



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 29, 2018

Weather Study

METEOROLOGY

ERA18FA016

Table Of Contents

A.	ACCIDENT	3
B.	METEOROLOGIST	3
C.	DETAILS OF THE INVESTIGATION	3
D.	FACTUAL INFORMATION	3
1.0	Synoptic Situation	3
1.1	Surface Analysis Chart	4
1.2	Upper Air Charts	5
2.0	SPC Products	9
3.0	Surface Observations	11
4.0	Upper Air Data	15
5.0	Satellite Data	17
6.0	Radar Imagery Information	18
7.0	Pilot Reports	18
8.0	SIGMET and CWSU Advisories	19
9.0	AIRMETs	19
10.0	Terminal Aerodrome Forecast	21
11.0	NWS Area Forecast Discussion	22
12.0	Winds and Temperature Aloft Forecast	23
13.0	Pilot Weather Briefing	24
14.0	Astronomical Data	24
E.	LIST OF ATTACHMENTS	25

A. ACCIDENT

Location: Near Morrison, Tennessee
Date: November 7, 2017
Time: 1845 central standard time
0045 Coordinated Universal Time (UTC) on November 8
Airplane: Piper PA-32-300, Registration: N47831

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 the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Centers for Environmental Information (NCEI). All times are central standard time (CST) on November 7, 2017, and are based upon the 24-hour clock, where local time is -6 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.

The final wreckage location was located at latitude 35.6528° N, longitude 85.9164° W, at an approximate elevation of 1,035 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 Advisory Circular "Aviation Weather Services", AC 00-45H.¹

¹ http://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_00-45H.pdf

1.1 Surface Analysis Chart

The Tennessee Valley section of the NWS Surface Analysis Chart for 1800 CST is provided as figure 1 with the approximate location of the accident site marked within the red circle. The chart indicated a frontal system stretched from central Louisiana northeastward into eastern Tennessee and from eastern Tennessee into northern South Carolina through eastern North Carolina. A surface low pressure center with a pressure of 1014-hectopascals (hPa) was located in eastern Tennessee. Another surface low pressure center with a pressure of 1013-hPa was located in northern South Carolina. The station models around the accident site depicted air temperatures in the low 50's to mid 60's degrees Fahrenheit (°F), dew point temperatures in the upper 40's to mid 50's °F with temperature-dew point spreads of 11° F or less, a north to northwest wind of 5 to 10 knots, and mostly cloudy skies.

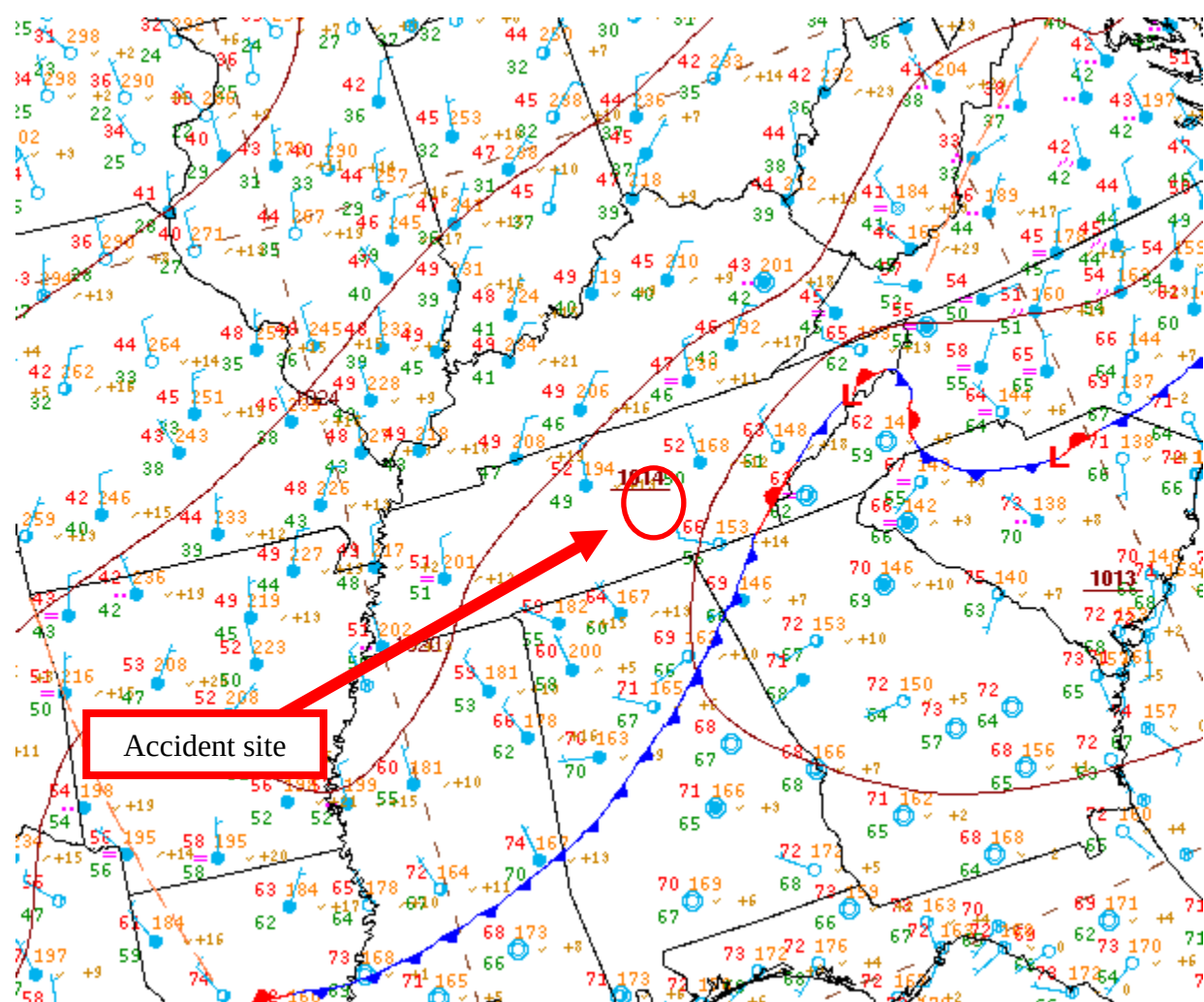


Figure 1 – NWS Surface Analysis Chart for 1800 CST

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1800 CST at 925-, 850-, 700-, 500-, and 300-hPa are presented in figures 2 through 6. There was a low-level trough² located around the accident site (figures 2 and 3) at 925- and 850-hPa. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. There was a north to northwest wind of 10 knots at 925- and 850-hPa with the wind becoming westerly at 40 knots by 700-hPa. The wind remained westerly and increased in magnitude to around 90 knots through 300-hPa (figure 6).

