NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, D.C. 20594

January 8, 2020

Flight Display Factual Report

Specialist's Factual Report
by Nick Swann

1. EVENT

Location:	Tappahannock, Virginia
Date:	August 19, 2019
Aircraft:	Cirrus SR22
Registration:	N621JE
Operator:	Private
NTSB Number:	ERA19FA251

On August 19, 2019, about 0343 eastern daylight time, a Cirrus SR22, N621JE, was destroyed when it impacted terrain following a Cirrus Aircraft Parachute System (CAPS) deployment near Tappahannock-Essex County Airport (XSA), Tappahannock, Virginia. The private pilot was seriously injured. The personal flight was operated under the provisions of Title 14 *Code of Federal Regulations* Part 91. Night visual meteorological conditions prevailed and no flight plan was filed for the flight that originated from Richmond International Airport, Richmond, Virginia, about 0327. The flight was destined to Easton/Newnan Field (ESN), Easton, Maryland.

2. RECORDED FLIGHT DATA GROUP

A recorded flight data group was not convened.

3. DETAILS OF INVESTIGATION

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

Device 1:	Avidyne MFD CF Card
Device 1 Serial Number:	Unknown
Device 2:	Avidyne DFC-90 Autopilot
Device 2 Serial Number:	M151858518

3.1. Avidyne Multifunction Flight Display (MFD) Description

The MFD unit is used to display the pilot checklist, terrain/map information, approach chart information and other aircraft/operational information depending on the specific configuration and options that are installed. One of the options available is a display of

comprehensive engine monitoring and performance data. Each MFD contains a compact flash (CF) memory card located in a slot on the side of the unit. This memory card contains all of the software that the MFD needs to operate. Additionally, this card contains all of the checklist, approach charts, and map information that the unit uses to generate the various cockpit displays. During operation, the MFD display receives information from several other units that are installed on the aircraft. Specifically, the MFD receives GPS position, time and track data from the aircraft's GPS receiver. The MFD may also receive information from the aircraft concerning altitude, engine and electrical system parameters, and outside air temperature. This data is also stored on the unit's CF memory card. The MFD generates new data files for each MFD power-on cycle. The oldest file is dropped and replaced by a new recording once the storage limit has been reached. MFD data are sampled every six seconds, and is recorded to memory once every minute. If an interruption of power occurs during the minute between MFD memory write cycles, data sampled during that portion of a minute are not recorded.

3.1.1. Avidyne MFD Data Recovery

The data from the MFD arrived at the Vehicle Recorder Laboratory in the form of the CF card located within the full unit. The MFD card was read and converted to engineering units using laboratory equipment. A visual inspection showed the card appeared to be in good working order and undamaged. The state of the CF card as it arrived is shown below in Figure 1.

Figure 1. Undamaged CF Card from MFD

3.1.2. Avidyne MFD Data Description

The data extracted from the MFD card included 177 individual data log files from February 24, 2019[1], to August 25, 2019. The accident flight was the second to last session, starting at 07:19:18 and going until 07:43:30 on August 19, 2019. The last power session recorded was the session when the data was recovered.

[1] All dates and times are referenced to Coordinated Universal Time (UTC).

3.2. Avidyne DFC-90 Description

The Avidyne DFC-90 is an attitude-based flight control system that contains Envelope Protection and Envelope Alerting. Each DFC-90 contains an SD card in a small orange case onboard that records attitudes, attitude rates, and many flight control system related parameters. The data on the DFC-90 is stored sequentially in three sampling rate fidelities in the Common Data Format (CDF) convention.

3.2.1. Avidyne DFC-90 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, the device showed signs of minor impact damage. The damage to the unit is shown below in Figure 2.

