

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



**GROUP CHAIRMAN'S FACTUAL REPORT OF
INVESTIGATION**

WPR16FA055

**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 30, 2020

Onboard Image and Data Recorders

Specialist's Factual Report
By Sean Payne

1. EVENT

Location:	Hanalei, Hawaii
Date:	January 17, 2016
Aircraft:	Airbus Helicopters EC130T2, N11VQ
Operator:	Blue Hawaiian Helicopters
NTSB Number:	WPR16FA055

2. SUMMARY

On January 17, 2016, about 1430 Hawaii standard time (HST), an Airbus Helicopters EC130 T2, N11VQ, landed hard on a beach 2 miles west of Hanalei on the Hawaiian island of Kauai after a reported loss of engine power. The commercial pilot and 2 passengers sustained minor injuries, and 4 passengers were seriously injured. The helicopter sustained substantial damage to the tailboom and airframe. The helicopter was registered to Nevada Helicopter Leasing LLC, operated by Blue Hawaiian Helicopters (BHH) under the provisions of 14 *Code of Federal Regulations*, Part 135, and was conducting an air tour flight at the time of the accident. Visual meteorological conditions prevailed for the flight, and a company visual flight plan had been filed. The local flight originated in Lihue, HI at 1406.

3. GROUP

A group was convened on June 2, 2016. The group consisted of the following members:

Chairman:	Sean Payne Mechanical Engineer National Transportation Safety Board (NTSB)
Member:	Van McKenny Investigator-In-Charge National Transportation Safety Board (NTSB)

Member: Patrick Hempen
Air Safety Investigator, AVP-100
Federal Aviation Administration (FAA)

Member: Seth Buttner
Manager, Accident Investigation
Airbus Helicopters, Inc.

Member: Bryan Larimore
Accident Investigation and Safety
Safran/Turbomeca USA

Member: Eric Lincoln
Director of Operations
Blue Hawaiian Helicopters

Member: Don Lambert
Senior Director of Technical Safety
Air Methods (Blue Hawaiian)

4. DETAILS OF INVESTIGATION

On February 3, 2016, the NTSB Vehicle Recorder Division received the following electronic devices:

Recorder Manufacturer/Model: **Appareo Vision 1000**
Recorder Serial Number: **VIS-FGC0**

Recorder Manufacturer/Model: **Datatoys AirKnight HD4s + 8 GB USB Thumb Drive**
Recorder Serial Number: **BW1114-074**

4.1.1. 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. 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 crash and fire resistant memory module that 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. Anytime 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.

4.1.2. Appareo Vision 1000 Recorder Damage

Upon arrival at the NTSB Vehicle Recorder Division, it was evident that the Appareo Vision 1000 had not sustained any heat, water or structural damage and the device's records were extracted from the unit normally, without difficulty. Figure 1 is an image of the Appareo Vision 1000 as received.



Figure 1. The Appareo Vision 1000 and SD card.

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

4.1.3. Appareo Vision 1000 Data Recovery and Video Files

The download of the Appareo Vision 1000's SD card produced 289 proprietary files associated with the normal operation of the device. Of those files, six were associated with a proprietary image file type, six were associated with a proprietary audio file type, and 277 were associated with proprietary indexing and parametric data files.

The proprietary imagery files recorded images for the following intervals:

- January 17, 2016, from 2136:37 UTC to 2206.50 UTC
- January 17, 2016, from 2255:21 UTC to January 18, 2016 at 0034:17 UTC

The image files recorded: (1) approximately the last 30 minutes of the flight previous to an electrical power cycle event, (2) the tour flight previous to the accident flight, (3) the accident flight. The recovered audio files associated themselves with these image files.

The imagery files recorded an over the shoulder view of the pilot from a centralized roof mounting position within the cockpit. The pilot's cyclic and pedal movements were visible. The collective and the pilot's left arm movement were not visible to the recorder. Much of the instrument panel and rotorcraft system controls were also visible. A view out of the forward windscreen was also visible. Figure 2 is a digital illustration of the Appareo V1000's field of view during the flight previous to the accident flight. The camera position remained unchanged for the accident flight.



Figure 2. A digital illustration of the Appareo Vision 1000's field of view as mounted on the accident rotorcraft during a flight previous to the accident flight.

The parametric data consisted of approximately 277 files. The accident flight, as well as a multitude of other previous flights were captured by the Appareo Vision 1000's parametric data recorder. Relevant recorded parameters were output to .CSV and plotted using NTSB software. Keyhole Markup Language (.KML) files were constructed and plotted in Google Earth.

Figure 3 is a plot of the relevant parameters for the entire accident flight. The plotted time interval is from 14:00 HST to 14:35 HST. The data shows takeoff occurred about 14:05:44 HST. The flight continued normally for the next 26 minutes. About 14:31:31 HST, the rotorcraft began to yaw to the right of its course of around 360 degrees. The altitude at this time was approximately 1,450 feet MSL. Around the same moment, vertical speed began spiking to local minima of around -4,000 feet per minute. The aircraft experienced a roll to the right of around 30 degrees and a nose down pitch of about 20 degrees as its heading changed to about 108 degrees. Around 14:31:54 HST, the rotorcraft's heading began changing again to the left, the rotorcraft's roll became around 20 degrees left and, as it reached a heading of around 065, the rotorcraft's pitch had become slightly positive. During this time, recorded vertical speed ranged from about -285 feet per minute to -4,000 feet per minute. Around 14:32:03 HST, the rotorcraft began to roll right. During this time, data showed the aircraft at approximately 374 feet MSL. During this period of maneuvers, the rotorcraft's groundspeed was between approximately 70 and 80 knots. By 14:32:06 HST, the rotorcraft's roll was about 51 degrees right, pitch increased to about 35 degrees nose down, and vertical speed approached -4,000 feet per minute. The rotorcraft came to a heading of about 220 degrees as its roll component began to level out around 14:32:11 HST. At this time, groundspeed decreased to around 20 knots. Impact with the ground occurred around 14:32:12 when the value for normal acceleration showed a spike in G force. The recorder's sample rate of 4Hz was not enough to quantify the force of the impact. The recording ended at 14:34:17.50 HST.

Figure 4 shows the approximate final three minutes of flight. The plotted time interval starts at 14:29:30 and ends at 14:33:00.

Figure 5 shows the approximate final one minute of flight. The plotted time interval starts at 14:31:20 and ends at 14:32:30.

Figures 6 through 13 are satellite overlays created using the Appareo Vision 1000's software. Weather and lighting conditions shown are not necessarily an accurate representation of those on the accident flight. Additionally, the imagery may depict terrain and coastal features that do not represent the conditions of those experienced during the accident flight. Overall, the reader of this report is cautioned that the aerial imagery depicted in the graphic may not accurately represent the conditions at the time of the accident.

Figure 6 is a north up graphical representation of the rotorcraft's GPS tracklog files for the accident flight as well as the entire previous flight.

Figure 7 is a graphical representation of the rotorcraft's GPS tracklogs showing the homogeneity between a portion of the previous flight and the accident flight.

Figure 8 is a graphical representation of the rotorcraft's GPS tracklogs for the accident flight only.

Figure 9 is a graphical representation of the rotorcraft's GPS tracklogs showing the rotorcraft's departure from Blue Hawaiian's operation area at Lihue Airport (KLIH), Kauai, Hawaii.

