



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

June 24, 2021

Specialist's Factual Report

METEOROLOGY

ERA21LA101

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A. ACCIDENT

Location: Columbia, South Carolina
Date: January 13, 2021
Time: 1033 eastern standard time
1533 Coordinated Universal Time (UTC)
Airplane: Beech F33A; Registration: N266DC

B. METEOROLOGIST

Paul Suffern
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist did not travel for this investigation and gathered the weather data for this investigation from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources and also from the National Centers for Environmental Information (NCEI). In addition, the NTSB Meteorologist participated on the NTSB Air Traffic Control (ATC) workgroup during this investigation. This specialist factual contains the meteorological factors pertinent to the weather surrounding the accident time. All times are eastern standard time (EST) on January 13, 2021, and are based upon the 24-hour clock, where local time is -5 hours from UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports.

The accident site was located at latitude 33.937° N, Longitude 81.0030° W, with an approximate elevation of 270 feet (ft).

D. FACTUAL INFORMATION

1.0 Synoptic Situation

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction and the Weather Prediction Center, located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC 00-45H.¹

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over the southeastern United States for 1000 EST is provided as figure 1 with the location of the accident site within the red circle. The chart depicted a trough² that stretched from southern Pennsylvania into northwestern South Carolina, along the Appalachian Mountain Range. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. A high-pressure center was located over central Alabama and another high-pressure center was located in the western Atlantic Ocean with pressures of 1026- and 1021-hectopascals (hPa), respectively. The accident site was located southeast of the surface trough.

The station models around the accident site depicted air temperatures in the low to mid 30’s degrees Fahrenheit (°F), dew point temperatures in the mid 30’s °F with temperature-dew point spreads of 1°F or less, a south wind at 5 knots, and sky obscured by clouds and mist.

¹

https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

² Trough – An elongated area of relatively low atmospheric pressure or heights.

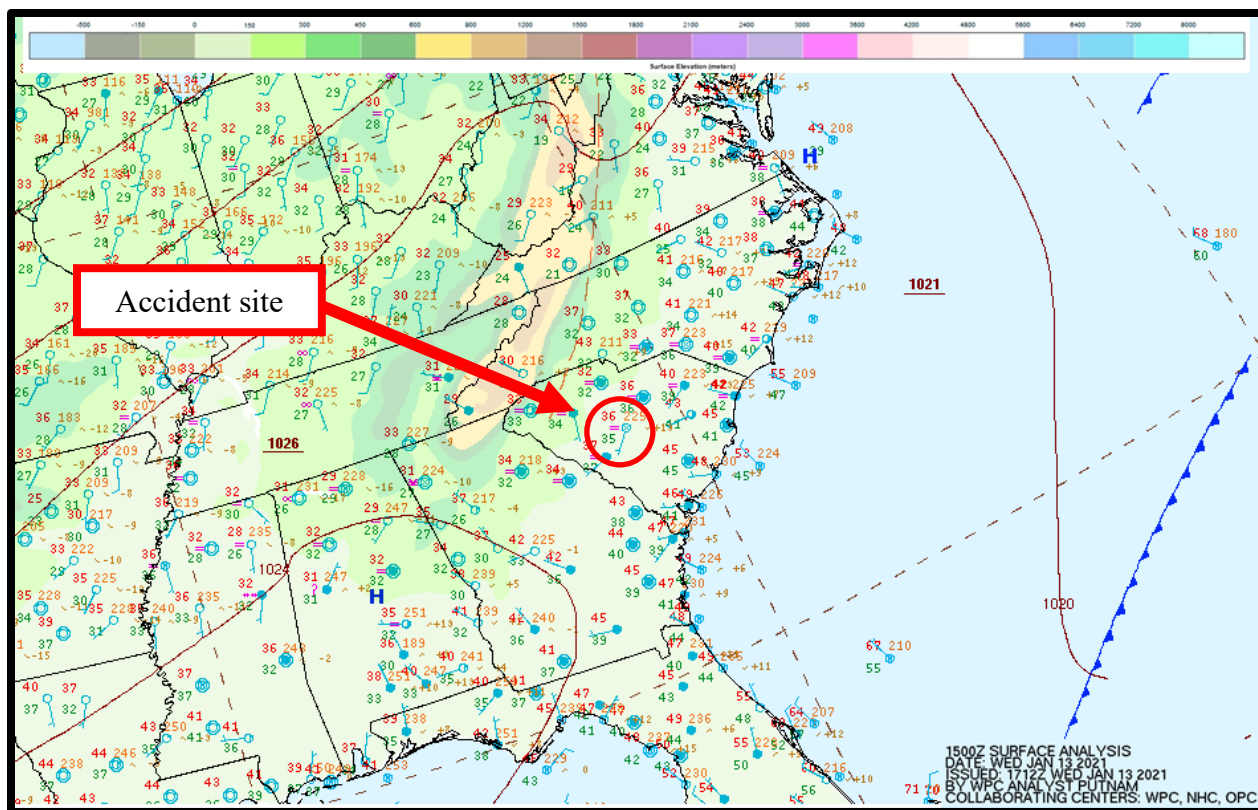


Figure 1 – NWS Surface Analysis Chart for 1000 EST.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0700 EST at 925-, 850- and 700-hPa are presented in figures 2 through 4. A low-level trough was located above the accident site at 925- and 850-hPa (figures 2 and 3). There was a light and variable wind at 925-hPa with the wind becoming westerly at 30 knots by 700-hPa.

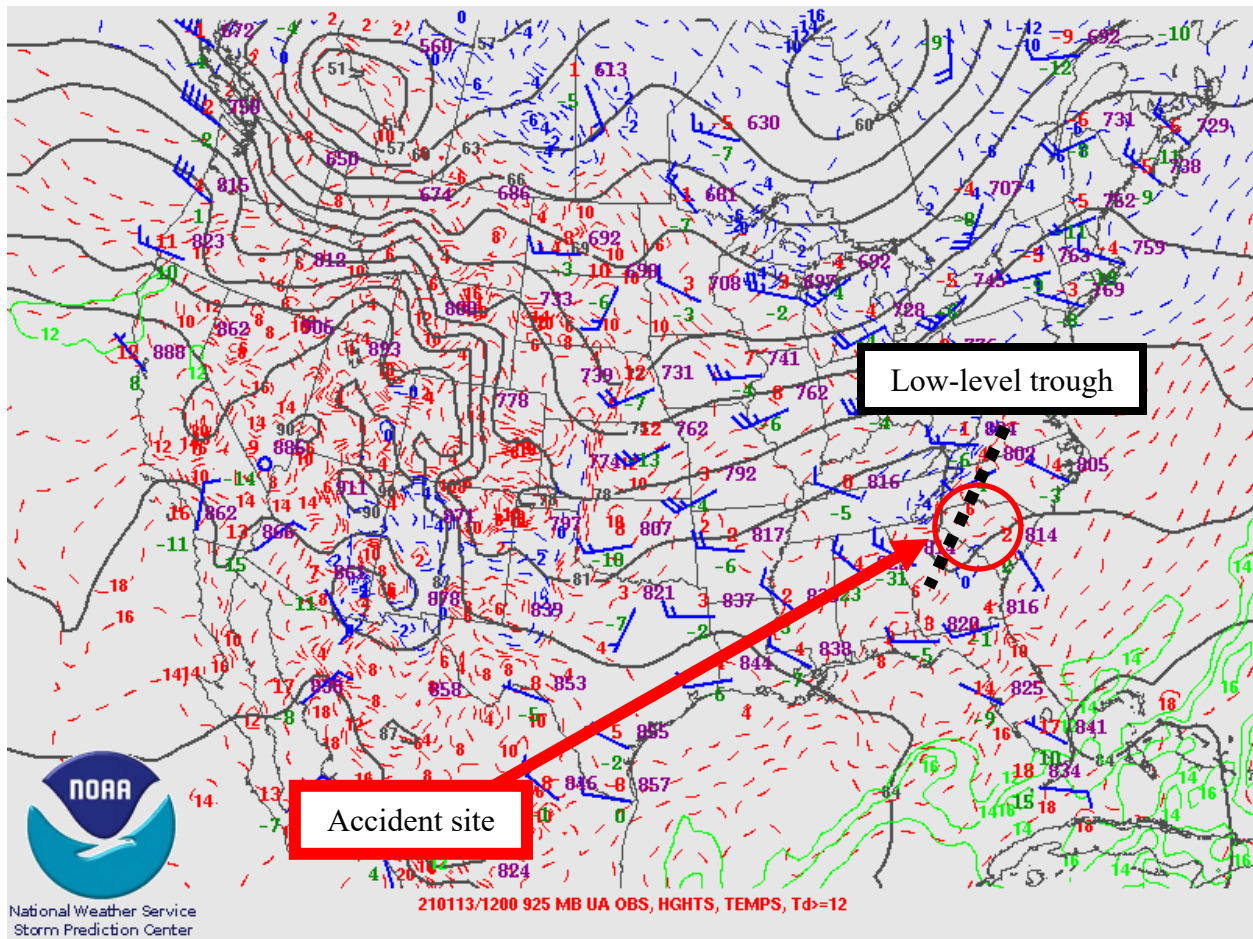


Figure 2 – 925-hPa Constant Pressure Chart for 0700 EST.

