

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA23LA309

AIRCRAFT PERFORMANCE STUDY

May 2, 2025

TABLE OF CONTENTS

A. ACCIDENT	3
B. AIRCRAFT PERFORMANCE SPECIALIST	3
C. SUMMARY	3
1. Introduction	3
2. Objective and Scope of the <i>Aircraft Performance Study</i>	4
3. Summary of Results	4
D. DETAILS OF THE INVESTIGATION	4
1. Method.....	4
2. Bell Helicopters 206L4	4
3. Cambridge Municipal Airport, Landing Zones, and Cargo Drop Zones	4
4. Meteorological Conditions	5
5. Summary of Pilot and Ground Crew Statements	7
6. ForeFlight Parametric Data.....	8
7. Aircraft Flight Path Reconstruction	15
8. Aircraft Weight & Balance	16
9. Bell Helicopters 206L4 Hover Performance Capability	18
E. FINAL SUMMARY	19
F. ATTACHMENTS	19
Attachment 1: Bell Helicopters 206L4 Engineering Drawing	
Attachment 2: Cambridge Municipal Airport, Landing Zones, and Cargo Drop Zones ...	
Attachment 3: ForeFlight Parametric Data	
Attachment 4: Aircraft Flight Path Reconstruction	
Attachment 5: Aircraft Weight & Balance	
Attachment 6: Bell Helicopters 206L4 Hover Performance Capability.....	

A. ACCIDENT

Description: Helicopter impact with terrain during external lift line operations
Location: Caldwell, Ohio
Date: July 23, 2023
Time: 1420 Eastern Daylight Time (EDT), 1920 Coordinated Universal Time (UTC)
Operator: Sky Aviation Corporation
Aircraft: Bell 206L4 LongRanger, N482TJ
Manufacturer: Bell Helicopters (Textron)

B. AIRCRAFT PERFORMANCE SPECIALIST

Kevin J. Renze
Sr. Engineer, Aircraft Performance
National Transportation Safety Board

C. SUMMARY

On July 23, 2023, about 1420 eastern daylight time, a Bell 206L4 LongRanger helicopter, N482TJ, was involved in an accident near Caldwell, Ohio during external lift line operations. The commercial pilot sustained serious injuries. The helicopter was operated by Sky Aviation Corporation under the provisions of Title 14 *Code of Federal Regulations* Part 133 external load operations.

The commercial pilot had completed several external load cargo drop operations in the morning and had refueled multiple times from a trailer based fuel tank at an off-airport landing zone (LZ2). The ground crew assisting the pilot reported that there were no anomalies observed during the morning flying. The helicopter completed another flight; flight track data showed that the pilot maneuvered over eight drop zones before returning to the landing zone and shutting down the helicopter.¹ During the stop, the ground crew added 335 lb of fuel, checked fluid levels, and loaded 8 cargo bags on the external carousel. No fluids besides fuel were added to the helicopter.

After departing the landing zone, the N482TJ flight track data indicated that the pilot maneuvered southeast towards 1 drop zone and then maneuvered to drop another bag. The flight track data showed the helicopter circled the area over the accident site before the helicopter descended through the trees in a near vertical path (straight-down) and impacted terrain.

1. Introduction

The accident flight was documented by ForeFlight data and photographs of the aircraft wreckage in situ. Other NTSB specialists gathered additional factual evidence including weather, aircraft operating manuals, maintenance records, and pilot and ground crew witness statements.

No NTSB investigators launched to the accident site. An NTSB aircraft performance group was not convened for this investigation. On scene evidence was documented by a Federal Aviation Administration (FAA) investigator. Documents were exchanged via email or through an NTSB document server.

The aircraft performance investigation was concentrated in several areas, including 1) collection and distribution of factual evidence regarding the accident flight, such as weight, balance,

¹ The helicopter was equipped with an external load line and carousel hook system that could carry a total of 8 bags. The pilot/helicopter flight mission was to drop 1 bag at each drop zone location.

performance, operations, and weather data, 2) time alignment and visualization of recorded ForeFlight data, 3) review of accident site wreckage photographs, and 4) development of an NTSB two-dimensional parametric data visualization model and a three-dimensional Google Earth model that could be used to evaluate the helicopter flight path relative to the target external load drop zones.

2. Objective and Scope of the *Aircraft Performance Group Study*

The objectives of the study were to 1) reconstruct the aircraft flight path and ground track and 2) determine what events/factors initiated the helicopter vertical descent and terrain impact, if possible. Recorded and computed (from recorded) parameters, such as groundspeed and course over ground were used in item 1.

3. Summary of Results

Specific reasons for the helicopter's descent and terrain impact could not be determined based on the available evidence.

D. DETAILS OF THE INVESTIGATION

1. Method

This study provides data-driven, quantified assessments of the Bell 206L4 external lift line flight path preceding the terrain impact event. The study is based primarily on the recorded N482TJ position (latitude, longitude, and altitude), derived groundspeed, derived course over ground, documented drop site locations, load line length, load ring height, load height, and Google Earth imagery and terrain elevation data.

The available factual evidence includes ForeFlight data, Bell 206L4 performance data, operating manuals, photographs, witness marks, pilot and ground crew statements, and meteorological data.

The event(s) that preceded the helicopter descent and impact with terrain are the focus of this study. The study scope is primarily from the preceding flight origin to the accident flight descent through the trees. This study did not evaluate the helicopter motion during the vertical descent and terrain impact.

2. Bell Helicopters 206L4

The Bell 206L4 is a 7-seat (1 pilot, 1 passenger up front, 5 passengers in the main cabin), single engine, light helicopter powered by the Rolls Royce 250-C30P light turboshaft engine. The Bell 206L4 was designed and manufactured by Bell Helicopters as one of several derivatives of the Bell 206 helicopter. A Bell 206L4 three-view engineering drawing is provided in Attachment 1.

3. Cambridge Municipal Airport (CDI), Landing Zones, and Cargo Drop Zones

According to a ground crew member statement, N482TJ operations on July 23, 2023 occurred at CDI, had been planned at LZ1, and occurred at LZ2. The CDI runway 4/22 pavement is constructed of asphalt and the surface is grooved. The runway pavement is 4,298 feet long by 75 feet wide. The runway headings are 220° magnetic, 213° true and 040° magnetic, 033° true (magnetic variation is 7° W). Landing zone 1 (LZ1) is located 12.3 nm southwest of CDI at latitude 39.8011709 °N, longitude 81.7170492 °W. Landing zone 2 (LZ2) is located about 15.3 nm south of CDI at latitude 39.7217891 °N, longitude 81.6100475 °W. Planform views of the CDI runway 4/22 configuration, LZ1, LZ2, and the cargo drop zones are included in Attachment 2.

