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National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: JAN 19 1995

In reply refer to: A-95-9 through -12

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On May 28, 1992, the National Transportation Safety Board issued four safety recommendations (A-92-45 through -48) to the Federal Aviation Administration (FAA) concerning fire protection standards for cockpit voice recorders (CVR) and flight data recorders (FDR). The recommendations were prompted by the loss of vital information from several CVRs and FDRs as a result of thermal destruction of the magnetic tape recording media in postimpact fires.[1] The recommendations asked the FAA to cancel Technical Standard Orders (TSO) C51a and C84 (for FDRs and CVRs, respectively), which contain less stringent survivability standards than the current standards in TSOs C123 and C124 (for CVRs and FDRs, respectively) (Safety Recommendation A-92-45); to conduct a study to determine the actual thermal profile of postimpact fires and a revised certification test protocol (A-92-46); to revise TSOs C123 and C124 to reflect the results of the study (A-92-47); and to cancel the original (unrevised) editions of C123 and C124 once the TSOs are revised (A-92-48). In its letter to the Board dated August 5, 1992, the FAA agreed with the recommendations and planned to take appropriate actions. On October 6, 1992, the Safety Board classified Safety Recommendations A-92-45 through -48 "Open--Acceptable Response." In the interim, the Safety Board has monitored the progress of the FAA's response through staff-level communications and meetings with personnel from FAA headquarters and the FAA Technical Center.

On October 18, 1994, the FAA Technical Center in Atlantic City, New Jersey, released the final report on its study of flight recorder fire test requirements, which responds to Safety Recommendation A-92-46. As part of the study, the Technical Center performed experiments using the high intensity fire test described in document ED-55,

[1] The accidents occurred between March 1989 and January 1992, and were summarized in the Safety Board's letter of May 28, 1992, to the FAA.

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"Minimum Operational Performance Specification for Flight Data Recorder Systems," issued in May 1990 by the European Organisation for Civil Aviation Equipment (EUROCAE). (The same high intensity fire test is specified by TSO C124 and by ED-56A, "Minimum Operational Performance Specification for Cockpit Voice Recorders," issued by EUROCAE in December 1993. However, TSO C123 does not specify a method to verify the thermal flux requirements as does TSO C124 or ED-55 and -56A). The FAA study determined that the high intensity, 30-minute fire test specified in ED-55 and 56A (and TSO C124) is not as severe as a 30-minute jet fuel pool fire the test is intended to replicate. However, the Technical Center found that doubling the exposure time from 30 to 60 minutes on the fire tests produced a total heat that is equivalent to the heat experienced in a 30-minute postimpact jet fuel pool fire. The FAA study also determined that flight recorders meeting the 10-hour low intensity fire test conditions described in ED-56a would survive postimpact smoldering fires involving natural materials. The study conducted by the FAA and the published findings meet the intent of Safety Recommendation A-92-46. Accordingly, the Board classifies Safety Recommendation A-92-46 "Closed--Acceptable Action."

The accident of a Jetstream 4101 in Columbus, Ohio, on January 7, 1994, corroborates the study's finding with regard to high intensity, short duration fires experienced in a postimpact environment.[2] The airplane crashed short of the runway, penetrated a block building, and came to rest within the structure. A fire erupted, fed primarily by fuel from the airplane and from an automobile stored in the building, and by the wooden roof of the structure. The fire in the area of the solid-state flight recorders burned out of control for about 1 hour.

Examination of the crash-protected storage units of the flight recorders at the Safety Board's laboratory revealed internal thermal damage that extended to the solid-state memory modules. Evidence indicated that a portion of the FDR's memory chips had experienced temperature greater than 350 °C (which indicates that the FDR was exposed to very intense fire). The CVR was exposed to a less intense fire, and its memory chips were not damaged. Although all recorded data were recovered from the recorders, the memory module of the FDR required extensive and intricate repairs, and the memory module of the CVR required a new connector cable.

This accident is the first occurrence of solid-state recorders being exposed to a significant postimpact fire. The thermal damage experienced by the FDR, in addition to the findings of the Technical Center fire test study, suggest that solid-state flight recorders--despite their enhanced survivability capabilities over magnetic tape recorders--may experience postaccident thermal conditions that could result in loss of critical recorded

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[2] The airplane, N304UE, was operated by Atlantic Coast Airlines as United Express flight 6291. The accident resulted in five fatalities (three crewmembers and two passengers) and minor to no injuries to three passengers. The airplane was destroyed by the impact and subsequent fire. The Safety Board's investigation of the accident is continuing.

data. Evidence from the damage also indicates that the thermal conditions of the postimpact fire substantially exceeded the test conditions required for TSO C124 certification. During the TSO C124 fire test of the model FDR involved in the Columbus, Ohio, accident, the crash survival storage unit survived the fire test without any internal thermal damage.

The Safety Board recently learned from FAA staff that the designation TSO C136 has been reserved for a revised CVR standard. According to the FAA staff, the new TSO is to incorporate the upgraded standards of EUROCAE document ED-56A that address (1) the use of solid-state storage media, (2) digital speech encoding techniques, and (3) long-term, low intensity fire test requirements. While the Safety Board is encouraged by FAA action to begin upgrading the CVR survivability performance standards, the Board is also concerned that the standards to be included in TSO C136 may not require tests that realistically reflect the total heat to which a recorder is subjected in an actual, high intensity fire.

The Safety Board is aware of the FAA's efforts to harmonize its regulations with those of Europe's Joint Aviation Authorities (JAA). The Board recognizes that a change to the ED-56A or -55 would also require a change to the (JAA) flight recorder rules. Further, the Board understands that some members of the European aviation community oppose such a change. While the Safety Board agrees that international regulatory harmony is desirable, the Board does not believe that needed changes in flight recorder standards should be compromised by harmonization issues.

