

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

November 4, 2021

Flight Data Recorder

Specialist's Factual Report

By Kyle Garner

1. EVENT

Location: Ontario, California
Date: January 29, 2021
Aircraft: Boeing 767-300
Registration: N363CM
Operator: Aerotransportes Mas de Carga, S.A. de C.V.
NTSB Number: ENG21LA013

2. FLIGHT DATA RECORDER GROUP

A flight data recorder (FDR) group was not convened.

3. FDR CARRIAGE REQUIREMENTS

The event aircraft, N363CM, was manufactured in 1990 and was operating as a Title 14 *Code of Federal Regulations* (CFR) Part 129 cargo flight. 14 CFR 129.20 states that an aircraft operating under this part that is registered in the United States must have a flight recorder that records parameters that would be required to be recorded if the aircraft were operated under 14 CFR 121. Thus, this aircraft was required to be equipped with an FDR that recorded, at a minimum, 22 parameters, as cited in 14 CFR 121.344.

4. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following FDR:

Recorder Manufacturer/Model:	L-3 FA2100, 256 wps
Recorder Serial Number:	580375

4.1. L-3 FA2100 FDR Description

The L3 FA2100 solid-state flight data recorder (SSFDR) records airplane flight 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 can record a minimum of 25 hours of flight data.

It is configured to record 256 12-bit words of digital information every second. Each grouping of 256 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 256-word intervals. Each data parameter (for example, altitude, heading, and airspeed) has a specifically assigned word number within the subframe. The SSFDR is designed to meet the crash-survivability requirements of TSO-C124a.

4.1.1. Recorder Condition

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

4.1.2. Recording Description

The FDR recording contained approximately 128 hours of data. The event flight was the last flight on the recording, and it was approximately one hour and nine minutes in duration.

Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The parameters evaluated for this report appeared to be per federal FDR carriage requirements.

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

4.1.4. Non-Computed Data

Some parameters recorded a non-computed data (NCD) pattern. An NCD pattern is indicative that the raw data is no longer reliable or not available. An NCD pattern is typically recorded for parameters, like computed airspeed, when the aircraft is on the ground, however, NCD patterns can also appear for certain parameters following an event.

For this recording, engine 2 throttle resolver angle and engine 2 fuel pressure parameters recorded, at times, a NCD pattern following the engine fire event.

4.2. Time Correlation

Correlation of the FDR data from SRN to Coordinated Universal Time (UTC) was established by using the recorded parameters GMT hours, GMT minutes, and GMT seconds. Accordingly, the time offset from SRN to UTC is the following:

$$\text{UTC} = \text{SRN} - 387566.$$

Therefore, for the remainder of this report, all times are referenced as UTC, not SRN, to the nearest whole second.

4.3. FDR Plots and Tabular Data

Figures 1 to 6 contain FDR data recorded during the event flight on January 29, 2021. Figures 1 to 5 show basic, autopilot, autothrottle, and engine parameters for the entire event flight from 18:40 to 20:00 UTC. Figure 6 shows only engine 2 parameters during the fire event from 18:43 to 18:55 UTC.

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 = +, Pitch Up = +, Elevator Trailing Edge Up = +, Right Rudder = +. The only exception to this convention is that positive left aileron will be indicative of a left turn/roll.

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 tabular data used to create figures 1 to 6 are provided in compressed electronic comma-separated value (*.csv) format as attachment 1 to this report. Note that not all parameters provided in the tabular data are plotted.

