannot have the statistics that we have seen here for our region. We need to start working together to solve these problems. Flight Safety Foundation can help us, but we need to help ourselves."♦

Dries Wehmeyer, senior manager of aviation safety for South African Airways, vice chairman of the Africa Aviation Safety Council and a member of the FSF International Advisory Committee. (FSF photo)

Notes

1. The Flight Safety Foundation (FSF) *Approach-and landing Accident Reduction (ALAR) Tool Kit* provides on compact disc a unique set of pilot briefing notes, videos, presentations, risk-awareness checklists and other tools designed to help prevent ALAs and controlled flight into terrain (CFIT), the leading cause of fatalities in commercial aviation. The tool kit contains 19 elements resulting from several years of work that culminated in the data-driven findings and recommendations of the FSF international CFIT Task Force and the FSF international ALAR Task Force.

2. Zewdie, Tesfaye. E-mail communication with Lacagnina, Mark. Alexandria, Virginia, U.S. Dec. 17, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

3. Rowan, Bruce. E-mail communication with Lacagnina, Mark. Alexandria, Virginia, U.S. Dec. 26, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

4. Huson, Mike. Interview with Lacagnina, Mark. Nairobi, Kenya. Nov. 27, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

5. Rowan. Interview with Lacagnina, Mark. Johannesburg, South Africa. Nov. 29, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

6. Flight Safety Foundation. "Killers in Aviation: FSF Task Force Presents Facts About Approach-and-landing and Controlled-flight-into-terrain Accidents." *Flight Safety Digest* Volume 17 (November–December 1998) and Volume 18 (January–February 1999).

7. Biwott, Ngeny. E-mail communication with Lacagnina, Mark. Alexandria, Virginia, U.S. Dec. 14, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

8. FSF Editorial Staff. "International Organizations Rise to Challenge to Prevent Approach-and-landing Accidents." *Flight Safety Digest* Volume 20 (August–September 2001): 1–38.

Further Reading From FSF Publications

FSF Editorial Staff. "Descent Below Minimum Altitude Results in Tree Strike During Night, Nonprecision Approach." *Accident Prevention* Volume 58 (December 2001): 1–5.

Bailey, Larry L.; Peterson, Linda M.; Williams, Kevin W.; Thompson, Richard C. "Controlled Flight Into Terrain: A Study of Pilot Perspectives in Alaska." *Flight Safety Digest* Volume 20 (November–December 2001): 1–41.

FSF Editorial Staff. "AS 350BA Strikes Glacier During Alaskan Air Tour." *Helicopter Safety* Volume 27 (November–December 2001): 1–4.

FSF Editorial Staff. "Douglas DC-3 Strikes Hill During Night Cargo Flight." *Accident Prevention* Volume 58 (November 2001): 1–5.

Harris, Joel S. "EMS Helicopter Strikes Terrain on Dark, Snowy Night." *Helicopter Safety* Volume 27 (September–October 2001): 1–4.

FSF Editorial Staff. "Pitch Oscillations, High Descent Rate Precede B-727 Runway Undershoot." *Accident Prevention* Volume 58 (September 2001): 1–8.

FSF Editorial Staff. "Crew Loses Control of Boeing 737 While Maneuvering to Land." *Accident Prevention* Volume 58 (August 2001): 1–6.

FSF Editorial Staff. "Lightning Strike, Loose Electrical Connector Disable Fokker 100 Hydraulic Systems." *Accident Prevention* Volume 58 (July 2001): 1–8.

FSF Editorial Staff. "Runway Overrun Occurs After Captain Cancels Go-around." *Accident Prevention* Volume 58 (June 2001): 1–11.

FSF Editorial Staff. "Helicopter Strikes Terrain During Low-visibility Flight to Mountain Helipad." *Helicopter Safety* Volume 27 (May–June 2001): 1–4.

Veillette, Patrick R. "Data Show That More Than Half of EMS Airplane Accidents Occur During Approach and Landing." *Flight Safety Digest* Volume 20 (April–May 2001): 39–54.

FSF Editorial Staff. "Hughes 369FF Strikes Power Lines During Approach to Landing Site." *Helicopter Safety* Volume 27 (March–April 2001): 1–4.

FSF Editorial Staff. "Destabilized Approach Results in MD-11 Bounced Landing, Structural Failure." *Accident Prevention* Volume 58 (January 2001): 1–8.

FSF Editorial Staff. "A340 Crew Conducts Emergency Landing With Left-main Gear Partially Extended." *Accident Prevention* Volume 57 (December 2000): 1–7.

FSF Editorial Staff. "Embraer Bandeirante Strikes Mountain Ridge During Trans-island Flight in Fiji." *Accident Prevention* Volume 57 (November 2000): 1–7.

FSF Approach-and-landing Accident Reduction (ALAR) Task Force. "FSF ALAR Briefing Notes." *Flight Safety Digest* Volume 19 (August–November 2000): 1–196.

FSF Editorial Staff. "Preliminary Data Show Downward Trend in Controlled-flight-into-terrain Accidents Among Large Western-built Commercial Jets." *Flight Safety Digest* Volume 19 (August–November 2000): 197–207.

FSF Editorial Staff. "ATR 42 Strikes Mountain on Approach in Poor Visibility to Pristina, Kosovo." *Accident Prevention* Volume 57 (October 2000): 1–6.

FSF Editorial Staff. "Pilot Loses Control of Twin Turboprop During ILS Approach in Low Visibility." *Accident Prevention* Volume 57 (July 2000): 1–7.

Flight Safety Foundation. "Controlled Flight Into Terrain: Korean Air Flight 801, Boeing 747-300, HL 7468, Nimitz Hill, Guam, August 6, 1997." *Flight Safety Digest* Volume 19 (May–July 2000): 1–120.

FSF Editorial Staff. "Improper Loading of Cargo Causes Loss of Aircraft Control on Approach." *Accident Prevention* Volume 57 (May 2000): 1–12.

