NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

July 8, 2021

Specialist's Factual Report

METEOROLOGY

ERA21FA148

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A. ACCIDENT

Location: Purcellville, Virginia
Date: March 4, 2021
Time: 1510 eastern standard time
2010 Coordinated Universal Time (UTC)
Airplane: Beech C23; Registration: N67013

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). This specialist factual contains the meteorological factors pertinent to the weather surrounding the accident time. All times are eastern standard time (EST) on March 4, 2021, and are based upon the 24-hour clock, where local time is -5 hours from UTC. 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 39.2305° N, Longitude 77.7483° W, with an approximate elevation of 720 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 eastern United States for 1600 EST is provided as figure 1 with the location of the accident site within the red circle. The chart depicted a frontal boundary located from the western Atlantic Ocean across North Carolina and westward through the Tennessee Valley. A high-pressure center with a pressure of 1030-hectopascals (hPa) was located over Lake Michigan. The accident site was located north of the frontal boundary on the cold side of the front.

The station models around the accident site depicted air temperatures in the low 50's degrees Fahrenheit (°F), dew point temperatures in the low 20's °F with temperature-dew point spreads of 30°F or more, a northwest wind at 15 knots, and mostly clear skies.

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

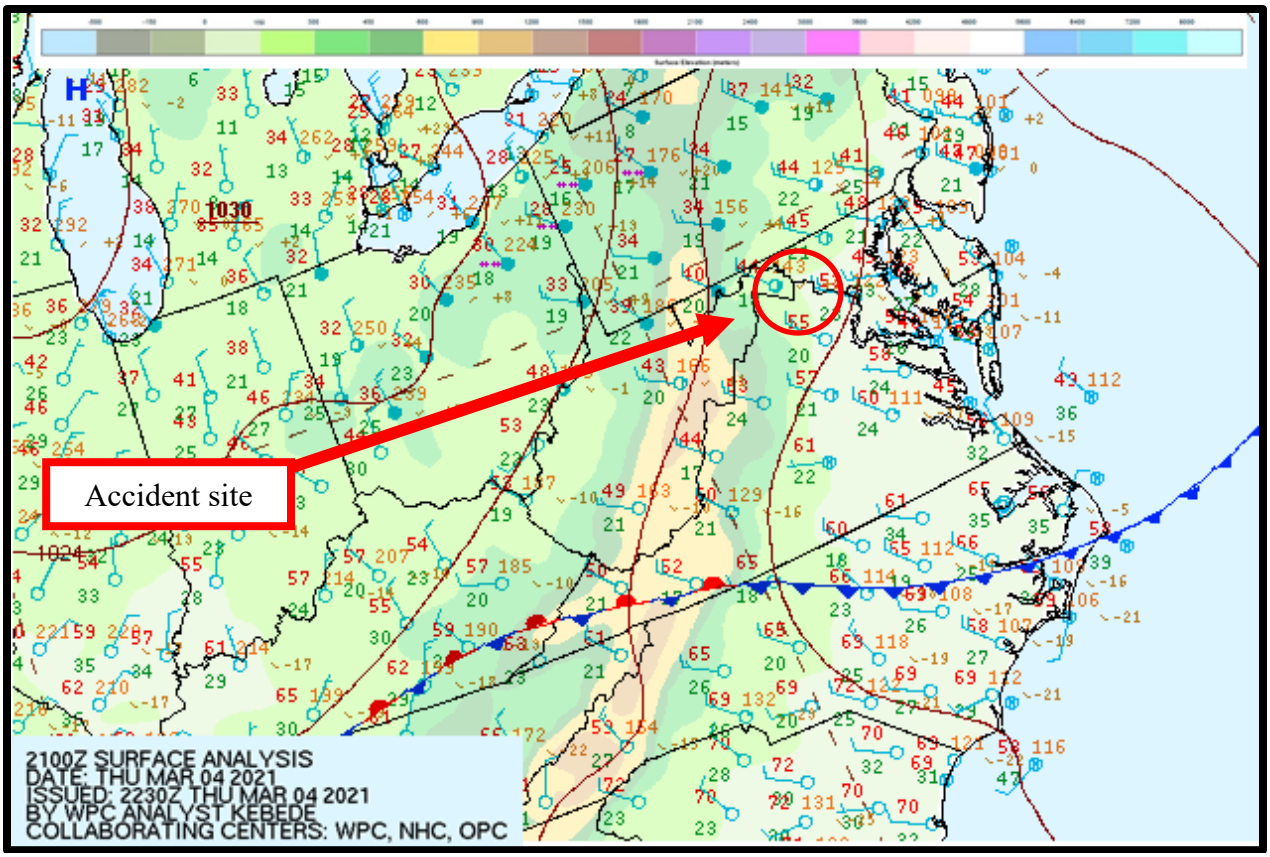

Figure 1 – NWS Surface Analysis Chart for 1600 EST.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1900 EST at 925-, 850- and 700-hPa are presented in figures 2 through 4. Low-level troughs[2] were located east of the accident site in the western Atlantic Ocean at 850-hPa (figure 3). Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. There was a northwest wind at 25 knots at 925-hPa with the wind remaining northwesterly through 700-hPa but with an increase in speed to 50 knots.

