

National Transportation Safety Board

Office of Research and Engineering

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ELECTRONIC DEVICES

Specialist's Factual Report

November 7, 2024

TABLE OF CONTENTS

A. ACCIDENT.....	3
B. ELECTRONIC DEVICES SPECIALIST	3
C. DETAILS OF THE INVESTIGATION	3
1.0 Dynon Engine Monitoring System D120 Description.....	3
1.1 Dynon EMS-D120 Data Recovery	4
1.2 Dynon EMS-D120 Data Description	4
1.2.1 Dynon EMS-D120 Parameters Provided.....	5
1.3 Dynon EMS-D120 Time Correlation	5
2.0 Dynon Electronic Flight Information D100 Description	5
2.1 Dynon EFIS -D100 Data Recovery	6
3.0 Garmin GPSMAP 496 Description	7
3.1 Garmin GPSMAP 496 Data Recovery	7
4.0 iFly 740b Description	8
4.1 iFly 740b Data Recovery	8
D. FIGURES AND TABULAR DATA.....	9

A. ACCIDENT

Location: Southport, North Carolina
Date: October 15, 2023
Time: 0759 eastern daylight time (EDT)
1159 coordinated universal time (UTC)
Airplane: Czech Aircraft Sport Cruiser, private operator, N72FU

B. ELECTRONIC DEVICES SPECIALIST

Specialist: Steven Smith
Mechanical Engineer (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: Dynon EMS-D120
Part Number: 100563-001
Recorder Serial Number: 002052

Recorder Manufacturer/Model: Dynon EFIS-D100
Part Number: 100488-001
Recorder Serial Number: 002401

Recorder Manufacturer/Model: Garmin GPSMAP 496
Recorder Serial Number: 19713952

Recorder Manufacturer/Model: iFly 740b
Recorder Serial Number: VH15030003

1.0 Dynon Engine Monitoring System D120 Description

The Dynon Engine Monitoring System (EMS) D120 is a 7-inch widescreen display mounted in the cockpit of non-type certificated aircraft. The instrument integrates up to 16 engine related instruments including manifold pressure, temperatures, RPM and fuel system information. Depending on the type of engine installed in the aircraft and pilot preferences, not all display options may be available.

Depending on the firmware version on the unit, the ability to log data to internal memory exists. According to the manufacturer, firmware versions 3.0 and

later contain the ability to log certain engine parameters. The data logging must be configured by the operator to enable logging and set the data log interval. The unit can also be configured to start logging data automatically at boot-up. The data logging interval can be set to store at 1, 3, 5, 10, 30 and 60 second intervals. The internal memory can store at least 30 minutes of cumulative data at a 1 second recording interval or at least 30 hours at a 60 second data recording interval. When the recording limit in the internal memory is reached, the oldest record is deleted and a new record is added.

1.1 Dynon EMS-D120 Data Recovery

The Dynon EMS-D120, shown in figure 1, was in good condition and the data were downloaded using the manufacturer's procedure.



Figure 1. Dynon EMS-D120 as received by the NTSB Vehicle Recorder Laboratory.

1.2 Dynon EMS-D120 Data Description

The Dynon EMS-D120 received contained firmware version 5.5.0.249. Based on information from the manufacturer, the unit does store data. The operator had the datalog function enabled and it was set to record information at a 1 second interval and start recording at boot up. The recording contained 11 flights from September 19, 2023, through October 15, 2023. The last recording was identified as the accident flight recording and was approximately 11 minutes and 55 seconds. The distance from the last recorded sample at 07:59:07 EDT and the reported wreckage location was approximately 267 feet.

1.2.1 Dynon EMS-D120 Parameters Provided

Table 1 lists the Dynon EMS-D120 parameters verified and provided in this report. This aircraft has a 4-cylinder engine. In the data plots, the '#' is replaced with the appropriate cylinder ID. A data review determined that the number 3 and 4 cylinders were reporting erroneous data. Therefore, cylinder head temperature (CHT) and exhaust gas temperature (EGT) for cylinders 3 and 4 were excluded from this report.

Table 1. Dynon EMS-D120 verified and provided parameters.

