



NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

September 24, 2020

System's Group Chairman's Factual Report

NTSB No: CEN18FA400

A. ACCIDENT:

Aircraft: Cirrus SR22T, registration number N325JK
Location: Gulf of Mexico
Date: January 3, 2018
Time: 1830 Central Daylight Time

B. GROUP MEMBERS:

Chairman: Mike Hauf
National Transportation Safety Board
Member: Brannon Mayor
Cirrus Design Corporation
Member: Dan Withers
Federal Aviation Administration

C. SUMMARY:

On January 3, 2018, about 1830 central standard time, a Cirrus SR22T airplane, N 325JK, was involved in an accident in the Gulf of Mexico. The pilot is presumed to be fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

D. DETAILS OF THE INVESTIGATION:

D.1 SR22T:

The accident airplane was a Cirrus SR-22T. The five-place, low wing, single-engine airplane, serial number 1290, was manufactured in 2016, and had a standard airworthiness certificate classifying its operation in the normal category, dated April 1, 2016. The airplane was powered by one Continental Motors, Incorporated TSIO-550- fuel-injected and turbocharged 6-cylinder horizontally opposed reciprocating engine, serial number 1032040, rated at 315 horsepower at 2,500 rpm. The airplane was equipped with a 3-blade Hartzell model PHC-J3Y1F-1N/N7605CB constant-speed propeller.

According to the Cirrus Design Corporation SR22T Type Certificate Data Sheet¹ (TCDS) A00009CH, Revision 22, the SR22T airplane was granted normal category approval on February 10, 2010. The airplane has a maximum operating altitude of 25,000 feet.

The accident airplane was equipped with a Cirrus Perspective+ integrated flight deck² (GIFD) comprised of a primary flight display (PFD) and a Multi-function display (MFD) for presenting flight information to the pilot. The PFD presents graphical flight instrumentation (attitude, heading, airspeed, altitude, vertical speed), and the MFD displays a full-color moving map with navigation information while the left portion of the MFD is dedicated to the Engine Indication System. All displays offer control for COM and NAV frequency selection.

The Perspective+ system was also configured with an Emergency Descent Mode (EDM) function. This function was a standard “feature” that has been on all production approved Cirrus SR2X software since early versions of 0764.XX software³. According to the aircraft records⁴, the airplane had Garmin Software version 0764.32 (P/N: 006-B0764-32) which included the EDM function.

¹ The TCDS is a formal description of the aircraft, engine or propeller. It lists limitations and information required for type certification including airspeed limits, weight limits, thrust limitations, etc.

² The Cirrus Perspective+ Integrated Avionics was manufactured by Garmin

³ EDM was first available on Phase E, SW load 0764.09, MY2011, (January 2011).

⁴ Garmin avionics system software production report for aircraft 22T-1290

D.2 Accident Flight:

