

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA24LA330

FLIGHT DATA RECORDER'S

Specialist's Factual Report

September 16, 2025

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A. INCIDENT

Location: Kenner, Louisiana
Date: December 20, 2023
Time: 1414 central standard time (CST)
2014 coordinated universal time (UTC)
Airplane: Boeing 737-8, Southwest Airlines, N8830Q

B. FLIGHT DATA RECORDER'S SPECIALIST

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

C. FEDERAL CARRIAGE REQUIREMENTS

The event aircraft, N8830Q, was operating as Title 14 *Code of Federal Regulations* (CFR) Part 121 scheduled passenger flight. The event aircraft was manufactured in 2022 and was operating such that it was required to be equipped with a flight data recorder (FDR) that recorded, at a minimum, 91 parameters, as cited in 14 CFR Part 121.344(f).

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

D. DETAILS OF THE INVESTIGATION

A group was not convened. The NTSB Vehicle Recorder Division received electronic files containing the FDR and QAR data from the N8830Q aircraft.

1.0 Recorder Data File Description

FDR:

The FDR data in the electronic file was configured such that 1024 12-bit words of digital information were recorded every second. Each grouping of 1024 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 1024-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.

QAR:

The QAR data in the electronic file was configured such that 2048 12-bit words of digital information were recorded every second. Each grouping of 2048 words is called a subframe. Each subframe has a unique 12-bit 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 2048-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

FDR:

The FDR recording contained 27 minutes and 44 seconds 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 only flight of the recording. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

QAR:

The QAR recording contained 29 minutes and 12 seconds of data. Timing of the QAR data is measured in SRN, where each SRN equals one elapsed second. The event flight was the only flight of the recording.

1.1.1 Engineering Unit Conversions

The engineering unit conversions used for both data files 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 in appendix A lists the FDR parameters verified and provided in this report. Table 2 in appendix A lists the QAR parameters verified and provided in this report. Additionally in Appendix A, table 3 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 = +.

1.1.2 Time Correlation

Correlation of the FDR and QAR data from SRN to the event local time, CST, was established by using the recorded UTC Hours, UTC Minutes, and UTC Seconds and then applying an additional 6 hours offset to change UTC to CST.

Accordingly, the time offset for the event flight data from SRN to local CST is the following:

$$\text{FDR: CST} = \text{SRN} + 50,718$$

$$\text{QAR: CST} = \text{SRN} + 50,675$$

Therefore, for the rest of this report, all times are referenced as CST, not SRN.

1.2 QAR Time Difference

The FDR and QAR both source from the Flight Data Acquisition Unit (FDAU) but use two different partitions. The QAR receives non-FDR data parameters from the optional aircraft condition monitoring partition, whereas the FDR sources from the mandatory partition. However, FDR parameters that are recorded to the QAR also source from the mandatory partition of the FDAU. This results in the QAR data being partially non-time-aligned, which means that some parameters have lost their original timestamp. For the parameters that have lost their original timestamp, the data are buffered and output in "clusters" of data, corresponding to common sample rates. Then, post-processing tools evenly distribute the data samples throughout each sample interval based on sample rate, without knowledge of when that event occurred on the airplane. For example, a parameter that is recorded at 4 samples per second will have the recorded data points evenly distributed at 0.00, 0.25, 0.50, and 0.75 seconds within a given second. As a result, there may be an error in time (at most 1 second) when comparing recorded data points to UTC and to other parameters. Thus, caution should be exercised when interpreting this data and comparing to the FDR. As a result of the time alignment difference between the QAR and FDR, the QAR will be referred as QAR Central Standard Time. QAR Central Standard Time has been time aligned to the QAR UTC time parameters but does not accurately correlate to the FDR timing.

E. FIGURES AND TABULAR DATA

Figures 1 to 4 contain FDR data recorded during the event on December 20, 2023. All the parameters listed in table 1 are plotted except UTC Hours, UTC Minutes, UTC Seconds, Latitude, and Longitude. Figure 5 contain QAR data recorded during the event. All the parameters listed in table 2 are plotted except UTC Hours, UTC Minutes, UTC Seconds, Latitude, and Longitude.

Figures 1 and 2 are time history plots of engine parameters presented from 14:12:00 CST to 14:27:00 CST and 14:13:00 CST to 14:16:30 CST, respectively.

Figure 3 is a time history plot of additional engine parameters presented from 14:12:00 CST to 14:27:00 CST.

Figure 4 is a time history plot of basic parameters presented from 14:12:00 CST to 14:27:00 CST.

