

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



DCA23LA109

FLIGHT DATA RECORDER

Specialist's Factual Report

September 8, 2023

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A. ACCIDENT

Location: Montgomery, Alabama
Date: December 31, 2022
Time: 15:39 central standard time (CST)
Airplane: Embraer 170-200, Envoy Air Inc., N264NN

B. FLIGHT DATA RECORDER SPECIALIST

Specialist Cassandra Johnson
Mechanical Engineer
National Transportation Safety Board (NTSB)

C. FEDERAL CARRIAGE REQUIREMENTS

The event aircraft, N264NN, was operating under Title 14 *Code of Federal Regulations* (CFR) Part 121. The event aircraft was manufactured in 2018 and was operating such that it was required to be equipped with a flight data recorder (FDR) that recorded, at a minimum, 88 parameters, as cited in 14 CFR Part 121.344(f).

D. DETAILS OF THE INVESTIGATION

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

Recorder Manufacturer/Model: Universal Avionics CVFDR W / RIPS
Part Number: 1605-01-00
Recorder Serial Number: 1040

1.0 Universal Avionics CVFDR Description

The Universal Avionics cockpit voice flight data recorder (CVFDR) with recorder independent power supply (RIPS) is a dual function recorder providing both flight data recorder (FDR) and cockpit voice recorder (CVR) functions with an integrated RIPS. The FDR function records airplane flight information in a digital format using solid-state flash memory as the recording medium. The Universal Avionics CVFDR 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 512 12-bit words of digital information 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, altitude, heading, airspeed)

has a specifically assigned word number within the subframe. The CVFDR is designed to meet the crash-survivability requirements of TSO-C123b and TSO-C124b. For the rest of this report, the CVFDR will be referred to as an FDR.

1.1 Recorder Condition

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

1.2 Recording Description

The FDR recording contained approximately 141 hours of data. Timing of the FDR data is measured in subframe reference number (SRN), where each SRN equals one elapsed second. The event was recorded at the end of the FDR data. The parameters evaluated for the purpose of this report appeared to be in accordance with federal FDR carriage requirements.

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

1.4 Time Correlation

Correlation of the FDR data from SRN to the event local time, CST, was established by using the recorded coordinated universal time (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 CST is the following: $CST = SRN - 450,140$. Therefore, for the rest of this report, all times are referenced as CST, not SRN.

E. FIGURES AND TABULAR DATA

Figures 1 and 2 contain FDR data recorded during the event on December 31, 2022. All the parameters listed in table 1 are plotted except UTC Hours, UTC Minutes,

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 = +.

and UTC Seconds. Both figures cover data from landing to the end of the FDR recording. Figure 1 contains select basic and door parameters and figure 2 contains additional door parameters. 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 data indicated the following sequence of events:

- At 15:38:36 CST, about 3 minutes and 23 seconds after landing, the inboard and outboard parking brake pressure statuses changed from not applied to applied. At this time, the statuses for both engine 1 and engine 2 control modes were Idle gas generator speed (Idle NG).
- Approximately 9 seconds later, at 15:38:45 CST, the engine 2 control mode changed to shutdown while the engine 1 control mode remained Idle NG.
- About 27 seconds later, at 15:39:12 CST, the forward baggage door locked sensor changed from locked to not locked.
- Three seconds later, at 15:39:15 CST, the forward baggage door closed sensor and the forward baggage door latched sensor 1 transitioned from closed to not closed and latched to not latched, respectively.
- Less than a second later, at 15:39:15.7 CST, the master warning forward cargo door open enabled transitioned from false to true and the master warning forward cargo door open displayed changed from not for all to active/display.
- Two seconds later, at 15:39:17.7 CST, the master warning forward cargo door open displayed transitioned to active/acknowledge/displayed (Active/Ack/Display).
- About 35 seconds later, at 15:39:52.7 CST, the master warning forward cargo door open enabled transitioned back to false and the master warning forward cargo door open displayed changed to not for all.
- About 1 second later, at 15:39:54 CST, the engine 1 control mode changed to shutdown.

