



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation Report

Extended Duration Cockpit Voice Recorders

Accident Number:	Multiple (see tables 1 and 2)
Location:	Multiple (see tables 1 and 2)
Date:	Multiple (see tables 1 and 2)
Adopted:	October 2, 2018

The National Transportation Safety Board (NTSB) is providing the following information to urge the Federal Aviation Administration (FAA) to take action on the safety recommendations issued in this report. These recommendations address the need to install cockpit voice recorders (CVR) with a minimum 25-hour recording capability on all newly manufactured airplanes required to have a CVR and retrofit these CVRs on existing aircraft required to have flight recorders. These recommendations are derived from the NTSB's experiences with investigations that lacked access to relevant CVR data. Information supporting these recommendations is discussed below.

Background and Analysis

The NTSB has longstanding concerns about the availability of CVR information following events that meet the reporting criteria of 49 *Code of Federal Regulations* 830.5. The availability of relevant CVR data is also a recurring issue in our safety investigations of events that don't meet reporting criteria but turn out to have safety significance (for example, the July 7, 2017, incident at San Francisco International Airport in which the flight crew of an Airbus A320 lined up to land on a taxiway and overflew four air carrier airplanes on the taxiway awaiting takeoff).

CVRs are among the most valuable tools used for accident investigation. Information such as flight crew verbalizations of intentions and coordination, as well as pilots' awareness of the state of the aircraft and cockpit information, allows investigators to more comprehensively assess accident/incident factors. These factors include flight crews' procedural compliance, distraction, decision-making, workload, fatigue, and situational awareness. Ultimately, CVRs provide unique information with which the NTSB can conduct more thorough investigations to more effectively target safety recommendations. CVRs have a current standard recording duration of only 2 hours and, unfortunately, recent safety investigations have been hampered because relevant portions of the recordings were overwritten.¹

¹ In response to instances of overwritten data on CVRs with a required recording duration of 30 minutes, the NTSB issued Safety Recommendation A-96-171 on December 20, 1996, which superseded A-95-23, asking the FAA to "require that all newly manufactured [CVRs] intended for use on airplanes have a minimum recording duration of 2 hours." As a result of the final rule implementing the recommended requirement, Safety Recommendation A-96-171 was classified "Closed—Acceptable Action" on October 14, 2008. On March 9, 1999, the NTSB issued A-99-16,

In 2013, the European Aviation Safety Agency (EASA) proposed an amendment that, after January 1, 2019, requires newly manufactured, large commercial aircraft to carry a CVR capable of recording the last 15 hours of aircraft operation.² Considering the comments received on the proposed amendment and after technical review, the European Union, in 2015, extended the requirement to 25 hours with an implementation date of January 1, 2021.³ In 2016, after receiving recommendations from member states to extend the required duration of CVRs, the International Civil Aviation Organization (ICAO) adopted a new standard calling for the installation of CVRs capable of recording the last 25 hours of aircraft operation on all aircraft manufactured after January 1, 2021, with a maximum certificated takeoff mass over 27,000 kg engaged in commercial transport. In its rationale, ICAO emphasized the value of CVR recordings in analyzing human factors and other sounds. ICAO also noted that extended duration CVRs are necessary to cover the longest duration flights, including pre- and postflight activities, delays, and the time required to secure the recordings. The CVR technical standard for flight recorders already has provisions for a 25-hour CVR.⁴

As discussed in this report, the NTSB believes that our ongoing experience with overwritten CVR recordings demonstrates the limitations of the current 2-hour recording requirement, particularly in cases where relevant data were overwritten due to (1) a delay in reporting a safety event that was not immediately recognized to be of a serious nature until further data review; (2) a failure to immediately deactivate the CVR following arrival after a safety event; or (3) the time remaining in the flight after a safety event, which exceeded the CVR's 2-hour recording duration.

