



Log # 2590

National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: June 27, 1996

In reply refer to: A-96-33 and -34

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

On August 21, 1995, about 1253 eastern daylight time, an Embraer EMB-120, N256AS, operated by Atlantic Southeast Airlines (ASA) as flight 529, crashed on approach to the West Georgia Regional Airport, Carrollton, Georgia. The flightcrew was attempting to make an emergency landing following the in-flight separation of a propeller blade. The captain and seven passengers were killed, and the airplane was destroyed by impact forces and a postcrash fire. Flight 529 was being conducted under the provisions of Title 14 Code of Federal Regulations (CFR) Part 135 as a domestic, scheduled passenger service flight from Atlanta, Georgia, to Gulfport, Mississippi. The National Transportation Safety Board's investigation of this accident is ongoing.

ASA flight 529 was equipped with a flight data recorder (FDR); however, examination of FDR data for the accident flight revealed that malfunctions of two flight control position sensors prevented the required data from being accurately recorded. The absence of these data has hindered the investigation.

The EMB-120 is equipped with sensors, known as potentiometers, to measure control wheel, control column, and rudder pedal positions. These potentiometers are mounted in a way that causes movement of the cockpit flight control devices to produce a voltage input to the flight data acquisition unit (FDAU). The FDAU then converts the voltages to digital values that are recorded by the FDR. The digital values are calibrated so that the position of the wheel, column, or rudder pedals can be determined for the full operating range of the flight controls.

The FDR from ASA flight 529 recorded rudder pedal position data that were not usable. Examination revealed that the coupler connecting the input shaft of the potentiometer to the rudder pedals was loose, causing incorrect data to be recorded. In addition, the control wheel and control column position potentiometers were not calibrated correctly; therefore, the recorded data were not accurate.

The Safety Board has been involved in seven other EMB-120 accident/incident investigations. In six of these investigations, malfunctions of the potentiometers prevented accurate data from being recorded. A number of these accidents/incidents involved circumstances that did not require an examination of the flight control parameters, and thus, the malfunctions initially went undetected. However, a retrospective examination of the recorded values revealed inaccurate data. Although these malfunctions varied between "noisy"¹ signals, loose couplers, and improper calibrations, the Safety Board believes that these malfunctions are indicative of a design deficiency and/or inadequate FDR system maintenance practices. A summary of these investigations appears in the table below:

Operator	Location	Date	Potentiometer Malfunction(s)
Continental Express	College Station, TX	Aug 90	Control column: not calibrated properly Rudder pedal: not calibrated properly
Atlantic Southeast	Brunswick, GA	Apr 91	Control column: "noisy" Control wheel: "noisy"
Continental Express	Eagle Lake, TX	Sep 91	Control column: not calibrated properly
Mesa Air	Denver, CO	Jul 92	No malfunction
Continental Express	Houston, TX	Dec 92	Control column: "noisy" Rudder pedal: "noisy"
Continental Express	Pine Bluff, AR	Apr 93	Control wheel: not calibrated properly Control column: not calibrated properly Rudder pedal: "noisy"
Midway Airlines	Raleigh, NC	Feb 96	Control column: "noisy" Rudder pedal: "noisy"

Title 14 CFR 135.152 defines the requirements for operators to equip their airplanes with FDRs. Appendix D, "Airplane Flight Recorder Specifications," states that the flight control parameters must be recorded throughout their full range with an accuracy of +/- 2 percent from sensor input to FDR readout. The Safety Board's experience with the EMB-120 potentiometers indicates that they do not meet these specifications. The Safety Board believes that the FAA should review the design, installation, and reliability of these potentiometers, with emphasis placed on determining the reasons for "noisy" data and improper calibration. The necessary design, installation,

¹"Noisy" data consist of many random, large amplitude spikes, and are typical of a sensor malfunction.

and/or maintenance practice improvements should be incorporated into the EMB-120 FDR system to ensure that accurate data are recorded.

Until such improvements are incorporated, there are tests that can be done to ensure timely identification and repair of potentiometer malfunctions. The Maintenance Program Manual for the EMB-120 requires operators to perform a readout of the FDR every year. Potentiometer malfunctions are often identified and repaired during these checks, but malfunctions that occur between readouts are undetected. Section 31-31-00 of the EMB-120 Maintenance Manual contains the procedure to test the potentiometers for proper operation and calibration; however, operators are not required to perform this test at regular intervals. To ensure timely identification and correction of potentiometer malfunctions, the Safety Board believes that the FAA should require EMB-120 operators to perform an FDR readout or a potentiometer calibration test per maintenance manual section 31-31-00 every 6 months.

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

Conduct a design review of the Embraer EMB-120 flight data recorder system, with emphasis on potentiometer failures, and mandate design, installation, and/or maintenance changes, as necessary, to ensure that reliable flight control data are available for accident/incident investigation.
(Class II, Priority Action) (A-96-33)

Require Embraer EMB-120 operators to perform a flight data recorder (FDR) readout or a potentiometer calibration test per section 31-31-00 of the EMB-120 Maintenance Manual every 6 months until FDR sensor design, installation, and/or maintenance improvements are incorporated.
(Class-II, Priority Action) (A-96-34)

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.

By: 
Jim Hall
Chairman