



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 6, 2020

Weather Study

METEOROLOGY

ERA20LA134

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A. ACCIDENT

Location: Swansboro, North Carolina
Date: March 23, 2020
Time: 2103 eastern daylight time
0103 Coordinated Universal Time (UTC) on March 24
Aircraft: Maule MT-7; Registration: N899ZZ

B. METEOROLOGIST

Paul Suffern
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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 including the National Centers for Environmental Information (NCEI). All times are eastern daylight time (EDT) based upon the 24-hour clock, where local time is -4 hours from UTC, and UTC=Z (unless otherwise noted). 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. Airport and NWS station identifiers are referenced using 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 location used for the accident site was latitude 34.41694° N, longitude 77.03417° W.

D. WEATHER 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 (AC) “Aviation Weather Services”, AC 00-45H change 2¹.

1.1 Surface Analysis Chart

The eastern United States section of the NWS Surface Analysis Chart for 2000 EDT is provided as figure 1 with the location of the accident site located within the red circle. The chart identified a surface low pressure system located over the northeastern United States with a sea-level pressure of 1008-hectopascals (hPa). A frontal boundary stretched from the low pressure center southwestward through the western Atlantic Ocean and remained east of the accident site at 2000 EDT. The accident site was located on the cold air side of the frontal system. A surface trough² was located from central Pennsylvania southwestward into western North Carolina.

The station models around the accident site depicted air temperatures ranging from 61 to 67 degrees Fahrenheit (°F), dew point temperatures between 55°F and 59°F with temperature-dew point spreads of 6°F or less, a southwest wind of 10 knots, and overcast cloud cover.

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.

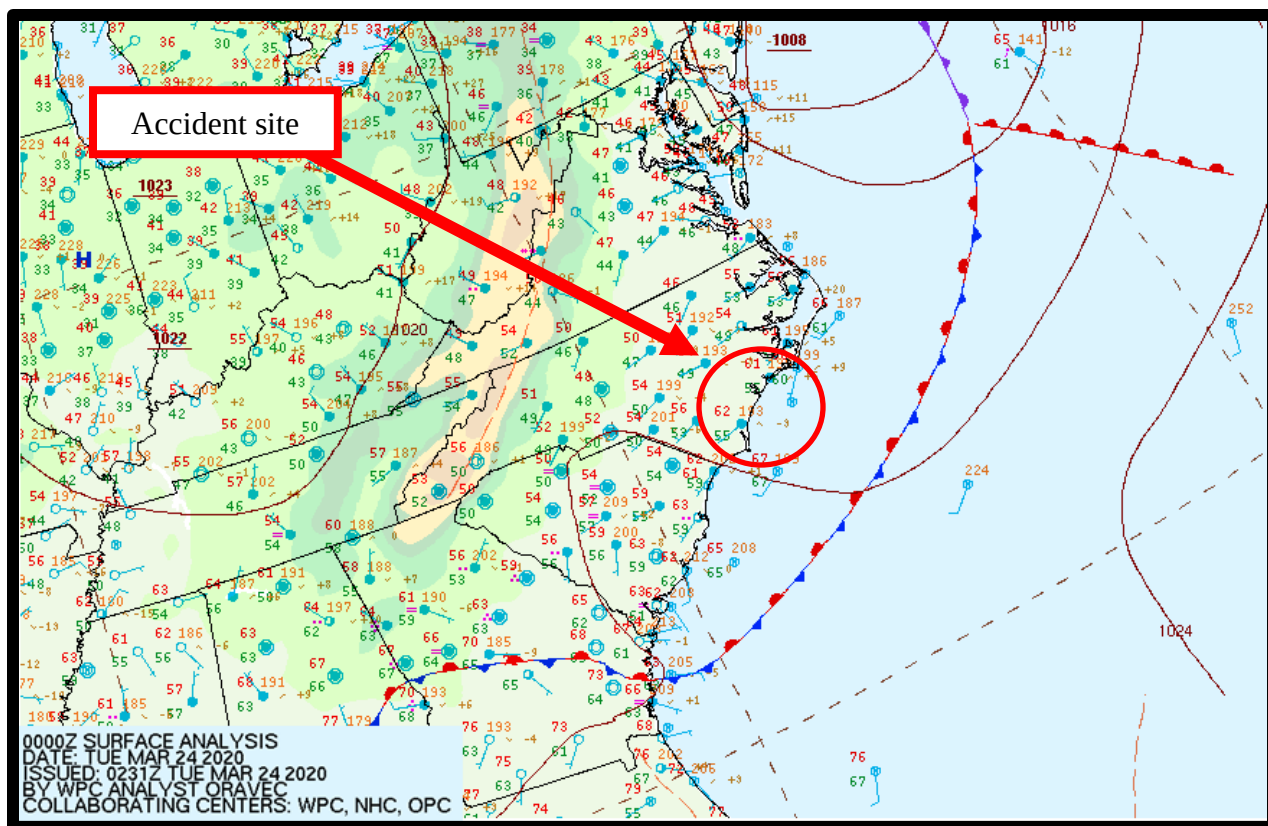


Figure 1 – NWS Surface Analysis Chart for 2000 EDT

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 2000 EDT at 925-, 850-, and 700-hPa are presented in figures 2 through 4. There were troughs at low- and mid-levels near the accident site at the accident time (figures 2 through 4). Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. There was a west-southwest wind to 35 knots at 925-hPa above the accident site, and by 700-hPa, the wind above the accident site was from the southwest and the wind speed was around 45 knots (figure 4).