In addition to the concerns about CVR standards, the Board is also concerned about the lack of activity to upgrade TSO C124 (for FDRs.) The long-term, low intensity fire test requirements described in ED-56A, and the findings of the FAA's fire test study should be included in an upgrade of the TSOs for both FDRs and CVRs. Based on the FAA's efforts to upgrade only TSO C123, the Board classifies Safety Recommendation A-92-47 "Closed--Unacceptable Action/Superseded" by a new recommendation that addresses upgrades of the current standards in TSOs C123 and C124. Because flight recorders may experience conditions that exceed the current standards, the Safety Board believes that the FAA should revise TSOs C123 and C124 to reflect the findings of the FAA fire test study by (a) incorporating the long-term, low intensity fire test requirements described in ED56A, and (b) incorporating the high-intensity fire test requirements described in ED55 and ED56A, with the exception of extending the duration of the high-intensity fire test from 30 minutes, as specified in the EUROCAE documents, to 60 minutes.

U.S. performance standards for flight recorders have, historically, been adopted as the standards for the international aviation community. The Safety Board notes that flight recorder certification requirements are to be discussed at a meeting of the International Civil Aviation Organization (ICAO) flight recorder panel scheduled for February 1995. Of the six topics to be addressed by the participants, the agenda indicates that flight recorder certification requirements rank second in order of importance. A U.S. representative will

participate in the forum, which will provide an excellent opportunity for the United States to share its flight recorder survivability experience with the international aviation community. Presentation at the forum of revised TSOs, that reflect the improved standards in EUROCAE documents ED55 and ED56A along with the findings of the FAA fire test study, would increase the possibility of ICAO adopting the most up-to-date flight recorder requirements as the international standards. Timely revision of the TSOs could positively affect new flight recorders (combination-unit CVR/FDRs, and 2-hour CVRs) now being designed by manufacturers. These flight recorders, if required to meet the improved performance standards, would be more likely to survive a postimpact fire than if they met only the current standards in TSOs C123 and C124. Because of developing events regarding international performance standards and new model flight recorders, the Safety Board believes that the FAA should issue within 3 months a Notice of Availability and Request for Comments on revising TSOs C123 and C124 to reflect the most up-to-date knowledge concerning postimpact fires, as discussed above, and then issue the revised TSOs within 3 months after the comment period closes.

In 1992, when the Safety Board initially sought actions to improve the fire test requirements for flight recorder certification and to upgrade the standards in the TSOs, the Board also asked the FAA to cancel the original (unrevised version) TSOs C123 and C124 within 1 year after issuing the revised versions (Safety Recommendation A-92-48). At the time Safety Recommendations A-92-46 through -48 were issued, no flight recorders had been certificated under C123 or C124 standards.[3] Had the findings of the FAA's recent fire test investigation been available, revised TSOs with upgraded standards (rather than C123 and C124) would have been in effect when new model flight recorders were tested and certificated. However, this was not the case, and many new model flight recorders are now in service that were certificated under TSOs C123 and C124. Because the original intent of Safety Recommendation A-92-48 can no longer be met, the Safety Board classifies A-92-48 "Closed--No Longer Applicable." The Board notes, however, that once TSOs C123 and C124 are upgraded as described above, the FAA should establish a cancellation date for the existing TSOs C123 and C124 to be effective 2 years after the standards are upgraded.

Despite the need to strengthen the flight recorder performance standards of TSOs C123 and C124, the Safety Board recognizes that the current standards provide better protection from postimpact fires than do the standards in TSOs C84 and C51a, which preceded the current TSOs. Because the FAA has not canceled TSOs C84 and C51a within a year, as requested in Safety Recommendation A-92-45, flight recorder manufacturers are still allowed to produce recorders and spare parts for models certificated under the earlier, inferior standards. Consequently, the Safety Board classifies Safety Recommendation A-92-45 "Closed--Unacceptable Action/Superseded" by a new recommendation that seeks cancellation of TSOs C84 and C51a within the next 90 days.

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[3] Models of the flight recorders in service at that time had been certificated under TSOs C84 and C51a, which preceded C123 and C124.

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

Cancel Technical Standard Orders C84 and C51a within the next 90 days. (Class II, Priority Action) (A-95-9) (Supersedes A-92-45)

Issue within 3 months a Notice of Availability and Request for Comments on revising Technical Standard Orders C123 and C124 to reflect the findings of the Federal Aviation Technical Center fire test study into flight recorder fire test requirements by (a) incorporating the long-term, low intensity fire test described in document ED-56A, published by the European Organisation for Civil Aviation Equipment (EUROCAE), and (b) incorporating the high intensity fire test requirement described in EUROCAE documents ED-55 and ED-56A, with the exception of extending the duration of the high intensity fire test from 30 minutes to 60 minutes. (Class II, Priority Action) (A-95-10) (Supersedes A-92-47)

Issue revised versions of Technical Standard Orders (TSO) C123 and C124 within 3 months after the close of the comment period identified in Safety Recommendation A-95-10. The revised TSOs should reflect the fire test requirements described in the recommendation. (Class II, Priority Action) (A-95-11)

Establish a cancellation date for Technical Standard Orders (TSO) C123 and C124 to be effective 2 years after the flight recorder performance standards are revised, as described in Safety Recommendation A-95-11. (Class II, Priority Action) (A-95-12)

Chairman HALL, and Members LAUBER and HAMMERSCHMIDT concurred in these recommendations.

By: Jim Hall
Chairman