Rick Darby

Presenters at a winter operations conference offered guidance for aviation's most difficult season.

BY RICK DARBY | FROM TORONTO

COLD REMEDIES

For artists, photographers and anyone with an eye for beauty, winter has its attractions. For aviation professionals involved with winter flying, the season brings the need for extra vigilance and adherence to proven operational practices. Held in Toronto, the International Winter Operations Conference, themed "Safety Is No Secret," aimed to reduce the mysteries surrounding winter aviation's special demands.

The Air Canada Pilots Association/Association des pilotes d'Air Canada (ACPA) and the Canadian Society of Air Safety Investigators sponsored the event. Barry Wiszniowski, a captain, air safety investigator and chair, ACPA Technical and Safety Division, was the chief organizer (see sidebar, p. 27).

"For an inspector of accidents in a Nordic country, this was a valuable conference," said Edith Irgens, inspector of accidents, Accident Investigation Board Norway. "It covered most of the challenges we experience up north: contaminated runways, weather, snow clearing, de- and anti-icing, airframe icing and aerodynamics, runway excursions and safety areas, cabin safety and even some of the challenges of a winter accident investigation."

The keynote speaker was Robert "Hoot" Gibson, mission commander aboard the space shuttles *Challenger*, *Columbia*, *Atlantis* and *Endeavour*. The *Challenger* was destroyed shortly after launch when an O-ring seal failed. Investigation found that the unusually cold weather, outside the range of previous operations, was a leading causal factor in the failure of the seal.

Dave Mastel, manager, Area Control Centre operations, NAV Canada, described the preparations his organization makes before a major winter storm. They can be described under three headings, he said. First, planning — strategic and tactical; second, execution — communications, ground operations and traffic management initiatives; and third, monitoring, including follow-up debriefings.

He offered "rules of thumb" for ground control during snow or icy conditions. Establish separate arrival and departure traffic flows if feasible; minimize runway crossings; be aware of, and respect, anti-icing fluid holdover times; keep the time between brake release and departure to one hour; and ask pilots for single-engine taxiing. For wet runways, he recommended a maximum crosswind component of 15 kt including gusts; for contaminated runways, he said controllers should use the one most directly into the wind; in either case, there should be no tailwind.

Chicago O'Hare International Airport must cope with winter weather while maintaining 178 aircraft gates, 13 mi (21 km) of runway and 48 mi (77 km) of taxiways. George Lyman, Chicago Department of Aviation general manager of airfield operations, described the planning and coordination needed.

Weather forecasting is obtained from six different sources, he said. The airport is divided into airside and landside snow operational areas, with four snow removal manuals published annually. Snow alerts to airport personnel are as detailed as possible, including wind direction, temperature, expected snow accumulation, expected duration of the storm and type of snow.

For the most severe storms, as many as 196 workers are on the job to keep the airport open. A total of 199 vehicles — deicers, brooms, plows, sanders, etc. — are available. The airport uses new technology, including three-in-one equipment, a combination of plow, broom and blower in a single unit.

Jacques Leroux, account executive with Dow Chemical, emphasized that anti-icing fluids protect for a limited period, measured as holdover time (HOT). Depending on the type of fluid, the HOT can range from 20 to 80 minutes. He described the procedures for receiving, testing and storing fluids, noting, "The spray operator should be trained to notice and report anything unusual about the fluid as it is applied, such as abnormal foaming or the agent being the wrong color for the type of anti-icing fluid."

Additional forms of anti-icing and deicing are now in wide use, said Kelvin Williamson, corporate director, Basic Solutions North America. Chemicals include potassium acetate for anti-icing and sodium formate for deicing. "Potassium acetate is virtually odorless, contains a corrosion inhibitor and is 100 percent nontoxic," he said. "It is effective in very low temperatures." The chemical is also effective at cleaning rubber, grease, oil and fuel off runway surfaces. During snow clearing operations, these surface contaminants along with frozen contaminants can be removed at the same time, leaving an improved surface, he said.

Sodium formate is effective to minus 22 degrees C (minus 8 degrees F), fast-acting and environmentally sound, Williamson said. It is used to melt through packed snow and ice, breaking ice-to-pavement bonds and making mechanical removal easier.

Clint Tanner, Bombardier senior technical adviser, flight sciences, Core Engineering, discussed the recent history of takeoff accidents and incidents in winter operations involving CRJ200 and CL600 aircraft, in which, he said, "Generally, it has been found that there was a failure to follow the published operational procedures for the aircraft."



Speakers from left: Williamson, Wiszniowski and Leroux

Photos: Rick Darby

Among the analytical findings, he said, were that "in all cases, a premature wing stall occurred during the takeoff rotation. It is believed that the premature wing stall was caused by ice contamination along the wing leading edge."

Accidents involved failure to deice or anti-ice properly, he said. In every accident, the wing anti-icing system was not used. In-service experience with the two Bombardier models showed that "no 'winter operations' accident has *ever* occurred where the wing anti-ice system was selected 'ON,'" he said. Tanner said that a review of operators' documentation found that several operators had pilot checklists lacking a pre-takeoff check for wing anti-ice selection. Another causal factor was excessive rate of rotation, with the average maximum pitch rate greater than 6 degrees per second.

Airplane flight manuals (AFMs) for the CRJ200 and CL600 now call for tactile inspection of the wing leading edge and upper surface when the outside air temperature is lower than 5 degrees C (41 degrees F), or the wing fuel temperature is 0 degrees C (32 degrees F), or "the atmospheric conditions have been conducive to frost formation," he said. Such definite criteria are better than vague conditions such as "water on the wing" or "visible moisture." In another change to the AFMs, "wing anti-ice is required to be 'ON' for all takeoff operations when the outside air temperature is less than or equal to 5 degrees C, and visible moisture is present below 400 ft above ground level, or the runway is wet or contaminated, or there is any precipitation." The new procedure and a new definition of ground icing conditions supersede a former 1-mi (1.6-km) visibility criterion that was found to be ineffective in ensuring that wing anti-ice was used appropriately.

