ISASI FORUM

"Air Safety Through Investigation"

OCTOBER–DECEMBER 2005

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John D. Rawson, left, accepts the 2005 Jerome F. Lederer Award from ISASI President Frank Del Gandio during ceremonies at the Society's annual seminar (see page 12). The award is the highest laudation bestowed by ISASI. Photo: Esperison Martinez, Editor.

ISASI FORUM
"Air Safety Through Investigation"

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AIR SAFETY INVESTIGATORS
INCORPORATED AUGUST 31, 1964

Welcome to Texas

By Frank Del Gandio, President

(President Del Gandio's September 13 opening remarks to the delegates of ISASI 2005 have been abbreviated.—Editor)

Texas has always had a special place in American folklore. To most Americans and to many people in other lands, Texas symbolizes open space, self-reliance, and, perhaps most of all, size—everything associated with Texas is BIG. The state is nearly twice the size of Japan, or 1,000 square miles bigger than France, Belgium, the Netherlands, Luxembourg, and Denmark combined.

It's fitting that we should meet in Dallas-Fort Worth, an area rooted in transportation: first as an early cattle town, then as an early railroad center; now as an aviation center with two of the world's four largest air carrier fleets in American and Southwest, and the world's largest regional airline in American Eagle. The region also is home to DFW, one of the world's largest airports and to Love Field. The region also has an important history in aircraft manufacturing: General Dynamics and Bell Helicopters and other aerospace firms. Yes, aviation has a strong presence here.

Our strong presence is in aviation safety. Once again, the past year's accident rate reminds us that we who work in air accident investigation and aviation safety are not at risk of going out of business. But I must tell you that when I first drafted my comments in mid-July, I was touting the wonderfully safe year that we had. At that time, the log showed four jet accidents of note, worldwide, with 185 fatalities, most of which occurred in a single event.

Noteworthy jet accidents included the Kam Air CFIT accident in Afghanistan killing 104; a China Eastern RJ takeoff crash killing 53; a high-speed overrun by Lion Air of Indonesia killing 25; and an Iranian B-707 that landed long and overran at high speed into a river, drowning 3 of 176 occupants. Then, I planned to add a fairly short list of five significant turboprop accidents, with 99 fatalities. Overall, I was prepared to argue 2005 was a good year with continued long-term improvements in air safety, particularly at the air carrier level.

However, as I was working on that draft, an AN-24 crashed on climb-out in Equatorial Guinea, killing all 62 occupants. Then came August and early September: On August 2, an Air France A340 overran at high speed in Toronto, with no fatalities but a badly burned-out airplane. Just 4 days later, a Tunisian ATR 72 ditched off the coast of Sicily, killing 16 of 39 occupants. Then came the Helios Airways B-737-300 in Greece (121 fatal), the Colombian MD-80 that crashed in Venezuela (160 fatal), then a B-737-200 operated by TANS of Peru, killing 40 people. Finally, a B-737-200 crashed on climb-out in Indonesia, killing 111 on board and up to 50 people on the ground.

In just 5 short weeks a good story turned into a bad story, with six major accidents and some 500 fatalities. This brought the total to eight major jet accidents, seven major turboprop accidents, and close to 800 fatalities in air carrier passenger operations since we last met. Clearly, the past year or so has not been such a good story.

All the major accidents of the past year remind us that when major accidents occur, the basic scenarios are all too familiar. For example, of the major accidents I mentioned, we had five CFITs, four undershoots, one windshear, and one fuel exhaustion. In short, when things go wrong, we continue to see the usual suspects.

Yet, the long-term story remains a good one. Just a few short years ago, we would have been thrilled with "only" eight major jet accidents. In fact, we can expect the long-term improvement in accident rates to continue and even to accelerate. We will continue to see more application of satellite navigation, such as RNP and Local Area Augmentative System (LAAS) or WAAS.

On the design side, manufacturers continue to make major advances in their ability to test new designs and materials, complete with lifecycle testing, before an actual aircraft is ever built. The cockpit, too, will continue to advance with synthetic and enhanced vision, vertical situation display, energy-state displays, electronic flight bags, fault isolation, etc. These are just some of the improvements that are under way or very close at hand in the airline world.

As promising as the future is for air carriers, the real revolution in aviation safety is coming in general aviation. Except perhaps for large corporate jets at the very top of the market, technology in general aviation had stagnated for years. That state of affairs is finally changing, and fast!

General aviation has incorporated satellite technology into the cockpit with precision navigation, much better displays, data link, air-to-air monitoring, on-board diagnostics—the whole package. Suddenly the term "glass cockpit" is part of the general aviation vocabulary. Every established manufacturer now offers a glass cockpit of one degree or another. New aircraft like the Cirrus SR-20 and SR-22 and the Diamond DA-40 already show 2,000 aircraft on the U.S. registry. These will soon be followed by micro-jets, such as the Adam-700, the Citation Mustang, the Diamond D-Jet, and the Eclipse.

In short, the air carrier industry, particularly among the richer countries of the world, already has achieved accident rates that we thought were beyond reach just a few years ago, and those rates will continue to improve. Meanwhile, we still have some work to do, and our annual seminars offer a chance to improve our skills and understanding of a broad range of issues in accident investigation and aviation safety in general. ◆

ISASI Website Gets New Look

By Richard Stone, Executive Advisor

At its May 2005 meeting, the International Council determined that the Society's website required change to meet some new needs. Up to this point, Corey Stephens, with support from corporate member the Air Line Pilots Association (ALPA), had developed and maintained the existing site at minimal cost to ISASI. We all appreciate that vital service Corey and ALPA provided.

However, it appeared that the web update and maintenance would require more time and resources than could be provided on a volunteer basis. We turned to a commercial concern, Communications by Design (CBD), a full-service technology company that provides repair, instruction, web hosting, and design.

After extensive exploratory sessions with Ann Schull, ISASI office manager, and myself, CBD has redesigned and expanded, by category, our website to allow for high efficiency with timely updates.

The changeover to the new server is now accomplished. Members and the general public can access the site using the same web address, http://www.isasi.org. The changes involve a new overall page design and website expansion that presents these nine categories:

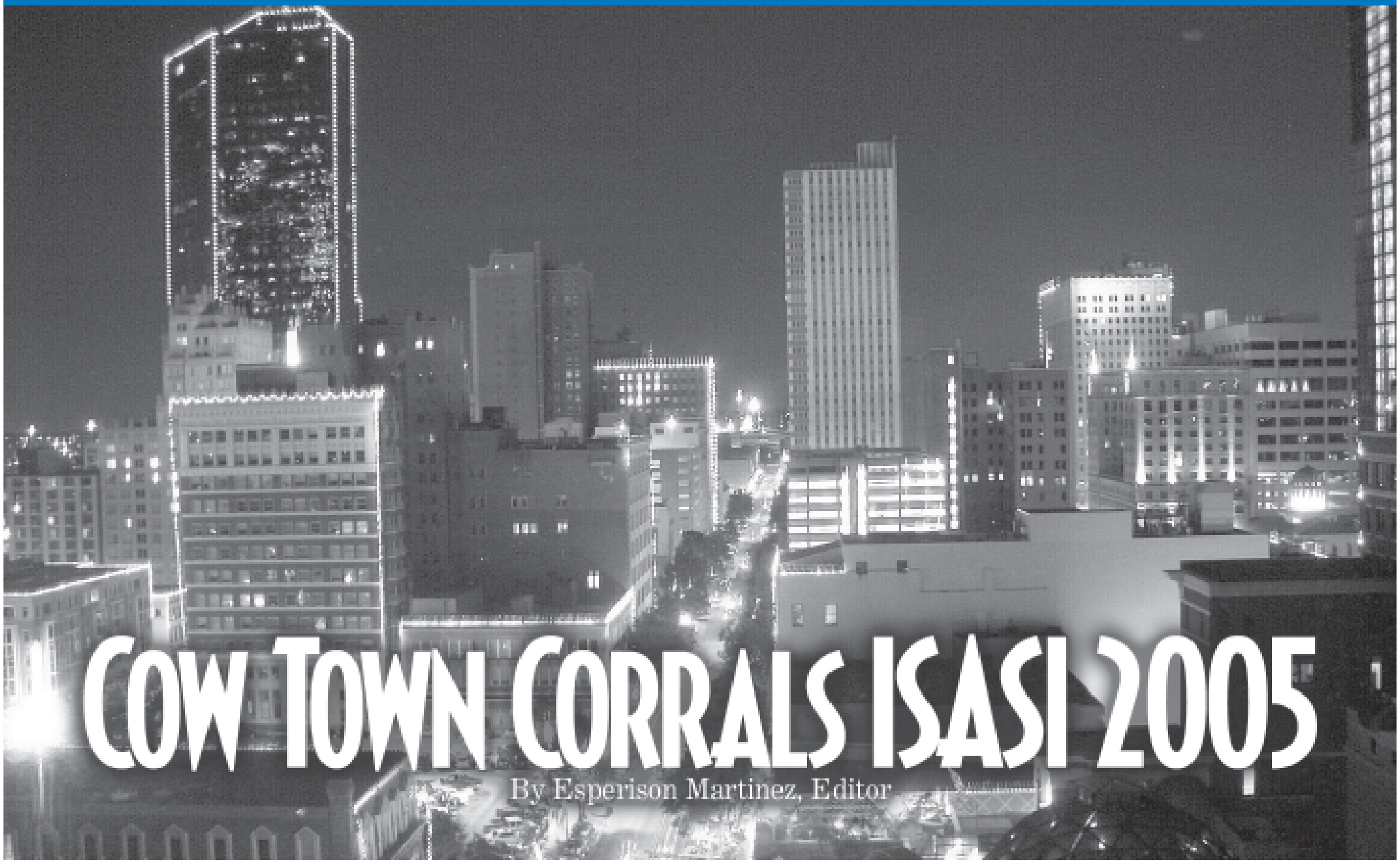
- **About ISASI—**two sections: (1) General—history, positions, guidelines; (2) Join—member classification definitions, applicable forms to join, upgrade classification, and reinstate membership.
- **Contact Us—**provides contact information for all elected officials, all chairmen of working groups and committees, *Forum* magazine, safety-related aviation resource Internet links, and the Government Air Safety Investigators Group Directory, which lists all official governmental investigation authorities worldwide, whether or not the authorities are members of ISASI.
- **Donations—**directions and form to forward a donation to ISASI (tax free for U.S. residents).

- **ISASI Kapustin Scholarship—**provides history, past winners and essays, application instructions, and form.
- **Jerry Lederer Award—**provides history, past winners, nomination instructions, and form.
- **Members Only**—two sections: (1) Requires sign in to access individual, corporate, or bibliography database. "User name" and "password" restrict access. Each member in good standing can enter his or her member number in the "user name" space and the member's first name will be the "password." All entries should be made in lowercase letters; (2) Publications & Governance—*Forum* magazine, Proceedings, ISASI By Laws, Code of Ethics and Conduct, International Council meeting minutes. (When downloading, members should be aware that the *Forum* material and Proceedings files are lengthy and can be time consuming to download.)
- **Promotional Items—**regalia wear and order form.
- **Reachout Workshops—**program defined and workshop reports (14).
- **Corporate Members—**list of corporate members. When a listing is "clicked," the user is taken to the appropriate Internet website.

Another significant change is that the membership, corporate directories, and the bibliography of *Forum* articles are now maintained from the ISASI computer system. This means that our office manager can make additions, deletions, or other changes in a more timely fashion.

Most of the other information on the web page is housed in the host computer system of Communications by Design. All matters pertaining to changing, updating, or editing any of the material on the website should be submitted to Ann Schull at isasi@erols.com by the first of the month; changes will occur monthly.

Submission and corrections by committee/working group chairpersons should follow the above procedures. This also applies to placing announcements on the home page. ◆



PHOTOS: E. MARTINEZ

COW TOWN CORRALS ISASI 2005

By Esperison Martinez, Editor

Everything about Texas is BIG, ISASI President Frank Del Gandio told the assembled attendees when he opened ISASI 2005 in Fort Worth, Tex., which is more reverently thought of in terms of “Cow Town, where the West begins.” So, it is fitting that this year’s seminar earned the tag of “one of the biggest” yet held: 431 total overall participants. This number represents 390 delegates and 41 companions. The 1-day tutorial program attracted 145 attendees, also a high for that part of the event. In all, 37 countries were represented in the makeup of the delegates.

City Mayor Mike Moncrief invited all to explore the city of “cowboys and culture,” nicely blending in the city’s preserved historic past with its successful urban renaissance. What the delegates quickly discovered was that their “corral” was the city’s Sundance Square, which is filled with restaurants, theaters, night clubs, and the expansive two-city-block large Renaissance Worthington Hotel, the conference hotel. The culture museum district was a $10 cab ride away, but well worth the trip to feast eyes on “western” art and sculpture. Similarly, the historic Stockyards area was also a drive away, but city-provided shuttles carried visitors to the place where cowboys once drove longhorns to market and played in poker and piano saloons.

Owing to the tightly woven programming of the event, tourist sights had to be seen before the seminar start date or after its end date. Some attendees managed to do this, as the majority registered on Sunday with the seminar opening on Tuesday. The registration welcoming kit contained an hour-by-hour agenda of the occurring events; full details of the local areas, including easily read maps, dining locations, and tourist brochures.

Other innovations developed by the seminar planners included a vastly energized and enlarged exhibitors’ area. In all, 29 companies opted to display their services at this ISASI event. The exhibit area was adjacent to the main hall, so the space was very busy during all coffee breaks and pre- and post-event times. Many of the exhibitors also gained “sponsor” status by contributing funds to the success of the seminar. This year, sponsors were able to select a specific event with which they wished their contribution to be associated.

In another move to hold attendees’ attention, drawings of donated prizes were made at unannounced times throughout the technical programs. As expected, some of the prizes were domestic and international airline tickets, many models of airliners, and an array of smaller, but useful, prizes. A highly appreciated innovation was the establishment of a “network café” donated by RadioShack, which gave attendees computer and printer access, including Internet and e-mail capability.

Tutorials

While the seminar is a 3-day event, it is a weeklong affair because of the full day of tutorials that occur on the first day of the week and the post-seminar social tour that occurs on the last day of the week. This year was no exception and the two tutorials squared nicely with the overall program theme “Investigating New Frontiers in Safety.” The first tutorial dealt with helicopter accident investigation basics and the second with emergency response preparedness.

The helicopter session was very apropos for the area as Fort Worth is the home of Bell Helicopter, as well as the center of a great deal of helicopter activity to service offshore oil rigs. The cadre of rotary-wing experts speaking included Matthew Rigsby, FAA; Chris Lowenstein, Sikorsky; Yasuo Ishihara, Honeywell; Sergio Sales, Safety and Security Ltd, Brazil; and Tom

ISASI 2005 registrants receive their "welcoming" kit to the annual seminar. In all, 431 delegates and companions from 37 countries attended.

Workman, Shell Oil Company.

Providing the proverbial "All you ever wanted to know…," the helicopter speakers covered a large number of topics. Rigsby, from FAA's Rotorcraft Directorate, provided an analysis of U.S. civil helicopter accidents. He related that rotorcraft operations with the highest numbers of accidents were restricted category, air medical, and Gulf of Mexico. The top operational causes of accidents included wire/object strikes and flight into terrain/water. The number one cause of fatal accidents was fuel starvation. He went on to reveal the main mechanical causes of accidents in turbine and recip craft in the 1998-2004 period.