In the event of a major or catastrophic accident, the CVR is typically deactivated due to a loss of electrical power (without manual intervention), and the relevant audio that was recorded before the accident is preserved.⁵ However, following less severe events in which the airplane's electrical system remains functional, pilots or others must act to deactivate the CVR as promptly as possible after landing to preserve the most relevant audio. Sometimes a delay in reporting an event to the FAA, the NTSB, or the operator also results in a significant delay in actions to safeguard recorder data. Lacking these data means that an investigation may not identify issues that played a role in the event, which could result in a similar—or worse—occurrence in the future.

asking in part, that the FAA “require retrofit after January 1, 2005, of all [CVRs] on all airplanes required to carry both a CVR and a flight data recorder with a CVR that...is capable of recording the last 2 hours of audio.” As a result of the final rule, which the NTSB believed represented an acceptable alternate method of compliance with the recommended action, Safety Recommendation A-99-16 was classified “Closed—Acceptable Alternate Action” on October 14, 2008.

² Notice of Proposed Amendment 2013-26, “Amendment of requirements for flight recorders and underwater locating devices.”

³ *Official Journal of the European Union*. Commission Regulation (EU) 2015/2338 of 11 December 2015 amending Regulation (EU) No 965/2012 as regards requirements for flight recorders, underwater locating devices and aircraft tracking systems.

⁴ “Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems,” ED-112A, European Organization for Civil Aviation Equipment.

⁵ Most CVR installations are designed to operate whenever the airplane's electrical system is on, and the CVR continually overwrites the oldest data stored on the tape or memory module.

In an August 2002 safety recommendation letter to the FAA, the NTSB identified delays or failures to deactivate CVRs after reportable events as a major factor in the systemic problem of retaining relevant data. As a result, the NTSB recommended the following to the FAA:

Require that all operators of airplanes equipped with a [CVR] revise their procedures to stipulate that the CVR be deactivated (either manually or by automatic means) immediately upon completion of the flight, as part of an approved aircraft checklist procedure, after a reportable incident/accident has occurred. These procedures must also ensure that the recording remains preserved regardless of any subsequent operation of the aircraft or its systems. Any doubt as to whether or not the occurrence requires notification of the [NTSB] must be resolved after steps have been taken to preserve the recording. (A-02-24)

In response, the FAA issued Notice N8400.48, “Cockpit Voice Recorder Deactivation After a Reportable Event,” advising air carriers to add a checklist line item stipulating that the CVR be deactivated (either manually or automatically) immediately upon completion of a flight having a reportable incident/accident. The expanded checklist procedures also included an item for flight crews to notify maintenance personnel if the CVR is deactivated so CVR data aren’t lost on a subsequent flight. The notice also specified that any doubt as to whether an occurrence required NTSB notification be resolved after steps have been taken to preserve the recording. On October 6, 2003, noting that the FAA’s actions met the recommendation’s intent for Part 121 and Part 135 operators (but not Part 91 operators), the NTSB classified Safety Recommendation A-02-24 “Closed—Acceptable Alternate Action.”

The NTSB notes that even with the issuance of Notice N8400.48, several NTSB investigations have lacked access to pertinent CVR data following safety events; fourteen such instances have occurred since 2003 (see table 1). The NTSB recognizes that preserving CVR data is often challenging because the significance of an event is not readily apparent to the flight crew or air traffic controllers when it occurs. In some cases (examples identified in the following table), the aircraft operation time between the event’s occurrence and NTSB notification or the NTSB’s full awareness of the nature of the event exceeds 25 hours, so even an extended duration CVR wouldn’t retain the pertinent data. However, such cases highlight the need for layers of protection in mitigating the loss of CVR information.

Table 1. Safety Events for Which Pertinent CVR Data Were Overwritten

Date	Event type	NTSB #	Location	Length of CVR	Event Description
6/21/2018	Incident	OPS18IA015	Chicago, IL	2 hr	Runway excursion
4/18/2018	Accident	DCA18LA163	Atlanta, GA	2 hr	Engine fire
7/7/2017	Incident	DCA17IA148	San Francisco, CA	2 hr	Taxiway line-up and overflight of 4 air carrier airplanes by an Airbus A320 (46-hour notification delay)
5/9/2014	Accident	CEN14LA239	Columbus, OH	2 hr	Ground engine fire
9/12/2013	Incident	CEN13IA563	Austin, TX	2 hr	Loss of pitch control during takeoff (4-day notification delay)

