

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

September 21, 2018

Cockpit Display– Recorded Flight Data

Specialist's Factual Report
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1. EVENT SUMMARY

Location: Bloomfield, New Mexico
Date: October 28, 2016
Aircraft: Cirrus SR22
Registration: N234PJ
Operator: Private
NTSB Number: CEN17LA030

On October 28, 2016, about 1015 mountain daylight time, a Cirrus SR22 airplane, N234PJ, was substantially damaged during a forced landing following a loss of engine power during cruise flight near Bloomfield, New Mexico. The pilot was not injured. The airplane was registered to Coastal King Aviation, LLC, and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, which was not operated on a flight plan. The flight originated from the Albuquerque International Airport (ABQ), Albuquerque, New Mexico, about 0915 MDT. The intended destination was the Stevens Field Airport (PSO), Pagosa Springs, Colorado.

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 PFD**
Recorder Serial Number: **20382475**

Recorder Manufacturer/Model: **Avidyne MFD card**
Recorder Serial Number: **20382475**

3.1. 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 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.

3.1.1. PFD Data Recovery

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

3.1.2. PFD Data Description

The downloaded files contained data from October 28, 2016, from 15:40:00 MDT to 16:10:00 MDT. The data captured the event.

3.1.3. PFD Engineering Units Conversions

Where applicable, changes to the conversions have been made to ensure the parameters conform to the Safety Board's standard sign convention that climbing right turns are positive (CRT=+).¹

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

3.2. Avidyne Multi-Function Display (MFD) Description

The MFD unit displays 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 the software that the MFD needs to operate. Additionally, this card contains all 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

¹ CRT=+ means that for any parameter recorded that indicates a climb or a right turn, the sign for that value is positive. Also, for any parameter recorded that indicates an action or deflection, if it induces a climb or right turn, the value is positive. Examples: Right Roll = +, Left Aileron Trailing Edge Down = -, Right Aileron Trailing Edge Up = +, Pitch Up = +, Elevator Trailing Edge Up = +.

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 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.

3.2.1. MFD Data Recovery

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

3.2.2. MFD Data Description

The downloaded files contained data from October 28, 2016, from 15:40:00 MDT to 16:10:00 MDT. The data captured the event.

3.2.3. MFD Engineering Units Conversions

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

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

3.3. Time Correlation

The data was recorded in Universal Coordinated Time (UTC). The difference between MDT and UTC is six hours. The incident flight data has been offset from recorded MFD and PFD time to MDT by subtracting six hours.

3.4. Plots and Corresponding Tabular Data

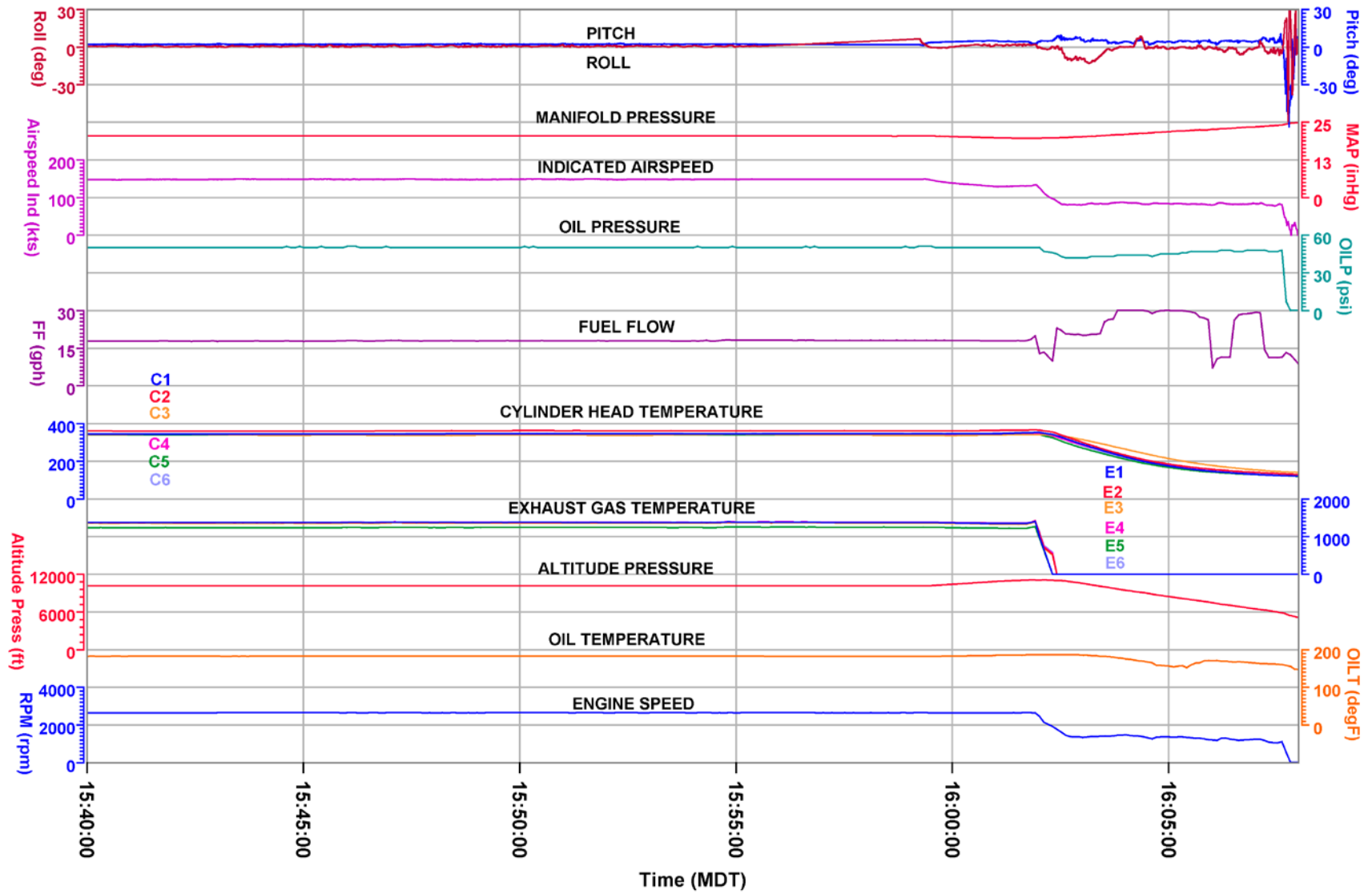
The following figure contains PFD and MFD data recorded during the October 28, 2016 event.

