



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 18, 2021

Specialist's Factual Report

METEOROLOGY

ERA21LA295

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A. ACCIDENT

Location: Point Harbor, NC
Date: July 19, 2021
Time: 1848 eastern daylight time (2248 UTC)¹
Aircraft: Type – R44 II; Registration – N4529J

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
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 daylight time (EDT) for July 19, 2021 (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: 36.029491° north latitude; 75.991991° west longitude at sea level.

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

D. WEATHER INFORMATION

1.0 Synoptic Conditions

The National Weather Service (NWS) east central section of the Surface Analysis Chart for 1700 EDT is included as figure 1. The chart depicted a low-pressure system at 1013 hectopascals (hPa) over southeast North Carolina along a stationary front which extended northeast from North Carolina into extreme southeastern Virginia and into the Atlantic Ocean. The accident site was located immediately east of the stationary front. The station models in the vicinity of the accident site on the warm air side of the stationary front depicted southerly winds magnitudes from calm to 15 knots.

¹ UTC – abbreviation for Coordinated Universal Time

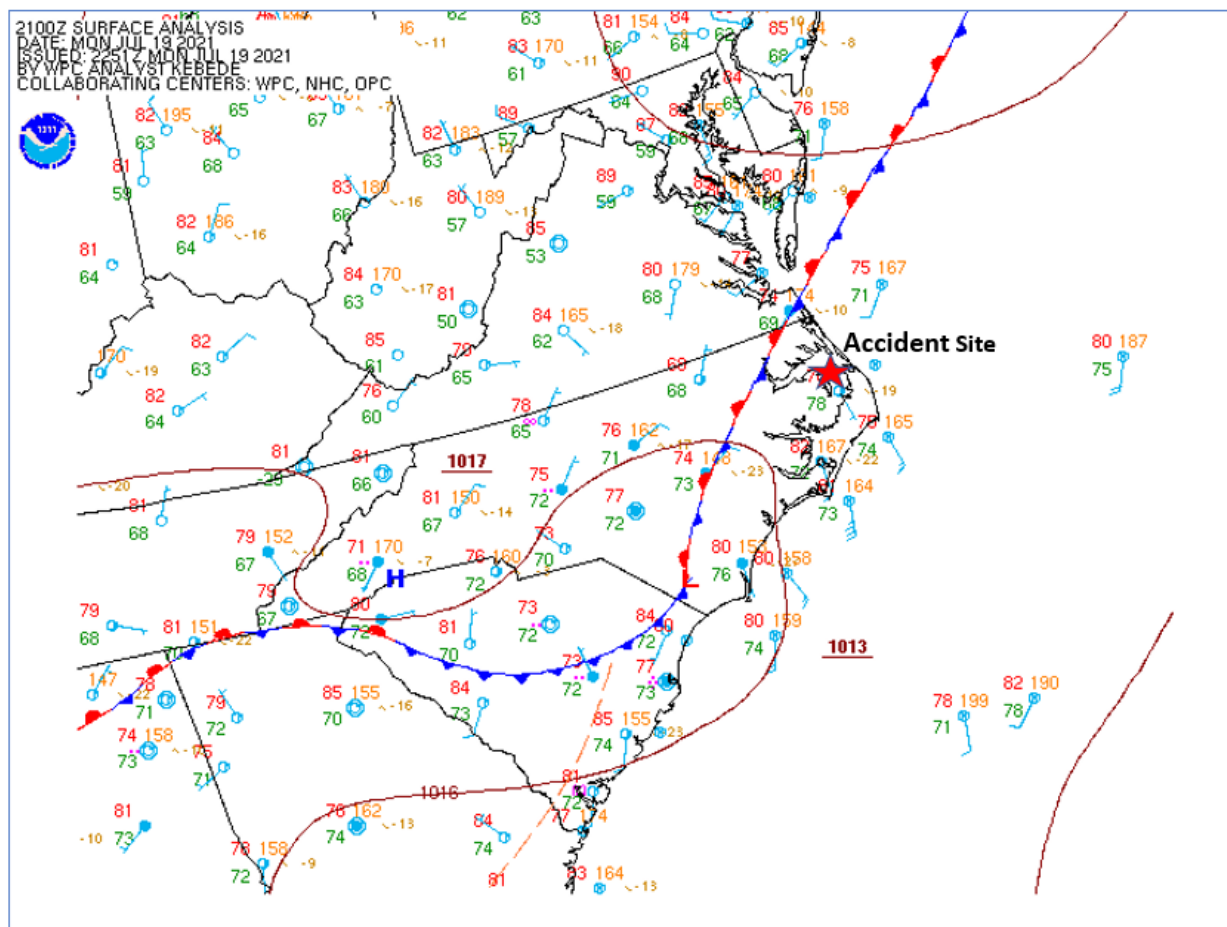


Figure 1 - NWS east-central Surface Analysis Chart for 1700 EDT.

