



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 18, 2017

Group Chairman's Factual Report

METEOROLOGY

ERA16FA035

Table Of Contents

A.	ACCIDENT	3
B.	METEOROLOGY GROUP	3
C.	SUMMARY	3
D.	DETAILS OF THE INVESTIGATION	3
E.	FACTUAL INFORMATION	3
1.0	Synoptic Situation.....	4
1.1	Surface Analysis Chart	4
1.2	Upper Air Charts.....	5
2.0	Storm Prediction Center Products.....	10
3.0	Surface Observations	12
4.0	Upper Air Data.....	20
5.0	Satellite Data	22
6.0	Radar Imagery Information.....	23
6.1	Volume Scan Strategy.....	24
6.2	Beam Height Calculation.....	25
6.3	Reflectivity.....	25
6.4	Base Reflectivity and Lightning Data.....	27
7.0	Pilot Reports.....	31
8.0	SIGMET and CWSU Advisories	31
9.0	AIRMETs.....	35
10.0	Area Forecast	36
11.0	Terminal Aerodrome Forecast	37
12.0	National Weather Service Area Forecast Discussion	38
13.0	Pilot Weather Briefing.....	41
14.0	Visit to the National Weather Service in Tallahassee.....	41
15.0	Center Weather Service Weather Graphics	41
16.0	Astronomical Data	44
17.0	Witness Information.....	44
F.	LIST OF ATTACHMENTS	49

A. ACCIDENT

Location: Climax, Georgia
Date: November 9, 2015
Time: About 1017 eastern standard time (1517 UTC₁)
Aircraft: Cessna 441; registration N164GP

B. METEOROLOGY GROUP

Paul Suffern
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C. 20594-2000

C. SUMMARY

For a summary of the accident, refer to the *Accident Summary* report, which is available in the docket for this investigation.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) meteorologist launched on a go-team for this accident investigation and gathered information from Tallahassee Air Traffic Control Tower (TLH ATCT) and from the National Weather Service (NWS) office in Tallahassee. Information was also gathered for this investigation from the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) NWS sources including the National Climatic Data Center (NCDC). All times in this report are east standard time (EST) on November 9, 2015, based upon the 24 hour clock, local time is -5 hours to UTC, and UTC=Z. 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 approximate accident site was identified at latitude 30.90° N and longitude 84.45° W at 215 feet.

E. FACTUAL INFORMATION

¹ UTC – is an abbreviation for Coordinated Universal Time.

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 (NCEP) and the Weather Prediction Center (WPC), 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 Surface Analysis Chart

The NWS Surface Analysis Chart for 1000 EST is provided as figure 1, with the approximate location of the accident site marked. The chart depicted a warm front stretched from western Florida eastward into southeastern Georgia. A low pressure center with a pressure of 1014-hectopascals (hPa) was located in the northeastern Gulf of Mexico. The station models around the accident site depicted air temperatures in the mid 50’s to low 60’s Fahrenheit (F), with temperature-dew point spreads of 2° F or less, a northeast to east wind below 10 knots, cloudy skies, light rain, and fog. Areas near frontal boundaries and low temperature-dewpoint spreads at the surface are typically locations conducive for low clouds and fog, and if enough moisture is available in the vertical, then precipitation can also be present.