FSF Editorial Staff. "Floatplane Strikes Ridge During Sightseeing Flight." *Accident Prevention* Volume 57 (April 2000): 1–8.

FSF Editorial Staff. "Crew Fails to Compute Crosswind Component, Boeing 757 Nosewheel Collapses on Landing." *Accident Prevention* Volume 57 (March 2000): 1–7.

Harris, Joel S. "Air Ambulance Strikes Mountain in Heavy Snow and High Winds." *Helicopter Safety* Volume 26 (January–February 2000): 1–4.

Airports Record 5,526 Apron Incidents/Accidents in 2000

Data collected by Airports Council International from 359 airports show that about 34 percent of the apron incidents and apron accidents involved aircraft and that the remainder involved equipment and facilities.

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FSF Editorial Staff

Data collected from 359 airports worldwide by Airports Council International (ACI), which represents more than 500 airports and airport authorities, show that the airports reported 5,526 apron incidents[1] and apron accidents[2] in 2000 (Table 1, page 14). The apron incident/accident rate was 0.214 incidents/accidents per 1,000 aircraft movements — which corresponds to one incident/accident per 4,700 aircraft movements.

Of the total number of apron incidents/accidents, 1,883 incidents/accidents (34.08 percent) involved aircraft, and 3,643 incidents/accidents (65.92 percent) involved equipment and facilities, said the report, *ACI Survey on Apron Incidents/Accidents.*

The apron incidents/accidents involved 2,455 fatalities[3] and injuries[4], including 12 fatalities, 90 severe injuries and 2,353 minor injuries (Table 2, page 14). Overall, the apron incident/accident injury rate was 0.095 fatalities and injuries per 1,000 aircraft movements.

The airports participating in the survey recorded 25,846,942 aircraft movements in 2000 — 10.10 percent more than the 23,476,235 aircraft movements recorded in 1999, the first year in which information was gathered for an entire year. The 5,526 apron incidents/accidents recorded in 2000 represented a 12.94 percent increase from 4,893 apron incidents/accidents in 1999. The 2000 apron incident/accident rate of 0.214 incidents/accidents per 1,000 aircraft movements was 2.88 percent higher than the 1999 apron incident/accident rate of 0.208 incidents/accidents per 1,000 aircraft movements. In 2000, 359 airports participated in the survey; the report did not say how many airports participated in 1999.

Of the 1,883 incidents/accidents involving aircraft, 1,488 incidents/accidents involved stationary aircraft that were damaged[5] by passenger-handling equipment, aircraft-loading equipment or aircraft-servicing equipment (Table 3, page 14). The remaining 395 incidents/accidents involved moving aircraft, such as aircraft that had direct contact with another aircraft, jet blast, foreign objects, fixed objects or parked equipment, the report said. Of the 3,643 apron incidents/accidents that did not involve aircraft, 2,570 involved equipment-to-equipment damage;[6] the remainder involved equipment-to-facility damage[7] and jet-blast damage.

The highest rate of apron incidents/accidents occurred in Asia (Table 4, page 15), where the apron incident/accident rate was 0.464 incidents/accidents per 1,000 aircraft movements. The lowest apron incident/accident rate was 0.073 incidents/accidents per 1,000 aircraft movements in North America.

Table 4 also shows a regional breakdown of incident/accident rates at larger airports (i.e., those with more than 70,000 annual aircraft movements), compared with incident/accident rates at smaller airports (with fewer than 70,000 annual aircraft movements). The incident/accident rate at larger airports was 0.221 incidents/accidents per 1,000 aircraft movements; at smaller airports, the incident/accident rate was 0.184 incidents/accidents per 1,000 movements.

The report said that the findings of the survey resulted in the following conclusions:

- Regular communications must be maintained between airport operators and airlines, handling agents and

Table 1
Apron Incidents/Accidents at 359 Airports Worldwide, 2000[1]

	Number	Percent[2] of Total	Rate per 1,000 Aircraft Movements
Incidents/accidents	5,526	100.00	0.214
Involving aircraft	1,883	34.08	0.073
Involving equipment and facilities	3,643	65.92	0.141
Incidents/accidents involving aircraft	1,883	34.08	0.073
Caused by apron equipment	1,488	26.93	0.058
Caused to/by moving aircraft	395	7.15	0.015
Incidents/accidents involving equipment and facilities	3,643	65.92	0.141
Caused by jet blast	89	1.61	0.003
Equipment-to-equipment damage	2,570	46.51	0.099
Equipment-to-facility damage	984	17.81	0.038

[1]Airports participating in the survey reported 25,846,942 aircraft movements in 2000.

[2]Percentages have been rounded.

Source: Airports Council International

Table 2
Injuries Resulting From Apron Incidents/Accidents At 359 Airports Worldwide, 2000[1]

	Number	Percent[2] of Total	Rate per 1,000 Aircraft Movements
Total	2,455	100.00	0.095
Fatal	12	0.49	0.000
Severe	90	3.67	0.003
Minor	2,353	95.85	0.091
Injuries to personnel	2,325	94.70	0.090
Fatal	12	0.49	0.000
Severe	89	3.63	0.003
Minor	2,224	90.59	0.086
Injuries to passengers	130	5.30	0.005
Fatal	0	0.00	0.000
Severe	1	0.04	0.000
Minor	129	5.25	0.005

[1]Airports participating in the survey reported 25,846,942 aircraft movements and 5,526 apron incidents/accidents in 2000.

[2]Percentages have been rounded.

Source: Airports Council International

Table 3
Causes of Apron Incidents/Accidents At 359 Airports Worldwide, 2000[1]

	Number	
Damage to stationary aircraft by apron equipment	1,488	(26.93%)[2]
Passenger-handling equipment	313	
Aircraft-loading equipment	583	
Aircraft-servicing equipment	322	
Others	270	
Damage to/by moving aircraft	395	(7.15%)[2]
Another aircraft	17	
Jet blast	48	
Aircraft marshaller/follow-me vehicle	11	
Aircraft maneuvering	89	
Fixed objects	29	
Parked ground equipment	42	
Foreign object damage (FOD)	119	
Others	40	
Property/equipment damage from jet blast	89	(1.61%)[2]
Equipment-to-equipment damage	2,570	(46.51%)[2]
Equipment-to-facility damage	984	(17.81%)[2]

[1]Airports participating in the survey reported 25,846,942 aircraft movements and 5,526 apron incidents/accidents in 2000.

