

# National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR16FA036

## **ONBOARD IMAGE RECORDER**

Specialist's Factual Report - Supplemental

January 25, 2023

## **A. ACCIDENT**

Location: Hurricane, Utah  
Date: December 10, 2015  
Time: 13:47 mountain standard time (MST)  
Airplane: Van's Aircraft RV7, N307AB

## **B. ONBOARD IMAGE RECORDER GROUP**

Group Chair Sean Payne  
Branch Chief  
National Transportation Safety Board (NTSB)

Specialist Clint Crookshanks  
Structures Group Chair  
NTSB

## **C. DETAILS OF THE INVESTIGATION**

In agreement with the Investigator-in-Charge, an Onboard image Recorder Addendum group was convened on July 13, 2022, to examine new photographic information recovered and the following supplemental information was prepared.

The NTSB Vehicle Recorder Division received the following image files:

Device Manufacturer/Model: GoPro HERO 4 Session  
Device Serial Number: C3141324890770.  
Filenames: Multiple

### **1.0 Device Condition**

Refer to the Onboard Image Recorder - Specialist's Factual report which can be found in the public docket for this accident.

### **1.1 Device Description**

Refer to the Onboard Image Recorder - Specialist's Factual report which can be found in the public docket for this accident.

### **2.0 Image/Video File(s) Information**

The device was lightly damaged in a high impact scenario during the event. An initial readout of the device's media in 2015 did not produce files that were a record of the accident.

Image recorders exposed to high impact scenarios have the potential to produce corrupted, missing, or unplayable media files due to abrupt cessation of power to the recording device or the ejection of the device's removable media card. A standard laboratory software file carving procedure was initially used in December 2015, when the NTSB first received the device. The purpose of this search was to examine the device's media for potentially missing video and image files. The initial examination in December 2015 produced 25 files that were native to the device's media (not corrupted) and 53 fragments of video (likely deleted files by the user that were still present on the media). These fragments were a mixture of files recorded in an aircraft that was consistent with the accident aircraft, as well as a number of files that were recorded in a transport category jet. None of these fragments that were recovered using this method produced files related to the accident sequence.

The initial file carving method looked only for video (.mp4) type files and did not look for other types of files, such as still images. An image file of the device's media was retained by the NTSB lab for future use if more advanced file carving methods became available.

In 2022, the NTSB began using an updated file carving process. The image file from this device's media was searched using the new file carving process. In this instance, both videos and still image files were attempted to be recovered.

The updated file carving method produced a number of video fragments consistent with the files recovered in December 2015, however, the process also produced a number of JPEG files that were not recovered previously. Of the recovered JPEG files, 29 files were consistent with having been recorded on the accident flight. These files metadata suggested they were captured in a time lapsed still image mode, which is a capture mode that initiates a .JPG sequence to be recorded when the user presses the device's shutter button. More than half the images in the timelapse mode captured the accident sequence.

### **3.0 Timing and Correlation**

Metadata from the first recovered .JPG that was captured in burst mode showed that the file was created on December 10, 2015, at a time of 13:34:47 local. The last JPG recovered showed that the file was created on December 10, 2015, at a time of 13:37:24 local.

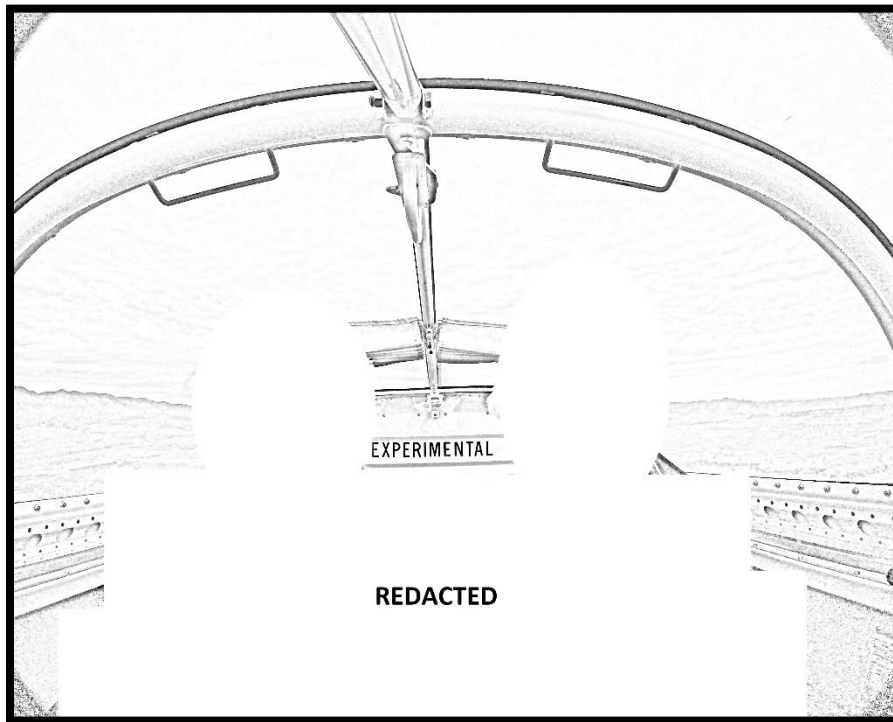
Furthermore, the data suggested the series of 29 images were captured at two distinct times, with the first interval (photos 1-13) recorded between 13:34:47 and 13:35:21), and the second interval (photos 14-29) recorded between 1:36:43 and 1:37:24).