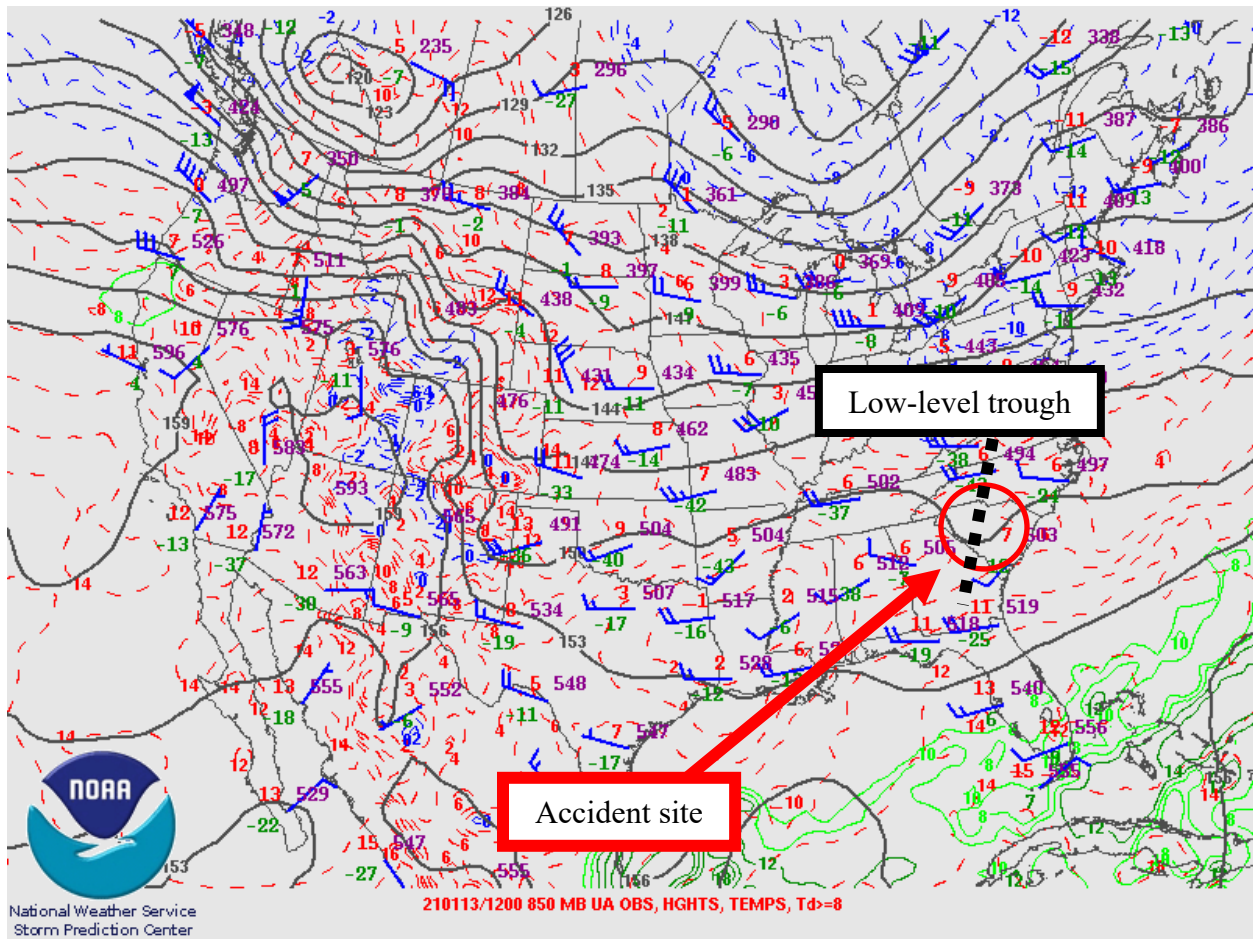


Figure 3 – 850-hPa Constant Pressure Chart for 0700 EST.

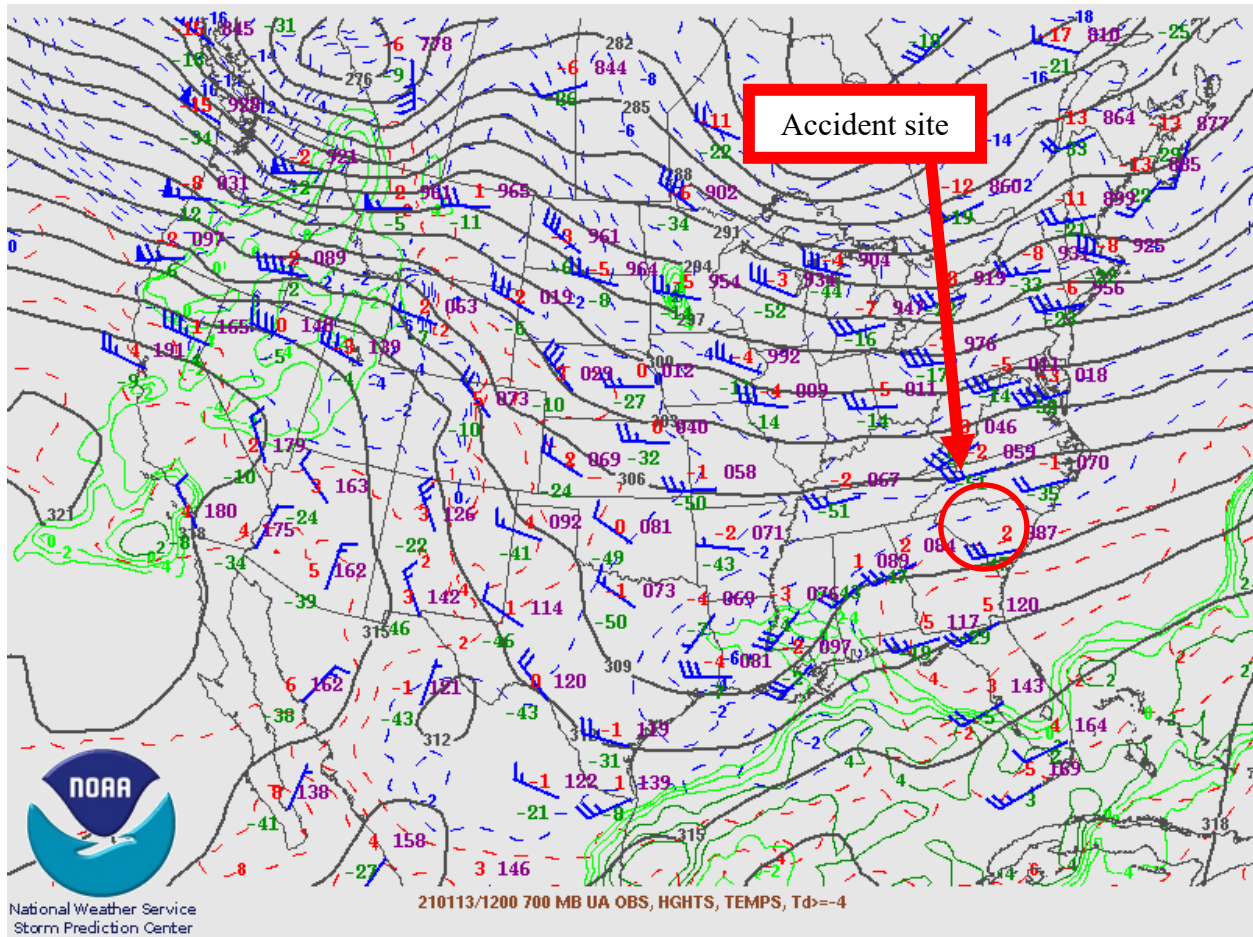


Figure 4 – 700-hPa Constant Pressure Chart for 0700 EST.

2.0 SPC Convective Outlook

SPC issued the following Day 1 Convective Outlook at 0726 EST (figure 5) with areas of general thunderstorms forecast for the accident site. SPC defines the “TSTM” area as an area that encloses where a 10% or higher probability of thunderstorms is forecast during the valid period. The SPC Day 1 Convective Outlook text follows figure 5.

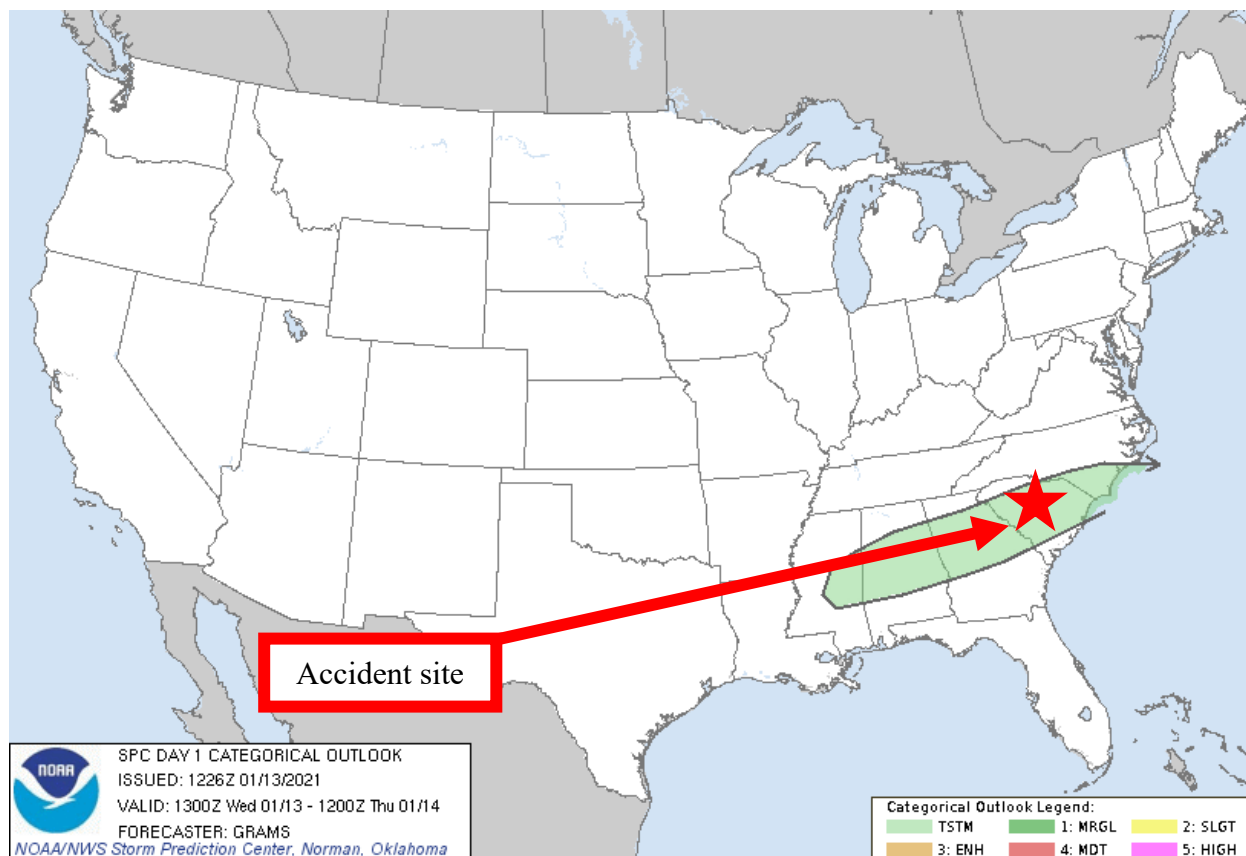


Figure 5 – SPC day 1 Convective Outlook valid at the time of the accident.

