

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



SPECIALIST'S FACTUAL REPORT OF INVESTIGATION

DCA18IA081

**By
Joseph A Gregor**

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 a Safety Board 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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November 5, 2018

Cockpit Voice Recorder

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1. EVENT SUMMARY

Location: Pullman, Washington
Date: December 29, 2017
Aircraft: Bombardier DHC-8-Q400
Operator: Horizon Air, Flight 2184
NTSB Number: DCA18IA081

On December 29th, 2017 at about 1840 pacific standard time, Horizon Air flight 2184, a Bombardier DHC-8-Q400, N412QX, landed on the taxiway of runway 6 at Pullman/Moscow Regional Airport (KPUW), Pullman, Washington. After the airplane landed at the uncontrolled airport, the flight crew observed that the runway lights were inoperative. The flight was operating under 14 *Code of Federal Regulation* (CFR) Part 121 as a regularly scheduled passenger flight originated from Seattle/Tacoma International Airport (KSEA), Seattle, Washington.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division received the following cockpit voice recorder (CVR):

Recorder Manufacturer/Model: **Honeywell 6022**
Recorder Serial Number: **1557**

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 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 a 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 panel 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 quality¹ is indicated in Table 1. Channel number one did not contain any audio information (nor was it required by federal regulations).

Table 1: Audio Quality.			
Channel Number	Content/Source	Quality	Duration
1	Other	Good	30 min
2	CAPT or FO	Good	30 min
3	CAPT or FO	Good	30 min
4	CAM	Poor to Good	2 hr
5	Combined	Good	2 hr

The audio quality of channel number four, the CAM channel, was poor to unusable during flight due to excessive wideband noise masking virtually all other sounds and crew conversations. The quality of the recording produced by this channel became good during ground operations, once the aircraft had stopped and certain (unspecified) systems had been shut-down.

3.5 Timing and Correlation

In consultation with the Investigator-In-Charge (IIC), timing on the summary was expressed in elapsed time from the beginning of the CVR recording.

3.6 Description of Audio Events

In consultation with the IIC, a CVR group did not convene. A summary of events from the CVR follows.

The recording started with the CAM recording high level broadband noise that masked virtually all other sounds. At 04:34 [min:sec] into the recording, a voice could be heard stating "I just did...". In general, only sounds consistent with unintelligible speech and indications of movement in the cockpit were discernable. This included clicking sounds at 13:45 [min:sec] into the recording that were consistent with electronic sounds produced

¹ See attached CVR Quality Rating Scale.

by repeated keying of a radio transmit switch. At 31:19 [min:sec] into the recording, the broadband noise recorded on the CAM stopped. The CVR continued to record partially intelligible speech and sounds consistent with movement in the passenger cabin supporting deplaning activities. At 55:24 [min:sec] into the recording, the CAM recorded the sound of a triple-chime warning. At 01:26:27 [hr:min:sec] into the recording, the CAM recorded the sound of another triple-chime warning. At 01:38:09 [hr:min:sec] into the recording, the CAM recorded electronic sounds produced by repeated keying of a radio transmit switch. At 01:43:59 [hr:min:sec] into the recording, the CAM recorded sounds consistent with ground personnel servicing the aircraft. At 02:01:18 [hr:min:sec] into the recording, the CAM recorded sounds consistent with ground personnel talking on a radio about pulling and collaring the FDR and CVR circuit breakers. The recording ended 02:05:16.2 [hr:min:sec] from the beginning.

3.7 Recorder Evaluation

The quality of the audio recording was brought to the attention of the operator, Horizon Air. On February 1, 2018, the Horizon Air Flight Ops Division conducted a maintenance test of the incident aircraft with a different CVR installed. The CVR system passed this test.

The CVR corresponding to this incident was forwarded to Honeywell Aerospace on March 2, 2018 for acceptance testing. On March 16, Honeywell reported that there were no anomalies and the CVR exhibited normal input impedances and reliable power connections. The unit was capable of recording intelligible audio on all four channels and could be downloaded normally, without difficulty. At the request of Horizon Air, the unit completed acceptance testing and was returned to the operator upon completion of the work.

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.