Parameter Name (unit)	Parameter Description (unit)
cht# (degF)	Cylinder Head Temperature # (degrees Fahrenheit)
date (MM/DD/YYYY)	Date (Month/Day/Year)
egt# (degF)	Exhaust Gas Temperature # (degrees Fahrenheit)
fuel flow (gph)	Fuel Flow (gallons per hour)
fuel pres (psi)	Fuel Pressure (pounds per square inch) ¹
gals rem (gal)	Fuel Remaining (gallons)
grnd spd (kts)	Groundspeed (knots)
grnd trk (deg)	Ground Track (degrees)
lat (deg)	Latitude (degrees)
lon (deg)	Longitude (degrees)
man pres (inHg)	Manifold Pressure (inches of Mercury)
oil pres (psi)	Oil Pressure (pounds per square inch)
oil temp (degF)	Oil Temperature (degrees Fahrenheit)
rpm (rpm)	Engine Speed (revolutions per minute)
time (HH:MM:SS)	UTC Time (Hours:Minutes:Seconds)

1.3 Dynon EMS-D120 Time Correlation

The GPS time was recorded in UTC. The difference between EDT and UTC is 4 hours, or 14,400 seconds. An offset was applied to display the data with the local time zone. Therefore, for the rest of this report, all times are referenced as EDT.

2.0 Dynon Electronic Flight Information D100 Description

The Dynon Electronic Flight Information System (EFIS) D100 is a 7-inch widescreen display mounted in the cockpit of non-type certificated aircraft. The instrument integrates multiple flight instruments including airspeed, altitude, gyro-

¹ Fuel Pressure normal operating range is 2.2 psi - 5.58 psi per the Czech Aircraft Sport Cruiser Pilot's Operating Handbook (Date of Issue: 11/2010, Revision 3.2), §9.2 Engine instruments markings.

stabilized magnetic compass, turn rate, slip/skid ball, bank angle, pitch angle and vertical speed. The unit also has other functions that include a clock/timer, g-meter, voltmeter, and a density altitude/true airspeed calculator. The unit contains an Air Data, Attitude and Heading Reference System (ADAHRS) to provide air data, attitude and heading information to the display. Depending on the installation in the operator's aircraft certain parameters might not be displayed, for example angle-of-attack.

Depending on the firmware version on the unit, the ability to log data to internal memory exists. According to the manufacturer, firmware versions 5.0 and later contain the ability to log certain EFIS and GPS parameters. The data logging must be configured by the operator to enable logging and set the data log interval. The unit can also be configured to start logging data automatically at boot-up. The data logging interval can be set to store at 1, 3, 5, 10, 30 and 60 second intervals. The internal memory can store at least 2 hours of cumulative data at a 1 second recording interval or at least 120 hours at a 60 second data recording interval. When the recording limit in the internal memory is reached, the oldest record is deleted and a new record is added.

2.1 Dynon EFIS-D100 Data Recovery

The Dynon EFIS-D100, shown in figure 2, was in good condition. The unit was able to power on, however, when the unit was downloaded, the file contained no data. An inspection of the device's datalog config page showed that the recording function was set to "off." This option is configurable by the operator. Therefore, no data were recovered from this device.



Figure 2. Dynon EFIS-D100 as received by the NTSB Vehicle Recorder Laboratory (left) and the Dynon EFIS-D100 powered on (right) with the datalog config page showing the recording feature set to "off."

3.0 Garmin GPSMAP 496 Description

The Garmin GPSMAP 496 is a battery-powered portable 12-channel GPS receiver with a 256-color thin-film transistor (TFT) liquid-crystal display (LCD) display screen. The unit includes a built-in Jeppesen database and can receive XM satellite radio for flight information including NEXRAD radar, lightning, METARs, TAFs, and TFRs. A built-in AOPA Airport Directory and SafeTaxi Airport Diagrams are included for selected fields.

The unit stores date, route-of-flight, and flight-time information for up to 50 flights. A flight record is triggered when groundspeed exceeds 30 knots and altitude exceeds 250 feet and ends when groundspeed drops below 30 knots for 10 minutes or more. A detailed track log, including latitude, longitude, date, time, and global positioning system (GPS) altitude information is stored within the unit whenever the receiver has a lock on the GPS navigation signal. Position is updated within the tracklog as a function of time or distance moved, depending on how the unit has been configured.