[2]Percentages have been rounded.

Source: Airports Council International

others involved in apron operations. Apron safety committees should exist at every airport to facilitate the discussion of safe apron operations. Individual incidents and accidents should be analyzed to determine whether they resulted from particular procedures, training or equipment;

- Airlines and handling agents must ensure that aircraft-handling personnel receive proper training. "Airline [management] and airport management should monitor compliance with the applicable rules, including those established by the airport operator and [should] ensure that staff are qualified to work at the airport,"

Table 4
Apron Incidents/Accidents by Region and Airport Size, 2000

Region	Number of Airports	Number of Aircraft Movements	Incidents/ Accidents To Aircraft	Incidents/ Accidents to Equipment/ Facilities	Total Number of Incidents/ Accidents	Rate* to Aircraft	Rate* to Equipment/ Facilities	Overall Rate*
All airports	359	25,846,942	1,883	3,643	5,526	0.073	0.141	0.214
Africa	58	889,389	99	109	208	0.111	0.123	0.234
Asia	19	875,064	93	313	406	0.106	0.358	0.464
Europe	138	8,071,552	1,224	2,410	3,634	0.152	0.299	0.450
Latin America/Caribbean	34	978,980	51	95	146	0.052	0.097	0.149
North America	65	12,582,491	350	565	915	0.028	0.045	0.073
Pacific	45	2,449,466	66	151	217	0.027	0.062	0.089
Airports reporting more than 70,000 annual aircraft movements	92	20,855,317	1,464	3,145	4,609	0.070	0.151	0.221
Africa	2	251,539	29	65	94	0.115	0.258	0.374
Asia	4	439,991	28	228	256	0.064	0.518	0.582
Europe	29	5,819,418	1,076	2,186	3,262	0.185	0.376	0.561
Latin America/Caribbean	3	383,867	16	34	50	0.042	0.089	0.130
North America	41	12,016,521	271	531	802	0.023	0.044	0.067
Pacific	13	1,943,981	44	101	145	0.023	0.052	0.075
Airports reporting fewer than 70,000 annual aircraft movements	267	4,991,625	419	498	917	0.084	0.100	0.184
Africa	56	637,850	70	44	114	0.110	0.069	0.179
Asia	15	435,073	65	85	150	0.149	0.195	0.345
Europe	109	2,252,134	148	224	372	0.066	0.099	0.165
Latin America/Caribbean	31	595,113	35	61	96	0.059	0.103	0.161
North America	24	565,970	79	34	113	0.140	0.060	0.200
Pacific	32	505,485	22	50	72	0.044	0.099	0.142

*Rate = Number of incidents/accidents per 1,000 aircraft movements

Source: Airports Council International

the report said. "Airport operators, airlines and handling agents should take all necessary measures to develop positive attitudes among managers and personnel in order to achieve a safe apron environment"; and,

- All apron incidents and accidents should be reported to the airport operator; "commercial confidentiality" should not prevent airlines from informing airport operators of apron incidents/accidents, and airport operators typically will attempt to maintain the confidentiality of such reports, the ACI said. "Even small or seemingly unimportant incidents may reveal an unsafe situation, such as a lack of knowledge or rules and procedures," the report said.♦

Notes

1. Airports Council International (ACI) defines an incident as "an occurrence, other than an accident, associated with the operation or handling of an aircraft, which affects or could affect the safety of operation."

2. ACI defines an accident as "an occurrence associated with the operation or handling of an aircraft in which a person is fatally or seriously injured or the aircraft sustains damage."

3. ACI defines a fatality — or "injury (fatal)" — as "any injury [that] results in death within 30 days of the incident/accident."

4. ACI defines an injury as "any condition [that] requires medical assistance, including first aid."

5. ACI defines aircraft damage as "any adverse condition [that] affects the structural strength, performance or flight characteristics of an aircraft or causes delay in flight operations due to repairs."

6. ACI defines equipment damage as "any damage or adverse condition [that] limits or prevents the use of aircraft handling equipment."

7. ACI defines facility damage as "any damage or adverse condition [that] prevents or limits the use of an aircraft-handling facility or requires repairs."

Publications Received at FSF Jerry Lederer Aviation Safety Library

ICAO Publishes Statistical Yearbook of Worldwide Civil Aviation Activities

The data are based on information provided by the International Civil Aviation Organization's contracting states and include statistics for traffic and aircraft accidents.

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FSF Library Staff

Reports

Civil Aviation Statistics of the World 1998–1999. 24th edition. International Civil Aviation Organization (ICAO). June 2001. 206 pp. Tables, appendixes. Available from ICAO.*

The statistical yearbook contains commercial air carrier statistics that are based on summaries and selections of detailed data provided by ICAO's contracting states. ICAO statistical regions represented are: Africa, Asia-Pacific, Europe, Latin America and Caribbean, Middle East and North America. Statistics tables summarize data about aircraft and aircraft registries, accidents, aircraft fleets, air carrier financial performance and airport traffic.

