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International Organizations Rise to Challenge to Prevent Approach-and-landing Accidents

Regional Initiatives Launched

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 830 member organizations in more than 150 countries.

Momentum Builds in Regional ALAR Implementation Efforts

The Pan American Aviation Safety Team has launched the world's first regional awareness campaign based on the FSF* ALAR Tool Kit *to prevent approach-and-landing accidents. Regional team leaders also are beginning to organize locally tailored initiatives in Africa, the Middle East and the Asia Pacific region.

FSF Editorial Staff

The Pan American Aviation Safety Team (PAAST) continues to develop its awareness campaign for approach-and-landing accident reduction (ALAR) in 2001, based on the Flight Safety Foundation (FSF) *ALAR Tool Kit.* The tool kit, a unique set of pilot briefing notes, videos, presentations, risk-awareness checklists and other tools, is designed to help prevent ALAs, including those involving controlled flight into terrain (CFIT).[1] 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 phases, which typically comprise about 16 percent of the average flight duration of a large commercial jet.

PAAST is at the forefront of international efforts to apply these tools and provides aviation safety professionals from other regions a case study to consider in launching CFIT/ALAR awareness and education programs, said Stuart Matthews, FSF president and CEO.[2]

PAAST includes aviation safety specialists affiliated with the International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO), the Asociación Internacional de Transporte Aéreo Latinoamericano (Latin American International Air Transport Association [AITAL]), the Foundation, the International Federation of Air Line Pilots' Associations (IFALPA), the International Federation of Air Traffic Controllers Associations (IFATCA), and airlines, manufacturers and regulators. PAAST was created in July 1998 to gather participation in aviation safety programs by people from nations and territories of the Caribbean, Central America, Mexico and South America.[3]

In working with PAAST, timing and a good match of interests were important factors, Matthews said.

James Burin, FSF director of technical programs, said, "PAAST had people ready to work, and they wanted a suitable aviation safety product; the Foundation knew that the tool kit could be the product that could help PAAST build credibility as a new organization in the region. We expect the same process to occur in other regions."[4]

The level of activity in the region addressed by PAAST has been increasing rapidly, he said.

"PAAST members are well ahead of where we envisioned their work to be now," Burin said. "PAAST has grown since March 2001 from eight action team leaders to 18 action team leaders."

Al Castan, director, operations and infrastructure for IATA, Latin America and Caribbean, and a member of the PAAST executive team, said that PAAST's implementation of the tool kit has demonstrated the value of regionally developed strategies.[5]

"PAAST is proof that regions know best — that we are in touch with our own constituencies, characteristics, safety cultures and flying profiles — how things get done in the region," said Castan. "We are very proud of our ALAR implementation effort — interest has grown like wildfire. Part of our motivation for the last three years has been to get a new generation of aviation safety professionals off and running before we retire. Hopefully, in 10 years, accident data for the region will be very good. That is what we are trying to do."

Several leaders of PAAST have explored methods of linking pilot license requirements to ALAR training.

"In Mexico, for example, the General Directorate of Civil Aviation (DGAC) determined that the best method of reaching all of the nation's pilots would be through a new requirement in the pilot license revalidation process," said Burin (see "Mexico Works to Integrate CFIT/ALAR Into Pilot Licensing in 2002").

During a June 2001 PAAST meeting in Mexico City, Mexico, representatives of Mexican pilot organizations told how they had presented to Mexico's DGAC data from the tool kit and a prototype ALAR course for pilots, he said. PAAST also presented an ALAR workshop to operators, regulators and air traffic controllers, he said.

Typical CFIT/ALAR presentations in Mexico have used a combination of three briefings — from Microsoft PowerPoint presentations and FSF *ALAR Briefing Notes* — from the tool kit and its two videos, said Burin. AITAL has used the standard operating procedures (SOPs) template from the tool kit to develop customized SOPs that PAAST will distribute as best practices, said Burin.

As part of the PAAST effort, the ALAR briefings in PowerPoint presentation format have been prepared using tool kit material translated into Spanish. Capt. Luis García, a Mexicana Airlines pilot, cochairman of PAAST, representative of the Asociación Sindical de Pilotos Aviadores de México (Mexican Aviation Pilots Union Association [ASPA]) and representative of IFALPA, and pilots from Cubana de Aviación, a Cuban airline, obtained the script for translation and dubbing of the sound track in Spanish for *An Approach and Landing Accident: It Could Happen to You!,* the 19-minute ALAR video included in the tool kit.

"Previously, many people gave presentations of accident statistics and said, 'Here is the problem,'" said Castan. "With the tool kit, we are saying 'Here are practical solutions — things you can do to avoid ALAs and CFIT.'"

As in Mexico, civil aviation authorities (CAAs) in Colombia and Brazil are considering tool kit material for a national training syllabus, Castan said. ICAO also is planning a CFIT/ALAR seminar during 2001 in South America, he said.

PAAST action team leaders have been very effective in conducting indoctrinations for 10 people to 15 people, such as training captains in an academic setting, Castan said.

To assess the influence of the PAAST education activities and awareness activities, IFALPA currently is conducting baseline surveys of pilots in the region; the results will be compared to surveys to be conducted two years after the first surveys have been completed, he said (see "Surveys Assess Pilot Awareness of Methods to Prevent Controlled Flight Into Terrain," page 30).

ICAO Regional Leaders Recognize Compatibility of PAAST ALAR Strategy

Raymond Ybarra, regional director, ICAO North American, Central American and Caribbean Office, said that the release

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Mexico Works to Integrate CFIT/ALAR Into Pilot Licensing in 2002

The General Directorate of Civil Aviation (DGAC) in Mexico has been involved since 1995 in developing interventions to prevent controlled-flight-into-terrain (CFIT) accidents, said Jorge Romero, subdirector of DGAC's Adjunct General Directorate of Air Safety.[1] DGAC plans to introduce by April 2002 a requirement for all Mexican pilots to attend an approved course on the prevention of CFIT and on approach-and-landing accident reduction (ALAR) as part of annual license revalidation, Romero said.

Among the 1995 interventions, DGAC issued an obligatory circular, signed by the agency's director general, which still requires all Mexican pilots to provide evidence of attendance at a DGAC-approved course on the prevention of CFIT as part of annual license revalidation, he said. Implementation of a new CFIT/ALAR course requirement will be patterned after the 1995 methods, he said.

In 1995 and 1996, pilots from the Colegio de Pilotos Aviadores de México (Mexican College of Pilots) trained instructors at DGAC-authorized pilot training centers to present the approved course on CFIT prevention. A one-day course was presented as part of an initial CFIT-awareness campaign in 12 Mexican cities; subsequently, pilots have attended initial CFIT courses or recurrent CFIT courses, as required, at one of the DGAC-authorized pilot training centers, said Romero.

The legal processes for adding and revising aviation laws and regulations in Mexico changed during the mid-1990s, and DGAC has been working toward creation of a new official Mexican standard that will incorporate the current requirement for CFIT-related training for pilots and will supersede the obligatory circular with a CFIT/ALAR requirement, he said.

This rule-making process includes review and approval by several government agencies, a public notice of proposed rule making and consideration of industry comments before a final official Mexican standard is adopted, he said.

Romero said that DGAC has looked at the relationship of ALAR efforts and CFIT-prevention efforts under the official Mexican standards, and DGAC officials are meeting weekly with representatives of Colegio de Pilotos and representatives of the Asociación Sindical de Pilotos Aviadores de México (Aviation Pilots Union Association [ASPA] of Mexico) on awareness, instructor training and CFIT/ALAR course introduction in early October 2001. Several avenues for accomplishing this change are being considered and several rule-making processes are being initiated, he said.

Romero said that DGAC expects the CFIT/ALAR-related change to occur in several stages:

- Increasing Mexican industry awareness of CFIT/ALAR and of the new CFIT/ALAR course under development;
- Completing development of the DGAC-approved CFIT/ALAR course, including requirements for training instructors and a method for pilots to prove their course attendance;
- By April 2002, requiring proof of CFIT/ALAR course attendance at a DGAC-authorized pilot training center as one of the requirements for annual revalidation of any Mexican pilot license; and,
- Requiring CFIT/ALAR information to be included in all refresher training for pilots under programs authorized by DGAC.

"The first step is awareness and announcing the intention to make CFIT/ALAR training obligatory," said Romero. "Then it will be easy to get acceptance of the new requirement from the pilot community. We need people from Colegio de Pilotos and ASPA who know the subject well to assist in conducting CFIT/ALAR training."

Capt. Carlos Limón, a Mexicana Airlines pilot representing the International Federation of Air Line Pilots' Associations (IFALPA) on the Flight Safety Foundation CFIT/ALAR Action Group and ASPA (see "Foundation Focuses on Identifying Worldwide Regional Team Leaders," page 17), said, "The idea is to be ready for implementation of a DGAC-approved course, although legal issues remain before making it mandatory. We are planning to travel to eight major Mexican cities before the end of the year to promote the CFIT/ALAR course."[2]

Capt. Angel Goñi, an Aeroméxico pilot, a project leader for the Pan American Aviation Safety Team (PAAST) and a representative of ASPA, said that current plans call for a course of 3.5 hours to 4.0 hours, a program for instructor preparation and a system to control the process of documenting course attendance, perhaps with an official certificate, for purposes of meeting license revalidation requirements.[3]

Mexico's three largest airlines determined that they would need time to select pilots within their companies to provide the course, he said.

"This is the best way to reach at least 90 percent of all pilots in Mexico, regardless of the type of aviation in which they are involved," said Goñi. "The greatest achievement is to have the full support of DGAC and to have the greatest reach based on a new requirement. We will assure the quality of the instructors and materials, and we will have the certainty of DGAC approval. We have been taking time this summer to prepare the course instructors; 31 course instructors attended training Aug. 9 at ASPA offices in Mexico City. We have sent information to everyone who has come forward and demonstrated the ideal characteristics to be course instructors."

Course instructors will maintain controls and records of course attendees' name, pilot license data, type of license and the number of attendees at each session, he said.

"We will want to check these instructors once in a while to keep them current and motivated," he said. "For instructors who do not submit a report in three months, we will talk to them, offer a second chance or take away their [CFIT/ALAR] instructor's certificate."

Goñi said that ASPA estimates that, when instructor preparation is complete, a total of 100 to 120 CFIT/ALAR course instructors will comprise 55 pilots from Mexicana Airlines and 35 pilots to 40 pilots from Aeroméxico, as well as a group of Mexican DGAC inspectors and pilots from other organizations. He said that Fernando Antillón, director general of civil aviation of Mexico, and Capt. Mauro Gómez, chief inspector of the DGAC inspectors, have been strong supporters of the ALAR work.

Instructors who travel around the country will represent Colegio de Pilotos while ASPA provides technical support, said Goñi.♦

— FSF Editorial Staff

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1. Romero, Jorge. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 20, 2001. E-mail communication with Rosenkrans, Wayne. August 29, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

2. Limón, Carlos. Telephone, fax and e-mail communication with Rosenkrans, Wayne. Alexandria, Virginia, U.S. July 31, 2001 and August 29, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

3. Goñi, Angel. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 19, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

of the tool kit has coincided with other important initiatives in the region.[6]

An ICAO organization known as GREPECAS (Grupo Regional de Ejecución y Planificación para el Caribe y América del Sur [Caribbean and South American Regional Planning and Implementation Group]) was reorganized and restructured in 2000 to include a regional aviation safety board (ASB) that discusses regularly the safety problems that ICAO safety analysts consider to be urgent. The board comprises representatives of states and operators, said Ybarra.

"The important thing is that PAAST has a close relationship with GREPECAS and ASB, and both have given information [about air navigation problems] to PAAST," he said. "The ICAO objective is solutions to air navigation problems — and PAAST has more access to resources than GREPECAS. We have CFIT accidents, ALAs and air navigation problems everywhere. These relationships could be taken and adapted in other regions. For ICAO, the establishment of PAAST-like groups certainly would help to address air navigation deficiencies."

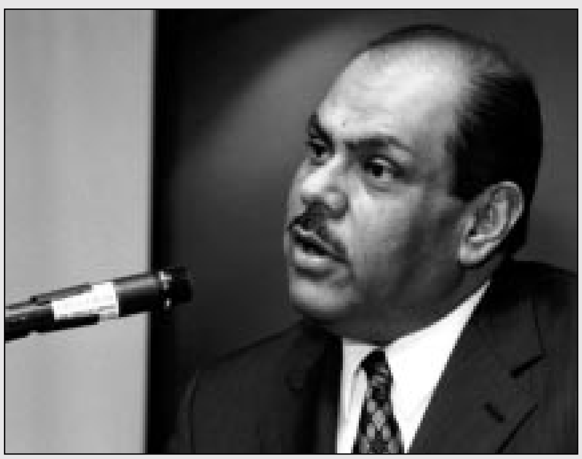
Ybarra said that ALAR implementation also complements the ICAO safety oversight organization. A CFIT/ALAR seminar in San Jose, Costa Rica, July 16–20, 2001, was the world's first ALAR-related function under ICAO auspices, he said (see "CFIT/ALAR Seminar in Costa Rica Attracts Diverse Group of Participants"). PAAST was cosponsor for this seminar.

Ybarra said that ICAO's regional methods provide enough flexibility to address the diverse needs of specific states.

Castan said that the tool kit has filled a void in access to training material and guidance. Beginning the PAAST ALAR safety initiative with a product in hand was a significant

CFIT/ALAR Seminar in Costa Rica Attracts Diverse Group of Participants

The International Civil Aviation Organization (ICAO) and the Pan American Aviation Safety Team (PAAST) in July 2001 conducted a five-day seminar in San Jose, Costa Rica, about the prevention of controlled flight into terrain (CFIT) and approach-and-landing accident reduction (ALAR). The seminar, organized by ICAO and hosted by the General Directorate of Civil Aviation (DGAC) of Costa Rica, was attended by 70 aviation professionals from Colombia, Costa Rica, El Salvador, Guatemala, Mexico, Nicaragua, Peru, Turks and Caicos Islands, and the United States.



Carlos Castro, minister of public works and transport of Costa Rica, welcomes participants to the July 2001 seminar on the prevention of approach-and-landing accidents, including those involving controlled flight into terrain. (FSF photo)

Carlos Castro, minister of public works and transport of Costa Rica, welcomed the seminar participants, who included pilots of fixed-wing aircraft and helicopters (including air carrier pilots, air taxi pilots, instructors, police and agricultural application pilots); DGAC staff; officials of the Costa Rican government; ICAO representatives; International Air Transport Association representatives; airport representatives; air traffic controllers; civil aviation regulators, flight standards inspectors and accident investigators; and operators of aviation schools.

During the seminar, Capt. Roberto Alfaro, director general of civil aviation, DGAC, said, "We are sending an unmistakable signal to the world that Latin American countries know how to respond to the call of our times. This is necessary to operate at the level of the most-developed countries, to bring ourselves up to date in the demands and refinements of globalization that permit us to increase our competitiveness in the world. It is of the highest importance that we return to our countries or our workplaces carrying all that we have learned here because each of us must be part of reducing the high rates of incidents and accidents."

The agenda comprised the following topics:

- The ICAO CFIT-prevention program;
- Introduction of the PAAST CFIT/ALAR implementation;
- An ALA data overview;
- Use of the FSF *ALAR Tool Kit* products (focusing on the FSF *CFIT Checklist*, the FSF *Standard Operating Procedures Template*; the FSF *Approach-and-landing Risk Awareness Tool* and the FSF *Approach-and-landing Risk Reduction Guide*.)[1]
- FSF *ALAR Briefing Notes* on operating philosophy, use of automation, golden rules of operations, standard calls, normal checklist, approach briefings, altimetry, descent and approach profile management and approach hazard awareness, preparation to go around

and conducting the go-around, the terrain-avoidance maneuver, bounce recovery and rejected landings; approach techniques (including stabilized approach criteria and constant-angle approaches, visual references and visual approaches); flight operations and training; runway excursion and runway overruns, final approach speed and landing distances; and,

- Group analysis of a CFIT accident.

Jan Jurek, regional officer, safety oversight, ICAO North American, Central American and Caribbean Office in Mexico City, Mexico, said that he began organizing the Costa Rica seminar in January 2001 after receiving an invitation from Alfaro to host an international event.[2]

Capt. Roberto Alfaro, director general of civil aviation of Costa Rica, invited the International Civil Aviation Organization and the Pan American Aviation Safety Team to conduct the July 2001 seminar in his country. (FSF photo)

"We had good support from the government of Costa Rica," Jurek said. "We had very positive feedback, including a lot of interest in the tool kit and in serving as PAAST action team leaders. The Costa Rican aviation industry was a good target — and [conducting this seminar] was a very productive move for us. The basic thing I was trying to do was present the tool kit. The material I selected was based on my experience with ICAO Universal Safety Oversight Audit audits, in which we made visits to many operators and training facilities, and I saw CFIT/ALAR subjects missing from SOPs, training syllabuses and regulations."[3]

Jurek said that more questions were asked outside the seminar's formal setting than during the sessions, including many about how to obtain the tool kit, how to participate in PAAST activities and how to obtain Spanish-language versions of material used in presentations.

Jurek said that some information was repeated during the presentations because of the design of the FSF materials, but in some cases, repetition was valuable for reinforcing points and making them memorable.

In written critiques of the seminar, several participants said that they learned new terminology, understood the relationship of CFIT/ALA preventive measures to real world situations and planned to share the information with others. Some participants suggested more group discussion of case studies and emphasizing the practical application of information while presenting the facts about CFIT accidents and ALAs.♦

— FSF Editorial Staff

References

1. The Flight Safety Foundation (FSF) *Approach-and-landing Accident Reduction (ALAR) Tool Kit* is a multimedia resource on compact disc (CD) for safety professionals and training organizations working to prevent the leading causes of fatalities in commercial aviation: approach-and-landing accidents, including those involving controlled flight into terrain. The CD contains a wide range of textual material and graphic material based largely on the data-driven studies of the FSF Approach-and-landing Accident Reduction Task Force.

2. Jurek, Jan. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 19, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

3. Universal Safety Oversight Audits by the International Civil Aviation Organization (ICAO) became mandatory in 1999 and 2000. The audits target the compliance of member states with ICAO Annex 1, *Personnel Licensing,* Annex 6, *Operation of Aircraft* (Part 1, Part 2 and Part 3) and Annex 8, *Airworthiness of Aircraft,* said Jurek, regional officer, safety oversight, ICAO North American, Central American and Caribbean Office in Mexico City, Mexico.

advantage, and coverage of PAAST activities in regional trade media also triggered interest in some countries of the region, he said.

"The timing was beautiful," said Castan. "PAAST, ASB and the tool kit all happened at the same time. Regional teams may be working on ALAR in Africa [and the Middle East] much earlier than IATA and the Foundation expected. What we are doing in PAAST can be a case study."

Castan said that the following are critical questions to consider in developing a regional ALAR effort:

- Who are the members of the regional team?
- How do we create an effective leadership group for the team?
- What are the qualities needed in people to make the team work?

- How do we attract and motivate volunteers as action team leaders?

- What written material can we provide to people as guidance?

PAAST, for example, generated Spanish-language questions and answers about the tool kit and provided instructions about effective techniques for presenting the information to an audience, he said.

Previously, to conduct a regional safety initiative in this part of the world, the initiators would have to contact separately manufacturers, airlines and organizations such as ICAO, IATA, AITAL and IFALPA, and frequently, conflicts in conference plans occurred, said Castan.

"States would have to send people to [many] seminars, perhaps on the same subject — and then they might get conflicting views, directions and products," Castan said. Without a harmonized base of information, states may generate confusion in developing their own ALAR training; PAAST can organize one seminar for multiple countries, he said.

