

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

November 16, 2018

Flight Data Recorder

Specialist's Factual Report
By Cassandra Johnson

1. EVENT SUMMARY

Location: Pullman, Washington
Date: December 29, 2017
Aircraft: Bombardier DHC-8-Q400
Registration: N412QX
Operator: Horizon Air
NTSB Number: DCA18IA081

On December 29th, 2017 at about 1840 pacific standard time (PST), 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. Weather at the time of landing was reported as wind from the southeast, light rain, overcast ceiling with 5 miles visibility. There were no injuries to the 42 passengers and crew onboard and there was no damage to the airplane. 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 regularly scheduled passenger flight originated from Seattle/Tacoma International Airport (KSEA), Seattle, Washington, to KPUW.

2. FLIGHT DATA RECORDER GROUP

A flight data recorder (FDR) group was not convened.

3. FDR Carriage Requirements

The event aircraft, N412QX, was manufactured on January 29, 2002, and was operating such that it was required to be equipped with an FDR that recorded, at a minimum, 57 parameters, as cited in 14 CFR Part 121.344(e).

4. DETAILS OF FDR INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model: **Honeywell 4700**
Recorder Serial Number: **4567**

4.1. Honeywell 4700 Description

The Honeywell solid state flight data recorder (SSFDR) records airplane flight information in a digital format using solid-state flash memory as the recording medium. The SSFDR can

receive data in the ARINC 573/717/747 configurations and can record a minimum of 25 hours of flight data. It is configured to record 128 12-bit words of digital information every second. Each grouping of 128 words (each second) is called a subframe. Each subframe has a unique 12-bit synchronization (sync) word identifying it as subframe 1, 2, 3, or 4. The sync word is the first word in each subframe. The data stream is "in sync" when successive sync words appear at proper 128-word intervals. Each data parameter (for example, altitude, heading, and airspeed) has a specifically assigned word number within the subframe. The SSFDR is designed to meet the crash-survivability requirements of TSO-C124.

4.1.1. Recorder Condition

The recorder was in good condition and the data were extracted normally from the recorder.

4.1.2. Recording Description

The FDR recording contained approximately 27 hours of data. Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The event flight was the last flight of the recording and its duration was approximately 40 minutes. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

4.1.3. Engineering Units Conversions

The engineering unit conversions used for the data contained in this report are based on documentation from the aircraft manufacturer. Where applicable, the conversions have been changed to ensure that the parameters conform to the NTSB's standard sign convention that climbing right turns are positive (CRT=+).¹

Table A-1 lists the FDR parameters verified and provided in this report. Additionally, table A-2 describes the unit and discrete abbreviations used in this report.

4.1.3.1. Latitude and Longitude

Latitude and longitude are sampled once every 4 seconds. At Pullman, Washington, the latitude parameter has a resolution of about 500 feet (ft) and the longitude parameter has a resolution of about 343 ft.

4.2. Time Correlation

Correlation of the FDR data from SRN to the event local time, PST, was established by using the recorded Time Coordinated Universal Time (UTC) hours, Time UTC Minutes, and Time UTC Seconds and then applying an additional 8 hours offset to change UTC to PST.

Accordingly, the time offset for the event flight data from SRN to local PST is the following: $PST = SRN - 30,396$. Therefore, for the rest of this report, all times are referenced as PST, not SRN.

¹ CRT=+ means that for any parameter recorded that indicates a climb or a right turn, the sign for that value is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the value is positive. Examples: Right Roll = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

4.3. FDR Plots and Corresponding Tabular Data

Figures 1 and 2 contain FDR data recorded during the event on December 29, 2017. All the parameters listed in table A-1 are plotted except Time UTC Hours, Time UTC Minutes, and Time UTC Seconds.

Figure 1 is an overlay of the aircraft's position during landing from 18:39:32 PST to 18:40:48 PST using Google Earth. The "saw-tooth" appearance of the path is due to the low recorded resolution of latitude (about 500 ft) and longitude (about 343 ft). The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figure 2 covers the final descent from a pressure altitude of approximately 4,560 ft through landing. The time covered is from 18:37:40 PST to 18:40:50 PST.

The FDR data indicated that at 18:40:07 PST (about 40 minutes after takeoff) the aircraft landed at Pullman/Moscow Regional Airport (KPUW), Pullman, Washington.