The corresponding tabular data used to create figures 1 and 2, including UTC Hours, UTC Minutes, and UTC Seconds, are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

Submitted by:

Cassandra Johnson
Mechanical Engineer

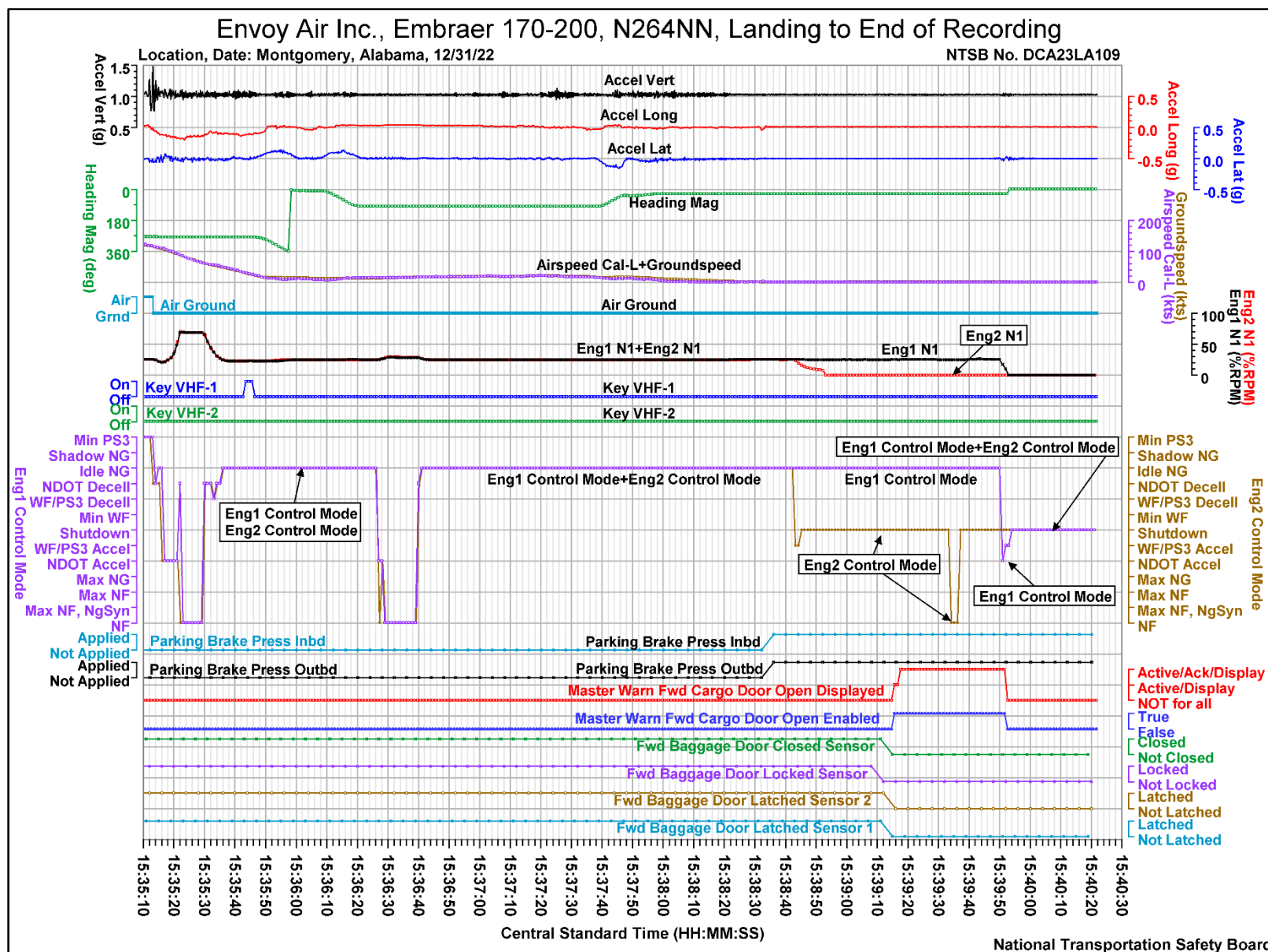


Figure 1. Plot of select basic and door status parameters from landing to end of recording.

