

# National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



ERA23FA131

## **METEOROLOGY**

Specialist's Factual Report

April 21, 2023

## TABLE OF CONTENTS

|                                            |    |
|--------------------------------------------|----|
| A. ACCIDENT.....                           | 3  |
| B. METEOROLOGY INVESTIGATOR .....          | 3  |
| C. DETAILS OF THE INVESTIGATION .....      | 3  |
| D. WEATHER INFORMATION.....                | 3  |
| 1.0 SURFACE OBSERVATIONS .....             | 3  |
| 2.0 WEATHER RADAR.....                     | 4  |
| 3.0 HRRR MODEL SOUNDING.....               | 5  |
| 4.0 SATELLITE IMAGERY .....                | 6  |
| 5.0 PILOT REPORTS .....                    | 8  |
| 6.0 AREA FORECAST DISCUSSION.....          | 8  |
| 7.0 SIGMETs.....                           | 9  |
| 8.0 CWSU PRODUCTS.....                     | 9  |
| 9.0 G-AIRMETs BELOW FL180.....             | 9  |
| 10.0 GRAPHICAL FORECASTS FOR AVIATION..... | 10 |
| 11.0 ASTRONOMICAL.....                     | 14 |

## **A. ACCIDENT**

Location: Hillsville, Virginia

Date: 27 February 2023

Time: 1655 eastern standard time (2155 UTC<sup>1</sup>)

Aircraft: Type - Cessna 150G; Registration - N2991J

## **B. METEOROLOGY INVESTIGATOR**

Mike Richards

Senior Meteorologist

Office of Aviation Safety

Operational Factors Division (AS-30)

National Transportation Safety Board

## **C. DETAILS OF THE INVESTIGATION**

The National Transportation Safety Board's meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in eastern standard time for 27 February 2023 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl). The accident site was located at about: 36.656234° north latitude; 80.542626° west longitude at an elevation of about 2,800 feet.

This report provides information on the weather conditions and forecasts applicable to the accident flight.

## **D. WEATHER INFORMATION**

### **1.0 Surface Observations**

An Automated Weather Observing Station (AWOS) was located at Twin County Airport (HLX<sup>2</sup>), which was located about 15 miles west-northwest of the accident site at an

---

<sup>1</sup> UTC - abbreviation for Coordinated Universal Time

<sup>2</sup> This report uses the 3-digit International Air Transport Association format for airport identification, which does not use the geographic designating digit (e.g., "K" for stations in the continental U.S. and "P" for U.S. stations in Alaska and the Pacific region) as found in the 4-digit International Civil Aviation Organization (ICAO) identifier format. Weather observations from airports in this report are referenced by their reporting station's identifier (using ICAO format that includes the geographic designating digit), not by the airport at which the reporting station is located.

elevation of about 2,695 feet. It had a magnetic variation of about 8° west. Automated longline<sup>3</sup> reports from the HLX AWOS during the times surrounding the accident time are presented here, and the observations closest in time to the accident time are highlighted with bold text.

[1615] METAR KHLX 272115Z AUTO 17005KT 3SM -DZ OVC004 08/08 A2959  
RMK AO2 T00820078=

[1635] METAR KHLX 272135Z AUTO 17007KT 2 1/2SM -DZ OVC002 09/08  
A2957 RMK AO2 T00850081=

**[1655] METAR KHLX 272155Z AUTO 18006KT 160V220 1 3/4SM BR  
OVC002 09/09 A2957 RMK AO2 T00860085=**

[1715] METAR KHLX 272215Z AUTO 18007KT 2SM BR OVC002 09/09 A2955  
RMK AO2 T00860085=

At 1655, the HLX AWOS reported a wind from 180° at 6 knots and variable between 160° and 220°, visibility 1 and 3/4 statute miles, mist, ceiling overcast at 200 feet above ground level (agl), temperature of 9° Celsius (C) and dew point temperature of 9°C, altimeter setting of 29.57 inches of mercury; Remarks: automated station with a precipitation discriminator, temperature of 8.6°C and dew point temperature of 8.5°C.

## 2.0 Weather Radar

WSR-88D<sup>4</sup> Level-II base reflectivity weather radar imagery from the Blacksburg, Virginia, site (KFCX) is presented in Figures 1 and 2. KFCX was located approximately 25 miles north-northeast of the accident location with an antenna elevation of about 2,965 feet. Assuming standard refraction and considering the 0.95° beam width<sup>5</sup> for the WSR-88D radar beam, the KFCX 0.484° tilt would have “seen” altitudes above the accident location of between about 2,500 and 5,900 feet. A vertical cross-section of the Level-II base reflectivity weather radar imagery along the final portion of the accident aircraft’s flight track<sup>6</sup> is presented in Figure 2.

