NATIONAL TRANSPORTATION SAFETY BOARD
Vehicle Recorder Division
Washington, DC 20594

May 11, 2022

Onboard Image Recorder

Specialist's Factual Report
By Sean Payne

1. EVENT

Location:	Angwin, CA
Date:	July 16, 2021
Aircraft:	Beech V35, N112TW
Operator:	Private
NTSB Number:	WPR21FA273

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

On October 21, 2021, the National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following GoPro camera:

Recorder Manufacturer/Model:	**GoPro Hero 3**
Filename:	**Multiple .MP4 files**

3.1. Recorder Description

The GoPro HERO is a compact, lightweight, POV 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.[1] Depending on the model, the camera supports 4K HD at 60 frames per second (fps) as well as other lower quality recording resolutions at higher frame rates.[2, 3] The camera can be set to record still images simultaneously or independently of a video stream at a

[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 – A resolution format of 3840 x 2160 pixels.
[3] HD – High Definition – A resolution generally consisting of greater than 480 lines of horizontal resolution.

resolution of up to 12 megapixels.[4] The camera supports recording to micro SD cards.[5] A built in Wi-Fi 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.[6]

3.2. Recorder Damage

Figure 1 is a photo of the GoPro Hero device at the NTSB lab. The device exhibited characteristics of impact and fire damage, but was otherwise intact. The device's protective outer case was removed, the battery compartment was opened and the removable media card was found to be in good condition. The removable media card was removed and read in a PC via a USB write blocker. Media capturing the accident flight was downloaded and is discussed later in this report.

Figure 1. A photo of the GoPro Hero recovered from the accident.

3.3. Video Files

The video was provided at a resolution of 1280 x 960 pixels and at a frame rate of 48 frames per second (fps). The accident flight recording consisted of video multiple files that were a continuation of each proceeding file. This sequencing of files is normal behavior for a GoPro camera recording a long duration video. The files recovered were continuous.

3.4. Timing and Correlation

The timestamps used in this report are expressed as Pacific daylight time. Timing of the GoPro files and PDT was correlated by taking the last available timing information provided from the recording and offsetting it to the reported time of the accident. Timing in this report is presented in the format HH:MM:SS,

[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.

where HH stands for the number of hours, MM, the number of minutes and SS, the number of seconds.

3.5. Summary of Recording Contents

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

Summary

This summary is comprised of the following elements:

- General Overview
- Factors related to destination planning, altitude planning, weather information, discussion of alternates and external pressures
- Detailed summary of the accident sequence
- Characteristics of the Left Seat Pilot (LSP)
- Characteristics of the Right Seat Pilot (RSP)
- Miscellaneous Information

General Overview

The recorded video files began as the aircraft was in a departure and climb phase, provided a record of the entire accident flight, and concluded after the aircraft had impacted terrain near Angwin-Parrett Field (2O3), Angwin, California. In total, the recordings comprised just over 2 hours and 49 minutes in length and seemed to cover almost the entirety of the cross-country leg from French Valley Airport (F70), Temecula, California, through the accident sequence at 2O3.

The GoPro was installed on the headliner of the aircraft and was set up to provide an over the shoulder view of both the LSP and RSP. Figure 2 is a digital sketch made from a frame in the recording that illustrates the point of view of the camera. The pilots have been redacted. In general, the GoPro captured both the LSP and RSP's actions and a view of most of the aircraft's instrument panel. At times, the pilots' torsos and extremities may have obscured potions of the instrument panel. At other times, lighting conditions in combination with the resolution of the video made it difficult to read indications on the aircraft's instruments.

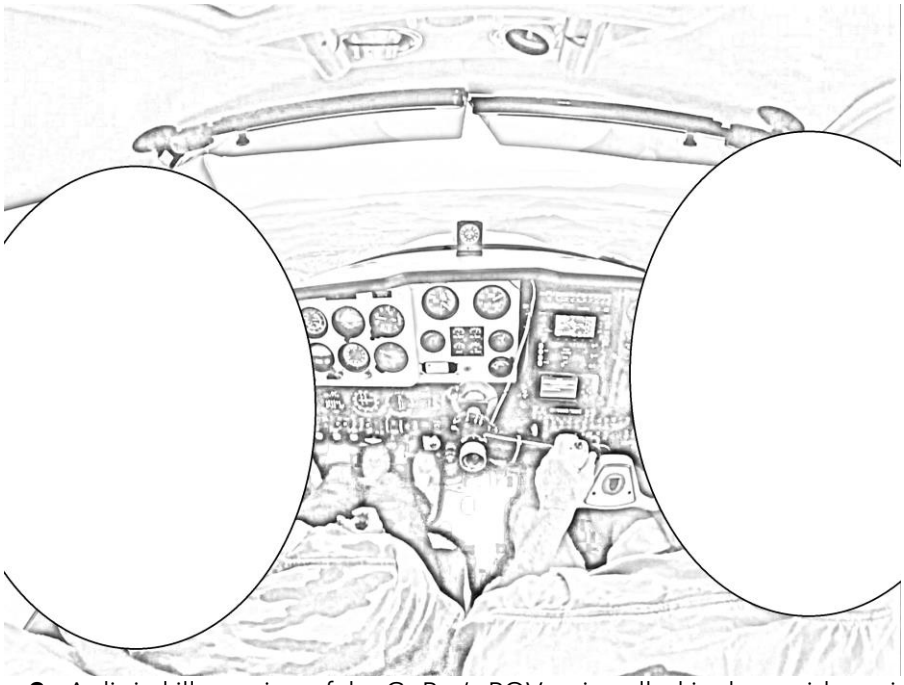

Figure 2. A digital illustration of the GoPro's POV as installed in the accident aircraft.

