

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR23LA150

FLIGHT DATA RECORDER

Specialist's Factual Report

January 17, 2025

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A. ACCIDENT

Location: Ashland, Oregon
Date: April 7, 2023
Time: 1652 Pacific daylight time (PDT)
2352 coordinated universal time (UTC)
Airplane: Compagnie Daher TBM-700, private, N6924G

B. FLIGHT DATA RECORDER SPECIALIST

Specialist: Steven Smith
Mechanical Engineer (Recorder Specialist)
National Transportation Safety Board (NTSB)

C. FEDERAL CARRIAGE REQUIREMENTS

The event aircraft, N6924G, was operating as Title 14 *Code of Federal Regulations* (CFR) Part 91 flight. The event aircraft was manufactured in 2021 and was operating such that it was not required to be equipped with a flight data recorder (FDR).

Although not required by regulation, an FDR was installed and operating at the time of the accident.

D. DETAILS OF THE INVESTIGATION

An FDR group was not convened. The NTSB Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model: L-3 Lightweight Data Recorder (LDR)
Part Number: 1000-1210-11
Recorder Serial Number: 000002054786

1.0 L-3 Lightweight Data Recorder Description

The L-3 LDR is a crash-protected multi-function recorder providing both FDR and cockpit voice recorder (CVR) functions along with provisions for GPS data and video capture. Information is stored in a digital format using solid-state flash memory in an embedded USB drive as the recording medium.

The FDR portion can receive data in the ARINC 429 or ARINC 717 formats and can record a minimum of 25 hours of flight data. This installation was configured to record 40-bit words of digital information at a variable rate in ARINC 429 format. The LDR is designed to be compliant with ED-155 and is certified to FAA TSO-C197.

1.1 L-3 Lightweight Data Recorder Condition

Upon arrival at the laboratory, it was evident that the exterior of the recorder had sustained some heat damage as shown in figure 1. However, the unit was able to mount (connect) to laboratory computers and the parametric data was extracted from the recorder normally, without difficulty.



Figure 1. Top and side view of the L-3 LDR as received by the NTSB Vehicle Recorder Laboratory.

1.2 L-3 Lightweight Data Recorder Data Recording Description

The FDR recording contained approximately 2 hours and 10 minutes of data. The FDR data was recorded in UTC time. The difference between PDT and UTC is 7 hours, or 25,200 seconds. The accident and previous flight have been offset from the recorded time to PDT by subtracting 25,200 seconds. The event flight was the last flight of the recording, and its duration was 34 minutes and 58 seconds. The previous flight before the event flight was also reviewed, and its duration was 30 minutes.

1.2.1 L-3 Lightweight Recorder Engineering Unit 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

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

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 = +, Left Aileron Trailing Edge Down = -, Right Aileron Trailing Edge Up = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +.

1.2.2 Left Gear Up Parameter

There are 3 parameters that identify when the landing gear is in the up configuration: left gear up, right gear up, and nose gear up. An examination of the data revealed that the left gear up parameter was invalid, as the decoded data remained constant for the entire recording. Therefore, left gear up is excluded from this report.

1.3 L-3 Lightweight Recorder Time Correlation

ARINC 429 is an avionics communications protocol and is a technical standard for avionics data bus used on many aircraft. The manufacturer of this aircraft was contacted and informed the NTSB that there were special 40-bit words that record every second that is based on the internal clock system on the recorder. The internal clock system is set by the manufacturer and is not GPS correlated. Each of these special 40-bit words records seconds past Unix Epoch time, which is 0000 UTC on January 1, 1970. The special 40-bit words group the ARINC 429 messages that recorded within the same second and assign a time label. Each new 40-bit word indicates a new second and a new grouping of data.

Correlation of the recorded data from UTC to the event local time, PDT, was established by using the recorded UTC time, and then applying an additional 7 hours offset to change UTC to PDT. For the remainder of this report, all times are referenced in PDT.

E. FIGURES AND TABULAR DATA

Figures 2 to 17 contain FDR data recorded during the event on April 7, 2023. All the parameters listed in table 1 are plotted except parking brake and baro setting. Note: for the entire flight figures, pressure altitude is shown. Radio altitude is shown in the approach and landing figures.

Figures 2 through 10 are data presented from the accident flight from Crater Lake/Klamath Regional Airport (KLMT) Klamath Falls, Oregon, to Ashland Municipal Airport-Sumner Parker Field (S03) Ashland, Oregon.

Figures 2 and 3 are time history plots that present basic parameters for the entire flight and the approach and landing into S03, respectively. Figures 4 and 5 are time history plots of landing gear and other system parameters for the entire flight and approach and landing into S03, respectively. Figures 6 and 7 are time history plots of engine parameters for the entire flight and approach and landing into S03, respectively.

Figures 8 through 10 are graphical overlays generated using Google Earth for the entire accident flight, approach and landing, and the landing into S03. The

weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording. The appearance of the flight track may not be representative of the airplane's actual flight track and may be attributed to the update rate and precision of GPS parameters as well as the software encoding of the GPS input to the device.

Figures 11 through 17 are data presented from the previous flight from Rogue Valley International/Medford Airport (KMFR) Medford, Oregon to KLMT.

Figures 11 and 12 are time history plots that present basic parameters for the entire flight and the approach and landing into KLMT, respectively. Figures 13 and 14 are time history plots of landing gear and other system parameters for the entire flight and approach and landing into KLMT, respectively. Figures 15 and 16 are time history plots of engine parameters for the entire flight and approach and landing into KLMT, respectively.

Figure 17 is a graphical overlay generated using Google Earth for the entire previous flight from KMFR to KLMT. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording. The appearance of the flight track may not be representative of the airplane's actual flight track and may be attributed to the update rate and precision of GPS parameters as well as the software encoding of the GPS input to the device.

The FDR data indicated the following sequence of events:

- **15:27:16 PDT:** The aircraft began takeoff roll on runway 32 at KMFR.
- **15:27:43 PDT:** The autothrottle was engaged. The autopilot remained off the entire flight.
- **15:27:48 PDT:** The weight on wheels (WOW) left main landing gear parameter changed from ground to air. The aircraft departed from KMFR.
- **15:35:54 PDT:** The aircraft reached a maximum pressure altitude of 14,057 feet.
- **15:50:41 PDT:** While descending through 5,800 feet pressure altitude (1,570 feet radio altitude), the autothrottle disconnect was active. Five seconds later, the autothrottle was off.
- **15:54:15 PDT:** While descending through 900 feet radio altitude, angle of attack (AOA) began to increase from 6.84%.
- **15:55:49 PDT:** The aircraft AOA had increased to 78.32% and the stall warning was active.
- **15:55:52 PDT:** The left WOW parameter changed from air to ground. The aircraft began landing rollout on runway 14 at KLMT.