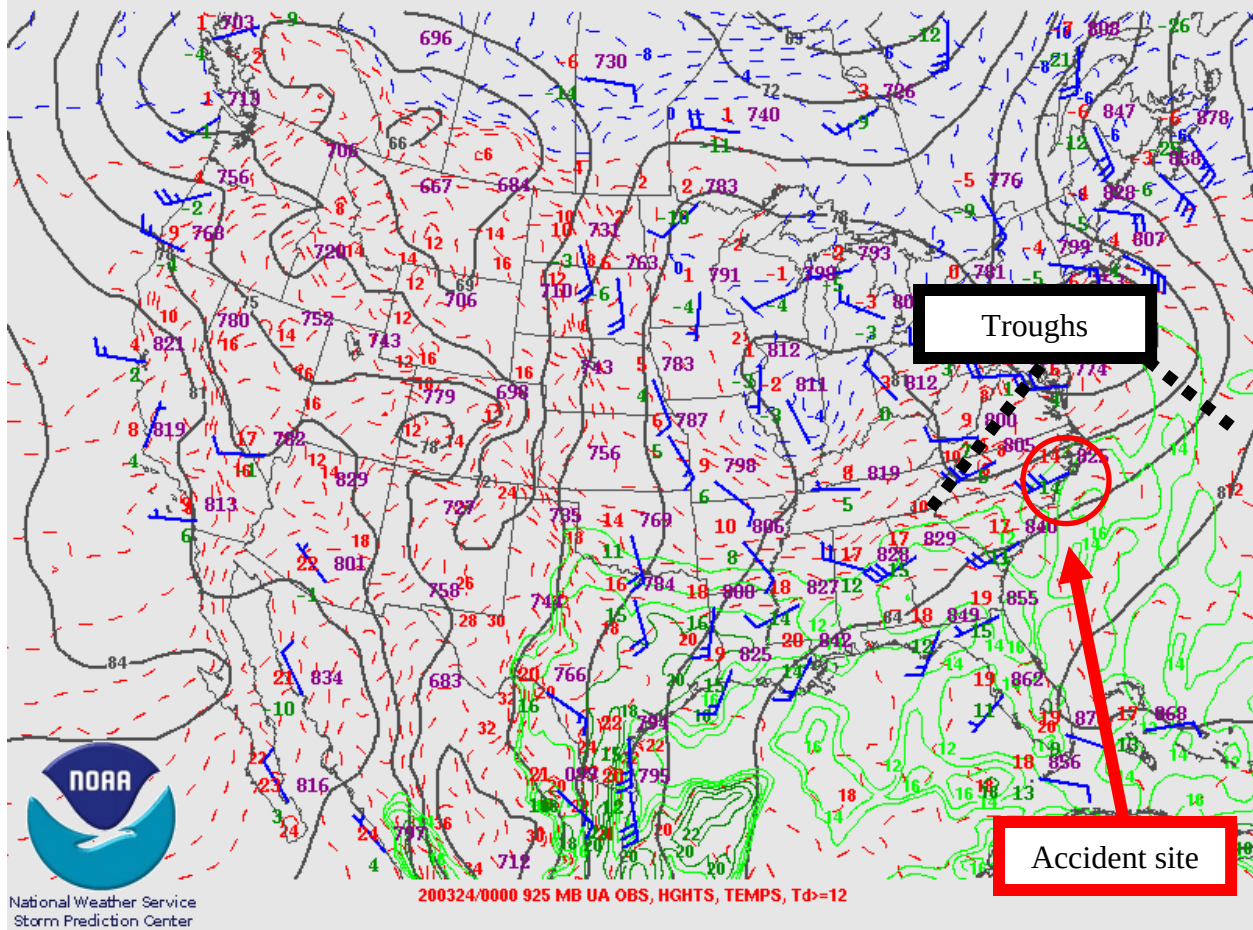


Figure 2 – 925-hPa Constant Pressure Chart for 2000 EDT

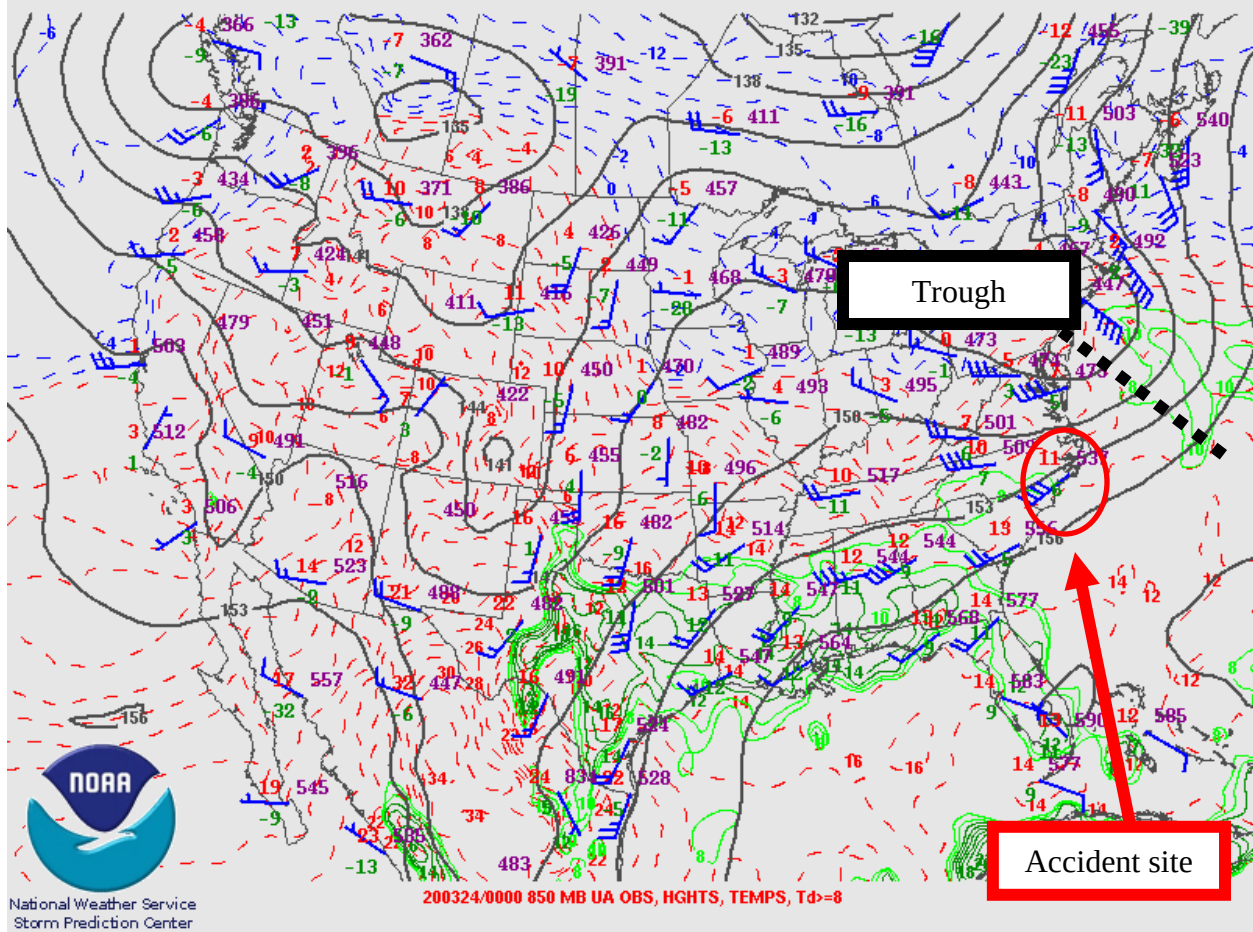


Figure 3 – 850-hPa Constant Pressure Chart for 2000 EDT

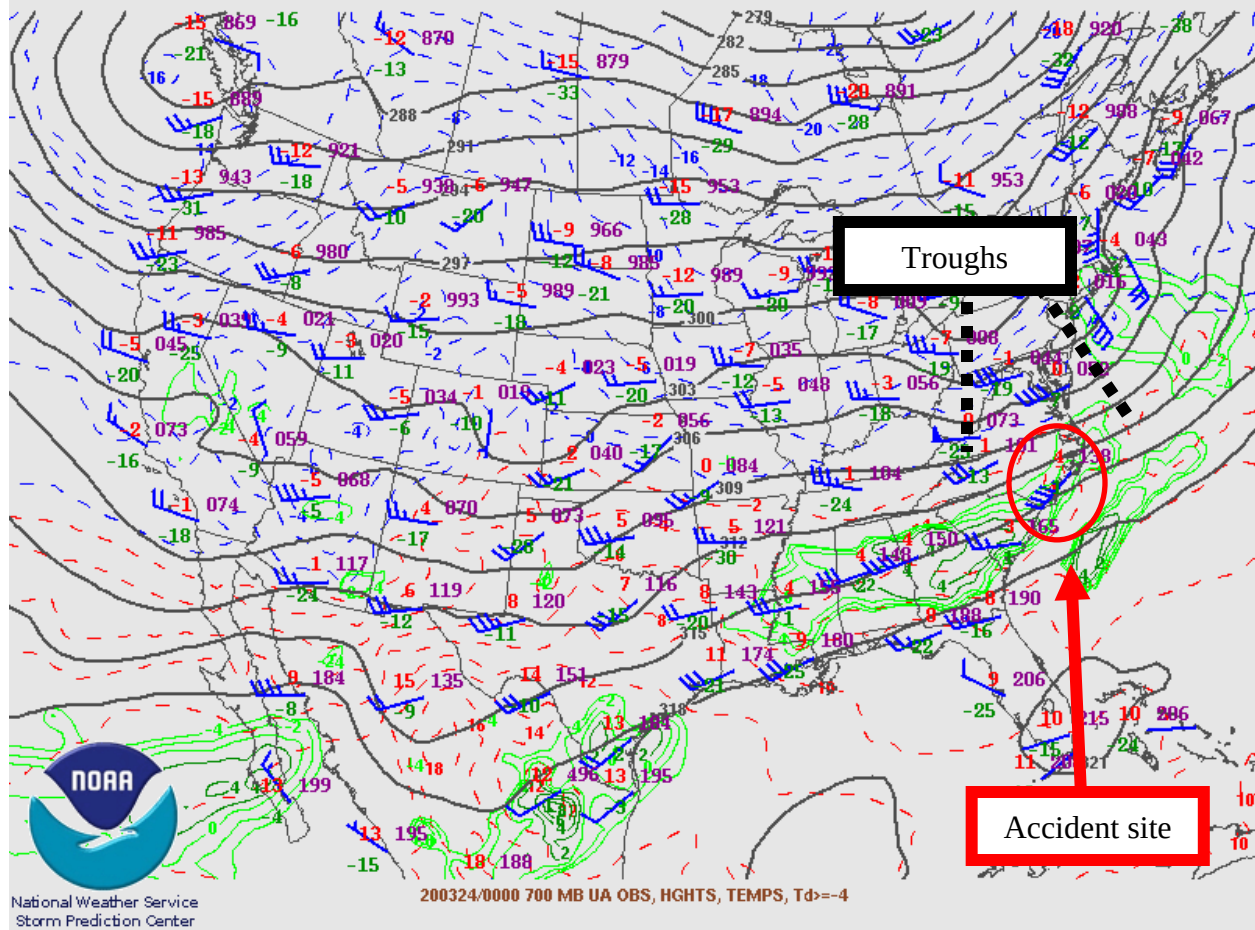


Figure 4 – 700-hPa Constant Pressure Chart for 2000 EDT

2.0 Surface Observations

The area surrounding the accident site was documented using official Meteorological Aerodrome 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 location marked.



Bogue Field Marine Corps Auxiliary Field (KNJM) had the closest official weather station to the accident site. KNJM was located 16 miles north of the accident site, at an elevation of 21 feet (ft), and had a 10° westerly magnetic variation³ (figure 5). The following observations were taken and disseminated during the times surrounding the accident:⁴

Bogue Field Marine Corps Auxiliary Field (KNJM) had the closest official weather station to the accident site. KNJM was located 16 miles north of the accident site, at an elevation of 21 feet (ft), and had a 10° westerly magnetic variation³ (figure 5). The following observations were taken and disseminated during the times surrounding the accident:⁴

