

**NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Vehicle Recorder Division
Washington, D.C. 20594**



GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

CEN18FA391

**By
Sean Payne**

WARNING

The reader of this report is cautioned that the transcription of a cockpit image and audio recording is not a precise science but is the best product possible from a Safety Board group investigative effort. The transcript or parts thereof, if taken out of context, could be misleading. The transcript should be viewed as an accident investigation tool to be used in conjunction with other evidence gathered during the investigation. Conclusions or interpretations should not be made using the transcript as the sole source of information.

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

March 31, 2020

Onboard Image, Audio and Data Recorder

Specialist's Factual Report By Sean Payne

1. EVENT

Location: Gustavus, Alaska
Date: September 28, 2018
Aircraft: Airbus Helicopters AS350-B3e, N907PL
Operator: Private
NTSB Number: CEN18FA391

2. SUMMARY

On September 28, 2018, about 1055 Alaska daylight time, an Airbus Helicopters AS350-B3e, impacted shallow water on a beach in Glacier Bay National Park about 60 miles northwest of Gustavus, Alaska. The co-pilot was fatally injured, one passenger sustained serious injuries, and the pilot and one other passenger are missing. The helicopter was registered to Chinilna Equipment LLC and operated by a private individual under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight. Visual meteorological conditions prevailed at the time of the accident and no flight plan had been filed. The flight departed from the Juneau International Airport (JNU) Juneau, Alaska, and was en route to Yakutat Airport (YAK), Yakutat, Alaska.

3. GROUP

A group was convened on October 24, 2018. The group consisted of the following members:

Chairman: Sean Payne
Sr. Mechanical Engineer
National Transportation Safety Board (NTSB)

Member: Josh Lindberg
Investigator-In-Charge
National Transportation Safety Board (NTSB)

Member: Chihoon Shin
Helicopter Engineer – AS-40
National Transportation Safety Board (NTSB)

Member: Matt Rigsby
Accident Investigator – AVP-100
Federal Aviation Administration (FAA)

Member: Seth Buttner
Manager of Accident Investigation
Airbus Helicopters

Member: Bryan Larimore
Accident Investigation and Safety
Safran HE USA

4. DETAILS OF INVESTIGATION

On October 5, 2018, the NTSB Vehicle Recorder Division received the following electronic devices:

Recorder Manufacturer/Model: **Appareo Vision 1000**
Recorder Serial Number: **VIS-FHJE**

4.1. Appareo Vision 1000 Recorder Description

The Appareo Vision 1000 device is a small self-contained image, audio, and data recorder. The unit is typically mounted in the overhead of aircraft's cockpit and records a cockpit image at a rate of four times per second. In addition to cockpit images, the device is also capable of recording two tracks of audio that are synchronized with the image data. The unit also contains a GPS receiver that receives GPS satellite based aircraft time, position, altitude, and speed. In addition to the GPS position, the Appareo unit also has a self-contained real-time inertial measuring unit that provides 3-axis accelerations as well as aircraft pitch, roll and yaw data.

The two recorded audio tracks can be wired to record the following inputs: an external audio source such as the aircraft's intercom or radios and audio picked up by a microphone mounted internal to the Vision 1000 unit. In this installation no external aircraft audio was connected to track one and the track two microphone only picked up very loud engine and/or transmission sounds from the helicopter.

The Appareo unit records the image, audio and parametric data on a removable SD¹ memory card that is inserted into the unit. Depending on card size, this removable memory retains approximately the last two hours of image and audio data and about the last 100 hours of parametric data. In addition to the removable memory the Vision 1000 is also equipped with a memory module that

¹ SD – Secure Digital – A type of nonvolatile memory card used extensively in portable devices.

is mounted internal to the unit. This internal memory contains an exact duplicate of the data stored on the removable card.

The Appareo unit on this aircraft was connected to the aircraft's electrical bus. Any time the battery switch is turned on the Appareo unit will start to record audio, images and data. The Vision 1000 unit creates a new file for every electrical power application and can create multiple files for the same power cycle if the recording time exceeds a certain time limit.

4.2. Appareo Vision 1000 Recorder Damage

Upon arrival at the NTSB Vehicle Recorder Division, it was evident that the Appareo Vision 1000 had water damage. In accordance with NTSB procedures for electronic devices recovered from water, the device was shipped to the laboratory in fresh water. The unit showed signs of the start of corrosion to some internal parts, but was otherwise undamaged. Figure 1 is an image of the Appareo Vision 1000 as received, after being removed from a container of fresh water.



Figure 1. The Appareo Vision 1000 and SD card.

4.3. Appareo Vision 1000 Data Recovery

The unit's SD memory card was removed and x-rayed to determine the card type. The x-ray revealed that the card type would likely have been unaffected by water. The SD card was cleaned with alcohol and dried in a vacuum drying oven. After the drying process, data was retrieved from the SD card normally, using the manufacturer's suggested procedure. The SD card contained recordings (audio, image and parametric data) from the accident flight, but the initial data set stopped just prior to impact.