4. Meteorological Conditions

The Automated Surface Observing System (ASOS) and observer weather data near the accident time include 20-minute interval data from Cambridge Municipal Airport (CDI) in Cambridge, Ohio; hourly and 5-minute interval data from Zanesville Municipal Airport (ZZV) in Zanesville, Ohio; and hourly observer and 5-minute interval data from Mid-Ohio Valley Regional Airport (PKB) in Parkersburg, West Virginia. The respective ASOS data are shown below with the event data identified by the black (as opposed to gray) text. The ASOS locations are plotted in Figure 1.

Cambridge, Ohio (CDI), located about 15.7 nm north of wreckage, bearing 357° true

KCDI 231855Z AUTO 22004KT 10SM SCT055 SCT075 SCT090 29/16 A2998 RMK AO2 T02860160
KCDI 231915Z AUTO 17004KT 10SM SCT055 SCT075 BKN100 28/17 A2998 RMK AO2 T02770166
KCDI 231935Z AUTO 18004KT 10SM SCT055 SCT100 29/15 A2997 RMK AO2 T02890152

At 1915 UTC, 1415 EDT, the CDI ASOS reported winds from 170° at 4 knots, visibility of 10 statute miles or greater, scattered clouds at 5,500 feet and 7,500 feet above ground level (agl), broken clouds at 10,000 feet agl, temperature of 27.7° Celsius (C), dew point temperature of 16.6°C, and altimeter setting of 29.98 inches of mercury.

Zanesville, Ohio (ZZV), located about 20.5 nm northwest of wreckage, bearing 312° true

KZZV 231850Z AUTO 19005KT 10SM CLR 29/16 A2999 RMK T02900160 MADISHF
KZZV 231853Z AUTO VRB06KT 10SM FEW110 29/16 A2999 RMK AO2 SLP147 T02890161
KZZV 231855Z AUTO 18005KT 10SM FEW055 FEW110 29/16 A2998 RMK T02900160 MADISHF
KZZV 231900Z AUTO 21005KT 10SM FEW055 FEW110 29/16 A2998 RMK T02900160 VRB05KT MADISHF
KZZV 231905Z AUTO 18008KT 10SM FEW055 29/16 A2998 RMK T02900160 MADISHF
KZZV 231910Z AUTO 19005KT 10SM SCT055 28/16 A2998 RMK T02800160 MADISHF
KZZV 231915Z AUTO 21004KT 10SM FEW055 28/16 A2998 RMK T02800160 MADISHF
KZZV 231920Z AUTO 23008KT 10SM FEW055 29/15 A2998 RMK T02900150 MADISHF
KZZV 231925Z AUTO 20007KT 10SM FEW055 28/14 A2998 RMK T02800140 MADISHF
KZZV 231930Z AUTO 20009KT 10SM SCT055 29/15 A2998 RMK T02900150 MADISHF
KZZV 231935Z AUTO 20005KT 10SM SCT055 29/16 A2997 RMK T02900160 MADISHF

At 1920 UTC, 1420 EDT, the ZZV ASOS reported winds from 230° at 8 knots, visibility of 10 statute miles or greater, few clouds at 5,500 feet agl, temperature of 29°C, dew point temperature of 15°C, and altimeter setting of 29.98 inches of mercury.

Parkersburg, West Virginia (PKB), located about 22.9 nm southeast of wreckage, bearing 166° true

KPKB 231850Z AUTO 22005KT 10SM SCT040 27/13 A2999 RMK T02700130 MADISHF
KPKB 231853Z 22004KT 10SM SCT040 27/14 A2999 RMK AO2 SLP150 T02720139
KPKB 231855Z AUTO 23005KT 10SM FEW060 28/14 A2999 RMK T02800140 MADISHF
KPKB 231900Z AUTO 22005KT 10SM FEW060 28/14 A2999 RMK T02800140 MADISHF
KPKB 231905Z AUTO 20005KT 10SM CLR 28/13 A2999 RMK T02800130 MADISHF
KPKB 231910Z AUTO 20002KT 10SM FEW060 A2999 RMK T0280 MADISHF
KPKB 231915Z AUTO 17004KT 10SM SCT060 A2999 RMK T0280 MADISHF
KPKB 231920Z AUTO 20005KT 10SM FEW060 A2999 RMK T0280 MADISHF
KPKB 231925Z AUTO 23005KT 10SM FEW060 28/13 A2999 RMK T02800130 MADISHF
KPKB 231930Z AUTO 20002KT 10SM FEW060 28/13 A2999 RMK T02800130 VRB03KT MADISHF
KPKB 231935Z AUTO 21005KT 10SM FEW060 28/13 A2999 RMK T02800130 MADISHF

At 1920 UTC, 1420 EDT, the PKB ASOS reported winds from 200° at 5 knots, visibility of 10 statute miles or greater, few clouds at 6,000 feet agl, temperature of 28°C, and altimeter setting of 29.99 inches of mercury.

ASOS source: https://mesonet.agron.iastate.edu/request/download.phtml?network=MI_ASOS



Figure 1: The CDI, ZZV, and PKB ASOS weather locations are defined by the yellow balloon symbols and text. The N482TJ accident flight and immediately preceding flight ground track are highlighted in green toward the center of the page. Landing zones 1 and 2 are identified by the green balloon symbols and text. North is toward the top of the page. Cambridge Municipal Airport (CDI) is located about 15.7 nm north of the wreckage location on a bearing of 357° true. Zanesville Municipal Airport (ZZV) is located about 20.5 nm northwest of the wreckage on a bearing of 312° true. Mid-Ohio Valley Regional Airport (PKB) is located about 22.9 nm south-southeast of the wreckage location on a bearing of 166° true.

5. Summary of Pilot and Ground Crew Statements

The NTSB Investigator-In-Charge (IIC) interviewed the pilot via telephone call. The pilot statements and responses were summarized by the IIC in *Memorandum for Record - Pilot* which is available on the NTSB public docket for accident number ERA23LA309. The summary of pilot statements pertinent to helicopter performance include:

- The pilot does not remember much surrounding the accident. He recalls waking up, several feet from the helicopter, on the ground. He does not remember any unusual helicopter noises, annunciators, or other details pertaining to the flight. The pilot does not remember descending through the forest.
- The pilot recalled starting the day about 8AM or 9AM. He then recalled that he flew for about 3 hours, and then shut down for 15-20 minutes. He checked all fluid levels and recalled that everything seemed normal, and no engine fluids were needed.
- The pilot does not remember whether he was maneuvering to drop a load or had already dropped the load immediately preceding the descent and impact with terrain. He said he is not completely sure, but he may have been maneuvering to drop a bag.
- The pilot said the accident could be due to a mechanical problem with the helicopter, or maybe it was a wind shift. He does not remember. He did not recall that weather was a factor during the earlier flights in the day.

