

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

November 19, 2019

Cockpit Displays – Recorded Flight Data

Specialist's Factual Report
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1. EVENT SUMMARY

Location: Foley, Alabama
Date: September 1, 2019
Aircraft: Cirrus Design Corporation SR22
Registration: N878SR
Operator: Private
NTSB Number: ERA19LA264

On September 1, 2019, about 1520 central daylight time, a Cirrus Design Corporation SR22, N878SR, experienced a loss of engine power and was substantially damaged during a forced landing at Foley, Alabama. The private pilot and three passengers were not injured. The airplane was privately owned and operated under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual meteorological conditions prevailed at the time of the accident. No flight plan was filed for the flight that originated from Jack Edwards National Airport (JKA), Gulf Shores, Alabama, about 1510 and was destined for Concordia Parish Airport (OR4), Vidalia, Louisiana.

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 electronic devices:

Recorder Manufacturer/Model: **Avidyne MFD**
Recorder Serial Number: **20070107**

Recorder Manufacturer/Model: **Avidyne PFD**
Recorder Serial Number: **20011317**

Recorder Manufacturer/Model: **Aerosance RDM**
Recorder Serial Number: **0737002**

3.1. Avidyne Multi-Function Display (MFD) Description

The MFD unit is able 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 checklists, 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. MFD Data Recovery

The recorder was in good condition and the data were downloaded using the manufacturer's procedure.

3.1.2. MFD Data Description

The MFD CF card contained 222 data files. One data file was identified as recording during the incident flight. The data file was approximately 16 minutes and 6 seconds in duration.

3.1.3. MFD Engineering Units Conversions

The data files downloaded from the MFD are in engineering units.

APPENDIX A lists the MFD parameters verified and provided in this report.

3.2. Avidyne Primary Flight Display (PFD) Description

The PFD unit includes a solid state Air Data and Attitude Heading Reference System (ADAHRS) and displays aircraft parameter data including altitude, airspeed, attitude, vertical speed, and heading. The PFD unit has external pitot/static inputs for altitude, airspeed, and vertical speed information. Each PFD contains two flash memory devices mounted on a riser card. The flash memory stores information the PFD unit uses to generate the various PFD displays. Additionally, the PFD has a data logging function, which is used by the manufacturer for maintenance and diagnostics. Maintenance and diagnostic information recording consists of system information, event data and flight data.

The PFD samples and stores several data streams in a sequential fashion; when the recording limit of the PFD is reached, the oldest record is dropped, and a new record is added. Data from the Attitude/Heading Reference System (AHRS) is recorded at a rate of 5 Hz. Air data information such as pressure altitude, indicated airspeed, and vertical speed are recorded at 1 Hz. Global Positioning System (GPS) and navigation display and setting

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data are recorded at a rate of 0.25 Hz, and information about pilot settings of heading, altitude, and vertical speed references are recorded when changes are made.

3.2.1. PFD Data Recovery

The recorder was in good condition and the data were downloaded using the manufacturer's procedure.

3.2.2. PFD Data Description

Initial data analysis occurred using data obtained from the MFD, as previously described. This analysis was evaluated to be sufficient, and as such, analysis using data obtained from the PFD was not performed.

3.3. Aerosance RDM Description

The Aerosance recoverable data module (RDM) is a crash-hardened data storage unit installed in the tail of some Cirrus aircraft. The unit records flight, engine, and autopilot parameters. Data is logged once per second and stored internally on a CF card installed inside the crash-hardened enclosure. When the storage limit of the memory device is reached, the oldest recording is deleted.

3.3.1. RDM Data Recovery

The RDM was in good condition, however the data was not downloaded as the data previously recovered from the MFD was deemed to be sufficient.

3.4. Time Correlation

MFD data was recorded in Universal Coordinated Time (UTC). The difference between central daylight time (CDT) and UTC is five hours, or 18,000 seconds. The incident flight data has been offset from recorded MFD time to CDT by subtracting 18,000 seconds.

Due to the six second update rate of the GPS time, the times noted in this report could be up to six seconds off from actual GPS time.

3.5. Plots and Corresponding Tabular Data

The following four figures contain MFD data recorded during the September 1, 2019, event.

Figure 1 is a plot of basic aircraft parameters between 15:10:20 and 15:21:20 CDT. This plot captures the entire event flight from before takeoff through impact.