Onboard Inert Gas Generation System/Onboard Oxygen Gas Generation System (OBIGGS/OBOGS) Study, Part II: Gas Separation Technology — State of the Art. Reynolds, Thomas L.; Eklund, Thor I.; Haack, Gregory A. NASA CR–2001-210950, D950-10529-2. August 2001. 73 pp. Figures, tables. Available from NASA ** or NTIS.***

This contract study was sponsored by the U.S. National Aeronautics and Space Administration (NASA). Boeing Phantom Works, Systems/Subsystems Technology, in Seattle, Washington, U.S., conducted the study to assess advanced technologies for gas separation (separating nitrogen and oxygen from air) in commercial aircraft. Potential on-board applications include nitrogen for fuel-tank inerting (reducing the risk of fire/explosion) and for improved cargo-compartment fire suppression, and oxygen for passenger emergency use and crew use in the event of loss of cabin pressure. Three principal methods of gas separation were investigated: hollow-fiber membrane, ceramic membrane and total atmospheric liquefaction of oxygen and nitrogen. The report describes the technologies and the tests conducted, compares the technologies and discusses their capabilities to meet the requirements for use in commercial aircraft.

Association of Postmortem Blood Hemoglobin A_{1c} Levels With Diabetic Conditions in Aviation Accident Pilot Fatalities. White, V.L.; Chaturvedi, A.K.; Canfield, D.V.; Garber, M. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine (OAM). DOT/FAA/AM-01/12. July 2001. 7 pp. Figure, table. Available from NTIS.***

The FAA OAM evaluates present and proposed medical certification standards for U.S. pilots. Part of the OAM's responsibility is to investigate potential effects and impairments of medical conditions and medications on pilot performance. Previous research established a link between abnormal glucose levels (in the eye's vitreous humor and in the urine) and diabetic conditions in pilots involved in fatal aviation accidents.

Post-accident factors, such as trauma, stress and medical intervention, are known to influence blood glucose levels. Although abnormal glucose levels can be used to identify pilots whose blood sugar was elevated at the time of death, abnormal levels do not indicate how well diabetes was being controlled before death. With this report, the authors identify a method of measuring elevated postmortem hemoglobin levels that could be used to support an investigator's determination of medical impairment or incapacitation in an aviation accident.

Air Traffic Control: FAA Enhanced the Controller-in-Charge Program, but More Comprehensive Evaluation Is Needed. U.S. General Accounting Office (GAO). October 2001. GAO-02-55. 42 pp. Figures, tables, appendixes. Available through GAO.****

In a 1998 agreement between the U.S. Federal Aviation Administration (FAA) and the National Air Traffic Controllers Association (NATCA), FAA agreed to a nationwide plan to reduce by attrition the number of supervisors who oversee air traffic controllers. The plan will change the controller-to-supervisor ratio from 7-to-1 to 10-to-1. To avoid compromising safety when supervisors are not present, the FAA is asking controllers to perform supervisory duties as controllers-in-charge (CIC), a practice that has been in place at some FAA facilities for more than 40 years.

The GAO, which conducts research for the U.S. Congress, was asked to review the FAA plan to make greater use of CICs. The GAO staff and an independent panel of air traffic control training experts focused on four questions:

- How is the plan being implemented?
- How adequate is the training of controllers for new duties and responsibilities?
- What quality-assurance procedures are in place to measure the effects of change on safety?
- What is the current status of FAA's progress toward financial savings and productivity gains from CIC expansion?

The GAO found that nationwide, 8,268 air traffic controllers, or about 55 percent of the air traffic control work force, have been selected to serve as CICs, with percentages varying by size and type of facility. Smaller facilities selected all or nearly all of their controllers as CICs. Towers with lower volume and lower complexity of air traffic generally have the highest percentage of CICs, and terminal radar approach control facilities and en route centers have lower percentages of CICs relative to their controller work force.

Quality-assurance procedures and measures have not been implemented consistently. Nevertheless, FAA said that "to date, no CICs have been found to have caused or contributed to operational errors." FAA also said that "supervisors are rarely the cause of or a contributing factor to these errors."

The GAO recommended that FAA provide comprehensive evaluation of the CIC training program and periodic refresher training as needed at all facilities. The GAO interviewed some supervisors and managers who were concerned that CICs would not correct the performance of their peers to the extent that supervisors do. (FAA expects its supervisors to correct controller performance immediately, as needed.) The report said, "FAA has said it will immediately stop reductions of supervisors at any facility where they find indications that the expanded use of CICs might be having an adverse effect on safety."

Books

Human Error — by Design? Bennett, Simon. Ames, Leicester, U.K.: Perpetuity Press, 2001. 53 pp.

This book discusses the "conventional" belief that the cause of most aviation accidents is pilot error. The author says that, although pilots make mistakes, the underlying causes of many accidents are problems in aircraft design, maintenance and manufacturing; training; operational procedures; and air traffic control. The author discusses systemic analysis or holistic (human factors) analysis as developed by human factors researchers. He applies the holistic method to case studies of several accidents in aviation history. The book is written as an introduction to "systems thinking" as applied to aviation accident investigation.

Combat: The Great American Warplanes. Wilson, Jim. New York, New York, U.S.: Hearst Books, 2001. 192 pp. Photographs, drawings.

Based upon his experience in writing about U.S. combat aircraft, the author has compiled a book describing 40 classic warplanes. The aircraft were selected for their technological innovation, fighting performance and contributions to U.S. military requirements. Aircraft are grouped as bombers; fighters; attack aircraft; reconnaissance and electronic-warfare aircraft; cargo aircraft, transport aircraft and tankers; helicopters; naval aircraft; and future and experimental aircraft. Descriptive profiles are accompanied by photographs and cutaway illustrations.

Peak Performance for Aerobatics. DeLacerda, F.G. Ames, Iowa, U.S.: Iowa State University Press, 2001. 168 pp. Photographs, tables, appendixes.

Conducting competition aerobatics or sport aerobatics is physically demanding and requires concentration for situational awareness and effective timing for aircraft control. The author said that competition aerobatics is "at least 90 percent mental." With a background in sports science, human performance and competition aerobatics, the author discusses the mental training and physical training required by pilots. He discusses psychological influences that affect human performance, such as concentration, evaluation, coaching, confidence-building and stress-management. Nutrition and physical conditioning also are discussed. Included in the book are photos of champions in their competitive categories and of different models of aerobatic airplanes.