The aircraft was equipped with a "throw over" yoke. For most of the cross-country portion of the flight, the throw over yoke was positioned such that the left seat pilot (LSP) was flying. For the departure portion and the accident portion of the recording, the throw over yoke was positioned such that the right seat pilot (RSP) was flying. Throughout the recording, it was obvious that the right seat pilot was acting as pilot in command (PIC). While the LSP was in control of the aircraft during most of the cross-country portion of the flight, the RSP was in control of the aircraft during the accident sequence. Additionally, while the LSP was pilot flying, the LSP often deferred to the RSP. This is discussed in detail throughout the report.

The video recordings also included an associated audio track. The audio track was a result of the GoPro's audio input being connected to the aircraft's audio panel. As such, all three occupants' voices were recorded when the meeting the VOX threshold set on the audio panel.[7] In general, the wiring of the GoPro's audio input eliminated any input from the GoPro's built in microphone. As such, cockpit sounds, such as that of the engine, or the aircraft's stall horn, were obscured unless the aircraft's intercom VOX threshold was broken by an occupant of the aircraft. When the VOX threshold was broken by an occupant, sounds that emanated from the aircraft's engine or systems were picked up by the speaking occupant's headset boom mic. Those sounds were transcribed when they were recorded and determined to be relevant to the investigation.

[7] VOX – Voice Operated Exchange.

The 2 hour, 49 minute and 9 second recording and associated audio track contained numerous segments that were determined to be related to the accident.

Factors related to destination planning, altitude planning, weather information, discussion of alternates and external pressures

The nearly three-hour recording contained numerous references to destination planning, altitude planning, discussions of alternates and external pressures related to arriving at the destination. The entire recording was reviewed multiple times. The following section provides a summary of relevant discussions in these areas.

The time is presented in local time of the accident, Pacific daylight time (PDT).

05:57:51– Approach asked the aircraft if they were direct Napa County Airport (KAPC), Napa, CA, and the intended route of flight. The RSP initially keyed the yoke mounted mic for the LSP on the yoke in front of him, then corrected himself and keyed the panel mounted mic for the RSP and stated, "Pomona (POM), Gorman (GMN), Avenal (AVE), pretty much direct from there." The RSP then amended their planned altitude to 8,000 and approach acknowledged.

06:23:51 – The LSP and RSP discussed weather at "Calistoga."[8] The LSP stated the TAF for Calistoga (2O3) called for VFR at 0900 and stayed, "so maybe it will be."[9] And the RSP stated, "maybe."

06:27:51 – The LSP asked the RSP about landing techniques in the accident aircraft. The LSP began, "Okay just to clarify and I'd like to know you're – you're * that you're looking at – and don't tell me you just do it by feel, that's not going to help me. But when we're landing what are the speeds you want to be at?"

The RSP responded, "Come into the pattern about a hundred, you reduce it to like eighteen inches of manifold pressure and then keep it at about a hundred, get to your gear speed gunna drop the gear before a hundred. Right and that'll bring your airspeed down and that'll put you into the white." The LSP then asked, "What's your gear speed?" The RSP responded, "154 knots." The LSP stated, "154? Oh. Interesting."

[8] There is no public use airfield in Calistoga, California. The closest public use airport to Calistoga, California is Angwin-Parrett Field (2O3), Angwin, California. In the first half of the recording, the LSP and RSP used "Calistoga" to reference 2O3. Later in the recording, the LSP began referring to the airport as Angwin, Angwin-Parrett, or by the identifier 2O3.

[9] The LSP and RSP frequently referred to Terminal Area Forecasts (TAF) for different airports discussed throughout the accident flight. The TAF for 2O3 likely referred to the TAF for Charles M. Schultz Sonoma County Airport (KSTS), Sonoma, California. KSTS is 18 nautical miles southwest of 2O3. The LSP would later verbally indicate this was a reference to the KSTS TAF at 07:12:11.

The LSP and RSP then had a brief discussion about different model bonanzas with different gear speeds. The LSP then stated, "Okay so on downwind ninety?" The RSP stated, "No downwind you can stay higher, when you turn base you should be around a hundred and then when you're on final you'll be around ninety." The LSP asked, "ninety with flaps or without flaps?" The RSP stated, "With flaps. Then you bring your flaps down you're gunna - as you're descending you're gunna keep it around ninety all the way." The LSP queried, "and then with your flaps will bring you to like eighty?" The RSP said, "Yeah but I like to go in a little bit faster. So I try to keep it at ninety and then when you're - you're landing is assured then you can bring the power back all the way." The LSP then asked, "okay, now when you say landing is assured there is different definitions of that like do you wait until you are over the runway or 'till you just know you can land?" The RSP stated, "no, when you know you can make the runway." The LSP then began to describe her experience with landing a Cirrus and how the Cirrus responded to reducing power on short final. The conversation then changed to another topic.

