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The Decision To Fly

Icing has contributed to major air carrier accidents that have resulted in personal tragedy and grief, in addition to major economic losses they impose on the aviation community. The aviation community continues to gain knowledge and understanding about the nature of icing hazards, but on-going communication and education are integral to success in reducing aviation's vulnerability to ice, as well as other hazards.

by

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Flight Safety Foundation has found that the fatal accident rate per million departures over the past decade is the same for takeoff icing accidents as it is for wind shear accidents. While more lives have been lost in wind shear accidents, both cases have occurred at the same rate. The exposure to risk is therefore the same. With this situation in mind, contrast the different degree of attention given to research, education and communication concerning these two serious problems.

Three years ago, Flight Safety Foundation, with the support of Finnair, conducted a three-day Regional Workshop in Helsinki, Finland, on the topic: "Safe Operations in Cold Weather." It was well-attended by more than 120 delegates from Europe, South America, Southeast Asia, the Far East and Middle East. The U.S. and Canada were under-represented. This was unfortunate, because much valuable knowledge and information was shared by our European and Nordic members who have very successfully operated in harsh winter weather with an enviable safety record. A session devoted to ground operations previewed what I am addressing now. I am pleased to report that significant progress has been made in ground de-icing since the meeting in Helsinki.

I chose this title, "The Decision to Fly," because it represents the crucial transfer point where responsibility for the success of the flight passes from the ground engineer to the pilot. Successful preparation of the aircraft for flight is the essential starting point for the pilot as he or she assesses all of the factors bearing on committing to take off.

The chains of events that comprise preparing an airplane and its crew for flight, the decision to fly, and the flight itself, are long series of tasks that must be carefully performed by many people of high skill, good judgment and having dedication to thoroughness and quality. The mixture of technical tasks and human subjective behavior makes these tasks very difficult. As countless accident investigations have shown, any interruption in these chains of events provides opportunity for error. The error may be trivial; it may be serious. It may be recognized and remedied, or it may go undetected, until it causes another error, and another, and another, until their accumulation destroys the safety margins and they coalesce into an accident. Because we have learned from our mistakes, for the most part, we have laboriously built up our technologies and have established procedures through painful trial and error to where we believe that we have assured safety. That is a perception, and it may or may not be true.

The statistics reflect our overall success. The statistics also show our remarkably few failures. The reliability of today's commercial aircraft is phenomenally good. Only 3-5 percent or so of the fatal accidents in air carrier operations involve mechanical failures or maintenance errors as primary factors. Some 70 percent, on the other hand, involve the cockpit crew as a primary factor. However, we cannot simply dismiss these so-called crew errors as of no concern to maintenance and engineering. As one pilot not long ago summed up his report to the Aviation Safety Reporting System: "In the final analysis, the error was mine and I take full responsibility for it; but I did have a helluva lot of help along the way in making it."

Education. Communication. Are we doing enough? No, or we wouldn't see the types of accidents that are happening today.

Several years ago, I wrote an article for the Flight Safety Foundation's *Flight Safety Digest,* expressing concern that many of today's pilots are unaware of the hazards of ice on the wing or other parts of the airplane. Aerodynamic penalties of meager amounts of ice escape their awareness. Why do our crews ignore these known and proven facts to press on with routine operations? Schedule or economic pressures? Macho thought (i.e. I can handle that little bit of snow or ice)? Or just plain ignorance? It makes no sense at all to invest tens of thousands of dollars in developing a skilled pilot and then permit an operation where such crucial factors can be ignored.

The engineering community seems to understand to a great degree the appropriate processes for applying proper formulations of de-icing fluids over a range of climatic conditions. Is this adequately translated to the ground crews? Is a quality check maintained on the actual application? Does the cockpit crew understand the process and its limitations? I think the answers must be "no" in too many cases. Why?

De-icing is not inexpensive. Deciding its use is a judgment call. Added to the cost of the fluids themselves is the cost of delay, inconvenience and environmental protection. Type II fluids are more expensive than Type I, but have more "holding time." Are the decisions to use Type I or Type II rationally made? Does the pilot have enough basic information to make a rational decision in all cases? What of economic pressures? Schedule pressures? How does one trade off the cost of delay with savings of fluids use? How does one rationalize the saving of a few thousand dollars of de-icing services with the cost of a wrecked airplane, loss of passengers' lives and loss of a trained crew? Does a deregulated air transportation system accommodate the rationalization of precautionary expenses? Especially when competing carriers' overall route structures differ and may favor one over the other in the number of de-icing applications annually? I mention these points because I think they need to be continually reviewed so that the duty of care imposed on us all is carried out properly.

FAA identifies nine serious part 121 and 135 accidents in North America since 1968 that are ground de-icing related. Every one of them represents a mistaken decision to fly. Why? Was the pilot in possession of all the information needed to make a proper decision, or was ignorance the culprit? Where was the communication? The education?

I visited the United Kingdom's Accident Investigation Board's wreckage hangar facility at Farnborough a year ago. There, grouped on the hangar floor were the sad remains of once-proud, functioning aircraft and helicopters. Each of these 14 or so piles of twisted metal and fractured structures represented loss of life, resulting somehow from judgment errors or ignorance on the part of the human element in the overall system. They ranged from a single-pilot ultra-light whose main support structural member had fatigued, to the Manchester B-737 fuselage and wings.