Figure 10 is an approximate north up oriented view showing a graphical representation of the rotorcraft's GPS tracklogs during the final portion of the accident flight.

Figure 11 is an approximate north up oriented view showing a graphical representation of the rotorcraft's GPS tracklogs during the final portion of the accident flight. The figure is zoomed to show the landing area.

Figure 12 is an alternate view showing a graphical representation of the rotorcraft's GPS tracklogs during the final portion of the accident flight. The figure is zoomed to show the landing area.

Figure 13 is an alternate view showing a graphical representation of the rotorcraft's GPS tracklogs during the final portion of the accident flight. The figure is zoomed to show the landing area.

Attachment 1 is the data from the Appareo Vision 1000 in .CSV (comma separated values) format.

4.2.1. Datatoys AirKnight HD4s Recorder Description

The Datatoys AirKnight HD4s is an airborne video recorder designed for helicopter tour applications. The HD4s is a digital video recorder (DVR) that supports recording up to 4 streams at a resolution and frame rate of up to 1920 x 1080 pixels and 60 frames per second (fps). The unit allows the operator to manually or automatically switch between 4 camera streams. The device also contains an audio input that permits operator audio to be overlaid on the video recording. When configured, the device is capable of overlaying GPS data onto the video recording. The device records directly to a USB flash drive or a SD solid state media card.

4.2.2. Datatoys AirKnight HD4s Recorder Damage

Upon arrival at the NTSB Vehicle Recorder Division, it was evident that the Datatoys AirKnight HD4s had not sustained any heat, water or structural

damage. The USB drive was examined for image and audio files. Figure 14 is an image of the Datatoys AirKnight HD4s and the associated USB flash drive that contained video data.



Figure 14. The Datatoys AirKnight HD4s.

4.2.3. Datatoys AirKnight HD4s Data Recovery and Video Files

The thumb drive associated with the AirKnight HD4s initially contained three .AVI files. Those files were 160117_140249_141425.avi, 160117_141425_142523.avi and tmprecord.avi. The files were of 1920 x 1080 pixels in resolution and were recorded at a frame rate of 29.97 fps. The files contained an audio track that recorded intra-aircraft communications between the pilot and passengers², air traffic control transmissions, the pilot's VOX³ input, and occasional music. The pilot retained control over the rotorcraft's audio panel and camera selection controls for the AirKnight HD4s. Specific audio and video information captured on the recording were dependent upon which audio parameters the pilot had selected through the audio panel and which camera input the pilot was currently selecting. During most of the flight, the pilot switched between cameras that were externally mounted on the rotorcraft. Figure 15 is a diagram of the cameras associated with the Datatoys AirKnight HD4s that were mounted to the rotorcraft. Figure 16 is a graphic that depicts the seating arrangement of the rotorcraft. Figure 17 is an illustrated image of the internal cockpit camera's view. Figure 18 is a screenshot taken from one of the rotorcraft's external cameras.

² In this installation, the passengers were required to key a handheld mic to speak on the rotorcraft's intercom. The boom mic from the passengers' headsets were not present.

³ VOX – Voice Operated Exchange – A setting that allows the user's voice to trigger an open microphone switch.

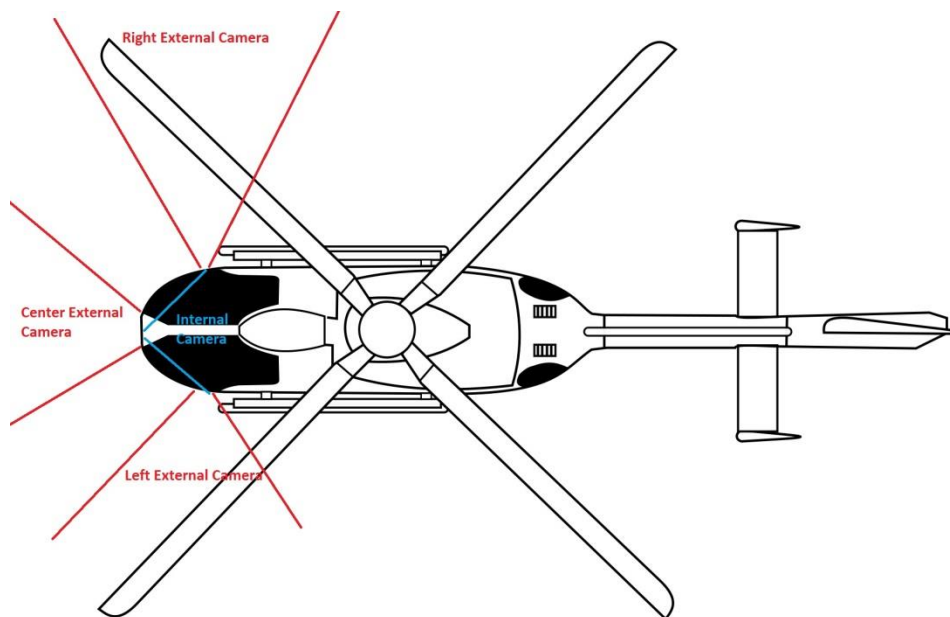


Figure 15. A diagram of the cameras associated with the Datatoys AirKnight HD4s camera system.

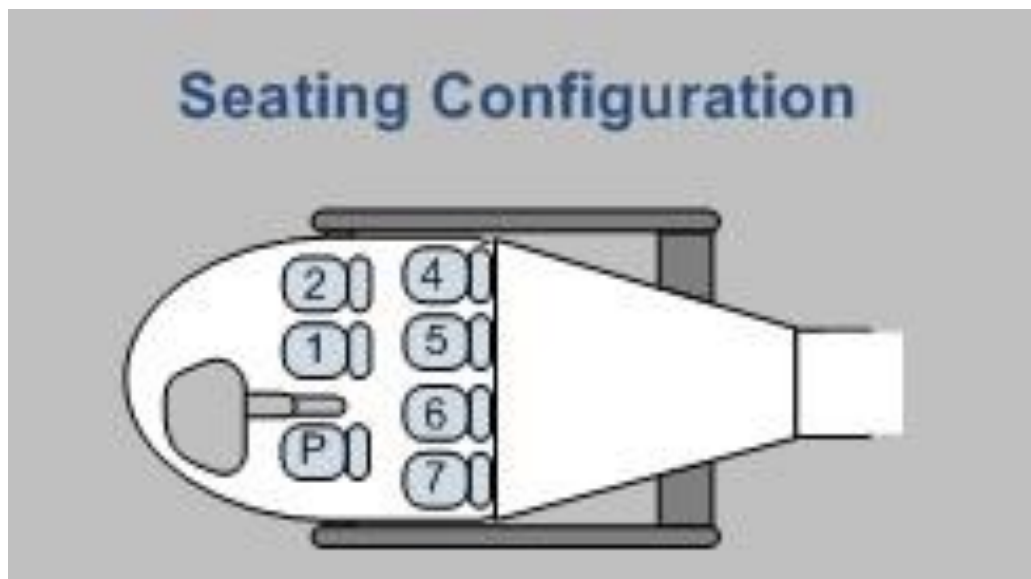


Figure 16. A chart depicting the seating arrangement of the rotorcraft.



Figure 17. An illustrated image of the internal cockpit camera's view.