Basic Parameters - Event Flight

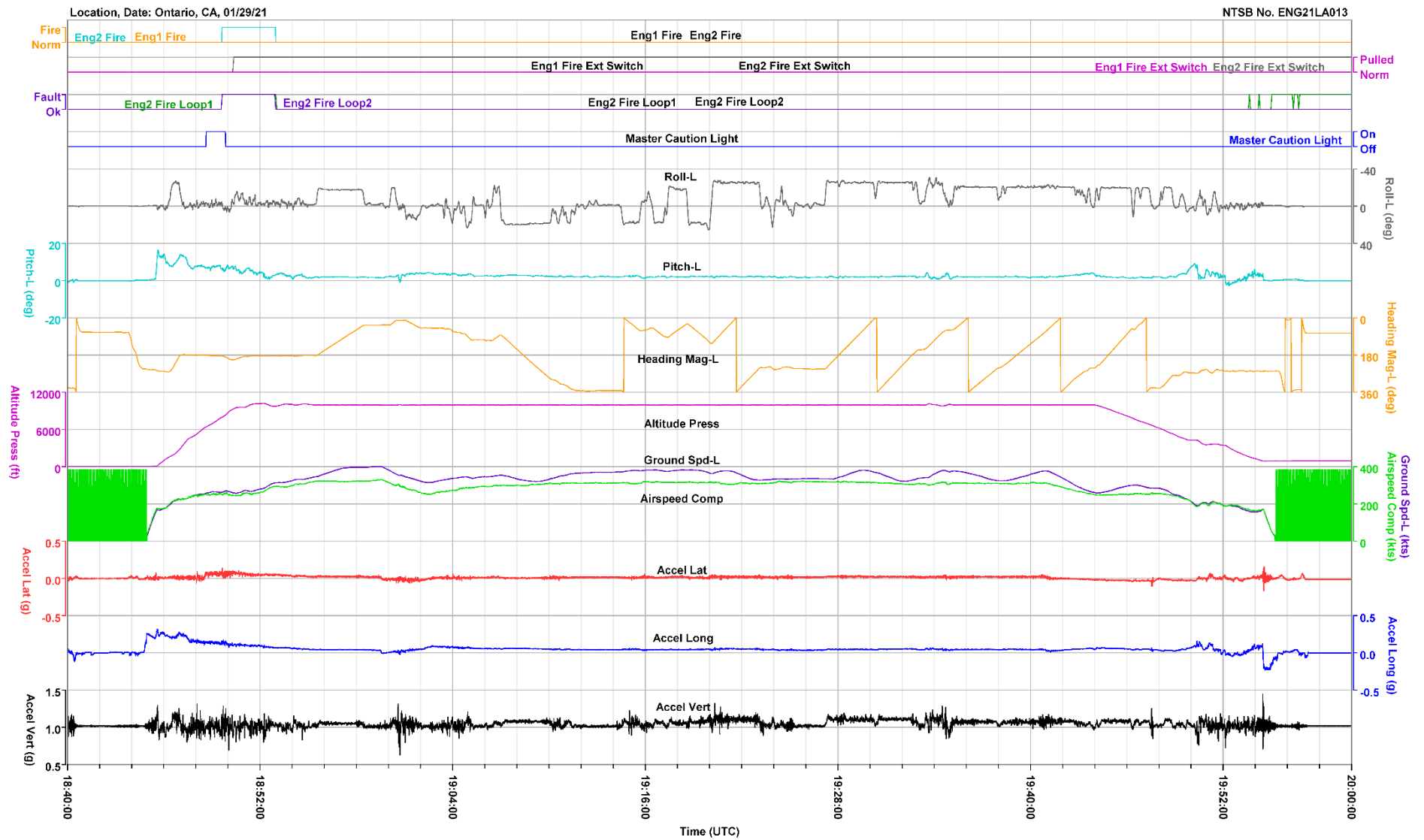


Figure 1. Basic parameters – event flight.

