ISASI FORUM

"Air Safety Through Investigation"

JULY–SEPTEMBER 2006

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ABOUT THE COVER

This CRJ that crashed at Brest Guipavas was totally destroyed by impact and post-impact fire. The investigation by BEA France determined that the main causes of the crash were human factors related (see page 6). Photo courtesy BEA France.

ISASI FORUM
"Air Safety Through Investigation"

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AIR SAFETY INVESTIGATORS
INCORPORATED AUGUST 31, 1964

ISASI Stalwart Departs International Council

By Frank Del Gandio, President

At the recently conducted International Council meeting, Max Saint-Germain, our European councillor, announced that he would not run for reelection in the upcoming election of European officers. His reasons were twofold: medical issues relative to glaucoma and his desire to infuse new vigor into the governing body of the Society.

He told the assembled Council: "I have been the European councillor for more than 15 years now, and I do think that somebody else, younger, more dynamic, and, very important, still actively involved in aircraft accident investigation should take the lead. There's a lot of talent within our membership. I wish to give them the opportunity to express their capabilities and use a part of their energy for the benefit of the Society."

Max always exhibits the demeanor of a quiet man; those of us who have benefited from his counsel know him as a thinking man who looks upon ISASI as the premier accident investigation/accident prevention organization in the world: "I believe ISASI is unique relative to accident investigation and its techniques. In 1985, about 100 people attended the annual seminar; in 2005 almost 400 attended. In 1985 we were only about 500 members; today we are 125 corporate members and 1,300 individuals, representing 58 countries. We are recognized worldwide and well appreciated by everybody associated with accident investigation. Today it seems that all persons engaged in accident investigation and accident prevention want to attend our seminar because they know that they will meet all of the key people in the world who are involved in looking after this kind of activity."

Max's move to invoke new and younger energy into deliberations is commendable, but there is much to say for experience to fend off the ode that says "history repeats itself." He is an aerodynamic and thermodynamics engineering school graduate whose first flight-safety task was military oriented—collecting/drafting accident reports on the twin-jet bombing aircraft Vautour.

His civil career began with Sud Aviation, and his first accident investigation was a Varig Caravelle crash at Brazilia in 1961. Sud became Aerospatiale and with that the Concorde venture. For the French side, he was responsible for setting up and defining the training, the spares and technical documentation systems, and maintenance programs for the new generation of modern aircraft.

In 1970, he had the responsibility of being in charge of Airbus Industrie's Customer Services to investigate in-service problems and incidents concerning the A300, A310, and the A320 in airline operation. In 1985 he became flight safety director to set up, organize, and manage the Airbus Flight Safety System for accident/incident investigations. He retired in 1989, having investigated and/or managed the investigation of about 35 accidents/incidents affecting the Airbus fleet.

From 1987 and into retirement, he has taught accident investigation and prevention at IFSA (Institut Français de Sécurité Aérienne), the French Institute for Flight Safety. He belongs to numerous prestigious international aviation organizations and joined ISASI in 1985. He has attended most of the ISASI seminars and chaired several ISASI seminar sessions. For example, he managed the 1994 seminar in Paris and held committee positions for the Barcelona, Spain, and Shannon, Ireland, seminars. He is also on the Jerome Lederer Award Committee.

Although he has given up his Council position, he has applied for Fellowship status. Max will remain active in the organization, believing we should help, through training and training guides, develop knowledge about the proper method of conducting an investigation. Max believes such need for help applies to both developed and undeveloped countries. Sadly, he notes, a country that can use this type of training sometimes doesn't know that it needs help—it may be caused by funding, by lack of sufficient experienced investigators, or something similar. Stating that "where there is a will, there is a way," Max intends to stay involved in providing his experience to groups that want to become better acquainted with the international standards of investigation.

E. MARTINEZ

Max Saint-Germain, left, accepts an Award of Appreciation for his long-term service to the membership from ISASI President Frank Del Gandio. The presentation was made at the May annual meeting of the ISASI Mid-Atlantic Chapter, held in conjunction with the May International Council meeting.

As he leaves his councillor's chair, I asked Max to share with all of us a bit of the thinking about our profession he has developed over the years. This is what he said: "Accident investigation is a tremendous job. It is filled with stress, with anxious moments, and unforgiving pressures; it is also a very good school for human behavior. I have come to believe that to be a good investigator one has to be a good technician, one has to be modest, one has to have some conviction as to what is right and what should not be done, one has to have a calm demeanor, be able to shake off stress, and have an equal temperament. Mostly, a good investigator needs to accept that one's views are never fully right and never fully wrong—all that is said should be listened to." ◆

Air Safety Is About Sharing

By Nick Sabatini, FAA Associate Administrator for Aviation Safety

(Remarks were presented before the ISASI Mid-Atlantic Chapter on May 11, 2006.—Editor)

It is truly a pleasure to be here tonight. I give many speeches to people who do a lot for aviation safety. I have to say that tonight's audience is a group that does much and is deeply committed to safety. Thank you for what you do. The contributions of air safety investigators are clear: Air travel in our country is incredibly safe.

Tonight, I want to talk briefly about how we reached this remarkable level of safety, about what we in aviation must do to maintain pressure on the accident rate. And I'll touch on the role of air safety investigators in the 21st century.

As FAA's safety official, I am frequently asked, "What are the major causes of fatal airliner accidents?" In the United States (and the developed world), there are *no major* causes. Fatal airline accidents are such rare events that there are no longer what qualifies as "common causes." Air travel is so safe that we at the FAA find it a challenge to meaningfully express the level of safety. The official way we express it is in fatal accidents per 100,000 departures. That rate is now at .022.

But, what does .022 mean to the man on the street? And, when you drill down, you will find that .022 largely consists of cargo accidents or cases where a ground employee is struck by an aircraft on the ramp or an employee drives a tug into an aircraft. If we speak only of events that most people have in mind when they think fatal airline accidents, the rate for passenger airlines is on the order of 0.007 per 100,000 departures. If we speak only of passenger jets, the number is about half that level.

How do you explain how safe point-zero-zero four is? We keep trying. Here's one way: You must fly every day for 43,000 years to get to an even chance of being killed in an airline accident. Or how about: An accident with fatalities occurs about every 15 to 16 million flights. Or try this: you are about 40 times safer in an airliner than on the safest highway system in the country (the interstate).

I think you see the challenge. Add to that challenge the news media's appeal of airline accidents—they are so rare, therefore, they *are* big news. Then, add all the reasons why people are nervous about flying and you can begin to understand why people don't appreciate the magnitude of the achievement that is modern air travel.

Let's turn to how we reached the point where pilots are safer on the job than when they are not at work. For the most part, it's been continual improvements in technology that reduce the opportunity for human error or that enable us to recover after a serious error.

Here are a few examples. Pressurized aircraft in the 1940s started flying above most of the weather and terrain, at least enroute. That change alone significantly reduced CFIT accidents and loss of control in flight. The introduction of VORs and the first ILSs in the 1940s and 1950s also drove down the number of CFIT accidents and approach-and-landing accidents. Radar in the 1950s changed the environment permanently. VOR/DME receivers in the 1960s further reduced those types of events.

Most agree the jet remains the biggest single long-term improvement in safety. Remember the joke about the four-engine DC-7 being the best three-engine aircraft ever designed? The introduction of the jet engine dramatically increased engine reliability for about a twentyfold increase. Within several years of the first jet in the U.S. fleet, reliability increased fiftyfold. Now we are approaching a hundredfold versus the pinnacle of reciprocating engine technology.

How do you explain how safe point-zero-zero four is? We keep trying. Here's one way: You must fly every day for 43,000 years to get to an even chance of being killed in an airline accident. Or how about: An accident with fatalities occurs about every 15 to 16 million flights. Or try this: you are about 40 times safer in an airliner than on the safest highway system in the country (the interstate).

Before the jet, we averaged 3.5 fatal air carrier accidents per year due to engine failure in a rather small system. In contrast, Part 121 jet operators have had just two such fatal accidents in the past 20 years (Sioux City and Pensacola).

If we jump forward to more recent developments, such as TCAS and Terrain Awareness Warning Systems (or TAWSs), we find dramatic examples of technology getting us out of trouble. With TCAS, no Part 121 U.S. carrier has had a midair collision since 1978. Previously, fatal midairs had been a common accident scenario.

The experience with GPWS and controlled flight into terrain, or CFIT, is more dramatic. Between 1946 and 1955, large passenger aircraft averaged 3.5 fatal CFIT accidents a year. Think of it: A fatal CFIT accident about every 15 weeks. Through the mid-70s, we were still averaging two fatal passenger airline accidents per year due to CFIT.

In contrast, no jet operator has suffered such an event in U.S. airspace since 1974.

A new rule requiring TAWSs in March 2005 has increased both the level of sophistication and, more importantly, the range of aircraft equipped. *All* turbine-powered airplanes configured for six or more passenger seats now must be equipped with TAWS, whether they are used in air carrier service or in Part 91 operations.

Technology improves our ability to enhance human performance. Just look at the benefits from simulator training. With the six-axis simulator—using real data from real flights—we have improved crew resource management training with real-world scenarios. Pilots gain "real" experience flying through and out of windshear. They learn in a risk-free environment how to handle an engine failure or failed flight controls, and so much more.

Follow all these improvements with major leaps in automation and precision flying throughout the 1990s—plus the jet revolution reaching the regional industry—and we come to the level of safety we enjoy today.

We often hear that accident rates have reached such a low level that we should no longer expect sudden and sustained breakthroughs in future rates.

I disagree.

We are on the threshold of reaching the next level in commercial aviation safety. And here is the keystone to the next series of breakthroughs—safety information. Achieving a stronger future for aviation safety is all about sharing safety data.

Today, we don't even know how much safety information is out there, be it with operators, manufacturers, repair stations, suppliers, and more across the aviation community. How much of this safety information do you think the FAA can access? I'd say about 5 percent.

If we're going to continue to put downward pressure on the accident rate, we need far more information about trends, about precursors, and about what is going on every day in the manufacturing and operating and maintenance environments. We must get better about getting the right information. Our great safety record has come from a "forensics" and "diagnostics" approach to making enhancements. You know this better than anyone. We lose one. You investigate. We learn what happened. We make corrections.

Now, with no "common causes," we need to move more and more to a "prognostic" or predictive approach. We need more data points. We need analytical expertise to discern trends and identify precursors.

And we need *to share* what we learn. As you know, we're already gathering information to help identify trends and precursors. We have a demonstration project with the airlines on gathering and sharing data from Aviation Safety Action Programs, or ASAP, and from Flight Operational Quality Assurance, or FOQA, programs. ASAP encourages airline employees to voluntarily report critical safety information. Today, 51 carriers have 106 programs covering pilots, mechanics, flight attendants, and dispatchers.

While ASAP deals with the human element, FOQA collects and analyzes digital flight data generated during normal operations. FOQA data are unique because they provide objective information not available through other methods. It's this routine data that can give us insight into the total flight operations environment. Today, 15 U.S. airlines have FAA-approved FOQA programs. We've seen a host of benefits from ASAP and FOQA information, including changes in training as well as enhanced operational and maintenance procedures.

We need to use every tool, every skill, and every resource that we can bring to bear to enhance safety. Those tools, skills, and resources include accident investigators, yes, to look back, and leveraging information and analysis to look forward to anticipate to prepare and prevent. That's how all of us in aviation will improve safety and save lives. It does not get any more rewarding than that.

How many of you know about the work of the Commercial Aviation Safety Team?

CAST, which includes representatives from government, industry, and employee groups, is co-chaired by Hank Krakowski, vice-president of Corporate Safety for United Airlines, and FAA Deputy Associate Administrator for Aviation Safety Peggy Gilligan. The purpose is to develop an integrated data-driven strategy to reduce the U.S. commercial aviation fatality risk.

CAST has been highly successful. How? Because of its disciplined and focused approach to analyzing accidents and incidents, identifying precursors, and developing targeted implementation strategies. Furthermore, after the strategies are implemented, CAST monitors and measures their effectiveness and identifies future areas of study. Thanks to CAST, we're on target to reduce the fatality risk in commercial air travel by 73 percent by 2007. That's the power of using data to drive decisions.

At the same time, the FAA has been working with NASA to get our arms around the many aviation safety data sources. We want to bring them together and leverage the power of combined databases to help reveal the rare and infrequent emerging threats and hazards. We want to push the science of advanced data analysis tools that will enable "vulnerability discovery" to reveal precursors to accidents and permit us to proactively take steps to mitigate risks before loss of life.

(continued on page 30)

Investigations Use Differing Approac

Accident, serious incident, and incident investigations use different approaches, but all strive to reach the same objective throughout what can become, without insight into relative safety issues, long and costly processes.

By Stéphane Corcos and Pierre Jouniaux, BEA, France

(This article was adapted, with permission, from the authors' presentation entitled Accident, Serious Incident, and Incident Investigations: Different Approaches, the Same Objective *presented at the ISASI 2005 seminar held in Fort Worth, Tex., September 12-15, which carried the theme "Investigating New Frontiers of Safety." The full presentation including cited references index is on the ISASI website at www.isasi.org.—Editor)*

Stéphane Corcos *is the head of the BEA Investigations Department. Prior to joining the BEA in 1996 he worked for the DGAC (French civil aviation authority) for 8 years. He was graduated from the French National Civil Aviation School (ENAC) with a masters degree in aeronautical engineering in 1987. He holds a commercial pilot's license and a multiengine instrument rating. He also has a Beech 200 type rating.*

Pierre Jouniaux *received a masters degree in aerospace engineering and aviation operations from ENAC. He received a post-graduate degree in human factors from Paris University. He joined the BEA in 1997 and has acted as investigator-in-charge, accredited representative, or group leader on many investigations and is now a senior investigator. He holds a commercial pilot's license and helicopter private pilot's license.*

Increasingly, BEA accident investigations are showing that many accidents have precursors in incidents. Depending on the seriousness of the event, the number of parties involved, and the difficulty of carrying out examinations, an investigation can be a long and costly process. However, early into the investigation it is often possible to identify the major safety issues raised by an event. The next steps, including the validation process, with its examinations, testing, and highly sensitive discussions among all the parties, takes much longer. Noteworthily, 80 percent of causal factors are related to human factors. Thus, it is important to have an insight into safety issues, and to make an early determination of the potential of an event. This enables investigators to put the appropriate weight on particular investigations.

Such an approach has two prerequisites: being informed of the majority of events in time and having an organization that allows selective choice. To address the first issue, the European Union established a regulation that asks all operators (as well as ATC, manufacturers, and repair stations) to report significant events to investigative bodies. These operators should also, in the future, participate in event identification. Selective choice, the second requirement, poses the problem of being able to identify the relevant type of event. This can be a bit like panning for gold, so the investigator needs a sharp eye. The best way to do this is to have a group of dedicated specialists working together to draw out the relevant data from the different events.

Approaches

Non-stabilized approaches have claimed many lives over the years, and they keep occurring all around the world. Many have these attributes in common: IMC conditions, at least a partial loss of situational awareness, lack of crew coordination, deviation from SOPs, insufficient or non-existent consideration given to safety warnings (GPWS in the cockpit, MSAW in the tower). Non-stabilized approaches also often highlight the basics of instrument flight, and they can be studied in a variety of ways. European airlines have long conducted mandatory analysis of flight parameters, known in North America as FOQA (Flight Operations Quality Assurance) and have identified many safety deficiencies, including non-stabilized approaches.

In addition, while investigative bodies have insights into accidents, investigators should not miss an opportunity to study near ALARs, near CFITs, or near midair collisions. These studies are complementary. Here are two examples, one involving a CRJ and the other an MD-83, of different ways to deal with such study of investigations.