He noted that the helicopter medical emergency service (HEMS) operations have increased 100 percent between 1999 and 2004 with 660 rotary-wing flying an estimated 300,000 hours annually, accounting for one takeoff every 90 seconds in the U.S. The country's areas of greatest HEMS activity are the East, West, and Southern Coasts. In the 1998-2004 period, 85 HEMS accidents occurred, 27 of which recorded 74 fatalities; 21 of the 27 fatal accidents occurred at night. The FAA's Emergency Medical Service Task Force remains heavily involved in working with the air medical community in developing intervention strategies for reducing the accident numbers.

Rigsby's morning-long presentation was interrupted by a fire alarm that sounded, emptying the lecture level floor; it proved false. Upon return, Rigsby continued and included full statistical data on Gulf of Mexico operations (off shore) and restricted category (External Load Part 133, Agricultural Craft Part 137) operations. He may be contacted at matthew.rigsby@faa.gov.

Indeed, offshore helicopter operations were a heavy topic of the tutorials. Both Sales and Workman addressed the subject. Workman, addressing helicopter safety in the oil and gas business, talked about Shell Oil Company's safety experience and presented an accident review and a lessons learned review that led into a risk management analysis. He said he wanted to leave the audience with three main points: (1) Passenger risk in a helicopter is on an order of magnitude greater than and airliner; (2) Helicopter safety can be improved (he delved into how it could be done); (3) Success needs a combined effort from regulators, manufacturers, operators, and their customers.

Sales, too, turned to offshore operations, only in Brazil. At the outset, he gave a clue to the gravity of his presentation by saying: "I hope this presentation can help you to develop some kind of accident prevention procedures…. We are here to share experiences, not to point fingers at anyone, so we are not going to talk about companies or crew names."

With that he began his presentation on offshore operations characteristics in the Campos area of Brazil and a look at offshore accidents and incidents in the 5 years previous to 2005. He described the Campos oil area: southeastern Brazil; 100,000 thousand square kilometers, producing 1,265,000 barrels a day; 500,000 passengers per year. His talk centered on problems caused by helidecks locations, sizes, obstacles, and turbulence. The talk was supported by digital images of accident investigation scenes. He noted that there are many types of helidecks with various obstacles to overcome, such as roll and pitch on ship pads, and cranes on stationary platforms. Types of accidents encountered run the full scale: one engine inoperative, birdstrikes, hard landing, hovering hard over, and disbelieving new technology.

Speaker Ishihara concentrated his presentation on CFIT accidents and helicopter EGPWS. He provided a short flight history of data recovery in helicopter operations and described the workings of helicopter enhanced ground proximity warning system (EGPWS). He said that

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Above: Technical presentations revolved around data mining, analysis, and research, providing emphasis on aviation safety management. Left: Q-&-A sessions proved zestful and probing.

two-thirds of all helicopter accidents result from controlled flight into terrain (CFIT).

In describing the various modes of operation of the EGPWS, he explained that Honeywell developed a version of EGPWS specifically designed for helicopters. The helicopter EGPWS provides terrain awareness display and terrain alerting system customized for helicopter operations. A high-resolution terrain/obstacle database is included in the system. By knowledge of the aircraft's 3-D location, speed, and track, EGPWS can "see" conflicting terrain/water/obstacles along the flightpath that may not be seen by the pilots or a radio altimeter, and provides visual and aural alerts to the pilots when a threat is detected. He also reminded the audience that GPWS cannot be used for navigation, but only for situational display. He, too, showed a series of helicopter accident scene images to impact his discussion.

There were 50 attendees to the second tutorial, emergency response preparedness, which encompassed aircraft accident management and family assistance issues and was presented by Marten Bosman, Advance Aviation Safety Services, and Christa Meyer Hinckley, an aviation attorney in private practice.

Bosman's presentation stressed his view of the need to develop an aircraft accident management system to enable airlines to be better prepared to respond rather than just by participating in the accident investigation. The four main topics of such a system are the technical investigation, internal and external communications, the legal investigation, and assistance to the families of victims. He reviewed each of the topics, touching on the requirements of ICAO Annex 13 and how its mandates are fulfilled, and explained communications methods, means, strategy, and preparation to meet the press and family issues. Legal issues review also included identifying key players and interacting with the investigation process.

The main substance of his tutorial, however, was the need to develop a crisis cell to sustain a proper aircraft accident management system. He defined the cell as a "coherent organizational unit geared to manage an aviation crisis." He went on to comprehensively describe its six main elements and how they create the whole: policy, guidance, organization, infrastructure, people, and training.

Hinckley did an equally comprehensive presentation on the subject of, NTSB family assistance: history and support requirements issues, opportunities and challenges, with her tutorial review. The timeliness of this daylong presentation is attested to by a recent NTSB action to offer in 2006 extra sessions of its family assistance course at its NTSB Academy to "accommodate the increased interest from airlines and other transportation providers worldwide."

By the end of the tutorial, attendees were well schooled in the total history of how the current family assistance program came into being, the laws that govern it, and the regulations and procedures that must be followed. In recounting the history, Hinckley was able, through direct quotes, to provide an inkling to the sorrow felt by families of victims, and the shoddy treatment they received prior to the existence of "family assistance." She provided a clear development path to today governing Aviation Disaster Family Assistance Act (ADFAA) and the Foreign Air Carrier Family Support Act (FACFSA), which insure families of victims now receive the considerations due in such circumstances.

Her detailed presentation gave attendees, who could find themselves cast in a player's role during accident crises, knowledge of the respective roles of governmental, local, and aid agencies as well as that of air carriers. She made clear what types of actions are prohibited, the enforcement consequences an air carrier would suffer for failure to meet lawful requirement, and the role of family assistance coordinators in interfacing with investigators, among others.

MAIN PROGRAM

The main program began on September 13 and was opened with a few welcoming remarks by Curt Lewis, president of the ISASI Dallas-Ft. Worth Chapter, which hosted the 36th annual international seminar. ISASI President Frank Del Gandio, who in a formal address welcomed the assembled to ISASI 2005, followed him. His remarks cen-

Al Weaver, right, responds to a question as panel members, left to right, Joseph Rakow, Michiel Schuurman, and Barbara Burin, look on.

tered on the progress of lessening the aircraft accident rate and improving the overall air safety level, despite several accidents occurring in 2005. In urging the group to become actively involved in the activities and opportunities offered by the seminar, he said, "Look around you. Chances are very good that you are seated close to someone who knows everything there is to know about some topic that interests you." (See "President's View," page 3.)

He next introduced the selectee for the 2005 Jerome E. Lederer Award and the winner of the ISASI Rudy Kapustin Memorial Scholarship Award for 2005. John D. Rawson, ISASI Fellow, claimed the Lederer Award (see page 12). Identifying the Lederer awardee on the opening day, rather than on the final banquet night, was a recent innovation. It was designed to permit delegates to offer personal congratulations throughout the seminar. Winner of the $1,500 scholarship award was Carly Reil from Embry-Riddle Aeronautical University. The scholarship fund honors the memory of "tinkicker extraordinaire" Rudy Kapustin, who served for years as the ISASI Mid-Atlantic Regional Chapter president. This is the third awarding of the scholarship (see page 14).

Noting that the three previous winners of the scholarship were in attendance at the seminar, Ron Schleede, ISASI vice-president and scholarship fund administrator, said, "The scholarship program along with the Reachout program signifies the best of ISASI." He added, with a smile of pride for their accomplishments, that the first year's two award winners, Michiel Schuurman and Noelle Brunelle, are both now employed in aircraft accident prevention positions, Schuurman with the Dutch Safety Board and Brunelle with Sikorsky Aircraft. Moreover, he related, Schuurman made a delegate technical presentation at the seminar and has accepted a seat on the ISASI scholarship selection committee. The second year winner, Shannon Harris, is in her last year of school at Embry-Riddle Aeronautical University.

Keynote speakers

John J. Goglia, retired NTSB Board member, ISASI member, and presently a faculty

member of Saint Louis University, where he serves as a professor of aviation science, made the opening keynote presentation. In addressing the group he said: "In the recent past weeks we've had six major plane crashes with international involvement.… In light of these new tragedies our industry is facing, I think it is important to focus on just what are we, as an international body, to do to best prepare for a drain on our resources, meaning not just financial, but human and technological."

One of the first recognitions required, he noted, is that ISASI is an international group, "not just a conglomerate of independents. Of course, we cannot deny the reality that we are a group of big brothers and little brothers." He defines big brothers as "those who have had the experience, have people with the expertise, and have massive technological capabilities, while perhaps lacking the sheer number of human resources." Little brothers are those organizations just developing their program and that lack the resources of the larger organizations.

He cautioned that the drain of resources also affects the corporate partners of the Society, "because when our accident investigators are adrift, it puts increased burdens on our corporate partners to try and compensate.… [They] not just have to look out for their own industry, but be ready to assist at a moment's notice to do anything from decoding FDRs and CVRs to providing qualified investigators to assist in conducting a full-scale investigation in some of the most challenging environments on Earth."

However, the recognition factor has to be bolstered by "acting like an international group," he added. He recognized that mere attendance at the seminar in the numbers of persons that registered is evidence that the importance of "looking and acting" like an international body is well understood. He applauded the proactive stance of investigators in Europe in their periodic "lessons learned" forums in which they share experiences. Addressing the "little brothers," he urged that they assert their talents and not rely upon "big brother" to "take care of them."

ICAO Annex 13, he said is both " a blessing and a curse"—a blessing because it provides guidelines for conducting international accident investigation, a curse because it does not "deal with the real obstacles to accident investigation, which are the intangible idiosyncrasies that vary from country to country." Lastly, he addressed the matter of new entities that "do not take the proactive approach," urging them not to rely solely on "big brother."

He closed telling the assembled group: "ISASI has shown the ability to bring together the biggest grouping of world-class investigators with a common goal. If we can begin to address some of these issues under their umbrella, perhaps we can move forward another notch or two using the proven training tools we have seen over the years…." Delegates engaged in a robust question-and-answer period following his presentation.

FAA Director of Flight Standards Service Jim Ballough opened the second day's session with a keynote address titled Voluntary Safety Programs—Partnerships for Safety.

Speakers and Technical Paper Presented at ISASI 2005

TUESDAY—Topic: Recent Investigations

- **Bob Benzon,** Investigator-in-Charge, NTSB—*Challenges in the Afghan Investigation of the KAM Air Flight 904*
- **Stephane Corcos** and **Pierre Jouniaux**, BEA, France—*Accident, Serious Incident, and Incident Investigations: Different Approaches, the Same Objective*
- **Dr. Robert O. Besco**, President, PPI; Capt. (Ret.), American Airlines—*Find the Reasons: Stop Feeding the Causes and Let the Reasons Starve*
- **Wen Lin Guan**, Aviation Safety Council Taiwan, R.O.C.—*Performance and Flight Dynamics Analysis of the Flight in Ice Accretion*
- **Johann Reuss**, Federal Bureau of Aircraft Accidents Investigation, Germany—*Are the TCAS/ACAS Safety Improvements Sufficient?*

***Panel 1: Industry Flight Safety Information Sharing Activities**
Jim Ballough, AFS-1, U.S. FAA; **Michelle Harper**, University of Texas; **Capt. Terry McVenes**, Executive Central Air Safety Chairman, ALPA; **Dr. Steve Predmore**, JetBlue Airlines; **Tom O'Kane**, FRAeS; **Jill Sladen-Pilon**, IATA

WEDNESDAY—Topic: Data Analysis

- **Simone Sporer**, Psychologist, University of Applied Science, Austria—*Flight Data Monitoring—A New Approach*
- **Ahmet Oztekin**, M.S., Student, University of Rutgers—*A Case-Based Reasoning Approach for Accident Scenario Knowledge Management*
- **Jill Sladen-Pilon**, IATA, and **Mike Poole**, Flightscape, U.S.—*Airline Flight Data Analysis (FDA)—The Next Generation*
- **C. Edward Lan**, University of Kansas, and **Samason Y.C. Yeh**, Capt., China Airlines, Taiwan, R.O.C.—*Investigation of Causes of Engine Surge Based on Data in Flight Operations Quality Assurance Program*
- **Paul Jansonious**, Standards Pilot, West Jet, and **Elaine Parker**, North Caribou Air, Canada—*Practical Human Factors in the Investigation of Daily Events*
- **Tom O'Kane,** FRAeS, Aviation Safety Advisor—*Incident Classification Systems Made Irrelevant by Text Mining Tools?*
- **John Fish**, American Underwater Search and Survey, and **John Purvis**, Safety Service International—*Sonar as a Tool to Retrieve Airplanes and Schooners*
- **Robert Matthews**, Ph.D., U.S. FAA—*International Similarities and Differences in the Characteristics of Fatal General Aviation Accidents in Eight Countries*

*Panel 2—Post Accident/Incident Stress Management Guidance for the Investigator
Brenda Tillman, Readiness Group International
Mary Cotter, Air Accident Investigation Unit, Ireland

Papers: Special Investigations

- **A. Ranganathan,** Capt., SpiceJet, India—*Wet Runway Operations*
- **Christian Amaral** and **Bill Watts**, Delta Air Lines—*Delta Air Lines Emerging Technologies for Turbulence Avoidance: The Delta Perspective*

THURSDAY—Papers: Human Factors and Safety Management/Investigative Techniques

- **Derrick Tang**, Advent Management Consulting, Singapore—*Total Safety Management for Aircraft Maintenance Using TQM Approach*
- **Howard Leach**, MRAeS, British Airways, England—*Maintenance Error Prediction Modeling*
- **Donizeti de Andrade**, Ph.D., ITA, Brasil, and **Gustavo Moraes Cazelli**, Embraer, Brasil—*Aircraft Accident Investigation Applications of System Identification Techniques*
- **Joseph Rakow**, Ph.D., Exponent Failure Analysis Associates—*Thermostructural Failure in Aviation Accidents*
- **Jody M. Todd**, Capt., Honeywell Aerospace Electronic Systems—*EGPWS RAAS—Runway Awareness and Advisory System*
- **Al Weaver**, Senior Fellow Emeritus, Gas Turbine Investigations—*Rotor Seizure Effects*
- **Michiel Schuurman**, Student, Aerospace Engineering, Technical University Delft, Netherlands—*3-D Photogrammetric Reconstruction in Aircraft Accident Investigation*
- **Barbara Burian**, Ph.D., SJSUF, NASA Ames—*Do You Smell Smoke? Issues in the Design and Content of Checklists for Smoke, Fire, and Fumes*
- **Keith McGuire**, NTSB—*Selecting the Next Generation of Investigators*
- **Kathy Abbott**, Ph.D., FRAeS, Chief Scientific and Technical Advisor, U.S. FAA—*Applying Human Performance Lessons to Smaller Operators*
- **John Cox**, Capt., FRAeS, Safety Operating Systems—*Bringing Proactive Safety Methods and Tools to Smaller Operators*
- **Frank Gerards**, Col., Royal Netherlands Air Force, and **Rombout Wever**, NLR, Netherlands—*The Use of Operational Risk Management in the Royal Netherlands Air Force*
- **Mark Solper**, Chairman, ALPA Accident Investigation Board, and **Michael Huhn**, ALPA—*The Unified Field Theory*
- **Mohammed Aziz**, Ph.D., Advisor to Chairman, Middle Eastern Airlines—*The Role of GAIN in Enhancing Air Carrier Safety Management*
- **A.L.C. Roelen**, National Aerospace Laboratory, Netherlands, and **Rombout Wever**, NLR, Netherlands—*An Analysis of Flight Crew Response to System Failures*
- **Mark Smith**, Boeing—*Boeing Runway Track Analysis.*

*Panel participants did not submit written text of their discussions. ◆

His talk dovetailed nicely with the topic for the day Papers: Data Analysis.