The ground crew member statement summary below is based on *Ground Crew Statements Load Manifest-Redacted* that is available on the NTSB public docket for accident number ERA23LA309. The ground crew member responsible for fueling the aircraft stated that the pilot and he departed the hotel around 0700 and arrived at Cambridge Municipal Airport at 0710. N482TJ was pushed out of the hangar. The pilot conducted the helicopter preflight checks while the ground crew member collected fuel samples from the helicopter fuel tank and the fuel truck before adding 87 lb of fuel to N482TJ per pilot instruction. The pilot gathered additional fuel samples from the helicopter. Both the pilot and the ground crew member visually verified that all fuel samples taken were clean, clear, and bright. Fuel samples were secured inside the truck cabin.

The off-airport operational base for the day's flights was changed from LZ1 (latitude 39.8011709 °N, longitude 81.7170492 °W) to LZ2 (latitude 39.7217891 °N, longitude 81.6100475 °W). The pilot began the first flight of the day before the ground crew member arrived at LZ2, completed the first flight, hot fueled (added 335 lb fuel), completed the second flight, hot fueled again (added 321.6 lb fuel), completed the third flight, landed, and shut down around 1215 to 1220. The helicopter was on the ground 15 to 20 minutes. The pilot and ground crew member talked about how the helicopter was operating and there were no issues. The pilot completed the daily checks on the helicopter and 335 lb fuel was added. Before takeoff the pilot motored the engine to cool it down, waited 10 to 15 minutes, and then proceeded to takeoff.

About 20 to 40 minutes later, a lot of broken radio traffic came over the ground crew member's radio. Over all the traffic someone said, "the helicopter went down." The ground crew member reeled in the fuel hose and grounding cable before retrieving the medical kit out of the trailer. Five to ten minutes later, the crash site coordinates were provided to him (latitude 39.713810 °N, longitude 81.560210 °W) and he shared them with a manager and authorities, including the search team and paramedics. Authorities conducted the search, evaluated the pilot, evacuated the pilot on a medivac aircraft, and secured the crash site.

6. ForeFlight Parametric Data

Electronic ForeFlight data from several N482TJ external load flights were provided to NTSB investigators, processed, and plotted as a function of time or position. Recorded altitude, ground speed, pitch attitude, course over ground, and bank angle were plotted as a function of elapsed time in seconds. Recorded latitude and longitude data were plotted to construct the N482TJ ground track overview chart in Figure 2.

The N482TJ longitudinal and lateral-directional ForeFlight data were plotted and packaged as a sequence of two-dimensional time history and planform view (zoomed-in latitude vs. longitude) plots for each 45-second-segment of the accident flight. Each page of the ForeFlight parametric data plotted in Attachment 3 presents 2 rows by 3 columns of two-dimensional plots, ordered, left to right, and top to bottom. The top row illustrates recorded altitude with pertinent calculated altitude parameters, recorded and derived ground speed, and recorded latitude/longitude. The bottom row depicts recorded pitch attitude, recorded and derived course over ground, and recorded bank angle. Latitude is plotted versus longitude but all other recorded and derived parameters are plotted as a function of time in elapsed seconds. Please review the exemplar two-dimensional plot and accompanying notes in Figures 3 through 8 for guidance on content presented on each page in Attachment 3. Note that the recorded ForeFlight pitch attitude and bank angle parametric data have not been validated and these data may therefore contain continuous or intermittent samples that are unreliable/spurious.

The comparison plot sequence contained in Attachment 3 can be opened in Adobe Acrobat Reader, viewed in full screen mode, and interrogated using the arrow keys or mouse to flip forward or backward through the pages. Each 45-second-duration helicopter flight path segment is updated in blue in the inset latitude-longitude plot in the upper right corner. Some pages include floating drop zone (red text) labels that originate in the latitude-longitude zoomed-in view.

The parametric data plot time increment per page in Attachment 3 was changed from 60 seconds to 45 seconds to zoom in on the demonstrated helicopter/pilot drop zone approach, dwell time, and departure characteristics. Google Earth-sourced drop zone image snapshots and drop zone ground track scales were added to assist investigators in estimating horizontal distance traveled.² This presentation of the flight data may assist investigators in identifying patterns during the pre-accident and accident flights. For example, during the immediately preceding flight load drops, N482TJ generally lingered around the operator "IIC DZ" targets as opposed to the "ForeFlight DZ" targets. However, the helicopter appears to fly toward the ForeFlight DZ during the accident flight leg. Note that the list of operator drop zones provided to the NTSB IIC did not include a target drop zone near ForeFlight drop zone 088.

² Ground track scales are labeled at 50-ft increments and originate at each drop zone latitude/longitude source. The drop zone data sources are identified as operator/IIC (magenta color) and ForeFlight (red color).