Eduardo Bendeck (seated), operations inspector for the Agencia Centroamericana de Seguridad Aérea (Central American Aviation Safety Agency), questions Jan Jurek, regional officer, safety oversight, International Civil Aviation Organization North American, Central American and Caribbean Office, about the FSF Approach-and-landing Risk Awareness Tool *during the July 2001 seminar in Costa Rica.* (FSF photo)

Castan said that PAAST wants to help provide as much material as possible in the first languages of people who use the material to promote retention and depth of understanding, to reduce loss of meaning that can occur during real-time interpretation of complex material and to make information more attractive.

At the PAAST meeting in Mexico in March 2001, for example, Cuban action team leaders decided to develop a Spanish-language version of the ALAR video. They had proposed captions, but the consensus was that dubbing the sound track in Spanish would be more effective. (The Foundation provided the script and video for this project.) Pilots from Cubana de Aviación have been working on a dubbed version while adopting other ALAR information and recommendations, he said.

Having videos from the tool kit in Spanish multiplies the value many times, Castan said.

In addition to the ALAR work, PAAST with ICAO also is in the final stage of preparation of a safety self-evaluation checklist for small airlines, said Castan. PAAST also has been collecting information about runway incursions and will propose an educational package on this subject, he said. Castan said that the International Society of Air Safety Investigators (ISASI) recently has joined PAAST as a result of the April 2001 ALAR presentation at an accident investigation conference in Santa Cruz de la Sierra, Bolivia.

PAAST Efforts Take Shape Using Cell-like Structures

PAAST cochairman García said, "The most immediate challenges remain the dissemination of the tool kit and raising the awareness of civil aviation authorities about ALAR efforts."[7] He said that the following activities have been accomplished to date:

- Airline pilots in Mexico translated from English to Spanish several PowerPoint presentations and the FSF *Approach-and-landing Risk Awareness Tool* in the tool kit for training and workshops;

- PAAST developed and distributed ALAR action team leader guidelines in English and Spanish, including recommendations on presentation techniques;

- PAAST leaders wrote and sent a formal letter to nations and territories in the geographic area covered by PAAST to introduce their ALAR implementation effort and the tool kit and to seek support and participation;

- PAAST trained 18 ALAR action team leaders for the geographic area covered by PAAST;

- PAAST action team leaders trained more than 30 volunteer ALAR instructors from Brazil, Colombia and Mexico;

- PAAST instructors provided or assisted in arranging ALAR instruction using the tool kit for about 1,800 pilots; and,

- PAAST action team leaders in Mexico added air traffic control (ATC) personnel affiliated with IFATCA as action team leaders and ALAR instructors.

Rodrigo Solano (left), a flight standards inspector for the General Directorate of Civil Aviation (DGAC) of Costa Rica, and Luis González, a DGAC air navigation official, use wireless headsets to listen to interpretations in Spanish of presentations in English during the July 2001 seminar in Costa Rica. (FSF photo)

García said that the tool kit has been accepted well.

"Training centers in Latin America are establishing programs based on the tool kit," said García. "There has been good enthusiasm from the training centers that I have visited. The main issue is helping [more] people to obtain a copy of the [compact disc (CD)]." (Copies of the tool kit were distributed free of charge to FSF members and free copies are provided to the regional team leaders; the CD is sold for a single-copy price by the Foundation and discounts are available for larger quantities.)[8]

The most frequent request from audiences is to have tool kit material — especially the videos — available in their own language, said García.

"Except for specific airline personnel, not all people in aviation here are required to be able to speak and understand English," he said. "To penetrate into wider sectors of aviation, we have to expedite the methods of [subtitling or dubbing] the English videos and getting other material translated. This issue will be valid for other regions of the world, too."

Except in Mexico, efforts to interest representatives of the ATC community in ALAR work have not yet met PAAST objectives, said García.

"Perhaps we need a special invitation to them to [identify] ATC team leaders for different areas," he said. "We are having problems in the Caribbean area — the involvement has been far from satisfactory."

García said that a special seminar also should be considered as a method of engaging CAAs worldwide in ALAR implementation efforts, a technique the industry has used for disseminating information about satellite-based communication methods and data link.

He offered to aviation safety professionals in other parts of the world several recommendations about ALAR implementation.

"The most important message we need to convey and repeat is that reduction in ALAs is the objective we need to focus on *now* if we really want to improve safety worldwide — the benefits will reach all of us," he said.

García also said that regional team leaders should recognize that within a region or a country, cultures differ slightly from each other, and these differences must be accommodated.

"Two major airlines in a country also may have such cultural differences," said García. "So the best strategy is to respect that, to try to form a cell-like structure, which, as in the human body, has the same [genetic material throughout] yet cells that vary in their functions. With this concept, you avoid rigidity in establishing several safety cells through a regional leader or local leader. You let the safety cells spread the message in a manner that is best suited to their people. A safety-cell structure also has the advantage that you do not have to conduct frequent and costly meetings — just one or two meetings a year with the leaders to measure progress."

The safety-cell concept also allows for an ALAR course to be adapted to specific needs such as air traffic controllers or organizations that have achieved different levels of safety, he said.

Another advantage of the safety-cell concept is that the ALAR action team leader does not have to be present at every event and can focus on coordinating activities, sharing best practices and gauging results from the safety cells to improve the overall ALAR training/awareness effort, he said.

García recommended that other regions obtain the involvement of their CAAs, local ICAO representatives and local IATA representatives as early as possible in the process.

"They have the capability and the authority to call for seminars or meetings among large sectors of aviation industry that, most of the time, are segregated and 'fighting their own wars' for safety," he said.

Selecting one action team leader from each organization engaged in reaching a common ALAR goal will guarantee continuous participation, he said.

"The tool kit contains quality, comprehensive material from which people can design and satisfy their own training needs — with enough variety that it can be adapted easily to different cultures and/or organizations for progressive training and education," said García.

The July 2001 seminar in Costa Rica included group analysis of a controlled-flight-into-terrain accident and the use of the FSF CFIT Checklist, *FSF* Standard Operating Procedures Template, *FSF* Approach-and-landing Risk Awareness Tool *and FSF* Approach-and-landing Risk Reduction Guide. (FSF Photo)

Cooperation With Authorities Expands ALAR Effort in Brazil

Capt. Marco A.M. Rocha Rocky, group flight safety officer of TAM Brazilian Airlines, and cochairman of PAAST, said that PAAST members since March 2001 have been conducting a series of workshops and presentations tailored to national needs, languages and cultures; ALAR publicity; targeted distribution of the tool kit; and peer focus meetings for airline flight safety managers and airline flight operations managers.[9]

"In Brazil, we translated some parts of the tool kit to Portuguese, and we are using those parts with much more results than with the English version," said Rocky. "We are just waiting for the video [portions] of the two video presentations in the tool kit to translate them for our 'PAAST-ALAR road show.' Within TAM, we have begun what we call 'one day with safety,' when we provide a complete ALAR briefing to 25 pilots per time. Our August 2001 issue of *TAM Safety Digest* is dedicated 100 percent to ALAR."

Rocky said that, based on his experience with ALAR implementation to date, aviation safety professionals in other parts of the world should consider the following factors:

- The need to present ALAR information in a very simple and straightforward manner;

- CDs and large manuals of information will not work in less developed regions of the world. "In some places, a computer is a faraway dream," he said; and,

- Action team leaders should "hit the road and preach the ALAR message" face-to-face to beginning pilots who will become the next generation of corporate pilots and air carrier pilots.

CAAs typically have the power to require inclusion of ALAR awareness in pilot training and certification but may not have adequate resources to take action, Rocky said. He said that airlines can take the initiative, provide resources and collaborate with CAAs to conduct ALAR awareness programs and achieve results more quickly than government programs alone in all categories of aviation.

Overall, PAAST's ALAR action team leaders said that they have been committed to the following:

- Convincing all flight crews in the region to think in a new way about the prevention of CFIT and ALAs;

- Changing the methods of instructors who strongly influence pilots during training yet do not have adequate resources to attend seminars on the latest safety research and methods of preventing CFIT and ALAs;

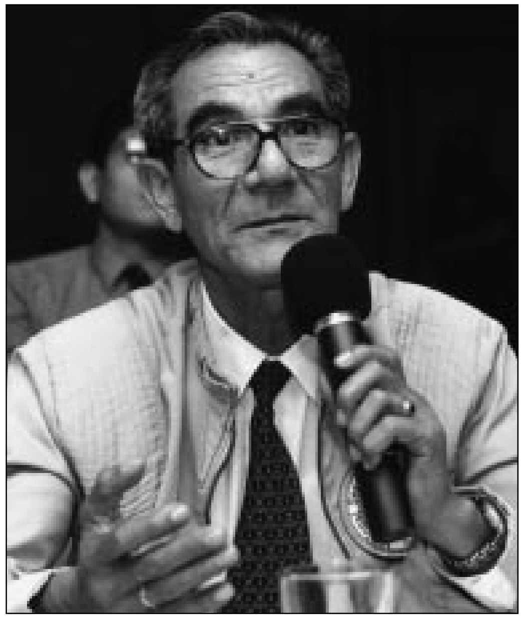
- Determining how best to reach non-AITAL pilots and non-IATA pilots — the approximately 10 percent of the region's professional pilots who do not belong to professional associations but fly for passenger airlines and cargo airlines on domestic and international routes;

- Identifying which parts of the tool kit should be translated into languages other than English, and which materials should be customized, to be most effective;

- Rapidly familiarizing team leaders with the tool kit to answer anticipated questions from airline managers, pilots and CAAs about ALAs, including CFIT;

- Adapting the tool kit recommendations to SOPs and to official operational safety bulletins that line pilots and individual air traffic controllers can consult routinely; and,

- Providing training materials adapted from the tool kit to schools for air traffic controllers, with translations to languages other than English as needed.



Silvio Montenegro, cargo aviation auditor for the Empresa Administradora de Aeropuertos Internacionales (International Airports Administration) of Nicaragua, asks presenters at the July 2001 seminar in Costa Rica to explain the basis of some recommendations for preventing approach-and-landing accidents. (FSF photo)

PAAST Activities Gain Momentum During 2001

The following CFIT/ALAR activities were conducted in the first eight months of 2001 in countries for which PAAST has served as regional team leader:

- Capt. Carlos Limón, a Mexicana Airlines pilot, an ASPA representative and the IFALPA representative on the FSF CFIT/ALAR Action Group (CAAG), presented two CFIT/ALAR workshops hosted by TAME Airlines in Quito, Ecuador, in facilities provided by the Ecuadorian Academy of War (see "Foundation Focuses on Identifying Worldwide Regional Team Leaders," page 17). Approximately 85 pilots attended the Feb. 13–15 workshop and the July 16–19 workshop. "The main subjects were CFIT, ALAR and human factors in CFIT/ALA prevention," Limón said. "Three [accident] study cases were reviewed and discussed; the FSF *CFIT Checklist* and videos [from the tool kit and videos demonstrating the ground-proximity warning system (GPWS) and the terrain awareness and warning system (TAWS)] were presented; and I gave an explanation of how to obtain the tool kit;[10]

- Limón presented a CFIT/ALAR workshop organized by the Asociación de Pilotos de Líneas Aéreas (Air Line Pilots Association [APLA]) of Argentina for approximately 100 attendees (pilots, operators and regulatory authority representatives) March 14–15 in Buenos Aires, Argentina. "The response was excellent, and I received invitations to make the presentation in some other places," he said;

- PAAST and AITAL organized a CFIT/ALAR workshop March 27–28 in Bogota, Colombia, attended by 10 aviation companies, and some of the 30 participants conducted a follow-up meeting April 24. Workshop presentations by Capt. Juan Carlos Duque, a pilot with Avianca, a Colombian air carrier, and a South American action team leader for PAAST, included the AITAL *CFIT Training Aid* and the tool kit (see "Colombian Airline Captain Takes ALAR to South America"). Three work groups were formed to produce SOPs based on tool kit recommendations, to

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Colombian Airline Captain Takes ALAR to South America

A program for approach-and-landing accident reduction (ALAR) at Avianca, a Colombian airline, and SAM, its affiliated regional airline, began after a March 2001 meeting in Mexico of the Pan American Aviation Safety Team (PAAST), said Capt. Juan Carlos Duque, a pilot for Avianca and a South American action team leader for PAAST.[1] Avianca has 450 pilots, SAM has 150 pilots, and the two pilot groups train together, he said. Duque said that the company began by translating Microsoft PowerPoint presentations from the Flight Safety Foundation (FSF) *Approach-and-landing Accident Reduction (ALAR) Tool Kit* into Spanish.[2]

Colombia in July 2000 added a requirement for mandatory crew training on controlled flight into terrain (CFIT) and the ground-proximity warning system (GPWS); most of the country's major air carriers were providing CFIT training before the requirement, said Duque (see "Foundation Focuses on Identifying Worldwide Regional Team Leaders," page 17).

"The decision to put this requirement in the regulations was influenced to a major degree by the recommendations of the

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FSF CFIT Task Force; the need to comply with U.S. Federal Aviation Administration requirements for [non-U.S. air carriers] also was a factor," he said. "Avianca, which implemented CFIT training in 1996, used the time already dedicated for CFIT training to introduce ALAR conclusions and recommendations. We present them simultaneously to crews; that way we get these subjects more correlated. I believe that the results are better. We teach it during one period of academic training every year. At this point today, about 90 percent of pilots of Avianca and SAM have taken that training."

During his July 2001 presentations in Costa Rica on CFIT prevention and ALAR (see "CFIT/ALAR Seminar in Costa Rica Attracts Diverse Group of Participants, page 4), Duque said that when he was a first officer, a captain once demonstrated to him a "perfect technique" for landing the McDonnell Douglas MD-83 — a technique not in the standard operating procedures.

"As you can imagine, those invented techniques are completely inappropriate," said Duque. "Unfortunately, the idea of inventing techniques and procedures can come with our [culture]; that is, we want to stand out among the 'average' pilots — to say 'I am the one who invented that technique' or 'I am the one who does it this way' or 'I am the one who is capable of doing that.' This is precisely where adherence to standard operating procedures — the SOPs standardized by the company — must occur."

When the *CFIT Education and Training Aid* was published in the United States, Avianca created a PowerPoint presentation of it in Spanish and implemented this product in 1996, said Duque. This year, Avianca implemented an updated version of the CFIT presentation incorporating recommendations, statistics and conclusions from the tool kit. Avianca and the Colegio de Pilotos Aviadores de México (Mexican College of Pilots) also have exchanged their respective translations of portions of the tool kit, he said.

Ideally, content of CFIT/ALAR presentations derived from the tool kit would be more standardized for the region, and that is being considered as presentations are collected and compared by leaders of PAAST, he said.

Capt. Juan Carlos Duque of Avianca, a presenter at the July 2001 seminar in Costa Rica, used materials from the FSF ALAR Tool Kit, *his company and the Asociación Internacional de Transporte Aéreo Latinoamericano (Latin American International Air Transport Association), with regional accident case studies and regional accident data.* (FSF photo)

"At a meeting in Lima, Peru, in 1996, we said [to the industry], 'There is no need to wait for the latest equipment to be installed in the airplanes, such as ground-proximity warning system, radio altimeters or the latest-generation simulator [to implement CFIT prevention]," said Duque. "Above all, you can use ground training in viable scenarios in a flight simulator to remind crews of what is CFIT, what is ALA and what are the risks. You can reduce risk by the use of the FSF *CFIT Checklist* and by the use of SOPs."

Through cooperation of members of the Asociación Internacional de Transporte Aéreo Latinoamericano (Latin American International Air Transport Association [AITAL]), two activities have been conducted in 2001, Duque said. During a workshop in March, participants agreed to share materials and experiences, and to work together on solving problems, including joint design of minimal SOPs for all AITAL airlines that incorporate ALAR recommendations. An additional meeting was scheduled in Miami, Florida, U.S., in September 2001. AITAL is a private nonprofit association with executive offices in Bogota, Colombia. Its 22 member air carriers and affiliate members from other organizations coordinate efforts to solve air transportation problems and to develop commercial aviation in Latin America.

AITAL also has planned two two-day conferences on CFIT/ALAR in September 2001 for the Colombian Air Force. There has been great interest among military transport pilots in implementing the ALAR recommendations, he said.

Part of the interest has been generated by professional journals and magazines. For example, in April, Duque made a presentation on CFIT/ALAR to the Iberoamerican Aerospace Medical Congress in Bogota. The audience comprised more than 300 pilots, psychologists, physicians and other aerospace professionals (with an estimated 80 percent from Colombia) and included presentations by representatives of Iberia Airlines of Spain, he said.

"My presentation was two hours long, but the response was absolutely positive and at the conclusion, everyone wanted another hour, so the presentation was extended," said Duque. "The great majority of the audience had never heard of the ALAR work."

Duque subsequently was invited to submit articles to several Spanish-language aviation publications, including *Revista Aérea Colombiana* (a Colombian trade magazine), *Aeronáutica* (a magazine of the Colombian Air Force), *Mundo Control* (a magazine of air traffic controllers in Colombia and Andean nations of South America), the U.S.-based magazine *Revista Aérea* (an aviation magazine covering Mexico, Central America and South America) and *Boletín AIMA* (the journal of the Iberoamerican Aerospace Medical Association), he said.

Duque said that scarcity of funds among many companies in the region requires creativity and recognition of inexpensive solutions that are now readily available from the tool kit and its derivatives. Some activities will require an investment of money, but others can be used immediately and practically without cost, he said.

"For example, a poster is very simple to use," said Duque. "You print it and hang it up. Period." Avianca pilots have found that many other materials in the tool kit can be printed at the office, copied and taken home for study, he said.

"We have used the tool kit to develop 10 basic training scenarios in the simulator that introduce ALAR," he said. "Low-level vectors, mountainous areas and flight authorizations below the MEA [minimum en route altitude] are used to demonstrate and to evaluate situational awareness. We have found the tool kit very easy to navigate. We have copied everything we can and distributed the printed materials."

The crew resource management (CRM) department at Avianca has produced nine videotapes related to CFIT and ALAR and is producing material about visual perception and illusions, disorientation, psychological factors and physiological factors, which are covered in FSF *ALAR Briefing Notes,* he said. The department also produced a PowerPoint recreation of a 1998 aircraft accident in Bogota, he said.

Some of the CRM videotapes were produced with commonly available video technology and off-the-shelf personal computer software. Typically, accident diagrams and videotape were combined with a reading of the cockpit voice transcript and images on a personal computer screen on which a pilot flew Microsoft Flight Simulator software to recreate Avianca accidents for study and discussion, he said.

"The recreations are not perfect, but the academic impact is gigantic," Duque said. "If I hear [simulation of] the voice recorder, and see the [recreation] of the flight with the [paint colors and logo] of the airline, there is a very large educational impact." One of these videos was used during a CFIT presentation at an April 2001 accident investigation conference in Santa Cruz de la Sierra, Bolivia, and Avianca expects a follow-up seminar in Bolivia to incorporate tool kit information, he said.

During August 2001, Avianca conducted a two-day 12-hour workshop in Havana, Cuba, on the integration of CFIT and ALAR for ground instructors, flight instructors and some line pilots of the Cubana de Aviación airline, he said.

"We really have to do much more, including evaluating SOPs and looking at methods of self-assessment," he said. "We need to make more aviation authorities and air traffic controllers aware of this information, to sell them on the idea that we all can provide ALAR programs." He said that airlines also must continue to share safety resources with other airlines.

Duque said that time constraints on training have been a challenge in developing locally tailored ALAR materials. In some countries, for example, material has to be delivered in specific periods of time — 45 minutes, two hours or five hours, for example — he said.