Once the current track log memory becomes full, new information either overwrites the oldest information or the recording stops, depending on how the unit is configured. The current tracklog can be saved to long-term memory and 15 saved tracklogs can be maintained in addition to the current tracklog. Tracklog storage may be activated or de-activated at user discretion. All recorded data is stored in non-volatile memory (NVM).² The unit contains hardware and software permitting the download of recorded waypoint, route, and track log information to a PC via a built-in serial port. An internal button-battery is used to back-up power to the internal memory and real-time clock during those periods when main power is removed.

3.1 Garmin GPSMAP 496 Data Recovery

The Garmin GPSMAP 496, shown in figure 3, was in good condition and the data were downloaded using the manufacturer's procedure. The device contained 49 logs recorded between June 19, 2023, and October 13, 2023. Therefore, no data were recovered from the accident flight.

² Non-volatile memory is semiconductor memory that does not require external power for data retention.



Figure 3. Garmin GPSMAP 496 as received by the NTSB Vehicle Recorder Laboratory.

4.0 iFly 740b Description

The iFly GPS 740b is a portable uncertified 7-inch widescreen display aviation GPS. It is loaded with FAA Sectional Charts, Low Altitude Enroute Charts, Approach/Departure Plates, and Airport Diagrams.

Data can be recorded on a SD card installed in the device. According to the manufacturer, without an installed SD card no data is recorded by the internal memory of the device.

4.1 iFly 740b Data Recovery

The iFly 740b, shown in figure 4, was in good condition and the data were downloaded using the manufacturer's procedure. The SD card contained 35 logs from January 2, 2021, to May 22, 2023. Therefore, no data were recovered from the accident flight.

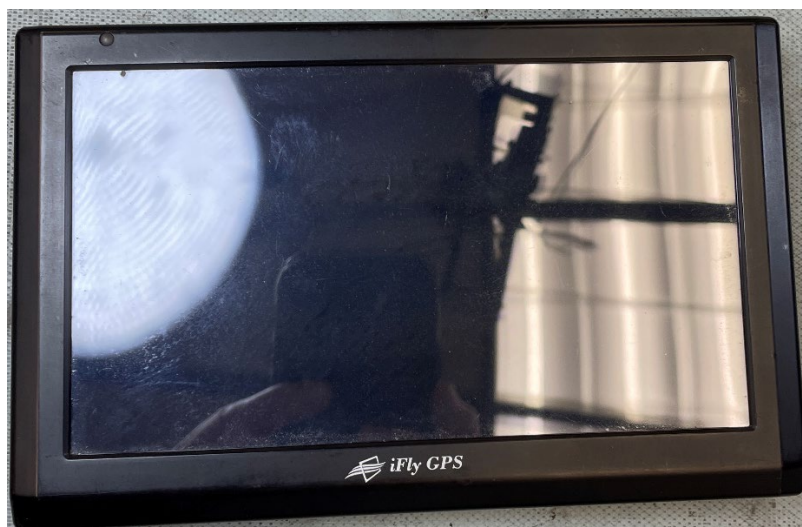


Figure 4. iFly 740b as received by the NTSB Vehicle Recorder Laboratory.

D. FIGURES AND TABULAR DATA

Figures 5 to 7 contain Dynon EMS-D120 data recorded during the event on October 15, 2023. All the parameters listed in table 1 are plotted except UTC Hours, UTC Minutes, and UTC Seconds.

Figures 5 and 6 are time history plots presenting the entire Dynon EMS-D120 recording and the takeoff roll through the end of the recording, respectively.

Figure 7 is a graphical overlay derived from the Dynon EMS-D120 data and generated using Google Earth presenting the entire accident flight from Cape Fear Regional Jetport/Howie Franklin Field Airport (KSUT) in Oak Island, North Carolina. Weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

The electronic device data indicated the following sequence of events:

- **07:51:00 EDT:** The device was powered on with the aircraft was parked in front of a hangar at KSUT.
- **07:51:50 EDT - 07:55:06 EDT:** The aircraft taxied via taxiway C, made a left turn onto taxiway A, and held short of runway 5.
- **07:57:33 EDT:** The aircraft turned onto runway 5 and began takeoff roll.
- **07:57:47 EDT:** Engine speed reached a maximum of 4852 rpm.
- **07:58:01 EDT:** Groundspeed was 60 kts.
- **07:58:29 EDT:** Engine speed reduced to 3237 rpm. Groundspeed was 58 kts.
- **07:58:39 EDT:** Engine speed was 3267 rpm.
- **07:58:40 EDT:** Engine speed reduced to 2455 rpm.
- **07:58:46 EDT:** Engine speed increased to 2967 rpm. Groundspeed was 56 kts.
- **07:59:07 EDT:** Last recorded data sample. Groundspeed was 50 kts and engine speed was 2656 rpm.