Figure 18. A screenshot taken from the externally facing camera mounted on the right side of the rotorcraft.

During high impact scenarios, the USB flash drive did not produce the accident video segment when read via a Windows file system. The first two files, 160117_140249_141425.avi, 160117_141425_142523.avi each contain about 1 GB of imagery and audio data. Typical of video recording hardware, during a continuous recording, recordings segment themselves into smaller subsections usually determined by a set file size limit. 160117_140249_141425.avi shows the first 11 minutes and 35 seconds of the accident flight and is 1,025,847 KB in size. 160117_141425_142523.avi is the second portion of the accident recording, is 10 minutes and 58 seconds in length and is 1,025,124 KB in size. The file

naming convention of these files can be associated with a timestamp, however, that timestamp information was determined to be incorrect (see section 4.3 for details). The USB flash drive also contained a file, temprecord.avi which contained imagery and audio that was determined to be recorded post-accident. When compared to the video contained on the Appareo Vision 1000 recording device, it was determined that approximately 5 minutes and 11 seconds of imagery and audio information from the AirKnight HD4S was not readable.

The USB flash drive was imaged using forensic software. The image file produced was then examined for video fragments. The video fragments were exported and recovered. This process revealed approximately 2 GB of missing imagery and audio files. This recovered file also included video files previously deleted from the USB flash drive that were recordings of previous flights. When examined, approximately 5 minutes and 46 seconds of the missing accident flight segment was recovered. When compared to the Appareo data, it was determined that at least 7 seconds of video was not present in the image file and, after discussion with the equipment manufacturer, was determined to be unrecoverable.

4.3. Timing and Correlation

The times used in this report are expressed as local time of the accident (HST).

Timing of the transcript was established by offsetting the recorded GMT time of the Appareo Vision 1000 to local HST.

The following time correlation was applied:

Appareo Vision 1000 recorded time – 36,000 seconds = HST

Files from the Datatoys AirKnight HD4s contained timing information within each video's file naming convention. File 160117_140249_141425.avi indicated it began at 1402:49 HST on January 17, 2016. In this recording, the accident flight departed from the Blue Hawaiian embark/disembark area at approximately 1 minute and 58 seconds into the file. When compared to the Appareo data, an offset of 335 seconds was applied to the Datatoys AirKnight HD4s files.

The following time correlation was applied:

Datatoys AirKnight HD4s recorded time – 335 seconds = HST

4.4. Summary of Recording Contents

In agreement with the Investigator-In-Charge, a video group was convened and the following transcript was developed from the two sources of imagery and audio data. The two sources of imagery and audio data were synced in a video editing suite and a timestamp was added. Additionally, each imagery and audio

stream was reviewed in detail, independently. The transcript was developed by noting events that were best captured from either video and audio stream.

The transcription began as the occupants embarked the rotorcraft at KLIH at 14:00:28.5 HST. The transcription offers detail as to how the occupants were situated in the rotorcraft. This portion of the transcription ends at 14:05:23 HST when the rotorcraft departed KLIH.

Events between 14:05:23 HST and 14:28:26.10 HST were considered nominal and uneventful. This portion of the two audio and video tracks were not transcribed.

The second portion of the transcript began at 14:28:26.10 HST, moments prior to the rotorcraft's loss of power and emergency decent. The second portion of the transcript begins by describing the seating positions of the rotorcraft occupants as they were last seen by the AirKnight's internal camera. At 14:28:36.40 HST, the AirKnight camera switched from an internal view of the rotorcraft's occupants and remained on views as seen by external camera positions only. At this time, the Appareo Vision 1000's camera field of view was used to describe events within the cockpit (refer to figure 2 for the field of view of the camera).

The second portion of the transcript ended at 14:32:36.75 HST when the pilot activated the rotorbrake. The recording ended approximately 1 minute and 40 seconds later at 14:34:17.50 HST.

4.4.1. Appareo Vision 100 and Datatoys AirKnight HD4s

The first portion of the transcript begins below and serves to document the seating and seatbelt use characteristics of the rotorcraft's occupants. All seating positions are as defined in figure 16.

Time (HST)	Comment
14:00:28.25	Pilot gave a thumbs up signal and passengers were seen embarking the rotorcraft.
14:00:48.00	The Seat 1 passenger was seen raising her arms. The seat 1 passenger appeared to be assisted with her belts by a third party. She was handed a headset by the pilot.
14:03:06.00	A sound consistent with door closing was heard.
14:04:03.73	The pilot's four point harness was low below his stomach, both shoulder harnesses were tight around his shoulders. Seat 1 passenger's four point was in the vicinity of her belly button area. Her hands were in her lap, the buckle was above her hands. Later, and for other portions of the flight, seat 1 passenger was seen reaching back with her left hand and arm to passenger 7's seat. Seat 2 passenger's four point seatbelt was in the vicinity of his belly button, his shoulder harness straps looked offset slightly to the right of his body. Seat 4 passenger's left shoulder harness was visible but all other harness features were obstructed

Time (HST)	Comment
	by the seat. Seat 5 passenger's four point seatbelt appeared to rest just below his belly button, his shoulder harness was centered on his body. Seat 6 passenger's should harness features were obstructed by the rotorcraft's seating arrangement. Seat 7 passenger's four point seatbelt was well above his belly button, in the vicinity of his lower sternum. The shoulder straps were centered on his body. Seat 7 passenger's lap belt straps were reaching upward above his belly.
14:04:23.00	The "TWT-GRP" (Twist Grip) annunciator light extinguished, engine noise changed consistent with entering flight idle.
14:05:43.75	The pilot performed a normal takeoff.

The second portion of the transcription begins below.

Time (HST)	Comment
14:28:26.10	The AirKnight camera showed the passenger cabin view. Seat 1 passenger was leaning forward, her right shoulder harness was secured over the right shoulder, her left shoulder harness was not seen over the left shoulder, but moved in concert with the right shoulder harness at the Y strap. The shoulder harness was moving consistent with the passenger's body movement which was slightly leaned forward. The pilot's shoulder harness was in place. The pilot's left hand was forward and resting on some unknown cockpit object. The seat 2 passenger was seated normally and wearing their shoulder harness. The seat 4 passenger was seen with the left shoulder harness clearly visible, their right shoulder harness was obstructed by the rotorcraft's seating arrangement. The seat 5 passenger was seated normally and seen wearing both shoulder harnesses. The seat 6 passenger was taking a photograph at head level and has their body oriented to the right of the rotorcraft. His harness position was obstructed by the rotorcraft's seating arrangement. The seat 7 passenger was seated normally and was looking out the left side of the rotorcraft, both shoulder harnesses were visible.
14:28:35.37	The AirKnight camera showed the passenger cabin view once again. The seat 1 passenger moved back to a normal seated position. The seat 7 passenger was seated normally. The four point buckle was resting near in the area between their sternum and belly button, it was above the passenger's elbow level when in a normal seated position. It was not low and tight near their waist. The seat 5 passenger was now seen speaking into a handheld mic. Seat 5 passenger's four point harness was seen near their belly button region. The pilot's four point harness was out of view, but based on the straps laying position it was likely resting near his belly button or lower.
14:28:44.43	The pilot spoke to the passengers and cleared his throat briefly and continued speaking.
14:29:03.00	The pilot coughed lightly, slightly moved his boom mic and stated "excuse me."
14:29:18.00	The pilot began speaking to the passengers again.
14:29:50.13	While speaking, the pilot coughed.
14:29:59.00	Between 14:29:59 and 14:30:01 the pilot coughed a few times and stated