"Obviously we have to make good presentations, but they must be in accordance with the available time, which varies with each company," said Duque. "What we try to do is translate English to Spanish in all the tool kit presentations. The advantage of Spanish is [in reaching] small airlines, regional airlines and military forces that do not require their pilots to speak English. It is much better to have this material in Spanish."

Organizing training activities in other countries has been a challenge because many pilots work from their homes on an on-call basis, he said. In some countries, Avianca has emphasized helping airlines to incorporate the latest ALAR information into their current training materials.

"Since 1997, we have been making CFIT presentations in Ecuador for crews of TAME and Ecuatoriana airlines and have given help to them to develop their own training programs," Duque said.

The exchange of CFIT/ALAR awareness and education materials — especially those involving language translation and other regional adaptation — has reduced the need to duplicate work among safety professionals from different air carriers and different countries, he said.♦

— FSF Editorial Staff

References

1. Duque, Juan Carlos. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 18, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

2. The Flight Safety Foundation (FSF) *Approach-and-landing Accident Reduction (ALAR) Tool Kit* is a multimedia resource on compact disc (CD) for safety professionals and training organizations working to prevent the leading causes of fatalities in commercial aviation: approach-and-landing accidents (ALAs), including those involving controlled flight into terrain. The CD contains a wide range of textual material and graphic material based largely on the data-driven studies of the FSF ALAR Task Force.

Mexican Cargo Operator Launches ALAR Program

Capt. Andrés Fabre, operations manager for MasAir Cargo Airline in Mexico, member of the Flight Safety Foundation (FSF) Approach-and-landing Accident Reduction (ALAR) Task Force and member of the FSF Controlled-flight-into-terrain (CFIT)/ALAR Action Group (CAAG), said that the company began an ALAR program in early 2001 that may serve as an example for other small operators. MasAir operates three McDonnell Douglas DC-8-71s and one Boeing 767 with 45 pilots, including four check pilot/ instructors, he said. The company hosted meetings of the CAAG and the Pan American Aviation Safety Team and a workshop for instructors on the use of the FSF *ALAR Tool Kit* June 5–7, 2001, in Mexico City, Mexico.[1]

Fabre said that MasAir took the following steps to implement its ALAR program:

- Involved the airline's instructors in detailed discussions of ALAs, Microsoft PowerPoint presentations, a review of the FSF *ALAR Tool Kit* and its ALAR video, discussion of some of the FSF *ALAR Briefing Notes* and a definition of a no-penalty policy when pilots conduct a go-around;
- Modified existing operating manuals to redefine a stabilized approach and to clarify the go-around policy;
- Presented to all the airline's pilots a PowerPoint presentation on operations and training, the ALAR video, a review of the tool kit and a binder insert for navigation charts listing the elements of a stabilized approach, as well as a review of their CFIT knowledge;
- Modified simulator-training maneuvers to include scenarios involving an unstabilized approach, emphasizing that go-arounds are acceptable and that landings after an unstabilized approach are not acceptable — with debriefing of pilots about why they continued an approach or conducted a missed approach;
- Distributed selected FSF *ALAR Briefing Notes*; distributed a flier explaining the reasons for the ALAR program; requested feedback from pilots; and ensured the company's readiness to receive crew comments; and,
- Installed the tool kit on a personal computer readily available for scheduled use by any pilot.

"We had good acceptance on the part of our pilots, wide-ranging discussions with the instructors and a lot of excellent feedback," said Fabre. "Our ALAR program also developed closer relations between pilots and management."♦

— FSF Editorial Staff

Reference

1. Fabre, Andrés. E-mail communication with Rosenkrans, Wayne. Alexandria, Virginia, U.S. July 17, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

produce in Spanish a CFIT/ALAR training course and flight simulator scenarios for flight crews, and to develop proposals for disseminating information from the tool kit in conferences, articles, posters and bulletins for flight operations schools;[11]

- Roberto Cardoso, ICAO South American regional officer for safety oversight in Lima, Peru, said that the accident investigation conference April 2–4 in Santa Cruz de la Sierra, Bolivia — organized by ICAO, IFALPA and IATA — included a presentation to 200 attendees by Robert Vandel, FSF executive vice president, on the tool kit and a presentation by Castan on the work of PAAST. Cardoso said that although work has only begun on a planned CFIT/ALAR seminar in his country, he often uses the tool kit as a source of information for operators. "When an airline asks for an interpretation or a recommendation of available [material for safety] issues related to aircraft operations, I have sent [relevant] FSF *ALAR Briefing Notes*, the FSF *Standard Operating Procedures Template* and the FSF *Approach-and-landing Risk Awareness Tool*," Cardoso said. "In consulting, I often hand a photocopy to a person or send this information by fax. A few times, I also have sent human factors material [so crews will] learn what errors they make."[12]
- On June 1, more than 40 Central American pilots attended an ALAR presentation conducted by TACA Group, a group of Central American airlines, in Guatemala;
- Capt. Andrés Fabre, operations manager for MasAir Cargo Airline in Mexico, member of the FSF ALAR Task Force and member of the CAAG, said that the airline hosted the meeting June 6–7 that included meetings of the CAAG, PAAST, the Foundation, ICAO and IATA, as well as ALAR indoctrination training for 190 industry representatives that included pilots, regulators and air traffic controllers. The meetings included Fabre's presentation of a summary of ALAR implementation within the company (see "Mexican Cargo Operator Launches ALAR Program");

- García said that PAAST and ICAO organized a CFIT/ALAR seminar/workshop, hosted by the General Directorate of Civil Aviation in San Jose, Costa Rica, July 16–20, 2001 (see "CFIT/ALAR Seminar in Costa Rica Attracts Diverse Group of Participants," page 4, and "Mexican Airline Captain Strives for Culturally Relevant Examples");

- Limón made a CFIT/ALAR presentation July 31 as part of the Aeronautical Diploma Course organized by the Aeronautical Medicine National Center (CENMA) in Mexico City. Other subjects were aviation human factors, accident investigation and medical issues;

- ASPA conducted the first CFIT/ALAR indoctrination course for 31 ALAR instructors Aug. 9 at its headquarters in Mexico City. "The course includes landing techniques and human factors," Limón said. "Mexicana Airlines already has begun conducting voluntarily a CFIT/ALAR course and Aeroméxico is expected to voluntarily adopt the CFIT/ALAR course before it becomes mandatory in Mexico;" and,

- Rocky said that efforts in Brazil have included the monthly "PAAST–ALAR road show" in different civil aviation regions of the country. "In very close coordination with the civil aviation authorities for the particular area, we have made presentations in Maceio, Alagoas (150 people); Teresina, Piaui (May 26, 183 people), Recife, Pernambuco (July 28, 330 people); and Belem, Para (Aug. 11, 310 people), reaching on average 250 pilots/mechanics-engineers per time," said Rocky. ALAR presentations have been scheduled for Goiania, Goias (Sept. 8); Santarem, Para; Salvador, Baihia (Sept. 22); Porto Alegre, Rio Grande do Sul (Sept. 22); Sao Paulo; Rio de Janeiro; Brasilia; and in Paraguay, he said. "Another big step has been that CENIPA [Centro de Investigação e Prevenção de Acidentes Aeronáuticos (Brazil Center for Investigation and Prevention of Aeronautical Accidents)] has requested this presentation as part of the next classes of its aviation safety course, which would mean a total of about 3,000 people." The scope of the effort has included military aviation and general aviation, he said.♦

Roberto Cardoso, regional officer for safety oversight, International Civil Aviation Organization, Lima, Peru, said during the July 2001 seminar in Costa Rica that approach-and-landing accident reduction tools are suitable for both safety consultations and formal training. (FSF photo)

Notes and References

1. The FSF *ALAR Tool Kit* is a multimedia resource on compact disc (CD) for safety professionals and training organizations working to prevent the leading causes of fatalities in commercial aviation: approach-and-landing

Mexican Airline Captain Strives for Culturally Relevant Examples

Mexican action team leaders of the Pan American Aviation Safety Team (PAAST) had the following objectives in mind while adapting information in the Flight Safety Foundation *Approach-and-landing Accident Reduction (ALAR) Tool Kit* to their needs, said Capt. Angel Goñi, an Aeroméxico pilot and representative of the Asociación Sindical de Pilotos Aviadores de México (Mexican Aviation Pilots Union Association, ASPA):[1]

- To give the presentation of the material more "Latino flavor" without losing the spirit or essence of the tool kit, from which 75 percent of content has been translated into Spanish;

- To add translations of English terms and jargon such as "press-on-itis" to equivalent Spanish terms used in the region;

- To add Spanish definitions of some terms;

- To incorporate honest discussion of issues such as ego or professional pride involvement in the decision to go around, professional pride and "machismo" as applicable to flight operations (for example, redefining the go-around as a sign of operational success rather than a sign of failure);

- To emphasize in crew resource management discussions that data show that the captain was the pilot flying in 74 percent of ALAs studied (to help overcome a cultural attitude, sometimes originating in traditional military training, that "I fly" and decisions are not challenged by pilots of lower rank);

- To prevent boredom by reducing the amount of statistical information presented; and,

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- To add actual experiences of pilots in the region, including information about specific accidents, observations about pilot behavior and reflections.

Goñi said that he and Capt. Carlos Limón — a Mexicana Airlines pilot, ASPA representative and representative of the International Federation of Air Line Pilots' Associations on the FSF CFIT/ALAR Action Group — are available to conduct the CFIT/ALAR courses inside and outside of Mexico (see "Foundation Focuses on Identifying Worldwide Regional Team Leaders," page 17). Limón presented a course in Quito, Ecuador, during the same week as the July 2001 CFIT/ALAR seminar conducted in Costa Rica by PAAST and the International Civil Aviation Organization, for example.

Capt. Angel Goñi, an Aeroméxico pilot representing the Asociación Sindical de Pilotos Aviadores de México (Mexican Pilots Union Association) and the Pan American Aviation Safety Team, supplemented tools from the FSF ALAR Tool Kit *with examples of regional cultural factors at the July 2001 seminar in Costa Rica.* (FSF photo)

During presentations at the Costa Rica seminar, Goñi said, "The mentality sometimes for us, as Latinos, is letting ego or macho [attitude interfere with safety]. We consider, sometimes unconsciously, that conducting a missed approach is a failure. For example, [we fear that someone might] say, 'Look, what a coward!' The go-around has to be accepted as a maneuver as completely normal as a takeoff. We should reflect on this and realize that there is nothing wrong with a go-around. We must use our simulators to practice go-around maneuvers — the basic elements and the particular techniques for each airplane — including the specific navigation for that go-around. The only life preserver we have to protect against an approach-and-landing accident is the go-around — if we use it for rescue, we are going to survive. If we are not well prepared to use the life preserver, or we are afraid to use it, or our pride will not let us use it, we probably will drown."

The Mexican pilots' first efforts to translate into Spanish parts of the tool kit in a relatively literal manner did not produce the desired results; several versions subsequently were produced, without changing the meaning, to give the material a more familiar writing style, fewer statistics and more anecdotes, he said.

Goñi said that he and others, like the authors of the tool kit, have invested many hours of their personal time — often during layovers and meetings — adapting the material to regional needs, but they have not tried to quantify the time.♦

— FSF Editorial Staff

Reference

1. Goñi, Angel. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 19, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

accidents (ALAs), including those involving CFIT. The CD contains a wide range of textual material and graphic material based largely on the data-driven studies of the FSF Approach-and-landing Accident Reduction (ALAR) Task Force. The tool kit has 2,600 searchable pages that include: FSF ALAR Task Force findings, conclusions and recommendations — and the data on which they were based; briefing notes on 34 major ALAR issues; supplements to approach briefings; guidelines for evaluating training, standard operating procedures and equipment; recommended standard operating procedures and risk-assessment checklists; four posters illustrating lessons learned; five slide presentations on accident data, flight operations and training, equipment, pilot-controller communication and instrument-approach design; two videos exploring ALAs and CFIT accidents, and how they could have been avoided; more than 100 FSF publications; and links to aviation-data sources on the Internet.

2. Matthews, Stuart. Interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. June 27, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

3. States and territories covered by the Pan American Aviation Safety Team can be identified using the International Civil Aviation Organization (ICAO) map of statistical regions. The ICAO Latin America and Caribbean Statistical Region comprises the following nations and territories (ICAO contracting states and noncontracting states are not distinguished):

   - Nations of Antigua and Barbuda; Argentina; Bahamas; Barbados; Belize; Bolivia; Brazil; Chile (including Easter Island); Colombia; Costa Rica; Cuba; Dominica; Dominican Republic; Ecuador; El Salvador; Grenada; Guatemala; Guyana; Haiti; Honduras; Jamaica; Mexico; Nicaragua; Panama; Paraguay; Peru; St. Kitts and Nevis;

Saint Lucia; Saint Vincent and the Grenadines; Suriname; Trinidad and Tobago; Uruguay; and Venezuela; and,

- Martinique, Guadeloupe, St. Martin, St. Barthelemy and French Guiana (territories of France); Aruba, Curaçao, Bonaire, St. Maarten, Saba and St. Eustatius (territories of the Netherlands); Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, St. Helena and Ascension Island, Turks and Caicos Islands (territories of the United Kingdom), and Falkland Islands (a dispute exists between the government of Argentina and the government of Great Britain and Northern Ireland concerning the sovereignty of the Falkland Islands [Malvinas]); and Puerto Rico and Virgin Islands (territories of the United States).

4. Burin, James. Interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. June 22, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

5. Castan, Al. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 17, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

6. Ybarra, Raymond. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 17, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

7. García, Luis. E-mail communication with Rosenkrans, Wayne. Alexandria, Virginia, U.S. July 31, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

8. Copies of the tool kit are available to members for US$40 (includes shipping and handling) prepaid and to nonmembers for $160 (includes shipping and handling) prepaid. Place orders with Ellen Plaugher, FSF executive assistant, at +1 (703) 739-6700 extension 101; fax +1 (703) 739-6708. Discounts are available for larger quantities; contact Robert Vandel, FSF executive vice president, at +1 (703) 739-6700, extension 110; fax +1 (703) 739-6708.

9. Rocha Rocky, Marco. E-mail communication with Rosenkrans, Wayne. Alexandria, Virginia, U.S. August 3, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

10. Limón, Carlos. Telephone and fax communication with Rosenkrans, Wayne. Alexandria, Virginia, U.S. July 31, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S. Terrain awareness and warning system (TAWS) is the term used by the European Joint Aviation Authorities and the U.S. Federal Aviation Administration to describe equipment meeting the International Civil Aviation Organization standards and recommendations for ground-proximity warning system (GPWS) equipment that provides predictive terrain-hazard warnings. “Enhanced GPWS” and “ground collision avoidance system” are other terms used to describe TAWS equipment.

11. Dueri, Eduardo. Asociación Internacional de Transporte Aéreo Latinoamericano (Latin American International Air Transport Association [AITAL]). E-mail communication with Vandel, Robert. Alexandria, Virginia, U.S. March 29, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

12. Cardoso, Roberto. Interview with Rosenkrans, Wayne. San Jose, Costa Rica. July 16, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

Foundation Focuses on Identifying Worldwide Regional Team Leaders

Ongoing efforts to prevent approach-and-landing accidents, including those involving controlled flight into terrain, have emerged from the commitment of international aviation safety specialists since the early 1990s to understand relevant data, generate credible recommendations and provide effective tools.

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FSF Editorial Staff

The Flight Safety Foundation (FSF) *Approach-and-landing Accident Reduction (ALAR) Tool Kit* has been distributed to members of the Foundation and to volunteers who worked on the FSF Controlled-flight-into-terrain (CFIT) and ALAR task forces.[1] Stuart Matthews, FSF president and CEO, said that the Foundation is discussing with industry trade groups, air carriers and pilot unions additional methods of distributing the tool kit.[2]

"Achieving a significant reduction in ALAs is within reach given the new tools at hand," said Matthews. The tool kit is based on the FSF ALAR Task Force's data-driven conclusions and recommendations, as well as data from the U.S. Commercial Aviation Safety Team (CAST) Joint Safety Analysis Team (JSAT) and the European Joint Aviation Authorities (JAA) Safety Strategy Initiative (JSSI).

"A 50 percent reduction in ALAs is not an unrealistic target but requires a total implementation effort," said Matthews. "Over the past several years, the Foundation has invested more than US$1 million in ALAR. We do not want any tool kit to sit on a shelf — it must be used. With 50 percent of all fatal accidents occurring during approach and landing, this is a target on which the industry must focus. A 10 percent improvement in the ALA rate means a 5 percent reduction in the overall accident rate."

During the past four years, 300 aviation professionals volunteered to work on the CFIT/ALAR task forces with the support of their organizations and employers, he said.

"We could not have done this work without the resources, volunteers and facilities offered by those who support us," said Matthews. "There is no doubt that Airbus Industrie and The Boeing Co., for example, provided a wide range of resources. Nevertheless, the work is a cooperative effort of many organizations under the auspices of the FSF membership."

James Burin, FSF director of technical programs, said that the Foundation continues to identify and support organizations that can lead ALAR awareness campaigns in other regions. The action plans of JSSI formally include parts of the tool kit, and a subgroup of CAST will use the tool kit as a basis for recommending ALAR training requirements for air carriers operating under U.S. Federal Aviation Regulations (FARs) Part 121, said Burin. The Royal Aeronautical Society in the United Kingdom has said that plans are being made to invite European industry representatives to a one-day ALAR presentation, he said.[3]

"The tool kit is not a training program but provides products that can be used to create a training program," said Burin. "Regional team leaders can take what we offer and modify it to meet their needs; we will provide additional information and help to arrange ALAR training workshops on request.

"We suggest that the tool kit can be used for various purposes — *regional teams decide what they need to do.*"

The 24-member FSF CFIT/ALAR Action Group (CAAG) has worked to develop regionally appropriate ALAR implementation methods, he said.[4]

"The goal is working with people in regions who are native speakers of local languages, have many contacts in aviation, have credibility and are active in the aviation community," said Burin.

To improve understanding and acceptance, the International Civil Aviation Organization (ICAO) has begun translating parts of the tool kit from English into the other five ICAO languages (Arabic, Chinese, French, Spanish and Russian), he said (see "IATA Endorses FSF *ALAR Tool Kit*, Supports Regional Initiatives").

In addition to collaboration with the Pan American Aviation Safety Team (see "Momentum Builds in Regional ALAR Implementation Efforts," page 1), the Foundation has played a role in the following ALAR implementation efforts:

- The Foundation and Boeing sponsored the FSF *ALAR Tool Kit* Workshop Sept. 6, 2001, attended by 100 aviation professionals following the Association of Asia

IATA Endorses FSF *ALAR Tool Kit,* Supports Regional Initiatives

Worldwide efforts to prevent approach-and-landing accidents (ALAs), including those involving controlled flight into terrain (CFIT), should be successful for many reasons, said Capt. Paul Woodburn, director of safety for the International Air Transport Association (IATA) and chairman of the Flight Safety Foundation (FSF) CFIT/Approach-and-landing Accident Reduction (ALAR) Action Group (CAAG) (see "Foundation Focuses on Identifying Worldwide Regional Team Leaders," page 17).[1]

"If we can achieve a significant reduction of CFIT accidents and ALAs, there are tremendous benefits in saving of lives and saving of costs," said Woodburn. "My perspective, after about 10 years, is that what to date has been an uphill struggle gradually is increasing in momentum."

Woodburn said ALAR efforts and CFIT prevention address two out of three of the industry's highest-priority safety issues (loss of control is the other issue). CFIT and loss of control are the two leading causes of fatalities; ALAs are the single largest cause of hull losses and significant damage, he said.