The corresponding tabular data used to create figures 5 to 7, including UTC Hours, UTC Minutes, and UTC Seconds, are provided in electronic comma-separated value (CSV) format as attachment 1 to this report.

Submitted by:

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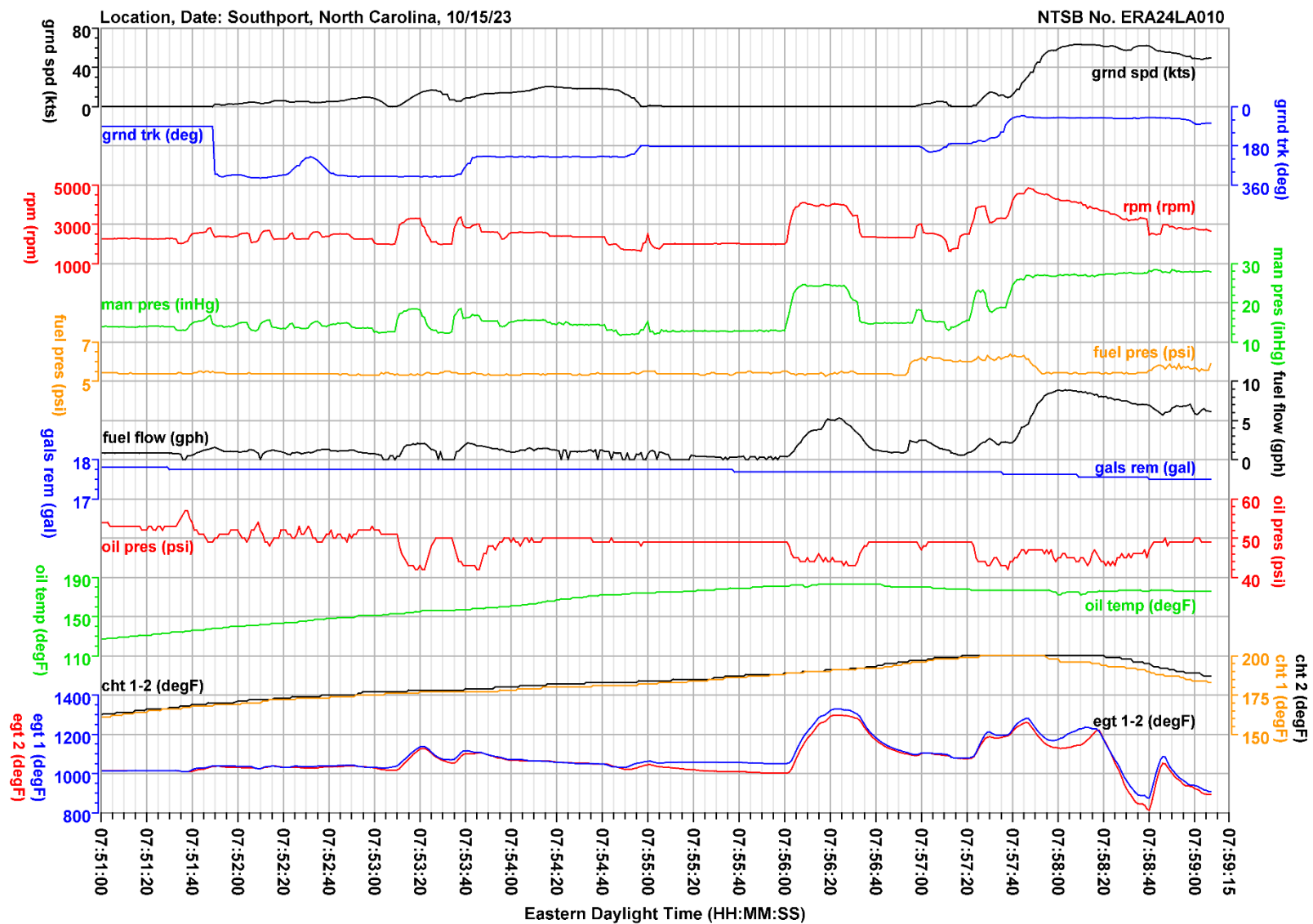


Figure 5. Time history plot of the entire Dynon EMS-D120 recording from 07:51:00 EDT to 07:59:15 EDT.

