



DEPARTMENT OF TRANSPORTATION  
NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D. C. 20591

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OFFICE OF  
THE CHAIRMAN

June 1, 1970

Honorable John H. Shaffer  
Administrator  
Federal Aviation Administration  
Washington, D. C. 20590

Dear Mr. Shaffer:

Over the past few years the cockpit voice recorder (CVR) has become one of the primary tools of the Aircraft Accident Investigator in air carrier accidents. The CVR was installed to record radio communications and the voices in the cockpit area. However, the cockpit microphone has provided additional information such as: sound of switch or lever actuation, engine noise and frequency signatures, sound of aircraft disintegration or impact, etc. The full potential to which cockpit area sounds can be utilized in accident investigation has yet to be determined; however, there are some existing problem areas which must be rectified before the total capabilities of the CVR can be realized. These are:

- a. The single point pickup for the cockpit area microphone channel as presently installed does not, in our opinion, meet the intended installation requirements specified in FAR 25.1457. The noise from the ventilation ports, utilization of the cockpit speaker system, microphone location, and the general aerodynamic noise level within the cockpit area of some aircraft limit, and quite often prevent, the recovery of information from voice communications between and among the flight crewmembers. We are presently approaching the limit in the state of the art for information recovery from magnetic tape. Therefore, the logical course of action is to improve the method of collecting the information on the magnetic tape.
- b. The requirement to provide a method for deactivation of the CVR erasure feature at impact as delineated in FAR 25.1457 is left to the discretion of the

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operator and the FAA regional office. One air carrier in the FAA Central Region employs a 3g impact switch which senses g forces in both the longitudinal and the vertical plane. An impact switch of this type could cause the CVR to become deactivated as the result of a 3g vertical acceleration, which would preclude recovery of vital information from that point until aircraft impact. The Board believes that any impact switch utilized in the CVR circuitry should be sensitive to the longitudinal plane only.

- c. Identification of the CVR and the Flight Data Recorder has been very difficult when the aircraft wreckage is under water. The present color coding in accordance with FAR 25.1457 does not provide sufficient definition on black and white television, which is sometimes utilized for underwater surveillance.
- d. The United Control V-557 CVR utilizes a random tape storage magazine, and tape recovered from CVR's using this type storage is usually kinked and sometimes severely wrinkled. The former type of tape damage is present when the tape is removed from the CVR of an aircraft subjected to a hard landing. Recovery of information from a tape with these types of damage is very difficult if not impossible.
- e. The CVR as installed today is dependent on the aircraft electrical system, and, in several instances, interruptions in the aircraft electrical system have prevented recovery of vital information prior to aircraft impact. The CVR should have a trickle charge nickel cadmium battery/static inverter power source to insure operation of the CVR until the aircraft impacts the ground.
- f. In four accidents the CVR's were subjected to high temperature for long periods of time and the magnetic tapes were destroyed. The present design criteria for the CVR's to withstand 2,000F° for 30 minutes is adequate in most cases. However, NASA might provide information as to changes in the state of the art

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which could provide better fire protection for the CVR's. This information should be correlated with future test and evaluation effort in connection with validation of the results of the recently completed FAA contract study of means to provide greater thermal protection for recorders.

Each of these problem areas has been reviewed to determine the existing degree of information degradation as well as the feasibility and economics of improvement.

The Board recommends that FAA take the following action to improve the capabilities of the CVR:

1. Improve the cockpit area microphone capability by requiring the installation of two additional small directional microphones mounted beneath the instrument panel glare shield, as a single or dual unit, with one directed toward the captain and the other toward the first officer. A small electronic switching network with an associated synchronization signal can be employed to adapt this new installation to the single track recording capability of the existing cockpit area microphone channel. The present area microphone would continue to provide pickup for other sounds within the cockpit. This type of installation will enhance speech intelligibility and provide more positive voice identification.
2. Issue an airworthiness directive defining the acceleration limits and the plane orientation of all impact switches employed to comply with FAR 25.1457. These switches should be sensitive to forces in the longitudinal plane only.
3. Improve the underwater visual identification of the CVR and Flight Data Recorder by requiring external reflective striping such as Scotchlite, which can be defined on a black and white television camera.
4. Preserve the intelligence gathered by requiring replacement of all random tape storage magazines

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—with a method which will provide tape protection similar to that afforded by the reel storage method.

5. Insure the operation of the CVR during all emergency situations by requiring the availability of an independent power source for the CVR when the aircraft electrical system fails.

6. Continue the investigation of the state of the art in fire protection material in an effort to upgrade the protection now afforded the CVR magnetic tapes.

Our technical staff will be available and pleased to provide any further assistance in this matter.

Sincerely yours,



John H. Reed  
Chairman