

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN22LA228

ELECTRONIC DEVICES

Specialist's Factual Report

July 5, 2023

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A. ACCIDENT

Location: Allport, Arkansas
Date: June 1, 2022
Time: 1700 Central Daylight Time (CDT)
Airplane: Air Tractor AT602, private operator, N5007R

B. ELECTRONIC DEVICES SPECIALIST

Specialist: Matthew Yandrick
Recorder Specialist
National Transportation Safety Board (NTSB)

C. DETAILS OF THE INVESTIGATION

A group was not convened.

The NTSB Vehicle Recorder Division received the following electronic devices:

Recorder Manufacturer/Model: SATLOC M3 Bantam
Part Number: 806-1034-000#_E
Recorder Serial Number: 1219-160222-0020

Recorder Manufacturer/Model: SATLOC Signet FPD (flat panel display)
Recorder Serial Number: 1648026

Recorder Manufacturer/Model: SATLOC Lightbar
Recorder Serial Number: Unknown

Recorder Manufacturer/Model: Shadin Avionics Fuel Flow Indicator
Part Number: 912021-38-D
Recorder Serial Number: 1458

1.0 SATLOC M3 Bantam Description

The SATLOC M3 Bantam is part of an on-board control system designed to programmatically control agricultural, aerial spray operations based on vendor and user specified prescription maps. The SATLOC M3 Bantam can drive a cockpit mounted lightbar guidance system and a real-time graphic moving map display providing visual guidance to the pilot. Flow rates can be pilot selected or based on mapping created using a proprietary software package called MapStar that runs on a desktop computer. The SATLOC M3 Bantam can record historical information to an internal, compact flash (CF) card or flash drive depending on user configuration.

1.1 SATLOC M3 Bantam Data Recovery

The SATLOC devices were in good condition (see figure 1) upon arrival at the Vehicle Recorder Laboratory. The internally mounted CF card was removed (figure 2). Data were extracted and converted to engineering units normally using the manufacturer's software (figure 2).

The SATLOC Signet FPD and Lightbar are part of an on-board control system designed to programmatically control spray rates based on vendor and user specified mapping. These devices interface with the SATLOC M3 Bantam and Intelliflow Controller to provide control overflow rates and spray routes. Neither unit stores flight data.



Figure 1. View of SATLOC display and M3 Bantam (top), and SATLOC Lightbar (bottom).



Figure 2. SATLOC M3 Bantam and internal CF card.

1.2 SATLOC M3 Bantam Recording Description

The data extracted included 3 sessions recorded on June 1, 2022. The last session was determined to be the accident flight. The device recorded data in central daylight time (CDT). According to the manufacturer, the unit records data in Coordinated Universal Time (UTC), however the user is able to set an offset from UTC to local time. The accident flight started at 10:01:38 CDT and ended at 15:36:10 CDT on June 1, 2022. The sampling rate was approximately one data point per second. The two previous flights on June 1, 2022, started at 03:59:06 CDT and ended at 06:17:04 CDT, and started at 07:40:11 CDT and ended at 08:19:39 CDT.

2.0 Shadin Avionics Fuel Flow Indicator Description

The Shadin Fuel Flow Indicator is a panel mounted gauge that acts as a digital fuel management system. It has capabilities to interface with other devices via an RS-232 serial connection. It can provide endurance (time), fuel flow (gallons per hour), fuel used (gallons), and fuel remaining (gallons) if the operator has set the initial fuel level correctly before starting the engine. The system includes non-volatile memory that retains fuel remaining and fuel used information.

2.1 Shadin Avionics Fuel Flow Indicator Data Recovery

The Shadin Avionics Fuel Flow Indicator was in good condition upon arrival at the Vehicle Recorder Laboratory (see figure 3) and powered on normally using the appropriate power harness and voltage.