#### 4.0 Summary of Recording Contents

The 29 recovered files were consistent with having been recorded in a timelapse still image mode at an interval of around 3 seconds per photo. According to the timing information discussed in the previous section, approximately 2 minutes and 37 seconds elapsed between the first recovered JPG and the last recovered JPG, with the data suggesting there were two distinct and separate intervals captured.

The GoPro Hero 4 Session is able to be remotely controlled by a mobile device application. At times during the recording, the pilot's eyes are diverted toward his lap, in the last two frames, the pilot was holding a mobile device.

In all images, the camera was mounted near the aircraft's glareshield and was pointed rearward towards the pilot and passenger. The occupants were visible from the waist up. Both occupants were wearing "Santa hats" and aviation headsets. A portion of the upper windscreen and the aft windscreen bow with both grab handles was visible. Most of the canopy and portions of both side rails were visible. The photographs suggested the occupants were attempting to capture a "selfie" from the GoPro's timelapse mode. Figure 1 is a digital sketch based on one of images captured in the sequence. The occupants of the aircraft have been redacted.



**Figure 1.** A digital illustration based on one of the images captured in the sequence. The occupants have been redacted.

In all figure descriptions, the photos are annotated using the aircraft's coordinate system. For example, forward would indicate the direction towards the aircraft's nose, and left would indicate to the aircraft's left wing when looking forward toward the nose.

The following were noted from the image sequence:

### **Photos 1 to 13 (Time 13:34:47 - 13:35:21)**

- The first 13 images differed in heading and location from the remaining 16 photos.
- The aircraft was flying nominally northeast with the sun directly behind the airplane.
- The skies were overcast, and the sun was mostly obscured by clouds.
- The airplane was nominally in straight and level flight at a constant pitch for the first 6 photos.
- Photos 7-10 showed an apparent pitch decrease.
- Photos 7-12 showed a slight roll right followed by slight roll left.
- A flattop mesa was visible on the aft right side of the airplane.
- A distant mountain range was visible on the aft left side of the airplane.
- The terrain was mountainous desert and sparsely populated.
- The canopy latch was engaged in all photos.
- In 11 of the 13 photos, the pilot's eyes were directed down toward his lap. In the other two photos, the pilot's eyes were directed forward.
- The passenger's (right seat) eyes were directed down toward the pilot's lap for the first two photos and then in varying locations for each of the remaining photos.
- The passenger's left hand was on the headset microphone in photo 12.

### **Photos 14-29 (Time 13:36:43 - 13:37:24)**

#### **Photo 14**

- Starting here, the airplane was in a different location, the sun was not visible to the rear, the lighting in cockpit was brighter, and the terrain was different.
- Mountains were visible on the horizon and the skies were overcast.
- Airplane roll attitude was essentially wings level.
- Airplane pitch attitude was essentially level with horizon visible and intersecting just below top of aft cockpit bulkhead.

- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- A mesa with dark rimrock features was visible just above the left canopy rail.
- A mesa with red rimrock features was visible just above the right canopy rail.
- The edge of a lake was visible at the forward end of the right canopy rail.
- The pilot was looking down, the passenger was looking forward, and both had eyes mostly closed.
- The shoulder harnesses were buckled on both and remained that way in the subsequent photos.

### **Photo 15**

- Airplane roll attitude was mostly unchanged from previous photo.
- Airplane pitch attitude was unchanged from previous photo.
- The yellow vertical stabilizer was visible on the left side of the center bow.
- Pilot was looking forward with eyes open, passenger was looking forward directly into GoPro.
- More of the lake was visible at the forward end of the right canopy rail.

### **Photo 16**

- Airplane roll attitude was still wings level.
- Airplane pitch attitude was increased with the horizon moving up in the frame.
- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- More of the lake was visible at the forward end of the right canopy rail.
- Pilot was looking forward with eyes open, passenger was looking forward directly into the GoPro.

