

# National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



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## **COCKPIT DISPLAY - RECORDED FLIGHT DATA**

Group Chair's Factual Report

December 1, 2025

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## **A. ACCIDENT**

Location: Nome, AK  
Date: February 6, 2025  
Time: 1520 Local  
Airplane: Textron Aviation 208B, Bering Air Inc, N321BA

## **B. COCKPIT DISPLAY - RECORDED FLIGHT DATA GROUP**

|              |                                                                                                               |
|--------------|---------------------------------------------------------------------------------------------------------------|
| Group Chair  | Christopher Babcock<br>Branch Chief, Vehicle Recorder Division<br>National Transportation Safety Board (NTSB) |
| Group Member | Ernest Hall<br>Sr. Air Safety Investigator<br>Textron Aviation                                                |
| Group Member | Todd Gentry<br>Air Safety Investigator<br>Federal Aviation Administration                                     |
| Group Member | Jeff Zwego<br>Aviation Systems Engineer<br>Garmin International                                               |

## **C. DETAILS OF THE INVESTIGATION**

The NTSB Vehicle Recorder Division received the following electronic devices:

|                              |                                      |
|------------------------------|--------------------------------------|
| Recorder Manufacturer/Model: | Garmin Flight Stream 510 SD card     |
| Part Number:                 | 011-03595-00                         |
| Recorder Serial Number:      | 4020 29x2 <sup>1</sup>               |
| Recorder Manufacturer/Model: | SanDisk 16 GB SDHC card <sup>2</sup> |
| Part Number:                 | NA                                   |
| Recorder Serial Number:      | NA                                   |
| Recorder Manufacturer/Model: | Pratt & Whitney FAST System          |
| Part Number:                 | FAST-A-010-4                         |
| Recorder Serial Number:      | 450208                               |

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<sup>1</sup> The "x" in the serial number represents a digit that was obscured

<sup>2</sup> SDHC cards are Secure Digital High Capacity cards with a maximum storage of between 2 GB and 32 GB

## 1.0 Secure Digital Data Cards Description

The Garmin Flight Stream 510 is a WiFi and Bluetooth enabled card that enables communications between certain avionics and compatible mobile devices operating the Garmin Pilot app. It does not contain recorded flight data.

The Garmin G1000 NXi Integrated Flight Deck is a collection of multiple avionics units which include flight displays, air data computers, attitude/heading reference system (AHRS), communications and other systems. A typical installation includes a primary flight display (PFD) and a multi-function display (MFD). Each display includes two secure digital (SD) card slots, an upper and a lower slot. The lower SD card slot is used by the system for software updates and various databases.<sup>3</sup>

Depending on the installed software, the display unit can include a data logging feature. The data logging feature must be enabled by the aircraft operator. If the data logging feature is available and enabled, an SD card has to be installed in the upper slot of the MFD. Depending on the airframe and engine combination as many as 64 parameters can be stored at a rate of one sample per second (1Hz). According to the manufacturer of the display unit, one flight hour generates approximately 2 megabytes (MB) of data.



**Figure 1.** Garmin Flight Stream 510 (left) and flight data (right) SD cards, as received.

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<sup>3</sup> Databases can include terrain data, obstacle data, SafeTaxi charts, flight charts and airport terrain databases

## 1.1 SanDisk SDHC Data Card Data Recovery

The SanDisk SDHC card installed in the Garmin G1000 NXi was in good condition and the data were downloaded using the manufacturer's procedure.

## 1.2 SanDisk SDHC Data Card Data Description

SD card received stores flight data in individual flight logs. The SD card contained 208 log files dating back to December 16, 2024. The accident/incident flight recording was identified and was approximately 45 minutes.

### 1.2.1 SanDisk SDHC Data Card Engineering Unit Conversions

The flight log data stored in the individual files was converted to engineering units by the display unit.

Appendix A lists the parameters verified and provided in this report.

## 1.3 SanDisk SDHC Data Card Time Correlation

The G1000 NXi SD card records time with the first data sample based on the unit's internal clock. This clock is set and updated by the unit and is based off GPS time and recorded in the local time zone, Alaska Standard Time (AKST) at the time of the accident.

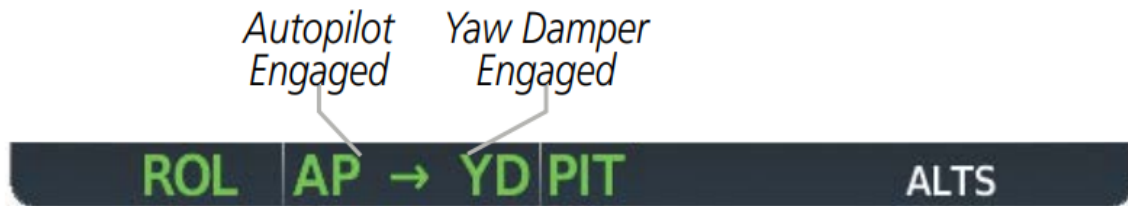
## 1.4 SanDisk SDHC Data Card Automatic Flight Control System (AFCS) Parameter

The log files contained a parameter called AFCSon which records the status of the AFCS at a 1 Hz sample rate. The parameter was configured to record 6 AFCS states on the accident airplane (Table 1).

**Table 1.** Recorded G1000 NXi AFCS states.

| Recorded AFCS States      |
|---------------------------|
| AFCS off                  |
| AFCS on                   |
| AFCS automatic disconnect |
| AFCS normal disconnect    |
| AFCS on, CWS on           |
| AFCS off, CWS on          |

When the AFCS is off, no power is provided to the flight control servos, however, the flight director may still provide visual guidance depending on the modes selected. When the AFCS is on, power is provided to the flight control servos (Figure 2) and a green "AP" is present in the ACFS status box on the PFD.



**Figure 2.** AFCS status box when AFCS and yaw damper are engaged.

When the AFCS is automatically disconnected, the flight control servos are disengaged from the flight controls and a flashing red and white "AP" appears on the AFCS control panel and an aural tone sounds until acknowledged by the pilot (Figure 3). According to the G1000 NXi Pilot Guide, automatic disengagement can occur due to system failure, invalid sensor data, yaw damper failure, stall warning, and flight director faults.<sup>4</sup> In certain cases, the yaw damper will remain active when the AFCS automatically disconnects. According to Garmin, the recorded AFCS state associated with the automatic disconnect remains active until the automatic disconnect is acknowledged by pressing the A/P DISC TRIM INTER button on the yoke, moving the Manual Electric Trim switch, or pressing the AP button on the GMC mode controller which reengages the autopilot.



**Figure 3.** AFCS status box when AFCS is automatically disconnected.

When the AFCS is normally disconnected by the pilot, the flight control servos are disengaged from the flight controls and an amber flashing "AP YD" appears on the AFCS control panel for five seconds or until acknowledged by the pilot (Figure 4). According to Garmin, the recorded AFCS state associated with a normal AFCS disconnect remains active until acknowledged by pressing the A/P DISC TRIM INTER button on the yoke, moving the Manual Electric Trim switch, pressing the AP button on the GMC mode controller which reengages the autopilot, or when the five second period elapses.



**Figure 4.** AFCS status box when AFCS is disengaged using the AP Disc button on the control wheel.

<sup>4</sup> G1000 NXi Pilot's Guide for Cessna Caravan System Software Version 2499.08 or later, Part Number 190-02138-01 Rev C, February 20, 2019.

As confirmed by an avionics bench test, if the autopilot disconnection is acknowledged within the 1 Hz sampling interval of the AFCSON parameter, the recorded AFCSON state will transition directly from "On" to "Off" without transitioning through either the AFCS Automatic Disconnect state or the ACFS Normal Disconnect state.

## 2.0 Pratt & Whitney FAST System Description

The FAST engine health management system captures and wirelessly sends full-flight data after engine shutdown to optimize maintenance planning.

### 2.1 2.0 Pratt & Whitney FAST System Data Recovery

The FAST system was in good condition and the data were downloaded at the manufacturer's facility under FAA supervision.



**Figure 5.** Pratt & Whitney FAST System, as received.

### 2.2 2.0 Pratt & Whitney FAST System Recording Description

The download process produced csv data files for the accident flight and four previous flights beginning at 1608 AKST on February 5, 2025.

#### 2.2.1 2.0 Pratt & Whitney FAST System Engineering Unit Conversions

No conversion was necessary as the recovery process produced csv files containing engineering units. Most of the parameters were duplicative of those recorded on the G1000 NXi, but recorded at a lower sample rate.

