

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594

September 21, 2022



COMPONENT EXAMINATION FACTAL REPORT

A. ACCIDENT INFORMATION

Place : Wheeling, IL
Date : August 11, 2021
Vehicle : Robinson Helicopter / R44 / N4043B
NTSB No. : CEN21LA369
Investigator: John Brannen

B. COMPONENTS EXAMINED

Nomenclature	Model	Part Number	Serial Number	Notes
Governor Controller/EMU	MD46	6420046-1	L19-10140	Config: R44, A/C SN: 14431, Nov 2020
Engine rpm (revolution per minute) Sensor Assembly	N/A	C143-1 rev A	0012	Mfr PN: 427040-00, 03/2018
RPM Signal Cable Electrical Connector	NA	N/A	N/A	4 pin plastic connector

C. DETAILS OF THE EXAMINATION

1.0 Governor Controller/ EMU (Engine Monitoring Unit), General Condition

The control box lower left mounting tab was broken off, otherwise the box appeared undamaged. The MidContinent Instruments Avionics warrantee seal was intact. The 44-pin connector was attached to the box and the wire bundle leading out of the connector had been cut. The 15-pin connector port was open. The Bluetooth Universal Serial Bus (USB) antenna was in the upper USB port and the lower USB port was open. The plastic elbow for the manifold pressure was attached to the side (Figure 1).

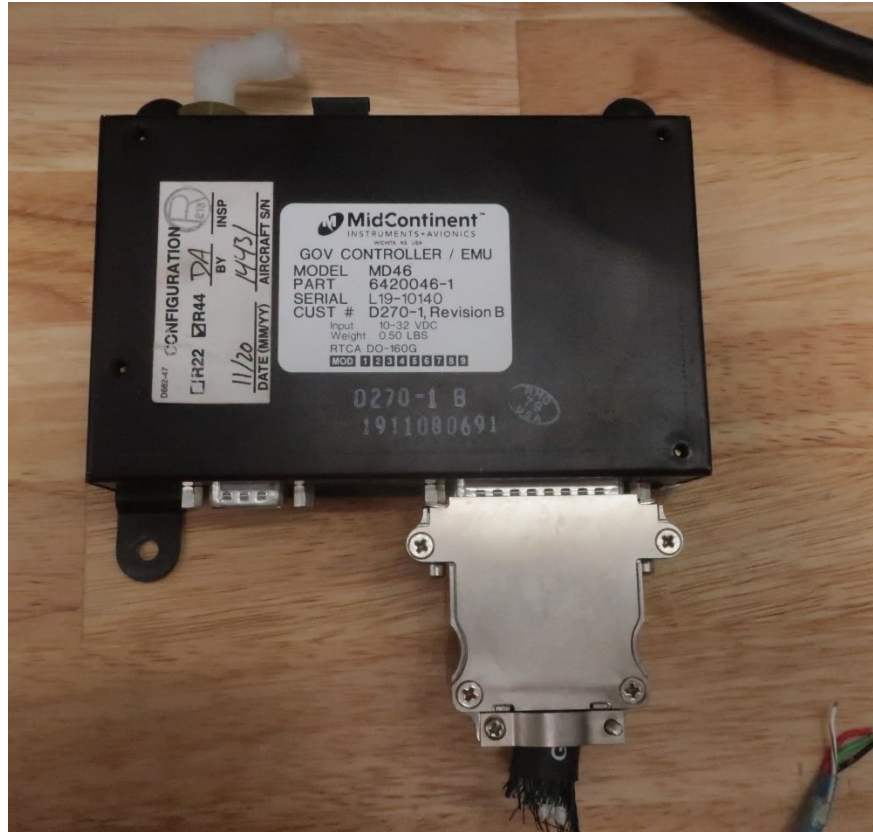


Figure 1. Engine Governor Controller / EMU as received.

