

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering

Vehicle Recorder Division

Washington, D.C. 20594



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

CEN22FA019

By

W. Deven Chen

WARNING

The reader of this report is cautioned that the factual report of an onboard image recording is not a precise science but is the best product possible from a Safety Board group investigative effort. The factual report thereof, if taken out of context, could be misleading. The factual report 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 factual report as the sole source of information.

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Washington, DC 20594

April 7, 2022

Onboard Image Recorder

Specialist's Factual Report

By W. Deven Chen

1. EVENT

Location: Marengo, Wisconsin
Date: October 23, 2021
Aircraft: American Champion Aircraft 8KCAB
Registration: N843AC
Operator: Private
NTSB Number: CEN22FA019

2. GROUP

A group was convened on December 15, 2021, at the NTSB's Vehicle Recorder Laboratory in Washington, D.C.

Chairman: W. Deven Chen
Electrical Engineer
National Transportation Safety Board (NTSB)

Member: Sean Payne
Mechanical Engineer
NTSB

3. DETAILS OF INVESTIGATION

On December 6, 2021, the National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following personal electronic devices (PEDs):

Recorder Manufacturer/Model: **Google Pixel 3 (pilot)**
IMEI Number: **358275094282825**

Recorder Manufacturer/Model: **Samsung Galaxy S9 (passenger)**
IMEI Number: **358211090326332**

3.1. Device Description

PEDs are a category of devices comprised primarily of portable computing devices and mobile phones. Portable computing devices are typically capable of internet access, email,

messaging services, and can run user-installed applications to perform specific tasks. Depending on the model, mobile phones can perform many of the same tasks as portable computing devices, plus have voice call and text messaging capabilities. PED user and system data is typically stored on non-volatile memory and can be accessed through manufacturer-provided interfaces.

3.2. Data Recovery

Upon arrival at the NTSB Vehicle Recorder Division, both PED devices showed signs of impact damage. Figure 1 shows the pilot's PED on the left and the passenger's PED on the right. The motherboard of the pilot's PED was removed, and the damage presented on the motherboard showed that it would require a chip-level data recovery procedure. However, the lab was notified that the passcode of the PED was unknown, thus no further data recovery procedure for pilot's PED was attempted. The passenger's PED powered up normally and was operable despite the scattered screen. The PED was unlocked with a passcode provided by family members, and the data were extracted using laboratory tools.



Figure 1: Pilot's PED (left) and passenger's PED (right) upon arrival at the laboratory.

3.3. Data Description

The extracted data from the passenger's PED contained a video recording of the accident flight. The video was taken by the passenger in the rear seat of the accident aircraft. The video was provided at a resolution of 1920 x 1080 pixels and at a frame rate of 30 frames per second (fps).

3.4. Timing and Correlation

The video started recording at 14:38:10, on October 23, 2021, and lasted 2 minutes and 1 second. The timing of the video is expressed in video elapsed time for this report.

3.5. Summary of Recording Contents

The video, which was taken by the passenger in the rear seat of the accident aircraft, was captured using a phone. The phone was handheld by the passenger, and the view during the accident recording changed frequently. In general, the rear seat passenger panned the camera out of the right rear seat windows and the left rear seat windows. The most often captured view was out of the left rear window which captured portions of the accident aircraft's left wing, at times the left aileron, the left-wing strut and occasionally forward out of the front windscreen (around the pilot's body) and below the aircraft (when pointed downward from the rear windows). At times, the back of the front seat pilot was captured, however, the pilot's body obscured any view of the instrument panel.

The recording was reviewed and a rough flight path in the vicinity of the accident location was constructed. Figure 2 is an estimated flightpath created from reviewing the video. Note that the flight path may not be to scale, and the aircraft may have crossed geographic landmarks that are not depicted on the aerial imagery. The flight path as drawn on the aerial image is likely smaller than the actual flight path route. Also note that the latest available aerial imagery was from 1985 and may not accurately depict structures in the vicinity of the accident site.



Figure 2: Estimated flight path with turn numbers in the vicinity of the accident location. Note that the flight path is not drawn to scale and the aircraft may have crossed geographic landmarks not depicted in the figure. Also note that the latest available aerial imagery was from 1985 and may not accurately depict structures in the vicinity of the accident site.

Figure 2 has numbers listed on the flightpath. These numbers chronologically list the number of turns the accident aircraft made during the onboard recording. Table 1 lists the turn number and the estimated bank angle of each turn. The bank angle was estimated by using a protractor which measured the aircraft bank with respect to the horizon. A positive angle indicates as right bank while a negative angle indicates as left bank. The maximum bank angle of each turn is represented in the table.

