

**CESSNA 208 DE-ICING EVALUATION  
INTERIM REPORT  
ALASKAN REGION**



**AAL-240**  
**System Safety Analysis Branch**  
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## **INTERIM REPORT- PURPOSE**

This document is an interim report. Its purpose is to provide principal inspectors and FSDO managers with timely data that may be needed for operator surveillance prior to the onset of Winter 2002-03. The scope of this document is limited to the background, analysis, and recommendations associated with the Cessna 208 deicing study.

The final Deicing report will have a larger scope and be distributed to operators, other agencies, other FAA divisions, and other Regions. In addition to information in the interim report, the final report will describe methods, techniques, and procedures used during the deicing study. The final report should be available later this year.

## **EXECUTIVE SUMMARY**

The Alaskan Region System Safety Analysis Branch (AAL-240) conducted a systems safety evaluation on air carriers who operate Cessna 208 aircraft in Alaska. The purpose of the evaluation was to determine if there were any identifiable systemic trends associated with the operation of these aircraft in ground icing conditions that could lead to future unsafe conditions. The findings and conclusions of this study are summarized below:

- The NTSB database contains a total of 61 FAR Part 135 accidents in the Cessna 208 aircraft. Eleven of these accidents were associated with icing. Five of the 11 were attributed to the failure of the pilot to adequately de-ice the aircraft prior to departure.
- The Alaskan Region holds certificates for 9 operators that use the Cessna 208 aircraft. All nine of those operators were included in this study.
- Air carrier systems for operating in ground icing conditions were found to be deficient. These systems contained inadequate, incomplete, or contradictory guidance and procedures for deicing Cessna 208 aircraft. Several operators' manuals contained operational procedures that were contrary to limitations found in the Cessna 208 Pilot Operating Handbook (POH). Approximately 25% to 30% of the pilots interviewed demonstrated inadequate knowledge of the Cessna 208 operating limitations in icing conditions.
- Identified system deficiencies combined with poorly trained pilots increase the likelihood of the Cessna 208 aircraft being improperly de-iced and/or operated outside of its limitations. Operations outside the Cessna 208 aircraft's limitations or the operation of an improperly de-iced Cessna 208 aircraft increases the likelihood of an incident or accident.
- FAA systems did not detect that operator training and qualification programs were not meeting the initial and recurrent training requirements of FAR Part 135. In addition, normal FAA surveillance did not detect that

Cessna 208 pilots were not properly trained for operations in ground icing conditions.

### **Recommendations**

- Certificate Management Teams (CMTs) responsible for operators using Cessna 208 aircraft should retarget surveillance activities prior to the beginning of the season for icing conditions.
- Based on the findings in this report, the Alaska Region will also work with other FAA Divisions, other agencies, and industry representatives to reduce the potential for icing related accidents.

## **BACKGROUND**

In October of 2001, a Cessna 208 crashed after take off at Dillingham, Alaska, fatally injuring all 10 people on board. One of the questions accident investigators were attempting to answer was whether airframe icing may have been involved. After this accident AAL-200 asked AAL-240 to begin a review of all Cessna 208 accidents, with an emphasis on icing related causes.

In December 2001, the NTSB database contained a total of 61 FAR Part 135 accidents involving the Cessna 208. These records identified icing to be a contributing factor in 11 of the 61 accidents. Five of the accidents were attributed to in-flight icing. Six of the 11 accidents were attributed to inadequate deicing prior to take off. (Note: There have been at least two additional Cessna 208 accidents involving icing since the completion of this study.)

Review of the Cessna 208 operational history revealed that the FAA issued Air Carrier Operations Bulletin NO. 2-91-2 (ACOB) in 1991. This bulletin indicated the identification of a possible negative trend when the Cessna 208 aircraft was operated in icing conditions. One of the concerns identified by Cessna 208 operators indicated the Cessna 208 pneumatic boots might lose their effectiveness after the third cycle in icing conditions. A second concern identified in the ACOB addressed the loss of pitch control and handling loss when operated in severe icing with an aft center of gravity (CG).

Operational characteristics of the Cessna 208 in icing were further identified by issuance of Airworthiness Directive (AD) 96-09-15. This AD was issued to minimize the potential hazards associated with operating the airplane in severe icing. Operational cautions, warnings, and limitations contained in this AD have been incorporated into the Pilot Operating Handbook (POH).

Cessna Aircraft Corporation has addressed operation of the Cessna 208 in icing conditions in two primary ways. First, the aircraft operations manual contains several pages of cautions, warnings, procedures, and limitations regarding operation in icing conditions. Some of these procedures include a gross take off weight limitation for icing operations; warnings to avoid operating in freezing rain, and the requirement for all ice snow and frost to be removed from critical surfaces prior to departure. Second, Cessna developed and presented detailed

training on cold weather operations to Cessna 208 operators. This training addresses performance and operational limitations of the aircraft in icing conditions.

## **EVALUATION FOCUS AND OBJECTIVES**

Based on the above historical review, the Alaskan Region Systems Safety Analysis Branch conducted a systems evaluation on the nine Alaskan Operators that are using the Cessna 208. The purpose of this study was to determine if there were any identifiable systemic trends associated with the operation of these aircraft that could lead to future unsafe conditions. The three primary objectives were as follows:

1. To conduct a systems evaluation on the deicing programs of the nine Air Carriers that operate Cessna 208 aircraft in Alaska.
2. To infuse system evaluations processes into the FAA inspector's daily activities.
3. To introduce and continue promoting systems safety processes and concepts to our operators.