## **2.3 2.0 Pratt & Whitney FAST System Time Correlation**

The FAST System csv contains two time parameters. The first is elapsed seconds from midnight on January 1, 2000, in UTC. The second is the elapsed seconds converted into typical day, month, year, hour, minute, second, millisecond format in UTC. This time was converted into local AKST by subtracting 9 hours.

### **D. FIGURES AND TABULAR DATA**

Figure 6 shows the end of the recorded flight data on the SD card compared with the last received ADS-B position reports. The weather, lighting, and sea/ice conditions do not represent the conditions present at the time of the accident. Figures 7-9 show basic, autopilot, and engine data from the entire accident flight. Figure 10-12 show basic, autopilot, and engine data from the last minute of the accident flight. Figures 13-15 show basic, autopilot, and engine data for the previous flight. Figures 16-18 show basic, autopilot, and engine data for the 2<sup>nd</sup> previous flight to the accident flight.

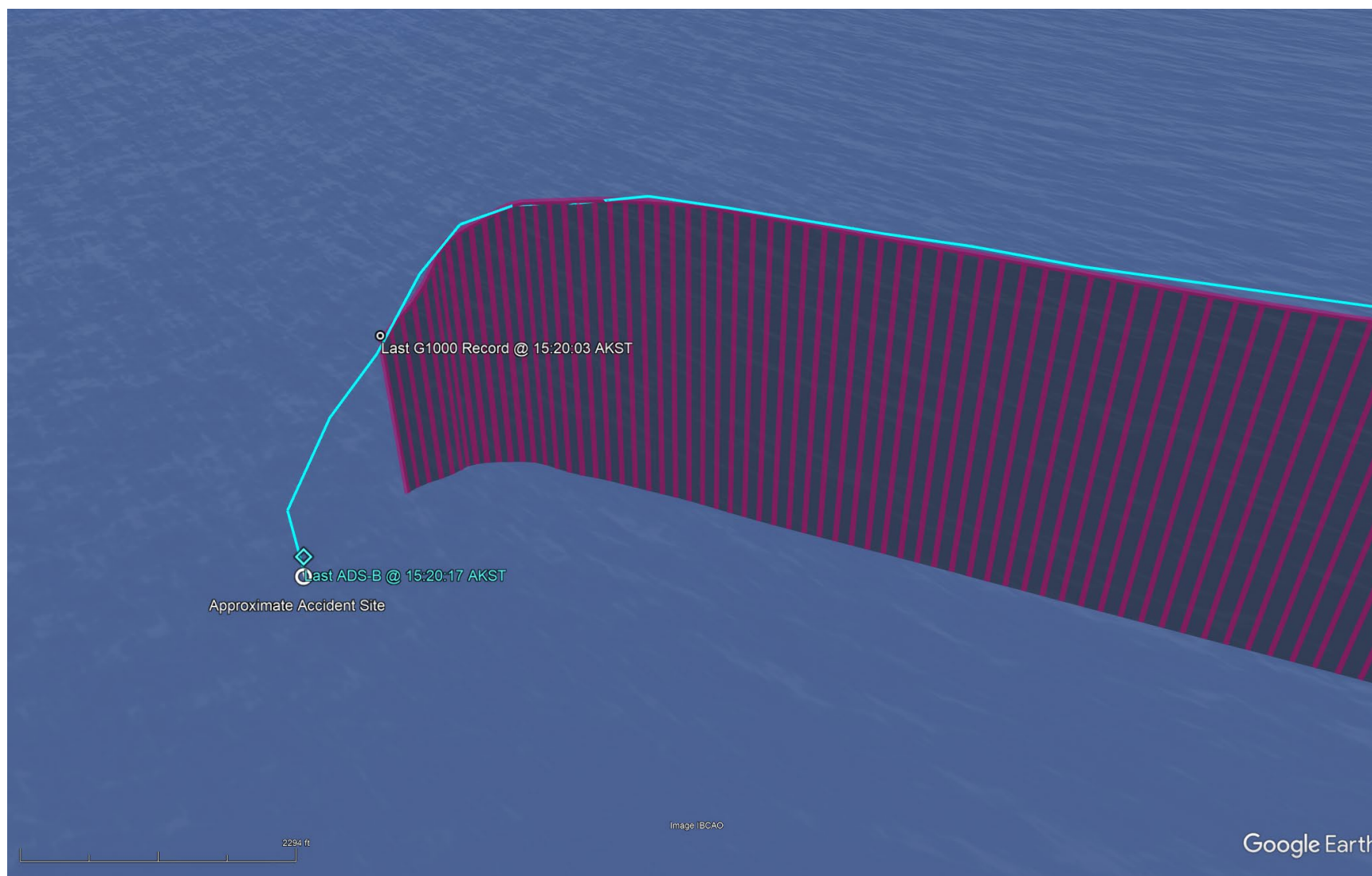
These figures are configured such that right turns are indicated by the trace moving toward the bottom of the page, left turns towards the top of the page, and nose up attitudes towards the top of the page.

The accident flight departed runway 33 at Unalakleet Airport at about 14:37:30 AKST, turned to a northwest heading, and climbed to 7500 feet MSL. The autopilot was engaged at 14:38:58. The aircraft began to descend with the autopilot engaged in vertical speed select mode at about 15:11:30, leveled off briefly at 5500 feet MSL and continued to descend with the autopilot engaged in vertical speed select mode. The aircraft leveled at about 3700 feet at 15:19 and the autopilot remained engaged in altitude hold mode at an indicated airspeed of 118 knots and decreasing. The pitch began to slowly increase from about nose level to about 9 degrees. The power was increased slightly at 15:19:24, but airspeed continued to decrease. At 15:19:36, at 99 knots indicated airspeed, the autopilot discrete switched from on to off. The aircraft entered a series of lateral oscillations and descended. The last recorded G1000 data point at 15:20:30 showed the aircraft at 87 knots ground speed (true airspeed and indicated airspeed had stopped recording 9 seconds prior), 64 degrees left wing down, 30 degrees nose down, about 2100 feet and descending at about 7800 feet per minute.

The corresponding tabular data used to create Figures 7 to 18 are provided in electronic comma-separated value (CSV) format as attachment 1 to this report. Attachment 2 contains FAST data for the accident flight.

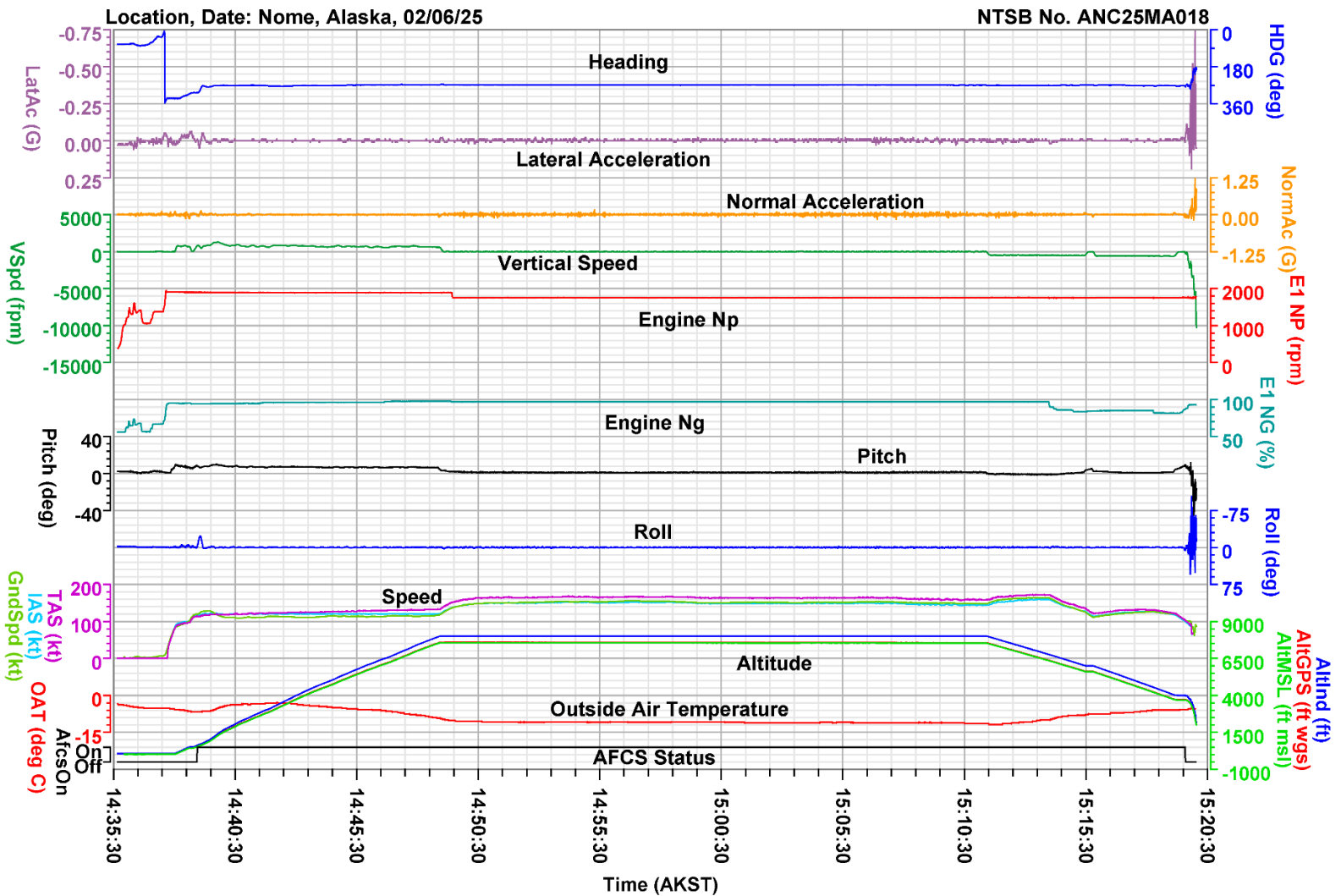
Submitted by:

Christopher Babcock  
Branch Chief, Vehicle Recorder Division



**Figure 6.** End of G1000 data at 15:20:03 and last received ADS-B position report at 15:20:17 AKST.

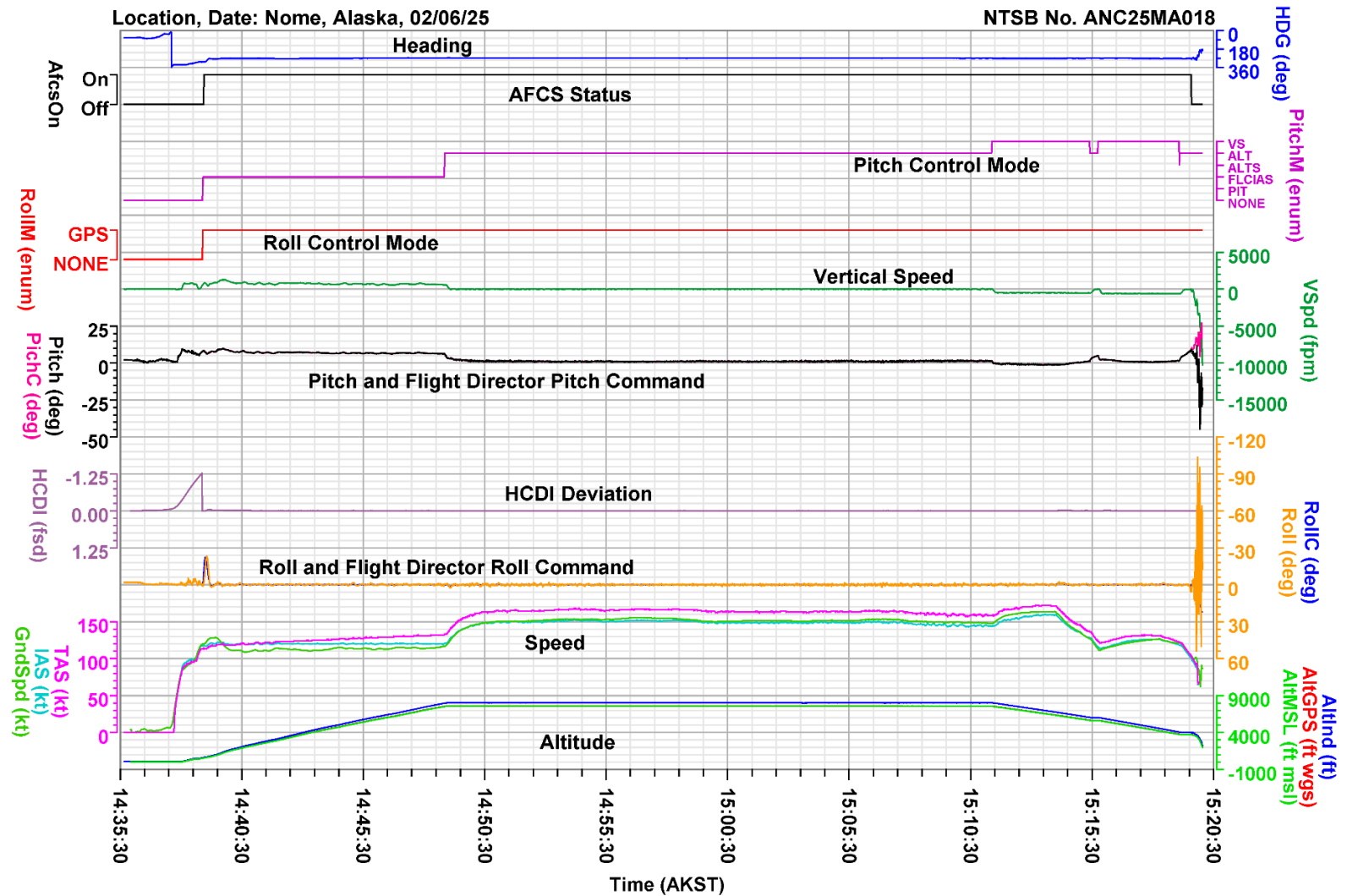
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**Figure 7.** Basic flight data for entire accident flight.

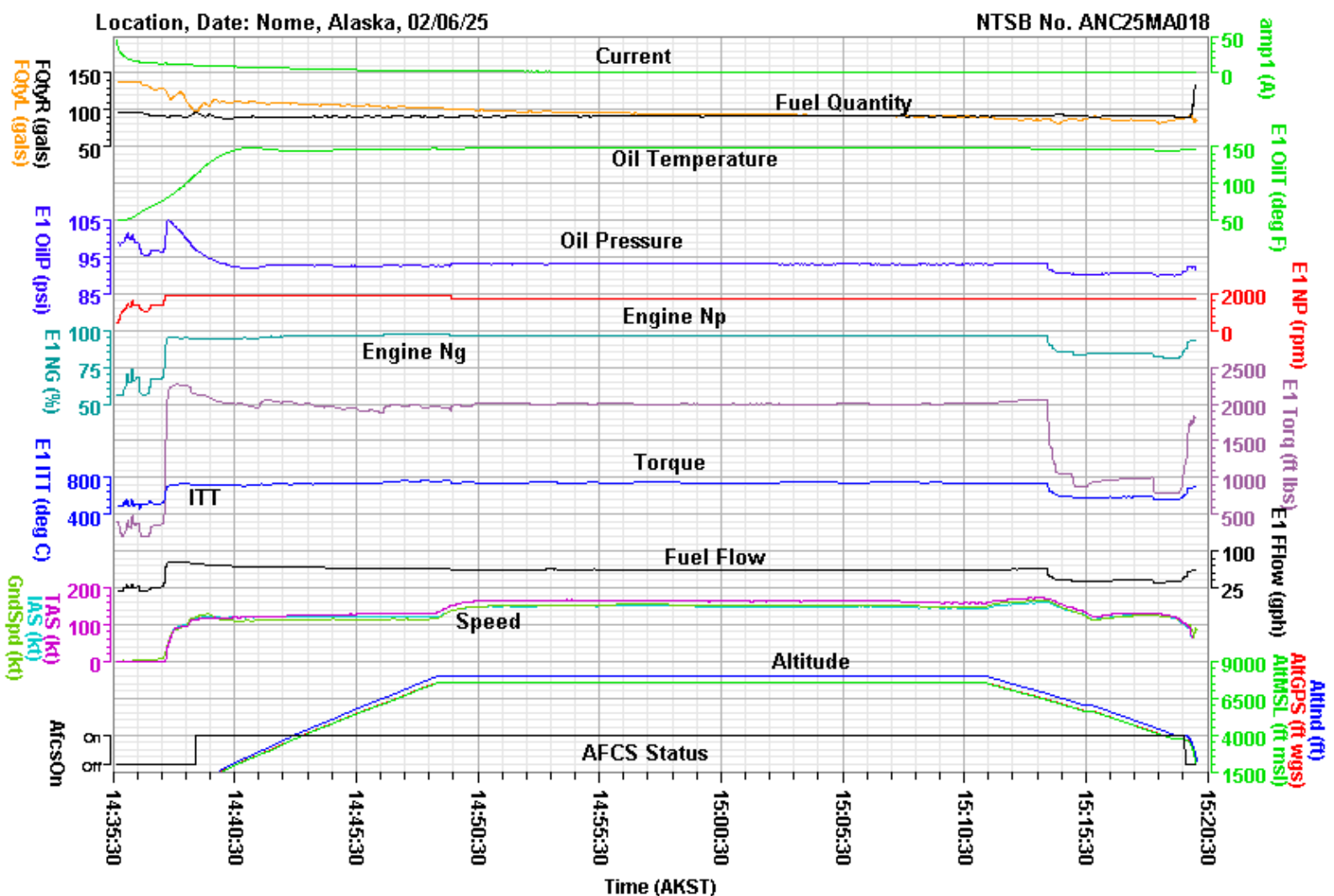
# Bering Air, Textron Aviation Inc 208B, N321BA