2.0 Weather Radar

WSR-88D² Level-II base reflectivity weather radar imagery from the Wakefield, Virginia, site (KAKQ) is presented in figure 2. KAKQ was located approximately 75 miles northwest of the accident location at an elevation of about 250 feet. Assuming standard refraction and considering the 0.95° beam width³ for the WSR-88D radar beam, the KAKQ 0.529° tilt would have “seen” altitudes above the accident location of between about 4,400 and 12,000 feet above msl. The imagery revealed light to extreme values of reflectivity⁴ in the immediate vicinity of the accident location at the accident time.

² Weather Surveillance Radar 88 Doppler (WSR-88D)

³ 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.

⁴ According to the Federal Aviation Administration’s Advisory Circular 00-24C, a reflectivity intensity of “light” is dBZ values less than 30, “moderate” is dBZ values between 30 and 40, “heavy” is dBZ values greater than 40 and less than or equal to 50, and “extreme” is dBZ values greater than 50.

(https://www.faa.gov/documentlibrary/media/advisory_circular/ac%2000-24c.pdf)

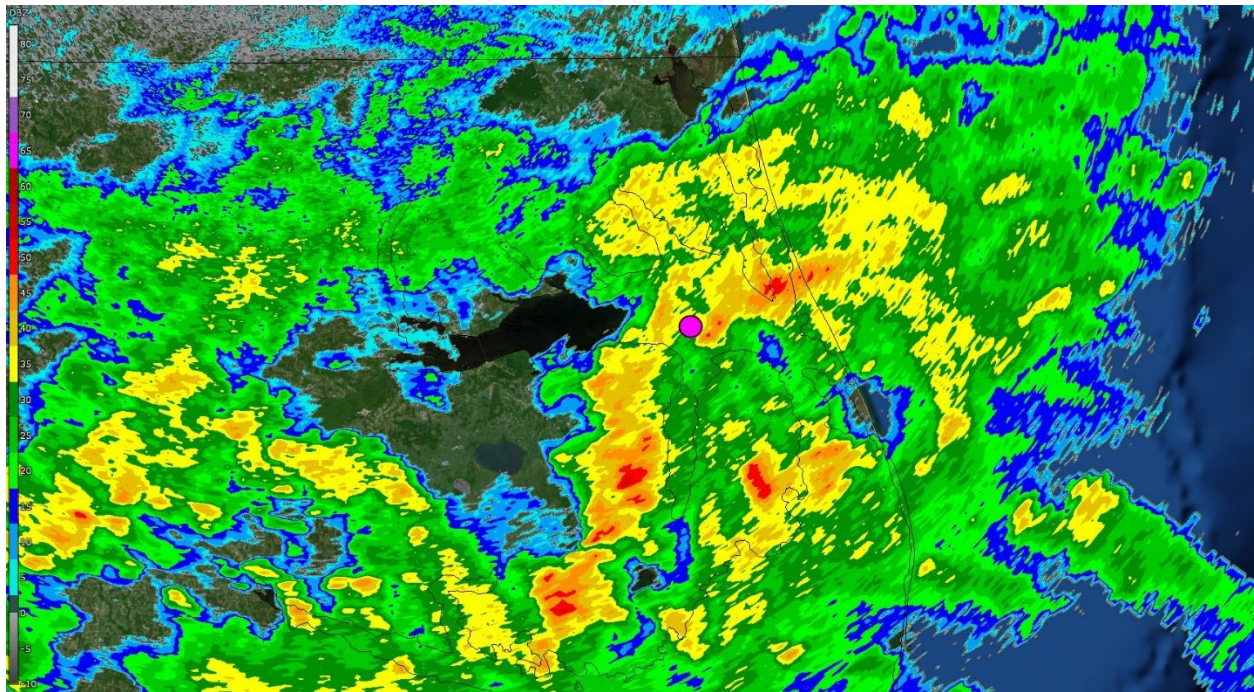


Figure 2 – KAKQ 0.529° Level-II base reflectivity product from a sweep initiated at 1848 EDT. Accident location marked by the purple circle. Reflectivity has been “smoothed” out.