A CRJ was flying the Brest-Nantes route with the captain at the controls. The meteorological conditions were deteriorating at Brest a short time before the takeoff from Nantes. The crew was informed in flight of the deteriorating visibility to be expected upon arrival. A NOTAM indicated that Category II and III approaches were not available at Brest Guipavas from June 2 to July 31, 2003. The crew was aware of this. The pilots communicated little with each other during the approach and some callouts were omitted. The airplane was number two on arrival. The approach controller asked the crew to descend to 4,000, then to 3,000 feet and to enter a holding pattern. He then cleared them to descend to 2,000 feet.

When the previous airplane [Number 1] had landed, the controller, seeing the CRJ on the localizer track and thinking that they were established, asked the pilot to continue the approach, before he had joined the holding pattern. The crew started the approach after this clearance. The APPR mode on the autopilot system was never activated. The start of the approach was performed in HDG and VS modes.

hes, Reach Same Objective

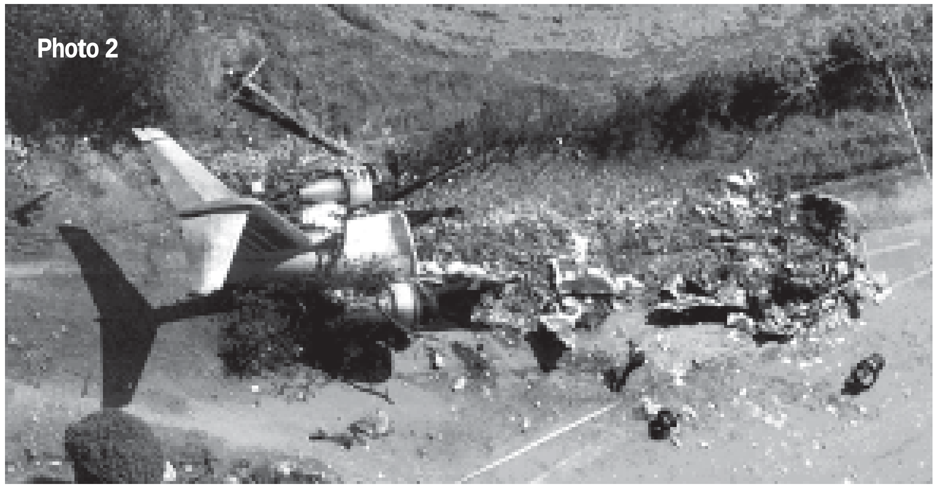


Photo 2

The wind, which was turning progressively to the northwest then to the north during the descent, made the airplane drift toward the left. This drift was not detected by the crew. The airplane exited the automatic localizer capture beam. The airplane descended below the glidepath and the pilot selected VS to get back onto the path. The crew's attention was focused on managing the airplane's vertical track. The airplane intercepted the path from above, and the crew's attention was then focused on the horizontal track. The airplane then descended through the glidepath and remained below it until contact with the ground. (See Photograph 1.)

The captain started a turn to the right and disconnected the autopilot. Several GPWS "glideslope" and "sink rate" warnings were issued without the crew reacting in any significant way. The captain started the go around at decision altitude. The airplane, offset to the left of the extended centerline, was then at about a hundred feet from the ground and its speed was low (between 115 and 120 knots). The first significant pitch-up input on the elevators was then recorded 4 seconds after the thrust increase. The airplane continued to descend, touched down softly, ran along the ground, and then struck several obstacles that severely damaged the cockpit. The aircraft came to a stop after about 150 meters. The airplane was totally destroyed by impact and post-impact fire. (See Photograph 2.)

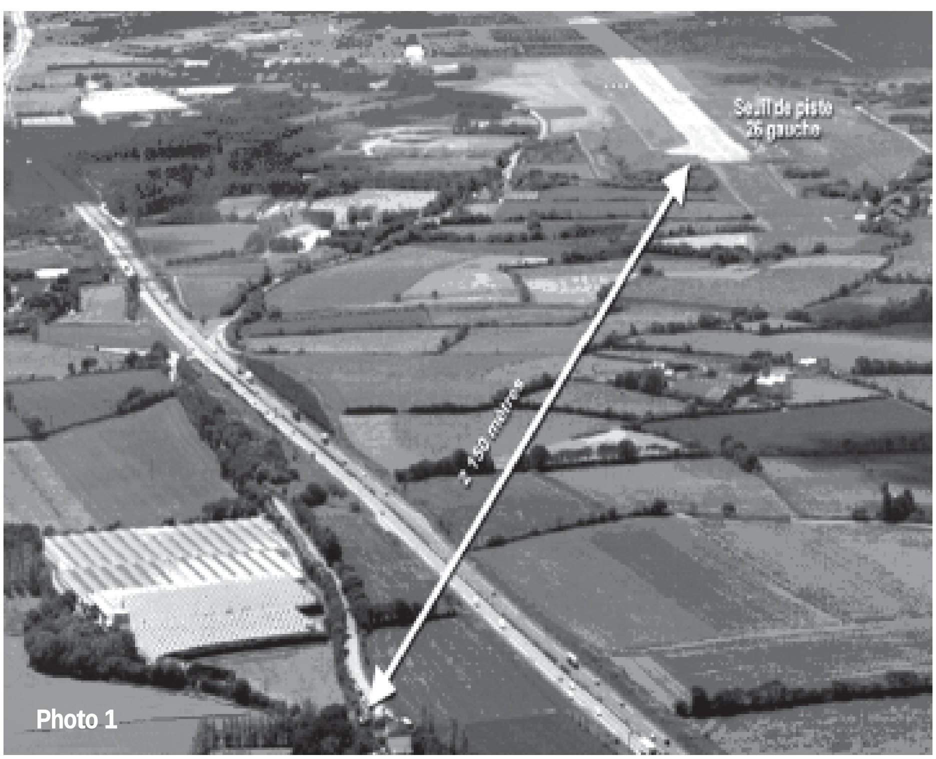


Photo 1

The causes were identified as

• failure to select APPR mode at the initiation of the approach, which led to a failure to capture the localizer, then the glideslope;

• incomplete detection of flightpath deviations due to the crew focusing on vertical navigation, then on lateral navigation;

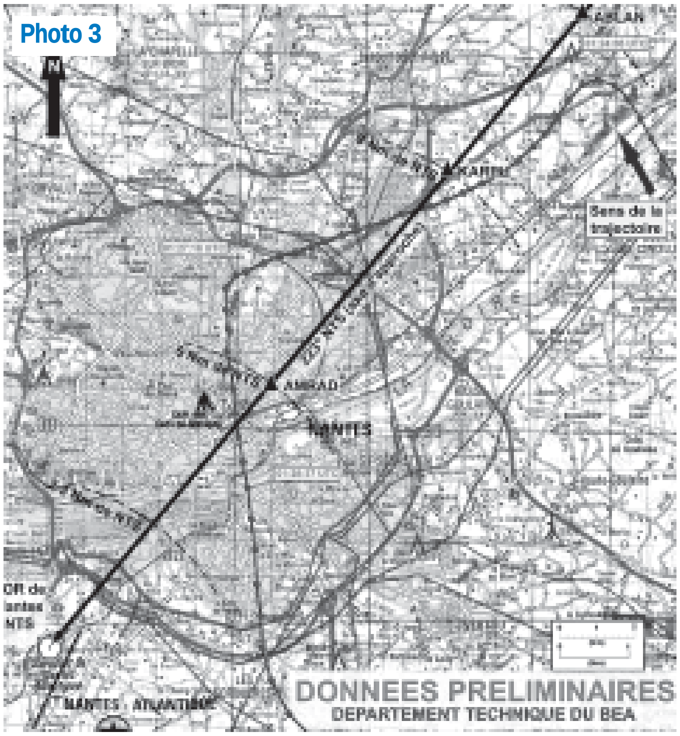
• the continuation of a non-stabilized approach until decision altitude; and

• lack of communication and coordination in the cockpit and a strategy change in the controller's handling of the airplane were contributory factors.

Detailed examinations of many airplane components was undertaken: flaps, all the pitch-axis channel components, ELT, electronic components with non-volatile memories, as well as use of the flight simulator, MSAW simulator, flight deck and instrument ergonomics, etc. Due to the condition of the various components after the accident, considerable amount of human and financial resources were used up over an 18-month period. Despite the extensive technical work carried out, the report's conclusions determined that the main causes were related to human factors.

Less than a year later, in the same region of France, at night, a foreign-operated MD-83 was flying a VOR-DME approach into Nantes (LFRS) (see Photograph 3). It was 02 h 20 local time and the weather was

Photo 3



marginal with drizzle, poor visibility, and low ceilings. The airplane was deliberately flown with 30° offset from the approach course due to suspected storm cells on the way to the runway (these were actually no more than ground clutter on the weather radar). The descent was initiated near the FAP, at a much higher rate than that published. The airplane overflew the city of Nantes and broke through the clouds at about 400 feet, then veered sharply to the left as a go-around was initiated. The crew's situational awareness was affected with reference to the weather information, the position of the city, and a lack of knowledge of the characteristics of non-precision approaches. (See Figure 1.)

The causes were determined as

- an erroneous interpretation of weather radar display,
- a lack of knowledge concerning protection envelopes, and more generally a lack of accuracy concerning VOR-DME approach techniques, and
- improvisation of an action (offset from approach procedure course) without any defined or shared action plan.

Several factors contributed to the event

- Lack of CRM training by the operator,
- The operator's inadequate feedback system,
- Discomfort and stress due to adverse weather,
- Deviation from SOPs, and
- A lack of air-ground synergy.

Two investigators worked on this for 3 months. Safety lessons were learned because it became clear that the root cause of the incident was related to human factors. Those persons concerned were willing to share information because they understood sharing was in the interest of safety. The investigators were able to establish the facts rapidly, despite the lack of any flight recorder information, using radar plots and by interviewing all parties involved, including those who were abroad.

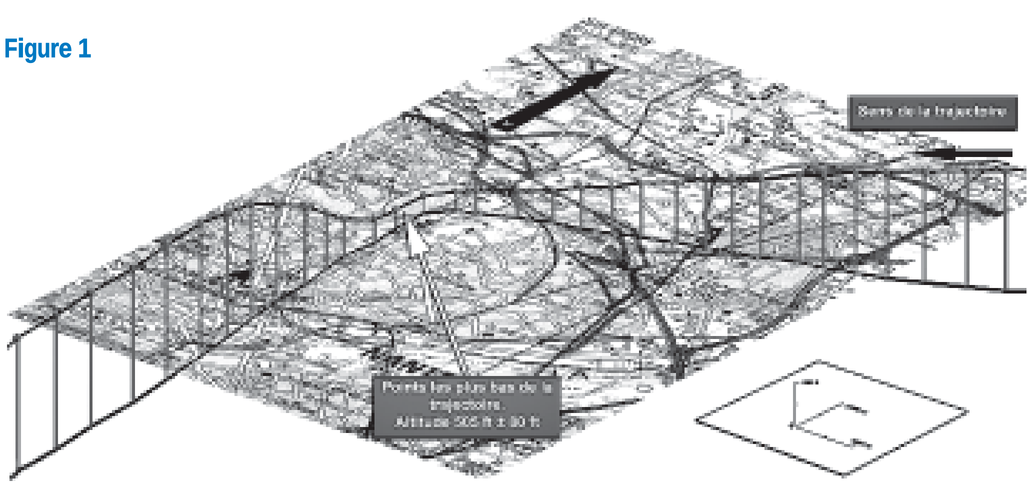
TCAS training and ergonomics

The integration of TCAS into the aviation system has generated new challenges. To mature, the use of TCAS has to be adapted to the aviation environment. One aviation disaster and a number of incidents highlighted the need for improved feedback. Pilots have had to get used to a new device (procedures, training, knowledge, etc.). Controllers have had to find a new way of interacting in order to make the system safe. A serious incident that occurred in March 2003 illustrates this.

An Airbus A319 was climbing to FL260 following the controller's clearance. The TCAS triggered a Traffic Advisory for a target located above and on an opposing route. Eight seconds later an "Adjust Vertical Speed" Resolution Advisory was generated, asking the crew to reduce the vertical speed. The pilot responded with a pitch-up input. The conflicting traffic was an Airbus A320, in level flight at FL270. Nine seconds after the initial Resolution Advisory in the A319, a "Climb" Resolution Advisory was triggered in the A320. The crew acted on this. During the crossing, the crews of both aircraft made visual contact. The pilot flying the A319 turned smoothly to the left. QAR recordings enabled us to compute the minimum lateral and vertical separations as 0.8 nautical miles and 300 feet. (See Figure 2.)

Two investigators were intensely in-

Figure 1



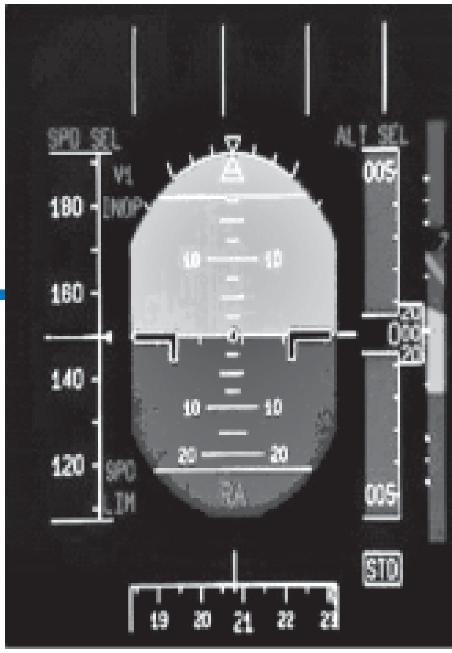


Figure 2

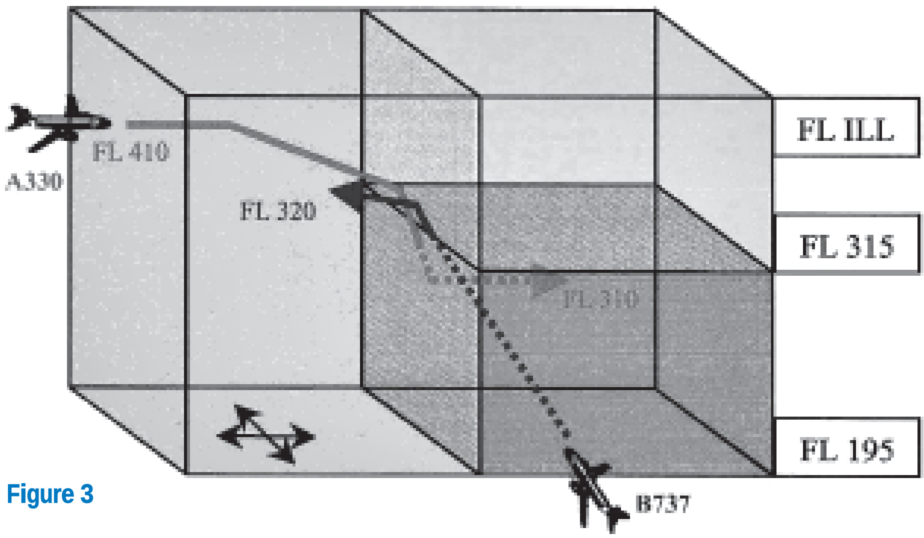


Figure 3

volved in this investigation. Many tests were performed and extensive research was carried out, working with a number of different organizations: Airbus (system issues, ergonomics), Air France (event analysis, training), ATC (procedures, testimony), TCAS specialists (systems and events review), human factors specialists (ergonomics, fatigue, stress). This was a complex investigation. The report was issued within 2 years. The major findings concerned the ergonomics of the TCAS interface, pilot and controller training, and TCAS versus autopilot logic. The report contained eight safety recommendations.