[1657 EDT] METAR KNJM 232057Z AUTO 24007KT 10SM CLR 17/12 A3010 RMK
AO2 SLP194 T01720122 56025 TSNO \$=

[1739 EDT] SPECI KNJM 232139Z AUTO 24006KT 10SM BKN027 17/12 A3011 RMK
AO2 T01720122 TSNO \$=

[1757 EDT] METAR KNJM 232157Z AUTO 25006KT 10SM OVC027 17/12 A3011 RMK
AO2 SLP199 T01720122 TSNO \$=

[1857 EDT] METAR KNJM 232257Z AUTO 24006KT 10SM OVC020 16/13 A3011 RMK
AO2 SLP200 T01610128 TSNO \$=

³ Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

⁴ The bold sections in this NWS product and the rest of the products in this report are intended to highlight the sections 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.

[1957 EDT] METAR KNJM 232357Z AUTO 10SM OVC020 16/13 A3011 RMK AO2 SLP199 T01610128 10183 20161 50005 TSNO \$=

[2057 EDT] METAR KNJM 240057Z AUTO 22004KT 10SM OVC017 16/13 A3012 RMK AO2 SLP202 T01610128 TSNO \$=

ACCIDENT TIME 2103 EDT

[2157 EDT] METAR KNJM 240157Z AUTO 23004KT 10SM OVC018 16/13 A3014 RMK AO2 SLP208 T01560133 TSNO \$=

[2257 EDT] METAR KNJM 240257Z AUTO 28004KT 10SM OVC016 16/13 A3014 RMK AO2 SLP209 T01610133 51009 TSNO \$=

[2357 EDT] METAR KNJM 240357Z AUTO 27004KT 10SM OVC019 16/13 A3013 RMK AO2 SLP205 T01610128 TSNO \$=

KNJM weather at 2057 EDT, automated, wind from 220° at 4 knots, 10 miles visibility or greater, overcast ceiling at 1,700 ft above ground level (agl), temperature of 16°Celsius (C), dew point temperature of 13°C, and an altimeter setting of 30.12 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, sea level pressure 1020.2 hPa, temperature 16.1°C, dew point temperature 12.8°C, thunderstorm information not available, maintenance is needed on the system.

KNJM weather at 2157 EDT, automated, wind from 230° at 4 knots, 10 miles visibility or greater, overcast ceiling at 1,800 ft agl, temperature of 16°C, dew point temperature of 13°C, and an altimeter setting of 30.14 inHg. Remarks: automated station with a precipitation discriminator, sea level pressure 1020.8 hPa, temperature 15.6°C, dew point temperature 13.3°C, thunderstorm information not available, maintenance is needed on the system.

The observations from KNJM surrounding the accident time indicated MVFR⁵ conditions with an overcast ceiling between 1,700 and 1,800 ft agl with a southwest wind around 5 knots.