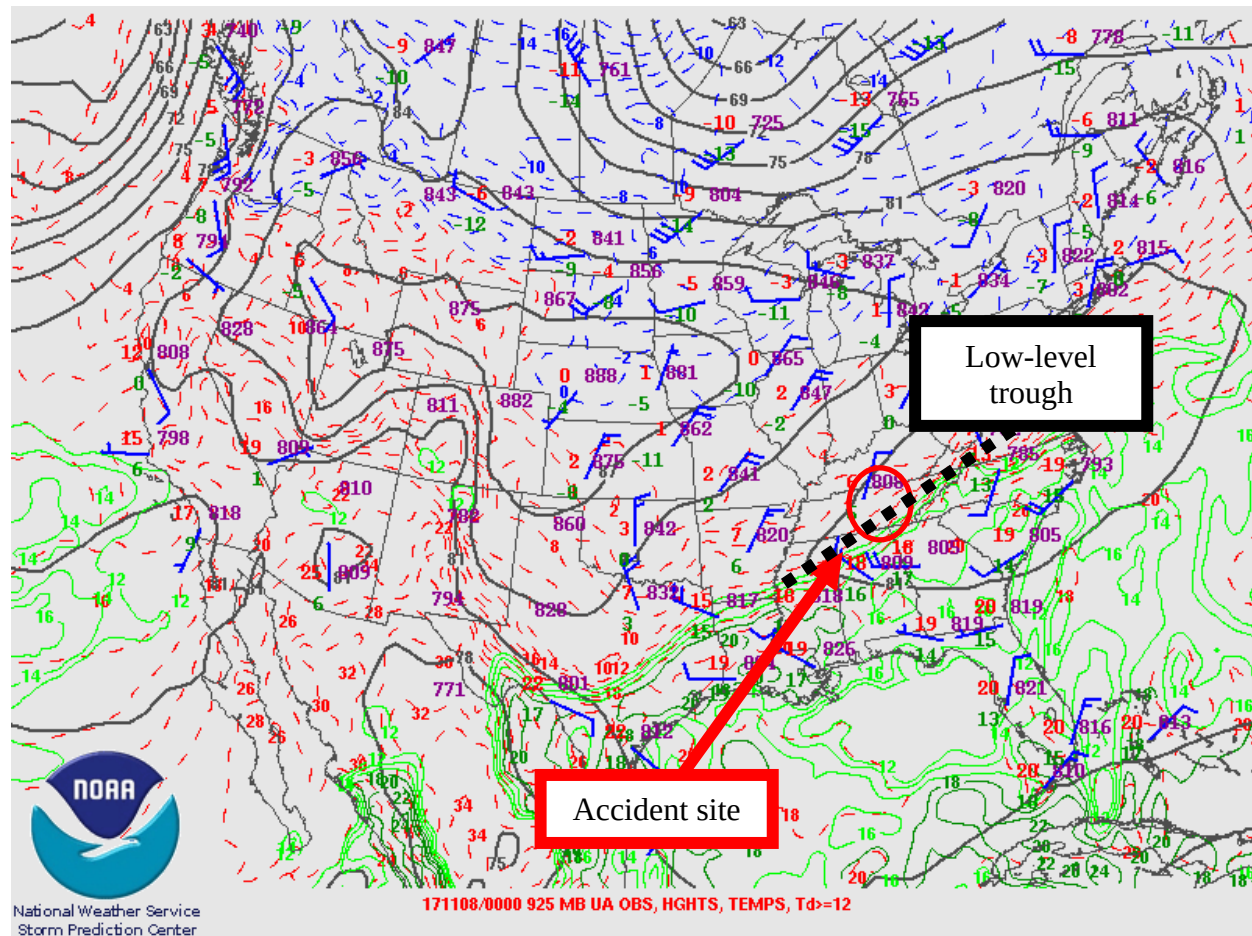


Figure 2 – 925-hPa Constant Pressure Chart for 1800 CST

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

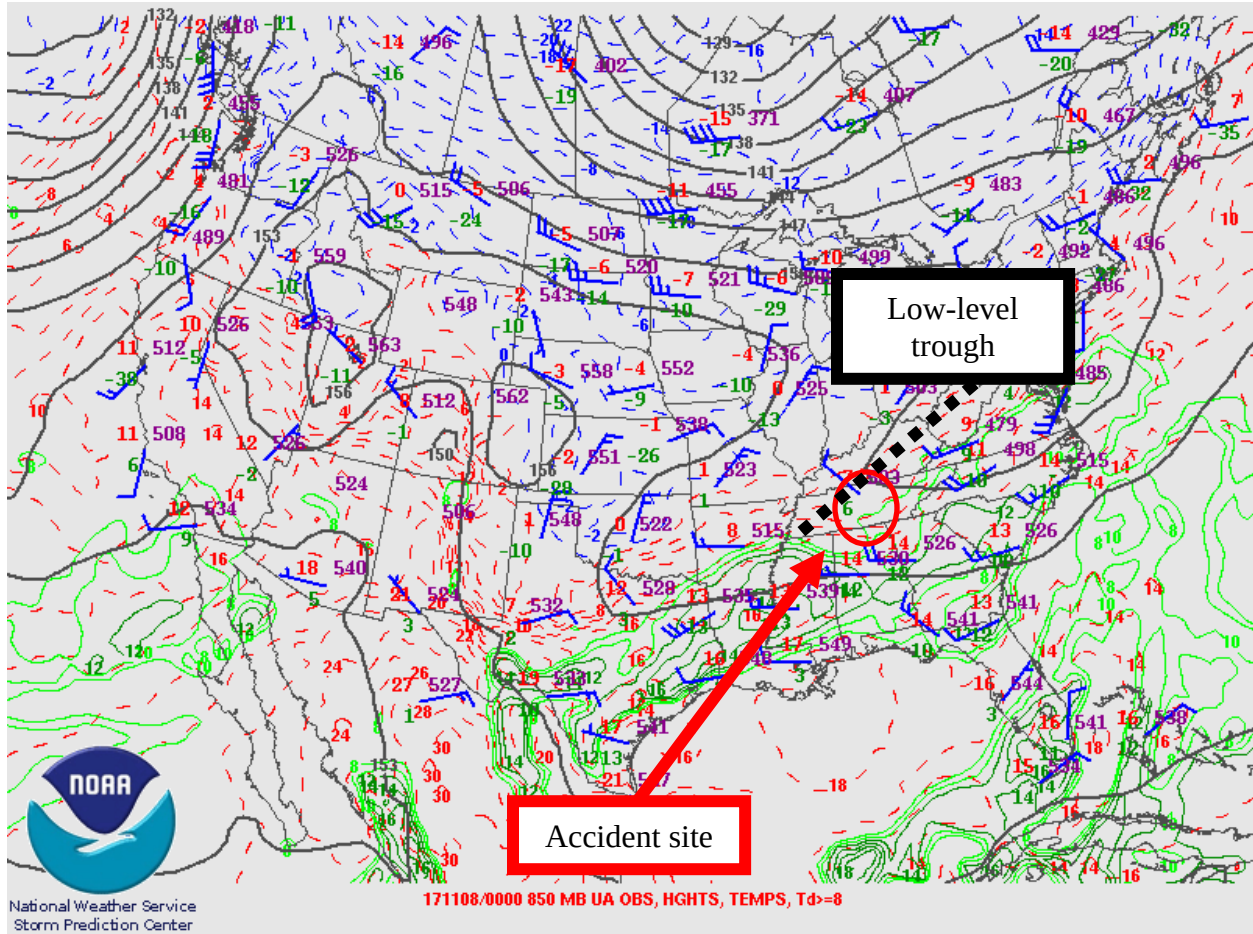


Figure 3 – 850-hPa Constant Pressure Chart for 1800 CST

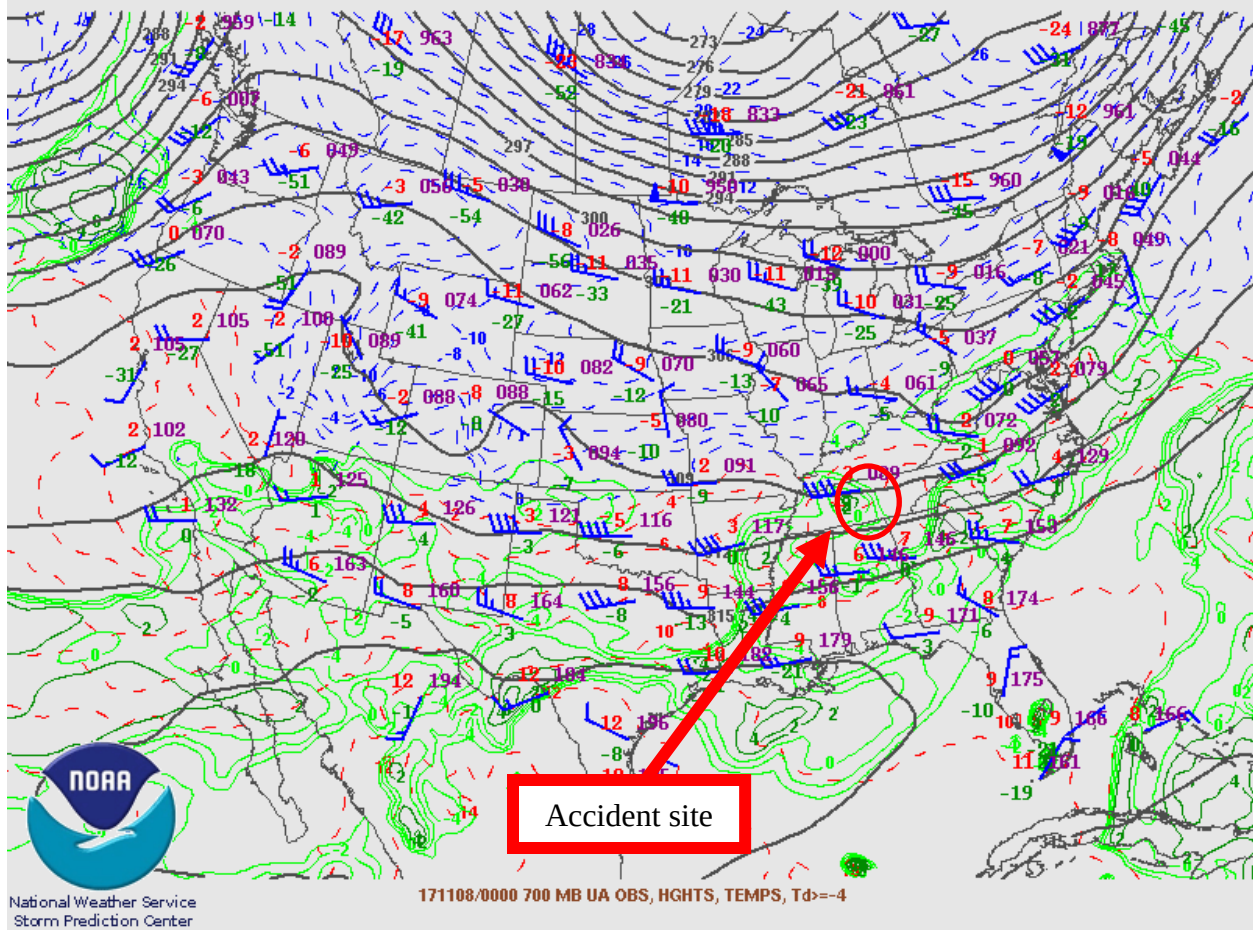


Figure 4 – 700-hPa Constant Pressure Chart for 1800 CST

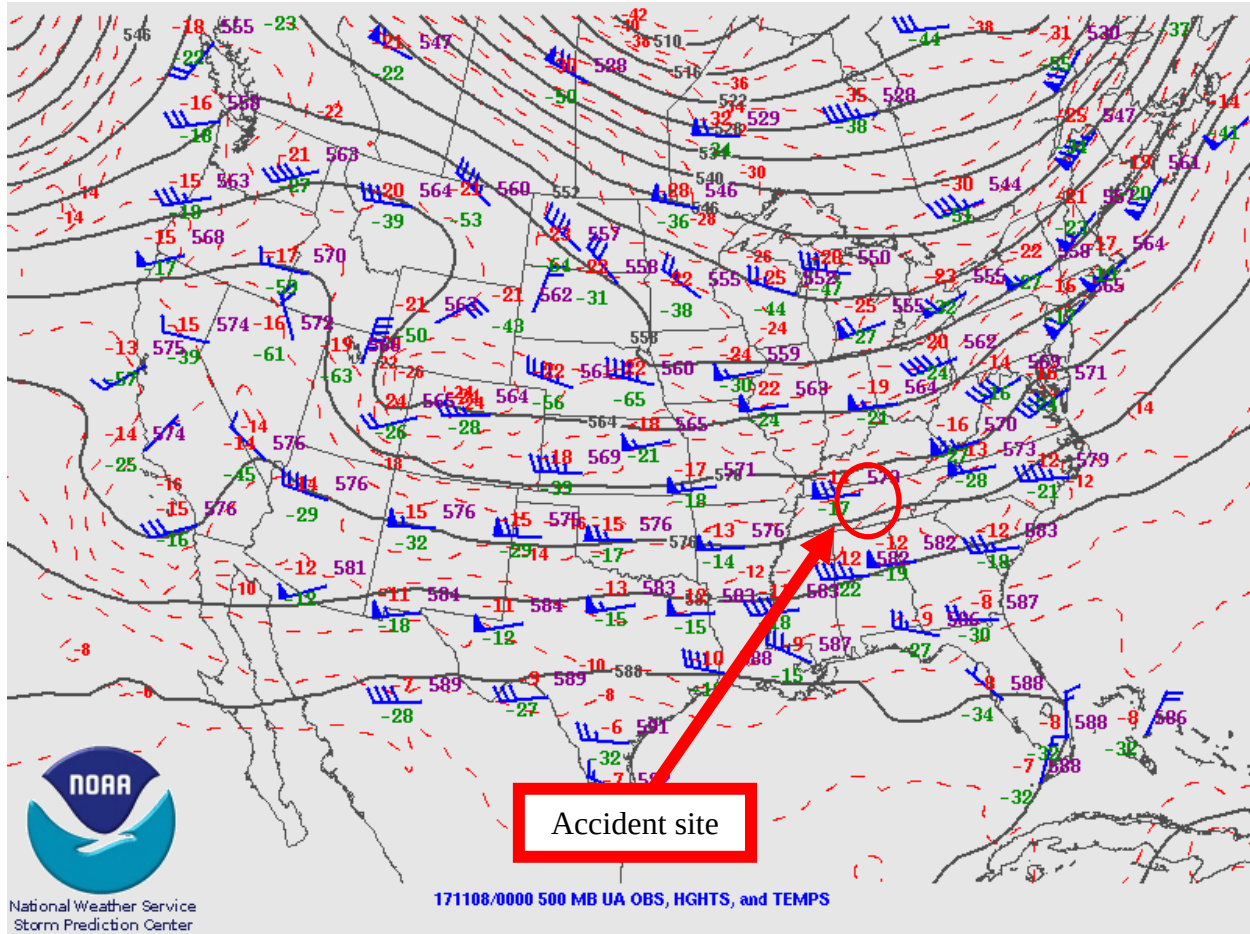


Figure 5 – 500-hPa Constant Pressure Chart for 1800 CST

