

NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

SP-20  
Log 1539

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Forwarded to:

Honorable J. Lynn Helms  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-82-150 and -151

About 0905, Alaska standard time, on February 16, 1982, Reeve Aleutian Airways, Inc., (Reeve) Flight 69, a Nihon YS-11A, N169RV, with 36 passengers and 3 crewmembers onboard, made an emergency gear-up landing on the frozen Naknek River adjacent to the King Salmon Airport, King Salmon, Alaska, following the loss of power in both engines. The airplane was damaged substantially, and one crewmember, two passengers, and two firefighters suffered minor injuries during the evacuation, firefighting, and rescue activities.

The airplane had been at cruise altitude, 14,000 feet, for about 45 minutes where the outside air temperature was  $-35^{\circ}\text{C}$  to  $-40^{\circ}\text{C}$  ( $-31^{\circ}\text{F}$  to  $-40^{\circ}\text{F}$ ). The crew had maintained the fuel heater switches in the manual position during cruise and kept them there during the descent. The reported temperature at their destination, King Salmon, was  $-15^{\circ}\text{F}$  ( $-26^{\circ}\text{C}$ ). About 0900, when positioned on a right base leg for runway 29, the first officer began to perform the before-landing check, which included turning off the fuel heaters. Shortly after he turned off the fuel heaters, the crew noted a loss of power from the right engine; they shut the engine down and feathered the right propeller. The left engine soon began to lose power and the crew smelled smoke. The crew shut down the left engine also and made the emergency landing on the ice.

The YS-11A is powered by Rolls-Royce Dart 542-10K, turboprop engines. Each engine is equipped with a fuel filter deicing system (fuel heater) to prevent the filter from clogging due to ice. Heat from engine compressor bleed air raises the temperature of the fuel before it enters the fuel filter, pump, and control unit to prevent entrained and suspended water from freezing in the filter and control and blocking fuel flow. The fuel heater for each engine is controlled by a switch in the cockpit having three positions: manual, off, and auto. The manual position provides fuel heat continuously, and the auto position regulates bleed air flow to the heater in response to fuel pressure drop across the fuel filter.

1/ For more detailed information, read Aircraft Accident Report—"Reeve Aleutian Airways, Inc. Flight 69, Nihon YS-11A, N169RV, King Salmon, Alaska, February 16, 1982" (NTSB-AAR-82-16).

The YS-11 Before-Landing Check is a challenge and response check of the following items:

Landing Gear	Down and 3 Green
H P Cock	HSWL
Landing Lights	On 165 knots
Fuel Trim	Set
Prop Lights	3 ON - 3 OFF
Fuel Heaters	OFF
Flaps	OFF
Water/Methanol	ON
Spill Valves	MANUAL

The Reeve training manual requires that for instrument approaches the check be performed before reaching the final approach fix. For visual approaches it is to be performed upon entering the traffic pattern and completed before turning onto final approach, except for the final flapsetting.

The before-landing check requires that the fuel heaters be turned off before landing because the source of heat is engine compressor bleed air. Extracting air from the compressor causes a reduction in the shaft horsepower output of the engine. Power available at takeoff is reduced 4 percent when air is extracted for fuel heat. Therefore, to make maximum power available in the event of a go-around or missed approach, the fuel heaters are turned off during the approach for landing.

The YS-11 operations manual describes the use of fuel heat for all phases of flight. For climb and cruise it states: "If the indicated fuel temperature is below 5° C or the outside air temperature is below -15° C in case of airplanes not equipped with the fuel temperature indicators, keep the fuel filter deicing switch in MANUAL."

For approach and landing the manual states: "If the indicated fuel temperature is below 5° C, or the outside air temperature is below 20° C in case of airplanes not equipped with the fuel temperature indicators, set the fuel filter deicing switch to MANUAL for 2 minutes within 5 minutes before landing and turn off the fuel filter deicing switch."

The Safety Board concluded that the loss of power in the right engine occurred due to the freezing of fuel-entrained water in the low-pressure filter when the fuel heaters were turned off in accordance with the before-landing checklist. Although the Safety Board could not establish the exact cause of the left engine failure, it is apparent that this accident sequence originated with the removal of fuel heat in accordance with the operating manual and checklist. The Safety Board believes that while the crew complied with the manual instructions and checklist, they did so without a full understanding of the significance of fuel temperatures well below freezing. The instructions in the Nihon operations manual and the Reeve training manual are not sufficiently detailed to provide adequate guidance for the crew to make a proper decision on the need for continuing the use of fuel heat. As this accident revealed, the requirement in the manual for using fuel heat for 2 minutes within 5 minutes of landing is not adequate to prevent engine fuel system icing when operating in extreme conditions. The Safety Board believes that if the manuals and crew training included more specific discussion and instructions for the use of fuel heat, the crew would have been aware of the need to make a decision on whether fuel heat was still required during the approach and also would have had the guidance necessary to make that decision.