Regulatory Materials

Vibration and Fatigue Evaluation of Airplane Propellers. U.S. Federal Aviation Administration Advisory Circular (AC) 20-66A. Sept. 17, 2001. 42 pp. Figures, tables, appendixes. Available from GPO.*****

The AC provides guidance and describes a method for complying with U.S. Federal Aviation Regulations Part 23.907 and Part 25.907 for airplane type certification. Vibration evaluation identifies propeller vibratory loads or stresses on the airplane. The vibration section of the AC discusses test methods and conditions, structural data and test data, restrictions and monitoring. Propeller-fatigue evaluation establishes fatigue life, replacement times and the requirement for inspections of components. The fatigue section describes the safe-life method and the damage-tolerance method for evaluating blades, hubs and other propeller components.

[This AC cancels AC 20-66, *Vibration Evaluation of Airplane Propellers*, dated Jan. 29, 1970.]

Guidance Material for Fatigue Limit Tests and Composite Blade Fatigue Substantiation. U.S. Federal Aviation Administration Advisory Circular (AC) 35.37-1A. Sept. 17, 2001. 45 pp. Figures, tables. Available from GPO.*****

The AC offers guidance and describes a method for complying with U.S. Federal Aviation Regulations Part 35.37 regarding fatigue-limit tests and fatigue substantiation of composite-material propeller blades. Propellers are subjected continuously to steady stresses and vibratory stresses while operating in many different conditions, in flight and on the ground. In addition, an increasing number of propeller blades are constructed of newer composite materials that may differ significantly from metal or other composite materials. The AC describes methods for evaluating propeller fatigue by determining fatigue limits and damage accumulation for propeller hub, blades and other related components; propeller loads; component endurance, repair, and degradation; damage tolerance and safe-life limits; and testing.

[This AC cancels AC 35.37-1, *Composite Propeller Blade Fatigue Substantiation*, dated May 11, 1993, and AC 35.37-1, Change 1, dated Sept. 7, 1993.]

Pilot Records Improvement Act of 1996, as Amended. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 120-68A. Sept. 20, 2001. 28 pp. Figures, appendixes. Available from GPO.*****

The Pilot Records Improvement Act (PRIA) was enacted by the U.S. Congress in 1996, primarily in response to airline accidents that were attributed to pilot error. Investigations had revealed that employers of the pilots involved in some accidents had not reviewed pilot performance histories and relevant background information. PRIA requires an employer to request and receive specific information about a pilot from the FAA, other air carriers or individuals, and the U.S. National Driver Register before allowing a pilot to begin flight duty. [The U.S. Department of Transportation National Highway Traffic Safety Administration describes the National Driver Register as a computerized database of information about drivers who have had their motor-vehicle operator licenses revoked or suspended or who have been convicted of serious traffic violations, such as driving while impaired by alcohol or drugs.] This AC provides guidance to air carriers who employ pilots and includes the amended text of PRIA and applicable request forms.

[This AC cancels AC 120-68, *Pilot Records Improvement Act of 1996*, dated May 8, 1997.]♦

Sources

* International Civil Aviation Organization (ICAO)
Document Sales Unit
9999 University Street
Montreal, Quebec, Canada H3C 5H7
Internet: <http://www.icao.org>

** NASA Center for Aerospace Information
7121 Standard Drive
Hanover, MD 21076 U.S.
Internet: <http://gltrs.grc.nasa.gov/GLTRS>

*** National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161 U.S.
Internet: <http://www.ntis.org>

**** U.S. General Accounting Office (GAO)
P.O. Box 37050
Washington, DC 20013 U.S.
Internet: <http://www.gao.gov>

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

Accident/Incident Briefs

Bird Strike After Takeoff Results in Engine Failure

The investigation revealed that the wrong type of bolt had been used to install the engine aft-center body and that the bolts had failed when they were subjected to the high vibration loads that followed the bird strike.

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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

Crew Heard Bang, Saw Flash of Light as Parts Separated From Engine

McDonnell Douglas DC-10 Series 30F. Substantial damage. No injuries.

Visibility of eight kilometers (five statute miles), a broken ceiling at 1,800 feet and 27-knot winds, with gusts to 40 knots, prevailed for the night takeoff from an airport in Ireland for a flight bound to the Caribbean. Because of weather conditions, the captain of the cargo flight was required by company standard operating procedures to conduct a maximum-thrust takeoff. At 300 feet above ground level, the flight crew heard a loud bang and saw a flash of light from the left side of the airplane, then felt airframe vibration and heard a rumbling sound.

About the same time, the no. 1 (left) engine “REVERSER UNLOCK” light and the no. 1 engine exhaust-gas-temperature warning light illuminated.

“The [captain] retarded the no. 1 engine throttle, and the flight engineer started to locate the ‘reverser unlock’ emergency checklist, but before it could be found, the no. 1 engine fire warning activated and the [captain] called for the ‘engine fire’ checklist,” the report said.

As the first officer and the flight engineer conducted the checklist, the flight engineer experienced difficulty moving the fuel selector lever to the “OFF” position. By the time they conducted the checklist item that required them to pull the no. 1 engine fire handle, the fire-warning indication in the handle had extinguished. Nevertheless, they completed all checklist items and activated one of the two fire extinguishers. The crew diverted the flight to an airport in England.

An inspection revealed that the no. 1 engine (General Electric CF6-50) had been struck by a gray heron, a bird weighing an average of 3.5 pounds (1.6 kilograms). The impact caused severe damage to the no. 1 engine and caused some large nacelle components to separate from the engine, striking the left-inboard aileron and left-inboard flap before falling to the ground.

The inspection also revealed that the aft-center body and the aft section of the core exhaust nozzle were missing from the no. 1 engine. The report said that the wrong type of bolt had been used in installation of the aft-center body, causing a weakened joint between the forward-center body and the aft-center body. The report said that the center-body attachment bolts had failed "when exposed to the high vibration loads following the bird strike."