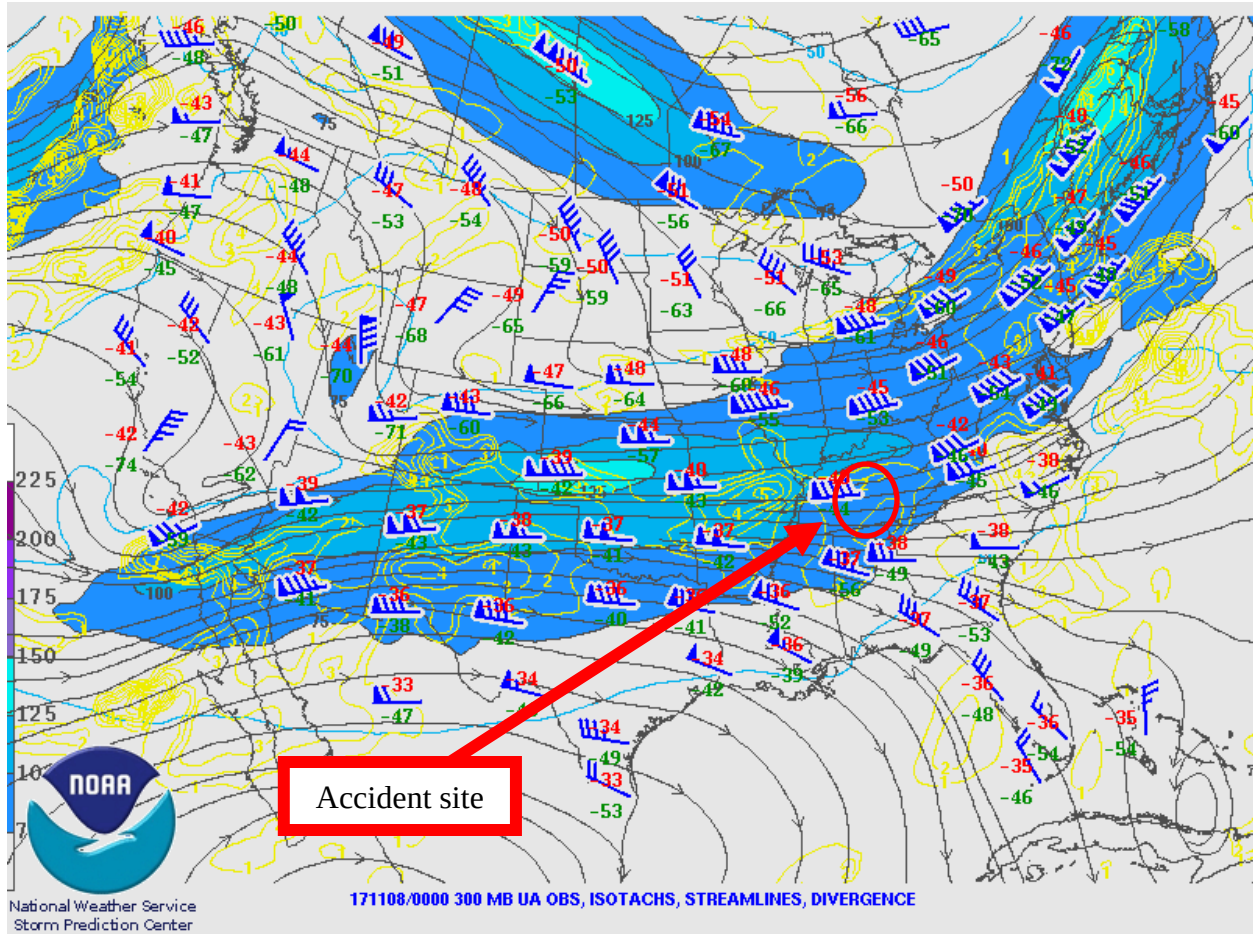


Figure 6 – 300-hPa Constant Pressure Chart for 1800 CST

2.0 SPC Products

The SPC issued the following Day 1 Convective Outlook at 1348 CST (figure 7) with no thunderstorms forecast for the accident site at the accident time:

SPC AC 071948

Day 1 Convective Outlook
NWS Storm Prediction Center Norman OK
0148 PM CST Tue Nov 07 2017

Valid 072000Z - 081200Z

...NO SEVERE THUNDERSTORM AREAS FORECAST...

