



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 18, 1993

In reply refer to: A-93-19 through -30

Mr. Joseph M. Del Balzo
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On Sunday, March 22, 1992, about 2135 eastern standard time, a Fokker 28-4000 (F-28), N485US, operating as USAir flight 405, crashed during an attempted takeoff from runway 13 at LaGuardia Airport, Flushing, New York. The airplane was operating under Title 14, Code of Federal Regulations (CFR), Part 121, as a scheduled passenger flight from Jacksonville, Florida, to Cleveland, Ohio, with a stopover at LaGuardia Airport. There were 47 passengers, 2 flightcrew members and 2 cabincrew members on board. The captain, one of the cabincrew members, and 25 passengers received fatal injuries. Impact forces and the subsequent fire destroyed the airplane.¹

The National Transportation Safety Board determines that the probable causes of this accident were the failure of the airline industry² and the Federal Aviation Administration (FAA) to provide flightcrews with procedures, requirements, and criteria compatible with departure delays in conditions conducive

¹For more detailed information, read Aircraft Accident Report--"Uncontrolled Collision with Terrain, USAir Flight 405, Fokker F-28, N485US, LaGuardia Airport, Flushing, New York, March 22, 1992" (NTSB/AAR-93/02)

²For the purposes of this report, "airline industry" includes government and industry organizations responsible for and capable of studying the problems associated with aircraft icing hazards, and disseminating information to flightcrews about these problems, and for developing technology and requirements to minimize such hazards.

to airframe icing and the decision by the flightcrew to take off without positive assurance that the airplane's wings were free of ice accumulation after 35 minutes of exposure to precipitation following deicing. The ice contamination on the wings resulted in an aerodynamic stall and loss of control after liftoff. Contributing to the cause of the accident were the inappropriate procedures used by, and inadequate coordination between, the flightcrew that led to a takeoff rotation at a lower than prescribed air speed.

Instrument meteorological conditions prevailed at the time of the accident, and a thin layer of wet snow covered the runway. Between 2100 and 2135, about 0.35 inch of this wet snow, having a water equivalent of about 0.05 inch, fell at the airport. About 2026, the airplane was deiced with Type I fluid, and, after a pushback delay of about 20 minutes, the captain requested a second deicing, which was completed about 2100. About 35 minutes elapsed between this second deicing, in freezing temperatures, and the taxi and takeoff of the airplane. This amount of time exceeded the fluid's safe holdover time, calculated at around 11 minutes, and the airplane accumulated ice on its wings.

The first officer testified that he used the ice (wing) inspection light to check the upper surface of the right wing and the black strip on the leading edge for ice buildup. Because he did not observe any contamination, he did not believe that a third deicing was necessary.

During the investigation of this accident, many pilots acknowledged the fact that the F-28, which has no leading edge devices on its wings, is sensitive to contamination. They also said that they would examine the wings from the cabin, if necessary. However, they all believed that they could detect any significant contamination from the cockpit window. The USAir Vice President of Flight Operations testified that he believed flightcrews had as good a view from the cockpit as they would from the cabin window. At the time of the accident, USAir did not require a specific exterior inspection for ice contamination on F-28 airplanes in periods of freezing precipitation. Its directive for the airplane was for flightcrews to conduct a "...careful examination of the surfaces...to determine the extent of accumulation and to assure that the takeoff can be made safely..." The observation by the first officer of USAir flight 405 was made through a closed cockpit window. Even with the wing inspection light on, the Safety Board believes that observing a wing from a distance of 30 to 40 feet through a closed cockpit window, which was most likely wet, does not constitute a careful examination.

The Safety Board recognizes the dilemma of flightcrews in comparable weather conditions--having to return to the gate only to be confronted with further delays or flight cancellations, or to proceed with takeoff and accept the risks involved. However, the Safety Board believes that the flightcrew of flight 405 should have taken more positive action to ensure a contamination-free wing, such as entering the cabin to look at the wing from a closer range. The Safety Board also believes that the detection of minimal amounts of contamination, sufficient to cause aerodynamic performance problems, is difficult, if not impossible, without a tactile inspection.

In light of the evidence obtained from this accident, as well as other accidents resulting from ice contamination of aerodynamic surfaces, the Safety Board strongly supports the recent actions taken by the FAA to alleviate this problem. They include sponsoring the International Conference on Airplane Ground Deicing last May. Based on recommendations made during the conference, on July 23, 1992, the FAA published a Notice of Proposed Rulemaking that would establish requirements for Part 121 certificate holders to develop an FAA-approved ground deicing/anti-icing program, including procedures for the use of holdover times and timetables, and to comply with that program any time such conditions as frost, ice, or snow could adhere to an aircraft's wings, control surfaces, propellers, engine inlets, and other critical surfaces. This interim rule became effective on November 1, 1992.