Figure 5 is a time history plot of QAR data presenting parameters for the Engine Fire, Engine Severe Damage or Separation checklist.

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 FDR and QAR data indicated the following sequences of events:

- **14:13:04 CST:** Groundspeed began to rapidly increase from 8 knots (kts), consistent with the aircraft beginning takeoff roll. The aircraft was on runway 11 at Louis Armstrong New Orleans International Airport (KMSY).
- **14:13:39 CST:** The air/ground relay switch changed from ground to air.
- **14:13:44 CST:** All three gear green lights were off, consistent with the gear no longer down and locked.
- **14:14:01 CST:** While passing through 687 feet (ft) radio altitude and 170 kts computed airspeed, engine 1 N1 began to rollback from 83.0 percent revolutions per minute (%RPM).
- **14:14:02 CST:** While passing through 747 ft radio altitude and 167 kts computed airspeed, engine 1 channel B airborne vibration monitor (AVM) increased from 0.1406 to 0.1797.
- **14:14:04 CST:** The aircraft passed through 810 ft radio altitude and the computed airspeed was 164 kts. Engine 1 Fail status changed from normal to fail.
- **14:14:05 CST:** Engine 1 N1 was 16.5 %RPM and continued to reduce to a minimum value of 6.1 %RPM, 46 seconds later (14:14:51 CST).
- **14:14:09 CST:** Engine 1 channel A and B AVM began to rapidly increase.

- **14:14:12 CST:** Engine 1 channel B AVM reached a maximum recorded value of 5. One second later, engine 1 channel A reached a maximum recorded value of 5. Note, Engine 1 channel A and B AVM operational range is limited at a maximum scalar value of 5.
- **14:14:14 CST:** The aircraft passed through 900 ft radio altitude and the computed airspeed was 167 kts. The master caution activated and remained active for the next 11 seconds. Engine 1 N2 was 57.9 %RPM and continued to reduce to a minimum value of 0.0 %RPM, 76 seconds later (14:15:30 CST).
- **14:14:16 QAR CST:** The left pressure regulating and shutoff valve (PRSOV) command changed from commanded open to commanded close. The left PRSOV remained closed the remainder of the flight.
- **14:14:17 QAR CST:** The left environmental control system (ECS) pack changed from on to off. The left ECS pack remained off for the remainder of the flight. The right ECS pack remained on.
- **14:14:31 CST:** The master caution activated and remained active for the next 2 minutes and 41 seconds.
- **14:16:07 CST:** The autothrottle (AT) disconnect switch was pressed. Subsequently, the AT was disengaged.
- **14:16:14 CST:** Engine 1 throttle resolver angle (TRA) began to reduce from 66.45 degrees. Four seconds later, it reached 36.04 degrees.
- **14:16:25 CST:** Engine 1 start lever was changed from run to cutoff.
- **14:16:56 QAR CST:** Engine 1 fire handle was pulled.
- **14:19:00 CST:** The auxiliary power unit (APU) changed from off to on. The APU remained on for the remainder of the flight.
- **14:19:59 CST:** The master caution activated and remained active for the next 5 seconds.
- **14:20:08 QAR CST:** The ECS isolation valve changed from closed to open. The ECS isolation valve was open the remainder of the flight.
- **14:23:32 CST:** The master caution activated and remained active for the next 9 seconds.
- **14:24:12 CST:** The speedbrake was armed.
- **14:24:16 CST:** Gear Lever Up transitioned from UP to NOT UP and Gear Lever Down transitioned from NOT DN to DOWN.
- **14:24:28 CST:** All three gear green lights were on, consistent with the main and nose gears down and locked.
- **14:24:42 CST:** The flap handle began to increase. One second later, the flap handle was at 15 degrees.

- **14:26:05 CST:** The air/ground relay switch changed from air to ground, consistent with the aircraft landing. The aircraft landed on runway 11 at KMSY.
- **14:26:06 CST:** The master caution activated and remained active for the next 2 seconds.
- **14:26:10 CST:** Engine 2 thrust reverser was deployed. Engine 1 thrust reverser was not deployed and remained stowed.
- **14:26:57 CST:** The groundspeed recorded was 1 kt. The aircraft position remained constant on runway 11, slightly past taxiway delta.
- **14:33:00 CST:** End of valid recorded FDR data.
- **14:33:45 QAR CST:** End of valid recorded QAR data. The aircraft position was in spot bravo 8 at the terminal at KMSY.