Time (HST)	Comment
	"excuse me."
14:30:04.83	The pilot pointed out the Honopu Sea Arch landmark and spoke about it.
14:30:22.30	The pilot coughed and grunted and adjusted his boom mic. He continued speaking after.
14:30:33.47	The pilot sounded as if he were speaking through a cough and later coughed while speaking.
14:30:37.73	The rotorcraft had turned back toward the coastline. Moments later, the pilot began coughing harder than he had previously. The coughing noise subsided moments later, possibly due to the pilot having moved his boom mic.
14:30:47.20	The seat 1 passenger was looking toward the pilot.
14:30:50.53	The pilot was heard coughing deeply, the seat 1 passenger diverted her head further left toward the direction of the pilot. The coughing subsided on the recording. It could not be determined if the coughing subsided or if it was no longer being picked up by the boom mic.
14:30:53.50	A passenger asked, "Are you ever able to spot sharks pretty easily over here?"
14:30:57.00	The pilot answered in a strained voice, "Not usually, no."
14:31:02.00	The pilot was heard coughing again. The seat 1 passenger was still looking toward the direction of the pilot. Although the boom mic could have been moved, the pilot's gestures indicated that he was no longer coughing. The pilot rested his left hand on his left thigh, his right hand was still gripping the cyclic.
14:31:15.00	The AirKnight camera view changed to the right external camera and remained on the right camera for the remainder of the recording.
14:31:19.00	The pilot stated, "sorry I'm starting to lose my voice a little bit" and chuckled as he patted his stomach with his left hand.
14:31:22.03	The pilot switched grip on the cyclic from his right hand to his left hand, freeing his right hand. At this time the rotorcraft was tracking toward the north, away from the coastline. The altitude was around 2,000 feet. The airspeed indicator was seen at the six o'clock position displaying around 80 knots. FLI ⁴ was steady at 5 (a unitless indication), engine oil temperature and pressure were within normal operating range. There were no lit annunciator panel lights. The pilot had an unquantified amount of left pedal input as the rotorcraft tracked away from the coastline.
14:31:23.20	The pilot moved his left hand to the cyclic and moved his right hand to pick up a bottle that came into view of the camera from between the pilot's seat and seat 1.
14:31:28.10	The pilot moved his boom mic and prepared to take a sip from the bottle which was now near his mouth. His left hand was still on the cyclic.
14:31:30.00	The pilot tipped the bottle up as if he were sipping from the bottle. His left hand was still on the cyclic. Seat 1 passenger was seen holding one of the passenger microphones.
14:31:31.50	The rotorcraft showed an indication of a yaw to the right when compared to features outside the windscreen. At the same moment, the pilot began moving the bottle away from his mouth.

⁴ FLI – First Limit Indicator

Time (HST)	Comment
14:31:32.00	The FLI began dropping from 5 down to 4 and continued falling rapidly. Engine noise recorded on the Appareo internal microphone was heard rapidly reducing in intensity. Indicated airspeed was around 80 knots.
14:31:33.25	FLI had reached zero. Oil pressure indicator was falling but at a slower rate than the FLI.
14:31:33.75	The "GENE" (Generator) annunciator light had illuminated. The FLI had switched to the "triple page". Pilot's pedal input was still an unquantified amount of left pedal as seen moments before. Nr (rotor RPM) was around 315 rpm.
14:31:34.25	The pilot increased his grip on the cyclic with his right hand, his left hand was not seen in the recording. His left hand was somewhere out of frame to the left, as it had been in most of the recording.
14:31:34.50	Some right pedal was added in a small unquantified amount.
14:31:34.75	Seat 1 passenger moved her left hand toward the pilot and touched the pilot's right arm.
14:31:35.50	The rotorcraft was in approximately a 20 degree right bank turn, turning back toward the coastline. The rotorcraft was pitched down about 3 or 4 degrees according to the flight instruments.
14:31:36.75	Seat 1 passenger's left hand went out of view of the camera. The rotorcraft pitched down 15 degrees and had a right bank of approximately 30 degrees.
14:31:38.50	Seat 1 passenger looked toward the left rear of the rotorcraft. Both of Seat 1 passenger's feet were flat on the floor.
14:31:40.25	"ENG P" (Engine oil pressure) annunciator light illuminated. Nr was seen rapidly increasing to around 450 rpm.
14:31:40.75	Seat 1 passenger's head moved to look forward and slightly to the right.
14:31:43.00	"Fuel P" (Fuel Pressure) annunciator light illuminated. Rotorslapping noise was recorded on both the AirKnight and Appareo audio track.
14:31:45.50	The coastline came into view as well as the coastal surf area. The pilot was heard grunting on the AirKnight audio track. The rotorcraft was 20 degrees nosedown, and about 20 degrees right bank. The heading was approximately 080 and the rotorcraft was still coming right. Altitude was around 900 feet.
14:31:50.25	The rotorcraft's roll was becoming less to the right and was starting to roll through level flight. The rotorcraft was pitched down approximately 15 degrees. Shoreline was visible directly out of the front windscreen. There was a small amount of beach abutted to a sheer rock/cliff wall. There was a undetermined small white spot on the beach, potentially a person, seen in the beach area.
14:31:51.00	The pilot was heard breathing heavily on the audio track which continued through impact when the boom mic picked up his voice.
14:31:53.00	The pilot stated, "my engine". The rotorcraft began rolling into a left turn from a brief level transition. The pitch attitude was about 20 degrees nose down. The airspeed indicator showed around 85 knots. The altitude was about 600 feet.
14:31:57.75	Up until this moment, Nr was seen fluctuating in the 300 rpm range. At this time, Nr was seen at a local maximum of around 430 rpm. The rotorcraft was in a left bank of about 10 degrees and was pitched nearly level. Indicated airspeed was around 80 knots.
14:31:59.00	The pilot stated, "yup."