1.1 Governor Controller / EMU Testing

The EMU was tested according to Robinson Helicopter Company (RHC) acceptance test procedure (ATP). The 44-pin connector was removed and visually inspected. All pins were present, undamaged, and no foreign debris identified. The EMU was connected to a power supply and signal generator. The ATP process was completed with the EMU box passing all internal testing criteria. EMU nonvolatile memory (NVM) data was downloaded using RHC software.

2.0 Engine RPM Sensor Assembly Testing

The engine rpm sensor assembly (Figure 2) was undamaged and had a 1.5 foot white electrical/signal cable protruding from the flat side. The signal cable end did not have a connector and the colored wires (4), green, black, red, white, yellow, all had bare wire tips (Figure 3). The end of the wires had been pulled from the plastic connector during the process of removing the assembly from the helicopter, giving the wire ends a “clipped” appearance. The cable was cut just below the free wire ends and the free wire ends retained. The sensor was placed on the test fixture. The rpm sensor produced a square wave signal and passed the ATP.



Figure 2. Engine rpm sensor.

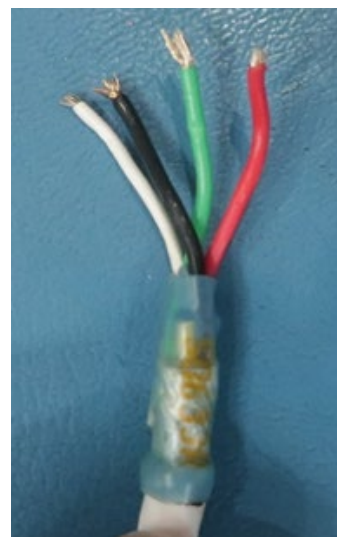


Figure 3. Engine rpm sensor signal cable end wires.

3.0 RPM Signal Cable Connector Examination

Both male and female halves of the rpm signal wire connector were examined (Figures 4 and 5). The continuity and resistance through the connector for each pin was individually checked with a multimeter. All pins had a $0.16\ \Omega$ (ohms) resistance or better. The heat shrink bundle of the wire ends was snipped off. Continuity was rechecked and remained good on all pins while physically moving and wiggling the individual wires. Visual examination of pins and wire crimped ends showed similar crimping features on all pins and conformed with RHC crimping guidance. A magnifying glass examination showed all pins had wire strands trapped in the crimped portion of the pin. An optical microscope was used to inspect all the wire strand ends, all which were necked down with a rupture type of separation at their tips.

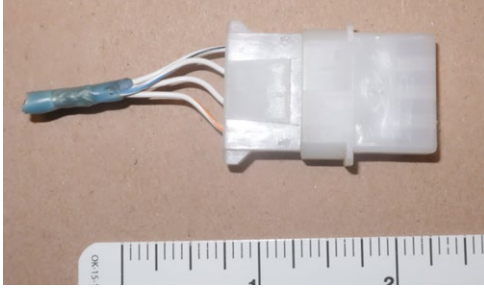


Figure 4. RPM signal cable connector (assembled).



Figure 5. Female and male halves of the rpm signal cable connector.

4.0 NVM Data

The NVM was downloaded into a single file, R44_14431_20220418.emu. This file can only be read by RHC proprietary software, R22R44_EMU.exe, which can be obtained on the Robinson Helicopter Company website, robinsonheli.com, under the publications tab. The accident flight was recorded as Flight 77, 11-08-2021 21:01:23, 11-08-2021 11:48:02, Duration 0:08:00. Figures 6 to 11 are plots for various times throughout the event flight.