The internal memory of the unit was removed, inspected and dried in a vacuum drying oven. The internal memory chips were found to be in good condition. After

drying, the internal memory chips were read on a chip reader which produced a bit for bit binary copy of the internal memory chip's data.

The chips were then brought to the manufacturing facility of the Appareo recorder in Fargo, North Dakota. Under supervision of the NTSB, the internal memory chips were installed in a surrogate camera and data were extracted normally using the manufacturer's suggested procedure for an internal memory readout from an undamaged unit. The internal memory data extraction procedure produced recordings (audio, image and parametric data) from the accident flight which contained data almost until the helicopter's impact with water.

Files produced from the internal memory read out procedure were then forensically examined for extra imagery data. Three more image files were extracted from the forensic examination. The last of these three images captured the helicopter's impact with water.

Figure 2 is a copy of the calibration image at the Airbus Helicopter's facility prior to delivery. It shows the Appareo V1000's field of view during the accident flight. The camera position remained in a similar position for the accident flight.



Figure 2. A capture from the Appareo image recorder, serial number VIS-FHJE installed on N907PL, prior to delivery to the owner.

Parametric data from the SD card was reviewed. Parametric data existed for approximately a number of power cycles of the Vision 1000's recording system. It was not specifically noted which power cycles resulted in capturing flight data.

4.4. Appareo Vision 1000 Parametric Data Description

Parametric data for the accident flight was exported and is included as attachment 1. A short video, an animation using Appareo software, showing approximately the last 5 minutes of the helicopter's flight is included as attachment 2. The terrain depicted in the software's imagery may not reflect the actual conditions at the time of the accident. In addition, the imagery may not reflect an accurate tidal state of the waters near the accident site.

Figure 3 is a screenshot of an exported GPS overlay showing the helicopter's departure from PJNU.

Figure 4 is a screenshot of an exported GPS overlay around 18:40 UTC when the helicopter entered a descent and began a turn to the northwest along the coastline.

Figure 5 is a GPS overlay showing the final moments of the helicopter's flight.

Figure 6 is a strip chart showing recorded parameters for the entire flight.

Figure 7 is a strip chart showing recorded parameters for the end of flight.

4.5. Appareo Vision 1000 Time Correlation

Timing information was recorded as UTC. The format given for this report is HH:MM:SS.00, where HH stands for the number of hours, MM, the number of minutes and SS.00, the number of seconds to the nearest hundredth. No timing offset was utilized for this data set.

5. Summary of Recording Contents

In agreement with the Investigator-In-Charge, a video group was convened, and the following summary was developed from the Appareo Vision 1000 imagery and audio data. All times are given in UTC.

The recording began at 18:03:41.50. The helicopter was on the ground in Juneau (PJNU), Juneau, Alaska. A view from the image recorder is provided in figure 2. The helicopter had dual controls installed. The left seat was occupied by a pilot rated passenger, the right seat was occupied by the accident pilot. A shoulder harness strap was seen over both individual's shoulders, they appeared to be wearing the factory equipped helicopter restraints. The two individuals were wearing casual street clothes. The two rear seat passengers were not visible.

As the recording began, the pilot was responding to a text message on his iPhone which was mounted on the center pedestal of the helicopter. The text message contained what appeared to be a geo-tagged photo with four lines of written text under the photo. The helicopter was idling, rotor RPM showed around 275 RPM,

the fuel gauge was full. The pilot manipulated a large iPad which was mounted to the right side of the instrument panel. The avionics powered on, and both pilots put on Bose aviation headsets. The pilot manipulated switches and buttons on the panel, however, no checklist usage was observed. It was unclear if the pilot entered waypoints or frequencies into the helicopter's nav/com GPS/radio. The pilot rolled the throttle into the [FLIGHT] detent, placed the pitot heat switch to [ON] and switched the rotor RPM horn to [ON]. The helicopter lifted off and appeared to depart PJNU normally around 18:06:50 UTC.

During portions of the flight, both the pilot and the pilot rated passenger interacted with their iPhones. The interaction with their iPhones appeared to be based around text and photographic applications. During the flight, the pilot took a photo, showed a photo to the pilot rated passenger; at other times, the pilot rated passenger used ForeFlight.

Around 18:25, the pilot rated passenger's iPhone displayed ForeFlight on the "Map" screen with a NEXRAD overlay. There appeared to be some green colored precipitation returns along the route of flight.

The bleed valve light occasionally illuminated and extinguished on the helicopter's VEMD and at various times in the flight, the pilot manipulated the collective input.

At 18:27:50, the pilot moved his hand in the vicinity of the HeliSAS control panel (autopilot) and then took his right hand off the cyclic stick. Both the pilot and the pilot rated passenger did not have their hands on their respective cyclic stick until approximately 18:38:00, when the pilot would later be seen adding forward cyclic pressure using only his thumb.

At 18:34:41, rain was noted impacting the windscreen. Around 18:39, the rainfall appeared to intensify slightly.

Around 18:46:00, the pilot accessed a recent, but previously read text message. The text message appeared to contain a screenshot of photographs which were geo-tagged over a map application. The photograph appeared to be the same photograph that the pilot viewed prior to departure. It was unclear where the map region was referenced. Around this time, the helicopter turned northwest along the coast toward the accident site and descended to around 650 feet MSL.