Ballough discussed FAA's realization from past experiences that traditional methods of FAA surveillance and enforcement would not achieve increased levels of safety. He noted that raising the bar would require the augmentation, "not replacement," of traditional FAA oversight with volunteer safety partnerships bundled into a volunteer safety program.

The FAA then set the goals for such a program—

- Foster partnerships for safety.
- Decrease accidents, incidents, and violations.
- Obtain safety information not available through traditional means.
- Better identify risks to public safety.
- Implement risk-reduction strategies based on voluntarily provided safety data.
- Track the effectiveness of these strategies over time.

Today there are these six voluntary safety programs administered by the Flight Standards Service: (1) voluntary disclosure program (VDRP), (2) aviation safety action program (ASAP), (3) flight operational quality assurance (FOQA) program, (4) advanced qualification program (AQP), (5) line operations safety audit (LOSA) program, and (6) internal evaluation program (IEP).

Ballough described the partner relationships and working details of each of the programs. He then outlined the programs that were on the horizon, such as expansion of FOQA and ASAP, codification of AQP as a permanent rule, and publication of an updated LOSA and IEP advisory circular. He concluded by expressing that in the future the partnership program hoped to achieve better integration of safety information from multiple programs, to transition VASIP from a demonstration program to a permanent systematic venue for safety information sharing, and to develop FAA guidance and incentives for a voluntary safety management system (SMS).

Technical sessions

In an assembly of 400 people, the measure of success isn't the content of the program, as much as it is the comfort level afforded those who, hour after hour, listen to the droning of speech and watch the flashing of PowerPoint images. Astute planners know this and select conference hotels accordingly.

So, while the outside temperatures in Cow Town hovered near the 100-plus degree Fahrenheit mark, those attending the 3-day-long ISASI 2005 technical program comfortably sat in air so cool that some resorted to long sleeves and jackets. Tables were angled so all could easily view the side screens and water jugs, drinking glasses, and hard candy were just an arm's length away.

With that setting, 46 speakers addressed the group either in an individual presentation or as a member of a panel. While the general theme of the event was Investigating New Frontiers in Safety, each daily a.m. and p.m. segment carried its own topic theme. Recent Investigations was the first day's subject for six morning speakers. The afternoon's seven-member panel delved into Industry Fight Safety Information Sharing. Each panel member presented a short paper on the subject before taking questions. The Data Analysis topic was addressed by the first 12 speakers on the second day; an afternoon two-member panel discussed Post Accident/Incident Stress Management Guidance for the Investigator, and the last two speakers of the day addressed Special Investigations. The 16 speakers who addressed attendees used the final day's topic, Human Factors and Safety Management/Investigative Techniques, in both the a.m. and p.m. sessions.

As can be seen from the daily topics, sharing of information was the heavy underlying element of the seminar's technical program. Accordingly, papers' content revolved around data mining, analysis, research, the practical, and the theoretical. One long-time attendee summed up the technical session this way: "The difference this year versus other years was the heavy emphasis on aviation safety management. There was more of this than on investigation."(See adjacent list of speakers and subjects.)

Throughout the technical program days, the various societies, committees, and working groups held meetings. President Del Gandio also conducted the annual membership meeting.

Social activities

Relaxed interactions contribute as much to the success of an event as does the formal program. To take full advantage of this fact, ISASI seminar planners set social activities through a full companions' program and activities for all attendees. The Welcome Reception allowed for a shake off of the travel weariness and an awakening of friendships from past seminars. Midway through the technical programming was an evening of gaiety related to the norms of the local area. ISASI 2005 bussed its crowd to Billy's Bob's, billed as the world's largest "honky tonk." It is housed in the middle of the historical Ft. Worth Stockyards area. The western-attired guests were greeted by comparatively dressed dance hall "queens" and "wranglers" as they stepped off the bus to be escorted into a one-time barn used for prize cattle during the stock shows.

Companions, although small in number, 41, were treated to an array of entertaining venues. They toured movie studios, discovering how images of mystical happenings and physical deformities are created. At the Botanic Garden, the high humidity overshadowed the magnificence of the rain forest, and most companions welcomed the cool comfort of the tasty lunch that followed the tour. A visit to the National Cowgirl Museum displayed the spirit of the women who made their living on ranches of the early West. But its captivating Hall of Fame display of slowly changing images of cowgirls was a crowd pleaser. The final companion event took them on a riverboat scenic cruise around Lake Granbury, where despite the hot sun, the upper deck breeze cooled the group as they viewed the lavish homes along the lake's shores.

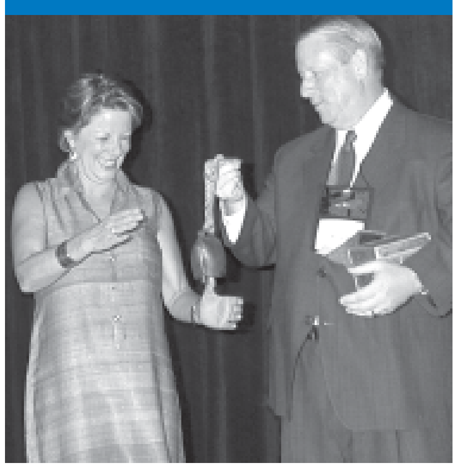
The post-event day activity has always been proven a great closer to a week of "studious" attention. First came a visit to the Sixth Floor Museum, which examines the life, times, death, and legacy of President John F. Kennedy. The museum is housed in the Texas School Book Depository building and floor from which the assassination shots

were fired on Nov. 22, 1963. The group then went on to a visit of the Circle R Ranch, an authentic, theme-oriented ranch on 100 acres of green rolling hills and open pastures. Disembarking from the busses, the group was welcomed by cowhands who draped them with 2-foot square red, white, and blue bandanas bearing the Circle R brand and the star of Texas. The line queued at the "chuck wagon" for grilled steak and other morsels. Then it was off to the corrals and horseback riding for some and boarding of hay wagons for others who were entertained by a wire-thin songster wearing a large-brimmed Texas hat and strumming a well-used guitar. In all, it was a relaxing time after the rigor of sitting in auditorium seats for 3 days.

Awards banquet

The evening before the Circle R excursion was the time for the heavily attended and anticipated awards banquet. The hall's linen-clothed tables seated 10 persons each; 40 tables filled the floor. Following dinner, Ralph Hood, with his background of being a pilot, aircraft salesman, book author, and profes-

Above left: Hay wagon singing cowboy serenades riders. Above: Seminar planners C. Lewis (left) and J. Darbo (right) accept prop-clock award from President Del Gandio. Left: Capt. Ranganathan accepts "Best Seminar Paper" Award of Excellence. Below: B. Dunn accepts traditional "passing of the Bell" from T. Carroll. Below left: At this "table of winners," each person won a significant prize in the final day's many prize drawings.



sional speaker, entertained the aviation-oriented audience with comical barbs and praise for their profession. He "loosened" up the group for the upcoming presentation of awards to deserving ISASI folk.

People and groups honored included ALPA and Corey Stephens for website support and webmaster work and new corporate members AeroVeritas Aviation Safety Consulting, Ltd, Aircraft Mechanics Fraternal Association, Centurion Inc., Cirrus Design, Colegio Oficial Pilotos Aviation Commercial/Spain, Cranfield University Safety and Accident Investigation Centre, Directorate of Aircraft Accident Investigations-Namibia, Dutch Airline Pilots Association VNV, European Aviation Safety Agency, Flight Attendant Training Institute at Melville College, Irish Air Corps/Military Airworthiness Authority, My Travel Airways, Star Navigation Systems Group, Ltd, Hellenic Air Accident Investigation and Aviation Safety Board-Greece, and Accident Investigation and Prevention Bureau, Federal Ministry of Aviation-Nigeria.

President Del Gandio also announced the awarding of Fellow status to John D. Rawson, Itzhak Raz, and Ken Smart. Ron Chippindale, New Zealand Councillor, was named chairman of the Fellow selection committee. He also called for audience recognition of the 2005 winner of the Kapustin Memorial Scholarship, Carly Reil (see page 14) and made special plaque presentations to the Cirrus Aircraft Corporation (see "RoundUp") and to Capt. A. Ranganathan, SpiceJet Limited, India.

The nature of the Award for Excellence "ISASI 2005 Best Seminar Paper" is a first for ISASI, but one that will continue to occur for the foreseeable future. The award is an outgrowth of an anonymous contribution to the Society to reward the writer(s) of the best paper presented at any respective annual seminar. The President and Executive Advisor, Richard Stone, make up the selection committee. "Based on the criteria established by the anonymous donor," said Stone, "the committee's criteria was a paper that provided meaningful technical advancement in accident investigation, properly addressed the theme of the seminar, and a written text and oral presentation that was understandable and interesting."

Capt. Ranganathan's paper was titled "Wet Runway Operations" and dealt with the hazards of operating in such conditions, what causes the hazards, and how the hazards can be reduced, along with a call for improved training and certification standards to overcome the accident potential involved. (The award-winning paper will be published in the January/March 2006 issue of the *Forum*.)

The final presentation of the evening was the awarding of the 2005 Jerome E. Lederer Award to John D. Rawson. The details of the presentation ceremony and the awardee's comments are published on page 12 of this issue.

The closing ceremony of ISASI 2005 was the traditional passing of the "Call to Order Bell" to ring the opening of ISASI 2006, which will be held in Cancun, Mexico, September 11-14 and is hosted by the ISASI Seminar Committee in cooperation with the ISASI Latin American Society and the Mexican ALPA group. ◆

Rawson Earns Lederer Award

The 2005 Jerome F. Lederer Award recipient is a "don't tell me, show me" type of investigator.

By Esperison Martinez, Editor

John D. Rawson, a Fellow member of the Society, was an almost-absent recipient of the Jerome F. Lederer Award for 2005 at the ISASI annual awards banquet. Unaware of his selection for the prestigious award, his original plans to attend the annual seminar were abruptly altered when Hurricane Katrina changed some of the landscape of his property in Meridian, Miss. This change of plans caused a dilemma for President Frank Del Gandio, who secrets away the name of the selectee until the opening day of the seminar. Finally reaching Rawson by phone, Del Gandio inquired, "John, have you decided if you are coming to Texas?" The reply was quick and positive, "Can't make it." With no recourse, Del Gandio had to share the secret: "John, you are receiving the Lederer Award!" Stunned silence was the reply, until, again, a quick and positive: "I'll be there."

So while the pleasure of surprise was absent when President Del Gandio introduced award winner Rawson to the near 400 attendees who filled the cavernous room, he appeared humbled at the thundering applause that filled the air. The early announcement allowed many delegates to offer private congratulations to the 29th recipient of the award, who would be more fully honored on the last evening of the seminar program.

The Jerome F. Lederer Award is conferred for outstanding lifetime contributions in the field of aircraft accident investigation and prevention and was created by the Society to honor its namesake for his leadership role in the world of aviation safety since its infancy. Jerry Lederer "flew west" on Feb. 6, 2004, at age 101. Awarded annually by ISASI, the Lederer Award also recognizes achievement of the Society's objectives and technical excellence of the recipient.

The presentation of the award always takes place on the last evening of the seminar, and it is the highlight of the award banquet. In introducing the winner to the audience, President Del Gandio commented, "The Jerry Lederer Award is the most prestigious award that the Society can confer, and John Rawson's 45 years of experience in aircraft accident investigation and aviation safety has proven spectacularly worthy of the highest accolades." He went on to relate highlights of Rawson's contributions:

"John started his career in accident investigation in 1960, when he accepted employment with the engineering division of the Civil Aeronautics Board (CAB), predecessor of the NTSB.

As a system specialist, he became one of only two original flight data recorder readout specialist for the CAB. He also was involved with investigating and analyzing electrical/electronics instrument systems and hydraulics and communications problems in dozens of major accidents.

PHOTOS: E. MARTINEZ

President Del Gandio, right, presents the 2005 Lederer Award to John Rawson.

"In 1962, he transferred to the CAB's Miami field office where he was an investigator-in charge (IIC) for 8 years and inves-

Past Lederer Award Winners

1977—Samuel M. Phillips
1978—Allen R. McMahan
1979—Gerard M. Bruggink
1980—John Gilbert Boulding
1981—Dr. S. Harry Robertson
1982—C.H. Prater Houge
1983—C.O. Miller
1984—George B. Parker
1985—Dr. John Kenyon Mason
1986—Geoffrey C. Wilkinson
1987—Dr. Carol A. Roberts
1988—H. Vincent LaChapelle
1989—Aage A. Roed
1990—Olof Fritsch
1991—Eddie J. Trimble
1992—Paul R. Powers
1993—Capt. Victor Hewes
1994—U.K. Aircraft Accidents Investigation Branch
1995—Dr. John K. Lauber
1996—Burt Chesterfield
1997—Gus Economy
1998—A. Frank Taylor
1999—Capt. James McIntyre
2000—Nora Marshal
2001—John Purvis and the Transportation Safety Board of Canada
2002—Ronald L. Schleede
2003—Caj Frostell
2004—Ron Chippindale

tigated a great many general aviation and air carrier accidents. In 1968, John left the government and joined HydroAire as a flight data recorder technical representative. In 1970, he returned to the NTSB as an CVR/FDR specialist in the Washington, D.C., headquarters, subsequently becoming chief of the CVR laboratory.

"John transferred to the FAA in 1974 and served as the FAA IIC on more than 70 major catastrophic accidents worldwide. In 1976 he became a branch manager and in 1982 was promoted to manager of the Accident Investigation Division in the Office of Accident Investigation, a position he held until retiring in 1994.

"During his career in both agencies, John authored more than a 100 safety recommendations, which have had a tremendous positive impact on aviation safety. He established and was responsible for the curriculum and training activities of the FAA's Accident Investigation School in Oklahoma City and lectured at the basic investigation class for many years. He was also instrumental in organizing and implementing the helicopter accident investigation course that is taught at the Bell Helicopter facility in Fort Worth, Tex.

"John's involvement with ISASI is as impressive as his government career. He joined in 1965 and held member number CH59, marking him as one of the founders of our Society. He has served as membership chairman, secretary, and as treasurer. In that position, he established an accounting system that served ISASI for many years. He has presented laudable papers at numerous ISASI seminars and at ICAO meetings worldwide.

"His government career and his involvement in ISASI indicate a total dedication and concern for aircraft accident investigation and aviation safety. His contribution to the aviation industry and this Society are monumental and worthy of making him the 2005 Jerome F. Lederer Award recipient. John, I present to you the Jerry Lederer Award for 2005. Congratulations."

As the applause of the full room quieted, the unassuming, straight-backed, and soft-spoken award winner moved to the microphone. The room was now still, all eyes front, ears primed to hear: "Thank you," he whispered. And with a stronger voice continued, "It is a great honor to receive this award and to be included with those people who have come before me as recipients of the same award. As Frank said, I have been doing this a long time. I have worked with a lot of you in this room and certainly with your organizations. I can say with all honestly that my experience totally shows that ISASI has made a big difference in safety, worldwide.