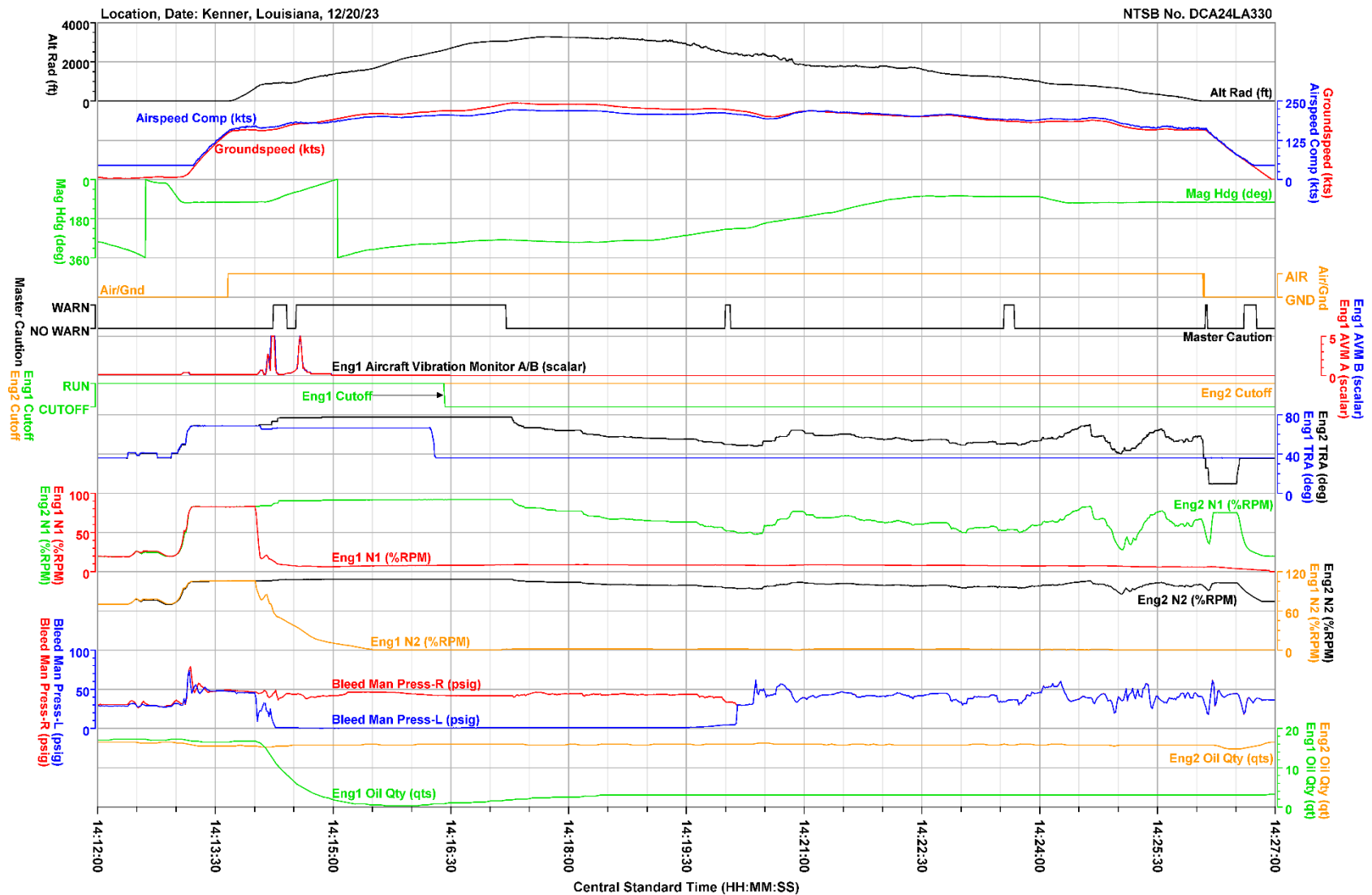
Figure 6 is a Google Earth overlay of the entire flight for the event flight created with FDR data. The weather and lighting conditions in Google Earth are not necessarily representative of the weather and lighting conditions present at the time of the recording.

The corresponding tabular data used to create figures 1 to 4 and figure 6, including UTC Hours, UTC Minutes, UTC Seconds, Latitude, and Longitude, are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

The corresponding tabular data used to create figure 5, including UTC Hours, UTC Minutes, UTC Seconds, Latitude, and Longitude, are provided in electronic CSV format as attachment 2 to this report.

