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

January 4, 2012

Engine Instrument

Specialist's Factual Report
By Bill Tuccio

1 EVENT SUMMARY

Location: Nashville, Pennsylvania
Date: December 22, 2011
Aircraft: Cessna 441
Registration: N48BS
NTSB Number: ERA12FA120

On December 22, 2011, about 1735 eastern standard time, a Cessna 441, N48BS, was substantially damaged when it impacted terrain near Nashville, Pennsylvania, while approaching York Airport (THV), Thomasville, Pennsylvania. The certificated commercial pilot was fatally injured. Night visual meteorological conditions prevailed. The airplane had been operating on an instrument flight rules (IFR) flight plan from Long Beach Airport - Daugherty Field (LGB), Long Beach, California, to THV; however, the pilot had cancelled the flight plan and was proceeding visually via the airport traffic pattern at the time of the accident. The personal flight was operating under the provisions of 14 Code of Federal Regulations Part 91.

2 ENGINE INSTRUMENTS GROUP

An engine instruments group was not convened.

3 DETAILS OF ENGINE INSTRUMENTS INVESTIGATION

On December 28, 2011, the Safety Board's Vehicle Recorder Division received the following engine instrument:

Recorder Manufacturer/Model: **Shadin Digiflo-L Fuel Flow Indicator**
Recorder Serial Number: **9546**

3.1 Shadin Avionics Digiflo-L™ Fuel Flow Indicator

One Shadin Avionics Digiflo-L™ fuel flow indicator was received in good condition (see figures 1 through 3). Figure 2 shows a cutout in the can[1] of the unit. The Shadin Digiflo-L™ Operating Manual, publication number OP91053D, indicates these switches are "normally covered by the red K-factor sticker." Upon arrival at the Safety Board's

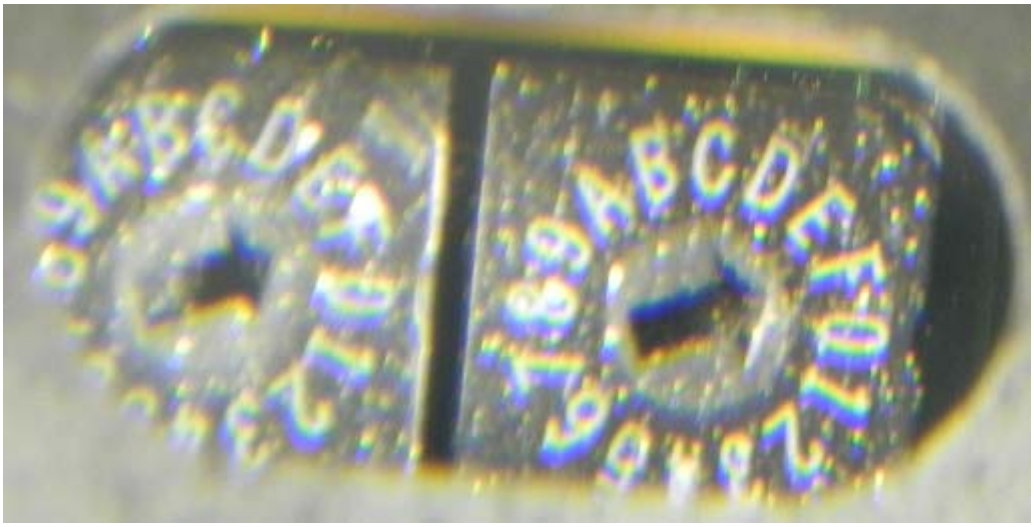
[1] The Shadin DigiFlow-L manual, Pub No OP91053D, refers to the elongated body of the back of the device as the "can."

Vehicle Recorder Division, no sticker was found on the unit. Figure 3 shows the positions of switch 1 and 2 as received.

Figure 1. Shadin Digiflo-L™ device.

Figure 2. Shadin Digiflo-L™ side of unit, and cut-out for switch settings.

Figure 3. Switch settings.



3.1.1 Description

The Shadin Avionics Digiflo-L™ 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 and can be connected to a Loran-C or GPS receiver serial port. The unit is also capable of transmitting fuel information to certain GPS receivers for additional calculations and display of fuel management data. The unit can display the following information to the crew:

- Fuel Flow per engine
- Fuel Used
- Fuel Remaining
- Fuel to Destination[2]
- Fuel Reserve[2]
- Specific Range[2]
- 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.

3.1.2 Recorded Data

The Digiflo-L™ contains non-volatile memory that retains setup information, fuel remaining and fuel used information, if power is removed from the unit.

4 RECOVERED DATA

The Shadin Avionics Digiflo-L™ was inspected internally for damage prior to applying power only. The unit was not connected to any fuel flow sensors or GPS/Loran devices

[2] Real time calculation that requires an active Loran-C or GPS input

during the data recovery process. Using procedures described in the Shadin Avionics Digiflo-L™ operating manual, data was recovered by applying power to the unit and cycling through the displayed values. Upon applying power, the unit self test reported a value of "Good." Table 1 contains recovered fuel and unit data.

Table 1 – Fuel and unit data

Data Description	Gal
Fuel Used	370.0
Fuel Remaining	104.8[3]
Full Fuel Setting	475.0
Unit SW Version	60.10.84

The unit was also configured to enable the inspection of the group 1 and group 2 configuration settings[4]. Group 1 settings in general are set up by the distributor and contain information defined by the part number. Table 2 contains the group 1 settings retrieved from the unit.

Table 2 – Group 1 Configuration Settings

Display	Value	Description
L	4690	Left K-Factor of 46,990[5]
r	4430	Right K-Factor of 44,330
A	0	Left Fuel Flow Offset Freq (Hz)
b	0	Right Fuel Flow Offset Freq (Hz)
U	0	Fuel Units – Gallons
E	1	Engine Type: Twin
C	0	Low Fuel Cutoff: Off

Group 2 settings in general are set up by the user or installer to change Loran or GPS input and output parameters, warning type and fuel flow filtering types. Table 3 contains the group 2 settings retrieved from the unit.

[3] Fuel remaining is calculated by the unit by subtracting fuel used from the initial starting fuel entered by the crew.
[4] For further information on configuration settings refer to Shadin Avionics Digiflo-L™ operating manual for P/N: 91053XP, publication number OP91053D.
[5] The K-factor displayed needs to be multiplied by 10 to obtain the correct K-factor

Table 3 – Group 2 Configuration Settings

Display	Value	Description
o	5	GPS/Output Type: Generic
I	1	GPS/Loran Input: On
d	0	Endurance Warning Time – 45 Minutes
F	0	Filter Type – Injector
u	0	With GPS, set to zero (0)
S	20.0	Low Fuel Level (gal)

The unit does not retain any information related to the four available rotary switch positions (nautical miles per gallon, gallons to destination, gallons reserve settings and endurance).