Figure 2 is a plot of available engine parameters for the same time frame between 15:10:20 and 15:21:20 CDT.

Figure 3 is a Google Earth overlay of the event flight. Weather and lighting conditions shown in Google Earth may not be representative of the conditions at the time of the accident flight.

Figure 4 is a Google Earth overlay of the end of the event flight.

The corresponding tabular data used to create these four plots are provided in electronic (*.csv¹) format as Attachment 1 to this report.

¹ Comma Separated Value format.

Figure 1. Plot of basic parameters during entire flight.

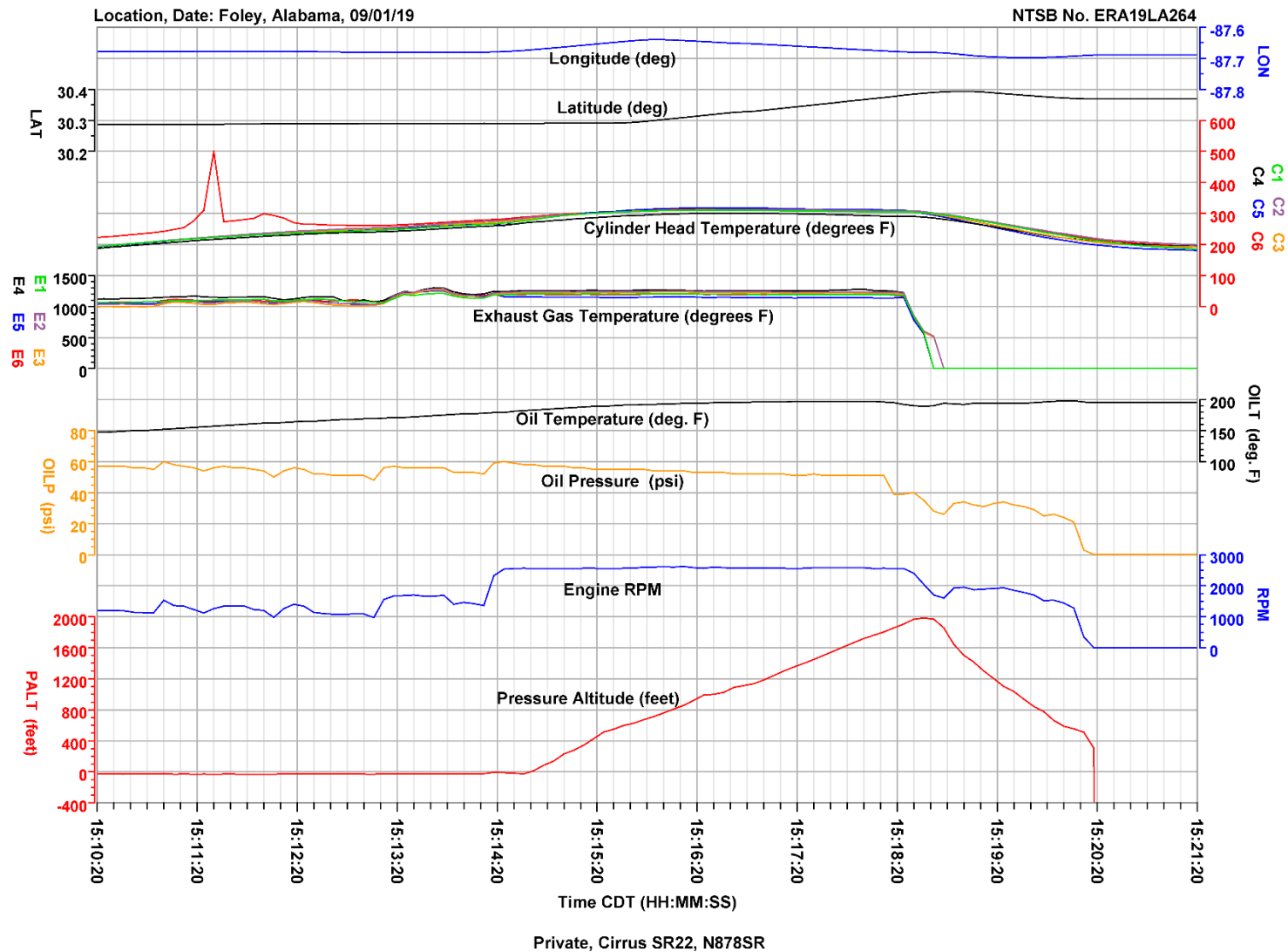


Figure 2. Plot of engine parameters during entire flight.