AP Parameters - Event Flight

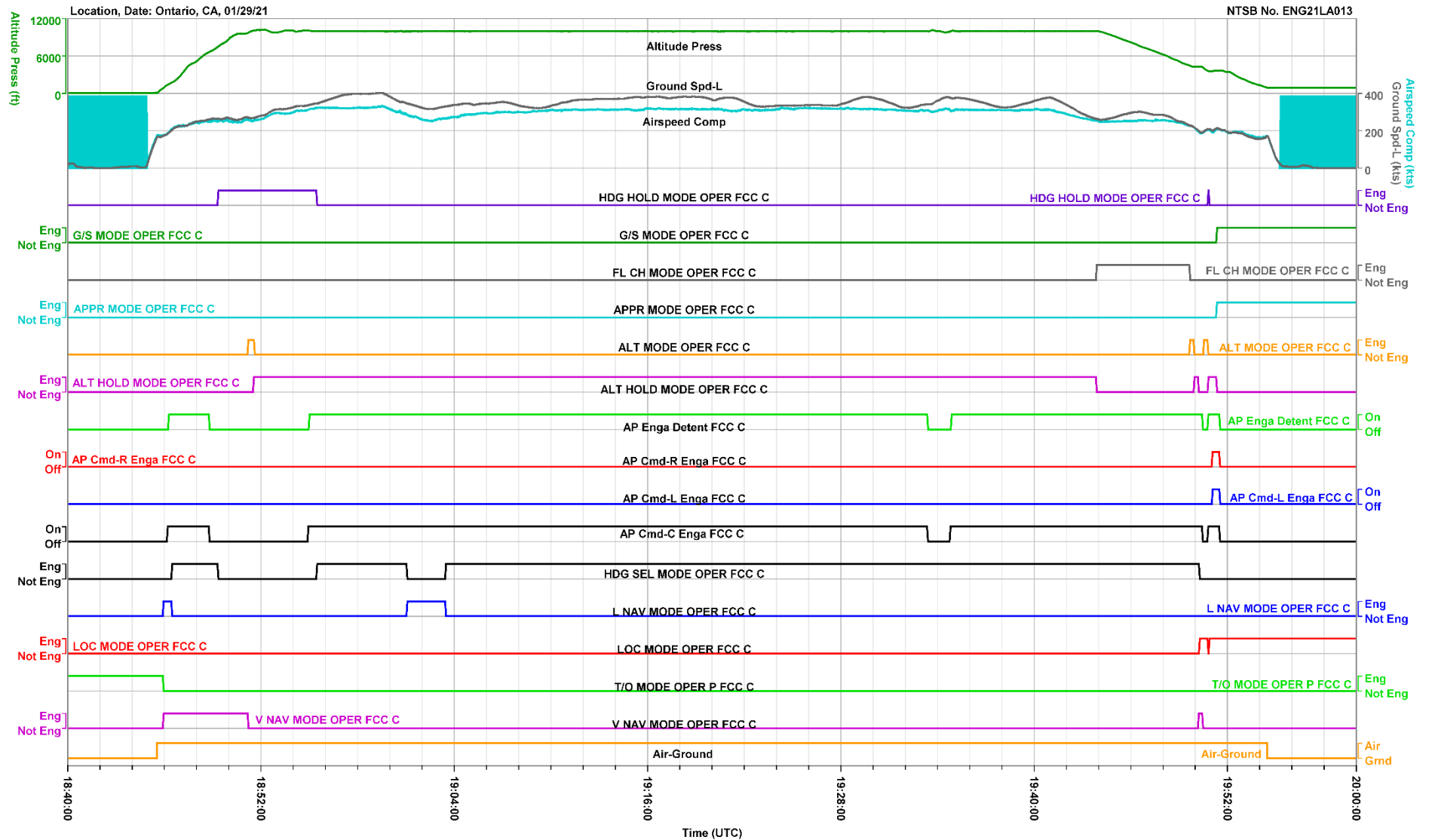


Figure 2. Autopilot parameters - event flight.