Figure 2. External damage to DFC-90 Autopilot Unit

3.2.2. Avidyne DFC-90 Data Description

The data extracted from the DFC-90 contained eight high fidelity CDF files, 41 medium fidelity CDF files, and 490 low fidelity CDF files. The high fidelity files contain data labeled from August 17, 2019, to August 19, 2019. The medium fidelity files contain data labeled from August 8, 2019, to August 19, 2019. The low fidelity files contain data labeled from March 23, 2016, to August 19, 2019. The high fidelity data from the accident flight was converted from a CDF file to a MATLAB variable file by Avidyne. This data was then processed by the Vehicle Recorder Laboratory into a comma separated format. The data was converted from its raw form to engineering units using specifications provided by the manufacturer.

3.3. Time Correlation

The Avidyne MFD records time in UTC and UTC will be used for the remainder of this report. The DFC-90 records time in epoch time since the unit is powered on. The timing of the MFD data did not need to be modified. The data from the DFC-90 was aligned with the MFD data by comparing a common parameter between the two systems, pressure altitude. The recorded parameters from both displays are shown in Figure 5.

3.4. Plots and Corresponding Tabular Data

The following plots show data from the accident flight. Lighting and weather conditions shown in Google Earth overlays are not indicative of lighting or weather conditions present at the time of the accident. The location marked in the Google Earth overlays is indicative of where the wreckage was found. The discrepancy between the last recorded position and the location of the accident wreckage can be attributed the pilot turning off the electrical system as noted in the NTSB Form 6120.1 statement located in the accident docket.

Figure 3 shows the flight path of the entire accident flight overlaid onto Google Earth.

Figure 4 shows the flight path of the end of the accident flight overlaid onto Google Earth.

Figure 5 shows the air data, attitude, and heading parameters for the entire flight from the DFC-90 as well as the pressure altitude recorded by both devices for timing alignment.

Figure 6 shows the air data, attitude, and heading parameters for the last 10 minutes of the accident flight from the DFC-90 as well as the pressure altitude recorded by both devices for timing alignment.

Figure 7 shows the engine relevant parameters for the entire duration of the accident flight.

Figure 8 shows the engine relevant parameters for the last 10 minutes of the accident flight.