Figure 1 shows an overview of 30 minutes of the flight PFD and MFD data. The plot interval began at 15:40:00 MDT and ends at 16:10:00 MDT. The RPM is constant until 16:02:00 MDT but gradually drops to zero. Oil temperature is constant at 190 deg F until 16:04:00 MDT and then decreases to 130 deg F at 16:06:00 MDT. The pressure altitude decreases significantly after 16:03:00 MDT. The indicated airspeed increased and remained constant at approximately 180 kts and then decreased to zero at 16:10:00 MDT. The manifold pressure increased at 16:05:00 MDT to 25 inHg. The cylinder head temperature and exhaust gas temperature decreased at 16:03:00 MDT to 150 deg F and 0 deg F respectively.

The corresponding tabular data used to create the plots are provided in electronic (*.csv²) format as Attachment 1 to this report.

² Comma Separated Value format.

Figure 1. Plot of basic parameters of MFD and PFD during entire flight.



APPENDIX A - PFD Parameters

This appendix describes the parameters provided and verified in this report. Table A-1 lists the PFD parameters and table A-2 describes the unit abbreviations used in this report for PFD parameters.

Table A-1 - Verified and provided parameters.

Parameter Name	Parameter Description
Airspeed Ind (kts)	Indicated Airspeed
Pitch (deg)	Pitch
Roll (deg)	Roll
Altitude Press (ft)	Pressure Altitude

The PFD 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.

Table A-2 - Unit abbreviations.

Units Abbreviation	Description
deg	degrees
degF	degrees Fahrenheit
ft	feet
gph	gallons per hour
kts	knots

NOTE: For parameters with a unit description of discrete, a discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

APPENDIX B - MFD Parameters

This appendix describes the parameters provided and verified in this report. Table B-1 lists the MFD parameters and table B-2 describes the unit abbreviations used in this report for MFD parameters.

Table B-1 - Verified and provided parameters.

Parameter Name	Parameter Description
C- # ³ (degF)	Cylinder Head Temperature # ³ (degrees Fahrenheit)
E- # ³ (degF)	Exhaust Gas Temperature # ³ (degrees Fahrenheit)
FF (gph)	Fuel Flow (gallons per hour)
MAP (inHg)	Manifold Pressure (inches of mercury)
OilP (psi)	Oil Pressure (pounds per square inch)
OilT (degF)	Oil Temperature (degrees Fahrenheit)
RPM (rpm)	Revolutions Per Minute (revolutions per minute)
PALT	Pressure Altitude

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.

Table B-2 - Unit abbreviations.

Units Abbreviation	Description
rpm	revolutions per minute
deg	degrees
degF	Degrees Fahrenheit
gph	gallons per hour
inHg	inches of Mercury
kts	knots
psi	pounds per square inch

NOTE: For parameters with a unit description of discrete, a discrete is typically a 1-bit parameter that is either a 0 state or a 1 state where each state is uniquely defined for each parameter.

³ Depending on aircraft configuration, the number of cylinders that are instrumented varies. In the data plots the '#' is replaced with the appropriate cylinder ID.