

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

May 3, 2022

Global Positioning System Devices

Specialist's Factual Report

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1. EVENT SUMMARY

Location: Urbana, Ohio
Date: August 20, 2021
Aircraft: Socata TBM 700
Registration: N700DT
Operator: Private
NTSB Number: CEN21FA376

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

On September 20, 2021, the National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following global positioning system (GPS) devices:

Device Manufacturer/Model: **Garmin GTN 750**
Serial Number: **1ZA017156**

Device Manufacturer/Model: **Garmin GTN 650**
Serial Number: **1ZA019343**

3.1. Device Description

3.1.1. Garmin GTN 750

The Garmin GTN 750 is a panel-mounted GPS receiver featuring an 800 x 600 pixel, 6.9 inch color liquid crystal (LCD) display. It has a GPS/SBAS engine and is TSO C146c certified for primary domestic, oceanic, and remote navigation including en route, terminal, and non-precision approaches, and approaches with vertical guidance, such as LPV and LNA/VNAV. The unit can simultaneously give aviators vital approach information and weather and traffic data in relation to their position on a large, color moving map display. Its color moving map features a built-in database that shows cities, highways, railroads, rivers, lakes, and coastlines. The unit has a slot on the front for a Jeppesen database containing all airports, VORs, NDBs, intersections, FSSs, approaches,

DPs/STARs and SUA information. A flight plan composed of multiple waypoints, including user-defined waypoints, can be programmed in the unit. The GTN 750 also includes a TSO'd airborne VHF communications transceiver and TSO'd airborne VOR/Localizer and Glideslope receivers. The unit contains an internal SD card storing flight log data, which can be accessed through the slot in the right side of the unit.

3.1.2. Garmin GTN 650

Garmin GTN 650 is a flight GPS navigation instrument by Garmin Ltd. The panel-mount units are equipped with touchscreens, remote audio control, flight planning and electronic chart capabilities. There is a built-in terrain database that shows when potential conflicts are ahead. There is also XM Satellite weather, traffic and lightning available on a moving map. The units also allow pilots to fly GPS-guided LPV (localizer performance with vertical guidance) glidepath approaches down to ILS (Instrument Landing System) minimums.

3.2. Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the devices had sustained impact damage, as shown in Figures 1 and 2. The GTN 750 was received without its display. Data from both units were downloaded by extracting the internal SD cards.



Figure 1. Garmin GTN 750 as received.



Figure 2. Garmin GTN 650 as received.

3.3. Devices Data Description

The downloaded data from Garmin GTN 750 were identical to the data from GTN 650. The data contained 58 sessions, ranging from January 15, 2021, to August 20, 2021. The last session was identified as the event flight. The session was approximately 27 minutes and 21 seconds, recorded from 14:11:30 to 14:38:51 EDT on August 20, 2021. The data were recorded at a 1 second-per-sample rate.

3.3.1. Parameters Provided

Table 1 describes data parameters provided by the Garmin GTN 750/650.

Table 1. Recorded Parameters from Garmin GTN 750/650.

Parameter Name	Parameter Description
Latitude (deg)	GPS position latitude in degrees
Longitude (deg)	GPS position longitude in degrees
LatAc (G)	Lateral direction Acceleration in G
NormAc (G)	Normal direction Acceleration in G
HDG (deg)	Heading with reference to magnetic north in degrees
TRK (deg)	Ground track with reference to true north in degrees
Roll (deg)	Roll angle in degrees
Pitch (deg)	Pitch angle in degrees
IAS (kt)	Indicated Air Speed in knots
TAS (kt)	True Air Speed in knots
GndSpd (kt)	Aircraft ground speed in knots
VSpd (fpm)	Vertical Speed in feet per minute
AltMSL(ft)	Altitude above Mean Sea Level in feet
AltB (ft)	Baro Altitude in feet
FQtyC (gal)	Fuel Quantity in gallons

3.4. Plots and Corresponding Tabular Data

The following figures contain data recorded during the August 20, 2021, event.

Figure 3 is a Google Earth overlay showing the overview of the event flight. The flight originated near Port Clinton, Ohio and headed south. The reported wreckage location is shown with a red pin. The weather and lighting conditions in Google Earth are not necessarily the weather and lighting conditions present at the time of the recording.