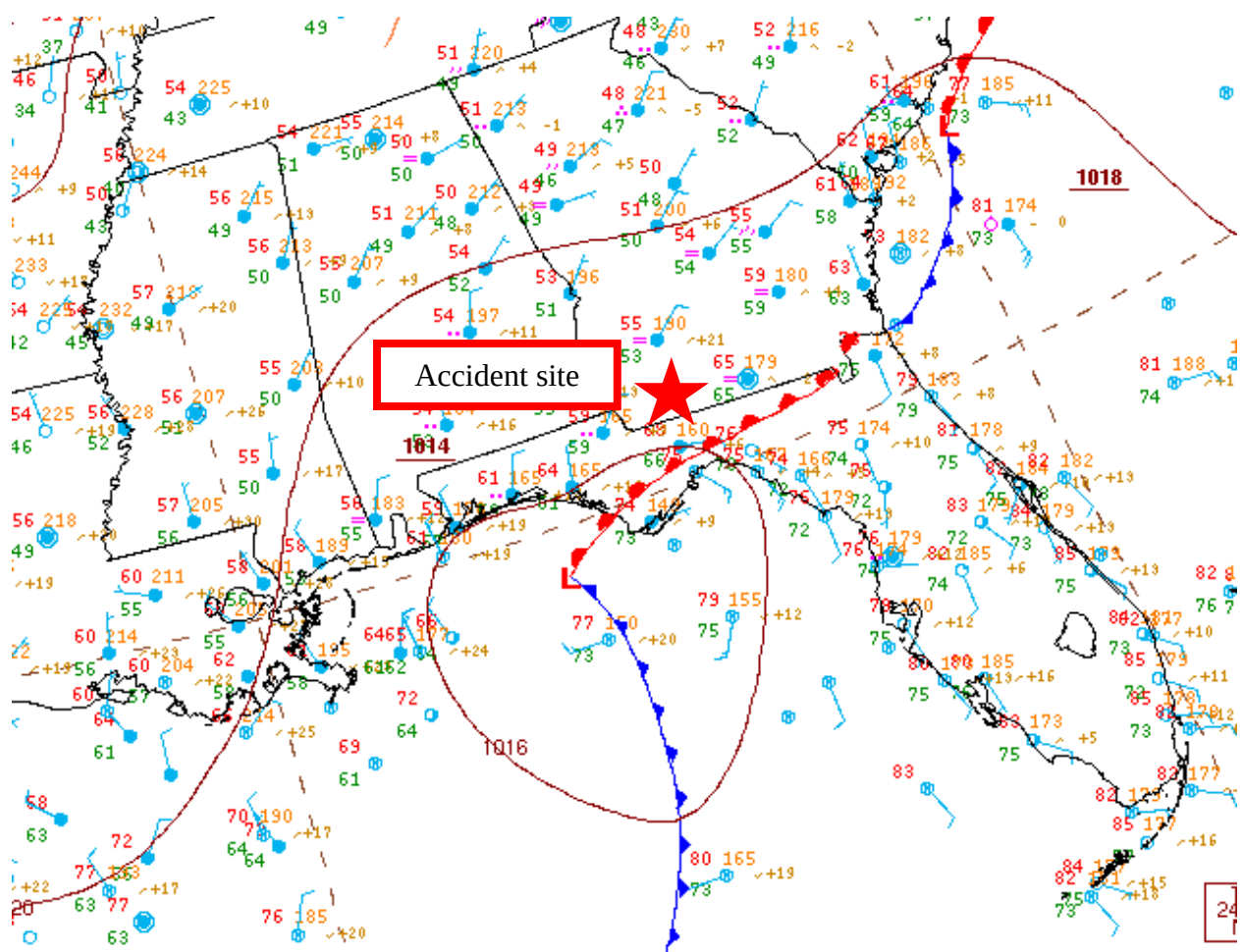


Figure 1 – NWS Surface Analysis Chart for 1000 EST

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0700 EST at 925-, 850-, 700-, 500-, and 300-hPa are presented in figures 2 through 6. The 850-, 700-, and 500-hPa charts depicted a mid-level trough just west of the accident site. Areas near and ahead of troughs are typically areas where enhanced lift, clouds, and precipitation can occur. The low-level environment at 925-hPa was close to having a record amount of moisture with a dew point value of 17.5° Celsius (C)² and an air temperature of 20° C. The wind was out of the south to southeast around 15 to 25 knots at 925-hPa with the wind turning to the southwest by 500-hPa at 25 knots. The wind increased to 50 knots out of the southwest by 300-hPa.

² Data taken from the SPC Sounding Climatology Page where 17.5° C is above the 90 percentile moving average and near the max moving average for the 1200 UTC sounding data going back to 1991 from KTLH and back to 1948 for KAAQ/KAAF.