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

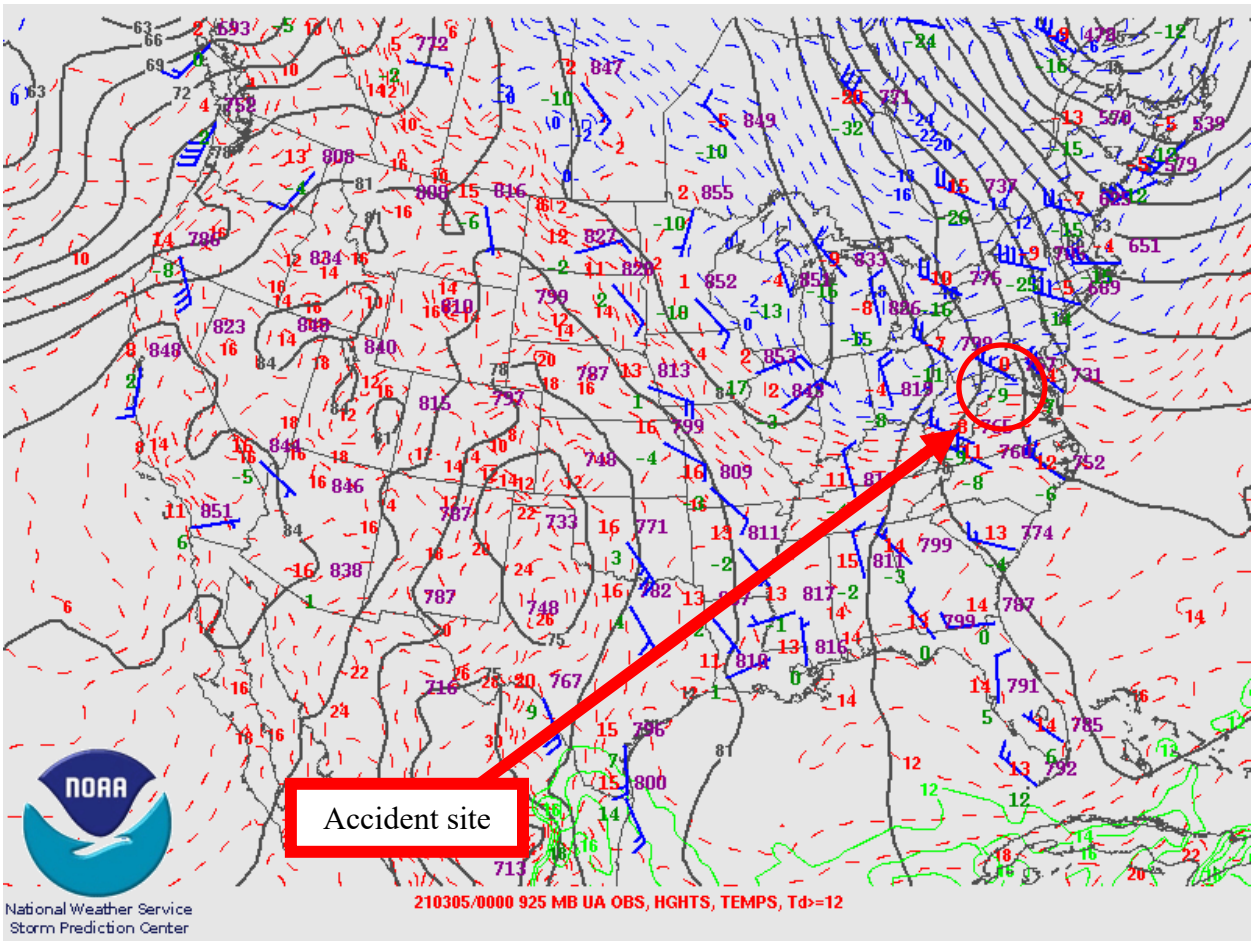

Figure 2 – 925-hPa Constant Pressure Chart for 1900 EST.

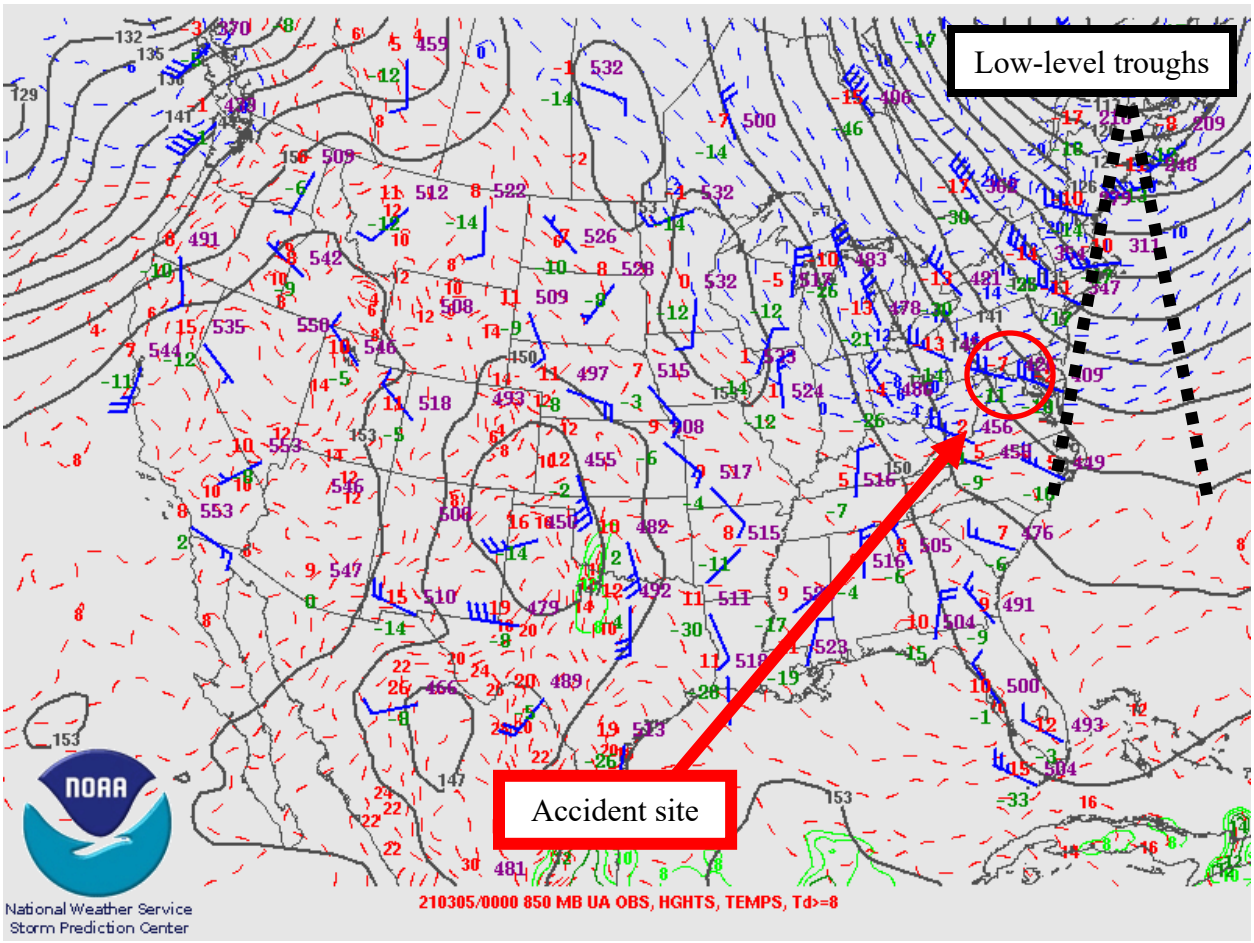

Figure 3 – 850-hPa Constant Pressure Chart for 1900 EST.

