NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

January 25, 2013

Cockpit Voice Recorder

Specialist's Factual Report
By Bill Tuccio

1. EVENT

Location:	Minneapolis, Minnesota
Date:	November 10, 2011
Aircraft:	Airbus A320-200, N331NW
Operator:	Delta Airlines, Flight 1691
NTSB Number:	DCA12CA043

2. GROUP

A group was not convened.

3. SUMMARY

On November 10, 2011, at 1157 central standard time (CST), an Airbus A320-211, registration N331NW, operated by Delta Airlines as flight 1691 struck birds shortly after take-off from the Minneapolis-St Paul International / World-Chamberlain Airport (MSP), Minneapolis, Minnesota. The aircraft returned to the MSP airport and landed without incident. A solid-state cockpit voice recorder (CVR) was sent to the National Transportation Safety Board's Audio Laboratory for readout.

4. DETAILS OF INVESTIGATION

The NTSB Vehicle Recorder Division's Audio Laboratory received the following CVR:

Recorder Manufacturer/Model: **Honeywell 6022**
Recorder Serial Number: **04313**

4.1. Recorder Description

Per federal regulation, aircraft manufactured prior to April 7, 2010, must be equipped with a CVR that records a minimum of the last 30 minutes 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 30 minutes or 2 hours of CVR operation, depending on the CVR model. This model CVR, the Honeywell 6022, is a solid-state CVR that records 2 hours of digital cockpit audio. The recorded audio data is separated by the Honeywell download software into 2 sets of audio data files: a) a 2-channel recording containing the last 2 hours of recorded events and b) a 4-channel recording containing the last 30 minutes of recorded events. During the 2-hour portion of the recording, one channel contains audio information from the cockpit area microphone (CAM) and the other channel contains a mixture or two audio sources: the captain's audio panel information and the first officer's audio panel information. The 30-minute portion of the recording contains 4 channels of audio data; one channel for each flight crew and one channel for the CAM audio information.

4.2. Recorder Damage

Upon arrival at the audio 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.

4.3. CVR Channels

The recording consisted of four channels of audio information. Two of the channels contained audio information from the captain's and first officer's audio panels. The quality of these two channels was excellent.[1] One channel contained the cockpit area microphone (CAM) audio information. The quality of this channel was good. The fourth channel contained audio information from the observer pilot. The quality of this channel was excellent.

4.4. Timing and Correlation

The times used in this report are expressed as CST.

Timing of the transcript was established by correlating the CVR events to common events on the flight data recorder (FDR). Specifically, radio transmissions on the CVR at 0122:26.8, 0135:32.4, and 0135:49.9 CVR Elapsed Time were correlated to the same Microphone Keying events recorded on the FDR at: 213004.16, 213789.16, and 213807.16 FDR Subframe Reference Number (SRN), respectively. This correlation resulted in 208056.7 being added to CVR Elapsed Time to convert to FDR SRN.

Given an FDR relationship of SRN – 170912 = Greenwich Mean Time (GMT), and a 6 hour offset from GMT to CST, a final relationship from CVR Elapsed Time to CST can be developed.

Specifically for this report, 1019:04.7 was added to CVR Elapsed Time to convert to CST.

[1] See Attachment I for the CVR Quality Rating Scale

4.5. Summary of Recording Contents

In agreement with the Investigator-In-Charge, a CVR group did not convene and only this summary report was prepared.

The two hour recording began when the prior flight, Delta 1301, was descending into the MSP terminal area.

At about 1049:48, the crew of flight 1691 was in the cockpit performing pre-departure activities, including checking the oxygen masks and related checklists. The aircraft pushed off the gate at about 1124. Shortly thereafter, the aircraft taxied to runway 30R.

At 1138:37, the aircraft was cleared for take-off with the first officer acting as the flying pilot. At 1139:29, the first officer asked for gear up. Shortly thereafter, the tower assigned the aircraft a heading of 300 degrees and asked for reports of cloud bases and tops, as well as icing conditions.