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**Figure 8.** Autopilot data for entire accident flight.

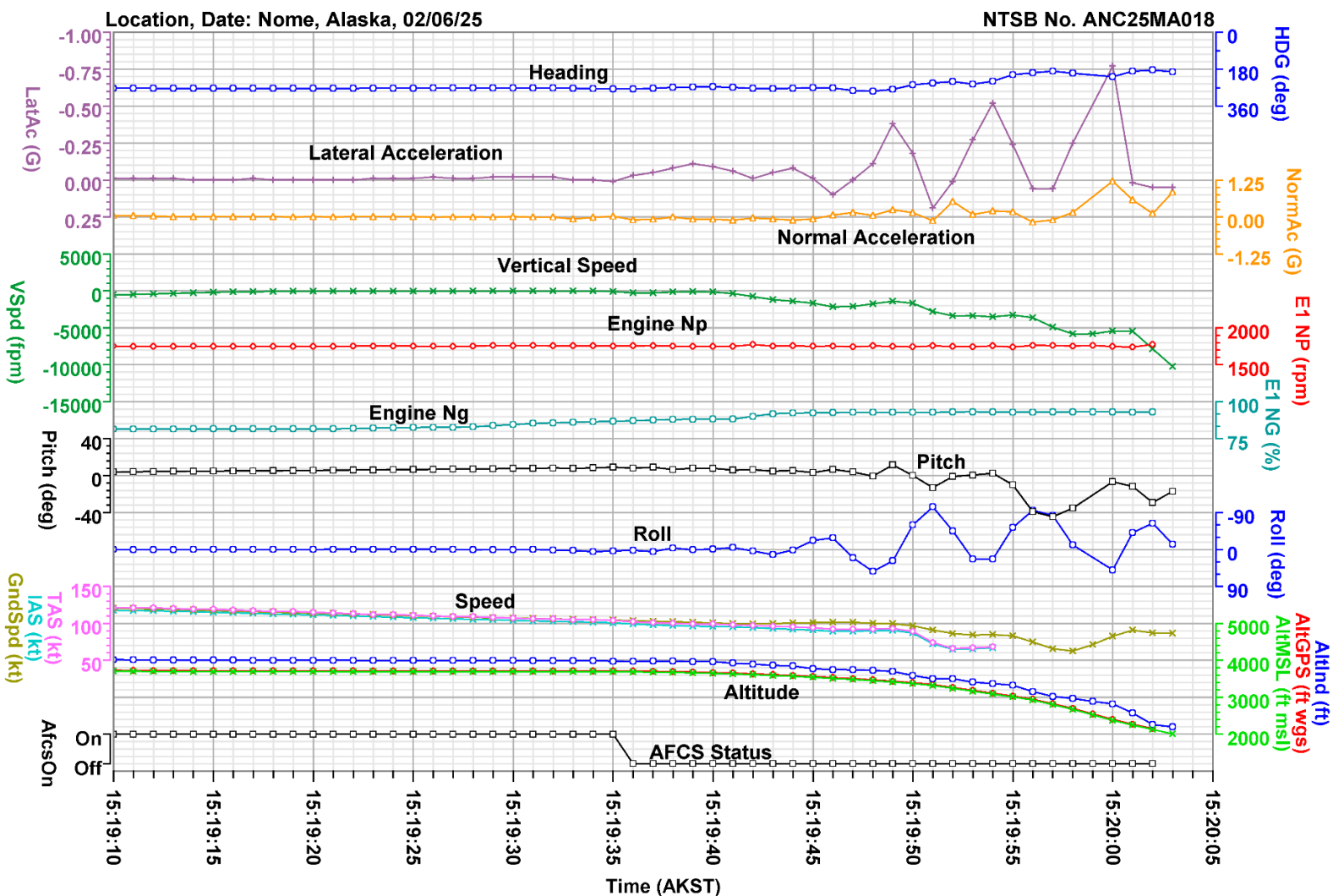
# Bering Air, Textron Aviation Inc 208B, N321BA



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**Figure 9.** Engine data for entire accident flight.

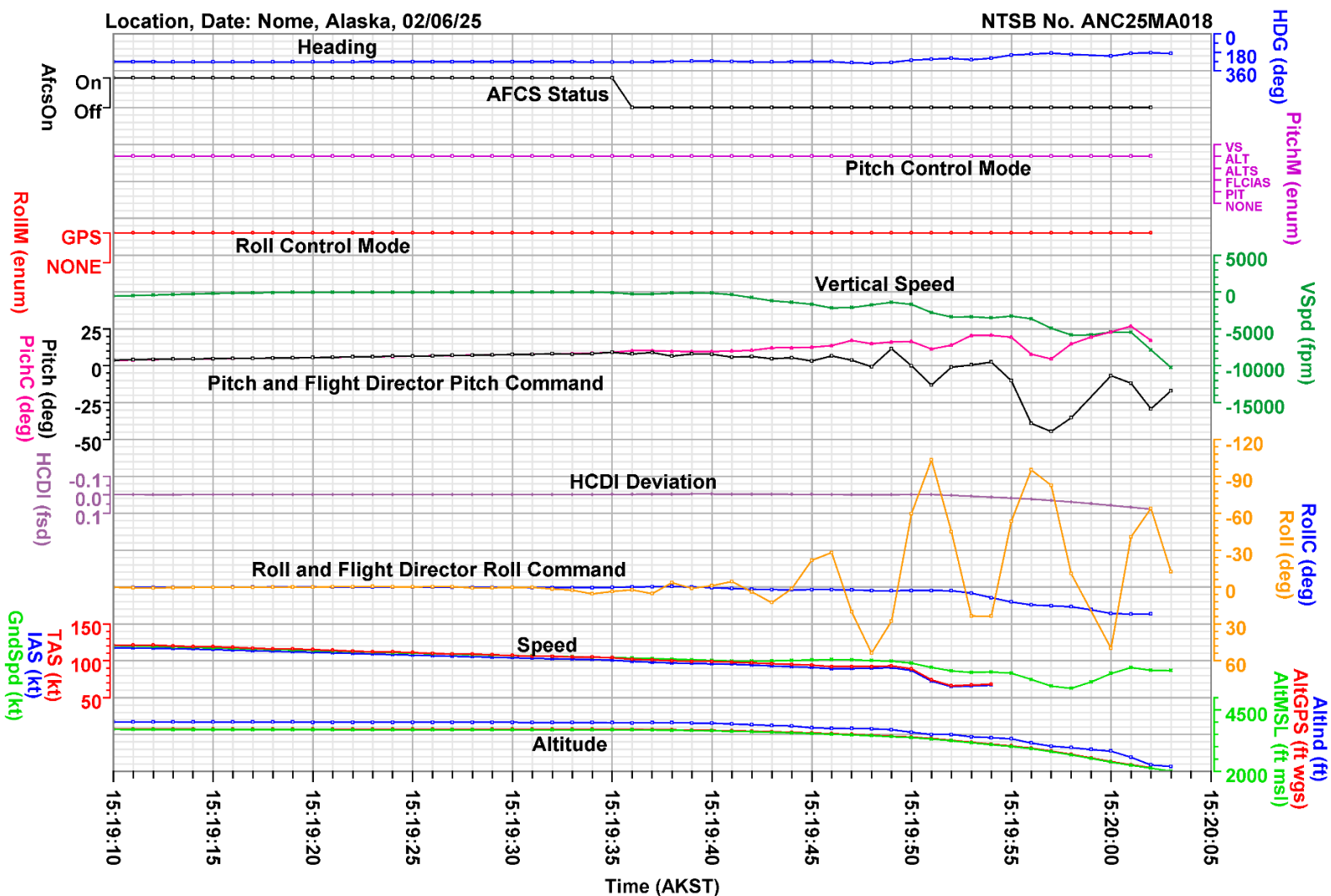
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**Figure 10.** Basic flight data for last minute of accident flight.