"One of the reasons is, of course, that we exchange information here, meet each other, go back to our organizations and inform about what is going on. Fortunately, a lot of the people here work for rule-making agencies and accident investigation groups. That's a good thing, and I want people to keep up the good work.

"A thought I want to pass along is something I've always practiced in my investigations and urged all the people I have worked with to practice: When you are investigating an accident, tell the person or the group that 'I appreciate all you have explained to me, but I would rather have you show me.'" ◆

Rawson speaks to the assembled banquet crowd.

Recent Lederer Award winners strike a pose. Left to right, Ronald L. Schleede (2002), Caj Frostell (2003), Rawson, Ron Chippindale (2004), and John Purvis (2001).

Carly Reil:
2005 ISASI Rudy Kapustin Scholarship Awardee

By Esperison Martinez, Editor

"Since the first plane crash on September 17, 1908, that seriously injured Orville Wright and killed his passenger, First Lieutenant Thomas E. Selfridge, accidents have been the shadow behind aviation. Investigating them, however, is providing the light needed to make changes. Though we have come a long way, the near art form of piecing together the puzzle formed when a plane crashes remains a relentless challenge for investigators. From evaluating a crash scene to educating the industry on their findings and everything in between, accident investigators face a number of challenges at every scene."

These insightful thoughts, descriptively cast, open the essay "Problems Facing Air Safety Investigators" submitted by Carly Reil, a senior at Embry-Riddle Aeronautical University (ERAU), Florida, U.S.A., in her quest to become the 2005 ISASI Rudy Kapustin Memorial Scholarship awardee. She succeeded! She was presented the final honors at the Society's annual seminar.

In presenting the award, ISASI President Frank Del Gandio noted that the scholarship was established in memory of all ISASI members who have died and was named in honor of Rudy Kapustin, the former ISASI Mid-Atlantic Regional Chapter president and long-term ISASI member who developed a reputation as "tin-kicker extraordinaire" among his peers. The scholarship is intended to encourage and assist college-level students interested in the field of aviation safety and aircraft occurrence investigation. The memorial provides an annual allocation of funds for the scholarship. Del Gandio announced that Reil would receive a $1,500 ISASI award to help offset attendance at the seminar. In addition, he said the FAA's Transportation Safety Institute and the Southern California Safety Institute are awarding fee-free attendance to the respective school's accident investigation course.

The 21-year-old student said of her essay, which is reprinted on the following page, "I focused on the obvious in the beginning, primarily to show the seldom-expressed difficulty of diverse groups working together in one investigation to arrive at one conclusion. I wanted to express the nature of an investigator's field work: the trials of working relationships with unknown investigators, the synergy developed in resolving differing opinions, the ideas and methods used. And finally, the necessity for all to come together as one group to come to one conclusion."

Carly recounts how her confidence and ability to write on the subject came about: "The aviation industry has always fascinated me, and in my high school years I became interested in forensic medicine as it applies to accident investigations. When I was looking at colleges to attend, I noted that ERAU offered a safety sciences degree that was related to crash investigations. It appeared perfect for me. It offered a bit about aviation and a bit about forensics, my favorite areas of interest.

"So, my insight for the paper came from my classroom studies and exposure to ISASI accident-investigation-generated material that I receive as a member of the University's ISASI student membership chapter. I read every issue of the *Forum*; it has so many great articles. From the articles, I digest what the investigators themselves experience as they search accident scenes for cause factors. I agree very much with the prevailing attitude that the results of investigations need to be more thoroughly acted upon to prevent future similar caused accidents. And to gain that positive action, more agencies and persons have to better understand the investigative process and the findings it produces." Carly joined the student chapter in her second year at the school and has served as treasurer and vice-president of the group. Her summers have been spent in aviation-safety-related internships.

Upon graduation in May 2006, she intends to apply for graduate school in a subject that will lead to placement into some aspect of the accident investigation profession. "I am interested in working on an international level, because other cultures have always been a high interest of mine. I think it would be very exciting to become involved with cultures that are developing their own safety investigative programs. To be involved in helping to build up a program from the ground up would be a terrific experience both from the learning and teaching standpoint."

How does she feel about her first ISASI annual conference? "It's been wonderful. I've met some great people who have helped point me in the right direction through the many different topics presented. They opened me up to many different aspects of investigation that I had not thought of before." ◆

E. MARTINEZ

President Del Gandio introduces Carly Reil, 2005 ISASI Kapustin Scholarship awardee, to the audience.

The Problems Facing Air Safety Investigators

By Carly Reil (ST5133), Safety Sciences
Embry-Riddle Aeronautical University

Since the first plane crash on September 17, 1908, that seriously injured Orville Wright and killed his passenger, First Lieutenant Thomas E. Selfridge, accidents have been the shadow behind aviation. Investigating them, however, is providing the light needed to make changes. Though we have come a long way, the near art form of piecing together the puzzle formed when a plane crashes remains a relentless challenge for investigators. From evaluating a crash scene to educating the industry on their findings and everything in between, accident investigators face a number of challenges at every scene.

Sights investigators may encounter when they get to a crash scene can affect them emotionally in a number of ways. Any such devastating scene is always hard to overcome, but it is necessary to do so in order to accomplish the far greater goal. Memories can stay with investigators their entire life, yet they ultimately know they are there to find answers and to help prevent such catastrophes in the future.

Investigators must be able to work with diverse groups. These groups help investigators locate, preserve, gather, and analyze evidence from crash scenes. For example, when Copa Flight 201 disappeared over Panama, investigators relied heavily on locals to navigate the dense jungle. When investigators work with local law enforcement and fire departments, evidence can be disturbed or destroyed in an effort to put out fires or rescue survivors. This relationship is important, though; law enforcement helps to protect a scene and often provides support for investigators. When parties to an investigation are allowed, they can bring investigators from different areas of the industry together with varying ideas and goals. Every situation and every person will be different, and accident investigators must be prepared for this diversity. The challenge is to maintain organization, cooperation, and an open mind.

E. MARTINEZ

Carly Reil

Numerous obstacles always face investigators in the field. Wreckage is often in the least likely place, scattered over great distances and in pieces offering sharp edges and the presence of bloodborne pathogens. Ephemeral evidence poses a challenge to time, and moveable parts can shift during impact. New technology can mislead an investigator, such as composite materials, which fail differently from traditional materials. Evaluation of the cockpit voice recorder and flight data recorder may hold key information, but they are not available in a certain aircraft or are unable to be found. If they are located, they can be damaged or unreliable. With pieces of information coming from many different sources, investigators must continue to look at the whole picture and not jump to conclusions. An additional piece of evidence may add new insight to the events leading up to an accident. Investigators next-best sources of information come from records and witnesses.

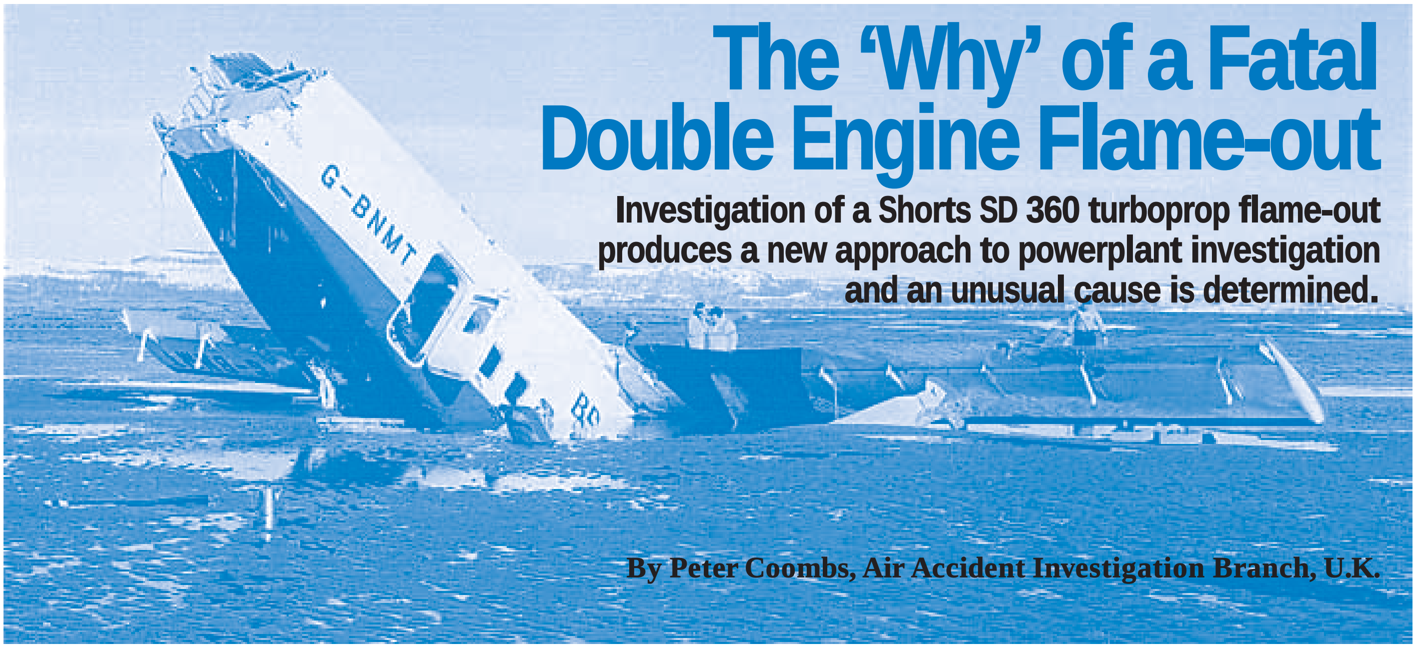
Operations, maintenance, ATC, aircraft, and weather records are all important pieces of information that investigators want to take into account. However, crew and aircraft records are often lost or destroyed. Assembling a history for the flight using these records and the statements of witnesses provides a time line and a base to put events together.

Interviewing witnesses is a delicate but beneficial process. They are the people who saw the crash, were in contact with the crew, or are family members and friends. They provide the insider's view for investigators. Witnesses should be interviewed as soon after an accident as practical to avoid bias and loss of information. Survivors may be in shock, unable to clearly reveal anything, and relatives and friends of the crew may be prejudiced in the information they give. "Eyewitnesses" may have conflicting accounts or may have heard stories from other witnesses. Interviewing can be frustrating, but investigators must be respectful and understanding when listening; their goal is to gain information. Not only do they have to be careful in the questions they ask, but they must also take into account numerous factors concerning the validity of each statement.

After gathering evidence from the field, a new challenge emerges. Now the pieces of the puzzle need to be evaluated and fit together; the who, why, and how need to be answered. Most importantly, once answers are determined, investigators must present their findings and hope that they do not fall on deaf ears. After all, the goal is not just to figure out what happened but how to prevent it from occurring in the future.

Clarifying the series of events that lead up to an accident can take months, if not years, to establish. Investigators work diligently to organize a final report on the determining factors behind an accident. In the process, important and useful information is integrated into these reports. Though, there will always be someone who doubts these findings. And more often than not, these data are simply not implemented into areas of the industry where they could be of great use. Unfortunately, this is one of the biggest challenges to investigators. It is counterproductive to put effort into solving what went wrong only to have the event repeated. Accident investigators work to prevent similar accidents from occurring in the future; it is up to them to be sure that their work is noticed and applied.

Accident investigation is an incredibly challenging occupation that requires a special person. There is a common thread among all investigators: a passion to solve the problem and save lives. How else could someone persevere through emotional, physical, mental, and social challenges? Everything from searching through debris to evaluating data to compiling the final report is a long and difficult journey for investigators. The greatest reward is to see their findings put to good use to save lives. ◆



The 'Why' of a Fatal Double Engine Flame-out

Investigation of a Shorts SD 360 turboprop flame-out produces a new approach to powerplant investigation and an unusual cause is determined.

By Peter Coombs, Air Accident Investigation Branch, U.K.

(This article was adapted, with permission, from the author's presentation entitled Investigation of Fatal Double Engine Flame-out to Shorts SD 360 Turboprop *prepared for the ISASI 2004 seminar held in Australia's Gold Coast region Aug. 30 to Sept. 2, 2004, which carried the theme "Investigate, Communicate, and Educate." The entire paper, including cited references index, is on the ISASI website at www.isasi.org.—Editor)*

In the early evening of Feb. 27, 2001, a Shorts SD 360 twin turboprop aircraft took off from Edinburgh, Scotland. Although normally serving as a passenger airliner, on this occasion it was carrying only two flight crew and a cargo of mail. Just over a minute after takeoff, a distress call was received stating that both engines had failed. The machine descended rapidly and ditched in shallow but exposed and extremely choppy waters of a local sea inlet, the Firth of Fourth. It sustained considerable damage at water impact and soon became partly submerged. Neither crewmember survived.

__Peter Coombs__ joined the U.K. AAIB in 1972 and has performed more than 200 field investigations to civil and military fixed- and rotary-wing aircraft and a comparable number of other technical investigations. While with the British Aircraft Corporation from 1966, he gained experience of manufacture, development, and testing of aircraft including BAC 1-11, VC10, and Bristol Britannia airliners, before becoming a design engineer on the Concorde SST. He was awarded a master of science degree in aircraft design at the College of Aeronautics, Cranfield, in 1971, and flies single- and multi-engine aircraft.

ABOVE: Figure 1: General view of main section of wreckage at low tide, on the morning after the accident.
LEFT: Figure 2: View of partly submerged wreckage at subsequent low tide.
BELOW: Figure 3: View of almost-submerged wreckage at high tide.

Investigation of the accident required salvage of the aircraft from the very exposed waters, where it was lying between low-and high-tide positions, followed by detailed examination of its systems and powerplants, development of a robust theory as to the cause of the obscure double power loss, and the preparation and implementation of experiments to support the theory.

The wreck site was such that the aircraft could only be accessed on one occasion on foot (Figure 1) before the changing tidal cycle dictated that at the lowest tides the aircraft still remained partly submerged (Figure 2). This situation was to continue until approximately a week had passed. The recovery task was further hampered by the extent to which the aircraft became buried in the sand with succeeding tides (Figure 3).

Eventually, however, the wreckage was salvaged (Figure 4) and detailed examination began. In the meantime, both the DFDR and the CVR were recovered, decontaminated, and replayed successfully.

My past experience of multiple power loss has led me to expect that one engine may lose power for a variety of reasons, while a second engine generally does so after a time interval, usually following crew actions intended to secure the first engine but incorrectly applied. The only other double power losses I can recall investigating have been

- an occasion on which both engines were selected to nearly empty main tanks on departure, following accidental fuel uplift into auxiliary tanks, unobserved by the crew.
- an occasion when an Eastern Bloc certificated aircraft, equipped with an automatic engine safety/shut down system, suffered an electrical fault that energized fuel shutoff valves on both engines, driving them to the closed position shortly after takeoff.

Fuel exhaustion, severe engine intake icing, and volcanic ash contamination are, of course, also well-known multiple power loss causes.