...SUMMARY...

A few thunderstorms remain possible from Louisiana to the coastal Carolinas through this evening.

...Discussion...

Only minor changes have been made to the ongoing general thunder

area. While a few thunderstorms over the southern Appalachians intensified briefly earlier today, various radar and lightning fields have suggested an overall weakening trend over the last several hours. Ahead of the surface front, updraft sustenance should continue to struggle, owing to veered flow (and related weak convergence) and dry air around 700 mb.

..Picca.. 11/07/2017

.PREV DISCUSSION... /ISSUED 0951 AM CST Tue Nov 07 2017/

...Southeast states...

A band of showers and thunderstorms is sagging slowly southward into parts of AL/GA/SC. Isolated cells along this band have produced locally gusty/damaging winds in the past couple hours. The environment downstream of this activity remains similarly favorable for gusty winds. However, trends in radar/lightning/satellite data and 12z CAM guidance provides little confidence that convective intensity will rise to severe levels this afternoon. Wind gusts are expected to remain below 50 knots, and therefore will maintain the ongoing forecast of less than 5% severe probabilities.

[CLICK TO GET WUUS01 PTSDY1 PRODUCT](#)

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 0100Z

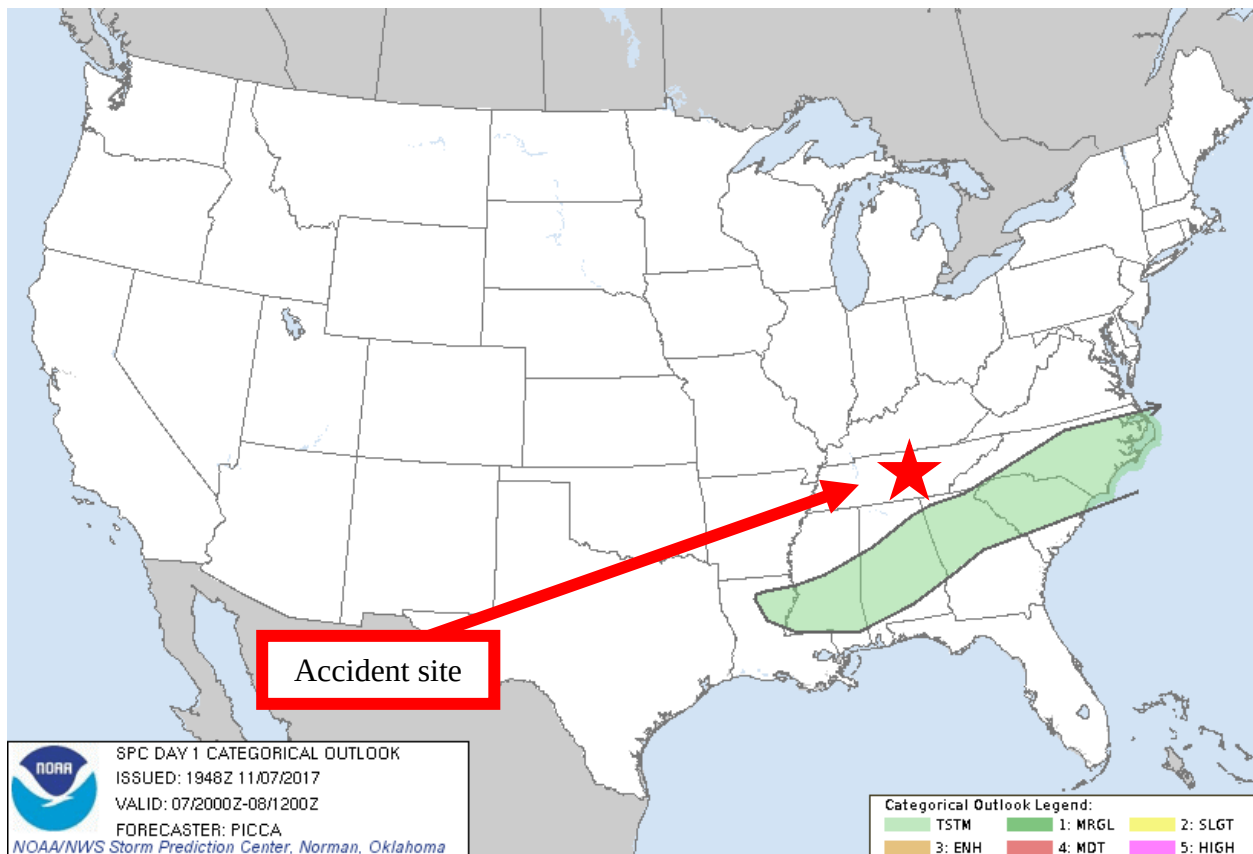


Figure 7 – SPC day 1 Convective Outlook valid at the time of the accident

3.0 Surface Observations

The area surrounding the accident site was documented using official Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). Figure 8 is a sectional chart with the accident site and the closest weather reporting locations to the accident site marked.

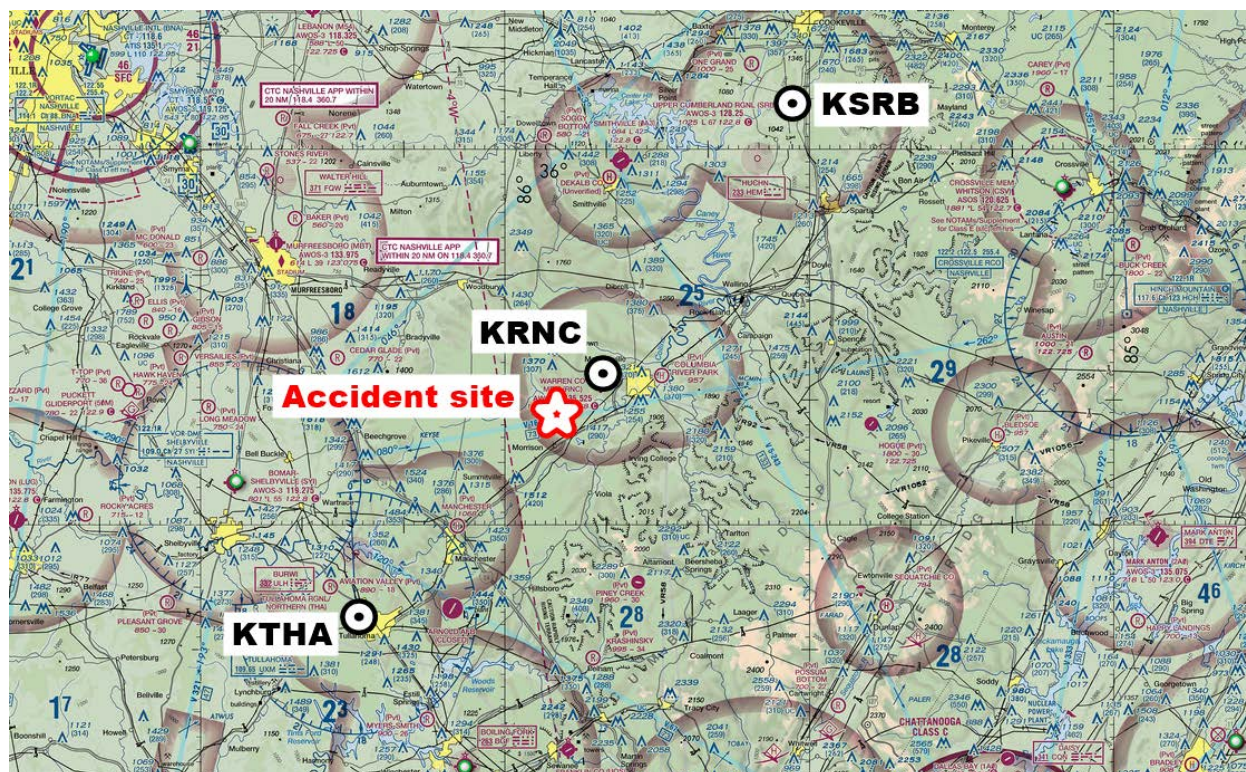


Figure 8 – Sectional chart of accident area with the location of the accident site and the closest surface observation sites

Warren County Memorial Airport (KRNC) had the closest official weather observation point to the accident site, and was located 3 miles west of McMinnville, Tennessee. KRNC had an Automated Weather Observing System (AWOS³) whose reports were not supplemented. KRNC was located 4 miles northeast of the accident site, at an elevation of 1,032 ft, and had a 2° easterly magnetic variation⁴ (figure 8). The 1-minute KRNC observations were obtained and are documented in attachments 1 and 2. In addition, the KRNC routine observations taken and disseminated during the times surrounding the accident are described below:

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 twelve thousand feet, and altimeter setting.