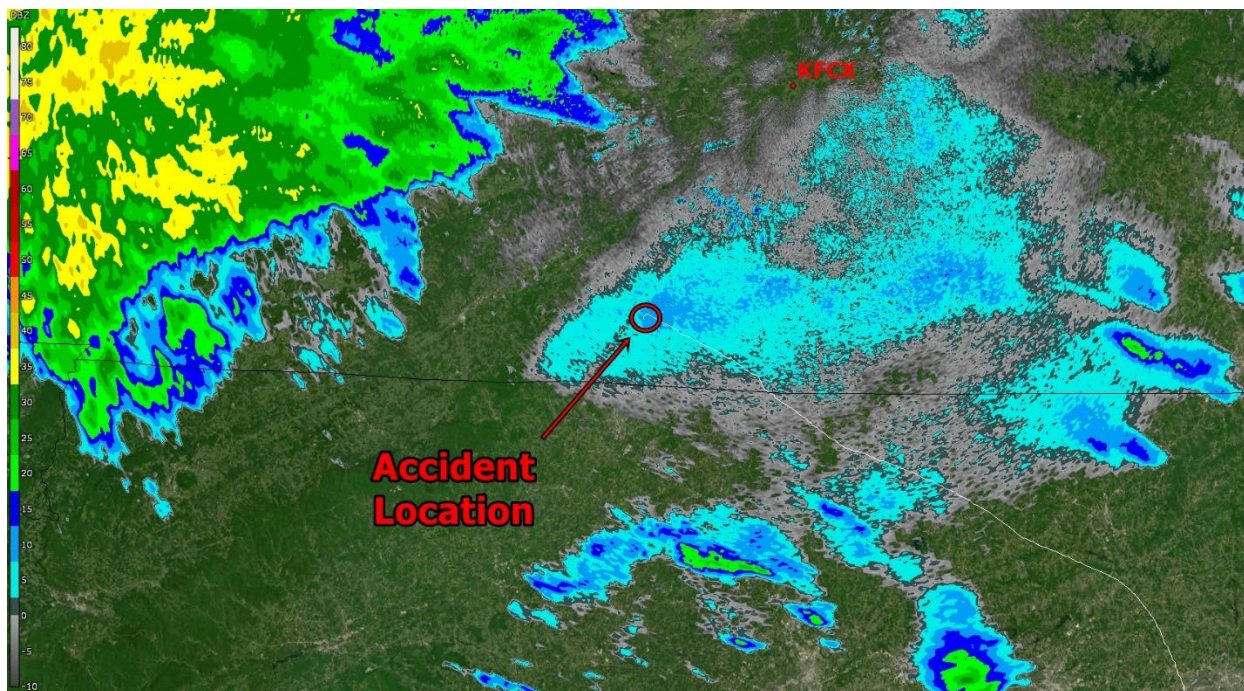
---

<sup>3</sup> “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.

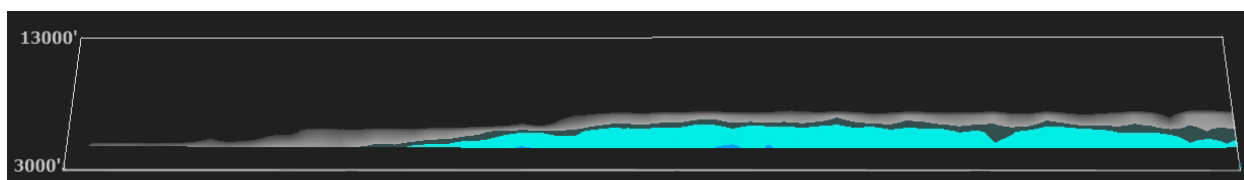
<sup>4</sup> Weather Surveillance Radar 88 Doppler (WSR-88D)

<sup>5</sup> Here we define the angular width of the radar beam as the region of transmitted energy that is bounded by one-half the maximum power. The maximum power lies along the beam centerline and decreases outward from the radar antenna.

<sup>6</sup> End points for the vertical cross section are: 36.727146°N, -80.704094°W and 36.13354°N, 80.431084°W



**Figure 1** - KFCX 0.484° Level-II base reflectivity product from a sweep initiated at 1655:28.



**Figure 2** - Vertical cross-section of the KFCX Level-II base reflectivity weather radar imagery for the volume scan initiated at 1655:28 along the final portion of the accident aircraft's flight path. Height scale is approximate to within about 100 feet.