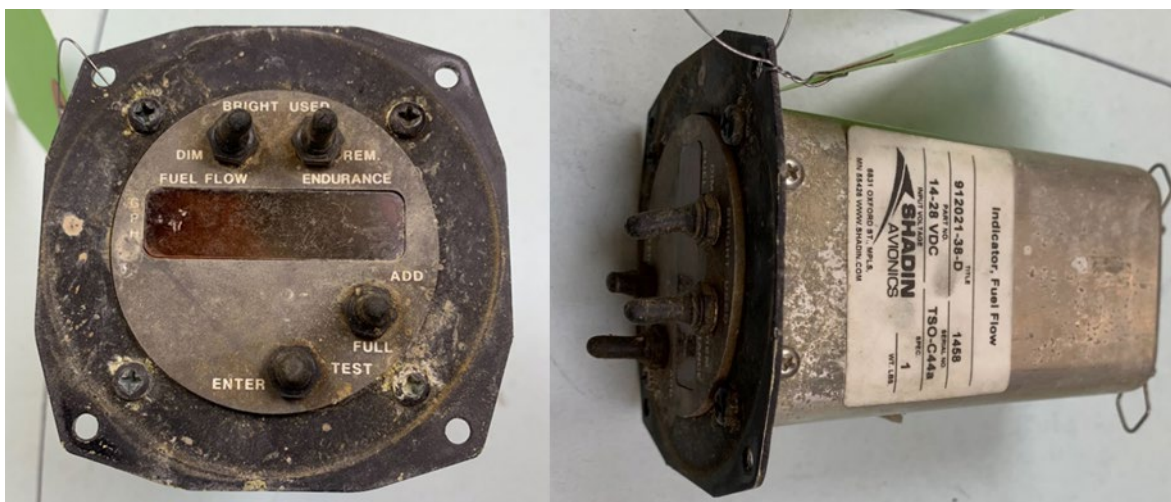


Figure 3. Front and top of the Shadin Avionics Fuel Flow Indicator as received.

2.2 Shadin Avionics Fuel Flow Indicator Recording Description

Upon power up, the fuel flow indicator performed a self-test and reported a status of “good” indicating a successful test (see figure 4). Fuel used and fuel remaining is displayed by moving the USED/REM toggle switch to the appropriate USED and REM positions. Figure 5 shows the fuel used reporting a value of 67.7 gallons and the fuel remaining reporting a value of 143 gallons. The device’s fuel value may not represent the total fuel amount relevant to the accident flight as it relies on proper user input to reflect accurate fuel load values upon engine start. No other data was available from the Shadin device.

A diagnostic software test is displayed by pressing the ENTER/TEST button. Figure 6 shows the K-factor setting of 2150 pulses per gallon and the units of measure set to gallons. Figure 6 also shows the software version 60.08.86. Figure 7 shows the maximum usable fuel reported a value of 210 gallons.

