

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

January 23, 2018

Engine Monitor and Fuel Flow Meter

Specialist's Factual Report
By Joseph Gregor

1. EVENT SUMMARY

Location: Destin, Florida
Date: August 2, 2016
Aircraft: Cessna 414A
Registration: N2735A
Operator: Private
NTSB Number: ERA16FA279

On August 2, 2016, about 2025 central daylight time, a Cessna 414A, N2735A, descended into the Gulf of Mexico shortly after takeoff from Destin Executive Airport (DTS), Destin, Florida. Night visual meteorological conditions prevailed at the time, and an instrument flight rules (IFR) flight plan was filed and active for the flight. The flight originated about 1 minute earlier from DTS, and was destined for Abbeville Chris Crusta Memorial Airport (IYA), Abbeville, Louisiana.

2. DETAILS OF RECORDER INVESTIGATION

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

Recorder Manufacturer/Model: **JPI EDM-760**
Recorder Serial Number: **06674**

Recorder Manufacturer/Model: **Shadin Fuel Flow Indicator**
Recorder Serial Number: **9410**

2.1. Shadin Fuel Flow Indicator Device Description

The Shadin Avionics Digiflo Fuel Flow Indicator is a digital fuel management system designed to provide fuel management information under real flight conditions to the flight crew. The unit is connected to the engine fuel flow transducers. The unit can display the following information to the crew:

- Fuel Flow
- Fuel Used
- Fuel Remaining
- Endurance

The unit does not interface with an aircraft's fuel quantity indicating system. The unit requires the flight crew to enter the initial fuel on board the aircraft. All calculations and data provided by the unit are based on fuel flow and any provided navigational information.

2.1.1. Shadin Fuel Flow Indicator Data Recovery and Description

Upon arrival at the Vehicle Recorder Laboratory, an inspection revealed the unit had sustained significant water damage rendering the unit inoperable. No data was recovered from the device.

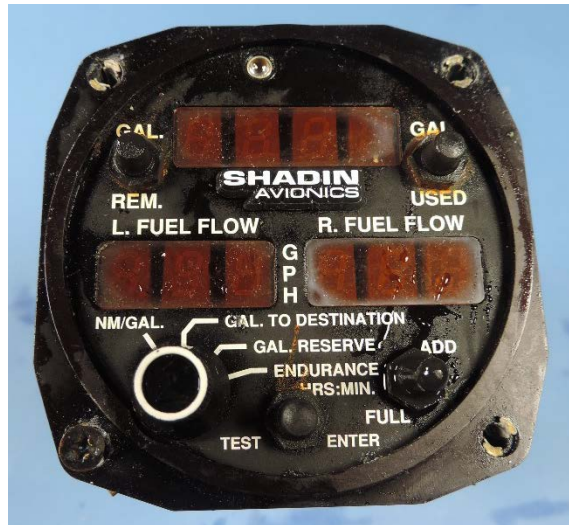


Figure 1. Shadin Avionics Fuel Flow meter as received in the Recorder Laboratory.

2.2. EDM 760 Device Description

The J. P. Instruments EDM-760 is a panel mounted gauge for twin engine aircraft. The operator can monitor and record up to 26 parameters related to engine operations. The accident device was set to record the following parameters for both engines:

- Exhaust Gas Temperature (EGT)
- Cylinder Head Temperature (CHT)
- Battery Voltage

The unit stores recorded and calculated parameters in non-volatile memory.¹ The rate at which the data is stored is selectable by the operator from 2 to 500 seconds per sample. The memory can store up to 20 hours of data at a 6 second sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

2.2.1. EDM 760 Data Recovery

Upon arrival at the Vehicle Recorder Laboratory, an exterior inspection revealed unit had sustained significant water damage rendering the unit inoperable. An internal inspection

¹ Non-volatile memory is semiconductor memory that does not require external power for data retention.

was performed. The main PC board was cleaned using fresh water and an acid brush. Excess water was driven off and the board de-greased using Acetone. The board was further degreased and cleaned using methanol and then dried in a vacuum oven at 40° C and 15 inches Hg. Data recorded by the unit was stored on a set of 5 serial FLASH² memory chips. These chips were removed and the data stored on them read out using a standard FLASH memory programmer. This data was then re-assembled using in-house software and converted to engineering units.



Figure 2. EDM 760 Engine Monitor, as received in the Recorder Laboratory.

2.2.2. EDM 760 Data Description

The data converted from EDM memory was segmented into 13 sessions. The most recent session was consistent with the accident flight, and contained 115 points of data covering a time span of 11 minutes, 24 seconds.

2.3. Engineering Units Conversions

Appendix A lists the EDM parameters provided in this report.

2.4. Time Correlation

The EDM 760 records session data using elapsed time. This data is later adjusted based on the time maintained by the unit's internal clock. Due to the loss of functionality of the EDM internal clock, no time conversion was performed and all times are referenced as elapsed time from the beginning of the recording session.