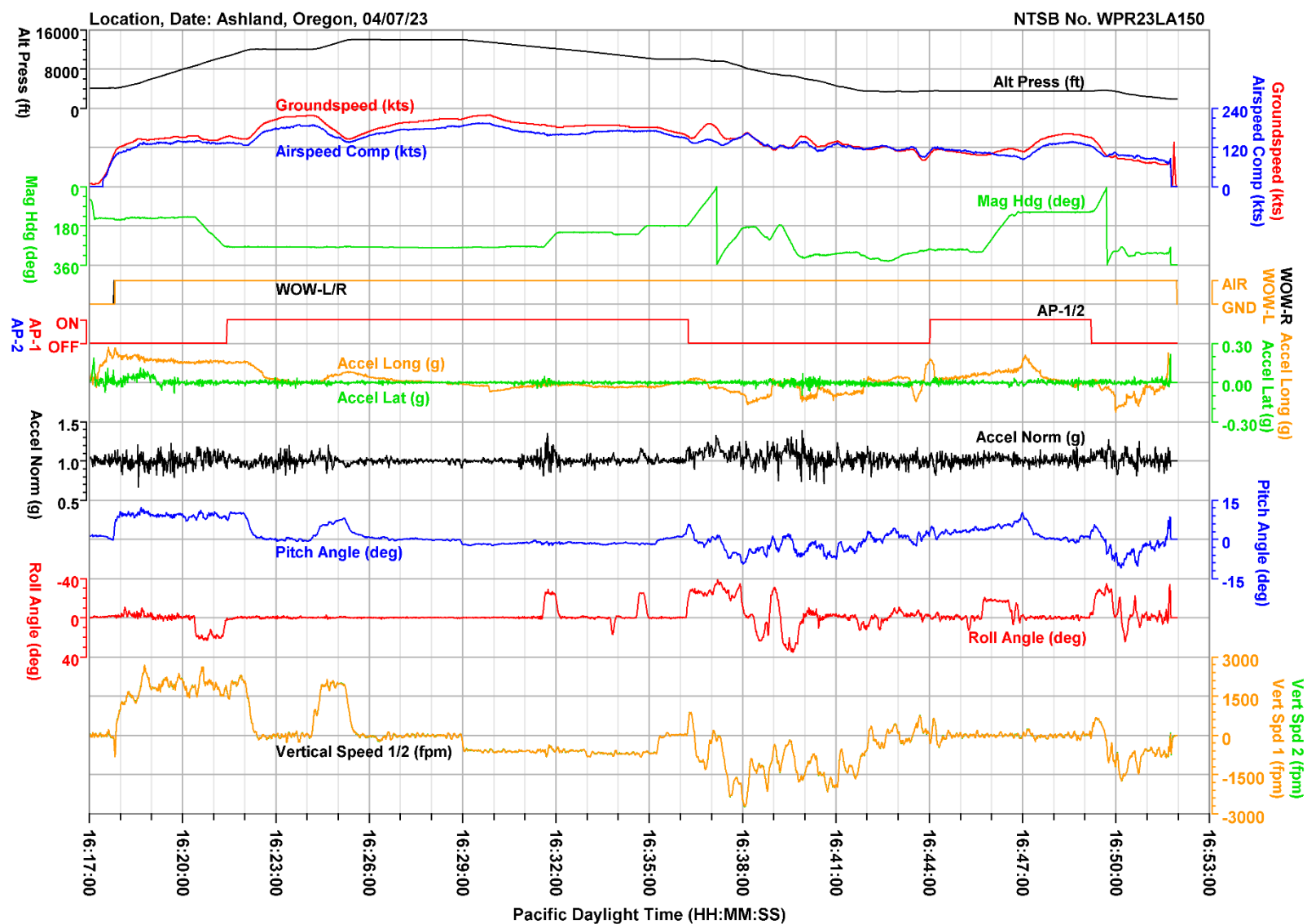
- **15:56:39 PDT:** The aircraft turned right onto taxiway F and proceeded to taxi.
- **16:01:12 PDT:** The parking brake was on.
- **16:10:18 PDT:** The parking brake was off.
- **16:11:28 PDT:** The aircraft groundspeed began to increase. The aircraft began to taxi.
- **16:17:17 PDT:** The aircraft began takeoff roll from runway 14 at KLMT.
- **16:17:48 PDT:** The right WOW parameter changed from ground to air. The aircraft departed from KLMT.
- **16:21:26 PDT:** Autopilots 1 and 2 were on.
- **16:22:22 PDT:** The aircraft leveled off at around 12,076 feet pressure altitude.
- **16:23:20 PDT:** The ice detection warning was active for 5 seconds.
- **16:24:10 PDT:** The aircraft started a climb.
- **16:25:36 PDT:** The aircraft leveled off at around 14,065 feet pressure altitude.
- **16:28:57 PDT:** The aircraft began to descend from 14,000 feet pressure altitude.
- **16:32:00 PDT:** While descending through 12,200 feet pressure altitude, the ice detection warning became active.
- **16:32:07 PDT:** The ice detection warning was no longer active.
- **16:36:11 PDT:** The autopilot amber alerts were active.
- **16:36:16 PDT:** The autopilot amber alerts were no longer active, and the autopilots were off.
- **16:42:00 PDT:** The aircraft leveled at around 3,500 feet pressure altitude.
- **16:43:06 PDT:** The barometric setting was changed to 29.94 inches of Mercury.
- **16:43:29 PDT:** The gear unsafe warning was active.
- **16:43:55 PDT:** The gear unsafe warning was no longer active.
- **16:44:02 PDT:** Autopilots 1 and 2 were on.
- **16:44:18 PDT:** AOA began to increase from 7.03%.
- **16:45:25 PDT:** The gear down parameter changed from "UP" to "DOWN", consistent with the landing gear not in the up and locked position.
- **16:45:28 PDT:** The gear unsafe warning was active.
- **16:47:01 PDT:** AOA reached a maximum of 73.05% before reducing.
- **16:47:20 PDT:** The left main landing gear was down and locked.

- **16:47:37 PDT:** The right main landing gear was down and locked.
- **16:48:23 PDT:** The nose gear was down and locked. The gear unsafe warning was no longer active.
- **16:49:08 PDT:** The autopilot amber alerts were active.
- **16:49:13 PDT:** The aircraft radio altitude was 1,331 feet. The autopilot amber alerts were no longer active, and the autopilots were off.
- **16:50:05 PDT:** The aircraft was descending and at a radio altitude of 1,169 feet and an airspeed of 96 knots. The aircraft AOA began to increase from 6.84%.
- **16:51:39 PDT:** The aircraft radio altitude was 48 feet and the computed airspeed was 75 knots. AOA was 75.78% and the stall warning was active.
- **16:51:41 PDT:** The aircraft airspeed was 70 knots. AOA was 90.63% and the stall warning was active. The aircraft radio altitude was 32 feet.
- **16:51:42 PDT:** The computed airspeed increased to 76 knots. Radio altitude was 27 feet and descending.
- **16:51:44 PDT:** The computed airspeed increased to 78 knots. Radio altitude was 11 feet and descending.
- **16:51:45 PDT:** The computed airspeed increased to 85 knots. Radio altitude was 2 feet and descending.
- **16:51:47 PDT:** Radio altitude was 0 feet.
- **16:51:58 PDT:** The last recorded FDR data point. The aircraft computed airspeed and groundspeed were 0 knots. The left WOW parameter was ground, while the right WOW parameter was air. The last recorded data point is approximately 16 feet away from the reported wreckage location.

The corresponding tabular data used to create figures 2 to 17 are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

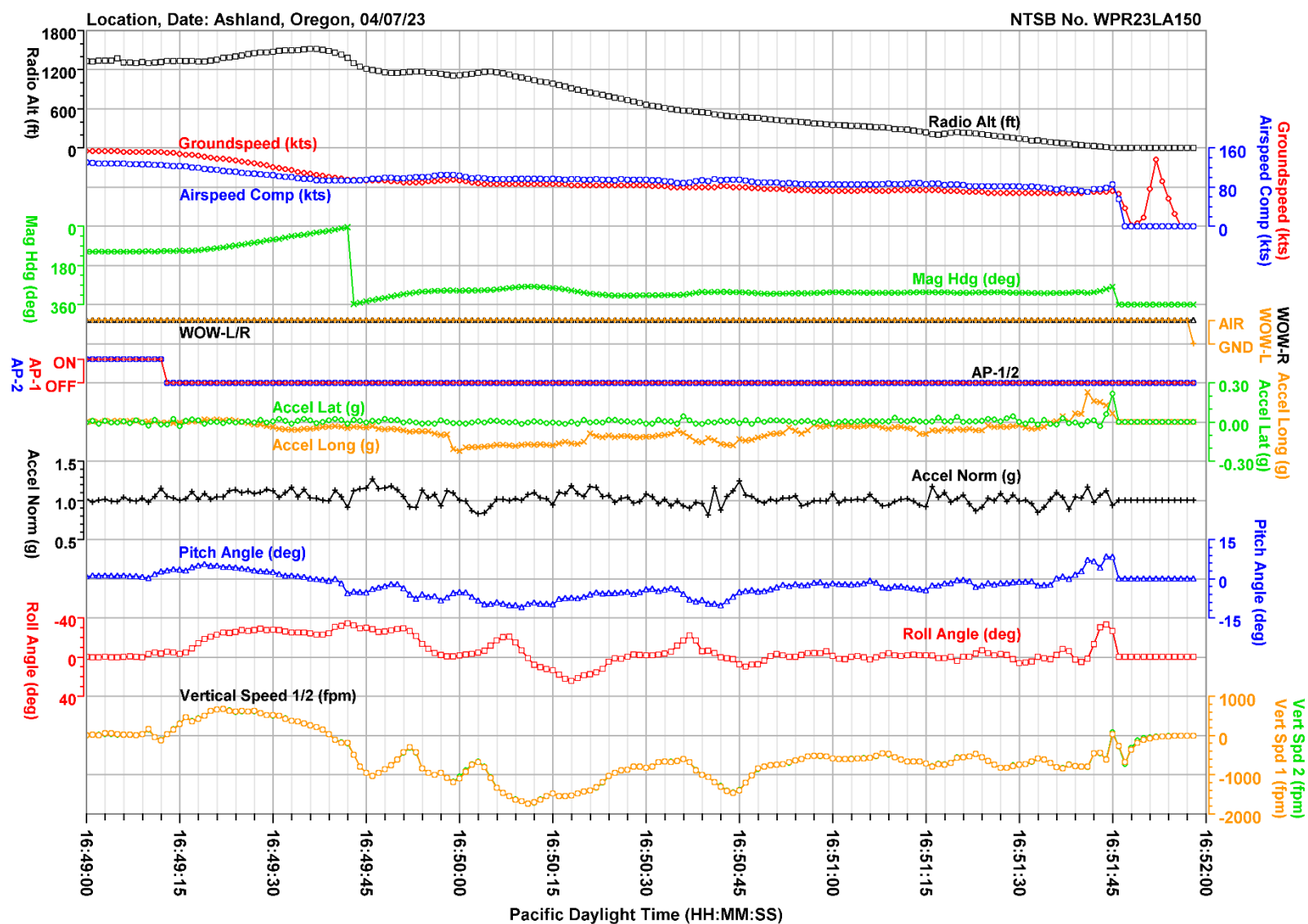
Submitted by:

Steven Smith
Mechanical Engineer (Recorder Specialist)



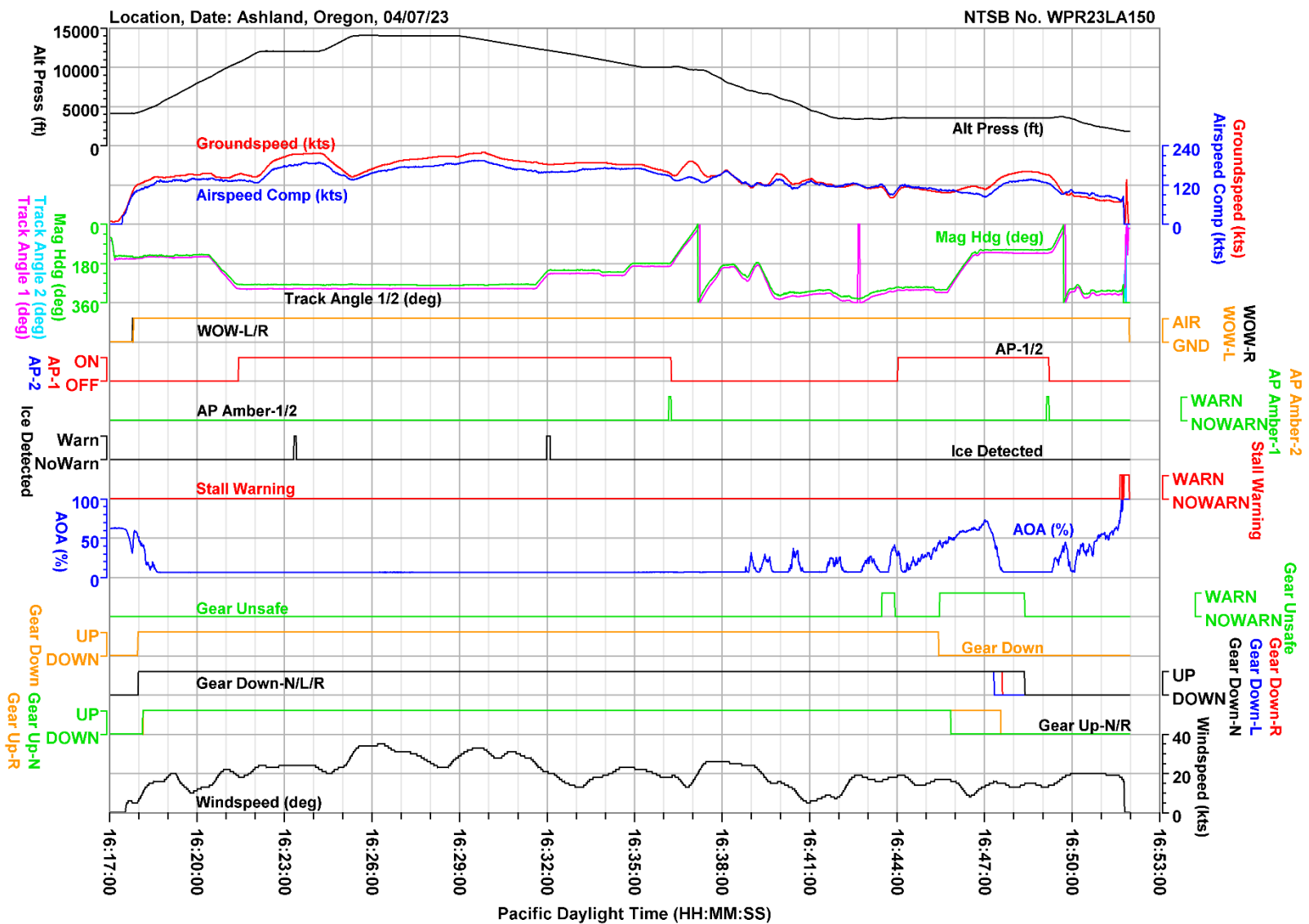
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Figure 2. Time history plot of basic parameters for the entire flight from KLMT to S03.



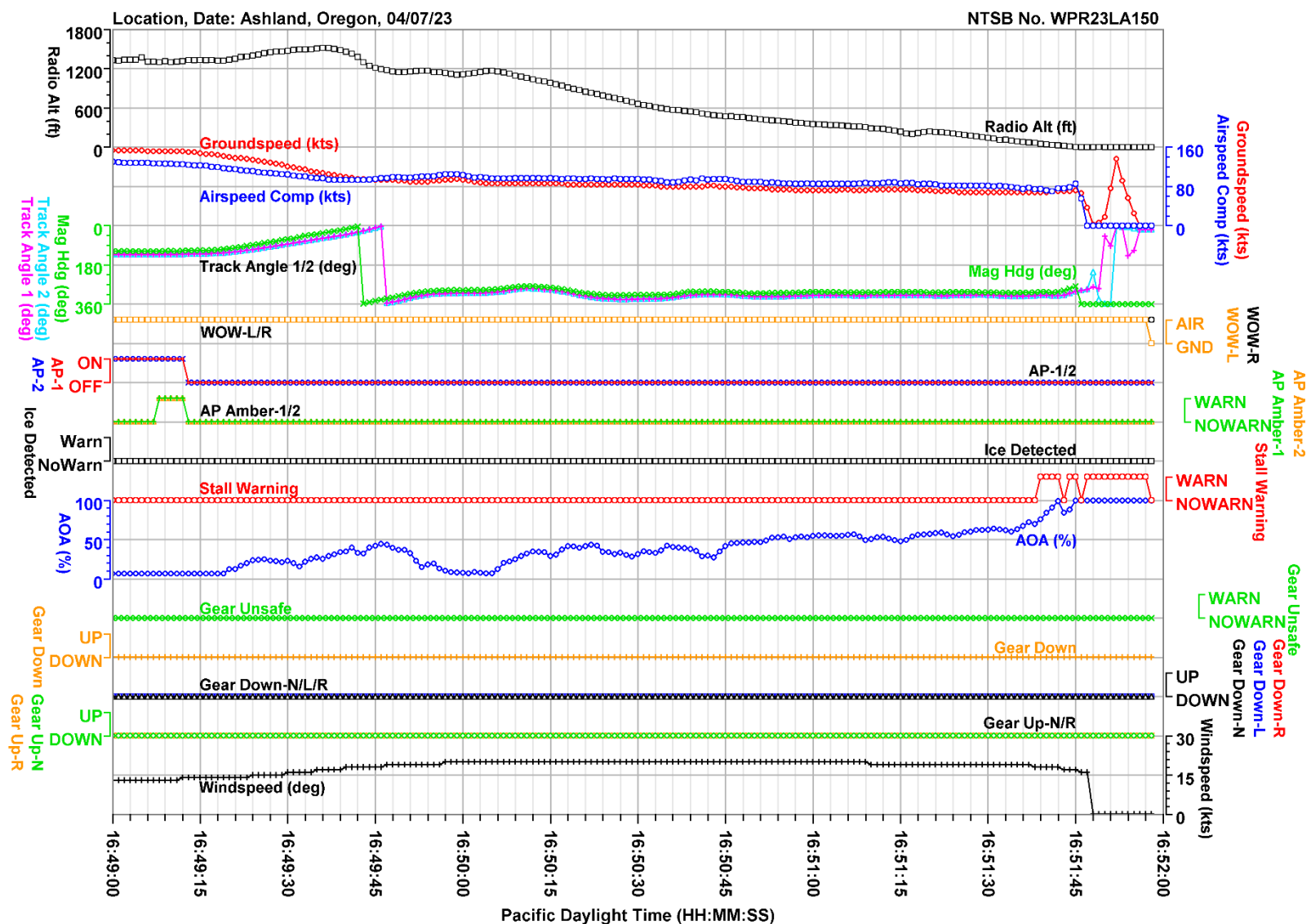
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Figure 3. Time history plot of basic parameters for the approach and landing into S03.