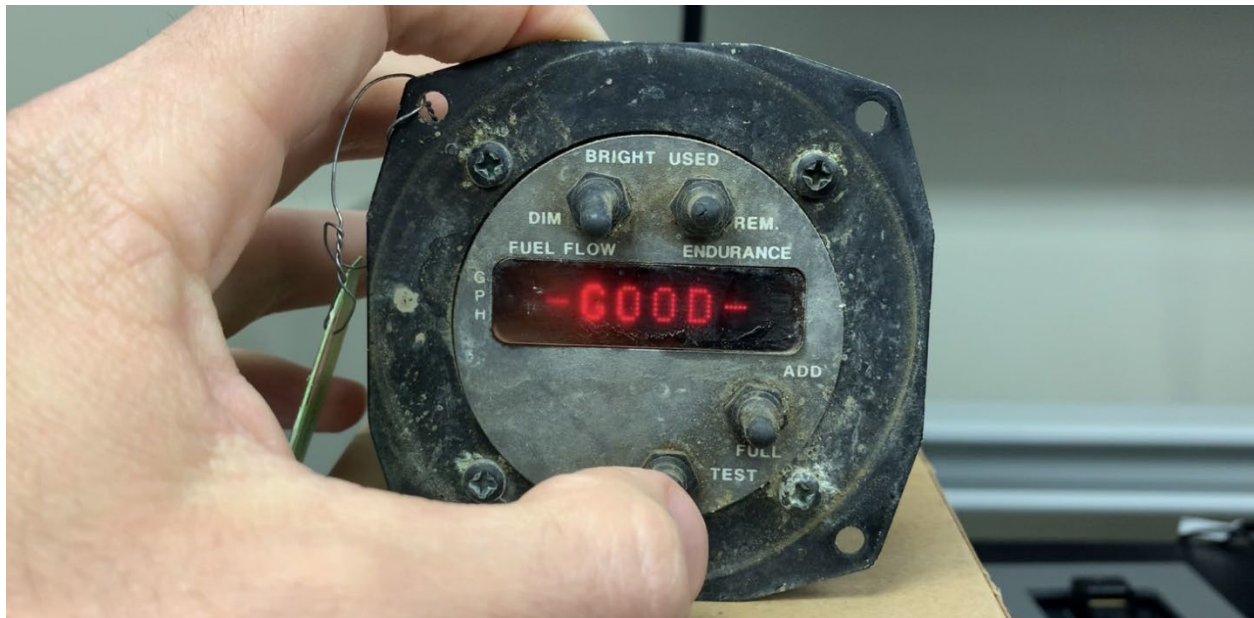


Figure 4. The Shadin device self test upon power up.

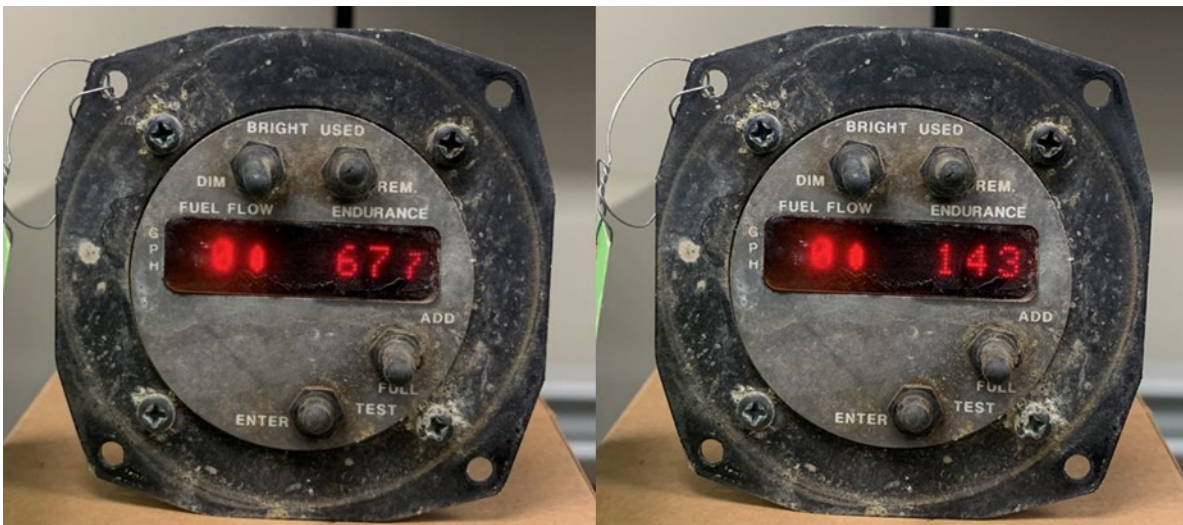


Figure 5. The Shadin device indicating the amount of fuel used (left) and fuel remaining (right).