Figure 4 is a Google Earth overlay showing that the aircraft took off at Erie-Ottawa International Airport at Carl R Keller Field at about 14:11:30 EDT.

Figure 5 is a Google Earth overlay in West-up direction showing the aircraft's descent to the event location. The last recorded data point was near Urbana, Ohio at 14:38:51 EDT.

Figure 6 is a plot of the recorded data parameters from the Garmin GTN 750/650 of the entire event flight, from 14:11:30 to 14:38:51 EDT.

Figure 7 is a plot of the last 3 minutes of recorded data parameters from the Garmin GTN 750/650 of the event flight.

Figure 8 is a plot of the last minute of recorded data parameters from the Garmin GTN 750/650 of the event flight.

The corresponding tabular data used to create figures 3-8 were from the Garmin GTN 750 and are provided in Comma Separated Values (CSV) format as Attachment 1 to this report. The attachment contains additional parameters that were recorded during the event flight.

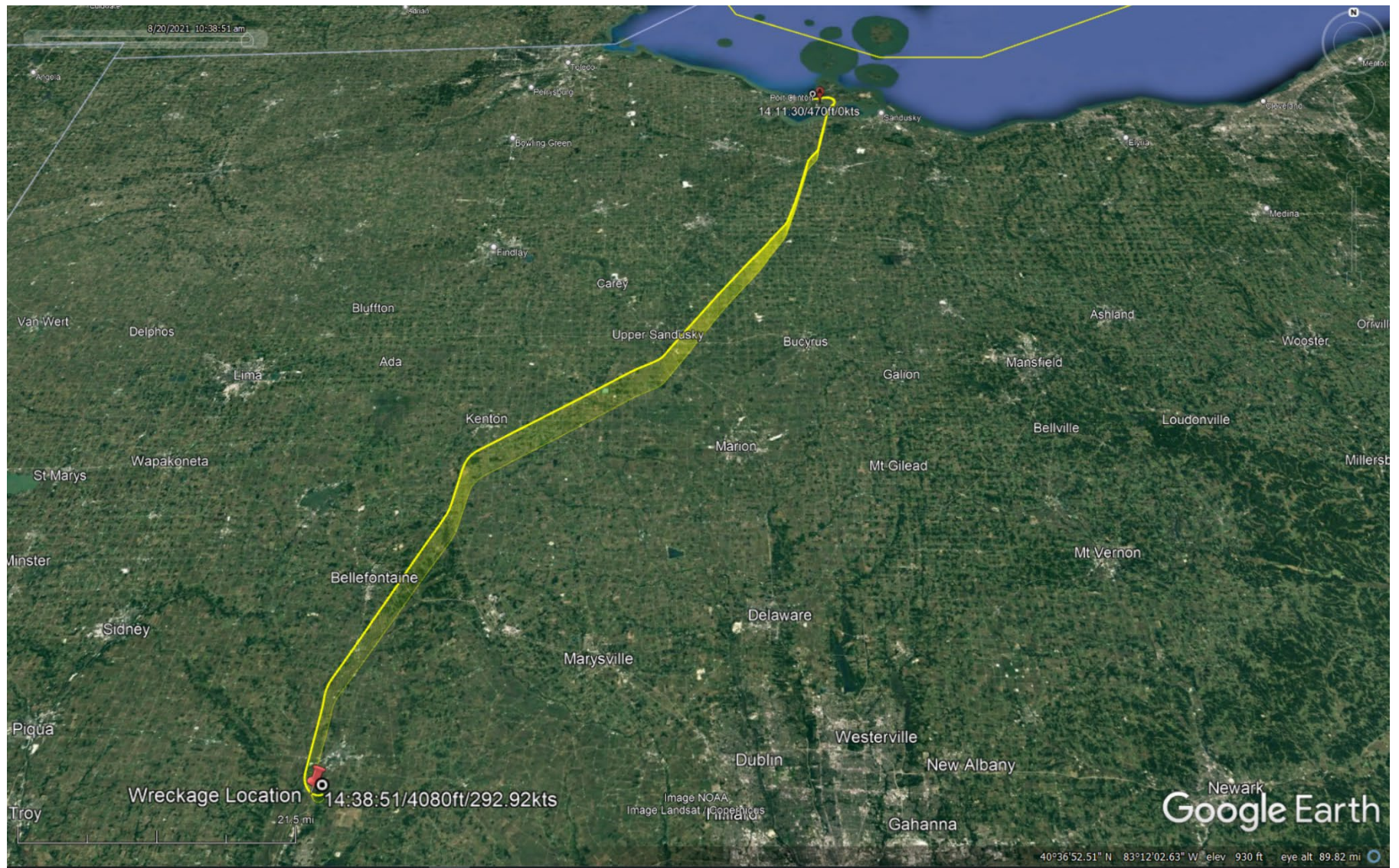


Figure 3. Google Earth overlay showing the overview of the entire flight.