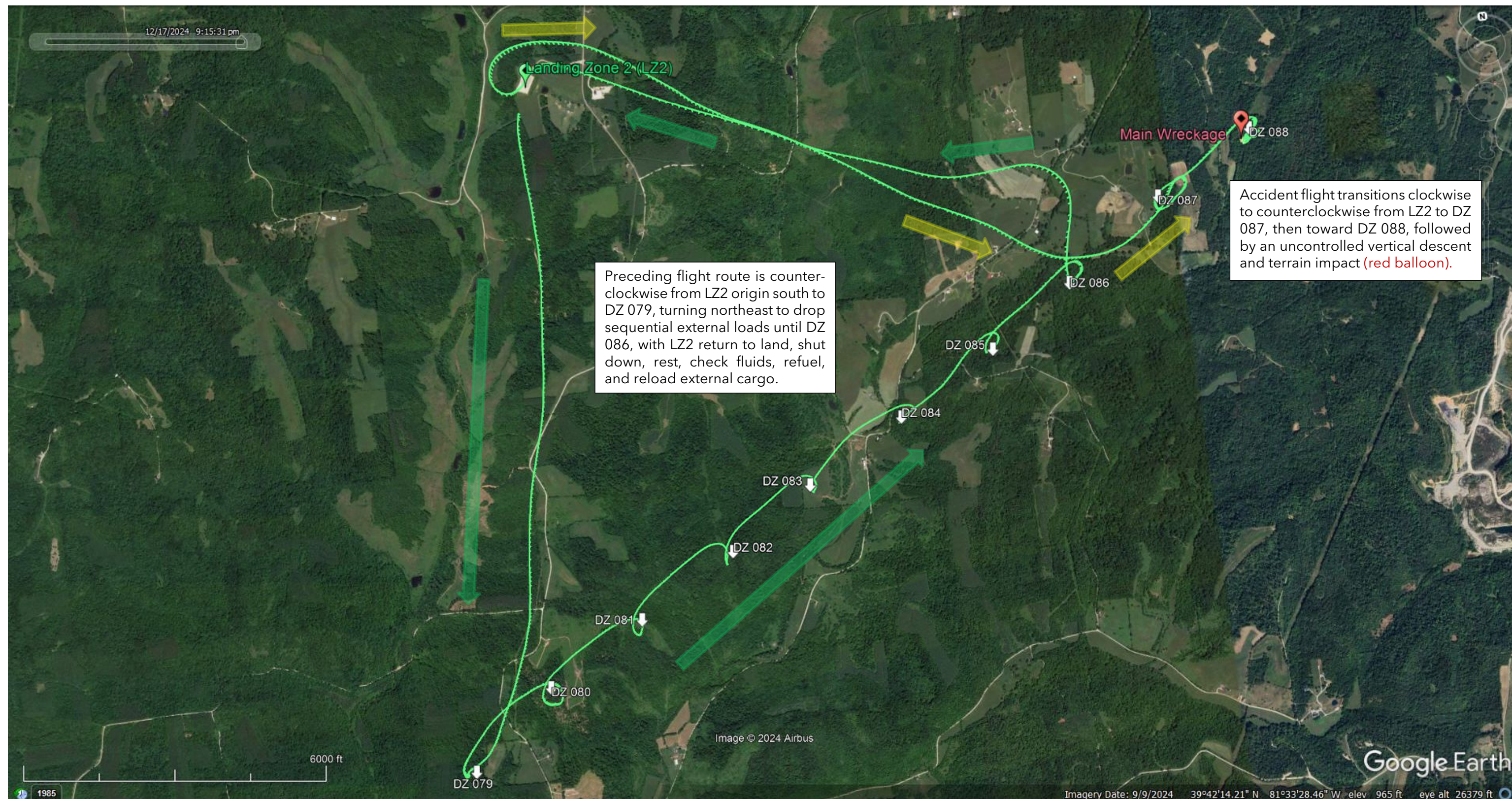


Figure 2: N482TJ ground track data (green lines) for the accident flight (yellow arrow progression) and the immediately preceding flight (green arrow progression) with annotations for landing zone 2, drop zones 079 through 088, and the helicopter main wreckage location. North is toward the top of the page.

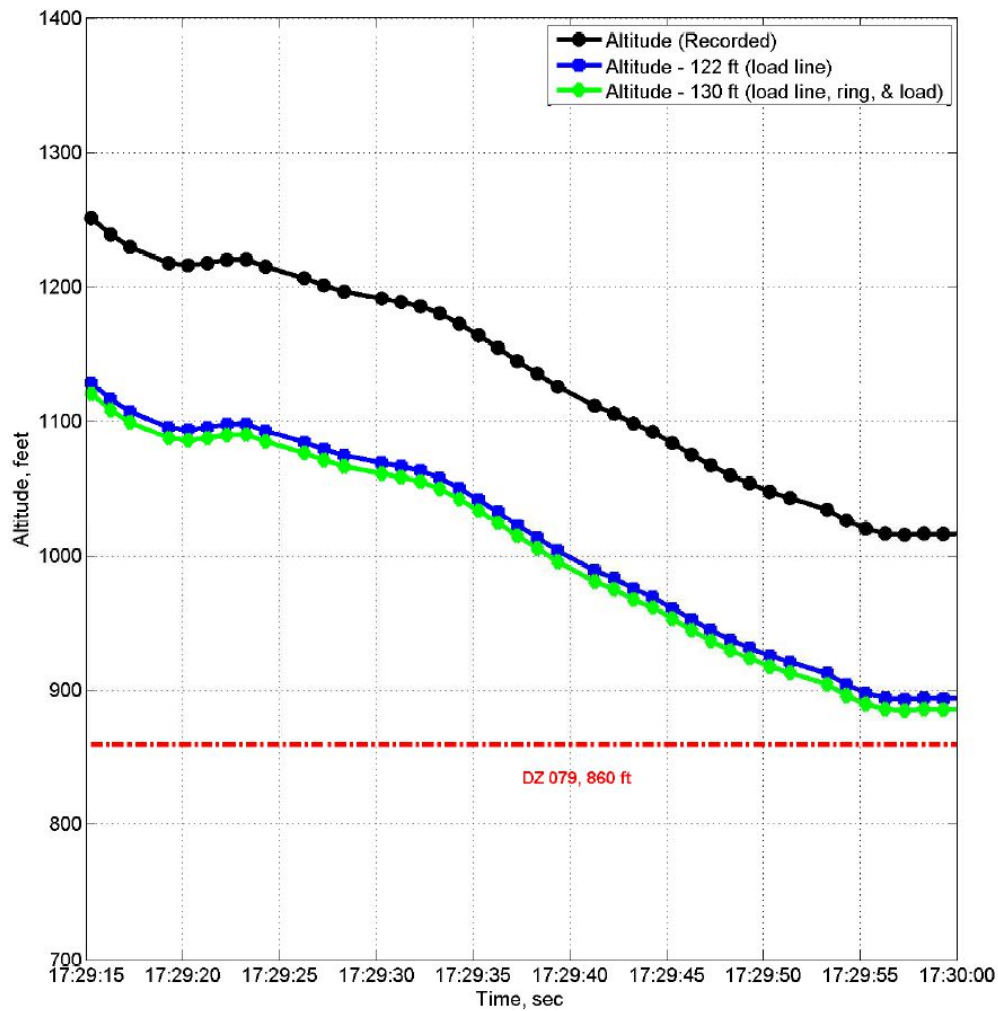


Figure 3: N482TJ recorded altitude, estimated load line position, and estimated load line, load ring, and load position as a function of time (near drop zone 079).

The exemplar altitude time history plot in Figure 3 shows recorded altitude (black line and circular symbols), recorded altitude minus the 122-ft load line length (blue line and square symbols), and the cumulative 130-ft length of the load line, load ring, and load subtracted from the recorded altitude (green line and diamond symbols) in feet on the y-axis as a function of time in seconds on the x-axis. Time major divisions occur every 5 seconds. Altitude major divisions occur every 100 feet. The drop zone (DZ) elevation of 860 feet (red dash-dot line) shown in Figure 3 is sourced from a Google Earth terrain elevation model.

The helicopter recorded altitude plot illustrates the recorded position of the helicopter, the estimated load line length, and the estimated load ring and load height compared to a Google Earth-based estimate of the drop zone terrain elevation.