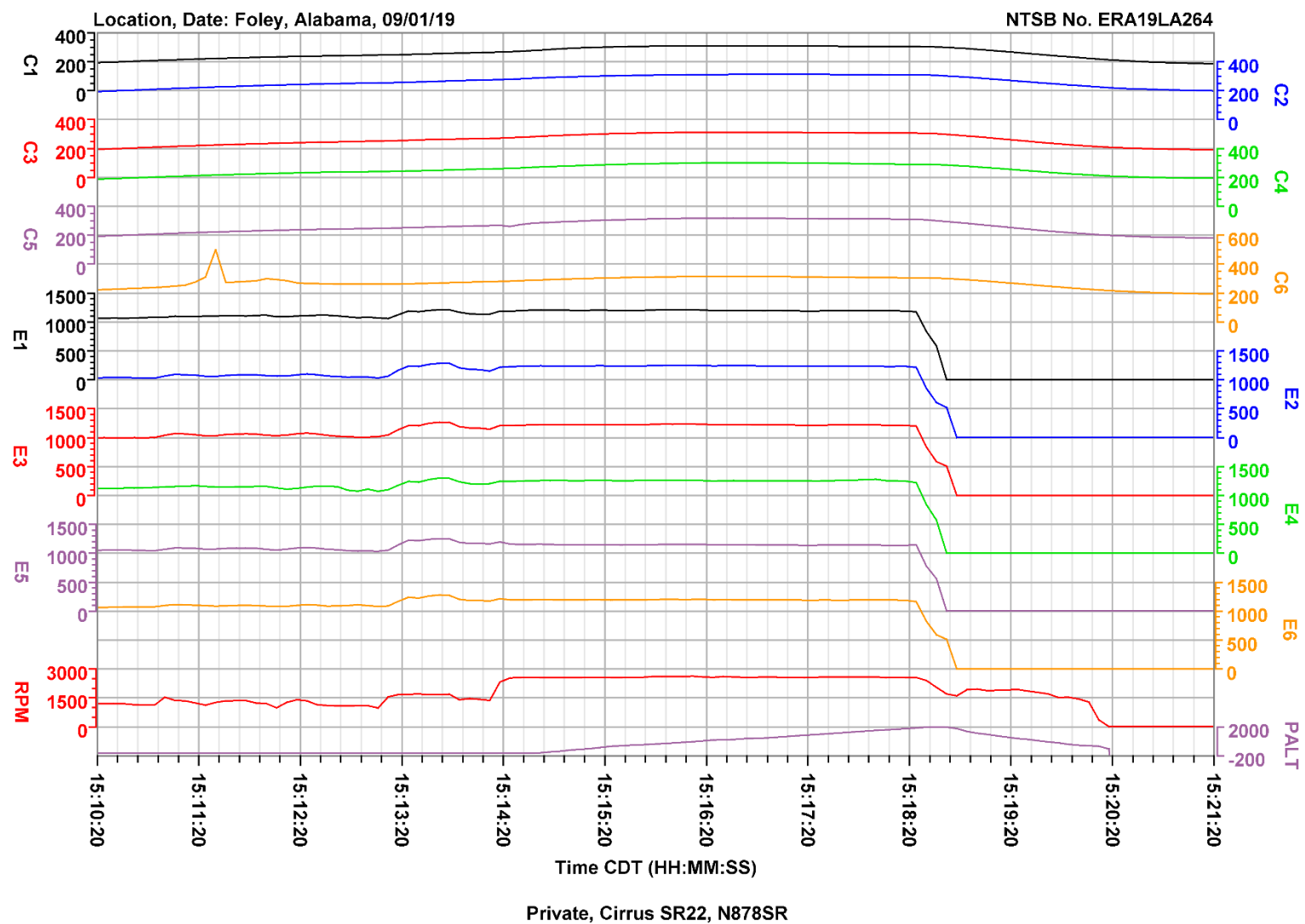


Figure 3. The aircraft's overall route of flight.

