

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA24LA097

QUICK ACCESS RECORDER

Specialist's Factual Report

November 5, 2024

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. QUICK ACCESS RECORDER SPECIALIST	3
C. FEDERAL CARRIAGE REQUIREMENTS.....	3
D. DETAILS OF THE INVESTIGATION	3
1.0 QAR Data File Description.....	3
1.1 Recording Description	3
1.1.1 Engineering Unit Conversions	4
1.2 Time Correlation	4
E. FIGURES AND TABULAR DATA.....	4
APPENDIX A. VERIFIED AND PROVIDED PARAMETERS	10

A. ACCIDENT

Location: Kelsey, New York
Date: February 10, 2024
Time: 1543 eastern standard time (EST)
2043 coordinated universal time (UTC)
Airplane: Boeing 777-222ER, United Airlines, N788UA

B. QUICK ACCESS RECORDER SPECIALIST

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

C. FEDERAL CARRIAGE REQUIREMENTS

Quick Access Recorders (QAR) are typically used in Flight Data Monitoring or Flight Operation Quality Assurance programs. QARs have no Federal Aviation Administration carriage requirements.

D. DETAILS OF THE INVESTIGATION

A QAR group was not convened. The NTSB Vehicle Recorder Division received an electronic file containing the QAR data from the N788UA aircraft.

1.0 QAR Data File Description

The QAR data in the electronic file was configured such that 512 12-bit words of digital information were recorded every second. Each grouping of 512 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 512-word intervals. Each data parameter (for example, pressure altitude, pitch angle, roll angle, and magnetic heading) has a specifically assigned word number within the subframe.

1.1 Recording Description

The QAR recording contained approximately 4.79 hours of data. Timing of the QAR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The event flight was the only recording on the file.

1.1.1 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

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

1.2 Time Correlation

Correlation of the QAR data from SRN to the event local time, EST, was established by using the recorded Greenwich mean time (GMT) Hours, GMT Minutes, and GMT Seconds and then applying an additional 5 hours offset to change GMT to EST.²

Accordingly, the time offset for the event flight data from SRN to EST is the following: EST = SRN + 41,111. Therefore, for the rest of this report, all times are referenced as EST.

E. FIGURES AND TABULAR DATA

Figures 1 to 4 contain QAR data recorded during the event on February 10, 2024. All the parameters listed in table 1 are plotted except UTC Hours, UTC Minutes, UTC Seconds, Latitude, and Longitude.

Figures 1 and 2 are time history plots presenting acceleration and attitude control parameters. Figure 1 is presented from 15:35:00 EST to 16:07:00 EST. Figure 2 is presented from 15:40:00 EST to 15:50:00 EST.

Figures 3 and 4 are time history plots presenting engine and attitude control parameters. Figure 3 is presented from 15:35:00 EST to 16:07:00 EST. Figure 4 is presented from 15:40:00 EST to 15:50:00 EST.

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.

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 = +.

² GMT is Greenwich mean time which is also known as UTC.

The QAR data indicated the following sequence of events:

- The flight was uneventful until the accident sequence occurred.
- **15:35:00 EST:** The aircraft was at 26,993 feet (ft) at 314 knots (kts) computed airspeed and a magnetic heading of 117 degrees (deg). The autopilot (AP) and autothrottle (AT) were engaged.
- **15:36:12 EST:** The aircraft began to descend from 27,006 ft. Vertical speed began to reduce from 0 feet per minute (fpm).
- **15:36:13 EST - 15:40:54 EST:** The aircraft vertical speed varied between -500 fpm and -900 fpm.
- **15:41:00 EST:** Vertical speed was -864 fpm. Vertical acceleration was approximately 1.01 g.
- **15:41:17 EST:** Vertical speed was 144 fpm. Vertical acceleration had fluctuated between 0.98 g and 1.00 g.
- **15:41:29 EST:** The aircraft passed through 24,000 ft at 307 kts computed airspeed.
- **15:41:34 EST:** Vertical speed was -1704 fpm. Vertical acceleration was approximately 0.83 g.
- **15:42:35 EST - 15:47:52 EST:** Vertical acceleration fluctuated rapidly between -0.55 g and 1.82 g. Vertical acceleration reached a maximum of 1.82 g at 15:42:52 EST. Vertical acceleration reached a minimum of -0.55 g at 15:42:53 EST. Vertical speed fluctuated between -2568 fpm and 568 fpm. The AP and AT did not disengage.
- **15:47:53 EST:** Vertical acceleration began to stabilize around 1.00 g. The remainder of the flight was uneventful.
- **16:04:28 EST:** The autopilot was disengaged.
- **16:06:08 EST:** The aircraft landed on runway 22L at Newark International Airport (KEWR).