According to data provided by the FAA, about 15:09:53 (local time), the pilot of N325JK contacted the Fort Worth Air Route Traffic Control Center (ZFW ARTCC) Ednas-low sector radar (EDN-LR) controller and advised that he was at Flight Level⁵ (FL) 190. At 15:10:06, the pilot was then advised by the EDN-LR controller that he was cleared direct to Gooch Springs (AGJ) and then direct to Georgetown; the pilot acknowledged (see Figures 1 and 2)⁶. About 15:15:47, the EDN-LR controller instructed the pilot of N325JK to descend and maintain 15,000 ft and issued an altimeter setting of 30.30; the pilot acknowledged (see Figure 3). At 15:16:57, the EDN-LR controller transmitted *“and uh five juliet kilo it’s still not looking like you’re direct gooch springs there uh vector for gooch springs alpha golf juliet fly heading one nine zero”*. The pilot replied *“okay, vector for gooch springs um heading one niner zero for five juliet kilo.”* At 15:17:09, the EDN-LR controller instructed the pilot of N325JK to descend and maintain 13,000 feet. At 15:18:13, the EDN-LR controller repeated the instruction. At 15:18:18, the pilot replied *“one three thirteen thousand five juliet kilo.”* At 15:18:21, the EDN-LR controller confirmed with the pilot of N325JK that he was the one that had responded to the descent instruction to 13,000 feet; the pilot replied in the affirmative. The controller then advised he had requested because he had not seen him start his descent; the pilot did not acknowledge. At 15:19:06, the EDN-LR controller queried *“and three two five juliet kilo are you at flight level one nine zero or are you descending;”* the pilot did not respond (see Figure 4). The controller attempted to contact the pilot three more times with no response. A review of radar data showed that about 15:19:15, while the airplane remained at FL190, its heading changed from about 180 to 140. At 15:20:09, the EDN-LR controller transmitted *“and five juliet kilo i see you identing can you hear me.”* At 15:20:19, the EDN-LR controller transmitted *“three two five juliet kilo ident observed i need you to fly heading two zero zero vector for your descent two zero zero acknowledge by ident;”* the pilot did not respond. The EDN-LR controller continued multiple attempts over several minutes to contact N325JK with no response. At 15:33:52, the EDN-LR controller transmitted *“november three two five juliet kilo fort worth center i can see your ident there please descend and maintain thirteen thousand three two five juliet kilo descend to one three thousand and if you have oxygen please switch it uh put it on right now;”* the pilot did not respond. At about 15:34, N325JK entered Houston (ZHU) ARTCC airspace. The EDN-LR and CUGAR-R controllers both continued with multiple attempts to contact N325JK with negative results. A review of radar data indicates that upon reaching FL190 at about 14:34:50, the aircraft then remained at about that altitude until radar data was lost at 18:06:16.

⁵ Flight Level - A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level (FL) 250 represents a barometric altimeter indication of 25,000 feet; FL 255, an indication of 25,500 feet. Aircraft altitudes from 18,000 feet and above are indicated by flight level (FL).

⁶ For a complete flight track, Reference ATC Information – Addendum 1, titled “flight track Graphic” in the NTSB public docket for this accident.

