



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: September 21, 1992

In reply refer to: A-92-84 through -89

Honorable Thomas C. Richards
Administrator
Federal Aviation Administration
Washington, D.C. 20591

The National Transportation Safety Board recently completed a special investigation and analysis of a series of Piper Aircraft Corporation (PAC) Model PA-46 airplane accidents that occurred from May 31, 1989 through March 17, 1991.¹ During this period, five fatal PA-46 accidents occurred in the United States, one in Mexico and one in Japan. Also, a significant incident occurred during the period which was almost a fatal accident.

As a result of the last PA-46 fatal accident on March 17, 1991, the Federal Aviation Administration (FAA) issued an airworthiness directive (AD) in March 1991, which imposed operational limitations on the PA-46 airplane and prohibited further use of the Bendix/King KAS 297B vertical speed and altitude selection features of the integrated flight guidance and control system. Also, in April 1991, the FAA initiated a special certification review (SCR) of the model PA-46 airplanes. As a result of the SCR, the AD on the PA-46 was rescinded in February 1992.

The Safety Board's analyses of the PA-46 accidents and the incident indicate that four of the five U.S. accidents probably involved ice blockage of the pitot tubes because the pilots failed to activate pitot heat before flying into freezing instrument meteorological conditions (IMC). Although the Safety Board could

¹ For more detailed information, read Special Investigation Report--"Piper Aircraft Corporation PA-46 Malibu/Mirage Accidents/Incident, May 31, 1989 to March 17, 1991" (NTSB/SIR-92/03).

not conclusively exclude either a malfunction of the Bendix/King KFC 150/KAS 297B integrated flight guidance and control system or pilot misuse of the system in each of the four accidents as an initiating event in the loss of airplane control, it was clear in the incident that the pilot failed to activate pitot heat before entering freezing IMC. As a result, the pitot tube was blocked by ice, and the airspeed indicators provided erroneous information and eventually indicated zero. Further, the pilot of the incident airplane reacted improperly to the erroneous airspeed indications and temporarily lost control of the airplane in a series of erratic high speed descents, ascents, and turns. With respect to the four accidents, the pilots lost control of the airplanes in high speed descents in which airspeed or load factor limitations, or both, were substantially exceeded, causing overstress failure and separation of critical structural components in flight. The pilot of the incident airplane only narrowly averted similar failures, probably because in response to his radio transmissions of no airspeed indications, the pilot of another airplane advised the pilot of the incident airplane to turn on the pitot heat, which he acknowledged had been off.

The Safety Board's special investigation and the FAA's SCR disclosed no irregularities in the certification of the PA-46 airplanes or in the certification of the Bendix/King integrated flight guidance and control system. However, both agencies identified improvements that would provide for safer operation of the PA-46 and other relatively high-performance small airplanes. The FAA's SCR team included its recommendations for improvements in a report in December 1991, and the Safety Board is pleased that the FAA has taken action on many of the recommendations. Also, the PAC has revised the pilot's operating handbook (POH) and airplane flight manual (AFM) normal procedures checklist sections to provide for preflight inspections of the ice protection equipment and pretakeoff activation of some of the equipment if flight into icing conditions is anticipated. However, since the possibility exists of encountering icing conditions in all phases of flight, the Safety Board believes that the climb, cruise, and descent sections of the PA-46 normal procedures checklist should be revised to include reminders for activation of pertinent ice protection equipment if IMC is encountered near and above the freezing level.

It is the Safety Board's understanding that almost all of the PA-46 series airplanes produced are equipped for flight into known icing conditions. Therefore, since these airplanes are capable of operating in IMC at altitudes where the ambient temperatures are always below freezing, we believe that a need exists for a means to caution the pilot that the electrical heating element in the pitot tube is not active.

The Safety Board has reviewed the checklists for many small pressurized airplanes that are certificated for flight into known icing conditions and has found none in which the climb, cruise, and

descent portions of the normal procedures checklist refer to activation of ice protection equipment, including pitot heat, if IMC is encountered near and above the freezing level. Similarly, none of these relatively high performance airplanes has a means to caution the pilot that the electrical heating element in the pitot tube is inactive. Although a review of the accident histories of some of these airplanes does not disclose that pitot tube icing has been a factor in the accidents, the Safety Board believes that a significant potential exists and that the FAA should consider requiring modification of the checklists of these airplanes and the addition of a means to caution the pilots of these airplanes that the pitot heating element is not active.