SPC AC 131226

Day 1 Convective Outlook
NWS Storm Prediction Center Norman OK
0626 AM CST Wed Jan 13 2021

Valid 131300Z - 141200Z

...NO SEVERE THUNDERSTORM AREAS FORECAST...

...SUMMARY...

Severe thunderstorms are not expected through tonight.

...Southeast...

Elevated convection may persist in a confined corridor downstream of a shortwave trough expected to progress from the Lower MS Valley to the South Atlantic Coast tonight. Saturation near 700 mb in conjunction with steep mid-level lapse rates will support scant buoyancy atop weak surface ridging and relatively dry low levels. Embedded lightning flashes will likely remain rather sparse in spatial coverage and sporadic in timing.

..Grams.. 01/13/2021

[CLICK TO GET WUUS01 PTSDY1 PRODUCT](#)

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 1630Z

3.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 6 is a local sectional chart with the accident site and the closest weather reporting locations marked.

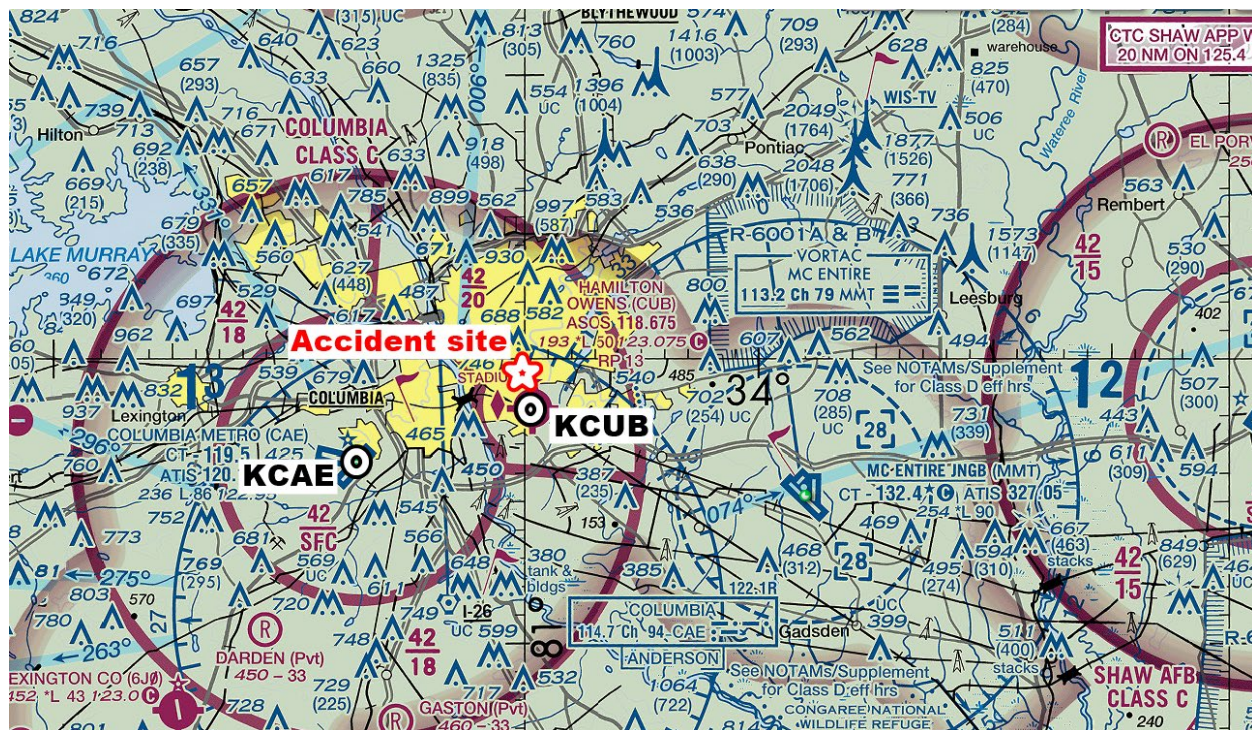


Figure 6 – Sectional map of the accident area with the location of the accident site and surface observation sites.

Jim Hamilton L.B. Owens Airport (KCUB) had the closest official weather station to the accident site. KCUB had an Automated Surface Observing System (ASOS)³ whose longline⁴ reports were not supplemented. KCUB ASOS was located within a mile of the accident site, at an elevation of 193 ft, and had a 7° westerly magnetic variation⁵ (figure 6). The following automated longline observations were disseminated during the times surrounding the accident:⁶

³ ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, weather phenomena, ceiling, temperature, dewpoint, altimeter, and barometric pressure.

⁴ “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station’s Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline-dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

⁵ Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

⁶ The bold sections in this NWS product and the rest of the products in this report are intended to highlight the text

[0704 EST] SPECI KCUB 131204Z AUTO 25003KT 1 1/4SM BR BKN003 BKN007
02/01 A3017 RMK AO2 T00170011=

[0711 EST] SPECI KCUB 131211Z AUTO 25004KT 1/4SM FG BKN002 OVC007 02/01
A3017 RMK AO2 T00170011=

[0753 EST] METAR KCUB 131253Z AUTO 26004KT M1/4SM FG VV002 02/02 A3018
RMK AO2 SLP221 T00170017=

[0853 EST] METAR KCUB 131353Z AUTO 27003KT M1/4SM FG VV002 02/02 A3019
RMK AO2 SLP225 T00220022=

***[0953 EST] METAR KCUB 131453Z AUTO 00000KT 1/4SM FG VV002 02/02 A3021
RMK AO2 SLP230 T00220022 53012=***

ACCIDENT TIME 1033 EST

***[1053 EST] METAR KCUB 131553Z AUTO 24005KT 1/4SM FG VV002 03/03 A3020
RMK AO2 SLP227 T00280028=***

[1153 EST] METAR KCUB 131653Z AUTO 00000KT 1SM BR OVC002 04/04 A3015
RMK AO2 SLP210 T00390039=

KCUB weather at 0953 EST, automated, wind calm, visibility 1/4 mile, fog, vertical visibility 200 ft above ground level (agl), temperature of 2°Celsius (C), dew point temperature of 2°C, and an altimeter setting of 30.21 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, sea level pressure 1023.0 hPa, temperature 2.2°C, dew point temperature 2.2°C, 3-hourly pressure increase 1.2 hPa.

KCUB weather at 1053 EST, automated, wind from 240° at 5 knots, visibility 1/4 mile, fog, vertical visibility 200 ft agl, temperature of 3°C, dew point temperature of 3°C, and an altimeter setting of 30.20 inHg. Remarks: automated station with a precipitation discriminator, sea level pressure 1022.7 hPa, temperature 2.8°C, dew point temperature 2.8°C.

Columbia Metro Airport (KCAE) had the next closest official weather station to the accident site. KCAE had an ASOS whose longline reports were supplemented by a weather observer. KCAE ASOS was located 6 miles southwest of the accident site at an elevation of 236 ft (figure 6). The following automated longline observations were disseminated during the times surrounding the accident:

[0747 EST] SPECI KCAE 131247Z 23004KT 1/4SM FG VV002 01/01 A3017 RMK AO2
T00110011 RVRNO=

that directly reference the weather conditions that affected the accident location around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times around the accident time.

[0756 EST] METAR KCAE 131256Z 23005KT 1/4SM FG VV002 01/01 A3017 RMK AO2
SLP216 T00110011 RVRNO=

[0856 EST] METAR KCAE 131356Z 27004KT 1/4SM FG VV002 02/02 A3018 RMK AO2
SLP220 T00170017 RVRNO=

[0956 EST] METAR KCAE 131456Z 22003KT 1/4SM FG VV002 02/02 A3019 RMK AO2
SLP225 T00220017 53013 RVRNO=

***[1029 EST] SPECI KCAE 131529Z 24003KT 1/2SM FG VV002 03/02 A3019 RMK AO2
T00280022 RVRNO=***

ACCIDENT TIME 1033 EST

***[1056 EST] METAR KCAE 131556Z 19003KT 1/2SM FG OVC002 03/02 A3018 RMK AO2
SLP220 T00280022 RVRNO=***

[1108 EST] SPECI KCAE 131608Z 00000KT 3/4SM BR OVC002 03/03 A3017 RMK AO2
T00280028 RVRNO=

KCAE weather at 1029 EST, wind from 240° at 3 knots, visibility 1/2 mile, fog, vertical visibility of 200 ft agl, temperature of 3°C, dew point temperature of 2°C, and an altimeter setting of 30.19 inHg. Remarks: automated station with a precipitation discriminator, temperature 2.8°C, dew point temperature 2.2°C, runway visual range not available.