Figure 3. Flight path of the entire accident flight

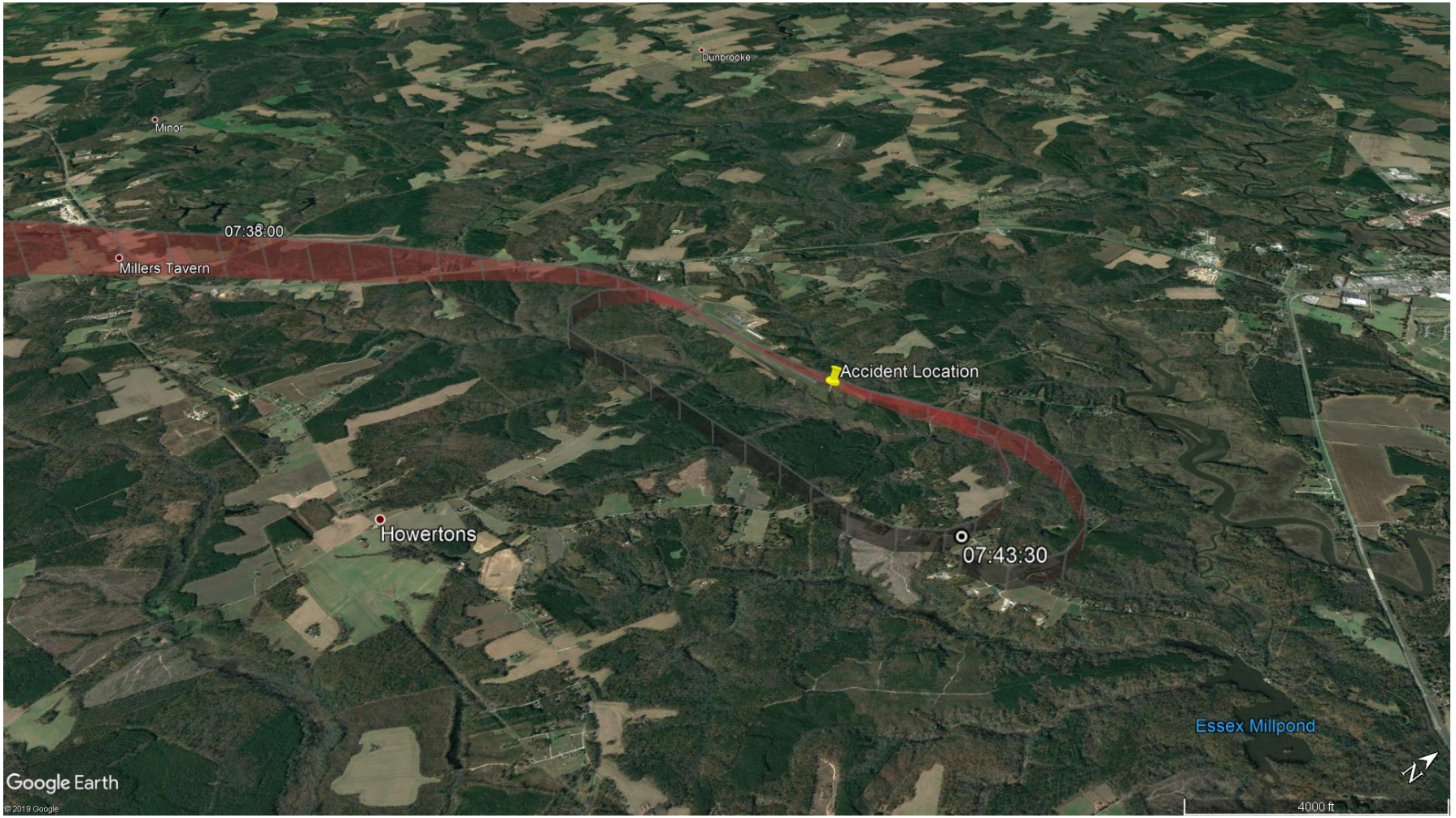

Figure 4. Flight path of the end of the accident flight

