NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

April 1, 2014

Flight Data Recorder - 10

Specialist's Factual Report
By Christopher Babcock

1. EVENT

Location:	Branson, Missouri
Date:	January 12, 2014, 1810 Central Standard Time (CST)[1]
Aircraft:	Boeing 737-700, N272WN
Operator:	Southwest Airlines, flight 4013
NTSB Number:	DCA14IA037

2. GROUP

A group was not convened.

3. SUMMARY

On January 12, 2014, at approximately 1810 Central Standard Time (CST), Southwest Airlines flight 4013, a Boeing 737-700, registration N272WN, mistakenly landed at M. Graham Clark Downtown Airport (PLK) instead of Branson Airport (BBG), 5 nautical miles away. Night visual meteorological conditions prevailed at the time. There were no injuries to the 124 passengers or 7 crewmembers and the aircraft was not damaged. The flight was being conducted under the provisions of 49 *Code of Federal Regulations* (CFR) Part 121 as a scheduled passenger flight from Chicago to Branson.

4. DETAILS OF INVESTIGATION

On January 14, 2014, the NTSB Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model: Honeywell SSFDR, Model 980-4700
Serial Number: 10856

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

[1] All times refer to the local CST of the incident

4.1. Recorder Description

The Honeywell Solid State Flight Data Recorder (SSFDR) records airplane 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 records 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 is called a subframe. Each subframe has a unique 12-bit synchronization word identifying it as either subframe 1, 2, 3 or 4. The synchronization 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 (e.g. altitude, heading, airspeed) has a specifically assigned word number within the subframe. The SSFDR is designed to meet the crash-survivability requirements of TSO-C124.

4.2. FDR Carriage Requirements

Federal regulations regarding the carriage requirements of FDRs on transport category aircraft can be found in 14 CFR Part 121.343 and Part 121.344. The incident aircraft, N272WN, was manufactured in 2007 and was required to be equipped with an FDR that recorded, at a minimum, the 88 parameters found in 14 CFR 121.344(f).

4.3. Recording Description

The FDR recording contained approximately 27 hours of data. Timing of the FDR data in measured in subframe reference number (SRN), where each SRN equals one elapsed second. The incident flight was the last flight on the recording and its duration was approximately fifty minutes.

4.4. Time Correlation

The incident flight data was offset from SRN to local CST using the recorded GMT parameter on the FDR and then adjusted for CST. The offset from SRN to CST was accomplished by subtracting 30759 seconds.

4.5. Engineering Units Conversions

The engineering units conversions used for the data contained in this report are based on documentation from the aircraft manufacturer. Where applicable, changes to the conversions have been made to ensure the parameters conform to the Safety Board's standard sign convention that climbing right turns are positive (CRT=+).[2]

4.5.1. Parameters Provided and Verified

Appendix A lists the FDR parameters provided and verified in this report, including the associated plot label.

[2] CRT=+ means that for any recorded parameter that indicates a climb or right turn, the sign is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the sign is positive. Examples: right roll=+, left aileron trailing edge down=+, right aileron trailing edge up=+, elevator trailing edge up=+.

4.5.2. Pressure Altitude

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

4.6. FDR Plot Description

Figure 1 shows basic flight data on approach as the aircraft descends below 10000 feet through the landing roll. Figure 2 shows autopilot related data over the same duration. Figure 3 shows landing performance related parameters during the landing roll. Figure 4 shows a 3D image of the aircraft approach overlaid on satellite imagery. The corresponding tabular data used to create these figures are provided in electronic (.csv) format as an attachment to this report.