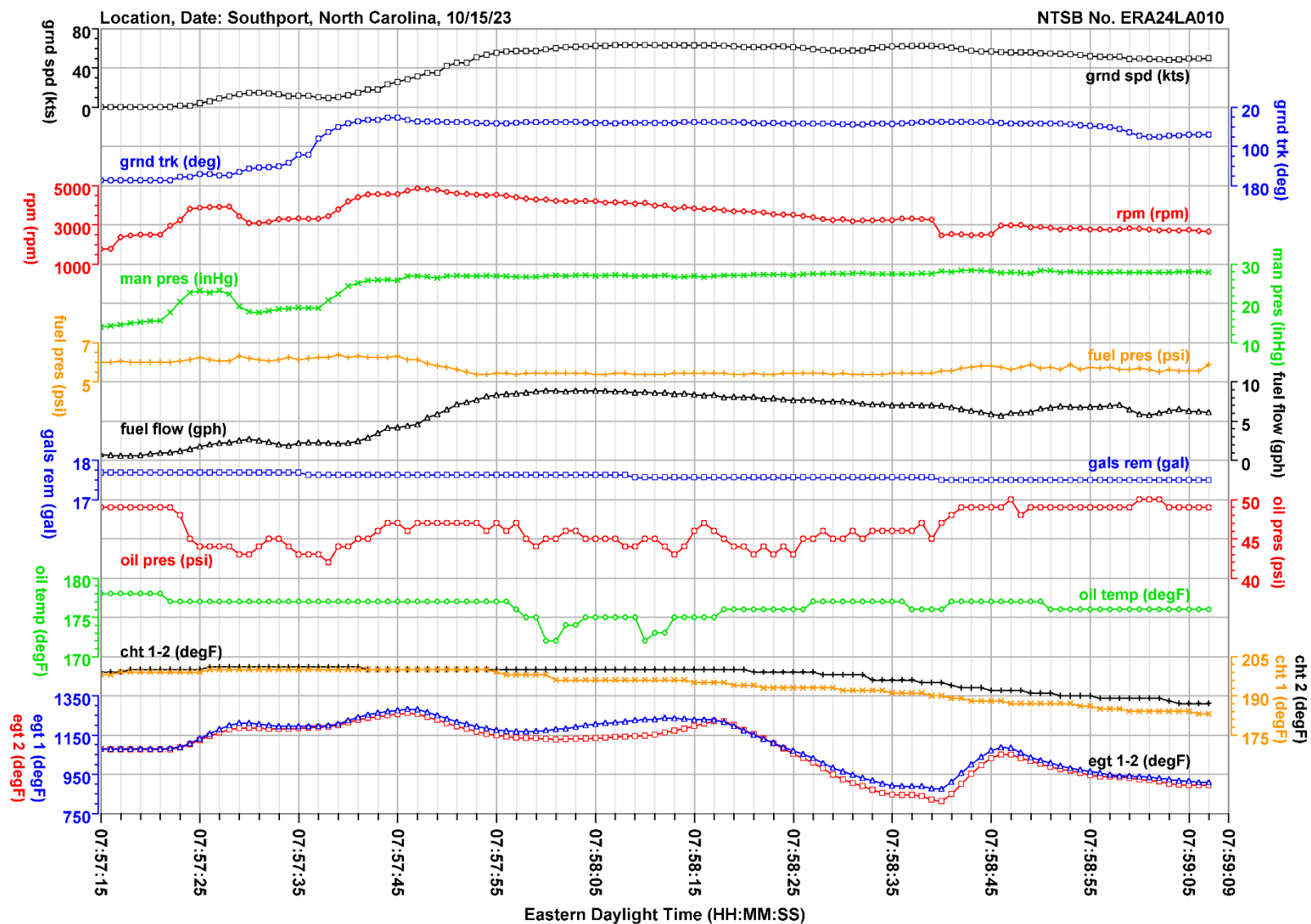


Figure 6. Time history plot of takeoff roll through the end of the recording from 07:57:15 EDT to 07:59:09 EDT.



Figure 7. Google Earth overlay of the entire recording.