Submitted by:

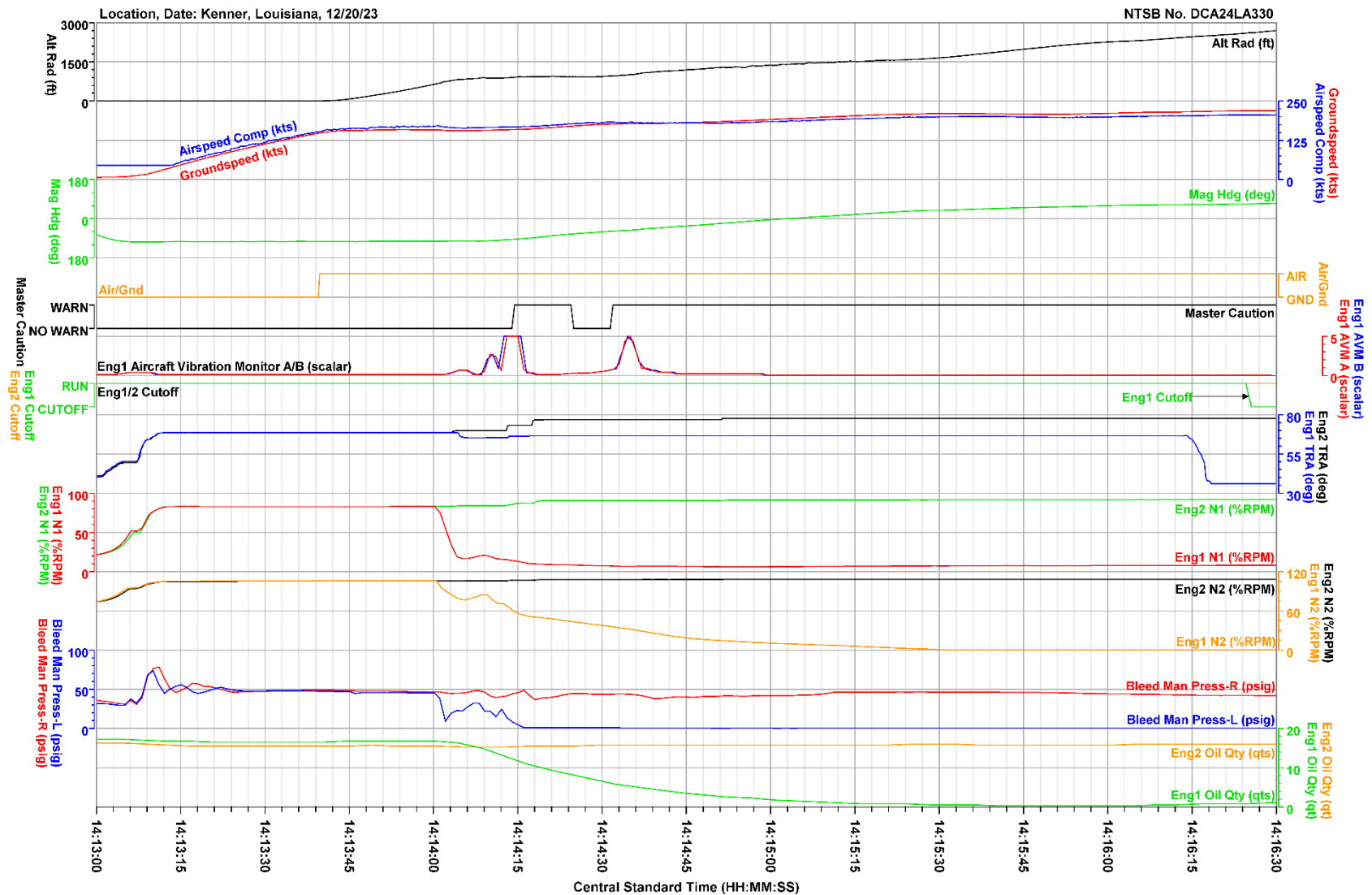
Steven Smith
Mechanical Engineer (Recorder Specialist)