Christopher Babcock
Aerospace Engineer
Vehicle Recorder Division

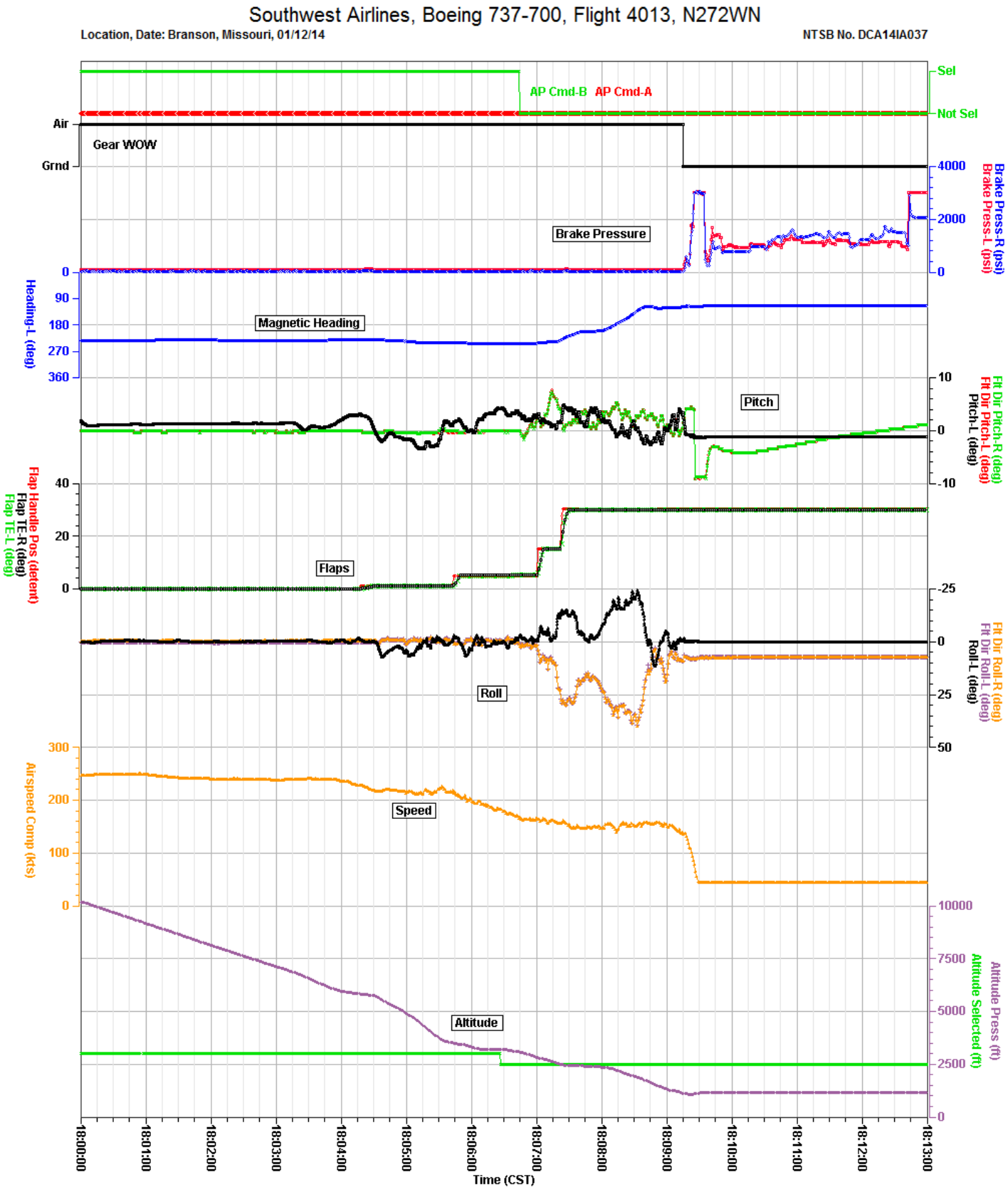

Figure 1. Basic flight data below 10000 feet.