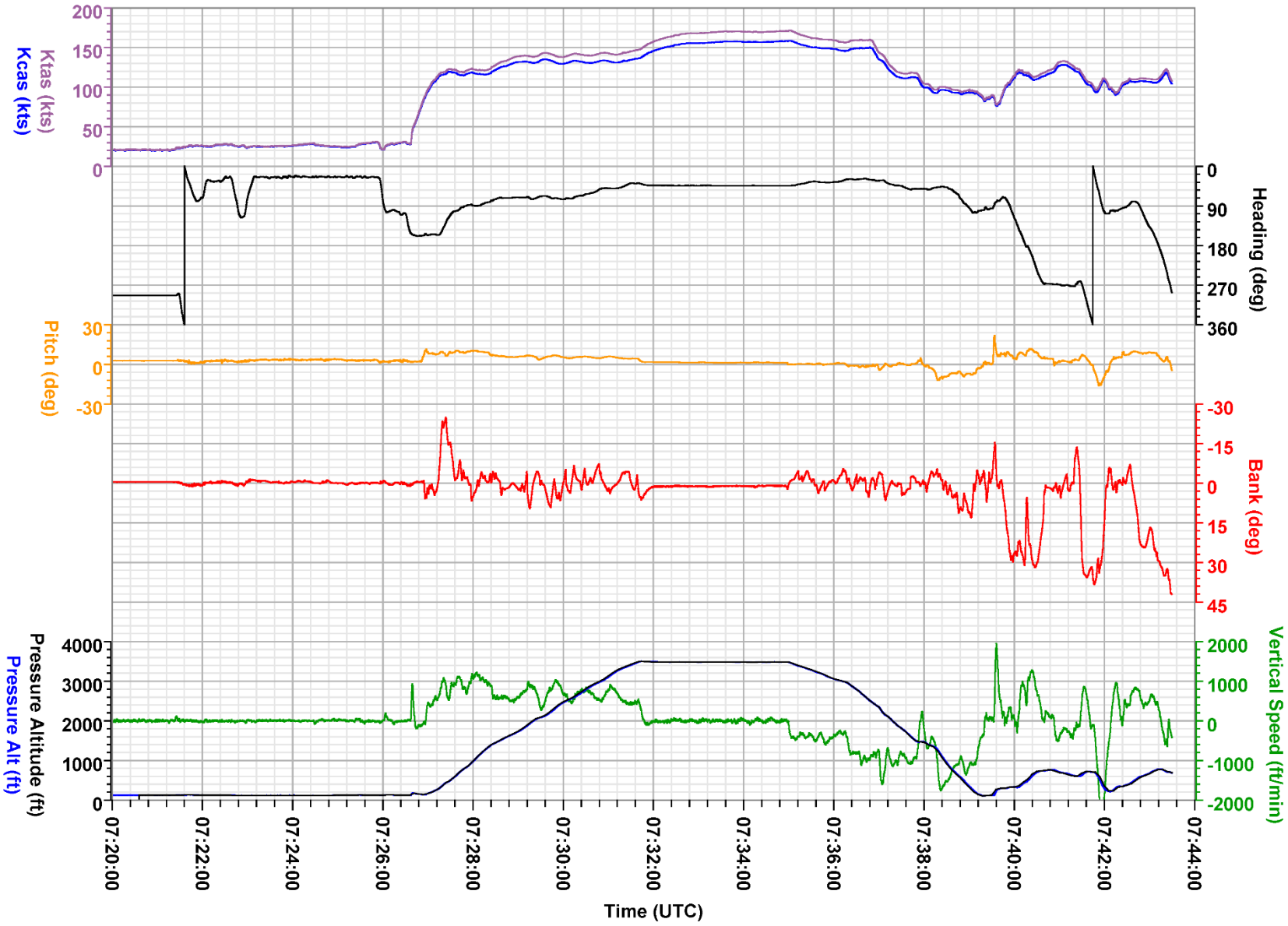

Figure 5. Air data, attitude, and heading for the entire accident flight