⁵ 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 Data

The Morehead/Newport (KMHX), North Carolina, upper air observation station number 72305 was the closest site with an upper air sounding located 23 miles north of the accident site with a surface elevation of 36 ft. The 2000 EDT KMHX sounding was plotted on a standard Skew-T Log P diagram⁶ with the derived stability parameters included in figure 6 with data from the surface to 600-hPa (or approximately 14,000 ft msl). These data were analyzed using the RAOB⁷ software package. The sounding depicted the lifted condensation level (LCL)⁸ at 1,296 ft agl and the convective condensation level (CCL)⁹ at 4,588 ft agl. The freezing level was located at 12,892 ft msl. The precipitable water value was 1.31 inches.

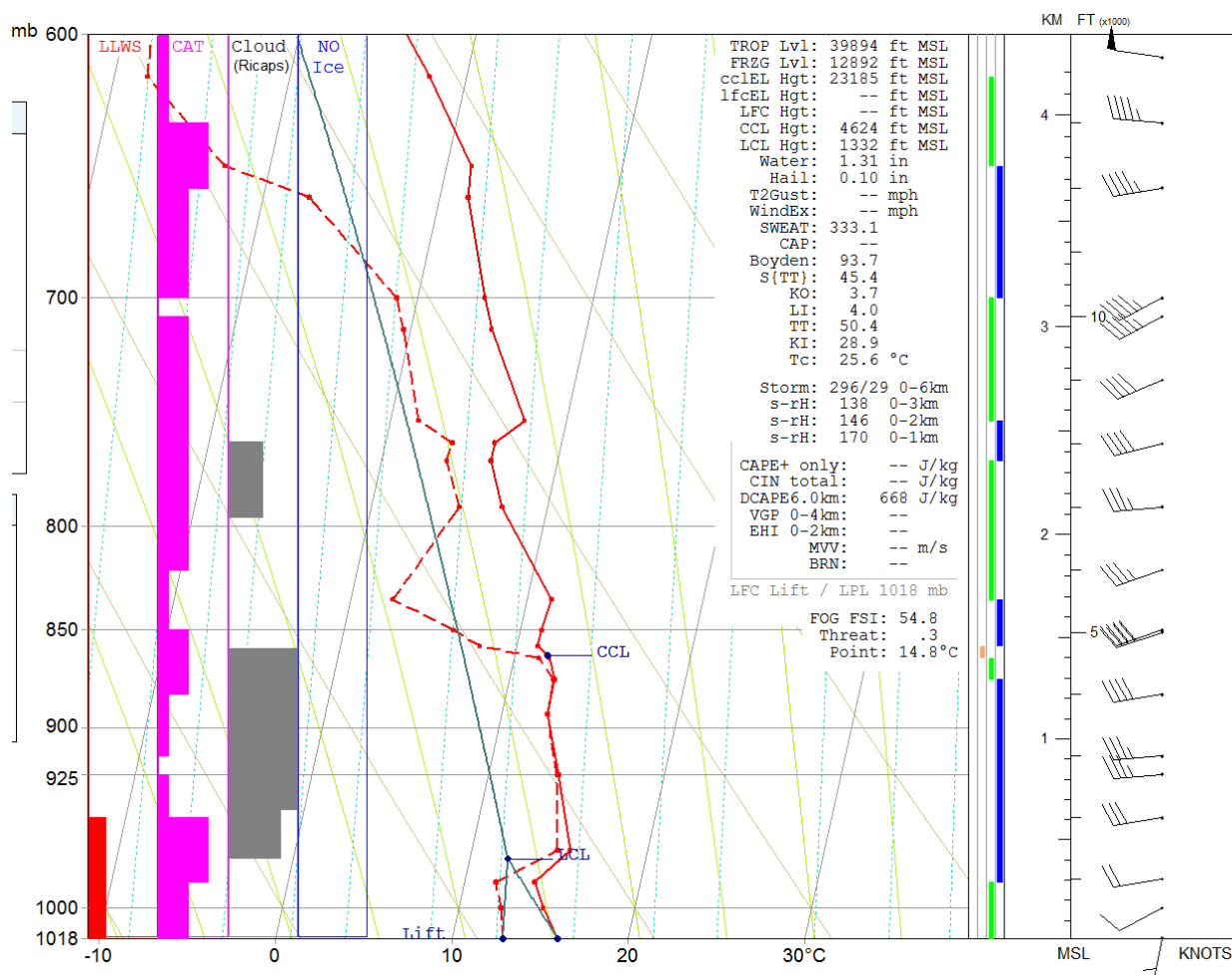


Figure 6 – 2000 EDT KMHX sounding

⁶ 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.

⁷ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

⁸ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

⁹ 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.

The 2000 EDT KMHX sounding indicated layers of conditional instability and instability between the surface and 14,000 ft msl. RAOB identified the possibility of clouds between 1,500 ft msl and 5,000 ft msl, then another layer of clouds between 7,000 and 8,000 ft msl. RAOB did not identify any layers of icing for below 10,000 ft msl.