Southwest Airlines, Boeing 737-8, SWA554, N8830Q

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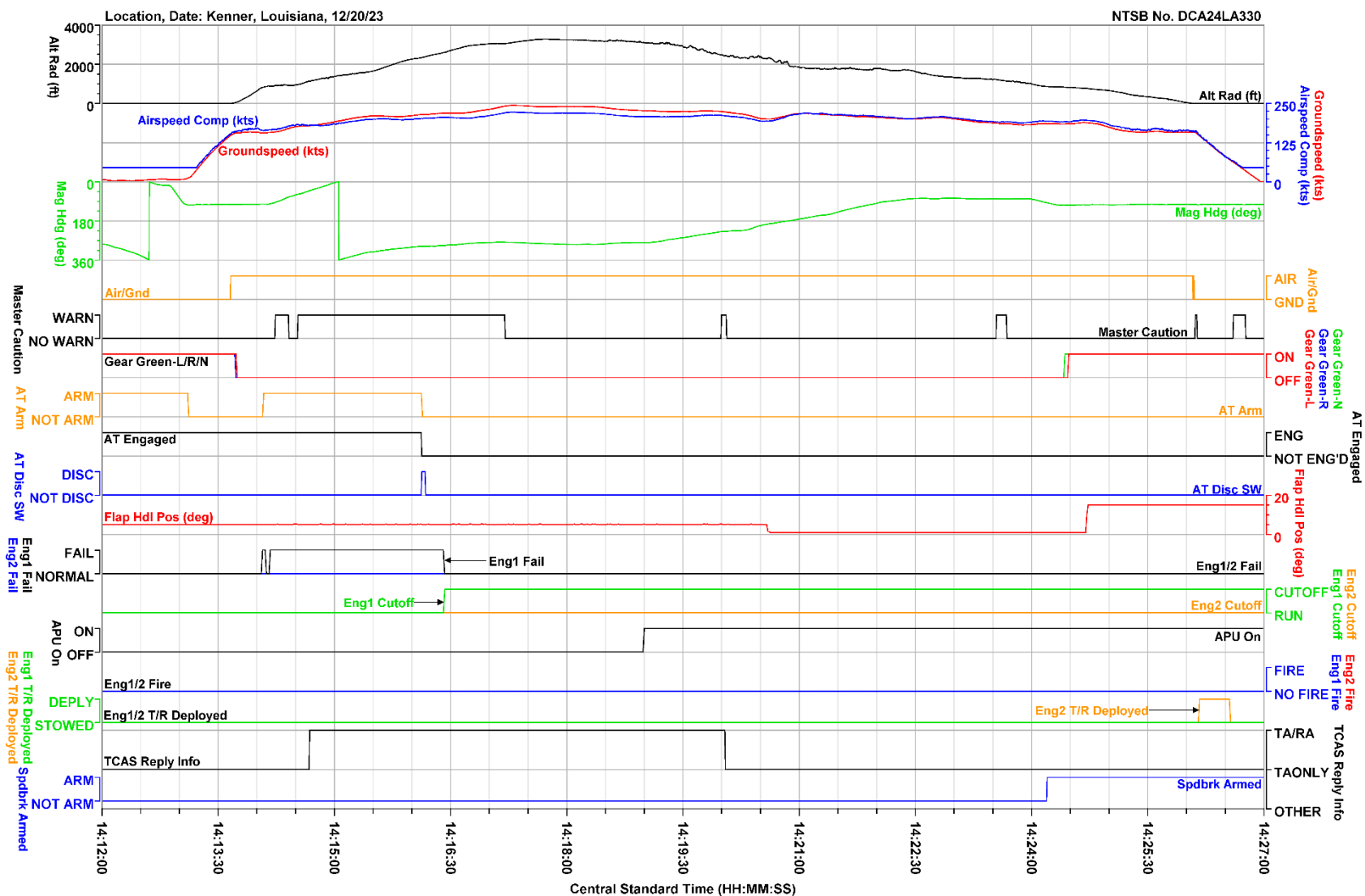
Figure 1. Time history plot of engine parameters from 14:12:00 CST to 14:27:00 CST.