The corresponding tabular data used to create figures 1 to 4, including GMT Hours, GMT Minutes, GMT Seconds, Latitude, and Longitude, are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

Submitted by:

Steven Smith
Mechanical Engineer (Recorder Specialist)

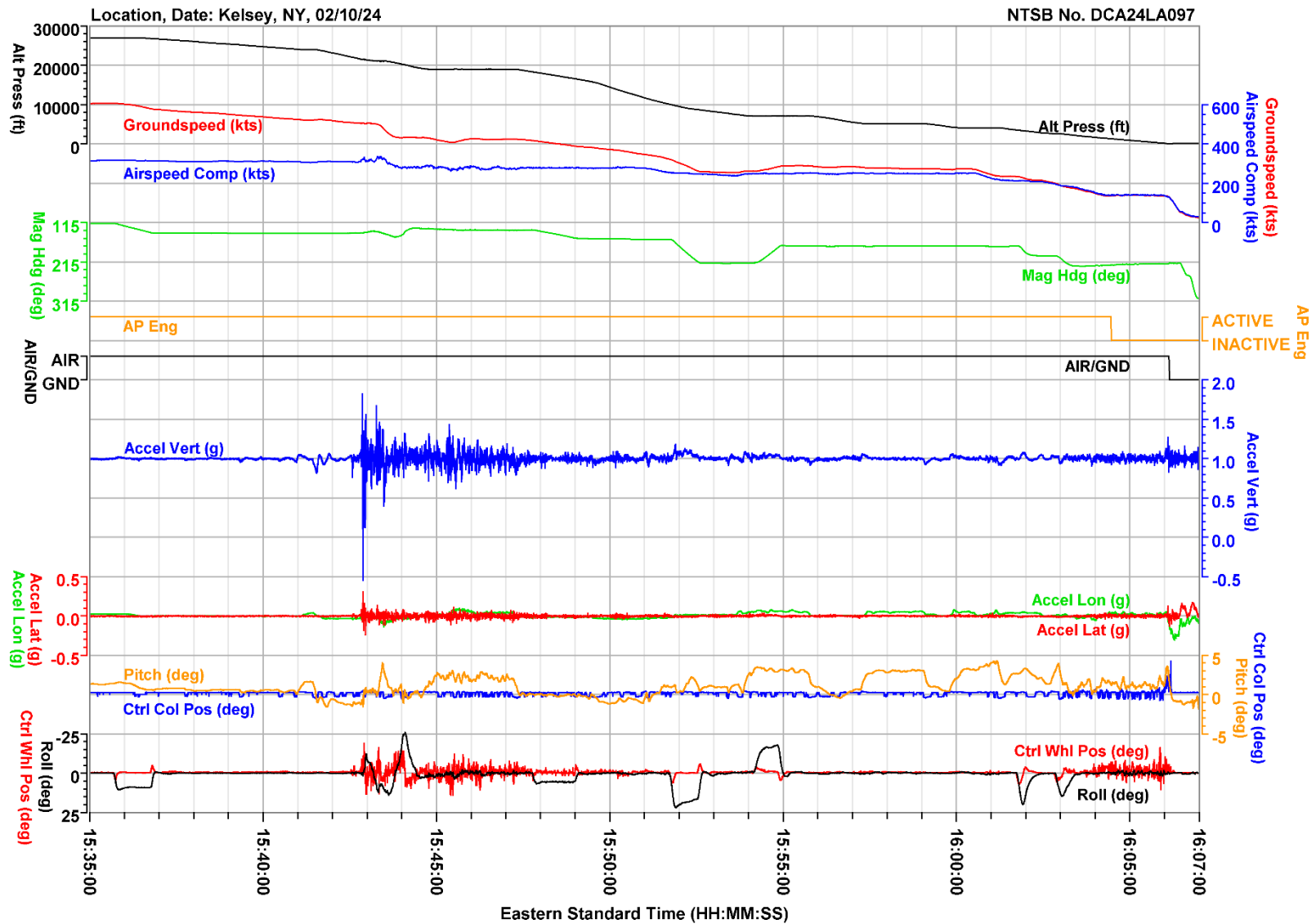


Figure 1. Time history plot presenting accelerations and attitude control parameters from 15:35:00 EST to 16:07:00 EST.