AT Parameters - Event Flight

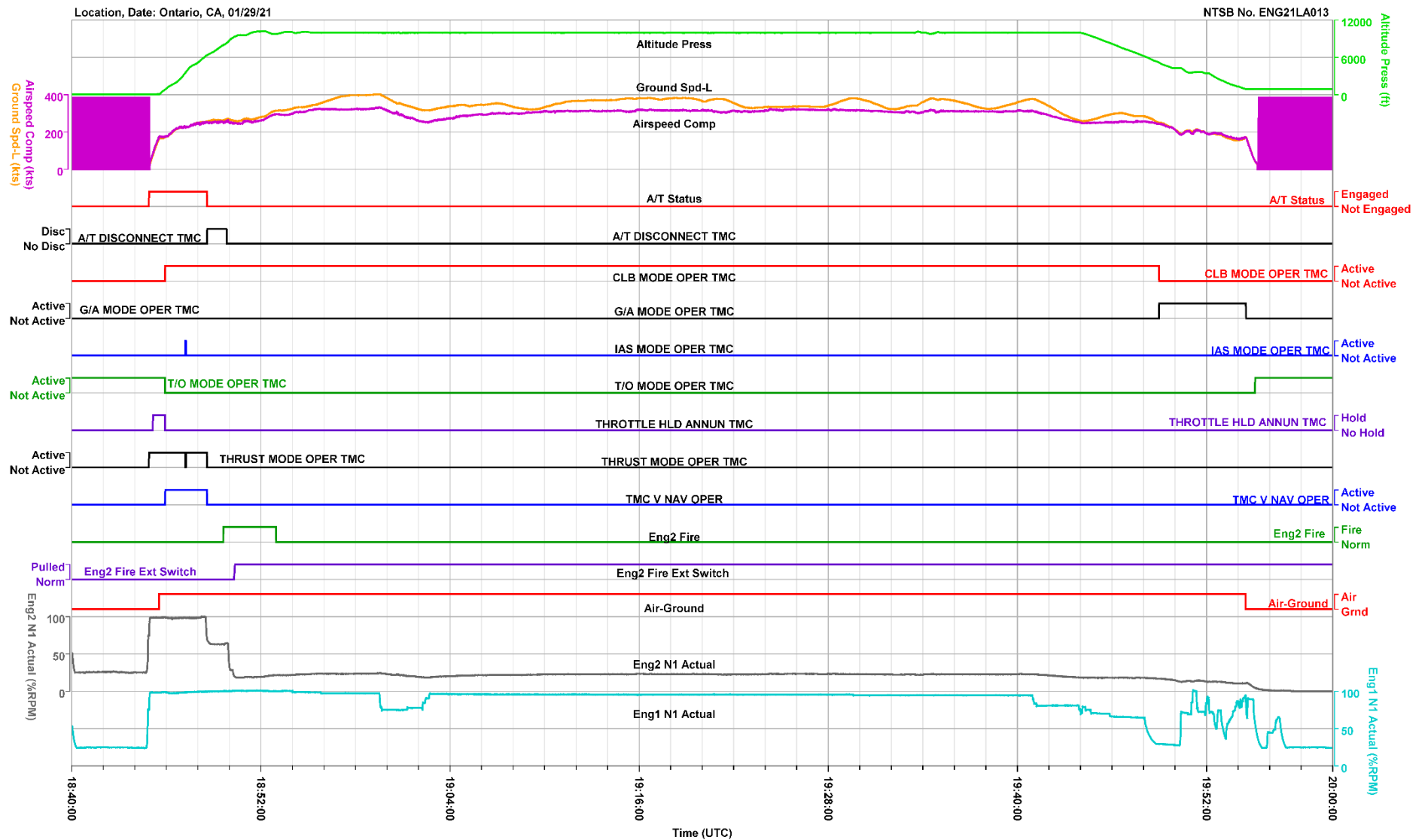


Figure 3. Autothrottle parameters - event flight.

