

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



GROUP CHAIRMAN'S FACTUAL REPORT OF INVESTIGATION

ANC17FA003

**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

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May 10, 2018

Onboard Image Recorder

Group Chairman's Factual Report

by Sean Payne

1. EVENT

Location: Palmer, Alaska
Date: October 29, 2016
Aircraft: Cessna 172
Registration: N6353E
Operator: Private
NTSB Number: ANC17FA003

On October 29, 2016, about 1445 Alaska daylight time, a Cessna 172 airplane, N6353E, sustained substantial damage after impacting terrain following a loss of control after takeoff from a remote, gravel-covered site adjacent to the Knik River, about 12 miles southeast of Palmer, Alaska. The sole occupant, the student pilot, sustained fatal injuries. The airplane was registered to the student pilot, and was operated as a visual flight rules (VFR) personal flight under the provisions of Title 14 *Code of Federal Regulations* Part 91 when the accident occurred. Visual meteorological conditions prevailed at the time of the accident, and no flight plan was filed. The flight originated from the Wasilla Airport, at an unknown time.

4. DETAILS OF INVESTIGATION

On June 5, 2014, the NTSB's Vehicle Recorder Laboratory received the following devices:

Recorder Model: GoPro Hero 3+
Serial Number: h3b+b06142b2ac2

Memory Card: SanDisk Extreme 32GB microSD

4.1. GoPro HERO 3+ Device Description

The GoPro HERO 3+ Black Edition is a compact, lightweight, POV¹ digital camera enclosed in a ruggedized housing that allows the camera to be mounted in a variety of positions using an array of supported accessories. The device is capable of recording a maximum of 4K² resolution video at frame rate of 15 frames per second (FPS). The camera supports 1080 HD³ as well as other lower quality recording resolutions at higher frame rates. The camera can be set to record still images simultaneously or independently of a video stream at a resolution of up to 12 megapixels.⁴ The camera includes a wide angle aspherical f/2.8 glass lens that provides a maximum of 170 degrees viewing angle. The camera supports recording to micro SD⁵ cards up to 64 GB in size. A built in Wi-Fi⁶ module allows users to connect to the camera either via an accessory remote control or via a smart phone app that permits camera control and image transfer.

4.2. Recorder Damage

The device arrived at the Vehicle Recorder Laboratory with no visible physical damage. Figure 1 shows the condition of the front of the unit as well as the undamaged microSD card.

Figure 1. The condition of the GoPro Camera.



4.3. Video File Recovery

The associated micro SD card was read out using a digital forensic card reader/write blocker which revealed six video files of different types that were determined to be recorded on the accident date. Five of the six files were of .MP4 type and had an associated .THM and

¹ POV – Point of View Shot – A photography technique that records the character's viewpoint from a singular camera location mounted in a manner that represents the character's field of view.

² 4K Resolution – A resolution consisting of a horizontal pixel count of around 4,000 pixels.

³ HD – High Definition – A resolution generally consisting of greater than 480 lines of horizontal resolution.

⁴ Megapixel – (MP) – A count of a million pixels in an image or used to express the number of individual image sensor elements on a digital camera image sensor.

⁵ SD – Secure Digital – a standard for nonvolatile memory card used in portable devices.

⁶ Wi-Fi – A local area wireless technology that allows electronic devices to exchange data over a network.

.LRV file present on the micro SD card. The .THM and .LRV files contained metadata associated with the 5 .MP4 files and were associated with portions of the accident flight recorded on the accident day. The .THM files contain a small image of the first frame of each associated video file, used to support thumbnail previews and the .LRV files contain information to support copy, playback and sharing functionality within the GoPro mobile phone application.

The sixth file set only displayed a .THM file and an .LRV file. It was apparent that the .MP4 file associated with the sixth recording was missing from the microSD card's file structure. In high impact scenarios during which time a camera is recording and sustains an impact, the possibility exists that a corrupted file is produced. A potential missing file in a Windows accessed file system is also possible. The only way to determine if the recording is present is to perform a binary forensic search of the microSD card's contents.

A disk image⁷ was taken of the micro SD card and it was determined that due to the battery likely being ejected upon the aircraft's impact with the ground, the video file did not terminate recording properly and was corrupted. Data recovery software and methods developed by the laboratory were used to recover the .MP4 file associated with the accident. The sixth .MP4 file was recovered and showed the portion of the accident flight right up to and including the aircraft's impact with terrain.

4.4. Timing and Correlation

The recovered video files showed they were recorded on the accident day. This date is set manually by the user on the GoPro. The correlation of the recorded time to the actual time the files were made was not quantified, instead the elapsed time from the beginning of each recording is referenced in the video summary below. The elapsed time is given in the format MM:SS, where MM stands for the number of minutes elapsed and SS stands for the number of seconds elapsed.

4.4. Video Summary

The recovered video files from the GoPro camera provided a view of the forward portion of the aircraft's fuselage as viewed from the left wing. The GoPro was mounted on the left wing of the aircraft, near the left wingtip of the aircraft.

In all recordings, the pilot was wearing a baseball cap and an aviation style headset. The pilot was seated in the left front seat of the aircraft. In general, the pilot was conscious during all recovered recordings. At no point during any of the recordings did the pilot appear to be utilizing the aircraft's installed shoulder harnesses. At times, the pilot was manipulating a device similar in size and shape to a PED.⁸ Those moments when the pilot manipulated the PED, the action corresponded to the beginning or end of a recorded video file.

⁷ Disk Image – a binary record of the entire contents of a memory device.