IATA has endorsed the FSF *ALAR Tool Kit* and recommends that its members use the tool kit, he said.

"IATA already has endorsed the FSF *ALAR Tool Kit,* which will be referenced in the forthcoming *IATA Technical and Operations Policy Manual* that is under development at present," he said. "IATA also is promoting the tool kit in seminars and regional safety initiatives either organized by IATA or in which IATA participates. Next year, the revised IATA web site also will include references to the tool kit and other products."

In addressing both ALAR safety problems and CFIT safety problems, the tool kit provides resources for both line flight crews and air carrier management, he said, and its credibility among airline pilots derives in part from the involvement of airline pilots.

Woodburn said that air carrier flight crews should resist any tendency to assume that this product would not apply to them. "Occasionally there is a tendency to think that we [flight crewmembers] already know it all; unfortunately, the world is littered with accident sites that show that there is always room for improvement," said Woodburn. "The day we stop learning as airline pilots is the day we should stop flying. All of us can make mistakes."

Similarly, no region of the world should consider the ALAR implementation effort irrelevant, said Woodburn.

"The data-driven method of the FSF ALAR Task Force analyzed 287 worldwide accidents; therefore, these products have been developed with worldwide application in mind," he said. "Nevertheless, we clearly recognize that — because of different infrastructures in world regions, for example — these products may need to be adapted to suit regional differences of culture, language, operating environment and particular regional accident records. We have pursued a strategy of regional safety initiatives because, many times, operators in a region may have the same problems."

The work of the U.S. Commercial Aviation Safety Team, a joint effort of U.S. industry and the U.S. Federal Aviation Administration, and the European Joint Aviation Authorities (JAA) Safety Strategy Initiative (JSSI) have confirmed the choices that the Foundation made in focusing on CFIT prevention and ALAR, said Woodburn.

Woodburn has been involved since 1992 in the work of the FSF CFIT Task Force and the FSF ALAR Task Force. He has served as a member of the JSSI Steering Team from its beginning and formerly represented both British Airways and the Association of European Airlines as a member of the Joint Steering Assembly working with JAA.♦

— *FSF Editorial Staff*

Reference

1. Woodburn, Paul. Telephone interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. August 9, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

Pacific Airlines (AAPA)–Boeing Flight Safety Seminar Sept. 4–5, 2001, in Bangkok, Thailand. AAPA and Boeing, with the assistance of the International Air Transport Association (IATA) and Thai Airways International, conducted the seminar. Burin said that AAPA has helped the CAAG to identify the following ALAR regional team leaders to date: Cooperative Development of Operational Safety and Continuing Airworthiness Program—South Asia (COSCAP–SA, an ICAO technical cooperation project) in India, Garuda Indonesia in Indonesia, Yangon Airways in Myanmar (Burma) and Thai Airways International in Thailand;

José Rafael Molina, flight standards inspector for the General Directorate of Civil Aviation of Costa Rica, reviews the compact disc table of contents for the FSF ALAR Tool Kit. (FSF Photo)

- The Foundation is working with the Arab Air Carrier Organization (AACO), which has volunteered to be a regional team leader in the Middle East;
- In Africa, the African Aviation Safety Council (AFRASCO) will serve as a regional team leader. AFRASCO leaders said in April that six training captains, four aviation safety specialists and nine airlines will become involved in ALAR regional implementation efforts. The nine airlines said that they will adopt the tool kit and will ask the CAAG to provide a one-day workshop to train the trainers; and,
- The Foundation is working with Icelandair as the ALAR regional team leader for Iceland.

The Foundation also has made presentations about ALAR implementation to the International Federation of Air Line Pilots' Associations (IFALPA), the International Society of Air Safety Investigators (ISASI), the board of the U.S. National Business Aviation Association (NBAA), the U.S. Regional Airline Association (RAA), the IATA Operations Committee and several airlines, said Burin.

Success Validates FSF Regional Team Strategy

Robert Vandel, FSF executive vice president, said that full appreciation of how far the industry has come in 10 years in its CFIT/ALAR awareness and education efforts requires historical perspective.[5]

"The tool kit probably is the most significant safety product the Foundation has produced," said Vandel. "It has been endorsed by JAA, IATA, NBAA and many international air carriers and the U.K. CAA. What we need now is more people to take on the regional team leader positions. We will help them, and we will offer flexibility and put people in contact with other regions."[6]

In the early 1990s, a definition of CFIT was required as a common frame of reference.

"We first needed a working definition to attack the problem," said Vandel. "The Foundation went to IATA, ICAO and IFALPA — and this was the first time that they had worked on one project under the nonaligned umbrella of the Foundation. We kept the industry involved all the way. Early meetings about CFIT and ALAs were conducted all over the globe."

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 phases, which typically comprise about 16 percent of the average flight duration of a large commercial jet.

CFIT accidents in the early 1990s represented the single greatest risk to aircraft, crews and passengers, and CFIT accidents continue to be the leading cause of fatalities in large-commercial-jet accidents (those involving aircraft heavier than 60,000 pounds/27,000 kilograms, excluding military aircraft and those manufactured in the Commonwealth of Independent States), Vandel said.

Efforts Evolve in Nine Years From FSF CFIT Task Force

Vandel said that in April 1992, the Foundation's International Advisory Committee (IAC) met in Washington, D.C., U.S., to develop strategies to reduce the number of CFIT accidents and ALAs. The workshop was divided into four working groups: technology, training, flight-deck management and procedures, and ground facilities and support (see "CFIT/ALAR Veteran Offers Encouragement," page 20).

In September 1992, an agenda development subcommittee of the IAC met in Long Beach, California, U.S., to address the challenge of international standards. One of the results of that meeting was the development of a steering committee

CFIT/ALAR Veteran Offers Encouragement

Earl Weener, Ph.D. — retired chief engineer, Systems Engineering, Boeing Commercial Airplanes, former chairman of the Flight Safety Foundation (FSF) Controlled-flight-into-terrain (CFIT) Task Force, and member of the FSF Board of Governors — said that industrywide analysis of accident trends and open discussion of solutions increased during the 1990s.[1]

"If you go back to the mid-1980s, safety was one of those things that everybody thought about but nobody talked about — not a lot of information was being shared," Weener said.

"The Foundation presented some CFIT accident data to industry leaders, but the tendency was to consider this someone else's problem. We put a great deal of effort into internal [discussions] of The Boeing Co. to be more proactive with data — more than the annual statistical summary sent out for about three decades."

Another problem was the shift of attention in the industry each time an accident occurred, he said.

"Everyone was chasing the last accident and focused on understanding it," said Weener. "When the next accident occurred, the focus shifted. By the late 1980s, the industry added an understanding of accidents over time and what kinds of accidents happened most often. That is how the industry found that CFIT comprised half of fatalities, which was a big surprise to the industry."

Because so few people realized the magnitude of the problem, the message was communicated widely.

"The Foundation literally went around the world with that story and began getting a great deal of support to work on CFIT," he said. "At one point, we had about 100 volunteers worldwide who were working on CFIT or approach-and-landing accident reduction as internationally relevant problems."

The data showed higher rates of this type of accident in some world regions, and the CFIT Task Force used objective methods of describing these data, he said.

Weener said that current technological solutions to prevent CFIT accidents and ALAs should be understood within the context of all safety recommendations.

"There is no technology-dependent solution; technologies like [the ground-proximity warning system (GPWS)] help, but in the end what you really want is never to receive a terrain warning or sink rate warning or any CFIT-related error," said Weener. "You only want to hear warning systems when you test them — if you hear them during operations, something about your operation is not tight enough."

Weener said that efforts by the Foundation and others to focus on regions is appropriate but the problems in some regions are formidable.

"Because of economic factors, for example, it is difficult to concentrate resources on safety," he said. "Conscious effort and significant resource commitments by an airline are required to send one or more of its best-qualified people to participate in a safety activity, to remain active in a region and to exchange information. This means they may have to forego short-term benefits for the long-term payback of such visible safety activities."♦

— FSF Editorial Staff

Reference

1. Weener, Earl. Telephone interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. July 30, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

for oversight of the entire CFIT and ALAR effort. This steering committee then established the composition of the FSF CFIT Task Force, identified CFIT accident-reduction goals and ALA-reduction goals, created four working groups and developed initial guidance for each working group.

The working groups focused on flight crew training and procedures, data and data dissemination, aircraft equipment and ATC training and procedures/airport facilities.

"Addressing both CFIT and ALAR would be too great a task, so the steering committee decided to focus on CFIT as the initial phase," said Vandel. "The committee planned to set up working groups for ALAR when the CFIT work was completed." An additional CFIT working group for flight training and procedures for corporate aircraft operations and regional airlines was created in June 1993.

The FSF CFIT Task Force, launched in consultation with ICAO, set as its five-year goal a 50-percent reduction in CFIT accidents. The task force reached that goal in 1996, when the number of CFIT accidents involving large commercial jets declined from seven in 1992 to three in 1996; in 1997 the number was two. This occurred despite increases in departures each year, he said.

The FSF CFIT Task Force included more than 150 volunteers from 24 airlines, five equipment manufacturers, aircraft manufacturers and many other technical, research and professional organizations. The task force believed that education and training would be excellent tools to help prevent CFIT accidents, especially until technology could be refined further, said Vandel.

In a report of preliminary actions, the task force announced plans for awareness and training material for the prevention of CFIT. The FSF CFIT Task Force by 1996 had produced the following products: the *CFIT Alert Bulletin,* the FSF *CFIT Checklist,* the video *CFIT Awareness and Prevention,* an IFALPA safety poster and the *CFIT Education and Training Aid* (including a CD and videotapes).

Raymond Ybarra, regional director, International Civil Aviation Organization (ICAO) North American, Central American and Caribbean office, Mexico City, Mexico, said that the July 2001 seminar in Costa Rica was ICAO's first regional seminar to combine the latest information on preventing approach-and-landing accidents, including those involving controlled flight into terrain. (FSF photo)

In November 1994, the FSF CFIT Task Force recommended actions by ICAO. Richard Slatter, consultant, operations/airworthiness, in the ICAO Air Navigation Bureau, said that since 1995 ICAO has developed amendments to its annexes, standards and recommended practices (SARPs), procedures for air navigation services–operations (PANS–OPS) and guidance material, and has adopted/approved various amendments (see Appendix, "Actions by the International Civil Aviation Organization for the Prevention of Controlled Flight Into Terrain," page 26).[7]

In December 1998, ICAO distributed a CD containing a CFIT education and training aid to directors general of civil aviation of all member states. ICAO also has been producing additional language versions of two FSF videos — *CFIT Awareness and Prevention* and *CFIT: An Encounter Avoided* — in Arabic, Chinese, French, Russian and Spanish.[8]

Upon completion of the CFIT research, recommendations and product development, the FSF ALAR Task Force was created as the anticipated follow-on project.

The FSF ALAR Task Force studied 287 fatal ALAs that occurred between 1980 and 1996 in Western-built transport category aircraft operations worldwide; conducted detailed case studies of 76 ALAs and serious incidents from 1984 to 1997; and assessed key crew behavioral markers isolated in the studied accidents and incidents, and in line audits of 3,300 commercial air transport flights.

Final reports were presented in November 1998 by working groups that focused on operations and training, data acquisition and analysis, aircraft equipment, and ATC training and procedures/airport facilities. The reports were published in a 121-page report in *Flight Safety Digest* in February 1999, and were accompanied by previous reports for context.[9]

Vandel said that the Foundation in 1998 prepared a critique of its 1997 CFIT implementation plan while developing an ALAR implementation plan. The U.S. Federal Aviation Administration distributed the *CFIT Education and Training Aid* to 178 civil aviation authorities in October 1998, said Vandel.

"We were unsuccessful in our attempt to implement CFIT prevention measures in the manner we desired," he said. "We believed that if we could get the attention of top managers, we would get their support to place the *CFIT Education and Training Aid* in every flight department. With support from airframe manufacturers, there was 99.9 percent coverage in the distribution to air carriers, but we did not have any way to be sure whether this huge document reached the safety departments."

The 1997 CFIT implementation had the following characteristics:

- A core team of 10 members to 15 members provided centralized overall direction to the entire implementation effort;
- In terms of participation, geographical diversity was limited; the involvement of air carriers, corporate operators and trade associations was limited; few regional air carriers and no insurers were involved; airframe manufacturers were not in agreement; and, with the exception of ICAO, few civil aviation authorities were involved and no regulatory action resulted;
- In terms of scope, the implementation focused on distribution of products through subteams; centralized recruiting of subteam members; leading others in implementation activities; and prioritizing distribution based on accident history;
- In terms of execution, the *CFIT Education and Training Aid* had wide distribution, but tracking of its use was not accomplished; no measurement method was included for measurement of results; prioritization did

not meet objectives; a focused message was not developed and areas where industry influence could be exerted were not identified; and the intended substructure was not developed; and,

- In terms of follow-through on action plans, a definitive plan for conducting the required actions was not developed; communication with industry segments was inconsistent; and an appropriate plan to communicate the CFIT prevention methods through meetings, presentations and correspondence was not completed.

Vandel said that the critique and feedback from FSF members enabled the development of a CFIT/ALAR implementation plan without the shortcomings of its predecessor and with the following key improvements:

- A "cascading structure" for implementation (involving many centers of focused activity triggered by the activities of others);

- Identification of leadership of an implementation team at the appropriate time;

- Review of all implementation proposals with FSF advisory committees; and,

- Specific actions to implement CFIT/ALAR awareness and education with methods of measuring results, use of feedback to improve communication and flexibility for the timely reworking of plans in response to the results.

Vandel said that changes were recognition of the need to involve many industry segments and specific types of expertise (such as marketing, data tracking, product tracking, translation and media relations) at the design stage of implementation and the need for distributing the work globally through regional safety groups. Regional team leaders would have complete flexibility and autonomy in determining local needs, priorities and methods — with the Foundation and the CAAG available to provide resources and advice.

The regional team leaders would:

- Design a national implementation plan;

- Identify the region's air carriers, regional air carriers, charter operators, air taxi operators and corporate aircraft operators;

- Identify and collaborate with the civil aviation authorities;

- Enlist marketing support;

- Determine the need for language translations of products;

- Collaborate with local aviation safety committees;

- Obtain coverage in trade media for the implementation effort; and,

- Track the distribution of products.

"The concept was first to go into regions and identify all of the aviation interests," said Vandel. "We looked at Brazil as an example of the number of unique features that would have to be considered in a regional strategy. In Brazil, the Foundation would have had a phenomenal task just identifying the regional airlines. We also realized that regulators should be engaged throughout implementation. Based on this analysis, we recognized the need for local people to determine the best way to implement their safety initiatives. We have to be sensitive to regional cultures. With this concept, we struck gold in the Pan American region."

Vandel said that the CAAG sought technological solutions but also was committed to ensure that people in all parts of the world — even those that lack adequate infrastructure and resources — would be empowered to select tools to achieve their objectives, such as training pilots to conduct stabilized approaches (see "Solutions to CFIT and ALAs Include Advances in Technology").

"If every pilot were trained to conduct stabilized approaches — even where there are first-generation jets, no infrastructure and no ATC — that would reduce ALAs," said Vandel.

The Foundation began to identify regional team leaders and to offer assistance as they, in turn, recruited their members, developed substructure according to their own assessment, developed regional plans and implementation phases, and set up national/local teams.

In 1999 and 2000, the CAAG began the implementation process by identifying and producing a range of products that were combined in early 2001 into the tool kit.

As the tool kit was being completed, representatives of PAAST recognized the compatibility of this product with their plans, he said.

"PAAST is doing wonderful things — what they are accomplishing now, we would not have known to try in their region," said Vandel.

Data-driven Methods Ensure Acceptance of ALAR Products

Ratan Khatwa, Ph.D., senior flight deck research engineer, Flight Safety Systems, Honeywell, said that the ALAR work has succeeded in creating a product that addresses basic items that cause accidents. Moreover, the product is among the first to be buttressed by hard data, he said.[10]

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Solutions to CFIT and ALAs Include Advances in Technology

Don Bateman, chief engineer, Flight Safety Systems, Honeywell, said that work on preventing approach-and-landing accidents (ALAs), including those involving controlled flight into terrain (CFIT), has generated appropriate countermeasures.[1] For example, Bateman said that during 2001, one U.S. air carrier accident was averted during a nonprecision approach by the warning from a terrain awareness and warning system (TAWS). TAWS is the term used by the European Joint Aviation Authorities and the U.S. Federal Aviation Administration to describe equipment meeting the International Civil Aviation Organization (ICAO) standards and recommendations for ground-proximity warning system (GPWS) equipment that provides predictive terrain-hazard warnings. "Enhanced GPWS (EGPWS)" and "ground collision avoidance system" are other terms used to describe TAWS equipment.

"The crew began a [very-high-frequency omnidirectional radio (VOR)] approach and confused VOR [distance measuring equipment (DME)] with [instrument landing system (ILS)] DME, resulting in a perfect approach to the VOR but with an actual distance of 4.5 miles from the runway threshold," said Bateman. "The crew descended to the correct altitude for the approach, got the EGPWS warning and immediately pulled up. If they had continued to descend, they could have collided with terrain. There have been 18 or 19 similar occurrences worldwide in the last four years — among corporate operators and air carriers."

Education and awareness efforts for approach-and-landing accident reduction (ALAR) help reduce the risk of these occurrences, he said.

"Flight Safety Foundation's method of implementing ALAR through local people is the right one — it is working," said Bateman. "These people know local politics, local operators and local problems — they are proactive in trying to work within that environment, and they can circumvent what would be formidable obstacles to outsiders. The CFIT/ALAR work has been worthwhile and very pertinent. The Foundation, ICAO and International Air Transport Association have made a difference in getting CFIT/ALAR information to pilots. I hope that the difference will be reflected in the statistics for CFIT losses and ALAs."

Bateman said that reluctance exists among aircraft operators to authorize the publication of factual information about occurrences that could have resulted in a CFIT accident or ALA. Nevertheless, he said that the reports he receives show that TAWS technology is working in a positive manner. U.S. pilots sometimes submit reports about these occurrences to the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System, a database available to the public, he said.[2]

"Five years ago, I was very keen to believe that the FSF CFIT-awareness campaign implementation was going to be effective — that operators and others would share education/awareness materials with pilots and that we would see a drop in CFIT accidents," he said. "Now I believe that technology is one of the more effective solutions. The world now has the [global positioning system (GPS)] — powerful technology — and the cost of GPS receivers has been reduced to a small amount. Five years ago, people were skeptical that GPS would get this far — now GPS makes TAWS technology practical."

Nearly half of the jet fleet of the world's air carriers now has TAWS, but fewer air carriers in developing countries have installed this equipment, sometimes because of lack of money and infrastructure, he said.

"This equipment really reduces the risk because it gives situational awareness to pilots in terms of the picture of terrain and aural annunciation," said Bateman. "I have been advocating lower-cost Class B TAWS — which does not require an ILS receiver, an air data computer or a radar altimeter — as a very effective technology for operators in nations that do not require Class A TAWS."[3]

Data improvements are increasing the accuracy of TAWS for the time period in which aircraft are flown the last mile to the runway, he said.

"These critical few seconds are the Achilles heel [weak point] of TAWS because the aircraft is close to the ground," he said. During this period, nuisance warnings must be suppressed by TAWS for normal landing, and the aircraft position information and the runway coordinates used by TAWS, including elevation data, must be accurate, he said. Survey projects continue to improve the TAWS databases with worldwide data that conform to the World Geodetic System 1984 (WGS-84), a standard for defining the location of a runway (latitude/longitude) and its elevation (relative to mean sea level) based on its geodetic model.