The Safety Board has noted that since the air traffic control and air carrier deicing programs have been established and implemented, average times from deicing to takeoff have been reduced, and air traffic control personnel have a heightened awareness of the unique problems associated with winter operations. The Safety Board also notes that since this accident, the deicing plan established at LaGuardia Airport includes provisions intended to reduce the time that a flight is delayed in the takeoff queue, and the use of Type II deicing fluid has been approved. In addition, the FAA is continuing its efforts to examine aspects of aircraft design, performance characteristics, handling qualities, and flying techniques.

While the Safety Board strongly supports all of the actions taken by the FAA during the current winter season, the Board believes that still more attention is needed to address some of the specific issues identified in this accident investigation.

As a result of its investigation of this accident, the National Transportation Safety Board recommends that the Federal Aviation Administration:

If gate holds are required to limit deicing fluid holdover time, encourage air traffic control (ATC) to initiate the gate holds as soon as a deicing operation begins rather than after delays have exceeded 15 minutes, as in the current air traffic control definition of gate hold. (Class II, Priority Action) (A-93-19)

Where deicing operations are conducted away from the departure runway, report taxi delays in conditions conducive to airframe icing in increments that are less than 15 minutes to provide more realistic and useful reports to dispatchers and flightcrews. (Class II, Priority Action) (A-93-20)

Require that flightcrew and appropriate ground personnel responsible for the inspection of transport-category airplanes for wing contamination receive specific periodic training that will illustrate what contamination looks like and feels like on a wing and the amount of contamination that is detectable under different light conditions. (Class II, Priority Action) (A-93-21)

Study the effects on performance of swept-wing turbojet airplanes when specific amounts of air speed are added to the computed rotation speed (delayed rotation) during takeoffs when wing contamination is possible. (Class II, Priority Action) (A-93-22)

Require Fokker to determine how takeoff performance and stall margin would be affected by using a lower initial target pitch attitude on F-28 and F-100 airplanes in the event that undetected upper wing ice contamination is present, and change the normal operating procedures if takeoff performance requirements can be met while the stall margin is improved. (Class II, Priority Action) (A-93-23)

In conjunction with the National Aeronautics and Space Administration, establish a wind tunnel or flight test program to study the aerodynamic degradation of both nonslatted and slatted airplane wings that have upper surface contamination. The study

should be sufficient to define lift, drag and pitching moment changes related to ice contamination. (Class II, Priority Action) (A-93-24)

In conjunction with the National Aeronautics and Space Administration, determine the differences, if any, in effects on takeoff performance and stall margin when upper wing ice contamination is present on slatted and nonslatted airplanes; include consideration of operational and aerodynamic factors that may explain the disproportionate number of takeoff icing accidents of nonslatted airplanes. (Class II, Priority Action) (A-93-25)

Require airlines to establish a way to inform flightcrews of the type of fluid and mixture used, the current moisture accumulation rate, and the available holdover time. (Class II, Priority Action) (A-93-26)

Thoroughly research the effects of Type II fluids on runway surface friction coefficients to ensure that its use does not degrade airplane traction and braking beyond safe limits, and publish guidelines for the use of Type II fluids by airport operators. (Class II, Priority Action) (A-93-27)

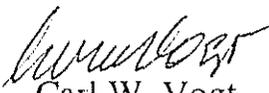
Require that all airports, which might experience freezing conditions and that are certified under Title 14 CFR Part 139, establish deicing plans for approval. (Class II, Priority Action) (A-93-28)

Study the feasibility of building a frangible ILS antenna array for LaGuardia Airport. (Class II, Priority Action) (A-93-29)

Review Fokker 28-4000 passenger safety briefing cards to ensure that they clearly and accurately depict the operation of the two types of forward cabin doors in both their normal and emergency modes and that they describe clearly and accurately how to remove the overwing emergency exit handle cover. (Class II, Priority Action) (A-93-30)

Also, the Safety Board issued Safety Recommendations A-93-31 and A-93-32 to the Port Authority of New York and New Jersey; A-93-33 to the Department of Transportation, in cooperation with the Federal Emergency Management Agency, the National Fire Protection Association, and the American Association of Airport Executives; and A-93-34 to the New York City Health and Hospitals Corporation.

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HAMMERSCHMIDT and HART concurred in these recommendations.

By: 
Carl W. Vogt
Chairman