Around 18:49:30, the pilot appeared to make a comment to the passenger in the left rear passenger seat (unseen). At 18:50:41, an iPhone was handed from the rear seat to the pilot rated passenger. The photo appeared to be of four individuals holding fish. The pilot rated passenger looked at the photo and handed it back to the rear seat area.

At 18:50:42, the pilot's left hand manipulated his boom mic near his mouth and then made an arcing hand motion to the right. The pilot rated passenger, looked over at the pilot. Around this time, rainfall on the windscreen appeared to diminish. Around 18:53, the pilot made another series of hand gestures, the pilot rated passenger continued to look in the direction of the pilot. Twenty seconds later at 18:53:20, the pilot made another series of hand gestures in which he pointed to the right.

Around 18:54, the pilot rated passenger picked up his iPhone and manipulated the "Map" screen on the ForeFlight app. The map screen showed the helicopter inside the Alaska ADIZ just south of Lituya Bay, Alaska. The helicopter was traveling northwest along a coast line.

Around 18:55:20, the pilot made some additional gestures with his left hand, the pilot rated passenger looked in the direction of the pilot. There were no more hand gestures from the pilot, however, the pilot rated passenger appeared to be actively looking to the right of the helicopter toward the shoreline.

At 18:57:00, the helicopter was flying straight and level on a heading of approximately 300 degrees at an altitude of approximately 590 feet MSL and a groundspeed of 114 knots. Prior to this time, there were no obvious indications from the recorded cockpit video or engine audio that would have precluded normal operations. Furthermore, there were no indications illuminated on the helicopter's caution and warning panel (CWP), or any anomalous engine instrument indications.

The pilot rated passenger was sitting with his hands on his knees and his feet flat on the helicopter's floorboard. The pilot had his right hand on the base of the cyclic's grip and his left hand was resting on his left knee.

Around 18:57:20, the pilot rated passenger looked in the direction of the shoreline and his mouth was moving as if he were making a comment.

At 18:57:34.75, the pilot moved his left hand off of his left knee and onto the twist grip portion of the collective. Just around the moment the pilot gripped the twist grip, the pilot rated passenger moved his left hand out of view to his left and moved his right hand into a ready position, guarding the cyclic (collective area unseen) hovering his right hand near the left seat cyclic control grip. The pilot rated passenger had not guarded the flight controls at any time prior in the accident flight prior to this moment.

At this time (18:57:34.75), rotor RPM indicated approximately 395 RPM, the first limit indicator (FLI) on the VEMD indicated around 8.5 FLI, the fuel gauge indicated approximately $\frac{3}{4}$ of a tank, engine parameter indicator gauges were in the normal range and the autopilot system appeared to be inactive. Parametric data indicated the helicopter was pitched forward approximately 6 degrees nose down, roll

altitude was level. GPS data showed the helicopter at 618 feet and 116 knots groundspeed.

At 18:57:35.25, the pilot actively twisted the twist grip out of the [FLIGHT] detent using his left hand and the twist grip rotated towards the idle position. The [TWT GRIP] red warning light illuminated on the CWP panel. The pilot repositioned his left hand on the twist grip, but the angle of the collective remained the same. The left seat pilot rated passenger was still hovering his right hand near the left seat's cyclic control, his feet were still flat on the floor.

At 18:57:38.50, the FLI had dropped to 7 FLI, a green bleed valve indicator light illuminated on the VEMD. A sound consistent with engine deceleration was audible. The rotor RPM began decaying just below 390 RPM. The pilot had slightly lowered the collective. The pitch attitude of the helicopter was 3.6 degrees nose down, groundspeed was 115 knots and altitude was 627 feet. The pilot began a slight left pedal (left yaw) input. The pilot rated passenger's position had not changed from the last observation.

In the next seven frames (1.75 seconds, 18:57:40.25), the FLI needle had decayed to a value of 1.75 FLI and the rotor RPM gauge read 328 RPM. The twist grip was still in the [IDLE] position, the pilot had added slightly more left pedal input. Engine parameter indicator gauges were in the normal range. The helicopter was at 630 feet and 112 knots groundspeed with 8 degrees pitch nose down and approximately a level roll attitude. The pilot rated passenger still had his feet flat on the floor, but now raised his right arm away from the left seat's cyclic grip and motioned with his right thumb in a pointing manner in the direction of the shoreline (to the right of the helicopter). The shoreline was visible in the upper right of the camera's image. The water appeared to be near high tide for that region.

Five frames later (1.25 seconds, 18:57:41.50), the FLI had decayed to a value of 1.25 FLI and the rotor RPM gauge read 300 RPM. The twist grip was still in the "Idle" position. The pilot's left pedal input had not changed. The pilot's left hand now moved off of the collective and reached up toward the vicinity of the rotor horn silence switch. The pilot rated passenger was no longer pointing toward the shore. The pilot rated passenger's right hand was now back on his right knee, his left hand was not seen in the camera's field of view. The pilot rated passenger still had both feet flat on the floor. The helicopter was at 625 feet and 109 knots groundspeed with 2 degrees pitch nose up and a value of around 7 degrees right roll.