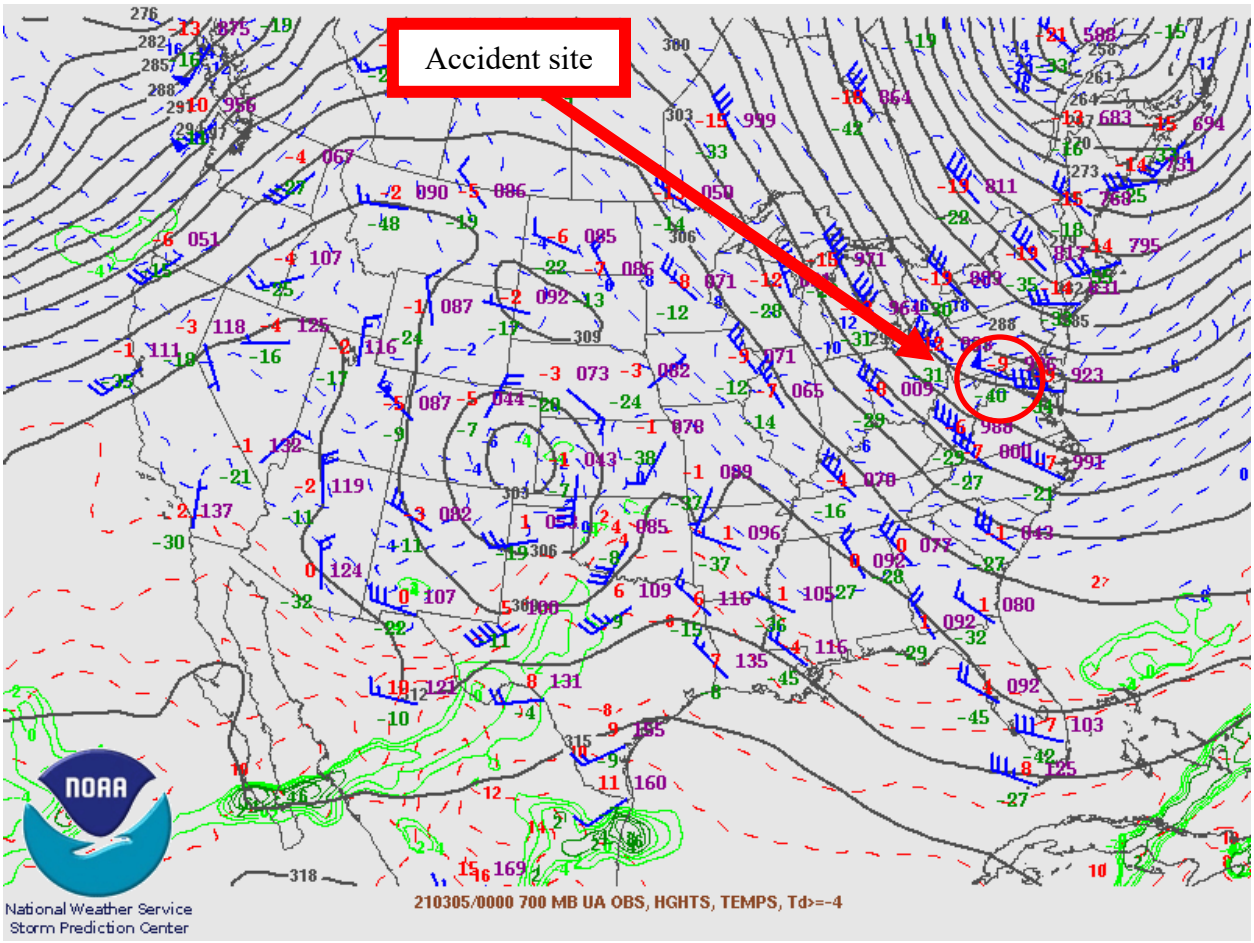

Figure 4 – 700-hPa Constant Pressure Chart for 1900 EST.

2.0 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 5 is a local sectional chart with the accident site and the closest weather reporting locations marked.