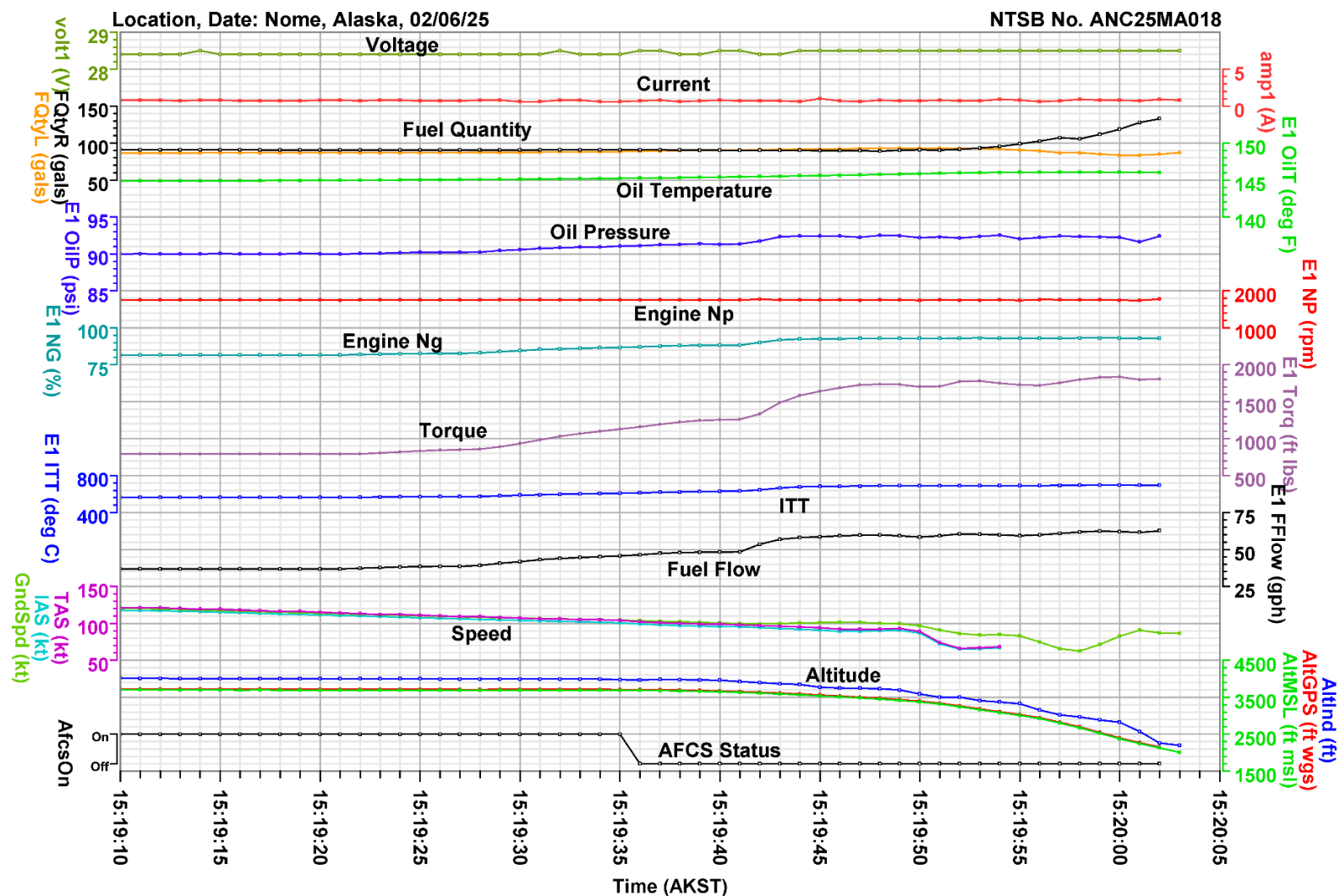
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**Figure 11.** Autopilot data for last minute of accident flight.

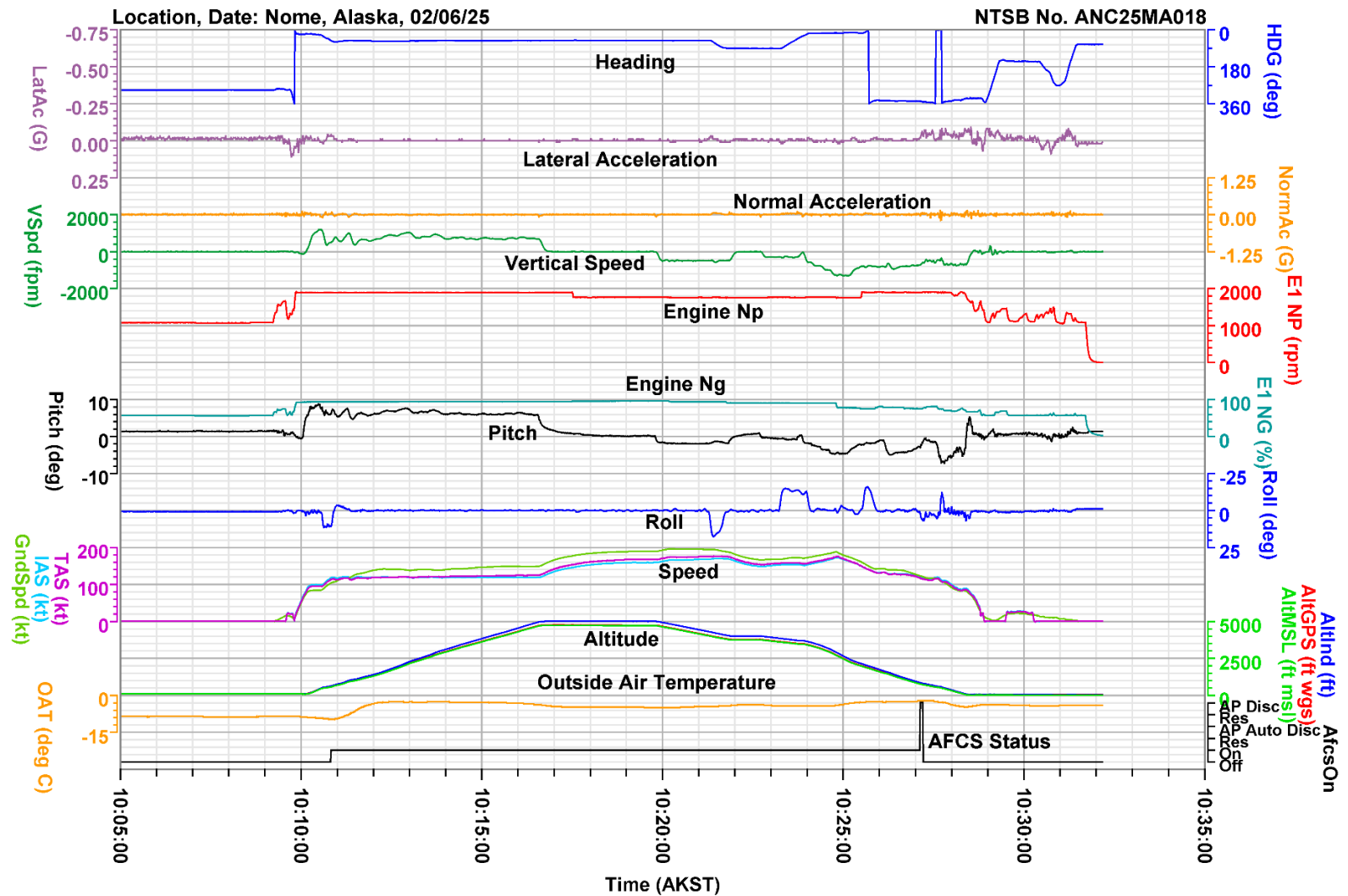
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**Figure 12.** Engine data for last minute of accident flight.