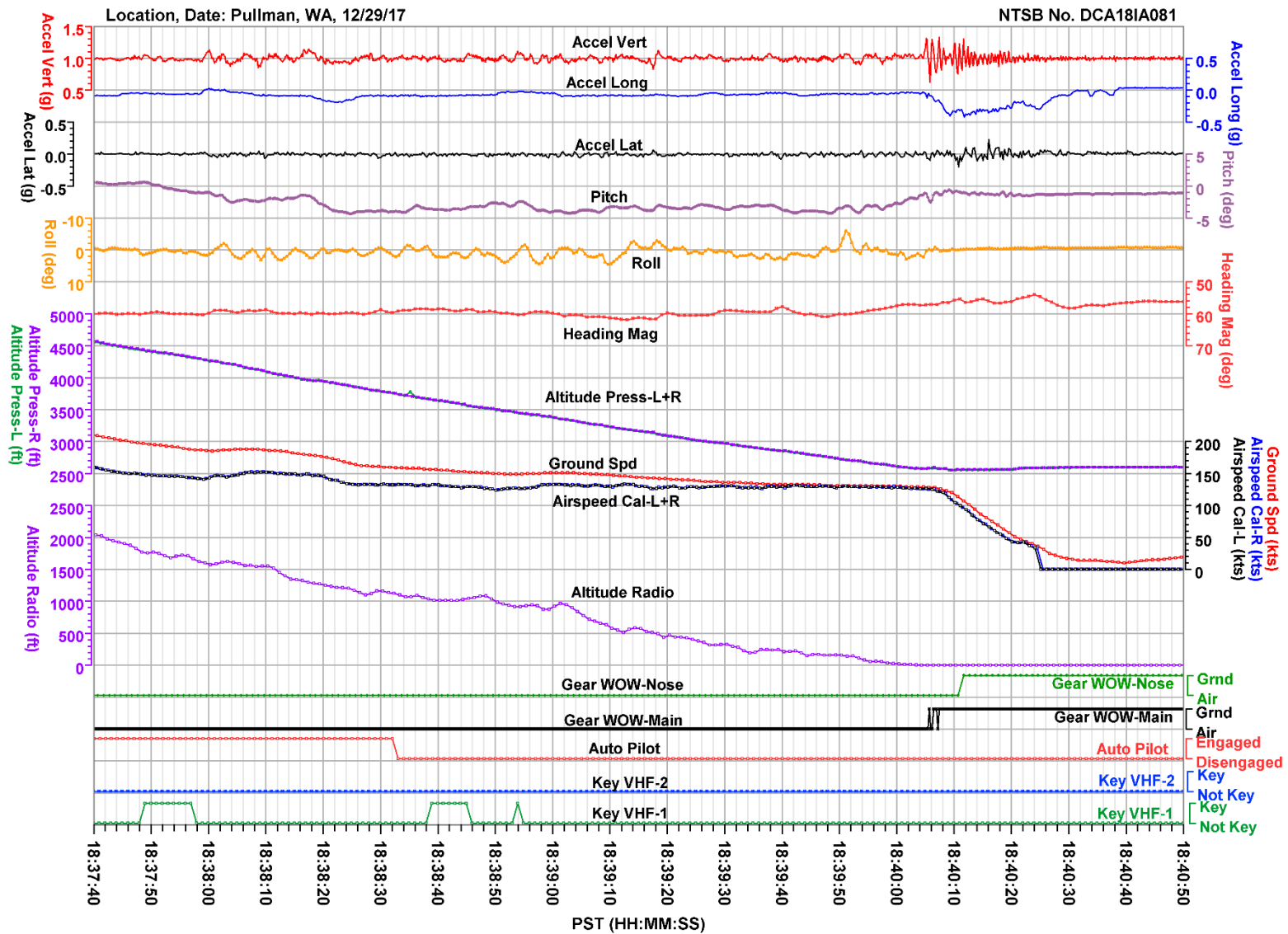
These figures are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page.

The tabular data for the entire flight from 17:59:00 PST to 18:40:50 PST for all the parameters listed in table A-1 are provided in electronic comma separated value (*.csv) format as attachment 1 to this report.

Figure 1. Google Earth overlay showing aircraft's position during landing.



Figure 2. Plot of parameters during landing.



Horizon Air, Bombardier DHC-8-400, N412QX

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APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the plot/table labels, descriptions, and units. Additionally, table A-2 describes the unit and discrete abbreviations used in this report.

Table A-1. Verified and provided FDR parameters.

Plot/Table Labels	Description	Units
Accel Lat	Lateral Acceleration	g
Accel Long	Longitudinal Acceleration	g
Accel Vert	Vertical Acceleration	g
Airspeed Cal-L	Calibrated Airspeed - Left	kts
Airspeed Cal-R	Calibrated Airspeed - Right	kts
Altitude Press-L	Pressure Altitude- Left	ft
Altitude Press-R	Pressure Altitude- Right	ft
Altitude Radio	Radio Altitude	ft
Auto Pilot	Autopilot Status	
Gear WOW-Main	Main Landing Gear Weight on Wheels	
Gear WOW-Nose	Nose Gear Weight on Wheels	
Ground Spd	Ground Speed	
Heading Mag	Magnetic Heading	deg
Key VHF-1	Microphone Keying-1	
Key VHF-2	Microphone Keying-2	
Latitude	Latitude Position	deg
Longitude	Longitude Position	deg
Pitch	Pitch Angle	deg
Roll	Roll Angle	deg
Time UTC Hrs	Coordinated Universal Time Hours	hrs
Time UTC Min	Coordinated Universal Time Minutes	min
Time UTC Sec	Coordinated Universal Time Seconds	sec

NOTE: This FDR records pressure altitude, which is based on a standard altimeter setting of 29.92 inches of mercury (in Hg). The pressure altitude information presented in the FDR plots and in the electronic data has not been corrected for the local altimeter setting at the time of the event.

NOTE: Parameters with a blank unit description in table A-1 are discretes. A discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

Table A-2. Unit and discrete abbreviations.

Unit and discrete Abbreviations	Descriptions
deg	degrees
ft	feet
grnd	ground
hrs	hours
kts	knots
min	minutes
sec	seconds