

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN21FA230

ENGINE CONTROL UNIT

Specialist's Factual Report

October 27, 2022

A. EVENT

Location: Shreveport, Louisiana
Date: May 23, 2021
Time: 14:47 central daylight time (CDT)
Airplane: SubSonex JSX-2 experimental amateur built jet airplane, N465JC

B. ENGINE CONTROL UNIT SPECIALIST

Specialist: W. Deven Chen
National Transportation Safety Board (NTSB)
Washington, DC

C. DETAILS OF THE INVESTIGATION

A recorder group was not convened. The NTSB Vehicle Recorder Division received the following engine control unit (ECU):

Recorder Manufacturer/Model:	UNIS FADEC
Recorder Serial Number:	0031-D402

1.0 Recorder Description

The UNIS FADEC (full authority digital engine control) is a computer-managed aircraft ignition and engine control system, manufactured by UNIS, Inc and supplied to PBS Velka Bites for further implementation. The device contains an SD card internally to record communication on the CAN (controller area network) bus. Depending on the configuration, the recorded data can include engine RPM, inlet air temperature, exhaust gas temperature, fuel pump speed, oil separator speed, and voltage on the electric bus, etc.

1.1 Recorder Condition and Data Recovery

The device had sustained damage upon arrival at the Vehicle Recorder Division. As shown in figure 1, the circuit board inside the device was corroded. An SD card containing raw data was recovered from the device. The raw data were sent to PBS Velka Bites for decoding with the assistance of the Air Accidents Investigation Institute (AAIL) of the Czech Republic, and PBS Velka Bites sent back decoded data in engineering units.



Figure 1. The UNIS FADEC as received.

1.2 Recording Description

The data sent back from PBS Velka Bites contained 235 data logs. The last data log was determined to be associated with the event flight. The recording was approximately 12 minutes and 44 seconds in duration and with an approximately 1.4 Hz sampling rate.

1.2.1 Parameters Provided

Table 1 lists the recorder parameters verified and provided in this report.

Table 1. UNIS FADEC data parameters provided.

Parameter Name (unit)	Parameter Description (unit)
n_fp (1/min)	Fuel pump speed (revolutions per minute)
n_main (1/min)	Engine speed (revolutions per minute)
n_mainp (%)	Corrected Engine speed (percentage)
n_oil (1/min)	Oil separator speed (revolutions per minute)
t_in (degF)	Inlet air temperature (degrees Fahrenheit)
t_int (degF)	Internal temperature of the ECU (degrees Fahrenheit)
t_out (degF)	Exhaust gas temperature (degrees Fahrenheit)
t_tr (degF)	Temperature of power element in the ECU (degrees Fahrenheit)
U_sup (V)	Supply voltage of the ECU (volts)

1.3 Time Correlation

The data were recorded in Coordinated Universal Time (UTC), but there was a time deviation between the recorded time and the real time. According to PBS Velka Bites, the time deviation was caused by the instability of the internal clock frequency accumulated over the life span of the device. A time correlation of the data was not conducted, instead, the times in the report are presented in elapsed time from the start of the recording.

D. FIGURES AND TABULAR DATA

Figures 2 and 3 contain data recorded during the event on May 23, 2021. All the parameters listed in table 1 are plotted.

The corresponding tabular data used to create figures 2 and 3 are provided in electronic comma separated value (CSV) format as attachment 1 to this report.

Submitted by:

W. Deven Chen
Electrical Engineer – Recorder Specialist

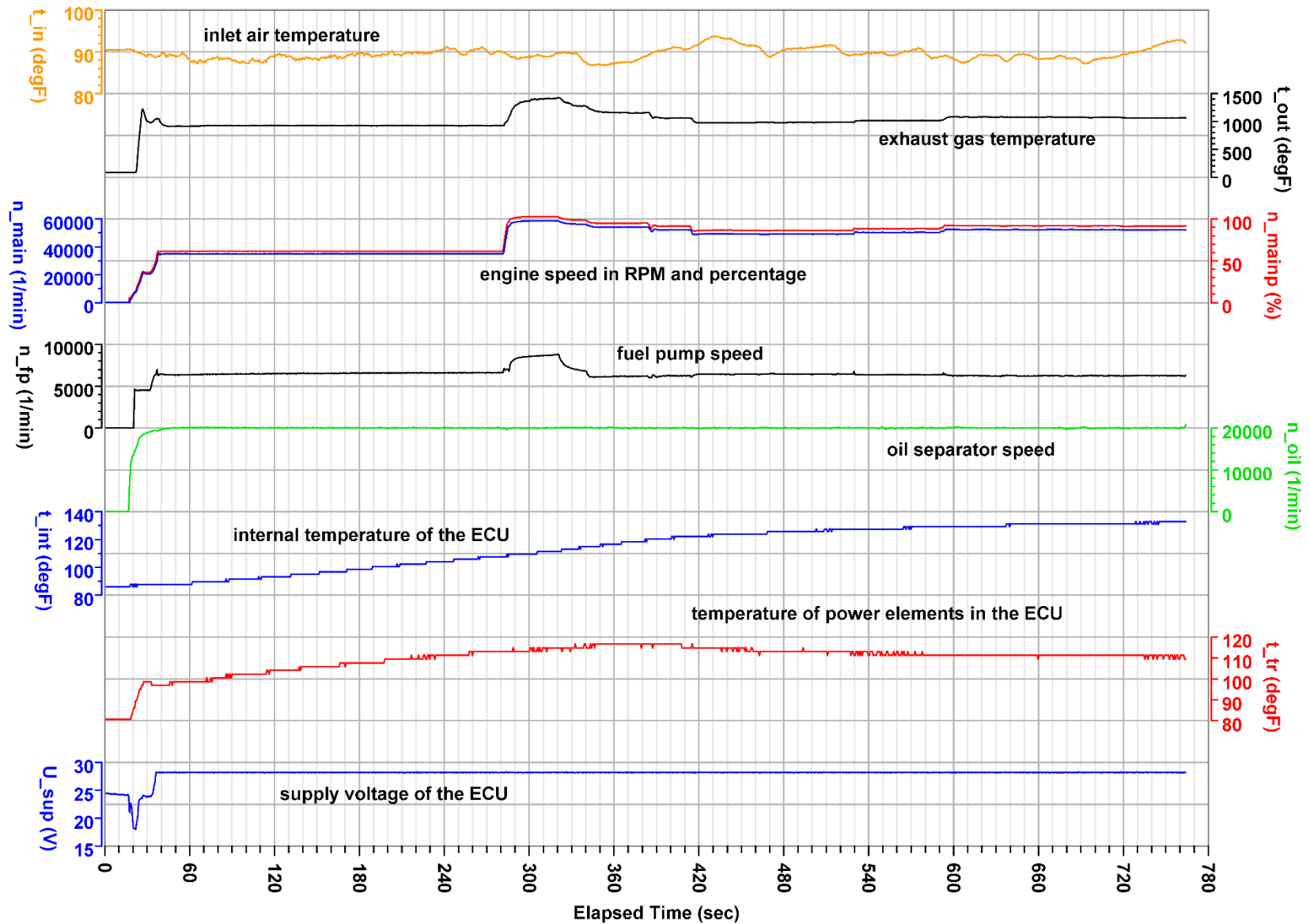


Figure 2. Plot of data parameters for the entire event recording.

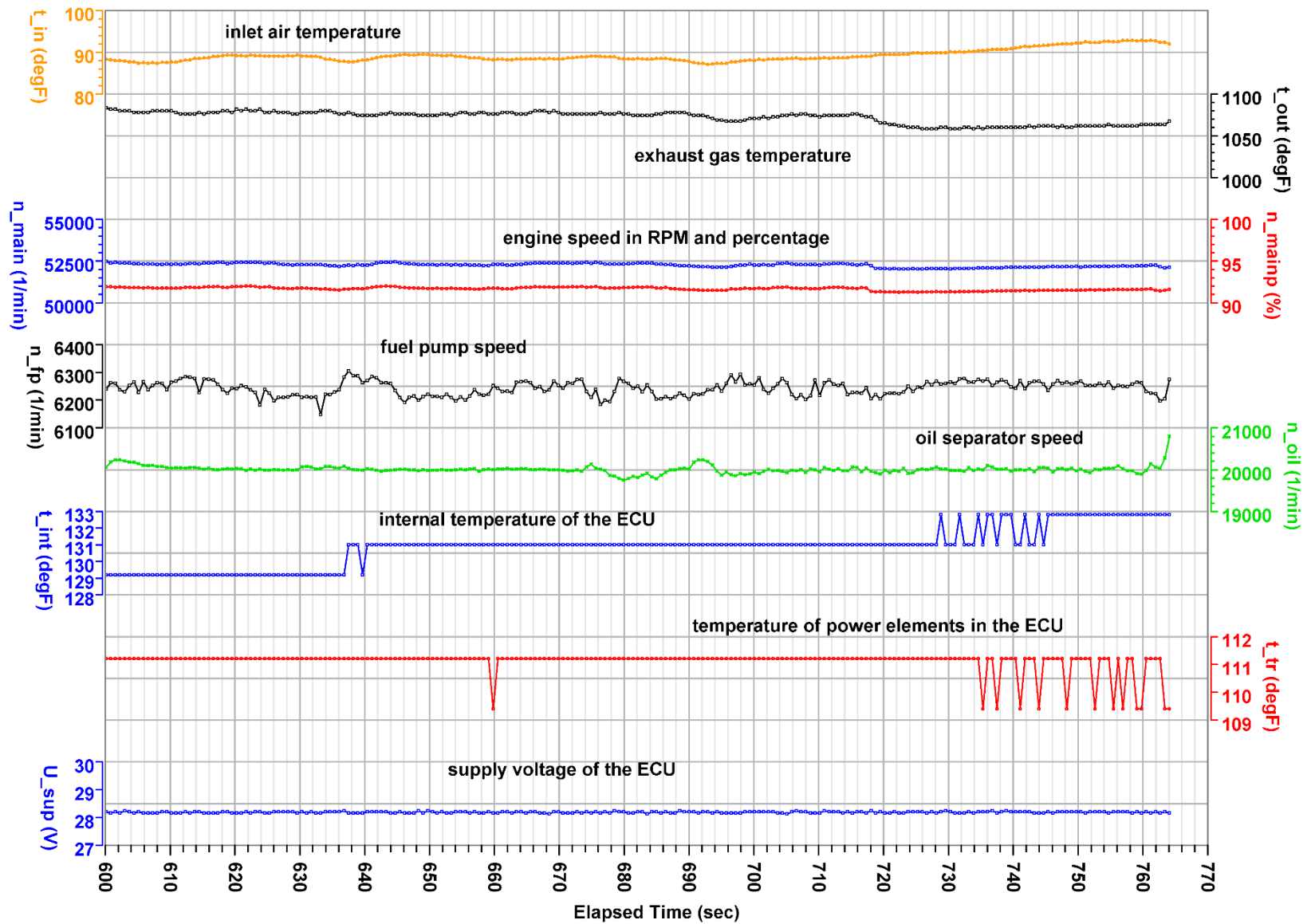


Figure 3. Plot of data parameters for the last 3 minutes of the event recording.