

NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

March 28, 2016

Onboard Image Recorder

Specialist's Factual Report
By Sean Payne

1. EVENT

Location:	Corona, California
Date:	06/28/2015
Aircraft:	Great Lakes 2T-1A, N7LM
Operator:	Private
NTSB Number:	WPR15FA200

2. GROUP

A group was not convened.

3. SUMMARY

On June 28, 2015, about 1214 Pacific daylight time (PDT), an experimental amateur-built Great Lakes 2T1A-E, N7LM, collided with terrain near Corona, California. The pilot/owner was operating the airplane under the provisions of Title 14 *Code of Federal Regulations* (CFR) Part 91. The private pilot sustained fatal injuries, and one passenger sustained serious injuries. The airplane was destroyed during the accident sequence. The local personal flight departed Corona at an undetermined time. Visual meteorological conditions (VMC) prevailed, and no flight plan had been filed.

4. DETAILS OF INVESTIGATION

On June 30, 2015, the National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following imaging device:

Recorder Manufacturer/Model:	GoPro Hero 4 Silver
Recorder Serial Number:	C313112 4608350

4.1. Recorder Description

The GoPro HERO 4 Silver 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 1080p² resolution video at 60 frames per second (fps). The camera supports 720 HD³ as well as other lower quality recording resolutions at higher frame rates. The camera can be set to record still images simultaneously or independent of a video stream at a resolution of up to 12 megapixels.⁴ The camera supports recording to MicroSD⁵ 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. The camera also includes a built-in rear facing LCD touch screen which permits image file preview and camera control functions.

4.2. Recorder Damage

Upon arrival at the NTSB Vehicle Recorder Division, it was evident that the GoPro Hero 4 had not sustained any heat or structural damage. The video and audio information was extracted from the device's MicroSD card using a digital forensic write blocker⁷, without difficulty.

4.3. Video Files

A number of video and still picture files were downloaded from the device's MicroSD card. Only two recordings, files GOPR2523.MP4 and GOPR2524.MP4, contained portions of the accident flight and were examined. The timestamps of these files were consistent with the date of the accident. No other files downloaded from the device's MicroSD card contained metadata that was consistent with being recorded on the day of the accident.

The video files were recorded at a resolution of 1920 x 1080 pixels at a frame rate of 30 fps in color. The recording also contained a stereo audio track recorded at a sample rate of 48 kHz. The recording device was enclosed in a sealed case which muffled the recorded audio track. Wind noise and engine

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 1080p Resolution – 1920 x 1080 pixels using progressive recording.

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 MicroSD – a miniaturized Secure Digital flash memory device commonly used in personal electronic devices.

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

⁷ Forensic Write Blocker – A hardware device that prohibits digital manipulation of electronics files on a hardware memory device.

noise were detected on the audio track throughout both recordings. File GOPR2523.MP4 was 3 minutes and 3 seconds in length and file GOPR2524.MP4 was 17 minutes and 43 seconds in length.

The camera was mounted using a plastic accessory fixture to an aircraft wing strut on the right side of the accident aircraft. The camera provided a rearward view of both the front seat passenger and rear seat pilot. The field of view also included the left aileron, the rudder, and the elevator. During portions of the flight, the pilot's hand on the stick could occasionally be seen through an access hole between the front seat and rear seat cockpits. Figures 1 and 2 show a screenshot from the camera's mounting position.

4.4. Timing and Correlation

The times used in this report are expressed as Local Time of the accident (PDT) using a 24 hour clock. The GoPro recovered from the accident was repowered in the laboratory and a time offset was created to bring the camera's timestamp into alignment by comparing the camera's metadata to an internet clock.

The time offset for each video file is as follows:

GOPR2523.MP4 – 232 seconds = PDT

GOPR2524.MP4 – 232 seconds = PDT

4.5. Summary of Recording Contents

In agreement with the Investigator-In-Charge, a video group did not convene and a summary report was prepared.

4.5.1. Video Recording One: GOPR2523.MP4

The recording began at 11:50:23 capturing a view of the rear seat pilot activating the GoPro camera using an electronic wristwatch-like device on his right forearm. The engine was running at a low power setting and the aircraft was taxiing in the vicinity of a hold short line next to a runway. By 11:50:30, the aircraft had come to a stop adjacent to a hold short line. The rear seat pilot looked left and right while the aircraft was stopped.