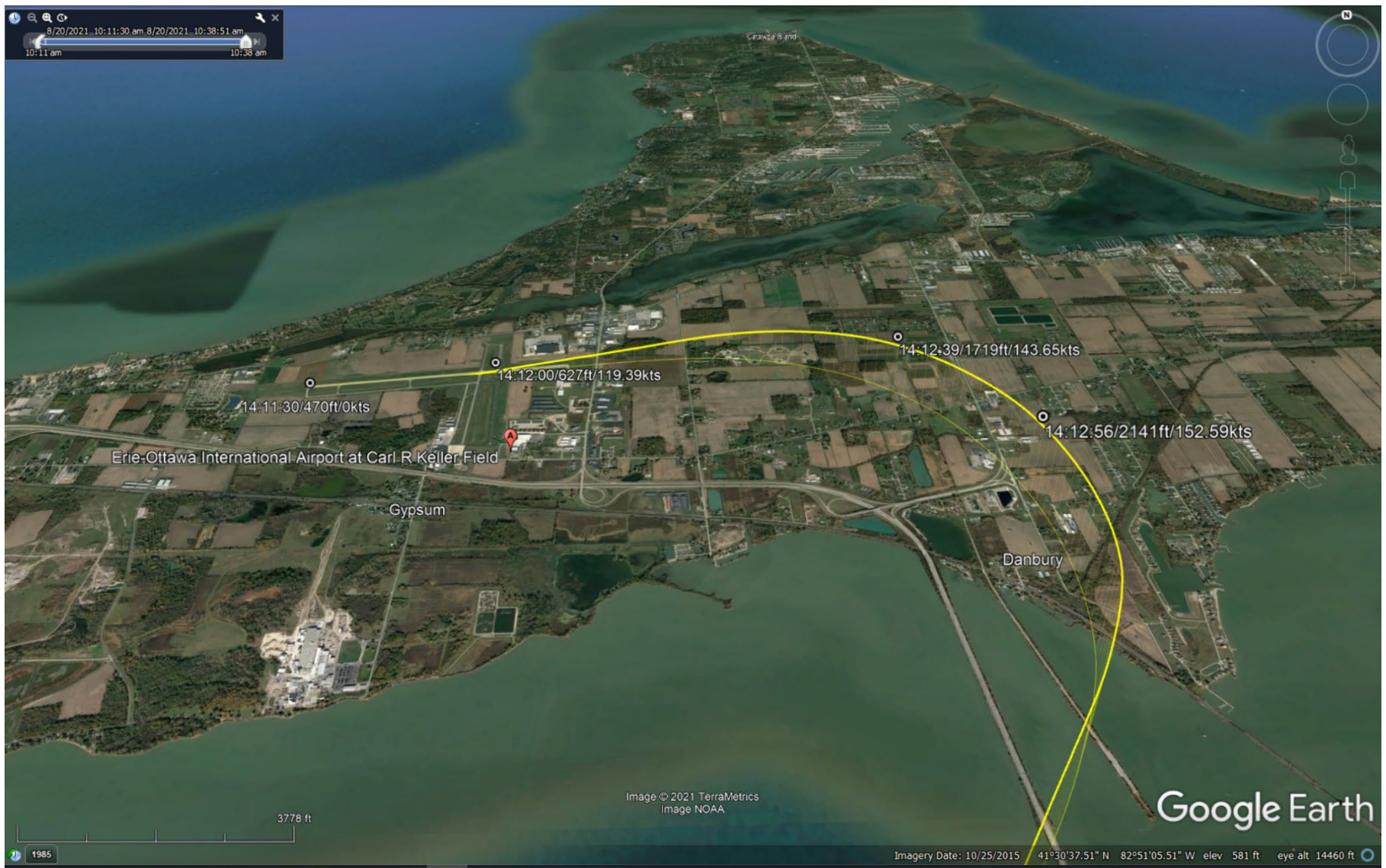


Figure 4. Google Earth overlay showing the beginning of the event flight.