As revealed by the investigation of the accidents, we believe that the area of most concern in operating the PA-46 and other similar airplanes is the adequacy of initial and recurrent training received by the pilots. In this regard, we note that effective April 15, 1991, the FAA amended 14 CFR 61.31 to add certain ground and flight training requirements for a pilot-in-command (PIC) of a pressurized airplane that has a service ceiling or maximum operating altitude, whichever is lower, above 25,000 feet mean sea level (msl). The ground training includes instruction in high altitude aerodynamics and meteorology and subjects related to the physiological aspects of high altitude flight. The flight training can be accomplished in an airplane or in a simulator that meets the requirements of 14 CFR 121.407.

The Safety Board believes that the above requirements represent improvements in safety for the pilots and passengers of relatively high performance small airplanes for which a type rating is not required. However, as a result of the investigation of the five fatal PA-46 accidents, we believe that the above requirements should not be limited to PICs of pressurized airplanes that have service ceilings or maximum operating altitudes, whichever is lower, above 25,000 feet msl. Based on the performance and operating complexities of the PA-46 series airplanes and other similar airplanes, the Safety Board believes that 14 CFR 61.31 should be amended to include small pressurized airplanes that have service ceilings or maximum operating altitudes, whichever is lower, at or above 18,000 feet msl. We believe that the lower altitude is needed because it is the altitude at and above which instrument flight rules (IFR) flight is mandatory, which usually imposes an additional workload on the PIC. Also, under standard atmospheric conditions, the air density at 18,000 feet msl is about 57 percent of the air density at sea level, the ambient pressure is about 50 percent of the pressure at sea level, and the ambient temperature is well below freezing. Consequently, sufficient physiological and atmospheric hazards exist at and above 18,000 feet msl to warrant training similar to that required in paragraph (f) of 14 CFR 61.31.

Since the airplanes that meet the criteria specified in 14 CFR

61.31 (f) are likely to have relatively sophisticated integrated flight guidance and control systems similar to the systems in the PA-46 series airplanes, the Safety Board believes that such systems should be included in both ground and flight training that is required by paragraph (f) of 14 CFR 61.31.

Also, we believe that flight schools that provide formal training in small airplanes equipped with relatively sophisticated integrated flight guidance and control systems should be able to provide detailed training information about the systems to its students. The training information should be adequate to enable pilots to diagnose system failures and malfunctions, understand pilot-induced flight control system problems, and use the system in a safe and proficient manner. Therefore, we believe that manufacturers of integrated flight guidance and control systems, for which supplements to the AFM and POH must be provided, should be required to develop and make available to operators detailed training information on the systems.

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

Require modifications to the Piper Aircraft Corporation's airplane flight manual and pilot's operating handbook for the PA-46 series airplane to add warnings in the normal procedures checklist for climb, cruise, and descent flight that pertinent ice protection equipment should be turned on if instrument meteorological conditions are encountered near and above the freezing level. (Class II, Priority Action) (A-92-84)

Require modification to the PA-46 series airplanes to provide for a pitot heat operating light similar to the light required by 14 CFR 25.1326 for transport category airplanes. (Class II, Priority Action) (A-92-85)

Consider application of Safety Recommendations A-92-84 and A-92-85 above to all models of small airplanes certificated to operate in icing conditions and at altitudes of 18,000 feet mean sea level and above. (Class II, Priority Action) (A-92-86)

Amend 14 CFR 61.31 to require the ground and flight training specified in paragraph (f) for pilots-in-command of pressurized airplanes that have service ceilings or maximum operating altitudes, whichever is lower, at and above 18,000 feet mean sea level. (Class II, Priority Action) (A-92-87)

Amend 14 CFR 61.31 (f) to include integrated flight guidance and control systems as part of the ground and flight training requirements specified in subparagraphs (f) (1) (i) and (ii). (Class II, Priority Action) (A-92-88)

Require the manufacturers of integrated flight guidance and control systems, for which supplements to the airplane flight manual and pilots operating handbook must be provided, to develop and make available to operators detailed training information that will enable pilots to diagnose system failures, understand pilot-induced flight control system problems, and use the system in a safe and proficient manner. (Class II, Priority Action) (A-92-89)

Chairman, VOGT, Vice Chairman, COUGHLIN, and Members LAUBER, and HAMMERSCHMIDT concurred in these recommendations. Member HART concurred in all of the recommendations except A-92-87.



By: Carl W. Vogt
Chairman