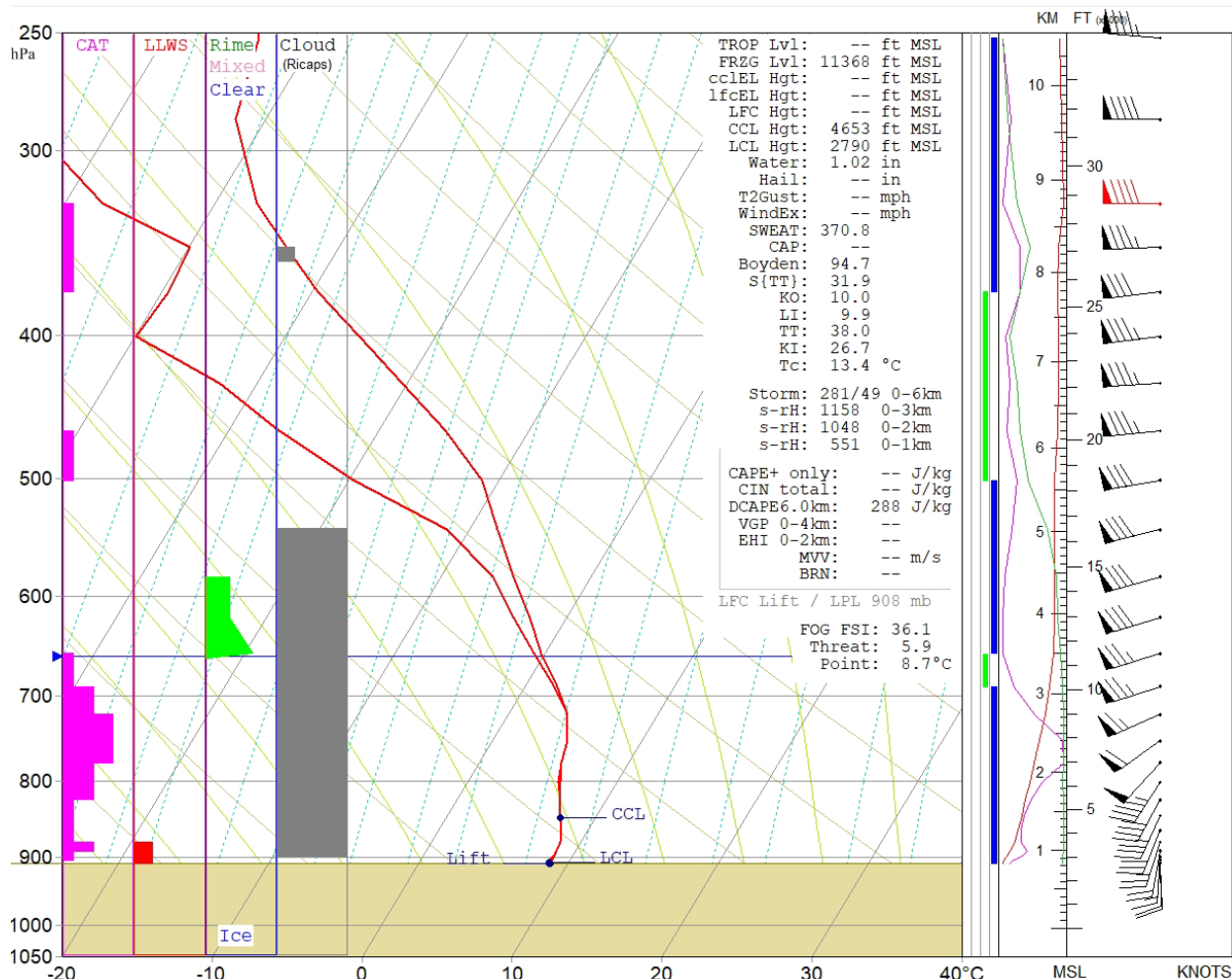
### 3.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model<sup>7</sup> sounding (Figure 3) for near the accident site<sup>8</sup> at 1700 using an elevation of 2,745 feet was retrieved from the National Oceanic and Atmospheric Administration's (NOAA) Air Resources Laboratory and analyzed by the RAwinsonde OBservation (RAOB) program. Clouds were identified by RAOB between about 3,000 and 16,500 feet. The freezing level was at about 13,400 feet and RAOB identified the presence of trace to light icing between about 11,000

<sup>7</sup> 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.

<sup>8</sup> Coordinates used for the model were latitude: 36.66°N; longitude: 80.54°W.

and 14,500 feet. RAOB identified the potential for “severe” turbulence (using their “CAT [FAA]” definition<sup>9</sup>) between about 7,000 and 9,000 feet. The wind near the surface was from the south at about 10 knots and increase in magnitude and veered with height to a westerly wind of about 73 knots near 10,000 feet. Above this level through 30,000 feet the wind was generally westerly between 75 and 85 knots. Light low-level wind shear was noted by RAOB near the surface.



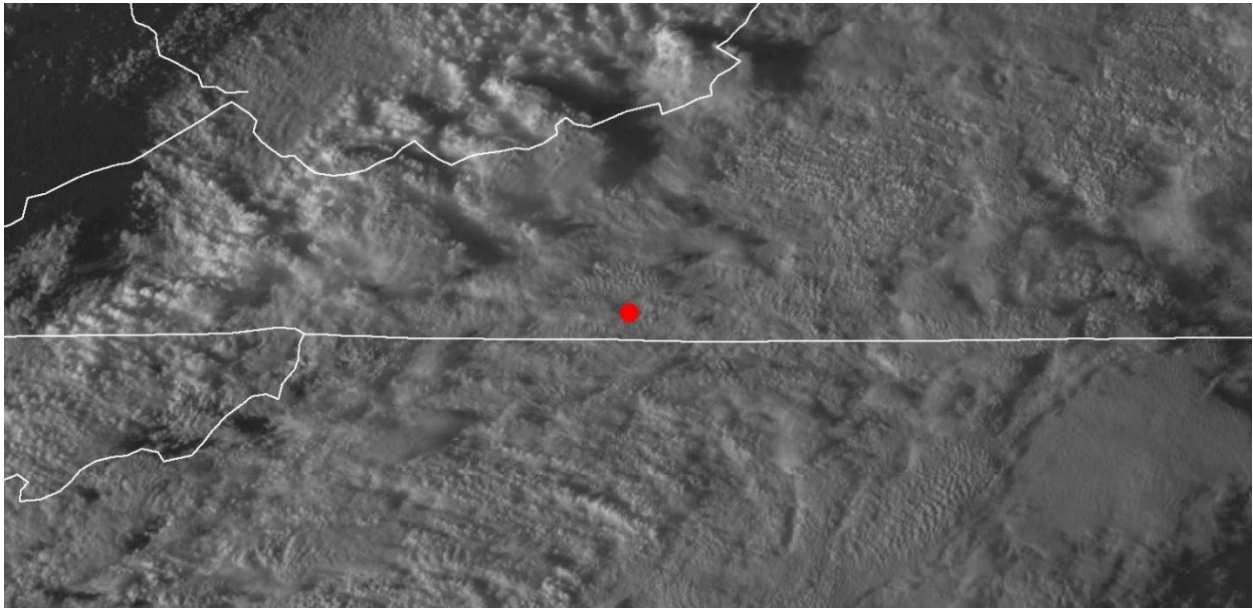
**Figure 3 - HRRR model sounding data in SkewT/LogP format for 1700 near the accident site, surface to 250 hectopascals (hPa).**