⁴ Magnetic variation – The angle (at a particular location) between magnetic north and true north. 1995, latest measurement taken from <http://airnav.com/airport/KRNC>

KRNC weather at 1800 CST, wind from 340° at 4 knots, 9 miles visibility, an overcast ceiling at 600 ft above ground level (agl), temperature of 12° Celsius (C), dew point temperature of 11° C, and an altimeter setting of 30.07 inches of mercury. Remarks, station without a precipitation discriminator.

KRNC weather at 1815 CST, wind from 340° at 6 knots, 5 miles visibility, mist, an overcast ceiling at 600 ft agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 30.07 inches of mercury. Remarks, station without a precipitation discriminator.

KRNC weather at 1830 CST, wind from 350° at 4 knots, 2 and a half miles visibility, an overcast ceiling at 500 ft agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 30.08 inches of mercury. Remarks, station without a precipitation discriminator.

ACCIDENT TIME 1845 CST

KRNC weather at 1845 CST, wind from 350° at 6 knots, 2 and a half miles visibility, an overcast ceiling at 500 ft agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 30.09 inches of mercury. Remarks, station without a precipitation discriminator.

KRNC weather at 1900 CST, wind from 350° at 6 knots, 2 and a half miles visibility, an overcast ceiling at 500 ft agl, temperature of 12° C, dew point temperature of 11° C, and an altimeter setting of 30.08 inches of mercury. Remarks, station without a precipitation discriminator.

Tulahoma Regional Airport (KTHA) was the next closest airport with official weather observations. KTHA had an AWOS whose reports were not supplemented. KTHA was located 23 miles southwest of the accident site, at an elevation of 1,084 ft, and had a 3° westerly magnetic variation⁵ (figure 8). The following observations were taken and disseminated during the times surrounding the accident:⁶

[1655 CST] METAR KTHA 072255Z AUTO 34007KT 3SM BR OVC004 12/12 A3005
RMK A01=

[1715 CST] METAR KTHA 072315Z AUTO 36008KT 3SM BR OVC004 12/11 A3005
RMK A01=

[1735 CST] METAR KTHA 072335Z AUTO 34007G13KT 7SM OVC005 12/11 A3006
RMK A01=

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

⁶ Bolded sections in this report highlight information that directly reference the weather conditions that affected the accident location around the accident time.

[1755 CST] METAR KTHA 072355Z AUTO 36008KT 5SM BR OVC005 11/11 A3006
RMK A01=

**[1815 CST] METAR KTHA 080015Z AUTO 35008KT 4SM BR OVC005 11/11 A3007
RMK A01=**

**[1835 CST] METAR KTHA 080035Z AUTO 34008KT 7SM OVC005 11/11 A3008 RMK
A01=**

ACCIDENT TIME 1845 CST

**[1855 CST] METAR KTHA 080055Z AUTO 00000KT 10SM OVC005 11/11 A3008 RMK
A01=**

**[1915 CST] METAR KTHA 080115Z AUTO 33009KT 7SM BKN005 BKN025 OVC030
11/10 A3008 RMK A01=**

[1935 CST] METAR KTHA 080135Z AUTO 33008KT 10SM BKN006 BKN020 OVC025
11/10 A3008 RMK A01=

[1955 CST] METAR KTHA 080155Z AUTO 35007KT 10SM OVC006 11/10 A3007 RMK
A01=

KTHA weather at 1815 CST, automated, wind from 350° at 8 knots, 4 miles visibility, mist, an overcast ceiling at 500 ft agl, temperature of 11° C, dew point temperature of 11° C, and an altimeter setting of 30.07 inches of mercury. Remarks: automated station without a precipitation discriminator.

KTHA weather at 1835 CST, automated, wind from 340° at 8 knots, 7 miles visibility, an overcast ceiling at 500 ft agl, temperature of 11° C, dew point temperature of 11° C, and an altimeter setting of 30.08 inches of mercury. Remarks: automated station without a precipitation discriminator.

KTHA weather at 1855 CST, automated, wind calm, 10 miles visibility or greater, an overcast ceiling at 500 ft agl, temperature of 11° C, dew point temperature of 11° C, and an altimeter setting of 30.08 inches of mercury. Remarks: automated station without a precipitation discriminator.

KTHA weather at 1915 CST, automated, wind from 330° at 9 knots, 7 miles visibility, a broken ceiling at 500 ft agl, broken skies at 2,500 ft agl, overcast skies at 3,000 ft agl, temperature of 11° C, dew point temperature of 10° C, and an altimeter setting of 30.08 inches of mercury. Remarks: automated station without a precipitation discriminator.

Upper Cumberland Regional Airport (KSRB) was the airport the accident airplane was diverting to after the missed approach into KRNC. KSRB had an AWOS whose reports were not supplemented. KSRB was located 31 miles northeast of the accident site, at an elevation of 1,025 ft, and had a 3° westerly magnetic variation⁷ (figure 8). The following observations were taken and disseminated during the times surrounding the accident:

[1635 CST] METAR KSRB 072235Z AUTO VRB06KT 1 1/4SM BR OVC006 12/11 A3005
RMK A01=

[1655 CST] METAR KSRB 072255Z AUTO 32005KT 1 1/2SM BR OVC004 12/11 A3005
RMK A01=

[1715 CST] METAR KSRB 072315Z AUTO VRB04KT 5SM BR OVC005 11/11 A3005
RMK A01=

[1735 CST] METAR KSRB 072335Z AUTO VRB05KT 10SM BKN007 OVC011 11/11
A3006 RMK A01=

[1755 CST] METAR KSRB 072355Z AUTO 36005G10KT 10SM OVC006 11/10 A3007
RMK A01=

**[1815 CST] METAR KSRB 080015Z AUTO VRB04G10KT 4SM BR OVC003 11/10 A3007
RMK A01=**

**[1835 CST] METAR KSRB 080035Z AUTO VRB06KT 6SM BR OVC003 11/10 A3008
RMK A01=**

ACCIDENT TIME 1845 CST

**[1845 CST] METAR KSRB 080045Z AUTO 34006KT 8SM OVC004 10/10 A3008 RMK
A01=**

**[2015 CST] METAR KSRB 080215Z AUTO VRB05G10KT 4SM BR BKN005 OVC009 10/09
A3010 RMK A01=**

[2035 CST] METAR KSRB 080235Z AUTO 33006KT 5SM BR OVC005 10/09 A3009
RMK A01=

[2055 CST] METAR KSRB 080255Z AUTO 36005KT 2 1/2SM BR OVC005 10/09 A3009
RMK A01=

⁷ Magnetic variation – The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <http://airnav.com/airport/KSRB>

KSRB weather at 1815 CST, automated, wind variable at 4 knots with gusts to 10 knots, 4 miles visibility, mist, an overcast ceiling at 300 ft agl, temperature of 11° C, dew point temperature of 10° C, and an altimeter setting of 30.07 inches of mercury. Remarks: automated station without a precipitation discriminator.

KSRB weather at 1835 CST, automated, wind variable at 6 knots, 6 miles visibility, mist, an overcast ceiling at 300 ft agl, temperature of 11° C, dew point temperature of 10° C, and an altimeter setting of 30.08 inches of mercury. Remarks: automated station without a precipitation discriminator.

KSRB weather at 1845 CST, automated, wind from 340° at 6 knots, 8 miles visibility, overcast ceiling at 400 ft agl, temperature of 10° C, dew point temperature of 10° C, and an altimeter setting of 30.08 inches of mercury. Remarks: automated station without a precipitation discriminator.

KSRB weather at 2015 CST, automated, variable wind at 5 knots with gusts to 10 knots, 4 miles visibility, mist, broken ceiling at 500 ft agl, overcast skies at 900 ft agl, temperature of 10° C, dew point temperature of 9° C, and an altimeter setting of 30.10 inches of mercury. Remarks: automated station without a precipitation discriminator.

The observations from KRNC, KTHA, and KSRB surrounding the accident time indicated mainly IFR⁸ conditions with brief periods of LIFR⁹ visibility and ceiling conditions in mist. No precipitation was observed around the accident time.