Figure 1 Flight Track for N325JK

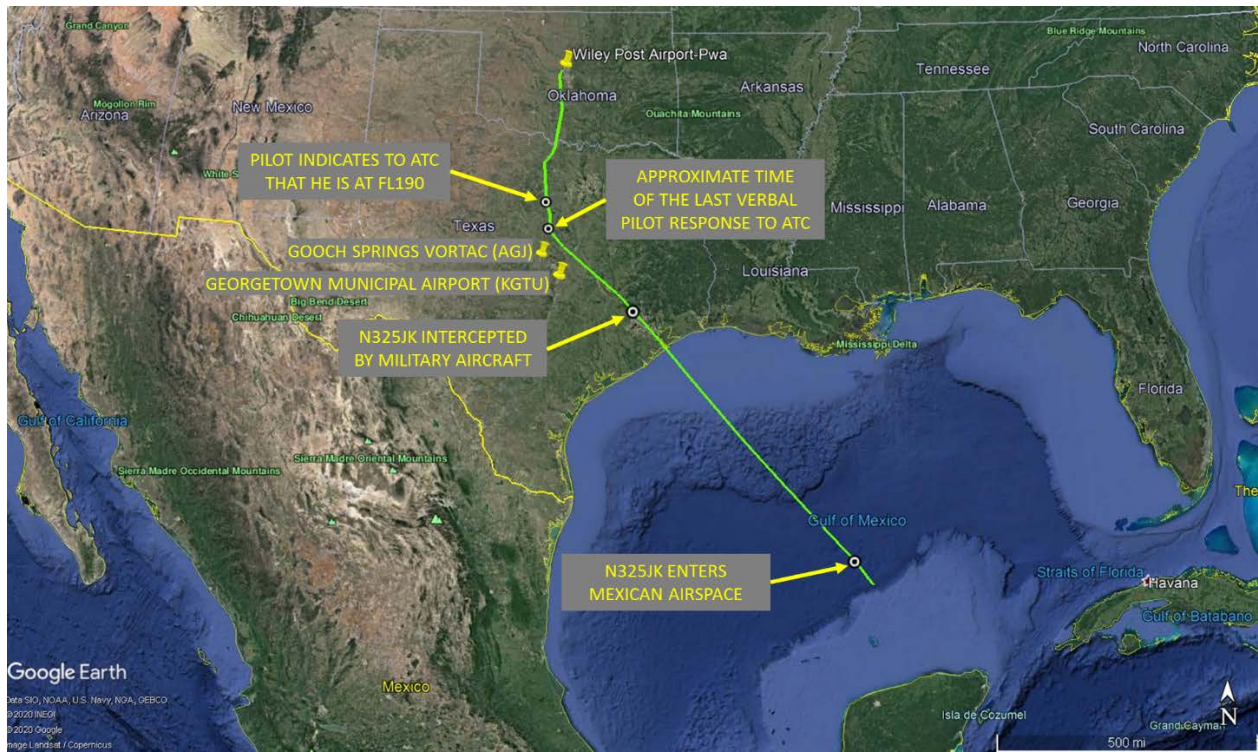


Figure 2 Entire Flight