KCAE weather at 1056 EST, wind from 190° at 3 knots, visibility 1/2 mile, fog, overcast ceiling at 200 ft agl, temperature of 3°C, dew point temperature of 2°C, and an altimeter setting of 30.18 inHg. Remarks: automated station with a precipitation discriminator, sea level pressure 1022.0 hPa, temperature 2.8°C, dew point temperature 2.2°C, runway visual range is missing.

The observations from KCUB and KCAE surrounding the accident time indicated LIFR⁷ conditions with light and variable winds at or under 5 knots over the area.

⁷ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

4.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)⁸ model sounding was created for the accident site for 1100 EST which provided a surface elevation of 243 ft.⁹ The 1100 EST HRRR sounding was plotted on a standard Skew-T Log P diagram¹⁰ with the derived stability parameters included in figure 7 with data from the surface to 700-hPa (or approximately 10,000 ft msl). These data were analyzed using the RAOB¹¹ software package. The sounding depicted the lifted condensation level (LCL)¹² and the level of free convection (LFC)¹³ at the surface, and the convective condensation level (CCL)¹⁴ at 19 ft agl (262 ft above msl). The freezing level was located at 10,756 ft msl. The precipitable water value was 0.36 inches.

⁸ The HRRR is a NOAA real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one hour period.

⁹ HRRR sounding was created using NOAA Air Resource Laboratory: <https://ready.arl.noaa.gov/READYamet.php>

¹⁰ Skew T log P diagram – is a standard meteorological plot using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

¹¹ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Eosonde Research Services, The Villages, Florida.

¹² LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹³ LFC – The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

¹⁴ CCL – The level in the atmosphere to which an air parcel, if heated from below, will rise dry adiabatically, without becoming colder than its environment just before the parcel becomes saturated.

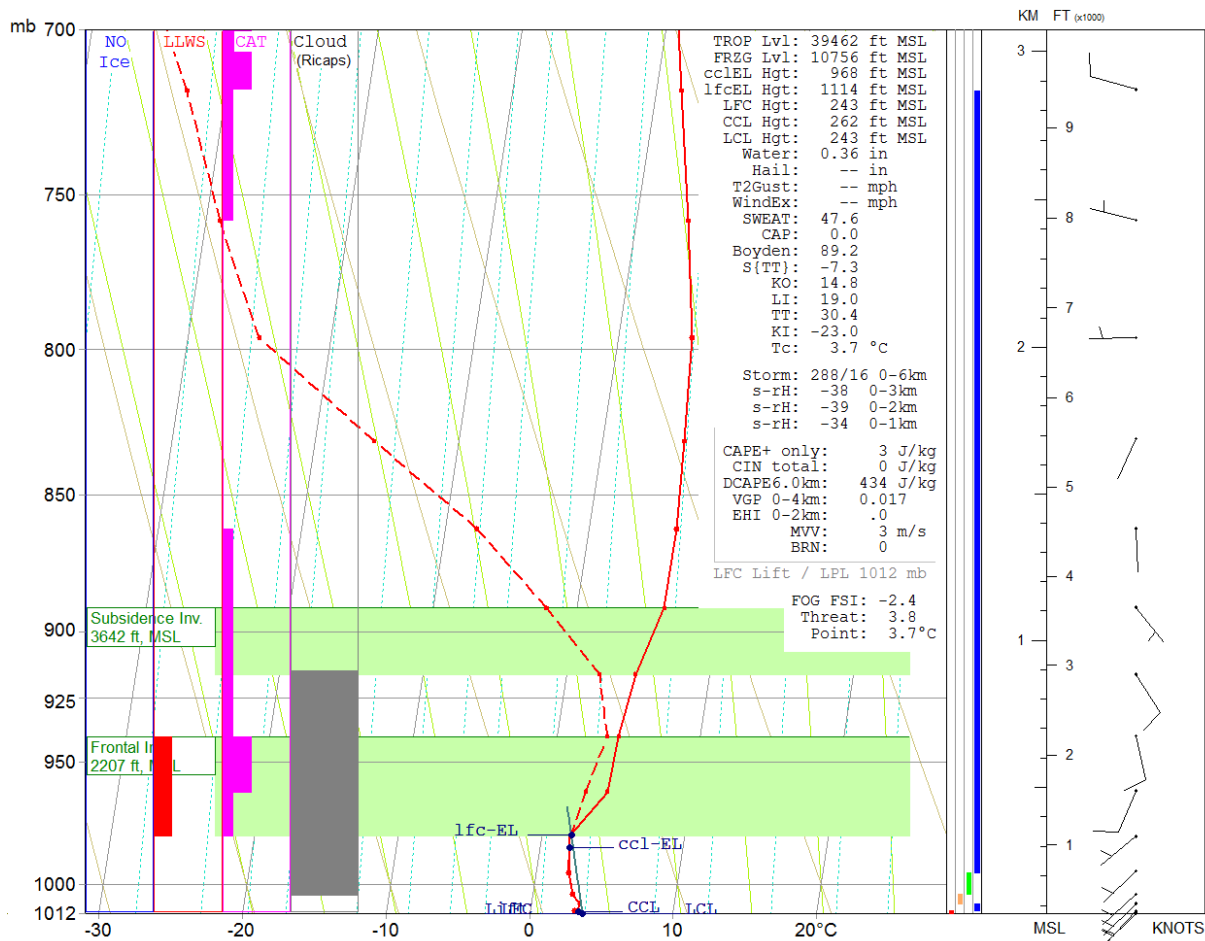


Figure 7 – 1100 EST HRRR sounding.

The 1100 EST HRRR sounding for the accident site indicated a mainly stable environment from the surface through 10,000 ft above msl with a frontal inversion¹⁵ at 2,207 ft above msl and a subsidence inversion at 3,642 ft above msl. Clouds were indicated by RAOB between 200 ft agl and 3,000 ft above msl. No icing was indicated below 10,000 ft above msl.

The 1100 EST HRRR sounding wind profile indicated a near surface wind from 223° at 3 knots with the wind from the west to south at 10 knots or less through 10,000 ft. RAOB indicated the possibility of light low-level wind shear (LLWS) between 1,000 and 2,000 ft above msl. RAOB indicated the possibility of light clear-air turbulence between 1,000 ft and 5,000 ft above msl.

¹⁵ Inversion – A departure from the usual decrease of the value of an atmospheric property with increasing altitude; also, the layer through which this departure occurs (the "inversion layer"), or the lowest altitude at which the departure is found (the "base of the inversion").

5.0 Satellite Data

The Geostationary Operational Environmental Satellite number 16 (GOES-16) visible and infrared data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System software. Visible and infrared imagery (GOES-16 bands 2 and 13) at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period from 0800 EST through 1300 EST and reviewed, and the closest images to the time of the accident were documented.

Figure 8 presents the GOES-16 visible imagery from 1030 EST at 2X magnification with the accident site highlighted with a red square. There was cloud cover above the accident site at the accident time with the cloud cover stationary in nature (attachment 1). Figure 9 presents the GOES-16 infrared imagery from 1030 EST at 6X magnification with the accident site highlighted with a red square. There was cloud cover above the accident site at the accident time with the brightness temperatures of the cloud tops uniform in nature. It should be noted these figures have not been corrected for any parallax error. Due to the isothermal nature of the temperature profile in the surface to 5,000 ft msl layer, cloud top height estimation is not possible or difficult based on the brightness temperature technique.

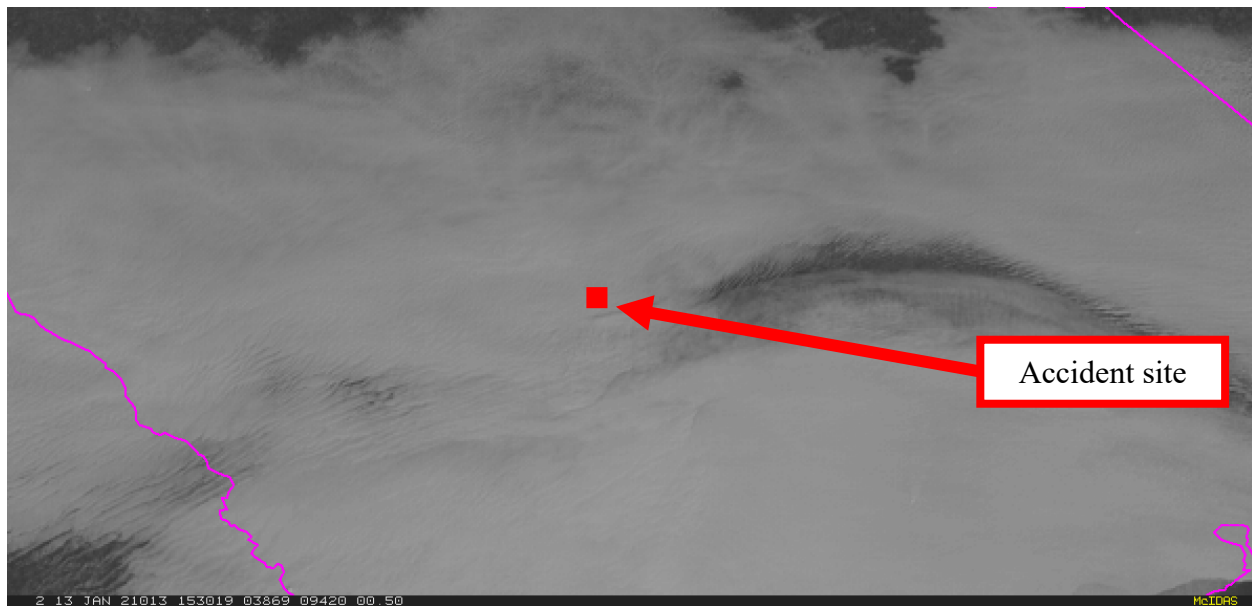


Figure 8 – GOES-16 visible image at 1030 EST.