"Accuracy will improve dramatically for the reported locations of runways, terrain and obstacles," said Bateman. "This technology reduces CFIT risks. TAWS effectiveness near the end of runway will improve, but the industry also should be using such additional tools as head-up displays and autoland systems."♦

— FSF Editorial Staff

Notes and References

1. Bateman, Don. Interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. July 31, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S. Bateman received the Flight Safety Foundation (FSF) *Aviation Week & Space Technology* Distinguished Service Award in 1997 and the FSF Admiral Luis de Florez Flight Safety Award in 1998 for his role in the development of the enhanced ground-proximity

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warning system (EGPWS). He received the FSF Business Aviation Meritorious Service Award in 2001 for his role in developing the ground-proximity warning system and EGPWS for business aircraft, the first wind shear detection system for business aircraft and for maintaining a worldwide database of controlled-flight-into-terrain accidents.

2. The U.S. National Aeronautics and Space Administration Aviation Safety Reporting System (ASRS) is a confidential incident-reporting system. The ASRS Program Overview said, "Pilots, air traffic controllers, flight attendants, mechanics, ground personnel and others involved in aviation operations submit reports to the ASRS when they are involved in, or observe, an incident or situation in which aviation safety was compromised." ASRS acknowledges that its data have certain limitations. ASRS *Directline* (December 1998) said, "Reporters to ASRS may introduce biases that result from a greater tendency to report serious events than minor ones; from organizational and geographic influences; and from many other factors. All of these potential influences reduce the confidence that can be attached to statistical findings based on ASRS data. However, the proportions of consistently reported incidents to ASRS, such as altitude deviations, have been remarkably stable over many years. Therefore, users of ASRS may presume that incident reports drawn from a time interval of several or more years will reflect patterns that are broadly representative of the total universe of aviation-safety incidents of that type."

3. In advisory circulars about the terrain awareness and warning system (TAWS), the U.S. Federal Aviation Administration said that Class A TAWS equipment, as a minimum, will provide alerts for the following circumstances: reduced required terrain clearance, imminent terrain impact, premature descent, excessive rates of descent, excessive closure rate to terrain, negative climb rate or altitude loss after takeoff, flight into terrain when not in landing configuration, excessive downward deviation from an ILS glideslope, and descent of the airplane to 500 feet (152.4 meters) above the terrain or nearest runway elevation (voice call-out "five hundred") during a nonprecision approach. Class A TAWS equipment must provide a terrain awareness display of the surrounding terrain and/or obstacles relative to the airplane. Class B TAWS equipment, as a minimum, will provide alerts for the following circumstances: reduced required terrain clearance, imminent terrain impact, premature descent, excessive rates of descent, negative climb rate or altitude loss after takeoff, and descent of the airplane to 500 feet above the terrain or nearest runway elevation (voice call-out "five hundred") during a nonprecision approach. This class of TAWS equipment does not require a terrain awareness display of the surrounding terrain and/or obstacles relative to the airplane.

"The industry might have tried to guess some of the FSF ALAR Task Force conclusions, but this was the first time that someone quantified the nature of problem and prioritized where the effort should be placed," said Khatwa. "The Foundation set the precedent for a data-driven method combined with sound operating experience and judgment."

That fact that basic things — poor decision making, descending below minimum approach altitudes — have caused so many ALAs was intriguing, Khatwa said. In the absence of supporting data, however, the task force encountered many who said, "I already know that — tell me something new," he said.

"Once we had the data, we could characterize the nature of ALAs and quantify the nature of the problem — for example, that 80 percent of accident pilots did not go around," Khatwa said. "In the tool kit, the ALAR implementation team put together a product that fundamentally is about good airmanship."

Although some ALAR Task Force recommendations involve issues such as improvements in air navigation, ALAR product development intentionally focused on tangible products that address directly practical aviation problems at the level of organizations and individuals, he said.

"The tool kit contains detailed checklists, SOPs, risk assessments, videos and crew task sharing and coordination — at that level, materials are directly usable by end users such as flight crews and air traffic controllers," he said. "The general focus of our industry — addressing competing priorities with scarce resources — means that you really have to convince decision makers, who demand to see evidence and results. Our industry requires hard data before focusing resources on a safety issue. In this project, we were very effective in convincing decision makers who control the dollars."

CFIT and ALAR are almost household words in North America and Europe, but the penetration of awareness of the ALAR problems is unknown in other regions, he said.

"There is the usual puzzle for aviation safety professionals that accident rates are lowest where the best accident data and incident data are available," said Khatwa. "I believe that the ALAR work of PAAST already has been an amazing accomplishment. They have brought people from the region to their table, and they have agreed on the best methods for their region. The FSF ALAR Task Force might not have thought this scenario possible. Members of PAAST have been the champions — ahead of anyone else in ALAR implementation efforts."

The ALAR Task Force acknowledged that as soon as technical issues were mastered by its international membership, implementation would require an acknowledgement of cultural issues.

"PAAST validates the need to understand languages and cultures — and to be well connected," Khatwa said. "Basically, implementation comes down to training for the threat."

Formal analysis of ALAs since the periods studied by the FSF ALAR Task Force has not been conducted yet, he said.

"Personally, I believe that we would see the same pattern of ALAs if we were to include the last three years in the analysis," he said. "The message has not changed. Most significantly, this would tell us that the same mistakes are being made and that the industry is just starting to implement change. I do not believe that the first three years after the ALAR Task Force report is an adequate time frame to measure the effectiveness of our work. This is the early part of implementation. We will need a larger sample than three years, and the implementation cannot be measured until we have a better understanding of the implementation status through the ALAR regional teams."

Khatwa said that inviting multinational participation at the outset — not just for implementation — has been a key to the FSF ALAR Task Force's successes.

"The working groups and task forces sought a good cross section of people from all the major ICAO regions and from multiple disciplines in the industry," said Khatwa.♦

Notes and References

1. The Flight Safety Foundation *ALAR Tool Kit* is a multimedia resource on compact disc (CD) for safety professionals and training organizations working to prevent the leading causes of fatalities in commercial aviation: approach-and-landing accidents (ALAs), including those involving controlled flight into terrain (CFIT). The CD contains a wide range of textual material and graphic material based largely on the data-driven studies of the FSF Approach-and-landing Accident Reduction (ALAR) Task Force. The tool kit has 2,600 searchable pages that include: FSF ALAR Task Force findings, conclusions and recommendations — and the data on which they were based; briefing notes on 34 major ALAR issues; supplements to approach briefings; guidelines for evaluating training, standard operating procedures and equipment; recommended standard operating procedures and risk-assessment checklists; four posters illustrating lessons learned; five slide presentations on accident data, flight operations and training, equipment, pilot-controller communication and instrument-approach design; two videos exploring ALAs and CFIT accidents, and how they could have been avoided; over 100 FSF publications; and links to aviation-data sources on the Internet.

2. Matthews, Stuart. Interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. June 27, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

3. Burin, James. Interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. June 22, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

4. The 24-member FSF CFIT/ALAR Action Group (CAAG) was created in April 1998 to supersede the FSF ALAR Task Force. The CAAG is involved currently in implementing the task force's recommendations.

5. Vandel, Robert. Interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. June 27, 2001. Flight Safety Foundation. Alexandria, Virginia, U.S.

6. The Foundation has received the following aerospace industry awards for efforts to prevent CFIT and ALAs: the 1994 *Aviation Week & Space Technology* Laurels Award; the 1998 *Flight International* Aerospace Industry Award — Training and Safety; the 2000 Embry-Riddle Aeronautical University Pinnacle Award for Outstanding Achievement in Safety Education; the 2000 *Flight International* Aerospace Industry Award — Safety; and the 2001 *Flight International* Aerospace Industry Award — Training and Safety — Finalist.

7. Weener, Earl F. Letter to Philippe Rochat, International Civil Aviation Organization (ICAO). November 23, 1994. Slatter, Richard. E-mail communication with Rosenkrans, Wayne. Alexandria, Virginia, U.S. August 30, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S. Slatter received The Laura Taber Barbour Air Safety Award, administered by the Foundation, in 2000 for identification of factors involved in CFIT accidents and ALAs, for development and implementation of methods to prevent CFIT and ALAs, and for his role in the implementation of changes to ICAO regulations and standards and recommended practices that aim to prevent these types of accidents.

8. ICAO. "Progress Report on the ICAO Program for the Prevention of Controlled Flight Into Terrain (CFIT)" and "Progress Report on the ICAO Global Aviation Safety Plan (GASP)." ICAO Assembly 33rd Session Documents A33–WP/55, July 13, 2001, and A33–WP/54, July 9, 2001.

9. 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): 1–121.

10. Khatwa, Ratan. Interview with Rosenkrans, Wayne. Alexandria, Virginia, U.S. July 30, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

Appendix
Actions by the International Civil Aviation Organization For the Prevention of Controlled Flight Into Terrain

In November 1994, the Flight Safety Foundation Controlled-flight-into-terrain (CFIT) Task Force recommended actions by the International Civil Aviation Organization (ICAO) for the prevention of CFIT accidents. 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 phases, which typically comprise about 16 percent of the average flight duration of a large commercial jet.

Richard Slatter, consultant, operations/airworthiness, in the ICAO Air Navigation Bureau, said that from 1995 to 2001, ICAO developed amendments to its annexes, standards and recommended practices (SARPs), procedures for air navigation services–operations (PANS–OPS) and guidance material, and adopted/approved various amendments related to the following task force recommendations:[1]

- *That requirements for the use of ground-proximity warning system (GPWS) equipment[2] be broadened.* In 1995, ICAO adopted two amendments applicable to GPWS — Amendment no. 21 to Annex 6, *Operation of Aircraft,* Part I, "International Commercial Air Transport – Aeroplanes," and Amendment no. 16 to Annex 6, Part II, "International General Aviation – Aeroplanes." These amendments made the requirements for GPWS applicable beginning Jan. 1, 1999, to turbine-engine airplanes with maximum certificated takeoff mass (MCTM) in excess of 5,700 kilograms (12,500 pounds) or authorized to carry more than nine passengers. These standards replaced an earlier standard in Part I and an earlier recommended practice in Part II, which referred to turbine-engine airplanes with MCTM in excess of 15,000 kilograms (33,000 pounds) or authorized to carry more than nine passengers. The new standard in Part I also eliminated an earlier recommended practice that had allowed, in effect, the operation — without GPWS — of turbine-engine airplanes that had been first certificated before July 1, 1979, with MCTM in excess of 15,000 kilograms or authorized to carry more than 30 passengers. The ICAO SARPs that affect GPWS in any form apply to both passenger-carrying operations and to cargo operations but do not extend to cargo operations involving airplanes with MCTM of 5,700 kilograms or less;

- *That early-model GPWS equipment be replaced.* In 1999, ICAO adopted two amendments applicable to GPWS: Amendment no. 24 to Annex 6, Part I, and Amendment no. 19 to Annex 6, Part II. These amendments expanded the requirements for GPWS to include the provision of a predictive terrain-hazard warning or a forward-looking terrain-avoidance function. In effect, equipment must meet the terrain awareness and warning system (TAWS) standard or the enhanced ground proximity warning system (EGPWS) standard in Annex 6, Part I, Chapter 6, 6.15, "Aeroplanes Required to Be Equipped With Ground Proximity Warning Systems (GPWS)." These requirements will result in the replacement or the updating of earlier GPWS equipment. Amendment no. 24 standards that require TAWS/EGPWS were effective Jan. 1, 2001, for turbine-engine airplanes first certificated on or after that date with MCTM in excess of 15,000 kilograms or authorized to carry more than 30 passengers. The requirement will be effective beginning Jan. 1, 2003, for all turbine-engine airplanes of this size. Amendment no. 19 introduced a recommended practice for equipment with EGPWS/ TAWS applicable to turbine-engine airplanes with MCTM in excess of 5,700 kilograms or authorized to carry more than nine passengers. ICAO has further amendments to Annex 6, Part I and Part II, under development to take into account the TAWS A and TAWS B standards of GPWS forward-looking terrain-avoidance equipment provided in the United States (U.S. Federal Aviation Administration [FAA] Technical Standard Order [TSO] TSO–C151A, "Terrain Awareness and Warning System–Article") and equivalent European Joint Aviation Authorities (JAA) documents. The proposed amendment to Annex 6, Part I, would require TAWS A for all turbine-engine airplanes first certificated on or after Jan. 1, 2004, with MCTM in excess of 5,700 kilograms or authorized to carry more than nine passengers, and, effective Jan. 1, 2005, for all turbine-engine airplanes of this size. Another standard has been proposed to require, effective Jan. 1, 2005, TAWS B equipment in all piston-engine airplanes with MCTM in excess of 5,700 kilograms or authorized to carry more than nine passengers. The proposed standard for piston-engine airplanes would replace an existing recommended practice for equipment with GPWS. A recommended practice also has been proposed for TAWS B, applicable to turbine-engine airplanes with MCTM of 5,700 kilograms or less or authorized to carry more than five passengers but not more than nine passengers. The proposed amendment to Part II would replace the existing standard requiring GPWS and the recommended practice requiring TAWS A with new standards requiring TAWS B for turbine-engine airplanes with MCTM in excess of 5,700 kilograms or authorized to carry more than nine passengers. These standards would become effective Jan. 1, 2004, for airplanes first certificated on or after that date and, effective Jan. 1, 2005, for all turbine-engine airplanes of this size. The current recommended practice applicable to piston-engine airplanes would be amended to refer to TAWS B instead of TAWS A. A new recommended practice has been proposed for TAWS B for turbine-engine airplanes with MCTM of 5,700 kilograms or less or authorized to carry more than five passengers but not more than nine passengers. The proposed amendments are scheduled for adoption by the ICAO Council in March 2002 and, if adopted, would become part of Amendment no. 27 to Part I and Amendment no. 22 to Part II, applicable Nov. 28, 2002, and effective on the dates included in the individual standards. These amendments and proposals not only will require the replacement and updating of equipment but will broaden the scope of the requirements for GPWS/EGPWS/TAWS introduced by the 1999 amendments to Part I and Part II with respect to the size of airplane and the type of airplane engine;

- *That color-shaded depictions of terrain heights be shown on instrument approach charts.* Amendment no. 52 to Annex 4, *Aeronautical Charts*, applicable Nov. 1, 2001, introduces a new standard in Chapter 11, "Instrument Approach Chart–ICAO," which requires the depiction of terrain contour lines with layer tints in brown. This standard and a supporting recommended practice say, "Relief shall be shown in a manner best suited to the particular elevation characteristics of the area. In areas where relief exceeds 1,200 meters (4,000 feet) above the [airport] elevation within the coverage of the chart or 600 meters (2,000 feet) within 11 kilometers (six nautical miles) of the [airport] reference point or when final approach or missed approach procedure gradient is steeper than optimal due to terrain, all relief exceeding 150 meters (500 feet) above the [airport] elevation shall be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, shall also be shown printed in black. Note 1 — The next higher suitable contour line appearing on base topographical maps exceeding 150 meters (500 feet) above the [airport] elevation may be selected to start layer tinting. Note 2 — An appropriate brown [color], on which a halftone layer tinting is to be based, is specified in Appendix 3, page A-3-1, 'Colour Guide for Contours and Topographical Features.' Note 3 — Appropriate spot elevations are those provided by the procedure specialists. (Annex 4, Chapter 11, 11.7.2) In areas where relief is lower than specified in 11.7.2, all relief exceeding 150 meters (500 feet) above the [airport] level should be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, shall also be shown printed in black. Notes 1, 2 and 3 are as for 11.7.2 above." (Annex 4, Chapter 11, 11.7.3) ICAO has deleted the recommended practice that previously provided for combining information about relief and significant obstacles with area minimum altitude; this recommended practice had resulted in contours with layer tinting in green. Other amendments to Annex 4 introduced related recommended practices. Chapter 8, "Area Chart–ICAO," says, "To improve situational awareness in areas where significant relief exists, all relief exceeding 300 meters (1,000 feet) above the elevation of the primary [airport] should be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. Significant obstacles should also be shown. Notes 1, 2 and 3 are as for 11.7.2 above." (Annex 4, Chapter 8, 8.6.2) Chapter 9, "Standard Departure Chart–Instrument (SID)–ICAO," says, "To improve situational awareness in areas where significant relief exists, the chart should be drawn to scale and all relief exceeding 300 meters (1,000 feet) above the elevation of the primary [airport] should be shown by smoothed contour lines, contour values and layer tints printed in brown. Appropriate spot elevations, including the highest elevation within each top contour line, should be shown printed in black. Significant obstacles should also be shown. Notes 1, 2 and 3 are as for 11.7.2 above." (Annex 4, Chapter 9, 9.6.2) Chapter 10, "Standard Arrival Chart–Instrument (STAR)–ICAO," paragraph 10.6.2 is similar to paragraph 9.6.2;

- *That aircraft operators be warned against using three-pointer altimeters and drum-pointer altimeters.* Amendment no. 21 to Annex 6, Part I, applicable Nov. 9, 1995, added a sentence to the note in the standard that required two sensitive pressure altimeters. The note says, "Due to the long history of misreadings, the use of drum-pointer altimeters is not recommended." Amendment no. 23 to Part I, applicable Nov. 5, 1998, revised the standard in Chapter 6, "Aeroplane Instruments, Equipment and Flight Documents," to require: "two sensitive pressure altimeters with counter drum-pointer or equivalent presentation. Note — Neither three-pointer [altimeters] nor drum-pointer altimeters satisfy the requirement in [paragraph c]." (Annex 6, Part I, Chapter 6, paragraph 6.9.1c) Amendment no. 16 to Part II, applicable Nov. 9, 1995, added a note to the standard requiring a sensitive pressure altimeter. The note says, "Due to the long history of misreadings, the use of drum-pointer altimeters is not recommended." Part II has not been amended in this context since Amendment no. 19. The standards and notes about altimeters in Annex 6, Part III, "International Operations–Helicopters," Section II and Section III, are similar to those in Parts I and II, respectively;

- *That the design and presentation of nonprecision instrument approach procedures be improved with a standard three-degree approach slope, except where prohibited by obstacles.* The ICAO manual *Preparation of an Operations Manual* (Document 9376), first edition 1990, introduced material on the stabilized approach and the need to define this approach in the operations manual. Amendment no. 23 to Annex 6, Part I, applicable Nov. 5, 1998, introduced a requirement for an operations manual to contain material about conducting a stabilized approach. Amendment no. 10 to PANS–OPS, Volume I, applicable Nov. 5, 1998, introduced the concept of the stabilized approach for nonprecision approach procedures. Amendment no. 11 to PANS–OPS, Volume I, applicable Nov. 1, 2001, expanded on the constant approach slope for nonprecision approaches. This amendment also includes a new chapter on the stabilized approach procedure with the parameters, the requirements for an operations manual (including go-around policy) and the need for standard operating procedures. Amendment no. 11 to PANS–OPS, Volume II, applicable Nov. 1, 2001, provides criteria to define the constant approach slope for nonprecision approach procedures in terms of optimum descent gradients, minimum descent gradients and maximum descent gradients;

- *That automated altitude call-outs be used.* Amendment no. 23 to Annex 6, Part I, applicable Nov. 5, 1998, introduced additional requirements for the content of an operator's operations manual, which included "instructions on the maintenance of altitude awareness and the use of automated [call-out] or flight crew call-out." (Annex 6, Part I, Appendix 2, paragraph 5.13); and,

- *That the important CFIT-avoidance benefits provided by the global positioning system/global navigation satellite system (GPS/GNSS) be recognized.* An ICAO state letter in August 1995 said that the Air Navigation Commission emphasized the navigation accuracy and aviation safety advantages of satellite navigation and informed the ICAO All Weather Operations Panel, the ICAO Global Navigation Satellite System Panel and the ICAO Obstacle Clearance Panel of the urgent need for progress in the application of satellite navigation to nonprecision approach procedures. Amendment no. 10 to PANS–OPS, Volume I and Volume II, applicable Nov. 5, 1998, introduced operational information and criteria on area navigation (RNAV) approach procedures for basic GNSS receivers, which are defined as first-generation GNSS receivers that meet at least Radio Technical Commission for Aeronautics (RTCA) DO–208, Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS), RTCA Committee SC–181, Navigation Standards, and JAA Temporary Guidance Leaflet (TGL) no. 3, Revision 1, JAA Interim Guidance on Airworthiness Approval and Operational Criteria for the Use of the NAVSTAR Global Positioning System (GPS), and equivalent certification standards for instrument flight rules, such as FAA TSO–C129, "Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)." Amendment no. 11 to PANS-OPS, Volume I and Volume II, applicable Nov. 1, 2001, introduced operational information and criteria for RNAV and required navigation performance (RNP) departure procedures and arrival procedures, including departure procedures and arrival procedures for basic GNSS and the introduction of barometric vertical navigation procedures. The material on basic GNSS approach procedures was amended considerably, said Slatter. The current work of the Obstacle Clearance Panel includes: the development procedures, areas and obstacle-clearance criteria for the approach phase, holding phase and departure phase of flight based on GNSS, including satellite-based augmentation system (SBAS) RNAV in support of nonprecision operations, nonprecision operations with vertical guidance and Category I operations; ground-based augmentation system (GBAS) RNAV in support of Category I operations; and RNP including random arrival criteria and relating SBAS to RNP performance levels. Further amendments to PANS–OPS, Volume I and Volume II, are scheduled for applicability in November 2004. Amendment no. 26, Amendment no. 21 and Amendment no. 8 to Annex 6, Part I, Part II and Part III, respectively, applicable November 1, 2001, introduced new definitions for approach-and-landing operations with vertical guidance where the vertical guidance does not meet the requirements established for precision approach-and-landing operations. The definitions for airport operating minimums and heliport operating minimums also have been amended to include approach-and-landing operations with vertical guidance. The Global Navigation Satellite System Panel has developed the first package of SARPs and guidance material for GNSS, including provisions for SBAS and GBAS. The SARPs provide for GNSS-based operations down to Category I precision approach procedures and, for locations where this capability cannot be achieved, SBAS will support RNAV nonprecision approach (NPA) operations and approach with vertical guidance (APV) operations. The first package of SARPs and guidance material will be introduced with Amendment no. 76 to Annex 10, *Aeronautical Telecommunications*, Volume I, applicable Nov. 1, 2001.