### **Photo 17**

- Airplane roll attitude was still wings level.
- Airplane pitch attitude was increased with the horizon moving up in the frame.
- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- More of the lake was visible at the forward end of the right canopy rail.
- Buildings and green fields were visible at the base of a cliff out the left side.
- Both occupant's shoulders were slightly lower in the frame (consistent with an increased positive g load).

- Pilot was looking forward with eyes open, passenger was looking forward and directly into the GoPro.

### **Photo 18**

- Airplane roll attitude was still wings level.
- Airplane pitch attitude was increased with the horizon moving up in the frame.
- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- More of the lake was visible at the forward end of the right canopy rail, the edge of a smaller adjacent lake was visible, buildings were visible near the lakes.
- More buildings and green fields were visible at the base of the cliff out the left side.
- Pilot was looking forward with eyes open, passenger was looking forward directly into the GoPro.
- Pilot's head had moved closer to the center of the airplane (in a manner of which they are closer together).

### **Photo 19**

- Airplane roll attitude approximately 15° right bank (with respect to nominal horizon).
- Airplane pitch attitude essentially unchanged from previous photo.
- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- More of the lake was visible out the right side, the smaller adjacent lake was fully visible, and a large white building near the lakes was visible.
- Buildings and green fields were no longer visible out the left side
- Both occupants were looking forward directly into the GoPro with eyes open, their heads had moved closer to center of airplane (in a manner of which they are closer together).

### **Photo 20**

- Airplane roll attitude was about 54° right bank (with respect to nominal horizon).
- Airplane pitch attitude was increased from previous photo.
- The yellow vertical stabilizer was obscured by the pilot's head.

- Most of the lake was visible out the right side, the smaller adjacent lake was fully visible, and the large white building near lakes was visible.
- Rectangular and trapezoid shaped green fields were visible out the right side.
- Only sky was visible out the left side.
- Both occupants were looking forward directly into the GoPro with eyes open.
- Pilot's upper body and head had moved toward center of airplane (in a manner of which they are closer together).
- Passenger's upper body and head had moved to right.
- Lighting was dimmer.

### **Photo 21**

- Airplane roll attitude was about 95° right bank (with respect to nominal horizon).
- Airplane pitch attitude was increased from previous photo.
- The yellow vertical stabilizer was obscured by the pilot's head.
- The lakes were no longer visible out the right side.
- Rectangular and trapezoid shaped green fields were visible out the right side.
- Mostly sky was visible out the left side, horizon was visible near left side of the center canopy bow.
- Both occupants were looking forward directly into the GoPro with eyes open.
- Occupant position was mostly unchanged.
- Lighting was dimmer.

### **Photo 22**

- Airplane roll attitude was about 153° right bank (with respect to nominal horizon).
- Airplane pitch attitude appeared increased from previous photo.
- The yellow vertical stabilizer was obscured by the pilot's head.
- A portion of the trapezoid shaped green field was visible out the upper left side.
- The horizon was visible out the left side.
- Pilot was looking forward with eyes open, passenger was looking forward directly into the GoPro Both occupants' upper bodies and heads had moved slightly left.
- Lighting was dimmer

### **Photo 23**



- Airplane roll attitude was inverted, about 185° right bank (with respect to nominal horizon, continue to roll through).
- Airplane pitch attitude had increased from previous photo.
- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- Rectangular and trapezoid shaped green fields were visible out the upper left side.
- Pilot was looking forward with eyes open, passenger was looking left toward pilot with eyes open.
- Both occupants' upper bodies and heads had moved several inches up, out of their seats (consistent with increased negative g load).
- Both Santa hat tails, the passenger's hair, and the passenger's headset cord had fallen down with respect to the earth (up with respect to the airplane), and passenger's left hand was up near throat.
- Lighting was slightly brighter than previous photo.

#### **Photo 24**

- Airplane roll attitude was inverted, about 220° right bank (with respect to nominal horizon).
- Airplane pitch attitude had increased significantly since previous photo.
- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- Mostly sky was visible outside, terrain was visible in upper left and upper right corners of photo.
- Pilot was looking up and forward, passenger was looking left toward pilot.
- Both occupants' upper bodies and heads had moved several inches down close to original position (consistent with increased positive g load).
- Both Santa hat tails, passenger's hair, and passenger's headset cord had returned close to original position, passenger's left hand was near stomach.
- Lighting was brighter.

#### **Photo 25**

- Airplane roll attitude unknown, no visual references outside.
- Airplane pitch attitude unknown, apparent increase when compared to previous photo and clouds.

- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- All sky and no terrain was visible.
- Pilot was looking downward toward lap or lower portion of instrument panel with eyes open, passenger was looking up and forward with eyes open.
- Both occupants' upper bod and heads moved slightly lower than previous photo (consistent with increased positive g load).
- Passenger's right hand was on the right canopy rail.
- Passenger's left hand was still near stomach.
- Lighting was brighter.