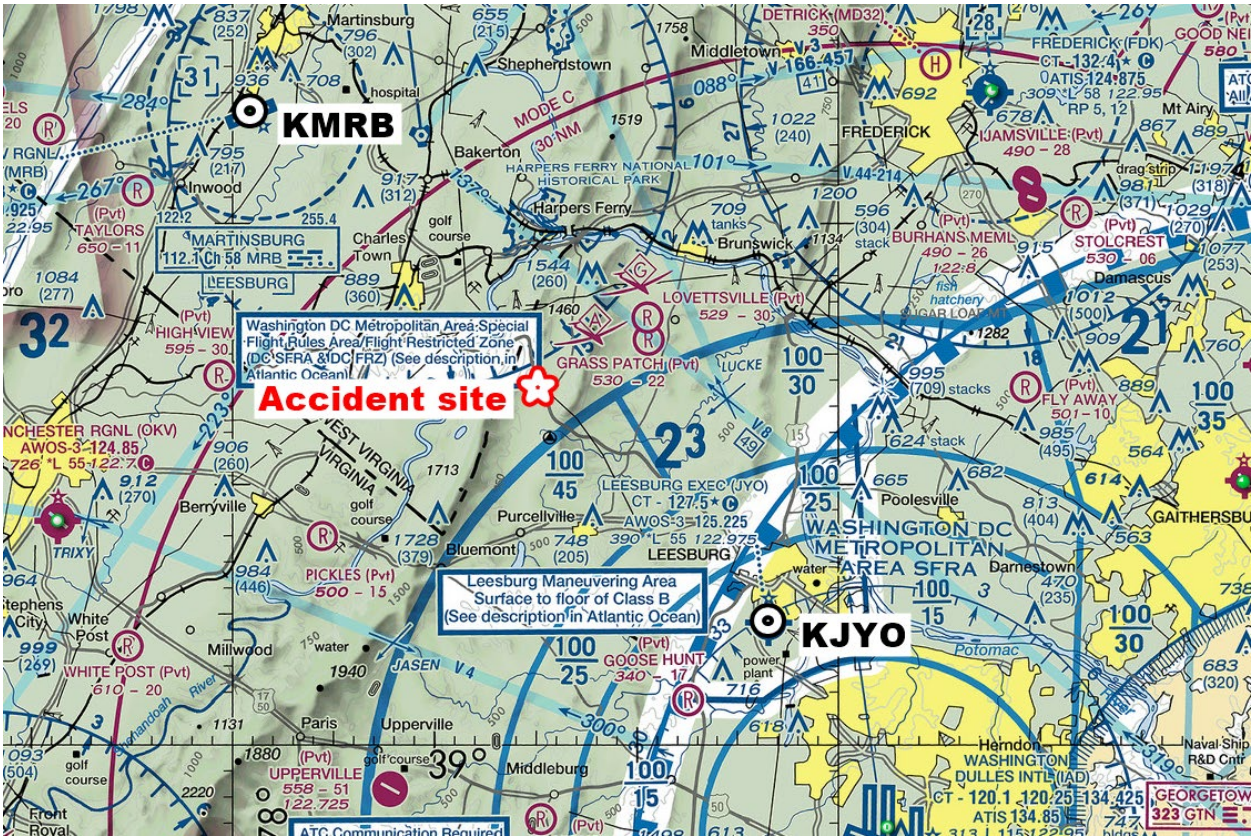

Figure 5 – Sectional map of the accident area with the location of the accident site and surface observation sites.

Leesburg Executive Airport (KJYO) had the closest official weather station to the accident site. KJYO had an Automated Weather Observing System (AWOS[3]) whose longline[4] reports were not augmented. The KJYO AWOS was located 13 miles southeast of the accident site, at an elevation of 390 ft, and had a 10° westerly magnetic variation[5] (figure 5). The following automated longline observations were disseminated during the times surrounding the accident:[6]

[3] AWOS – Automated Weather Observing System is equipped with meteorological instruments to observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to 12,000 feet, and altimeter setting. AWOS are maintained by the FAA.

[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 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.

[1335 EST] METAR KJYO 041835Z AUTO 33015G24KT 10SM BKN060 11/M02 A2991 RMK AO2=

[1355 EST] METAR KJYO 041855Z AUTO 33017G25KT 10SM BKN070 BKN080 11/M02 A2990 RMK AO2=

[1415 EST] METAR KJYO 041915Z AUTO 30015G27KT 10SM SCT070 SCT080 10/M02 A2990 RMK AO2=

[1435 EST] METAR KJYO 041935Z AUTO 31024G31KT 10SM CLR 11/M02 A2990 RMK AO2=

[1455 EST] METAR KJYO 041955Z AUTO 31024G29KT 10SM CLR 11/M03 A2990 RMK AO2=

ACCIDENT TIME 1510 EST

[1515 EST] METAR KJYO 042015Z AUTO 31018G29KT 10SM CLR 10/M03 A2991 RMK AO2=

[1535 EST] METAR KJYO 042035Z AUTO 32019G25KT 10SM SCT065 10/M03 A2992 RMK AO2=

KJYO weather at 1455 EST, automated, wind from 310° at 24 knots with gusts to 29 knots, visibility 10 miles or greater, clear skies below 12,000 ft above ground level (agl), temperature of 11° Celsius (C), dew point temperature of -3°C, and an altimeter setting of 29.90 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator.

KJYO weather at 1515 EST, automated, wind from 310° at 18 knots with gusts 29 knots, visibility 10 miles or greater, clear skies below 12,000 ft agl, temperature of 10°C, dew point temperature of -3°C, and an altimeter setting of 29.91 inHg. Remarks: automated station with a precipitation discriminator.

The observations from KJYO surrounding the accident time indicated VFR[7] conditions with a northwest wind gusting to 29 knots.

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[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.

3.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)[8] model sounding was created for the accident site for 1500 EST which provided a surface elevation of 745 ft.[9] The 1500 EST HRRR sounding was plotted on a standard Skew-T Log P diagram[10] with the derived stability parameters included in figure 6 with data from the surface to 700-hPa (or approximately 10,000 ft msl). These data were analyzed using the RAOB[11] software package. The sounding depicted the lifted condensation level (LCL)[12] at 6,374 ft msl and the convective condensation level (CCL)[13] at 13,059 ft msl. The freezing level was located at 2,844 ft msl. The precipitable water value was 0.24 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] 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.