#### 4.0 Satellite Imagery

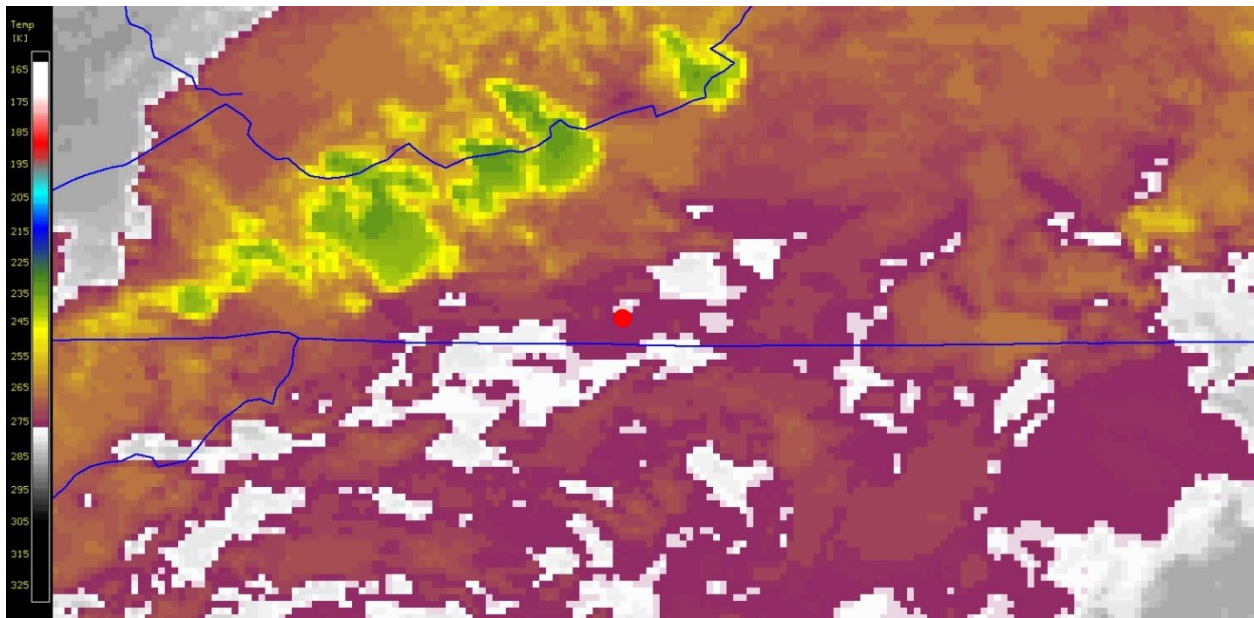
Geostationary Operational Environmental Satellite (GOES)-16 visible (0.64μm) and infrared (10.3μm) data were obtained from an archive at the Space Science

<sup>9</sup> RAOB assesses “CAT (FAA)” turbulence severity as follows: “light” (LGT) = 3-5 knots of shear per 1,000 feet; “moderate” (MDT) = 6-9 knots of shear per 1,000 feet; “severe” (SVR) = 10-14 knots of shear per 1,000 feet; “extreme” (XTR) = ≥ 15 knots of shear per 1,000 feet.

Engineering Center at the University of Wisconsin-Madison. Images from 1656 are presented in Figures 4 and 5. The GOES-16 visible imagery depicted cloudy conditions over the accident region. Infrared cloud-top temperatures near the accident location were around 5°C to 2°C, which, when considering the 1700 HRRR sounding, corresponded to cloud top heights of around 7,900 to 10,200 feet.



**Figure 4** - GOES-16 visible imagery from 1656. Accident location denoted by the red dot. Image is not corrected for parallax error.



**Figure 5** - GOES-16 infrared brightness temperature imagery from 1656. Accident location is denoted by the red dot. This image has not been corrected for any parallax error.

## 5.0 Pilot Reports

The following are the longline-disseminated pilot reports<sup>10</sup> (PIREPs) reported between 1500 and 1900 below FL180<sup>11</sup> within 50 miles of the accident location.

