

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division

October 30, 2017

Cockpit Voice Recorder

Specialist's Factual Report
By Christopher Babcock

1. EVENT SUMMARY

Location: Pensacola, Florida
Date: August 27, 2016
Aircraft: Boeing 737-700, Registration N766SW
Operator: Southwest Airlines, Flight 3472
NTSB Number: DCA16FA217

On August 27, 2016, a Boeing 737-700, registration N766SW, operated as Southwest Airlines flight 3472 (WN3472), experienced an uncontained engine failure and cabin depressurization while climbing through flight level 310. None of the 99 passengers or 5 crewmembers were injured and the airplane sustained substantial damage. The flight crew diverted to Pensacola International Airport, Pensacola, Florida. The regularly scheduled passenger flight was operating under 14 *Code of Federal Regulations (CFR)* Part 121 and was enroute from New Orleans, Louisiana, to Orlando, Florida. A solid-state cockpit voice recorder (CVR) was sent to the National Transportation Safety Board (NTSB) Vehicle Recorder Division for evaluation.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following CVR:

Recorder Manufacturer/Model: **Honeywell 6022**
Recorder Serial Number: **2474**

3.1 CVR Carriage Requirements

Per federal regulation, turbine engine powered aircraft operating under 14 CFR Part 121 must be equipped with a CVR that records a minimum of the last 2 hours of aircraft operation. When the CVR is deactivated or removed from the airplane, it retains only the most recent 2 hours of CVR operation.

3.2 Recorder Description

This model CVR, the Honeywell 6022, is a solid state CVR that records 120 minutes of digital audio. Specifically, it contains a 2-channel recording of the last 120 minutes of

operation and separately contains 3-channel recording of the last 30 minutes of operation. The 120-minute portion of the recording is comprised of one channel that combines three audio panels sources and a second channel that contains the cockpit area microphone (CAM) source. The 30-minute portion of the recording contains 3 channels of audio information: one channel for each flight crew, and one channel for a cockpit observer.

3.3 Recorder Damage

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

3.4 Audio Recording Description

Each channel's audio quality is indicated in Table 1.¹

Table 1. Audio contents and quality.

Channel Number	Content/Source	Quality	Duration (h:mm:ss)
1	Captain	Excellent	0:30:28
2	First Officer	Excellent	0:30:28
3	Observer	Excellent	0:30:28
4	Mixed Audio Panel	Excellent	2:04:56
5	CAM	Good	2:01:10

3.5 Timing and Correlation

Timing on the transcript was established by correlating the CVR events to common events on the flight data recorder (FDR). Specifically, the two radio transmissions that the aircraft made prior to takeoff were correlated to the radio transmit microphone key parameter from the FDR. Both radio transmissions acted as an anchor point for a linear interpolation between the remaining CVR events. Once a correlation between the two recorders was established, a reference to local time was determined using the recorded UTC time parameter from the FDR. The resultant times were offset to reflect the local central daylight time of the accident. As a result, 32111 seconds were added to the CVR elapsed time to convert to local CDT.

3.6 Description of Audio Events

In agreement with the Investigator-In-Charge, a CVR group did not convene. A summary of events from the CVR follows.

Time (CDT)	Event
09:03:21	sound of engine 1 starting
09:04:21	sound of engine 2 starting
09:07:08	crew is cleared for takeoff
09:21:42	sound of double chime
09:21:45	sound of bang followed by engine rpm decrease
09:21:52	captain asked first officer to declare an emergency
09:21:55	first officer declared emergency and told ATC they are descending
09:22:06	crew completed engine failure checklist

¹ See attached CVR Quality Rating Scale.

Time (CDT)	Event
09:22:17	sound similar to cabin pressurization alarm
09:22:43	ATC told WN3472 that Pensacola is ahead of them about 70 miles
09:22:51	sound of crewmembers on oxygen masks
09:23:53	ATC cleared WN3472 to flight level 180
09:26:47	captain communicated to cabin crew about engine failure and to secure cabin
09:29:22	crew commented that they cannot get rid of vibration and are going to keep the speed up
09:31:38	flight crew told cabin crew that there will be no evacuation
09:32:10	crew removed oxygen masks
09:35:17	crew commented again about high vibration levels
09:37:39	ATC told crew to expect ILS runway 17 approach
09:37:54	crew selected flaps 1 and 5 to check handling
09:38:19	crew selected autobrakes 3
09:38:30	crew selected flaps 15
09:39:10	ATC cleared WN3472 for ILS runway 17 approach
09:39:32	crew completed descent/approach checklist
09:40:01	crew reported field in sight
09:40:13	crew selected landing gear down
09:41:40	crew commented again about vibration
09:41:51	sound of five hundred foot automated callout
09:42:10	crew commented autobrakes are not arming
09:42:30	sound of touchdown
09:46:20	sound of engine 2 shutdown and power interruption

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.