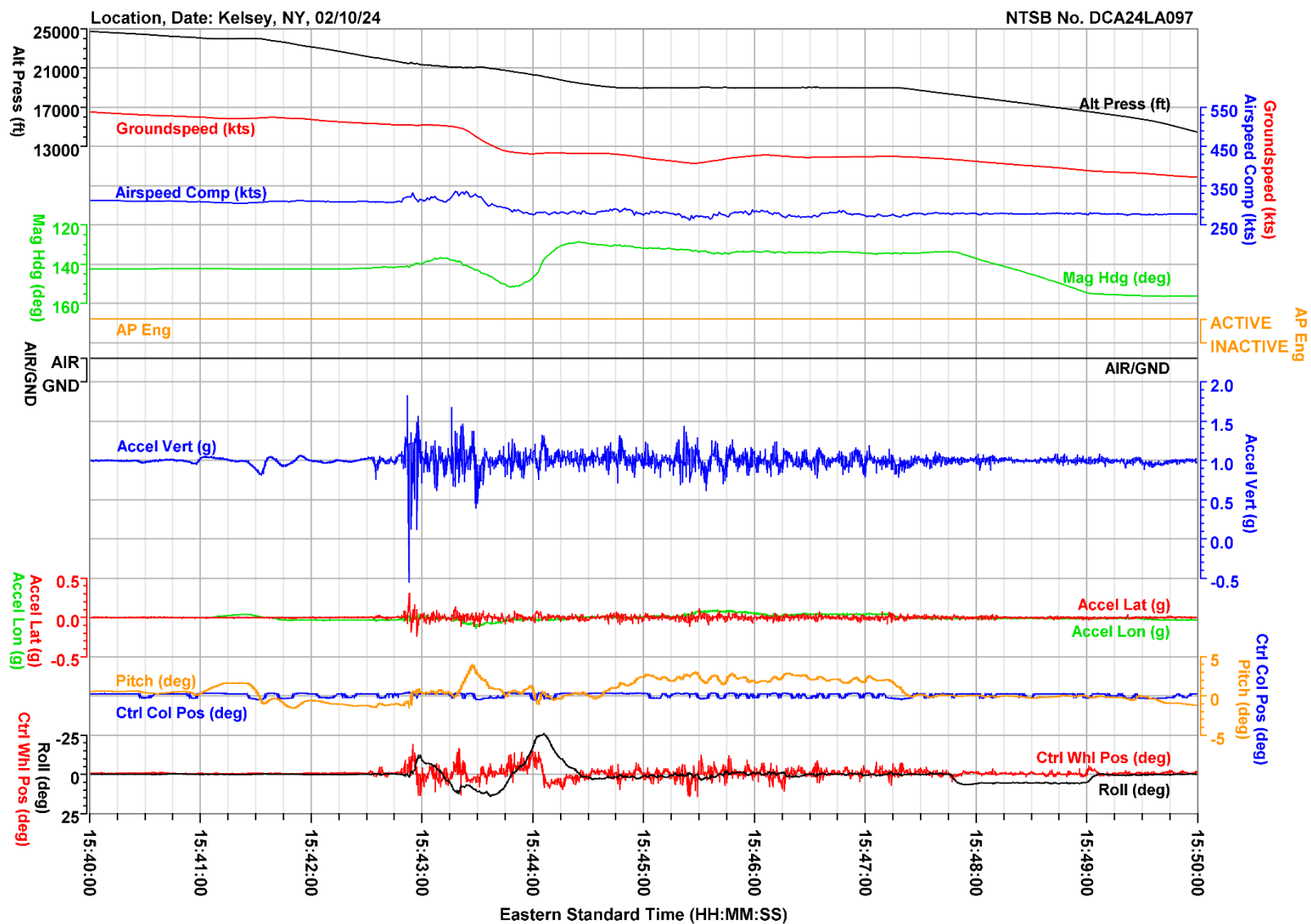


Figure 2. Time history plot presenting accelerations and attitude control parameters from 15:40:00 EST to 15:50:00 EST.

