

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

May 7, 2020

Electronic Devices

Specialist's Factual Report
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1. EVENT SUMMARY

Location: Quincy, Florida
Date: August 24, 2018
Aircraft: Beech A36
Registration: N773CB
Operator: Private
NTSB Number: ERA18LA229

On August 24, 2018, about 1235 eastern daylight time, a Beech A36, N773CB, was substantially damaged when it was involved in an accident near Quincy Municipal Airport (29J), Quincy, Florida. The private pilot was seriously injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

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

Device 1 Manufacturer/Model:	JPI EDM-800
Device 1 Serial Number:	16158
Device 2 Manufacturer/Model:	Garmin GPSMAP 696
Device 2 Serial Number:	1H6012897
Device 3 Manufacturer/Model:	Honeywell KGP-560 EGPWS¹
Device 3 Serial Number:	0357

3.1. JPI EDM-800 Device Description

The JPI EDM-800 is a panel-mounted gauge that allows the operator to monitor and record up to 24 parameters related to engine operations. Depending on the installation, engine parameters monitored can include: Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT), Oil Pressure and Temperature, Manifold Pressure, Outside Air Temperature, Turbine Inlet Temperature, Engine Revolutions Per Minute (RPM),

¹ Enhanced Ground Proximity Warning System

Compressor Discharge Temperature, Fuel Flow, Carburetor Temperature, and Battery Voltage.

The unit can also calculate in real time, percent of maximum horsepower, fuel used, shock cooling rate, and EGT differentials between highest and lowest cylinder temperatures. The calculations are also based on the aircraft installation.

The unit contains non-volatile memory² for data storage of the parameters recorded and calculated. 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-per-sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

3.1.1. JPI EDM-800 Data Recovery

The device was undamaged upon arrival at the Vehicle Recorder Division, as shown in Figure 1, and the data stored in the internal memory was extracted normally using the manufacturer's software.



Figure 1. JPI EDM-800 as received.

3.1.2. JPI EDM-800 Data Description

The data extracted included 16 sessions from December 26, 2017³, through August 24, 2018. The last three sessions recorded are included in this report and are summarized in Table 1. The data was recorded at a 6 second-per-sample rate.

Table 1: Last 3 sessions recorded on the JPI EDM-800.

Start (recorded)	End (recorded)
April 14, 2018 21:26:28	April 14, 2018 21:34:58
April 15, 2018 01:02:52	April 15, 2018 01:11:58
August 24, 2018 18:28:44	August 24, 2018 18:32:14

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

³ All dates and times are referenced to Coordinated Universal Time (UTC).

3.1.3. JPI EDM-800 Parameters Provided

Table 2 describes data parameters recorded by the device.

Table 2: JPI EDM-800 Data Parameters

Parameter Name	Parameter Description
Time	Time (UTC) for recorded data point (HH:MM:SS)
EGT 1-6 (degF)	Exhaust Gas Temperature Cylinder # (degrees Fahrenheit)
CHT 1-6 (degF)	Cylinder Head Temperature Cylinder # (degrees Fahrenheit)
CLD (degF/min)	Shock Cooling Rate (degrees Fahrenheit per minute)
HP (%)	Horsepower (percent)
RPM (rpm)	RPM (Revolutions Per Minute)
FF (gph)	Fuel Flow (gallons per hour)
MAP (inHg)	Manifold Pressure (inches of Mercury)
OilT (degC)	Oil Temperature (degrees Celsius)
OAT (degF)	Outside Air Temperature (degrees Fahrenheit)
TIT (degF)	Turbine Inlet Temperature (degrees Fahrenheit)
BATTERY (V)	Battery Voltage (Volts)

3.1.4. JPI EDM-800 Data Time Correlation

The date and time on the device are manually adjusted by the operator. The dates recorded for sessions on the device corresponded to the dates for sessions recorded on the Garmin GPSMAP 696, however, times were offset. Time recorded on the device was adjusted by correlating when the takeoff power was applied to position data recovered from the Garmin GPSMAP 696.

3.2. Garmin GPSMAP 696 Device Description

The Garmin GPSMAP 696 is a portable GPS receiver capable of storing date, route-of-flight, and flight-time information for up to 50 flights. A detailed tracklog – including latitude, longitude, date, time, and groundspeed information – is stored within the unit whenever the receiver has a lock on the GPS navigation signal. All recorded data is stored in non-volatile memory. The unit contains hardware and software permitting the download of recorded waypoint, route, and tracklog information to a PC via a built-in serial port. The unit can also communicate with external devices such as a computer using a built in USB 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.