3.0 Lightning

A review of the Earth Networks Total Lightning Network (ENTLN) lightning database indicated that there was no lightning activity between 1830 and 1900 EDT around the accident location.⁵

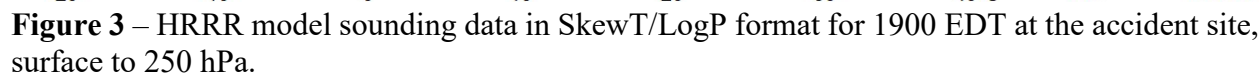
4.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁶ sounding (figure 3) for the accident site at 1900 EDT using an elevation of sea level was retrieved from the National Oceanic and Atmospheric Administration’s Air Resources Laboratory. The wind and turbulence data likely do not reflect conditions experienced in convection. Calculations made by the Rawinsonde OBservation Program indicated that the most-unstable Convective Available Potential Energy (CAPE) parameter was 483 Joules/kilogram (from 1017 hPa). The Lifting Condensation Level (LCL) and Level of Free Convection (LFC) for this scenario were calculated to be 256 feet. Maximum vertical velocity⁷ for the most-unstable atmosphere was calculated as 31 meters/second (about 6,100 feet per minute).

⁵ The ENTLN was queried for a geographic area bounded by latitudes 36.482°N and 35.5769°N, and longitudes 76.7477°W and 75.163°W.

⁶ 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.

⁷ MVV is not usually considered a realistic estimate for maximum vertical velocity in a storm. Anecdotes suggest considering a value of MVV/2, however it is not well understood when or where such a half-value should be applied.



Geostationary Operational Environmental Satellite (GOES)-16 visible (0.64 μm) and infrared (10.3 μm) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Images from 1846 EDT are presented in figures 4 and 5. The GOES-16 visible imagery depicted cloudy conditions over the accident region. Infrared cloud-top temperatures over the accident site were about -33°C, which, when considering the 1900 EDT HRRR sounding, corresponded to cloud top heights greater than 30,000 feet.