While this investigation was under way, TCAS events were becoming more and more frequent, all such events being reportable. There were a number of events that had similar origins to the one just mentioned. But other events emerged that were of a type that had previously been considered to have been covered by the investigation into the Überlingen accident. One of these events led to a long investigation, though a full report was not subsequently deemed necessary as most of the issues had already come to light and been studied. The BEA issued a simplified form of report on this incident to raise awareness and remind the aviation community of some important principles concerning TCAS.

In the upper airspace of a French control area, a B-737 was in climb and an A330 in descent on two converging routes. The controller incorrectly gave a level to the climbing aircraft above the descending one. A Short Term Conflict Alert was presented to the controller that was not considered valid by him, and the aircraft continued toward each other. The controller realized there was a conflict and issued an emergency descent order to the climbing aircraft, which the pilot acted upon. A short while later the TCAS triggered in both aircraft. The TCAS gave an opposite order to the controller's emergency instruction. In the end, as the B-737 pilot saw the other aircraft, he decided to follow the controller's instruction and not TCAS. The A330 pilot followed TCAS. The two aircraft crossed with a lateral separation of less than one nautical mile. (See Figure 3.)

Initially, the seriousness of the event was underestimated because the local investigation, performed by the ATC service, did not bring to light all of the issues, especially those related to visual separation and to the conflict between a Short Term Conflict Alert and TCAS. The investigation was reopened 6 months later by the BEA, and investigators worked on it for 4 months. As the aircraft were operated by foreign airlines, two accredited representatives were associated with the investigation, along with ATC personnel and radar specialists. The scope of the investigation was quite extensive and the report writing process was deliberately simplified. One year after the incident, the report was issued. This type of simplified report does not include safety recommendations but is aimed at contributing to the feedback system. Thus, safety issues presented in this document dealt with ATC methods, the coexistence of backup systems based on radar and TCAS, and visual separation at high speed and high altitude. ◆

Acronym Glossary

BEA: Bureau D'enquêtes Et D'analyses Pour La Sécurité De L'aviation Civile
ATC: Air Traffic Control
SOP: Standard Operating Procedures
GPWS: Ground Proximity Warning System
MSAW: Minimum Safe Altitude Warning
ALAR: Accident and Landing Accident Reduction
CFIT: Controlled Flight into Terrain
NOTAM: Notice to Airmen
ELT: Emergency Locator Transmitter
CRM: Cockpit Resource Management
TCAS: Traffic Collision Avoidance System
FAP: Final Approach Point
QAR: Quick Access Recorder
IMC: Instrument Meteorological Conditions
HDG: Heading Mode (Autopilot)
VS: Vertical Speed Mode (Autopilot)
APPR: Approach Mode (Autopilot)

Litigation And Aviation Safety: Friends or Foes?

By James T. Crouse

(Reprinted with permission from the NTSB Bar Association Newsletter, *Winter 2005 issue, in which it was originally published for its readership of aviation attorneys. The author is preparing an article for the January/March 2007 issue of* ISASI Forum *to help accident investigators better understand the legal process. He asks readers of the reprinted article for feedback that reveals: "What's on the minds of ISASI folks when they think of litigation? What do they see as its greatest intrusions? Do they see any beneficial aspects? What would they like to see changed?" He may be contacted at jtc@CrouseLaw.com.—Editor)*

This year, I decided to continue my education by attending some non-legal aviation seminars—the International Society of Air Safety Investigators (ISASI) program *Investigating New Frontiers of Safety* and, three weeks later, the International Helicopter Society's *International Helicopter Safety Symposium*, the stated purpose of which was to "initiate an international collaborative effort to reduce both civil and military accidents in the vertical flight industry." My primary goal in attending these programs was to learn about new technical developments in the aviation industry—something that I had not done for years. I also hoped to contribute informally to the topics of the moment, to renew friendships, and to make new friends. Some of those past friends had been opponents, some allies, and some neutral government officials, but all were polite and some were even enthusiastic.

The technical presentations described many new and exciting progressions in operations, maintenance, and design, in such areas as aircraft system monitoring, terrain and obstacle avoidance, and even turbulence avoidance. Through presentations and conversations, I came away with the unmistakable impression that I had been in the company of hundreds of dedicated individuals who were deeply concerned about the unimproving safety record of vertical flight, and who were determined to do something about it.

Impressed as I was with the programs and the participants, a gnawing question entered my mind: "What are you and your profession doing about aviation safety?" Initially, I found refuge in the wisdom of my mentor and dear friend, Stuart Speiser, who taught me that we aviation lawyers play a role in aviation safety by filling the gaps of what slips between what the manufacturers, designers, and operators do (and don't do) and what the government catches. Stu persuasively expressed his views on the positive effect of litigation in his book, *Lawsuit*: "I believe that the deterrent effect of tort litigation is its most important public interest feature…. Even though other nations have government regulators and manufacturing experts equally knowledge-

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able and dedicated to aviation safety, they are not pushed to the limits of their safety performance as American manufacturers are by the litigation system. The knowledge that they will have to face intensive questioning for weeks at a time, covering every piece of paper they signed or handled in connection with the design of an airplane, has a sobering effect on the personnel of manufacturers, airlines, and government agencies…. The American tort system also causes insurers who pay the bills to bring more pressure on manufacturers and operators to maintain safety. (S. Speiser, *Lawsuit* at 344 and 346 (1980). See also pp. 341-348.)

Stu's thoughts are echoed by an experienced aviation product liability defense lawyer:

"I generally attribute to the U.S. tort system the substantial increases in safety of products for the U.S. consumer—in all products, not just aviation products. Aviation plaintiffs' lawyers have indeed done their part for many reasons, including monetary compensation. Unfortunately, the ultimate goal desired of an absolutely safe society—especially in aviation—will not be achieved for the many reasons articulated here. Therefore, the threat of tort litigation, especially product liability lawsuits, and skilled advocacy remain necessary elements of our legal system for our protection. The Ford Explorer cases and recent drug litigation make all this self-evident."

Maybe Stu and the defense lawyer are right. Frankly, I cringe at thinking of what would happen to families and certificate-actioned pilots if no one was there to represent them. The same is true of designers, manufacturers, maintainers, and operators—they are well served by conscientious and competent counsel. I have long believed, without any scientific proof except for my own empirical observations, that the best way to find out what really happened in a aviation crash is for opposing parties, represented by legally and technically astute counsel, aided by honest and diligent subject matter experts, to test their hypotheses through the litigation process. My experience has shown that we frequently uncover facts that were missed or never reached by the overworked and hurried National Transportation Safety Board investigators and their fellow investigators from the Federal Aviation Administration.

Even though other nations have government regulators and manufacturing experts equally knowledgeable and dedicated to aviation safety, they are not pushed to the limits of their safety performance as American manufacturers are by the litigation system.

But there is a downside to this litigation process. As attendees at both conventions brought to my attention, the threat of litigation can limit the willingness of individuals and companies to engage in full disclosure. Ever-expanding digital capabilities of data gathering, recording, and storage mean that more information than ever before will be collected and retained. The potential of this information getting into the hands of aggressive litigators, or prosecutorially minded government agents, has its chilling aspects. We must find a way to balance the fact-finding efforts and the privacy concerns so that the information can be shared in a way that benefits safety without sacrificing the individuals involved. Clearly, lawyers have a role in striking that balance.

On a larger scale, what is it that we do, in the performance of our roles, that actually enhances aviation safety? Personally, I asked what have I done in my 25-year career as an aviation accident attorney that has saved a life or prevented an accident? Other than just being there after the crash in a representative role—a very important

NTSB Bar Association

Founded in 1984, the NTSB Bar Association is comprised of attorneys who practice before the United States National Transportation Safety Board (NTSB), the Federal Aviation Administration (FAA), and the Department of Transportation (DOT). While the main focus of the group is the representation of pilots and aviation businesses in regulatory, certification, and enforcement actions, many members practice in other areas of the law as well, such as air crash litigation, aviation insurance defense, taxation, and business law. Membership in the Association is open to practicing attorneys, law students, or other individuals interested in aviation law. Many members are active pilots. *The NTSB Bar Association is not affiliated* with *nor part of any U.S. governmental agency.* ◆

We can do better, not only in streamlining the litigation process, but also in providing real evidence of lessons learned through the litigation process. We can change this perception, and in so doing, we can become a powerful force for what benefits us all—safe skies.

job in helping families recover from the financial aspects of what has befallen them (and if we are at our best, help provide some renewal)—do we actually help prevent accidents, and if so, how?

Attorney roles

Let's begin the analysis with our roles—our foundational roles—as attorneys. We represent people and companies and organizations and government agencies in multiple roles—contracting, tort, tax, legislation, regulation, employment, investment, disability, etc. But whatever word comes first, the last word, the defining word, is "lawyer." Regardless of our sub-specie, we are lawyers first and, secondarily, a particular type of lawyer.

So what do our "lawyer rules" say about our roles that might impact our potential, if not present, roles as aviation safety enhancers? According to the North Carolina Rules of Professional Conduct, a lawyer is "a representative of clients, an officer of the legal system, and a public citizen having special responsibility for the quality of justice." N.C. Rules of Professional Conduct, ¶ 0.1, Preamble, [1]. The North Carolina Rules go on to say that in our r*epresentative capacity* we perform various functions: as (1) *advisor,* we provide the client with an informed understanding of his/her/its rights and obligations and the practical implications thereof; as (2) *advocate,* we zealously assert the client's positions under the adversarial rules; as (3) *negotiator*, we seek an advantageous result for our client consistent with the duty of honest dealings with others; and as (4) *evaluator*, we examine a client's legal affairs and advise the client about them. Id. [2].

Nothing in these rules helps with the question of what we do, or what we can do, to augment aviation safety. Even the platitudes of "A lawyer should render public interest legal service and provide civic leadership," Id.[7] and "lawyers play a vital role in the preservation of society" Id.[16] aren't much help. Although I cannot think of anything more preserving of a precious part of society than preventing an aviation mishap and thereby saving a life, these generalities do not give guidance in the particulars of aviation safety.

So, where does that leave us? It leaves us, in my view, as people whose primary role is the representation of our clients, but whose secondary but equally vital role is as aviation safety advocates. What good does it do if we find real safety issues, life-threatening issues, with operations, flight, maintenance, and overhaul manuals; maintenance and overhaul procedures; or design and manufacturing problems, if the evidence of these problems goes back into the file and then on to storage? Surely we can do better than that.

Promoting aviation safety

Here are my thoughts on how we can employ our primary role as advocates to promote, indeed to crusade, for aviation safety —to make a difference.

1. Represent your client with all of your legal and technical ability. Without our best efforts, the true causes of aviation crashes might never be fully discovered or determined. Do your best, whether it is drafting an interrogatory or questioning a witness. Don't become complacent. Litigation is nerve-wracking and frustrating at times, but stay the course. Remember that you took an oath to do your best for your clients. I submit that as an aviation attorney, you tacitly represent more than the person or entity on the fee agreement.

2. **Get the best technical expertise.** There are many subject matter experts who can help. There are the "usual suspects," but resist using the expert whom you know will sing your song or with whom you are familiar. I am not so naive as to believe that we all want completely neutral experts—that's not our advocate/adversary system. But look beyond the usual and find the unique. Find someone who really knows and cares about the particular matter at issue—not just someone who can come up to speed and offer opinions—for a fee.

If the opportunity presents itself, allow your experts to work with the government agencies. Encourage them to share their knowledge with those agencies in a non-partisan, technical exchange of information. We have done this in the past, and we believe it has benefited the safety effort.

3. Get help if you need it. Don't try to handle something outside of your expertise. I frequently see e-mails on list-serves that make me wonder what that lawyer is doing with that type of lawsuit. Find out who has handled this type of accident before. I have found that lawyers are generally willing to give at least some help for no compensation other than the reward of helping. Even if a fee-sharing arrangement is necessary, however, don't let greed prevent you from doing the right thing.

4. Talk to the government agencies. Representatives from the NTSB and the FAA are understandably and legally unwilling to become embroiled in your litigation. But that doesn't mean you cannot ask them questions and discover their releasable files, and that you cannot impart information to them (see item number 6 regarding restrictions on disclosure). With rare exception, I have found these (and other) government officials are willing to help if they can. It may well be that something that arises in your litigation is a special concern of a particular government employee or office. It may well be that a government employee may know someone who would be very interested in helping—or at least in hearing what you have to say.

5. Actively assist your client in learning from mistakes. Eagerly review your client's procedures, processes, manuals, inspection, audit programs, and results for potential safety problems. Do not simply defend your client—assist him/her in understanding what went wrong, how to fix it, and how to identify other problem areas. In my brief life as a defense attorney, I have reviewed the flight, maintenance, and overhaul manuals of a helicopter manufacturer client to identify problems—this after an issue had been raised about one of its maintenance manual procedures. That manufacturer got it right.

6. Share whatever you learn where it will be most useful. I cannot recall any product liability case in recent years where I was not asked to agree to a confidentiality order or agreement, which more than not has been required before I saw the first piece of paper. These agreements often provide not only for non-disclosure of documents but also for non-disclosure of certain portions of deposition transcripts. Obviously, one cannot just take what is covered by these agreements and disseminate it outside of the litigation.

Before you agree to one of these, read it carefully. Look at it with the view that it might prevent you from disclosing information that could save a life. Fight for the narrowest possible agreement. Take the matter before the court if need be.

If you take depositions of government officials, look for opportunities to use the litigation documents. Share with them, legitimately, what you have learned. And if no government witness is deposed but you have discovered information that could save a life, seek court approval to obviate the protective order for that particular purpose. This has been successfully done in the past, and we're better for it.

7. Get out of the legal rut: Expand your perspective. At the risk of offending the folks at SMU, Embry-Riddle, TIPS Aviation, and our own NTSB Bar Association, try a non-legal symposium for a change. There is one almost weekly—AIAA, AHS, HAI, ISASI, AOPA, etc. Join one of the non-legal aviation associations. You'll be pleased by the camaraderie and impressed by the genuine interest these people have in aviation safety.

When you get back to the office, you will have a vivid picture of the people who are the front line of aviation safety—who daily experience the joy of flight but who daily also confront the risk of aviation tragedy. It will make a difference in the way you do what you do.

8. Fight for aviation safety. When the case is concluded, that might well be the beginning of your aviation safety efforts. Without violating any rulings or agreements made during the litigation, take what you have learned to the Office of Aviation Safety at the NTSB and the appropriate Directorate of the FAA. Don't stop until you get someone's attention; push the bureaucracy. See if your client wants to help—clients make appealing advocates.

Conclusion

I am sure that litigation can and does enhance aviation safety—even if only indirectly and generally. But it does not assist in this goal as much as it could. If one talks to the aviation community, there is doubt that we, either plaintiff or defense, serve any vital safety purpose—that we generally only show up after something has gone wrong and that we take people away—for meetings, depositions, document searches, etc.—from what they are doing that could enhance aviation safety. They have a point. We can do better, not only in streamlining the litigation process, but also in providing real evidence of lessons learned through the litigation process. We can change this perception, and in so doing, we can become a powerful force for what benefits us all—safe skies. ◆

Smoke, Fire, and Fumes!

An inflight smoke or fire event is an emergency unlike almost any other. The early cues for nonalerted smoke, fire, and fumes (SFF) conditions are often ambiguous and elusive. Checklists are indispensable tools to guide crews' decision- making and response when faced with multiple tasks during these high-stress events.