3.2.1. Garmin GPSMAP 696 Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed no obvious damage, as shown in Figure 2. The device was able to power on, however, normal download procedures were unsuccessful. An internal examination of the device revealed damage to connections on the board. The non-volatile memory chip was removed, readout and converted to engineering units using laboratory tools.



Figure 2. Garmin GPSMAP 696 as received.

3.2.2. Garmin GPSMAP 696 Data Description

The data extracted included 150 sessions from June 24, 2017, through August 24, 2018 UTC. The last three sessions recorded are included in this report and are summarized in Table 3.

Table 3: Last 3 sessions recorded on the Garmin GPSMAP 696.

Start (UTC)	End (UTC)
April 14, 2018 19:30:02	April 14, 2018 20:49:55
April 14, 2018 23:07:20	April 15, 2018 00:21:30
August 24, 2018 16:28:35	August 24, 2018 16:34:39

3.2.3. Garmin GPSMAP 696 Parameters Provided

Table 4 describes data parameters recorded by the device.

Table 4: GPS Data Parameters

Parameter Name	Parameter Description
Date	Date for recorded data point (MM/DD/YYYY)
Time	Time (UTC) for recorded data point (HH:MM:SS)
Latitude	Recorded Latitude (degrees)
Longitude	Recorded Longitude (degrees)
GPS Alt	Recorded GPS Altitude (feet)
Groundspeed	Average derived groundspeed (knots)
Track	Average derived true course (degrees)

3.3. Honeywell KGP-560 EGPWS Device Description

The KGP-560 is an Enhanced Ground Proximity Warning System built for general aviation. The KGP-560 provides aural and visual alerts and warnings to the pilot to help reduce the risk of Controlled Flight into Terrain (CFIT).

The EGPWS does not continuously record data, rather, the EGPWS device stores data to non-volatile memory only when certain criteria are met. The readout process at the manufacturer's facility produces several files of flight history data that encompass operational, documentary, fault, and warning information.

The flight history data warning file outputs performance data related to the operation of the aircraft. These data are only recorded when an alert or warning related to the EGPWS function activates, resulting in data points for 20 seconds prior to the activation of the warning and 10 seconds afterwards. The EGPWS parameters are sampled 1 time per second, but the actual time of occurrence can be anywhere within the second.

3.3.1. Honeywell KGP-560 EGPWS Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed no obvious signs of damage, as shown in Figure 3. The device was delivered to the manufacturer's facility for data download in the same condition it was received.



Figure 3. Honeywell KGP-560 EGPWS as received.

3.3.2. Honeywell KGP-560 EGPWS Data Description

The manufacturer downloaded and decoded the files from the non-volatile memory and provided them to the investigation team.

The EGPWS does not record date and time, only the operating time of the unit in hours:minutes:seconds format. The recorded time at powerup at the manufacturer's facility showed an operating time of 804:17:58. The accident leg was identified as flight leg 737. The takeoff time from Quincy Municipal Airport (2J9) for flight leg 737 was 804:14:38. No warnings were activated during flight leg 737. Table 5 shows a record of INOPs associated with flight leg 737 for the EGPWS unit.

Table 5: Record of INOPs associated with flight leg 737.

Event Name	Status	Faults	Time
GPWS INOP	ON GROUND	5	804:15:29
MODE6 INOP	ON GROUND	5	804:15:29
TAD INOP	ON GROUND	5	804:15:29
PRESENT STATUS	ON GROUND	5	804:17:58
PRESENT STATUS	ON GROUND	5	804:20:28

4. OVERLAYS AND TABULAR DATA

Figure 4 is a plot of JPI parameters for the session recorded on August 24, 2018. An offset of 1 hour 57 minutes and 24 seconds (7044 seconds) was applied by correlating takeoff power with Garmin position data. The time interval plotted is 16:31:10 to 16:35:00 correlated time. EGT 4 recorded two data points at the beginning of the session but did not record for the remainder of the session. Past sessions revealed the same behavior for this parameter.

The normal operating range as specified in the pilot's operating handbook (POH) for CHT is 116 to 238 degrees Celsius (240.8 to 460.4 degrees Fahrenheit). The maximum values during the last session recorded did not exceed 325 degrees Fahrenheit (162.8 degrees Celsius).

The normal operating range as specified in the POH for Oil Temperature is 24 to 116 degrees Celsius (75.2 to 240.8 degrees Fahrenheit). The maximum value recorded during the last session was 75 degrees Celsius.

The normal operating range as specified in the POH for Fuel Flow during takeoff is 32.0 to 35.0 gph. At 16:34:08 the value for fuel flow was 30.9 gph and the succeeding three values recorded were 37.5 gph at 16:34:14, 36.8 gph at 16:34:20, and 36.8 gph at 16:34:26.