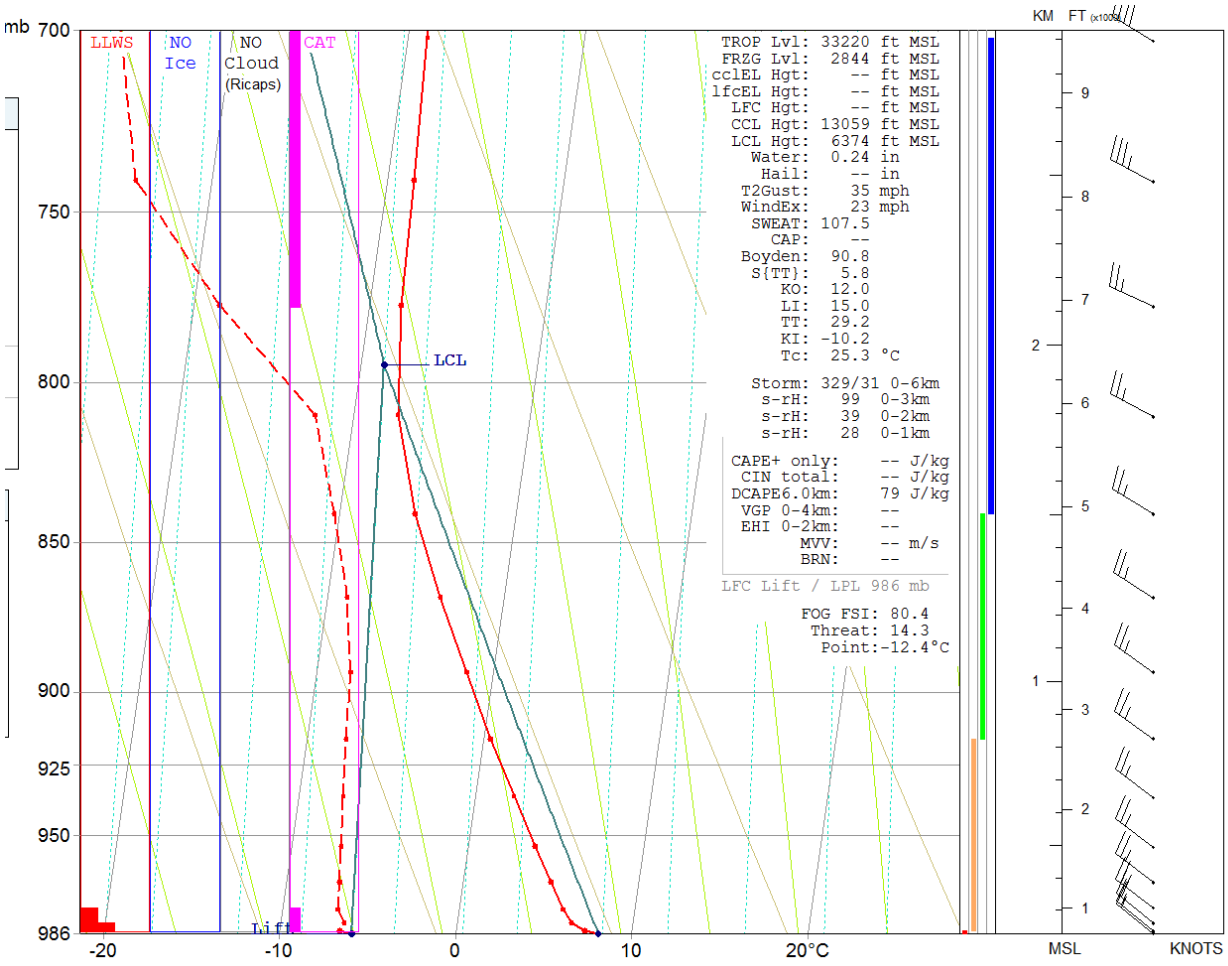

Figure 6 – 1500 EST HRRR sounding.

The 1500 EST HRRR sounding for the accident site indicated an unstable to conditionally unstable environment from the surface through 5,000 ft msl. No cloud or icing were indicated by RAOB below 10,000 ft msl.

The 1500 EST HRRR sounding wind profile indicated a near surface wind from 311° at 17 knots with the wind remaining from the northwest through 10,000 ft msl. The wind speed increased to 25 knots by 300 ft agl with the wind speed to 40 knots by 10,000 ft msl. RAOB indicated the possibility of moderate low-level wind shear (LLWS) between the surface and 500 ft agl. RAOB indicated the possibility of light clear-air turbulence between the surface and 500 ft agl and above 7,000 ft msl.

4.0 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 1200 EST through 1800 EST and reviewed, and the closest images to the time of the accident were documented.

Figure 7 presents the GOES-16 visible imagery from 1510 EST at 2X magnification with the accident site highlighted with a red square. There was transverse band[14] oriented cloud cover above the accident site at the accident time with the cloud cover moving from northwest to southeast (attachment 1). Figure 8 presents the GOES-16 infrared imagery from 1510 EST at 6X magnification with the accident site highlighted with a red square. The lower brightness temperatures (yellow colors; higher cloud tops) were located north of the accident site. Based on the brightness temperatures (about 273 Kelvin) above the accident site and the vertical temperature profile provided by the 1500 EST HRRR sounding, the approximate cloud-top heights over the accident site were 3,000 ft msl at 1510 EST. It should be noted these figures have not been corrected for any parallax error.

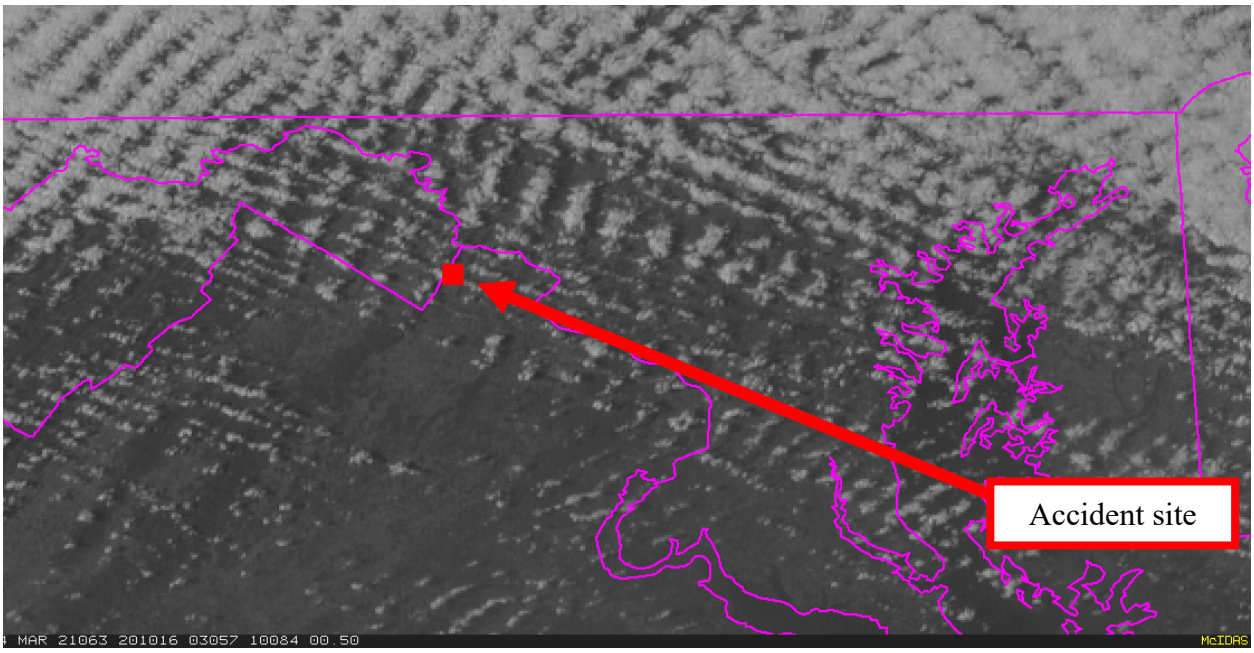

Figure 7 – GOES-16 visible image at 1510 EST.