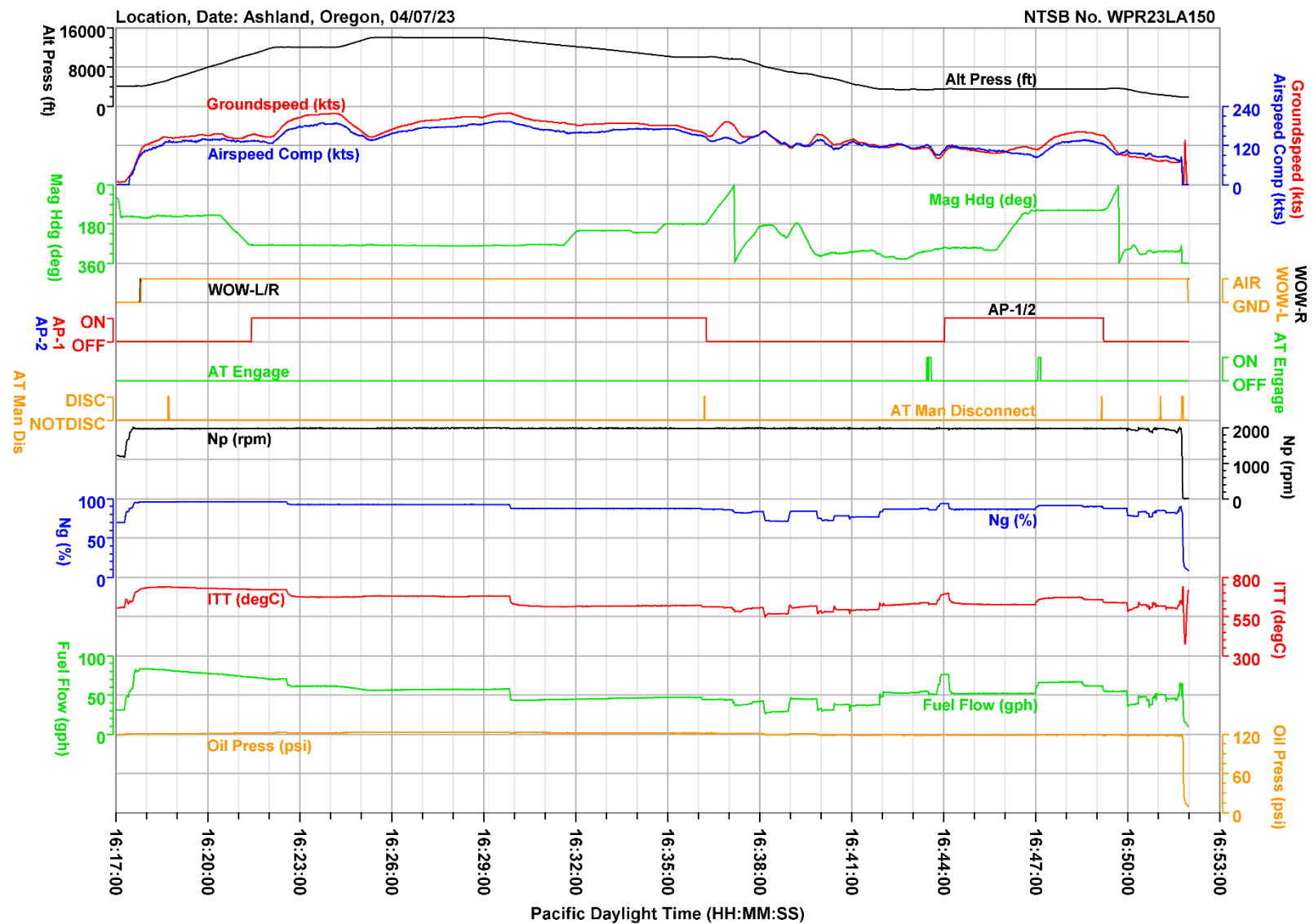
National Transportation Safety Board

Figure 4. Time history plot of gear and other systems for the entire flight from KLMT to S03.



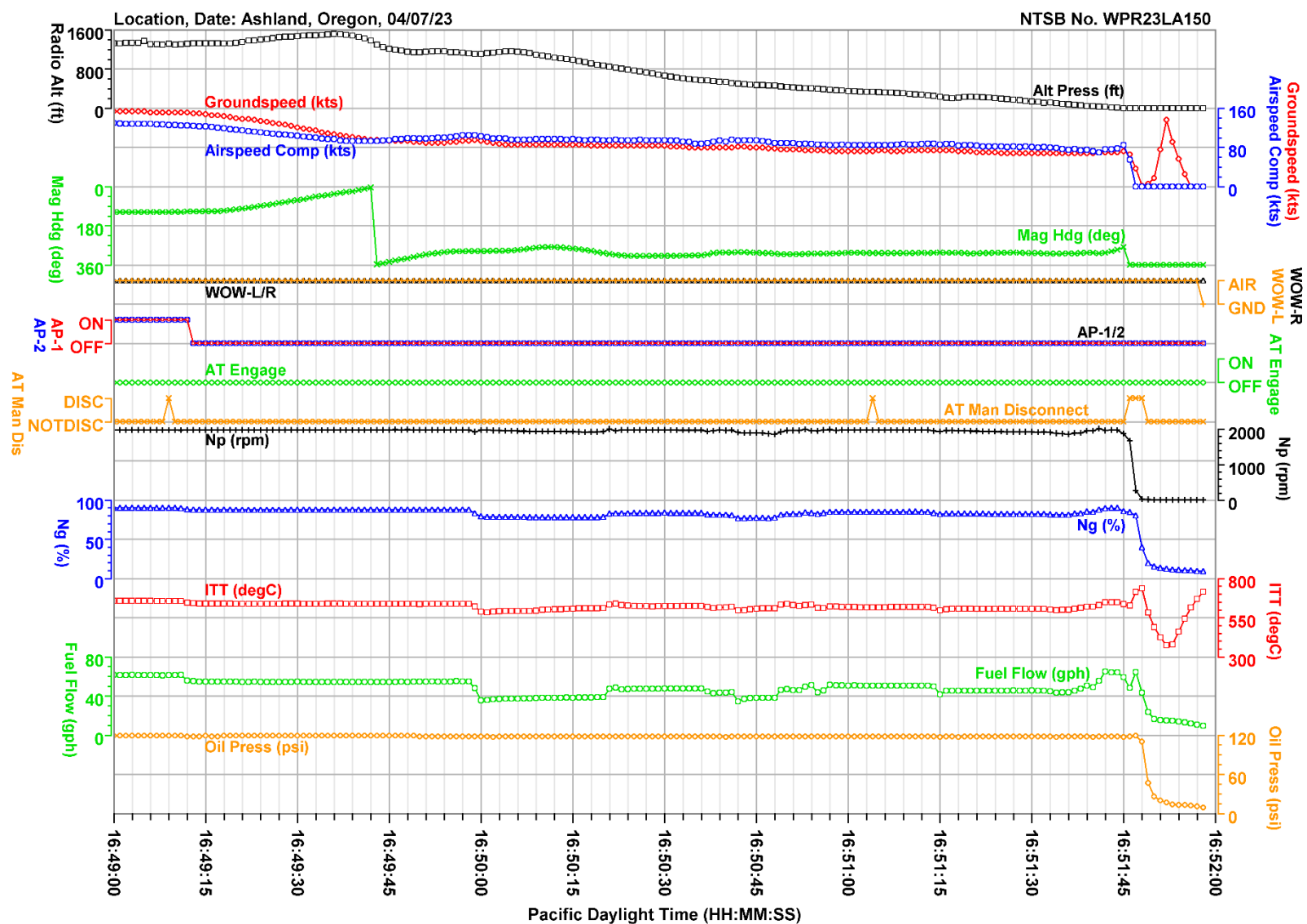
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Figure 5. Time history plot of landing gear and other systems for the approach and landing into S03.



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Figure 6. Time history plot of engine parameters for the entire flight from KLMT to S03.



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Figure 7. Time history plot of engine parameters for the approach and landing into S03.