At 18:57:42.00, the [HORN] light illuminated on the CWP panel (silenced condition), rotor RPM indicated 290 RPM, FLI indicated around 1.25 FLI. The pilot rated passenger began reaching with his right hand toward his cyclic stick. The helicopter was 623 feet and 108 knots groundspeed with 3 degrees pitch nose up and a value of around 9 degrees right roll.

Two frames later (0.50 seconds, 18:57:42.50), rotor RPM indicated 285 RPM, FLI indicated around 1.25 FLI. The pilot had moved his left hand back to the collective. The collective moved slightly toward the floor. The pilot rated passenger now gripped his cyclic with his right hand using a firm grip. The pilot was also manipulating the right seat cyclic. The helicopter was at 619 feet and 106 knots groundspeed with 3.6 degrees pitch nose up and a value of around 11 degrees right roll.

At 18:57:43.50, rotor RPM indicated 282 RPM, FLI indicated around 1.25. The pilot rated passenger was still gripping his cyclic with his right hand, his right foot was now on his pedal.

At 18:57:43.75, rotor RPM indicated 283 RPM, FLI indicated around 1.25 FLI. The [HYD1] light illuminated on the CWP panel and then cleared 0.25 seconds later. The collective had risen slightly at this time.

At 18:57:44.75, rotor RPM indicated 259 RPM, FLI indicated around 1.75 FLI. Both the pilot and the pilot rated passenger had their hands on their cyclic grips. The cyclic was moving forward and to the left, it was unclear who was performing cyclic inputs. The pilot rated passenger now had both feet on his pedals. The collective was moved to a slightly lower position.

Around 18:57:45.25, a sound consistent with blade vortex interaction (blade slap) was briefly audible.

At 18:57:46.00, rotor RPM indicated 259 RPM, FLI indicated around 1.75. It continued to be unclear who was manipulating the cyclic as both individuals still had their right hands on their respective cyclic grip. The twist grip was still in the idle position. Loose objects in the cockpit showed an indication of a negative G force.

At 18:57:47.00, rotor RPM indicated 254 RPM, FLI indicated around 1.50 FLI. The [MGB P] light illuminated on the CWP panel. It continued to be unclear who was manipulating the cyclic as both individuals still had their right hands on their respective seat's cyclic stick. The pilot looked down at the collective. During this time, the pilot had rolled the twist grip back toward [FLIGHT].

At 18:57:47.50, rotor RPM indicated 256 RPM, FLI indicated around 1.50 FLI. The Twist grip was now back in the [FLIGHT] detent. The pilot was still looking down at the collective. It continued to be unclear who was manipulating the cyclic as both individuals still had their right hands on their respective seat's cyclic grip. The [TWT] grip light on the CWP panel had extinguished.

At 18:57:47.75, rotor RPM indicated 256 RPM, FLI indicated around 1.50 FLI. It continued to be unclear who was manipulating the cyclic as both individuals still

had their right hands on their respective seat's cyclic grip. The [MGB P] light extinguished from the CWP panel.

Around 18:57:48.25, a sound consistent with blade slap was audible until the end of the recording.

At 18:57:48.50, rotor RPM indicated 277 RPM, FLI indicated around 2 FLI. It continued to be unclear who was manipulating the cyclic as both individuals still had their right hands on their respective seat's cyclic grip. There appeared to be cyclic input to the forward and left. The [TWT] grip light illuminated again on the CWP panel. The twist grip was not in the [FLIGHT] detent. The collective had risen slightly. The [LIMIT] light illuminated on the CWP panel.

At 18:57:50.50, rotor RPM indicated 270 RPM, FLI indicated around 2 FLI. It continued to be unclear who was manipulating the cyclic as both individuals still had their right hands on their respective seat's cyclic grip. The pilot looked back down toward the twist grip on the collective. There appeared to be cyclic input to the forward and left.

In the next two frames (0.50 seconds, 18:57:51.00), the collective seemed to raise slightly, the twist grip was momentarily rolled slightly toward [FLIGHT].

At 18:57:52.00, rotor RPM indicated 254 RPM, FLI indicated around 2 FLI. An amber caution light believed to be the [DOOR] caution illuminated.

Six frames later, impact occurred with water (1.50 seconds, 18:57:53.50). During the descent to impact, the collective position was noted moving up. The helicopter appeared to roll to the right and pitch nose up. The camera's image exhibited signatures of rolling shutter blurriness consistent with a strong vibration or impact. The ELT light illuminated. Both individuals in the front seats had their hands and feet on the helicopter's controls.

The recording ended. No further information was recovered.

Previous Flights

A 2 hour and 4 minute flight was reviewed. This recording showed the helicopter's arrival to PJNU. For the first 43 minutes, the accident pilot flew the helicopter. From 43 minutes until 1 hour and 6 minutes into the flight, the pilot rated passenger flew the helicopter. For the last 58 minutes of the flight, the accident pilot flew the helicopter. At no time during when the accident pilot was flying, did the pilot rated passenger guard the flight controls in a manner described at 18:57:34.75 on the accident flight recording. Nothing remarkable was noted about the manner in which the two pilots exchanged flight controls.