High-altitude ice crystals have recently been connected to engine power loss and aircraft damage. Since 1991, more than 100 such events have been recorded. Jeanne Mason, senior specialist engineer in engine icing and inclement weather with Boeing Commercial Airplanes, described an incident in which high-altitude ice crystals resulted in multiple engine flameouts in a 747 on descent into Manila, Philippines.

"'Icing conditions' has always referred to conditions where supercooled liquid drops cling to airframe surfaces, typically below 22,000 ft," she said. "But high-altitude water is likely to be frozen ice particles — crystals — rather than super-cooled liquid drops." Crystals can form ice even on surfaces warmer than freezing temperature, such as compressor surfaces aft of the engine fan, she said. Ice shed from compressor surfaces can cause surges, flameouts or engine damage.

Convective, cumulonimbus clouds have a high concentration of ice crystals, Mason said. "Strong updrafts and heavy rain are conducive to water and lots of potential ice crystals," she said. "The key to identifying clouds that contain ice crystals is heavy rain below the freezing levels." Crystals accumulate in the "anvil" part of a cumulonimbus cloud and have poor reflectivity for aircraft weather radar. "Use the tilt feature of the radar to identify heavy rain below, a good indicator that ice crystals may exist above the rain," she said.

Bryon Mask, a retired Air Canada captain and ACPA director of flight safety, discussed the use of flight data analysis (FDA) in winter operations in a program "designed to enhance safety through the controlled, automated recording and analysis of flight data generated during routine line

operations." The data are retained and used for safety, trend and operational analysis.

"It is imperative to store lots of data for best results," he said. "From our perspective, 15 months is the minimum for data mining, that is, asking complex questions of the database and receiving answers based on enough data. Air Canada has kept over 4 terabytes of data." A terabyte is 1,000 gigabytes.

As examples of how FDA can help reveal risk factors in winter operations, Mask cited studies to determine whether tail-mounted engines like those on the Challenger CL-65 were susceptible to icing, and another study to see if engine ice-clearing procedures for operating engines at idle in prolonged icing conditions on the ground were followed. In both cases, the danger to be avoided was engine fan blade damage.

Mask told an anecdote that summed up the importance of taking precautions to reduce the risks of winter operations:

"Back in the early 1970s, I was flying helicopters. We stopped at a small airport in Quebec for refueling. We set the chopper down beside a light twin, which had obviously been there for two or three days because it was covered with snow and ice.

"We saw a gentleman walk up to the aircraft, open the door and get out a broom. He went over to the left wing and took a little snow off it, then did the same on the right wing. He didn't even bother with the tail. He then started to get back in the pilot seat.

"We went over to him and asked, 'Excuse me, are you waiting for the deicing truck?' I'll always remember his words: 'There's no need for deicing. I'm not going very far.'"

A Conversation With Capt. Barry Wiszniowski, Air Canada Pilots Association

AeroSafety World: Why did you organize this conference?

Wiszniowski: For one thing, because the Air Canada Pilots Association was respected but not well known. We have 3,000 professional pilots with experience and expertise operating in the Canadian winter environment. This is one of our specialties, and we wanted to share it with the industry, including foreign carriers coming into Canada — because for many of them, operating in icing conditions is anything but a normal procedure, and some have never seen a major snow or ice event before. For us, winter operations are normal operating procedures.

ASW: Quite a few Canadian pilots are here as well. They must have felt they had something to learn, too.

Wiszniowski: It's like what one of your Americans, [former Secretary of Defense] Donald Rumsfeld, said: There are the known knowns, the known unknowns and the unknown unknowns. There are things we don't even know that we don't know.

ASW: What are some of the things that even pilots experienced in winter ops might not understand, or not fully understand?

Wiszniowski: [Deicing] fluid failures, deicing techniques, some of the technological advances that will make operations safer and things that we should avoid — the traps in deicing. So through the education process we had today, with the airport authorities, fluid and deicing equipment manufacturers, and so on, we can eliminate the known unknowns.

ASW: What if anything is still uncertain?

Wiszniowski: We don't know the characteristics of a fluid failure. As one of the presentations demonstrated, we don't know the effect of one wing being contaminated and what level of contamination is going to lead you into a serious event. From the airport side, we don't know the effect of an unstable approach or noncompliance with SOPs that is going to put you in harm's way.

ASW: What kind of noncompliance is especially risky in winter operations?

Wiszniowski: There's always the possibility of the normalization of deviance, where someone thinks, "I don't have to perform a stable approach all the time, because I've always gotten away with it." And now he's in a situation where he has a contaminated runway, the airframe has picked up ice on the flaps and he's above the approach speed.

ASW: So the margin for error is drastically reduced.

Wiszniowski: Yes. In another example of an unknown discussed here, we found that air traffic control (ATC) did not know that we do an engine run-up on the runway. We do that because it's part of our operational procedures — it's in the Embraer FOM [flight operations manual], it's in the Airbus FOM, that when you're in icing conditions, before you take off you have to do a run-up.

So the unknowns aren't only among the pilots. They're on the ATC side of the house and the airport side of the house. Through this conference, now we're getting together as a community.

ASW: Is this conference a one-off, or will there be others?

Wiszniowski: We are planning to hold another two years from now.

— RD