By Barbara K. Burian, Ph.D., SJSUF at NASA Ames Research Center

(This article was adapted, with permission, from the author's presentation entitled Do You Smell Smoke? Issues in the Design and Content of Checklists for Smoke, Fire, and Fumes *presented at the ISASI 2005 seminar held in Fort Worth, Tex., September 12-15, which carried the theme "Investigating New Frontiers of Safety." Sources referenced by the author have been removed from this text. The full presentation including cited references and Appendix A and B are on the ISASI website at www.isasi.org.—Editor)*

When a smoke, fire, or fumes (SFF) event occurs in flight, time is the most precious resource available to crews. Yet, at least some of this resource must be invested to determine if suspicious cues do in fact indicate smoke or fire, as cues are often ambiguous, especially for air conditioning, electrical, and other nonalerted sources (i.e., SFF for which there are no aircraft detection systems). Also, false alarms occur frequently enough to make crews want to have a definitive picture of their situation before committing to a diversion and emergency landing.

When smoke or fire does occur, a cascading loss of systems is likely if it spreads, and crews' ability to respond effectively may be impaired. Thus, rapid isolation and elimination of the ignition source are necessary to prevent the condition from escalating. However, timely decisions to divert and complete an emergency landing are also essential if the ignition source cannot be identified or if efforts to extinguish a fire are unsuccessful.

The stress and workload of responding to these events is exceptionally high, and unlike many other types of emergency or abnormal situations, the flight and cabin crews absolutely must communicate and coordinate their assessment and response. However, even the most rigorous joint training cannot realistically present crews with the full extent of the demands they will face when dealing with smoke, fire, and fumes in flight.

Checklists are indispensable tools to guide crews' decision-making and response when faced with multiple tasks during these high-stress events. Checklist designers must carefully consider all essential tasks crews must perform and prioritize how those tasks are to be accomplished, given the wide range of potential SFF events: those that are easily identified, isolated, and extinguished as well as those whose sources are unknown, hidden, and cannot be put out. This article focuses on some of the many design and content issues for checklists that are used by flight crews to respond to nonalerted SFF events. Current titles of such checklists typically refer to the ignition source (e.g., air conditioning smoke; electrical smoke, fire, or fumes; fluorescent light ballast smoke or fire), to the location of the event (e.g., galley fire, cabin fire), or to the fact that the ignition source and/or location is unknown (e.g., fires of unknown origin).

Drivers of nonalerted SFF checklist design

Various interrelated factors have traditionally influenced how the issues listed in the Sidebar are dealt with, but not *all* of these factors have affected the design of *every* nonalerted SFF checklist currently in use. These factors are

- *Differences in aircraft equipment design.* Design of a particular system and aircraft largely determines the steps crews initiate to isolate and eliminate a source of SFF and removal of smoke. For example, smoke removal in some aircraft requires depressurization, thus necessitating a descent from cruise altitude when passengers are on board.
- *Different types of operations.* Extended-range operations (i.e., involving flight over an ocean) may use different procedures as compared to those for short-haul operations flown within easy reach of land. Similarly, procedures such as depressurization to minimize fire-feeding oxygen may be appropriate for cargo-only operations, but not when transporting passengers.
- *History of an air carrier and history within the industry.* Past SFF events within an air carrier and across the aviation industry as a whole have taught lessons that clearly influence the design and content of SFF checklists and the priority placed on items within them.
- *Knowledge of how different types of fires are ignited, fed, and spread.* Closely related to an understanding of how differences in aircraft and system design influence procedures is knowledge of how various types of fires are ignited, the availability and flammable properties of various materials aboard the aircraft, and how smoke and fire may be spread (such as by a ventilation system).
- *Assumptions about efficacy of crew response.* Some current checklists appear to be written with the implicit assumption that the actions specified will be successful (or that guidance about other actions is not necessary); in other words, there are no references to diverting or instructions regarding smoke evacuation included in the checklists.

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Sidebar—Issues in Nonalerted SFF Checklist Content and Design

A variety of difficult issues face designers of all emergency and abnormal checklists but particularly checklists involving inflight SFF. Several are listed below in the form of questions.

- What is the best way to help crews access the correct checklist quickly, especially when they may not be able to tell what kind of SFF they are dealing with?
- How many checklists for nonalerted SFF are necessary?
- What is the best way to guide crews when the SFF is of an unknown origin/hidden?
- What should the relationship be, if any, regarding the completion of nonalerted SFF checklists if an alerted checklist (e.g., engine fire, cargo fire) is ineffective?
- What size font should be used to increase checklist readability in a smoke-filled cockpit?
- What colors of text and background are the most readable if there is smoke?
- Do choices of font size and color of text and background differ if the checklist is presented in an electronic format as compared to paper?
- What is the best way to design a checklist that accommodates the normal cognitive performance limitations the crew may experience under the high stress and workload typical of SFF events?
- Should any memory items be included, and if so, involving what actions?
- Should the donning of smoke masks and goggles be required?
- How long should a SFF checklist be—both in terms of physical length and in terms of amount of time it takes to complete it?
- What is the best way to design a checklist that has applicability for serious SFF events as well as for SFF that is relatively minor and easily eliminated?
- How much time should crews spend on source identification/troubleshooting?
- Within a checklist, what should the relative priority of items be for a) source identification, b) smoke removal, c) descent initiation, and d) fighting/extinguishing a fire?
- Should crews be prompted to divert and, if so, where in the checklist should this guidance be given?
- Should guidance regarding different descent profiles be included in a SFF checklist?
- What kind of special guidance, if any, should be given to crews who are transporting dangerous goods (hazardous materials)?
- Should checklist actions differ for extended-range operations as compared to actions for flights flown over land?
- What kind of guidance, if any, should be given related to expediting a descent/approach, ditching, conducting an overweight landing, an off-airport landing, a downwind landing, or other types of non-normal landings?
- What is the best way to construct a SFF checklist to accommodate and support the high degree of communication and coordination that is needed between flight and cabin crews?

Part of what makes responding to some of these issues so difficult is that they involve tradeoffs that require making choices that may conflict with each other. For example, toxic fumes and smoke can quickly enter a cockpit during a SFF event. Therefore, oxygen masks and goggles should be donned by a flight crew at the first sign of SFF (NTSB, 1998). On the other hand, oxygen masks can make communication difficult and goggles can restrict one's vision; should donning such protective gear be required if the SFF event is unlikely to cause the flight crew difficulty (e.g., a burned muffin in the back galley)? ◆

Likewise, some checklists may take quite a bit of time to complete, seeming to imply that time is not a factor when responding to the event. Also, many procedures assume that the crew is aware of the type/source/seriousness of SFF and thus can readily identify and execute the appropriate checklist or procedure, leaving crews uncertain about how to proceed in more ambiguous situations. These implications and assumptions are inherent in the design of the checklists and may not have even been apparent to the developers who constructed them.

• *Human factors considerations.* Text for some SFF checklists is in a larger-than-normal font size to make reading easier when smoke is in the cockpit. Stress-induced human performance limitations are also sometimes accommodated. For example, in one of the SFF checklists provided to the crew of Swissair 111, a great deal of information was provided regarding aircraft limitations when configured in a particular manner, thereby reducing crews' cognitive processing requirements and memory load.

• *Regulations, advisory, and guidance material.* Often (but not always) as a result of accidents or incidents involving SFF, various regulations, recommendation letters, bulletins, advisory circulars, and other guidance materials are developed that pertain to the design and content of checklists.

• *Various philosophies, company policies, and economic considerations.* Philosophies (both implicit and explicit) and company policies may influence SFF checklist design and content, as can a variety of economic considerations related to the handling of these events (e.g., cost of diversions in terms of fuel, scheduling issues, etc.). Many of these issues implicitly shape procedures and guidance for crew response and are not a part of any stated policy or philosophy.

Developing a new approach

Because there is so much variability across air carriers in terms of types of aircraft flown, types of operations, history, philosophies, and policies, up until very recently there has been no industrywide agreed-upon approach regarding crew response to SFF events and the design and content of checklists that guide this response.

However, beginning in 2004, a small steering committee began developing checklist content and design guidance that could be adopted across the industry. Individuals representing four major aircraft manufacturers (Airbus, Boeing, Bombardier, and Embraer), the International Federation of Air Line Pilots Associations (IFALPA), and four air carriers (Air Canada, British Airways, Delta, and United) comprised the committee. Contact was also made with governmental agencies such as the FAA, NASA, the NTSB, and the TSB of Canada.

Two checklist products have been developed that, it is hoped, will be adopted by the international aviation industry as the standards that will guide the design and content of nonalerted SFF checklists. One product is a template to be used by designers when developing a nonalerted SFF checklist, and the other is a description of the philosophy upon which the template is founded, as well as a few definitions of various terms and concepts used in the template. Both products are currently available through the Flight Safety Foundation.

The template is not, in and of itself, a checklist but *is* a framework to guide checklist design and content. Some of the steps on the template are actually sections, and several checklist items might be developed for a single template "step." The accompanying philosophy and concept definitions must also be consulted during checklist development so that the resulting checklist is truly in keeping with the intent of the template.

Below I discuss a few of the SFF checklist issues listed in Chart 1 as they are typically treated in current checklists and also as they are treated in the newly developed template/philosophy. Note that the template/philosophy represents a significant change in the approach to these issues and that some,

With an integrated SFF checklist, the time crews would initially spend is actually spent by completing actions that have applicability for all

though not all, of the difficult tradeoffs these issues pose have been addressed.

Access—separate checklists vs. an integrated checklist

Currently, when crews wish to complete a checklist for a nonalerted SFF situation, they must typically access a checklist that has been developed for a specific type of smoke, fire, or fumes, e.g., air conditioning smoke, electrical smoke, fire, or fumes, etc. Thus, crews are presented with a list of several different SFF checklists, and they must first determine what type of SFF they have in order to select the proper checklist from the list. However, recall that the cues for nonalerted events are often quite ambiguous and making a distinction between air conditioning, electrical, materials, florescent light ballast, dangerous goods (i.e., hazardous materials), or some other type of SFF can be quite difficult. Precious time may be wasted if a crew was to complete a checklist for one type of SFF but, in reality, was faced with a different type.

In response to these issues, several air carriers (e.g., Delta, United) have independently developed a single integrated checklist to be used for multiple types of nonalerted SFF events. With such an integrated checklist, the time crews would initially spend trying to figure out which checklist to complete is actually spent by completing actions that have applicability for all types of nonalerted events. Similarly, the template developed by the steering committee is for an integrated nonalerted SFF checklist in which the first 11 steps/sections are to be accomplished irrespective of the specific type of SFF faced. Actions that are pertinent to specific types of SFF are to be grouped according to SFF type and appear in Sections 12, 13, and 14 of the template.

Even though the template guides development of a single checklist to be used for multiple types of SFF events, crews may still be required to access more than one checklist during their response to such events, however. For example, the template and philosophy call for crews to refer to a separate smoke removal checklist when necessary, and to return to uncompleted sections of the nonalerted SFF checklist, if any, following smoke removal. (A template for the separate smoke removal checklist was not developed by the steering committee; manufacturers and/or air carriers are expected to provide them.)

The philosophy document states that a checklist developed using this template "does not replace alerted checklists (e.g., cargo smoke) or address multiple events." Some air carriers, however, may choose to have their crews complete the integrated nonalerted SFF checklist after having completed an alerted checklist if the alerted checklist did not resolve their situation. Thus, these crews would need to access two SFF checklists (one each for alerted and nonalerted events) and possibly also a third (for smoke removal). The use of the nonalerted checklist following completion of an ineffective alerted checklist is not addressed by the template or accompanying philosophy document.

Diversion and landing guidance

Giving guidance to crews to divert and complete an emergency landing and *when* crews should be given this guidance are some of the most hotly debated issues in the design of nonalerted SFF checklists. In many current nonalerted SFF checklists, guidance to complete a diversion and/or emergency landing is given as one of the last steps, if it is given at all, and the guidance to complete such a diversion is only pertinent if efforts to extinguish the SFF were unsuccessful. The philosophy implicit in this design is that continued flight to a planned destination is acceptable if inflight smoke or fire is extinguished. If crews follow these types of checklists exactly as written, a diversion is initiated only after the completion of steps related to other actions, such as crew protection (i.e., donning of oxygen masks and goggles), establishing communication and source identification, troubleshooting, source isolation, firefighting, and smoke removal, and then only if the SFF is continuing.

In a study of 15 inflight fires that occurred between January 1967 and September 1998, the TSB of Canada determined that the amount of time between the detection of an onboard fire and when the aircraft ditched, conducted a forced landing, or crashed ranged between 5 and 35 minutes. These findings indicate that crews may have precious little time to complete various checklist actions before an emergency landing needs to be completed and, hence, the checklist guidance to initiate such a diversion should be provided and should appear early in a checklist.

However, some types of fire or smoke may be relatively simple to identify and extinguish, such as a burned muffin in a galley oven. Few people would argue that an emergency landing is necessary in such a situation, and it is undesirable to complete an unscheduled landing unnecessarily because of the many safety and operational concerns involved (e.g., tires bursting and possible emergency evacuation after an overweight landing). Thus, developers struggle with the priority to place on guidance to complete a diversion in nonalerted SFF checklists.

In the newly developed template, the very first item states that "diversion may be required." The intent of this item, and the reason it appears first in the checklist, is to "establish the mindset that a diversion may be required." The placement of this item as the very first in an SFF checklist represents a significant change from the current philosophy about how crews are to respond to SFF events described above. It is not intended that crews read this item as direction to immediately initiate a diversion or even begin planning a diversion, however, just that they should keep in mind that a diversion may be necessary. It is possible that under stress, crews may misread this item and begin a diversion right away, so training and/or a change in wording to emphasize that they are only to *remember* that a diversion is an option may be needed.

One other concern about this item as it

trying to figure out which checklist to complete types of nonalerted events.

appears in the template is that it is followed by three items that currently are often completed from memory during SFF events: crew protection items (donning smoke masks and goggles—Steps 2 and 3) and establishing crew communication (Step 4). Neither the template nor the accompanying philosophy mentions anything about items on the checklist being or not being completed from memory—this decision is left up to the individual air carriers and manufacturers using the template. Crews who complete these actions from memory, whether by requirement or out of habit, may miss the first item reminding them about a possible diversion unless it, too, is considered a memory item.

Step 10 is the first place in the checklist where crews are specifically directed to "initiate a diversion to the nearest suitable airport," and they are to do this "while continuing the checklist." This step follows five steps (5, 6, 7, 8, 9) pertaining to source identification and/or source isolation/elimination. The steering committee believes that crews will be able to complete all actions in these five steps fairly quickly—the philosophy even states, "Checklist authors should not design procedures that delay diversion." Thus, using a checklist developed according to the template, crews will complete self-protection and establishing communication items (Steps 2, 3, and 4), complete five sections of "quick" actions to eliminate probable sources of SFF, and then initiate a diversion in Step 10 if the earlier actions to eliminate the SFF source were unsuccessful. A more-thorough discussion of the source identification, isolation, and elimination items in Steps 5 through 9 is provided below.

Following Step 10, wherein crews are directed to initiate a diversion, the template includes the following: "Warning: If the smoke/fire/fumes situation becomes unmanageable, consider an immediate landing." If "landing is imminent" (Step 11) crews are directed to review various operational considerations (e.g., "overweight landing, tailwind landing, ditching, forced off-airport landing, etc.") and to accomplish a separate smoke or fumes removal checklist, if needed. The nonalerted SFF checklist is then "complete" and crews are left to focus upon landing the aircraft. In other words, landing has a higher priority at this point than the continued completion of additional SFF identification items, such as those in Sections 12, 13, and 14.