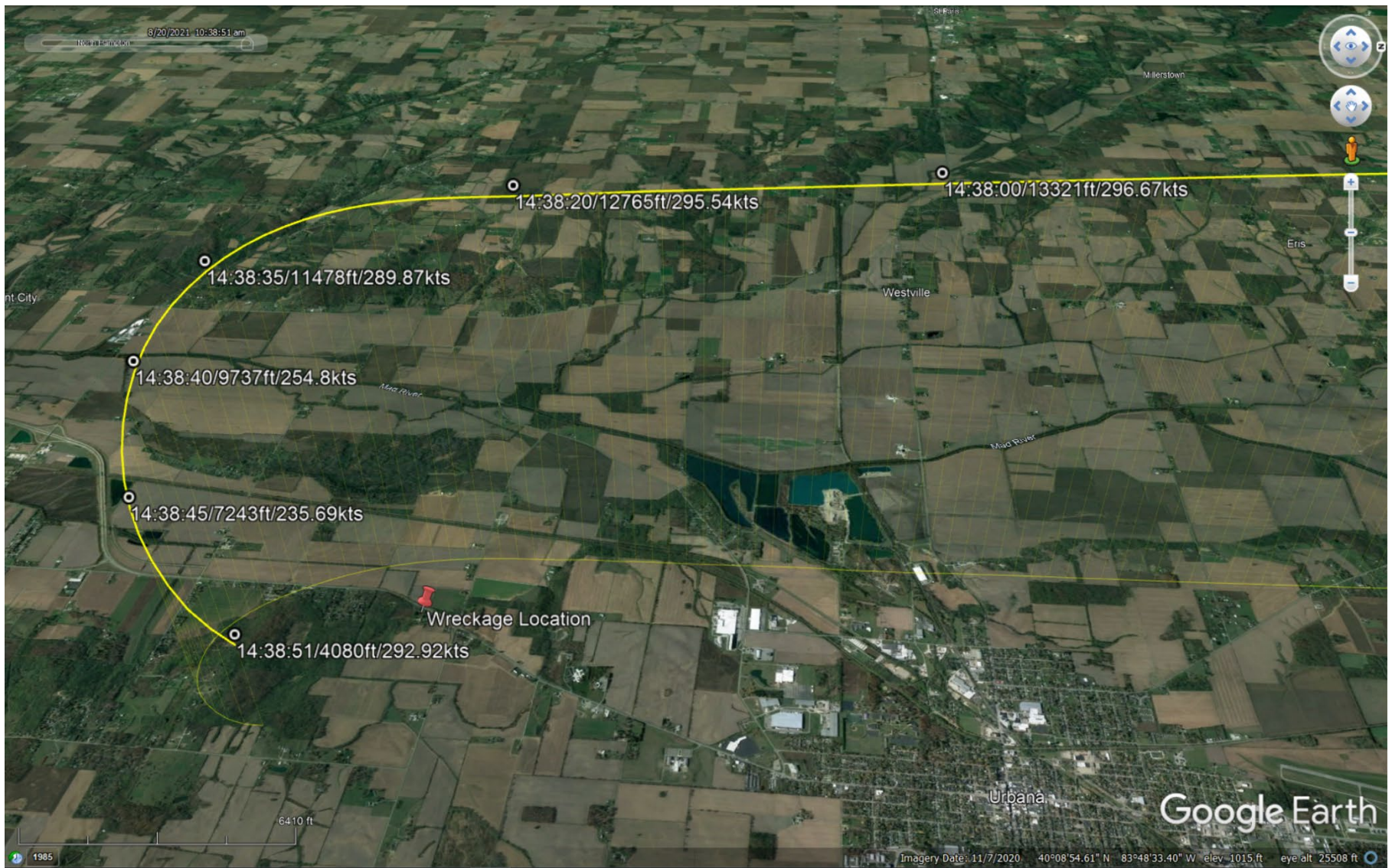


Figure 5. Google Earth overlay showing the end of the event flight and reported wreckage location.