Date	Event type	NTSB #	Location	Length of CVR	Event Description
7/31/2012	Incident	CEN12IA502	Denver, CO	2 hr	Bird strike
12/1/2011	Accident	WPR12LA053	Oakland, CA	2 hr	Enroute turbulence
2/9/2011	Incident	ENG11IA016	Minneapolis, MN	2 hr	Tailpipe fire following push back
11/23/2010	Accident	WPR11LA058	Salt Lake City, UT	2 hr	On ground collision with tow tractor
6/21/2011	Incident	ENG11IA035	Atlanta, GA	2 hr	Engine fire
6/28/2010	Accident	CEN10LA363	Pioneer, LA	2 hr	En route turbulence
12/13/2009	Incident	DCA10IA015	Charlotte, NC	2 hr	Wing tip strike during landing
6/29/2007	Incident	LAX07IA198	Los Angeles, CA	2 hr	Blown tires on takeoff
3/21/2006	Incident	DEN06IA051	Denver, CO	2 hr	Tail strike on landing
10/16/2003	Accident	MIA04LA004	Tampa, FL	2 hr	Taxiway excursion
6/3/2002	Accident	DCA02MA039	Subic Bay, Philippines	2 hr	Abrupt maneuver due to ground proximity warning system alert and elevator damage
6/2/2002	Accident	DCA02MA042	Subic Bay, Philippines	2 hr	Flight control malfunction during approach

Although delayed event notifications and delayed deactivation of CVRs following safety events remain an ongoing problem, there is a limit to the efficacy and reliability of procedures to preserve these data because they are predicated on timely human action. The required use of extended duration CVRs on all aircraft currently required to be equipped with a CVR would better accommodate the variances resulting from the current procedural protections to safeguard these data by providing another layer of protection (additional recording time), particularly in cases where a crew does not deactivate the CVR in a timely manner after the event.

The NTSB has also conducted investigations of safety events for which CVR data were overwritten because of continued operation of the flight beyond 2 hours after the event. A particularly notable case was the October 21, 2009, incident involving Northwest Airlines flight 188. The flight crewmembers did not communicate with air traffic control (ATC) for about 1 hour 17 minutes, during which time they overflew the intended destination at a cruise altitude of 37,000 ft.⁶ The flight eventually landed without further incident after radio communication was reestablished. The event information on the airplane's Honeywell solid-state 30-minute CVR was overwritten by the remaining 2 hours and 11 minutes of the 4-hour flight; the duration of the remaining flight time means that the result would have been the same if the aircraft had been equipped with a 2-hour CVR. Both pilots later reported that neither had fallen asleep during the flight and that "cockpit distractions" led to the event. Without a CVR recording covering the period the flight crewmembers weren't in communication with ATC and overflew the intended destination, the NTSB was not able to determine the nature of the distraction, the sequence of events leading to the distraction, why the distraction lasted for such a long period of time, and appropriate procedures and actions to mitigate the safety risk.

⁶ For more information about this incident, see NTSB case number [DCA10IA001](#).

In 2017, about 56% of US block times consisted of long and medium haul flights with durations longer than 2 hours, including some international flights lasting over 12 hours.⁷ Therefore, in some cases, it may take longer than 2 hours to safely land and secure the airplane following an in-flight incident, and overwriting some of or all the pertinent audio is unavoidable. The NTSB also investigates many cases involving aircraft encounters with en route weather for which the CVR is sometimes not even requested due to the amount of time between the event and the completion of the flight. For in-flight weather events, CVR information can provide insight into flight crewmembers' understanding of impending weather, including verbal descriptions of what they see on radar or outside the aircraft; weather sources and whether they were used; how weather information was used to make in-flight decisions; flight crew coordination with the cabin crew before the encounter; and the effect of the encounter on workload/cockpit task management.⁸

Table 2 lists incidents and accidents since 2002, including in-flight encounters with en route weather, in which the CVR was overwritten by continued operation of the flight beyond 2 hours after the event. In situations such as these, an extended duration CVR would have the capacity to capture information during the remainder of the flight, a return to the airport (or diversion), landing, and taxi to the gate before relevant audio would be erased.