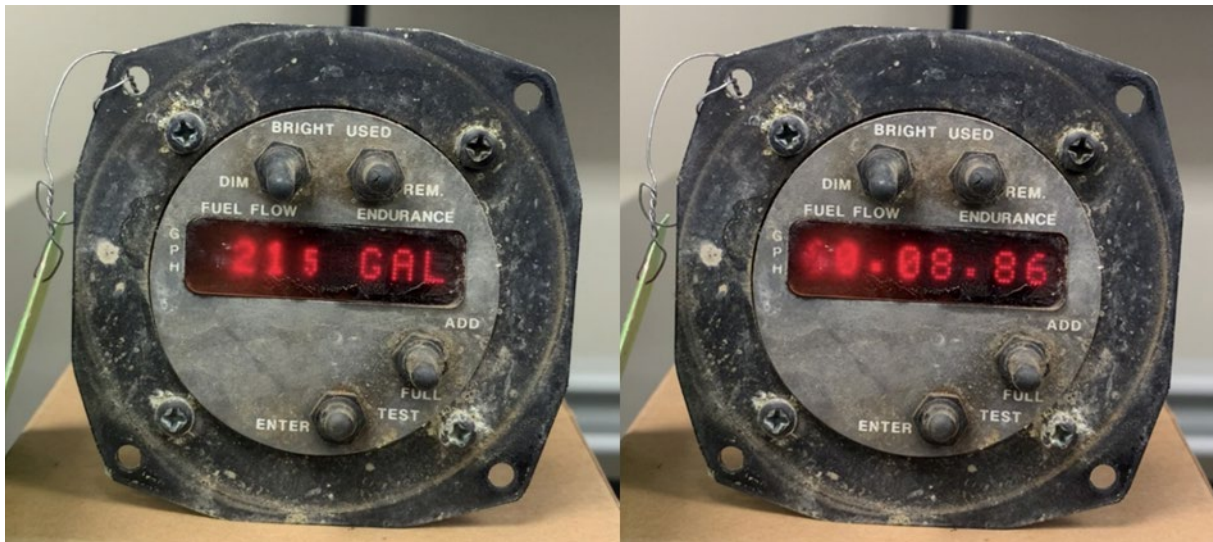


Figure 6. The Shadin device indicating K-factor setting and units of measure (left) and the software version (right).

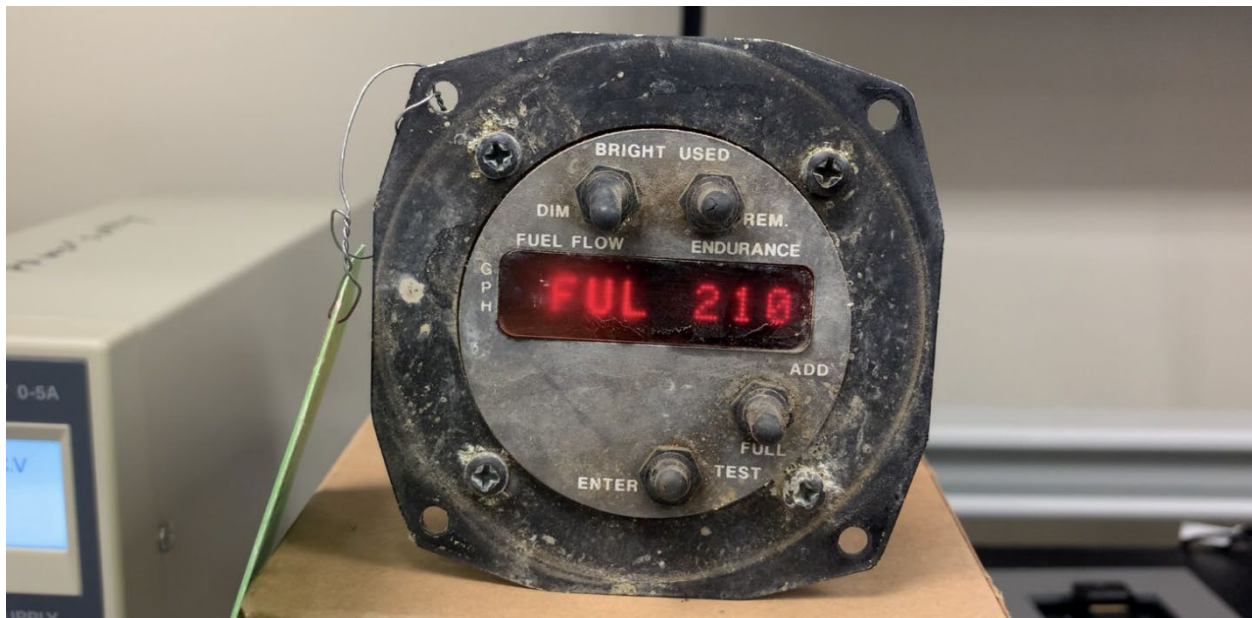


Figure 7. The Shadin device indicating the maximum usable fuel setting.

D. OVERLAYS AND TABULAR DATA

Data obtained from the SATLOC M3 Bantam were used to produce the following overlays and tabular data. Figure 8 is graphical overlay generated using Google Earth for the entire accident flight. Figure 9 is a zoomed overlay detailing the takeoff and departure from Allport, Arkansas. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figure 10 is a plot of parameters of the entire accident flight recorded on the M3 Bantam. The time displayed is 10:00:00 UTC to 16:00:00 UTC.

Figure 11 is a plot of parameters at the end of the accident flight recorded on the M3 Bantam. The time displayed is 15:15:00 UTC to 15:37:00 UTC.