"Evidence suggested that as the aft-center body separated, it rotated and struck the core nozzle lip, causing the aft section of the core exhaust nozzle to break away," the report said.

Two configurations exist for the forward-to-aft center-body joint: one configuration with eight bolts and one configuration with 16 bolts. General Electric Service Bulletin (SB) 78-216, issued in 1987, increased the number of bolts to 16 from eight and required a shear-type bolt instead of a fully threaded tension bolt.

"The pre[-modification] and post-modification center bodies may be mixed, but this is subject to constraints on fastener types as specified within the SB," the report said. "Mixing of the pre[-modification] and post-modification standards of bolts is not permitted, as this results in insufficient clamping forces at the forward-to-aft center-body joint. However, it is physically possible for an operator to mix pre[-modification] and post-modification standards, and it would appear that some operators have inadvertently used the wrong type of bolt and [have] been unaware of the constraints on and implications of mixing the bolt types."

The report said that another SB (78-240) was introduced because of problems with cracks in the "C" ring, to which the core-exhaust nozzle is attached. SB 78-240 was intended to strengthen the "C" ring.

"The engine manufacturer is of the opinion that if the forward-to-aft center-body bolted joint had been in compliance with existing SBs, the forward-to-aft center-body joint would not have failed under the loads encountered and the parts would not have been liberated," the report said.

After the accident, the U.K. Air Accidents Investigation Branch (AAIB) recommended that the engine manufacturer clarify what type of bolts should be used when installing the aft-center body.

The report said that the manufacturer planned the following actions:

- Issuing bulletins to operators to "reiterate the importance of full implementation of current SBs [that] improve the integrity of the bolted center body and riveted core nozzle joints";
- Issuing a new SB that would "not allow interchangeability of modified and unmodified forward and aft center-body sections to reduce the likelihood of mixing the types of bolts [that] would result in an unapproved combination and reduced joint strength." The SB also would "improve the integrity of this joint by incorporating larger-diameter bolts to provide a greater margin of robustness"; and,
- Improving the assembly section of the engine shop manual to "ensure proper assembly of the core nozzle C-channel rivet joint."

The AAIB also recommended that the U.S. Federal Aviation Administration (FAA) require inspections of the aft-center-body attachment bolts on affected CF6-50 engines to ensure that the correct types of bolts were used. The FAA has asked the manufacturer to review the problem.

Nose Landing Gear Collapses After Touchdown

Fokker 100. Minor damage. No injuries.

Visual meteorological conditions prevailed as the airplane was being flown on final approach to an airport in the United States. After receiving a nose-landing-gear-unsafe indication, the flight crew abandoned the approach and "recycled the gear per procedures to no avail," the incident report said. The crew of another airplane told air traffic control that the landing gear appeared to be extended. The flight crew of the incident airplane landed the airplane and stopped it on the runway.

Maintenance personnel placed pins in the landing gear. As the airplane was being towed to the gate, the nose landing gear collapsed. Passengers were deplaned and taken by bus to the gate area.

An inspection revealed a semicircular indentation that began in the nose-landing-gear wheel well and extended forward. The pressure bulkhead in front of the nose-landing-gear wheel well was wrinkled and ruptured.

Crewmembers Don Oxygen Masks After Detecting Burning Odor

Boeing 767-338ER. No damage. No injuries.

The airplane was being flown at cruise altitude on a domestic flight in Australia when the flight crew smelled a burning odor emanating from the captain's light panel on the glareshield. As the odor intensified, the flight crew donned oxygen masks.

They determined that the odor was being produced by the map-light rheostat switch and the chart-light rheostat switch, which were hot to the touch, as was the panel around the switches. The switches were selected off, and the odor dissipated.

The aircraft technical log said that a similar discrepancy had occurred two days earlier, but maintenance personnel were unable to replicate the problem. The map-light rheostat was replaced, and no further problems were reported; the report did not discuss further action involving the chart-light rheostat.

Incorrect Training Procedure Cited in Control Loss

Beech 1900D. No damage. No injuries.

The airplane was being flown on a midday training flight in Australia when the pilot-in-command (PIC) simulated a left-engine failure after takeoff by moving the left power lever to the "FLIGHT IDLE" position. The pilot flying — who had accumulated 5,043 flight hours, with 1,143 flight hours in Beech 1900Ds — applied full right rudder and right aileron, but the airplane continued to yaw left until the PIC — a check pilot with 8,300 flight hours, including more than 3,000 flight hours in Beech 1900Ds — restored power to the left engine.

The incident report said that during the 21 seconds following takeoff, while the maneuver was being conducted, the airplane did not climb above 160 feet and at one point descended to 108 feet.

After recovery from the maneuver, the airplane was climbed to 2,000 feet. At that altitude, the PIC again moved the power lever for the left engine to the "FLIGHT IDLE" position to simulate an engine failure.

"The aircraft again lost controllability," the report said.

Power was restored to the left engine, and the pilots conducted a normal landing.

An investigation revealed no aircraft malfunction or systems malfunction. The report said that an incorrect procedure was responsible for the airplane's failure to achieve predicted performance during takeoff and initial climb and that the PIC "placed the aircraft in a potentially hazardous situation by using an incorrect procedure to simulate one-engine inoperative procedures."

"Since 1992, it was the practice of the operator's check pilots to simulate one-engine inoperative by retarding the power lever of the 'failed' engine to 'FLIGHT IDLE,'" the report said. "That was contrary to the procedure prescribed in the [U.S. Federal Aviation Administration]-approved Beech 1900D airplane flight manual and also to that specified in the operator's Civil Aviation Safety Authority [CASA]-approved training-and-checking manual. Reducing power to 'FLIGHT IDLE' also had the effect of simulating a simultaneous failure of the engine and its propeller auto-feather system. The simulation of simultaneous in-flight failures was contrary to the provisions of the CASA-approved training-and-checking manual."

The report said that the operator's training-and-checking organization and the operator's check pilots knew that simulating an engine failure by retarding engine power to less than zero thrust could result in reduced climb performance and increased minimum control speed (V_{MCA}) and that risks increase when in-flight training involves simulation of multiple failures.