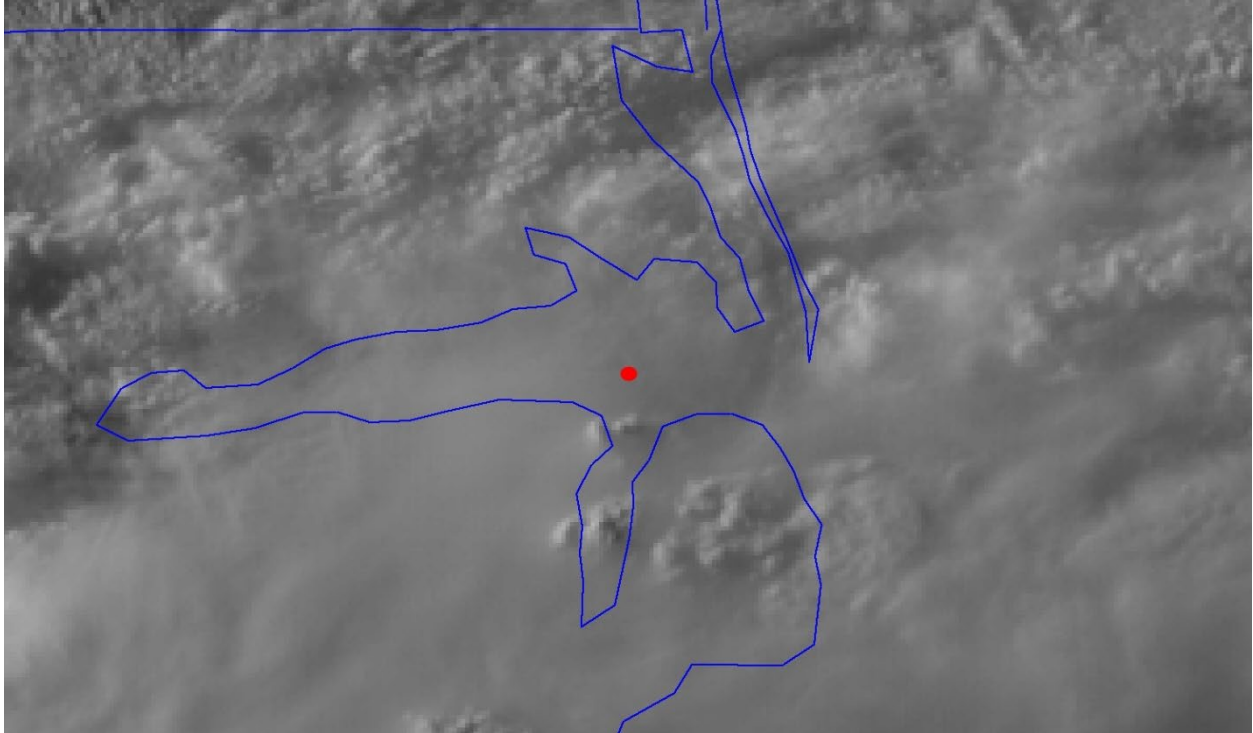


Figure 4 – GOES-16 visible imagery from 1846 EDT. Accident location denoted by red dot. Image is not corrected for parallax error.

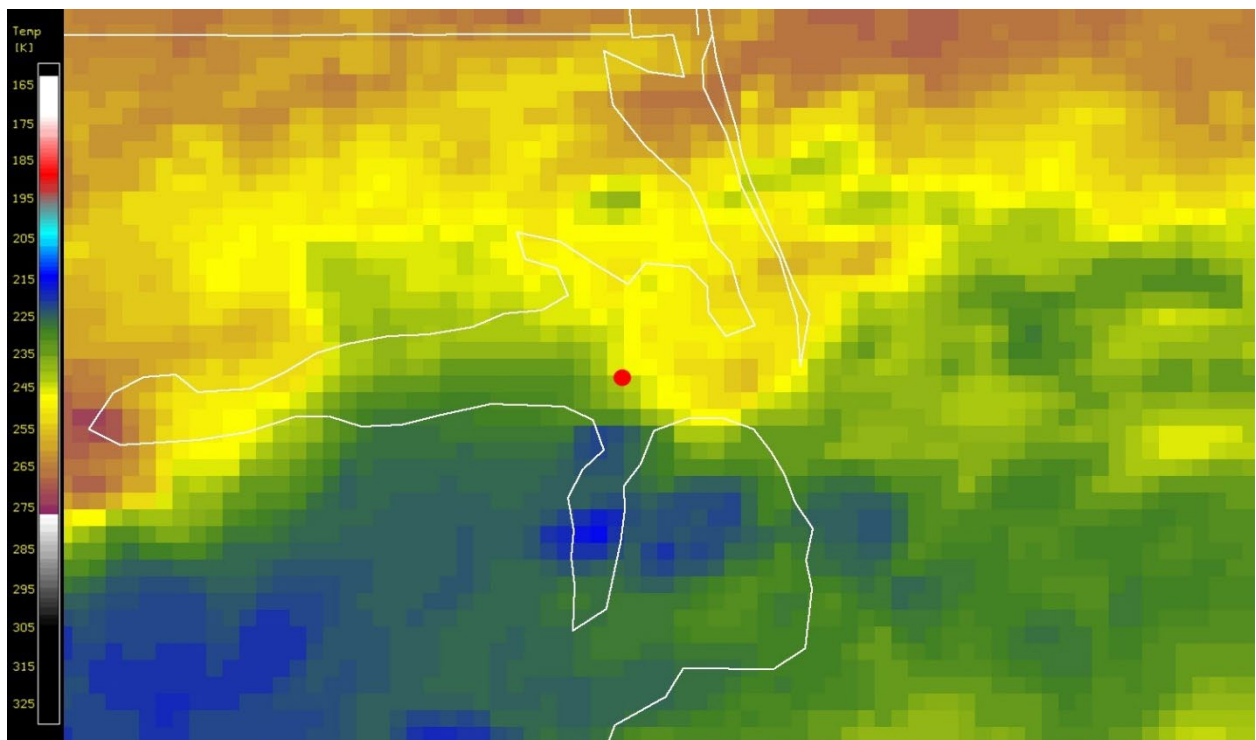


Figure 5 – GOES-16 infrared imagery from 1846 EDT. Accident location denoted by red dot. Image is not corrected for parallax error.

6.0 Surface Observations

An Automated Weather Observing System (AWOS) was located at First Flight Airport (FFA⁸) which was located in Kill Devil Hills, North Carolina, about 15 miles east-southeast of the accident location at an elevation of about 10 feet and had a magnetic variation of about 11° west. Automated longline⁹ reports from the FFA AWOS during the times surrounding the accident time are presented here.