Engine 1 Parameters - Event Flight

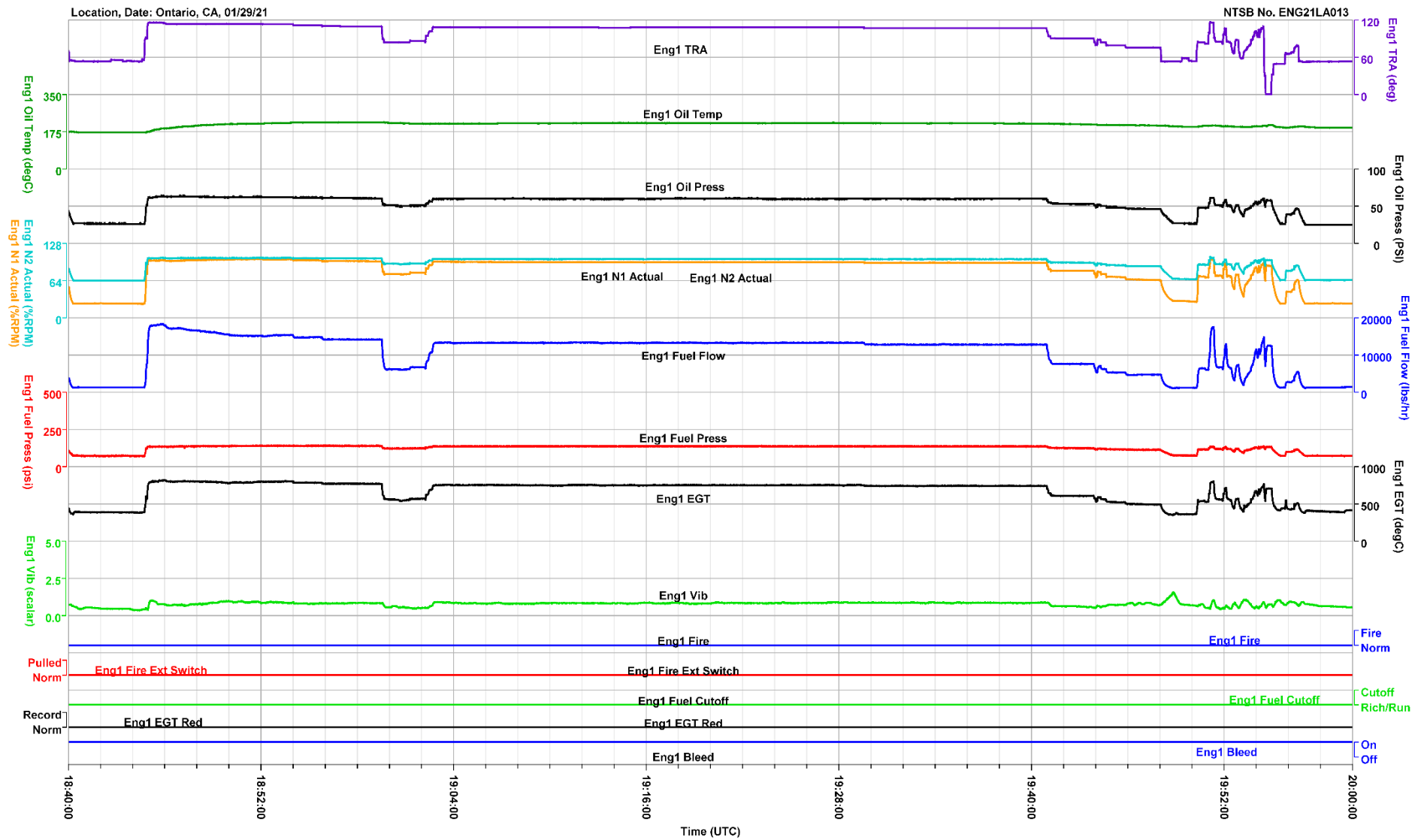
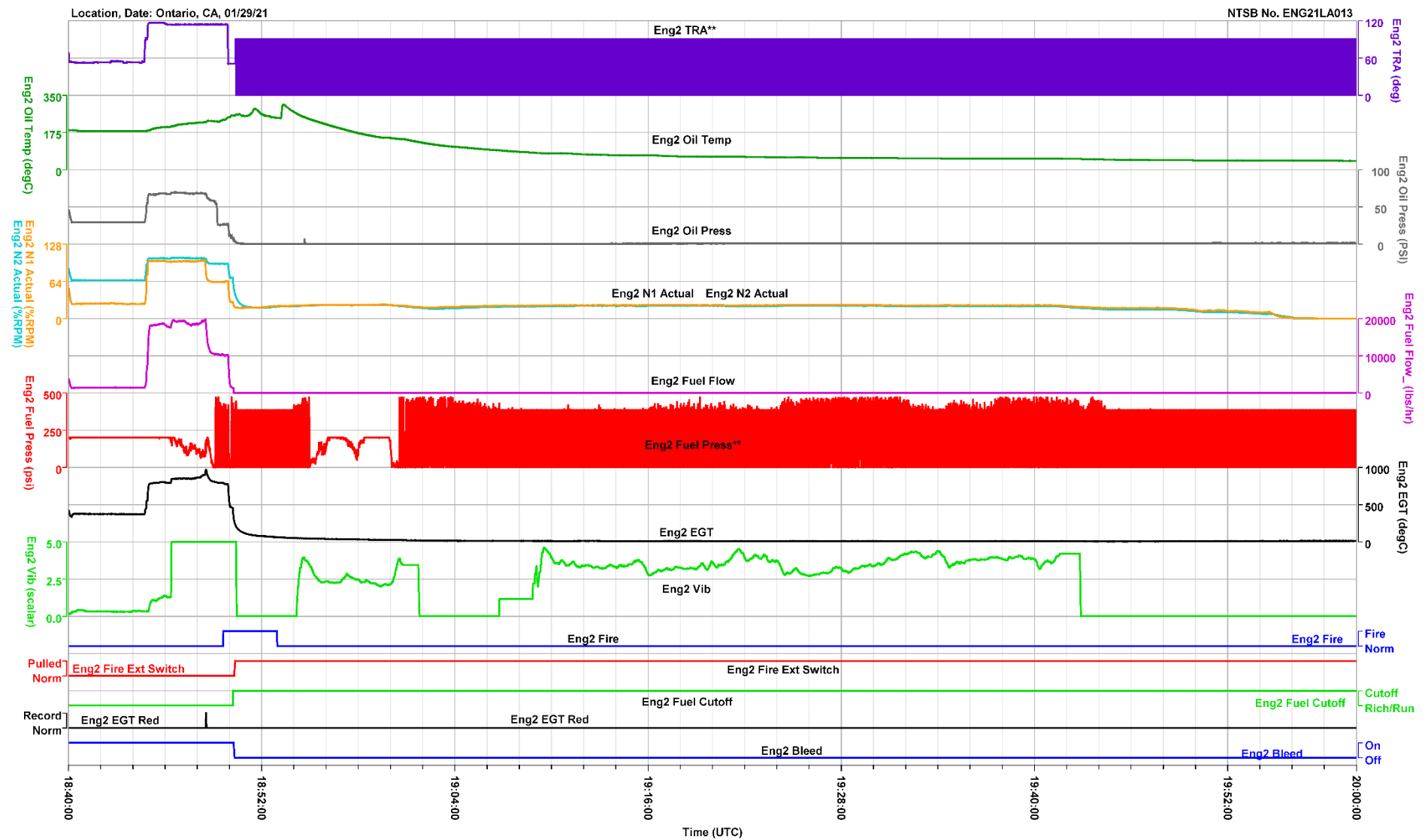