Southwest Airlines, Boeing 737-8, SWA554, N8830Q

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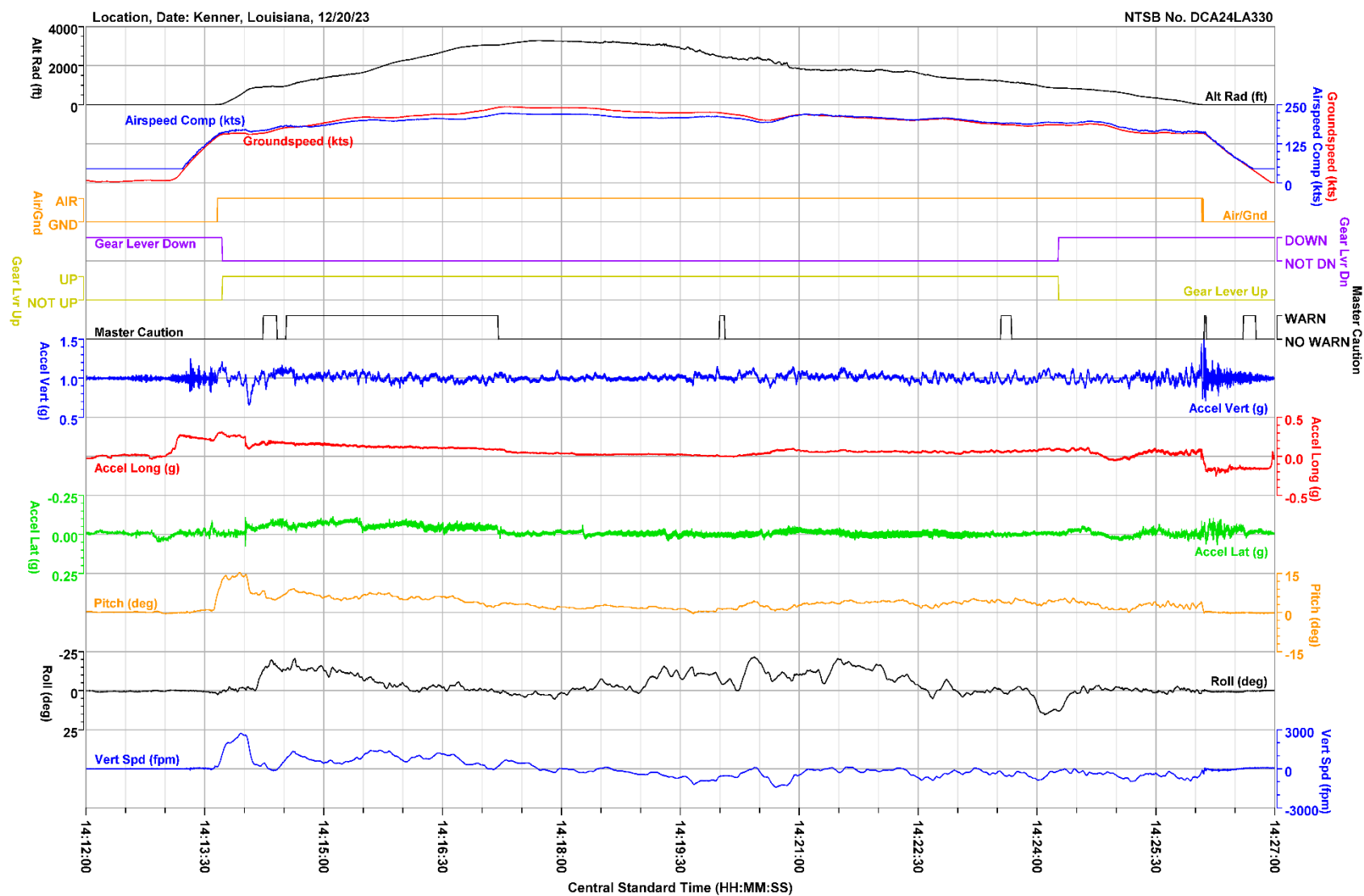
Figure 2. Time history plot of engine parameters from 14:13:00 CST to 14:16:30 CST.