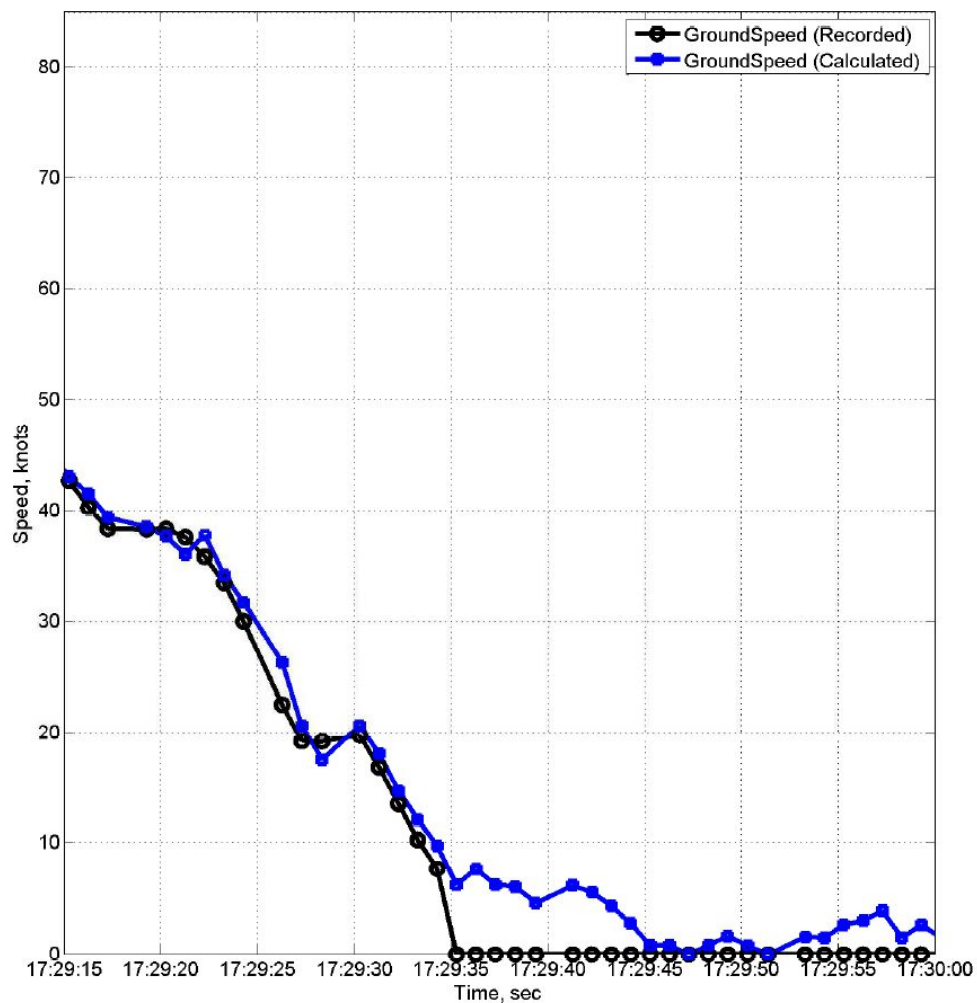


Figure 4: N482TJ recorded and calculated groundspeed as a function of time near drop zone 079.

The exemplar groundspeed time history plot in Figure 4 shows recorded groundspeed (black line and circular symbols) and calculated groundspeed (blue line and square symbols) in knots on the y-axis as a function of time in seconds on the x-axis. Time major divisions occur every 5 seconds. Ground speed major divisions occur every 10 knots. Calculated groundspeed is derived from recorded aircraft latitude and longitude positions. The recorded groundspeed data appear to drop to zero when the helicopter groundspeed drops below about 8 knots, near time 17:29:35.

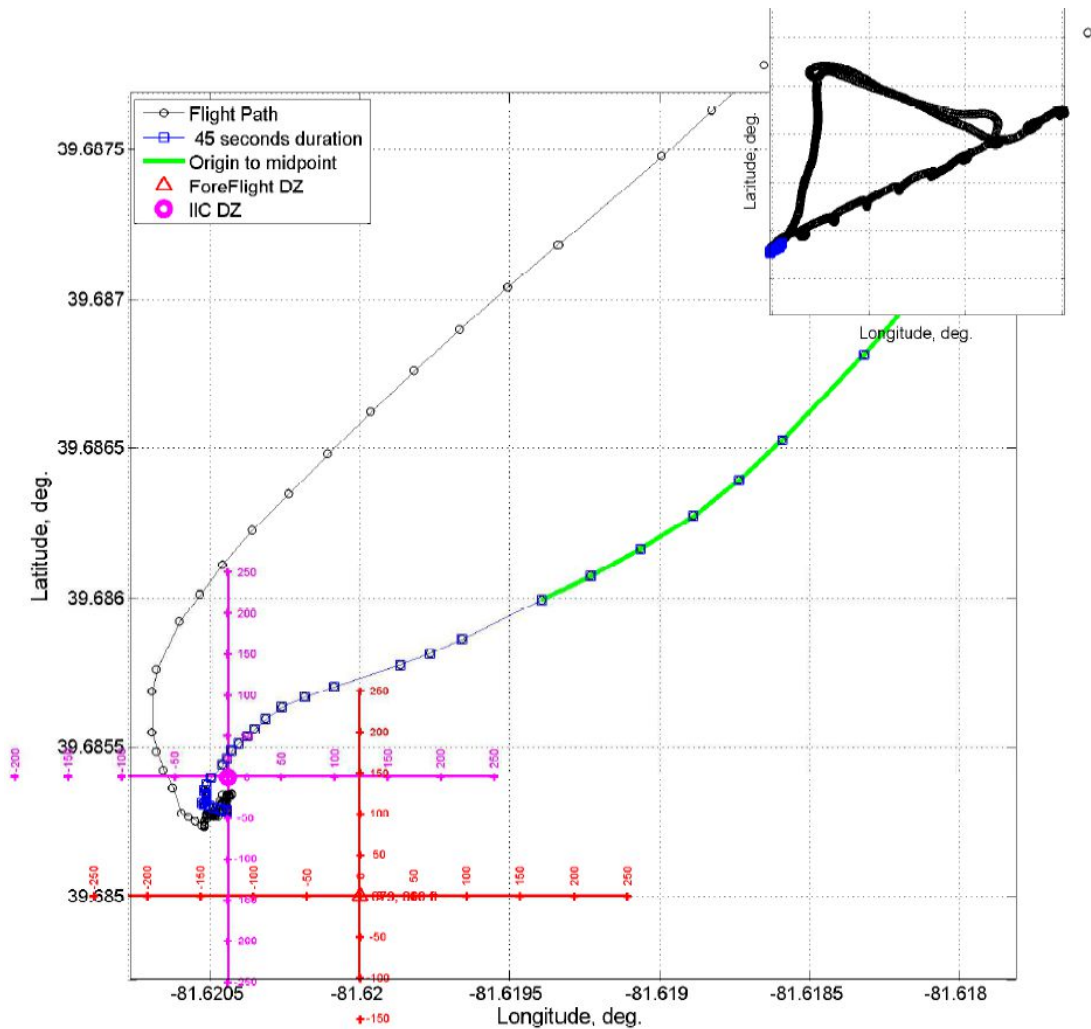


Figure 5: N482TJ recorded position as a function of time near drop zone 079.

The exemplar helicopter ground track plot in Figure 5 (black line and circular symbols) shows recorded latitude in degrees on the y-axis and recorded longitude in degrees on the x-axis. The blue squares identify a 45-second flight segment duration. The local direction of flight during the 45-second flight segment is indicated by the origin to midpoint segment (green line through blue squares) towards the destination segment (blue squares with no green line). In this example, N482TJ is progressing clockwise through the green and blue line segments toward the drop zone, transitioning to/from drop zone 079, and then progressing toward the next drop zone along the black line segment. The inset latitude-longitude plot in the upper right corner shows a zoomed out view of the helicopter ground track (black circular symbols) and the local 45-second flight window (blue squares).