The corresponding tabular data used to create figures 8 through 11 are provided in comma-separated value (CSV) format as attachment 1 to this report.

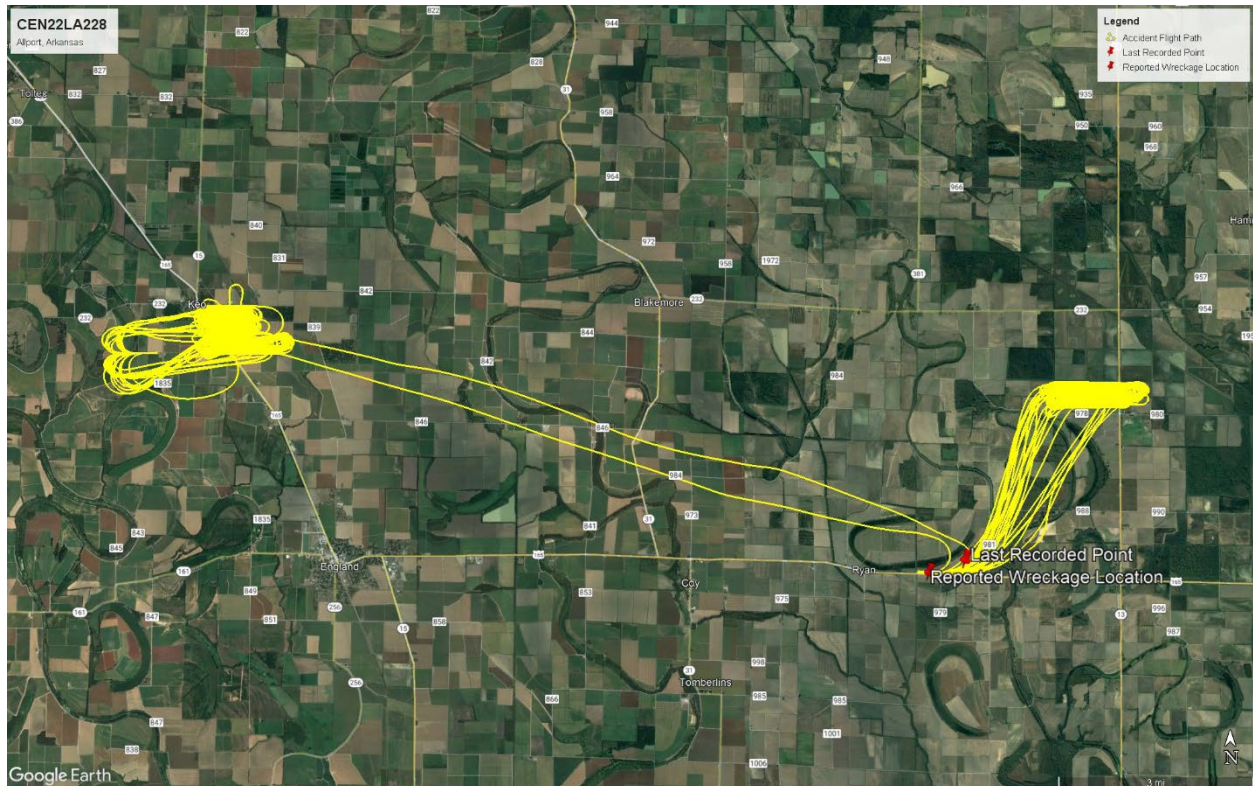


Figure 8. Google Earth overlay of track log recorded on the SATLOC M3 Bantam.



Figure 9. Google Earth overlay showing the last recorded data point on the SATLOC M3 Bantam and the reported wreckage locations.

Submitted by:

Matthew Yandrick
Recorder Specialist

Air Tractor Inc, AT-602, N5007R

Location, Date: Allport, AR, 06/01/22

NTSB No. CEN22LA228

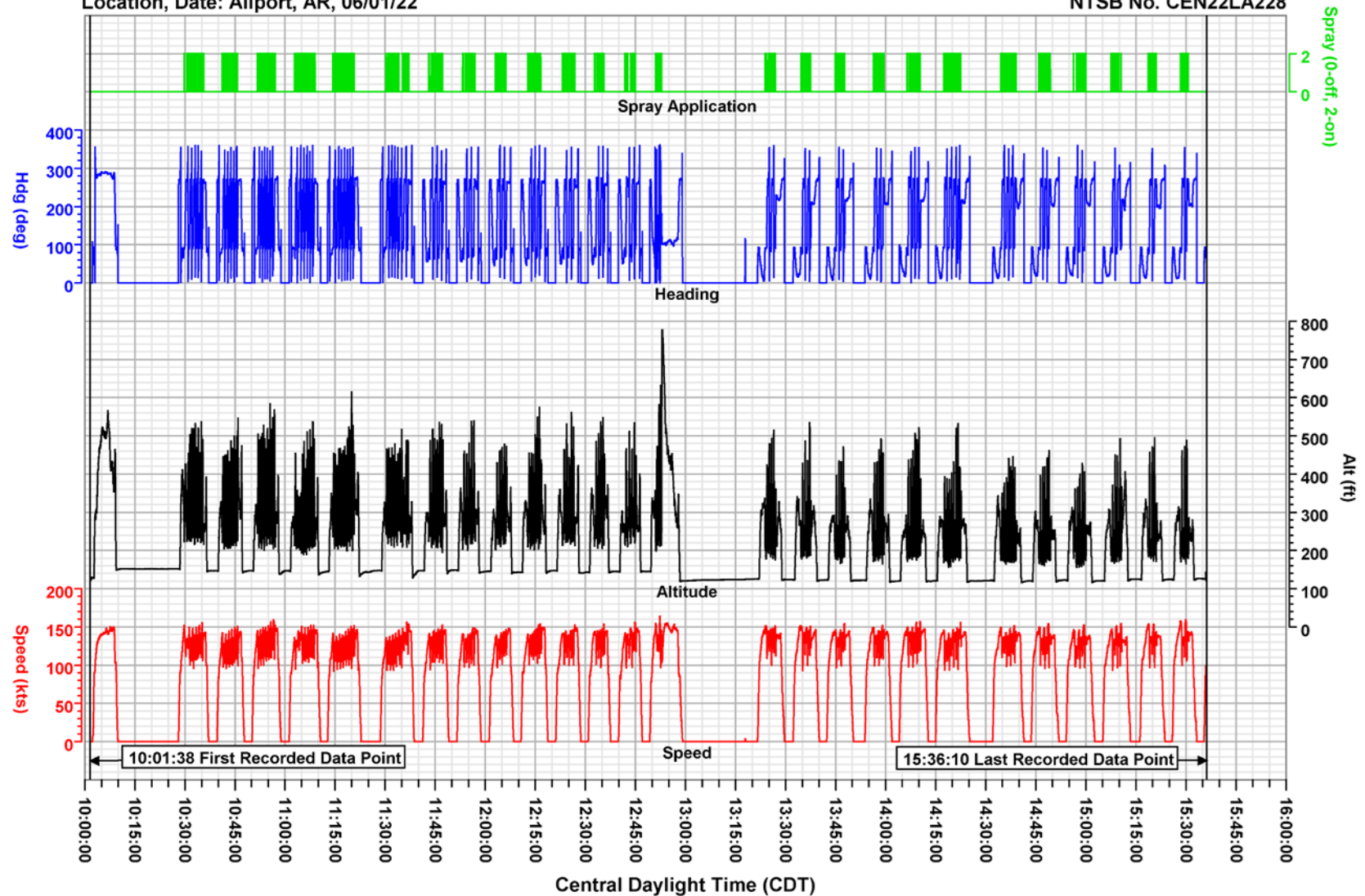


Figure 10. Plot of SATLOC M3 Bantam parameters for the entire accident flight.