The last template step involving guidance to land is Step 15: "Consider landing immediately." Crews will reach this step only if all checklist actions involving source identification, isolation, and elimination within the checklist were ineffective and the SFF was continuing. It is difficult to imagine a situation such as this where the crew would not choose to land immediately.

Notably, the template never directs crews to initiate a *descent*—only a diversion. Some in the industry believe that at the first sign of SFF, crews should initiate a descent to the minimum enroute altitude or get fairly close to the water, if flying over the ocean. This would allow a crew to complete the descent and landing/ditching quickly in the event that a situation becomes uncontrollable. Others in the industry point out that such a descent may commit a crew to completing an unscheduled landing as they may no longer have enough fuel to reach their planned destination (due to the higher rate of fuel consumption at lower altitudes). The template is constructed so that crews will always have the option to continue to their planned destination if the source of SFF "is confirmed to be extinguished and the smoke/fumes are dissipating."

Source identification/isolation/elimination

In many current nonalerted SFF checklists, a number of items are devoted to identifying the specific source of SFF and concurrently isolating and eliminating it. Thus, in a checklist for air conditioning smoke, crews are often told to, in a stepwise fashion, turn off various pack switches, bleed air switches, and other air conditioning system components and, after each configuration change, make a determination about whether the smoke is continuing or decreasing.

If smoke is continuing, crews are commonly instructed to reverse the action(s) just taken (i.e., turn the switch(es) back on) and proceed with making the next configuration change. The checklist template developed by the steering committee also includes a place for such system-specific source identification items (Sections 12, 13, and 14), but these actually appear after three other steps (or sets of steps) involving source identification and/or source isolation/elimination. All source identification/isolation/elimination steps are discussed below in the order in which they are presented to crews on the template.

Following the completion of crew self-protection and communication steps, crews would complete items related to template Step 5: "Manufacturer's initial steps… Accomplish." In the accompanying philosophy, "manufacturer's initial steps" are described as those "that remove the most probable smoke/fumes sources and reduce risk…. These steps should be determined by model-specific historical data or analysis." Furthermore, the philosophy specifies that these initial steps "should be quick, simple, and reversible; will not make the situation worse or inhibit further assessment of the situation; and do not require analysis by the crew." Thus, when using a checklist designed according to the template guidance, crews will eliminate the most likely sources of SFF early on in checklist completion *without* making a determination first as to whether one of these sources is in fact causing the smoke, fire, or fumes; this step involves source isolation/elimination but *not* source identification.

In Step 6, crews are asked if the source of the SFF "is immediately obvious and can be extinguished quickly" and, if so, are told to extinguish it in Step 7. In Step 8, if the "source is confirmed visually to be extinguished" it is suggested that crews consider reversing the manufacturer's initial steps accomplished in Step 5, presumably if they know which actions were and were not re-

Crews may complete a template-driven checklist successfully (i.e., fire is extinguished, smoke is dissipating) without ever having positively identified the source of the SFF.

lated to causing the SFF, although this is not addressed in the template. It is then suggested that crews complete a smoke removal checklist, if necessary, and this marks the completion of the nonalerted SFF checklist. These three steps have been developed for those types of smoke or fire that are relatively simple to identify and extinguish (recall the burned muffin in a galley oven). Note that if extinguishing is successful and can be *visually* confirmed, continued flight to the planned destination is implied.

The steering committee believes that these steps will be quick and easily accomplished. However, identifying a source of SFF (even when it appears to be obvious) and then extinguishing it can take some time. For example, imagine that a burned muffin in a galley oven is the source of smoke/fire. Cabin crew must let the flight crew know there is smoke/fire, confirm that a muffin is the source (and not something like an electrical short in the oven), turn off the oven, possibly locate a fire extinguisher, put out the fire with the extinguisher or by some other method (e.g., put the smoking muffin in the sink and douse it with water), respond to passenger questions/concerns, confirm that the fire/smoke is extinguished, and get that information back to the flight crew. Thus, even relatively simple events can take some time to resolve. As a result, Steps 6 and 7 in the template represent a bottleneck, but the time these actions require cannot be helped. Crews should be aware of this, and in training they may wish to address how much time should be devoted to these efforts before moving on to subsequent items on the checklist.

The 9th step of the template states: "Remaining minimal essential manufacturer's action steps…Accomplish" and is followed by a note to the checklist developer indicating that "These are steps that do not meet the 'initial steps' criteria but are probable sources." This step was one of the last to be added to the template during its development, and no other information pertaining to it is included in the philosophy document. Therefore, what is meant by "minimal essential" is unclear. However, because the additional note specifies that these steps still pertain to "probable sources," it can probably be safely inferred that crew analysis should still *not* be required when completing them.

During the feedback meeting with the larger industry group, one manufacturer representative to the steering committee expressed the need for crews to be able to complete quick and simple items that did not entail crew analysis but might *not* be able to be reversed or *might* inhibit further assessment of the situation (by cabin crew). Thus, these additional steps would meet only some of the criteria for the "initial steps" in Section 5. It is likely that Section 9 was added to meet this need expressed by the manufacturer.

As mentioned earlier, according to template specifications, traditional types of source-specific identification, isolation, and elimination actions are included in Sections 12, 13, and 14, with each section including items for a different aircraft system (for example, Section 12 might include items for systematically identifying and isolating an electrical source of SFF). The actual steps to be included within these sections are to be determined "based on model-specific historical data or analysis." Although it is not explicitly stated in the philosophy document, historical data for a particular aircraft model could also be used to determine the *ordering* of the various system-related items across Steps 12, 13, and 14. Thus, if aircraft model X has historically had more problems with air conditioning smoke than any other type of SFF, source identification and isolation items for air conditioning smoke or fumes would be presented first (i.e., in Section 12).

After each of the system-specific sections of items is completed, the crew is to determine if their efforts have been successful (i.e., the fire is extinguished, the smoke is dissipating). If so, they are to skip the remaining system-specific sections. If their actions were not successful, they are to complete the next set of system-specific items.

For example, if the actions related to Step 12 in the template are not successful, they should complete items related to Step 13. If Step 13 actions *are* successful, they should not complete the items in Section 14. Once crews have completed a set of system-specific items that have successfully dealt with the SFF, the template directs them to review operational considerations for their landing and accomplish a smoke removal checklist, if necessary (recall that if crews are completing any system-specific items in Steps 12, 13, or 14, they should concurrently be diverting and conducting an emergency landing as directed in Step 10).

Thus, in contrast to some current nonalerted SFF checklists, checklists developed according to the template include both system-specific source identification items as well as smoke elimination items that do not require source identification. Additionally, crews may complete a template-driven checklist successfully (i.e., fire is extinguished, smoke is dissipating) without ever having positively identified the source of the SFF.

The construction and design of checklists to be used for nonalerted SFF events is very challenging. The types of events for which they might be needed vary widely but, at their extreme, are highly time critical and life threatening. Additionally, the cues available to crews may not be very helpful in determining their situation and at times may actually be misleading. The steering committee that developed the attached template and supporting philosophy document should be commended for addressing a number of difficult issues and for helping to move the industry forward in thinking differently about response to inflight SFF. There are a number of other issues beyond the scope considered by the steering committee that checklist designers will also need to consider, however. The treatment of these issues within a SFF checklist will not necessarily contradict the framework for response established within the template, but will also need to be addressed as nonalerted SFF checklists are developed. ◆

Scaling Up Safety on Smaller Operations

Here is how proactive safety tools used by large operators can be implemented into smaller flight operations to help investigations of incidents and accidents and to improve the safety of daily flight operations.

By Capt. John M. Cox (M03291), FRAeS, President, Safety Operating Systems

(This article was adapted, with permission, from the author's presentation entitled Bringing Proactive Safety Methods and Tools to Smaller Operators *presented at the ISASI 2005 seminar held in Fort Worth, Tex., September 12-15, which carried the theme "Investigating New Frontiers of Safety." Sources referenced by the author have been removed from this text. The full presentation including cited references are on the ISASI website at www.isasi.org.—Editor)*

Many large airlines have developed systems and processes that allow the confidential collection of routine flight data. These data can be collected from the airplane and flight crews by programs such as Flight Operations Quality Assurance (FOQA) programs and/or by confidential reports in the Aviation Safety Action Program (ASAP) and the Line Operational Safety Audit (LOSA). Data collection programs such as these provide a real-time review of current safety issues in the flight operations department. Real-time data review facilitates the identification of areas where modifications to training programs or standard operating procedures (SOPs) or other areas might be appropriate. Such training program modification might prevent the occurrence of future safety events (incidents or accidents) and reduce costs as well.

FOQA programs, which evaluate various aircraft parameters recorded in normal flight, are a primary source of objective safety data. However, FOQA (which is by nature quantitative) cannot supply subjective—or qualitative—data. Subjective data, which help explain *why* a situation occurred, are gleaned by operations personnel through confidential safety reporting systems like ASAP. The independent observations from LOSA add a more objective "snapshot" to determine the effectiveness of SOPs, checklists, procedures, and other safety mitigations applied to the operation. These three data sources provide the safety department with a significantly improved ability to communicate the real needs of a specific area of flight operations to the appropriate level of flight operations management. This is a holistic approach allowing the constituent elements of ASAP, FOQA, and LOSA to become more than the sum of the parts, further benefiting the operator.

Until recently, smaller operators were unable to take advantage of these proactive methods and tools due to the substantial infrastructure required. The cost of this infrastructure was too high for many operators. Budget constraints, unfortunately, resulted in missed opportunities for safety enhancement.

Today, however, there are new marketplace strategies that allow small operators to have the same proactive safety programs that the large airlines enjoy. The proactive safety methods and tools, used successfully by large operators, can be implemented by smaller flight operations. The utilization of proactive safety methodology can facilitate investigations and improve the safety of daily flight operations.

Proactive safety

Accident data (both hull loss and accidents with fatal injuries) show that aircraft accident rates are declining. These data are collected from several sources; this article uses the Flight Safety Foundation recitation of Boeing data where possible (cited at the IASS Conference 2004).

A gap remains between the accident rate for smaller jet and turboprop aircraft and the accident rate for larger jet transports (greater than 60,000 lbs). This gap, well-known and well-documented, exists even when the data are adjusted for different exposure levels of different fleets.

Are differences in equipment part of the reason for the accident rate gap? Terrain Awareness Warning Systems (TAWSs) have significantly reduced (some would argue have eliminated) controlled flight into terrain (CFIT) accidents in aircraft equipped with TAWS. The TAWS example suggests that differences in equipage might be a partial explanation for differences in accident rates between the communities of larger and smaller aircraft. However, other factors come into play when analyzing the accident rate gap. For example, another factor contributing to the gap in accident rates might be airport facilities. Significant additional infrastructure is available to a large, intercontinental jet operator landing at a big international airport, compared to that available to the small turboprop operator landing at a tiny, remote airport.

Economies of scale (size and infrastructure) often allow a large operator to enjoy significant operational advantages. Dedicated in-house safety departments, highly qualified technical writers, well-developed cultures of SOP usage, and extensive reporting systems are demonstrably advantageous.

Safety reporting systems (such as ASAP, FOQA, and LOSA) allow the large operator to harvest reams of data, upon which a

Capt. John Cox, *a veteran major airline, corporate, and general aviation pilot, has flown more than 14,000 hours with more than 10,000 hours in command of jet airliners. In December 2004, he retired from airline flying after 25 years to found Safety Operating Systems, a Washington, D.C.-based aviation safety consulting firm. He holds an ATR certificate with type ratings in the Airbus 320 family, the Boeing 737 family, the Fokker F28, and the Cessna Citation. He is an experienced accident investigator having been involved in six major NTSB investigations (the best known being the US Air 427 accident in Pittsburgh in 1994) and numerous smaller investigations. He served as the Air Line Pilots Association Executive Air Safety Chairman, ALPA's top safety job.*

keener understanding of the realities of the operation can be based. These data-rich environments, which facilitate a proactive approach to problem solving, have paid off in appreciable improvements to safety and operational efficiency. For example, adjustments and enhancements in training programs, revisions to SOPs, and modifications to checklists can be facilitated before an accident or incident occurs. Thus the cost of an incident or accident may be avoided (and the overall risks lowered) by the proper and timely use of the information extracted from these reporting systems.

These same highly successful data analysis tools have the potential to improve the accident rate gap between smaller jets/turboprops and large jets. Unfortunately, most small jet/turboprop operators, as well as some small operators of large jets and some large operators of large jets, do not gather FOQA data. Older aircraft with low-tech flight data recorders (FDRs) make gathering these data very difficult and expensive. How can smaller operators gain the same benefits from safety reporting systems that large operators enjoy? How can these needed data be gathered, evaluated, and used by a smaller operator at a reasonable cost?

Virtual safety departments

The cost of a large, extensive, and dedicated aviation safety department is high. Those that shoulder this high cost usually see a quantifiable reduction in risk. Large operators around the world have found this to be a good investment. The payback on the outlay has been considerable. With a large fleet there is direct contribution to the profitability of the company by FOQA, ASAP, and LOSA data-reporting programs. Millions of dollars have been saved by information obtained from FOQA, ASAP, and LOSA. One U.S. airline saved more than one hundred million dollars in a single year by using FOQA data to explain the causes of engine exhaust gas temperature (EGT) exceedances. This allowed the engine to stay on wing, in service, for a longer time. This same operator was able to use combined FOQA and ASAP data to show the FAA of the need to redesign an instrument approach to reduce excessive descent rates. LOSA subsequently verified the effectiveness of the improved approach. For the smaller operator to reap similar advantages, the barrier of high initial cost must be addressed.

Cost of operation is a major concern to most aircraft operators nowadays. Fuel prices have climbed faster than a high-performance jet, and revenue is as hard to find as affordable fuel. As a result, outsourcing has become the standard. For example, large operators once had their maintenance performed "in house." Today it is often performed "off shore" on a "bid-for-contract" basis. The drive to lower operating costs has become an integral part of today's flight operation.

So the question arises: Can a smaller operator gain the benefit of data-gathering programs without having the high costs of a dedicated safety department? The answer is "maybe." That answer, too, depends on the exact requirements of the small operators. Germane questions could include Does the operator fly charters? Does the operator fly internationally? Can the small operator define what aspects of the operation could be improved? Is the operator willing to seek solutions from outside the company?

The proper handling of aviation safety reports is critical. How the data and the reports are to be transmitted to the outside safety company must be determined. In today's electronic age (identity theft, hacking), the encryption of data is essential to maintain confidentiality and security. It is imperative that the security of this sensitive information be ensured from the beginning of the project.

An operator might hire an outside source to compile the aviation safety reports. That independent contractor would then evaluate the safety reports and provide recommendations (e.g., training, SOPs, and checklists) if appropriate. The small operator could benefit from the arrangement. There are, however, important issues that must be clearly identified before "outsourcing" is initiated. What are the characteristics of a successful outside consulting firm? The arrangement with an outside source should add value to the operator's business. To enhance the operation, the outside consulting firm might provide cost savings and/or a significant level of expertise otherwise unobtainable by the aircraft operator. Any other additional expertise of the consultant to potentially enhance the operation should be considered.

The proper handling of aviation safety reports is critical. How the data and the reports are to be transmitted to the outside safety company must be determined. In today's electronic age (identity theft, hacking), the encryption of data is essential to maintain confidentiality and security. It is imperative that the security of this sensitive information be ensured from the beginning of the project. There must be a non-punitive reporting environment so that reports can be filed without fear of disciplinary or certificate action. The non-punitive aspects of an aviation safety reporting program apply only to sole-source, non-criminal, and non-deliberate actions.