4.0 Upper Air Data

The closest official upper air sounding to the accident site was from Nashville, Tennessee, (KBNA) with a site number 72327. KBNA had a surface elevation of 591 ft and was located 47 miles northwest of the accident site. The 1800 CST KBNA sounding was plotted on a standard Skew-T log P diagram¹⁰ with the derived stability parameters included in figure 9 (with data from the surface to 600-hPa, or 14,000 ft msl.) This data was analyzed using the RAOB¹¹ software package. The sounding depicted the lifted condensation level (LCL)¹² at 715 ft msl, a convective condensation level (CCL)¹³ of 2,298 ft, and a level of free convection (LFC)¹⁴ at 1,011 ft. The freezing level was 11,424 ft. The precipitable water value was 1.01 inches.

⁸ Instrument Flight Rules (IFR) – Refers to the general weather conditions pilots can expect at the surface. IFR criteria means a ceiling below 1,000 ft agl and/or less than 3 miles visibility.

⁹ Low Instrument Flight Rules (LIFR) – Refers to the general weather conditions pilots can expect at the surface. LIFR criteria means a ceiling below 500 ft agl and/or less than 1 mile visibility.

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 Environmental Research Services, Matamoras, Pennsylvania.

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.

¹⁴ 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.

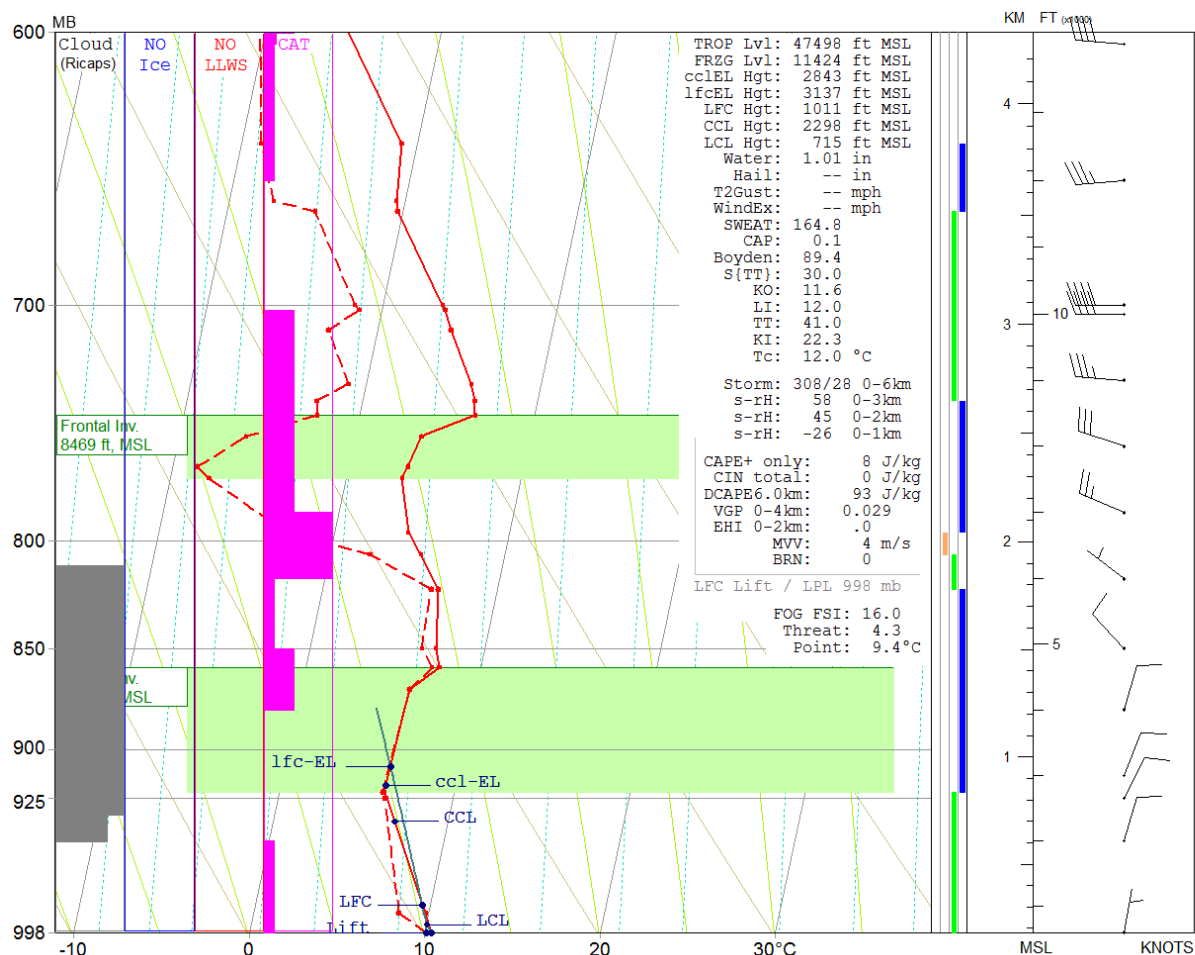


Figure 9 – 1800 CST KBNA sounding

The 1800 CST KBNA sounding indicated an alternating conditionally unstable and stable environment from the surface through 14,000 ft. Two inversions¹⁵ were located above the accident site with the first inversion located at 4,650 ft. The inversions would have acted to keep any cloud cover in place below that altitude. RAOB identified the possibility of clouds between 2,000 ft through 6,000 ft. No areas of icing were indicated by RAOB for below 14,000 ft.

The 1800 CST KBNA sounding wind profile indicated a surface wind from 010° at 5 knots with the wind remaining northerly through 5,000 ft. Above 5,000 ft the wind became westerly through 14,000 ft and the wind speed increased to between 30 and 40 knots. RAOB did not indicate the possibility of low-level wind shear between the surface and 2,000 ft. RAOB indicated the possibility of clear-air turbulence in several layers between the surface and 14,000 ft.

¹⁵ Inversion – A layer in which temperature increases with altitude.

5.0 Satellite Data

Visible and infrared data from the Geostationary Operational Environmental Satellite number 16 (GOES-16) data was 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. Satellite imagery surrounding the time of the accident, from 1600 CST through 2000 CST at approximately 15-minute intervals were reviewed, and the closest images to the time of the accident are documented here.

Figures 10 and 11 present the GOES-16 infrared imagery from 1830 and 1845 CST at 4X magnification with the accident site highlighted with a red square. Inspection of the infrared imagery indicated cloud cover over the accident site with the cloud cover moving from west to east. The lower brightness temperatures (green colors; higher cloud tops) were located above the accident site at 1830 CST and moved east of the accident site by 1845 CST. Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the 1800 CST KBNA sounding, the approximate cloud-top heights over the accident site were 23,000 ft at 1845 CST. It should be noted these figures have not been corrected for any parallax error.