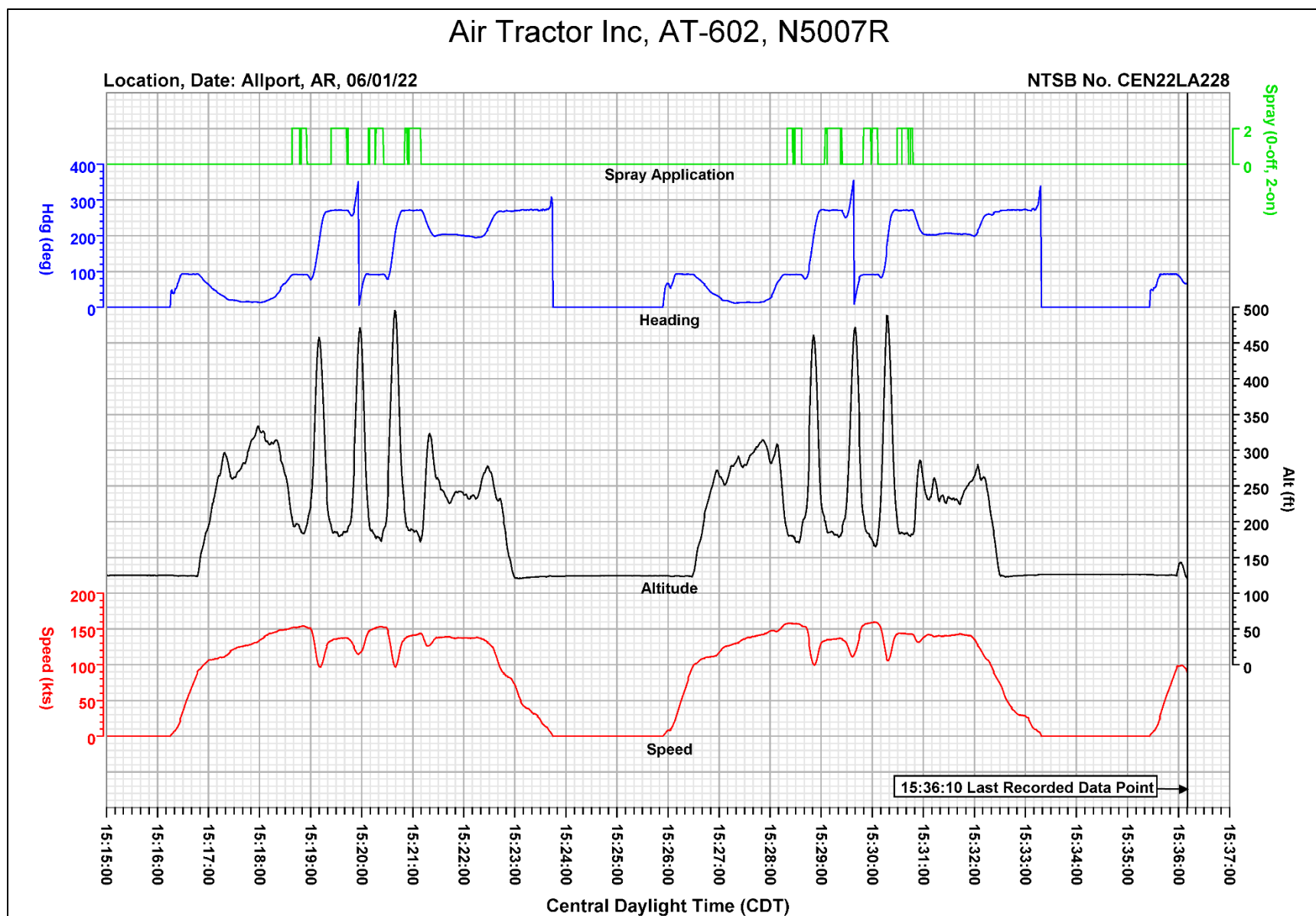


Figure 11. Plot of SATLOC M3 Bantam parameters of approximately the final 22 minutes of the accident flight.

APPENDIX A. VERIFIED AND PROVIDED PARAMETERS SATLOC M3 BANTAM

This appendix describes the parameters provided and verified in this report. Table 1 lists the SATLOC M3 Bantam parameters and describes the parameter unit abbreviations used in this report. Time, Latitude, Longitude, and Altitude are recorded by the device. Ground Speed and Heading are derived from the recorded parameters.

Table 1. Verified and provided parameters.

Parameter Name (units)	Parameter Description
Time (HH:MM:SS.SS)	CDT for recorded data point (hours, minutes, seconds)
Lat (deg)	Latitude (degrees)
Lon (deg)	Longitudinal (degrees)
Alt (ft)	Altitude Above Mean Sea Level (feet)
Speed (kts)	Average Ground Speed (knots)
Hdg (deg)	Ground Track (degrees)
Spray (discrete)	Spray Application

Note: The SATLOC M3 Bantam records GPS 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. 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.