[14] Bands of clouds oriented perpendicular to the flow in which they are embedded. They often are seen best on satellite photographs. When observed at high levels (i.e., in cirrus formations), they may indicate severe or extreme turbulence. Transverse bands observed at low levels (called transverse rolls or T rolls) often indicate the presence of a temperature inversion (or cap) as well as directional shear in the low- to mid-level winds.

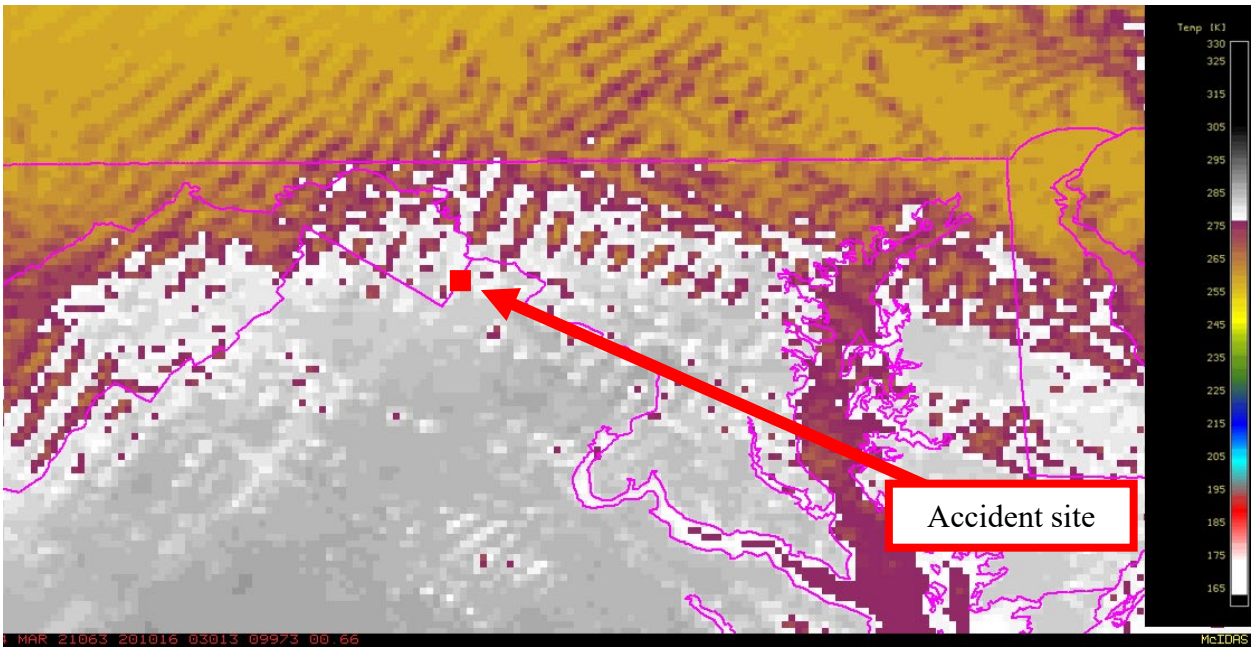

Figure 8 – GOES-16 infrared image at 1510 EST.

5.0 Regional Radar Imagery Information

A regional view of the NWS national composite radar mosaic is included as figure 9 for 1510 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.

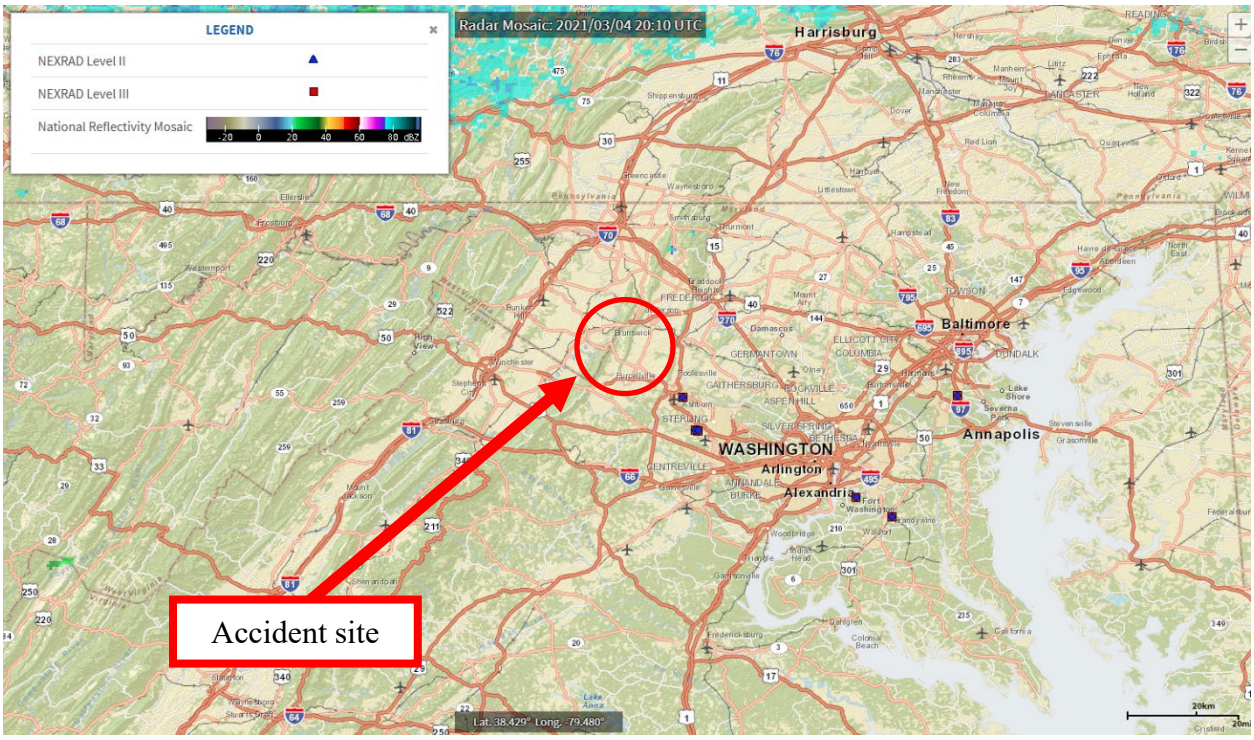

Figure 9 – Regional Composite Reflectivity image for 1510 EST.