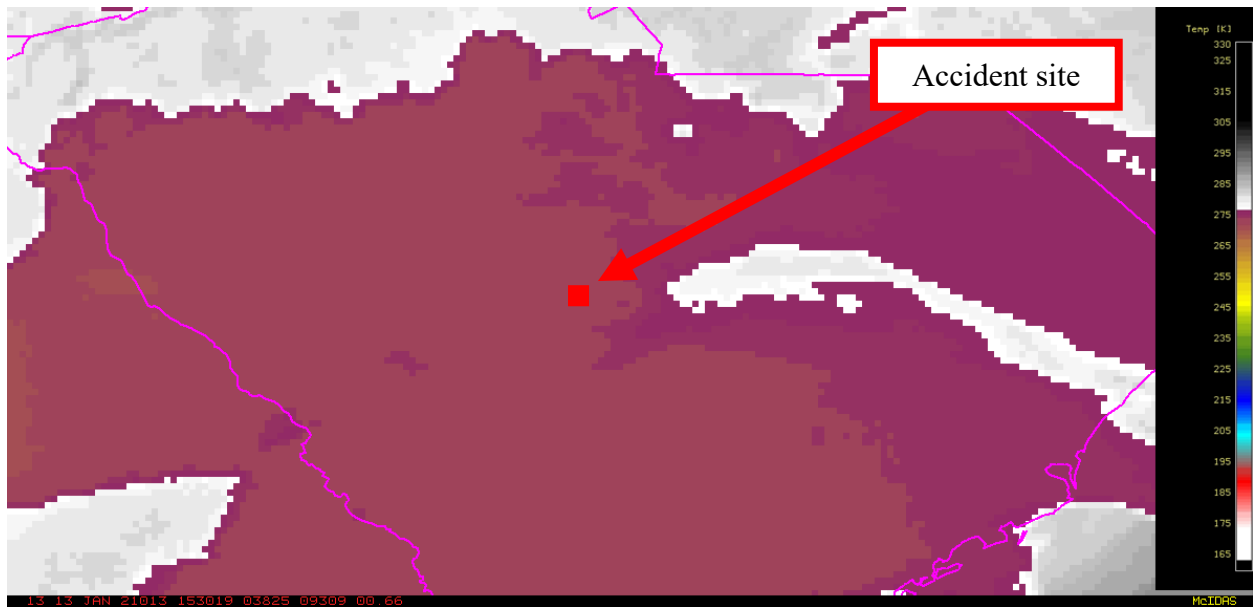


Figure 9 – GOES-16 infrared image at 1030 EST.

6.0 Regional Radar Imagery Information

A regional view of the NWS national composite radar mosaic is included as figure 10 for 1035 EST with the approximate location of the accident site marked within a red circle. The image depicted no precipitation echoes above the accident site at the accident time.

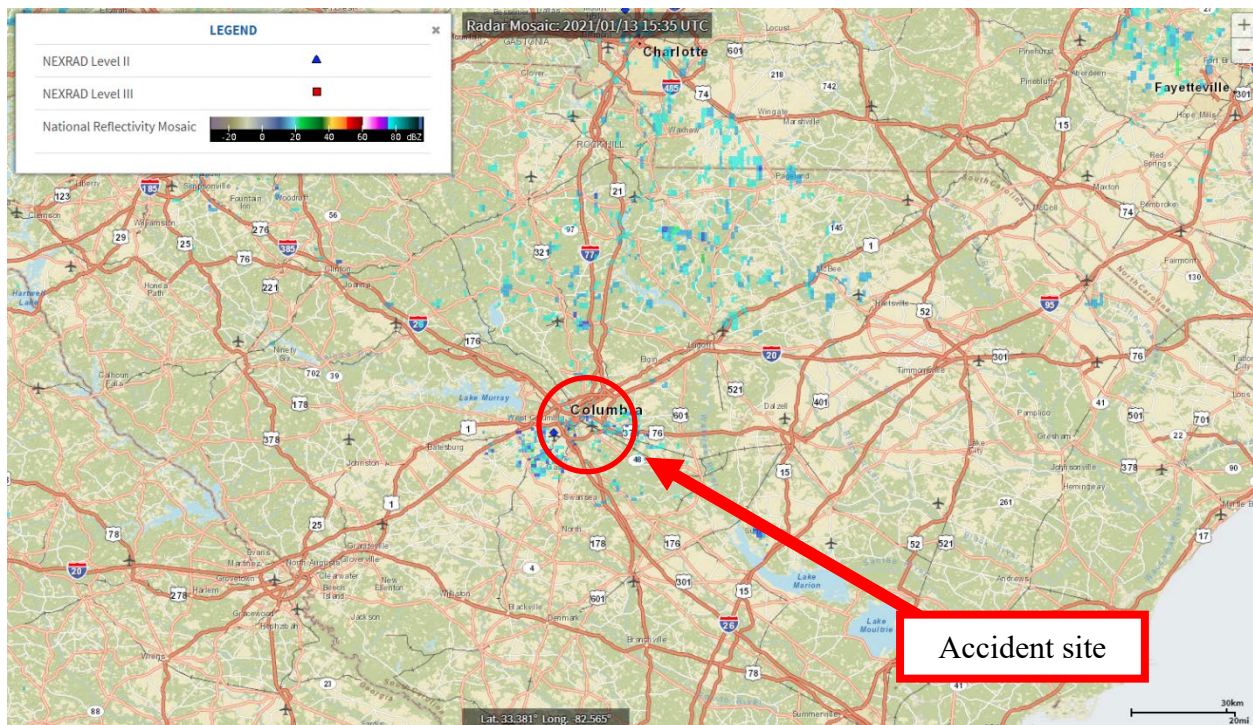


Figure 10 – Regional Composite Reflectivity image for 1035 EST.

7.0 Pilot Reports

There were no publicly longline-disseminated pilot reports¹⁶ (PIREPs) distributed into the national airspace (NAS) by Columbia Air Traffic Control Tower (CAE ATCT) on the date of the accident (attachment 2).¹⁷ PIREP information was reviewed from about three hours prior to the accident time to two hours after the accident time and there was only 1 PIREP (at 1132 EST) within 50 miles of the accident site below 15,000 ft msl:

KSSC UA /OV KSSC/TM 1632/FLUNKN/TP F16/SK OVC008-TOP035/RM DURD

For more information on CAE ATCT local PIREP procedures and information please see the ATC information and interviews located in the docket of this accident.

8.0 Significant Meteorological Information

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories valid for the accident site at the accident time.

9.0 Center Weather Service Advisories

The Jacksonville (ZJX) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. The ZJX CWSU issued Center Weather Advisory (CWA) 203 at 0902 EST valid for the accident site at the accident time which warned of LIFR conditions in mist and fog:

FAUS22 KZJX 131402
ZJX2 CWA 131400
ZJX CWA 203 VALID UNTIL 131600
FROM 40E CLT-25SE ILM-40SE IRQ-30NNE IRQ-40E CLT
AREA LIFR CONDS IN BR FG. SLOW IMPROVEMENT THRU PD.
NC SC

=

In addition, ZJC CWSU issued several Pre-Duty Weather Briefings on the accident day with the Pre-Duty Weather Briefing issued 0543 EST viewed by the CAE ATCT. For more information please see attachment 3 and the ATC docket information.

10.0 Airmen's Meteorological Information

Airmen's Meteorological Information (AIRMET) advisory Sierra was valid for the accident site at the accident time. AIRMET Sierra issued at 0945 and 0345 EST are contained below. The AIRMET warned of IFR conditions due to fog and mist:

WAUS42 KKCI 131445

¹⁶ Only pilot reports with the World Meteorological Organization headers UBSC**, UBNC**, and UBGA** were considered. These do not include pilot reports only broadcast via radio.

¹⁷ For more information, please see the ATC factual located in the docket for this accident.

WA2S

-MIAS WA 131445

AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 132100

.

AIRMET IFR...FL AND CSTL WTRS

FROM ORL TO 30S TRV TO 30NE RSW TO 50SSW RSW TO 20NNE PIE TO ORL
CIG BLW 010/VIS BLW 3SM BR. CONDS ENDG 15-18Z.

.

AIRMET IFR...NC SC GA FL AND CSTL WTRS

**FROM 30ENE RIC TO 30E ORF TO 80SSE ECG TO 70SSW ILM TO 60SSE IRQ
TO 20SE AMG TO 60S TLH TO 70SE CEW TO 60SSE SJI TO 40W CEW TO
50SW PZD TO GQO TO 40E VXV TO 20E CLT TO 70ESE RDU TO 30ENE RIC
CIG BLW 010/VIS BLW 3SM BR/FG. CONDS ENDG 15-18Z.**

.

AIRMET MTN OBSCN...NC SC GA

FROM 40W BKW TO PSK TO 40WNW SPA TO ATL TO GQO TO HNV TO 40W BKW
MTNS OBSC BY CLDS/BR. CONDS ENDG 15-18Z.

.

OTLK VALID 2100-0300Z...MTN OBSCN NC SC

BOUNDED BY 30N GSO-CLT-40SE ODF-40W SPA-40SSW PSK-30N GSO
MTNS OBSC BY CLDS/BR. CONDS DVLPG 00-03Z. CONDS CONTG THRU 03Z.

....

WAUS42 KPCI 130845

WA2S

-MIAS WA 130845

AIRMET SIERRA UPDT 1 FOR IFR AND MTN OBSCN VALID UNTIL 131500

.

AIRMET IFR...NC SC GA FL WV VA AND CSTL WTRS

**FROM 40W BKW TO 60SSE SBY TO 70SE ECG TO 40ESE SAV TO 30NE OMN
TO CTY TO 70SE CEW TO 50S CEW TO 60SE SJI TO 40W CEW TO 50SW PZD
TO GQO TO HNV TO 40W BKW
CIG BLW 010/VIS BLW 3SM BR/FG. CONDS CONTG BYD 15Z ENDG 15-18Z.**

.