06:35:54 – The RSP was entering waypoints for KAPC and 2O3 into a handheld GPS. The LSP and RSP were discussing estimated arrival times at both airports. The RSP appeared to reference a METAR and stated "700 overcast." The RSP seemed to be reading a TAF and was discussing potential overcast conditions at 2O3. The LSP and RSP discussed the field elevation at 2O3. The LSP then stated, "here on the TAF saying 9AM it'll be VFR, it'll be scattered at 800." The LSP asked for weather at University Airport (KEDU), Davis, California and 2O3. The RSP was referencing a handheld GPS and appeared to be viewing a weather information screen. The LSP stated the TAF she was referencing was associated with 2O3 in the electronic flight bag (ForeFlight) she was using and stated the TAF (KSTS TAF) called for VFR by 9am local. The LSP then asked the RSP which weather source he trusted more, the RSP stated, "I don't trust any of them." The RSP suggested getting closer to "take a look at it" and the LSP agreed they could get closer and make a decision to divert later.

The LSP went on to state she would like to re-asses conditions in another hour.[10] The LSP continued, "I need to tell @[*Friend picking up the accident party, name redacted*] if she needs to leave 40 minutes earlier to pick me up or not." The LSP and RSP discussed that if they land at "Calistoga" (2O3) that she could be picked up by her friend which would allow her to make an appointment for a tour. The RSP stated, "if we can't land there you're not going to make the tour? Correct?" The LSP stated, "correct," and restated that she would wait another hour and reassess the reported and forecasted weather. The LSP stated to the

[10] The LSP likely was referring to a METAR for KSTS, as the LSP would later state in the flight that based on synoptic times, the TAF for KSTS would not update prior to their arrival.

RSP that if they were not to make Calistoga (2O3), she would like to inform the friend who would be picking them up, "don't worry about us, we'll land at Davis."

06:55:43 – The RSP asked the LSP, "so when you were flying the Bonanza, what were his airspeeds for landing?"[11] The RSP stated, "he was ninety, eighty with flaps. So we would be ninety on downwind and base and be eighty on final." The RSP remarked, "be the same, same as this airplane." The LSP went on to state, "but he also buries – he doesn't like flaps at all. So he likes to land without flaps." The RSP then stated, "I don't know why." The LSP replied, "he said it just feels like it gets mushy with the flaps and he prefers to land without flaps. But he's like there's nothing wrong with landing with flaps that's just how I like to land." The RSP asked, "Did you land with flaps?" The LSP stated. "I did both. I prefer flaps."

07:12:11 – The LSP stated she was going to text the friend that was supposed to pick them up at their destination and tell her "that it's not looking good." The RSP then stated, "700 overcast." The LSP stated she was using the KSTS TAF for 2O3 which she was reading off Foreflight on an iPad. The RSP was using a handheld GPS and stated he was also referencing a TAF for KSTS. The LSP restated that the TAF for STS was calling for VFR conditions at 0900 local. The RSP asked, "how far is Davis (KEDU) from where you want to be?" and the LSP stated, "like an hour [drive]" and the RSP replied, "oh really?" The LSP then stated it would be more like an hour and a half drive from Davis (KEDU) to her ultimate destination. The LSP then stated the field elevation of KEDU and 2O3 were different and how that may influence conditions upon arrival. The LSP continued that the field elevation may explain why one field may be VFR and the other field may have cloud cover.

The LSP then asked the RSP to have the controls while she sent a text message.[12] The LSP then stated she would update her friend in another 30 minutes but stated that she told the friend to "most likely abort" as she verbalized a message while she held her phone. The LSP sent another text message while the RSP handled the controls. The LSP stated that her friend knows that they may need to divert and expressed her concern for making her friend drive to the airport (2O3) to pick them up if they were not going to end up landing there.

07:24:51 – An approach controller called and asked the aircraft if they were direct Napa (KAPC). The LSP stated they may be diverting to 2O3.[13] The

[11] A source familiar with the LSP indicated that she had received instruction from a CFI in a different Bonanza at some time before the accident flight.

[12] At times when the LSP sent a text message, she typically relieved herself of the flight controls and asked the RSP to monitor the aircraft and instruments.

[13] The GoPro recording did not capture the accident aircraft's initial request to ATC for flight following which may have included the initially stated destination. Later, at 07:36:31, the LSP checked in with NorCal approach and stated 2O3 was the intended destination using language that

approach controller acknowledged. The LSP and RSP discussed the arrival time at destination and continued to discuss the TAF calling for VFR conditions at 0900. The LSP and RSP agreed they would continue ahead to 2O3 and re-evaluate later. The RSP then discussed the differences between scattered clouds and broken clouds and in a difficult to understand statement, suggested that he didn't feel comfortable with letting the LSP fly from the left seat in the accident aircraft in marginal VFR conditions. The LSP and RSP continued to discuss the TAF reports they were referencing on their respective devices. The LSP restated that while she had no problem diverting, she did not want to inconvenience her friends who were supposed to pick them up at the destination (2O3). The LSP expressed her desire to indicate to the friends an arrival plan.

07:31:51 – The LSP stated everything east of their track is VFR and everything west of their track was IFR as she referenced her iPad. The LSP then asked the RSP if he wanted to "just call it and go elsewhere? I would be fine with that." The RSP was preoccupied with programing a route into the panel mounted Garmin 430 and did not respond to the LSP's suggestion. The LSP then stated "and again dad…" and the RSP finally responded "let's just get there and see what it looks like."

