

**NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Vehicle Recorder Division
Washington, D.C. 20594**



SPECIALIST'S FACTUAL REPORT OF INVESTIGATION

DCA20LA107

**By
Kyle Garner**

WARNING

The reader of this report is cautioned that the summary of a cockpit voice recorder audio recording is not a precise science but is the best product possible from an NTSB investigative effort. The summary or parts thereof, if taken out of context, could be misleading. The summary should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the summary as the sole source of information.

NATIONAL TRANSPORTATION SAFETY BOARD
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July 6, 2022

Cockpit Voice Recorder

Specialist's Factual Report
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1. EVENT

Location: Near Victorville, California
Date: May 19, 2020
Aircraft: Boeing 737-800, Registration N820TJ
Operator: Swift Air
NTSB Number: DCA20LA107

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received four waveform audio file format (WAV) files downloaded from the following solid-state cockpit voice recorder (CVR):

Recorder Manufacturer/Model: **L3Harris FA2100 CVR**
Recorder Serial Number: **000382552**

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; 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.

3.2 Recorder Description

This FA2100 CVR records a minimum of 120 minutes of digital audio stored on solid-state memory modules. Four channels are recorded: one channel for each flight crew, one channel for a cockpit observer, and one channel for the cockpit area microphone (CAM).

3.3 Audio Recording Description

Each channel's content, audio quality, and duration are indicated in Table 1.¹

¹ See attached CVR Quality Rating Scale.

Table 1: Audio Quality.

Channel Number	Content/Source	Quality	Duration
1	3 rd Crew Member/Spare	Good	02:04:13
2	First Officer	Good	02:04:13
3	Captain	Good	02:04:13
4	CAM	Good	02:04:13

3.4 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 last four radio transmissions that the aircraft made before landing were correlated to the radio transmit microphone key parameter from the FDR.

Each of the four radio transmissions acted as an anchor point for linear interpolation between the remaining CVR events. Once a correlation between the two recorders was established, a reference to Coordinated Universal Time (UTC) was determined. The CVR and FDR times were offset to reflect UTC. UTC was then changed to local time, Pacific daylight time (PDT), by subtracting 7 hours. Therefore, for the remainder of this report, all times are referenced as PDT.

3.5 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.

The first hour of the recording captured the event aircraft's previous flight cruise, approach, landing, and taxi-in to Southern California Logistics Airport (VCV) in Victorville, California. The captured events of the previous flight were deemed not pertinent to the investigation and are not discussed in this summary report.

The event flight recording began at 1503:22 when the aircraft was on the ground at VCV. The captain and first officer completed various preflight tasks and checklists.

At 1505:34, the first officer radioed the tower at VCV and stated they were ready to taxi. The tower replied with taxi instructions and the aircraft began to taxi to departure runway 17.

At 1510:45, the first officer used the interphone to inform the flight attendants to be seated for departure. The crew then performed the before takeoff checklist.

At 1513:10, the tower informed the crew they were cleared to takeoff. The flight began its takeoff roll from runway 17 at 1514:01. After takeoff, the aircraft continued to climb to an altitude of 7,000 feet.

At 1516:11, the captain instructed the first officer to perform the after-takeoff checklist. Two seconds later, at 1516:13, a loud bang was heard on the CAM. The captain subsequently remarked, "Woah, what the hell was that?"

At 1516:55, a flight attendant used the cabin interphone to ring the flight crew. The flight attendant inquired about the noise they had just heard. The first officer responded that

they had encountered wake turbulence. The flight attendant thanked the first officer for the information and hung up.

At 1517:27, the captain asked the first officer what the flight attendants had asked him. The first officer replied, "They wanted to know what it [the noise] was." The captain then stated, "We don't know." The aircraft then began a climb to an air traffic control (ATC) assigned altitude of 13,000 feet.

At 1518:18, the first officer stated, "We must have hit their wake" and the captain responded, "Something, yeah."

At 1521:21, ATC instructed the flight crew to climb to an altitude of 15,000 feet.

At 1521:35, the captain stated, "It seems like it's vibrating weird, doesn't it?" and the first officer replied, "Yes, it does." The captain then instructed the first officer to call a mechanic that was on the flight to the cockpit to discuss the vibrations.

At 1522:25, the mechanic entered the cockpit and the captain stated, "I don't know what that shutter was on takeoff, but do you feel the airplane kind of shuttering right now?" The mechanic replied that he did feel the airplane vibrating. The captain then stated that besides the vibration, there was no indication of any abnormalities on any of the gauges and everything appeared to be normal.

As the mechanic and flight crew continued to scan the gauges, they noted that the number 2 engine vibration indication was "coming up really quick." About 14 seconds later, the mechanic noted that the number 2 engine vibration indication was coming back down. The mechanic then stated that he would return to the cabin and look out the window at the number 2 engine to see if there were any abnormalities.

At 1524:37, the captain stated, "As soon as the engine RPM comes up, look at that" and the first officer responded, "Yeah, it [the number 2 engine vibration indication] goes crazy."

At 1525:29 the mechanic returned to the cockpit and indicated that, after looking at the number 2 engine through the cabin window, he could see no abnormalities. The mechanic then returned to the cabin for the remainder of the flight.

At 1532:19, the captain instructed the first officer to begin setting up the aircraft for the approach to San Diego International Airport (SAN) in San Diego, California.

The aircraft descended and landed on runway 27 at SAN at 1555:40.

After landing, the captain expressed that both he and the first officer would be doing a walk-around to see if they could find a cause of the vibrations.

At 1607:15, the recording ended.

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.