Southwest Airlines, Boeing 737-8, SWA554, N8830Q

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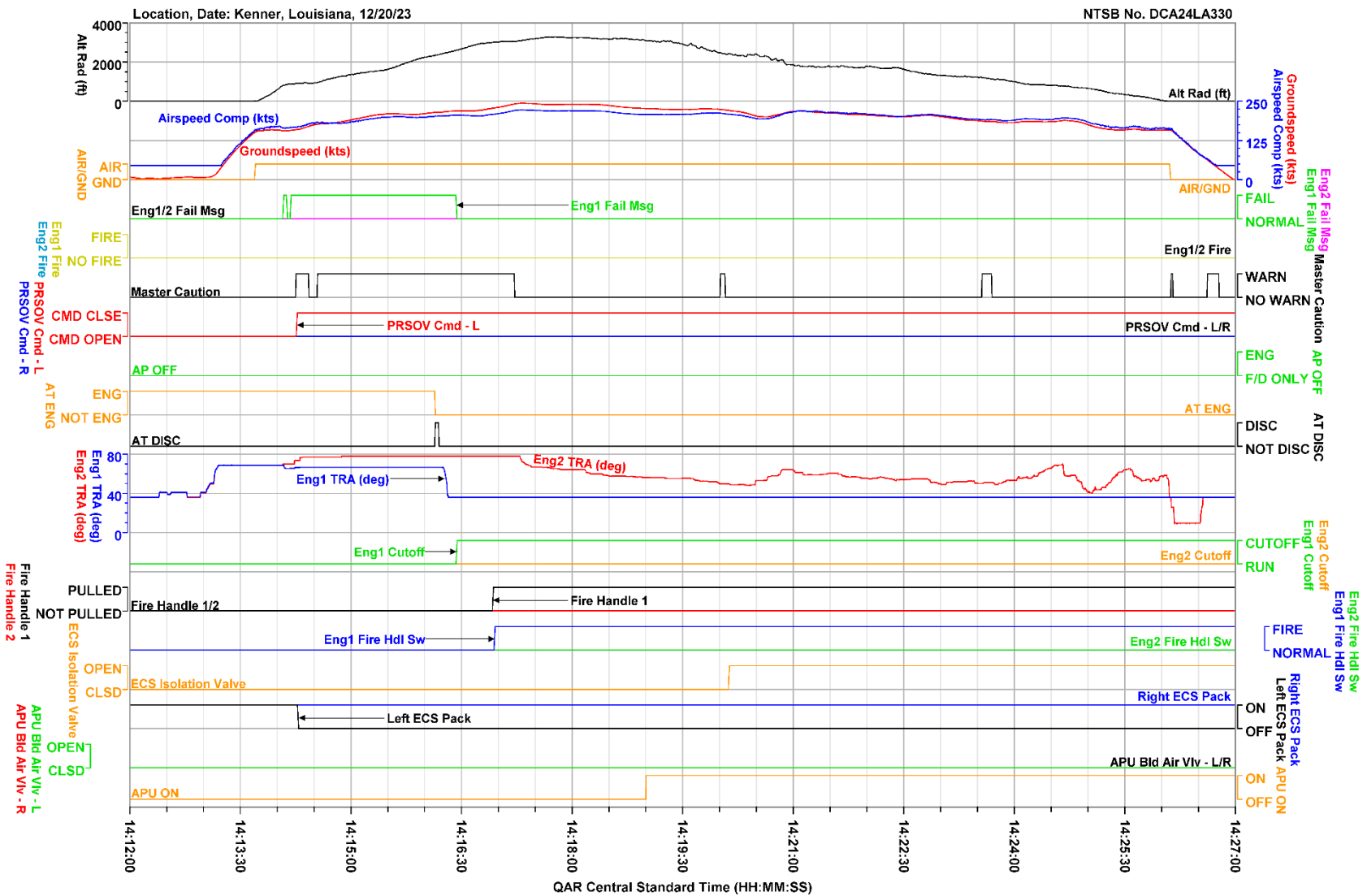
Figure 3. Time history plot of additional engine parameters from 14:12:00 CST to 14:27:00 CST.



Southwest Airlines, Boeing 737-8, SWA554, N8830Q

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Figure 4. Time history plot of basic parameters from 14:12:00 CST to 14:27:00 CST.



Southwest Airlines, Boeing 737-8, SWA554, N8830Q, QAR Data

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Figure 5. Time history plot of QAR parameters for the Engine Fire, Engine Severe Damage or Separation checklist from 14:12:00 CST to 14:27:00 CST.



Figure 6. Google Earth overlay of the entire event flight.

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS

This appendix describes the FDR and QAR parameters provided and verified in this report. Table 1 lists the FDR plot/table labels, parameter names, and units. Table 2 lists the QAR plot/table labels, parameter names, and units. Additionally, table 3 describes the unit and discrete state abbreviations used for both the FDR and QAR 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 Vert	Vertical Load Factor	g
Air/Gnd	Air/Ground Relay Switch	
Airspeed Comp	Computed Airspeed	kts
Alt Rad	Radio Altitude	ft
APU On	Auxiliary Power Unit On	
AT Arm	Autothrottle Armed	
AT Disc SW	Autothrottle Disconnect Switch	
AT Engaged	Autothrottle Engaged	
Bleed Man Press-L	Left Bleed Manifold Pressure	psig
Bleed Man Press-R	Right Bleed Manifold Pressure	psig
Eng1 AVM A	Engine 1 Airborne Vibration Monitor Highest Wins Channel A (Highest Vibration Level)	scalar
Eng1 AVM B	Engine 1 Airborne Vibration Monitor Highest Wins Channel B (Highest Vibration Level)	scalar
Eng1 Cutoff	Engine 1 Cutoff Switch	
Eng1 Fail	Engine 1 Failed	
Eng1 Fire	Engine 1 Fire	
Eng1 N1	Engine 1 Fan Speed	%RPM
Eng1 N2	Engine 1 Core Speed	%RPM
Eng1 Oil Qty	Engine 1 Oil Quantity	qts
Eng1 T/R Deployed	Engine 1 Thrust Reverser Deployed	
Eng1 TRA	Engine 1 Throttle Resolver Angle	deg
Eng2 Cutoff	Engine 2 Cutoff Switch	
Eng2 Fail	Engine 2 Failed	
Eng2 Fire	Engine 2 Fire	
Eng2 N1	Engine 2 Fan Speed	%RPM
Eng2 N2	Engine 2 Core Speed	%RPM
Eng2 Oil Qty	Engine 2 Oil Quantity	qts
Eng2 T/R Deployed	Engine 2 Thrust Reverser Deployed	
Eng2 TRA	Engine 2 Throttle Resolver Angle	deg
Flap Hdl Pos	Flap Handle Position	deg
Gear Green-L	Left Landing Gear Green Light On	
Gear Green-N	Nose Landing Gear Green Light On	
Gear Green-R	Right Landing Gear Green Light On	
Gear Lvr Dn	Landing Gear Lever Down Position	
Gear Lvr Up	Landing Gear Lever Up Position	
Groundspeed	Groundspeed	kts
Latitude	Latitude Coordinate	deg
Longitude	Longitude Coordinate	deg