Time (HST)	Comment
14:32:02.75	The rotorcraft began rolling out of the left bank turn as the coastline appeared through the windscreen. The coastline looked rocky and appeared to be an unsuitable landing area. Nr was 364 rpm. Indicated airspeed was around 60 knots. Altitude was around 350 feet.
14:32:05.25	The rotorcraft was established in a right bank turn. The rotorcraft's pitch had become slightly positive. Nr showed around 340 rpm. Indicated airspeed was about 40 knots. There was a sheer rock wall visible through the windscreen. Seat 1 passenger's left arm was grasping the pilot's right forearm. The pilot's right hand was gripped on the cyclic, the pilot's left hand and arm was still out of view of the camera. Seat 1 passenger's feet were flat on the floor of the rotorcraft, she was looking ahead. The pilot's pedal position was about neutral.
14:32:06.30	The pilot stated, "I'm... ." The recovered AirKnight HD video stream ended at this moment.
14:32:06.75	Seat 1 passenger had released her hand hold on the pilot's right forearm. Her arm was now near her left knee, her feet were flat on the floor. A sheer rock wall was visible directly in front of the rotorcraft through the windscreen. Indicated airspeed was around 0 knots. Nr was around 300 rpm.
14:32:08.00	The rotorcraft was in approximately a 45 degree right bank. The rotorcraft was pitched nose down greater than 15 degrees. Nr was around 350 rpm. Indicated airspeed was around 0 knots. Altitude showed around 275 feet. The rotorcraft came around on a right turn toward a beach area.
14:32:08.25	The PFD AHRS flagged off and showed a large red "X." A sandy beach area came into view outside of the windscreen. Indicated airspeed was still zero.
14:32:10.00	The rotorcraft was pitched about 30 degrees nose down. Nr was somewhere in the range of the mid to low 300s.
14:32:10.25	The pilot began moving the cyclic aft.
14:32:10.50	The "LIMIT" (Servo Limit) light illuminated on the annunciator panel.
14:32:10.75	The pilot moved the cyclic slightly forward and the "LIMIT" annunciator light extinguished.
14:32:11.50	Nr showed around 330 rpm. The indicated airspeed needle was coming off of a zero indication. The rotorcraft was pitched down an undetermined amount.
14:32:11.75	The "LIMIT" (Servo Limit) light illuminated on the annunciator panel as the pilot moved the cyclic aft back toward his lap. The "LIMIT" servo stayed on throughout the rest of the recording.
14:32:12.25	The rotorcraft had nearly a level pitch attitude. There was a slight right bank. The "LIMIT" light was still illuminated. Indicated airspeed was just off the needle from a zero position, registering a slight forward component of airspeed. Nr appeared to be in the high 200 rpm range. The pilot was inputting slight left pedal. A sandy beach area was seen prominently through the windscreen, some washing water was seen on the right side of the rotorcraft.
14:32:12.50	The Appareo Vision 1000 unit failed to record a successive frame.
14:32:12.75	The Appareo Vision 1000 unit failed to record a successive frame.
14:32:13.00	The Appareo Vision 1000 rolling shutter indicated that an impact was occurring, effects of a shock to the camera filled the lower part of the image frame. The pilot's seating position suddenly shifted lower. Seat attenuation was seen. Nr showed about 260 rpm. Seat 1 passenger's feet were seen about shoulder width

Time (HST)	Comment
	apart. Her feet appeared to be flat on the rotorcraft's floor. The position of seat 1 passenger's left hand was not visible. Her right hand was not visible. Her headset was still on.
14:32:13.25	Seat 1 passenger's headset was seen off of her head. Her hair was seen floating and was not at rest. A headset was near the pilot's right knee. It is uncertain whether it was a passenger or pilot's headset near the pilot's knee. Some paper print media material were seen falling from the right instrument panel area. The ELT indicator light was illuminated. The pilot's left pedal was broken. There was flying material throughout the cabin.
14:32:13.50	The pilot's position did not appear to have changed between this moment and the last frame. Seat 1 passenger's head was shown as if it had moved upward, her hair was no longer floating upward. Seat 1 passenger's left hand and forearm was now visible near the pilot's right shoulder. The pilot's body was generally lower than seat 1 passenger's body overall.
14:32:13.75	A crack developed in the left windscreen just above the instrument panel. Seat 1 passenger's body was seen moving forward, the back of seat 1 passenger's neck was now visible. Seat 1 passenger's right arm, elbow, and hand were above the pilot's right shoulder. Seat 1 passenger's left shoulder harness was seen tight around the Seat 1 passenger's left shoulder. The right portion of the seat 1 passenger's shoulder harness was not observed in the camera's field of view. The "PITOT" (Pitot Heat) annunciator light illuminated. The "MGBP" (Main Gearbox Pressure) annunciator light illuminated.
14:32:14.00	Seat 1 passenger's body appeared to have been restrained by the shoulder harness as the shoulder harness appeared tight in the visible portion. Seat 1 passenger's head had moved back toward the seat.
14:32:14.75	Seat 1 passenger's body was pulled back closer to the seat. Seat 1 passenger's legs were somewhat extended forward from the position seen throughout most of the recording.
14:32:15.25	The rotorcraft appeared to have come to rest.
14:32:36.75	The pilot pulled the rotorbrake with his right hand. End of transcript.
14:34:17.50	End of recording.

4.4.2. Flight Crew Review and Commentary

As per standard NTSB procedure involving voice and video recordings, the surviving flight crew members (the pilot in this case) was offered to watch the recording the accident at the NTSB Vehicle Recorder Division laboratory in Washington, D.C. This viewing took place on Friday, July 29th, 2016 and lasted for approximately 1.5 hours.

After viewing the recording, the pilot stated he was wearing a noise canceling headset, and in comparison to the audio recorded and in combination to the

music that was playing, that he did not hear the engine lose power as clearly as was recorded on the audio track.

The pilot recalled transmitting, "I think I just lost my engine." The pilot recalled making this VHF radio transmission to another Blue Hawaiian Helicopters (BHH) pilot in a tour ahead of his rotorcraft. The pilot remembered the other BHH pilot asking, "you lost your what?" The pilot stated that at 14:31:53.00, he was replying "I lost my engine" and only the portion of that transmission that was captured on the recording was "...my engine."

The pilot stated when he said "yup" at 14:31:59, he was reaffirming that yes, he had indeed had an engine failure.

The pilot had no further comments.

Figure 3. A plot of parametric data for the entire accident flight.