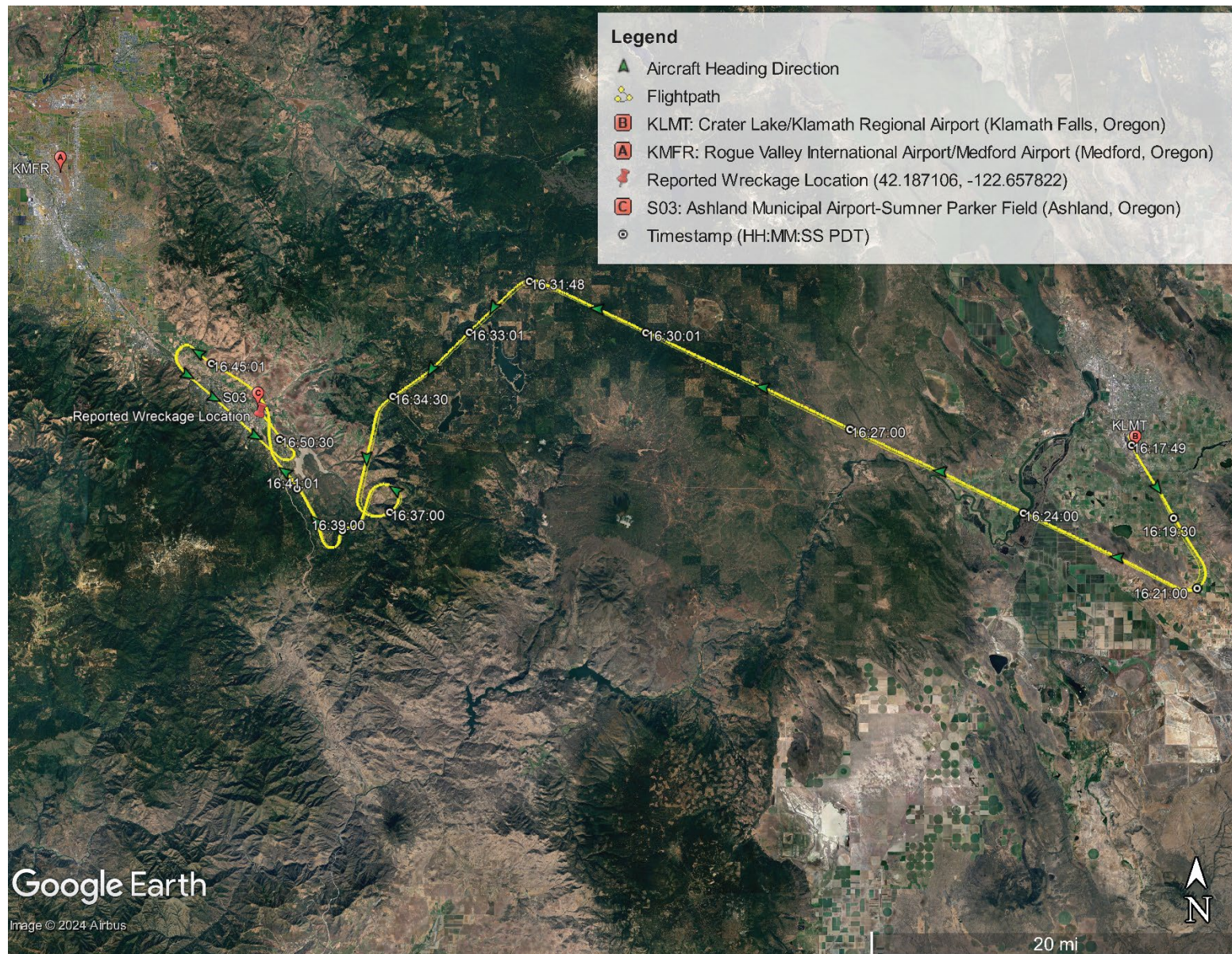


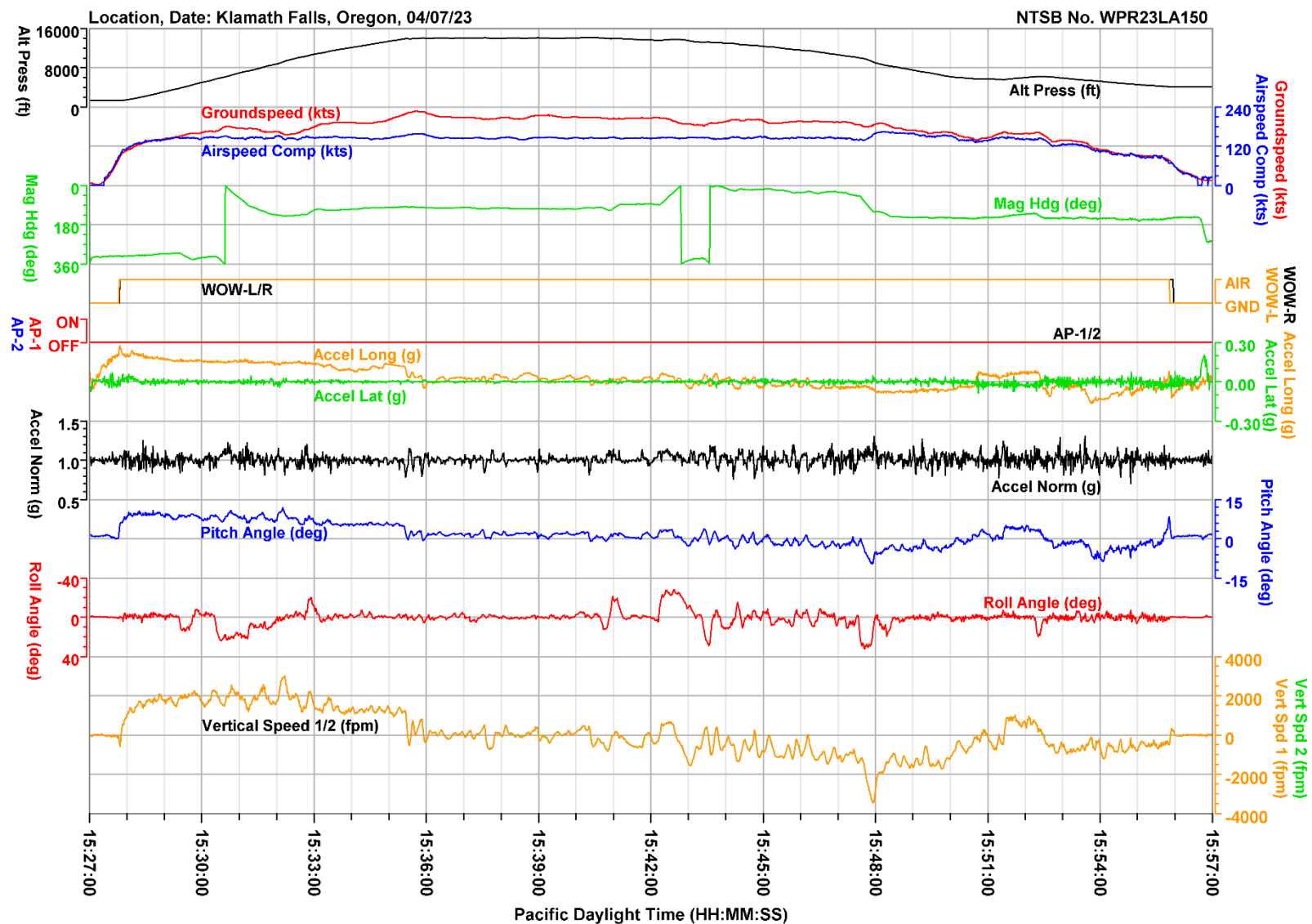
Figure 8. Google Earth overlay of the entire flight from KLMT to S03.



Figure 9. Google Earth overlay of the approach and landing into S03.