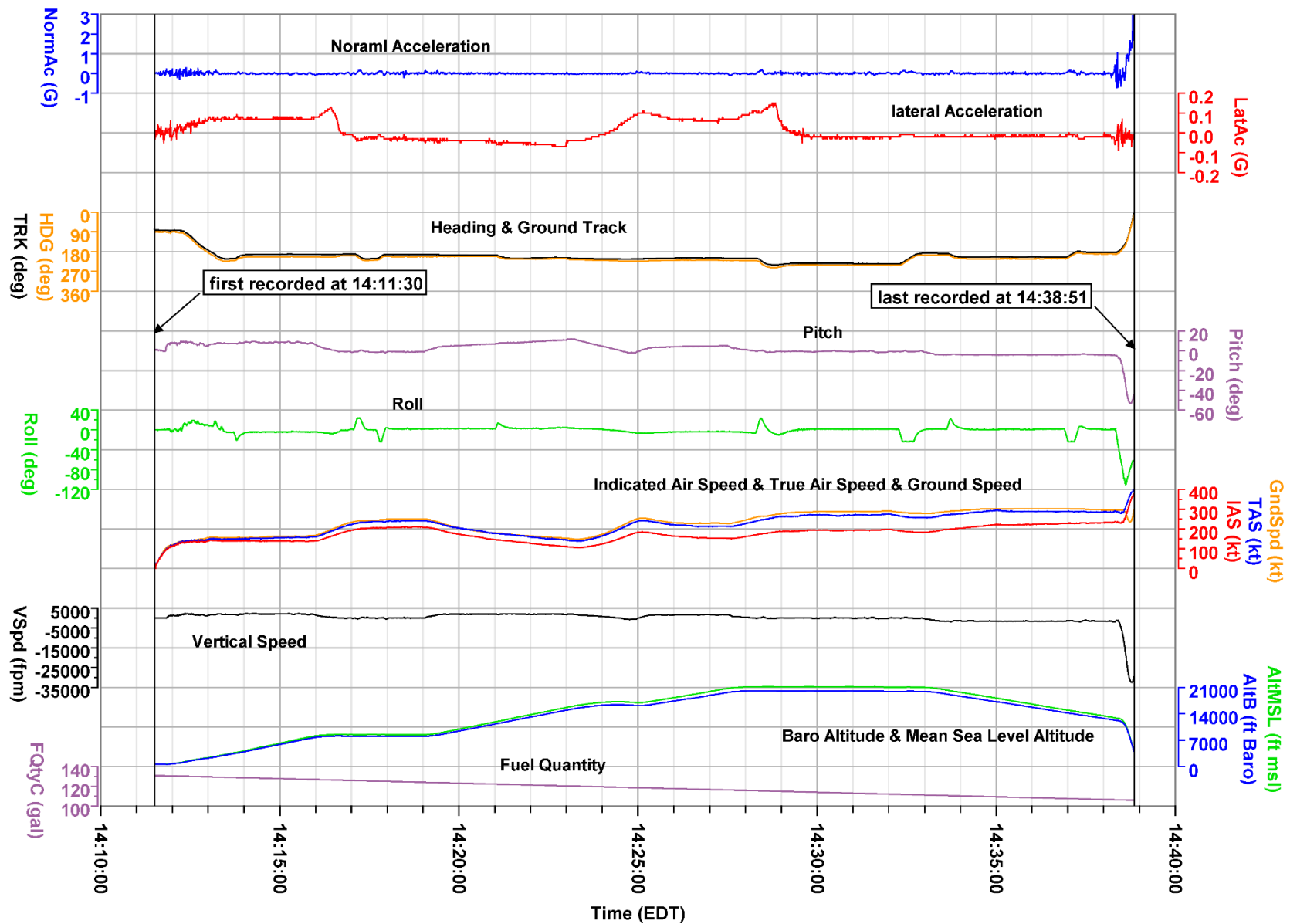


Figure 6. Plot of data parameters from Garmin GTN 750/650 of the entire event flight.

