

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA24LA007

AIRCRAFT SYSTEMS

Specialist's Factual Report

January 7, 2025

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A ACCIDENT

Location: Martinsville, Virginia
Date: October 11, 2023
Time: 22:47 eastern daylight time (EDT)
Airplane: Cirrus SR22T, registration N253BC

B SPECIALIST

Specialist: Tom Jacky
 National Transportation Safety Board
 Washington, DC

No group was formed for this portion of the investigation.

C SUMMARY

On October 11, 2023, at about 2247 eastern daylight time, a Cirrus SR22T, N253BC, was substantially damaged when it struck trees to the left of the departure end of runway 31 at Blue Ridge Airport (MTV), Martinsville, Virginia. The pilot and three passengers were not injured. The airplane was operated as a Title 14 Code of Federal Regulations Part 91 personal flight.

The pilot indicated that he had updated the airplane's electronic flight instrument system prior to departure. The pilot reported that shortly after takeoff the airplane's primary flight display blinked off momentarily and then reappeared with a "Taxiway! Taxiway!" banner. He looked at the multifunction flight display and noted that it was "completely orange" and appeared to depict an autopilot track turning directly left, which made him wonder if the autopilot was engaged.

After the collision with trees, the pilot was able to maintain control of the airplane and made a safe landing on the departure airport's runway 13.

The following devices were removed from the airplane for further investigation:

1. Garmin GDU 1250A, marked "MFD", by investigators
 Part Number: 011-03471-20
 Serial Number: 495203501
 Mod Level: None marked
2. Garmin GDU 1250A, marked "PFD" by investigators
 Part Number: 011-03471-20
 Serial Number: 495303613

Mod Level: None marked

In addition, the NTSB Vehicle Recorder Division received the following electronic files, downloaded or resident on a removeable secure digital (SD) card, from the aircraft:

Device: Appareo Recoverable Data Module RDM-300
Electronic File #1: arinc_20231025_115337_237.csv

Device: Garmin G1000 running Cirrus Perspective+ software
Electronic File #2: log_231012_024156_KMTV.csv

Device: Garmin G1000 running Cirrus Perspective+ software
Electronic File #3: rpt_231011_205524_N253BC.csv

For more information regarding the examination of electronic files number 1 and number 2, please see the Specialist's Factual Report - Recorded Flight Data Report, dated April 7, 2025, in the public docket of this investigation.

D DETAILS OF THE INVESTIGATION

1.0 Description of Airplane's Autoflight and Display Systems

The airplane was equipped with a Garmin GFC 700 digital Automatic Flight Control System (AFCS) Autopilot system, composed of multiple Line-Replaceable Units (LRUs) and servos. The GFC 700 is fully integrated within the airplane's Perspective+ Integrated Avionics System. The Perspective+ avionics platform provides a standard cockpit display for Cirrus airplanes.

As part of the Perspective+ system, the airplane's flight deck is equipped with two Garmin GDU 1250A 12-inch displays. One display, the Primary Flight Display (PFD) is installed directly in front of the left seat (pilot) and the second unit, the Multi-Function Display (MFD), was installed above the center console. The PFD is intended to be the primary display of flight parameter information (attitude, airspeed, heading, and altitude) during normal operations. See Figure 1.



Figure 1. The airplane's PFD, as marked by investigators, removed from the airplane.

The PFD accepts data from a variety of sources, including the MFD and the Integrated Avionics Units, through a high-speed data bus connection. In conjunction with the Flight Management System Keyboard, the PFD also controls and displays all communication and navigation frequencies as well as displaying warning/status annunciations on aircraft systems.

As part of the Perspective+ system, the Garmin SafeTaxi and SurfaceWatch¹ programs were installed on the airplane.

The MFD, located above the center console, depicts navigation, terrain, engine, traffic data, NAV/COM frequencies, and annunciation information. See Figure 2.

¹ SurfaceWatch is a monitoring system that provides pilots with alerts related to runway and/or taxiway identification, or a too-short runway.



Figure 2. The airplane's MFD, as marked by investigators, removed from the airplane.

2.0 Database Loads on the Airplane's Avionic Suite

The Perspective+ avionics platform allows for loading updated databases into the system. The updates are loaded onto the airplane using the MFD or PFD card slots and inserting an SD card with the update(s) into the slot. The procedure for loading databases into the avionics platform is provided in the Cirrus Cockpit Reference Guide for the SR20/SR22/SR22T.

3.0 Examination of Airplane's Database Status

In his interview, the pilot indicated that he uploaded (or updated) the airplane's databases the morning of the accident but had to re-load the databases because the databases did not properly load the first attempt.

Following the accident, Cirrus downloaded and provided the NTSB with the following electronic file: rpt_231011_205524_N253BC.csv. The file was one of the files found on the removable SD card in the MFD upper SD slot. A portion of the file listed the identity and status of the database files for the avionics system. The following image of the database status of the system on the airplane was included in Figure 3.