The simple two-tank fuel system layout

Figure 4: Salvage ships in position during lifting 6 days after accident.

of the SD 360 did not favor the possibility of a system handling error. The possibility of a repetition of the second failure scenario described above was effectively precluded by the purely mechanical operation of both HP and LP fuel valves and the ergonomic difficulty of operating both left- and right-hand controls of either simultaneously. The large fuel uplift apparently carried out at Edinburgh, together with fuel remaining on arrival, virtually precluded the possibility of complete fuel exhaustion so soon after departure, and the aircraft was not flying in icing conditions at the time of the power loss. Finally, there are no volcanoes within 5,000 miles upwind of Edinburgh.

It was, therefore, with great surprise that

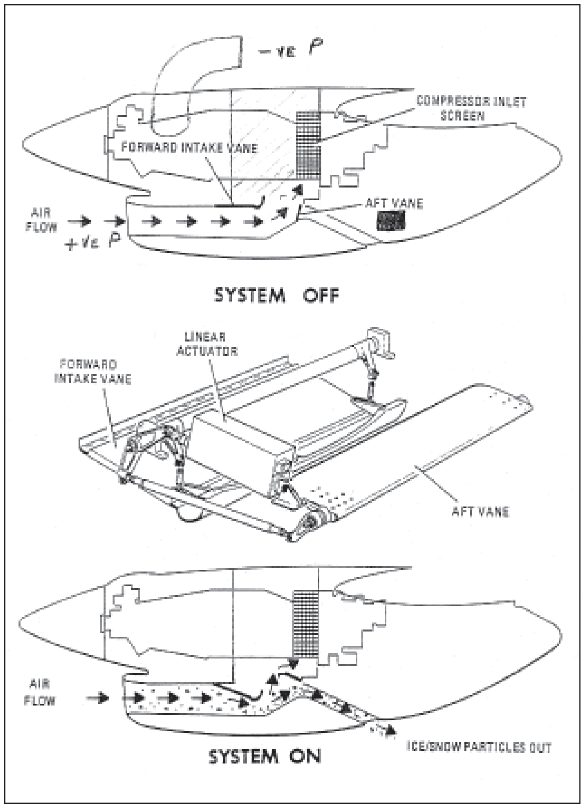


Figure 5: Schematics of nacelle with inertia separator vanes in normal (or OFF) position, above, and deployed (or ON) position, below. Plenum chamber volume is shaded in upper section. Vane drive mechanism is shown in middle diagram.

I learned from our recorder specialists that both engine torque values dropped from climb power to zero precipitately and within milliseconds of one another. This occurred at about 1,800 feet, within 8 seconds of the captain requesting the first officer to select the anti-ice systems and almost exactly 5 seconds after the sound of two switch selections, which were immediately followed by the electrical sound of two motors operating.

Relevant aircraft features

Two PT 6A series reverse-flow turboprop engines power the aircraft type. Each engine is orientated with its compressor at the rear. There are a number of reversals of air and combustion gas flow directions within each powerplant (a total of 720 degrees direction change of flow axis between the external intake and the aft-facing exhausts). As shown in Figure 5, air is supplied to the engines via a forward-facing intake behind and below each propeller, while exhaust gases leave via a pair of curved pipes at the front of each engine, arranged to direct the gases backward. The air, having entered each external intake, passes below the whole length of the relevant engine, before turning through a right angle and traveling vertically upward into airtight plenum chambers. From these, it is drawn into each engine compressor through a cylindrical mesh guard (Figure 5). An external view of a nacelle on the salvaged wreck, showing the intake and one exhaust stack, is shown in Figure 6.

In icing conditions, the crew may select so-called anti-icing vanes to the ON position (Figure 5). Under these circumstances, a ramp (or forward vane) is lowered from the top surface of each air intake path, reducing the available cross-section for the airflow and causing it to both accelerate and change direction through a bigger angle than would be the case without the vanes deployed. This centrifuges solids and liquids to the outer radius of the curved airflow path. At the same time, a bypass door (or aft vane) opens in each airflow, causing that part of the flow cross-section containing the solids and liquids to be ejected overboard rather than to enter the plenum chambers to risk forming a frozen obstruction on the mesh guard covering the inlet to the relevant engine.

Initial tests

Tests carried out on an example of the linear actuator type, which drives the inertia separators (Figure 5), confirmed that the frequency of the electrical "noise" produced was identical to that of the acoustic noise present on the CVR initiating 5 seconds before engine torque was recorded as lost by the DFDR. It, therefore, became clear that staggered operation of the selector switches of each inertia separator took place 5 seconds before a similarly staggered sudden loss of all power on both engines occurred. There was thus little doubt that deployment of each inertia separator had lead to the consequent power loss of the corresponding engine. This left the question of how this entirely normal system operation could have had such a dramatic and abnormal effect on both engines.

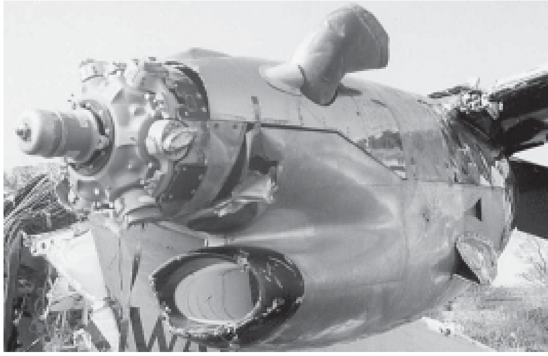
Relevant weather

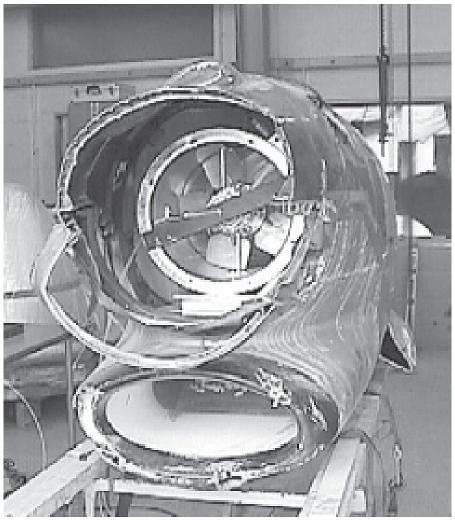
Early in the investigation it became clear that the aircraft had arrived at Edinburgh at midnight, approximately 17 hours before the accident and had been refueled with the intention of departing within 2 hours. Snow began to fall as the aircraft arrived, however, and became so severe that deicing services and runway snow clearance activities became overwhelmed. No movements took place through the remainder of that night, and snow continued to fall until 0800 the next morning. Services only recovered early in the afternoon. Through the night, moderate snow (the meteorological term) was accompanied by wind gusting up to 40 knots from a NNE direction. The aircraft was also parked on a heading of approximately NNE. The temperature was between zero and +1 degree C. As the day began, the wind moderated but continued to gust up to 17 knots on the same heading while the temperature slowly rose to 2 degrees C by midday.

Sequence of events prior to departure

A new crew arrived in the early afternoon and observed that the aircraft was now free of visible contamination apart from an area of the windscreen. Following a preflight check, the aircraft was started but it was found that a generator would not come on line. The aircraft was shut down and assistance summoned.

A ground engineer carried out troubleshooting and a simple rectification. This required both engines to be briefly run by the crew while electrical loads were applied. These included operation of all anti-icing systems, i.e., windscreens, propellers, air intakes, and inertia separators, before the engines were again shut down. Once the problem was rectified, normal predeparture actions took place and the engines were re-





RIGHT: Figure 6: Left engine nacelle with external intake and one exhaust stack visible after wreckage recovery.
BELOW RIGHT: Figure 7: Assembled nacelle mock-up, utilizing panels salvaged from wrecked aircraft, incorporating cylinder forming dummy engine. Extractor fan can be seen. Adjustable valve has yet to be fitted to threaded shaft in front of fan. Transparent Plexiglas bulkheads are fitted in place of metal bulkheads at front and rear of plenum chamber (not visible).

started. During taxiing, the normal checks were carried out. These included a check of the autofeather. When a propeller is feathered on this type, the corresponding inertia separator is automatically powered to the anti-ice position to further reduce drag.

The accident flight

With inertia separators now reset to the normal position, takeoff and initial climb took place followed by torque and RPM reduction to climb settings. Only shortly after further reselection of the inertia separators to the anti-ice position, in preparation for entering a sub-zero cloud layer, did the fatal double power loss occur.

Investigation process

Since the most unusual event during the period of idleness at Edinburgh was the weather of the night, I decided to find out what affect the snowfall had on the air intake systems. A special rig was, therefore, built, consisting of a controllable extractor fan mounted on a tapered transition tube incorporating pressure-tapping points. The tube was bolted in the place of one exhaust stack of an engine in a borrowed SD 360 aircraft. The other exhaust on that engine was sealed off. The pressure tapings were connected to a digital pitot-static test set.

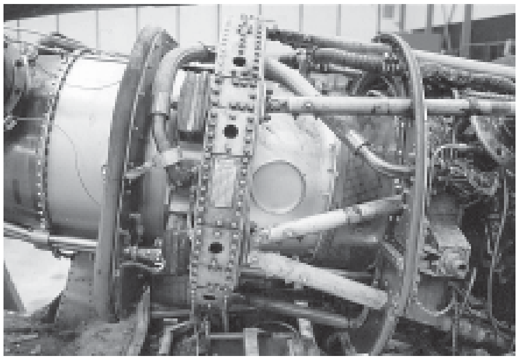
A downstream pressure drop was created by the fan, having similar magnitude to the pressure difference between the intake face and exit pipe pressures (Figure 5) calculated for the known average headwind speed recorded during the night's snow storm. The speed of the airflow created in the extractor tube was measured by means of the digital test set and the corresponding speed in the intake system calculated. Despite the complex flow path through the total powerplant and the effect of at least seven stages of fixed blades and a similar number of stages of rotating blades in each engine, the velocity through the system was found to be a high percentage of the local wind speed.

An engine intake system and engine cowling panels, salvaged from the wrecked aircraft, were then assembled into a mock-up of a nacelle incorporating a dummy engine, complete with the intake mesh. Sealed plenum chamber bulkheads were manufactured from Plexiglas and fitted in representative positions within the cowlings. An electric extractor fan was mounted within the dummy engine and an adjustable shutoff valve was fitted at the forward end. Figure 7 shows the front of the arrangement before the adjustable shutoff valve was fitted. The fan was run and the valve adjusted to create airflow velocities in the mock intake system of similar values to those measured and calculated earlier in the intake of the borrowed aircraft.

Simulated snowflakes, comprised of finely cut fragments of expanded polystyrene, were released near the external intake, and their progress through the trunking and into the plenum chamber was observed via the Plexiglas rear bulkhead. It was found that the flakes readily rose up to and over the top of the dummy engine.

It was, therefore, clear that during the

Figure 8 (below): View of interior of plenum chamber with cowlings removed. Enclosed volume is between the forward and rear flexible bulkhead seals. Exhaust stack visible at top left.



night, the wind, despite the complex flow path involved, created a powerful airflow into the external forward-facing intakes, through the intake trunking, upward via the plenum chambers, through the engine inlet mesh filters, and through the engines. This airflow had sufficient speed to lift snowflakes up into the area of the plenum chambers, passing around and over the engines. Numerous pipes, tubes wiring looms, and skin stiffeners within the plenum chambers would have ensured that snow was readily deposited on these obstructions and the chamber volumes easily filled with snow. Figure 8 shows a plenum chamber interior volume with the upper cowling removed. The condition of many parked aircraft noted in the morning after the snowfall ceased attested to the large volume of snow that must have passed into the intake and thus remained in the plenum chambers.

Effect of ambient conditions

Although the ambient temperature rose above freezing during the following morning, the large heat sink of the snow-filled plenum chambers, allied with the latent heat of melting ice and the small margin of ambient temperature above freezing level, would have severely limited the volume of trapped snow that melted. In contrast, the outside surfaces of the aircraft heated more rapidly, due to exposure to sunlight and ultimately required no deicing. Examination, by a crew, of the high-mounted aircraft intakes from the ground or indeed from a closer position would not, for geometric reasons, enable the interior of the plenum chambers to be seen.

Effect of subsequent engine operation

Engine starting would rapidly raise the temperature of the engine carcasses, causing the deposited snow to turn to slush and fall from the plenum chambers into the region of the inertia separators. Although some melt material may have been ingested, the bulk of the tightly packed slushy substance would have arrived at and remained in the area of the vanes. Since air was being drawn through a narrowing cross-section created by the wet slush deposit, and the deployed inertia separators, a condition analogous with the throat of a carburetor would occur in which a temperature drop would be created. A drop of only approximately 2 degrees C would lead to gradual refreezing and solidification of the surface of the slush. Operation of the inertia separators would cause the bypass doors to move the solidifying ice volume forward. Once the separators were returned to the normal position, however, the solidified masses would be free to slide backward toward the bypass doors, under the influence of the airflow. After engine shutdown, the wind would continue to drive air at just above freezing temperature over the refrozen slush, limiting the effect of the hot engines on the ice and rapidly cooling the engines by both internal and external flow.

The engines were soon restarted, creating a renewed cooling effect, presumably returning the slush to a fully frozen state. Again, inertia separators were operated automatically during autofeather checks, presumably driving refrozen slush forward. Once the separators were returned to the off position, the ice was again free to slide back toward the bypass doors.

As was stated earlier, there is compelling evidence that the anti-ice vanes were selected ON seconds before the fatal power loss. This action normally causes a 50% area reduction or blocking of the free flow of air to the engines at the position of each first vane and a similar 50% blocking at the more down downstream position of the bypass door (Figure 5). Data supplied by the engine manufacturer showed that an 87% reduction of cross-sectional area of the intake duct, under the torque, RPM, and ambient air conditions recorded and derived at the time of the power loss, would cause engine surge and flameout. A similar degree of blocking occurring at the low power settings and, hence, much lower mass-flow rates present during operation of the intake vanes on the ground, however, would not have this effect.

Thus a mechanism can be visualized in which weather conditions introduced large volumes of snow into the intake systems where it remained undetected and in a largely solid state. Operation of engines and vanes took place in a sequence that resulted in a large volume of refrozen slush finally lodging in the region of the inertia separators where it added to the blocking effect created by deployment of the latter. With the final volume of slush reducing each inlet duct cross-section by approximately 40%, the effect of its presence and that of the deployment of the vanes would have been sufficient to cause both engines to surge and flame out. The DFDR shows that the HP spools of both engines decelerated almost immediately to below their self-sustaining speed. This effect, coupled with the absence of continuous or auto ignition, ensured that flame-out was total and the engines did not relight.

Although many other possible causes have been suggested for this power loss, none was found to be as likely as the process described above, given the known conditions and sequence of events. As with most accidents involving icing, the direct evidence was lost, and in this case the contamination conditions within the intake systems could not be physically confirmed. Nonetheless, a process of reasonable deduction, based on all the available evidence and the test results, leads us to conclude that the sequence described above was the cause of the power loss. ◆

The Role of Lessons Learned

By Dr. Paul Werner and Richard Perry, Sandia National Laboratories, U.S.A.