The FSF CFIT Task Force also recommended that all civil aviation authorities adopt the use of hectopascals for altimeter settings. Amendment no. 15 to ICAO Annex 5, *Units of Measurement to Be Used in Air and Ground Operations*, introduced in 1987 standards for using only hectopascals for reporting atmospheric pressure and altimeter settings, a practice consistent with the World Meteorological Organization.

Slatter said that some ICAO member states have not implemented these standards. To alleviate the problem of the use of different units, ICAO has taken action in Annex 3, *Meteorological Service for International Air Navigation,* and in the Procedures for Air Navigation Services–Rules of the Air and Air Traffic Services (PANS–ATM, Document 4444).

With Amendment no. 72 to Annex 3, applicable Nov. 1, 2001, the recommended practice in Chapter 4, “Meteorological Observations and Reports,” says, “In local routine reports, QNH [defined by ICAO as altimeter subscale setting to obtain elevation when on the ground] should be included regularly and QFE [defined by ICAO as atmospheric pressure at airport elevation (or at runway threshold)] should be included either on request or, if so agreed locally, on a regular basis. Those values should be rounded down to the nearest whole hectopascal and given in four digits together with the units used. If QFE values are required for more than one runway, the required values should be indicated using four digits for each runway.” (Annex 3, Chapter 4, paragraph 4.11.4)

Amendment no. 4 to the PANS–ATM, applicable Nov. 1, 2001, adds the following text to Part IX, “Air Traffic Services,” section 4.3.2.3.7, “Altimeter Settings,” which is relocated, as a procedure to support the Annex 3 recommended practice, to Part XI, section 4.3.2.3.7: “The QNH altimeter setting shall be given. The QFE altimeter setting shall also be available and passed either on a regular basis in accordance with local arrangements, or if requested by the pilot. Altimeter settings shall be given in hectopascals in four digits together with the unit of measurement used, and shall be rounded down to the nearest whole hectopascal.” (PANS–ATM, Part XI, paragraph 4.3.2.3.7.1)

“There is an illogical situation [involving] the standard in Annex 5, the recommended practices in Annex 3 and the procedures in the PANS–ATM,” said Slatter. “It is intended that proposals will be made to the [ICAO] Meteorological Division meeting planned for September 2002 for upgrading to standards of the applicable recommended practices in Annex 3, Chapter 4.”♦

References

1. Slatter, Richard. E-mail communication with Rosenkrans, Wayne. Alexandria, Virginia, U.S. August 30, 2001 and September 13, 2001. Flight Safety Foundation, Alexandria, Virginia, U.S.

2. The International Civil Aviation Organization (ICAO) Annex 6, *Operation of Aircraft*, Part I, Chapter 6, 6.15, “Aeroplanes Required to Be Equipped With Ground Proximity Warning Systems (GPWS),” contains the requirement for ground-proximity warning systems (GPWS), which are defined as equipment that “shall provide automatically a timely and distinctive warning to the flight crew when the airplane is in potentially hazardous proximity to the earth’s surface,” including, as a minimum, warnings of the following circumstances (paragraph numbering omitted): “excessive descent rate; excessive terrain-closure rate; excessive altitude loss after takeoff or go-around; unsafe terrain clearance while not in landing configuration; gear not locked down; flaps not in a landing position; and excessive descent below the instrument glide path.”

Surveys Assess Pilot Awareness of Methods to Prevent Controlled Flight Into Terrain

Responses from pilots and other aviation professionals in the Caribbean, Central America, Mexico and South America show that two-thirds of those questioned knew about the Flight Safety Foundation initiative to prevent approach-and-landing accidents, including those involving controlled flight into terrain.

FSF Editorial Staff

Surveys of pilots and other aviation professionals from the Caribbean, Central America, Mexico and South America showed that two-thirds of those questioned were aware of the Flight Safety Foundation (FSF) initiative to prevent approach-and-landing accidents (ALAs), including those involving controlled flight into terrain (CFIT).

Fifty-one percent said that their companies had changed policies or procedures as a result of an evaluation of the FSF recommendations, which are available in the FSF *Approach-and-landing Accident Reduction (ALAR) Tool Kit*, a unique set of pilot briefing notes, videos, presentations, risk-awareness checklists and other tools designed to help prevent ALAs, including those involving CFIT.

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 phases, which typically comprise about 16 percent of the average flight duration of a large commercial jet.

The surveys were created and administered by the Pan American Aviation Safety Team (PAAST) and the International Federation of Air Line Pilots' Associations (IFALPA) to pilots in Argentina, Ecuador and Mexico and to a San Jose, Costa Rica, seminar of Caribbean, Central American, Mexican and South American pilots and aviation professionals (see "Momentum Builds in Regional ALAR Implementation Efforts," page 1).

The largest surveyed group comprised 144 pilots for major airlines in Mexico. Surveys also were conducted of 21 pilots for major airlines in Argentina, 15 pilots for an airline in Ecuador and 36 pilots and other aviation professionals who attended the Costa Rica seminar.

The surveys administered to the Argentine pilots, the Ecuadorian pilots and the Mexican pilots were similar; the survey administered to the pilots and other aviation professionals in Costa Rica differed slightly. In the Costa Rican survey, most questions referring to CFIT also referred to ALAs; in the other surveys, references to ALAs were not included.

These ongoing baseline surveys will be used by PAAST to assess the influence of PAAST ALAR information dissemination in the region; the results will be compared with surveys to be conducted two years after the first round of surveys is completed. Table 1 (page 31), Table 2 (page 33), Table 3 (page 35) and Table 4 (page 37) show results of the surveys.

(Because of variations in sampling methods, including small sample sizes, the results of these surveys represent the responses of those questioned; the data are not presented as a reflection of an entire region's pilots and other aviation professionals.)

The combined survey data also show that:

- Sixty-seven percent of the 216 respondents said that they were aware of the FSF initiative to prevent CFIT;[1]

Table 1
Answers From 21 Pilots for Major Airlines in Argentina to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[1]

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)
1 CFIT Awareness			
1.1 Are you aware of the Flight Safety Foundation (FSF) initiative to help prevent controlled flight into terrain (CFIT)?	71	29	0
1.2 Are you aware that the Foundation produced the *CFIT Education and Training Aid,*[2] which made recommendations about reducing the CFIT risk?	52	48	0
1.3 Has your airline/company introduced or amended any policies or procedures as a result of an evaluation made of the FSF CFIT initiative?	44	33	24
2 Communication			
2.1 Did you receive any of the information contained in the *CFIT Education and Training Aid*?	76	24	0
2.2 Have there been any changes in your company's policies and procedures that were related to reducing CFIT risk?	57	33	10
2.3 Was the CFIT training package used as the rationale for any changes in your company's policies and procedures?	43	19	38
3 Safety Systems			
Has your airline/company implemented any of the following safety systems?			
3.1 Quick access recorder analysis	24	48	29
3.2 Databases for safety analysis	19	48	33
3.3 Flight data recorder analysis	19	52	29
3.4 A policy statement that reflects a "nonpunitive" culture; a reporting system that is normally free from the threat of disciplinary action	43	19	38
3.5 Do you have a system of communication for collating and disseminating safety-related information?	62	19	19
4 Training			
Does your airline/company have the following?			
4.1 Simulator CFIT training	48	48	5
4.2 Ground-based CFIT training	24	52	24
5 Ground-proximity Warning System (GPWS) Policy			
In the event of a GPWS warning ("pull-up" audio), which of the following criteria would your GPWS policy require for the flight crew to perform a "pull-up" go-around?			
5.1 Upon the activation of a GPWS warning, whatever the condition	38	48	14
5.2 In instrument meteorological conditions only	38	38	24
5.3 In all circumstances below minimum safe altitude	38	43	19
5.4 Only after making certain that the warning is genuine	19	67	14

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- Seventy-eight percent said that they received information contained in FSF training aids that discussed prevention of CFIT;[2]
- Fifty-four percent said that there had been changes in their company's policies and/or procedures that were related to reducing the CFIT risk;[3]
- Fifty-three percent said that their airline or organization had implemented a policy statement reflecting a "nonpunitive" culture with a self-reporting system that is normally free from the threat of disciplinary action;
- Fifty-four percent said that their airline/company offered simulator CFIT training;[4]

Table 1
Answers From 21 Pilots for Major Airlines in Argentina to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[1] *(continued)*

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)
6 Stabilized Approach Policy			
6.1 Does your airline/company have a defined "gate" for stabilized flight on the final approach by which the aircraft is to be configured for landing and stabilized in airspeed, power setting, trim and rate of descent and on the defined descent profile?	90	5	5
6.2 Does your airline/company have a mandatory requirement for flight crew to reject any approach that exceeds the "gate" parameters of a defined altitude/radar altitude?	81	10	10
6.3 Do your airline/company procedures permit level flight at minimum descent altitude/decision altitude on a nonprecision approach?			
Jet aircraft	76	14	10
Propeller aircraft	NA	NA	NA
7 Operation			
Does your airline/company have the following procedures?			
7.1 Policy to encourage greater use of autoflight systems	90	10	0
7.2 Rate of descent policy	86	10	5
7.3 Monitored approach procedures	86	10	5
7.4 Procedures to increase altitude awareness	81	14	5
8 Equipment			
Has your airline/company installed, replaced or upgraded any of the following equipment?			
8.1 Altimeters	62	24	14
8.2 GPWS system	71	29	0
8.3 Radio altimeters	62	29	10
8.4 Approach charts	81	14	5

Note: Responses to some questions do not total 100 percent because of rounding.

[1]The Flight Safety Foundation (FSF) initiative to prevent approach-and-landing accidents, including those involving controlled flight into terrain (CFIT), has many elements; the latest is the FSF *Approach-and-landing Accident Reduction Tool Kit*.

[2]The *CFIT Education and Training Aid* was produced in 1996 by the Boeing Commercial Airplane Group (now Boeing Commercial Airplanes) with the assistance of the international FSF CFIT Task Force and distributed worldwide under the auspices of the task force.

NA = Not applicable

Source: Pan American Aviation Safety Team

- Sixty-five percent said that their airline/company offered ground-based CFIT training;[5]
- Eighty-nine percent said that their airline/company had a defined "gate" or phase for stabilized flight on the final approach by which the aircraft is to be configured for landing and stabilized in airspeed, power setting, trim and rate of descent and on the defined descent profile;
- Forty-five percent said that, in the event of a ground-proximity warning system (GPWS) warning, the flight crew would be required to conduct a "pull-up" go-around whatever the condition; and,
- *Sixteen percent said that the flight crew would be required to conduct a "pull-up" go-around only after making certain that the warning was genuine.*♦

Notes

1. Questions in the survey administered to 36 pilots and other aviation professionals meeting in Costa Rica include references to Flight Safety Foundation (FSF)

Table 2
Answers From 15 Pilots for a Major Airline in Ecuador to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[1]

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)
1 CFIT Awareness			
1.1 Are you aware of the Flight Safety Foundation (FSF) initiative to help prevent controlled flight into terrain (CFIT)?	67	20	13
1.2 Are you aware that the Foundation produced the *CFIT Education and Training Aid,*[2] which made recommendations about reducing the CFIT risk?	67	13	20
1.3 Has your airline/company introduced or amended any policies or procedures as a result of an evaluation made of the FSF CFIT initiative?	53	0	47
2 Communication			
2.1 Did you receive any of the information contained in the *CFIT Education and Training Aid*?	47	33	20
2.2 Have there been any changes in your company's policies and procedures that were related to reducing CFIT risk?	40	0	60
2.3 Was the CFIT training package used as the rationale for any changes in your company's policies and procedures?	47	7	47
3 Safety Systems			
Has your airline/company implemented any of the following safety systems?			
3.1 Quick access recorder analysis	40	40	20
3.2 Databases for safety analysis	60	20	20
3.3 Flight data recorder analysis	13	47	40
3.4 A policy statement that reflects a "nonpunitive" culture; a reporting system that is normally free from the threat of disciplinary action	40	40	20
3.5 Do you have a system of communication for collating and disseminating safety-related information?	87	0	13
4 Training			
Does your airline/company have the following?			
4.1 Simulator CFIT training	13	80	7
4.2 Ground-based CFIT training	40	40	20
5 Ground-proximity Warning System (GPWS) Policy			
In the event of a GPWS warning ("pull-up" audio), which of the following criteria would your GPWS policy require for the flight crew to perform a "pull-up" go-around?			
5.1 Upon the activation of a GPWS warning, whatever the condition	47	53	0
5.2 In instrument meteorological conditions only	53	47	0
5.3 In all circumstances below minimum safe altitude	80	20	0
5.4 Only after making certain that the warning is genuine	13	80	7

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initiatives to prevent both controlled flight into terrain (CFIT) and approach-and-landing accidents (ALAs).

2. The question in the surveys administered to 144 pilots referred to the *CFIT Education and Training Aid*, which was produced in 1996 by the Boeing Commercial Airplane Group (now Boeing Commercial Airplanes) with the assistance of the international FSF CFIT Task Force and distributed worldwide under the auspices of the task force. The question in the survey administered to 36 pilots and other aviation professionals meeting in Costa Rica referred to the FSF *Approach-and-landing Accident Reduction Tool Kit,* distributed in 2001 by the Foundation.

Table 2
Answers From 15 Pilots for a Major Airline in Ecuador to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[1] *(continued)*

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)
6 Stabilized Approach Policy			
6.1 Does your airline/company have a defined "gate" for stabilized flight on the final approach by which the aircraft is to be configured for landing and stabilized in airspeed, power setting, trim and rate of descent and on the defined descent profile?	93	7	0
6.2 Does your airline/company have a mandatory requirement for flight crew to reject any approach that exceeds the "gate" parameters of a defined altitude/radar altitude?	67	13	20
6.3 Do your airline/company procedures permit level flight at minimum descent altitude/decision altitude on a nonprecision approach?			
Jet aircraft	100	0	0
Propeller aircraft	NA	NA	NA
7 Operation			
Does your airline/company have the following procedures?			
7.1 Policy to encourage greater use of autoflight systems	87	7	7
7.2 Rate of descent policy	93	0	7
7.3 Monitored approach procedures	80	13	7
7.4 Procedures to increase altitude awareness	87	13	0
8 Equipment			
Has your airline/company installed, replaced or upgraded any of the following equipment?			
8.1 Altimeters	67	27	7
8.2 GPWS system	60	33	7
8.3 Radio altimeters	73	20	7
8.4 Approach charts	100	0	0

Note: Responses to some questions do not total 100 percent because of rounding.

[1]The Flight Safety Foundation (FSF) initiative to prevent approach-and-landing accidents, including those involving controlled flight into terrain (CFIT), has many elements; the latest is the FSF *Approach-and-landing Accident Reduction Tool Kit*.

[2]The *CFIT Education and Training Aid* was produced in 1996 by the Boeing Commercial Airplane Group (now Boeing Commercial Airplanes) with the assistance of the international FSF CFIT Task Force and distributed worldwide under the auspices of the task force.

NA = Not applicable

Source: Pan American Aviation Safety Team

3. The question in the survey administered to 36 pilots and other aviation professionals meeting in Costa Rica referred to ALA risks and CFIT risks; other surveys did not reference ALA risks in the question.

4. The question in the survey administered to 36 pilots and other aviation professionals meeting in Costa Rica referred to simulator training to prevent ALAs and CFIT; other surveys did not reference ALA simulator training in the question.

5. The question in the survey administered to 36 pilots and other aviation professionals meeting in Costa Rica referred to ground-based training to prevent ALAs and CFIT; other surveys did not reference ALA ground-based training in the question.