The sounding wind profile indicated a surface wind from 190° at 4 knots with a westerly wind from 300 ft msl through 14,000 ft msl. The wind increased in speed to 20 knots by 1,000 ft msl with a 40 knot wind by ~5,000 ft msl. RAOB indicated the possibility of light low-level wind shear (LLWS) between the surface and 2,000 ft msl. RAOB indicated a possibility of light to moderate clear-air turbulence between the surface and 14,000 ft msl.

4.0 Satellite Data

Geostationary Operational Environmental Satellite 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. The GOES-16 visible (band 2) and infrared (band 13) imagery at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period from 1700 EDT through 2300 EDT and reviewed. The closest images to the time of the accident are documented here. Due to the sun angle at the accident time the visible imagery did not provide beneficial data.

Figure 7 presents the GOES-16 infrared imagery from 2106 EDT at 4X magnification with the accident site highlighted with a red square. Inspection of the infrared imagery indicated overcast cloud cover over the accident site with the lower brightness temperatures (green and blue colors; higher cloud tops) located above of the accident site at the accident time. Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the KMHX sounding, the approximate cloud-top heights over the accident site were 26,000 ft msl at 2106 EDT (temperature of ~244 Kelvin). It should be noted these figures have not been corrected for any parallax error.

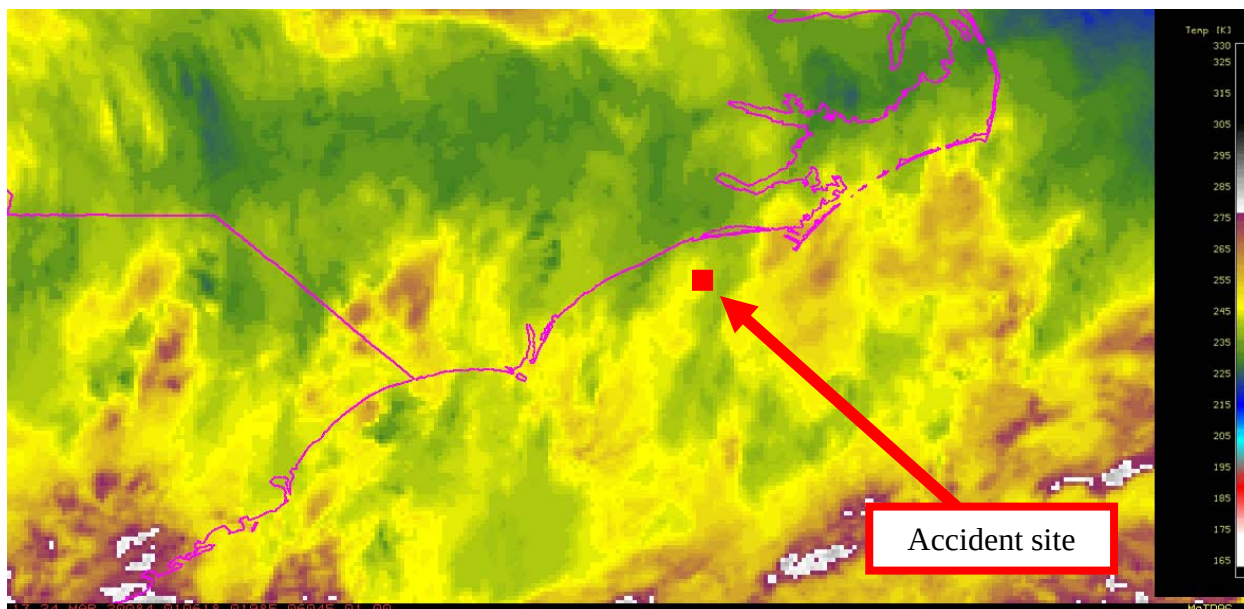


Figure 7 – GOES-16 infrared image at 2106 EDT

5.0 Regional Radar Imagery Information

A regional view of the NWS National Composite Radar Mosaic is included as figure 8 for 2105 EDT with the approximate location of the accident site marked by a red circle. The image depicted no precipitation targets above the accident site at the accident time.