EXX UA /OV EXX/TM 2002/FL028/TP BE40/SK BASES 028  
ROA UA /OV ROA/TM 2022/FLDURC/TP E145/SK 048 OVC 058  
ROA UA /OV ROA/TM 2037/FL047/TP BE20/SK 047 OVC/TB MOD  
ROA UA /OV ODR250010/TM 2037/FLDURD/TP BE20/SK 045 OVC/TB MOD  
ROA UA /OV ODR250009/TM 2209/FLDURD/TP CRJ9/SK 041 OVC  
ROA UUA /OV BCB/TM 2240/FL070/TP E545/TB SEV  
BCB UA /OV BCB310004/TM 2338/FLDURD/TP PC12/SK 035 OVC/TB NIL

## 6.0 Area Forecast Discussion

The National Weather Service (NWS) Blacksburg, Virginia, Weather Forecast Office issued the following Aviation section of an Area Forecast Discussion at 1442, applicable for a region that included the accident location.

*FXUS61 KRNK 272029*

*AFDRNK*

*Area Forecast Discussion*

*National Weather Service Blacksburg VA*

*242 PM EST Mon Feb 27 2023*

*.AVIATION /19Z MONDAY THROUGH SATURDAY/...*

*As of 200 PM EST Monday...*

*Strong weather system will move through the region overnight. Expect gusty west winds to develop across the higher terrain in the west this evening then spread east overnight. A High Wind Warning is in effect for Watauga, Grayson, Ashe, Alleghany, and Carroll with a Wind Advisory for areas east to along the Blue Ridge. Brief showers will also accompany the front.*

*Ceilings...Generally VFR until showers arrive, then becoming MVFR overnight west and low end VFR east with brief MVFR-IFR possible in rain showers.*

---

<sup>10</sup> These do not include pilot reports only broadcast via radio.

<sup>11</sup> Flight Level (FL) - a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the international standard pressure datum of 1013.25 hPa (29.92 inches of mercury), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

*Visibilities...VFR for the most part. Brief MVFR visibilities possible in showers and low clouds.*

*Winds...Southwest this evening 10-20 mph and gusty, especially west becoming west to west-northwest 15-30 mph with gusts to 50-55 mph west and 15-20 mph with gusts to 45 mph east overnight through Tuesday morning. Winds diminish quickly Tuesday afternoon.*

*/Confidence Levels in Forecast Parameters/*

- Moderate Confidence in Ceilings,*
- Moderate to High Confidence in Visibilities,*
- Moderate to High Confidence in Wind Direction and Speed.*

*Extended Aviation Outlook...*

*High pressure will provide mostly VFR conditions by Tuesday afternoon through most of Wednesday.*

*A series of low pressure systems will track into the region along a lingering frontal boundary Thursday through Friday. Widespread rain and sub-VFR ceilings are expected for an extended period Thursday through Friday.*

## **7.0 SIGMETs**

There were no non-convective or Convective Significant Meteorological Information (SIGMET) advisories active for the accident flight.

## **8.0 CWSU Products**

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at the Atlanta and Washington Air Route Traffic Control Centers that were active for the accident flight.

## **9.0 G-AIRMETs below FL180**

A Graphical-Airmen's Meteorological Information (G-AIRMET) is a graphical advisory of weather that may be hazardous to aircraft but are less severe than SIGMETs. They are only valid at specific time "snapshots". G-AIRMETs are issued at 0300 UTC, 0900 UTC, 1500 UTC and 2100 UTC (with updates as necessary). At each issuance time, there are G-AIRMETs issued that are valid for the issuance time and for discrete times three hours apart for a period of up to 12 hours into the future (i.e., 03-, 06-, 09- and

12-hour forecasts). For example, at 1500 UTC, G-AIRMETs valid for 1500 UTC, 1800 UTC, 2100 UTC, 0000 UTC and 0300 UTC and issued.

There were G-AIRMET advisories issued about 1600 and active for the accident location below FL180 at both 1600 and 1900 for moderate icing between the surface and FL210, moderate turbulence from the surface to FL180, low-level wind shear, instrument flight rule conditions (IFR)<sup>12</sup> and mountain obscuration.