Figure 5 is graphical overlay generated using Google Earth for the accident event. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording. The recording started at 16:28:35 UTC and ended at 16:34:39 UTC. At 16:34:32 the value for fuel flow recorded on the JPI was 11.9 gph. Due to data buffering on the GPS unit, the recording may have ended before impact.

Figure 6 is a plot of JPI parameters for the session recorded on April 14, 2018 recorded time. An offset of 1 hour 54 minutes and 13 seconds (6853 seconds) was applied by correlating takeoff power with Garmin position data. The time interval plotted is 19:32:00 to 19:41:00 correlated time.

Figure 7 is a graphical overlay generated using Google Earth for the takeoff portion of the session recorded on April 14, 2018 UTC. The flight departed 29J approximately 19:34:21 UTC.

Figure 8 is a plot of JPI parameters for the session recorded on April 15, 2018 recorded time. An offset of 1 hour 54 minutes and 13 seconds (6853 seconds) was applied to the plot. The application of takeoff power was not captured in the recording. The time interval plotted is 23:08:30 to 23:18:00 correlated time.

Figure 9 is a graphical overlay generated using Google Earth for the takeoff portion of the session recorded starting on April 14, 2018 UTC and ending on April 15, 2018 UTC. The flight departed Umatilla Municipal Airport (X23) approximately 23:08:21 UTC.

The tabular data recorded by the JPI EDM-800 device is included as Attachment 1. The tabular data recorded by the Garmin GPSMAP 696 device is included as Attachment 2. These attachments are provided in electronic comma separated value (csv) format.

Figure 4. Plot of JPI parameters for the session recorded on August 24, 2018.