Table 3
Answers From 144 Pilots for Major Airlines in Mexico to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[1]

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)
1 CFIT Awareness			
1.1 Are you aware of the Flight Safety Foundation (FSF) initiative to help prevent controlled flight into terrain (CFIT)?	67	27	6
1.2 Are you aware that the Foundation produced the *CFIT Education and Training Aid,*[2] which made recommendations about reducing the CFIT risk?	73	21	6
1.3 Has your airline/company introduced or amended any policies or procedures as a result of an evaluation made of the FSF CFIT initiative?	60	13	26
2 Communication			
2.1 Did you receive any of the information contained in the *CFIT Education and Training Aid*?	88	10	1
2.2 Have there been any changes in your company's policies and procedures that were related to reducing CFIT risk?	62	24	14
2.3 Was the CFIT training package used as the rationale for any changes in your company's policies and procedures?	47	15	38
3 Safety Systems			
Has your airline/company implemented any of the following safety systems?			
3.1 Quick access recorder analysis	26	19	56
3.2 Databases for safety analysis	23	17	60
3.3 Flight data recorder analysis	30	18	52
3.4 A policy statement that reflects a "nonpunitive" culture; a reporting system that is normally free from the threat of disciplinary action	56	19	25
3.5 Do you have a system of communication for collating and disseminating safety-related information?	61	17	22
4 Training			
Does your airline/company have the following?			
4.1 Simulator CFIT training	65	28	7
4.2 Ground-based CFIT training	80	20	0
5 Ground-proximity Warning System (GPWS) Policy			
In the event of a GPWS warning ("pull-up" audio), which of the following criteria would your GPWS policy require for the flight crew to perform a "pull-up" go-around?			
5.1 Upon the activation of a GPWS warning, whatever the condition	51	36	13
5.2 In instrument meteorological conditions only	60	30	10
5.3 In all circumstances below minimum safe altitude	68	22	10
5.4 Only after making certain that the warning is genuine	19	63	18

Continued on page 36

Table 3

Answers From 144 Pilots for Major Airlines in Mexico to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[1] *(continued)*

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)
6 Stabilized Approach Policy			
6.1 Does your airline/company have a defined "gate" for stabilized flight on the final approach by which the aircraft is to be configured for landing and stabilized in airspeed, power setting, trim and rate of descent and on the defined descent profile?	96	3	1
6.2 Does your airline/company have a mandatory requirement for flight crew to reject any approach that exceeds the "gate" parameters of a defined altitude/radar altitude?	90	8	1
6.3 Do your airline/company procedures permit level flight at minimum descent altitude/decision altitude on a nonprecision approach?			
Jet aircraft	93	6	1
Propeller aircraft	NA	NA	NA
7 Operation			
Does your airline/company have the following procedures?			
7.1 Policy to encourage greater use of autoflight systems	91	6	3
7.2 Rate of descent policy	89	8	3
7.3 Monitored approach procedures	92	1	7
7.4 Procedures to increase altitude awareness	83	6	11
8 Equipment			
Has your airline/company installed, replaced or upgraded any of the following equipment?			
8.1 Altimeters	55	22	23
8.2 GPWS system	62	19	19
8.3 Radio altimeters	55	20	26
8.4 Approach charts	70	15	15

Note: Responses to some questions do not total 100 percent because of rounding.

[1]The Flight Safety Foundation (FSF) initiative to prevent approach-and-landing accidents, including those involving controlled flight into terrain (CFIT), has many elements; the latest is the FSF *Approach-and-landing Accident Reduction Tool Kit*.

[2]The *CFIT Education and Training Aid* was produced in 1996 by the Boeing Commercial Airplane Group (now Boeing Commercial Airplanes) with the assistance of the international FSF CFIT Task Force and distributed worldwide under the auspices of the task force.

NA = Not applicable

Source: Pan American Aviation Safety Team

Table 4
Answers From 36 Pilots and Other Aviation Professionals[1] From the Caribbean, Central America, Mexico and South America to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[2]

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)[3]
1 CFIT Awareness			
1.1 Are you aware of the Flight Safety Foundation (FSF) initiative to help prevent approach-and-landing accidents (ALAs) and controlled flight into terrain (CFIT)?	61	31	8
1.2 Are you aware that the Foundation produced a CFIT and ALA education and training aid that made recommendations about reducing the CFIT and ALA risk?	39	50	11
1.3 Has your airline or organization introduced or amended any policies or procedures as a result of an evaluation made of the FSF CFIT/ALA initiative?	19	58	22
2 Communication			
2.1 Did you receive any of the information contained in the education and training aid for the prevention of ALA and CFIT?	50	50	0
2.2 Have there been any changes in your company/organization policies and procedures that were related to reducing ALA/CFIT risk?	25	50	25
2.3 Was the ALA/CFIT training package used as the rationale for any changes in your company/organization policies and procedures?	14	47	39
3 Safety Systems			
Has your airline/organization implemented any of the following safety systems?			
3.1 Quick access recorder analysis	22	58	19
3.2 Databases for safety analysis	19	61	19
3.3 A policy statement that reflects a "nonpunitive" culture in a self-reporting system that is normally free from the threat of disciplinary action	53	25	22
3.4 A system of communication for collating and disseminating safety-related information	50	33	17
4 Training			
Does your airline/organization have the following?			
4.1 Simulator training for the prevention of ALA/CFIT	28	61	11
4.2 Ground-based training for the prevention of ALA/CFIT	39	53	8
5 Ground-proximity Warning System (GPWS) Policy			
In the event of a GPWS hard warning ("pull up"), which of the following criteria would your GPWS policy require for the flight crew to perform a go-around?			
5.1 Upon the activation of a GPWS warning, whatever the condition	22	39	39
5.2 In instrument meteorological conditions/instrument flight rules only	28	36	36
5.3 In all circumstances below minimum safe altitude	28	33	39
5.4 Only after making certain that the warning is genuine	3	58	39

Continued on page 38

Table 4
Answers From 36 Pilots and Other Aviation Professionals[1] From the Caribbean, Central America, Mexico and South America to Questions Involving the Flight Safety Foundation Initiative to Help Prevent Controlled Flight Into Terrain and Approach-and-landing Accidents[2] *(continued)*

	Yes (Percent)	No (Percent)	Don't Know/ Unsure (Percent)[3]
6 Stabilized Approach Policy			
6.1 Does your airline/organization have a defined phase for stabilized flight on the final approach by which the aircraft is to be configured for landing and stabilized in airspeed, power setting, trim and rate of descent and on the defined descent profile?	61	14	25
6.2 Does your airline/organization have a policy that establishes that you/the flight crew reject any approach that exceeds the parameters of a stabilized approach?	58	14	28
6.3 Do your airline/organization procedures permit level flight at minimum descent altitude/decision altitude on a nonprecision approach?			
Jet aircraft	19	17	64
Propeller aircraft	22	31	47
7 Operation			
Does your airline/organization have the following procedures?			
7.1 Policy to encourage greater use of autoflight systems	42	47	11
7.2 Rate of descent policy	64	19	17
7.3 Monitored approach procedures	53	33	14
7.4 Procedures to increase altitude awareness	56	25	19
8 Equipment			
Has your airline installed, replaced or upgraded any of the following equipment?			
8.1 Altimeters	58	17	25
8.2 GPWS/enhanced ground-proximity warning system (EGPWS)	36	42	22
8.3 Radio altimeters	39	36	25
8.4 Approach charts	61	14	25

Note: Responses to some questions do not total 100 percent because of rounding.

[1]The respondents from several nations were attending a July 2001 seminar in Costa Rica.

[2]The Flight Safety Foundation (FSF) initiative to prevent approach-and-landing accidents, including those involving controlled flight into terrain (CFIT), has many elements; the latest is the FSF *Approach-and-landing Accident Reduction Tool Kit*.

[3]This category includes responses that indicated that the question was not applicable.

Source: Pan American Aviation Safety Team

Publications Received at FSF Jerry Lederer Aviation Safety Library

U.K. CAA Final Report Provides Analyses of Call-sign-confusion Occurrences

The report said that 84 percent of occurrences of call-sign confusion involved numeric-only call signs.

FSF Library Staff

Reports

ACCESS: Aircraft Call Sign Confusion Evaluation Safety Study. U.K. Civil Aviation Authority (CAA). April 2000. Civil Aviation Publication (CAP) 704. 39 pp. Figures, tables, appendixes.

Representatives from U.K. CAA, National Air Traffic Services (NATS) and several airlines conducted a study to determine the scope of problems resulting from the similarity of airline call signs used in U.K. airspace in 1997. The study was intended to improve safety, increase operator awareness and provide guidance to the aviation industry. The group and the study were known as ACCESS, the Aircraft Call Sign Confusion Evaluation Safety Study. An initial analysis of the study was made public in U.K. CAA CAP 687 in 1998. This final report, CAP 704, provides detailed analysis of occurrences of call-sign confusion.

Airline call signs are composed of a three-letter prefix (such as an airline designator) and a suffix of up to four characters. Call-sign confusion may be aural confusion or visual confusion and may occur among different flight crews or between flight crews and air traffic control (ATC) service providers. Data were analyzed from 482 reports provided by airlines and ATC service providers.

The report said that 45 percent of the 482 reported occurrences involved actual confusion and that 89 percent of the reports of actual confusion occurred during the climb, descent or cruise phases of flight. The report also said that 73 percent of reported occurrences involved an increase in ATC workload; that nearly 50 percent of occurrences involved U.K. airlines; that nearly 33 percent involved non-U.K. airlines; and that 84 percent of occurrences involved numeric-only call signs, compared with 10 percent that involved alphanumeric call signs.

The ACCESS group concluded that call-sign confusion is a safety problem that could affect safe and expeditious aviation operations in U.K. airspace. The group's recommendations to CAA and NATS received favorable responses and subsequent action.

Data-Linked Pilot Reply Time on Controller Workload and Communication in a Simulated Terminal Option. Prinzo, O. Veronika. U.S. Federal Aviation Administration (FAA) Office of Aviation Medicine. DOT/FAA/AM-01/8. May 2001. 21 pp. Figures, tables. Available through NTIS.*

As part of FAA's modernization plan to improve safety, reduce delays and increase efficiencies of human resources and system resources, the agency is developing an aeronautical data link system (ADLS).

One part of the ADLS under development is controller-pilot data link communication (CPDLC). CPDLC will redirect routine air traffic services provided by FAA's voice radio communications system, a change that represents the first phase in complying with International Civil Aviation Organization standards and recommended practices for digital communication systems. When data link communications become available, air traffic controllers are expected to have the option of performing tasks sequentially or in parallel using voice radio or CPDLC. In this study, the author observed the communication requirements and workload requirements of eight air traffic controllers in a simulated radar approach control environment during pilot-to-controller data-link acknowledgment periods.

"The primary finding of this study was that controllers took longer to formulate and transmit messages over a data link communications system, but their messages were more accurate and contained fewer message elements," the author said.

Pilot Visual Acquisition of Traffic: Operational Communications From OpEval-1. Prinzo, O. Veronika. U.S. Federal Aviation Administration Office of Aviation Medicine. DOT/FAA/AM-01/9. May 2001. 18 pp. Figures, tables. Available through NTIS.*

Air traffic controllers and pilots operate as a team, with controllers scanning their radar displays to ensure separation between airborne aircraft and pilots scanning their airspace for other aircraft. Avionics equipment is being developed to facilitate scanning and to provide pilots with graphically displayed traffic information. The purpose of the cockpit display of traffic information (CDTI) equipment is to display geometrically the location of one aircraft in relation to another. One limitation of CDTI appears to be a compromise of precision because non-users of CDTI are not able to transmit their locations as precisely as users of CDTI. Another limitation may be phraseology to accommodate operational communication and procedures.

In this study, the author analyzed audiotaped recordings from a previous study (OpEval-1, July 1999) of communication between 16 pilots flying aircraft equipped with CDTI devices and three terminal radar approach controllers who provided the pilots with air traffic services. The author concluded that CDTI created an apparent tradeoff in air-ground workload and created an environment for collaborative communication between pilots and air traffic controllers. When CDTI was in use, controllers sent fewer messages and took less time conveying traffic-related information to pilots. Pilots sent fewer traffic-related messages to controllers and assumed more active roles in traffic management. Communication problems resulted from information load, the novelty of pilot-initiated traffic calls, pilots' lack of access to aircraft call signs and lack of knowledge of aircraft call signs and variability in air traffic controllers' message structure. The author said that new operating procedures and new operational communications will be required to support CDTI and to provide guidance in collaborative decision making involving air-ground traffic flow management.

Aviation Rulemaking: Further Reform Is Needed to Address Long-standing Problems. U.S. General Accounting Office (GAO). July 2001. GAO-01-821. 104 pp. Figures, tables, appendixes. Available through GAO.**

GAO, which conducts research for the U.S. Congress, reviewed the U.S. Federal Aviation Administration (FAA) rule-making process to identify methods of improving efficiency.

FAA has a range of responsibilities affecting aviation, such as developing regulations to improve aviation safety and security and to promote efficient use of airspace. The requirement for rule making is influenced by internal sources, such as FAA offices, and by external sources, such as Congress — which can order rule making — and the U.S. National Transportation Safety Board (NTSB) — which can recommend rule making.

For this report, GAO examined studies of FAA rule-making procedures to identify common factors that delayed the promulgation of rules. The studies identified three main areas of concern — management involvement, administration of the rule-making process and human capital. GAO focused on these three areas during an examination of 76 significant rule-making actions from 1995 through 2000 to measure the effects of FAA-initiated changes in the rule-making process since 1998.

GAO found that median times required to complete the rule-making process were not reduced and that the number of significant rules published by FAA decreased after the changes took effect. FAA began about 60 percent of the rule-making projects ordered by Congress and about 33 percent of the rule-making projects recommended by NTSB within six months of the mandate or recommendation, the report said.

The report said, "However, for one-fourth of the mandates and one-third of the recommendations, at least five years passed before FAA initiated the process."

A significant number of rule-making staff members believed that there were too many top-priority rules, too many instances of management changing priorities and not enough training to effectively perform their jobs. A new automated information and project management system was not implemented fully. GAO recommended that the U.S. secretary of transportation direct the FAA administrator to expedite the rule-making process by implementing fully the 1998 changes to address long-standing problems.

Books

Air Traffic Control. Duke, Graham. Eighth edition. Surrey, England: Ian Allan Publishing, 2001. 111 pp.

The author wrote this guide for aviation enthusiasts who enjoy listening to messages between pilots and air traffic controllers. He said that his intent was to offer sufficient information and detail for aviation enthusiasts to keep informed about the latest developments in air traffic control and to understand the arrangements for controlling air traffic in the airspace of the United Kingdom and the North Atlantic. Topics covered are: airspace classifications, aviation language, charts and other publications, meteorology, flight management systems and free-flight concepts.

Understanding Aviation Safety Data: Using the Internet and Other Sources to Analyze Air Travel Risk. Curtis, Todd. Warrendale, Pennsylvania, U.S.: Society of Automotive Engineers, 2000. 209 pp.

Before the proliferation of advanced communications such as the Internet, e-mail and 24-hour television news, access to in-depth aviation data was limited primarily to academia, aviation professionals, legal professionals and policymakers.

Today, there is public access to data and information from governments, news media and industry sources; nevertheless, the author said that not all public users have sufficient understanding of the limitations of raw data or of methods to interpret and to evaluate critically the information and data that they find.

Drawing upon his professional experience in risk assessment and safety analysis, the author provides guidance to those who need to use data and analysis to answer questions about aviation safety. He uses information resources, case studies and instructions to address the following topics: "Key fundamental concepts of risk and safety; how aviation safety data [are] collected and used for analysis; the role of the World Wide Web in providing access to aviation safety data; traditional sources of publicly accessible data; a systematic process for planning and executing aviation safety analyses; and examples of how the process can be used to analyze aviation safety data from the Internet, libraries and other public sources."

Advisory Circulars

Fuel Tank Ignition Source Prevention Guidelines. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 25.981-1B. April 18, 2001. Figure. 27 pp. Available through GPO.***

This AC provides guidance for demonstrating compliance with certification requirements for preventing ignition sources within fuel tanks of transport category airplanes. This guidance applies when a new type certificate, amended type certificate or supplemental type certificate is requested; the guidance is directed to airplane manufacturers, modifiers, foreign regulatory authorities and FAA transport airplane type certification engineers and their designees. The AC discusses ignition sources, design considerations, fuel tank system analysis, assessment of components and instructions for continued airworthiness of a fuel tank system.

[This AC cancels AC 25.981-1B, *Guidelines for Substantiating Compliance with the Fuel Tank Temperature Requirements*, dated Jan. 20, 1971.]

Fuel Tank Flammability Minimization. U.S. Federal Aviation Administration (FAA) Advisory Circular (AC) 25.981-2. April 18, 2001. 22 pp. Figures, appendix. Available through GPO.***

This AC provides information and guidance for demonstrating compliance with airworthiness standards for transport category airplanes for which a new type certificate, amended type certificate or supplemental type certificate is requested. The AC is directed to airplane manufacturers, modifiers, foreign regulatory authorities and FAA transport airplane type certification engineers and their designees. The AC provides information about minimizing fuel tank flammability and mitigating hazards if ignition of fuel vapor occurs.♦

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Accident/Incident Briefs

Engine Failure Prompts Unscheduled Landing of A300

An investigation showed that separation of a high-pressure turbine stage 2 rotor blade caused the engine to lose power.

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

Holes Found in Engine Core Cowl, LPT Case

Airbus A300B4-605R. Minor damage. No injuries.

The airplane was being flown at Flight Level (FL) 290 (29,000 feet) over Casablanca, Morocco, during a flight from England to the Gambia when the flight crew observed a vibration indication and a loss of thrust from the no. 2 engine, a General Electric CF6-80C2A5 turbofan. The no. 2 engine high-pressure turbine (HPT) vibration indication increased to 5.8 units.

The flight crew disconnected the autothrottles, applied maximum continuous thrust to the no. 1 engine and set the throttle lever for the no. 2 engine to idle. The HPT indication decreased to 5.0 units, then increased to 5.6 units. The crew declared an urgency (pan-pan) and landed at an en route airport.

Investigation revealed a hole with a 12-inch (30-centimeter) circumference in the left-hand core cowl of the no. 2 engine, a smaller hole in the right-hand core cowl and a 0.5-inch (1.3-centimeter) opening in the low-pressure turbine (LPT) case. The stage 5 rotor blade-tip shrouds were missing, and several blades were bent opposite the direction of rotation. One blade-tip shroud was in the opening of the LPT case, and pieces of blades and tip shrouds were found in the engine cowls.

The preliminary accident report said that the engine failure originated with the separation of an HPT stage 2 rotor blade, which broke above the blade platform.

"The fracture had propagated from the edge of a 0.25-inch (0.64-centimeter) deep notch, which had been worn in the blade leading edge," the report said. "Similar notches were found on all of the stage 2 blades."

Several HPT stage 2 nozzle segments were cracked and were in contact with the leading edges of the stage 2 blades. The manufacturer said that similar failures had occurred previously and that Service Bulletin (SB) CF6-80C2 72-0952 had been issued in December 1998 recommending a borescope inspection of part no. 9373M80G29/G30 HPT stage 2 nozzles to check for cracks and other signs of metal distress. The inspection for the HPT stage 2 nozzles was included in a revised service bulletin issued in June 2000. The operator had not conducted the inspection and was not required to conduct the inspection because the service bulletin was "not of mandatory status," the report said.

The report said, “It is believed that the cracked stage 2 nozzles would have been identified and that corrective action could have been taken in time to prevent the engine failure had the nozzle inspections been accomplished.”

The U.K. Air Accidents Investigation Branch recommended that the U.K. Civil Aviation Authority and the U.S. Federal Aviation Administration issue instructions requiring operators to conduct borescope inspections of the HPT stage 2 nozzles to check for nozzle cracking and other signs of metal distress in accordance with SB CF6-80C2 72-0952.

Airplane Was Taxied Onto Closed Taxiway During Rainstorm

Airbus A340-300. No damage. No injuries.

During the landing rollout at an airport in Japan, the flight crew’s visibility was reduced by moderate-to-heavy rain. Airport lighting was not illuminated.

The airplane was taxied onto a closed high-speed taxiway. The flight crew stopped the airplane and told air traffic control the location of the airplane. The flight crew received clearance to taxi but decided to have the airplane towed to the gate because of the proximity of taxiway lights.

After the incident, warning lights were installed across the entrance to the closed taxiway.

Holes Found in Fuselage Skin After Emergency Descent, Landing

Boeing 767. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the afternoon flight from an airport in the Dominican Republic.

The airplane was being flown at Flight Level 310 (31,000 feet) when the captain observed a cabin-altitude warning indication. He conducted an emergency descent to 10,000 feet, dumped fuel and returned to the departure airport for a normal landing.

An inspection showed that the “left overwing slide-compartment door was missing and the slide had disintegrated,” the report said. “Two holes were found in the left-aft fuselage skin.”

The inspection also showed that electrical wires were damaged.

Duct Tape Found in Engine Inlet

Fokker F28. No damage. No injuries.