Figure 4. Engine 1 parameters - event flight.

Engine 2 Parameters - Event Flight



**Following the event, parameters Eng2 Fuel Press and Eng2 TRA at times displayed a non-computed data pattern.

Figure 5. Engine 2 parameters - event flight.

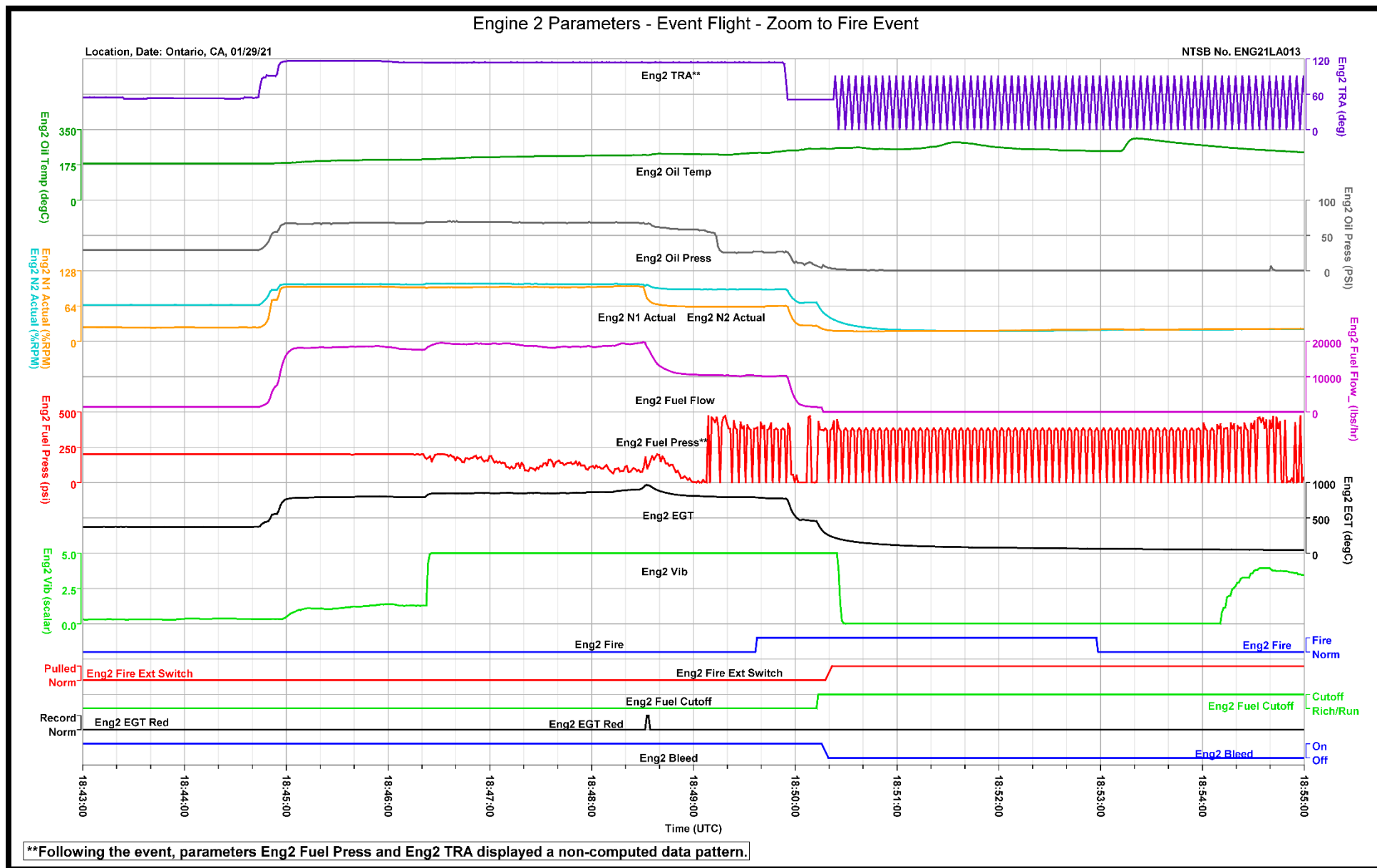


Figure 6. Engine 2 parameters - zoom to fire event.

APPENDIX A

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

Table A-1. Verified and provided FDR parameters.

Plot/Table Labels	Parameter Names	Units
Accel Lat	Lateral Acceleration	g
Accel Long	Longitudinal Acceleration	g
Accel Vert	Vertical Acceleration	g
Air-Ground	Air-Ground	
Airspeed Comp	Computed Airspeed	kts
ALT HOLD MODE OPER FCC C	Alt Hold Mode Operate - Flight Control Computer Center	
ALT HOLD MODE OPER MCP	Alt Hold Mode Operate - Mode Control Panel	
ALT MODE OPER FCC C	Alt Mode Operate - Flight Control Computer Center	
Altitude Press	Pressure Altitude	ft
Altitude Radio Comb	Radio Altitude	ft
AP Cmd-C Enga FCC C	Autopilot Command - Center Engaged Flight Control Computer Center	
AP Cmd-C Enga MCP	Autopilot Command - Center Engaged Mode Control Panel	
AP Cmd-L Enga FCC C	Autopilot Command - Left Engaged Flight Control Computer Center	
AP Cmd-L Enga MCP	Autopilot Command - Left Engaged Mode Control Panel	
AP Cmd-R Enga FCC C	Autopilot Command - Right Engaged Flight Control Computer Center	
AP Cmd-R Enga MCP	Autopilot Command - Right Engaged Mode Control Panel	