(This article was adapted, with permission, from the author's presentation entitled The Role of Lessons Learned in the Investigate, Communicate, Educate Cycle for Commercial Aviation *prepared for the ISASI 2004 seminar held in Australia's Gold Coast region Aug. 30 to Sept. 2, 2004, which carried the theme "Investigate, Communicate, and Educate." The presentation was not orally presented due to unexpected circumstances affecting the authors. The entire paper, including cited references index, is on the ISASI website at www.isasi.org.—Editor)*

Aviation safety begins with safe aircraft. The safety of large transport airplanes operating in commercial service throughout the world has steadily improved over the last several decades. Nevertheless, accidents still occasionally occur. When they do occur, it is important to identify the root causes, precursors, and lessons learned of these accidents so that appropriate steps may be taken to reduce the risk of their reoccurrence. When presented with the data, facts, and histories available, it becomes painfully obvious that most, if not all, accidents followed one or more precursors or previous accidents that were not acted on for several reasons. The predominant reason is that those involved were unaware of the significance of what they had observed. This lack of awareness was due to a failure to view the event from the airplane level rather than the aircraft system, subsystem, or component level. Another reoccurring reason is that those involved were unaware of the existence of critical, relevant information. These reasons are actually common throughout many industries and tolerated or accepted by most. It is unacceptable in commercial aviation.

The aviation industry cannot afford the time and resources related to the loss or non-use of important safety information. Work must go on and airplanes must fly. The lessons learned system must allow individuals to do their jobs more effectively and the aviation system to operate safer and more efficiently. Such a system did not exist in the FAA. The need and urgency has been recognized and action taken to move in that direction. The first step is awareness and a transition to a different way of making decisions for regulatory and industry personnel at all levels doing their job.

Safety standards and the methods used to apply them must continually evolve due to advances in technology and demand for higher levels of safety. Each phase of the product lifecycle continuum impacts safety as information and experience derived from one phase is systemically applied to the other phases. Success of the entire continuum is dependent on effective safety management in each and every phase, capturing and using lessons learned from all phases of a product's lifecycle to continuously improve standards, validate design assumptions, identify precursors, mitigate risk in safety-related decision-making, and correct underlying sources of problems systemwide. Lessons learned from accidents are perhaps the most costly. It is vital to capture these lessons through investigation, communicate them to the appropriate organizations, and educate people to recognize and use these hard-learned lessons to proactively make commercial aviation safer.

Why lessons learned are important

Lessons learned are defined as knowledge or understanding gained by experience. The experience may be positive, such as a successful test or mission, or negative, such as a mishap or failure. A lesson must be significant in that it has an impact on safety; valid in that it is factually correct; and applicable in that it identifies a specific design, process, or decision that reduces or eliminates the potential for failures and mishaps, or reinforces a positive result.

Establishing a culture where we capture and use day-to-day information and experience from certification, maintenance, and operational activities is crucial to improving aviation safety. By doing so, we can expect to gain benefits that include

- documented guidance, information, and best practices passed on to less-experienced people,
- more-consistent safety decisions,

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Richard Perry *is manager of the Airworthiness Assurance Department of Sandia National Laboratories. An Air Force Academy graduate, he holds a M.S. in aeronautical engineering. He is an airline transport pilot rated with 4,600 hours of flight experience in a broad range of aircraft. He has served as the director of system safety and engineering at the Air Force Safety Center, reviewing approximately 50 accident investigations annually.*

• improved safety by reducing accidents and preventing any repeat accidents, and
• reduction in safety problems caused by breakdowns in communication between design and maintenance or operation organizations.

The best way to learn and improve is to analyze previous experience and draw conclusions for future direction based on them. One way regulators capture lessons learned is through development of regulations, policies, and procedures. *(See page 22.)*

Attributes of a successful process

Development and implementation of an effective lessons learned process is critical for improving aviation safety. Ideally, it would be an integrated, common infrastructure that captures and provides access to lessons learned safety information throughout a product's lifecycle. As such, a successful lessons learned process would have the following characteristics:

• A structured process for incorporating lessons learned into rules, policies, and procedures for certification, maintenance, and operations. The process should ensure that in-service lessons learned are incorporated in design or certification methods of compliance, and results of project-specific decisions are easily accessible by other certification projects.
• Use of a disciplined, data-driven approach to find root causes and determine the best actions to break the chain of events that lead to accidents.
• A process that includes periodic reviews and feedback. This should be a unique task from daily business for a "look back" and should ensure reviews are conducted at regular intervals.
• A process that ensures corrective actions are implemented for all root causes assessed, so that underlying sources of problems are corrected systemwide.

Barriers to capturing and using lessons learned

Several observations have been noted across diverse industries regarding effective capture and use of lessons learned. First, most organizations strive to reuse all kinds of documented experience, but it is not easy to do so in an effective manner. The reuse is rather ad hoc and unplanned, and it is often hard to know what to search for or how to find useful documents.

Another observation is that the "right" knowledge for solving a problem often exists somewhere within the organization, but the challenge is to take the time to search for it, identify it, get access to it, and then learn from it. Because that experience is represented internally by experts, the major problem is often finding and getting access to the "expert" in order to solve a problem.

In today's complex and fast-moving aviation system, engineers and inspectors often do not have the time to do extensive research and analysis of aircraft accidents and incidents. Instead, they must rely on their experience and training, and possibly the insight of others. So, why are lessons not learned?

• Cultural barriers, such as the lack of time to capture or submit lessons and a perception of intolerance for mistakes,
• Organizational barriers, such as communication across companies or lines of business is often difficult or nonexistent,
• Lessons are not routinely identified, collected, or shared across organizations and industry due to a lack of communication or other factors, and
• Unorganized lessons are hard to use with too much material to search; information may be formatted differently for different accident reports; the information needed is not available; it's not quickly available; or work pressures don't allow the time or resources.

Critical concepts

The concepts discussed below are critical to the identification of design and certification lessons learned from accidents.

***Aircraft-level awareness*—**When presented with the data, facts, and histories available, it becomes painfully obvious that most, if not all, accidents followed previous events that were not acted upon because someone was unaware of the significance of what they observed. Often this was because they failed to view the significance of the event at the airplane level rather than the system, subsystem, or component level. In most cases, those involved were unaware of the existence of critical, relevant information, i.e., lessons learned.

A conclusion from many of the accidents reviewed during the Commercial Airplane Certification Process Study (March 2002) was that adequate processes do not exist within the FAA or in most segments of the commercial aviation industry to ensure that the lessons learned from specific experiences in airplane design, manufacturing, maintenance, and flight operations are captured permanently and made readily available to the aviation industry. Consequently, the failure to capture and disseminate lessons learned has allowed airplane accidents to occur from causes similar to those of past accidents. In response to this concern, Change Area 1.C, Precursor Awareness, was tasked to specifically *"Develop AVR airplane-level awareness for improved identification and risk assessment of accident precursors. Define methods to capture, share, and use lessons learned information throughout industry and the lifecycle."*

***Precursors*—**The role and importance of accident precursor recognition cannot be overemphasized. Precursor data can be a valuable source of information for decision-making, either directly or as a supplement to risk analysis. Moreover, precursor data inherently

Partial Listing of Major Transport Airplane Accidents that Have Helped Shape U.S. Federal Aviation Regulations (FARs) and Policies

- Ford Trimotor in U.S.—1930 (engine failure on takeoff)
- TWA L1049/UAL DC-7 near Grand Canyon—1956 (enroute ATC)
- Braniff L-188 near Buffalo, Texas—1959 (propeller whirl mode)
- U.S. operator/Viscount in Maryland—1962 (birdstrike to tail)
- Northwest L-188 near Cannelton, Indiana—1960 (propeller whirl mode)
- Eastern L-188 at Boston—1960 (bird ingestion to engines)
- Pan Am B-707 near Elkton, Maryland—1963 (lightning strike to fuel tanks)
- United B-727 at Salt Lake City—1965 (stretchable fuel lines)
- Pan Am B-707 at San Francisco—1965 (rotor burst)
- Mohawk BAC1-11 in United States—1967 (APU inlet fire)
- U.S. carrier B-727 at Los Angeles Int. Airport—1969 (human factors, cockpit switches)
- Air Canada DC-8 near Malton, Ontario—1970 (human factors, spoilers)
- Eastern L-1011 near Miami—1972 (human factors, ATC)
- VARIG B-707 near Paris—1973 (smoking/waste bin fire in lavatory)
- Turk Hava Yollari DC-10 near Paris—1974 (pressure relief, human factors)
- Lufthansa B-747 near Nairobi—1974 (takeoff warning, human factors)
- TWA B-727 near Berryville, Virginia—1974 (human factors, ground proximity)
- Eastern B-727 near New York City—1975 (windshear)
- KLM B-747/Pan Am B-747 at Tenerife—1977 (human factors, ATC)
- Southern Airways DC-9 near Atlanta, Georgia—1977 (rain ingestion to engines)
- Pacific Southwest Airlines B-727 at San Diego, California—1978 (human factors, TCAS)
- United Airlines DC-8 near Portland, Oregon—1978 (human factors, low fuel warning)
- American Airlines DC-10 at Chicago, Illinois—1979 (system isolation, human factors)
- Saudia L-1011 near Riyadh, Saudi Arabia—1980 (interior fire, human factors)
- Air Florida B-737 at Washington, D.C.—1982 (human factors, airframe/engine icing)
- British Airtours B-737 at Manchester, England—1985 (fuel tank access covers)
- Delta L-1011 at Dallas, Texas—1985 (windshear)
- Japan Air Lines B-747 near Tokyo—1985 (system isolation, pressure venting)
- Mexicana B-727 near Maravatio, Mexico—1986 (wheelwell fire)
- Northwest DC-9 at Detroit—1987 (human factors, takeoff warning)
- South African Airways B-747 in Indian Ocean—1987 (cargo compartment fire)
- Aloha Airlines B-737 in Hawaii—1988 (structural corrosion)
- American Airlines DC-10 at Dallas/Ft. Worth—1988 (break wear)
- TACA B-737 near New Orleans, Louisiana—1988 (hail ingestion to engines)
- United Airlines B-747 in Hawaii—1989 (structural inspection)
- United Airlines DC-10 near Sioux City, Iowa—1989 (system isolation, engine inspections)
- USAir Jetstream 3100 at Beckley, West Virginia—1991 (tail plane icing)
- Lauda B-767 near Bangkok, Thailand—1991 (thrust reverser inflight deployment)
- American Eagle SF340 near New Roads, Louisiana—1994 (propeller beta in flight)
- Simmons Airlines ATR 72 near Roselawn, Indiana—1994 (freezing rain)
- ValuJet DC-9 near Miami—1996 (hazmat, cargo fire protection)

incorporate the effects of factors such as human errors and intersystem dependencies.

Accident precursor identification should identify latent and potential design, certification, and operational safety issues and correct them before they become accidents through

- comprehensive monitoring, sharing, and use of design and operational safety information and a consequent growth in the understanding of current and emerging accident precursors and direct causes.
- immediate certification and operational interventions at the regional, national, and international levels.

Precursor events can be any service information or experience or test or inspection data that could be interpreted as a predictor that the event consequence could occur if the event conditions were present. Accident precursor data can be from any discipline (e.g., risk analysis, statistics, engineering, ergonomics, psychology, sociology, organizational behavior).

Daniel Cheney of the Federal Aviation Administration suggested the following definitions of precursor types:

Type 1: Precursors with no protection or mitigation elements associated with the prevention of the event initiation, progression, or consequences. Types 1 are the most potentially serious of all precursor events.

Type 2: Precursors with no consistent or dependable protection or mitigation elements associated with the prevention of the event initiation, progression, or consequences. Nearly as potentially serious as Type 1, but may have an opportunity for intervention by flight crew, ground crew, or others.

Type 3: All other precursor events—those that have at least one consistent or dependable protection or mitigation element associated with the prevention of the event initiation, progression, or consequences. Type 3 precursors require at least one other condition in addition to the event condition to occur. These represent the vast majority of service information (i.e., data) used in the safety-oversight process.

An example of a Type 1 precursor for the 1979 American Airlines DC-10 crash would be the 1978 pylon flange failure on a Continental Airline DC-10 during maintenance. This incident was essentially masked in trivia in a report circulated to other airlines and did not specifically identify that the failure was related to the method used to remove the pylon.

Precursors are not just technical in nature. The DC-10 example also shows how precursors can be related to procedural/human factors, political events, and decisions. Accident precursor recognition is a vital part of a proactive intervention strategy and needs to be an important part of any safety management program.

Root causes

A driving reason for investigating accidents is to prevent future accidents. By identifying root causes (a cause is a set of sufficient conditions—each is necessary but only together are they sufficient), we can potentially avoid a whole "class" of accidents. Unfortunately, there is significant variation in people's perceptions of accidents. For example,

- viewing accidents as a single event. This often includes regulatory compliance/violation thinking.
- linear chain-of-events thinking, like knocking over a row of dominos.
- statistical analysis methods.
- viewing an accident as a process involving concurrent actions by various actors to produce an unintended outcome.

At the heart of root-cause analysis is the knowledge that things do not just happen. Events are caused to happen, and by understanding the causes we can decide which ones are within our control and manipulate them to meet our goals and objectives. Root causes can be defined as the first factor in a chain of events that can be controlled through a regulation, policy, or standard. It is a point in the chain of events at which internal control can be exercised. Simply put, they can be found by stating the end result and keep asking "why?" until you have found a factor that can be corrected by the application of a regulation/policy/standard at the governing/management, implementing, or individual level, or you have reached a non-correctable situation. There may also be insufficient data to proceed further.

There is a strong link between root causes, decision-making, and lessons learned, especially in

- establishment and communication of a regulation or policy,
- application of a regulation or policy,
- establishment and communication of monitoring and oversight, and
- enforcement of that regulation or policy, based on monitoring and oversight.

System safety

In commercial aviation, a single accident is often disastrous. One obvious lesson from the short history of aviation is that most accidents are not the result of unknown scientific principles but more likely result from the failure to apply well-known engineering practices. A valuable lesson is that technology alone will not provide a solution; another lesson from history is that the non-technical issues cannot be ignored. Safety requires control of all aspects of the development and operation of a system. System safety covers the entire spectrum of risk management, from design of hardware to the culture and attitudes of the people involved.

Safety is a property of a system. For example, determining whether an aircraft is acceptably safe by examining the landing gear, or any other component, is not possible. Talking about the "safety of the landing gear" out of context of the aircraft and how it operates is really meaningless. Safety can only be determined by the relationship between the landing gear and other aircraft components, that is, in the context of the whole aircraft and its environment.

A systems approach provides a logical structure for problem solving. It views the entire system as an integrated whole. To make the system safe, we must manage safety (risk) and we must assess safety. Management is what is done to ensure safety (limit risk), and assessment (surveillance, in this case) is what is done to determine whether the results are satisfactory. One cannot be practiced without the other to have a positive impact on safety.

System safety is characterized by the systematic identification and control of hazards throughout the lifecycle of a system. It calls for the timely identification of system hazards before the fact and emphasizes the designing an acceptable level of safety into the system.

Some basic concepts of system safety are that

- safety should be built into the system, not added on to a completed design.
- safety is a property of the system, not a component.
- accidents are not always caused by failures and all failures do not cause accidents.
- analysis to prevent the accident is emphasized instead of reacting to the accident.
- emphasis is on identifying hazards as early as possible and then designing to eliminate or control those hazards (more qualitative than quantitative).
- tradeoffs and compromises in system design need to be recognized.
- system safety is more than just systems engineering.