Another seven minute recording of a reposition flight at PJNU was also reviewed. Only the accident pilot was flying the rotorcraft. At no time did the pilot rated passenger guard the controls in a manner described at 18:57:34.75 on the accident flight.

No other video data was available.

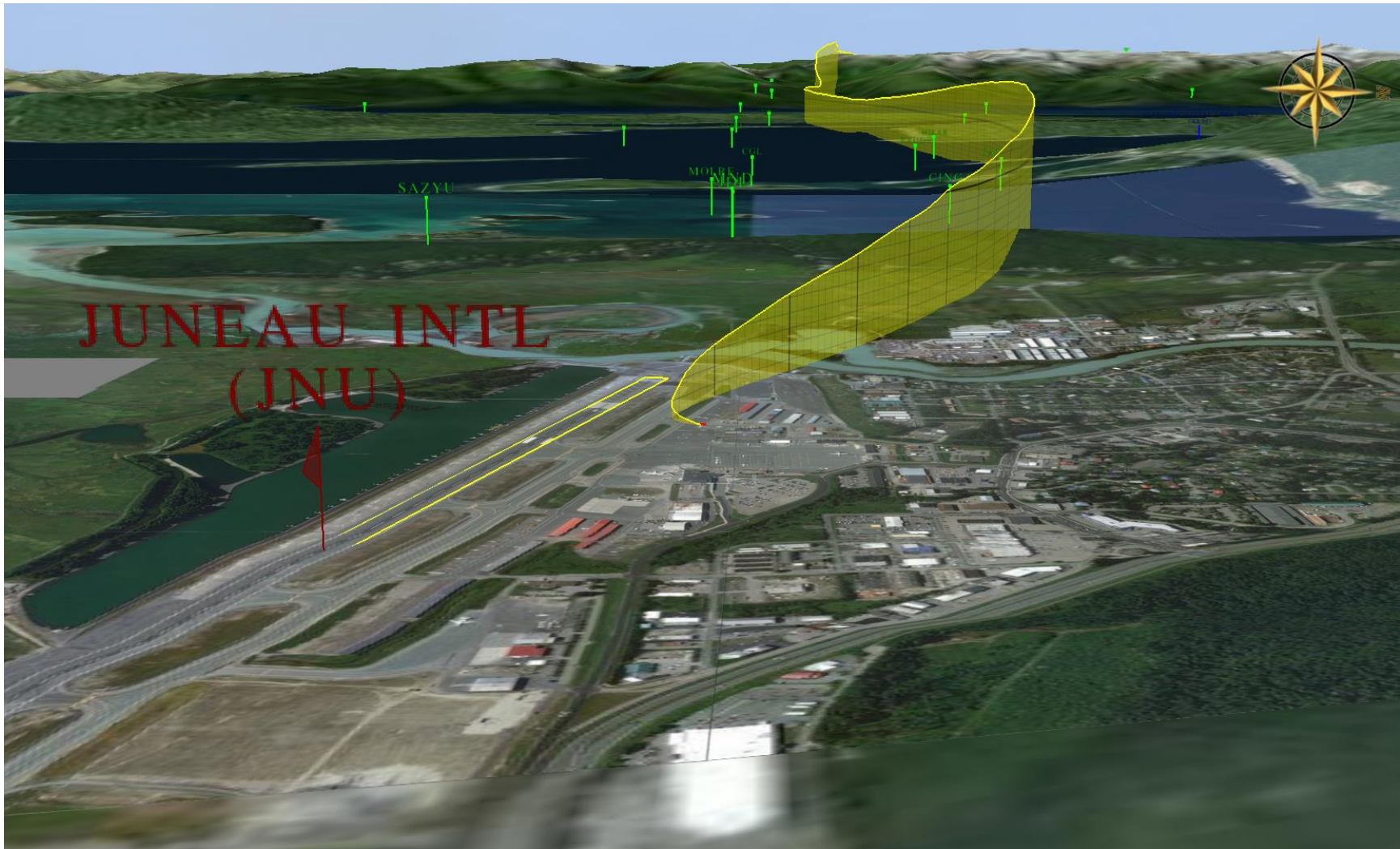


Figure 3. The helicopter's departure from PJNU.

