

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

November 20, 2014

Cockpit Voice Recorder

Specialist's Factual Report
By Joe Gregor

1. EVENT

Location:	Charleston, South Carolina
Date:	July 28, 2012, 1600 Eastern Daylight Time (EDT) ¹
Aircraft:	Boeing 787-8, VT-ANJ
Operator:	Boeing
NTSB Number:	DCA12IA114

2. GROUP

A group was not convened.

3. SUMMARY

On July 28, 2012, about 1600 eastern daylight time, a Boeing 787-8, registration VT-ANJ, experienced a contained engine failure during a taxi test at Charleston International Airport (CHS), Charleston, South Carolina. The airplane was being operated by Boeing under the provisions of 14 Code of Federal Regulations (CFR) Part 91 for the purpose of conducting a pre-delivery taxi test with no intention for flight. There were no injuries to the 5 people on board and the airplane sustained minor damage. A solid-state cockpit voice recorder (CVR) was sent to the National Transportation Safety Board's Audio Laboratory for readout.

¹ All times are expressed in Eastern Daylight Time (EDT), unless otherwise noted.

4. DETAILS OF INVESTIGATION

On June 8, 2012, the NTSB Vehicle Recorder Division's Audio Laboratory received the following CVR:

Recorder Manufacturer/Model: **General Electric EAFR-2100**
Recorder Serial Number: **16PLHY**

4.1. Recorder Description

Per federal regulation, all turbine engine powered aircraft constructed after April 7, 2010 operating under 14 CFR Part 91 must be equipped with a CVR that records a minimum of the last 2 hours of aircraft operation; this is accomplished by recording over the oldest audio data. When the CVR is deactivated or removed from the airplane, it retains only the most recent 2 hours of CVR operation. The EAFR-2100 is a multifunction recorder which records flight data, audio data, and communication, navigation, surveillance air traffic management (CNSATM) messages designed to meet the characteristics of ARINC Characteristic 767, Enhanced Airborne Flight Recorder (EAFR). Two EAFRs are installed on Boeing 787 aircraft, one forward (S/N 16PL73) and one aft (S/N 16PLDM). The forward and aft recorders are powered by the left and right 28V DC buses respectively. The forward recorder is equipped with a recorder independent power supply (RIPS) to provide backup power to the recorder for approximately 10 minutes once left DC bus power is lost. The CVR function of the EAFR-2100 combination solid-state recorder, records 2 hours of high quality 4-channel digital cockpit audio data. The recorded audio data is separated by the GE download software into four 2-hour electronic audio files. The resulting audio files contain one file of information from the cockpit area microphone (CAM), another with the Captain's audio selector panel/hot microphone information, the third with Co-Pilot's audio selector panel/hot mike information and a fourth with the jump seat/observer's position audio information.

4.2. Recorder Damage

Upon arrival at the audio laboratory, it was evident that the CVR had not sustained any significant heat or structural damage and the audio information was extracted from the recorder normally, without difficulty.

4.3. CVR Channels

The recording consisted of four channels of audio information. Two of the channels contained audio information from the captain's (CAPT) and first officer's (FO) audio panels. The quality of these two channels was excellent.² One channel contained the cockpit area microphone (CAM) audio information. The quality of this channel was good. The last channel contained audio from the flight test engineer's (FTE) position. The quality of this channel was good.

4.4. Timing and Correlation

The times used in this report are expressed as Eastern Daylight Time (EDT). Timing of the transcript was established by correlating the CVR events to common events on the FDR. Specifically, sounds and comments related to the engine rollback and subsequent engine shutdown were correlated with the timing of the rollback of the Eng2_N2 parameter during the initial malfunction, and the dropping to 0% rpm of the Eng2_N1 parameter as the engine was subsequently shut-down.

A relationship between EDT and CVR Elapsed Time (time from the beginning of the CVR recording) was determined based on the above correlation using GMT time as recorded on the FDR. A -4 hours offset was applied to convert from GMT to EDT. Specifically for this report, it is assumed that 16:00:34.0 EDT corresponds to 00:24:46.0 CVR Elapsed Time. Nominal timing accuracy is +/- 2 seconds.