The ForeFlight drop zone (DZ) record (red triangular symbol) is also compared to the operator drop zone record (magenta circular symbol) in Figure 5. Each drop zone source is the origin for a calculated, color-coded coordinate scale that ranges from -250 to +250 feet, annotated every 50 feet, along the respective red/magenta x- and y-axes. These annotated scales assist investigators in quantifying helicopter forward/aft, lateral, and/or compound maneuvers and dwell time near each drop zone target.

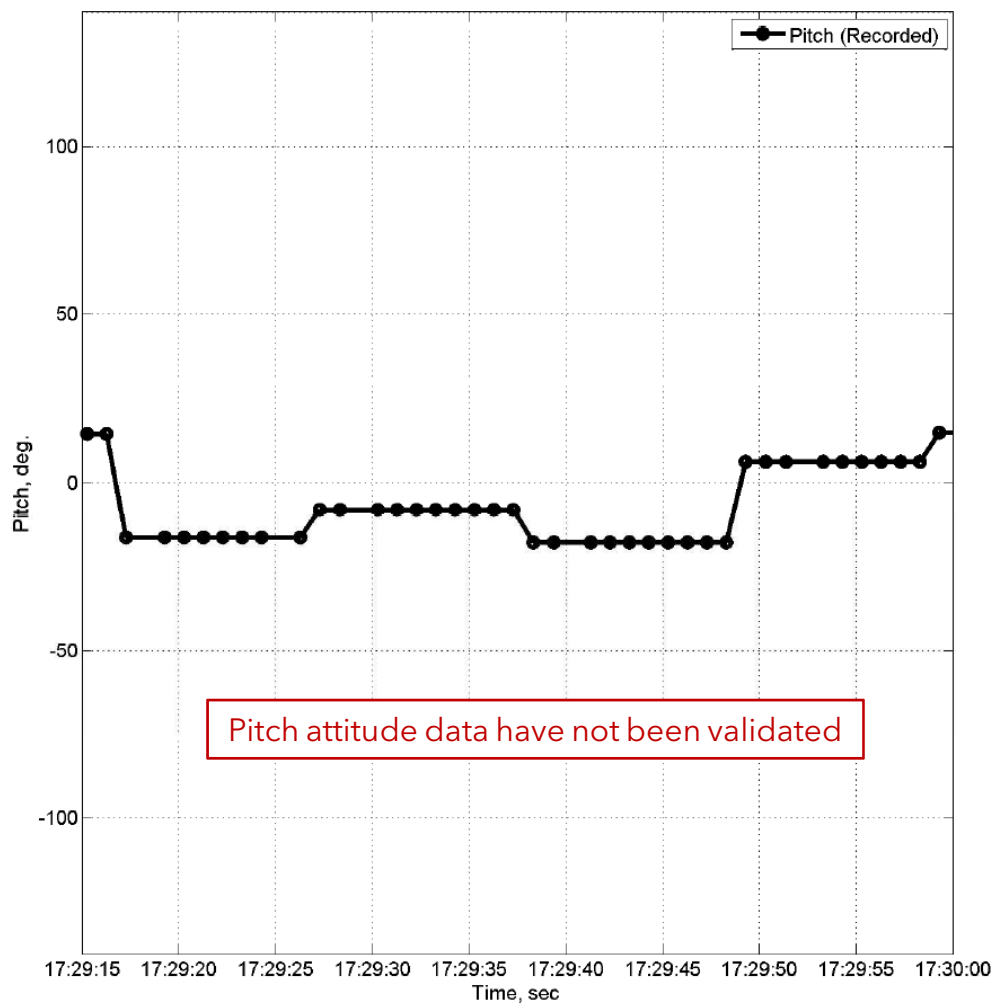


Figure 6: N482TJ recorded pitch attitude as a function of time near drop zone 079.

The exemplar pitch attitude time history plot in Figure 6 shows recorded pitch attitude (black line and circular symbols) in degrees on the y-axis as a function of time in seconds on the x-axis. Time major divisions occur every 5 seconds. The recorded pitch attitude data in this example indicate unexpected, large step changes in pitch attitude, transitioning from greater than 10° nose up to greater than 10° nose down over a period of one second between about 17:29:16 and 17:29:17. Similarly, there is an unexpected, large step change in pitch attitude, transitioning from greater than 10° nose down to greater than 10° nose up over a period of one second between about 17:29:48 and 17:29:49. The recorded ForeFlight pitch attitude data have not been validated and may therefore contain continuous or intermittent samples that are unreliable/spurious.³

The recorded and calculated parametric data suggest that the end of flight occurred about 25 minutes prior to the end of the recorded data (near the bank angle and pitch attitude end of recording, which is indicated in the Attachment 3 plots by pitch attitude and bank angle values set to an arbitrary constant of -9°).

³ The recorded pitch attitude data include unexpected behavior, such as negative (nose-down) pitch attitude as the helicopter slows down and areas earlier in the flight with possible pitch excursions.