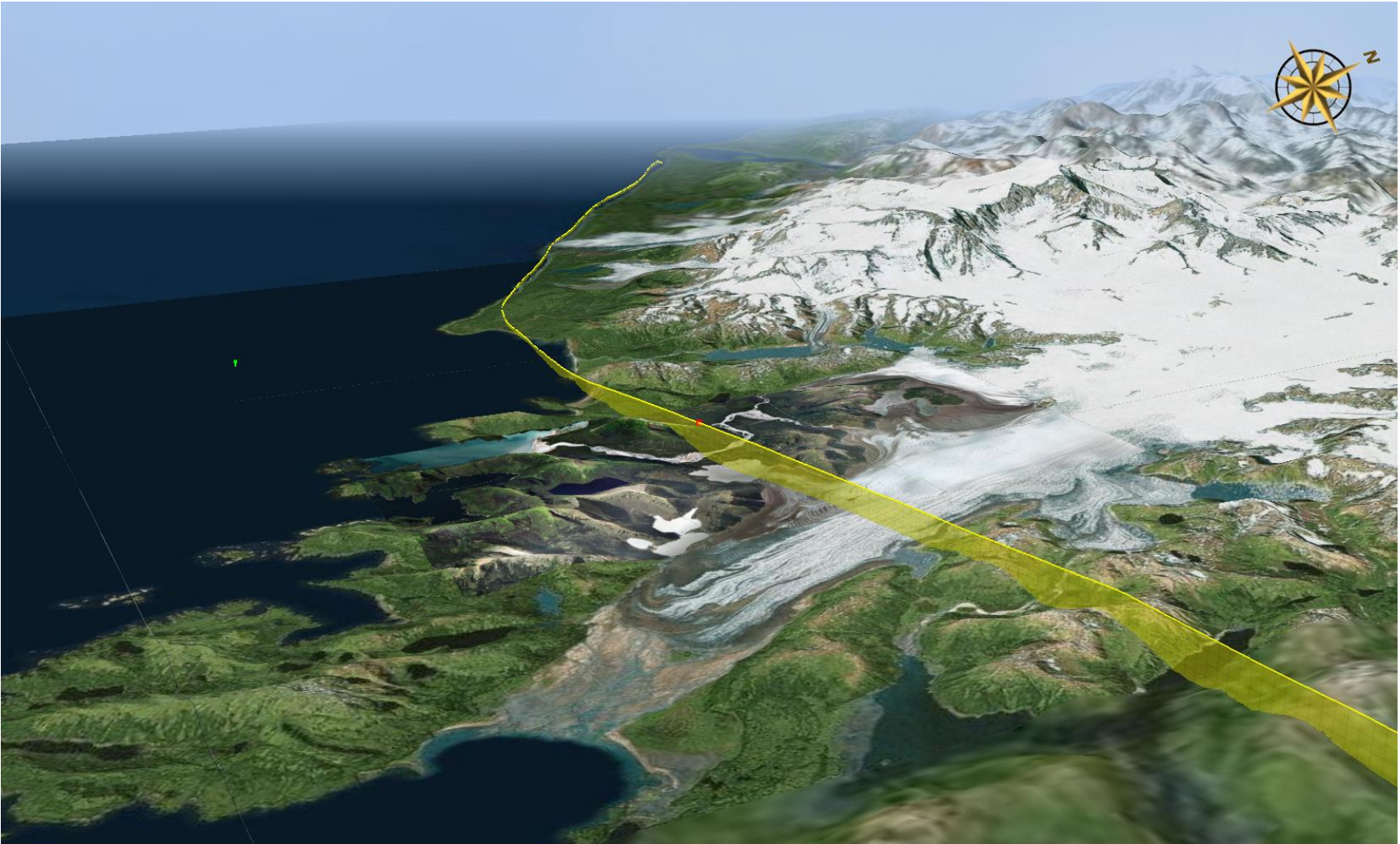


Figure 4. The helicopter's flight path around 18:40 UTC. The route of the helicopter's flight was to the northeast (bottom right of page to top left of page).