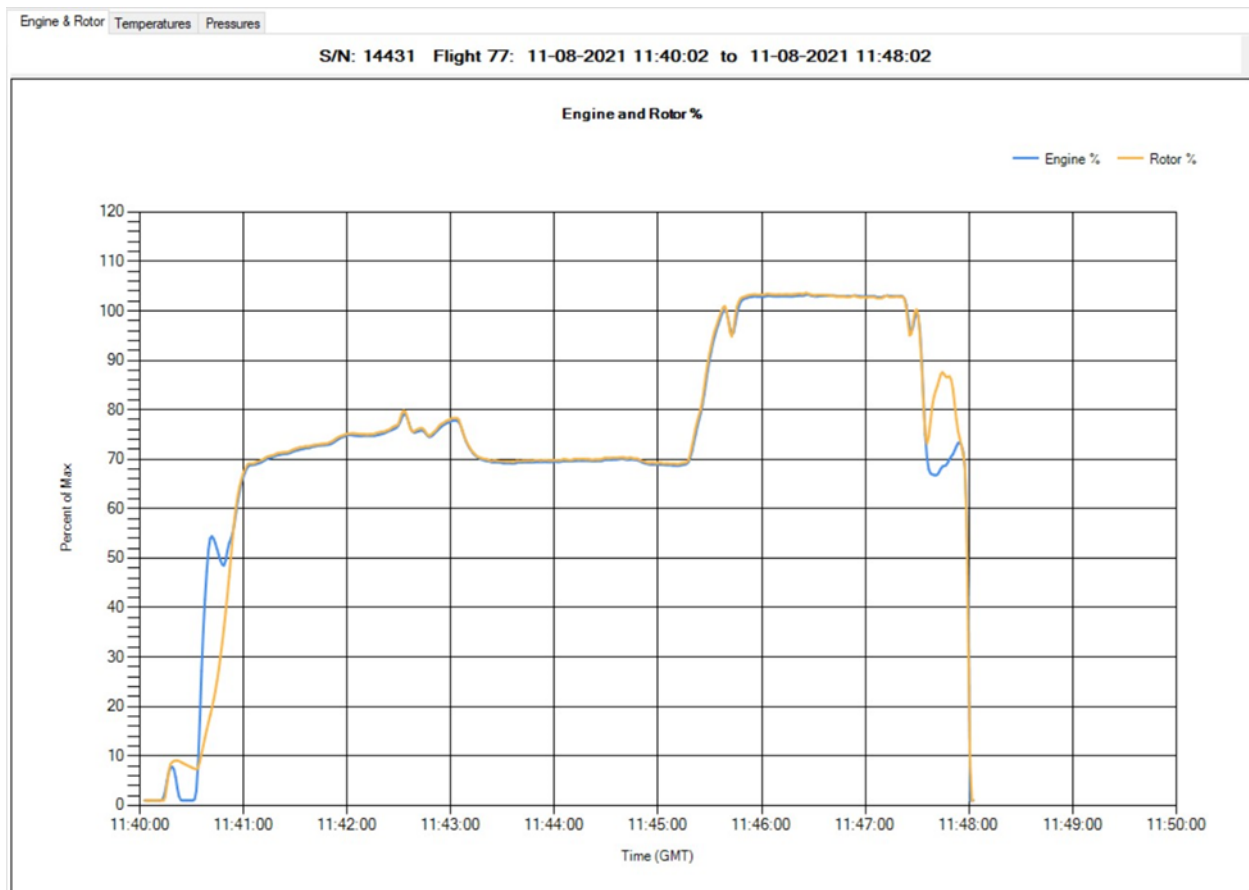


Figure 6. Engine and rotor rpm for the entire flight.