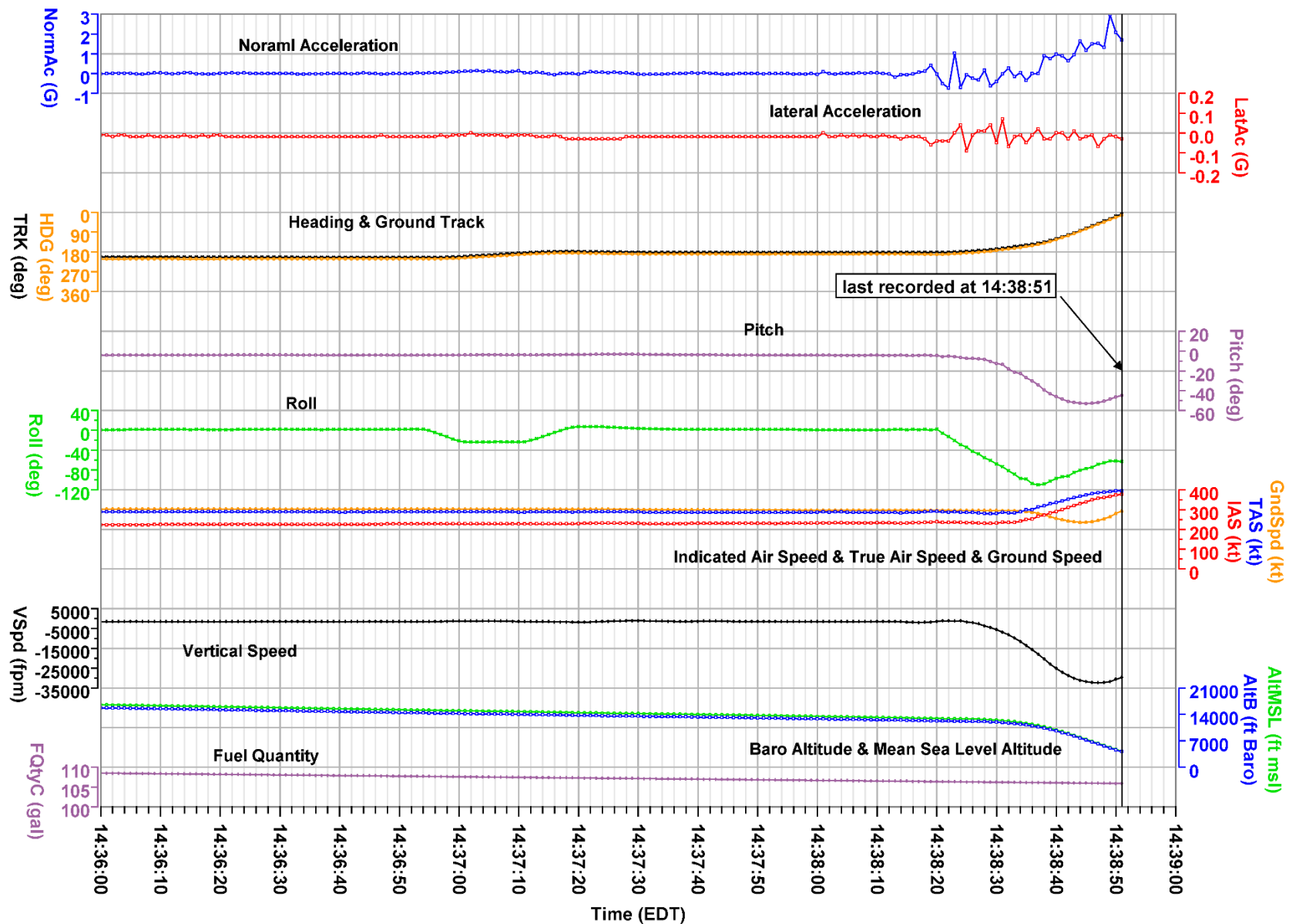


Figure 7. Plot of the last 3 minutes of data parameters from Garmin GTN 750/650 of the event flight.