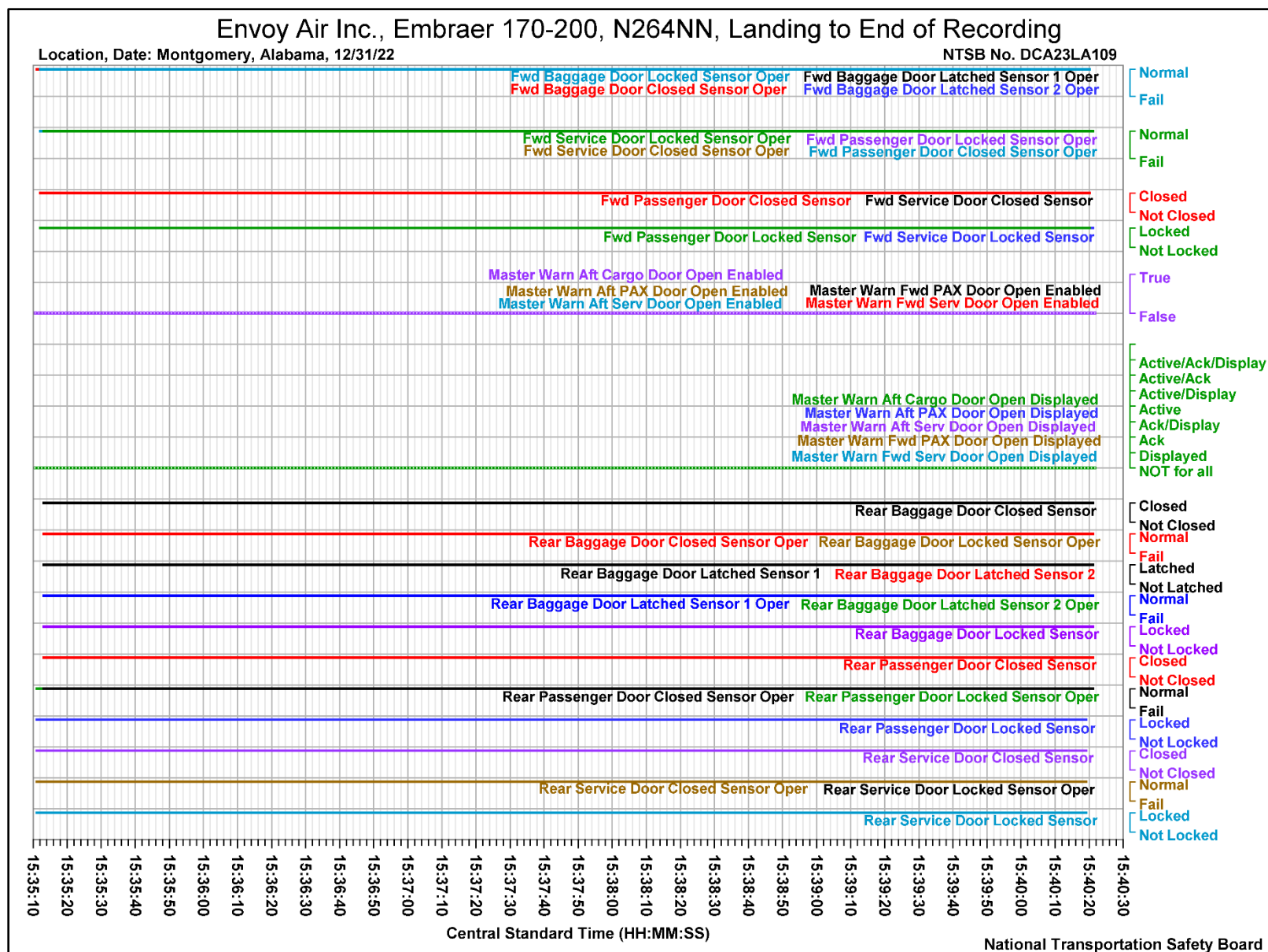


Figure 2. Plot of additional door status parameters from landing to end of recording.

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 Acceleration	g
Accel Long	Longitudinal Acceleration	g
Accel Vert	Vertical Acceleration	g
Air Ground	Air Ground Sensor	
Airspeed Cal-L	Left Calibrated Airspeed	kts
Eng1 Control Mode	Engine 1 Control Mode	
Eng1 N1	Engine 1 Fan Speed Actual	%RPM
Eng2 Control Mode	Engine 2 Control Mode	
Eng2 N1	Engine 2 Fan Speed Actual	%RPM
Fwd Baggage Door Closed Sensor	Forward Baggage Door Closed Sensor	
Fwd Baggage Door Closed Sensor Oper	Forward Baggage Door Closed Sensor Operational	
Fwd Baggage Door Latched Sensor 1	Forward Baggage Door Latched Sensor 1	
Fwd Baggage Door Latched Sensor 1 Oper	Forward Baggage Door Latched Sensor 1 Operational	
Fwd Baggage Door Latched Sensor 2	Forward Baggage Door Latched Sensor 2	
Fwd Baggage Door Latched Sensor 2 Oper	Forward Baggage Door Latched Sensor 2 Operational	
Fwd Baggage Door Locked Sensor	Forward Baggage Door Locked Sensor	
Fwd Baggage Door Locked Sensor Oper	Forward Baggage Door Locked Sensor Operational	
Fwd Passenger Door Closed Sensor	Forward Passenger Door Closed Sensor	
Fwd Passenger Door Closed Sensor Oper	Forward Passenger Door Closed Sensor Operational	
Fwd Passenger Door Locked Sensor	Forward Passenger Door Locked Sensor	
Fwd Passenger Door Locked Sensor Oper	Forward Passenger Door Locked Sensor Operational	
Fwd Service Door Closed Sensor	Forward Service Door Closed Sensor	
Fwd Service Door Closed Sensor Oper	FWD Service Door Closed Sensor Operational	
Fwd Service Door Locked Sensor	Forward Service Door Locked Sensor	
Fwd Service Door Locked Sensor Oper	Forward Service Door Locked Sensor Operational	
Groundspeed	Groundspeed	kts
Heading Mag	Magnetic Heading	deg
Key VHF-1	Microphone Keying Very High Frequency-1	
Key VHF-2	Microphone Keying Very High Frequency-2	
Master Warn Aft Cargo Door Open Displayed	Master Warning Aft Cargo Door Open Displayed	
Master Warn Aft Cargo Door Open Enabled	Master Warning Aft Cargo Door Open Enabled	
Master Warn Aft PAX Door Open Displayed	Master Warning Aft Passenger Door Open Displayed	