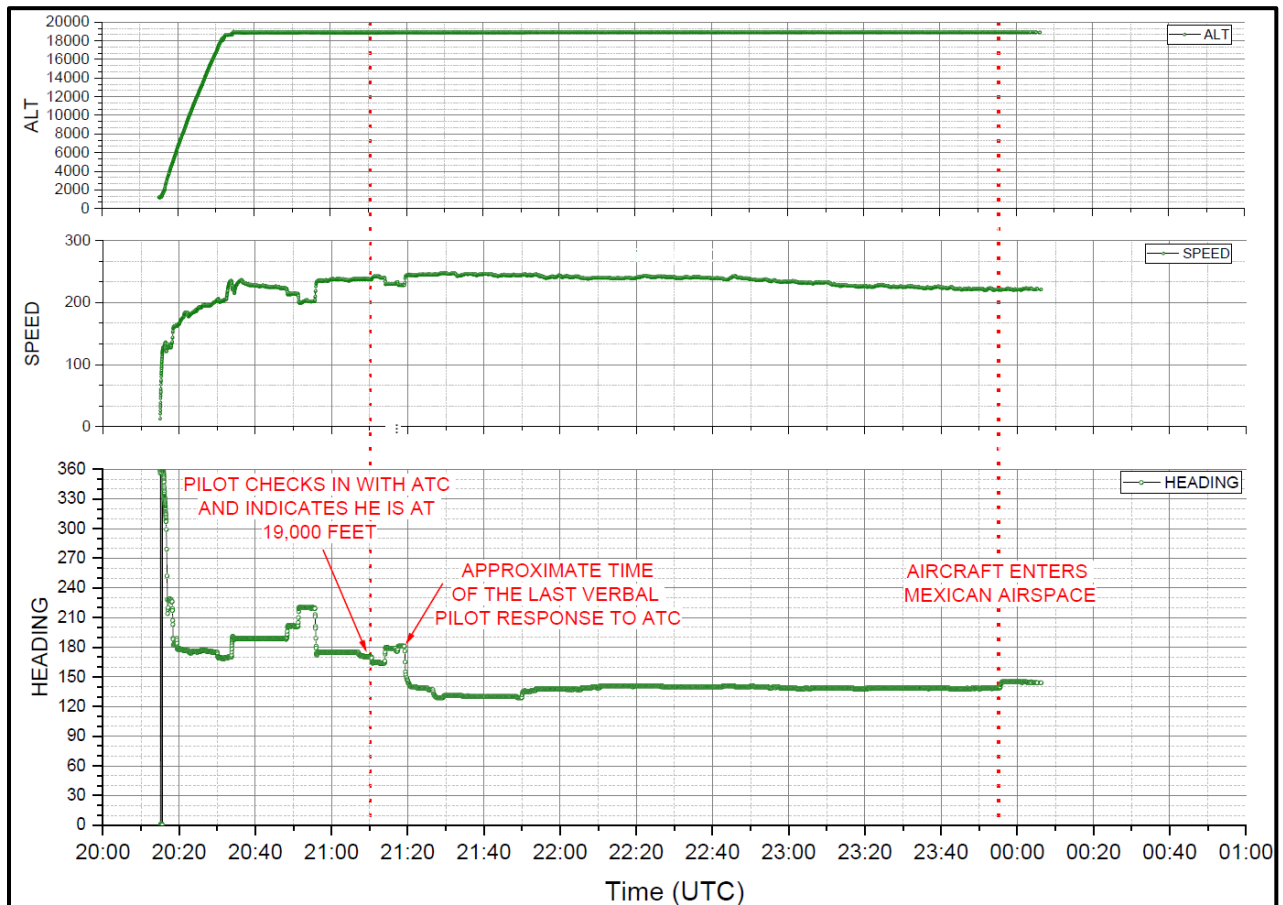


Figure 3 30-Minute portion of the flight (21:00 to 21:30)