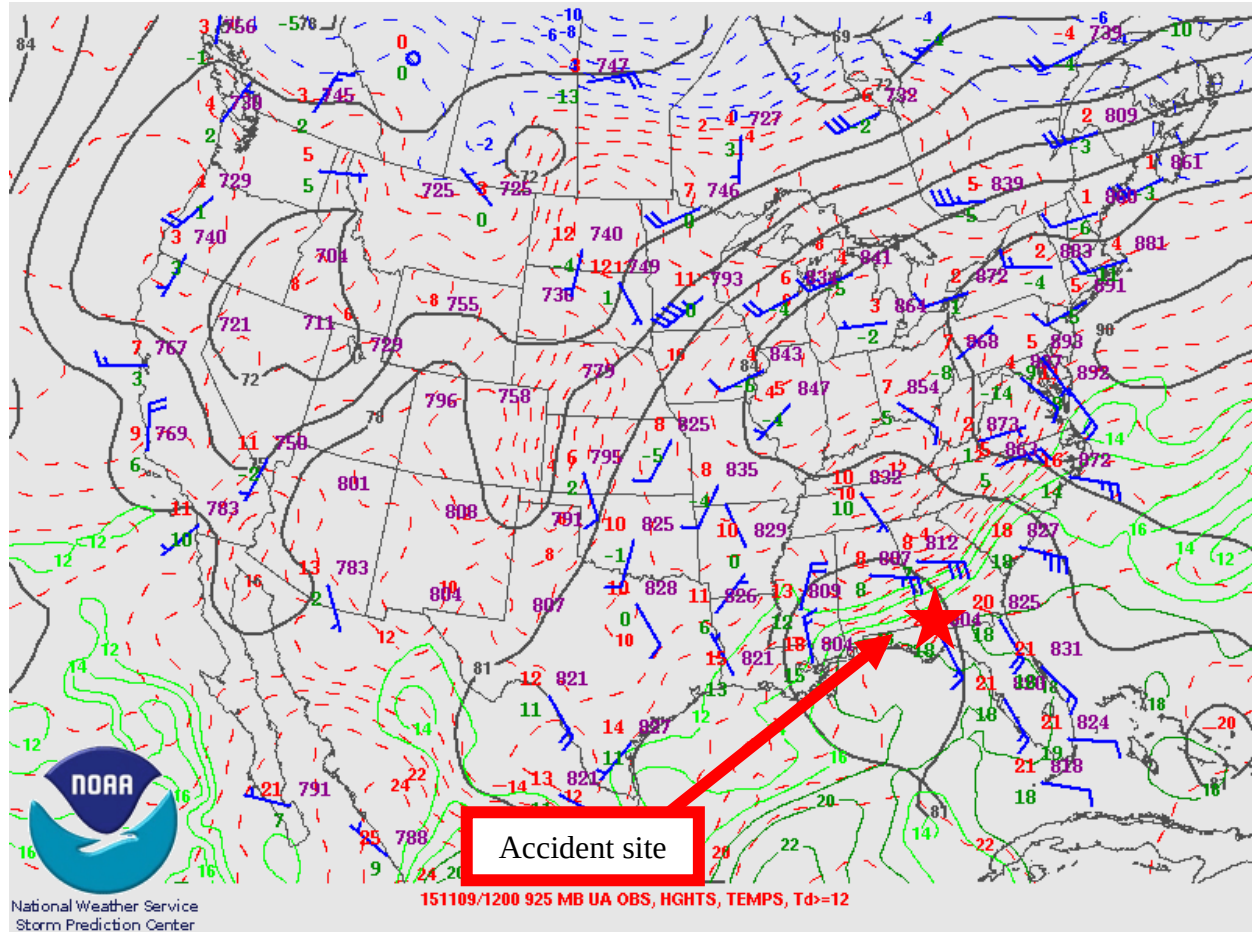


Figure 2 – 925-hPa Constant Pressure Chart for 0700 EST

