

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

October 27, 2014

Onboard Image Recorder

Specialist's Factual Report
By Sean Payne

1. EVENT

Location: Watkins, Colorado
Date: May 31, 2014
Aircraft: Cessna 150, N6275G
Operator: Private
NTSB Number: CEN14FA265

2. GROUP

A group was not convened.

3. SUMMARY

On May 31, 2014, at an undetermined time, a Cessna 150K airplane, N6275G, impacted terrain 2 miles west of Front Range Airport (KFTG), near Watkins, Colorado. The instrument rated pilot and one passenger were fatally injured. The airplane sustained substantial damage. The airplane was registered to and operated by a private individual under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Night instrument meteorological conditions prevailed for the flight, which did not operate on a flight plan. The local flight originated from KFTG about 0010 mountain daylight time.

4. DETAILS OF INVESTIGATION

On May 30, 2013, the NTSB Vehicle Recorder Division's Laboratory received the following image device(s):

Recording Device: GoPro Hero 3
Serial Number: HD3BB041 331E46E

Recording Device: SanDisk Ultra Micro SDXC 64GB
Serial Number: 32533DG8ZV12M

4.1. Recorder Description

The GoPro HERO 3 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 camera supports 1080 HD² 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.³ 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 SD⁴ cards up to 64 GB in size. A built in Wi-Fi⁵ 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 GoPro camera arrived to the laboratory in an undamaged state. The lens and rear communications port was found to have trace amounts of debris. The rear battery door was missing, however, the unit was shipped with the battery in place. The GoPro was unable to power up using a charged battery. The SanDisk Ultra MicroSDXC 64GB memory card also arrived undamaged and was read out normally on a PC using a forensic write blocker. Figure 1 shows the condition of the GoPro Hero, figure 2 shows the condition of the SanDisk SDXC memory card.

Figure 1. The condition of the GoPro Camera.



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.

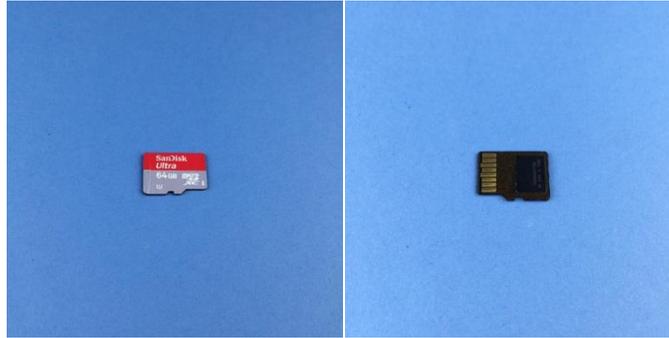
² HD – High Definition – A resolution generally consisting of greater than 480 lines of horizontal resolution.

³ 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.

⁴ SD – Secure Digital – a standard for nonvolatile memory card used in portable devices.

⁵ Wi-Fi – A local area wireless technology that allows electronic devices to exchange data over a network.

Figure 2. The condition of the micro SD card.



4.2.1. Video Files

The majority of the files were delivered in an MP4⁶ format of 1280 x 960 resolution at 47 frames per second with a 128kbps⁷ audio track that captured engine and cockpit noise in stereo. The GoPro, which was mounted to the instrument panel area in front of the pilot, was facing toward the rear of the aircraft and captured the front seat occupants as well as a view out of the left and right windows and portions of the rear window. Figure 1 shows the field of view of the rearward facing GoPro camera for most of the recording.

The SD card file structure contained files consistent with a GoPro recording in normal operation. Seven .MP4 video files were contained on the card. The files, duration and timestamp information is shown below in Table 1.

Table 1. Video files found on the SDXC memory card.