Ownership of the information is a difficult question. Are the provided data the property of the operator or the outside safety contractor? Clear definitions of data ownership and authority to access information are fundamental. All parties must agree upon how the data will be stored, as well as when and how it will be de-identified and finally destroyed. What reports will the safety company provide to the operator? How often? What will the reports contain exactly? Will the operator indemnify the safety company for the content of the reports? These are a few of the many issues that require agreement before an outside safety contractor can begin to use data gathered or reported by an operator's pilots. The outside safety company must keep all data it receives isolated and confidential. However, the outside contractor might request, for the purpose of enhanced statistical validity, that an operator's data be compared in the blind to like data from similar operators.

Data analysis, in this case, requires a standard of comparison, or it is of very limited value. Pooling sanitized data enhances the overall base of information. Comparing like-operators with similar data provides a much better understanding of the real-world flight operation. A safety company with several similar operator-clients can observe and track trends and report to an operator without any loss of confidentially. By compiling data into trends over time and comparison to other similar operators, the maximum benefit for the collective few can be achieved.

Achieving consensus

There must be agreement among the operator, the regulator, the pilot representative organization (if applicable), and the safety company. This agreement will result in a memorandum of understanding (MOU) or similar written document. The specifics of how the data and reports can be used will be clearly stated in this document. The MOU becomes the backbone of the relationship among the operator, the regulator, the pilot representative body (if applicable), and the outside safety contractor. Successes at larger operators have proven that achieving a good, solid MOU is a good predictor of notable safety enhancements from the safety reporting program.

Guidance material from the FAA provides standard recommendations on the construction of MOUs for large operators. These templates can be downloaded from the FAA website. Additionally, the outside safety company should have access to other approved MOUs. These recommendations and examples from other operators can provide the framework for a virtual safety department. The cost of the virtual safety department is usually defrayed for individual operators when the independent safety company contracts with a number of operator-clients. In numbers, it becomes a symbiotic, win-win relationship.

A theoretical example

The following is a purely fictional example of the benefits gained by a virtual safety department. Any resemblance to a real event, person, or company is purely coincidental.

Tiny Air, a small jet airline with 10 aircraft and 85 pilots, accepts a bid from "Safety R Us," an aviation safety firm, to provide FOQA and ASAP reports. A meeting is held between Tiny Air and Safety R Us officials and the exact requirements are specified. The senior flight management of Tiny Air, the regulating authority's principle operations inspector, the chairman of Tiny Air's pilot association, and the senior management of Safety R Us meet to detail exactly how safety data will be gathered, evaluated, held, and reported.

There is agreement by all parties that de-identified reports will be presented to an Event Review Committee (ERC), made up of a representative from flight operations management, the regulator, and the pilot association, who will meet once a month to accept or decline reports into the program. The reports reviewed by the multiparty ERC are referenced only by number, so that Safety R Us is the only party with the ability to identify a flight crew. Should the ERC determine that it is imperative that the flight crew submitting a report be contacted, the ERC will submit, in writing, a request that the pilot association representative be given the name(s) of the flight crew. The pilot association representative will then call the flightcrew members for clarification of their report. The representative of the pilot association will then report the results of the call to the ERC.

The cost of the virtual safety department is usually defrayed for individual operators when the independent safety company contracts with a number of operator-clients. In numbers, it becomes a symbiotic, win-win relationship.

Once the ERC has determined that a reports meets the criteria for admission into the program (sole source, non-criminal, not a deliberate act, etc.), it is logged into the system for evaluation. No disciplinary action or certificate action will be taken against the flight crew once the report is accepted into the program.

Safety R Us evaluates the report and compares it against other similar reports. If a trend is evident, Safety R Us will advise Tiny Air that an undesirable trend is developing. Any trend report generated by the outside safety company will include recommendations for mitigation of the problem.

Reports are de-identified 2 weeks after the ERC meeting so that only a reference number is maintained. The reports can be used to make up month-over-month and year-over-year trend evaluations so that training effectiveness, SOP changes, and other items of emphasis can be observed, evaluated, and quantified.

This fictitious airline now has the ability to take a realistic look at its flight operation. Tiny Air can now learn of operational "near misses" that would have gone undetected previously. For the first time, Tiny Air can make safety improvements before an incident or accident occurs. Tiny Air is in the proactive league. The little airline has made a significant improvement in safety at a fraction of the cost of doing it "in house."

The regulator now has a means to monitor safety issues without waiting for an incident or accident. These data allow the regulator to work with the airline to resolve potential safety problems much earlier than previously possible. Additionally, the regulator can compare the airline to other similar airlines with similar programs to better understand how effectively the safety programs are working.

The pilot association now has a means to submit safety reports with the necessary protections from self-incrimination in place. NASA's highly successful Aviation Safety Reporting System has clearly demonstrated the value of confidential aviation safety reports. Through its non-incriminatory reporting system, NASA was informed of many, many near-miss events that otherwise might have gone unreported.

The ERC group members each become a part of the solution to the reported problems or issues. Not only do the ERC members accept a report into the program, they recommend corrective action so that the likelihood of recurrence is reduced or eliminated. The combination of the airline, regulator, pilot association (if applicable), and the outside safety company brings together a team to recognize, evaluate, and solve safety issues facing the airline.

The process is similar for FOQA data. The data are harvested from Tiny Air's fleet of aircraft and sent to Safety R Us where it is evaluated for "exceedances." Should an exceedance be observed, it is plotted, and a monthly trend report is provided to Tiny Air. This objective data, when combined with the ASAP reports, provide a comprehensive evaluation of the performance of the flight operation. The same process of data protection and reporting used in the ASAP program is used with FOQA data. Over time, maintenance costs alone can pay for this type of program. For example, careful monitoring of fuel burns can identify specific aircraft that may need rig adjustment.

LOSA data are never identified, so the confidentiality issues are slightly different. The flight deck observations and recordings during normal line operations result in the tabulation and classification of observed problem areas. Specially trained LOSA auditors, like the ERC members, should come from company flight operations, the regulator, the pilot association, and the outside safety company. The uniquely qualified LOSA auditor/pilots mark a form that clas-

(continued on page 29)

‘Kapustin’ Scholars Selected

Students from Embry-Riddle Aeronautical University, Florida, U.S.A., and Politecnico di Torino, Italy, have been selected as the 2006 recipients of the ISASI Rudy Kapustin Memorial Scholarship Fund.

By Esperison Martinez, Editor

Leonardo Ferrero, Politecnico di Torino, Italy, and Sheena D. McCune, Embry-Riddle Aeronautical University, Florida, U.S.A., have been selected by the ISASI International Council as the 2006 recipients of the ISASI Rudy Kapustin Memorial Scholarship Fund. The Fund was established in memory of all ISASI members who have died and was named in honor of the former ISASI Mid-Atlantic Regional Chapter president.

The scholarship is intended to encourage and assist college-level students interested in the field of aviation safety and aircraft occurrence investigation, according to Richard Stone, ISASI executive advisor and one of the two Fund administrators. Contributions such as those made at the recent MARC meeting (see page 25) have and will continue to provide an annual allocation of funds for the scholarship.

The ISASI executive advisor and ISASI vice-president, offices presently filled by Stone and Ron Schleede, serve as executors and administrators of the Fund. They review all applications, which include a 1,000 (+/- 10%) word essay in English addressing “The Challenges for Air Safety Investigators.” The scholarship consists of an annual $1,500 award, a one-year ISASI membership, and a fee-free attendance at an accident investigation course at both the FAA’s Transportation Safety Institute and the Southern California Safety Institute.

Leonardo Ferrero (ST5135) was enrolled in a program leading to a master of science degree in aerospace engineering, which he received in March. It is a 5-year curriculum that includes 29 courses of 10 European Credit Transfer System (ECTS) credits each, and it is recognized by the Partnership of a European Group of Aeronautics and Space Universities (PEGASUS).

As the issues of aircraft accident investigation (AAI) are not widely known in the Italian academic world, his graduation thesis dealt with procedures and techniques in aircraft accident investigation. However, he notes that “my primary interest was earning some experience in the field with AAI-related activities.”

Originally, he intended to include in his thesis some critical comments about Italian regulations on aircraft accident investigation. He ultimately decided that the issues were outside the scope of the thesis. So, he used the material to form the basis for his scholarship submission.

Sheena D. McCune graduated this May from Embry-Riddle Aeronautical University with a B.S. in human factors. She is continuing her studies in human factors by applying to the graduate program this fall. In an academic competition for her human-centered systems engineering senior design project, her team won first place presenting research for a non-profit organization.

Sheena’s aspiration, as a student of engineering design, is to optimize usability in the cockpit. She believes her preliminary research as an undergraduate in glass cockpit displays will direct her work as a graduate student. She says, “I am interested in how humans interact with a program that does a large amount of the information processing. As a Wilderness First Responder with heavy concentration on human physiology, I am also interested in survival aspects of accidents, and I am definitely interested in aircraft accident investigation.”

The scholarship essays of both awardees follow.

The Challenges for Air Safety Investigators: The Italian Regulatory Framework

By Leonardo Ferrero

Italy adhered to the Convention on International Civil Aviation as soon as 1947, but it hadn’t a permanent aircraft accident investigation body until 1999. After a number of unsuccessful efforts on a national basis, a significant contribution to the rulemaking process came from the Council of the European Union. On Nov. 21, 1994, the Council adopted Directive 94/56/EC establishing the fundamental principles governing the investigation of civil aviation accidents and incidents. Italy complied with Council Directive 94/56/EC, albeit with some delay. In February 1999, the Italian Parliament adopted *decreto legislativo* n. 66/1999, a law that established a permanent and independent aircraft accident and incident investigation body named *Agenzia Nazionale per la Sicurezza del Volo* (ANSV, literally translated as National Flight Safety Agency).

Since its inception, the ANSV has overcome many challenges. To name a few, in 2002, it acquired an office building in Rome, which provides ample space for staff and equipment. In 2003, a state-of-the-art laboratory for readout and analysis of flight recorders became operational. Since 2003, the ANSV website provides comprehensive information about the Agency’s activity, including full text incident and accident reports.

Ferrero

There are still some open issues, the most significant of which is the need to harmonize the investigative activity of the ANSV with the existing domestic law on criminal investigations. Italy is a civil law country. As a consequence, the application of the principles of accident prevention and investigation as developed in common law countries is not always straightforward. A number of crimes listed in the Italian penal code are applicable to aviation occurrences: for example, *omicidio colposo* (manslaughter) if the occurrence involves fatalities, *lesioni personali colpose* (negligent personal injury) for non-fatal accidents, and/or *disastro aviatorio colposo* (negligent aviation disaster). Moreover, in Italy the prosecution of a crime is compulsory.

This means that prosecutors have a duty to immediately start a criminal investigation into many air-safety-related occurrences, even non-fatal ones.

Under his/her authority, the *pubblico ministero* (public prosecutor) can impound any evidence, and he/she can withhold any information while the preliminary investigation is under way. Any person who may have played a role in the occurrence can be put under investigation. This does not necessarily imply a punitive intent, as it allows those under investigation to enjoy the fundamental rights of the accused. For example, their defense counsels can be present during evidence gathering or teardown of components and have access to the documents pertaining to the case.

Before the establishment of the ANSV, there were a number of examples of interference between the criminal and the air safety investigation. In his book *Safety is No Accident*, William H. Tench, former chief inspector of the U.K. AIB, cites the case of a *pubblico ministero* who caused a delay in the readout of a flight recorder during the investigation of the crash of a U.K.-registered aircraft in Italy in 1969. In a study on aircraft accident investigation resources in Europe sponsored by the European Commission, Geoffrey C. Wilkinson, former chief inspector of the U.K. AIB, stated that in Italy there was "a deep-seated distrust of the technical administration by the judiciary."

What has changed after the adoption of *decreto legislativo* n. 66/1999 and the establishment of the ANSV? Formally, not much because the law still gives a priority to the criminal investigation over the air safety investigation. If requested, the ANSV is obliged to cooperate with the judicial authority. The access to the evidence pertaining to an occurrence under criminal investigation by air safety investigators still requires prior consent from the *pubblico ministero*.

On a positive side, the law has made the legal status of air safety investigations less ambiguous, and now there is a better awareness of the mandate of the ANSV. Generally speaking, the "deep-seated distrust" of the judicial authority is slowly changing into a will to cooperate. For example, in May 2001, the Italian Ministry of Justice issued a circular on possible cooperation between the judicial authority and the ANSV during the preliminary phase of aircraft accident investigations. Recent experience has shown that, with the open cooperation of the judicial authority, the fact-finding phase can proceed faster and with a better respect of the aims and objectives of each investigation.

A word of caution. In some cases, cooperation has led to a formal involvement of the air safety investigator in criminal investigations as an expert witness of the *pubblico ministero*. It should be noted that, according to the law, the air safety investigator can not refuse to act as an expert witness, if so requested by the *pubblico ministero*. This form of cooperation allows the air safety investigator to access the evidence rapidly, with a positive effect on the criminal investigation as well.

However, in my opinion, this compromise could be a threat to the effective separation of the air safety and criminal investigations. It is true that the expertise of the air safety investigator is of great assistance in the fact-finding phase, that there is a need for an immediate release of the evidence to the air safety investigator, and that a closer collaboration with the *pubblico ministero* is to be fostered, but there shouldn't be any formal involvement of the air safety investigator with any party to a legal proceeding, be it criminal or civil. It is worth mentioning that the draft of Council Directive 94/56/EC addressed the issue of the incompatibility between the role of the air safety investigator and that of expert witness in legal proceedings. This provision, among others, was deleted in the final version of the text because of the conflicts with existing domestic laws.

A radical change in the Italian regulatory framework is not foreseeable in the near future because it would require a complex revision of the legal system defined in the constitution. At the same time, it should be considered that existing regulations allow for the establishment of satisfactory practices as long as the *pubblico ministero* in charge of the criminal investigation understands and accommodates the needs of the air safety investigation.

In conclusion, under current law, the key issue is the orientation of the judicial authority toward the air safety investigation. This does not mean that the air safety investigators should assume a passive attitude and rely on the good will of the *pubblico ministero*. On the contrary, they should actively voice their concerns with the support of the international community of air safety investigators, and they should assist the judicial authority in making reasoned decisions on matters that may compromise the timely conduct of air safety investigations.

(The views expressed in the paper are those of the author and do not necessarily reflect the opinion, policy, or official position of the Agenzia Nazionale per la Sicurezza del Volo *or Politecnico di Torino.—Editor).* ◆

The Challenges for Air Safety Investigators: A Human Factors Perspective

By Sheena D. McCune

The International Society of Air Safety Investigators (ISASI) is a unifying entity exchanging ideas to promote safety awareness, education, and information about preventable accidents and advancing flight safety. ISASI, along with investigative bodies such as the FAA and the NTSB, are all in positions of responsibility to ensure that the purpose of flight safety is actively moving forward. Without "safe skies," passengers may feel uncomfortable with flight as a mode of transportation and flood the already overcrowded roads. The challenges arise for air safety investigators on multifaceted levels, including age gap, glass cockpit displays in general aviation, unmanned aerial vehicles interfering with airspace, and very light jets emerging with personal-use consumers. All of these areas entertain the news media and cause headaches for lawyers and investigators alike. Leading causes and factors in aircraft accidents hold evidence concluding that human factors as the human-machine interaction is an ongoing concern that needs to be continually addressed.