07:36:30 – The LSP got a frequency change from a controller, checked in on the next frequency and informed NorCal approach that they were direct 2O3.

07:38:11 – The LSP and RSP discussed their projected arrival time at 2O3 and suggested that landing at that destination was "debatable" based on the available weather information. They projected their arrival time to be just prior to 0900 local. The LSP again restated that she just wanted to tell her friend whether she should be picked up at 2O3.

07:48:51 – The LSP looked at cloud cover to the left of the route and stated, "it's just the terrain that makes the difference." The LSP then stated to the RSP "in 20 minutes we need to make a call. I need to let them know." The LSP then stated, "If it's marginal and you still want to do it, then obviously you fly and I will observe." The RSP observed some visible moisture in the vicinity of the aircraft and stated they were looking at "tule" and then stated, "it's moisture in the ground that condenses very low."[14]

suggested this was an amendment to an earlier statement. At, 07:57:21, the RSP stated to controllers that they were "no longer going to KAPC" which would indicate that KAPC was the initial destination.

[14] An NTSB meteorologist was queried as to the meaning of the RSP's use of the phrase "tule fog." The meteorologists stated "tule" fog is a type of radiation fog local to the area, but an in-depth weather analysis of the conditions were not conducted.

07:57:21 – The LSP received a frequency change and checked in. The RSP later got on frequency and told NorCal that they would try to get into 2O3. He stated that they were not landing Napa (KAPC) as forecasts called for IFR. The RSP then stated to the controller if they could not get into 2O3 then they would go to Davis (KEDU). During this exchange with NorCal approach, the right seat pilot did not speak the correct identifier for 2O3, the right seat pilot repeatedly misstated the identifier numerous different ways, all incorrectly. The LSP attempted to correct him while the RSP was keyed up with the controller. The RSP continued to misstate the identifier. The controller then read back the wrong identifier. The only person that had caught the mistake was the LSP. She corrected the RSP again and the RSP got back on frequency and stated the correction to the controller.

08:02:21 – The RSP referenced the handheld GPS and pointed out a tab on the GPS that displayed a calculated descent rate and stated to the LSP, "This is the rate of descent that will get you to your airport one mile away from it at pattern altitude." The LSP then stated, "so you just go off of that, you're not doing the math in your head of what you need to do?" The RSP shrugged and confidently stated, "no, why?" The LSP just stated deferentially, "I don't know, I'm just trying to learn," and was cut off by the RSP stating, "you figure out what the pattern altitude is then you have to get to it whenever you want to get to it." The LSP then manipulated her iPad and stated, "so pattern is 2,800."

02:16:20 – The LSP pulled out a clipboard with a hand written flight plan and instructed the RSP to enter the UNICOM frequency for 2O3. The LSP stated, "I don't know dad I think it's probably going to look like this." The aircraft was flying over an area of low laying but broken cloud cover at the time of the comment. The RSP stated, "let's just go look." The LSP then told the RSP that she was going to text her friend and tell her "we are aiming for it (2O3)."

08:16:36 – The LSP noted the winds reporting on the METAR for Sonoma and noted they were variable. The RSP asked for the weather at Sonoma (KSTS), the LSP noted the weather hadn't changed, "and its not going to, until it resets." [15] The LSP then referenced the MOS on the iPad for Sonoma (KSTS) and noted that weather forecast was slightly different.[16] The LSP verbally noted the MOS weather computation is different from the computation done to generate a TAF. The RSP stated, "who knows?" Based on the winds for Sonoma (KSTS), the LSP and RSP again discussed a left traffic arrival for runway 16 at 2O3. Approach then issued an altimeter setting 29.92 which the LSP set.[17]

[15] It was not clear if the LSP was referring to the KSTS METAR or the KSTS TAF.
[16] MOS – Model Output Statistics
[17] This altimeter setting was unchanged for the remainder of the flight and can be used to understand the referenced altitude from the altimeter in this report.

08:16:57 – The LSP and RSP discussed that the TAF they were referencing for 2O3 (on the iPad) hadn't changed. The LSP seemed to understand that TAF would not be updated before their arrival based on synoptic times. The LSP stated that the MOS said IFR conditions were predicted at 0800 local but at 1000 it was calling for VFR. Both pilots stated, "who knows?" and then began to discuss which runway to use. They noted the winds were variable and elected to use runway 16 at 2O3 and mentioned that it had a standard left traffic pattern at the destination.

08:21:51 – The RSP noted they were 38 nautical miles out from 2O3. The LSP, RSP and rear seat passenger (RPAX) noted cloud cover looked thick and low ahead. The RSP stated, "that's not looking good." The LSP then sent text message to friend where she verbalized a portion and stated, "it's very debatable." She did not verbalize the whole message, it is unclear if she told the friend that the accident aircraft would be diverting from 2O3 to Davis (KEDU).

08:23:30 – The aircraft changed course slightly, the LSP stated 2O3 would be straight ahead. Thick low, laying cloud cover was ahead and to the left of the aircraft. The area to the right of their track line was clear. The LSP stated, "very debatable." The RSP stated, "yeah well we're still gunna look at it but it looks to me like it's on the other side of that ridge and its pretty thick over there." The LSP then stated, "well I don't know," and sent a text message in what appeared to be the same conversation thread as seen previously." The RSP then appeared to be looking for a frequency, the LSP stated, "oh I have that written down already," and stated the correct AWOS and UNICOM frequencies for 2O3 as she referenced a clipboard with a handwritten flight plan. The LSP and RSP continued to look at cloud cover ahead and restated that it looked "pretty thick." The RSP restated, "see what it looks like."