Filename	Timestamp Information	Duration (MM:SS)	Contained Accident?
GOPR0016.MP4	05/29/2014 10:59 PM	00:40	No
GOPR0017.MP4	05/29/2014 11:11 PM	08:08	No
GOPR0018.MP4	05/29/2014 11:20 PM	07:06	No
GOPR0019.MP4	05/29/2014 11:39 PM	17:25	No
GP010019.MP4	05/29/2014 11:46 PM	06:51	No
GOPR0020.MP4	05/30/2014 12:00 AM	10:07	No
GOPR0021.MP4 ⁸	05/30/2014 11:10 AM	14:13	No

After review of the recorded contents, it was determined that none of the files contained the accident flight. A disk image of the memory card was then made using forensic software. The disk image was then input to forensic photo and video recovery software to search for lost files. The photo and video forensic software turned up a variety of deleted recordings and .THM files associated with other recordings. None of these files were found to be related to the accident.

A teleconference was held with engineers from GoPro in San Mateo, California regarding this accident and similar accidents involving the use of GoPro cameras exposed to high velocity impact scenarios. It was determined that an associated .THM file should be found on the memory card had the GoPro

⁶ MPEG-4 Part 14 -- A digital multimedia container format used to store video and audio.

⁷ kbps – kilobits per second.

⁸ This video was recorded at a resolution of 1920 x 1080 pixels.

camera been recording at the time of impact. A .THM file is essentially a low resolution screenshot of the first video frame which serves as a thumbnail image of the video recording when displayed in a computer file structure or when using the GoPro Wi-Fi smartphone application. The absence of a .THM file that corresponded with the accident flight would indicate that the camera was likely not recording.

Additionally, the forensic disk image was searched bit by bit using software capable of viewing binary code. The disk image did not show traces of a missing video file that would have corresponded to the accident recording using current laboratory techniques.

4.3. Timing and Correlation

Time is expressed as video elapsed time, which is time from the beginning of the recording. Times are expressed as MMSS, where MM represents elapsed minutes and SS seconds of elapsed video.

The timestamp information shown in Table 1 was likely incorrect and a result of the camera's internal clock being set incorrectly. Since the GoPro camera was unable to power up after the accident, a time offset to correct for the incorrect timestamp was unable to be determined.

4.4. Summary of Recording Contents

In agreement with the Investigator-In-Charge, a video group did not convene and a summary report was prepared. The summary below covers recordings of previous flights that were discovered on the memory card. The previous flights were deemed relevant to the accident investigation as they show the operational habits of the pilot.

GOPR0016.MP4 – 5/29/2014 – 10:59PM – Daylight

Pilot and passenger (Passenger #1) are getting belted in. The pilot makes some keyboard entries to his PED and reaches to the back compartment of the aircraft to grab a notepad. Recording ends.

GOPR0017.MP4 – 5/29/2014 – 11:11 – Daylight

Taxiing with Passenger #1 from file GOPR0016.MP4. The aircraft is taxiing toward an unknown runway via multiple taxiways. The pilot can be seen making radio calls and at times, adjustments to devices in the vicinity of the instrument panel. The pilot and Passenger #1 are speaking in a language other than English. The pilot appears to perform an engine run-up while taxiing. Later, the controller asks the pilot if he wants to do a run-up. The pilot's response is muffled by the engine noise on the audio track and his actions are consistent with the pilot indicating that he said he had already completed it. The video recording ends before the pilot reaches the active runway.

GOPR0018.MP4 – 5/29/2014 – 11:20 – Daylight

Video starts at takeoff roll. The passenger is still Passenger #1 from the previous video files. The pilot takes off and it appears that he flies a large right pattern for

the active runway. The pilot takes a few selfies⁹ using a Personal Electronic Device (PED), likely a cell phone, on base near final and possibly also on final. The pilot's PED screen can be seen in camera mode. Passenger #1 is also taking selfies and forward facing photographs with his own PED for approximately the last two minutes of video. The pilot makes an uneventful landing. Passenger #1 appears to begin recording a short video. The pilot clears the runway and receives taxi instructions from ATC¹⁰ and the video ends.