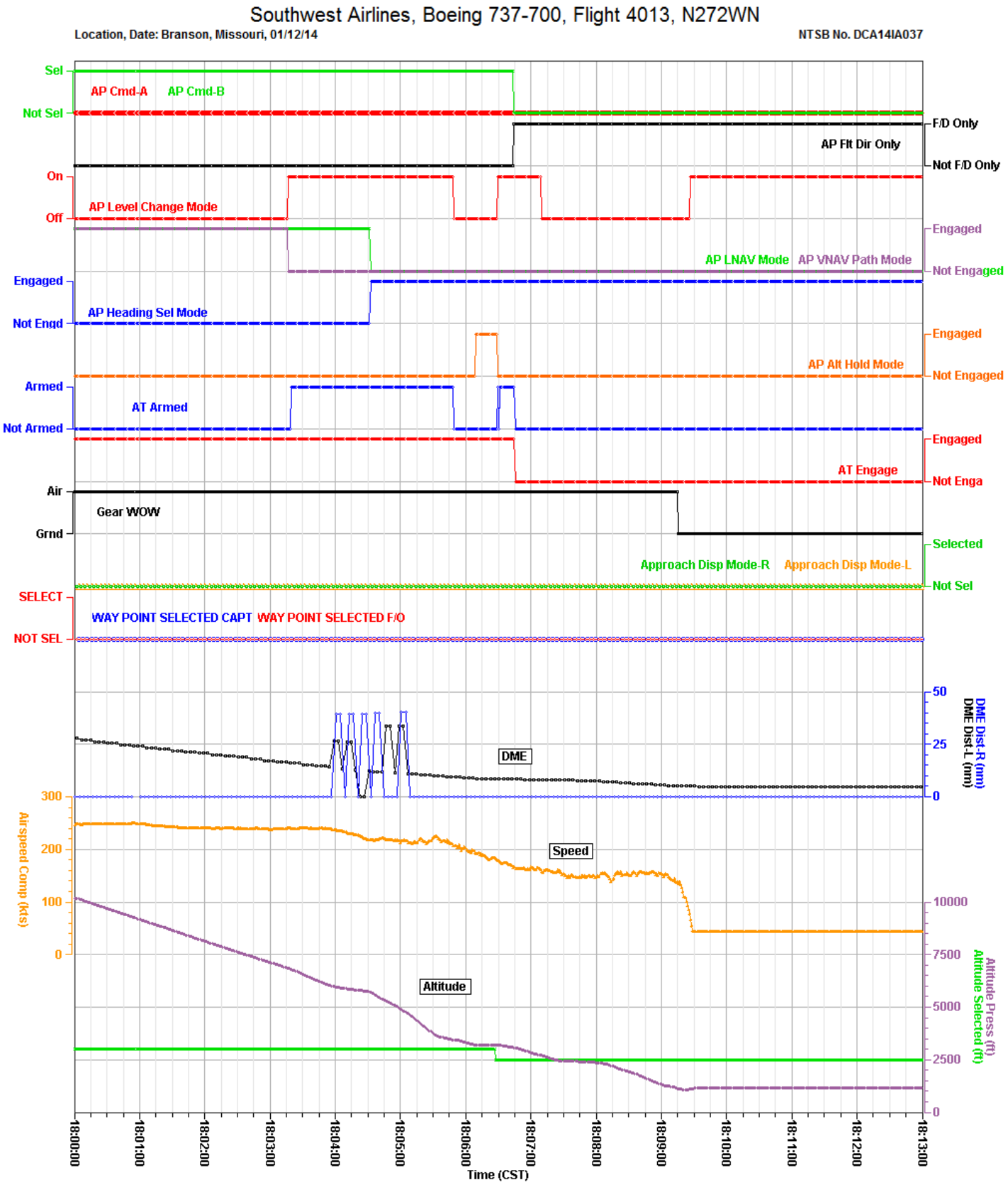

Figure 2. Selected autopilot parameters during approach.