AIRMET IFR...FL AND CSTL WTRS

FROM 20E OMN TO PBI TO 90WNW EYW TO 90WSW PIE TO 40SSE CTY TO
20E OMN
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS ENDG 12-15Z.

.

AIRMET MTN OBSCN...NC SC GA WV VA

FROM 20ENE BKW TO 20N GSO TO CLT TO ATL TO GQO TO HNV TO 50WSW
BKW TO 20ENE BKW
MTNS OBSC BY CLDS/BR. CONDS ENDG 12-15Z.

....

11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products made available before the accident flight and valid at 1000 EST are shown in attachment 4. The GFA surface forecast products indicated VFR surface visibilities and a surface wind from the southwest at 5 knots. LIFR surface visibilities were forecast between the departure and destination airport. The GFA cloud forecast valid before departure for around the accident time indicated ceilings between 500 and 2,400 ft msl and cloud tops between 1,300 and 4,000 ft msl, respectively. The Graphical AIRMET¹⁸ (G-AIRMET) Sierra valid for the accident site was overlaid on the GFA surface forecast graphics. The only human-generated information reflected in the two GFA products are the G-AIRMETs and the GFA is “human-over-the-loop.” For more information please see attachment 4.

12.0 Terminal Aerodrome Forecast

KCUB was the closest airport to the accident site with an NWS¹⁹ Terminal Aerodrome Forecast (TAF). The KCUB TAF valid at the time of the accident was issued at 0924 EST and was valid for a 22-hour period beginning at 0900 EST. The 0924 EST TAF for KCUB was as follows:

AMD TAF KCUB 131424Z 1314/1412 00000KT 1/4SM FG VV002
FM131600 VRB03KT 5SM BR OVC006
FM131900 23004KT P6SM BKN025
FM132200 21004KT P6SM BKN060=

Between 0900 and 1100 EST, the forecast expected a calm wind, 1/4 mile visibility, fog, and ceiling or vertical visibility of 200 ft agl. The KCUB TAF valid at the time of departure follows (issued at 0634 EST):

TAF KCUB 131134Z 1312/1412 00000KT 2SM BR OVC004
TEMPO 1312/1314 1/4SM FG OVC004
FM131500 VRB03KT 6SM BR BKN010
FM131700 23005KT P6SM BKN025
FM132200 21006KT P6SM BKN060=

13.0 NWS Area Forecast Discussion

The NWS office in Columbia, South Carolina, (WFO CAE) issued Area Forecast Discussions (AFD) at 1031 and 0648 EST. The aviation sections of the AFDs discussed LIFR conditions at KCAE and KCUB. In the 0648 EST CAE AFD LIFR conditions were expected to improve by 1000 EST. By the 1031 CAE AFD LIFR conditions were expected to persist at KCAE and KCUB into the early afternoon:

FXUS62 KCAE 131531
AFDCAE

Area Forecast Discussion

¹⁸ <https://aviationweather.gov/gairmet>

¹⁹ According to NWS Instruction 10-813: “A NWS TAF consists of the expected meteorological conditions significant to aviation at an airport for a specified time period. For the U.S., this is the area within five (5) statute miles (SM) of the center of an airport's runway complex.” www.nws.noaa.gov/directives/sym/pd01008013curr.pdf

National Weather Service Columbia SC
1031 AM EST Wed Jan 13 2021

.SYNOPSIS...

A shortwave trough will bring increased moisture into the region with isolated showers tonight. High pressure ridging increasing into Friday, with a cold front bringing a brief chance of showers Friday night. Cool and dry conditions for the weekend.

&&

.NEAR TERM /THROUGH TONIGHT/...

Have extended the Dense Fog Advisory until noon for the northern half of South Carolina. There appears to be 2 areas of clouds across the forecast area this morning. To the north, fog and low clouds are predominant. And to the south, strato-cumulus clouds are widespread. Should see some diurnal improvement during the afternoon as a upper low over the lower MS Valley moves east into the southeastern states. Given widespread clouds, have lowered max temperatures a few degrees to the upper 40s north and west to low/mid 50s south and east.

As the upper low/short wave nears the area, the associated mid and upper jets passing to the south of the area will produce scattered showers tonight. The chance for measurable rainfall appears low, so continued only slight chance pops. Overnight lows in the low to mid 30s are expected.

&&

.SHORT TERM /THURSDAY THROUGH FRIDAY/...

Dry conditions Thursday into Friday morning behind the shortwave with high pressure building into the region. With high pressure centered in the Gulf and the exiting low to our northeast, winds will be breezy with gusts up to 20mph in the southern Midlands and CSRA. Temperatures will be warmer than Wednesday with southeasterly flow and clear skies throughout the day. Guidance has been trending towards cooler temperatures and weaker warm air advection, so went with the cooler blend. Highs in the mid to upper 50s.

By Thursday evening, a deep longwave trough will dig into the Great Plains, with the broadening high pressure directly to our southwest. Clouds will begin to increase with stronger moisture transport ahead of the trough. Cloud coverage should keep temperatures moderate and around average, with lows in the mid 30s.

The associated cold front will be moving towards the area Friday afternoon. The GFS has brought brought back the dry slot across South Carolina, whereas the ECMWF brings a deeper swath of moisture prior to the frontal passage. Went closer to the ECMWF as it has been more consistent with the PoPs. The majority of the rain will occur in the evening. Looking at BUFKIT, showers will be mostly light to moderate as moisture does not appear to be very deep. Temperatures will quickly drop after the frontal passage, so have temperatures below freezing in western counties and in

the mid 30s along the coastal plain.

&&

.LONG TERM /FRIDAY NIGHT THROUGH TUESDAY/...
The cold front will be quick moving and will be well to the east by Saturday morning. Strong cold air advection behind the front, with surface winds gusting up to 30mph during the day on Saturday. A weak shortwave may increase cloud coverage slightly Saturday afternoon but quickly dry out overnight. The weather will remain benign over the weekend with significant drying. Some of the coldest temperatures of the season on Sunday morning with clear skies overnight. Lows in the mid to upper 20s and highs in the upper 40s.

The next system will move through on Monday morning and stall just east of the region. Models are in pretty good agreement that available moisture will not be enough to trigger any rain. Kept PoPs below slight chance. Temperatures around average for the rest of the week. Dry into Tuesday night as yet another low pressure system moves up the Texas coast and over the Deep South.

&&

**.AVIATION /15Z WEDNESDAY THROUGH SUNDAY/...
MVFR or lower conditions will linger into the afternoon.**

LIFR fog/stratus affecting CAE/CUB will continue into early afternoon. Should see some diurnal improvement during the afternoon as a upper disturbance approaches the area. MVFR cigs to affect AGS/DNL/OGB into the afternoon.

Low confidence as to timing of the return of VFR given inconsistent guidance. However, all guidance indicate VFR after 14/00z. Scattered light showers expected tonight as an upper level disturbance moves through the region.

EXTENDED AVIATION OUTLOOK...A strong cold front will move through the region Friday with brief restrictions possible.

&&

.CAE WATCHES/WARNINGS/ADVISORIES...
GA...Dense Fog Advisory until noon EST today for GAZ040.
SC...Dense Fog Advisory until noon EST today for SCZ016-018-020>022-025>029-031-037-115-116.

&&

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FXUS62 KCAE 131148
AFDCAE

Area Forecast Discussion

.SYNOPSIS...

A shortwave trough will bring increased moisture into the region with isolated showers Wednesday night. High pressure ridging increasing into Friday, with a cold front bringing a brief chance of showers Friday night. Cool and dry conditions for the weekend.

&&

.NEAR TERM /THROUGH TONIGHT/...

A dense fog advisory is in effect until 10am. Current satellite imagery shows the fog spreading across the CSRA and Midlands. The most dense fog is expected in the northern midlands as a stratus deck will help to limit fog development across the southern extent of the CWA. The areas of dense fog will slowly burn off this morning but the stratus deck is expected to remain in place across the southern CWA. Mid-level clouds associated with an advancing shortwave will begin to spread across the region later this morning. Because of uncertainty in the low and mid-level cloud cover, there is fairly large spread in the guidance in high temperatures Wednesday afternoon. So a consensus blend was chosen, keeping high temperatures in the low to mid 50s across the CWA. As the short wave nears the area, the associated mid and upper jets passing to the south of the CWA will help produce a scattered precipitation shield. PoPs begin to increase from southwest to northeast starting early this evening. The CAM suite appears to have a better grasp on the position and intensity of the jet setup, and therefore precipitation, compared to other guidance so I favored their solution. The scattered precipitation will exit the region by early Thursday and conditions should quickly clear up as the shortwave moves off the coast and low temperatures will fall into the low to mid 30s tonight due to the clearing. Westerly winds develop in wake of the low and help usher in a drier airmass for Thursday.

&&

.SHORT TERM /THURSDAY THROUGH FRIDAY/...

Dry conditions Thursday into Friday morning behind the shortwave with high pressure building into the region. With high pressure centered in the Gulf and the exiting low to our northeast, winds will be breezy with gusts up to 20mph in the southern Midlands and CSRA. Temperatures will be warmer than Wednesday with southeasterly flow and clear skies throughout the day. Guidance has been trending towards cooler temperatures and weaker warm air advection, so went with the cooler blend. Highs in the mid to upper 50s.

By Thursday evening, a deep longwave trough will dig into the Great Plains, with the broadening high pressure directly to our southwest. Clouds will begin to increase with stronger moisture transport ahead of the trough. Cloud coverage should keep temperatures moderate and around average, with lows in the mid

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&&

.LONG TERM /FRIDAY NIGHT THROUGH TUESDAY/...

The cold front will be quick moving and will be well to the east by Saturday morning. Strong cold air advection behind the front, with surface winds gusting up to 30mph during the day on Saturday. A weak shortwave may increase cloud coverage slightly Saturday afternoon but quickly dry out overnight. The weather will remain benign over the weekend with significant drying. Some of the coldest temperatures of the season on Sunday morning with clear skies overnight. Lows in the mid to upper 20s and highs in the upper 40s.