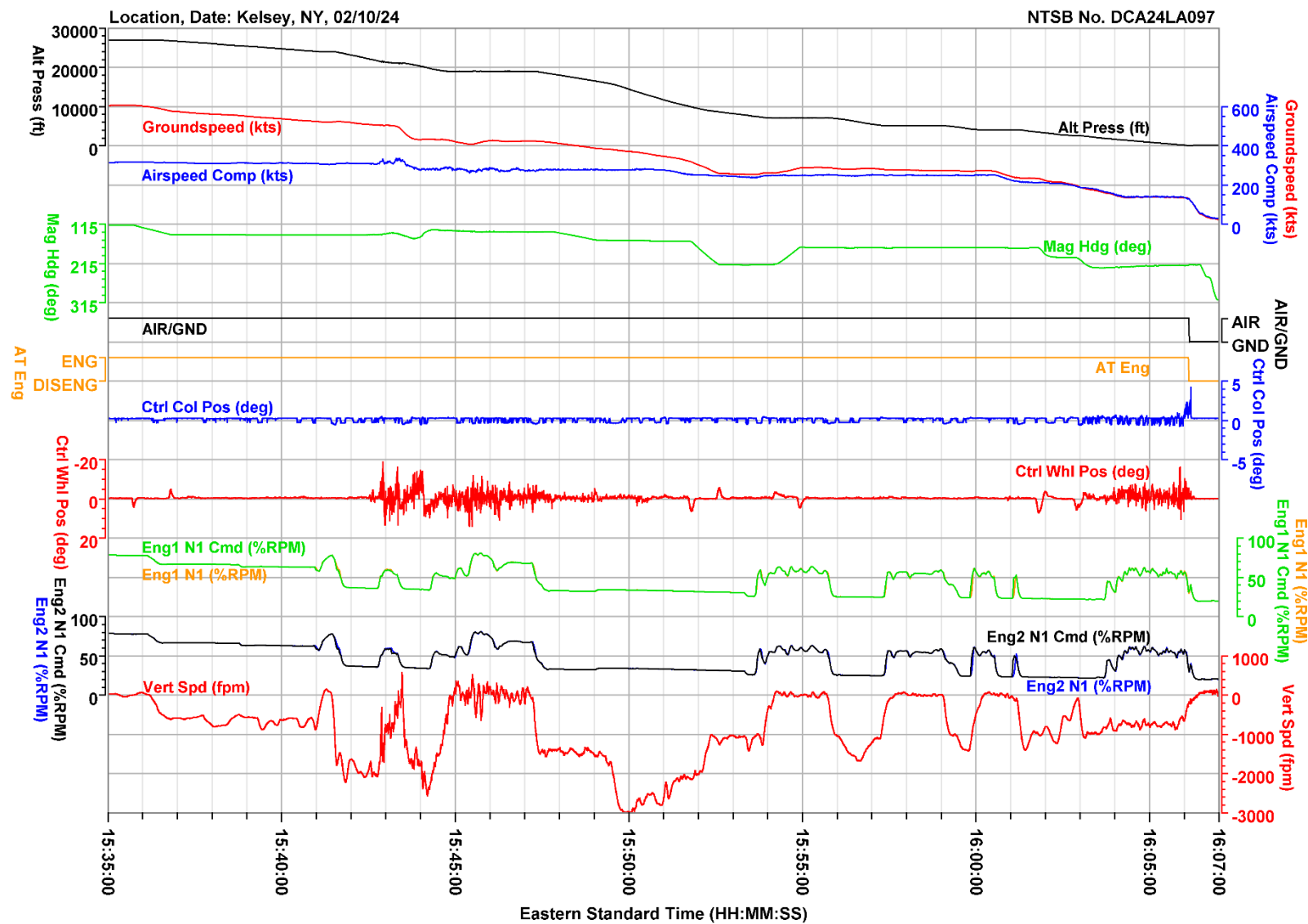


Figure 3. Time history plot presenting engine and attitude control parameters from 15:35:00 EST to 16:07:00 EST.