4.5. Summary of Recording Contents

In agreement with the Investigator-In-Charge, a CVR group did not convene and a transcript was not prepared.

The CVR recording was composed of three segments of 4-channel sound. The first segment (session 40) was 1:20:08.0 (h:m:s) long and contained the audio recorded during the event. The second segment (session 41) was 0:29:07.6 (h:m:s) long. The third segment (session 42) was 0:14:43.8 (h:m:s) long. The second and third segments contained information consistent with the aircraft on the ground with ground maintenance personnel moving about the cabin.

Session 40 began at approximately 1535:48 EDT. At 1551:35 EDT, a taxi check was called for and completed. At 1554:07 EDT, Boeing 238 Heavy contacted ground and received clearance to taxi to runway 21 for low speed taxi tests. At 1600:21 EDT, the CAM recorded sounds and crew comments consistent with engine run-up. Approximately 9 seconds later, the CAPT stated, "okay that's stable here we go." The FO responded, "TOGA thrust..." At 1600:34 EDT, the CAM recorded the sounds of a hi-lo warning tone followed by a 4-chirp warning tone and crew comments concerning an unexpected event.

² See Attachment I for the CVR Quality Rating Scale

At 1600:46 EDT, the FO stated, "Engine limit exceeded, wow." The FE responded, "Oh we got something with that engine that went crazy," and, "two in the red, N2 went into red, over-spiced N2." At 1601:03 EDT, the FO made a radio call to tower announcing that they were done for the day and asking for taxi directions back to parking. For the next 3 minutes, the crew ran checklists and discussed the nature of the event as they taxied back to parking.

At 1603:53 EDT, one FTE commented, "that fan is like stopped solid out there," and the other FTE added, "is not turning right now, well it's zero down here we seized the engine." The crew then performed a shutdown of the right engine.

At 1609:49 EDT, the CAM recorded sounds consistent with aircraft shutdown, and the CAPT called for a debrief of the event. At 1611:25 EDT, the CAPT made a radio call to ground crew asking them to check the right hand engine for any external signs of damage. Ground responded that everything looked good.

At 1629:31 EDT, all checklists were confirmed complete. Approximately 7 seconds later, ground personnel informed the cockpit crew that there was damage to the right engine.

The session ended at 1655:56 EDT.

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Vehicle Recorder Division

Attachment I

CVR Quality Rating Scale

The levels of recording quality are characterized by the following traits of the cockpit voice recorder information:

Excellent Quality	Virtually all of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate only one or two words that were not intelligible. Any loss in the transcript is usually attributed to simultaneous cockpit/radio transmissions that obscure each other.
Good Quality	Most of the crew conversations could be accurately and easily understood. The transcript that was developed may indicate several words or phrases that were not intelligible. Any loss in the transcript can be attributed to minor technical deficiencies or momentary dropouts in the recording system or to a large number of simultaneous cockpit/radio transmissions that obscure each other.
Fair Quality	The majority of the crew conversations were intelligible. The transcript that was developed may indicate passages where conversations were unintelligible or fragmented. This type of recording is usually caused by cockpit noise that obscures portions of the voice signals or by a minor electrical or mechanical failure of the CVR system that distorts or obscures the audio information.
Poor Quality	Extraordinary means had to be used to make some of the crew conversations intelligible. The transcript that was developed may indicate fragmented phrases and conversations and may indicate extensive passages where conversations were missing or unintelligible. This type of recording is usually caused by a combination of a high cockpit noise level with a low voice signal (poor signal-to-noise ratio) or by a mechanical or electrical failure of the CVR system that severely distorts or obscures the audio information.
Unusable	Crew conversations may be discerned, but neither ordinary nor extraordinary means made it possible to develop a meaningful transcript of the conversations. This type of recording is usually caused by an almost total mechanical or electrical failure of the CVR system.