The airplane had been leveled off in cruise flight over Canada when a passenger observed a roll of duct tape wedged against the stator vanes in the inlet to the no. 1 engine. The flight crew was informed, and they shut down the no. 1 engine as a precaution.

The flight crew did not declare an emergency and continued to the intended destination, where a normal landing was conducted. The company maintenance department was investigating to determine the source of the duct tape.

Air Taxi Commuter

Flight Crew Ditches Airplane After Double Engine Failure

Shorts SD3-60. Destroyed. Two fatalities.

Visual meteorological conditions prevailed for the departure from an airport in Scotland. The airplane, which was being used for a scheduled mail flight, had been parked on the ramp from midnight until about 1700; during that time, there were periods of light snow and moderate snow and temperatures around 2 degrees Celsius (36 degrees Fahrenheit).

The flight crew received a start clearance at 1503, but at 1512 they told air traffic control (ATC) that they were shutting down the engines. They told their company that a generator was not functioning. Both engines were started and were operated at low power on the ground while an avionics technician examined the airplane and found no anomalies. The engines then were shut down.

The engines later were restarted, and after 20 minutes, the crew received taxi clearance. While taxiing, the flight crew conducted an autofeather test and observed the automatic operation of the engine anti-icing vanes.

They conducted a normal takeoff, reduced power to climb power at 1,200 feet and turned on the anti-icing systems at 2,200 feet.

The accident report said, “Three seconds later, the torque on each engine reduced rapidly to zero. A mayday call was made by the crew advising that they had experienced a double engine failure. A further call was made advising ATC that the aircraft was ditching.”

The report said that, because the time between the failure of the first engine and the failure of the second engine was 0.37 second, the failures probably resulted from a common event.

"The possibility is being considered that a change of intake conditions, caused by the activation of the anti-ice vanes in flight, might have resulted in the simultaneous failure of both engines," the report said. "Engine blanks [covers] had not been fitted during the period when the aircraft was parked at Edinburgh. It is therefore probable that there was an accumulation of snow in the engine air-intake systems. … It is also possible this did not clear during the interval of clear weather or during the low-power engine runs. Icing conditions were not present during flight, and the airframe was reported to be clear of ice prior to departure.

"The mechanism by which operation of the inertia separator vanes may have interacted with residual ice, snow or slush to cause engine power loss is not understood at present."

The U.K. Air Accidents Investigation Branch recommended that the U.K. Civil Aviation Authority (CAA) require the manufacturer to tell operators about the possibility that snow accumulation in engine air intakes while the airplane is parked could result in engine failure and that such an engine failure could be "precipitated by a change of intake conditions resulting from the activation of the anti-ice vanes." CAA accepted the recommendation.

Flight Attendant Injured During Turbulence

Avions de Transport Regional ATR 42-300. No damage. One serious injury.

Instrument meteorological conditions prevailed for the flight from an airport in the Bahamas. The airplane was being flown at 16,000 feet when moderate turbulence to severe turbulence was encountered.

The captain said that the airplane was being flown through light rain and that the weather-avoidance radar showed no serious convective activity. The flight crew was given vectors around turbulence that air traffic control said was about 20 nautical miles to 30 nautical miles (37 kilometers to 56 kilometers) ahead, but the airplane encountered turbulence after entering a cloud. During the encounter, a flight attendant broke two bones in her right leg; the captain subsequently declared a medical emergency.

The flight continued to the destination airport for a normal landing.

Airplane Tips While Being Unloaded After Flight

Shorts SC.7 Skyvan. Minor damage. One serious injury.

The airplane was parked in front of a hangar at an airport in Canada after completion of a charter flight. The four occupants, including the pilot and a maintenance technician, deplaned and prepared to unload equipment from the rear cargo compartment. Before extending the "pogo stick" to support the airplane's tail, the pilot opened the cargo door and climbed into the cargo compartment. As the airplane began to tip back, the pilot exited the cargo compartment and tried to brace the fuselage with his leg. The airplane's tail moved to the ground, trapping the pilot under the fuselage; the pilot's leg was broken. A tractor equipped with lift forks was used to lift the fuselage; the trailing edge of the elevator was damaged when it was struck by a lift fork.

The operator said that this was the fifth time that one of its Skyvans had tipped because the pogo stick was not placed in position after shutdown.

Corporate Business

Compressor Stall Prompts Engine Shutdown, Ditching at Sea

Pilatus PC-12/45. Destroyed. One minor injury.

The airplane was being flown from Japan to Russia in instrument meteorological conditions at 8,000 feet when the pilot felt a vibration and observed an increase in the engine's turbine temperature indication (TTI). TTI increased further, and a compressor stall occurred.

The pilot shut down the engine, feathered the propeller and began a power-off emergency descent. During the descent, the pilot declared an emergency, set the transponder code to 7700 and activated the emergency locator transmitter. The airplane emerged from the overcast about 100 feet above the Sea of Okhotsk in the western Pacific Ocean, and the pilot ditched the airplane, which at first floated in an upright attitude. All four occupants exited the airplane and climbed into a life raft. Fifteen hours later, they were picked up by the crew of a Russian container ship.

Airplane Strikes Terrain After Engine Shutdown

Piper PA-31-T2 Cheyenne II. Airplane destroyed. Five fatalities.

Visual meteorological conditions prevailed for the afternoon flight from an airport in the United States. About 30 minutes after takeoff, the pilot told air traffic control (ATC) that he was shutting down the left engine.

Ten minutes later, the pilot requested radar vectors for an instrument landing system approach to a nearby airport. Five minutes later, the pilot said that he was experiencing a propeller runaway. Then the pilot told ATC that he was in visual meteorological conditions and requested radar vectors to the airport. Soon afterward, however, he said that there were clouds beneath the airplane and that he had set navigation equipment for the localizer frequency. He acknowledged ATC instructions to contact the control tower; no further transmissions were received.

Witnesses saw the airplane flying below clouds at 150 feet.

"The airplane … made a gradual turn to the left and was lost from sight behind trees," the accident report said. "The engine noise was increasing and decreasing. Engine noise then stopped and about 10 seconds later, [the witnesses] heard tree branches breaking and then a loud pop."

When the witnesses found the wreckage, small fires were burning in the nose and in the right engine.

Helicopter's Main-rotor Blade Strikes Taxiing Airplane

Gulfstream Aerospace Gulfstream IV. Minor damage. No injuries.

Bell 206B. Substantial damage. No injuries.

The helicopter was parked at an airport in the United States, and the airplane was being taxied to a parking space with assistance from line-service personnel when the helicopter's main-rotor blades struck a winglet on the airplane.

The helicopter pilot said that he had not yet called ground control and that he had started the engine of his helicopter. He said that he had observed line-service personnel gesturing to the airplane pilot to taxi between his helicopter and another airplane. (Three line-service personnel were walking with the airplane — one at each wing and the third at the airplane's nose.)

The airplane pilot said that he observed passengers boarding the helicopter. Initially, he saw no movement of the main-rotor blades.

"He then saw the main-rotor blades turn about three times," the report said. "He further reported that, because the cockpit was past the helicopter when the main-rotor blades struck the winglet, he did not see the rotor-blade strike but did hear it."

The wing-walker on the right side of the airplane said that there was a clearance of about 10 feet (three meters) between each wing and the parked aircraft and that he believed there was room for the airplane to be taxied safely. He said that he was standing about two feet (0.6 meter) in front of the helicopter's main rotor blades and that as he walked, he heard the engine starting.

"He turned around … and tried to obtain the attention of the pilot but was unable to," the report said. "He then ducked to get out of the way of flying objects. The wing walker indicated that he did not see the pilot and passengers of [the helicopter] enter the cockpit, nor was there any warning that the pilot was going to start the engine."

A line-service worker who had helped passengers board the helicopter said that after the helicopter's door was closed, he began moving away from the helicopter.

"He heard the engine start," the report said. "He stated that he was scared because the main-rotor blades were turning, and he ducked to get out of the way. He further stated that he did not see the pilot … clear the area before starting the helicopter."

Other General Aviation

Power Loss Follows Sideslip Landings

Piper PA-18 Super Cub. Substantial damage. No injuries.

The pilot was receiving instruction in crosswind approaches and landings on a grass runway in England and had flown four approaches using the sideslip technique to counter the crosswind.

After the fourth approach, the airplane touched down normally on Runway 11, and the pilot selected flaps up and carburetor heat cold and applied full power for another takeoff.

The accident report said, "At about 30 feet [above ground level], and without warning, the engine suddenly failed. The instructor took control and landed the aircraft straight ahead, but there was insufficient runway remaining in which to bring the aircraft to a halt, and the instructor judged that the aircraft would impact the perimeter hedge. He therefore deliberately induced a ground loop to the right, and the aircraft came to a halt to the south of the runway … . During the ground loop, the engine restarted without input from the crew."

An investigation showed that there was adequate fuel, no problem with the engine and no water in the fuel system. There was no oil or soot on the spark plugs, and the electrical system was "serviceable," the report said. The pilot said that carburetor icing might have caused the loss of power, but the accident report said that carburetor icing was unlikely.

Maintenance personnel said that they believed that the engine "might have been starved of fuel after prolonged sideslipping. Although the right tank was quite full, they considered that the normal fuel feed from the right tank might have been interrupted in a right-wing-down attitude, and the engine feed would therefore have been dependent on fuel flow from the right header tank only. The repeated prolonged sideslip approaches would have used fuel from the header tank, possibly to the point where, during the climb-out on the final touch-and-go, the header-tank fuel was exhausted before fuel flow from the right-main tank could be re-established. During the ground loop to the right, normal forces could have helped re-establish fuel flow to the engine."

The manufacturer found no record of a similar incident.

The report said, "An air test, carried out after the aircraft had been repaired, sought to replicate the loss-of-power symptoms after prolonged sideslips but without success."

Airplane Strikes Power Lines During Attempted Landing

Cessna 210M. Substantial damage. One serious injury.

Visual meteorological conditions prevailed for the approach to a private road in the United States.

The accident report said that witnesses told investigators that the pilot had landed the airplane on the road "hundreds of times." The witnesses were keeping vehicles and animals away from the road while the pilot maneuvered the airplane for landing.

"During the approach, the airplane's nose contacted four power lines approximately 20 feet [six meters] AGL [above ground level] that intersected perpendicular to the road," the report said. "The power lines stretched, snapped, and the airplane impacted the ground in a nose-low attitude."

The power lines were not marked.

Pilot's Heart Ailment Blamed for Fatal Accident

Beech V35B Bonanza. Destroyed. Four fatalities.

The airplane was being flown at 11,000 feet during a flight from Germany to Sweden. There were clouds below 17,000 feet, and the pilot was flying according to instrument flight rules.

The pilot had questioned air traffic control about weather en route and at the destination airport. Later, an air traffic controller observed on radar that the airplane had climbed to 11,400 feet, then descended to 8,500 feet and disappeared from radar.

The accident report said, "When the air traffic controller observed the aircraft performing the unexplainable altitude changes, he called the pilot several times without receiving any response."

Witnesses said that after the airplane descended beneath the cloud base at 3,000 feet, the engine made a "loud and piercing" sound, and the airplane made a climbing turn, then flew nose-first into a wooded area.

The investigation showed that, several years before the accident, the pilot (who was 58 years old when the accident occurred) experienced an irregular heartbeat and was diagnosed with hypertension (high blood pressure) and that he had been examined regularly by a heart specialist. Results of an electrocardiogram and other tests conducted during his last examination, three months before the accident, were considered satisfactory. His aeromedical certification was renewed the same month.

About a week before the accident, the pilot experienced slight discomfort in his chest and left shoulder but believed that it was not serious and did not consult a physician.

The report said that the accident probably was caused "by the pilot being stricken by acute heart problems, in connection with the aircraft entering an area with severe turbulence and icing, which made him incapable of controlling the aircraft."

A contributing factor might have been that the center of gravity (CG) was behind the aft CG limit, the report said.

Glider Struck by Airplane's Tow Rope

Piper PA-25-235 Pawnee. Substantial damage. One minor injury.

Visual meteorological conditions prevailed for the afternoon flight from an airport in England. The airplane departed with a glider in tow, and the glider was released from the airplane at about 2,200 feet about one mile (1.6 kilometers) east of the airport. Three other gliders were being flown nearby.

The pilot of the airplane observed two gliders being flown above a ridge north of the airport and began a descent, intending to drop the 60-meter (197-foot) tow rope at the glider launch point before entering the traffic pattern to land the airplane. As the pilot completed a left turn and leveled the airplane's wings, she observed a third glider about 200 meters (656 feet) ahead and "on a collision course at a high closing speed," the report said.

"At the same instant, the glider pilot saw the [tow plane] coming toward him and slightly above," the report said. "Both pilots took immediate avoiding action, with the glider diving and continuing the right turn and the [airplane] pilot turning hard left and applying full power to climb away. The [airplane] pilot felt a slight tug on the tow rope and realized that it had contacted the glider."

The metal ring (used to connect the glider to the tow rope) struck both of the glider's wings and broke the cockpit canopy. A passenger in the glider was cut and scratched by the broken plastic.

The report said that the glider may have been obscured from the airplane pilot's view because of the airplane's long nose and because of reflection caused by a white paper placard. After the accident, the placard was removed and the gliding club considered equipping the airplane with a device to allow the tow rope to be reeled in and stowed for descent and landing.

Computer Shuts Down Engine of Homebuilt Airplane

TRI-R KIS Cruiser TR-4. No damage. No injuries.

The airplane was being flown by the pilot and the owner-builder at an airport in South Africa when the laptop computer that was connected to the engine-management computer displayed a "cam sensor failure" message.

The engine-management computer determined that there was a mechanical problem that could cause damage, and the computer automatically shut down the engine. The owner-builder tried to reset the engine-management computer and to restart the engine. The engine started but operated for only a brief time until it was shut down automatically again.

The report said that the pilot misjudged the high sink rate and landed the airplane short of the runway threshold on a grass embankment.

Airplane Overruns Grass Runway During Landing

Yakovlev Yak-52. Substantial damage. No injuries.

Visual meteorological conditions and calm winds prevailed for the landing on a 1,300-foot-long (397-meter-long) grass runway at an airport in the United States.

The pilot, who recently had purchased the airplane and who reported 3,064 total flight hours and 14 flight hours in the make and model, said that the airplane touched down in the first quarter of the runway and that he "applied brakes but was not getting any braking action."

The accident report quoted the pilot as saying, "As I applied more brakes, the aircraft began to just skid down the grass runway. … I was thinking of going around, but with full flaps down and trees on the opposite end of the runway, I elected to continue to try to stop."

The airplane continued past the departure end of the runway and over an embankment and stopped on railroad tracks.

Examination of the airplane revealed no pre-accident mechanical malfunctions.

The airport manager said that the location the pilot identified as the touchdown point was about 650 feet (198 meters) beyond the runway threshold.

Rotorcraft

Helicopter Overturns During Emergency Landing

Aerospatiale AS 350B2 Ecureuil. Substantial damage. No injuries.

The helicopter was being flown on a sightseeing trip in South Africa. During a descent through 100 feet above ground level, there was a bang, which "appeared to come from directly behind the rear-seated passengers," the accident report said.

The helicopter yawed left, rolled right and shuddered. The report said that the cyclic control and the collective control "became heavy, as if there was a hydraulic failure." The pilot lowered the collective control to stop the yaw and pulled back on the cyclic control to stop the roll. He did not recall hearing a warning alarm or seeing warning lights.

The helicopter was landed at a low forward speed on both skids on an uphill incline. The main-rotor blades struck an embankment on the right side of the helicopter, and the helicopter overturned.

Pilot's Actions Blamed for Helicopter Accident

Eurocopter EC 120 B Colibri. Substantial damage. One minor injury.

The pilot landed the helicopter on a helipad trailer next to a hangar at an airport in Sweden. Before reducing rotor speed and locking the collective, the pilot opened the right cabin door to check the position of the helicopter on the trailer; the left-landing-gear skid lifted, and the helicopter turned left.

The pilot then hovered the helicopter about three feet above the trailer and allowed the helicopter to turn left. The pilot said that he intended to turn the helicopter 180 degrees, to climb and to conduct another approach and landing on the trailer. Instead, when the pilot applied right pedal, the helicopter's left rotation increased. When the pilot tried to fly the helicopter out of the rotation, uncontrolled oscillations began at 20 feet to 30 feet (six meters to nine meters) above ground level. The pilot then tried to end the flight by moving the control stick aft and to the right and moving the collective down. The helicopter struck the ground and came to rest on its right side.

The accident report said that the probable cause of the accident was "the fact that the pilot did not hastily enough and with sufficient rudder input stop the left-hand yaw, which began in connection with the helicopter's unplanned liftoff."

Loss of Tail-rotor Effectiveness Prompts Landing

Bell 206B. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the morning aerial application flight in the United States.

The pilot had completed a spraying pass and was flying the helicopter through 100 feet when he heard a bang and felt the tail rotor lose effectiveness. The pilot conducted an autorotation to land the helicopter on the far side of a line of trees. The helicopter landed hard, and the skid mounts were pushed into the fuel cell.

The preliminary accident report said, "The Thomas coupling disc assembly was twisted and bent, and the tail-rotor drive shaft just aft of the coupling was bent and separated, about mid-length. In addition, an AN174-7A retaining bolt was missing from the no. 1 Thomas coupling."

The retaining bolt and washers later were found, apparently undamaged, in the tail-rotor drive shaft tunnel area. The bolt's retaining nut was not found. Maintenance records showed that the tail assembly was replaced 57 flight hours before the accident.

Missing Oil Cap Prompts Engine Shutdown

Bell 212. No damage. No injuries.

After departure from an airport in Canada, the pilot observed decreasing oil pressure on one engine. He shut down the engine and advised air traffic control that one engine had failed and declared an emergency. The helicopter was flown about seven nautical miles (13 kilometers) to the departure airport for landing.

Investigation revealed that an oil cap had not been replaced. Oil was added to the engine, the cap was replaced and a ground run was conducted before the helicopter was returned to service.

Helicopter Strikes Terrain During Landing Attempt on Foggy Night

Bell 206L-3. Destroyed. Five fatalities.

Night instrument meteorological conditions prevailed for the emergency medical services flight in Australia.

Because of fog, the pilot was unable to use the customary landing site and therefore requested that the driver position the ambulance near a lighted highway intersection. As the pilot attempted to land the helicopter near the intersection, the helicopter struck the ground in a paddock about 300 meters (984 feet) away.

Inspections of the wreckage and the engine revealed no pre-accident technical defects.

Faulty Temperature Gauge Cited in Engine Failure

Hughes 369E. Substantial damage. No injuries.

Visual meteorological conditions prevailed for the afternoon flight from an airstrip in the United States. The pilot said that the warm-up and liftoff were normal but that as the helicopter's speed increased to 30 knots to 35 knots, at about 15 feet to 20 feet (five meters to six meters) above ground level, he felt the helicopter stop climbing. The engine-out audible warning sounded, and the engine-out warning light illuminated. The pilot conducted an emergency landing, and during the landing, the main-rotor blades struck and severed the tail boom.

The accident report said that post-accident inspections revealed that "the TOT [turbine-outlet temperature] indicated on the cockpit gauge was below actual engine-outlet temperatures and that lower-than-actual TOT readings provided to the pilot via the cockpit TOT gauge may have resulted in numerous operations being conducted in higher temperature ranges than … authorized by the pilot's flight manual and/or the engine manufacturer's temperature limitations."

Inspections also revealed that failures and stress ruptures throughout the engine turbine assembly components had resulted from engine operations at temperatures higher than 2,000 degrees Fahrenheit (1,093 degrees Celsius). The report said that the probable cause of the accident was that the TOT indicating system was out of calibration; the report said that factors included improper maintenance calibration.♦

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