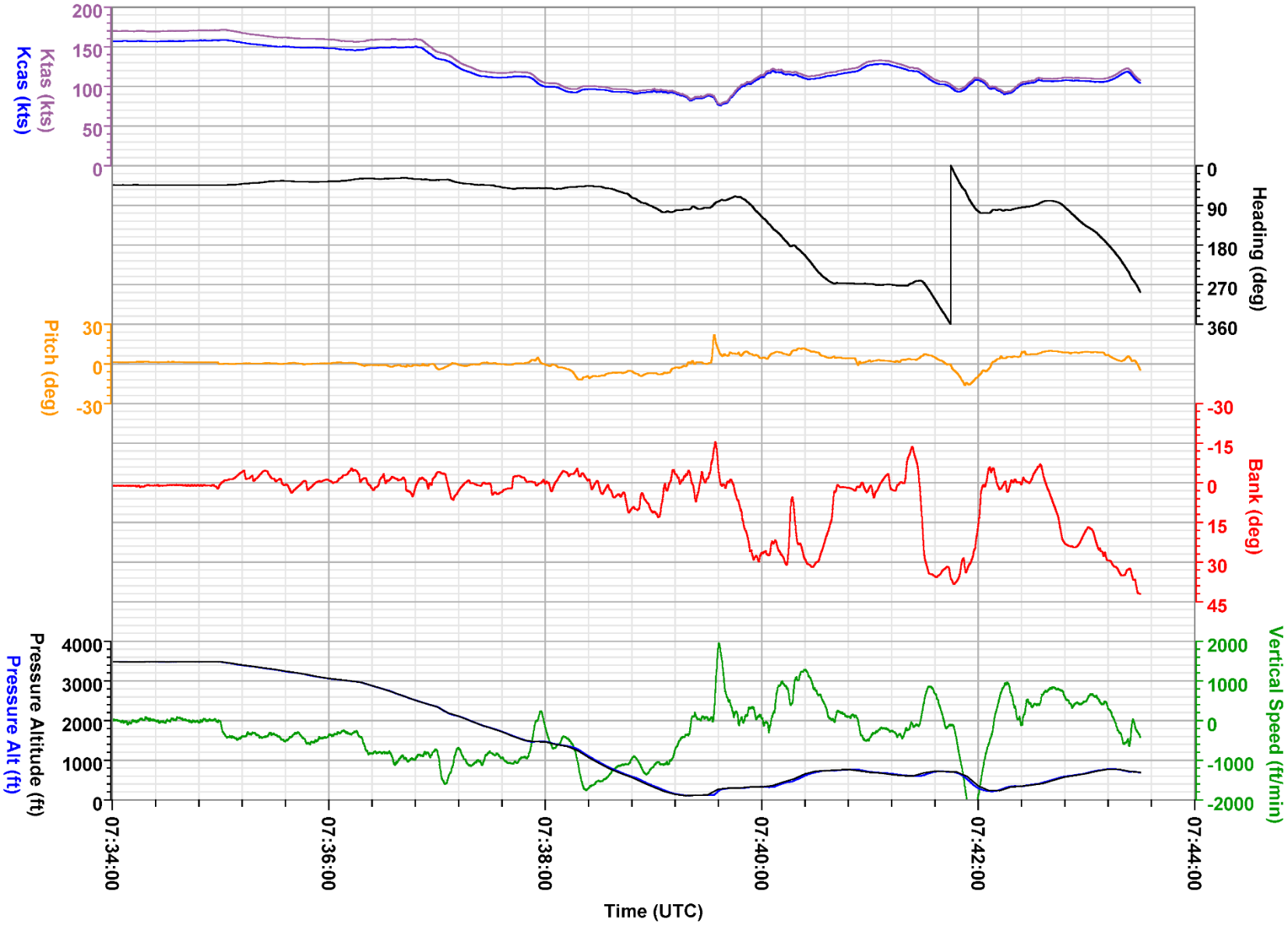

Figure 6. Air data, attitude, and heading for the last 10 minutes of the accident flight