Examination of the right overwing exit revealed that the operating instructions on the exit placard were simple and clearly stated. The instructions were as follows:

TAKE OFF THIS COVER  
RELEASE CATCH  
PULL HANDLE  
THROW DOOR OUT

However, Safety Board investigators found that when they followed the placarded instructions, it was difficult to locate the catch referred to in the instructions, because both the handle and catch were painted the same color. In addition, neither the handle nor the catch was labeled. The exit operated without difficulty once the catch was located and released. The Safety Board believes that under conditions of panic, poor lighting, or fire with its accompanying smoke and toxic fumes, where time for escape is severely limited, a person unfamiliar with the exit operation would have difficulty locating the catch and subsequently opening the exit.

The type certificate for the YS-11 was applied for on June 15, 1962, and was approved on September 7, 1965. Certification for the YS-11 and all subsequent models is based on Civil Air Regulation (CAR) 10, "Certification and Approval of Import Aircraft and Related Products." This regulation states, in part, that a type certificate will be issued when the government of the manufacturing country certifies that the airplane "has been examined, tested, and found to comply with" the airworthiness requirements of the applicable CAR's or the applicable airworthiness requirements of the government of the manufacturing country and any additional requirements "prescribed by the FAA to provide a level of safety equivalent to the requirements" of the applicable CAR's.

The applicable requirements for the YS-11 were those in CAR 4b in effect on December 31, 1953. CAR 4b.362(f), "Emergency exit marking," states, in part, that "All emergency exits, their means of access, and their means of opening shall be marked conspicuously." The Federal Air Regulation (FAR) currently in effect, 14 CFR 25.811(a), which resulted from the recodification of CAR 4b.362(f), carries forward the requirement that the exits, their access, and means of opening be "conspicuously marked." The current regulation has been added to and clarified periodically since 1967 to provide more specific guidance on how to mark the exits and their means of opening. However, the Safety Board is concerned that the unchanged guidelines for exit markings on airplanes certificated and still being manufactured under CAR 4b are too subjective and do not take into account fully the reactions and understanding of passengers unfamiliar with air travel, or of different sociological/cultural backgrounds. Such guidelines, therefore, may not provide a level of safety equivalent to that required by current regulations.

Title 14 CFR 121.571, which addresses briefing of passengers before takeoff, includes only the requirement that passengers be briefed orally on the locations of the emergency exits, and does not require a briefing on their methods of operation. The regulation further states that the airplane shall have printed cards supplementing the oral briefing. The cards are to contain "diagrams of, and methods for operating, the emergency exits. . . ." The Reeve card, which has small, unlabeled diagrams of an exit door and window, with the methods for operating the exits presented in written form only, apparently meets these criteria.

Advisory Circular (AC) 121-24 <sup>2/</sup> provides guidance material for the preparation of passenger briefings and briefing cards. The circular states that most of the passenger

<sup>2/</sup> "Passenger Safety Information Briefing and Briefing Cards," Advisory Circular 121-24, Department of Transportation, Federal Aviation Administration, June 23, 1977.

briefings have been standardized, but that the briefing cards continue to exhibit a wide variety of both quality and methods used to communicate information. It further states that the primary method used to present the required information on the briefing card should be pictorial. Although the passenger briefing and the briefing card used by Reeve apparently meet the requirements in the regulations, the Safety Board believes that neither the amount of information nor its manner of presentation is sufficient to allow passengers, especially those whose knowledge of the English language is limited, to operate the exits with minimum delay in an emergency situation.

Because of the circumstances of this accident, the passengers' difficulty in opening the overwing exit was not a major factor in their survival. However, had a rapid evacuation been necessary in this case, the passengers' inability to operate the exit could have resulted in unnecessary injuries or deaths, especially if crewmembers had been unable to assist in opening the exits.

The Safety Board has issued several recommendations<sup>3/</sup> concerning the adequacy of passenger briefings and briefing cards in dealing with specific problem areas. The FAA has been responsive to these recommendations, and they have been classified by the Safety Board as "Closed--Acceptable Action" or "Closed--Acceptable Alternate Action." However, it is apparent that there are additional significant problems in passenger education and awareness. The Safety Board believes that additional problems will continue to surface, and therefore a systematic approach to periodic evaluation of oral briefings and briefing cards is needed.

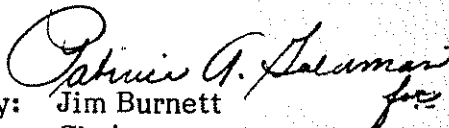
The Safety Board understands that Reeve already has taken steps to mark more clearly the catch on each emergency exit on its YS-11's and is currently revising its passenger safety cards.

Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Review and revise as necessary the Federal Aviation Administration-approved Nihon YS-11 operations manual, the Reeve Aleutian Airlines, Inc., training manual, and the YS-11 before-landing checklist to incorporate more specific information and guidance to enable YS-11 crews to decide when fuel deicing may be safely terminated. (Class II, Priority Action) (A-82-150)

Issue an Operations Bulletin requiring Principal Operations Inspectors to inform all air carrier and commercial operators of Nihon YS-11 airplanes under their cognizance of the need to mark the catches on all emergency exits so that they are easily located and distinguishable from the exit handles and other components. (Class II, Priority Action) (A-82-151)

BURNETT, Chairman, GOLDMAN, Vice Chairman, and McADAMS, BURSLEY, and ENGEN, Members, concurred in these recommendations.

By:   
Chairman

<sup>3/</sup> Safety Recommendations A-69-15, A-74-112, A-76-25, A-76-26, A-77-28, A-77-59, and A-82-70.