Design safety concepts

Aviation safety begins with safe aircraft. The safety of large transport airplanes operating in commercial service throughout the world has steadily improved over the last several decades. Many techniques are used to achieve a safe design and include

- design integrity (will not fail or has very high margins, e.g., propellers, landing gears, turbine rotor discs) and quality,
- redundancy,
- isolation,
- reliability,
- failure indication,
- flight crew procedures,
- checkable/inspectable,
- damage tolerance,

- failure containment,
- designed failure path,
- margins/factors of safety, and
- error tolerance.

Four basic elements of design safety (U.S. transport-category aircraft)

ELEMENT NO. 1. Basic Design Philosophy and Methodology

The design philosophy governs the overall design approach, establishes design criteria, and dictates failure assumption. The fail-safe philosophy is the chosen basic design philosophy and from this has emerged the fail-safe design concept, i.e., "no single failure or probable combination of failures during any one flight shall jeopardize the continued safe flight and landing of the airplane."

Design safety precedence:

- Design to minimum hazard—Design the hazard out. If it cannot be eliminated, minimize the residual risk.
- Use safety devices—Do this by incorporating a fail-safe mode, safety devices, or fault-tolerant features.
- Use warning devices—Done through measuring devices, software, or other means. The warning should be unambiguous and attract the operator's attention.
- Use special procedures—Used when the above means are unable to control the hazard.

ELEMENT NO. 2. The Official Code of Airworthiness Design Standards for Transport-Category Aircraft, Engines, Propellers, and APUs

This is the legal codification of Element No. 1 and is usually referred to as the type certification code. The legal design safety code specifies how the design safety methodology is to be applied; what general or specific design safety methods are to be incorporated; what, if any, specific exceptions are to be allowed; and any specific additions.

FAR Parts 25, 33, and 35 are the legal codifications of the basic "fail-safe design concept" that was developed by the U.S. aircraft transport industry over a period from the days of the Ford Trimotor of the 1920s until the present day.

ELEMENT NO. 3. The Type Design Check

The purpose of the "design safety check" is to verify or validate that the design does, in fact, meet the required minimum safety standards embodied in Elements 1 and 2. The "Type Design Safety Check" is formally completed with the issuance of an FAA type certificate. The design safety check also includes the manufacturer's in-house safety assessments, flight, and laboratory test programs, qualification test programs, and the FAA Type Design Certification Program.

ELEMENT NO. 4. The Official Accident Investigation and the Finding of Probable Cause

This includes an official public report of the accident findings. The knowledge contained in the findings, especially the lessons learned, is used to improve and strengthen the design philosophy, code, and checks of Elements 1, 2, and 3.

Safety and reliability

System safety and reliability are often confused. Although similar, it is important to first understand the difference between the two. Fundamentally, the two disciplines ask and seek to answer two different questions about two different concepts. Reliability asks, "How often does something fail?" System safety asks, "What happens (to the system) when something fails or behaves unexpectedly?" Although it is obviously concerned with system failure, reliability is usually concerned with individual parts. Remember, a reliable system is not necessarily a safe system.

As applied to civil aircraft designed to FAR 25, safety is not reliability. As standards, they are related but distinctly different concepts with different objectives. Both are concerned with the causes of failure. The difference is, briefly, reliability is concerned with the frequency of failure and safety is concerned with the impact of failure. An aircraft design can be safe but unreliable, it can be reliable but unsafe, and it can be safe and at the same time reliable. Safety and reliability are essentially related, independent design parameters that tend to complement or oppose each other, but one cannot be substituted for the other. The type certification process finds an aircraft design to be in compliance only with safety standards; it does not and cannot establish the reliability level of the design.

Design integrity

The probability of failure of an aircraft component is controlled by its design specification, including its qualification testing, and is a measure of its design integrity. The concept of design integrity is concerned with the quality of the design and its ability to perform its intended functions as required by the design specification and FAR 25.1309(a). Design integrity is generally established through the qualification testing of individual aircraft components to their design specification requirements. Design integrity is an integral part of the basic aircraft safety concept. The achieved reliability of a component in service is a measure of its design integrity. The operator's approved maintenance program and the operator's/manufacturer's product improvement program control the reliability of an approved aircraft design.

It is necessary to adopt a more rigorous and systematic approach to lessons learned safety training and management. A first step is awareness and a transition to a different way of making decisions for regulatory and industry personnel at all levels doing their job.

Aircraft-centered system

As discussed earlier, accidents, and consequently the lessons learned, are products of system interactions. Therefore, it is critical to have at least a minimal understanding of all the subordinate elements and how they behave as a system in order to identify, understand, and apply lessons learned.

The hierarchical breakdown used here is consistent with and adds to the Air Transport Association (ATA) index. This breakdown provides a familiar structure and is consistent with normal systems engineering practice. It is convenient for lessons learned because it groups subsystems together technologically. The aircraft is broken down as

- Airframe—This element includes wing, fuselage, and empennage.
- Mechanical—This element includes landing gear, hydraulics, flight controls, and cargo loading equipment.
- Electrical—This element includes electrical power and lighting.
- Propulsion—This element includes the engine pod and pylon and their components, fuel components, and thrust management components.
- Avionics—This element includes communication, navigation, and aircraft monitoring equipment.
- Environmental—This element includes cabin pressure, air conditioning, and oxygen equipment.
- Interior—This element includes crew and passenger accommodations.
- Auxiliary, other—This element includes auxiliary electrical and pneumatic power supplies.

Other factors in aircraft accidents

Aging aircraft—The average age of the U.S. commercial aircraft fleet today already exceeds 75 percent of the typical nominal 20-year design life of a passenger aircraft. Significant attention must accordingly be given to better understanding and quantifying the mechanisms of aircraft aging. If these failure mechanisms are left unchecked, the significantly longer times in service that can be anticipated could lead to a significant increase in the accident rate.

Human factors—Basic automated flight control systems and electromechanical displays are giving way to new generations of jet transport aircraft equipped with highly automated flight management systems and flat panel or liquid crystal displays. The new technology has significantly changed the work of airline pilots and has implications for all elements of the aviation system, especially design and safety regulation. Air safety investigators and researchers worldwide have witnessed the emergence of new human factors problems related to the interaction of pilots and advanced cockpit systems.

Environment—This is the environment external to the aircraft. Weather is probably the most prominent factor.

Maintenance, operations—Maintenance and operational events are the primary source of information for accident precursors and lessons learned.

Regulations, policies, standards—Past lessons learned are often captured in regulations, policies, and standards. Most accidents have factors related to the absence of or misapplication of such guidance and direction. Accident precursor information and lessons learned are a valuable source to aid in interpretation, implementation, and certifications decisions.

Software—All commercial transport aircraft designed and built within the last 15 years have some computer technology, mostly in the cockpit. The computers are intended to make flying easier and safer, and in general they do. But when things don't happen as expected, it can be hard to figure out quickly what's going on and how to deal with it. The safety of an aircraft depends on designing and building it to the highest standards of safety we know, and the same goes for its computer systems. Careful attention must be paid to how well we design and build those computer systems.

Most accidents will have lessons learned in more than one of the previously mentioned elements and involve one or more of the concepts and factors discussed.

Conclusion

Lessons learned are defined as knowledge or understanding gained by experience. Aviation experience and knowledge now spans several generations of safety managers and engineers. It is no longer possible for comprehensive knowledge to be exchanged from experienced safety individuals to the next generation of safety personnel through on-the-job training alone. The system is so complex that it is unlikely that any one individual can possess truly comprehensive system safety understanding. Advances in technology and demands for higher levels of safety dictate that standards and the methods used to apply them must continually evolve.

The role of lessons learned in the *investigate, communicate, educate cycle* for commercial aviation cannot be overstated. It is a necessary part of the organizational safety strategy involving continuously improving standards, validating design assumptions, identifying precursors, mitigating risk in safety-related decision-making, and correcting underlying sources of problems systemwide. It is necessary to adopt a more rigorous and systematic approach to lessons learned safety training and management. A first step is awareness and a transition to a different way of making decisions for regulatory and industry personnel at all levels doing their job. ◆

Cirrus Training Effort Is Recognized

ISASI President Frank Del Gandio recognized the Cirrus Aircraft Corporation with an award at ISASI 2005 for its development of "First Responder" training seminars. In making the award presentation Del Gandio said, "Cirrus, one of the leading general aviation aircraft manufacturers, has made a remarkable commitment to general aviation safety awareness presenting 'First Responder' seminars."

He added, "On its own initiative, the corporation has initiated hundreds of seminars and workshops across the country. These presentations are being given to familiarize and educate First Responders, which include rescue personnel and accident investigators who may respond to an accident involving an aircraft equipped with a Ballistic Recovery System (BRS). This training is invaluable," he concluded.

Cirrus is a pioneer in an innovative and revolutionary general aviation safety enhancement known as the Cirrus Airframe Parachute System (known as CAPS.) CAPS is a "ballistic parachute" system created by Ballistic Recovery Systems for Cirrus Design to safely lower a light airplane from an emergency in the air to the ground. A solid-fuel rocket, housed in the aft fuselage, is used to pull the parachute out from its housing and fully deploy the canopy within seconds. The CAPS system is designed into all of the aircraft Cirrus builds—SRV, SR20, and SR22.

In the recent past, two different Cirrus pilots encountered inflight emergencies and brought their planes safely to the ground by deploying their onboard parachutes—only the second and third emergency uses of CAPS. This technology was first used in an emergency in October 2002.

Cirrus has been instrumental in assisting the Federal Aviation Administration in modifying its aircraft accident school's curriculum to ensure that aviation safety inspectors are also aware of the safety precautions involving Ballistic Recovery Systems installed on other types of aircraft, Del Gandio noted.

The Ballistic Recovery Systems, Inc. was named a recipient of a prestigious Laureate Award by *Aviation Week & Space Technology* magazine as the top business and general aviation company in 2004. The award was made in April. ◆

E. MARTINEZ

Bill King (left) and Mike Busch (center) accept recognition plaque from ISASI President Del Gandio.

Kapustin Scholarship Issues 2006 Application Call

The ISASI Rudolf Kapustin Memorial Scholarship Committee has issued its call for scholarship applications to universities and colleges whose students are eligible to participate in the program, according to the Fund's administrators, Richard Stone, ISASI Executive Advisor, and Ron Schleede, ISASI vice-president. The deadline for applications is April 1, 2006.

The goal of the Fund is to encourage and assist university and college-level students interested in the field of aviation safety and aircraft occurrence investigation. All members of ISASI enrolled as a full-time student in an ISASI-recognized education program, which includes courses in aircraft engineering and/or operations, aviation psychology, aviation safety, and/or aircraft occurrence investigation, etc., with major or minor subjects that focus on aviation safety/investigation, are eligible for the scholarship. A student who has once received the annual ISASI Rudolf Kapustin Memorial will not be eligible to apply for it again. One or more students will be selected in this process.

The scholarship consists of a $1,500 award to help cover travel, registration, lodging, and meal expense in attending ISASI's annual seminar, which will be held in Cancun, Mexico, Sept. 11-14, 2006.


E. MARTINEZ

Winners of the ISASI Kapustin Scholarship Fund to date. All attended the ISASI 2005 seminar and are shown here with the two Fund administrators. Left to right, R. Schleede, C. Reil, Noelle Brunelle, Shannon Harris, M. Schuurman, and R. Stone.

Application requirements

• A full-time college or university student in courses in aircraft engineering and/or operations, aviation psychology, aviation safety, and/or aircraft occurrence investigation, etc., with major or minor subjects that focus on aviation safety/investigation of minimum duration of 1 year. The student must be a member of ISASI.

• The student is to submit a 1,000 (+/- 10 percent) word paper in English addressing "The Challenges for Air Safety Investigators."

• The paper is to be the student's own work and must be countersigned by the student's tutor/academic supervisor as authentic, original work.

• The papers will be judged on their content, original thinking, logic, and clarity of expression.

• The student must complete the application available at the university or at ISASI headquarters and submit it to ISASI with his/her paper by April 1, 2006.

• Completed applications should be forwarded to ISASI, 107 Holly Ave., Suite 11, Sterling, VA 20164-5405 USA. E-mail address: isasi@erols.com, Telephone: 703-430-9668.

• Applicants will be notified of ISASI's decision by May 1, 2006.

• The judges' decision is final. ◆

Call for Papers—ISASI 2006

The International Society of Air Safety Investigators Presents its 37th International Seminar Sept. 11-14, 2006, at the Fiesta America Grand Coral Beach Hotel, Cancun, Mexico

Theme: *"Incidents to Accidents: Breaking the Chain"*

If you wish to offer a presentation in line with the seminar's theme, please adhere to the below schedule:
Indication of interest: Jan. 31 2006
Abstracts due: March 31, 2006
Selected papers due in electronic format: July 31, 2006

Topics sought

The Technical Committee is looking for about 16 papers on current investigation experience, techniques, and lessons learned with particular emphasis on international investigation challenges. In keeping with the theme, papers directed toward emphasizing how we can maximize the lessons learned from accident investigation and translate those lessons to effective prevention will be considered.

PowerPoint presentations are not acceptable for publication in seminar *Proceedings* or seminar CDs. Submittal of an abstract implies agreement that the author authorizes publication of the completed paper in the seminar *Proceedings* and the *ISASI Forum*.

Send indication of interest and abstracts to Jim Stewart, Technical Program Chair, e-mail to papers@rogers.com, or mail to 307-1500 Riverside Drive, Ottawa Ontario, Canada, K1G4j4.
Phone: 613-736-1491.

Athens Reachout Workshop Teaches 36 Attendees

ISASI's 14th Reachout Workshop conducted in Athens, Greece, July 18-29, covered aircraft accident investigation and safety management systems. The Hellenic Aircraft Accident Investigation and Aviation Safety Board (AAI & ASB) hosted the workshop. Capt. Akrivos Tsolakis, chairman of the AAI & ASB, opened the popular training session.

Held in the facilities of the AAI & ASB at the Athens International Airport, the 7-day-long accident investigation module was conducted by Ron Schleede and Caj Frostell. This module presented ICAO requirements and international obligations, Annex 13, selection and training of investigators, planning and organization to conduct an investigation, procedures and checklists, wreckage recovery, field investigation, accident site management, group organization, flight recorders, technical investigation, operations investigation, off-scene testing, crashworthiness, witness interviewing, pathology, family assistance, avoidance and protection of biohazards exposure, news media, factual reports and public records, writing the final report, identification of safety deficiencies, making safety recommendations, and nine interactive case studies.

Jim Stewart and Frostell conducted the 3-day safety management systems (SMS) module. It contained presentations on the international and national requirements for SMS, statistics and the need for data, the safety eras, the SHELL model, the Reason model, the MEDA/PEAT analysis tools, safety management evolution, building a non-punitive reporting program, SMS processes, lessons from the *Challenger* accident, risk management, safety culture, dealing with change, regulating SMS, assessing an SMS program, and three case studies.

The instructors prepared the training material for their modules consisting of paper handouts and CD-ROM libraries of published manuals and booklets. Each participant received copies of documents and CD-ROMs with considerable background materials for future reference

Thirty-six persons attended the workshop. They represented the AAI & ASB, Athens International Airport, Hellenic ATA, Hellenic Coast Guard, Hellenic Police, Hellenic Fire Corp., Hellenic Air Force, Hellenic Army, Hellenic Navy, Cyprus AAIB, Olympic Airlines, and Aegean Airlines. All participants received ISASI certificates for the accident investigation module, the avoidance and protection of biohazards exposure course, and the safety management systems module.