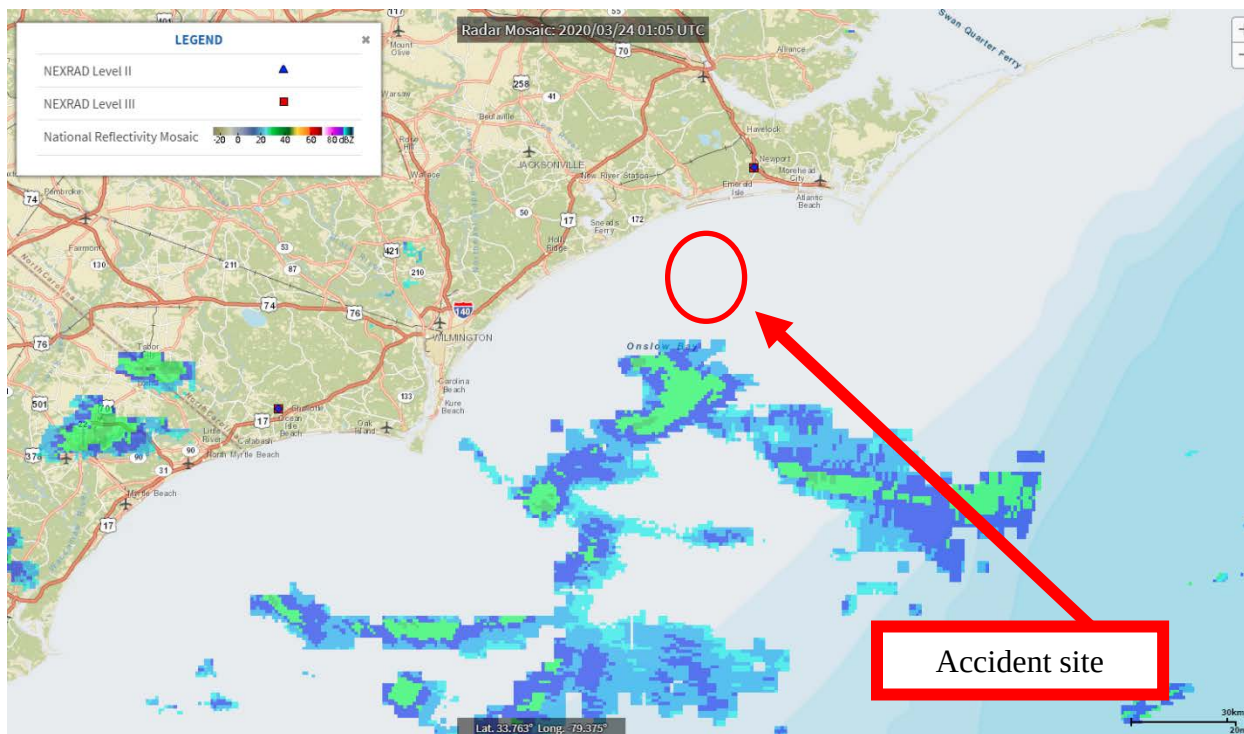


Figure 8 – Regional Composite Reflectivity image for 2105 EDT

6.0 Pilot Reports

There was one pilot report (PIREP)¹⁰ distributed into the national airspace within 100 miles of the accident site from about three hours prior to the accident time to three hours after the accident time for below 18,000 ft msl. The PIREP (below) indicated cloud bases at 1,500 ft msl on final into runway 04 at Coastal Carolina Regional Airport (EWN), in New Bern, North Carolina with the PIREP located 39 miles north of the accident site.

EWN UA /OV RWY04 ILS FINAL/TM 0105/FL015/TP CRJ2/SK OVC017/WX 10/RM AIRCRAFT REPORTED BASES AT 1,500 FEET ON FINAL RWY04=

7.0 SIGMET

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories valid for the accident site at the accident time for below 10,000 ft.

8.0 CWSU Products

There were no Center Weather Service Unit (CWSU) Center Weather Advisories (CWA) or Meteorological Impact Statement (MIS) valid for the accident site at the accident time.

9.0 AIRMETs

Airmen's Meteorological Information (AIRMET) advisories Tango and Sierra were issued at 1645 EDT and valid at the accident time. These AIRMETs were valid for the accident site, and warned of moderate turbulence below 14,000 ft, LLWS, and IFR conditions due to precipitation and mist:

WAUS42 KKCI 232045
WA2T
-MIAT WA 232045
AIRMET TANGO UPDT 5 FOR TURB AND LLWS VALID UNTIL 240300
.
AIRMET TURB...NC SC GA FL AND CSTL WTRS
FROM 30NNW LGC TO 20NE SAV TO 140ESE ILM TO 130SSE ILM TO 220SE
CHS TO 20ENE TRV TO 20SSW ORL TO 30SE TLH TO 30NNW LGC
MOD TURB BTN FL300 AND FL410. CONDS CONTG BYD 03Z THRU 09Z.
.
AIRMET TURB...NC SC GA ME NH VT MA RI CT NY LO NJ PA OH LE WV MD
DC DE VA AND CSTL WTRS
FROM 110SSW YSJ TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO
140ESE ILM TO 20NE SAV TO 30NNW LGC TO GQO TO HNV TO HNN TO CVG
TO FWA TO DXO TO 40SE ETX TO 20ESE ACK TO 110SSW YSJ
MOD TURB BTN FL180 AND FL400. CONDS CONTG BYD 03Z THRU 09Z.
.
AIRMET TURB...NC SC GA AND CSTL WTRS
FROM 160SE SIE TO 190ESE ECG TO 160ESE ILM TO 80SSW ILM TO 50ESE

¹⁰ Only pilot reports with the World Meteorological Organization headers UBNC**, UBSC**, and UBVA** were considered.

**AMG TO 40WNW PZD TO GQO TO HNV TO 20NE ECG TO 160SE SIE
MOD TURB BLW 140. CONDS CONTG BYD 03Z THRU 09Z.**

.
**LLWS POTENTIAL...NC SC GA AND CSTL WTRS
BOUNDED BY 20SSW ORF-50E ECG-60SE ECG-ILM-40SW FLO-30W IRQ-ATL-
20SSE GQO-20S VXV-30ENE ODF-30ESE RDU-20SSW ORF
LLWS EXP. CONDS CONTG BYD 03Z ENDG 03-06Z.**

....