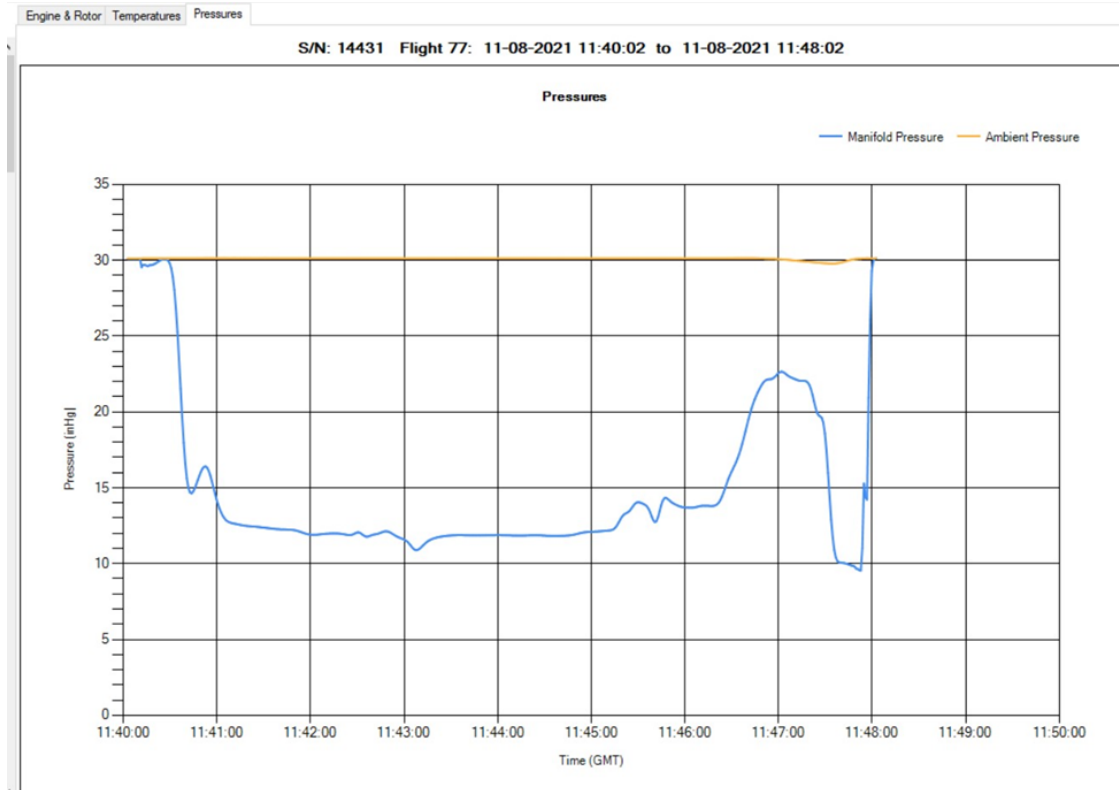


Figure 7. Manifold and ambient pressures for the entire flight.