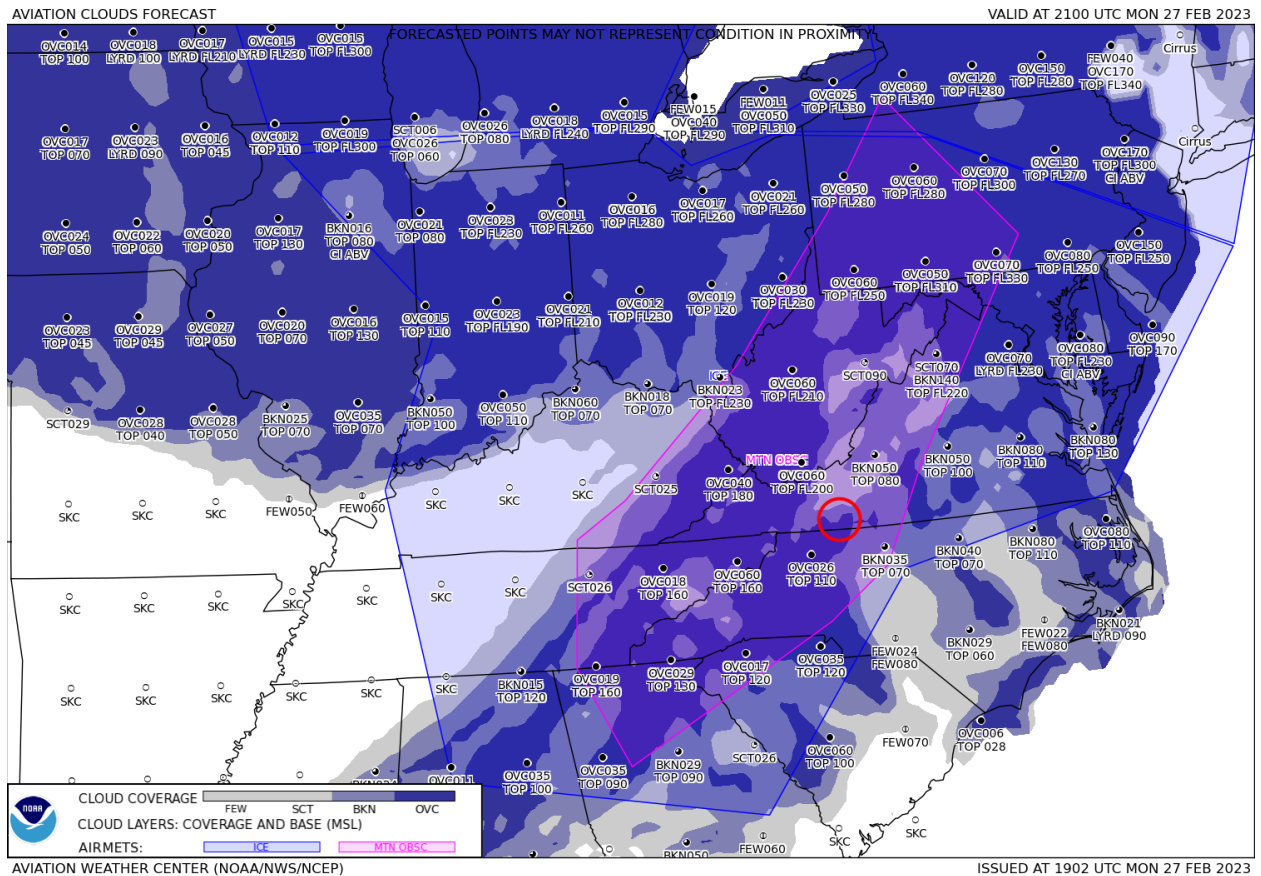
## **10.0 Graphical Forecasts for Aviation**

The Graphical Forecasts for Aviation (GFA) are intended to provide the necessary aviation weather information to give users a complete picture of the weather that might impact flight in the continental United States. Hourly model data and forecasts, including information on clouds, flight category, precipitation, icing, turbulence, wind, and other output from the NWS are available, however only certain imagery are archived by the NWS.

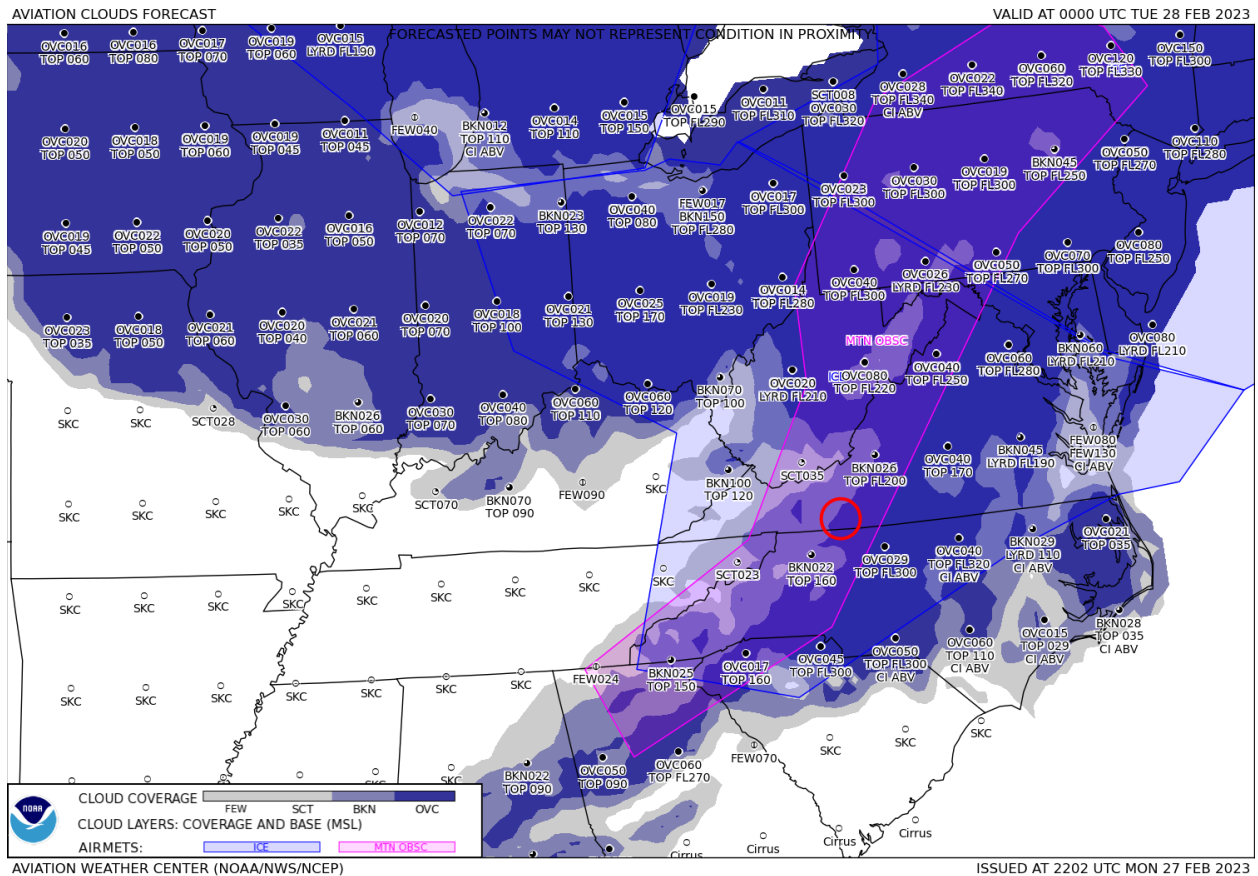
Figures 6 and 7 depict GFA forecast information on sky condition, icing, mountain obscuration, IFR condition and surface wind G-AIRMET advisories, surface visibility, surface wind, precipitation, and other obscurations and hazards, valid for a times near the accident time. These GFA forecast imagery depicted broken and overcast sky conditions in the immediate accident region with a point to the southwest of the accident site valid at 1600 identifying overcast clouds at 2,600 feet with tops to 11,000 feet (Figure 6). The GFA surface forecasts valid at 1600 and 1900 (Figures 8 and 9) depicted southerly to southwesterly gusting surface winds of 15-25 knots near the accident location with rain showers across the region. Visibilities in the accident region were forecast to be generally greater than 5 statute miles with small areas of decreased visibility present.