3. PLOTS AND CORRESPONDING TABULAR DATA

The following figure contains the last session data recorded by the EDM 760.

Figure 3 is a plot from the event flight that contains left and right engine parameters. The plot spans from 684 seconds, with each parameter measured once every 6 seconds.

² FLASH describes a specific type of non-volatile memory.

The corresponding tabular data from the EDM used to create figures 3 and 4 are provided in electronic (*.csv³) format as Attachment 1 to this report. Table A-1 lists the parameters plotted and table A-2 describes the unit abbreviations.

Table A-1. Verified and provided parameters.

Parameter Name	Parameter Description
1. Right TIT-# ^a (degF)	Right Engine Total Inlet Temperature
2. Left TIT-# ^a (degF)	Left Engine Total Inlet Temperature
1. Right CHT-# ^a (degF)	Right Engine Cylinder Head Temperature for Cylinder #
2. Right EGT-# ^a (degF)	Right Engine Exhaust Gas Temperature for Cylinder #
3. Left CHT-# ^a (degF)	Left Engine Cylinder Head Temperature for Cylinder #
4. Left EGT-# ^a (degF)	Left Engine Exhaust Gas Temperature for Cylinder #

^a number of cylinders from 1 to 6

Table A-2. Unit abbreviations.

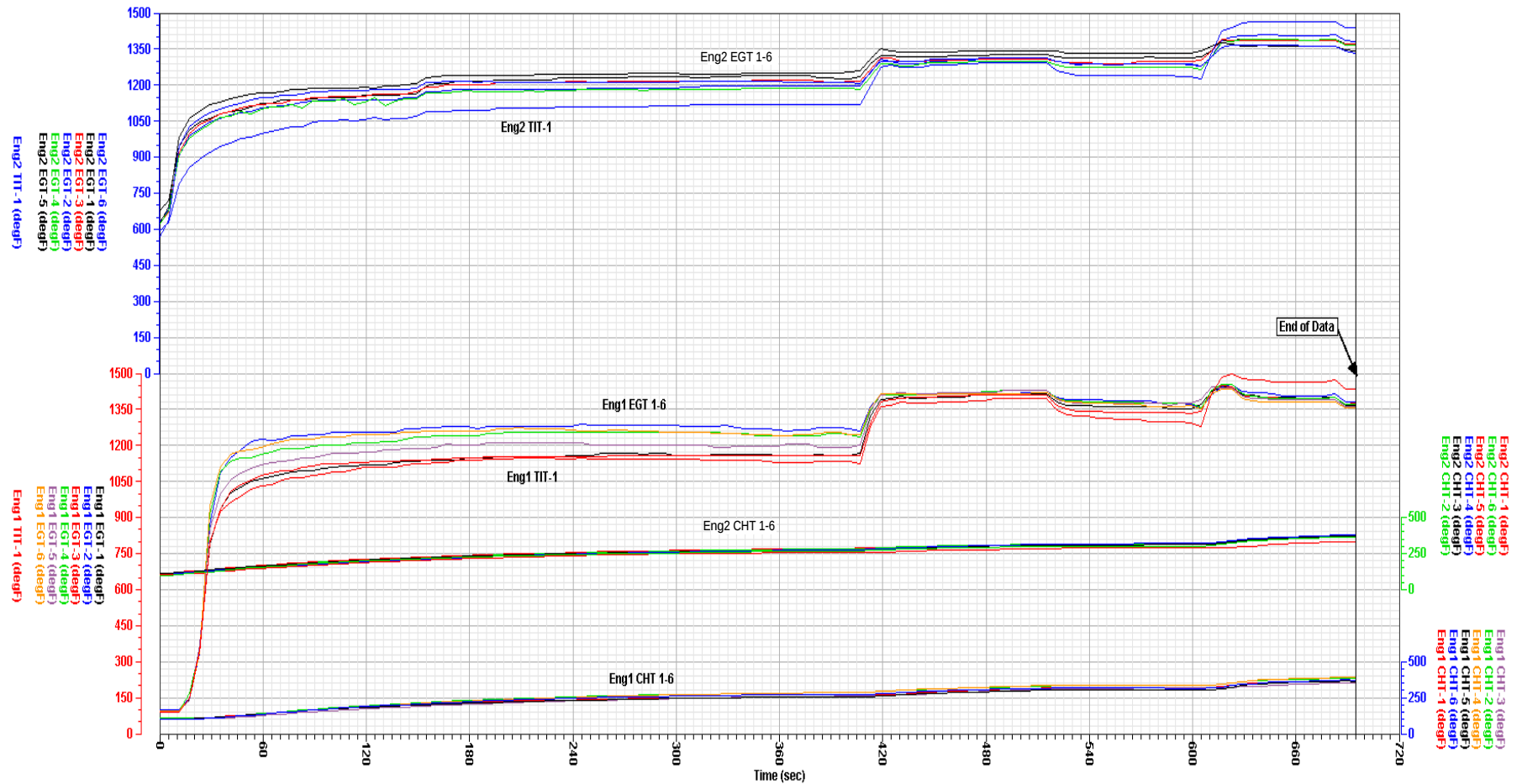
Units Abbreviation	Description
degF	Degrees Fahrenheit

³ Comma Separated Value format.