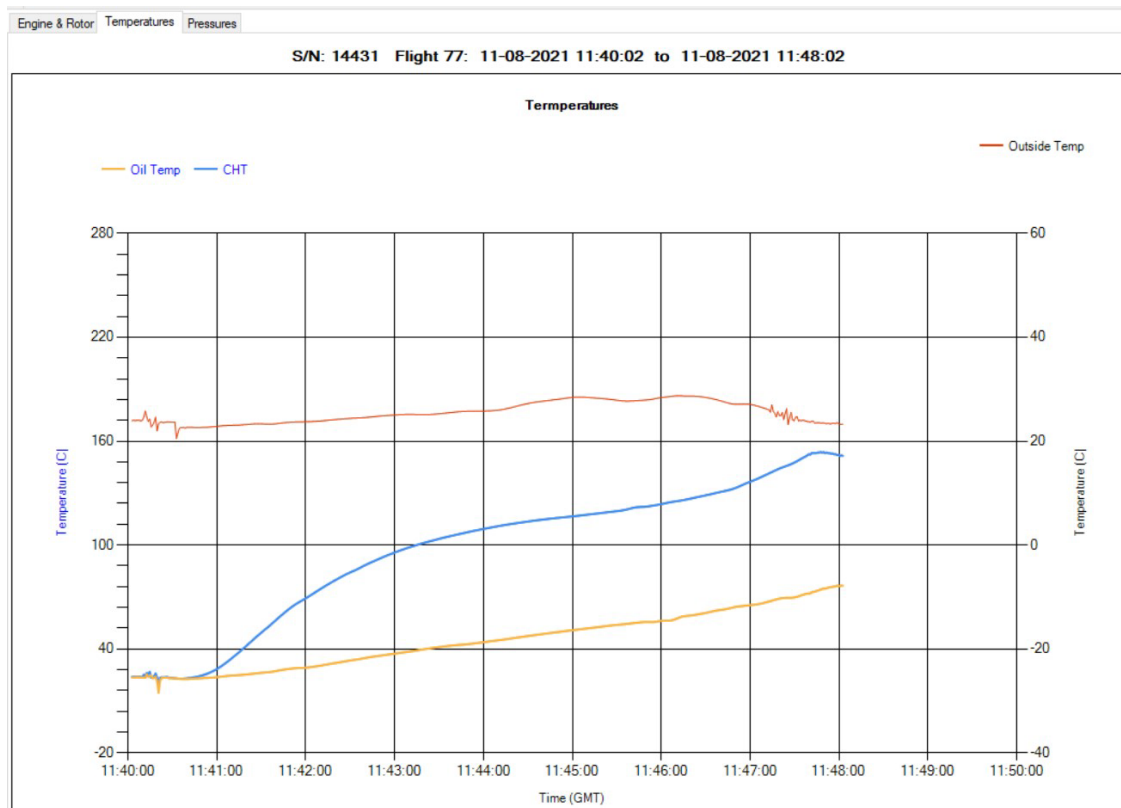


Figure 8. Engine temperatures for the entire flight.