Plot/Table Labels	Parameter Names	Units
Master Warn Aft PAX Door Open Enabled	Master Warning Aft Passenger Door Open Enabled	
Master Warn Aft Serv Door Open Displayed	Master Warning Aft Service Door Open Displayed	
Master Warn Aft Serv Door Open Enabled	Master Warning Aft Service Door Open Enabled	
Master Warn Fwd Cargo Door Open Displayed	Master Warning Forward Cargo Door Open Displayed	
Master Warn Fwd Cargo Door Open Enabled	Master Warning Forward Cargo Door Open Enabled	
Master Warn Fwd PAX Door Open Displayed	Master Warning Forward Passenger Door Open Displayed	
Master Warn Fwd PAX Door Open Enabled	Master Warning Forward Passenger Door Open Enabled	
Master Warn Fwd Serv Door Open Displayed	Master Warning Forward Service Door Open Displayed	
Master Warn Fwd Serv Door Open Enabled	Master Warning Door Service Forward Open Enabled	
Parking Brake Press Inbd	Inboard Parking Brake Pressure Applied status	
Parking Brake Press Outbd	Outboard Parking Brake Pressure Applied status	
Rear Baggage Door Closed Sensor	Rear Baggage Door Closed Sensor	
Rear Baggage Door Closed Sensor Oper	Rear Baggage Door Closed Sensor Operational	
Rear Baggage Door Latched Sensor 1	Rear Baggage Door Latched Sensor 1	
Rear Baggage Door Latched Sensor 1 Oper	Rear Baggage Door Latched Sensor 1 Operational	
Rear Baggage Door Latched Sensor 2	Rear Baggage Door Latched Sensor 2	
Rear Baggage Door Latched Sensor 2 Oper	Rear Baggage Door Latched Sensor 2 Operational	
Rear Baggage Door Locked Sensor	Rear Baggage Door Locked Sensor	
Rear Baggage Door Locked Sensor Oper	Rear Baggage Door Locked Sensor Operational	
Rear Passenger Door Closed Sensor	Rear Passenger Door Closed Sensor	
Rear Passenger Door Closed Sensor Oper	Rear Passenger Door Closed Sensor Operational	
Rear Passenger Door Locked Sensor	Rear Passenger Door Locked Sensor	
Rear Passenger Door Locked Sensor Oper	Rear Passenger Door Locked Sensor Operational	
Rear Service Door Closed Sensor	Rear Service Door Closed Sensor	
Rear Service Door Closed Sensor Oper	Rear Service Door Closed Sensor Operational	
Rear Service Door Locked Sensor	Rear Service Door Locked Sensor	
Rear Service Door Locked Sensor Oper	Rear Service Door Locked Sensor Operational	
Time UTC Hrs	Coordinated Universal Time Hours	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 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
Accel	Acceleration
Ack	Acknowledge
Decell	Deceleration
deg	degrees
g	unit of gravitation acceleration
Grnd	Ground
hrs	hours
kts	knots
Max	Maximum
min	minutes
Min PS3	Minimum Compressor Exit Pressure
Min WF	Minimum Fuel Flow
NDOT	Rate of change of core speed
NF	Power Turbine Section Speed
NG	Engine Gas Generator Speed
NgSyn	Engine Gas Generator Speed Sync
PS3	Compressor Exit Pressure
sec	seconds
WF	Fuel Flow