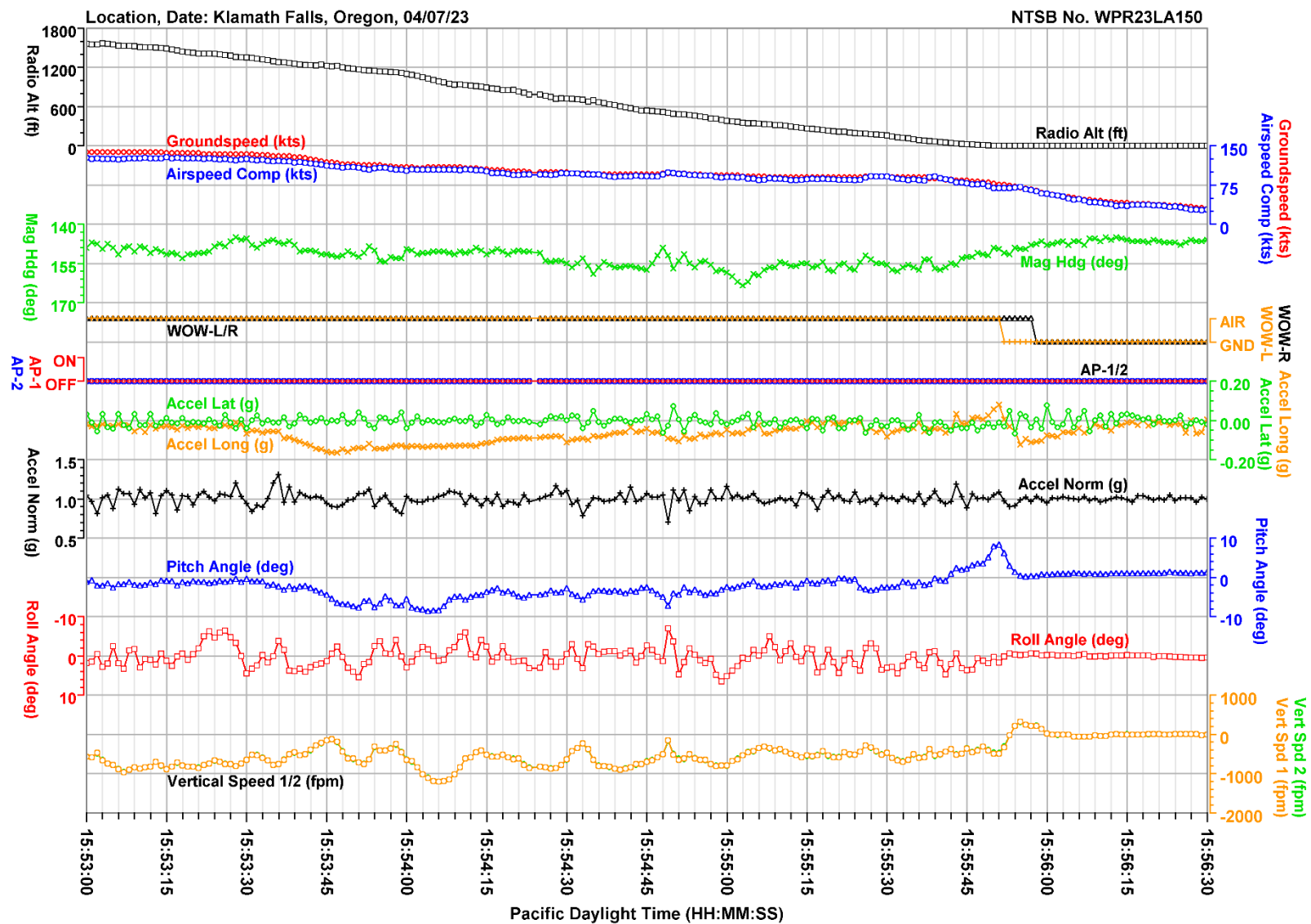


Figure 10. Google Earth overlay of the landing at S03.



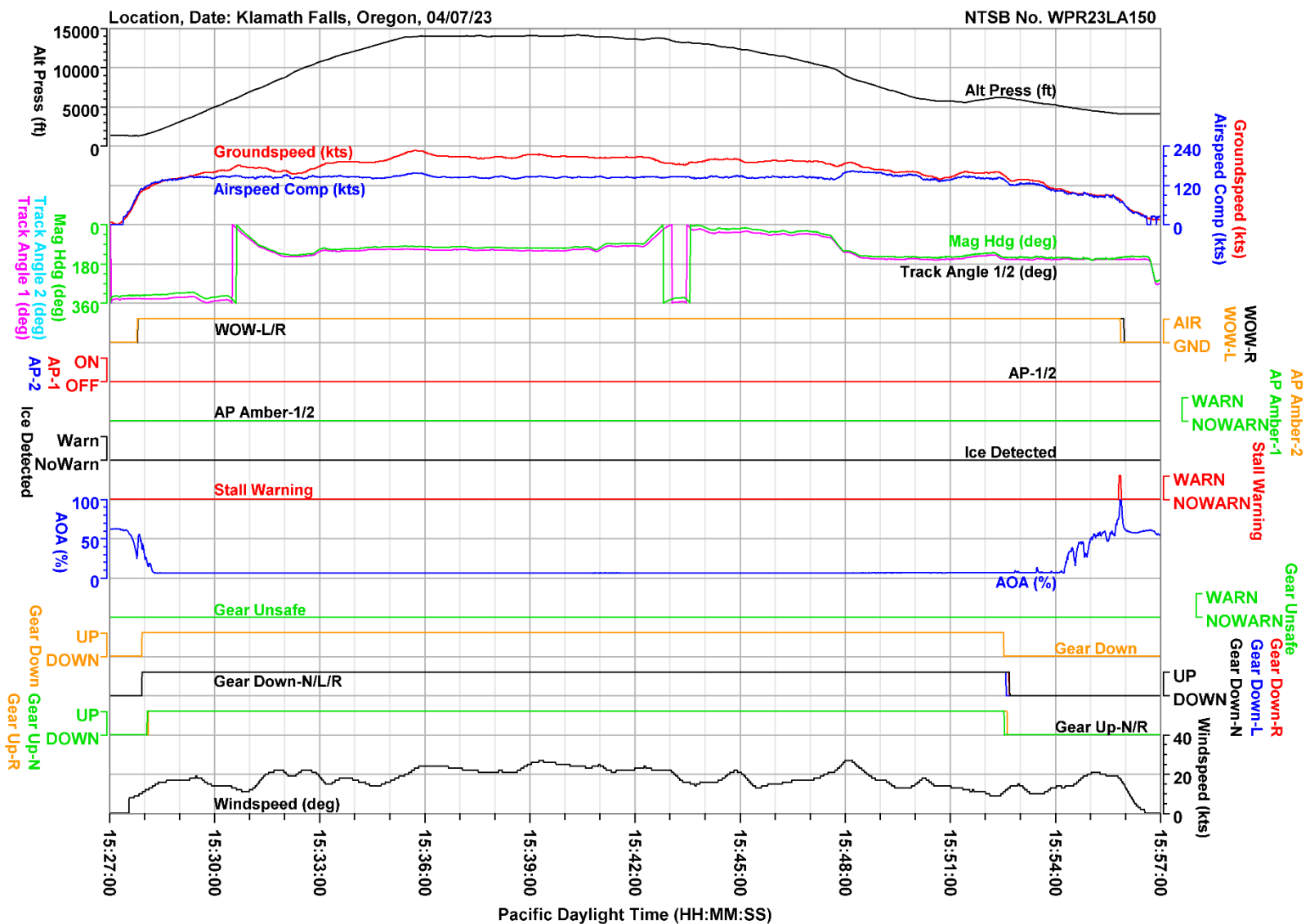
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Figure 11. Time history plot of basic parameters for the entire flight from KMFR to KLMT.