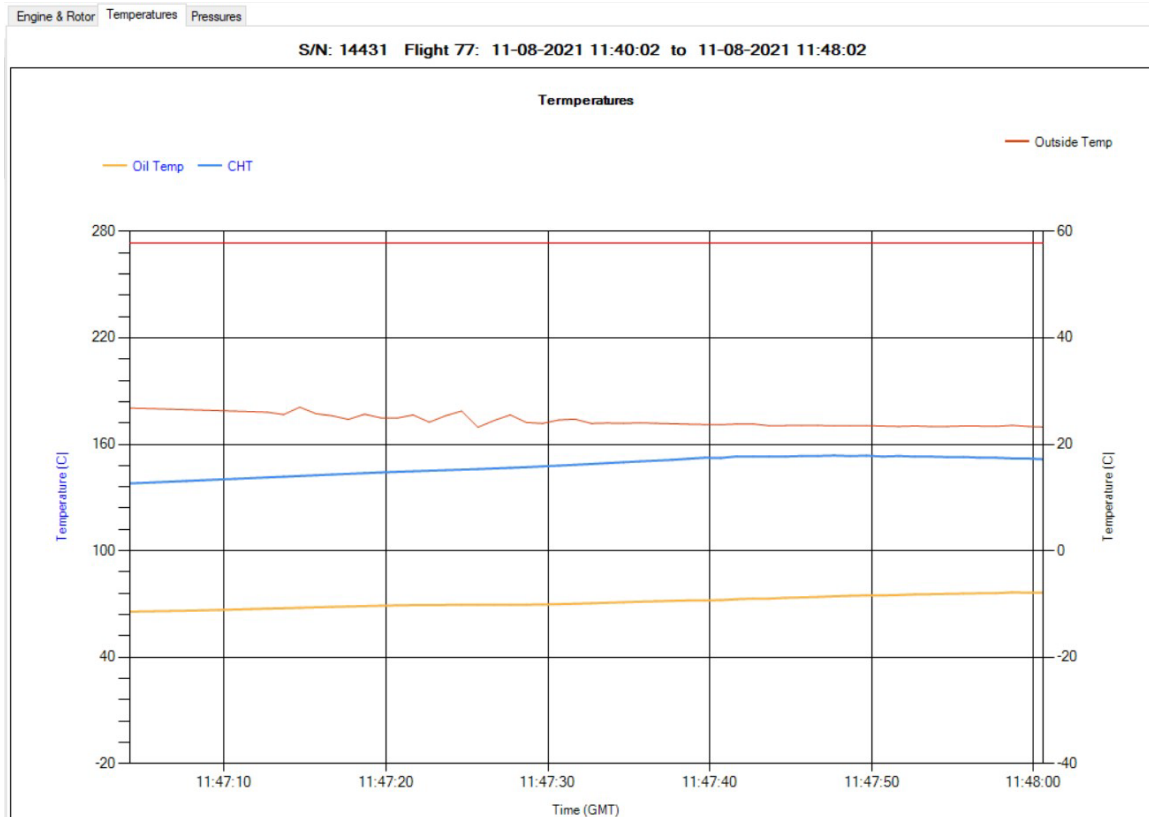


Figure 9. Engine temperatures for the last 60 seconds of the flight.

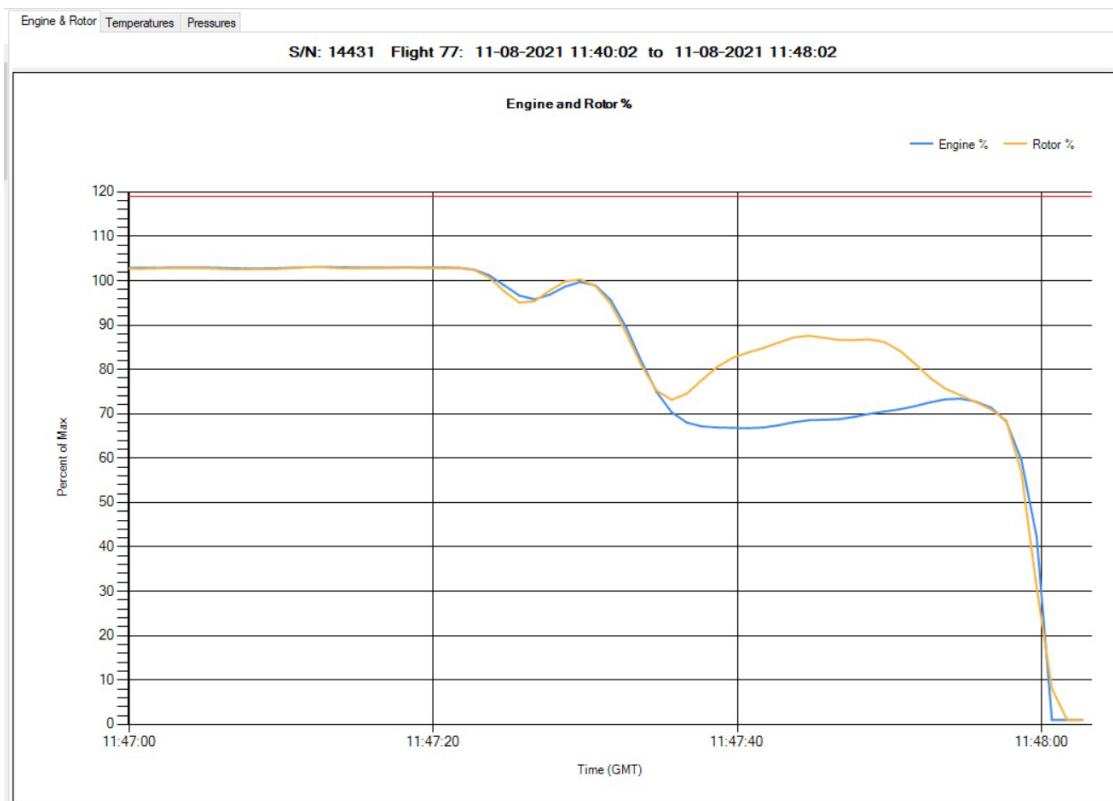


Figure 10. Engine and rotor rpm for the last 60 seconds of the flight.