[1755 EDT] METAR KFFA 192155Z AUTO 07003KT 3SM RA SCT017 BKN029
OVC070 22/22 A3002 RMK AO2 P0009 T02200220=

[1815 EDT] METAR KFFA 192215Z AUTO 07004KT 3SM RA SCT009 BKN021
OVC031 22/22 A3001 RMK AO2 P0009 T02200220=

[1835 EDT] METAR KFFA 192235Z AUTO 08003KT 5SM RA SCT004 BKN012
OVC018 22/22 A3001 RMK AO2 P0013 T02200220=

**[1855 EDT] METAR KFFA 192255Z AUTO 06003KT 5SM RA BKN004 OVC016
22/22 A3001 RMK AO2 P0016 T02200220=**

[1915 EDT] METAR KFFA 192315Z AUTO 00000KT 5SM RA BKN004 BKN020
OVC043 22/22 A3001 RMK AO2 P0001 T02200220=

[1935 EDT] METAR KFFA 192335Z AUTO 05003KT 7SM DZ SCT004 SCT018
OVC035 22/22 A3001 RMK AO2 P0001 T02200220=

At 1855 EDT, the FFA AWOS reported a wind from 060° at 3 knots, visibility of 5 statute miles, moderate rain, ceiling broken at 400 feet above ground level (agl), overcast clouds at 1,600 feet agl, temperature of 22° Celsius (C) and dew point temperature of 22°C, altimeter setting of 30.01 inches of mercury; Remarks: automated station with a precipitation discriminator, 0.16 inches of liquid equivalent precipitation collected since 1755 EDT, temperature of 22.0°C and dew point temperature of 22.0°C.

An Automated Surface Observing System (ASOS) was located at Elizabeth City Coast Guard Air Station/Regional Airport (ECG) which was located in Elizabeth City, North Carolina, about 16 miles northwest of the accident location at an elevation of about 10 feet and had a magnetic variation of about 11° west. Automated longline reports from the ECG ASOS during the times surrounding the accident time are presented here.

⁸ 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.

⁹ “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.

[1754 EDT] METAR KECG 192154Z AUTO 02008KT 5SM -RA FEW014 BKN055
OVC075 23/21 A3002 RMK AO2 RAB2059 SLP167 P0004 T02330206=

[1826 EDT] SPECI KECG 192226Z 10009KT 1 3/4SM +RA BR SCT010 BKN045
OVC070 23/21 A3003 RMK AO2 P0005 T02280211=

**[1854 EDT] METAR KECG 192254Z 08009KT 1 3/4SM +RA BR BKN043 OVC060
22/21 A3002 RMK AO2 SLP166 P0023 T02170206=**

[1903 EDT] SPECI KECG 192303Z 08008KT 2SM +RA BR BKN047 OVC060 22/21
A3002 RMK AO2 P0004 T02170206=

[1918 EDT] SPECI KECG 192318Z 06007KT 4SM -RA BR FEW007 OVC060 22/21
A3003 RMK AO2 P0007 T02220206=

At 1854 EDT, the ECG ASOS reported a wind from 080° at 9 knots, visibility of 1 and 3/4 statute miles, heavy rain, mist, ceiling broken at 4,300 feet agl, overcast clouds at 6,000 feet agl, temperature of 22°C and dew point temperature of 21°C, altimeter setting of 30.02 inches of mercury; Remarks: automated station with a precipitation discriminator, sea level pressure of 1016.6 hPa, 0.23 inches of liquid equivalent precipitation collected since 1754 EDT, temperature of 21.7°C and dew point temperature of 20.6°C.

An AWOS was located at Dare County Regional Airport (MQI) which was located in Manteo, North Carolina, about 16 miles southeast of the accident location at an elevation of about 15 feet and had a magnetic variation of about 11° west. Automated longline reports from the MQI AWOS during the times surrounding the accident time are presented here.