991	Database Data	v2.00							
992	Database	Status	Description	Cycle	Part Number	Version	Effective Date	Expiration Date	
993	APT Directory DB (MFD 1)	Success	Americas	23D5	006-D1430-21	1.01		10/5/2023	11/30/2023
994	AVTN STDBY DB (MFD 1)	Success	AMR-ADB2		2309 006-D5159-01			9/7/2023	10/5/2023
995	Aeronautical Charts (MFD 1)	Success	US IFR/VFR Charts		2310		2	10/5/2023	1/1/1990
996	Airport TRN DB (MFD 1)	Missing						1/1/1990	1/1/1990
997	Autoland Notice (MFD 1)	Missing						1/1/1990	1/1/1990
998	Aviation DB (MFD 1)	Success	AMR-ADB2		2310 006-D5159-01			10/5/2023	11/2/2023
999	Base Map (MFD 1)	Success	Worldwide Basemap 22M1	22M1		5.2		1/1/1990	1/1/1990
1000	Charts CRCs (MFD 1)	Success	Jeppesen ChartView		2321		12-31-65535		11/2/2023
1001	Charts CRCs (MFD 1)	Success	Jeppesen ChartView		2321		12-31-65535		11/2/2023
1002	Checklist (MFD 1)	Success	Checklist					1/1/1990	1/1/1990
1003	FliteCharts DB (MFD 1)	Missing						1/1/1990	1/1/1990
1004	Obstacle DB (MFD 1)	Success	Worldwide Fixed-Wing	23B5	006-D4731-15	1.5		10/5/2023	11/30/2023
1005	ROAAS Database (MFD 1)	Missing						1/1/1990	1/1/1990
1006	SafeTaxi Map (MFD 1)	Success	Americas SafeTaxi 23S5	23S5		3.18		10/5/2023	11/30/2023
1007	Terrain DB (MFD 1)	Success	Worldwide	20T1	006-D2659-01	3		4/8/2020	1/1/1990
1008	APT Directory DB (PFD 1)	Success	Americas	23D5	006-D1430-21	1.01		10/5/2023	11/30/2023
1009	AVTN STDBY DB (PFD 1)	Success	AMR-ADB2		2309 006-D5159-01			9/7/2023	10/5/2023
1010	Aeronautical Charts (PFD 1)	Missing						1/1/1990	1/1/1990
1011	Airport TRN DB (PFD 1)	Missing						1/1/1990	1/1/1990
1012	Autoland Notice (PFD 1)	Missing						1/1/1990	1/1/1990
1013	Aviation DB (PFD 1)	Success	AMR-ADB2		2310 006-D5159-01			10/5/2023	11/2/2023
1014	Base Map (PFD 1)	Success	Worldwide Basemap 22M1	22M1		5.2		1/1/1990	1/1/1990
1015	Charts CRCs (PFD 1)	Missing						1/1/1990	1/1/1990
1016	Charts CRCs (PFD 1)	Missing						1/1/1990	1/1/1990
1017	Checklist (PFD 1)	Success	Checklist					1/1/1990	1/1/1990
1018	FliteCharts DB (PFD 1)	Missing						1/1/1990	1/1/1990
1019	Obstacle DB (PFD 1)	Success	Worldwide Fixed-Wing	23B5	006-D4731-15	1.5		10/5/2023	11/30/2023
1020	ROAAS Database (PFD 1)	Missing						1/1/1990	1/1/1990
1021	SafeTaxi Map (PFD 1)	Success	Americas SafeTaxi 23S5	23S5		3.18		10/5/2023	11/30/2023
1022	Terrain DB (PFD 1)	Success	Worldwide	20T1	006-D2659-01	3		4/8/2020	1/1/1990
1023									
1024	Configuration IDs	v2.00							

Figure 3. Database status as indicated after the accident.

The following databases were not present (and indicated as “Missing”) in the database status file on the Database SD card at the time of data retrieval, along with a description of the contents within each database.

1. Runway Overrun Awareness and Alerting System (ROAAS²) Database (MFD1 and PFD1): Runway information to calculate landing distance and if aircraft will overrun runway with current flight parameters.
2. Flite Charts DB (MFD1 and PFD1): FliteCharts – Standard terminal arrival routes, departure procedures, approaches, and airport diagrams.
3. Charts CRCs (PFD1, two files):
4. Autoland Notice (MFD1 and PFD1): Autoland Notice³ – data for the emergency auto-land feature in Cirrus aircraft.
5. Airport TRN DB (MFD1 and PFD1): Airport Terrain database – man-made and natural airport structures (buildings, towers, etc).
6. Aeronautical Charts (PFD1): Aeronautical Charts (PFD) – IFR/VFR charts.