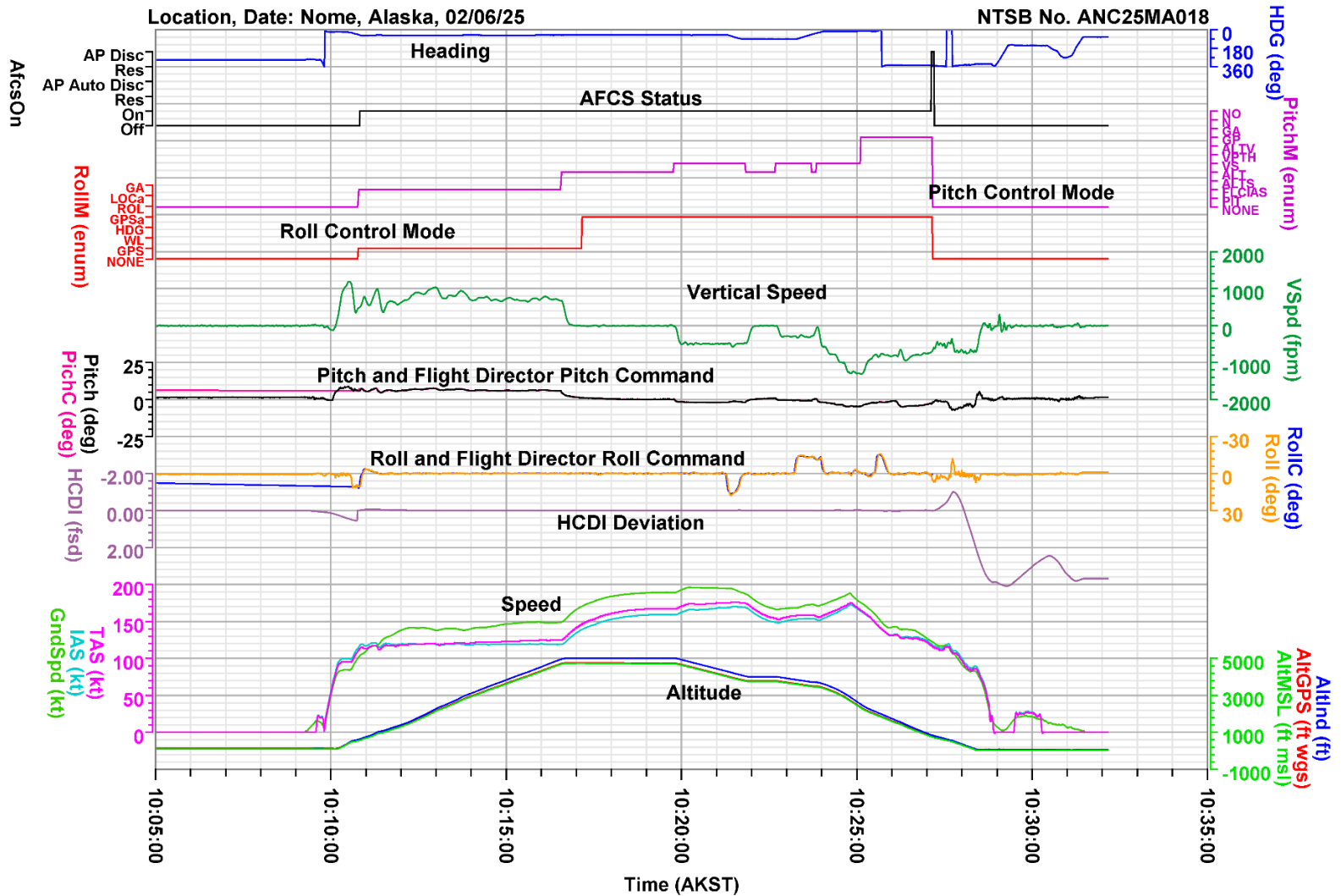
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**Figure 13.** Basic flight data for previous flight.

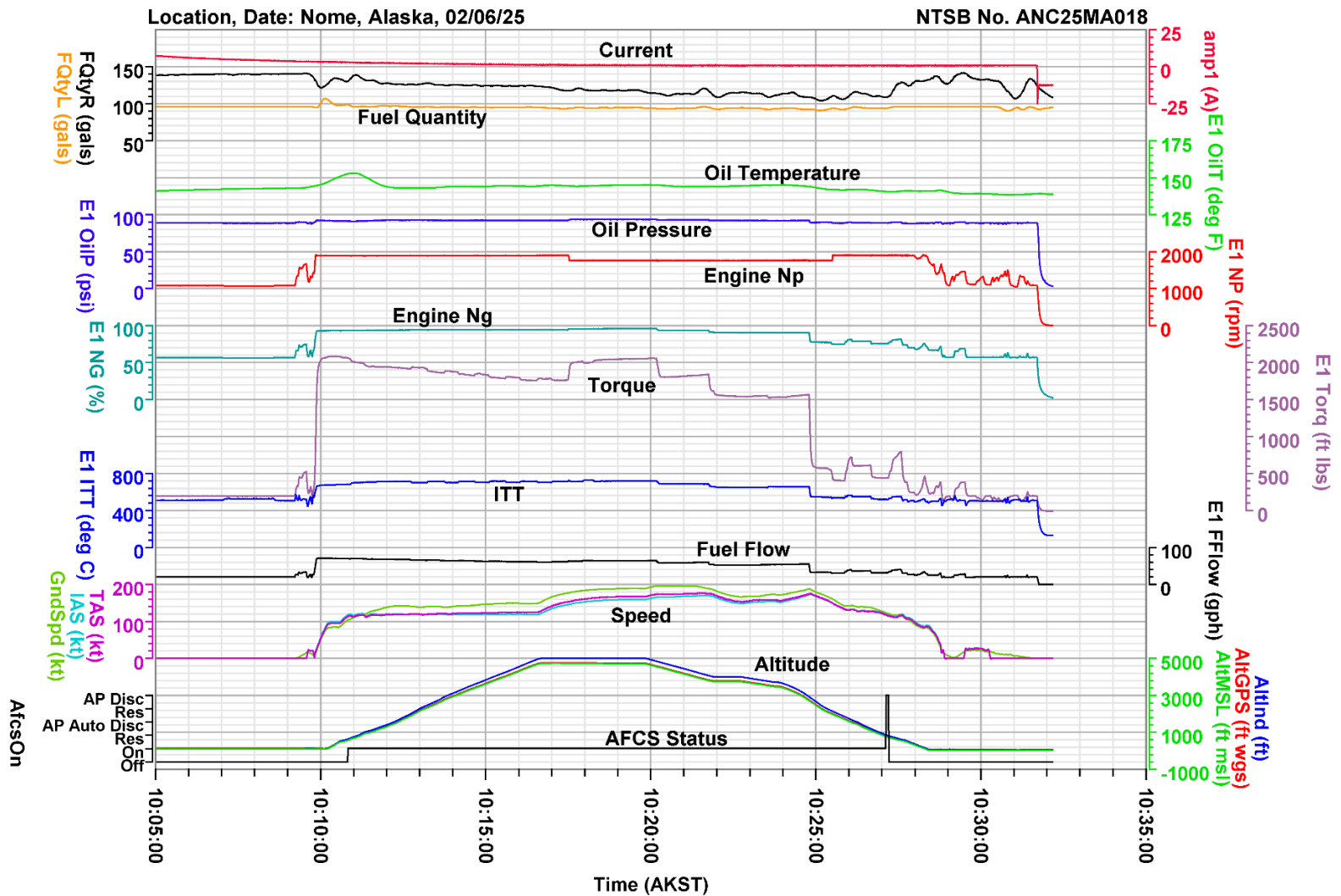
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**Figure 14.** Autopilot data for previous flight.