Table 2. Events for Which Pertinent CVR Data Were Overwritten During Remainder of Flight

Date	Event type	NTSB #	Location	Length of CVR	Event Description
3/9/2017	Accident	DCA17CA079	Dallas-Fort Worth (DFW), TX	Unknown (2 hr req)	En route Turbulence
10/2/2015	Incident	ENG16IA001	Russian airspace/diversion to Tokyo, Japan	Unknown (2 hr req)	Engine failure
6/17/2012	Incident	DCA12IA096	Las Vegas, NV	Unknown (2 hr req)	Loss of 2 of 3 hydraulic systems
7/29/2011	Accident	DCA11FA091	Tangshan, China	Unknown	En route Turbulence
1/3/2011	Accident	DCA11FA050	Los Angeles, CA	Unknown	Tail strike upon takeoff
10/21/2009	Incident	DCA10IA001	Minneapolis, MN	30 min	Overflight of intended landing airport
6/23/2009	Incident	DCA09IA064	Kagoshima, Japan	Unknown	Flight deck anomalies
11/26/2008	Incident	DCA09IA014	Bozeman, MT	Unknown	Uncommanded thrust reduction
12/25/2007	Accident	SEA08LA051	Honolulu, HI	Unknown	En route Turbulence
2/23/2007	Accident	CHI07LA078	Chicago, IL	Unknown	En route Turbulence
9/16/2006	Accident	NYC06LA223	Hastings, NE	Unknown	En route Turbulence
3/15/2006	Accident	CHI06LA099	Omaha, NE	Unknown	En route Turbulence
10/22/2005	Accident	NYC06LA016	Atlantic Ocean	Unknown	En route Turbulence
7/25/2004	Accident	DCA04MA061	Miami, FL	Unknown	En route Turbulence
6/4/2004	Accident	CHI04LA148	Liberal, KS	Unknown	En route Turbulence
4/21/2003	Accident	CHI03LA113	Lithonia, GA	Unknown	En route Turbulence
4/22/2002	Accident	NYC02LA088	Atlantic Ocean	Unknown	En route Turbulence

⁷ ICAO defines block time as the time encompassing “the moment the aircraft is pushed back from the gate or starts taxiing from its parking stand for take-off to the moment it comes to a final stop at a gate or parking stand after landing.” Block time data obtained from <http://web.mit.edu/airlinedata/www/Aircraft&Related.html>.

⁸ For example, for a 2007 in-flight weather event in which two flight attendants and one passenger received injuries (NTSB case number [MLA07LA086](#)), CVR information showed that the captain had both provided verbal warning of potential turbulence and had activated the fasten seatbelt sign well in advance of the turbulence event.

Summary

The NTSB concludes that despite current FAA regulations to require 2-hour CVR recording capability and guidance intended to operationally safeguard CVR data after an accident or incident, valuable CVR data continue to be overwritten and are unavailable for safety investigations. Therefore, the NTSB recommends that the FAA require that all newly manufactured airplanes that must have a CVR be fitted with a CVR capable of recording the last 25 hours of audio. The NTSB also recommends that the FAA require retrofit, by January 1, 2024, of all CVRs on all airplanes required to carry both a CVR and a flight data recorder with a CVR capable of recording the last 25 hours of audio. We recognize that the scope of these recommendations exceeds ICAO's standard (which applies only to airplanes that weigh more than 27,000 kg engaged in commercial transport), but the risk of lost CVR data is equal in accidents and incidents involving airplanes with a maximum takeoff weight under 27,000 kg, which include many regional airplane models.

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

Require all newly manufactured airplanes that must have a cockpit voice recorder (CVR) be fitted with a CVR capable of recording the last 25 hours of audio. (A-18-30)

By January 1, 2024, require retrofit of all cockpit voice recorders (CVR) on all airplanes required to carry both a CVR and a flight data recorder with a CVR capable of recording the last 25 hours of audio. (A-18-31)

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