At 1140:05, as the sound of a power reduction was recorded on the CAM, the captain radioed approached control, reporting out of 3,000 feet for 7,000. Shortly thereafter at 1140:19, the first officer asked for flaps 1.

At 1140:53, the captain cautioned the first officer to watch out. This was followed at 1140:57 by the sound of a 'thunk', followed by an increase in background noise. The captain and first officer acknowledged the bird strike, and the first officer noted the aircraft was responding normally and he would continue to climb at "green dot."

After the crew briefly assessed damage, at 1141:32, the captain advised air traffic control (ATC) of the bird strike and requested radar vectors back to the MSP airport. Approach control immediately provided a heading of 270 degrees and an altitude of 5,000 feet. The captain then requested 4,000 feet.

At 1142:25, the captain declared an emergency with ATC.

The captain asked the first officer to fly and communicate with ATC. At 1142:44, the captain made a passenger announcement (PA) informing the passengers of the bird strike and that the aircraft was returning to the airport. After the PA, the first officer said he pulled up to avoid the birds, and further noted the birds were likely not Canadian Geese as they were white. Thereafter, the captain spoke with a flight attendant over the intercom, discussing cabin preparations for landing.

At about 1144:17, the crew discussed the landing would be slightly over landing weight, about "ten over." Shortly thereafter, the first officer advised ATC they were requesting emergency equipment on landing, the souls on board, fuel remaining, and potential damage to the nosecone and nosewheel area. ATC acknowledged the information, while vectoring the aircraft for runway 35 at MSP.

As the aircraft was returning to the airport and the crew was conducting a variety of checklists, the first officer requested flaps 1 followed by flaps 2. Shortly after the flaps 2 request, at about 1149:45, the first officer noted his airspeed indications were erratic. After briefly discussing the issue, at 1150:01, the captain took over as the flying pilot, and first officer reverted to the non-flying pilot role.

At 1150:41, the captain asked for the approach checks. Shortly thereafter, the first officer advised ATC the aircraft was slowing to 170 knots. ATC then cleared the aircraft for the Converging ILS Runway 35 to MSP.

At about 1151:33, a single chime was recorded and the first officer said, “wing anti-ice valve open.” The crew discussed the issue briefly, and agreed the valve was not a problem.

At about 1152:46, the crew discussed the aircraft would be about 8,000 pounds over landing weight, agreeing this was not much overweight.

At 1153:30, the crew discussed concerns about the nosewheel landing gear and decided to put the gear down early to verify its functionality. At 1153:38, the captain asked for the landing gear down; followed shortly thereafter by the sound of gear extension and the crew confirming the gear was down.

At 1154:37, the first officer reported a 10 mile, visual approach to MSP Tower, reiterating the request for emergency equipment upon landing. MSP Tower cleared the aircraft to land, reporting winds from 310 degrees at 13 knots.

On final approach, the crew discussed the bird encounter, noting the flock must have been about 50 birds. Shortly thereafter, at 1155:34, the captain asked for full flaps and the landing checklist. The first officer began to execute the checklist, noting airspeed indications were still erratic on his instruments, but the captain instruments seemed normal.

At 1156:50, the first officer noted the aircraft was through one thousand feet and was cleared to land. At 1157:06, the autopilot was disengaged.

At 1158:05, an automated voice announced “one hundred.” This was followed shortly thereafter by the automated voice stating, “fifty thirty twenty retard retard.”

At 1158:17, the CAM recorded a sound similar to touchdown followed shortly thereafter by the sound of increased engine noise, similar to the application of reverse thrust.

After clearing the runway, the aircraft stopped and had emergency ground personnel inspect the aircraft as well as the brakes, due to the overweight landing. At about 1203, the emergency personnel reported damage to the radome, including some visible insulation, and possible damage to the right engine. The emergency personnel suggested shutting down the right engine and the crew complied.

The aircraft taxied back to the gate, followed by emergency ground equipment. The crew emphasized the ground personnel monitor the brakes due to high temperature indications.

The recording ended at 1224:01 as the crew completed the shut-down checklist.

Bill Tuccio
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.