AP Enga Detent FCC C	Autopilot Engaged Detent Flight Control Computer Center	
AP Enga Detent FCC L	Autopilot Engaged Detent Flight Control Computer Left	
AP Enga Detent FCC R	Autopilot Engaged Detent Flight Control Computer Right	
APPR MODE OPER FCC C	Approach Mode Operate - Flight Control Computer Center	
A/T DISC	Autothrottle Disconnect	
A/T DISCONNECT TMC	Autothrottle Disconnect - Thrust Management Computer	
A/T Status	Autothrottle Status	
AVM ALERT ENG 1/2	Airborne Vibration Monitor Alert - Engine 1/2	
CLB MODE OPER TMC	Climb Mode Operate - Thrust Management Computer	
ENG LO OIL PRES L	Engine 1 Low Oil Pressure	
ENG LO OIL PRES R	Engine 2 Low Oil Pressure	
Eng1/2 Bleed	Engine 1/2 Bleed	
Eng1/2 EEC Fault	Engine 1/2 Electronic Engine Control Fault	
Eng1/2 EEC Valid	Engine 1/2 Electronic Engine Control Valid	
Eng1/2 EGT	Engine 1/2 Exhaust Gas Temperature	degC
Eng1/2 EGT Red	Engine 1/2 Exhaust Gas Temperature Red	
Eng1/2 Filter1 Vib	Engine 1/2 Filter 1 Vibration	scalar
Eng1/2 Filter2 Vib	Engine 1/2 Filter 2 Vibration	scalar
Eng1/2 Filter3 Vib	Engine 1/2 Filter 3 Vibration	scalar
Eng1/2 Fire	Engine 1/2 Fire	
Eng1/2 Fire Ext Switch	Engine 1/2 Fire Extinguish Switch	
Eng1/2 Fire Loop1	Engine 1/2 Fire Loop 1	
Eng1/2 Fire Loop2	Engine 1/2 Fire Loop 2	
Eng1/2 Fuel Cutoff	Engine 1/2 Fuel Cutoff	
Eng1/2 Fuel Flow	Engine 1/2 Fuel Flow	lbs/hr
Eng1/2 Fuel Press	Engine 1/2 Fuel Pressure	psi
Eng1/2 N1 Actual	Engine 1/2 N1 Actual	%RPM