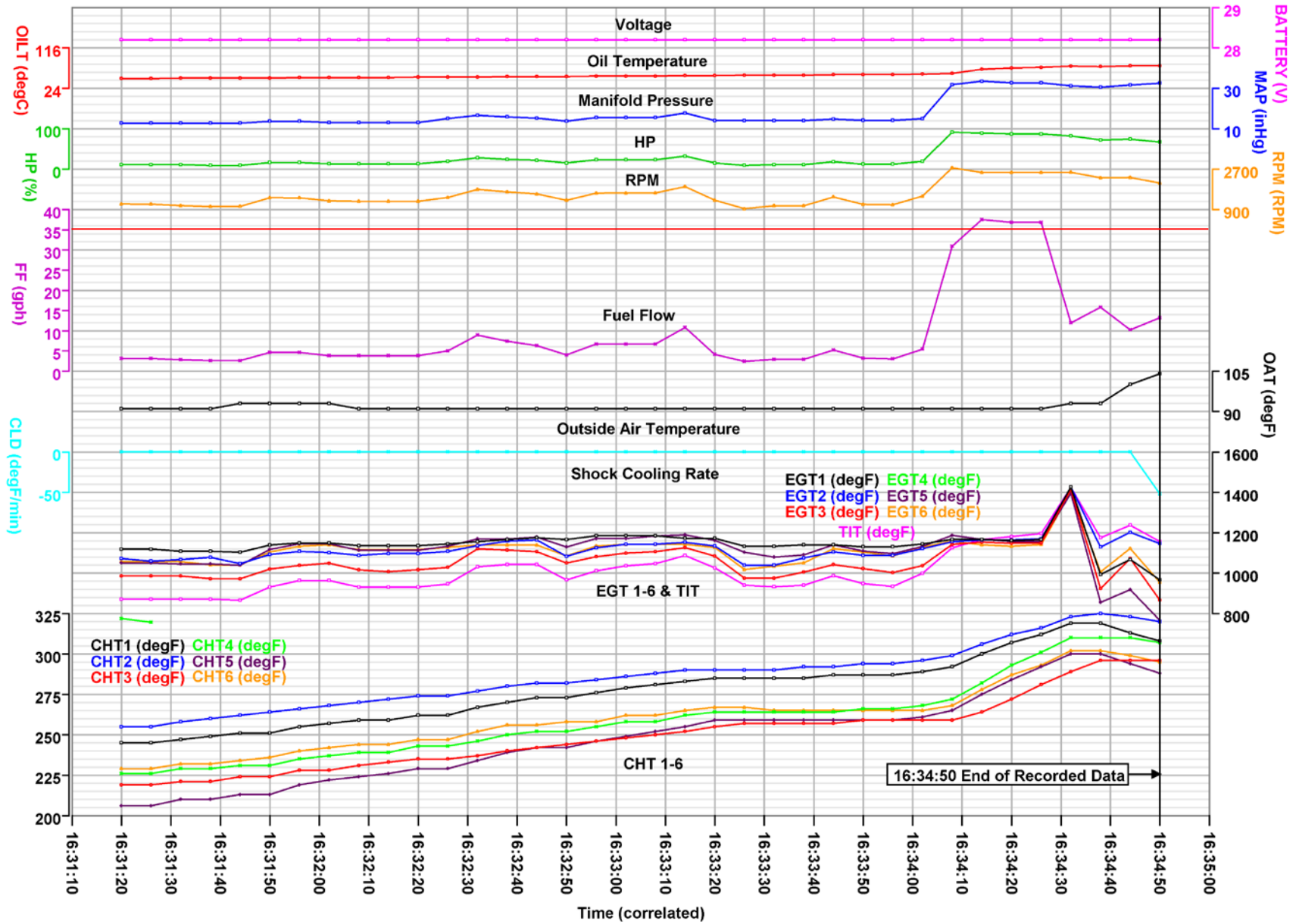


Figure 5. Google Earth overlay of the accident event.



Figure 6. Plot of JPI parameters for the session recorded on April 14, 2018.

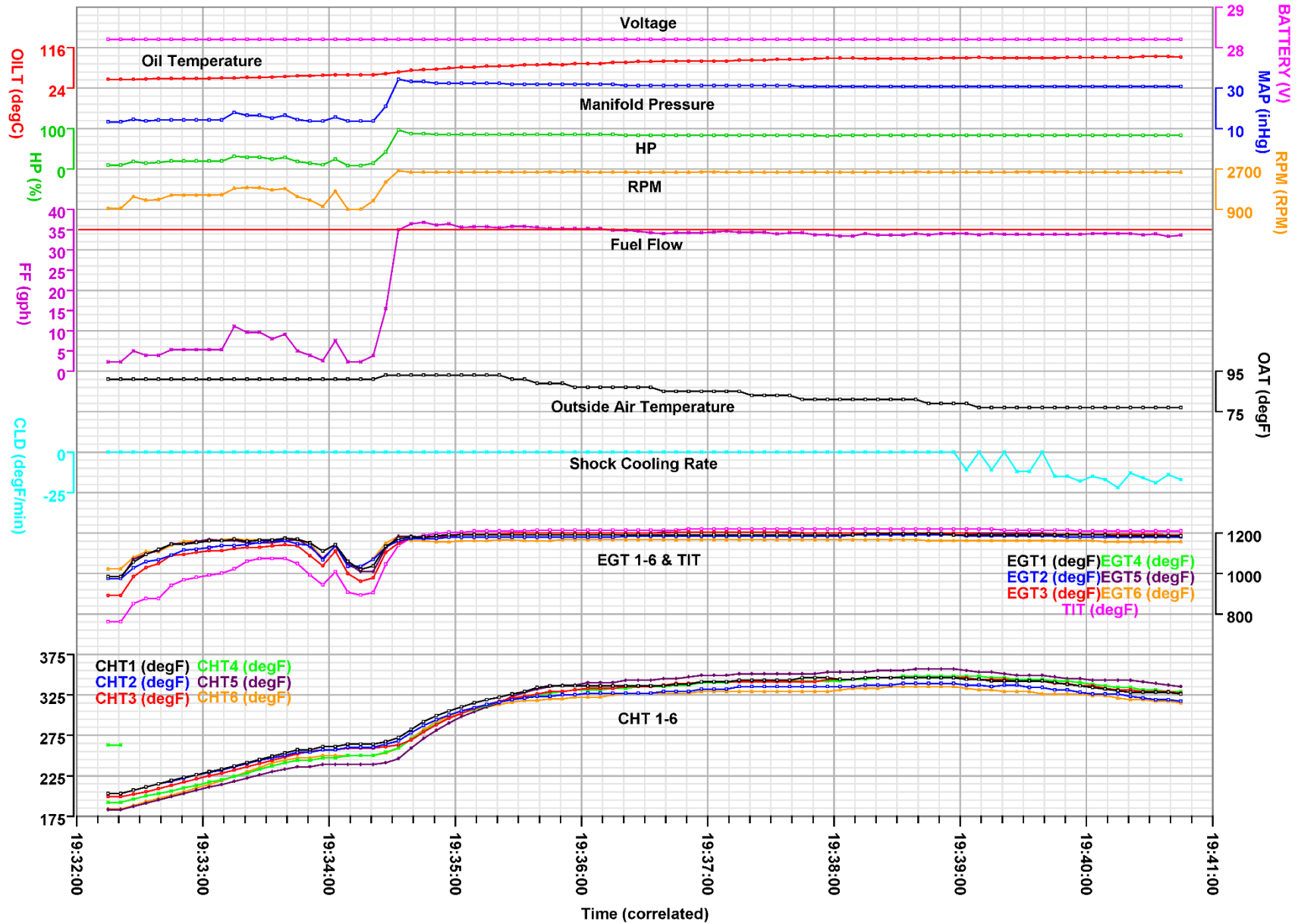


Figure 7. Google Earth overlay of takeoff portion of the session recorded on April 14, 2018.