08:26:21 – The LSP asked the RSP, "shouldn't we be descending?" The RSP then stated, "no we don't know if we are landing, we can always descend." The LSP deferentially stated, "true."

08:27:16 – The LSP and RSP had a conversation about when to switch from approach to UNICOM. The LSP asked the RSP if approach would issue a frequency change. The RSP stated, "no, you do it when you feel like it." The LSP stated, "okay." The RSP stated, "Just keep ATC informed." The LSP and RSP continued to reference landmarks ahead and visible cloud cover. The RSP stated, "if we're lucky it might be on the other side," as he referenced a line of terminating low lying cloud cover ahead of the aircraft. The LSP then referenced weather information from the iPad again and stated, "yeah it's next-door neighbor is saying the same thing, [VFR at 1000, IFR at 0800]. The one that's right next to it."

The aircraft continued enroute, the altimeter read 6,250 feet MSL. A detailed summary of the descent to 2O3 and the accident sequence continues below.

Accident Sequence

The detailed accident summary began around 08:29:21, the LSP was pilot flying. The LSP and the RSP were discussing the field elevation of Napa (KAPC) and 2O3. Ahead of the aircraft was a bank of low laying clouds that obscured terrain below mountain tops. The LSP stated that 2O3 had 1,000 feet higher field elevation than Napa (KAPC). The conversation seemed to focus on if 2O3 would be obscured by clouds at field elevation, or above the clouds. The aircraft was at approximately 6,250 feet MSL. Both the LSP and RSP were intently focused out of the front windscreen. The LSP and RSP discussed trying to visually identify 2O3. The RSP stated they were 14 nautical miles out from 2O3, altitude was still around 6,250 feet MSL (4375 feet AGL).

Around 08:31:21, NorCal approach called the accident aircraft, stated there was no traffic between them and the field and issued a VFR squawk code. The RSP responded to approach that they would "see if we can get in there," and, "if not we're gunna divert to Davis (KEDU). We would like to continue flight following if you're okay with that." Approach read back, "roger." The altitude of the aircraft remained around 6,200 feet MSL (4325 feet AGL).

At 08:32:06, the LSP asked, "don't you want to get down lower to see what it looks like?" The RSP pilot replied back sternly, "No." The RSP then followed up his comment and stated, "because if it's like this [you] definitely want to stay at altitude and go to Davis [KEDU]. It's not next door." The aircraft remained around 6,200 MSL (4325 feet AGL). The RSP stated, "we're ten miles from it now." The LSP appeared to be sending a text message at this time. The RSP remained intently focused outside and ahead of the aircraft, at times pulling himself forward toward the instrument panel to look out over the nose.

The RPAX, then asked, "is that the airstrip straight ahead?" The RSP, stated "I don't know if it is." The LSP listed some other airports in the area and then stated, "kinda lookin' like it." Later RSP stated, "that's gotta be it, that looks like a runway." The LSP then stated that she possibly identified Pope Valley (A charted private strip approximately 3 nautical miles northeast from 2O3).

Around this time, the RSP stated, "let me have it," and the RSP swung the throw over yoke to the right side of the aircraft and a transfer of controls occurred. The RSP was pilot flying for the reminder of the accident flight. The altitude was around 6,200 feet MSL (4325 feet AGL). The last verbalized reference of distance to 2O3 was 9 nautical miles. The LSP stated, "That's it. Sweet!" The RSP then questioned the LSP, "let's see if that's the airport?" The LSP responded

confidently, "that's the runway, that's the runway, that's it. And we are heading straight for it," as she shook her head in a frustrated manner and gestured to the RSP.

The RSP then stated slowly, "okay so we'll probably be landing on runway...what is the other runway?" The LSP referenced a handwritten document on a clipboard and stated slowly and clearly, "it's one six and three-four." The LSP then stated that the active would probably be runway 16 and then asked the RSP if they can switch to UNICOM frequency, "can we turn over to UNICOM?" and she looked at the RSP as if for approval. The RSP attempted to make a radio call, first keying the mic on the yoke (this keyed the LSP's headset), then corrected himself, keyed the RSP side headset on the instrument panel and asked approach to terminate flight following. The RSP then immediately asked the LSP for the UNICOM frequency at 2O3, of which the LSP immediately answered with the correct UNICOM frequency. The aircraft was gradually descending out of 5,500 feet MSL (3625 feet AGL). The LSP stated, "sweet. We got lucky," and the RPAX stated, "by not even a quarter mile," which seemed to be a reference to 2O3's proximity to a low laying layer of clouds which was visible off the left of the accident aircraft.

The RSP began to increase the aircraft's descent. The LSP stated, "so tell me what you are doing," and the RSP stated in a monotone voice, "dropping the gear so I can descend faster." The airspeed indicator at this time indicated about 170 mph, the RSP then called "three green." The RSP then asked the LSP, "What do they call it? What's the name of it again?" The LSP stated confidently and promptly, "Two Oscar Three, or Angwin-Parrett." RSP then again incorrectly keyed the yoke mounted mic, then keyed the RSP side mic and then stated the aircraft was "on a high left downwind for runway sixteen… or two-four." The RSP then looked to the LSP and stated again, "what is it?" and the LSP confidently and promptly stated, "one six." The RSP questioned the validity of the LSP's statement, the LSP restated firmly, "yeah, one-six." The RSP looked around the cockpit and over his left shoulder as if the airport was behind the aircraft. The altimeter read 4,600 feet MSL (2725 feet AGL). The LSP then pointed firmly and repeatedly in the direction of the runway and restated, "one six," firmly.