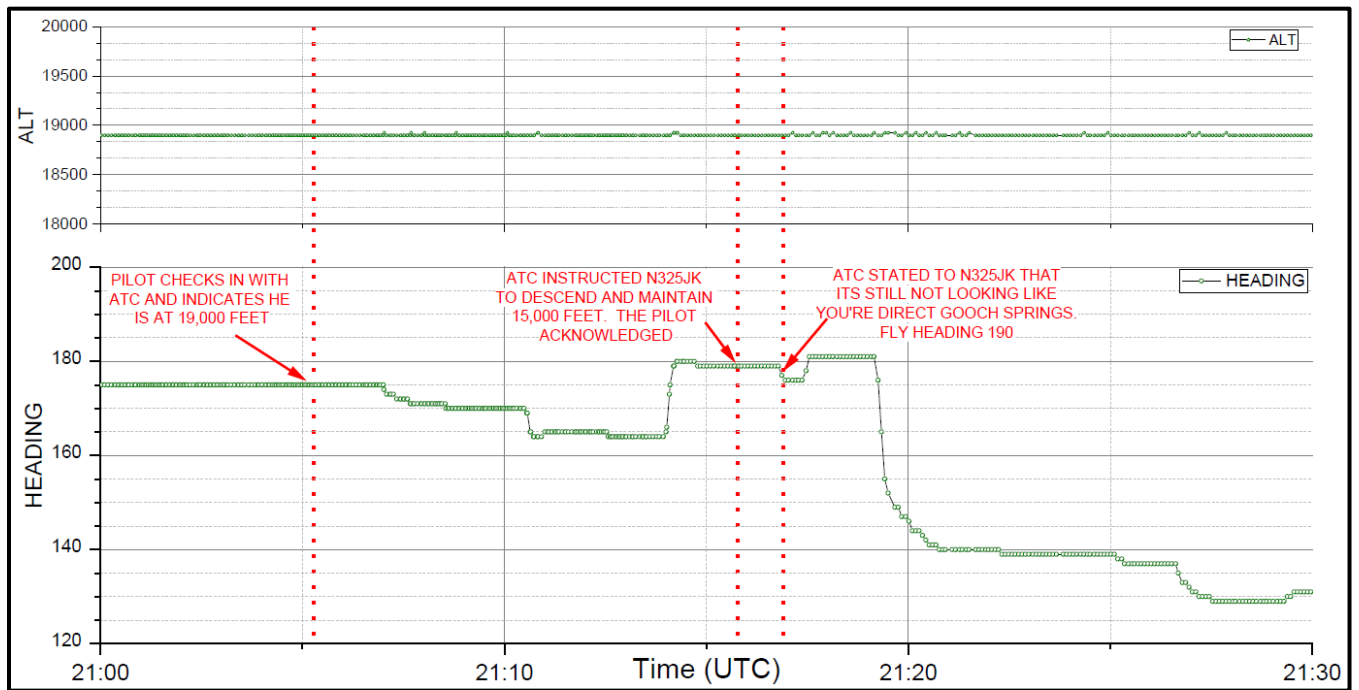
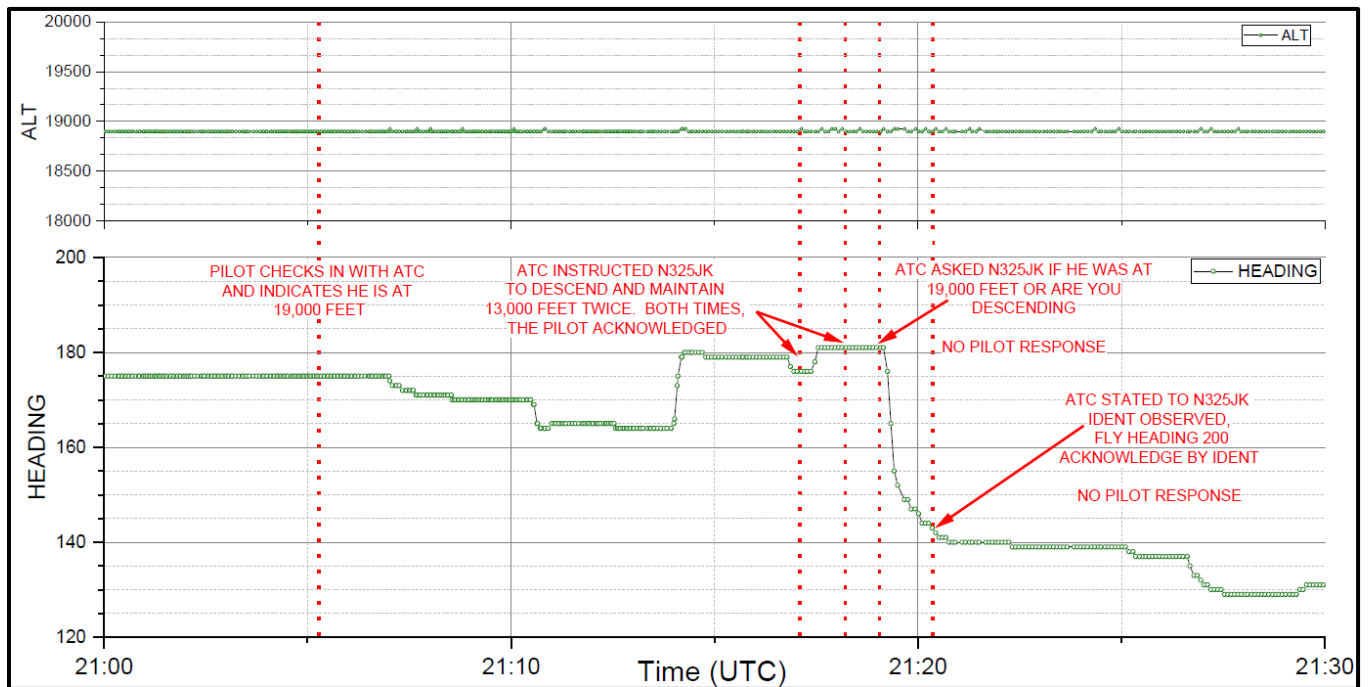