Plot/Table Labels	Parameter Names	Units
Mag Hdg	Magnetic Heading	deg
Master Caution	Master Caution	
Pitch	Pitch Angle	deg
Roll	Roll Angle	deg
Spdbrk Armed	Speedbrake Armed	
TCAS Reply Info	Traffic Alert and Collision Avoidance System Reply Information	
Time UTC-Hr	Coordinated Universal Time Hour	hrs
Time UTC-Min	Coordinated Universal Time Minutes	min
Time UTC-Sec	Coordinated Universal Time Seconds	sec
Vert Spd	Vertical Speed	fpm

Table 2. Verified and provided QAR parameters.

Plot/Table Labels	Parameter Names	Units
AIR/GND	Air/Ground Relay Switch	
Airspeed Comp	Computed Airspeed	kts
Alt Rad	Radio Altitude	ft
AP OFF	Autopilot Status	
APU Bld Air Vlv - L	Left Auxiliary Power Unit Air Bleed Valve	
APU Bld Air Vlv - R	Right Auxiliary Power Unit Air Bleed Valve	
APU ON	Auxiliary Power Unit On	
AT DISC	Autothrottle Disconnect Switch	
AT ENG	Autothrottle Engaged	
ECS Isolation Valve	Environmental Control System Isolation Valve	
Eng1 Cutoff	Engine 1 Cutoff Switch	
Eng1 Fail Msg	Engine 1 Failed	
Eng1 Fire	Engine 1 Fire	
Eng1 Fire Hdl Sw	Engine 1 Fire Handle Switch	
Eng1 TRA	Engine 1 Throttle Resolver Angle	deg
Eng2 Cutoff	Engine 2 Cutoff Switch	
Eng2 Fail Msg	Engine 2 Failed	
Eng 2 Fire	Engine 2 Fire	
Eng2 Fire Hdl Sw	Engine 2 Fire Handle Switch	
Eng2 TRA	Engine 2 Throttle Resolver Angle	deg
Fire Handle 1	Engine 1 Fire Handle	
Fire Handle 2	Engine 2 Fire Handle	
Groundspeed	Groundspeed	kts
Latitude	Latitude Coordinate	deg
Left ECS Pack	Left Environmental Control System Pack Status	
Longitude	Longitude Coordinate	deg
Master Caution	Master Caution	
PRSOV Cmd - L	Left Pressure Regulating and Shutoff Valve Command	
PRSOV Cmd - R	Right Pressure Regulating and Shutoff Valve Command	
Right ECS Pack	Right Environmental Control System Pack Status	
Time UTC-Hr	Coordinated Universal Time Hour	hrs
Time UTC-Min	Coordinated Universal Time Minutes	min
Time UTC-Sec	Coordinated Universal Time Seconds	sec

Note: Parameters with a blank unit description in table 1 and 2 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 3. Unit and discrete state abbreviations.

Unit and Discrete State Abbreviations	Descriptions
%RPM	percent revolutions per minute
CLSD	closed
CLSE	close
CMD	command
deg	degrees
DISC	disconnect
DN	down
ENG	engaged
F/D ONLY	flight director only
ft	feet
g	unit of gravitation acceleration
GND	ground
hrs	hours
in	inches
kts	knots
min	minutes
psig	pounds per square inch gauge
qt	quarts
RA	resolution advisory
sec	seconds
TA	traffic advisory