Cirrus indicated that the database status, as indicated after the accident, was a normal status for the airplane and avionics system.

4.0 Taxiway and Terrain Warnings

Per the Cirrus Cockpit Reference Guide (GPN 190-02184-03 Rev. A), the following Taxiway and Terrain warnings are available within the Perspective+ avionics platform:

² Garmin indicated that ROAAS was not available for this airplane.

³ Garmin indicated that Autoland was not available for this airplane.

4.1 Annunciations Related to SurfaceWatch and Taxiway Takeoffs

SurfaceWatch Alert Annunciation	Associated Voice Alert	Description
TWY TAKEOFF	"Taxiway"	Issued when the aircraft is taking off from a non-runway (e.g. a taxiway).
RWY TOO SHORT	"Runway too short"	Issued when the aircraft is taking off from a runway with a length less than needed as calculated by the PERF function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is taking off from a runway different than that entered in PERF.
TWY LANDING	"Taxiway"	Issued when the aircraft is landing on a non-runway (e.g. a taxiway).
RWY TOO SHORT	"Runway too short"	Issued when the aircraft is landing on a runway with a length less than needed as calculated by the PERF function.
CHECK RUNWAY	"Check runway"	Issued when the aircraft is landing on a runway different than that entered in PERF.

4.2 Terrain Awareness System and Status Alerts

TERRAIN ALERTS

Alert Type	PFD/'Map - Terrain- SVT' Page Alert	MFD Pop-Up Alert (except 'Map - Terrain- SVT' Page)	Voice Alert
Reduced Required Terrain Clearance Warning (RTC)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Line Clearance (RLC) Warning	TERRAIN	WARNING - WIRE	"Warning; Wire, Wire"
Imminent Terrain Impact Warning (ITI)	TERRAIN	WARNING - TERRAIN	"Warning; Terrain, Terrain"
Reduced Required Obstacle Clearance Warning (ROC)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Obstacle Impact Warning (IOI)	TERRAIN	WARNING - OBSTACLE	"Warning; Obstacle, Obstacle"
Imminent Line Impact Warning (ILI)	TERRAIN	WARNING - WIRE	"Warning; Wire, Wire"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN	"Caution; Terrain, Terrain"
Imminent Line Impact Caution (ILI)	TERRAIN	CAUTION - WIRE	"Caution; Wire, Wire"
Imminent Terrain Impact Caution (ITI)	TERRAIN	CAUTION - TERRAIN	"Caution; Terra in, Terrain"
Reduced Required Line Clearance Caution (RLC)	TERRAIN	CAUTION - WIRE	"Caution; Wire, Wire"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"
Imminent Obstacle Impact Caution (IOI)	TERRAIN	CAUTION - OBSTACLE	"Caution; Obstacle, Obstacle"

Terrain SVT Alerts Summary

Alert Type	PFD/'Map - TAWS-B' Page Alert Annunciation	MFD Pop-Up Alert (except 'Map - TAWS-B' Page)	Voice Alert
Excessive Descent Rate Warning (EDR)	PULL UP	PULL-UP	"Pull Up"
Reduced Required Terrain Clearance Warning (RTC)	PULL UP	TERRAIN - PULL-UP	"Terrain, Terrain; Pull Up, Pull Up"
Imminent Line Impact Warning (ILI)	PULL UP	WIRE AHEAD - PULL-UP	"Wire Ahead; Pull Up, Pull Up"
Reduced Required Line Clearance Warning (RLC)	PULL UP	WARNING - WIRE	"Wire, Wire; Pull Up, Pull Up"
Imminent Terrain Impact Warning (ITI)	PULL UP	TERRAIN AHEAD - PULL-UP	"Terrain Ahead, Pull Up; Terrain Ahead, Pull Up"
Reduced Required Obstacle Clearance Warning (ROC)	PULL UP	OBSTACLE - PULL-UP	"Obstacle, Obstacle; Pull Up, Pull Up"
Imminent Obstacle Impact Warning (IOI)	PULL UP	OBSTACLE AHEAD - PULL-UP	"Obstacle Ahead, Pull Up; Obstacle Ahead, Pull Up"
Reduced Required Terrain Clearance Caution (RTC)	TERRAIN	CAUTION - TERRAIN	"Caution, Terrain; Caution, Terrain"
Imminent Terrain Impact Caution (ITI)	TERRAIN	TERRAIN - AHEAD	"Terrain Ahead; Terrain Ahead"
Required Reduced Line Clearance Impact Caution (RLC)	TERRAIN	CAUTION - WIRE	"Caution, Wire; Caution, Wire"
Imminent Line Clearance Impact Caution (ILI)	TERRAIN	WIRE AHEAD	"Wire Ahead; Wire Ahead"
Reduced Required Obstacle Clearance Caution (ROC)	TERRAIN	CAUTION - OBSTACLE	"Caution, Obstacle; Caution, Obstacle"