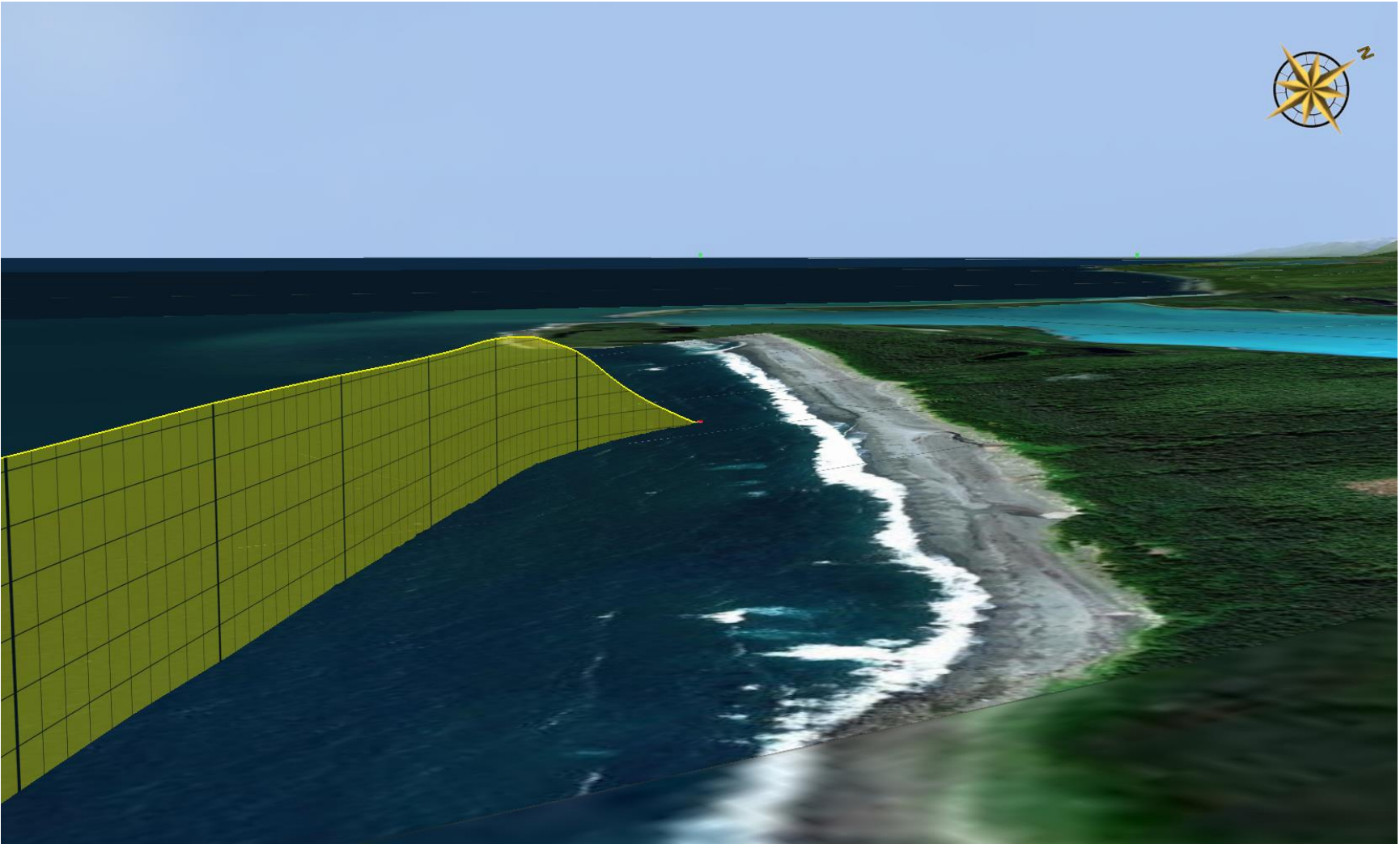


Figure 5. The helicopter's flight path at the final portion of flight.

