



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 16, 2023

Specialist's Factual Report

HUMAN PERFORMANCE

CEN22FA405

A. ACCIDENT

Location: Tomball, Tx
Date: September 1, 2022
Time: 1707 central daylight time (CDT)
2207 universal time coordinated (UTC)
Airplane: Cirrus Aircraft SR22; N420SS

B. HUMAN PERFORMANCE SPECIALIST

Specialist Sabrina Woods, Ph.D.
National Transportation Safety Board
Washington, D.C. 20594

C. SUMMARY

On September 1, 2022, about 1707 central daylight time, a Cirrus Aircraft SR22 airplane, N420SS, was substantially damaged when it was involved in an accident near Tomball, Texas. The flight instructor was fatally injured; the pilot and passenger sustained serious injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

D. FACTUAL INFORMATION

1.0 Human Performance (HP) Specialist's Activities

The HP specialist was notified of the accident and began collecting data to begin travel and start the investigation. A formal request was made via the Cirrus party coordinator to obtain pilot training and performance records, manuals, and to initiate plans for a site visit to the Cirrus Aircraft Vision Center in Knoxville, Tennessee. Before the site visit, the HP specialist conducted over-the-phone interviews with the pilot/owner and the passenger who survived the accident, three individuals who had been previously trained by the accident flight instructor at the Vision Center, a first responder who attended the accident scene, and two of the deceased flight instructor's next-of-kin. After the site visit the investigative team conducted an additional six interviews with instructors who had worked with the deceased, via video teleconference.

1.1 Cirrus Aircraft Vision Center Site Visit

During November 13-17, 2022, the Investigator-in-Charge (IIC) and HP specialist, with the party coordinator for Cirrus conducted a site visit at the Cirrus Aircraft Vision Center in Knoxville, Tennessee. The Vision Center is Cirrus' airplane delivery and training campus. Investigative activities conducted during this visit are detailed below.

The investigation team received a brief tour of the campus and its outbuildings which consisted of the flight center, various maintenance hangars, multiple-use building, the simulator center, and the delivery experience center where new customers view their airplane for the first time.

1.1.1 Simulator Session

A Cirrus flight training development specialist provided the investigation team with the same Cirrus Airframe Parachute System (CAPS) training briefing that

customers receive (see figure 1). After the briefing, the investigative team participated in a simulator session using an SR20 simulator.¹ The goals were to document the simulator fidelity, flight deck array, emergency procedures, aural/visual alerts, and the RNAV (GPS) Runway 17R approach procedures into David Wayne Hooks Memorial Airport (DWH), Spring, Texas.

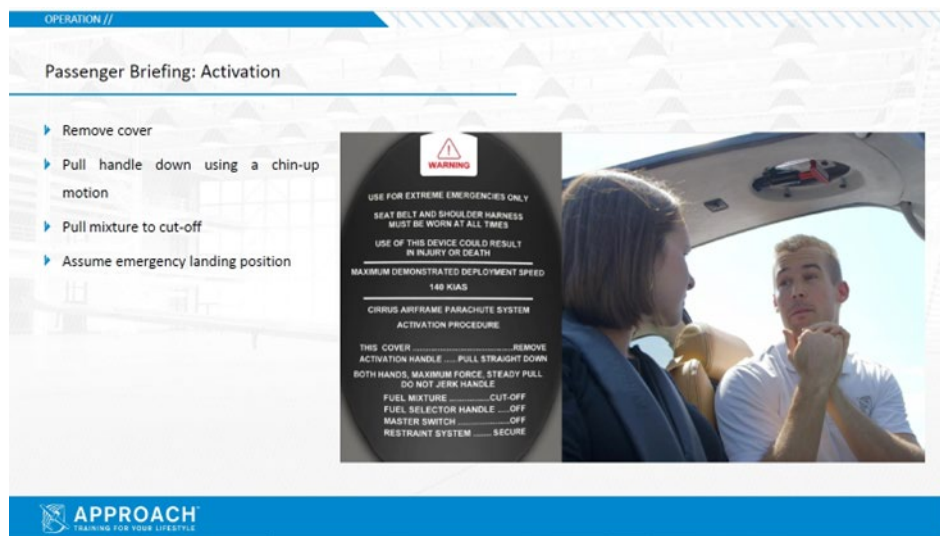


Figure 1: Excerpt from CAPS Briefing.