GOPR0019.MP4 – 5/29/2014 –11:39 – Daylight

The video begins near the hangar area. A new passenger (Passenger #2) is with the pilot now. The pilot does not appear to do a pretakeoff check in the time captured by the video recording. The pilot taxis to the runway and is cleared for takeoff. The pilot makes an uneventful takeoff. Passenger #2 is following the pilot's flight control manipulations on the control yoke for the duration of the entire flight but it appears that Passenger #2 is not actively manipulating the controls or adding additional control pressure. The pilot makes some slight negative G control movements. Passenger #2 is entertained. The pilot takes some selfies on what appears to be the downwind leg. The pilot makes an uneventful landing, taxis back to the hangar area and picks up a new passenger (Passenger #3) without shutting the engine down. Passenger 3 buckles in and puts on a headset. Passenger #3 is using his PED to take multiple selfies during taxi. The pilot picks up tail end of "Information Lima" ATIS¹¹ recording and then makes an input to a device near the instrument panel. The pilot appears to make some keyboard entries on his PED while he is taxiing. The use of a checklist or pre-flight check was not detected in the recording. The pilot takes off while Passenger #3 appears to be recording a video using his PED. The pilot moves Passenger #3's PED out of his line of sight at one moment. Later the pilot can be seen taking selfies during the climbout portion of the flight. Passenger #3 is using his PED to take more selfies during flight. The video segments to new chapter recording (next file, GP010019.MP4) as the aircraft is turning crosswind.

GP010019.MP4 – 5/29/2014 –11:46 – Daylight **Continuation of GP010019.MP4**

Passenger #3 is continuing to use his PED to take selfies and what appears to be a video recording. The pilot can be seen making keyboard entries to his PED during portions of the flight. The pilot conducts some mild and slight negative G manipulations of the control yoke. Passenger #3 is continuing to use his PED to take selfies and possibly videos. The pilot lands uneventfully and taxis back to the hangar area, Passenger #3 is still using his PED to take selfies. The pilot's associates and previous passengers walk to the aircraft to greet Passenger #3. The group uses their PEDs to take photos. At this time, Passenger #4 enters the cockpit and the video recording ends.

⁹ Selfie – A photograph that one has taken of oneself, typically one taken with a smartphone or webcam and shared via social media.

¹⁰ ATC – Air Traffic Control.

¹¹ ATIS – Automated Terminal Information Service.

GOPR0020.MP4 - 5/30/2014 –12:00 – Daylight

The recording begins as the pilot and Passenger #4 appear to be back taxiing to a runway. The pilot is cleared for takeoff on Runway 08 and instructed to make right closed traffic¹². The pilot performs an uneventful takeoff. During the climb-out phase the pilot can be seen making keyboard entries to his PED. The pilot makes additional keyboard entries to his PED on a portion of flight consistent with a downwind leg. During this time the pilot makes three distinct and separate interactions with his PED. The pilot performs some small wing rocks during the downwind leg. Passenger #4 is seen taking selfies and videos throughout the landing portion of the flight. The pilot taxis back to the hangar area and shuts down on the ramp. A language other than English is heard. The video file ends.

GOPR0021.MP4 – 5/30/2014 –11:10 AM – Night

Video recording begins at the hangar area. A new passenger, Passenger #5 is now onboard. The pilot's associates can be seen standing near the hangar behind the aircraft. A sound similar to the pilot pumping the primer is heard. The pilot starts the engine. The following ATIS recording can be heard through the GoPro's internal microphone:

Denver Front Range Airport automated weather observation zero-six-zero-five (0605) zulu weather – winds calm, visibility [seven]¹³, ceiling three-hundred overcast (300), temperature one-four Celsius (14) dew point one-three (13) altimeter three-zero-two-zero (30.20).

The pilot taxis to a runway. It appears that the pilot conducts an engine run-up during taxi. The pilot can be seen checking for freedom of control movement in the control yoke during taxi. The pilot begins the takeoff roll and takes off. During the climbout portion of flight, the pilot uses his PED to take a selfie. The camera's flash is activated at this time. The pilot's PED appears to be on a user screen consistent with using a camera application. The pilot lands and can be seen using his PED during landing rollout. The recording appears to have ended normally.

¹² Right Closed Traffic – The pilot flies the traffic pattern of an airport making right turns only, without leaving the traffic pattern.

¹³ Brackets - [] - indicate an uncertainty in the transcription.

Figure 1: A digital illustration of the field of view of rearward facing image recorder.