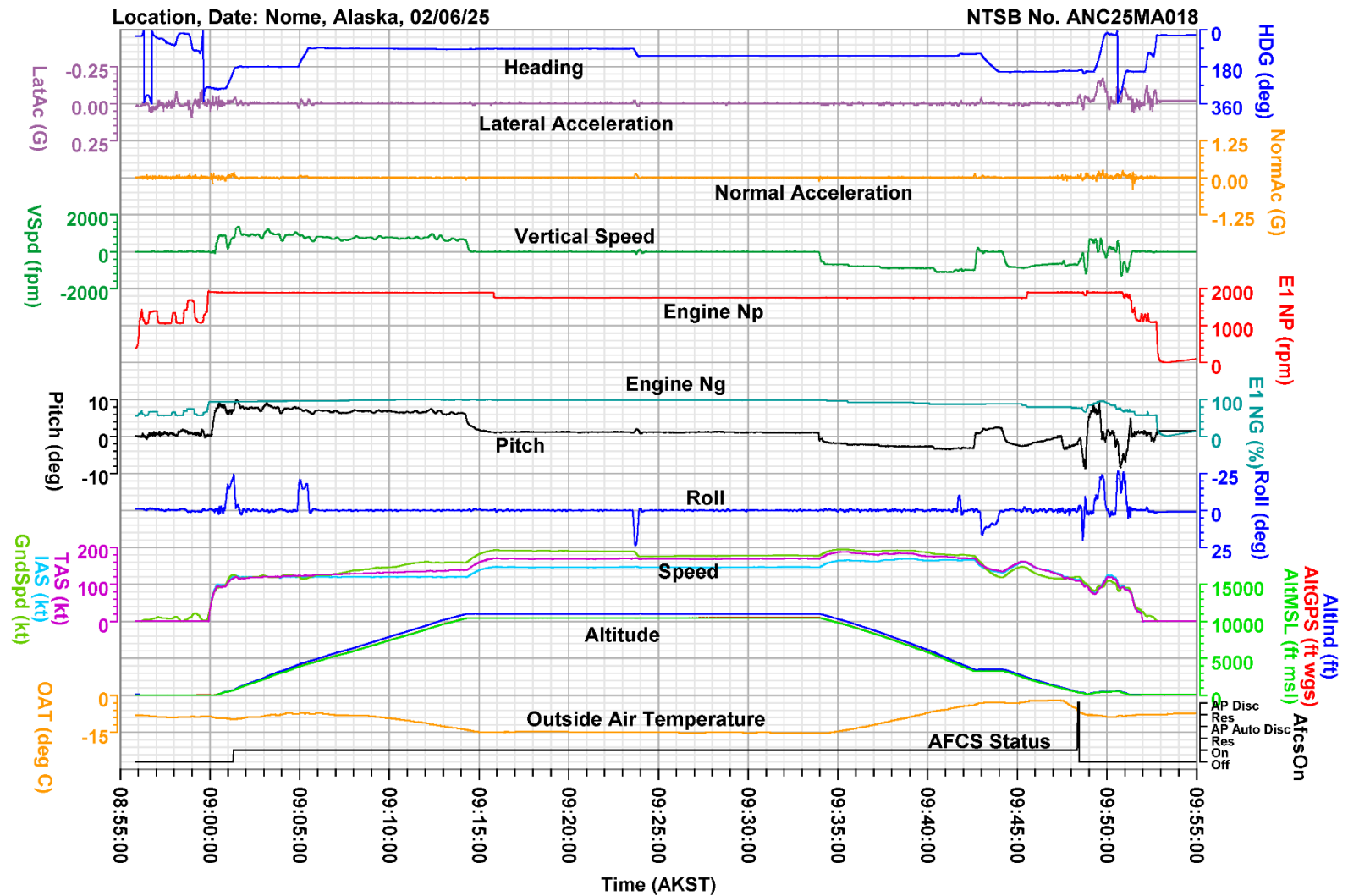
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**Figure 15.** Engine data from previous flight.

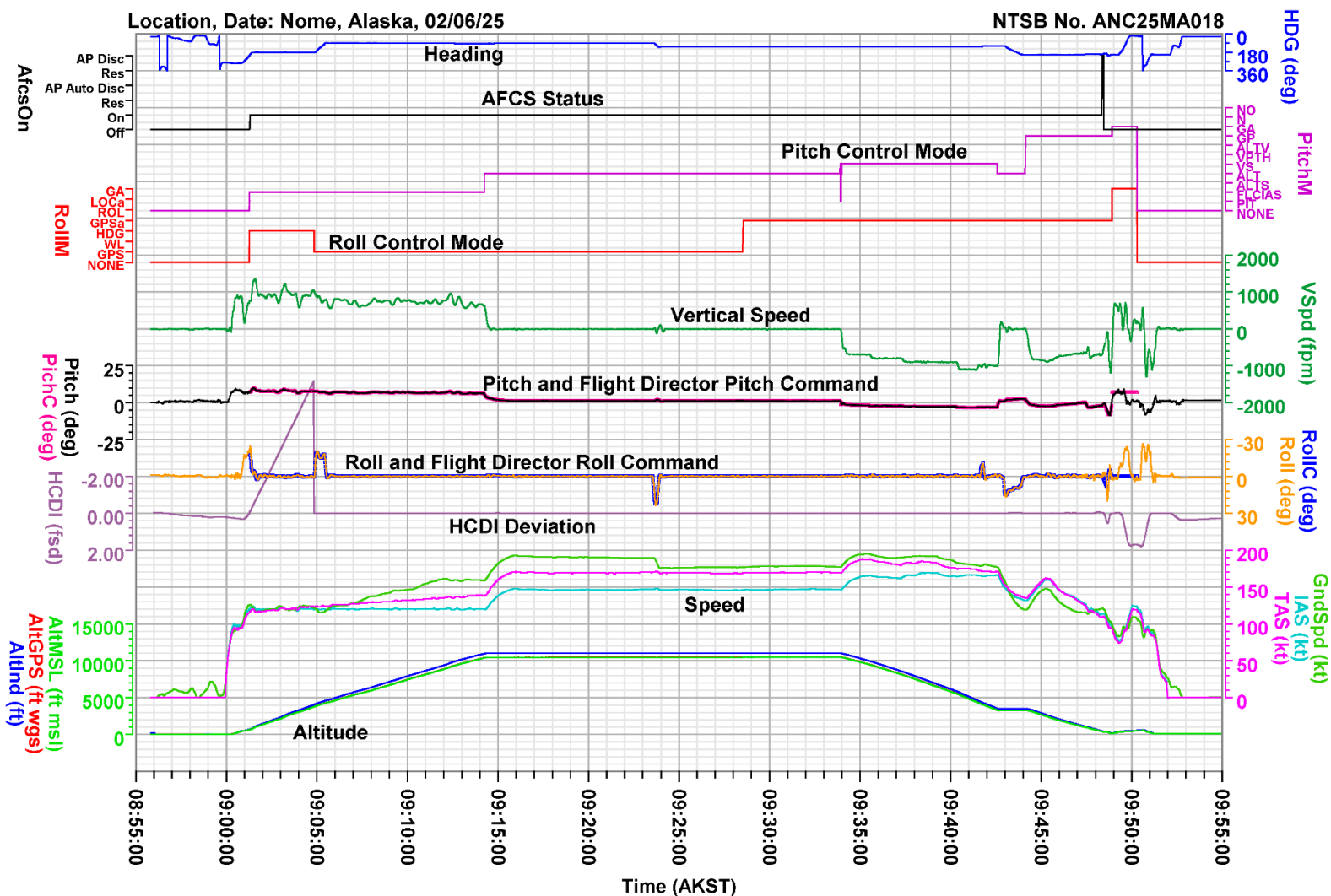
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**Figure 16.** Basic flight data for 2nd previous flight.