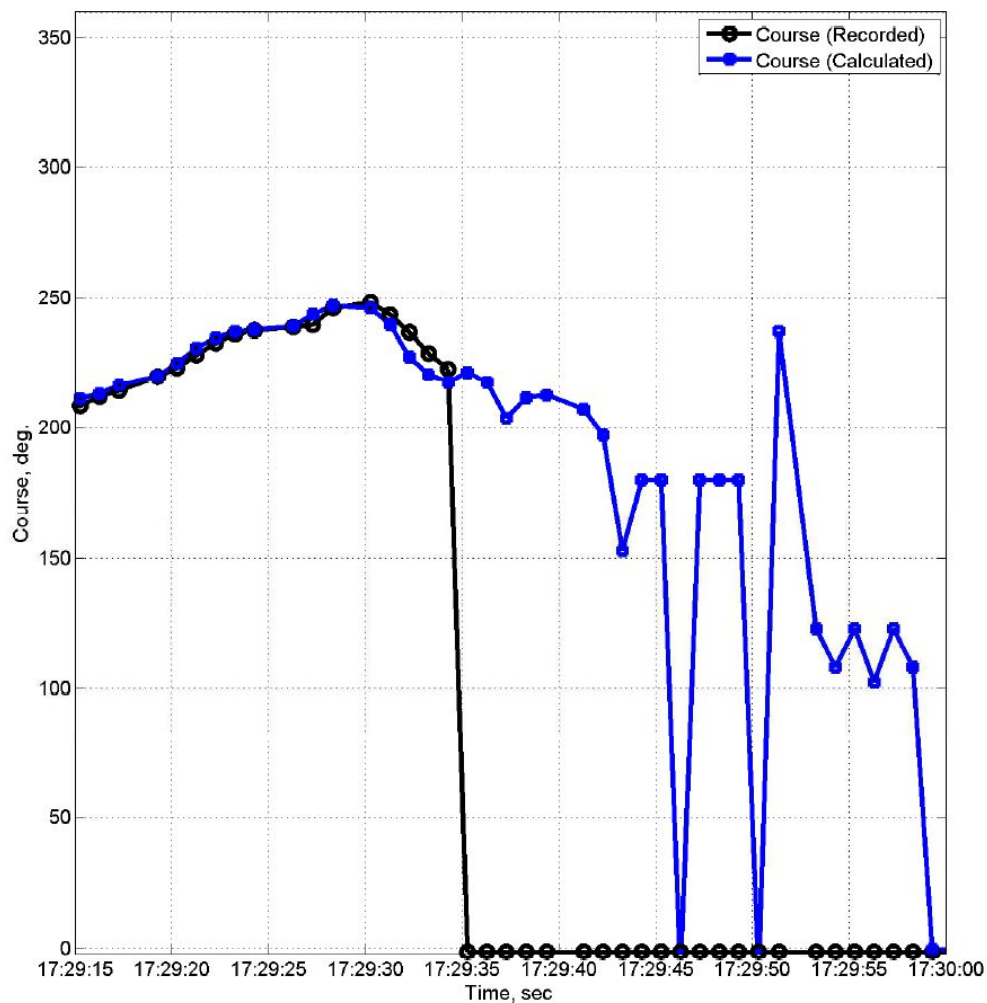


Figure 7: N482TJ recorded and calculated course over ground as a function of time near drop zone 079.

The exemplar course over ground time history plot in Figure 7 shows recorded course over ground (black line and circular symbols) and calculated course over ground (blue line and square symbols) in degrees on the y-axis as a function of time in seconds on the x-axis. Time major divisions occur every 5 seconds. Calculated course over ground is derived from recorded aircraft latitude and longitude position data. The recorded course over ground data appear to drop to zero when the helicopter groundspeed drops below about 8 knots, near time 17:29:35 (see the corresponding recorded groundspeed data in Figure 4 and the recorded course over ground data in Figure 7).

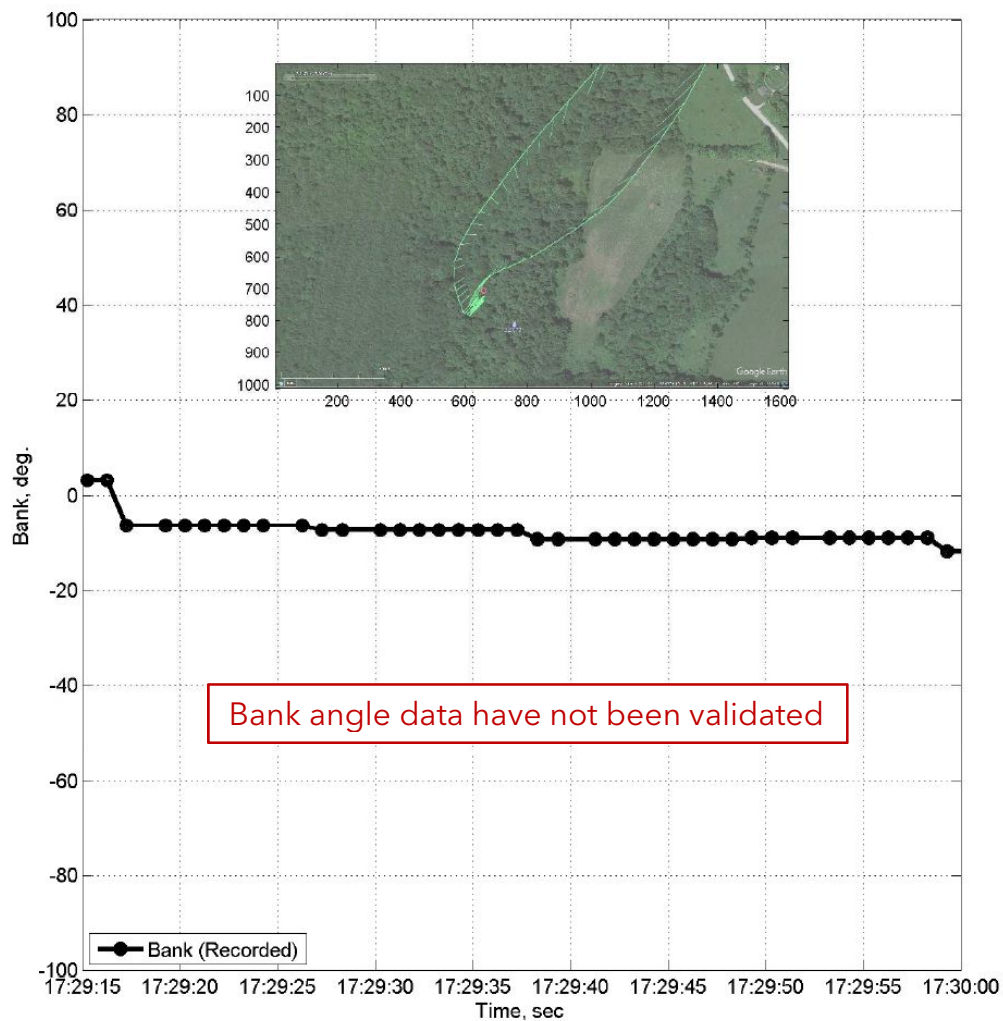


Figure 8: N482TJ recorded bank angle as a function of time near drop zone 079.

The exemplar bank angle time history plot in Figure 8 shows recorded bank angle (black line and circular symbols) in degrees on the y-axis as a function of time in seconds on the x-axis. Time major divisions occur every 5 seconds. The recorded bank angle data in this example include unexpected step changes in bank angle, transitioning from about 2° right to about 7° left over a period of one second between about 17:29:16 and 17:29:17. The recorded ForeFlight bank angle data have not been validated and may therefore contain continuous or intermittent samples that are unreliable/spurious.

The inset Google Earth imagery provides drop zone context information (for example, wooded versus open terrain) for comparison to the latitude-longitude ground track plot in Figure 5.

7. Aircraft Flight Path Reconstruction

The ForeFlight parametric data were also used to reconstruct and visualize the N482TJ flight path and ground track in a three-dimensional Google Earth model. Snapshots from the Google Earth model are presented in Attachment 4 for drop zones 079 through 086 on the flight preceding the accident flight, for the landing and departure from landing zone 2, and for drop zone 087 and maneuvering toward drop zone 088. A Google Earth .kmz file containing the Bell 206L4 flight path segmented into time durations of 60-, 50-, 40-, 30-, 20-, and 8-seconds prior to the crash, respectively, was used to construct the corresponding flight path snapshots in Attachment 4. Two

exemplar flight path snapshots near drop zone 088 are presented in Figures 9 and 10. The Google Earth .kmz file ForeFlight parametric data can be downloaded, opened in Google Earth, and interactively interrogated by individual users.