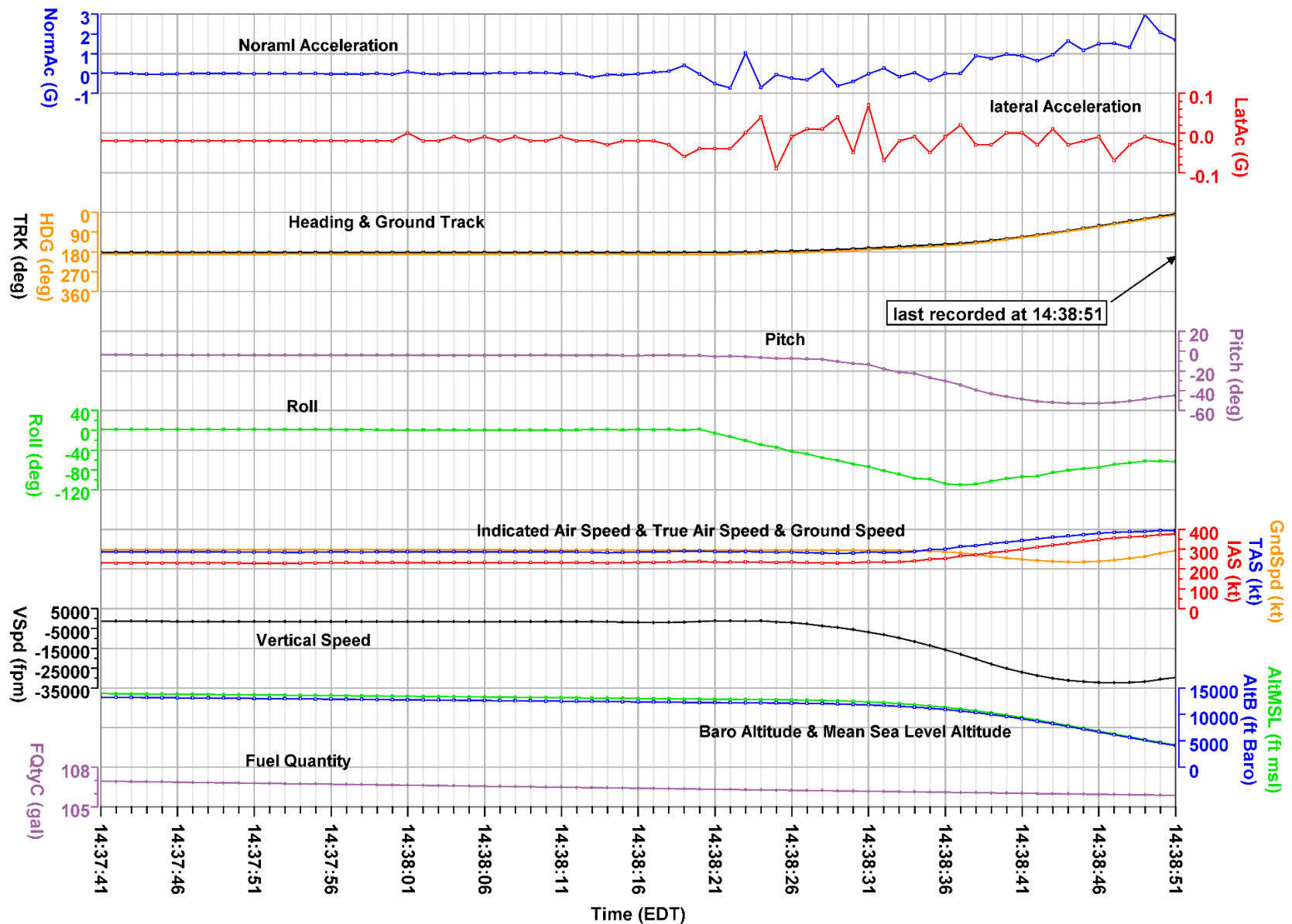


Figure 8. Plot of the last minute of data parameters from Garmin GTN 750/650 of the event flight.