Caj Frostell reports that AAI & ASB and the participants were appreciative of the ISASI initiative to bring the Reachout Workshop program to Greece. ISASI membership forms and corporate membership forms were made available to the participants. Capt. Tsolakis announced that the AAI & ASB was

ISASI Annual Report 2004—Profit & Loss Budget

	Jan.-Dec. 04	Budget	$ Over Budget	% of Budget
Ordinary Income/Expense				
Income				
601 Dues-New Individual Member	11,650.00	10,000.00	1,650.00	116.5%
603 Dues-New Corporate Member	4,183.00	5,000.00	-817.00	83.66%
611 Dues-Renewal Individual Member	65,700.00	71,000.00	-5,300.00	92.54%
613 Dues-Renewal Corporate Member	63,356.00	50,000.00	13,356.00	126.71%
614 Dues-Late Fees	1,460.00	500.00	960.00	292.0%
615 Dues-Upgrade Fees	185.00	300.00	-115.00	61.67%
616 Dues-Reinstatement Fees	150.00			
621 Contrib.-Unres. Membership	1,950.00	2,000.00	-50.00	97.5%
631 Publication Subscriptions	792.00	500.00	292.00	158.4%
632 Publication Income	1,451.00	500.00	951.00	290.2%
634 Library Services	58.06	150.00	-91.94	38.71%
642 Membership Services	187.37	400.00	-212.63	46.84%
643 Membership Regalia Sales	268.57	400.00	-131.43	67.14%
650 Seminar-*Proceedings*	0.00	5,000.00	-5,000.00	0.0%
651 Seminar-Net Proceeds	32,951.79	10,000.00	22,951.79	329.52%
652 Seminar-Reimbursed Advance	3,000.00	3,000.00	0.00	100.0%
Total Income	187,342.79	158,750.00	28,592.79	118.01%
Expense				
700 Condo Fees	3,968.60	2,800.00	1,168.60	141.74%
705 Mortgage Interest	5,719.14	9,500.00	-3,780.86	60.2%
711 Repairs and Maintenance	969.76	1,000.00	-30.24	96.98%
712 Storage Rental	1,620.00	1,000.00	620.00	162.0%
801 P/R Exp.-Office Mgr. Salary	41,237.92	37,000.00	4,237.92	111.45%
802 P/R Exp.-Health Insurance	11,182.00	9,000.00	2,182.00	124.24%
803 P/R Exp.-SEPP	1,864.02	1,800.00	64.02	103.56%
804 P/R Exp.-Trng. Misc. and Benefits	0.00	300.00	-300.00	0.0%
808 P/R Expense-Bonus	0.00	500.00	-500.00	0.0%
811 Accounting-Payroll	880.55	850.00	30.55	103.59%
812 Accounting-Tax Prep.	405.00	500.00	-95.00	81.0%
814 Insurance	3,166.00	1,500.00	1,666.00	211.07%
817 Licenses and Permits	140.00	150.00	-10.00	93.33%
821 OPS-Rent	233.38			
822 OPS-Telephone & Telex	3,465.87	2,400.00	1,065.87	144.41%
824 OPS-Equip Maint. & Repair	2,148.44	1,800.00	348.44	119.36%
825 OPS-Other Utilities	3,065.79	3,000.00	65.79	102.19%
826 OPS-Postage and Shipping	7,136.00	6,500.00	636.00	109.79%
827 OPS-Printing and Reproduction	3,211.38	1,600.00	1,611.38	200.71%
828 OPS-Office Supplies	4,293.97	3,000.00	1,293.97	143.13%
830 OPS-Computer Tech. Support	2,932.50	250.00	2,682.50	1,173.0%
831 OPS-Equipment Purchase	0.00	4,000.00	-4,000.00	0.0%
832 OPS-Equipment Lease	3,948.04	1,000.00	2,948.04	394.8%
833 OPS-Petty Cash	200.00	200.00	0.00	100.0%

Biohazards students shown in protection garb during course work. Also shown is Nikos Pouliezos (left), Ron Schleede (center), and John Papadopoulus (right).

vs. Actual

	Jan.-Dec. 04	Budget	$ Over Budget	% of Budget
840 OPS-Temp. Help	384.00	500.00	-116.00	76.8%
844 Publications-*Forum* Expense	36,523.28	38,000.00	-1,476.72	96.11%
845 Publications-*Proceedings*	6,324.95	5,000.00	1,324.95	126.5%
848 Publications-Handbook Expense	1,069.00	1,000.00	69.00	106.9%
856 Membership-Regalia Items	0.00	500.00	-500.00	0.0%
861 Membership-Service Expense	4,860.48	1,500.00	3,360.48	324.03%
871 Library Expenses	592.69	1,000.00	-407.31	59.27%
881 Management Council-Travel	12,324.43	16,500.00	-4,175.57	74.69%
882 Management Council-Admin. Exp.	951.83	1,300.00	-348.17	73.22%
883 Management Council-Other	3,911.74	3,000.00	911.74	130.39%
886 Management Council-Rep. Travel	93.84	500.00	-406.16	18.77%
887 Management Council-Rep. Admin.	0.00	200.00	-200.00	0.0%
891 Rebate-Natl./Reg./Corp.	0.00	2,000.00	-2,000.00	0.0%
901 Seminar-Advances	0.00	3,000.00	-3,000.00	0.0%
903 Seminar-Lederer Award	173.90	500.00	-326.10	34.78%
911 Bank Fees	290.48	400.00	-109.52	72.62%
912 Credit Card Charges	2,862.97	2,500.00	362.97	114.52%
Total Expenses	172,151.95	167,050.00	5,101.95	103.05%
Net Ordinary Income	15,190.84	-8,300.00	23,490.84	-183.02%
Other Income/Expense				
Other Income				
661 Rent-Tenant Rental Income	7,465.00	8,460.00	-995.00	88.24%
671 Interest-Checking Acct.	200.62	500.00	-299.38	40.12%
681 Other Income-Miscellaneous	30.00			
682 Other Income -Refunds	10.70			
Total Other Income	7,706.32	8,960.00	-1,253.68	86.01%
Other Expenses				
926 Penalties	1.58			
922 Misc.-Other Reimb. Exp.	976.88			
924 Misc.-Death/Illness Exp.	154.20			
925 Misc. Refunds	259.40			
930 Depreciation	11,039.00			
Total Other Expense	12,431.06			
Net Other Income	-4,724.74	8,960.00	-13,684.74	-52.73%
Net Income	**10,466.10**	**660.00**	**9,806.10**	**1,585.77%**

becoming an ISASI corporate member. Also, three workshop participants joined ISASI as individual members.

Olympic Airlines, Aegean Airlines, Athens International Airport, Hellas Jet, Air BP, Karayannis Group of Companies, and the Hellenic Flight Safety Foundation provided local sponsorships. All travel and daily subsistence costs for the three instructors were covered by AAI & ASB. ◆

International Councillor Shares Mail

ISASI'S International Councillor, Caj Frostell, shares mail he received from a Society member in China. He wrote:

"I recently received a very interesting communication from one of our members in China. Ms. Lin Yang wrote: 'I will never forget a day 10 years ago when I read the *ISASI Forum* for the first time. The authors with their valuable and diversified experiences gave me insights and inspirations. From then on, I have read every article in every issue of the *ISASI Forum* and I have never been disappointed.'

"Ms. Yang further suggested: 'As a member of ISASI in China, I think I could promote the ISASI mission in China and get more Chinese colleagues aware of ISASI, and to participate in the sharing of air safety investigation findings, investigation techniques, and experiences.' In this respect, she is planning to translate and distribute each issue of the *ISASI Forum* in China in order to assist our Chinese colleagues in the aviation safety investigation field. We wish Ms. Yang success in her endeavors in promoting ISASI, aviation safety, and accident investigation in China."

Ms. Yang graduated in 1994 with a BS in electronics engineering from Shandong University in China. She joined the flight safety group of the Civil Aviation Safety Research Center, which later became the CAAC's Accident Investigation Laboratory (CASTC). Ms. Yang is now a senior engineer. She has also translated several flight crew operations manuals into Chinese for airlines in China, as well as a flight data monitoring manual. ◆

DUES NOTICE

Invoices for the 2006 annual dues (January 1 through December 31) to ISASI have been mailed. All individual members are asked to check individual identification information and update where necessary. Members are reminded that the deadline for payment is Jan. 31, 2006. A fee of $20 will assessed for late payments. Credit card payment may be made. See the mailed invoice for credit card use. Checks should be made payable to ISASI and forwarded to ISASI, 107 E. Holly Avenue, Suite 11, Sterling, VA 20164-5405 USA. ◆

Transportation Fatalities Decrease In 2004

Transportation fatalities in the United States decreased slightly in 2004, according to preliminary figures released by the National Transportation Safety Board. Deaths from transportation accidents in the United States in 2004 totaled 44,870, down from the 45,158 fatalities in 2003.

"Although it is always gratifying to see transportation fatalities decline," NTSB Acting Chairman Mark Rosenker said, "the yearly toll, especially on our highways, continues to be unacceptable. We need to do more at all levels—federal,

ISASI ROUNDUP

Continued . . .

Australian and New Zealand Societies of Air Safety Investigators

PRELIMINARY NOTICE and CALL FOR PAPERS

2006 Regional Air Safety Seminar
Hilton on the Park, Melbourne, Victoria
Friday, Saturday, and Sunday, June 2–4, 2006

This seminar will be an educational event with emphasis on contemporary regional issues in aircraft accident investigation and prevention.

The Asia-Pacific Cabin Safety Working Group is expected to meet on Friday, June 2, and there will be a visit to the Defence Science and Technology Organization at Fishermen's Bend on the Friday afternoon.

If you wish to offer a presentation for the seminar, please provide an abstract (approximately 100 words) plus personal details by Feb. 1, 2006, to Paul Mayes, e-mail: Paul.Mayes@airnz.co.nz, phone: +64 9 256 3402, fax: +64 9 256 3911, post: ASASI, P.O. Box 588, Civic Square ACT 2608

state, and local—to protect our traveling public."

The number of persons killed in all aviation accidents dropped from 710 in 2003 to 651 in 2004. There were no fatalities on commuter carriers in 2004. The number of general aviation fatalities also decreased from 632 in 2003 to 556 in 2004. There were 14 airline fatalities, 13 of which occurred in a crash of a Jetstream aircraft in Kirksville, Mo. Air taxi fatalities increased from 42 to 65.

Highway transportation, which accounts for the largest portion of fatalities, decreased from 42,884 in 2003 to 42,636 in 2004. The number of fatalities increased in the motorcycle, light trucks and van, and medium and heavy trucks categories. However, there was a decrease in the number of deaths occurring in the passenger car category, which recorded 634 fewer fatalities in 2004 than in 2003.

Total rail fatalities increased from 760 in 2003 to 802 in 2004, reflecting a rise in every category except passenger fatalities, which remained at 3. Fatalities occurring on light rail, heavy rail, and commuter rail increased from 165 to 186. ◆

Who is Where?

Richard F. Healing, National Transportation Safety Board member, has retired from government service. He left his position as member of the National Transportation Safety Board on August 1. **Jim LaBelle** has been named as director of the National Transportation Safety Board's regional aviation office in Anchorage, Alaska. He is a senior NTSB air safety investigator who has been working in the Alaska office for the last 10 years. For the past year, he has been acting director of the office. ◆

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Japan Airlines Domestic Co., LTD
Japanese Aviation Insurance Pool
JetBlue Airways
KLM Royal Dutch Airlines
L-3 Communications Aviation Recorders
Learjet, Inc.
Lockheed Martin Corporation
Lufthansa German Airlines
MyTravel Airways
National Air Traffic Controllers Assn.
National Business Aviation Association
National Transportation Safety Board
NAV Canada
Phoenix International, Inc.
Pratt & Whitney
Qantas Airways Limited
Republic of Singapore Air Force
Rolls- Royce, PLC
Royal Netherlands Air Force
Royal New Zealand Air Force
rit, LLC
Sandia National Laboratories
Saudi Arabian Airlines
SICOFAA/SPS
Sikorsky Aircraft Corporation
Singapore Airlines, Ltd.
SNECMA Moteurs
South African Airways
South African Civil Aviation Authority
Southern California Safety Institute
Southwest Airlines Company
Star Navigation Systems Group, Ltd.
State of Israel
Transport Canada
Transportation Safety Board of Canada
U.K. Civil Aviation Authority
UND Aerospace
University of NSW AVIATION
University of Southern California
Volvo Aero Corporation
WestJet ◆

VNV: Dutch Airline Pilots Association

(Who's Who is a brief profile of, and prepared by, an ISASI corporate member to enable a more thorough understanding of the organization's role and functions —Editor.)

The employment terms and labor conditions for pilots, taken for granted at the moment, have not come about automatically. In its 75 years of existence, the Dutch Airline Pilots Association (VNV) has largely contributed to the promotion of interests and professionalization of pilots. And the VNV still stands for attention for flight safety, employment terms, and labor conditions on behalf of the professionals it represents. From their daily activities, members contribute valuable knowledge and experience to the union and the professional group, which marks the VNV.

The following practical objectives are characteristic of the VNV:
- advancing safety in aviation,
- creating good terms of employment,
- increasing pilots' professionalism,
- promoting individual member's interests.

The VNV pursues its objectives with the support of 3,000 members, almost all employed by Dutch airline companies. A high degree of organization is a major factor in issues such as promoting interests and exercising influence. But power from the number of members is not the means by which VNV achieves its aims. The VNV prefers the power of the argument because substantively better results can be achieved through constructive negotiations. Three thousand members form a rich source of knowledge of and experience with aviation. Several active members are highly qualified in other areas as well. Through them, the VNV has a range of disciplines at its disposal, varying from technology and economics to medical aspects and accident analysis. And when expertise is not available internally, the VNV provides it by having its members attend courses or by calling in know-how from external sources.

A real labor union

The VNV is a real union, which stands for above-average employment terms and conditions for pilots. It is successful as well. Since the first collective labor agreement with KLM in 1969, a number of labor agreements have been concluded for VNV members. The VNV has also managed to collectively regulate employment terms and conditions with smaller companies.

When collective labor agreements are concerned, salary always takes first priority. But in the course of years, the VNV has managed to lay down several, for pilots, important rules in labor agreements. Examples are the pilot career scheme, pension scheme, work and rest regulation, legal assistance, and legal protection in case of disciplinary measures. In many labor agreements, regulations governing redundancy, function proficiency investigation, and flight safety investigation have been included.

If necessary, and if convinced of the reasonableness of its demands, the VNV does not avoid a confrontation. Several times in the history of the VNV, actions have been necessary to enforce negotiations.

A committed professional association

As a professional association, the VNV has dedicated itself to a continuous improvement of flight safety and professionalism of pilots. This is a technical matter as well as a professional one. And the VNV is an up-to-date knowledge center for these matters. Commissions concerned with flight technical matters, work and rest times, training and assessing, flight medical matters, and accident/incident investigations make contributions. The VNV also provides effective individual and legal support for its members.

The VNV has contributed to the formation of legislation in the flight technical sphere to finding a solution to collisions of airplanes with birds and to turbulence caused by buildings surrounding the airport. Through its international contacts, the VNV has made contributions from a pilot's perspective to Boeing and Airbus to the design and use of new airplanes. The VNV also maintains contacts with sister organizations abroad and is co-founder of the International Federation of Air Line Pilots Associations and the European Cockpit Association. ◆

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