As a result of the occurrence, the Australian Transport Safety Bureau recommended that CASA publish information for operators and pilots about the correct procedures for simulating an engine failure in turboprop airplanes. In response, CASA said that an amendment would be published to Civil Aviation Advisory Publication 5.23-1(0) to discuss the correct procedures and that operators' manuals also would be required to contain information on appropriate multi-engine training procedures.

After the occurrence, the operator said that its check pilots had been told not to move power levers below the zero-thrust torque setting when simulating engine failures during takeoff and not to conduct engine-failure simulations below 250 feet above ground level.

Air Taxi Commuter

Airplane Strikes Fence During Takeoff

Cessna 310. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the afternoon departure from an airport in the United States.

The pilot of the cargo flight — the only person in the airplane — said that during the takeoff, the right engine stopped producing power, and he moved the left-engine throttle to idle. The airplane departed the right side of the runway. The accident report said that after the pilot observed that the airplane was nearing a fence, he "pushed the left throttle back to the full-power position so that he would have enough speed to lift the nose of the aircraft off the ground, resulting in the aircraft impacting the fence in a nose-high attitude."

The airplane stopped about 200 feet (61 meters) beyond the fence.

Pressure Spike Suspected in Gear Collapse

Cessna Model 550 Citation II. Minor damage. No injuries.

After flying the airplane from Switzerland to England, the flight crew conducted a visual approach and a short-field landing. The airplane touched down normally, and the crew applied the brakes, thrust reversers and speed brakes. The landing-gear warning horn then sounded, the landing-gear warning light illuminated, and the nose-landing-gear green light was extinguished.

The nose landing gear collapsed, and the airplane slid to a stop on the runway. The crew conducted an emergency shutdown of the engines, and the airplane was evacuated.

The incident report said that communications with the manufacturer revealed that five similar incidents had occurred and all were being investigated.

The report said, "The manufacturer has determined from tests that in certain circumstances, a check (i.e., 'non-return') valve located in the landing-gear hydraulic-system return circuit can allow a pressure 'spike,' produced in the return system, to be passed back through the valve to unlock the nose-landing-gear actuator downlock. Such pressure spikes can be caused by activation of either the speed brakes or thrust reversers on landing. The manufacturer thus believes that activating either the speed brakes or the thrust reversers simultaneously with nosewheel touchdown can cause the nose landing gear to retract."

As an interim measure, the manufacturer revised the airplane flight manual to caution crews against operating the speed brakes or thrust reversers before the nose wheel is "in firm contact with the ground."

Propeller Underspeed Prompts Engine Shutdown

Saab SF-340A. No damage. No injuries.

Ground fog had delayed the airplane's departure from an airport in Australia for 4.5 hours, and instrument meteorological conditions prevailed for the takeoff. While the flight crew taxied the airplane for departure, they completed the preflight checklist, including the "first-flight-of-day" propeller-governor-overspeed test.

After takeoff and after retraction of the landing gear, while the constant-torque-on-takeoff system was engaged, the crew observed that the right-engine-propeller speed was low — 1,100 revolutions per minute (rpm) — compared with the left-engine-propeller speed, which was 1,378 rpm and within the normal operating range.

Because of ground fog at the departure airport, the crew flew the airplane to an alternate airport. They conducted the checklist actions for propeller underspeed and shut down the right engine before descent, then conducted a single-engine approach and landing.

An investigation revealed that the right-propeller speed had not returned to normal levels after the propeller-governor-overspeed test.

"Both crewmembers reported that on completion of the propeller-overspeed governor checks, once they had observed the propeller indications returning toward normal, their attention was diverted toward other checks," the report said. "The crew also indicated that during the takeoff, they did not normally check the propeller rpm indications, instead monitoring the engine parameters of 'torque and inter-turbine temperature.' Consequently, the low right-propeller rpm had not been initially detected."

Nevertheless, during the takeoff roll, the crew observed that "the right-engine torque had lagged behind the left," the report said. As a result, they advanced the right power lever to equalize engine-torque indications.

After the incident, maintenance personnel checked the right engine and right propeller and found no abnormalities. The airplane was returned to service, and the problem did not recur.

Corporate Business

Airplane Strikes Ground After Crew Receives Descent Clearance

Gates Learjet 24D. Destroyed. Two fatalities.

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

Preliminary data showed that the airplane was being flown in cruise flight at Flight Level 390 (39,000 feet) and that the crew received clearance to descend to 10,000 feet. As the airplane was descending through 22,000 feet, the crew acknowledged air traffic control (ATC) instructions to call approach control. The airplane was observed on radar to enter a climb, which continued for 20 seconds, and then a descent, which continued for 18 seconds before the last radar return was observed. The flight crew did not call approach control, and ATC heard no distress calls.

Evidence of the initial impact was a crater that measured 17 feet (five meters) by 30 feet (nine meters). Sections of the right horizontal stabilizer, the right elevator and the outboard right wing were found south-southeast of the crater. Other wreckage was found in the crater and on the ground adjacent to the crater, with some debris as far as 0.25 mile (0.4 kilometer) away. The crater was excavated to depths of between four feet (one meter) and six feet (two meters) before investigators encountered undisturbed dirt.

Airplane Disappears From Radar During Approach in Instrument Conditions

Piper PA-46-350P Malibu Mirage. Destroyed. Three fatalities.

Instrument meteorological conditions prevailed, and an instrument flight rules flight plan was filed for the business flight in the United States.

Air traffic control radar showed that the airplane was being flown at 150 knots at 2,900 feet while passing the final approach fix on an instrument landing system (ILS) approach to Runway 5R. The pilot received clearance to land, but radar showed that the airplane remained at 2,900 feet and at a groundspeed of 118 knots.

Visibility was reported as 0.25 statute mile (0.4 kilometer) with broken clouds at 100 feet and an overcast ceiling at 800 feet.