⁸ PED – Personal Electronic Device

During all video recordings, there was no evidence of any pre-impact mechanical malfunctions or failures with the airframe or engine that would have precluded normal operation of the aircraft.

GOPR0621.mp4

The aircraft was on the ground, in what appeared to be a tie down location. The pilot started the engine. The engine start was nominal. The pilot moved slightly in the cockpit, and near the end of the recording was looking toward the GoPro camera that was mounted on the aircraft's wing. The recording ended at 01:03.

GOPR0622.mp4

The file began as the aircraft was on a final approach leg to Runway 06 at Wolf Lake Airport (4AK6), Palmer, Alaska. The aircraft performed a touch and go. The aircraft appeared to encounter a hard landing and a potential bounce. As the pilot was departing Runway 06, the flaps were retracted quickly while the aircraft was flying in ground effect. The aircraft departed the runway right of centerline. During climbout, the aircraft performed a steep climbing bank to the right. The video file ended at 01:48 as the aircraft was wings level and in a climb attitude. Right before the file ended, the pilot manipulated a device similar in size and shape to a PED.

GOPR0623.mp4

The file began as the aircraft was following river at low altitude. The region appeared to be the Knik River public use area, the nearest city based on geographic features was Palmer, AK. For most of the recording, the aircraft was generally under an estimated altitude of 30 feet AGL.⁹ At 01:48, the aircraft crossed Old Glenn Highway and a set of power lines at an estimated altitude of less than 500 feet AGL. The aircraft resumed flight along the river/riverbed at approximately 30 feet AGL and below after crossing the bridge and power lines. Near the end of the recording, the aircraft gained altitude above approximately 500 feet AGL. The area in which the flight was conducted did not appear populated and no persons were seen during the recording. The duration of the recording was 03:24.

GOPR0624.mp4

The majority of the recorded flight was conducted under 500 feet AGL. At 03:23, the pilot made a touch and go on a gravel sand bar. This gravel sandbar did not appear to be the same region in which the accident occurred. Around 05:25, the pilot made a low approach to the area where the pilot conducted the aforementioned touch and go, however, the pilot did not perform a landing, the aircraft remained in ground effect above the gravel sandbar. At least one set of aircraft wheel tracks from a previous landing was visible on

⁹ AGL- Above Ground Level – Geometric height above the ground.

the gravel sand bar. The video ended as the aircraft was departing the gravel sandbar area, climbing shallowly with the wings level. The duration of the recording was 05:44.

GOPR0625.mp4

The recording began as the pilot was on a low approach to a gravel sand bar. At 00:23, the pilot performed a touch and go on a gravel sandbar. Some tire marks on the gravel sandbar consistent with aircraft operation were noted. The aircraft climbed away from touch and go and remained under 500 feet AGL. Near the end of the recording, the pilot appeared to pull an object of a similar size and shape as that of a PED out of his breast pocket. The recording ended shortly thereafter. The duration of the recording was 00:53.

GOPR0626.LRV

The .LRV video showed a low resolution version of the accident recording that was later recovered (GOPR0626.MP4). The pilot manipulated a device similar in size and shape to a PED as the recording began. The aircraft was configured with full flaps and was descending. A gravel sandbar became in view of the camera around 01:00. The aircraft continued descending on a final approach leg to the gravel sandbar configured for landing with full flaps. At 01:50, the aircraft touched down on the gravel sandbar, the flaps were quickly retracted to approximately a 10 degree down position. At no point during the aircraft's ground roll did the nose wheel touch the gravel sandbar. The aircraft resumed flight around 01:55. The flaps were initially set around 10 degrees. The aircraft appeared to enter a steep climb shortly thereafter, the flap setting appeared to stay in the prior position during the steep climb. The .LRV video ended at 02:07.

GOPR0626.MP4 – Recovered File

The recovered portion of the file was of 1920 x 1080 pixels in resolution. The recovered portion of the video file showed the aircraft continued in a steep climb from the gravel sandbar area where the .LRV file ended. As the aircraft continued to climb, the pilot looked downward and to the left of the aircraft; the pilot appeared to be looking toward the ground below and to the left of the aircraft. Shortly thereafter, the pilot glanced forward toward the windscreen and instrument panel area. The pilot looked downward and to the left toward the ground once again. The aircraft was still in a steep climb, the wings appeared to be level with the horizon in the roll axis. The flaps were still set at about ten degrees down.

As the pilot was looking downward and to the left during the steep climb, the aircraft appeared to begin to yaw to the left. As the aircraft was yawing, the pilot once again looked toward the front of the aircraft; at the same moment, the pilot made a left roll control input on the aircraft's yoke. The portion of the left aileron that was captured in the camera's view showed the aileron moving in a manner corresponding to a left roll command. It was unclear if the pilot's left roll input was a reaction to the onset stall or if the pilot was intentionally attempting to roll the aircraft left. Within two seconds of the yaw

onset, and one second from the pilot's left roll control input, the aircraft was almost completely vertical, in a nose down attitude toward the ground. The terrain visible in the background of the image suggested the aircraft had begun spinning to the left rapidly as the nose was pointed vertically toward the ground. The recovered video file then showed an area of corrupted video that lasted a few seconds. The recovered recording resumed again and the aircraft was still vertically nose down, the ground now visible in front of the aircraft. The aircraft impacted the ground nearly vertically in a nose down attitude and still spinning to the left. The pilot appeared to be conscious and alert as the aircraft impacted the ground. An object similar in shape to a small vehicle or ATV¹⁰ was seen in the background of the video when the aircraft impacted the ground. The recovered video file then began to show a previously deleted recording. No other video evidence of the accident was detected on the GoPro's memory card.

¹⁰ All terrain vehicle