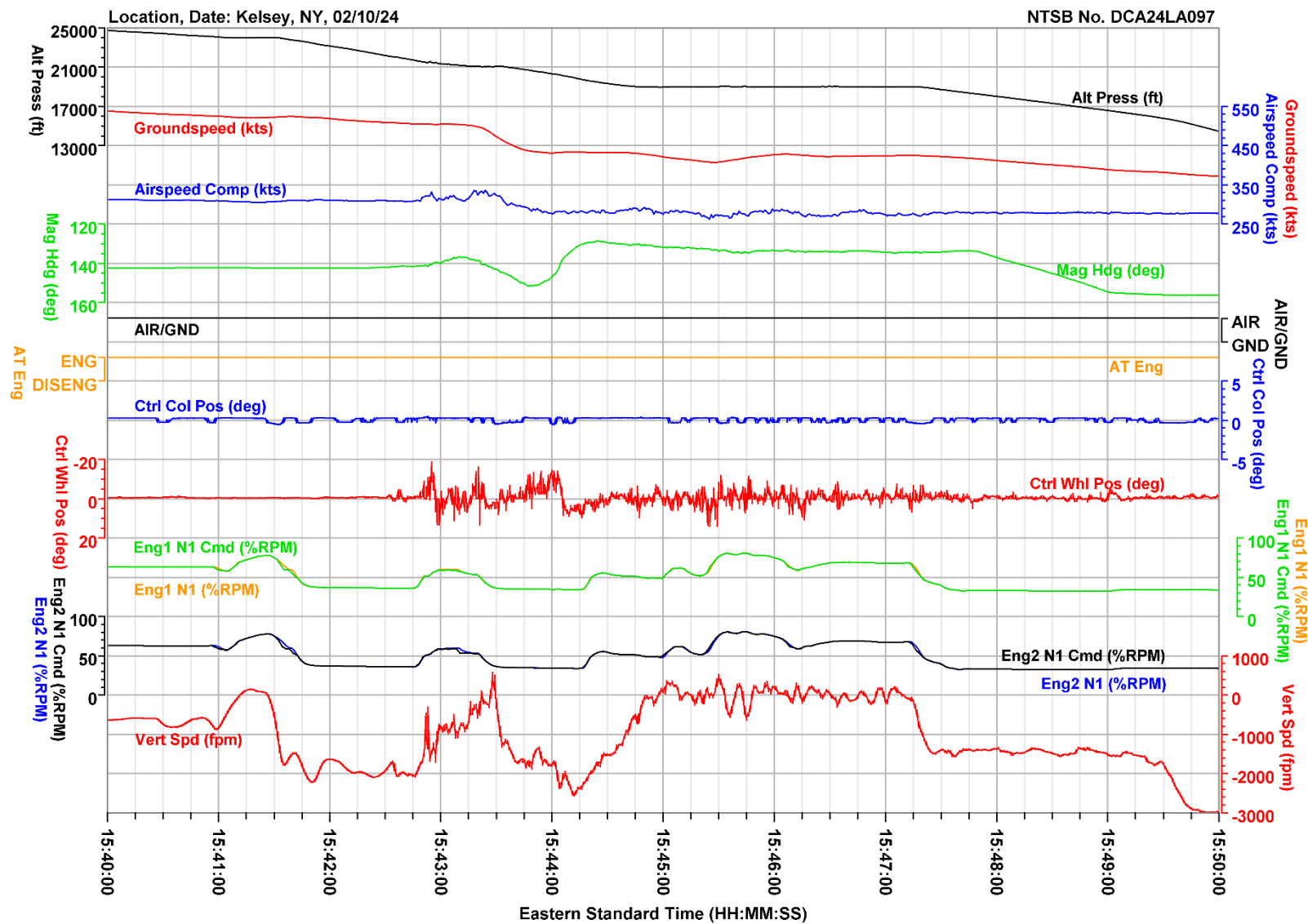


Figure 4. Time history plot presenting engine and attitude control parameters from 15:40:00 EST to 15:50:00 EST.

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 QAR parameters.

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Load Factor	g
Accel Long	Longitudinal Load Factor	g
Accel Vert	Vertical Load Factor	g
AIR/GND	Air-Ground Switch	
Airspeed Comp	Computed Airspeed	kts
Alt Press	Pressure Altitude	ft
AP Eng	Autopilot Engaged	
AT Eng	Autothrottle Engaged	
Ctrl Col Pos	Control Column Position	deg
Ctrl Whl Pos	Control Wheel Position	deg
Eng1 N1 Cmd	Engine 1 Fan Speed	%RPM
Eng1 N1	Engine 1 Fan Speed Actual	%RPM
Eng2 N1 Cmd	Engine 2 Fan Speed	%RPM
Eng2 N1	Engine 2 Fan Speed Actual	%RPM
Groundspeed	Groundspeed	kts
Latitude	Latitude Coordinate	deg
Longitude	Longitude Coordinate	deg
Mag Hdg	Magnetic Heading	deg
Pitch	Pitch Angle	deg
Roll	Roll Angle	deg
Time GMT-Hr	Greenwich Mean Time Hour	hrs
Time GMT-Min	Greenwich Mean Time Minutes	min
Time GMT-Sec	Greenwich Mean Time Seconds	sec
Vert Spd	Vertical Speed	fpm

Note: This QAR 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 QAR 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
%RPM	percent revolutions per minute
deg	degrees
Eng	Engaged
ft	feet
g	unit of gravitation acceleration
hrs	hours
inHg	inches of Mercury
kts	knots
min	minutes
sec	seconds