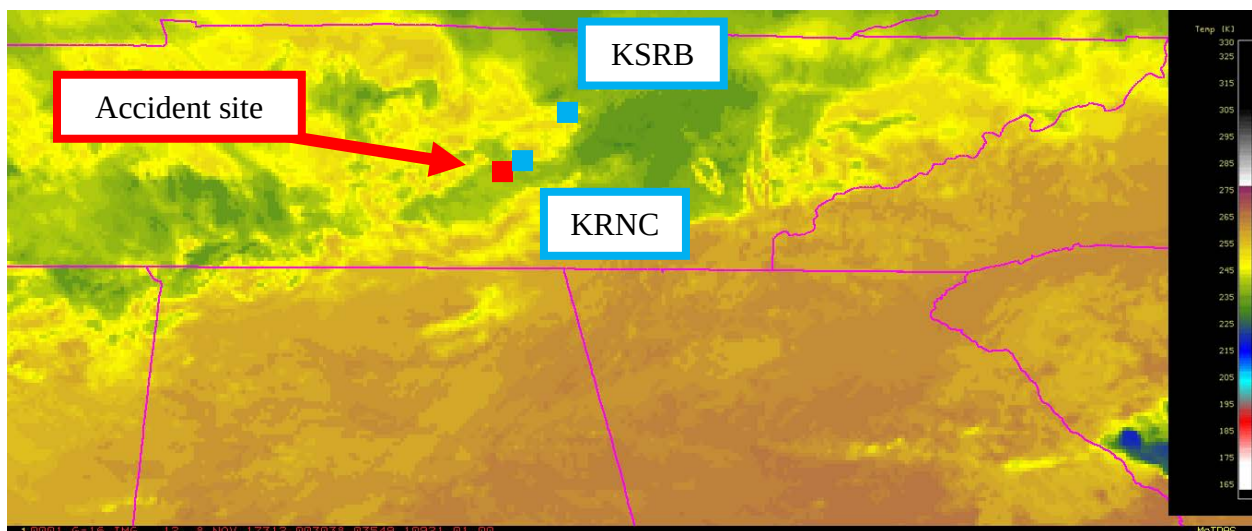


Figure 10 – GOES-16 infrared image at 1830 CST

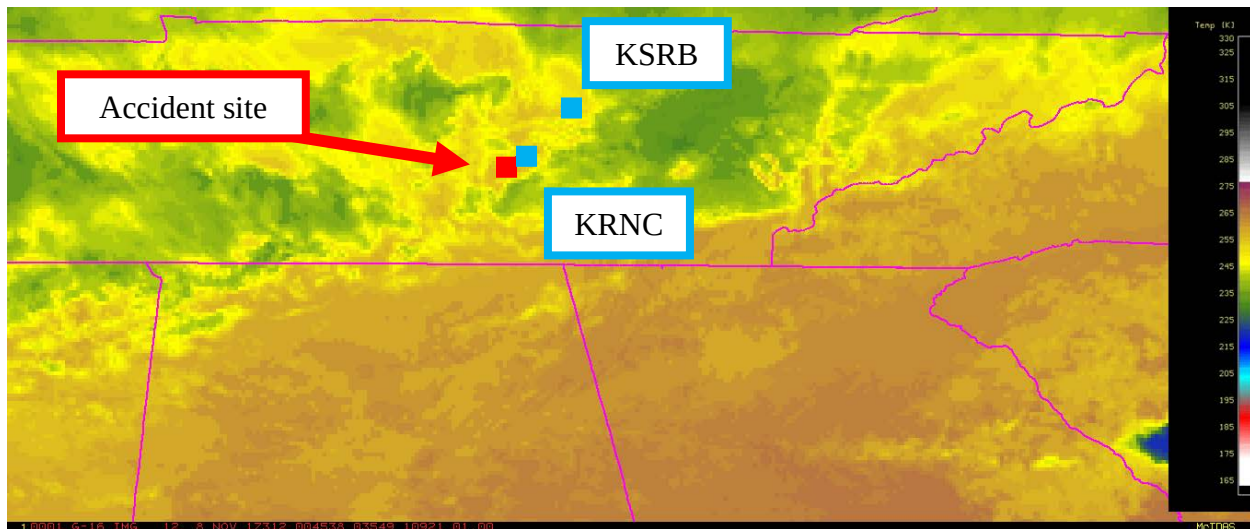


Figure 11 – GOES-16 infrared image at 1845 CST

6.0 Radar Imagery Information

The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹⁶ to the accident site was the Huntsville, Alabama, radar (KHTX), which was located 44 miles south of the accident site at an elevation of 1,760 ft. Level II and III archive radar data were obtained from the NCEI utilizing the NEXRAD Data Inventory Search and displayed using the NOAA's Weather and Climate Toolkit software. No reflectivity targets were located above the accident site around the accident time.

7.0 Pilot Reports¹⁷

All publicly-disseminated PIREPs within 150 miles of the accident site from about two hours prior to the accident time to about two hours after the accident time were reviewed. Only PIREPs for below FL180¹⁸ are provided below:

HSV UA /OV HSV/TM 2320/FLDURGC/TP LJ40/SK BKN010/ TOPS 043

HSV UA /OV HSV360005/TM 2333/FLDURGC/TP CRJ2/SK BKN030/ TOPS 045

KBNA UA /OV BNA050005/TM 2336/FL018/TP G150/SK OVC018

KBNA UA /OV BNA090007/TM 0034/FL043/TP DC91/SK TOP043

HSV UA /OV HSV270005/TM 0047/FLDURGC/TP E145/SK BKN020/ TOPS 040

¹⁶ The WSR-88D is an S-band 10-centimeter wavelength radar with a power output of 750,000 watts, and with a 28-foot parabolic antenna that concentrates the energy between a 0.87° and 0.96° beam width. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.

¹⁷ Only pilot reports with the WMO header UBTN**, UBAL**, and UBGA** identifier were considered.

¹⁸ 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 average 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.

Routine pilot report (UA); Over Huntsville, Alabama; Time – 1720 CST (2320Z); Altitude – During climb; Type aircraft – Learjet 40; Sky – Broken ceiling at 1,000 ft with tops at 4,300 ft.

Routine pilot report (UA); 5 miles from Huntsville, Alabama, on the 360° radial; Time – 1733 CST (2333Z); Altitude – During climb; Type aircraft – Bombardier CRJ-200; Sky – Broken ceiling at 3,000 ft with tops at 4,500 ft.

Routine pilot report (UA); 5 miles from Nashville, Tennessee, on the 050° radial; Time – 1736 CST (2336Z); Altitude – 1,800 ft; Type aircraft – Gulfstream G150; Sky – Overcast ceiling at 1,800 ft.

Routine pilot report (UA); 7 miles from Nashville, Tennessee, on the 090° radial; Time – 1834 CST (0034Z); Altitude – 4,300 ft; Type aircraft – McDonnell Douglas DC-9; Sky – Tops at 4,300 ft.

Routine pilot report (UA); 5 miles from Huntsville, Alabama, on the 270° radial; Time – 1847 CST (0047Z); Altitude – During climb; Type aircraft – Embraer ERJ-145; Sky – Broken ceiling at 2,000 ft with tops at 4,000 ft.

Routine pilot report (UA); Over Nashville, Tennessee; Time – 2013 CST (0213Z); Altitude – 700 ft; Type aircraft – Boeing B737-700; Sky – Overcast ceiling at 700 ft with clouds tops at 4,300 ft.

8.0 SIGMET and CWSU Advisories

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

No Center Weather Service Unit (CWSU) Center Weather Advisories were valid for the accident site at the accident time. No Meteorological Impact Statement (MIS) issued by a CWSU were valid for the accident site at the accident time.

9.0 AIRMETs

There was an Airmen's Meteorological Information (AIRMET) Sierra that was valid for the accident site at the accident time (figure 12). This AIRMET Sierra warned of IFR conditions due to precipitation and mist:

WAUS44 KKCI 072045

WA4S

-DFWS WA 072045

AIRMET SIERRA UPDT 5 FOR IFR AND MTN OBSCN VALID UNTIL 080300

AIRMET IFR...OK TX AR TN LA MS AL MO KY

FROM BWG TO HNV TO GQO TO LGC TO 40SSE MGM TO 40ENE IAH TO 20WSW

GGG TO 20ENE OKC TO TUL TO RZC TO BWG
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET MTN OBSCN...TN KY
FROM HNN TO HNV TO GQO TO 60ESE BWG TO HNN
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

.
AIRMET MTN OBSCN...TX
FROM FST TO 60WNW DLF TO 90S MRF TO MRF TO FST
MTNS OBSC BY CLDS/PCPN/BR. CONDS DVLPG 00-03Z. CONDS CONTG BYD
03Z THRU 09Z.

.
OTLK VALID 0300-0900Z
AREA 1...IFR OK TX AR TN LA MS AL MO KY AND CSTL WTRS
BOUNDED BY BWG-HMV-GQO-50SW PZD-40W CEW-20SW LEV-20SW LCH-20S
LFK-50WNW GGG-MLC-RZC-BWG
CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS CONTG THRU 09Z.

.
AREA 2...IFR OK TX
BOUNDED BY 50W LBL-40ENE MMB-20E OKC-20WNW ADM-40E TCC-30ESE TBE-
50W LBL
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS DVLPG 03-06Z. CONDS CONTG
THRU 09Z.

....