WAUS42 KPCI 232045
WA2S
-MIAS WA 232045
AIRMET SIERRA UPDT 9 FOR IFR AND MTN OBSCN VALID UNTIL 240300

.
**AIRMET IFR...NC SC GA AND CSTL WTRS
FROM 20NE ECG TO 60ESE ECG TO 70ENE ILM TO 30ESE FLO TO 20SE CHS
TO 40S SAV TO 40ESE LGC TO 20N LGC TO GQO TO HNV TO 20NE ECG
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.**

.
AIRMET MTN OBSCN...NC SC GA
FROM 30N GSO TO CLT TO ATL TO GQO TO HNV TO 30N GSO
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

.
OTLK VALID 0300-0900Z
AREA 1...IFR NC SC GA FL AND CSTL WTRS
BOUNDED BY 20NE ECG-70SE ECG-30SSE SAV-50SSW CAE-30ENE MCN-40ESE
PZD-40NNE CTY-90SSW TLH-50SE SJI-40W CEW-50SW PZD-GQO-HNV-20NE
ECG
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 09Z.

.
AREA 2...MTN OBSCN NC SC GA ME NH VT MA NY PA WV MD VA
BOUNDED BY 70NW PQI-MLT-CON-HAR-CLT-ATL-GQO-HNV-HNN-JHW-SYR-MSS-
YSC-70NW PQI
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG THRU 09Z.

....

10.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products available before the accident flight are shown in attachment 1. The GFA surface forecast products indicated VFR surface visibilities at the accident site for 2000 EDT with a chance (between 30 to 60 percent) of rain showers, and a surface wind from the southwest with wind speeds between 15 to 20 knots. The GFA cloud forecast valid at the accident time indicated a broken to overcast cloud ceiling at 1,500 ft to 2,100 ft msl and clouds tops to FL260¹¹ and FL420. For more information please see attachment 1.

¹¹ Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of ft. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 inHg), the standard sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

11.0 Terminal Aerodrome Forecast

New River Marine Corps Air Station (KNCA) was the closest airport to the accident site with a Terminal Aerodrome Forecast (TAF). KNCA was located 27 miles northwest of the accident site. The KNCA TAF valid at the time of the accident was issued at 1800 EDT and was valid for a 23-hour period beginning at 1800 EDT. The TAF for KNCA was as follows:

TAF AMD KNCA 2322/2421 25007KT 9999 BKN020 OVC040 QNH3007INS
BECMG 2323/2401 26007KT 9999 BKN015 OVC030 QNH3005INS
TEMPO 2405/2410 8000 -SHRA BR
FM241000 36010KT 9999 SCT050 SCT150 QNH2999INS T11/2412Z T19/2418Z AMD 2200=

After 1900 to 2100 EDT, the forecast expected a wind from 260° at 7 knots, greater than 7 miles visibility, a broken ceiling at 1,500 ft agl, overcast skies at 3,000 ft agl, and minimum altimeter setting of 30.05 inHg.

12.0 Winds and Temperature Aloft Forecast

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

FBUS31 KWN0 231955
FD1US1
DATA BASED ON 231800Z
VALID 240000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT 3000 6000 9000 12000 18000 24000 30000 34000 39000
ILM 2633 2535+10 2533+05 2727-01 2843-15 2659-24 276940 297651 309059

The accident site was located closest to the Wilmington, North Carolina, (ILM) forecast point. The 1455 EDT ILM forecast for use between 1600 EDT and 2300 EDT indicated a wind at 3,000 ft from 260° at 33 knots, a wind at 6,000 ft from 250° at 35 knots with a temperature of 10°C.

13.0 Pilot Weather Briefing

The accident pilot did not request nor receive a weather briefing from Leidos or ForeFlight.

Leidos did find that the accident pilot requested a standard weather briefing information through Garmin (attachment 2). The weather briefings were requested and received at 1822 EDT and contained all the standard information valid at that time, including, AIRMETs, METARs, TAFs, and PIREPs for the 2 intended flights that evening (attachments 3 and 4). There is no record in the sources reviewed of the accident pilot receiving or retrieving any other weather information before or during the accident flight.

14.0 Witness Information

A United States Coast Guard flight went across the accident area and at 2345 EDT reported a wind from 290° at 10 knots with gusts to 15 knots, visibility of 10 miles, cloud ceiling at 1,400 ft agl, no precipitation, and wave heights of 4 ft.

15.0 Astronomical Data

The astronomical data obtained for the accident site on March 23, 2020, indicated the following:

SUN

Begin civil twilight	0642 EDT
Sunrise	0707 EDT
Sun transit	1314 EDT
Sunset	1923 EDT
End civil twilight	1948 EDT
Accident time	2103 EDT¹²

MOON

Moonrise	0705 EDT
Moon transit	1255 EDT
Moonset	1851 EDT
Accident time	2103 EDT¹³

The Moon was set at the time of the accident.

E. LIST OF ATTACHMENTS

Attachment 1 – GFA products valid for the accident flight

Attachment 2 – Email Correspondence

Attachment 3 – Text weather briefing information for the first intended flight

Attachment 4 – Text weather briefing information for the accident flight

¹² Inserted accident time for reference and context.

¹³ Inserted accident time for reference and context.

Submitted by:

Paul Suffern
Senior Meteorologist

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