The RSP keyed the proper mic and stated on UNICOM that the aircraft was "on a wide downwind for one six." At this time, the RSP was looking behind the aircraft over his shoulder, the altitude was 4,400 feet MSL (2525 feet AGL), the aircraft was still descending at a speed of 160 mph indicated.

The LSP asked the RSP, "what [he was] doing," and, "what [he was] doing with the mixture?" The RSP stated, "nothing. nothing yet." The VSI indicated the aircraft was descending at approximately 1,500 feet per minute (fpm) and the altimeter was sweeping through 4,100 feet MSL (2225 feet AGL). The LSP started

sending a text message. The RSP rolled the aircraft into a left base turn. The RSP again keyed the wrong mic (yoke mounted LSP mic) and attempted a UNICOM call, quickly realizing his own mistake this time. The RSP made a left base call for runway 16. The altitude was 3,900 feet MSL (2025 feet AGL), the VSI indicated a descent of around 1,500 fpm, the airspeed was around 160 mph indicated. The aircraft had just begun rolling left onto a left base.

As the RSP continued through the left base turn, he swept his hands across the throttle and mixture area and may have set a notch a flaps. It was unclear if the RSP had adjusted the flap setting or simply touched the flap lever. The LSP mentioned, "eighteen?" and the RSP responded, "yeah something like that." The manifold pressure at this time indicated about 18 inHg. The RSP then stated, "remember, you're on the brakes honey." The LSP stated, "yup," and positioned her feet as if she were ready to manipulate the brakes.

As the RSP completed the left base turn he stated, "high," as if he were talking to himself. Moments later, the left base turn was rounded into a turn to final. The aircraft had entered into an approximate 30 degree left bank, the airspeed indicator displayed about 150 mph, the altitude was 3,000 feet MSL (1125 feet AGL), the RSP appeared to add a notch of flaps. The flap position indicator could not be resolved from the video and it was unclear whether the RSP was setting flaps at different times throughout the approach, or simply touching the flap lever without making a flap selection.

As the RSP rolled onto final, the LSP asked "all the flaps?"[18] At that time, the RSP was attempting to make a radio call, again the RSP incorrectly keyed the LSP yoke mounted PTT. The LSP quickly corrected the RSP by pointing sternly to the RSP side PTT on the panel. The RSP called short final on UNICOM, the runway came into view ahead of the aircraft. The aircraft heading was approximately 30 degrees right of centerline and tracking toward runway 16. The airspeed indicator displayed around 135 mph, the altitude was 2,750 feet MSL (875 feet AGL), the RSP added nose up pitch trim and began manipulating the yoke with both hands. Around this time, the RSP appeared to reduce manifold pressure to around 15 inHg.

Throughout the approach the RSP manipulated the yoke with both hands and attempted to the correct the aircraft toward centerline. The RSP continued to

[18] From the POH for this aircraft: *"The wing flaps are controlled by a three-position switch, UP< OFF, and DOWN, located in the subpanel, above the power quadrant. The switch must be pulled out of detent before it can be repositioned. A dial type indicator has markings for UO, 10 degrees, 20 degrees and DN. The indicator is located to the left of the control column. Limit switches automatically turn off the electric motor when the flaps reach the extremes of travel. Intermediate flap positions can be obtained by placing the switch in the OFF position as the flaps reach the desired position during flap extension or retraction."*

add nose up pitch trim, the RPM showed a value of around 2,300 RPM, the aircraft was right of centerline for runway 16, airspeed indicated around 130 mph. Moments later, the RSP appeared to decrease the aircraft's power setting (gauge indicated less than 15 inHg), RPM still indicated above 2,000 RPM. The LSP stated, "gear down" in a cadence that sounded somewhat like a checklist callout. The RSP appeared to have finally decreased the power setting significantly as the aircraft approached a short final to the runway. The airspeed here indicated 120 mph. The RSP returned to flying with both hands on the yoke.

The aircraft crossed a tree line to runway 16. The aircraft was still slightly right of centerline, the airspeed indicated about 115 mph. The pilot was using both hands on the yoke and the aircraft's roll angle was changing often to the left and right. The RSP stated, "'kay remember the brakes honey," again, and the LSP responded, "yup," and sat up more straightly.

The aircraft crossed the 16 numbers, the altimeter indicated 1,850 feet MSL (25 feet below ground level) and the airspeed was approximately 100 mph. The RSP's manipulated the yoke with a tight two-handed grip as he attempted to round out the aircraft just beyond the 16 numbers. The aircraft yawed to the left and the right, directional control did not appear stabilized. The aircraft touched down sharply and violently, the airspeed indicated approximately 85 mph. The swift touchdown happened in unison with the RPAX grunting as if from an impact, the LSP and RSP were visibly jostled. The LSP exclaimed, "Ohhh God" in a cringing tone. The aircraft settled into a large bounce and then a third bounce, each as strong than the initial touchdown. The LSP appeared to brace herself against the fuselage with her left hand. The RSP continued to tightly grip the yoke with both hands throughout the sequence.