[1755 EDT] METAR KMQI 192155Z AUTO 09005KT 10SM -RA SCT014 BKN021
OVC027 23/22 A3003 RMK AO2 P0005 T02300222=

[1815 EDT] METAR KMQI 192215Z AUTO 09003KT 7SM -RA SCT009 BKN041
OVC090 23/22 A3003 RMK AO2 P0002 T02300222=

[1835 EDT] METAR KMQI 192235Z AUTO 10006KT 10SM RA SCT008 BKN060
OVC090 23/22 A3003 RMK AO2 P0003 T02300222=

**[1855 EDT] METAR KMQI 192255Z AUTO 07007KT 3SM -RA BKN032 BKN039
OVC065 23/22 A3001 RMK AO2 P0007 T02260220=**

[1915 EDT] METAR KMQI 192315Z AUTO 08007KT 10SM DZ SCT034 OVC055
23/22 A3002 RMK AO2 T02250219=

[1935 EDT] METAR KMQI 192335Z AUTO 08005KT 1SM +RA BKN006 BKN014
OVC035 22/22 A3002 RMK AO2 P0025 T02220217=

At 1855 EDT, the MQI AWOS reported a wind from 070° at 7 knots, visibility of 3 statute miles, light rain, ceiling broken at 3,200 feet agl, broken clouds at 3,900 feet agl, overcast clouds at 6,500 feet agl, temperature of 23°C and dew point temperature of 22°C, altimeter setting of 30.01 inches of mercury; Remarks: automated station with a precipitation discriminator, 0.07 inches of liquid equivalent precipitation collected since 1755 EDT, temperature of 22.6°C and dew point temperature of 22.0°C.

7.0 Pilot Reports

There were no publicly longline-disseminated pilot reports¹⁰ (PIREPs) within 50 miles of the accident location below 10,000 feet between 1700 and 2100 EDT.

8.0 Area Forecast Discussion

The NWS Morehead City, North Carolina, Weather Forecast Office (WFO) issued the following Aviation (Short Term) section of an Area Forecast Discussion at 1634 EDT.

FXUS62 KMHX 192034

AFDMHX

Area Forecast Discussion

National Weather Service Newport/Morehead City NC

434 PM EDT Mon Jul 19 2021

.AVIATION /20Z MONDAY THROUGH SATURDAY/...

SHORT TERM /Through 18z Tuesday/...

As of 125 PM Mon...Latest radar showing a lull in shra/tsra activity across the area, but a cluster of heavier showers over central NC associated with a weak front. Expecting shower and tstm activity to increase across the region by 20Z as cluster of heavier showers moves eastward. Lower ceilings and pockets of heavy downpours can be expected this aftn with moments of IFR conditions possible. Showers and tstms will begin to move out and weaken with loss of daytime heating this evening, but ceilings likely to remain down in IFR territory for the overnight hours. Some patchy fog possible across the inner coastal plains with moist low levels from aftn rainfall. Ceilings will improve to MVFR after daybreak Tuesday.

9.0 AIRMETs

There were no Airmen's Meteorological Information (AIRMET) advisories for turbulence or icing valid for the accident location at the accident time below 10,000 feet. An AIRMET advisory for instrument flight rule conditions was issued by the NWS Aviation Weather Center, which identified ceilings below 1,000 feet, visibility below 3 statute miles, precipitation and mist, was issued at 1645 EDT and was valid for the accident site at the accident time.

WAUS42 KKCI 192045

WA2S

-MIAS WA 192045

AIRMET SIERRA UPDT 5 FOR IFR AND MTN OBSCN VALID UNTIL 200300

AIRMET IFR...NC SC AND CSTL WTRS

FROM 30E ORF TO 70ESE ECG TO 20SSW ILM TO 40SE CLT TO 30S LYH TO 30E ORF

¹⁰ These do not include pilot reports only broadcast via radio.

CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

10.0 SIGMETs

There were no non-convective Significant Meteorological Information (SIGMET) advisories active for the accident location at the accident time.

At 1755 EDT, the NWS Aviation Weather Center issued the following Convective SIGMET that was active for the accident location at the accident time that advised of an area of embedded thunderstorms.

WSUS31 KKCI 192155

SIGE

-MKCE WST 192155

CONVECTIVE SIGMET 18E

VALID UNTIL 2355Z

NC SC AND CSTL WTRS

FROM 20ENE ECG-60SSE ECG-60SW ILM-20SSW CAE-30SE CLT-20ENE ECG

AREA EMBD TS MOV FROM 26015KT. TOPS ABV FL450.

11.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the NWS Center Weather Service Units (CWSU) at the Washington Air Route Traffic Control Center that were active for the accident location at the accident time.

Submitted by:

Mike Richards
Senior Meteorologist