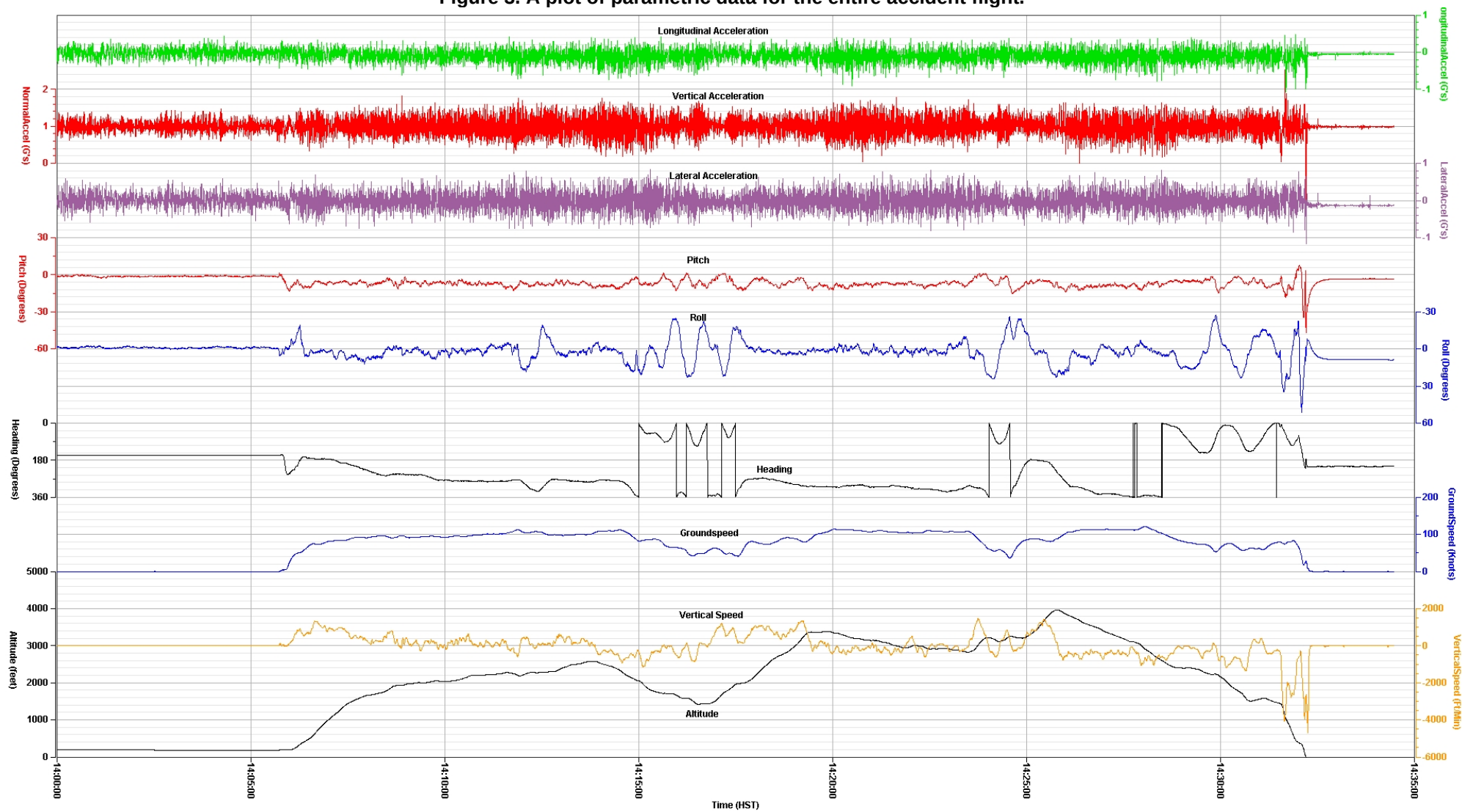


Figure 4. A plot of parametric data for the approximate final three minutes of the accident flight.

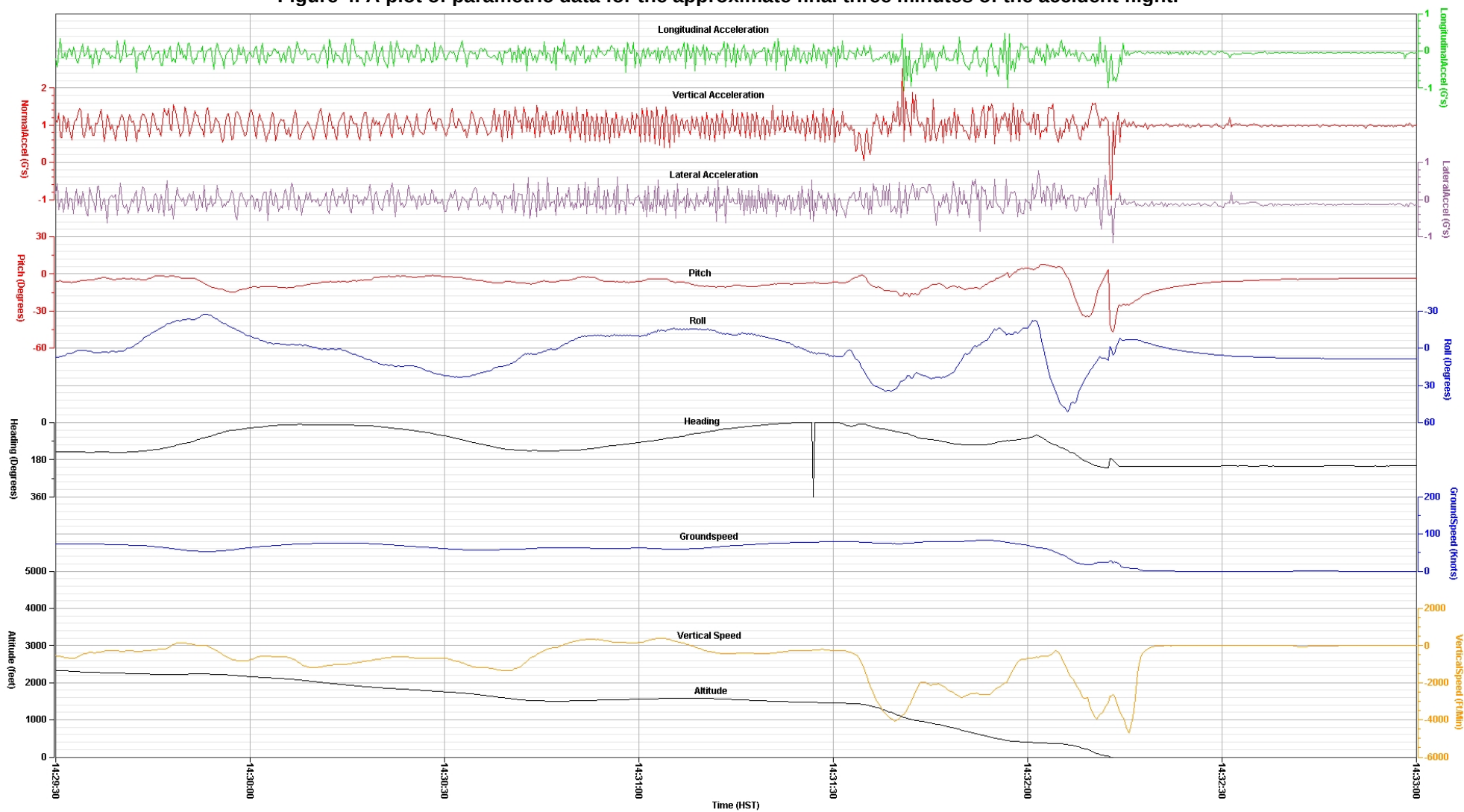


Figure 5. A plot of parametric data for the approximate final one minute of the accident flight.