## **Analysis**

Between January and April 2002, all nine Cessna 208 operators were evaluated. Operations specifications, training manuals, operations manuals, policy and procedures, deicing manuals and aircraft flight manuals (AFM's) were evaluated for each operator. Deicing procedures were observed and pilots of operators with more than one pilot were interviewed. Deicing observations were conducted in three Alaskan Flight Standards Districts. Airworthiness, avionics, and operations inspectors from each of the three Flight Standard District Offices (FSDOs) conducted these observations.

The findings are outlined in this report and are presented in two sections: Systems Concerns and Pilot Interview Results. The system concerns section is a summary of findings and concerns identified by CMT's using the de-ice design tool. Policies and procedures of all nine operators were evaluated during this phase.

### **Systems Concerns**

1. There was a general lack of or inadequate procedures for deicing, conducting operations in ground icing, and for conducting the 5-minute pre-takeoff contamination check. Some operators used deicing fluids but did not have procedures describing how to store, mix, heat, or apply the fluid. Other operators had procedures for storing, mixing, heating, or applying fluids and applicable standards, but did not train personnel in the procedures. Several operators had written procedures for conducting the 5-minute pre-takeoff contamination check. Some of these operators

admitted that the written procedures for this check were impractical or not used. Some operators did not know how to conduct a 5-minute pre-takeoff contamination check.

2. The controls or checks designed to ensure that company procedures are followed were ineffective. For example, one operator requires their Cessna 208 aircraft to be de-iced by placing the aircraft in a heated hangar. During one on-site observation, a pilot arrived in the early morning to find his Cessna 208 covered with ice. He was trying to de-ice the aircraft with a Herman-Nelson heater when the Director of Maintenance (DOM) arrived at work. The DOM admonished the pilot, stating that the aircraft was supposed to go in the hangar and not be de-iced with a Herman-Nelson. The company was unaware that pilots were not following company procedures. In other examples, pilots were not conducting the 5-minute pre-takeoff contamination check in accordance with company procedures.
3. There was an absence of process measures or internal audits within operator's processes. This contributed to the inability of operators to identify, analyze, and correct problems within the deicing programs that were identified by this audit.
4. Poorly defined interfaces allowed information in company operations manuals and training manuals to be contrary to regulations or specific operational limitations in the Cessna 208 POH. For example, several operations manuals allowed pilots to polish frost, snow, and or ice smooth on the wings, and then take off. This is contrary to warnings in the POH.
5. A lack of clearly defined authority and responsibility also contributed to system deficiencies. Some operations manuals did not identify who had the authority and responsibility for ensuring company deicing procedures were carried out in accordance with regulations, operations specifications, and POH limitations. In some cases, the operations manuals identified the person with authority for deicing, but failed to assign the responsibility to an individual. Systems without a responsible person providing oversight showed that company procedures were not followed.

### **Pilot interview results**

The following results were generated during de-ice observations and pilot interviews conducted by inspectors from each of the three FSDO's using the production job aid in Appendix 2. Twenty-two qualified Cessna 208 pilots were interviewed during this evaluation.

1. Twenty-eight percent of the pilots did not know the Cessna 208's maximum gross take off weight for operations in icing conditions.
2. Thirty-six percent of the pilots thought they could take off with polished frost, snow, or ice on the wings, or did not know the answer. The POH warns that failure to remove even small amounts of frost, snow, or ice from all critical surfaces of the Cessna 208 may make a safe take off impossible.

3. Twenty-seven percent of the pilots did not know the POH warns not to depart from or be flown into any airport where freezing rain or drizzle conditions are reported.
4. Eight pilots for one operator were asked what type of de-ice fluid was being used by the company; three said Type I. Five of the pilots thought the company was using Type II or IV. The operator was actually using Type I.
5. The five pilots who thought they were using Type II or IV did not know the required flap setting or rotation speed for take off when using Type II or IV fluid.

## **Recommendations**

1. Certificate Management Teams should revisit the results of the de-ice evaluations and determine if all system deficiencies identified have been corrected. Particular emphasis should be placed on training program revisions addressing Cessna 208 cautions, warnings, and limitations for operation in icing conditions found in the POH and the Cessna cold weather training program. The 1307 or 1626 PTRS entries for these reviews should contain comments stating whether the training program was revised. PTRS entries for this effort should have "ice" in the regional use block.
2. Certificate Management Teams should re-target surveillance plans for operators using Cessna 208 aircraft. The re-targeted surveillance should result in additional observations and interviews to determine if pilots have been retrained and possess adequate knowledge of the Cessna 208 operating limitations. The additional surveillance should be completed prior to the beginning of ground icing season, or no later than September 15, 2002. Additional follow up surveillance should be incorporated into the work plan for FY03. Inspectors should make an effort to observe check rides and training, and conduct interviews of all pilots qualified to operate the Cessna 208. PTRS entries associated with this effort should have "ice" in the regional use block, and comments that describe what was observed during the surveillance activities or found during interviews. (See PTRS data sheet revision 10, dated 7-22-2002)

3. AAL-240 should develop a set of five or six questions to be used by principal inspectors conducting pilot interviews in recommendation number 2 above. These questions should be completed and distributed to inspectors and supervisors no later than August 1, 2002.
4. AAL-240 should conduct a follow up PTRS review in December 2002 to determine if the above three efforts have been completed and documented. (**Note:** PTRS data sheet revision 10, dated 7-22-2002, should be used for pilot interviews and de-ice observations during the fall of 2002 and spring of 2003)