The result of each bounce lead to a larger excursion in aircraft pitch angle. The aircraft settled into a fourth bounce. It was uncertain if the aircraft had a prop strike with the runway at this time, or at any time throughout the bounce sequence. The bounces were violent enough that the camera was jostled, and the recording became unstable.

The LSP calmly asked, "go around?" as the RSP looked down and jammed the throttle in. Manifold pressure showed an increase to approximately 27 inHg. The manifold pressure would indicate in this position until the aircraft would later strike trees.

When the RSP added power, he moved his hand in the vicinity of other controls in this area. It was unclear if the RSP's left hand was manipulating more than just the throttle, but also the mixture and prop controls, had moved flap selector or was simply feeling for them. This action by the RSP was hurried. Flap indications on the instrument panel were not possible to conclusively resolve. The RPM

indicator showed it was passing through 2,000 RPM and increasing, the pilot may have also been re-trimming the aircraft, his exact actions were unclear. The aircraft settled into a brief positive pitch attitude as the RSP was looking down toward the throttle area. While looking down at the throttle area, the aircraft descended back toward the runway while in a positive pitch attitude. The aircraft quickly settled back onto the runway in another bounce, the RSP was startled and stated, "oh #," looked up out of the windscreen and back down toward the throttle quadrant.[19] RPM indicated around 2,500 RPM and manifold pressure still at 27 inHg as the aircraft bounced again violently on the runway. It appeared that the RSP selected the momentary flap switch upward at least once during this time interval, but the action could not be conclusively resolved. The airspeed indicator hovered around 60 mph and the RSP commanded a positive pitch attitude with a white knuckle grip. The aircraft pitched nose up sharply. The RSP then attempted to finely control the aircraft in pitch with both hands on the yoke and continued to make fine pitch changes, all commanding an overall nose high attitude. The aircraft remained in a nose high attitude throughout but did not climb significantly.

At no time during the remainder of the accident sequence did the RSP appear to lower the nose and let the aircraft accelerate. The aircraft would remain in a nose high condition until it would later strike trees.

The aircraft continued to travel above the remaining runway in a nose high attitude, the airspeed indicator still hovered around 60 mph and the RSP's attention seemed split between looking down at the throttle aircraft and forward through the windscreen. The LSP appeared to sit up more straightly in an attempt to see ahead of the high nose, however, the aircraft was not climbing, the pitch attitude remained positive, and the RSP had never lowered the nose. It appeared as though the RSP selected the momentary flap switch upward at least once more during this time interval, but the action could not be conclusively resolved.

The aircraft continued to travel above the runway in this manner and the RSP continued to attempt to maintain a positive pitch attitude based on his control inputs. At no point was it evident that the nose was lowered, the LSP chest began rising rapidly as if there was heavy breathing. The RSP continued with a gripped tightly with two hands on the yoke as the aircraft flew down the runway in a nose high attitude with the airspeed indicator showing around 60 mph steadily.

Eventually the aircraft began to run out of available airport property and was approaching a small line of high conifer trees. Due to the nose high attitude, it was not evident if the RSP noticed the line of trees as the aircraft was running out

[19] A # indicates a redacted explitive.

of airport property. The RSP's actions at this time were consistent with remaining focused on maintaining a nose high attitude. The LSP was breathing heavy and seemed intently focused on looking over the nose of the aircraft.

The aircraft continued in a nose high, low airspeed condition as it approached the end of the airport property. Seconds before impact, the tree line came into view of the camera directly ahead of the aircraft. The RSP continued to maintain a positive pitch attitude, the aircraft rolled slightly left. As the aircraft rolled slightly left, the RSP made an abrupt right roll command. The RSP's pitch command on the yoke remained positive and right roll command throughout the remainder of the recording. The RSP made a straining sound that activated the VOX threshold. The ambient audio through his boom recorded the sound of the aircraft's stall horn operating.

The aircraft impacted the tree line, with the first impact appearing to be a tree that stuck the left cowl and left wing root area of the Bonanza. The aircraft was in a slight left roll during impact, the RSP maintained a heavy right roll command. The impact sprayed pine needles from the tree which briefly filled the windscreen. The impact with the tree caused an abrupt negative pitch change. The aircraft became quickly nose down and entered an abrupt left roll. The aircraft became inverted as it rolled left and completed one and a quarter roll. The aircraft impacted a vineyard. The attitude at impact was approximately 15 degrees nose low and 90 degrees left bank. The RSP maintained a heavy two handed right roll command on the yoke throughout the roll sequence until impact. The impact caused the camera's view to immediately change and the recording quickly captured orange flames. The camera tumbled and came to rest in a vineyard amongst burning debris and vegetation.

The recording continued for approximately two minutes. The remainder of the recording captured the shouts of bystanders. The recording ended approximately 2 hours 49 minutes and 9 seconds after had it had been started by the LSP.

Characteristics of the Left Seat Pilot (LSP)

The LSP made some comments throughout the flight that indicated she was not familiar with the accident aircraft. For example, at 05:57:51, the LSP commented she was not used to the position of the VSI and climb speeds of the accident aircraft. At other times she stated she was not accustomed to the position of other instruments, such as the manifold pressure indicator. The LSP made comments related to aircraft systems in this manner in other portions of the accident recording, to which the RSP typically responded with an answer or an instructional-like comment.