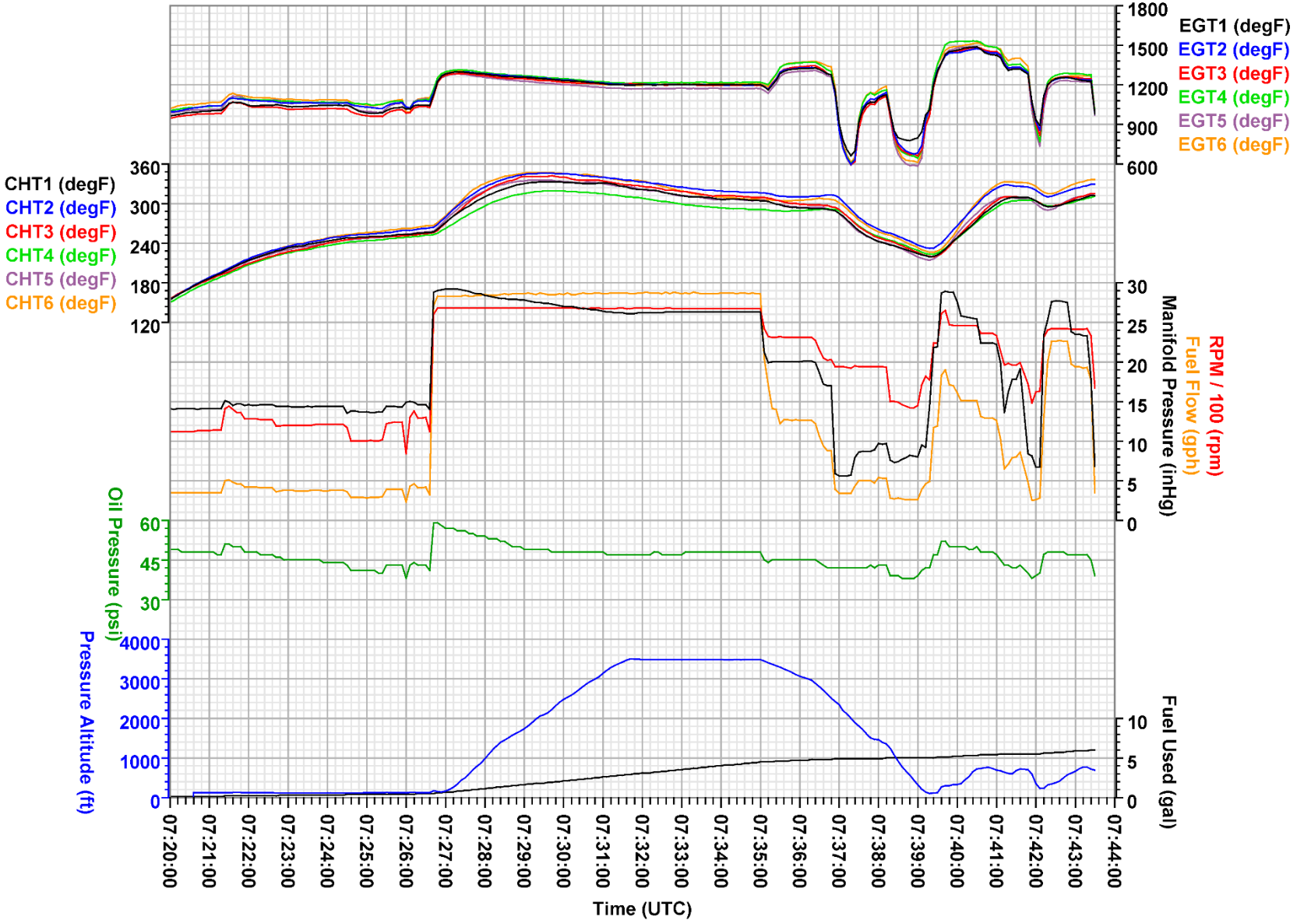

Figure 7. Engine data for the entire accident flight

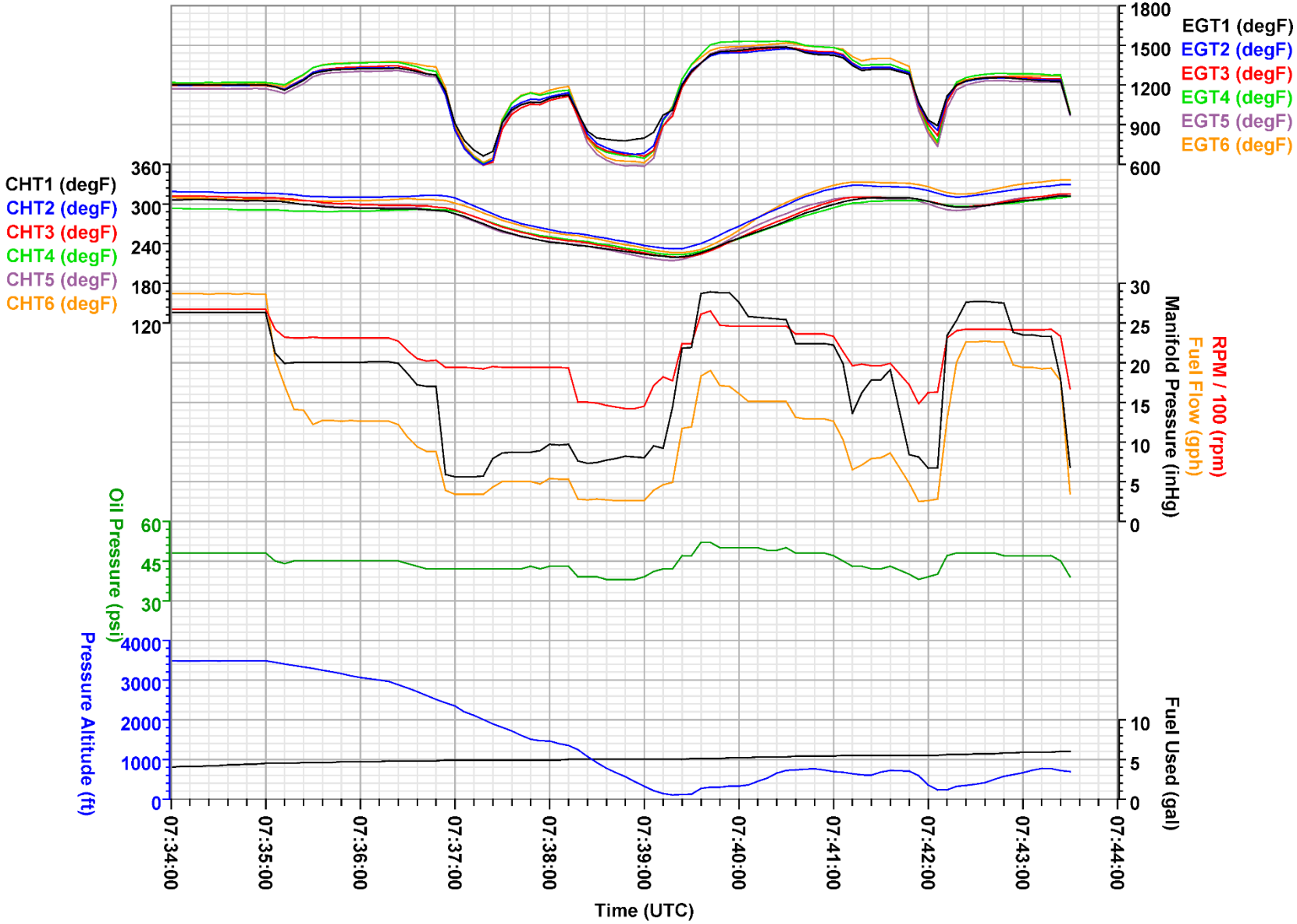

Figure 8. Engine data for the last 10 minutes of the accident flight

APPENDIX A

This appendix describes the parameters provided and verified in this report. Table A-1 lists the parameters used and their units

Table A-1. Verified and provided parameters

Parameter Name	Parameter Description
1. Kcas (kts)	Calibrated air speed (knots)
2. Ktas (kts)	True air speed (knots)
3. Heading (deg)	Heading True (degrees)
4. Pitch (deg)	Pitch (degrees)
5. Bank (deg)	Bank (degrees)
6. Pressure Altitude/Alt (ft)	Altitude with an assumed air pressure of 29.92 inches mercury (feet)
7. Vertical Speed (ft/min)	Vertical speed of the aircraft (feet per minute)
8. RPM (rpm)	Rotations per minute of the engine
9. CHT# (degF)	Cylinder head temperature of each cylinder (degrees Fahrenheit) (1-6)
10. EGT# (degF)	Exhaust gas temperature of each cylinder (degrees Fahrenheit) (1-6)
11. Oil Pressure (psi)	Oil pressure in the engine (pounds per square inch)
12. Manifold Pressure (inHg)	Engine manifold pressure (inches mercury)
13. Fuel Flow (gph)	Instantaneous fuel flow to the engine (gallons per hour)
14. Fuel Used (gal)	Total fuel used (gallons)