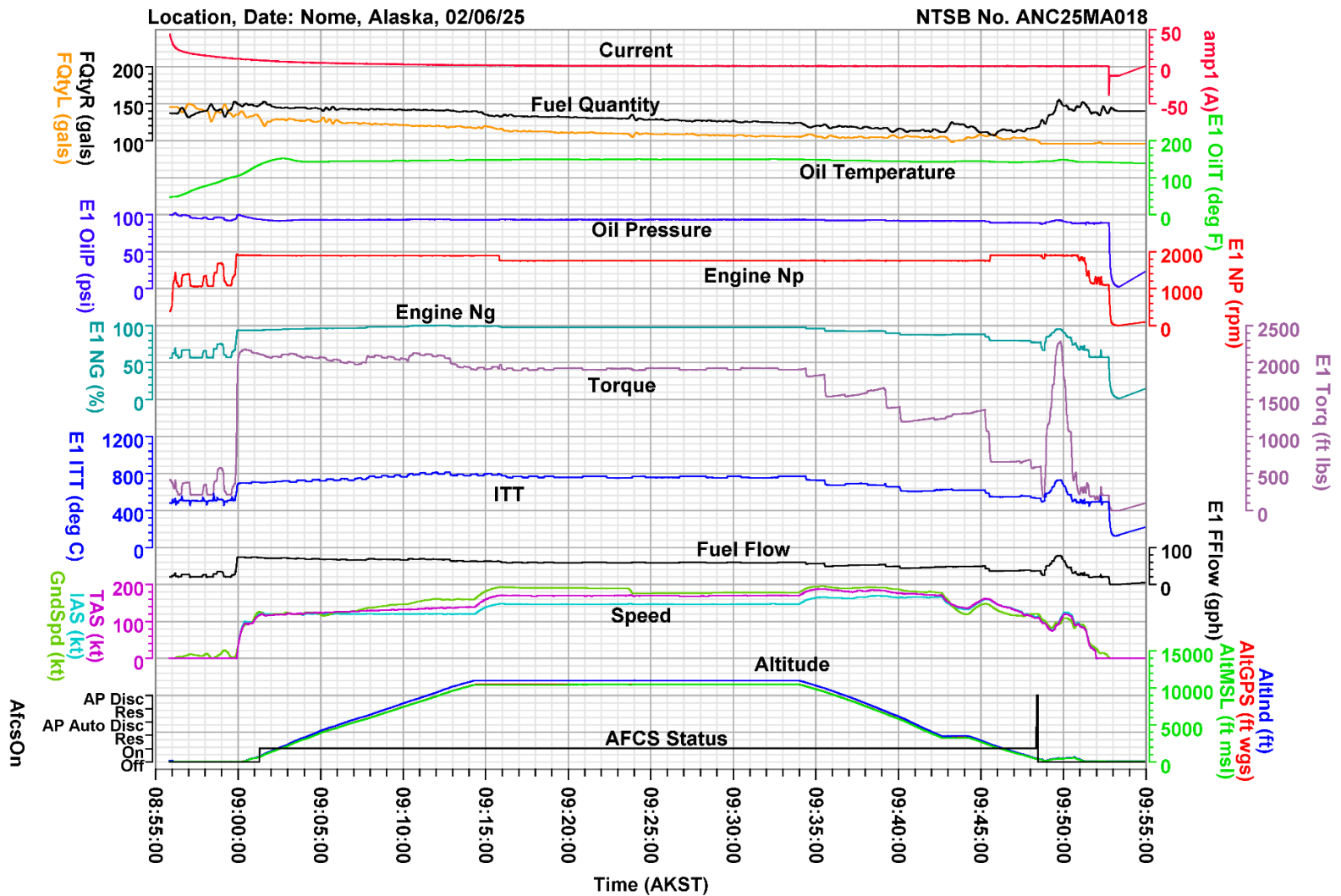
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**Figure 17.** Autopilot data for 2nd previous flight.

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**Figure 18.** Engine data for 2nd previous flight.

## APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

This appendix describes the parameters provided and verified in this report. Table 1 lists the G1000 NXi and FAST system parameters and table 2 describes the unit abbreviations used in this report.

**Table 2.** Verified and provided parameters.

| Parameter Name (units) | Parameter Description                                | Source    |
|------------------------|------------------------------------------------------|-----------|
| AfcsOn                 | Automatic Flight Control System Status               | G1000 NXi |
| AltGPS (ft)            | GPS Altitude                                         | G1000 NXi |
| AltInd (ft)            | Indicated Altitude                                   | G1000 NXi |
| AltMSL (ft)            | Altitude                                             | G1000 NXi |
| amp1 (A)               | Bus Current                                          | G1000 NXi |
| AtvWpt                 | Active Waypoint Identifier (8 Individual Characters) | G1000 NXi |
| Baro Setting (inHg)    | Barometric Correction Setting                        | G1000 NXi |
| CRS (deg)              | Course                                               | G1000 NXi |
| E1 Fuel Flow (gph)     | Engine Fuel Flow                                     | G1000 NXi |
| E1 ITT (degC)          | Engine Inter Turbine Temperature                     | G1000 NXi |
| E1 NG (%)              | Engine Gas Generator Speed                           | G1000 NXi |
| E1 NP (rpm)            | Engine Propeller Speed                               | G1000 NXi |
| E1 OilP (psi)          | Engine Oil Pressure                                  | G1000 NXi |
| E1 OilT (degF)         | Engine Oil Temperature                               | G1000 NXi |
| E1 RPM (rpm)           | Engine Revolutions per minute                        | G1000 NXi |
| E1 Torq (ft lbs)       | Engine Torque                                        | G1000 NXi |
| FQtyL (gal)            | Left Fuel Quantity                                   | G1000 NXi |
| FQtyR (gal)            | Right Fuel Quantity                                  | G1000 NXi |
| GPSFix (discrete)      | GPS Fix Type                                         | G1000 NXi |
| GndSpd (kts)           | Ground Speed                                         | G1000 NXi |
| HCDI Deviation (fsd)   | Horizontal Course Deviation Indicator                | G1000 NXi |
| HDG (deg)              | Magnetic Heading                                     | G1000 NXi |
| IAS (kts)              | Indicated Airspeed                                   | G1000 NXi |
| Latitude (deg)         | Latitude                                             | G1000 NXi |
| LatAc (g)              | Lateral Acceleration                                 | G1000 NXi |
| Longitude (deg)        | Longitude                                            | G1000 NXi |
| NormAc (g)             | Vertical Acceleration                                | G1000 NXi |
| OAT (degC)             | Outside Air Temperature                              | G1000 NXi |
| Pitch (deg)            | Pitch                                                | G1000 NXi |
| PitchC (deg)           | Flight Director Pitch Command                        | G1000 NXi |
| PitchM                 | AFCS Pitch Control Mode                              | G1000 NXi |
| Roll (deg)             | Roll                                                 | G1000 NXi |
| RollC (deg)            | Flight Director Roll Roll Command                    | G1000 NXi |
| RollM                  | AFCS Pitch Control Mode                              | G1000 NXi |
| TAS (kts)              | True Airspeed                                        | G1000 NXi |
| Track (deg)            | Ground Track                                         | G1000 NXi |
| VSpd (fpm)             | Vertical Speed                                       | G1000 NXi |
| VSpdG (fpm)            | GPS Vertical Speed                                   | G1000 NXi |
| volt1 (V)              | Bus 1 Voltage                                        | G1000 NXi |
| ITT-FAST (degC)        | Interturbine Temperature                             | FAST      |
| TQ-FAST (ft lb)        | Engine Torque                                        | FAST      |
| MOP-FAST (psi)         | Oil Pressure                                         | FAST      |
| MOT-FAST (degC)        | Oil Temperature                                      | FAST      |
| NG-FAST (%)            | Gas Generator Speed                                  | FAST      |
| NP-FAST (rpm)          | Engine Propeller Speed                               | FAST      |
| OAT-FAST (degC)        | Outside Air Temperature                              | FAST      |

| Parameter Name (units) | Parameter Description | Source |
|------------------------|-----------------------|--------|
| WF-FAST (pph)          | Engine Fuel Flow      | FAST   |
| IAS-FAST (kts)         | Indicated Airspeed    | FAST   |
| ALT-FAST (ft)          | Altitude              | FAST   |
| SO115-FAST (degF)      | Fuel Temperature      | FAST   |

**Table 3.** Unit abbreviations.

| Unit Abbreviations | Descriptions                   |
|--------------------|--------------------------------|
| %                  | percent                        |
| %rpm               | percent revolutions per minute |
| A                  | Amperes                        |
| deg                | degrees                        |
| degC               | degrees Celsius                |
| ft                 | feet                           |
| fsd                | full scale deflection          |
| degF               | degrees Fahrenheit             |
| ft                 | feet                           |
| lbs                | pounds                         |
| gals               | gallons                        |
| gph                | gallons per hour               |
| kts                | knots                          |
| msl                | mean sea level                 |
| pph                | Pound per hour                 |
| psi                | pounds per square inch         |
| Res                | reserved                       |
| rpm                | revolutions per minute         |
| V                  | Volts DC                       |
| wgs                | world geodetic system          |