The LSP did, however, make comments and perform actions that were consistent with having pre-planned knowledge of the flight. For example, the LSP often referred to information on a left seat mounted iPad that was running ForeFlight. The LSP also frequently referred to a clip board that had hand handwritten notes that were laid out in a manner consistent with a manually produced flight plan. The LSP frequently corrected the RSP on names of identifiers for referenced airports, runway numbers associated with referenced airports and quickly referenced proper frequencies for each of the destination area airports. The LSP understood the frequency at which TAFs updated and stated this during the accident recording. The LSP also frequently corrected the RSP when the RSP incorrectly keyed the yoke mounted PTT mic. The LSP suggested descending (08:26:21) as they approached the accident airport and the LSP also made a statement on final approach related to the aircraft's gear configuration that was presented in a checklist-like cadence.

The LSP acted deferentially to the RSP at various times in the recording. At various times, the LSP seemed to make statements in the form of questions to the RSP. At 07:31:51, when discussing a plan to divert, the LSP asked the RSP if he wanted to "just call it and go elsewhere? I would be fine with that." Around 08:26:21, as the aircraft was about 35 nautical miles from 2O3 at approximately 6,250 feet MSL, the LSP asked the RSP, "shouldn't we be descending?" As the aircraft approached 2O3 while remaining at the same altitude, the LSP would query the RSP a few more times about descending such as at 08:32:06 documented above.

Later at 08:27:16, the LSP asked if they should change cancel flight following and call UNICOM for 2O3. Lastly, during the accident sequence, immediately after the aircraft bounced violently on the runway four times, the LSP asked, "go around?"

The LSP had a brief conversation with the RSP and RPAX regarding flying with her family. At 07:53:51, the LSP stated she did not feel comfortable flying with her family "until I can handle distractions."

Characteristics of the Right Seat Pilot (RSP)

On numerous occasions, the RSP attempted to the key the right seat push to talk (PTT) mic by using the yoke mounted PTT switch. The yoke mounted PTT activates the left seat PTT. Most times this occurred, the LSP corrected the RSP, at times the LSP strictly pointed to the RSP PTT which was located on the instrument panel on the right side of the aircraft. This occurred at least 6 times, including the multiple times noted during the description of the accident sequence while in the traffic pattern.

When the RSP was pilot flying, the RSP controlled the yoke with two hands. At times, the RSP removed his left hand from the yoke to manipulate throttle, mixture, prop, gear or flap settings. At other times the RSP removed his right hand to adjust other instrument or radio settings. Whenever the RSP removed a hand to manipulate something in the cockpit, he quickly returned to a two handed grip on the yoke. Overall, when the RSP was pilot flying, the RSP controlled the aircraft using both hands on the yoke. Additionally, during the accident sequence, the RSP appeared to have a tight, two-handed grip on the yoke throughout.

Twice during the recording (07:14:51 and during the final descent) the LSP and RSP swapped the aircraft's throw over yoke. The action of the RSP while swapping the control yoke position appeared labored. When this occurred, the RSP used both hands to move the yoke and associated column. The action did not occur in a smooth or fluid motion. At one other time in the recording (07:15:31), the RSP pilot manipulated the yoke from the right seat while the yoke was mounted on the left side of the aircraft (LSP was pilot flying).

At various times throughout the recording, the RSP made comments to the LSP that were consistent with instruction. The following elements were noted that seemed related to instruction:

- RSP provided instruction on leaning procedures and power at 05:55:36, 05:59:51, 06:06:21, 06:08:21, 06:33:21, 08:03:11, 08:10:51
- RSP provided guidance on the route of flight and pointed out when the LSP was off course. The RSP made statements such as, "don't go into the airspace, make sure you are on your line." The RSP made comments related to "stay[ing] on" the "magenta line," At 05:56:51, 06:05:21, 06:07:51, 06:10:01, 06:11:21, 06:12:51, 06:22:06. Many of these statements were made in a frustrated tone by the RSP.
- The RSP frequently pointed out to the LSP when she was climbing or descending. The RSP made statements such as, "you're climbing," at 06:10:11, and, "you're descending."
- Landing technique, discussed in detail at 06:27:51 and again at 06:55:43 in the section above.
- The RSP explained the aircraft's fuel system at 06:22:51 and 08:13:51.
- The RSP explained the use of cowl flaps at 06:09:51.
- The LSP referred to the RSP as "CFI *@[Last Name of RSP]",* at 06:25:04.

Miscellaneous Information

Discussions of other aircraft accidents

At 07:06:51, the LSP and RSP discussed aviation accidents in a generalized sense. The conversation started as the RPAX made a statement as to how the aircraft was loaded. The RSP stated, "yeah to avoid aft C.G. danger." The LSP stated, "yeah either that or running out of gas is the most common cause of crashes. Running out of gas, isn't it?" The RSP looked at the LSP and responded, "well running out of gas, VFR into IMC, weather, always an issue." The conversation turned to another topic not related to the accident flight.

At 07:56:41, the RSP discussed an accident that occurred in Monterey, California, on July 13, 2021, involving a Cessna 421C (NTSB WPR21FA270). The RSP stated he "didn't know what happened." The RSP did not speculate on the cause of the accident.

Checklist Usage

At no time in the accident recording did either the LSP or the RSP reference a checklist. The recording did not include preflight portions of the accident flight, the departure and some of the climb portion of the initial enroute segment of the flight.