---

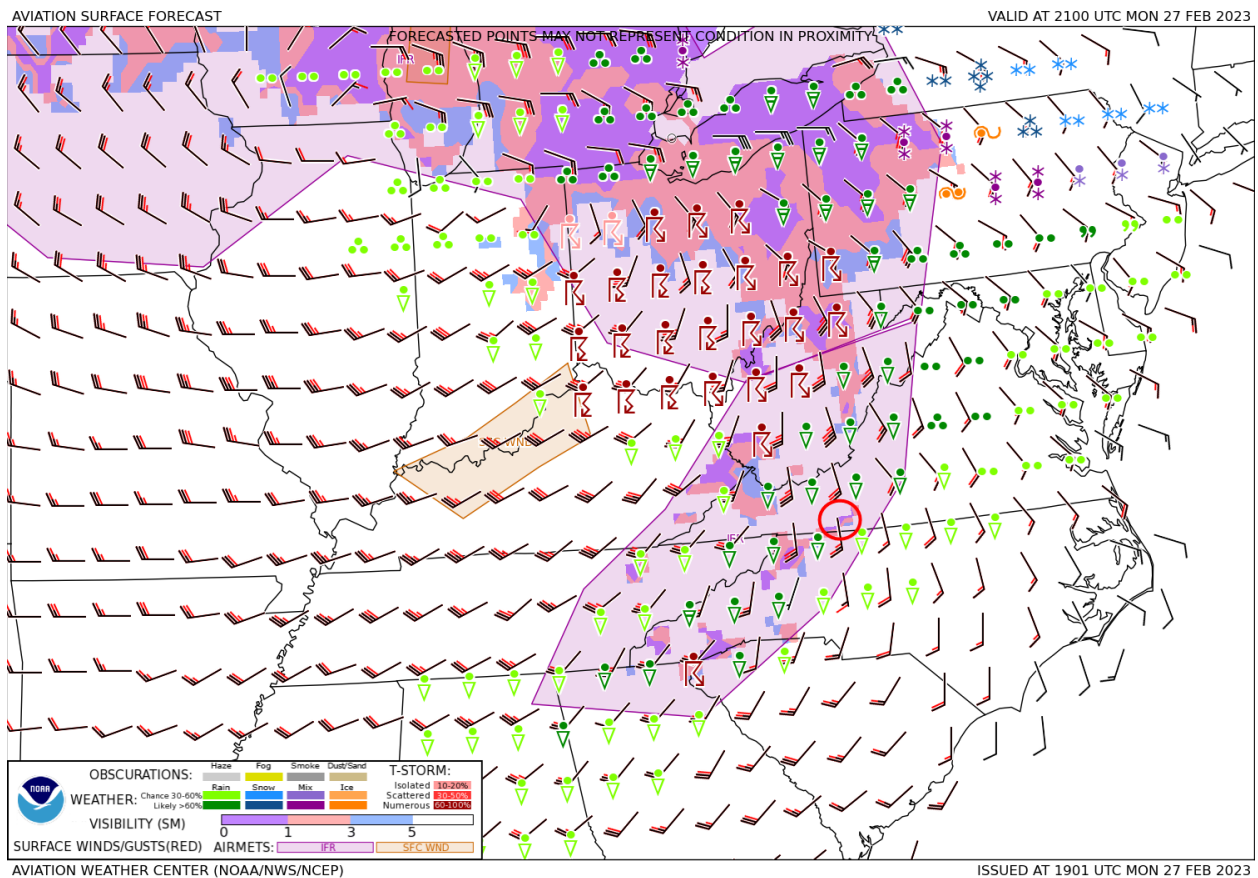
<sup>12</sup> IFR conditions - Ceilings less than 1,000 feet agl and/or visibility less than three statute miles.