1.1.1.1 Simulator Run 1 - RNAV (GPS) 17R approach into DWH

The simulator session consisted of two different runs. The first was a normal RNAV (GPS) 17R approach into DWH. The HP specialist documented the primary flight display (PFD) with descent profile captured on the RNAV approach, the fuel flow indicator on the multi-function display (MFD) and took a video to capture the audio call out for 600 ft above ground level (agl) as a method of indicating when the airplane was in the desirable parameters for CAPS deployment.

1.1.1.2 Simulator Run 2 - Engine Out

The second run was to simulate and document emergency procedures in a fuel-related event. The HP specialist documented visual and auditory indicators that a fuel emergency was taking place. Visual warnings included white, yellow, and red crew-alerting system (CAS) messaging on the PFD, and indicator (fuel flow, manifold pressure, RPM etc) fluctuations on the main and engine MFD pages. The auditory

¹ The simulator was based on a SR20 and not an SR22 or SR22T. The Garmin 1000/Perspective+ avionics suite in the simulator was consistent with the accident airplane however it used 10-inch displays rather than 12-inch displays.

indication was a decrease in engine noise. There are no discreet aural warnings for a loss of fuel flow pertaining to the fuel mixture control lever being in the cutoff position. It must be noted that during the simulator run the IIC (seated in the left seat of the sim) inadvertently moved the fuel mixture control lever aft while cycling through throttle positions. The IIC's inadvertent movement of the mixture was due to his hand/finger placement on the throttle's T-handle, and the throttle had to be moved to the full idle position to inadvertently move the mixture control to the idle cutoff position. The Flight Training Development (FTD) Specialist serving as the simulator technician remarked that it was not something he had ever seen happen before. Additionally, the FTD specialist discussed and demonstrated alternative hand/finger positions that he typically uses to move the throttle that did not interfere with the mixture control.



Figure 2: SR20 Simulator PFD and MFD

1.1.2 Airplane Review

An exemplar SR22 was uncowed and ready for review in the flight center hangar. The airplane flight deck array, throttle quadrant and fuel mixture control lever (see figure 3), PFD, MFD, and front seat restraint systems were photo documented.



Figure 3: Throttle quadrant and fuel mixture control lever

Additionally, the HP specialist photo documented use of the 4-point (front seats only) restraints using the FTD specialist as a reference (see Figure 4).



Figure 4: Photo documentation of 4-point seat restraint.

1.1.3 Airplane Delivery Observation

The chief pilot explained how Cirrus tries to personalize each customer's delivery experience to include music selection and stage lighting. The investigative team observed a new owner brought into the delivery center to view his airplane for the first time. The chief pilot then explained what typically happens after the customer takes receipt of the airplane. The new owner participates in a delivery acceptance flight flown by a Cirrus delivery pilot. A factory flight instructor is assigned to the new owner and takes the latter through a host of presentations diagramming key airplane components and a CAPS trainer to demonstrate its use and under what parameters it should be used. Cirrus then offers its new owners transition training, or advanced transition training if the individual is instrument rated. The transition training is designed to ensure the new owner has a basic understanding of the Garmin Perspective+ suite, airplane controls, and engine management.

1.1.4 Interviews

The investigative team interviewed the Director of Aircraft Delivery and Ramp Operations, the Supervisor of Flight Operations and the accident flight instructor's immediate supervisor, a Manager of Flight Operations, and the Vice President of Flight Training/Chief Pilot, a factory flight instructor/friend of the accident flight instructor, two of the individuals responsible for training the accident flight instructor, and the Aircraft Delivery Coordinator for the accident airplane and new owner. Transcripts of Interviews are included with the public docket information associated with the investigation. A summary of items discussed were the Cirrus process of moving a customer from the sales contract to the transition training certificate of completion, the training program for new owners, the training program for factory flight instructors, how CAPS training is taught, and details about interactions with the accident new owner/pilot and the factory flight instructor.