Around 11:50:43, the rear seat pilot spoke into his headset boom microphone. Shortly after at 11:50:49, engine noise increased and the aircraft began taxiing again. By 11:50:56, the aircraft crossed the hold short line and by 11:51:08, the aircraft had lined up with the runway centerline and the pilot applied power to begin the takeoff roll. By 11:51:22 the aircraft had become airborne and entered a brisk climb. Around 11:51:33, the aircraft's climb attitude had lessened and the aircraft continued to climb on runway heading. The rear seat pilot looked to the left and right of the aircraft throughout the recording.

By 11:52:12, the aircraft had entered a shallow left banked turn. The video file terminated at 11:53:26 as the pilot pressed a button on the wristwatch-like device that was associated with the GoPro camera. By this time, the aircraft had leveled its initial climb, a power reduction was audible and the wings had returned to near level with the horizon. The airport from which the aircraft departed was seen just off of the aircraft's left wing.

4.5.2. Video Recording Two: GOPR2524.MP4

The video file began at 11:58:09 with the aircraft in level flight over a mostly unpopulated area. The rear seat pilot looked toward the attached camera that made the recording. The rear seat pilot and front seat passenger looked to the left and right of the aircraft's cabin. At times, the rear seat pilot and front seat passenger spoke into their respective headset mounted boom microphones.

Around 12:00:49, the aircraft ceased straight and level flight and entered a shallow banked right turn over an industrial holding tank. By 12:01:17, the aircraft had passed over a reservoir and had returned to mostly straight and level flight. By 12:02:39, the aircraft reached the shoreline of the reservoir and conducted a moderately banked left turn. Around 12:02:59, the aircraft entered a moderately banked right turn. Portions of an unpopulated area and the reservoir were below the aircraft.

By 12:02:59, the aircraft had entered a moderately banked left turn. The pilot appeared to have conducted a 360 degree turn around a point. By 12:03:24, the aircraft had re-entered straight and level flight. The pilot spoke into his headset mounted boom microphone during portions of the flight.

Around 12:03:53, the aircraft entered a steeply banked right turn. The front seat passenger looked toward the ground and smiled. At 12:04:01, the aircraft swept back into a steeply banked left turn. At 12:04:09 a notable decrease in engine power was audible. Figure 1 shows the angle of the aircraft's bank at this time. One second later, the nose sharply fell through the turn, the aircraft appeared to depart controlled flight and entered an aerodynamic stall. The pilot immediately reacted to the upset. The control positions were seen as follows: up elevator, right rudder, left roll aileron. The pilot continued to manipulate positions of all control surfaces and by 12:04:14, the aircraft had become level and began pulling out of a descent. At no time during the recovery was the elevator surface seen in a position other than a nose up command. By the time of recovery, the elevator had become neutral, along with the rudder and ailerons.

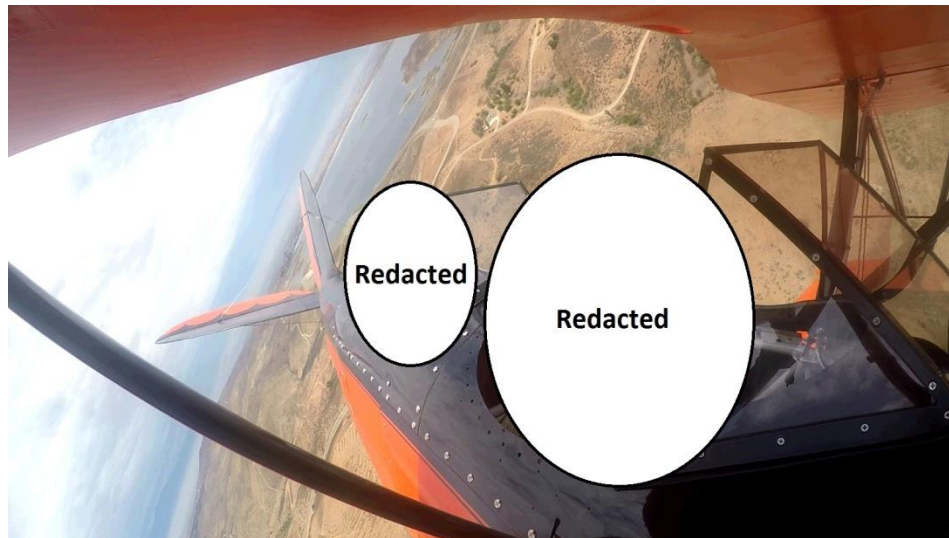


Figure 1. The aircraft's attitude at 12:04:09 just prior to the first departure from controlled flight.