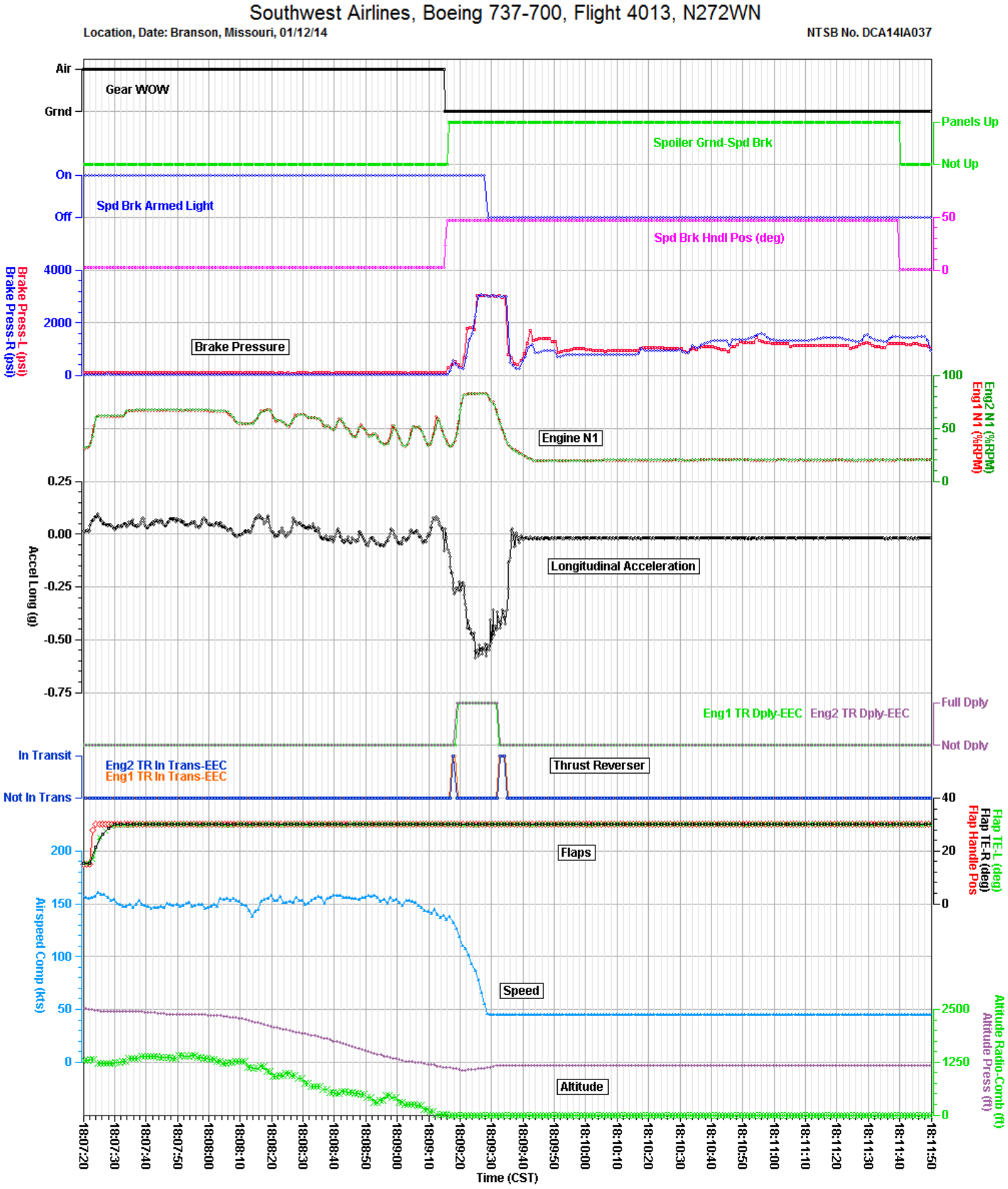

Figure 3. Landing performance.