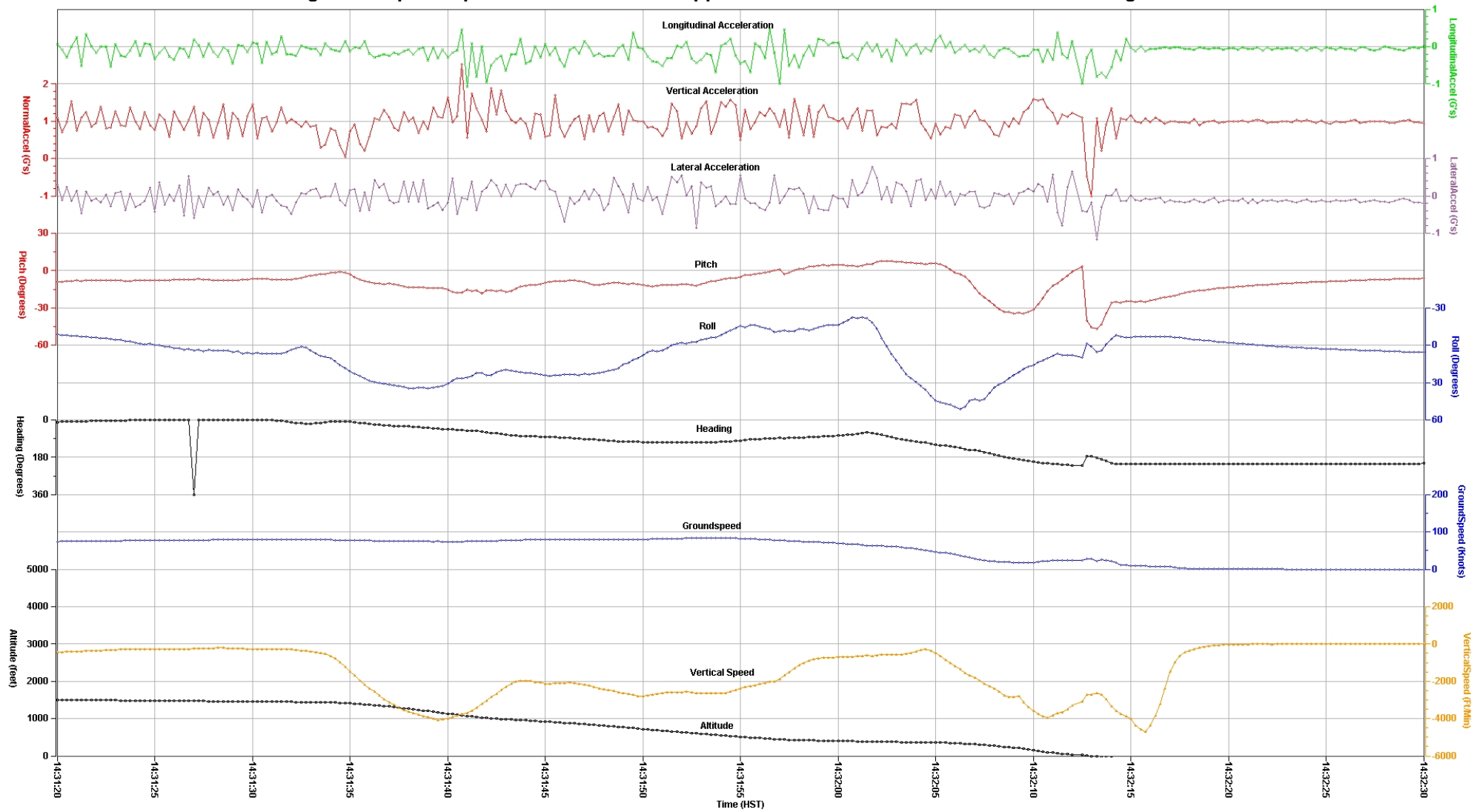


Figure 6. A north up view of GPS tracklogs recorded during the previous flight and the accident flight.



Figure 7. GPS tracklogs showing the homogeneity between the previous flight and the accident flight.



Figure 8. GPS tracklogs for the accident flight only.



Figure 9. GPS tracklogs showing the rotorcraft's departure from Lihue Airport (KLIH), Kauai, Hawaii.



Figure 10. GPS tracklogs showing a north up view of the final portion of the accident flight.

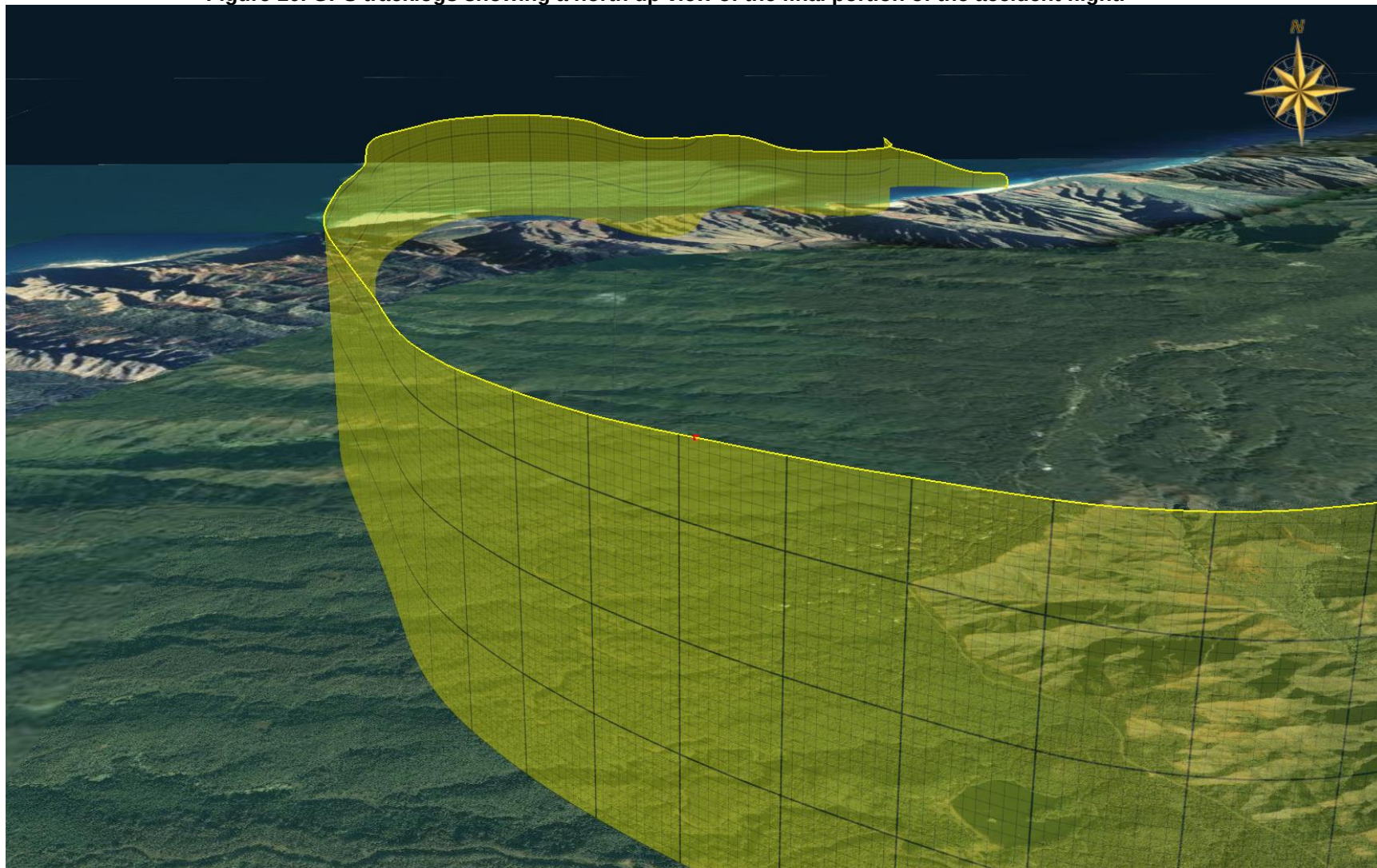


Figure 11. GPS tracklogs showing an alternate, closer view of the final portion of the accident flight.