6.0 Pilot Reports

The longline-disseminated pilot reports[15] (PIREPs) distributed into the national airspace (NAS) were reviewed from about two hours prior to the accident time to one hour after the accident time and the PIREPs within 150 miles of the accident site below 18,000 ft msl are shown below:

DCA UA /OV DCA360015/TM 1836/FL130/TP A319/TB OCC MODERATE TURB

JST UA /OV JST260010/TM 1911/FL075/TP SF50/TA M11/IC LGT RIME

HGR UA /OV KHMZ145025/TM 1913/FL068/TP C310/SK BKN053-TOP068/TB CONS LGT-MOD BLO 053/RM SMTH

BWI UA /OV BWI045032/TM 1955/FL066/TP SR22/TA M12/IC LGT RIME

W29 UA /OV ADW103016 /TM 2012 /FLUNKN /TP B737 /TB MOD OCNL CHOP 070-035 /RM OV RAVNN

BWI UA /OV RAVNN/TM 2012/FLDURD/TP B737/TB MOD OCNL CHOP 70-35

7.0 Significant Meteorological Information

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

8.0 Center Weather Service Advisories

The Washington DC (ZDC) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. There were no Meteorological Impact Statements (MIS) or Center Weather Advisories (CWA) valid for the accident site at the accident time.

9.0 Airmen's Meteorological Information

Airmen's Meteorological Information (AIRMET) advisories Tango and Zulu were valid for the accident site at the accident time (issued at 1452 and 0945 EST, respectively). The AIRMETs warned of moderate turbulence below 10,000 ft msl and moderate ice between the freezing level[16] and 8,000 ft msl:

WAUS41 KKCI 041952 AAA
WA1T
-BOST WA 041952 AMD
AIRMET TANGO UPDT 3 FOR TURB STG WNDS AND LLWS VALID UNTIL 042100
.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA
AND CSTL WTRS...UPDT

[15] Only pilot reports with the World Meteorological Organization headers UBWV**, UBVA**, UBPA**, and UBMD** were considered. These do not include pilot reports only broadcast via radio.
[16] Freezing level between the surface and 3,000 ft msl.

FROM 90NW PQI TO 40NNE PQI TO 50WSW YSJ TO 90NE ACK TO 60SSE JFK TO 50ESE ECG TO 20NE ECG TO HMV TO HNN TO 30W JHW TO 30SE YOW TO YSC TO 90NW PQI
MOD TURB BLW 100. CONDS CONTG BYD 21Z THRU 03Z.
.
LLWS POTENTIAL...ME NH
BOUNDED BY 60ESE YQB-20S HUL-30SW BGR-50NNW ENE-YSC-60ESE YQB
LLWS EXP. CONDS ENDG 15-18Z.
.
OTLK VALID 2100-0300Z...STG SFC WNDS ME NH MA RI CT NY NJ MD DE VA AND CSTL WTRS
BOUNDED BY 70SSE BGR-150ENE ACK-200SE ACK-160SE SIE-120SE SBY-30S SIE-20ENE CYN-30WSW HTO-30W ACK-30S ENE-40ENE ENE-70SSE BGR
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS DVLPG 21-00Z. CONDS CONTG THRU 03Z.
....

WAUS41 KKCI 041445
WA1Z
-BOSZ WA 041445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 042100
.
AIRMET ICE...ME NH VT NY LO AND CSTL WTRS
FROM 70NW PQI TO 30NNE PQI TO 50WSW YSJ TO 100SE BGR TO 50NNW SYR TO 30ESE YOW TO 30SE YSC TO 70NW PQI
MOD ICE BLW 120. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET ICE...ME NH VT MA RI CT NY NJ MD DE VA AND CSTL WTRS
FROM 30WSW MPV TO 100SE BGR TO 160ESE ACK TO 180SSE ACK TO 150SE SIE TO 30WSW MPV
MOD ICE BTN FRZLVL AND 080. FRZLVL SFC-030. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET ICE...VT MA CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS
FROM 30WSW MPV TO 150SE SIE TO 100ESE SBY TO 20E EMI TO 40WNW CSN TO 50SE APE TO 20W APE TO 60SSW DXO TO DXO TO 30NW CLE TO 50NNW SYR TO 30WSW MPV
MOD ICE BTN FRZLVL AND 080. FRZLVL SFC-030. CONDS CONTG BYD 21Z THRU 03Z.
.
OTLK VALID 2100-0300Z
AREA 1...ICE ME NH VT MA NY LO PA LE AND CSTL WTRS
BOUNDED BY 50NW PQI-40NE PQI-50SE HUL-110SSW YSJ-20N BDL-40SSE YYZ-30ESE YOW-30ESE YSC-50NW PQI
MOD ICE BLW 120. CONDS CONTG THRU 03Z.
.
AREA 2...ICE ME NH MA RI CT NY NJ PA OH LE WV MD DC DE VA NC AND CSTL WTRS
BOUNDED BY 110SE BGR-200SE ACK-160SE SIE-170E ECG-30SW SBY-30S EKN-30NW APE-20SSE DXO-40SSE YYZ-20N BDL-110SE BGR
MOD ICE BLW 080. CONDS CONTG THRU 03Z.
.
FRZLVL...RANGING FROM SFC-060 ACRS AREA
  SFC ALG 60SW DXO-20W CLE-20N JST-30ENE SAX-110SE BGR
  040 ALG 30S HNN-20N ORF-120E ORF

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10.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products made available before the accident flight and valid at 1600 EST are shown in attachment 2. The GFA surface forecast products indicated VFR surface visibilities and a surface wind from the northwest at 15 knots with gusts to 25 knots. The GFA cloud forecast valid before departure for around the accident time indicated few clouds at 6,000 to 7,000 ft msl. Graphical AIRMETs[17] (G-AIRMET) were noted north of the accident site. 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 2.

11.0 Terminal Aerodrome Forecast

Eastern West Virginia Airport/Shepherd Field (KMRB) was the closest airport to the accident site with an NWS Terminal Aerodrome Forecast[18] (TAF) located 15 miles northwest of the accident site (figure 5). The KONT TAF valid at the time of the accident was issued at 1230 EST and was valid for a 24-hour period beginning at 1300 EST. The 1230 EST TAF for KMRB was as follows:

TAF KMRB 041730Z 0418/0518 **32015G23KT P6SM FEW250**
FM042300 32012G25KT P6SM FEW060
FM050100 32010G25KT P6SM FEW250
FM051200 31012G19KT P6SM SKC=

Between 1300 and 1800 EST, the forecast expected a wind from 320° at 15 knots with gusts to 23 knots, greater than 6 miles visibility, few clouds at 25,000 ft agl.