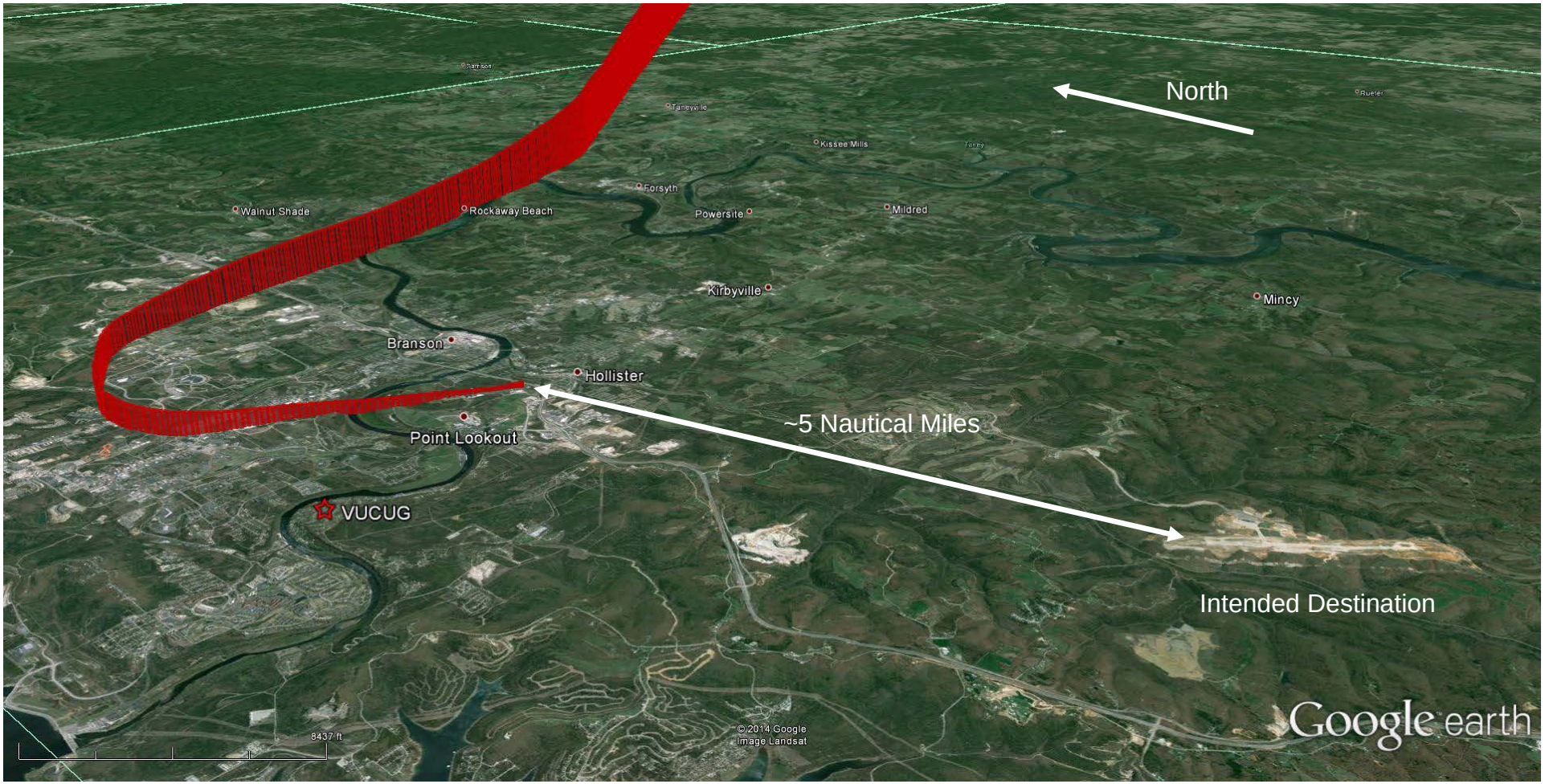

Figure 4. Aircraft approach to Branson.

Appendix A

Table A-1. Provided and verified parameters.

Plot Label	Parameter Description
Accel Long (g)	Longitudinal Acceleration
Airspeed Comp (kts)	Computed Airspeed
Altitude Press (ft)	Pressure Altitude
Altitude Radio (ft)	Radio Altitude
Altitude Selected (ft)	Selected Altitude
AP Alt Hold Mode	Autopilot Altitude Hold Mode Engaged Discrete
AP Cmd-A	Autopilot A Command Discrete
AP Cmd-B	Autopilot B Command Discrete
AP Flt Dir Only	Flight Director/Autopilot Status
AP Heading Select Mode	Autopilot Heading Select Mode Engaged Discrete
AP Level Change Mode	Autopilot Level Change Mode Active
AP LNAV Mode	Autopilot LNAV Mode Engaged Discrete
AP VNAV Mode	Autopilot VNAV Mode Engaged Discrete
Approach Disp Mode-L	Captain's Side Approach Mode Display Discrete
Approach Disp Mode-R	First Officer's Side Approach Mode Display Discrete
AT Armed	Autothrottle Armed Discrete
AT Engaged	Autothrottle Engaged Discrete
Brake Press-L (psi)	Left Main Brake Pressure
Brake Press-R (psi)	Right Main Brake Pressure
DME Dist-L (nm)	Left DME Distance
DME Dist-R (nm)	Right DME Distance
Eng1 N1 (%RPM)	Left Engine N1 Speed (%RPM)
Eng1 TR Dply-EEC	Left Engine Thrust Reverser Deployed Discrete
Eng1 TR In Trans-EEC	Left Engine Thrust Reverser In Transit Discrete
Eng2 N1 (%RPM)	Right Engine N1 Speed (%RPM)
Eng2 TR Dply-EEC	Right Engine Thrust Reverser Deployed Discrete
Eng2 TR In Trans-EEC	Right Engine Thrust Reverser In Transit Discrete
Flap Handle Pos (deg)	Flap Handle Position
Flap TE-L (deg)	Left Flaps Trailing Edge Position
Flap TE-R (deg)	Right Flaps Trailing Edge Position
Flt Dir Pitch-L (deg)	Captain's Flight Director Pitch Position
Flt Dir Pitch-R (deg)	First Officer's Flight Director Pitch Position
Flt Dir Roll-L (deg)	Captain's Flight Director Roll Position
Flt Dir Roll-R (deg)	First Officer's Flight Director Roll Position
Gear WOW	Weight on Wheel Switch Position
Heading-L (deg)	Magnetic Heading
Key VHF-1[a]	VHF #1 Microphone Keyed Discrete
Key VHF-2[a]	VHF #2 Microphone Keyed Discrete
Latitude (deg)[a]	Aircraft Position-Latitude
Longitude (deg)[a]	Aircraft Position-Longitude
Pitch (deg)	Pitch
Roll (deg)	Roll
Spd Brk Armed Light	Speed Brake Armed Light Status
Spd Brk Hndl Pos (deg)	Speed Brake Handle Position
Spoiler Grnd-Spd Brk	Ground Spoiler/Speed Brake Panel Position

[a] Only available in .csv format

Table A-2. Unit abbreviations.

Units Abbreviation	Description
deg	degrees
kts	knots
g	g
discrete	discrete
ft	feet
nm	nautical miles
psi	pounds per square inch

NOTE: For parameters with a unit description of discrete, 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.