The next system will move through on Monday morning and stall just east of the region. Models are in pretty good agreement that available moisture will not be enough to trigger any rain. Kept PoPs below slight chance. Temperatures around average for the rest of the week. Dry into Tuesday night as yet another low pressure system moves up the Texas coast and over the Deep South.

&&

.AVIATION /12Z WEDNESDAY THROUGH SUNDAY/...

IFR and LIFR conditions due to fog/stratus this morning.

Areas of dense fog are currently causing LIFR and IFR vis at CAE, CUB, AGS, and the central Midlands this morning. A low stratus deck is currently causing MVFR and IFR cigs across the southern Midlands including OGB. These conditions are expected to continue this through the morning before the fog is lifts around 15z. The stratus deck is expected to remain in place through the evening as an upper level system approaches. Expect MVFR conditions to continue until this upper level system moves through later today/tonight, around 3z. Conditions should improve to VFR at AGS and DNL first before improving across the rest of the terminals.

EXTENDED AVIATION OUTLOOK...A strong cold front will move through the region Friday with brief restrictions possible.

&&

.CAE WATCHES/WARNINGS/ADVISORIES...

GA...Dense Fog Advisory until 10 AM EST this morning for GAZ040-063>065.

SC...Dense Fog Advisory until 10 AM EST this morning for SCZ016-018-020>022-025>031-036>038-115-116.

&&

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14.0 NWS Dense Fog Advisory

WFO CAE issued a Dense Fog Advisory for the accident region at 0325 EST valid through 1000 EST. At 0957 EST, the Dense Fog Advisory for the accident region was extended until 1200 EST:

WWUS72 KCAE 131457

NPWCAE

URGENT - WEATHER MESSAGE

National Weather Service Columbia SC

957 AM EST Wed Jan 13 2021

GAZ063>065-SCZ030-036>038-131600-

/O.EXP.KCAE.FG.Y.0003.000000T0000Z-210113T1500Z/

McDuffie-Columbia-Richmond-Aiken-Orangeburg-Calhoun-Clarendon-

Including the cities of Thomson, Martinez, Evans, Augusta,

Hephzibah, Aiken, North Augusta, Orangeburg, Brookdale,

St. Matthews, Manning, and Summerton

957 AM EST Wed Jan 13 2021

...DENSE FOG ADVISORY WILL EXPIRE AT 10 AM EST THIS MORNING...

\$\$

GAZ040-SCZ016-018-020>022-025>029-031-115-116-131700-

/O.EXT.KCAE.FG.Y.0003.000000T0000Z-210113T1700Z/

Lincoln-Chesterfield-McCormick-Newberry-Fairfield-Kershaw-

Edgefield-Saluda-Lexington-Richland-Lee-Sumter-Northern Lancaster-

Southern Lancaster-

Including the cities of Lincolnton, Cheraw, Pageland, McCormick,

Newberry, Winnsboro, Winnsboro Mills, Camden, Lugoff, Edgefield,

Johnston, Saluda, Ridge Spring, Seven Oaks, West Columbia, Cayce,

Lexington, Red Bank, Oak Grove, Columbia, Bishopville, Sumter,

Indian Land, Lancaster, Elgin, and Lancaster Mill

957 AM EST Wed Jan 13 2021

...DENSE FOG ADVISORY NOW IN EFFECT UNTIL NOON EST TODAY...

* WHAT...Visibility one quarter mile or less in dense fog.

* WHERE...Portions of northern and central South Carolina.

* WHEN...Until noon EST today.

* IMPACTS...Hazardous driving conditions due to low visibility.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

If driving, slow down, use your headlights, and leave plenty of distance ahead of you.

&&

\$\$

WWUS72 KCAE 130825
NPWCAE

URGENT - WEATHER MESSAGE
National Weather Service Columbia SC
325 AM EST Wed Jan 13 2021

GAZ040-063>065-SCZ016-018-020>022-025>031-036>038-115-116-131500-
/O.NEW.KCAE.FG.Y.0003.210113T0825Z-210113T1500Z/
Lincoln-McDuffie-Columbia-Richmond-Chesterfield-McCormick-
Newberry-Fairfield-Kershaw-Edgefield-Saluda-Lexington-Richland-
Lee-Aiken-Sumter-Orangeburg-Calhoun-Clarendon-Northern Lancaster-
Southern Lancaster-
Including the cities of Lincolnton, Thomson, Martinez, Evans,
Augusta, Hephzibah, Cheraw, Pageland, McCormick, Newberry,
Winnsboro, Winnsboro Mills, Camden, Lugoff, Edgefield, Johnston,
Saluda, Ridge Spring, Seven Oaks, West Columbia, Cayce,
Lexington, Red Bank, Oak Grove, Columbia, Bishopville, Aiken,
North Augusta, Sumter, Orangeburg, Brookdale, St. Matthews,
Manning, Summerton, Indian Land, Lancaster, Elgin,
and Lancaster Mill
325 AM EST Wed Jan 13 2021

...DENSE FOG ADVISORY IN EFFECT UNTIL 10 AM EST THIS MORNING...

* WHAT...Visibility one quarter mile or less in dense fog.

* WHERE...Portions of central South Carolina and east central
Georgia.

* WHEN...Until 10 AM EST this morning.

* IMPACTS...Hazardous driving conditions due to low visibility.

PRECAUTIONARY/PREPAREDNESS ACTIONS...

If driving, slow down, use your headlights, and leave plenty of distance ahead of you.

&&

\$\$

15.0 Winds and Temperature Aloft Forecast

The NWS 0854 EST Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

```
FBUS31 KWNO 131354
FD1US1
DATA BASED ON 131200Z
VALID 131800Z    FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT  3000    6000    9000    12000    18000    24000    30000    34000    39000
CAE 1906 1907+06 2409+03 2635-02 2545-18 2563-30 259245 269854 760459
```

The closest forecast point to the accident site was Columbia, South Carolina, (CAE). The 0854 EST CAE forecast for use between 0900 EST and 1600 EST indicated a wind at 3,000 ft from 190° at 6 knots, a wind at 6,000 ft from 190° at 7 knots with a temperature of 6°C, and a wind at 9,000 ft from 240° at 9 knots with a temperature of 3°C.

16.0 Pilot Weather Briefing

The accident pilot did not request nor receive weather information²⁰ from Leidos Flight Service. A search of archived ForeFlight information indicated that the accident pilot did not request weather information via ForeFlight. There is no record of the accident pilot receiving or retrieving any other weather information before or during the accident flight.

17.0 HEMS Weather Tool

The AWC helicopter emergency medical services (HEMS) weather tool²¹ graphics were obtained for the accident timeframe. Figures 11 through 13 show the HEMS weather tool graphics valid at 1000, 1015, and 1030 EST, with the NWS dense fog advisory region highlighted on the 1030 EST graphic (figure 13).

²⁰ https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf

²¹ https://nws.weather.gov/products/PDD/PDD_OplHEMSTool_2020.pdf
<https://aviationweather.gov/hemst>
<https://aviationweather.gov/hemst/help>

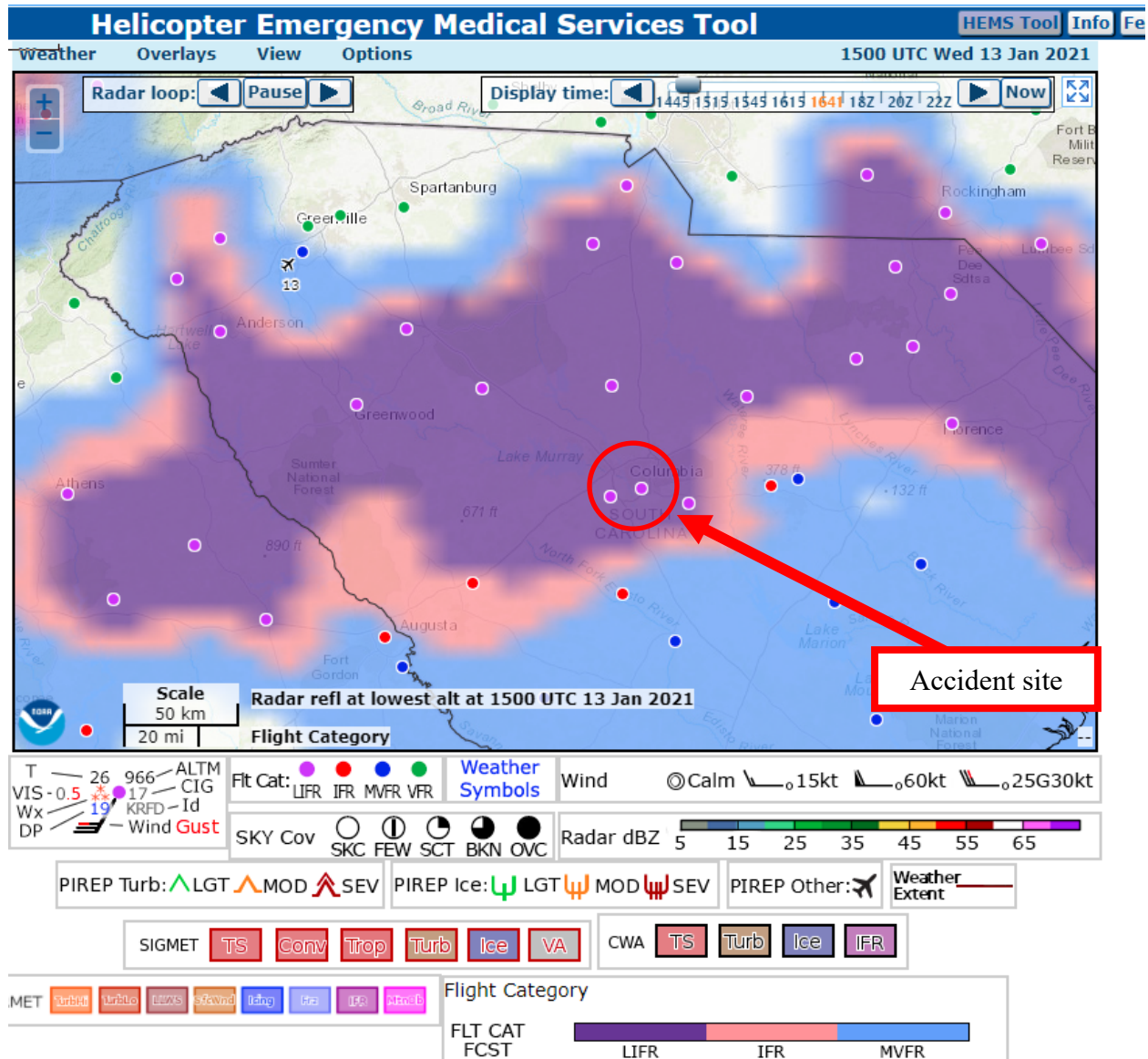


Figure 11 – HEMS weather tool graphic valid at 1000 EST.