Figure 4 30-Minute portion of the flight (21:00 to 21:30)

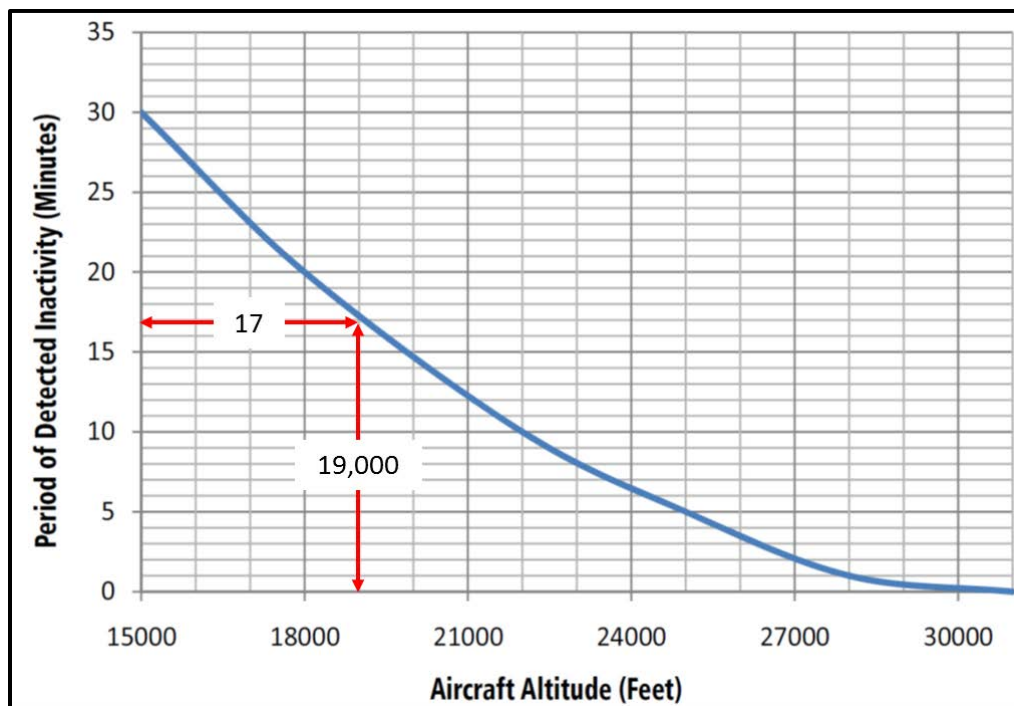


D.3 Hypoxia Recognition with Automatic Descent Mode:

The airplane was equipped with a hypoxia recognition system for the purpose of detecting pilot incapacitation because of hypoxia or other physical conditions by continuously monitoring the pilot's interaction with the Garmin Perspective+ system. If the system determines that the pilot is not responding, the Emergency Descent Mode function is engaged. When activated, the system commands the airplane to descend to a lower altitude to provide the pilot and passengers an opportunity to recover from the effects of hypoxia.

The system is only operative when the airplane's altitude is above 14,900 ft (pressure altitude) and the Garmin automatic flight control system (AFCS) is engaged. Pilot interaction with the Perspective+ system is monitored by detecting key presses and turns of the knobs (Audio Panel and push-to-talk switch excluded). If a period of inactivity, time dependent on altitude, is detected, the hypoxia recognition system will initiate the Emergency Descent Mode. The accident airplane was at an altitude of approximately 19,000 ft which would result in an activation time of about 17 minutes (Reference Figure 5)

Figure 5 Hypoxia Recognition Activation Times



Upon activation of the Emergency Descent Mode, there are four sequential phases employed by the system; determining pilot alertness, descent to 14,000 feet MSL, and descent to 12,500 feet MSL. The Phases are:

- Advisory Annunciation:
When the system detects a sufficient period of inactivity, the Advisory Annunciation “ARE YOU ALERT?” is displayed. Selecting the **ALERT** Softkey will acknowledge the message and reset the system. Pressing any other softkey or turning a knob will also reset the system.
- Caution Annunciation:
When no pilot interaction is detected for an additional 60 seconds, the Caution Annunciation “**HYPOXIA ALERT**” is displayed. Again, selecting the **ALERT** Softkey will acknowledge the message and reset the system. Pressing any other softkey or turning a knob will also reset the system.

- Warning Annunciation:
When no pilot interaction is detected for an additional 60 seconds, the Warning Annunciation “AUTO DESCENT” is displayed in the Annunciation Window and “Automatic descent to 14,000FT in 60 seconds” is displayed in the Alerts Window. Once again, selecting the **ALERT** Softkey will acknowledge the message and reset the system. Pressing any other softkey or turning a knob will also reset the system.
- Descent:
When no interaction is detected for another 60 seconds, the system will automatically proceed with the descent. As the system prepares for descent, the Selected Altitude is set to 14,000 and the AFCS enters Indicated Airspeed (IAS) mode with the airspeed reference set to the maximum allowable airspeed setting for the specific aircraft model. AFCS lateral mode settings are not affected.

As the descent begins, an “AUTO DESCENT” warning is displayed in the Annunciation Window. “AUTO DESCENT - Aircraft Descending to 14,000FT” is displayed in the Alerts Window. “EDM” is shown as an AFCS Status Annunciation indicating the system has entered Automatic Descent Mode. “EDM” A continuous repeating chime will be heard as long as Automatic Descent Mode is active. After the descent begins, Automatic Descent Mode can only be canceled by disconnecting the autopilot.