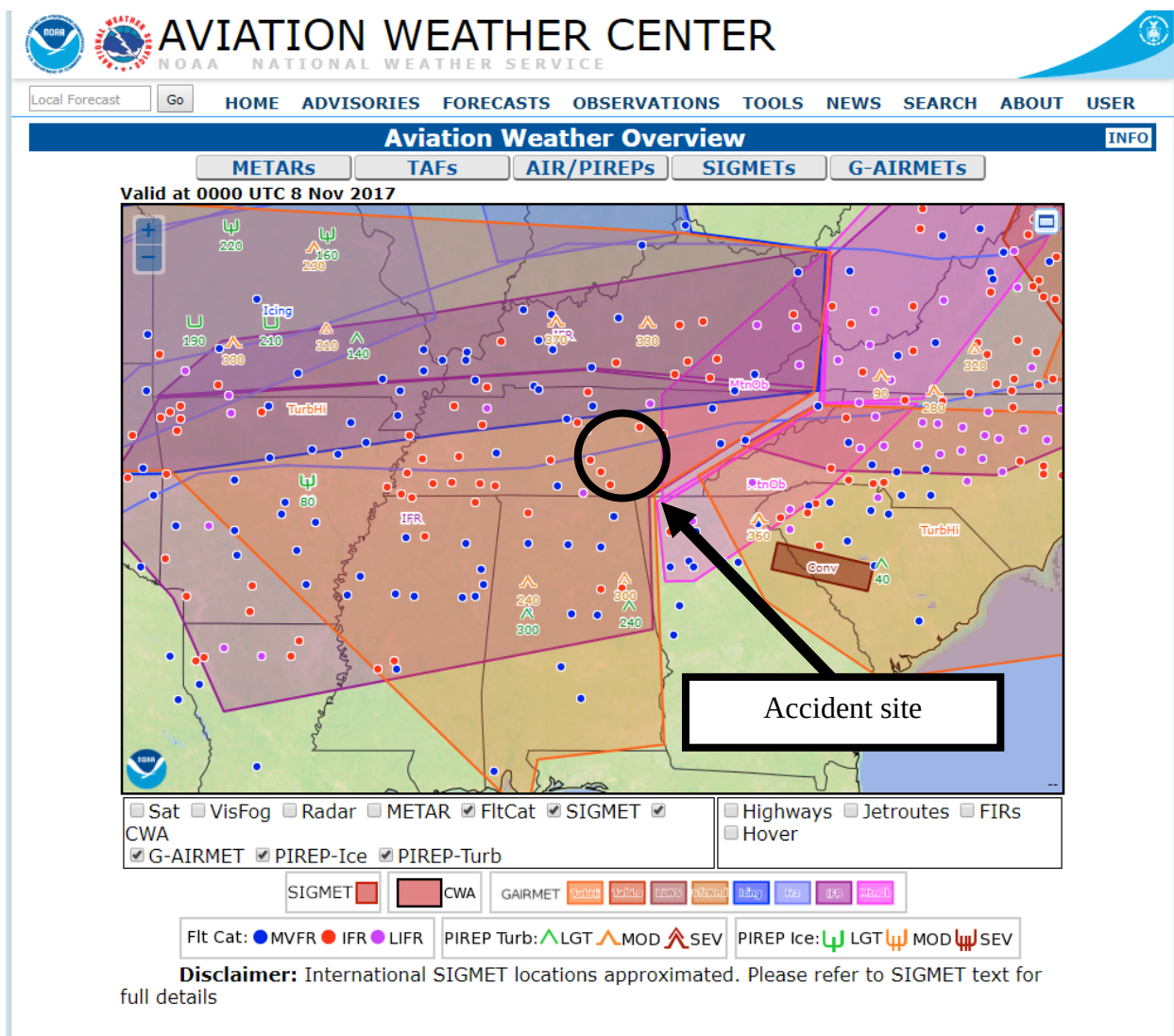


Figure 12 – AWC graphic with SIGMETs, CWAs, and AIRMETS valid at 1800 CST

10.0 Terminal Aerodrome Forecast

Smyrna Airport (KMQY) was the closest site to the accident site with an NWS Terminal Aerodrome Forecast (TAF) and was located 36 miles northwest of the accident site. The TAF valid at the accident time was issued at 1723 CST and was valid for a 24-hour period beginning at 1800 CST. The 1723 CST TAF for KMQY was as follows:

TAF KMQY 072323Z 0800/0824 36010KT 6SM BR OVC007
 FM081200 01012KT P6SM OVC015
 FM082000 01011KT P6SM OVC025
 FM082300 01012KT P6SM OVC050=

The TAF expected a wind from 360° at 10 knots, 6 miles visibility, mist, and an overcast ceiling at 700 ft agl.

11.0 NWS Area Forecast Discussion

The NWS Office in Nashville, Tennessee, issued the following Area Forecast Discussion (AFD) at 1800 CST (closest AFD to the accident time with an aviation section). The aviation section of the AFD discussed that IFR conditions would continue with on and off drizzle overnight. LIFR conditions would also be possible:

633
FXUS64 KOHX 080000
AFDOHX

Area Forecast Discussion
National Weather Service Nashville TN
600 PM CST Tue Nov 7 2017

.UPDATE...
FOR 00Z AVIATION DISCUSSION.

&&

.DISCUSSION...

Quiet day today after heavy rain impacted the mid state during the overnight hours. Chances for light showers will continue during the overnight hours tonight as the front works its way out of the area, but not expecting too much in regards to amounts. With the abundant moisture at the surface thanks to the heavy rainfall, some fog may be possible, however cloud cover and northerly winds staying up overnight may mitigate fog chances overnight.

Cloud cover looks to continue during the day tomorrow, with the cooler temps behind the front only allowing high temperatures to reach the mid 50s west of the Plateau. On the Plateau, highs look to struggle to hit 50. Skies will begin to clear out Wednesday evening and into the overnight hours, which will not help low temperatures Thursday and even Friday morning. Upper ridging/broad northwest flow aloft looks to settle in for the remainder of the week, which will keep the cold air around the mid state. When combined with clearing skies and light winds Friday morning, overnight lows may hit freezing along the KY border and northern Plateau. Models have been varying a bit on lows, but have been pretty consistent forecasting around freezing for those areas Friday morning.

Getting into the weekend, a fast moving Midwest shortwave will dive southeastward and bring rain chances for Saturday night and during the day Sunday. The GFS and ECMWF have slightly different solutions, with the ECMWF bringing in some decent southerly moisture and precip ahead of the wave late Saturday, but consensus does have higher chances Sunday morning and into the early afternoon. As the upper shortwave races eastward overnight into Monday morning, northwesterly flow aloft and dry conditions look to return to the area.

&&

.AVIATION...
00Z TAF DISCUSSION.

**A cold front is south of middle TN and north winds will prevail.
There will be some gusts this evening in the 16-19 KT range.**

**IFR conditions will prevail. Some light drizzle will be possible
off and on through the overnight hours. CSV might even go down to
LIFR around 02Z and stay there through the morning hours.**

Have MVFR conditions after 17/18Z and VFR conditions should
return after 00Z Thursday.

&&

.OHX WATCHES/WARNINGS/ADVISORIES...
NONE.

&&

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12.0 Winds and Temperature Aloft Forecast

The NWS 1402 CST Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

FBUS31 KWN0 072002
FD1US1
DATA BASED ON 071800Z
VALID 080000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
HSV	2715	2823+14	2831+08	2839+01	2751-12	2759-23	298638	299848	289159

The accident site was closest to the Huntsville, Alabama, (HSV) forecast point. The 1402 CST HSV forecast indicated a wind at 3,000 ft from 270° at 15 knots, a wind at 6,000 ft from 280° at 23 knots with a temperature of 14° C, and a wind at 9,000 ft from 280° at 31 knots with a temperature of 8° C.

13.0 Pilot Weather Briefing

A search of official weather briefing sources such as Leidos weather briefings and Direct User Access Terminal Service (DUATS) was done. The accident pilot received Leidos weather briefings at 0605 and 0953 CST (Attachments 3,4, 5, and 6) for flights on the accident day, but not for the accident flight. The accident pilot had additional contact with Leidos at 0838 CST and 1556 CST (Attachments 7 and 8). During the 1556 CST contact with Leidos, the accident flight route was discussed, the accident pilot mentioned he already had the weather conditions for the proposed destination and that the conditions were LIFR. The accident pilot did not request any weather information or forecast information on the 1556 CST briefing. All the standard weather forecast and current weather information was provided to the accident pilot during the 0605 and 0953 CST Leidos briefings (attachments 4 and 6) and this standard weather information included the Graphical Forecast for Aviation (GFA, Attachments 10 and 11).

A search of archived data from ForeFlight was done and the accident pilot did not request nor receive weather briefing information from ForeFlight.

14.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on November 7, 2017, indicated the following:

SUN

Begin civil twilight	0545 CST
Sunrise	0612 CST
Sun transit	1127 CST
Sunset	1643 CST
End civil twilight	1709 CST

MOON

Moonrise	1916 CST on preceding day
Moon transit	0231 CST
Moonset	0947 CST
Accident	1845 CST
Moonrise	2015 CST

The sun was set and the Moon was below the horizon and not yet risen at the accident time.

E. LIST OF ATTACHMENTS

Attachment 1 – KRNC 1-minute METAR observations from November 7, time in UTC

Attachment 2 – KRNC 1-minute METAR observations from November 8, time in UTC

Attachment 3 – Leidos contact with accident pilot at 0605 CST

Attachment 4 – Leidos text briefing information provided to accident pilot at 0605 CST

Attachment 5 – Leidos contact with accident pilot at 0953 CST

Attachment 6 – Leidos text briefing information provided to accident pilot at 0953 CST

Attachment 7 – Leidos contact with accident pilot at 0838 CST

Attachment 8 – Leidos contact with accident pilot at 1556 CST

Attachment 9 – Leidos contact history with accident pilot

Attachment 10 – GFA products provided to the accident pilot during the Leidos weather briefing from 0605 CST

Attachment 11 – Full GFA products provided to the accident pilot during the Leidos weather briefing from 0605 CST

Submitted by:

Paul Suffern
Senior Meteorologist

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