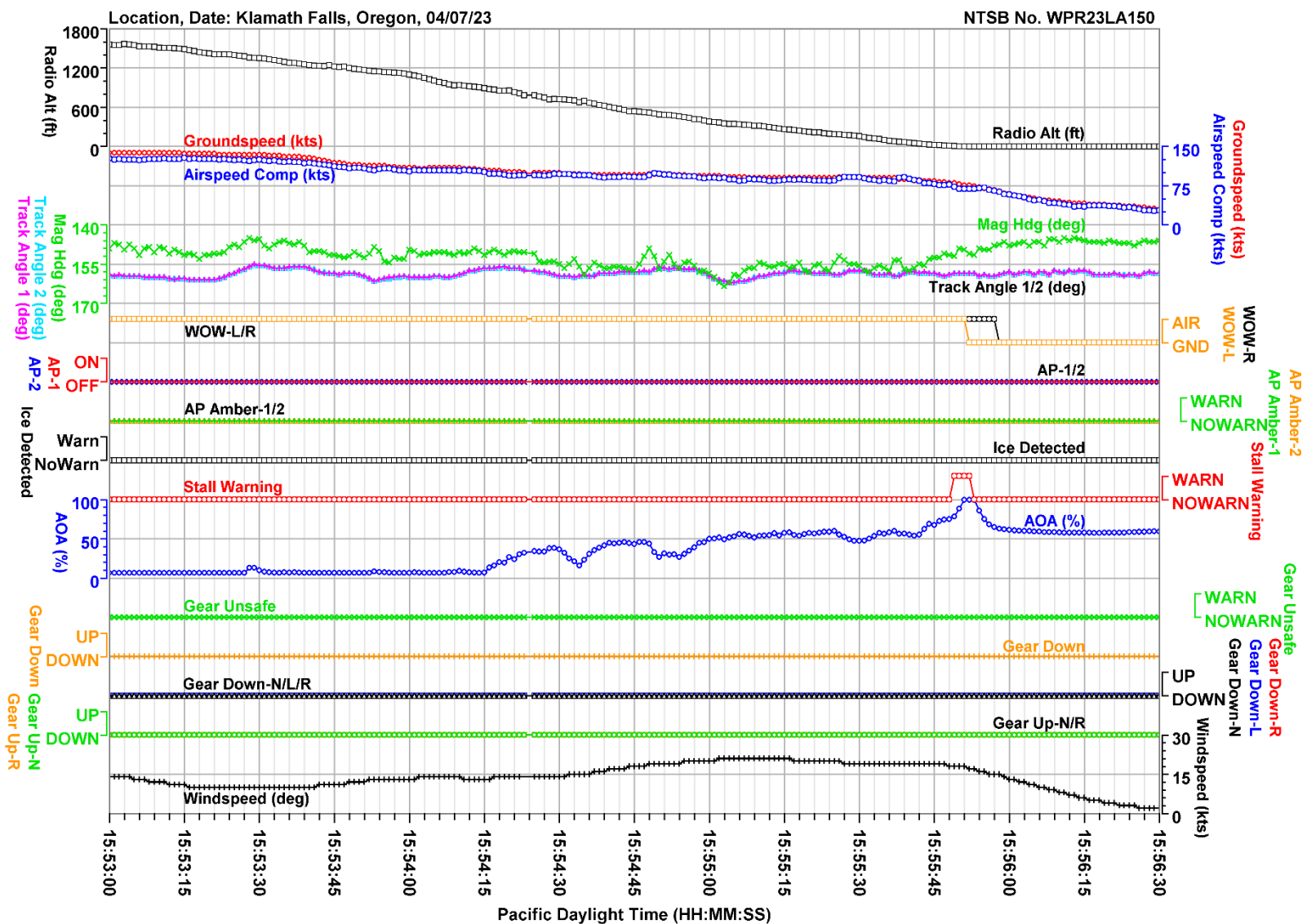
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Figure 12. Time history plot of basic parameters for the approach and landing into KLMT.



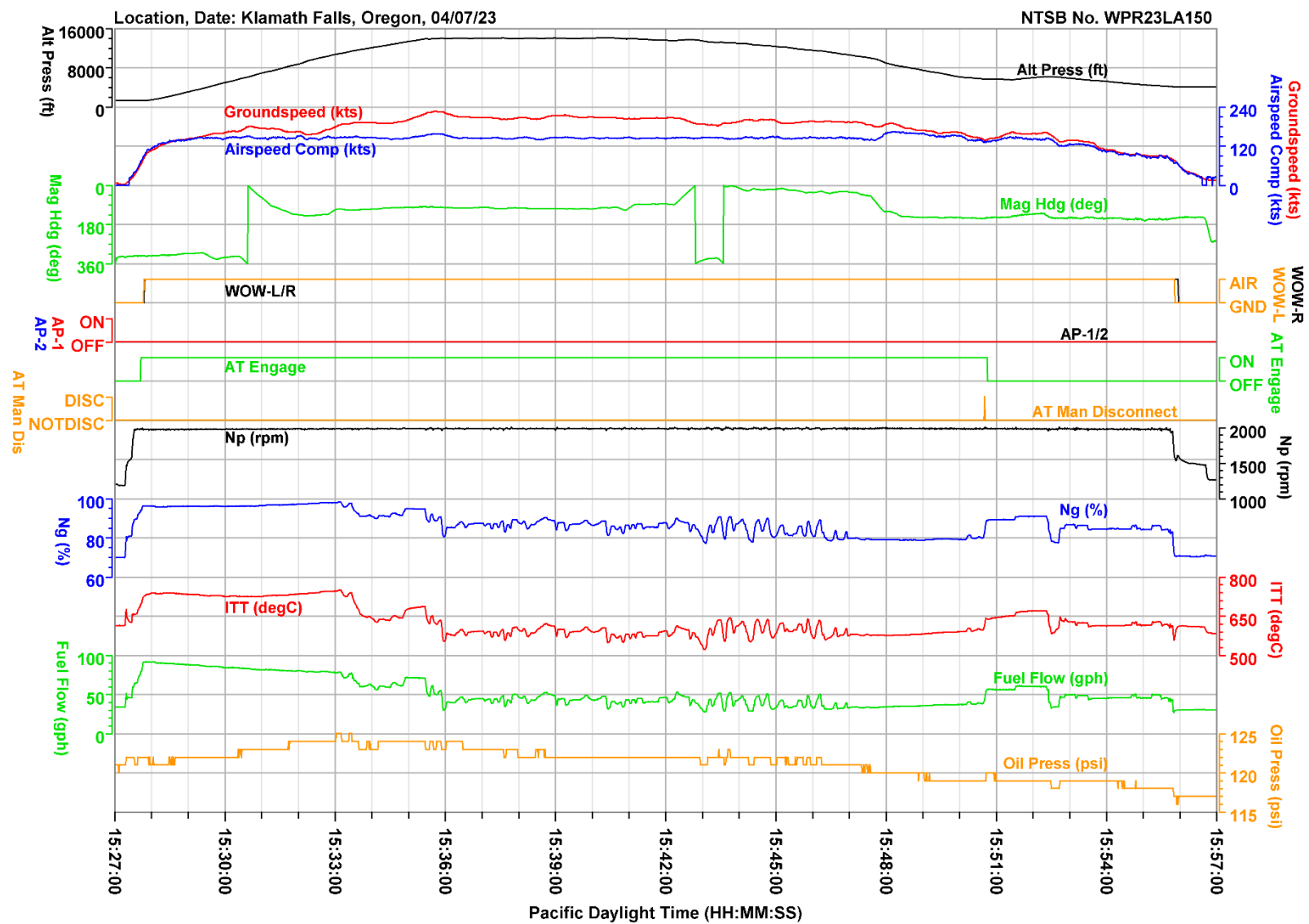
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Figure 13. Time history plot of landing gear and other systems for the entire flight from KMFR to KLMT.



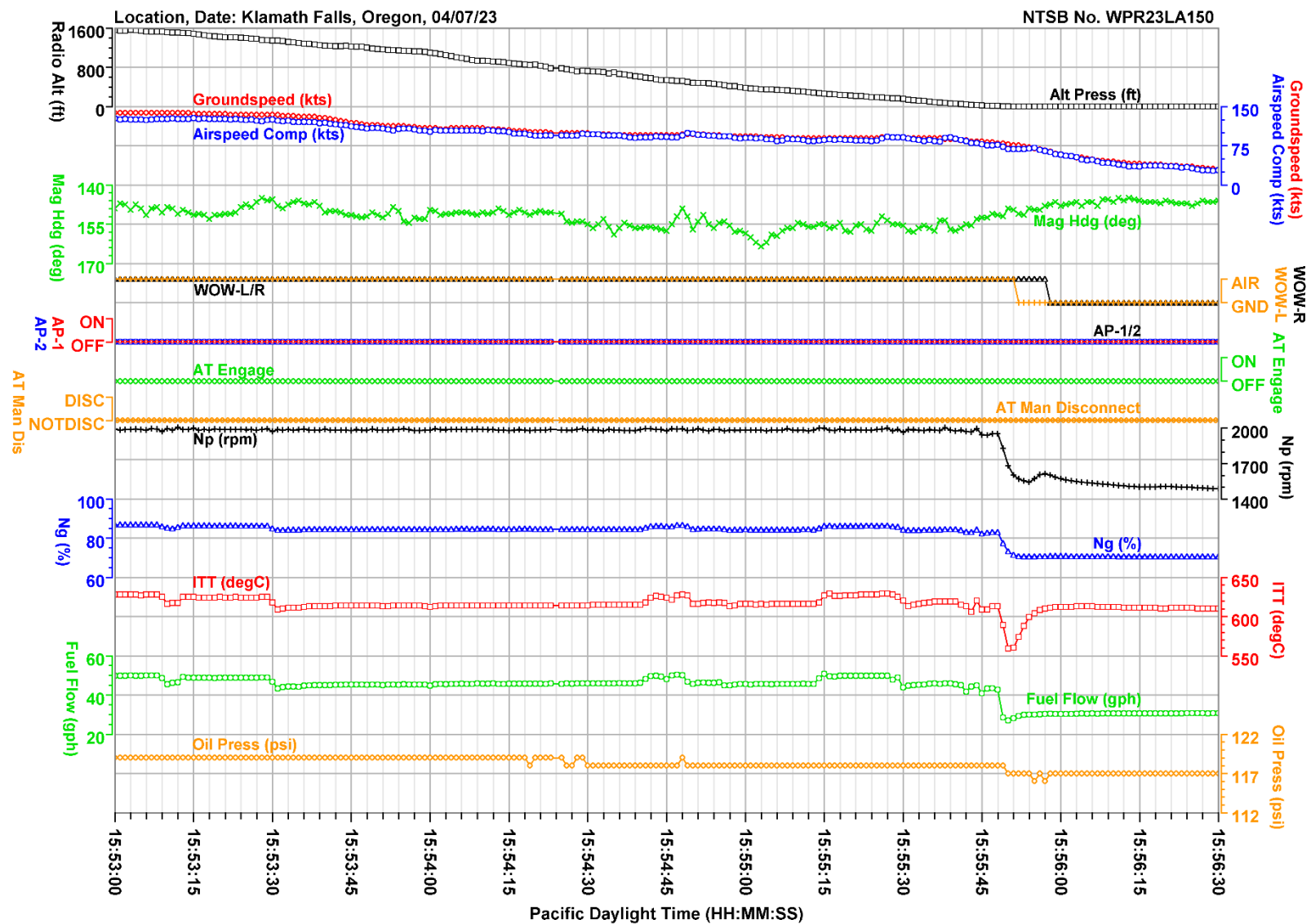
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Figure 14. Time history plot of landing gear and other systems for the approach and landing into KLMT.