By 12:04:19, a slight change in the aircraft's power was audible and the aircraft appeared to regain power. The rear seat pilot spoke into his headset mounted boom microphone, the front seat passenger then laughed. The aircraft had lost an unquantifiable amount of altitude and did not appear to significantly regain any altitude it had lost during the departure from controlled flight as the aircraft began to enter the next maneuver, which was a moderately left bank turn.

Throughout the left turn, the elevator position became increasingly more positive. Around 12:04:29, a further decrease in engine noise was audible. Two seconds later, at 12:04:31, the aircraft continued into the moderate left bank turn and the camera began shaking in a manner consistent with airframe buffeting. Figure 2 shows the condition of the aircraft's attitude at 12:04:31. One second later, at 12:04:32, the aircraft began to depart controlled flight. The aircraft's elevator control surface commanded a nose up pitch attitude. By this moment, the aircraft had begun to roll sharply to the left. By 12:04:33, the aircraft's roll attitude had become almost 90 degrees left in reference to the horizon. By 12:04:34, the engine's sound was non-nominal. The aircraft began a quick descent while rolling sharply left and back to the right. This roll condition repeated until ground impact. The aircraft was seen moving quickly toward the ground and by 12:04:39, the first indication of impact appeared and the aircraft struck pine-like vegetation with the left wing. In the same second, the camera had broken free of it's mounting position and began rolling in debris. One second later, at 12:04:40, the camera had come to rest and continued recording. The front seat female passenger's voice was audible for the remainder of the recording which ended at 12:15:52.

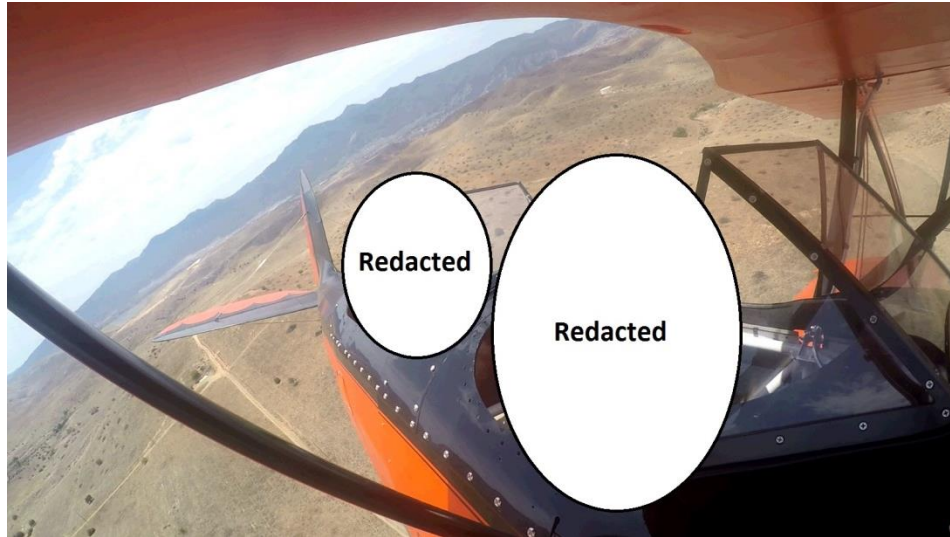


Figure 2. The aircraft's attitude at 12:04:31 just prior to the second and last departure from controlled flight.

During the aircraft's descent to impact, the control surfaces were observed in the following manner:

The elevator was mostly in a full nose up command position. At brief moments during the descent, the elevator command had slightly relaxed; however, the position mostly displayed a full nose up pitch command.

The rudder swung full left and full right in the direction opposite of the aircraft's rolling motion as the descent continued until ground impact.

The lower wing's left aileron was seen moving to roll command positions opposite of the aircraft's rolling direction as the descent continued toward impact. The magnitude of the aileron command position could not be characterized.