As a forward-moving entity, ISASI allows relationships between younger novice investigators to be directly involved with senior investigators who have the experience and wisdom that a student may not be able to gain by simply reading a book. Unfortunately, the gap between novice investigators and senior investigators is rising. Valuable knowledge should be passed on, but it takes effort and organization to do so. Even workshops that allow time for open conversations or provide starter topics at ISASI meetings could solve some of the age-gap problems.

General aviation (GA) is quickly advancing in flight technology due to glass cockpit displays. Advantages of the glass cockpit display include the increase of situational awareness through instrument scanning techniques. The glass cockpits have brought concerns with regard to pilot training. Aging pilots who have decades of experience with the "six pack" may have difficulty adapting to the newer glass cockpit, while younger pilots with little experience may quickly adapt.

Most aircraft accidents and near incidents and accidents are preventable. They usually reveal a deeper problem that involves a series of events. The issue here with a fundamental difference in the negative transfer of training between the glass cockpit and the six pack is that it could possibly be a first link in a chain of events leading to an accident, especially as glass cockpits are more frequently put in use. Investigators will need more research in this area to determine whether the concern for danger is apparent or simply cognitive theory.

The military offers the possibility of a cheaper, more capable fighting machine that decreases risk to pilots due to advancing technology with unmanned aerial vehicles (UAV) throughout the U.S. The ultimate goal in development of autonomy for UAVs is to replace the human pilot, almost like training the UAV to react and perform even better than a human would. Although this technology will reduce risk to military airmen, GA pilots may be faced with additional problems of shared airspace, causing confusion in the sky and possible midair collisions. Aircraft accident investigators would then find it difficult to determine what exactly hit the airplane depending on the type of crash. Additionally, rulemaking by the FAA will need to be organized, because with lack of ATC communication due to non-pilots operating the UAVs, the skies may become condensed with confusion.

New markets for very light jets (VLJ) have allowed complex airplanes with more power to become accessible not only for smaller companies, but also for personal-use consumers. The Eclipse 500 has brought innovative design, proficient performance, and is surprisingly affordable. The Avio Total Aircraft Integration System in this VLJ works like a software operating system for the entire airplane to enhance safety through reducing pilot workload and increasing aircraft reliability. Avio issues cautions and alerts if it senses electronic trouble and can stop non-dominant functioning to locate problems. It can even help with checklists and emergencies. Anytime a computer can override the pilot's will, a very dangerous situation is created, as learned from the problems with Airbus autopilot accidents. Proactively looking at where accidents could occur will benefit from further research and investigation to find significant evidence of where to fix and prevent the most errors.


McCune

Another challenge arises during an aircraft crash investigation that lacks the cockpit voice recorder (CVR) or flight data recorder (FDR). In this case, the glass displays will leave behind no physical data for investigators to capture as factual evidence.

The challenges described for air safety investigators, including age gap, glass cockpit displays in general aviation, unmanned aerial vehicles, and very light jets promise more research and investigation to keep promoting safety awareness. No improvement will take place unless the aeronautical field accepts and enforces the recommendations.

For example, the FAA issued rules on runway safety area in 1999 that provide a buffer space free of obstacles on the perimeter of airports. To this day, many U.S. airports do not meet this law, and as a result, Southwest Airlines had its first fatal accident at Chicago's Midway Airport in December 2005. The fatality did not occur on board the jet, but at a nearby intersection, in a car that was crushed by the oncoming jet.

Safety awareness is not always predictable and may be costly or difficult to provide for, as in this example of providing a runway safety area in a major city. Fortunately, with Congress's help, normalization of deviance, which occurs as individuals or teams repeatedly accept a lower standard of safety until that lower standard becomes the norm, can be avoided by providing funding for the investigative bodies such as the FAA and the NTSB.

Presently, the NTSB lacks minimal resources and, therefore, lacks the time to complete thorough investigations of all fatal accidents. Determining initial errors is costly and can take microscopic evaluation to avoid missing factual evidence. In exchange for valuable lifesaving information, it is priceless. As a final point, investigators are faced with enormous responsibility; therefore, they must take action to investigate, make recommendations for future design, and never stop trying to avoid complacency and apathy in investigation. We must not become so impressed by new technology in our culture that we put civilization in jeopardy. ◆

MARC Meeting Draws Enthused Crowd

More than 75 persons, both MARC Chapter members and non-members, attended the annual Chapter gathering that coincides with the spring meeting of the ISASI International Council. The event has come to be a premier evening for folks who are most interested in an international aviation safety venue to exchange ideas and promote air safety investigators' primary mission—the prevention of aircraft accidents.

MARC President Ron Schleede conducted the meeting held at the Days Hotel & Conference Center at Dulles in Herndon, Va. Before introducing the guest speaker, the Federal Aviation Administration's Associate Administrator for Aviation Safety Nick Sabatini, Schleede opened the buffet dinner lines to the guests milling about during the refreshment period that preceded dinner.

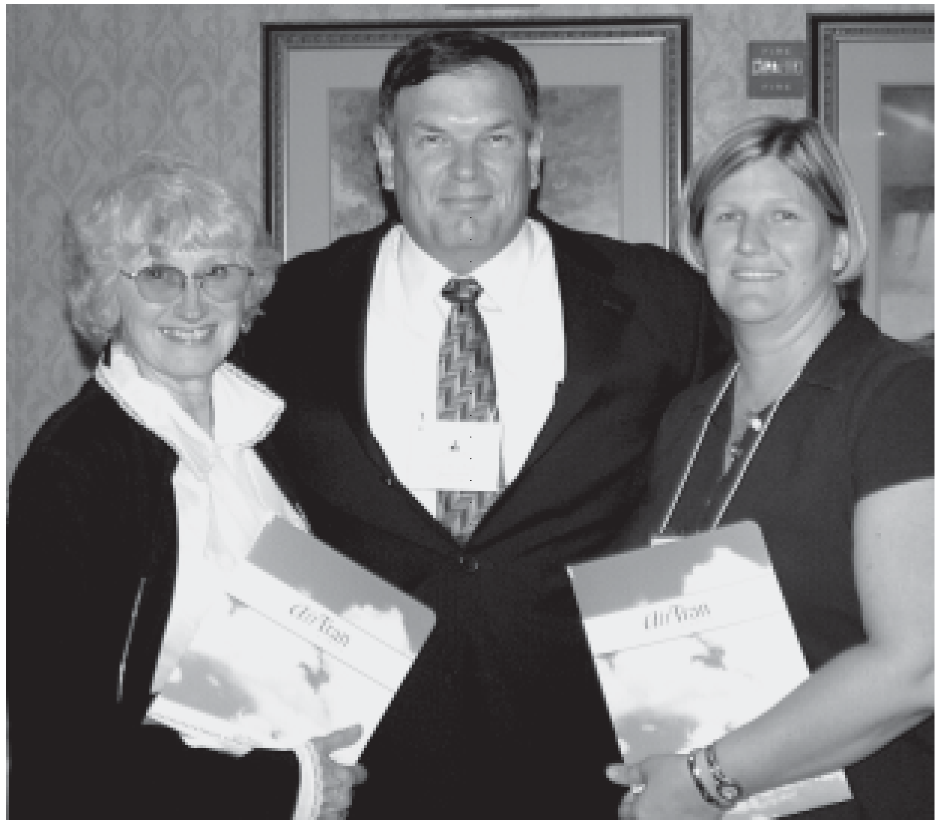
As dinner was being consumed, Tom McCarthy, MARC member and ISASI treasurer, began the first of a series of door prize raffles, and winners came forward to select from a table laden with hats, models, cups, and a variety of other prizes. The top prize of the evening was a donation by AirTran of two sets of roundtrip tickets to anywhere within its system. The winners of the two drawings were guest Nancy Wright and Jayme Nichols of the ISASI Florida Chapter.

ISASI President Del Gandio spoke briefly on the status of the Society, saying that it was financially sound and lauding the payback of purchasing an office condominium versus continued renting. He noted that the Society now numbers some 1,300 active members from 58 countries and that the Society's Reachout program has achieved worldwide acclaim for its 16 investigator training efforts conducted throughout the world. He estimated that its programs have taught about 1,000 persons. In closing his comments, President Del Gandio made a surprise presentation to Max Saint-Germain, a long-term member of the Society's International Council, which serves as its highest governing body (see page 3).

Sabatini then addressed the group (his full remarks begin on page 4). He spoke of how the industry reached its remarkable level of air safety, about what the aviation groups must do to maintain

E. MARTINEZ

MARC President Ron Schleede, left, and Jim Hall relax just before pledging begins for the "match" fund scholarship fundraising.



PHOTOS: E. MARTINEZ

ABOVE: MARC President Ron Schleede. ABOVE RIGHT: AirTran ticket winners Nancy Wright, left, and Jayme Nichols, right, are congratulated by Floy Ponder, AirTran director of flying. RIGHT: Winners of door prizes select their choice from a table laden with donated gifts.

pressure on the accident rate, and on the role of air safety investigators in the 21st century.

Just prior to closing the meeting, the MARC president raised the matter of contributions to the ISASI Rudy Kapustin Memorial Scholarship Fund. The Fund is a tribute to all ISASI members who have died. It was initiated upon the death of Rudy Kapustin, who at the time was president of the Mid-Atlantic Chapter. What began as a call for contributions, which Schleede began with a $100 personal pledge, was transformed into a $1,000 "match" rally by MARC member Jim Hall, former NTSB chairman, and now president of Hall & Associates. In all, $1,500 in pledges were made and that became $2,500 with the $1,000 match by Jim Hall—a good night for the Fund, which will enable the continued awarding of scholarships.

Scholarship donors were $100—Vicki Anderson, Jim Danaher, Barbara Dunn, Keith Hagy, Cynthia Keegan, Mike Klasing, Tom McCarthy, Joe Reynolds, Ron Schleede, and Richard Stone. The Dallas-Ft. Worth Chapter (John Darbo), $300, and John Purvis, $200. Matching the first $1,000 donated, Jim Hall. ◆

ISASI Voting Goes On Line

ISASI members are being urged to use the newly adopted on-line VoteNet system to vote in the current election of the national Executive Officers and Councillor positions for the years 2007-2008 before the August 1 deadline. The positions to be filled are president, vice-president, secretary, treasurer, U.S. councillor, and international councillor. All incumbents, except Keith Hagy, secretary, are on the ballot. Nominated for the position of secretary is Chris Baum, manager of the Engineering and Air Safety Department of the Air Line Pilots Association.

The goals for implementing the electronic ballot are to make it easier, faster for members to vote, and to significantly reduce postage, labor, and materials costs. President Del Gandio

CORRECTION—ISASI 2006

The Fiesta Americana Grand Coral Beach Hotel in Cancun, Mexico, site of ISASI 2006, has issued a correction to its fax number to which all hotel reservations must be sent. The corrected fax number is **52-998-881-3263**. The hotel reservation form printed in the April/June *ISASI Forum*, page 25, may continue to be used, but use the corrected fax number. A hotel reservation form is also available on the ISASI website, ISASI.org. ◆

noted, "We depend upon the participation of the eligible membership to make this a success."

To access VoteNet, go to the ISASI website (ISASI.org), click on VoteNet (http://www.votingondemand.com/ISASI), and a menu will appear. Follow the instructions: Use the same password and identification as you do to access the ISASI website, e.g., username (member number), password (first name, lower case), and click on "sign in." This action takes you to your ballot (U.S., Regional/National Society, International). The Following membership categories are ***not eligible*** to vote: Affiliate, Students, Corporate, Honorary. If any problems are encountered, please contact Ann Schull at (703) 430-9668 or at isasi@erols.com.

As you vote, please consider how the International Council shapes the programs and direction our association takes. This is another action taken by the Council to ensure that Society resources are spent in a productive manner. Your vote counts! Remember—Your vote is confidential! ◆

Reachout 16 Held in Helsinki, Finland

The Accident Investigation Board of Finland hosted the 16th ISASI Reachout workshop. The workshop was arranged for the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden) as an advanced aircraft accident investigation workshop. The workshop was opened on Monday, April 24 by the director of the AIB–Finland, Tuomo Karppinen. He was assisted throughout the workshop by the aviation investigators Esko Lahteenmaki and Hannu Melaranta of the AIB–Finland.

More than 30 persons from five countries attended the workshop and all received ISASI certificates for participation in the advanced aircraft accident investigation workshop.

The advanced accident investigation workshop comprised five working days. It was conducted by Caj Frostell, Alain Guilldou, and Ron Schleede. The workshop contained presentations on the requirements and international obligations contained in ICAO Annex 13, selection and training of investigators, preparing investigators and their managers for a major investigation, planning and organization to conduct an investigation, procedures and checklists, underwater wreckage recovery, field investigation, accident site management, group organization and group progress meetings, flight recorders, technical investigation, flight operations investigation, off-scene testing, crashworthiness, witness interviewing, human factors, 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 eight interactive case studies.

Of the participating organizations, at least four were corporate members of ISASI (AIB–Finland, AIB–Norway, AIB–Sweden, and Finnair). In addition, some of the participants were individual ISASI members. The participants expressed their appreciation to ISASI for bringing the workshop and the ISASI activities to the Nordic countries. The ISASI membership forms and ISASI corporate membership forms were made available to the participants. ◆

Engleman-Conners Leaves Safety Board

Member Ellen Engleman-Conners, who served 2 years as the NTSB's chairman, left the Safety Board on May 31. In her April 17 letter of resignation to President

2005 Annual Seminar Proceedings Now Available

Active members in good standing and corporate members may acquire, on a no-fee basis, a copy of the *Proceedings of the 36th International Seminar*, held in Fort Worth, Tex., Sept. 12-15, 2005, by downloading the information from the appropriate section of the ISASI web page at http://www.isasi.org. The seminar papers can be found in the "Members" section. Alternatively, active members may purchase the *Proceedings* on a CD-ROM for the nominal fee of US$15, which covers postage and handling. Non-ISASI members may acquire the CD-ROM for a US$75 fee. A limited number of paper copies of *Proceedings 2005* are available at a cost of US$150. Checks should accompany the request and be made payable to ISASI. Mail to ISASI, 107 E. Holly Ave., Suite 11, Sterling, VA USA 20164-5405.

Speakers and Technical Papers Presented at ISASI 2005

(Listing is in order of presentation, by paper title and author.)