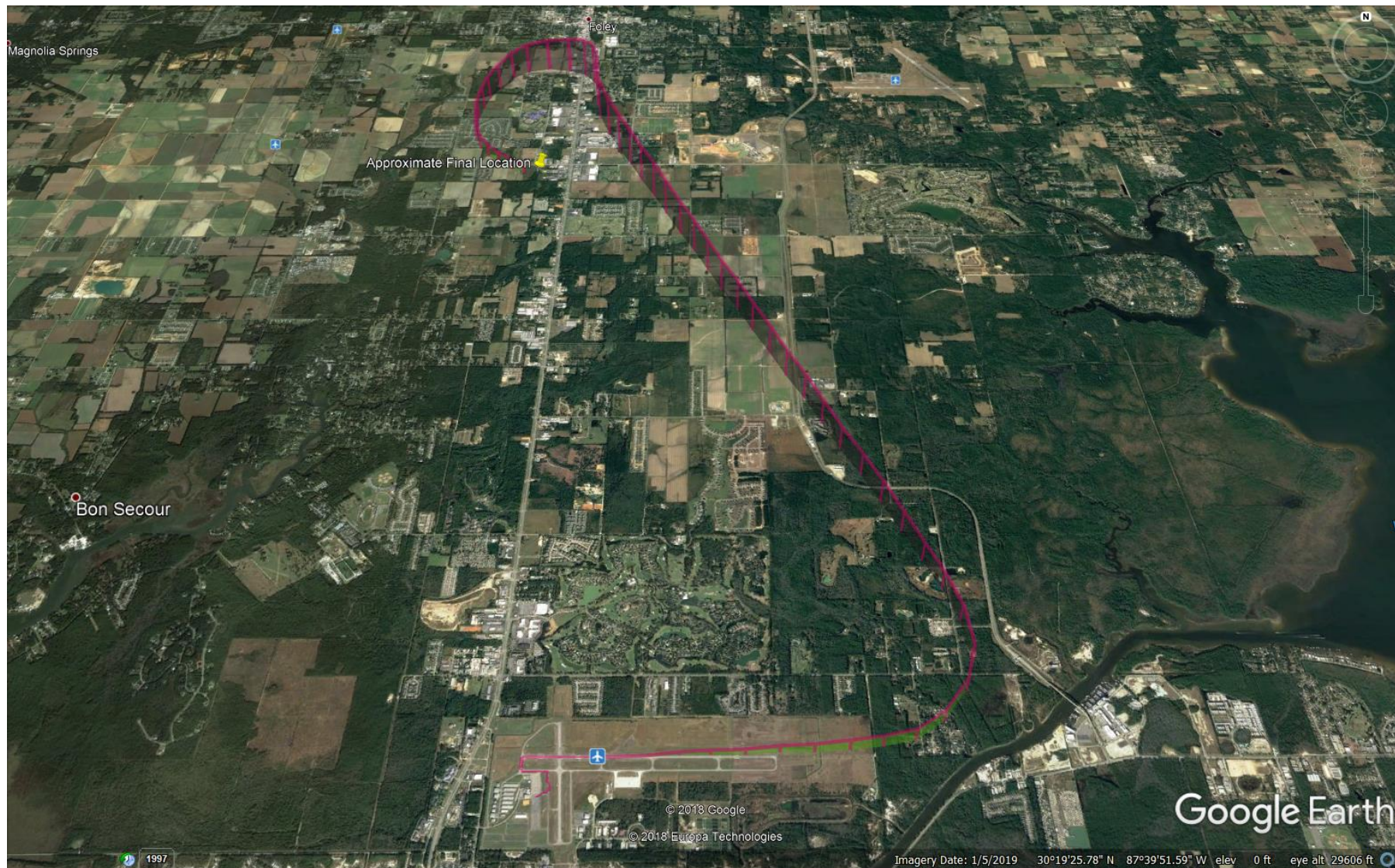
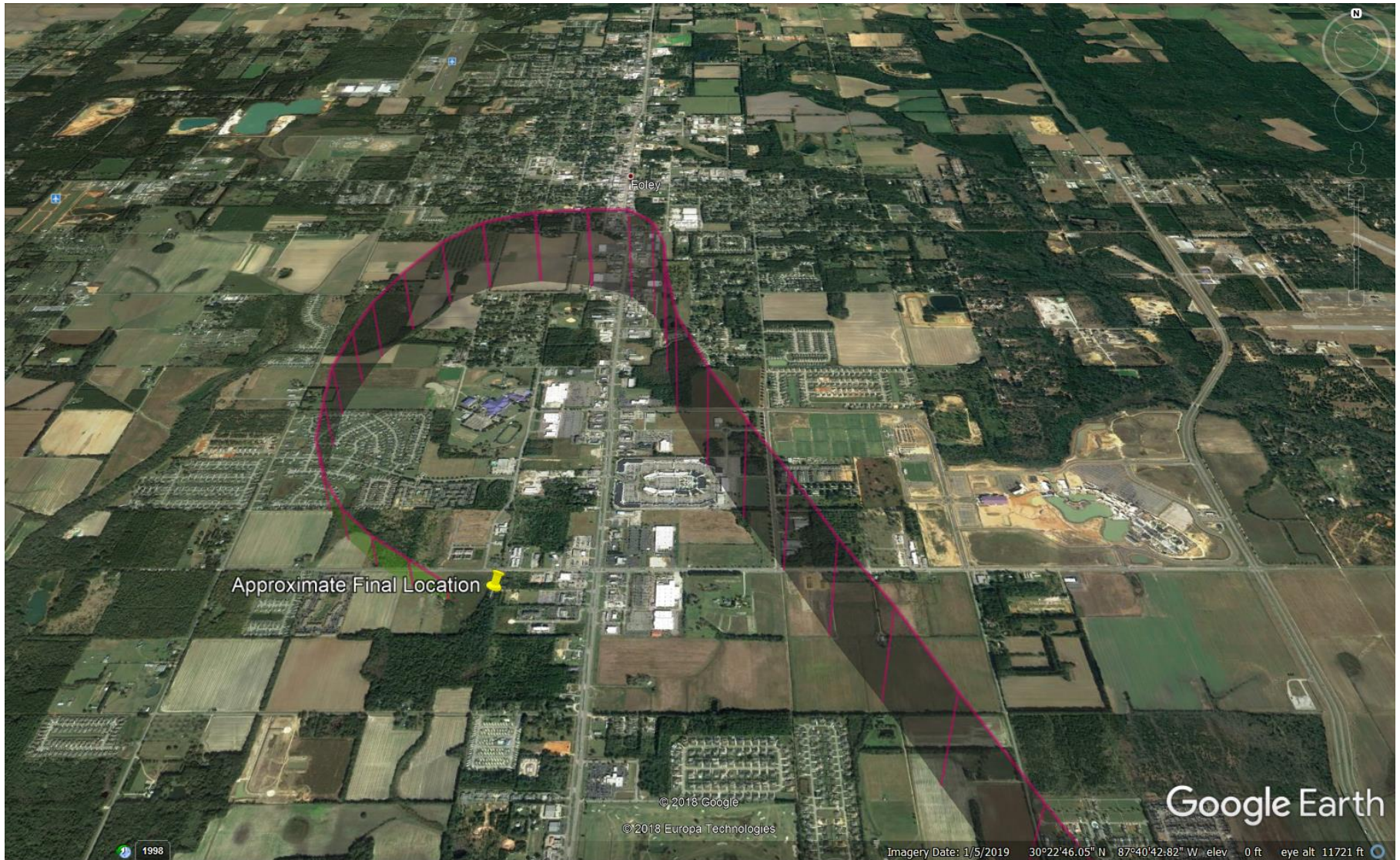


Figure 4. Last recorded portion of flight and approximate final location.



APPENDIX A - MFD Parameters

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

Table A-1 - Verified and provided parameters.

Parameter Name	Parameter Description	Source
C# (deg F)	Engine Cylinder Head Temperature Cylinder # ² (degrees Fahrenheit)	MFD
E# (deg F)	Engine Exhaust Gas Temperature Cylinder # ² (degrees Fahrenheit)	MFD
LAT (deg)	Latitude (degrees)	MFD
LON (deg)	Longitude (degrees)	MFD
OILP (psi)	Engine Oil Pressure (pounds per square inch)	MFD
OILT (deg F)	Engine Oil Temperature (degrees Fahrenheit)	MFD
PALT (ft)	Pressure Altitude (feet)	MFD
RPM (rpm)	Engine Revolutions Per Minute (revolutions per minute)	MFD
TIME (HH:MM:SS)	UTC Time (Hours:Minutes:Seconds)	MFD

The MFD 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 plots and in the electronic data has not been corrected for the local altimeter setting at the time of the event.

² Depending on aircraft configuration, the number of cylinders that are instrumented varies. In the data plots the '#' is replaced with the appropriate cylinder ID.