1.1.4.1 Use of CAPS

Throughout all the interviews, there was some variability in how the factory flight instructors perceived under what parameters the CAPS system should be used. The established guidance (see Attachment CAPS Training) for CAPS use is:

- Below 500 ft (600 ft for the Cirrus SR22/SR22T G5 and subsequent models) above ground level (AGL), do not deploy CAPS and land the airplane straight ahead. However, immediate deployment of CAPS is recommended if no other survivable alternative exists.
- From 500 ft (600 ft Cirrus SR22/SR22T G5 and subsequent models) to 2,000 ft AGL, deploy CAPS immediately.
- Above 2,000 ft AGL, troubleshoot and then deploy CAPS if required.
- During an engine failure that occurs above 2,000 ft AGL, where there is no airport within gliding distance, the pilot should troubleshoot the loss of engine power and maneuver to the best location for a CAPS deployment. Upon reaching 2,000 ft AGL, if not already deployed, CAPS deployment is recommended.
- If an engine failure occurs within gliding distance of a runway, the pilot must continually monitor the situation to verify if the landing is assured. At 2,000 ft AGL, the pilot must reassess if the landing is assured and, if not, then deploy CAPS. At 1,000 ft AGL, reassess if the landing is assured and, if not, then deploy CAPS.

- It is recommended to deploy CAPS before 400 ft (600 ft Cirrus SR22/SR22T G5 and subsequent models) AGL. According to the Cirrus SR22 Pilot Operating Handbook (POH), altitude loss from level flight deployments has been demonstrated at less than 400 feet; however, deployment at such a low altitude leaves little or no time for the airplane to stabilize under the canopy or for the cabin to be secured. A low altitude deployment increases the risk of injury or death and should be avoided. The chance of a successful deployment greatly decreases below 400 ft AGL.
- Spin recovery – immediate deployment of CAPS is required.
- Loss of airplane control or structural failure – immediate deployment of CAPS is recommended.

While none of the interviewees gave an answer that exceeded the minimum established parameters for CAPS deployment, several factory flight instructors varied on how long they believed they would troubleshoot the scenario, what the “hard deck” (altitude at which troubleshooting was no longer an option) was, and whether they were willing to attempt a glide to a surface suitable for landing (including the runway while in the traffic pattern).

1.1.4.2 Inadvertent Manipulation of Fuel Mixture Control

When asked during the interviews, none of the flight instructors had ever witnessed a fuel mixture control lever inadvertently pulled completely to cutoff; however, one instructor stated that he witnessed the cord of a headset get wrapped around the fuel mixture control knob, which leaned out the mixture to the point that the engine started running rough. It was the rough running engine that alerted the instructor to the problem. Another flight instructor said that he had seen a cord close enough to the throttle and fuel mixture control lever to make him uncomfortable enough to move it, but that it did not directly interfere with the engine controls.

1.1.4.3 Training Coordinator Process

During her interview, the Training Coordinator explained the process of when they are assigned to a new customer, how the training program is loaded on the learning management system and discussed some of the issues the accident new owner/pilot had with accessing the system and how that issue was ultimately resolved. She also stated that while infrequent, a customer being unable to access the learning management system has happened before. The accident pilot/owner reported that he was unable to access the learning management system on two different occasions. The first time was resolved by the Training Coordinator and the second time the Training Coordinator had to elevate the issue to their IT department.

On the second occasion, neither the Training Coordinator nor the factory flight instructor were able to locate the new owner's account. The pilot/owner was already in the Knoxville area and begun training when the issue was finally resolved.

2.0 Accident Factory Flight Instructor

2.1 72 Hour History

The human performance investigator was not able to establish a complete 72-hour history on the accident factory flight instructor as he lived alone at the time of the accident. What information was collected was via third party. The pilot was at work each day in the 72 hours leading up to the accident, working with the customer from about 0900 to 1700. His next-of-kin stated that he typically got 8-9 hours of sleep as a routine and that he was not in the habit of napping.

2.2 Factory Flight Instructor Training

The accident flight instructor was not qualified as a Cirrus Standardized Instructor Pilot (CSIP) before he was hired by Cirrus in May 2022 as a factory flight instructor. The investigative team interviewed several internal factory flight instructors who were responsible for training the accident flight instructor to perform his duties with Cirrus' new customers. The training included three phases; transition training in the Cirrus SR22, an intermediate phase to gain additional flight experience in the SR20/22 airplane while supporting internal company flight operations, and finally the completion of CSIP training.

Documented on his training records were concerns about maintaining situation awareness while operating in areas of high traffic (Class B airspaces), maintaining positive control (i.e. "staying ahead") of the airplane in dynamic situations, and use of the CAPS system. The primary instructor pilot responsible for training the accident factory instructor pilot noted the latter had difficulties in progressing through the Cirrus SR22 transition training program. He stated that after 23.9 hours of dual instruction completed over a 9-day period, he felt the accident instructor pilot was not yet ready to fly solo and required additional training once a relocation to the Cirrus Aircraft Vision Center in Knoxville, Tennessee, could occur and before the trainee would be ready to transition to the company's CSIP training. The consensus from all the instructors interviewed was that while the accident flight instructor did require additional time and performed just slightly below average in comparison to other new hires in training, he did ultimately perform to a satisfactory level and was determined to be proficient enough to work with customers as a factory flight instructor.