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Figure 15. Time history plot of engine parameters for the entire flight from KMFR to KLMT.



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Figure 16. Time history plot of engine parameters for the approach and landing into KLMT.

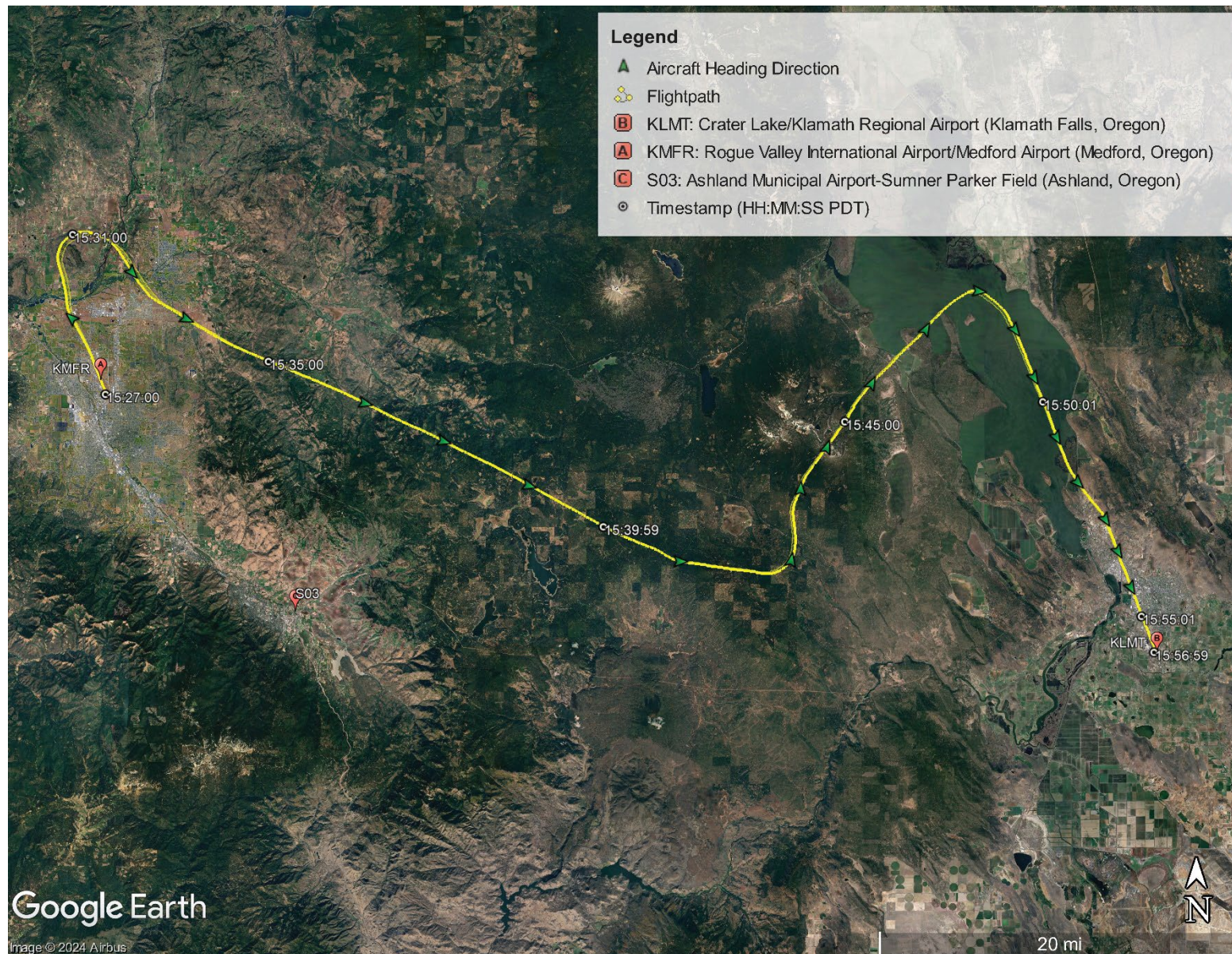


Figure 17. Google Earth overlay of the entire flight from KMFR to KLMT.

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

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

Table 1. Verified and provided FDR parameters

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Load Factor	g
Accel Long	Longitudinal Load Factor	g
Accel Norm	Vertical Load Factor	g
Airspeed Comp	Computed Airspeed	kts
Alt Press	Pressure Altitude	ft
AOA	Angle of Attack	%
AP Amber-1	Autopilot 1 Amber Alert	
AP Amber-2	Autopilot 2 Amber Alert	
AP-1	Autopilot 1 Engaged Status	
AP-2	Autopilot 2 Engaged Status	
AT Engage	Autothrottle Engaged Status	
AT Man Dis	Autothrottle Manual Disconnect	
Baro Setting	Altimeter Barometric Setting	inHg
Fuel Flow	Fuel Flow	gph
Gear Down	Landing Gear Down	
Gear Down-L	Left Landing Gear Down and Locked	
Gear Down-N	Nose Landing Gear Down and Locked	
Gear Down-R	Right Landing Gear Down and Locked	
Gear Unsafe	Landing Gear Unsafe Warning	
Gear Up-N	Nose Landing Gear Up and Locked	
Gear Up-R	Right Landing Gear Up and Locked	
Groundspeed	Groundspeed	kts
Ice Detected	Ice Detection Warning	deg
ITT	Interstage Turbine Temperature	degC
Latitude	Latitude Coordinate	deg
Longitude	Longitude Coordinate	deg
Mag Hdg	Magnetic Heading	deg
Ng	Gas Generator Rotation Speed	%
Np	Propeller Revolutions per Minute	rpm
Oil Press	Oil Pressure	psi
Parking Brake	Parking Brake	
Pitch Angle	Pitch Angle	deg
Radio Alt	Radio Altitude	ft
Roll Angle	Roll Angle	deg
Stall Warning	Stall Warning	
Time UTC-Hr	Coordinated Universal Time Hour	hrs
Time UTC-Min	Coordinated Universal Time Minutes	min
Time UTC-Sec	Coordinated Universal Time Seconds	sec
Track Angle-1	Magnetic Track Angle-1	deg
Track Angle-2	Magnetic Track Angle-1	deg
Vert Spd-1	Vertical Speed-1	fpm

Plot/Table Labels	Parameter Names	Units
Vert Spd-2	Vertical Speed-2	fpm
Windspeed	Windspeed	kts
WOW-L	Weight on Wheels Left Main Landing Gear	
WOW-R	Weight on Wheels Right Main Landing Gear	

Note: This 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 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 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 2. Unit and discrete state abbreviations

Unit and Discrete State Abbreviations	Descriptions
AT	Autothrottle
%	percentage
deg	degrees
degC	degrees Celsius
DISC	Disconnect
fpm	feet per minute
ft	feet
g	unit of gravitation acceleration
gph	gallons per hour
hrs	hours
inHg	inches of Mercury
kts	knots
min	minutes
psi	pounds per square inch
rpm	revolutions per minute
sec	seconds
WOW	Weight on Wheels