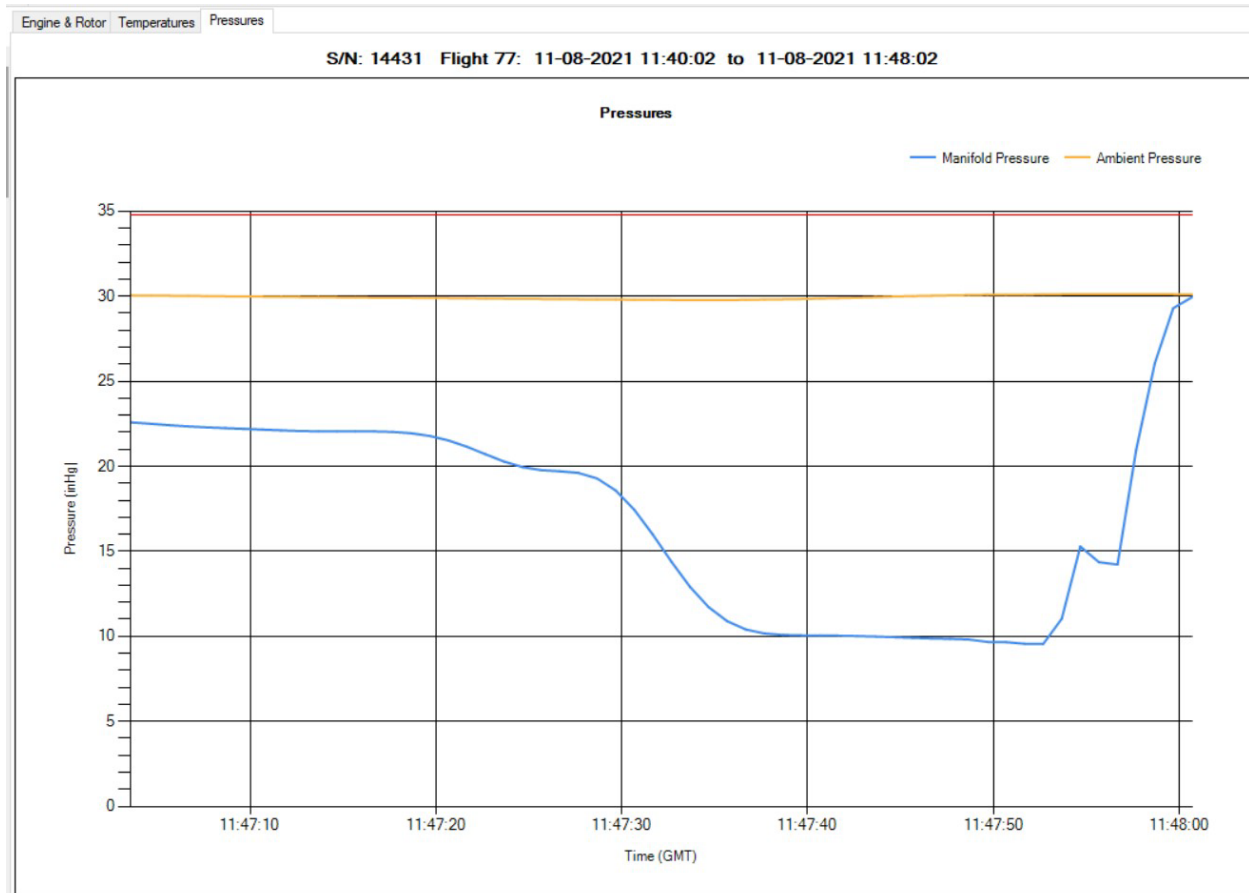


Figure 11. Engine pressures for the last 60 seconds of the flight.

Submitted by:

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