2.3 Interactions with Cirrus Customers

The accident factory flight instructor worked with three other customers before he was assigned to the pilot/new owner with which the accident flight occurred. Customer interview summaries are included with the public docket information associated with the investigation.

2.3.1 Customer 1

The first customer interviewed was a first officer for a Part 121 carrier. He had previous Cirrus SR20 experience before attending transition training at the Cirrus Aircraft Vision Center. Before his transition training, he did not have any flight experience with a Cirrus SR22 equipped with Garmin G1000 Perspective+ system. As part of his transition training, he wanted to acquire additional interface training on how to use the more advanced Garmin features. He talked with the accident instructor pilot about a week and a half before he traveled to the Cirrus Aircraft Vision Center to take receipt of his new airplane; however, no prearrival expectations were given to him at that time. The accident instructor pilot asked him what he was looking to accomplish during the transition training, and the customer replied that he wanted to ensure that he was "fly[ing] as standardized as possible." The customer remarked the entire process was more relaxed than he was expected it to be and that at times he would ask avionics questions to which the accident instructor pilot had no answer for. Overall, he rated the experience a "2-3" on a 1-5 scale with 5 being the highest score, and he rated his experience with the accident instructor pilot a "2" on the same scale.

2.3.2 Customer 2

The second customer interviewed was a private pilot with a single-engine land rating. He had previous flight experience in a Cirrus SR22T with a CSIP before taking receipt of his new airplane. The customer stated that he did not receive a formal training itinerary before he arrived at the Cirrus Aircraft Vision Center, nor did he receive any expectations for what he had to do before starting his transition training. He was originally slated to work with a different factory flight instructor but was then switched to the accident instructor pilot. He said that his desire was to receive instruction on flying in convective weather and its associated flight planning. During their time together, they worked on breaking in the engine, flying in and around weather, and had to divert once due to inclement weather. He said that no flights were logged even though he had an expectation that they would. On a scale of 1-5 he rated the experience a "5" and rated working with the accident instructor pilot a "5" as well.

2.3.3 Customer 3

The third customer that interviewed was a private pilot with 30-40 hours of experience in a Cirrus SR22T equipped with a Garmin1000 Perspective+ system. He was working on his instrument rating when he traveled to Cirrus Aircraft Vision Center to receive his new airplane. He said that before his arrival there was a lot of email communication and that he was introduced to the accident instructor pilot within a week of his arrival. He said he was asked what he wanted to accomplish from the transition training, and that he responded he wanted to accumulate additional instrument time. He introduced the accident instructor pilot to his personal CSIP at his home base and together, they developed a training plan. On their first day together, they went over emergency procedures to include willingness to deploy CAPS; and taxiing, takeoff, and flying under instrument meteorological conditions (IMC). He said they had one issue with an instrument approach when air traffic control gave different instructions to what they had loaded into the Garmin G1000 Perspective+ system. When they navigated away to attempt the instrument approach again, they had difficulty with the autopilot. The next time they flew they got confused with holding at a specific waypoint and felt they could have done a better job setting it up in the autopilot. He said that overall, the accident instructor pilot was a very experienced instrument pilot; however, he did not believe the instructor had as much Cirrus SR22T experience as he did. On a scale of 1-5 he rated his overall experience a "5" and his experience with the accident instructor pilot as a "5" as well.

2.3.4 Customer 4/Accident Pilot

The accident pilot/new owner's first interaction with the instructor pilot was the night the former had first arrived in Knoxville, Tennessee. The instructor asked him what he wanted to accomplish, and he told the instructor the type of flying he typically did. The next day the pilot accepted delivery of the accident airplane, completed his delivery flight (with a different Cirrus pilot), and received the airplane's pertinent logbooks and other assorted accoutrement. Afterwards, the instructor reviewed the operating parameters for and demonstrated the CAPS system deployment via simulator. Then they reviewed the airplane's fuel and electrical systems on a whiteboard.