Table 1: Estimated bank angle at each turn.

Turn #	Estimated Bank Angle
1	at least 55 degrees
2	at least -70 degrees
3	at least -80 degrees
4	unknown due to camera angle
5	about -45 degrees
6	accident maneuver, camera lost horizon. at least -80 degrees

Below describes the portion annotated in this section for the accident maneuver. The annotation begins at 1:42 (mm:ss) elapsed time of the recording. The annotation appears below in bullet format.

- 1:44 elapsed - The aircraft rolls out of turn #5 and became more level.
- 1:45 elapsed - The aircraft climbed slightly, with the wings nearly level.
- 1:48 elapsed - The pilot appeared to push the nose over in a slight negative G maneuver. The passenger stated, “whoooooa.”
- 1:50 elapsed - The aircraft seemed to reach the completion of the negative G maneuver and the aircraft began pitching up more rapidly into a positive G maneuver.
- 1:53 elapsed - The aircraft rolled aggressively left. The left aileron was captured in the recording. The left aileron was in an aggressive left roll command position.
- 1:55 elapsed - The camera view of the wing was lost in coordination and the camera was lowered as with the onset of a quick positive G motion of the aircraft. The interior of the rear seat portion of the aircraft became visible in the recording. The last view of the wing and the horizon showed the aircraft had rolled at least 80 degrees left.
- 1:56 elapsed – The aircraft’s rear control stick became visible. The rear stick appeared neutral in roll and slightly aft.
- 1:57 elapsed – The aircraft’s rear control stick showed an aft position (pitch nose up command) while roll command appeared neutral.

- 1:58 elapsed – The aircraft's rear control stick became quickly right roll command while remaining aft (pitch nose up command).
- 1:59 elapsed – The stall horn was audible.
- 2:01 elapsed (end of recording) – The passenger was heard laughing; the pilot was heard stating an expletive. The rear seat stick was still visible, the stick appeared slightly aft (pitch nose up command) and in a moderate right roll command. The sound of impact was audible, the video ended.

At no time in the recording did the rear seat passenger's hand appear to interfere with the flight controls. The rear seat passenger's left foot was visible flat on the floor and nowhere near the rear seat rudder pedals. The rear seat passenger's right foot was not visible, but the body position suggested the right foot was in a similar position to the left foot.

3.6. Correlation of Video and Ground Witness Live Photos

Several live photos¹ taken by a ground observer were sent to the NTSB, capturing the accident aircraft maneuvers in the vicinity of the accident location. Figure 3 contains estimations of the accident aircraft's locations when the ground live photos were taken by the ground witness. The image file numbers are listed on the depictions of the aircraft's flightpath in the vicinity of the estimated accident aircraft's locations. The live photos are appended below in this report as their filename, rather than a figure number. Additionally, short movie files created from the live photos are appended to this report as attachments 1-4. The attachments are listed based on their corresponding filename. The person in the live photos have been redacted.

¹ Live photos -- smartphone technology that allows a single photo to be both a still image and, when activated, a short video with motion and sound.



Figure 3: Estimated accident aircraft locations when the live photos were taken. Note that the flight path is not drawn to scale and the aircraft may have crossed geographic landmarks not depicted in the figure. Also note that the latest available aerial imagery was from 1985 and may not accurately depict structures in the vicinity of the accident site.

3.7. Text Message

Text messages from the passenger's phone were extracted and reviewed for content related to the accident. The only pertinent conversation identified was between that of the accident pilot and the accident passenger.

On October 22, 2021, the accident passenger discussed "coming to the cities to grab your [pilot's] car again." The passenger went on to state that she wanted to "go to the cities bring your car back to Duluth [*sic*] and go to the haunted ship. And bring your car home." The accident pilot then responded that he could "come to Ashland and pick you up in the plane. But it can't do aerobatics today unless I fly it 5.2 hours (it got a new engine_ and I decided that's too much money." The accident passenger then stated she wanted to "be in Duluth by 6." The accident pilot and accident passenger then discussed timing. The accident pilot then stated, "I'll land at like 130. I could get gas although we probably don't need it if we're just flying straight back to the cities." The accident pilot and passenger then discussed eating and other needs for the trip and the conversation ended.

APPENDIX: GROUND WITNESS LIVE PHOTOS



IMG_4852



IMG_4854



IMG_4855



IMG_4856