As the airplane reaches 14,000 ft the system sets the AFCS to Altitude Hold mode. The AFCS will also remain in Automatic Descent Mode as indicated by “EDM” continuing to be displayed as an AFCS Status Annunciation. The system again begins monitoring for pilot interaction. If no pilot interaction is detected for four minutes, the system initiates the second descent. As the system prepares for this descent, the Selected Altitude is set to 12,500 ft msl and the AFCS again enters IAS mode with the airspeed reference set to the maximum allowable airspeed for the specific aircraft model.

As the descent begins, an “AUTO DESCENT” warning is displayed in the Annunciation Window. “AUTO DESCENT - Aircraft Descending to 12,500FT” is displayed in the Alerts Window. “EDM” is shown as an AFCS Status Annunciation. Also, the continuous repeating chime is heard.

As the airplane reaches 12,500 ft the system sets the AFCS to Altitude Hold mode. The AFCS will also remain in Automatic Descent Mode as indicated by “EDM” continuing to be displayed as an AFCS Status Annunciation as well as the continuing presence of the repeating chime. At this point, the AFCS must be disconnected to cancel Automatic Descent Mode.

D.4 Oxygen System:

The airplane was equipped with a Precise Flight, Inc. fixed oxygen system. This system was designed to provide supplemental oxygen for the pilot and passengers. The system consisted of a 77 cu ft bottle and a pressure regulator assembly located in the aft fuselage, a four or five place distribution manifold located in the headliner, a control panel located in the center console next to the flap switch, and up to five (5) flow devices consisting of either constant flow meters or demand regulators, with either a cannula or face mask for each user. For the Cirrus Perspective system, the MFD engine page displays the oxygen bottle pressure on oxygen pressure indicator.

The Garmin display will also display a steady caution “OXYGEN QTY” when the bottle pressure is between 400 to 800 psig and will display a steady warning “OXYGEN QTY” when the bottle pressure is

less than 400 psig. These alerts will only be displayed when the oxygen system is ON, or the aircraft is above 10,000 ft and the conditions exist for the warning. The Cirrus Perspective provides secondary annunciation on the PFD in the alerts window with audio alerts (reference Figures 6 & 7). The three types of alerts are Warning, Caution, and Advisory.

Figure 6 Oxygen System Audio Alerts

ANNUNCIATION	ALERT TYPE	AUDIO ALERT
OXYGEN FAULT	WARNING	REPEATING DOUBLE CHIME
OXYGEN QTY	WARNING	REPEATING DOUBLE CHIME
OXYGEN QTY	CAUTION	DOUBLE CHIME
OXYGEN RQD	CAUTION	DOUBLE CHIME
OXYGEN QTY	ADVISORY	NO AURAL
OXYGEN LEFT ON	ADVISORY	DOUBLE CHIME