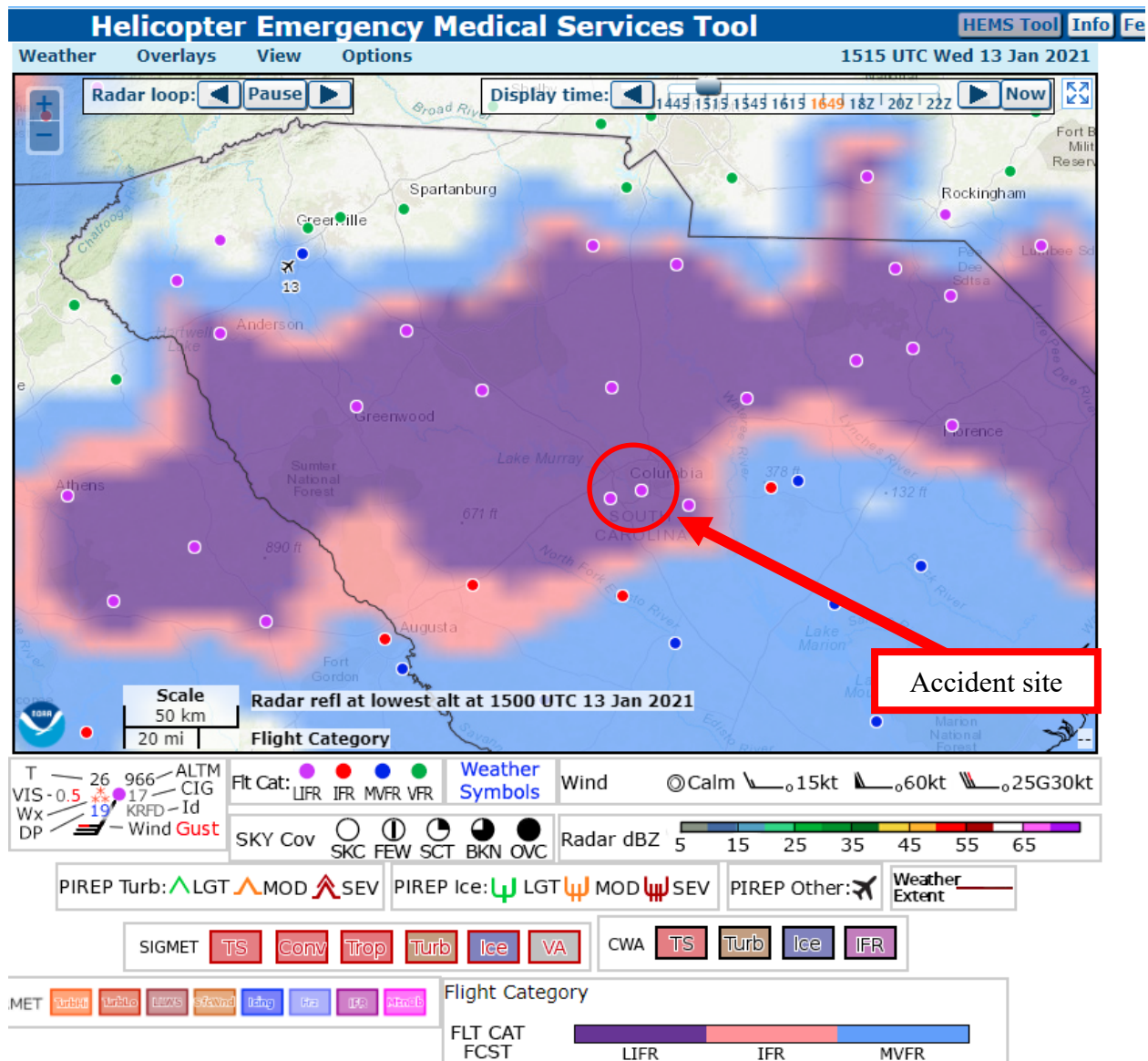


Figure 12 – HEMS weather tool graphic valid at 1015 EST.

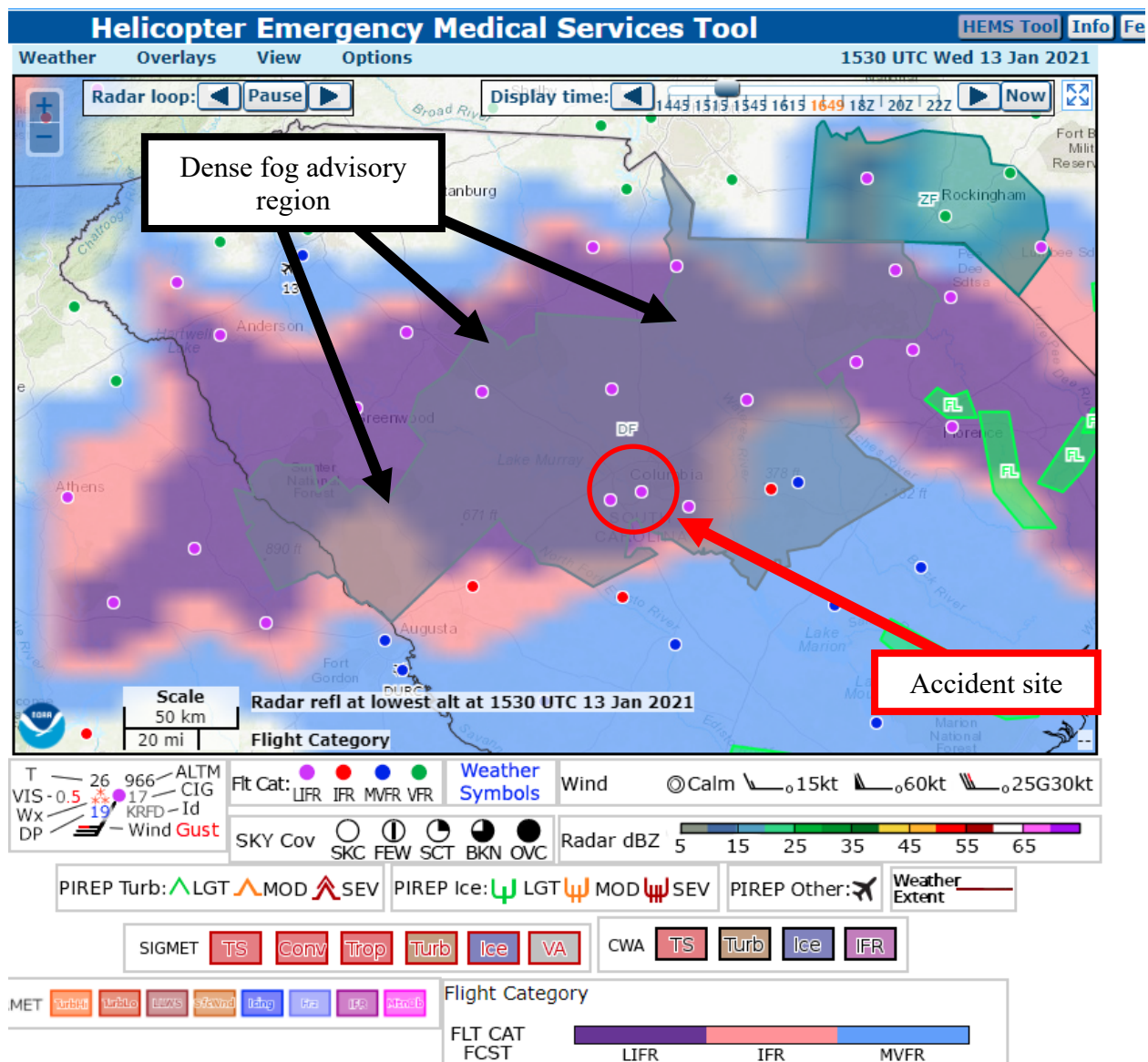


Figure 13 – HEMS weather tool graphic valid at 1030 EST.

18.0 Astronomical Data

The astronomical data obtained for the accident site on January 13, 2021, indicated the following:

SUN	
Begin civil twilight	0702 EST
Sunrise	0729 EST
Accident time	1033 EST²²
Sun transit	1233 EST
Sunset	1737 EST
End civil twilight	1804 EST

At the time of the accident the Sun was located at an altitude of 27.8° and azimuth of 148.3°.

E. LIST OF ATTACHMENTS

Attachment 1 – GOES16 visible satellite animation from 0901 to 1101 EST

Attachment 2 – CAE ATCT PIREP tracking page between January 9, and January 31, 2021

Attachment 3 – ZJX CWSU Pre-Duty Weather Briefing valid on the accident day

Attachment 4 – GFA valid for the accident site at accident time

Submitted by:

Paul Suffern
Senior Meteorologist

²² Inserted accident time for reference and context.