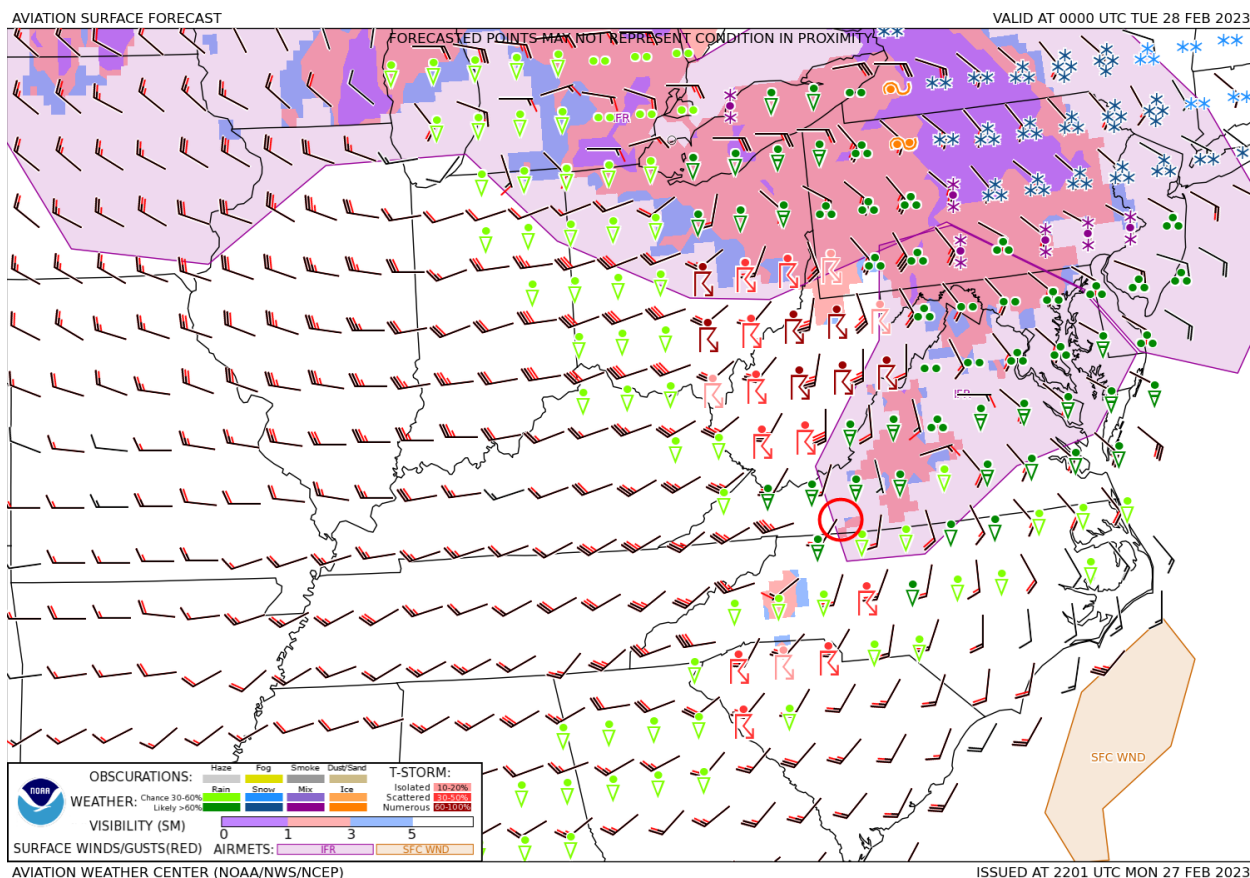
**Figure 6** - GFA forecast imagery depicting sky condition and icing and mountain obscuration G-AIRMETs issued about 1400 and valid for 1600. The accident location is located within the red circle.



**Figure 7** - GFA forecast imagery depicting sky condition and icing and mountain obscuration G-AIRMETs issued about 1700 and valid for 1900. The accident location is located within the red circle.



**Figure 8** - GFA forecast imagery depicting IFR conditions and surface wind G-AIRMETS, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 1400 and valid for 1600. The accident location is located within the red circle.



**Figure 9** - GFA forecast imagery depicting IFR conditions and surface wind G-AIRMETs, surface visibility, surface wind, precipitation, and other obscurations and hazards. Issued about 1700 and valid for 1900. The accident location is located within the red circle.

## 11.0 Astronomical

According to the US Navy<sup>13</sup>, on the accident day and relative to the accident location, sunset occurred at 1815.

Submitted by:

Mike Richards  
Senior Meteorologist

<sup>13</sup> [https://aa.usno.navy.mil/data/RS\\_OneDay](https://aa.usno.navy.mil/data/RS_OneDay)