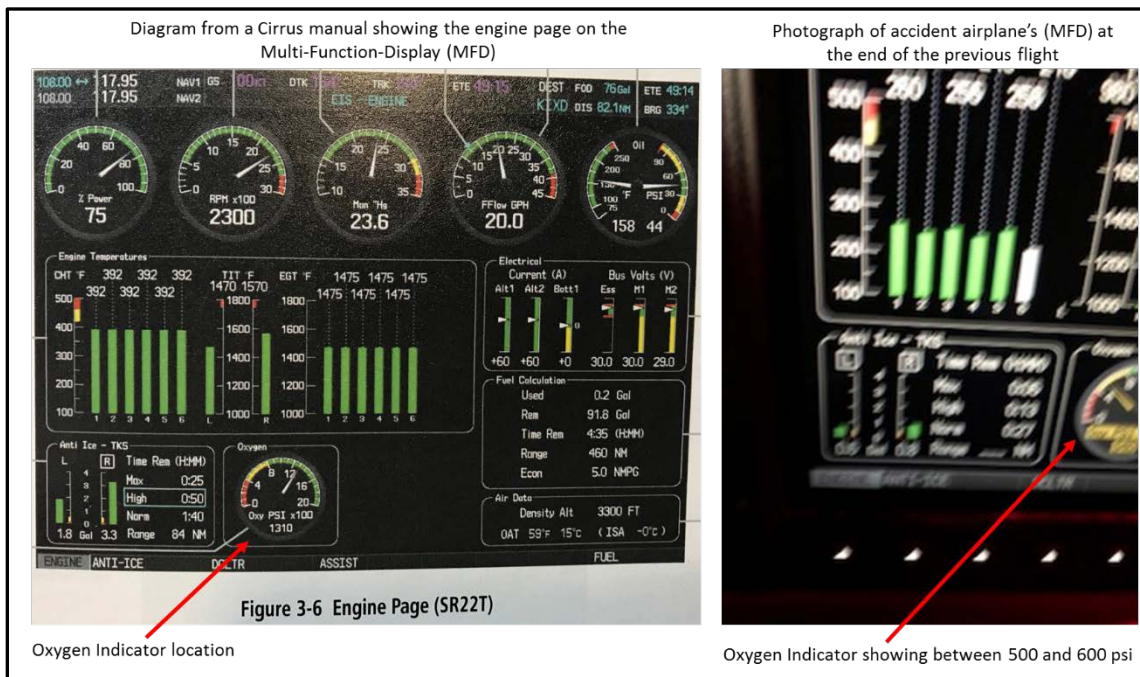
Figure 7 Oxygen System Alert – Descriptive Text and Logic

ANNUNCIATION	DESCRIPTIVE TEXT	LOGIC
OXYGEN FAULT	OXYGEN SYSTEM FAULT	O2 LOW OUTPUT OR O2 SOLENOID FAIL DISCRETE
OXYGEN QTY	OXYGEN QUANTITY IS LOW	(SYSTEM ON “OR” ALT ≤ 10K) & PSI ≤ 400
OXYGEN QTY	OXYGEN QUANTITY IS LOW	(SYSTEM ON “OR” ALT ≤ 10K) & PSI ≤ 800
OXYGEN RQD	OXYGEN QUANTITY IS LOW	(SYSTEM OFF “OR” ALT ≤ 10K) & PSI ≤ 800
OXYGEN QTY	OXYGEN IS REQUIRED	O2 REQUIRED DISCRETE FROM PSI
OXYGEN LEFT ON	OXYGEN SYSTEM IS LEFT ON AFTER SHUTDOWN	RPM = 0 AFTER SHUTDOWN & SYSTEM ON & ON GROUND

Prior to flight, the pilot should turn the system ON to ensure that a sufficient quantity (pressure) of oxygen exists for the flight and for passenger requirements using charts included in the supplemental Type Certificate (STC) SA01708SE, titled Precise Flight, Inc. Cirrus SR22/SR22T fixed oxygen system.

The NTSB was provided with a photograph showing a partial image of the oxygen indicator on the accident airplane. The photograph, taken after the end of the flight prior to the accident flight, shows the oxygen indicators pointer between 500 and 600 psi (Reference Figure 8).

Figure 8 Photograph of an exemplar oxygen indicator and indicator from accident aircraft



D.5 Cirrus Service Advisory:

According to Cirrus Service Advisory SA19-09, dated April 26, 2019, Cirrus was made aware of a condition where the Dual Concentric Knob (DCK) on certain Garmin LRUs (PFD and MFD) can exhibit uncommanded inputs, resulting in unintentional standby frequency changes, MFD page navigation, or similar behavior. In addition, these uncommanded inputs may interfere with the normal function of the Hypoxia Recognition System feature in the Garmin System Software.

For the SR22T, the Service Advisory is effective for airplanes with the Perspective Avionics having software version v0764.09 (& later) or Perspective+ Avionics (all software versions). The accident airplane was equipped with Garmin Software version 0764.32 (P/N: 006-B0764-32).

Cirrus provided the NTSB with a description of a software change that Garmin made to their Perspective+ system. According to Cirrus, Garmin revised the software responsible for resetting the hypoxia alert system. Prior to the change, the hypoxia alert would be reset when the system software detected when a knob on the PFD or MFD has been turned or when a key was pressed. Now, the alert will only be reset when the system detects that a key has been pressed.