Alert Type	PFD/'Map - TAWS-B' Page Alert Annunciation	MFD Pop-Up Alert (except 'Map - TAWS-B' Page)	Voice Alert
Imminent Obstacle Impact Caution (IOI)	TERRAIN	OBSTACLE AHEAD	"Obstacle Ahead; Obstacle Ahead"
Premature Descent Alert Caution (PDA)	TERRAIN	TOO LOW - TERRAIN	"Too Low, Terrain"
Touchdown Callout (VCO) "500"	None	None	"Five-Hundred"
Excessive Descent Rate Caution (EDR)	TERRAIN	SINK RATE	"Sink Rate"
Negative Climb Rate Caution (NCR)	TERRAIN	DONT SINK	"Don't Sink"

TAWS-B Alerts Summary

TERRAIN SYSTEM STATUS ANNUNCIATIONS

Alert Type	PFD/'Map - Terrain-SVT' Page Annunciation	'Map - Terrain-SVT' Page Center Banner Annunciation	Voice Alert
System Test in Progress	TER TEST	TERRAIN TEST	None
System Test Pass	None	None	Single Aural Chime
Terrain Alerting Inhibited	TER INH	None	None
No GPS position	TER N/A	NO GPS POSITION	"Terrain System Not Available"*
Excessively degraded GPS signal; or Out of database coverage area	TER N/A	None	"Terrain System Not Available"*

Alert Type	PFD/'Map - Terrain-SVT' Page Annunciation	'Map - Terrain-SVT' Page Center Banner Annunciation	Voice Alert
Terrain System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TER FAIL	TERRAIN FAIL	"Terrain System Failure"
MFD Terrain or Obstacle database unavailable or invalid, and Terrain-SVT operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAIL	None

* "Terrain System Available" will be heard when sufficient GPS signal is received, or Terrain database coverage area re-entered.

Terrain-SVT System Status Annunciations

Alert Type	PFD/'Map - TAWS-B' Page Annunciation	'Map - TAWS-B' Page Center Banner Annunciation	Voice Alert
System Test in progress	TAWS TEST	TAWS TEST	None
System Test pass	None	None	Single Aural Chime
TAWS-B FLTA Alerting Inhibited	TAWS INH	None	None
No GPS position	TAWS N/A	NO GPS POSITION	"TAWS Not Available"
Excessively degraded GPS signal; or Out of database coverage area	TAWS N/A	None	"TAWS Not Available"

Alert Type	PFD/'Map - TAWS-B ' Page Annunciation	'Map - TAWS-B' Page Center Banner Annunciation	Voice Alert
TAWS-B System Test Fail; Terrain or Obstacle database unavailable or invalid; Invalid software configuration; or System audio fault	TAWS FAIL	TAWS FAIL	"TAWS System Failure"
MFD Terrain or Obstacle database unavailable or invalid. TAWS-B operating with PFD Terrain or Obstacle databases	None	TERRAIN DATABASE FAILURE	None

TAWS-B System Status Annunciations

5.0 "TAXIWAY" Annunciations

The pilot reported that shortly after takeoff the airplane's primary flight display blinked off momentarily and then reappeared with a "Taxiway! Taxiway!" banner. He looked at the multifunction flight display and noted that it was "completely orange" and appeared to depict an autopilot track turning directly left, which made him wonder if the autopilot was engaged.

The GPS data from the G1000 system retrieved from the removed devices, once plotted using Google Earth, indicated that the airplane departed from runway 31 at Blue Ridge Regional Airport at Martinsville, Virginia⁴.

Cirrus indicated that the Perspective+ avionics suite may provide temporary but inadvertent warnings or cautions during flight. The Garmin Cirrus Perspective+ Pilot's Guide 190-02183-03 Rev. A, includes in the forward "Warnings, Cautions, and Notes" includes the following warnings:

- **WARNING:** Always refer to current aeronautical charts and Notices to Airmen (NOTAMs) for verification of displayed aeronautical information. Displayed aeronautical data may not incorporate the latest NOTAM information.

⁴ For more information, please see the [Specialist's Factual Report – Recorded Flight Data Report](#), dated April 7, 2025, in the public docket of this investigation.

- WARNING: Do not use terrain avoidance displays as the sole source of information for maintaining separation from terrain and obstacles. Garmin obtains terrain and obstacle data from third party sources and cannot independently verify the accuracy of the information.
- WARNING: Use appropriate primary systems for navigation, and for terrain, obstacle, and traffic avoidance.
- WARNING: Do not use the Garmin runway depiction as the sole means for determining the proximity of the aircraft to the runway or for maintaining the proper approach path angle during landing.

Submitted by:

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