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APPENDIX: 4

BULLETIN TYPE: Joint Flight Standards Information Bulletin for Air Transportation (FSAT), General Aviation (FSGA), and Airworthiness (FSAW)

BULLETIN NUMBER: FSAT 01-04, FSGA 01-01, and FSAW 01-05

BULLETIN TITLE: Autopilots on Boeing 727 Aircraft and Other Aircraft

EFFECTIVE DATE: 6/13/01

TRACKING NUMBER: NTSB Recommendations A-00-43 and A-00-45

APPLICABILITY: This bulletin applies to all operators of Boeing 727 airplanes that are equipped with Sperry Aerospace SP-50 and SP-150 autopilots and all aircraft equipped with autopilot systems that use time-based desensitization schedules.

1. PURPOSE. This bulletin provides responses to National Transportation Safety Board (NTSB) safety recommendations A-00-43 and A-00-45. It also provides guidance to principal operations inspectors (POI) and principal avionics inspectors (PAI) responsible for air carrier operators of Boeing 727 aircraft with Sperry Aerospace SP-50 and SP-150 autopilots and all operators of aircraft equipped with autopilot systems that use time-based desensitization schedules.

2. BACKGROUND. On February 9, 1998, a Boeing 727, registration number N845AA, operating as American Airlines (AA) Flight 1340, crashed short of the runway while on a coupled instrument landing system (ILS) Category II approach to runway 14R at Chicago O'Hare International Airport. The ceiling and visibility were close to Category II minimums at the time of the accident. A primary concern during the NTSB's investigation of the accident was to determine the reasons for the pitch oscillations during the approach. Flight control input by the autopilot is being considered as one of the possibilities. Test results have indicated the existence of an autopilot system anomaly that, under certain conditions, can produce undesirable pitch oscillations in the Boeing 727.

A. NTSB Recommendation A-00-43. Advise all operators of Boeing 727 aircraft equipped with Sperry Aerospace SP-50 and SP-150 autopilots to inform their pilots, maintenance, and engineering personnel of the dangers of conducting coupled instrument landing system approaches at airspeeds that are not consistent with the desensitization schedule of the autopilots, and notify the operators that the Federal Aviation Administration (FAA) has been asked to

develop operating limitations for the use of these autopilots on coupled approaches that will ensure that the approaches are conducted in a manner consistent with the autopilot design.

B. NTSB Recommendation A-00-45. Advise all operators of aircraft equipped with autopilot systems that use time-based desensitization schedules to inform their pilots, maintenance, and engineering personnel of the dangers of conducting coupled instrument landing system approaches at airspeeds that are not consistent with the autopilot desensitization schedule, and notify the operators that the FAA has been asked to develop operating limitations for the use of these autopilots on coupled approaches that will ensure that the approaches are conducted in a manner consistent with the autopilot design.

3. DISCUSSION.

A. The autopilot on N845AA was a Sperry Aerospace SP-150 autopilot. It should be noted that Boeing 727s might also be equipped with the older model of this autopilot, the SP-50. A simulator study showed that the autopilot sensitivity schedule has a significant effect on the autopilot performance during a coupled ILS approach. The sensitivity schedule of the autopilot refers to the amount of flight control input the autopilot commands. An aircraft on an extended ILS final will require more flight control input from the autopilot than one on a short final. Glide-slope deviations close to the runway require smaller pitch corrections than those required far from the runway, so the autopilot sensitivity has to be reduced as the airplane nears the runway. This process is called autopilot desensitization. The appropriate sensitivity depends on distance from the runway. Distance from the runway with the Sperry SP-150 autopilot (installed on N845AA) was determined using a time-based method. With this method, the distance is estimated from the threshold by measuring the time elapsed when passing a point of known distance from the runway, and then calculating the distance traveled from that point by multiplying the measured time by an assumed ground speed.

B. The Sperry SP-150 was scheduled to start desensitizing over a period of 150 seconds after passing a radio altitude of 1500 feet. The 150-second desensitization period, used by both the Sperry SP-50 and SP-150 autopilots, was optimized from approach speeds corresponding to a 40-degree flap setting. However, operators started landing the B-727 at 30-degree flap settings and correspondingly higher airspeeds in order to improve the maneuverability of the airplane during the approach. American Airlines Flight 1340 had 30-degree flaps when it crashed. Sperry had previously issued two service bulletins (SB). Service bulletin 21-1132-121, issued November 1982, applied to SP-50 autopilots. Service bulletin 21-1132-122, issued February 1983, applied to SP-150 autopilots. These SBs described autopilot modifications required to account for these new, higher approach speeds. Both SBs modified pitch control inputs of the autopilot due to the increased airspeed and the resultant decrease in time. They

also reduced the time required for autopilot desensitization from 150 seconds to 105 seconds. Compliance with these SBs is optional. However, the operator did not comply with SB 21-1132-122, which was applicable to the N845AA.

C. The Aircraft Certification Service, in compliance with the NTSB's requests, is reviewing operating limitations for the use of these autopilots on coupled approaches that will ensure that the approaches are conducted in a manner consistent with the autopilot design.

4. ACTION.

A. Aviation Safety Inspectors (ASI) should ensure that the information contained in this bulletin is made available to their assigned operators.

B. ASIs should ensure that their operators are fully aware of the dangers of conducting coupled ILS approaches at airspeeds that are not consistent with the desensitization schedule of their autopilot.

5. INQUIRIES. This bulletin was developed by AFS-200. Inquiries should be directed to Gary Martindell, AFS-200, at (202) 267-7731.

6. EXPIRATION. This bulletin expires one year from the date of publication.

/s/
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