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Plot/Table Labels	Parameter Names	Units
Eng1/2 N1 Cmd	Engine 1/2 N1 Command	%RPM
Eng1/2 N1 Limit	Engine 1/2 N1 Limit	%RPM
Eng1/2 N2 Actual	Engine 1/2 N2 Actual	%RPM
Eng1/2 Oil Press	Engine 1/2 Oil Pressure	psi
Eng1/2 Oil Press Red	Engine 1/2 Oil Pressure Red	
Eng1/2 Oil Qty	Engine 1/2 Oil Quantity	pint
Eng1/2 Oil Temp	Engine 1/2 Oil Temperature	degC
Eng1/2 Static Press	Engine 1/2 Static Pressure	inHg
Eng1/2 T2	Engine 1/2 T2	degC
Eng1/2 TRA	Engine 1/2 Throttle Resolver Angle	deg
Eng1/2 Vib	Engine 1/2 Vibration	scalar
Eng1/2 Vib Ident	Engine 1/2 Vibration Ident	
FL CH MODE OPER FCC C	Flight Level Change Mode Operate - Flight Control Computer Center	
FL CH MODE OPER MCP	Flight Level Change Mode Operate - Mode Control Panel	
Flap Handle Posn	Flap Handle Position	deg
G/A MODE OPER TMC	Go Around Mode Operate - Thrust Management Computer	
G/S MODE OPER FCC C	Glideslope Mode Operate - Flight Control Computer Center	
G/S MODE OPER MCP	Glideslope Mode Operate - Mode Control Panel	
Ground Spd-L	Ground Speed - Left	kts
HDG HOLD MODE OPER FCC C	Heading Hold Mode Operate - Flight Control Computer Center	
HDG HOLD MODE OPER MCP	Heading Hold Mode Operate - Mode Control Panel	
HDG SEL MODE OPER FCC C	Heading Select Mode Operate - Flight Control Computer Center	
HDG SEL MODE OPER MCP	Heading Select Mode Operate - Mode Control Panel	
Heading Mag-L	Magnetic Heading - Left	deg
IAS MODE OPER TMC	Indicated Airspeed Mode Operate - Thrust Management Computer	
L NAV MODE OPER FCC C	Lateral Navigation Mode Operate - Flight Control Computer Center	
L NAV MODE OPER MCP	Lateral Navigation Mode Operate - Mode Control Panel	
LOC MODE OPER FCC C	Localizer Mode Operate - Flight Control Computer Center	
LOC MODE OPER MCP	Localizer Mode Operate - Mode Control Panel	
Master Caution Light	Master Caution	
Master Warning-L	Master Warn - Left	
Master Warning-R	Master Warn - Right	
Pitch-L	Pitch Angle - Left	deg
Roll-L	Roll Angle - Left	deg
T/O MODE OPER P FCC C	Takeoff Mode Operate - Flight Control Computer Center	
T/O MODE OPER TMC	Takeoff Mode Operate - Thrust Management Computer	
T/R Deployed L	Thrust Reverser Deployed - Left	
T/R Deployed R	Thrust Reverser Deployed - Right	
T/R In Transit L	Thrust Reverser In-Transit - Left	
T/R In Transit R	Thrust Reverser In-Transit - Right	
THROTTLE HLD ANNUN TMC	Throttle Hold Annunciation - Thrust Management Computer	
THRUST MODE OPER TMC	Thrust Mode Operate - Thrust Management Computer	
Time GMT	Time GMT	hh:mm:ss
Time GMT Hrs	GMT HOURS	hrs

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Plot/Table Labels	Parameter Names	Units
Time GMT Min	GMT MINUTES	min
Time GMT Sec	GMT SECONDS	sec
TMC V NAV OPER	Vertical Navigation Operate - Thrust Management Computer	
V NAV MODE OPER FCC C	Vertical Navigation Mode Operate - Flight Control Computer Center	
V NAV MODE OPER MCP	Vertical Navigation Mode Operate - Mode Control Panel	

NOTE: This FDR records pressure altitude, which is based on a standard altimeter setting of 29.92 inches of mercury (in Hg). The pressure altitude information presented in the FDR plots and 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 A-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 A-2. Unit and discrete abbreviations.

Unit and discrete abbreviations	Description
deg	degrees
degC	degrees Celsius
ft	feet
g	gravitational constant
hh/hrs	hours
inHg	inches of mercury
kts	knots
lbs/hr	pounds per hour
mm/min	minutes
psi	pounds per square inch
%RPM	revolutions per minute
ss/sec	seconds