Figure 8. Plot of JPI parameters for the session recorded on April 15, 2018.

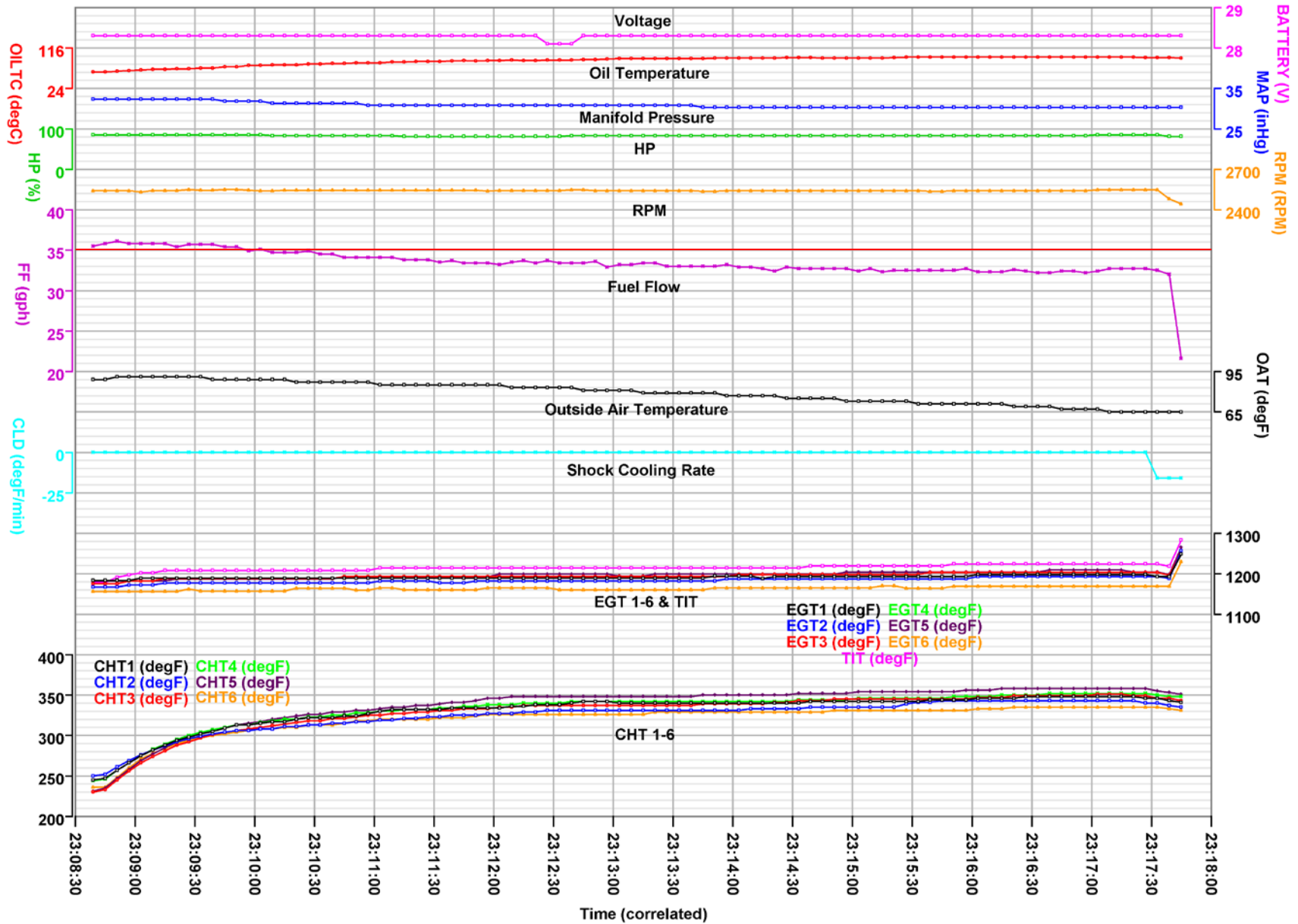


Figure 9. Google Earth overlay of takeoff portion of the session recorded starting on April 14, 2018 and ending on April 15, 2018.