TUESDAY—*Topic: Recent Investigations*

Kam Air Flight 904—Investigation Challenges in Kabul and on Chaperi Ghar *By Robert Benzon, Investigator-in-Charge, U.S. NTSB*

Accident, Serious Incident, and Incident Investigations: Different Approaches, the Same Objective *By Stéphane Corcos and Pierre Jouniaux, BEA, France*

Removing Pilot Errors Beyond Reason! Turning Probable Causes into Plausible Solutions *By Dr. Robert O. Besco, President, PPI; Capt. (Ret.), American Airlines*

Performance and Flight Dynamics Analysis of the Flight in Ice Accretion *Presented by Wen-Lin Guan, Aviation Safety Council, Taiwan, R.O.C.*

Are the ACAS/TCAS Safety Improvements Sufficient? *By Johann Reuss, Federal Bureau of Aircraft Accidents Investigation, Germany*

***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*

Flight Data Analysis—A New Approach *By Dieter Reisinger, Quality Manager Flight Operations, Austrian Airlines, Vienna, Austria; Simone Sporer, Psychologist, FH Joanneum/University of Applied Sciences, Department of Aviation, Graz, Austria; and Gernot Knoll, Electronic and Communication Engineer, FH Joanneum/University of Applied Sciences, Department of Aviation, Graz, Austria*

A Case-Based Reasoning (CBR) Approach for Accident Scenario Knowledge Management *By James T. Luxhøj and Ahmet Oztekin, Department of Industrial and Systems Engineering, Rutgers, the State University of New Jersey*

Airline Flight Data Analysis (FDA)—The Next Generation *By Michael R. Poole, P. Eng., Managing Partner, Flightscape, and David Mawdsley, CEng, FRAeS, Director-Safety, Safety, Operations and Infrastructure, IATA*

Investigation of Causes of Engine Surge Based on Data in Flight Operations Quality Assurance Program *By C. Edward Lan, University of Kansas, and Capt. Samson Y.C. Yeh, Vice-President, Safety, Security, and Compliance Division, China Airlines*

Practical Human Factors in the Investigation of 'Daily Events' *By Paul Jansonious, Standards Pilot, West Jet, and Elaine Parker, North Cariboo Air, Canada*

Safety Incident Classification Systems—Made Redundant by Text Mining Tools? *By Tom O'Kane, FRAeS, Aviation Safety Advisor*

Update: Finding Wreckage Under Water *By John Fish, American Underwater Search and Survey, and John Purvis, Safety Service International*

Similarities and Differences in the Characteristics of Fatal General Aviation Accidents in Several Countries *By Robert Matthews, Ph.D., U.S. FAA*

Wet (?) Runway Operations *By A. Ranganathan, Capt., SpiceJet, India*

Turbulence Forecasting, Detection, and Reporting Technologies: Safety and Operational Benefits *By Christian Amaral, Delta Air Lines*

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

THURSDAY—*Topic: Human Factors and Safety* Management/Investigative Techniques

Total Safety Management for Aircraft Maintenance Using Total Quality Management Approach *By Derrick Tang, Advent Management Consulting, Singapore*

Maintenance Error Prediction Modeling *By Howard Leach, MRAeS, British Airways, England*

System Identification Techniques Applied to Aircraft Accident Investigation *Presented by Donizeti de Andrade, Ph.D., ITA, Brasil*

Runway Awareness and Advisory System (RAAS) *By Jody M. Todd, Capt., Honeywell Aerospace Electronic Systems*

Rotor Seizure Effects *By Al Weaver, Senior Fellow Emeritus, Gas Turbine Investigations*

3-D Photogrammetric Reconstruction in Aircraft Accident Investigation *By Michiel Schuurman, Investigator, Dutch Safety Board, the Netherlands*

Do You Smell Smoke? Issues in the Design and Content of Checklists for Smoke, Fire, and Fumes *By Barbara Burian, Ph.D., SJSUF, NASA Ames*

Selecting the Next Generation of Investigators *By Keith McGuire, U.S. NTSB*

Applying Human Performance Lessons to Smaller Operators *By Kathy Abbott, Ph.D., FRAeS, Chief Scientific and Technical Advisor, U.S. FAA*

Bringing Proactive Safety Methods and Tools to Smaller Operators *By John Cox, Capt., FRAeS, Safety Operating Systems*

The Use of Operational Risk Management in the Royal Netherlands Air Force Applied to Apache Helicopter Operations in Afghanistan *By Rombout Wever, NLR, the Netherlands*

The Unified Field Theory *By Michael Huhn, ALPA, and Mark Solper, Chairman, ALPA Accident Investigation Board*

GAIN Contribution to an Airline Safety Management System *By Mohammed Aziz, Ph.D., Advisor to Chairman, Middle Eastern Airlines*

An Analysis of Flight Crew Response to System Failures *By A.L.C. Roelen, and Rombout Wever, National Aerospace Laboratory NLR, the Netherlands*

Boeing Runway Track Analysis *By Mark Smith, Boeing*

George W. Bush, member Engleman-Conners said: "With great humility and thankfulness, I tender my resignation as a member of the National Transportation Safety Board effective May 31, 2006."

She joined the Safety Board on March 24, 2003, when she began a 2-year term as chairman and chief executive officer of the agency. Since the expiration of her chairmanship in March 2005, she has served as a member of the NTSB. Her term as member was to expire on Dec. 31, 2007. ◆

SCSI, Czech Republic Conduct 2nd Cabin Safety Symposium

The Southern California Safety Institute (SCSI), in cooperation with the Civil Aviation Department of the Ministry of Transport, Czech Republic, conducted its second European Cabin Safety Symposium in Prague on June 7-9. Almost 100 delegates participated in the event. States represented were the Czech Republic, the Netherlands, Germany, Canada, Norway, the United States, Great Britain, Ireland, Poland, Finland, Sweden, Denmark, France, Croatia, Portugal, Lebanon, New

Some of the 100 attendees from 18 countries show deep involvement in the cabin safety material being presented.

Zealand, and Taiwan. Representatives from Airbus Industrie and *CAT* magazine also participated.

Michel Beland, North Atlantic Office of ICAO, was the keynote speaker. The content of the Symposium focused on trends and best practices in cabin safety training and cabin safety security and health. Information and experiences from the investigation of the year 2005 aircraft accidents were also presented.

Ladislav Mika (MO4226) served as the coordinator for the event on behalf of the country's Civil Aviation Department. He noted that the Czech Republic is "becoming quite active in the field of aviation safety within ICAO." He gave special acknowledgement to Czech Airlines, which, he said, "significantly supported the Cabin Safety Symposium." ◆

Scaling Up Safety *(from page 21)*

sifies errors made by the flight crew. This data is then compiled by the outside safety company and presented to the other participant groups for a consensus-based solution.

Limited resources and increased expectations

As the news media widely reports the airline industry's ever-improving safety record, airline customers' expectations of safer flights rise accordingly. Paradoxically, the flying public expects the airline industry to continue to improve flight safety while offering low-fare tickets, all in the face of record-high fuel prices.

The current economic squeeze is affecting some tangential aspects of the airline industry, too. Regulatory agencies (the FAA in the U.S.) face increased pressure on budgets. Those agencies must often do more work with fewer personnel. Regulatory oversight, while still mandated to improve aviation safety, is under significant fiscal pressure. New tools are needed to facilitate the administration of regulatory agencies and enhance aviation safety—concurrently.

One way to meet the emerging safety needs of the airline industry is to take big-airline proactive safety methods to the small operators. These methods of improving and enhancing operational safety are well-understood and proven. Since small operators are held to the same standards as large operators and the virtual safety department is a reality, *cost* is no longer a viable excuse for not having a dedicated safety department using all available safety tools. The virtual safety department offers the best of both worlds: the services and benefits enjoyed by the larger operators at a very affordable price.

The methodology to improve safety at the small operator exists at the large operator. Those successful safety solutions from the greater part of the industry must now be applied at the lesser part. The virtual safety department brings proactive safety methods and tools to smaller operators efficiently and at an affordable price.

All operators can now enjoy the benefit of reduced risks and improved efficiencies. Early detection and reporting of safety issues, followed by proper mitigation of those issues, is a time-honored methodology to achieve continuous improvement of aviation safety. That continuous improvement in operational safety will result in cost efficiencies throughout the airline.

A safer airline has fewer on-the-job injuries, often has lower insurance costs, has fewer passenger injuries (and resulting litigation), and can expect better resale price for equipment. The safer airline, too, may enjoy better relationships with the news media and the regulator.

The aviation industry has historically been a leader in safety. Our industry has the most enviable safety record in all of public transportation. Our accident rates have declined sharply over the years. This trend must continue. One method to help keep the safety trend going in the right direction is the utilization of all the means available for the early detection and mitigation of safety deficiencies. The methodology to improve safety at the small operator exists at the large operator. Those successful safety solutions from the greater part of the industry must now be applied at the lesser part. The virtual safety department brings proactive safety methods and tools to smaller operators efficiently and at an affordable price. ◆

Guest Commentary *(from page 5)*

This is how we will achieve the next level of breakthrough safety technology that will lead the way to orders-of-magnitude reduction in fatality risk—sharing safety information in a more powerful way than ever before—and desperately needed to keep pace with the planned increases in transportation system capacity.

Earlier this year, we established an

I applaud the work ISASI is doing to look ahead. You recognize that the role of air safety investigators is changing. You know that we are no longer domestic or international or even global. We are now in space. Increasingly, machines and technology will be different. The medical issues will be different. The human factors issues will be more complex.

Aviation Safety Analytical Unit headed by Jay Pardee. Jay headed our Engine and Propeller Directorate. In his new role, Jay and his team will pick up the analytical work that Jay did for CAST, as well as work with NASA on Aviation Safety Information Analysis and Sharing Systems (ASIAS).

In addition, the new unit will support Jay's work as the FAA aviation safety lead for the Joint Planning and Development Office (JPDO) Safety Integrated Product Team, or IPT. The Safety IPT is committed to implementing a Safety Management System within JPDO and its member governmental agencies and customers. A Safety Management System will set the standards for safety culture and safety risk management. Its foundation will be based on aviation safety information analysis and sharing.

Another assignment for the analytical unit is, quite simply, looking ahead. Often we get so caught up responding to today's issues that we don't make the time to look ahead and see what's coming, what it is we will need to address. With growing demand, introduction of new aircraft, globalization, and more—we must keep our eye firmly focused on the horizon.

We also know that risk will always be higher than zero. U.S. airlines have more than 30,000 daily flights. This will likely surpass 40,000 daily flights in the not-too-distant future. In a system of this size and complexity, fatal accidents will not go away.

I applaud the work ISASI is doing to look ahead. You recognize that the role of air safety investigators is changing. You know that we are no longer domestic or international or even global. We are now in space. Increasingly, machines and technology will be different. The medical issues will be different. The human factors issues will be more complex. In addition, business models are changing, as is the infrastructure of the entire National Aviation System.

What skills do we need in future air safety investigators?

Keith McGuire put it plainly at ISASI 2005. Top of the list—and this won't change—is "logical thought process." McGuire also listed strong interpersonal skills, psychological and physical preparedness, and a person who is continually learning. A person who is continually learning, that is especially important with the rate of change we're experiencing. Would you have imagined just several years ago the activity we're seeing today with very light jets, light sport aircraft, unmanned aircraft, and commercial space?

A few weeks ago we lost one of aviation's greats—Scott Crossfield. As a boy, Crossfield watched Boeing's test pilot Eddie Allen fly, and he took the advice he got seriously: "Be an engineer. Help build the airplanes. Then fly them and find out what you did wrong."

Fly them and find out what you did wrong. We will not always have that luxury. We need to use every tool, every skill, and every resource that we can bring to bear to enhance safety. Those tools, skills, and resources include accident investigators, yes, to look back, and leveraging information and analysis to look forward to anticipate to prepare and prevent. That's how all of us in aviation will improve safety and save lives. It does not get any more rewarding than that.

That's what you as professional air safety investigators do, and you do it extremely well. ◆

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COPAC/Colegio Oficial de Pilotos de la Aviacion Comercial
Cranfield Safety & Accident Investigation Centre
DCI/Branch AIRCO
Delta Air Lines, Inc.
Directorate of Aircraft Accident Investigations—Namibia
Directorate of Flight Safety (Canadian Forces)
Directorate of Flying Safety—ADF
Dutch Airline Pilots Association
Dutch Transport Safety Board
EL AL Israel Airlines
EMBRAER-Empresa Brasileira de Aeronautica S.A.
Embry-Riddle Aeronautical University
Emirates Airline
Era Aviation, Inc.
European Aviation Safety Agency
EVA Airways Corporation
Exponent, Inc.
Federal Aviation Administration
Finnair Oyj
Flight Attendant Training Institute at Melville College
Flight Safety Foundation
Flight Safety Foundation—Taiwan
Flightscape, Inc.
Galaxy Scientific Corporation
GE Transportation/Aircraft Engines
Global Aerospace, Inc.
Hall & Associates, LLC
Hellenic Air Accident Investigation & Aviation Safety Board
Honeywell
Hong Kong Airline Pilots Association
Hong Kong Civil Aviation Department
IFALPA
Independent Pilots Association
Int'l. Assoc. of Mach. & Aerospace Workers
Interstate Aviation Committee
Irish Air Corps
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
Qwila Air (Pty) Ltd.
Republic of Singapore Air Force
Rolls-Royce, PLC
Royal Netherlands Air Force
Royal New Zealand Air Force
RTI Group, LLC
Sandia National Laboratories
Saudi Arabian Airlines
SICOFAA/SPS
Sikorsky Aircraft Corporation
Skyservice Airlines Ltd.
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 ◆

Aircraft Mechanics Fraternal Association

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

The Aircraft Mechanics Fraternal Association (AMFA) is a craft-oriented, independent aviation union. It is not an industrial union and represents only airline technicians and related employees in the craft or class in accordance with the National Mediation Board rules and their dictates. AMFA is committed to elevating the professional standing of technicians and to achieving progressive improvements in the wages, benefits, and working conditions of the skilled craftsmen and women it represents.

AMFA was created in 1962 but did not represent any carrier until Ozark Airlines in 1964. It later represented Pacific Airlines, Airlift International, Hughes Airwest, and Southern Airways. AMFA's craft union now represents aircraft maintenance technicians and related support personnel at Alaska Airlines, ATA, Horizon Air, Mesaba Airlines, Northwest Airlines, Southwest Airlines, and United Airlines.

The goal of AMFA is to have all airline technicians and related employees under the AMFA "umbrella." Its mission is to raise the standards of and increase recognition of the technician and related class or craft for the protection of the profession, and to afford protection for AMFA members before government agencies and expand the education of members' rights and privileges before Congress whenever it pertains to the craft.

Negotiations

AMFA employs professionals at the bargaining table to present and utilize their particular expertise. For example, in economic areas AMFA hires a financial expert; in the pension and welfare areas it hires a pension actuary. The contract language is reviewed by AMFA's legal counsel before presenting it to the company. When a contract is submitted to AMFA-represented technicians and related members for a vote, the entire contract is presented, not merely a summary or highlights sheet.

Except for negotiations under bankruptcy, AMFA has never accepted concessions, give-backs, two-tier pay scales, or "B" rate mechanics. One reason for this is that the local airline representatives, who are well-acquainted with their airline's problems, are at the bargaining table with the national officers. AMFA also believes in having its members attend and observe contract negotiations. Although this is considered by many to be a novel idea, AMFA has been doing this in negotiations for years, and it has helped both sides to understand the problems and issues that must be resolved at the bargaining table.

Structure

Local officers and representatives are elected by the local membership and can be recalled by the membership. A petition signed by 25 percent of the members begins the recall procedure. The national office assists the locals throughout the system. The National Executive Council hires professionals to provide CPA accounting, legal representation, labor relations advice, insurance/pension actuaries, and national administration. National officers oversee these professionals and report to the membership. Candidates for national office need the endorsement of only one local to have his or her name placed on the ballot. National officers are subject to the same recall procedures as local officials.

Safety & Standards

AMFA is involved in ASAP (Aviation Safety Action Program) at three of its carriers to date. This is an FAA-approved program designed to obtain safety-sensitive information from an event that is then utilized to prevent reoccurrences of mishaps, incidents, etc., and to develop prevention strategies with the data that are obtained. Participants are the FAA, AMFA, and the airline, all of which sign an MOU and each has a voting member on the ERC (Event Review Committee). Additionally AMFA has Go Teams trained and ready to assist the NTSB in the party process for all of its represented airlines. Training is provided to team members on accident investigation, and members attend classes conducted at the NTSB Academy. AMFA works with the Air Line Pilots Association (ALPA) and has sent many folks to the ALPA advanced accident investigation training course. Annually it conducts a Safety & Standards Chairman training course held in conjunction with industry forums. ◆

AIR SAFETY INVESTIGATORS
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