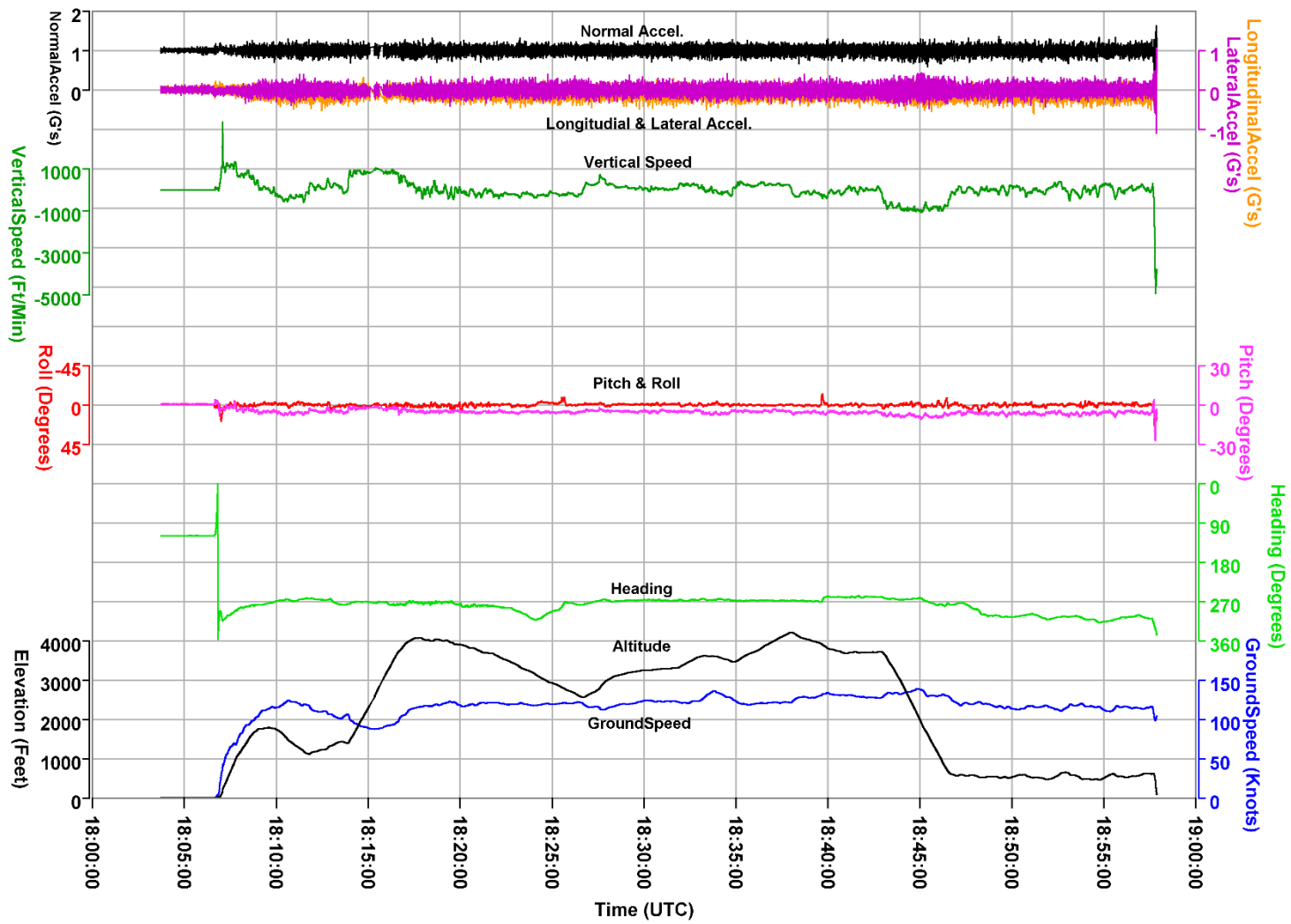


Figure 6. A plot of recorded parameters for the entire flight.

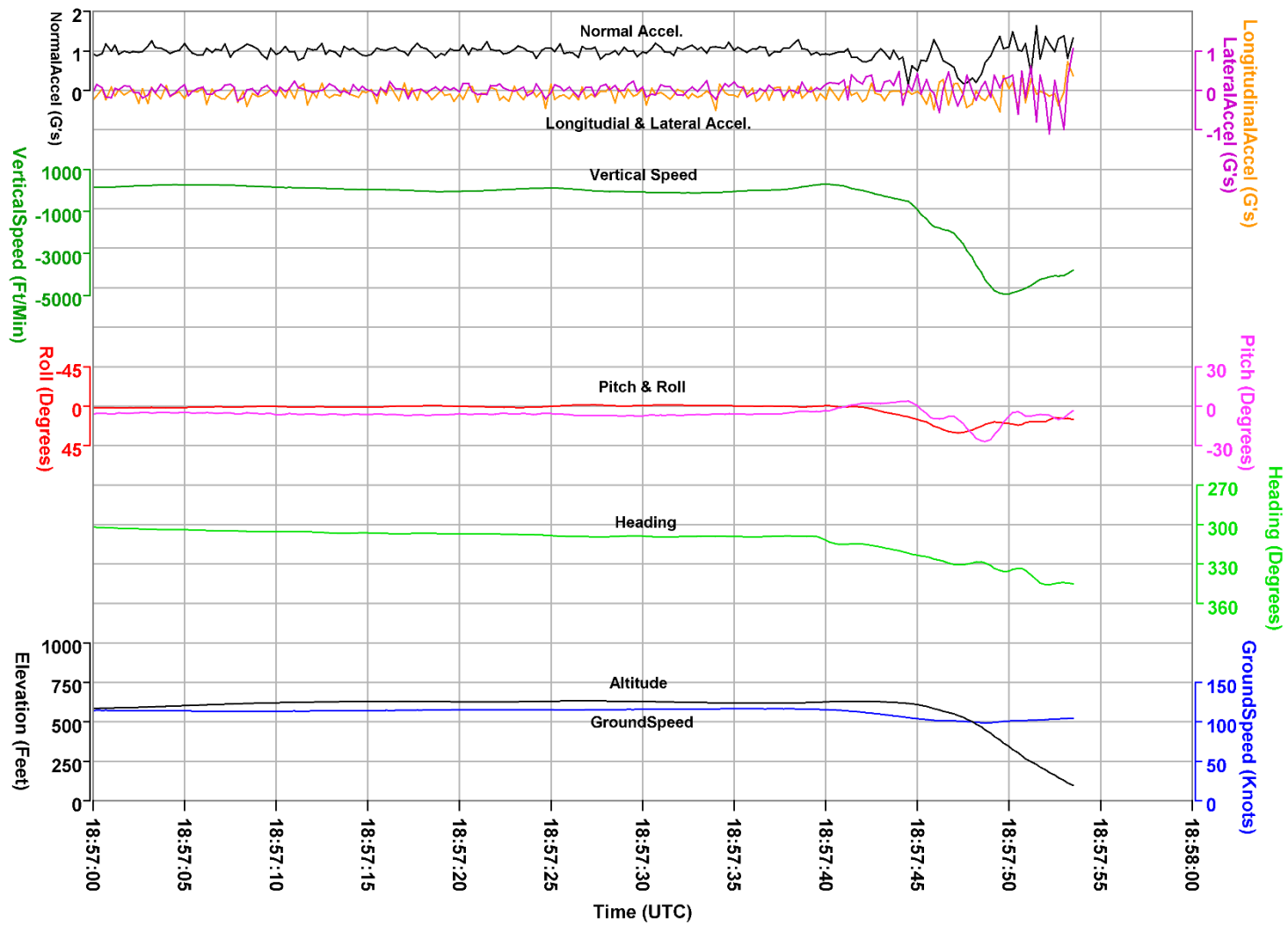


Figure 7. A plot of recorded parameters for the end of flight.