12.0 NWS Area Forecast Discussion

The NWS office in Baltimore, Maryland, and Washington, DC, region (WFO LWX) issued an Area Forecast Discussion (AFD) at 1451 EST. The aviation section of the AFD discussed VFR conditions with gusting northwest winds through the afternoon:

FXUS61 KLWX 041951
AFDLWX

Area Forecast Discussion
National Weather Service Baltimore MD/Washington DC
251 PM EST Thu Mar 4 2021

.SYNOPSIS...

High pressure over the Great Lakes region will continue the dry
weather trend over the next several days. Gusty northwesterly winds

[17] https://aviationweather.gov/gairmet
[18] 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

are expected to continue through Saturday before diminishing on Sunday as the high slowly shifts southward; becoming more concentrated over the region by early next week. The high will then shift offshore; inducing a warming trend through the middle of next week.

&&

.NEAR TERM /UNTIL 6 AM FRIDAY MORNING/...

This mornings cold front has moved well south of the CWA; resulting in continued dry conditions under a gusty NW flow. Some scattered strato-cu persist mainly across eastern WV, northern MD, and northern VA and should diminish into this evening.Seasonable temperatures this afternoon; ranging in the upper 40s to low 50s across our southernmost areas. However it will remain much colder across the higher elevations over the Alleghenies with temperatures in the 30s. NW winds will range between 20-30 mph. Hi-res guidance, coupled with the rest of the 12Z suite continued to indicate gusty NW flow continuing into the overnight hours across much of the CWA, which will cause frigid overnight conditions with temperatures in the 20s for most with teens in the mountains.

&&

.SHORT TERM /6 AM FRIDAY MORNING THROUGH SUNDAY/...

A large H5 low over eastern Canada will continue to retrograde inducing a large upper level trough that extends down to the southeast CONUS. Meanwhile upper level ridging persists over the Midwest which will result in a large surface high pressure residing over the Great Lakes region. Influence from the high will continue the dry weather trend into early next week as the gradient between the high and low induce gusty NW winds that are expected to continue through Saturday. Thereafter, the low will exit off into the North Atlantic, allowing the high to slowly slide southeast over the CWA which will allow the winds to diminish Sunday into Monday.

Temperatures will remain just below normal for this time of year through the weekend with cold overnight lows in the 20s and daytime highs in the 40s for most with low 30s across the mountains.

&&

.LONG TERM /SUNDAY NIGHT THROUGH THURSDAY/...

Mainly dry weather is likely to continue Sunday through Wednesday with a notable warming trend Tuesday into Wednesday.

An upper-level trough that will be overhead on Sunday will move offshore by Monday afternoon as a region of surface high pressure builds locally. The surface high will slowly move offshore Tuesday into Wednesday allowing for return flow. This coupled with an upper-level ridge building over the Plains propagating eastward will allow for temperatures to soar into the 60s with 70 degrees possible in some of the warmer locales Tuesday into Wednesday.

It is possible we get through the entire long term period without any measurable precipitation. The next opportunity for precipitation arrives with a cold front Wednesday night into Thursday. Guidance varies regarding how much moisture if any will be associated with this feature.

&&

.AVIATION /20Z THURSDAY THROUGH TUESDAY/...

VFR conditions are expected to continue through the weekend with high pressure in control. Gusty NW winds around 20-30 kts will continue this afternoon and are likely to persist through Saturday. Winds will begin to diminish Saturday night as high pressure becomes more centralized over the region. VFR conditions are likely Sunday into early next week as high pressure builds nearby.

&&

.MARINE...

Gusty northwest winds are expected to continue over the waters through Saturday. As a result, SCA will likely need to be extended through Saturday night. Winds will begin to diminish thereafter as high pressure becomes more centralized over the region into early next week. Sub-SCA winds are expected Sunday into Monday.

&&

.FIRE WEATHER...
Dry weather will persist through Saturday and the RH values will be low each day (20s and 30s today, teens and 20s Friday, and 20s to lower 30s Saturday). Gusty northwest winds are expected during this time as well, with frequent gusts around 20 to 30 mph for most areas. As fuels continue to dry out over the next few days, the meteorological conditions may enhance the threat for the spread of wildfires, especially Friday afternoon and Saturday afternoon (when fuels will be driest).

&&

.LWX WATCHES/WARNINGS/ADVISORIES...
DC...None.
MD...None.
VA...None.
WV...None.
MARINE...Small Craft Advisory until 6 PM EST Friday for ANZ530>543.

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13.0 Winds and Temperature Aloft Forecast

The NWS 1455 EST Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

```
FBUS31 KWNO 041955
FD1US1
DATA BASED ON 041800Z
VALID 050000Z   FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT  3000    6000    9000   12000   18000   24000  30000  34000  39000

EMI 3232 3229-12 3142-11 3053-14 3069-25 3081-37 299248 308652 297852
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The closest forecast point to the accident site was Westminster, Maryland, (EMI). The 1455 EST EMI forecast for use between 1500 EST and 2200 EST indicated a wind at 3,000 ft from 320° at 32 knots, a wind at 6,000 ft from 320° at 29 knots with a temperature of -12°C, and a wind at 9,000 ft from 310° at 42 knots with a temperature of -11°C.

14.0 Pilot Weather Briefing

The accident pilot did not request weather information[19] from Leidos Flight Service or ForeFlight. It is unknown what weather information, if any, the accident pilot reviewed before or during the accident flight.

15.0 Astronomical Data

The astronomical data obtained for the accident site on March 4, 2021, indicated the following:

SUN	
Begin civil twilight	0612 EST
Sunrise	0638 EST
Sun transit	1223 EST
Accident time	**1510 EST**[20]
Sunset	1807 EST
End civil twilight	1834 EST

At the time of the accident the Sun was located at an altitude of 30.44° and azimuth of 230.30°.

[19] https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf
[20] Inserted accident time for reference and context.

E. LIST OF ATTACHMENTS

Attachment 1 – GOES-16 visible satellite animation from 1401 to 1601 EST

Attachment 2 – GFA valid for the accident site at accident time

Submitted by:

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Paul Suffern
Senior Meteorologist