"During the entire approach until midway down the runway, the flight never descended below 2,000 feet," the accident report said. "The controller asked the pilot if he was going around, and he answered he was. [Air traffic control] cleared the pilot to maintain 2,000 feet and fly runway heading, which the pilot read back correctly. Radar data showed that the airplane turned right to a heading of about 123 degrees, then descended to 1,400 feet and within five seconds climbed to 1,600 feet. The flight stayed at 1,600 feet for about 30 seconds and then disappeared from radar."

The airplane struck a house about two statute miles (three kilometers) southeast of the airport.

Other General Aviation

No Fuel Found in Airplane That Struck Terrain Near Airport

Piper PA-28-160. Destroyed. Two fatalities.

Night visual meteorological conditions prevailed for the flight from Belize to Costa Rica, and an international instrument flight rules flight plan had been filed.

The accident report said that several minutes before the accident, the pilot had reported "mechanical difficulties" with the airplane, which struck the ground 3.4 nautical miles (6.3 kilometers) from an airport in Costa Rica. A post-accident inspection revealed that "the fuel cells, fuel line, gascolator and the carburetor bowl were totally dry," the report said.

Airplane Stalls During Approach at Precision Flying Contest

Cessna 150. Minor damage. No injuries.

The airplane was being flown in a precision-flying championship at an airport in Canada. The pilot was to fly the airplane as close as possible to a ribbon 12 feet above the runway and then to land the airplane on a runway marking 50 meters (164 feet) past the ribbon.

The pilot flew the airplane just above the stall speed with full flaps. When he observed that the airplane would strike the ribbon, he banked the airplane left and applied power. The airplane stalled, and the left wing struck the runway. The airplane stopped in a cornfield left of the runway.

Wing Separates From Amateur-built Airplane During Approach

Rominger Zic Zac Bird. Destroyed. One fatality.

Visual meteorological conditions prevailed for the flight to an airport in the United States. A witness said that the left wing separated from the amateur-built airplane as the airplane was turned onto final approach. The witness, a corporate pilot, said that the turn had appeared to be normal before the wing separation occurred.

After the wing separated, the airplane entered a vertical dive and roll and descended to a field about one statute mile (1.6 kilometers) from the airport.

The wood-and-fabric airplane had been flown between five hours and 15 hours when the accident occurred. The son of the pilot/builder said that his father had planned to use the airplane to compete for speed records and climb-performance records for airplanes with gross weights of less than 660 pounds (299 kilograms).

Rotorcraft

Dry Bearing Blamed for Emergency Ditching

Robinson R44. Minor damage. No injuries.

The helicopter was being flown on an afternoon charter flight in Australia. About 20 minutes after takeoff, the pilot said that he smelled a burning odor, felt "a slight shudder" and observed the rotor-clutch light flicker.

He conducted a powered descent, transmitted mayday calls on the helicopter's communications radio and landed the helicopter in the water.

A post-incident inspection revealed that the fan-shaft bearing on the fan shaft between the engine and the cooling fan had "overheated, melted and seized," the incident report said.

Maintenance records showed that another clutch actuator that had been installed previously in the helicopter "had experienced flickering clutch lights for a period of time," the report said. The actuator was replaced with a modified clutch actuator about 19 months before the accident, and the light stopped flickering. Nevertheless, about one month before the accident, the clutch light "began staying on for eight [seconds] to 10 seconds," the report said. "The problem was attributed to a faulty tensioner, and a new clutch actuator was fitted 21.6 flight hours [before the incident]."

The investigation determined that the lower actuator bearing had lost lubrication after 926.4 hours in service and that the dry bearing caused the overheating of the fan shaft.

"The excessive heat from the bearing partially melted the aluminum bearing spacers and the brass roller separator, and the bearing seized," the report said. "Spinning of the outer bearing housing tore the bearing free and fractured the actuator.

"Bearing and actuator failures resulted in a loss of drive-belt tension and caused an engine overspeed and rotor rpm decay, necessitating an autorotation onto water. The fractured actuator and loose belts caused secondary damage as they flapped around with the spinning clutch shaft."

The helicopter manufacturer said that some early bearings installed on R44 helicopters had non-concentric seal rings that had been pinched during assembly, causing distortion of the seals and that the distortion may have allowed grease to leak out of the bearings and water to leak in.

Because of damage to the bearing, the manufacturer could not determine why the lower actuator bearing lost lubrication. Nevertheless, the report said, "the distorted seal, loss of grease and water ingress was considered the most likely sequence of events."

As a result of the investigation, the manufacturer said that all bearings would be examined on aircraft and assemblies that were returned for maintenance. Robinson Service Bulletin (SB) 42, issued Aug. 1, 2001, required the lower actuator bearing to be lubricated every 300 flight hours, or annually. The manufacturer said that examination of the returned assemblies indicated that a change in seal-assembly methods that had been introduced in February 1999 apparently improved service reliability.

Cold Temperature Prevents Throttle Movement

Bell 47G-2. No damage. No injuries.

The helicopter was being flown on an instructional flight in Canada. At 4,500 feet, the throttle could not be moved from the full-power setting. The instructor took control of the helicopter but could not conduct a descent without shutting down the engine and autorotating to the ground. There were no desirable landing areas in the mountainous region, so the instructor flew the helicopter above an overcast to return to the airport and conduct the descent through a break in the clouds. The incident report did not include information on weather conditions but said that the cold temperature at 4,500 feet had caused the throttle to freeze at the full-power setting.

Helicopter Strikes Fence During Departure From Soccer Field

Bell 412EP. Substantial damage. One serious injury; nine uninjured.

The helicopter was being flown to evaluate seismic activity near a volcano in Mexico and to determine whether area residents should be evacuated.

When the pilot attempted to conduct a takeoff from a soccer field, the helicopter struck a fence and a residence. A preliminary accident report said that flight visibility was reduced by ash from the volcano and by dust generated by other helicopters that had been flying from the same soccer field.♦

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