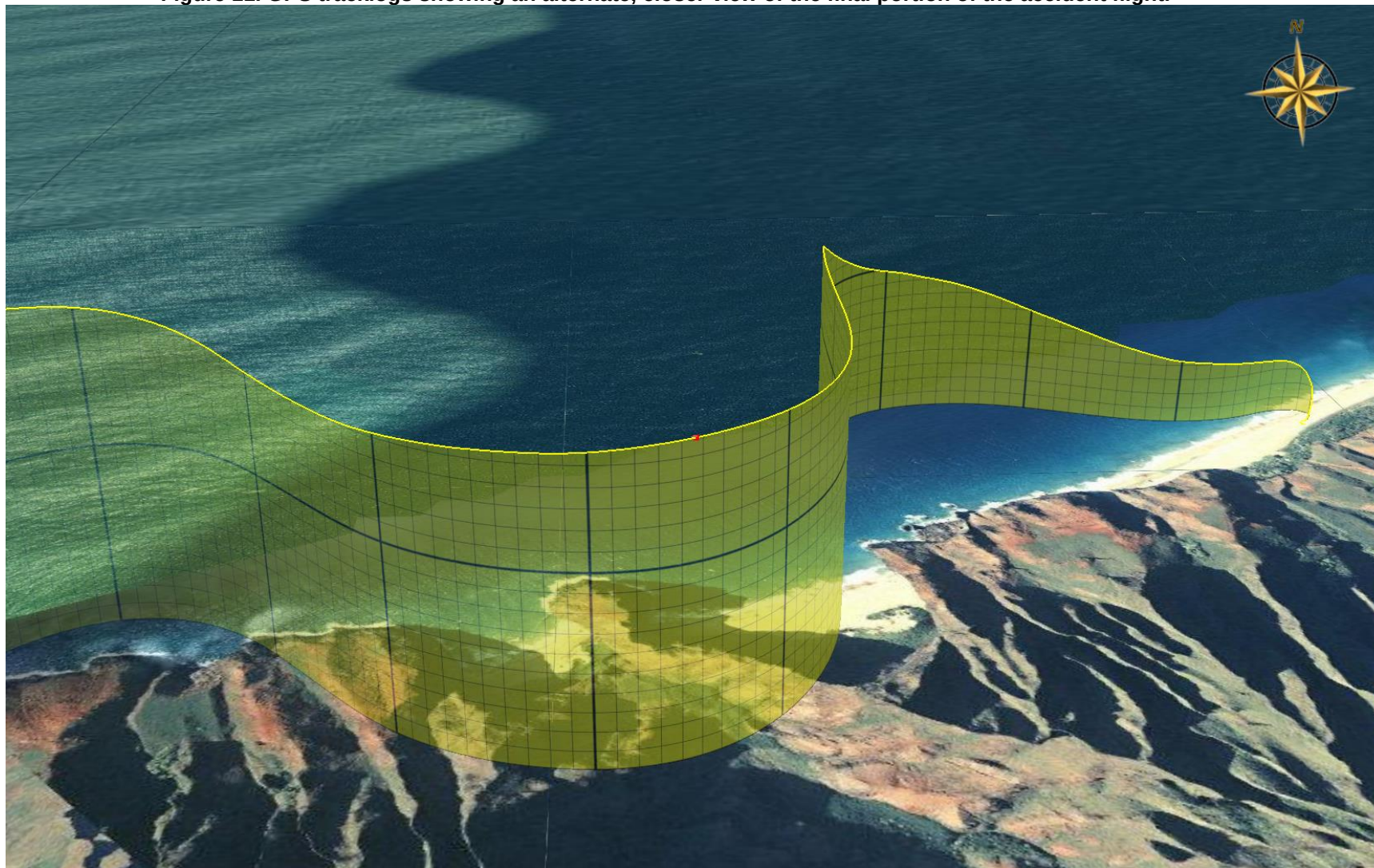


Figure 12. GPS tracklogs showing an alternate, closer view of the final portion of the accident flight.

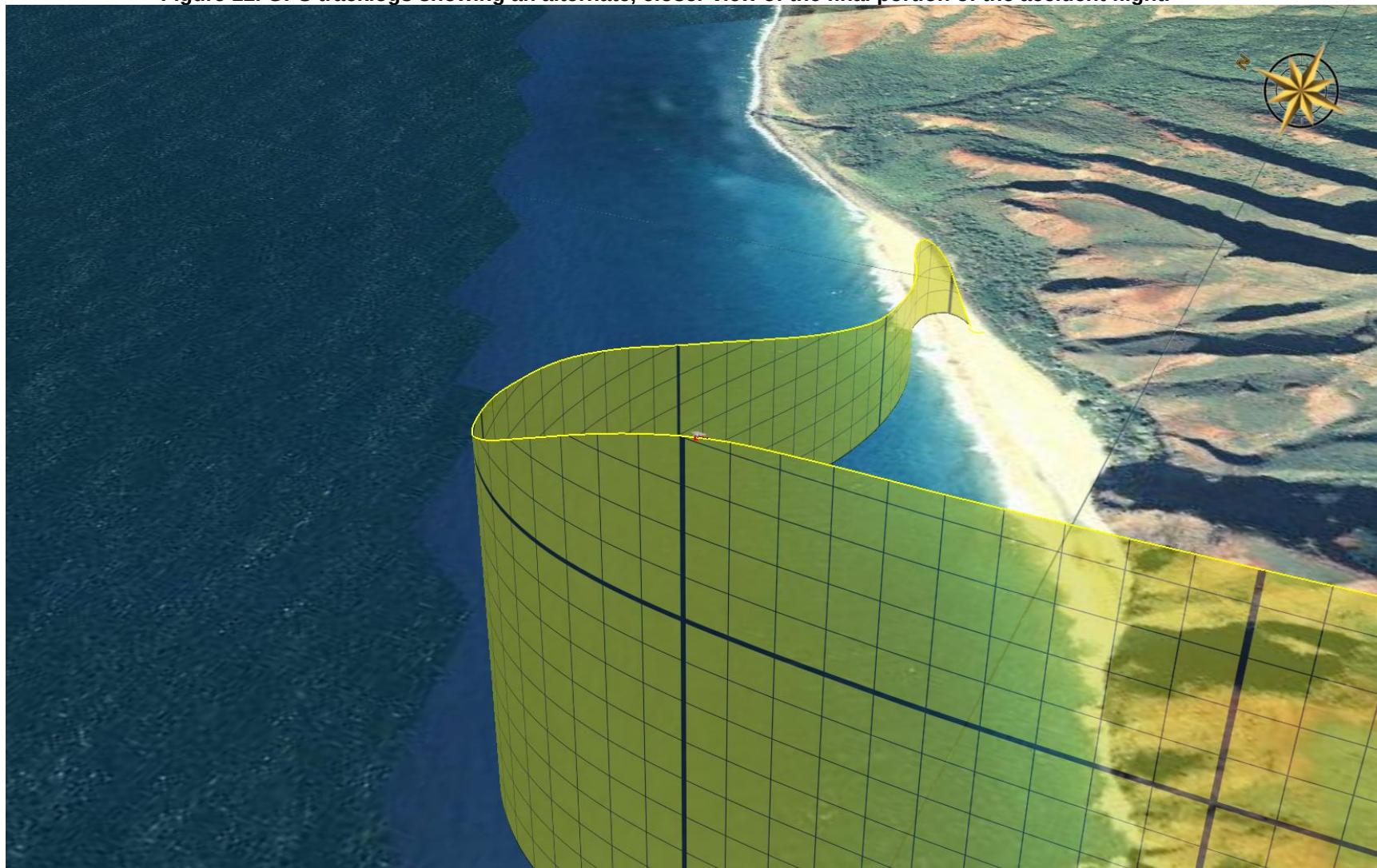


Figure 13. GPS tracklogs showing an alternate view of the final portion of the accident flight.