Cessna 414A, N2735A

Location, Date: Destin, FL, 08/02/16

NTSB No. ERA16FA279



Revised: 21 July 2017

Engine Parameters

National Transportation Safety Board

Figure 3. Plot of Engine parameters during last recorded session.

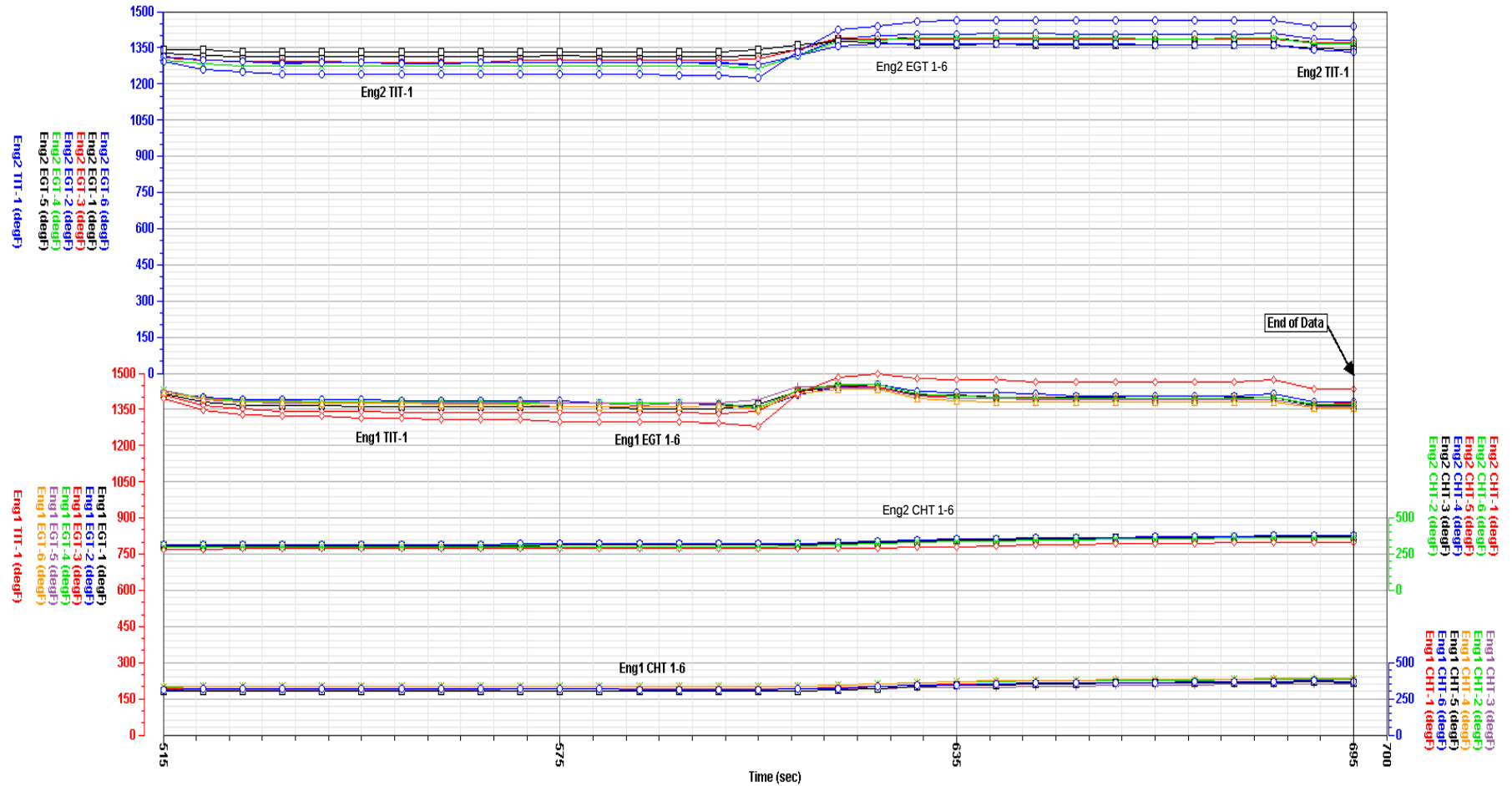
ERA16FA279

Engine Monitor and Fuel Flow Meter Factual Report, Page 5

Cessna 414A, N2735A

Location, Date: Destin, FL, 08/02/16

NTSB No. ERA16FA279



Revised: 21 July 2017

Engine Parameters

National Transportation Safety Board

Figure 4. Plot of Engine parameters during last recorded session highlighting last three minutes of the session.