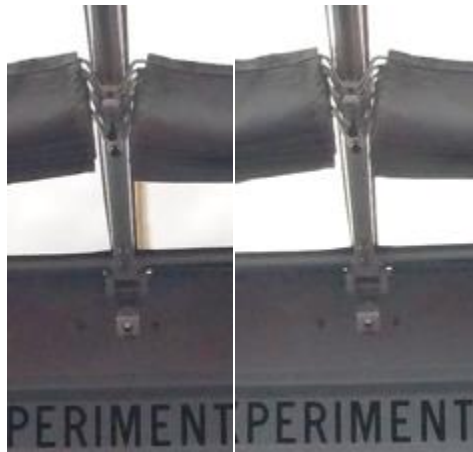
### **Photo 26**

- Airplane roll attitude unknown, no visual references outside.
- Airplane pitch attitude unknown, apparent increase based on clouds.
- The yellow vertical stabilizer was visible on the left side of the center canopy bow.
- All sky and no terrain was visible, clouds just above the horizon were visible out the aft, left side.
- Pilot was looking downward toward lap or lower portion of instrument panel with eyes open, passenger was looking forward with eyes open.
- Both occupants' upper bodies and heads had moved lower than previous photo (consistent with increased positive g load).
- Passenger's right hand was on the right grab handle.
- Passenger's left hand was still near stomach.
- Lighting was dimmer.

### **Photo 27**

- Airplane roll attitude was about 25° left bank.
- Airplane pitch attitude appeared nose down with horizon intersecting aft left canopy rail on left side.
- The yellow vertical stabilizer was not visible on the left side of the center canopy bow. Figure 2 shows the location of the vertical stabilizer in photo 26, next to it is a screen shot of the same location in photo 27. The photo has been cropped in such a way that the occupants have been redacted.
- Terrain was visible out the left side.
- Pilot and passenger both looking forward with eyes open.

- Both occupants' upper bodies and heads had moved lower than previous photo (consistent with increased positive g load).
- Passenger's right hand was on the right grab handle, head had moved right.
- Passenger's left hand was still near stomach.
- Lighting was slightly brighter.



**Figure 2.** A comparison of the location of the vertical stab in photo 26 (left) and photo 27 (right). In photo 26, the yellow vertical stab is visible, in photo 27 it is absent.

### Photo 28

- Airplane roll attitude was inverted, about 165° right bank.
- Airplane pitch attitude could not be determined.
- The yellow vertical stabilizer location was obscured by the occupants.
- Terrain was visible but blurry aft of the airplane.
- Pilot was displaced up with shoulders several inches above left canopy rail, headset was partially off, right hand with mobile device was near the canopy latch, the headset volume control was near left ear, the red tabs on the shoulder harnesses were not visible (consistent with increased negative g load).
- Passenger was displaced up with shoulders several inches above right canopy rail, head was obscured by an unknown object, right hand was on the right grab handle, upper legs were visible, the red tabs on the shoulder harnesses were not visible, the headset volume control was near windscreen bow, left hand was near pilot's right hand (consistent with increased negative g load).
- The right side of the canopy was separated from the fuselage.

- An unknown item was visible aft of airplane in the airstream by the pilot's left ear.
- Lighting was much dimmer.

## **Photo 29**

- Airplane roll attitude was inverted, about 202° right bank.
- Airplane pitch appeared increased from previous photo.
- The yellow vertical stabilizer location was obscured by occupants.
- Terrain was visible aft of the airplane.
- The canopy was separated and not visible, there was deformation of the left canopy rail.
- Pilot was displaced up further, hips and upper legs were visible, head and arms were flailed up and aft, mobile device was still in right hand, top of seat back was about mid torso, and the headset was separated and not visible (consistent with increased negative g load).
- Passenger was displaced up further, torso and legs were rotated right, the right foot and lower leg were above and outboard of the right canopy rail, the left knee was above the canopy rail, head and arms were flailed up and aft, the headset was separated and not visible, the top of the seat back was near the lower back, and the seat belt appeared partially unbuckled (consistent with increased negative g load).
- Lighting was much brighter.

## **Summary**

Based on comparison of terrain features, buildings, and lakes between photos 14-29 and Google Earth, the airplane is initially heading southbound over a sparsely populated mesa southwest of Hurricane. In some of the photos, the pilot and passenger were looking toward the pilot's lap, in some they were looking towards the GoPro, and at times during the maneuver, the pilot was looking downward. The pilot appeared to roll the airplane right to an inverted position and appeared to pull back into a split-S maneuver that resulted in a northbound heading. As the airplane almost gets to wings level, it appeared that the vertical stabilizer was no longer with the aircraft. Between photos 27 and 28 the airplane went from an almost wings level attitude to inverted with an apparent substantial negative g load.