The helicopter appears to transition from “normal” flight to the crash between 17:57:55 and 17:58:03 (page 43 of Attachment 3). A zoomed-in track of the flight path from 17:57:45 to 17:58:05 was provided (by deleting extraneous flight path data points that follow [what is believed to be] the crash).

In the last 20 seconds preceding the crash, the ground track is contained within about a 20 ft by 20 ft square. About 8 seconds before impact, a rapid loss of altitude occurs without much drift outside of the 20 ft square. The helicopter was about 200 ft agl about 8 seconds before impact.

8. Aircraft Weight and Balance

The accident flight weight and balance is based on operator maintenance records, the N482TJ equipment list, the external load manifest, the reported fuel load, and Bell 206L4 weight and balance procedures. A subset of the supporting N482TJ weight and balance maintenance records and the itemized weight and balance calculations are provided in Attachment 5. The N482TJ estimated takeoff weight for the accident flight is the empty weight (2,622.7 lb.) plus pilot (estimated 170 lb.) plus fuel (394 lb.) plus external load (1,070 lb.) equals 4,256.5 lb. One external load bag weighing 130 lb. was dropped at DZ 087 prior to the accident, yielding an estimated N482TJ weight at the time of the accident of $4,256.5 - 130 = 4,126.5$ lb.

9. Bell Helicopters 206L4 Hover Performance Capability

In response to an NTSB request, Bell Helicopters air safety and engineering staff evaluated the N482TJ hover capability out of ground effect. Bell 206L4 performance data published in the Rotorcraft Flight Manual-(RFM) indicate that N482TJ had adequate out of ground effect hover (HOGE) performance available for the accident helicopter load configuration and environmental conditions, assuming a skid height of 40 feet. The supporting Bell 206 L4 HOGE performance charts are provided in Attachment 6 (labeled Figure 4-7, sheets 1 and 2). The N482TJ accident flight assessment for HOGE yields operations in Area A with a maximum safe relative wind of 26 knots from all azimuths (assumes outside air temperature is 29°C or lower, density altitude is above 3,000 feet, and gross weight is 4,550 lb. or less for external load operations).



Figure 9: Flight path reconstruction (green lines) of N482TJ making clockwise approach to drop zone 088 during the accident flight, maneuvering, and experiencing an uncontrolled vertical descent and terrain impact. Due north is toward the top of the page.

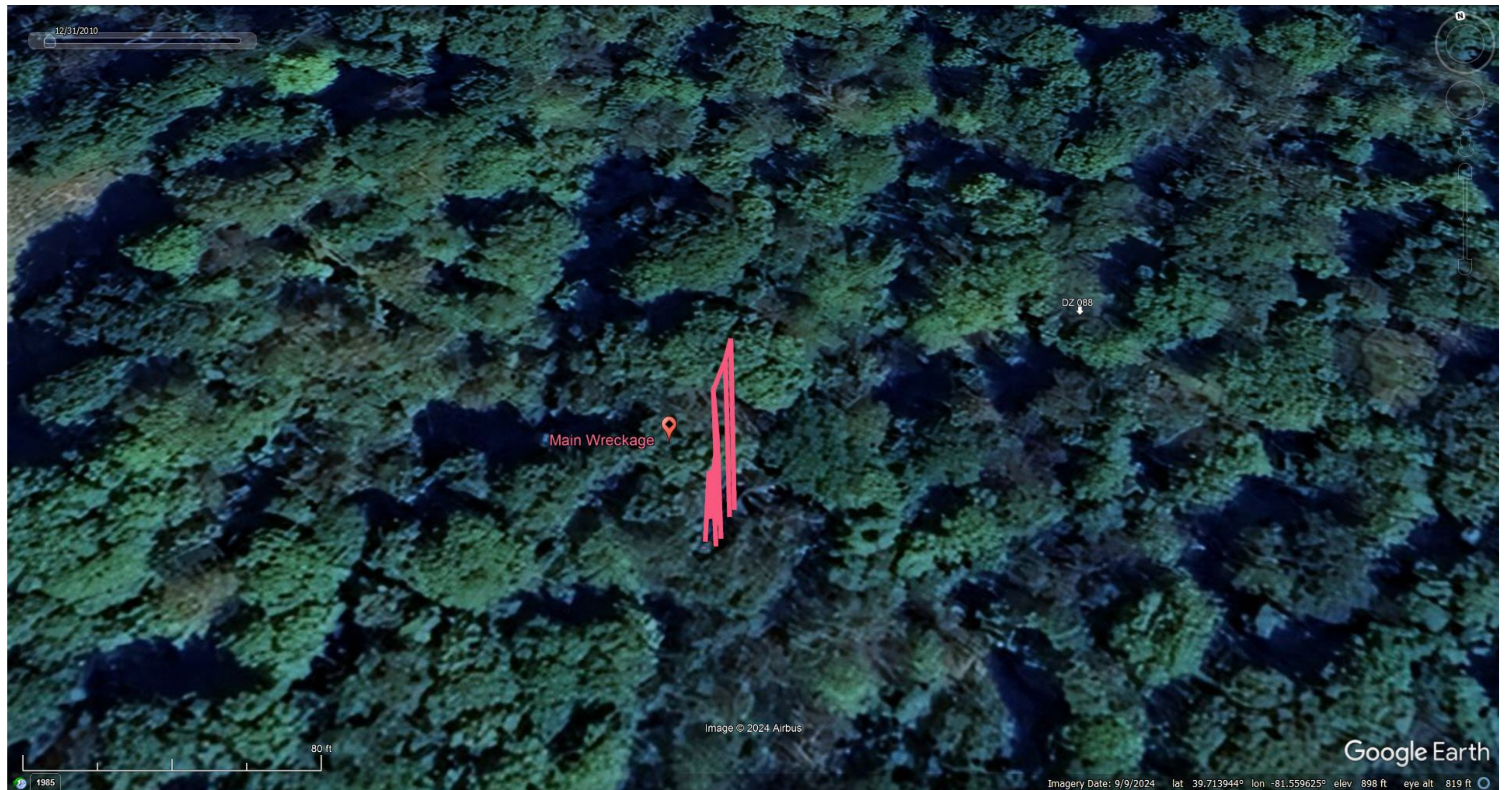


Figure 10: Flight path reconstruction (red lines) of N482TJ maneuvering near drop zone 088 during the accident flight about 8 seconds prior to experiencing an uncontrolled vertical descent and terrain impact. Due north is toward the top of the page.

E. FINAL SUMMARY

Specific reasons for the helicopter's uncontrolled vertical descent and terrain impact could not be determined based on the available evidence.

F. ATTACHMENTS

Attachment 1: Bell Helicopters 206LR Engineering Drawing

Attachment 2: Cambridge Municipal Airport, Landing Zones, and Cargo Drop Zones

Attachment 3: ForeFlight Parametric Data

Attachment 4: Aircraft Flight Path Reconstruction

Attachment 5: Aircraft Weight & Balance

Attachment 6: Bell 206L4 Hover Performance Capability