Don Cooper, chief investigator, guided me through the hangar, stopping at each grouping of wreckage and pointing out the main factors and circumstances. Two wrecks were icing-caused, an F-227 and a Shorts Skyvan. When we were through, Don looked at me and said, "You know, Jack, every one of these accidents is one that 'couldn't have happened.'" Hindsight exposes the deficiencies of foresight. It should sharpen the intellect.

I began my professional years 36 years ago at National Advisory Committee for Aeronautics (NACA) Lewis Flight Propulsion Laboratory in Cleveland, Ohio just as their extensive icing research program was winding down. This flight and ground facility research program provided basic understanding about the meteorology of icing, aerodynamics of ice formation and shapes, aerodynamic penalties with the then in-use airfoils, ice accretion processes and de-icing techniques. Airline engineering departments, strong and highly skilled at that time, translated the information into operational and maintenance procedures designed to educate pilots and ground crew and to minimize hazards. Manufacturers also used the information in ice protection designs.

The advent of the jet transport in the late 1950s brought a wide expectation that icing problems were over. The powerful jet engine, less susceptible to icing than piston engines, provided rapid climb through icing layers and comfortable cruising above weather. The excess power of the jet engine allowed pilots to sometimes "get away with" a meager amount of surface roughening on the wings on takeoff, masking the subtle aerodynamic lift and drag penalties. In time, the hazards of icing receded from many pilots' and ground engineers' consciousness. Icing research in the laboratories was terminated, only to be revived somewhat later as helicopter development pressed it towards bad weather operation.

Occasional icing accidents continued to occur. Most were due to failure to prepare the aircraft for flight in icing conditions. As air traffic continued to expand, the jets began to spend more time at icing levels in the terminal area, and about 12 years ago, the National Aeronautics and Space Administration (NASA) undertook a revival of the icing program in cooperation with the U.S. Federal Aviation Administration (FAA) to reexamine data from the earlier program for application to today's situation. They wanted to evaluate, with better sensors, measurement techniques and analysis methods, the nature of ice formation and its effects. New de-icing methods were explored. Last year I had the pleasure of addressing a 10th anniversary workshop at NASA Lewis, commemorating the first international workshop convened there in 1977 that restarted the program. Many new approaches to de- and anti-icing had been discovered and tested. Promising new on-board systems, such as the electro-impulsive technique, for one, may ultimately reduce the present dependency on chemical fluids and provide a less-expensive constraint protection for the aircraft of the future. Research is continuing in the field.

But for now, we must work with what we have. I am disappointed that it has taken so long for the North American side of the Atlantic to show serious interest in the potential benefits of Type II de-icing fluids and their derivatives. Its potential and acceptance within the European community were well demonstrated at the Helsinki Workshop, and one U.S. airline representative who attended, immediately made plans for exploratory use of it in the U.S. Again — we need to communicate to educate.

The Flight Safety Foundation has regularly communicated icing hazard information to both mechanics and pilots. Our publications go to nearly 480 member organizations in 64 countries. Yet, in-company distribution of this information varies from a few airlines that flood their flight and maintenance crews with reprints to many others, where the bulletins end up, never read, neatly-filed in FSF binders on someone's bookshelf. We have many requests from member company personnel trying to obtain a bulletin that may reside in such a bookshelf only a few office doors from them!

The Office of Technology Assessment's recent report, "Safer Skies for Tomorrow" echoes the FSF's long-time concerns in identifying the need for greater government and industry effort to educate air and ground crews about icing. Sharpened economics in a deregulated environment make this a more difficult task, as newer, less experienced flight and maintenance crews enter the workforce. Airline engineering staffs are smaller these days, with precious little additional time to help communicate engineering and performance information within the organization. That notwithstanding, we still need to communicate and to educate.

I visited an airline two years ago where my host, the assistant director for flight operations, had prepared the usual visit schedule for me. It was a comprehensive tour of flight training, dispatch, crew emergency training and cabin safety facilities. I asked if it would also be possible to visit their maintenance and engineering facility and see their engine overhaul shops and their quality control laboratory. My host looked at me, surprised for a minute, and readily agreed, remarking that he didn't know that I would be interested. I pointed out that safety begins with preparation of the airplane. He laughed and asked if he could accompany me on the visit. I of course agreed, and we had an interesting and thorough 2-hour tour and briefing of the airline's excellent facility. The spirit and attitude of the staff showed a professional dedication to high quality work. When we returned to flight operations, my host said that he was glad I had made my request, because he had not physically visited the maintenance facility in over two years! He was so impressed with his airline's technical department that he was going to schedule each of his flight crews to visit the facility over the next six months. When I saw him this summer, I asked if he had indeed done what he said. He replied that he had, and the effect was positive. Maintenance squawks had diminished and maintenance time on some squawks had been reduced because the crews now better understood the maintenance people's problems in assuring them of an airworthy airplane. This was one very graphic demonstration of the benefits of communication and education.

And after all, good communications and education are the only ways that a proper decision to fly can be made. The duty of care that each of us has in aviation extends to the business of communicating proper procedures, education about the best methods and techniques for de-icing aircraft, and seeing that the tasks are performed in a competent, thorough way so that the airplane is presented to the crew in condition that will make the decision to fly a safe one. ♦

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