On the second day of training, they discussed how to preflight the airplane and completed their first training flight. Due to restrictions for the engine power settings for a new airplane (less than 25 hours), they were unable to conduct traffic pattern work and the customer felt they "couldn't really learn anything" that he hoped to achieve on the flight. Instead, they focused on learning the G1000 Perspective+ system. In the post accident interview, the pilot stated that he thought it was interesting Cirrus "didn't have some syllabus for me" dictating what he was to learn each day.

On the third day of training, the instructor asked him where he wanted to go and offered Florida as an option. The pilot responded that he wanted to go "land somewhere or do a touch and go or something." They did instrument approaches, touch and go takeoffs and landings, and practiced crosswind landings.

Before the fourth day of training, the pilot started to feel unwell overnight, and in the morning a plan was made for the instructor to ferry him back to his home base in Texas and resume training. It was not clear with whom the pilot would continue training. Cirrus' Chief Pilot stated the pilot would likely resume training with a local CSIP while the pilot was under the assumption he would continue with the instructor if he was feeling better the next day. The pilot stated that before commencing the cross-country flight he and the instructor did not communicate what roles each would have should an emergency arise.

They departed Mc Ghee Tyson Airport (TYS), Knoxville, Tennessee, stopped once for fuel at Monroe Regional Airport (MLU), Monroe, Louisiana, and then resumed their journey to David Wayne Hooks Memorial Airport (DWH), Spring, Texas. The accident pilot stated that shortly after they departed MLU, about 10 minutes into the flight, the flight instructor told him that he needed to urinate. The pilot stated that the flight instructor appeared to be in discomfort for the remainder of the flight and did not speak much or provide any feedback until they got closer to DWH.

During communication with ATC, they switched from doing an RNAV approach to the visual. The pilot expressed confusion over how to load the visual approach into the Garmin G1000 Perspective+ system and concern that there were no step downs or waypoints assigned once he had. In the post accident interview, he said that he loaded it but was unsure if it was activated. He did not know how it was supposed to work in the Cirrus airplane. He said once they were cleared to land, he did see "two lights and two reds" indicating they were on glide slope. The airspeed started to decrease slightly, and the instructor told him to "watch you[r] airspeed." He increased the throttle but that he "didn't hear any noise, sound of the RPM of the motor." Almost immediately after that the instructor took control of the airplane and gave it full throttle; however, the airplane impacted trees and then crashed inverted between two trailer homes. The pilot stated that the flight instructor did not ask him to verify control positions or troubleshoot anything in the moments before the accident, nor did they discuss any anomalies with the airplane or if they should deploy the CAPS.

The pilot did not remember completing a before-landing checklist, or any emergency action procedures before impact. Further, the pilot reported that he did not interfere with, nor did he remember the instructor interfering with the fuel mixture control throughout the latter duration of the flight. He stated the only thing he had on him was a tablet strapped to his knee and a cell phone in the seat pocket. Likewise, the instructor did not have any items that could interfere with the operation of the

airplane (according to the pilot). Both pilots were wearing noise-canceling headsets and both were wearing seat restraints

3.0 Accident Pilot/Owner

The accident pilot and owner of the accident airplane had no flight experience in a Cirrus SR22 before traveling to Cirrus Aircraft Vision Center to accept delivery of his new airplane. He was previously provided a 30-minute demonstration flight about 1.5 years before the accident. At the time of the accident, he had owned and operated a Cessna 182 airplane. Before he arrived in Knoxville, Tennessee, he communicated with the person responsible for his delivery experience, and the person responsible for setting up his training. He was unable to access any of the online training platforms that Cirrus provided before he traveled to Knoxville to accept delivery of his airplane. He relayed this information to the training manager who told the investigation team in a subsequent interview that the issue had to be elevated to Cirrus' IT department to resolve. The accident pilot remained unable to access the Cirrus online training system before he accepted delivery of his airplane. As an interim resolution, the pilot/owner reached out to his Cirrus sales representative who provided a copy of the airplane's pilot operating handbook. The pilot stated repeatedly that he had no real experience with Cirrus airplane outside of his familiarization flight when he purchased the airplane, and believed he would be provided some sort of syllabus for his training at the Knoxville facility. He stated that his expectations were to be taught how to fly the plane. He said that he was "relying on them to teach me, not me tell them what to teach me."

E. List of Attachments

Attachment: Cirrus Airframe Parachute System Training
Attachment: Interview Summaries
Attachment: Interview Transcriptions

Submitted by:

Sabrina Woods
Human Performance