



National Transportation Safety Board

Washington, D.C. 20594
Safety Recommendation

Date: February 8, 1993

In reply refer to: A-93-3 through -5

Honorable Joseph M. Del Balzo
Acting Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 12, 1992, a British Aerospace Jetstream 3101, registered to Carolina Air Charter, crashed on a training flight at McGhee Tyson airport in Knoxville, Tennessee. During a practice approach, the crew inadvertently failed to lower the landing gear, which resulted in the aircraft propellers contacting the runway surface. During the go-around and subsequent landing attempt, the aircraft impacted the runway in an inverted attitude. Both the check airman and the student first officer were killed in the crash. The aircraft was equipped with a cockpit voice recorder (CVR) manufactured by B+D Instruments and Avionics (B+D). The 30-minute CVR recording of the accident flight contained valuable cockpit information about the circumstances leading up to the accident. However, the CVR recording was only of marginal quality because the recorder had failed to erase the previously recorded audio prior to recording the new information.

On June 12, 1992, a Gates Learjet 25B, N38DJ, operated by Jet Charter Group, Inc., crashed on takeoff from Sheboygan Airport, in Sheboygan, Wisconsin. Both pilots, who held airline transport ratings, were killed in the crash. The aircraft was equipped with a B+D CVR. The recorded information recovered from the CVR was from a flight that had occurred several days prior to the accident flight. The Board could not determine why the CVR stopped operating prior to the accident flight. However, the Board noted that the recording contained in the unit was of poor quality because the CVR had failed to erase the older information prior to recording new information.

On November 22, 1992, a Gates Learjet 25B, N893WA, operated by Flight Operations Inc., crashed on landing at the Cleveland Hopkins International Airport, in Cleveland, Ohio. Neither the pilots nor the three doctors who were transporting a human heart for transplant were injured in the accident. The aircraft was equipped with a B+D CVR. The recorded information contained in the unit was of poor quality because the CVR had failed to erase the older information prior to recording new information.

The CVRs from the three accident airplanes were in good condition and were returned to the B+D facility for evaluation. The results of the evaluation of the CVRs from the two earlier accidents confirmed that the units were operating within specifications. In both cases, B+D suggested that the installation of the units in the aircraft was not adequate because the required erase-enable jumper on the aircraft CVR connector had been omitted. The adequacy of the installation was not documented in these accidents prior to the release of the wreckage. The results of the manufacturer's evaluation of the Cleveland accident have not yet been completed. However, examination of the CVR installation in this wreckage verified that the erase-enable jumper was not properly installed. The Safety Board believes that the most likely cause for the poor recordings in all three accidents is inadequate installation.

Federal regulations require a four channel CVR to be installed on each U.S.-registered turbine-powered aircraft and rotorcraft that requires two pilots for operation and that is certificated to carry six or more passengers. Aircraft in which CVRs are installed after October 1991 are required to be equipped with individual boom microphones, and each crewmember must wear a boom microphone when the aircraft is operated below 18,000 feet. Signals from the boom microphones are recorded by the CVR.

When voice recorders were initially required on commercial aircraft, in 1965, CVR manufacturers, in cooperation with the airlines, developed guidelines for the design and installation of CVRs that exceeded the minimum standards required by the Federal Technical Standard Order (TSO). These voluntary guidelines were issued as Aeronautical Radio, Inc. (ARINC) Document 557, dated January 10, 1964.

The purpose of a CVR when installed in an aircraft is to record signals from the most recent 15 (or 30)¹ minutes of aircraft operation. Because the recording medium is limited to 15 (or 30) minutes, the CVR must be able to erase the earlier recorded signals before recording the current signals. No means are provided for playback of a recording in the aircraft. However, to allow playback after a CVR is removed from an aircraft, ARINC 557 provides a means to disable the erase and record functions of the unit. To accomplish this, the ARINC standard recommends the dedication of two pins on the aircraft CVR connector. When the CVR is installed in the aircraft, the two pins on the aircraft's CVR connector should be shorted together, enabling the unit to erase

¹ Part 121 aircraft are required to record 30 minutes. Part 91 and some Part 135 aircraft are required to record only 15 minutes. However, all recorders currently being manufactured for installation in Part 135 and Part 121 aircraft record 30 minutes of operation.

and record properly. When the CVR is removed from the aircraft, or when the jumper is not installed in the aircraft's CVR connector, the unit will not erase when electrical power is applied. Although the intent of the jumper was to control both the erase and record functions of the CVR, historically the jumper has been referred to as the "erase-enable jumper."

Most CVR manufacturers designed these CVRs so that they would neither record nor erase when the erase-enable jumper is not in place. However, B+D designed its CVR so that it will not erase without the erase-enable jumper in place, but it will record.

All CVRs, by regulation, must contain self-test circuitry to functionally check the units during preflight for proper operation. The Safety Board is unaware of any other manufacturer's CVR that will pass the internal functional test if the erase-enable jumper is not installed. However, the B+D CVR, because of the design of its self-test circuitry, passes the cockpit functional self-test even when the jumper is not in place. The subtle difference in the B+D CVR design discussed above, coupled with an inadequately designed self-test circuit, facilitates the placement into service of improperly installed B+D CVR's. The Safety Board believes that the FAA should require B+D to modify the self-test circuitry in its CVR so that the units will fail the internal self-test if the erase-enable jumper is not installed. The Board also believes this modification should be done promptly at each unit's next overhaul or within 2 years, whichever comes first.

The B+D installation manual, which is FAA-approved, is similar to the manuals of other CVR manufacturers in that it includes several warnings alerting the installer to the importance of properly wiring the erase-enable jumper. However, the B+D installation manual does not describe specific tests that are designed to detect an omitted erase-enable jumper. The Safety Board believes that the FAA should require B+D to revise the approved installation procedures by including a test or tests that will detect the omission of the erase-enable jumper when a CVR is installed in an aircraft.

Information obtained from CVRs removed from aircraft involved in accidents is critical to the determination of the cause and factors of the accidents. Since B+D began manufacturing CVRs 2 years ago, more than 2,000 B+D units have been installed in aircraft. The Safety Board is concerned that some of these units may have been installed incorrectly and believes that the FAA should require within 120 days, a one-time inspection of all aircraft equipped with a B+D CVR to ensure proper installation of the erase-enable jumper.

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

Require a one-time inspection of all aircraft equipped with a cockpit voice recorder manufactured by B+D Instruments and Avionics to ensure that the erase-enable jumper is properly installed. This inspection should be completed within 120 days. (Class II, Priority Action) (A-93-3)

Require B+D Instruments and Avionics to modify the self-test circuitry in its cockpit voice recorders (CVRs) so that the CVRs will fail the internal self-test if the erase-enable jumper is not installed. This modification should be accomplished at the next unit overhaul or within 2 years, whichever occurs first. (Class II, Priority Action) (A-93-4)

Require B+D Instruments and Avionics to revise the procedures contained in its approved installation manual to include a test or tests that will detect a cockpit voice recorder installation with an inadequate erase-enable jumper placement. (Class II, Priority Action) (A 93-5)

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HART, and HAMMERSCHMIDT concurred in these recommendations.


By: Carl W. Vogt
Chairman