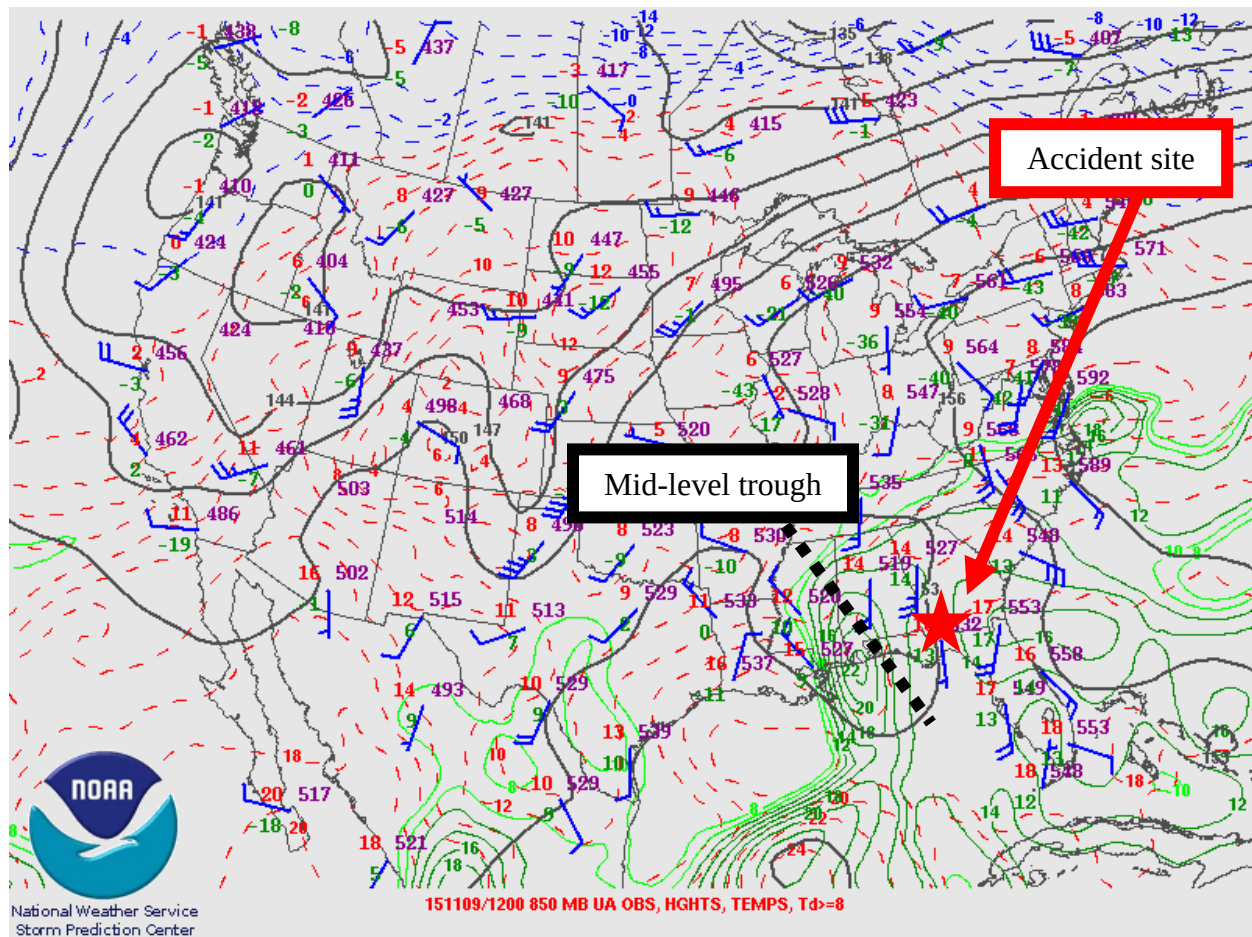


Figure 3 – 850-hPa Constant Pressure Chart for 0700 EST

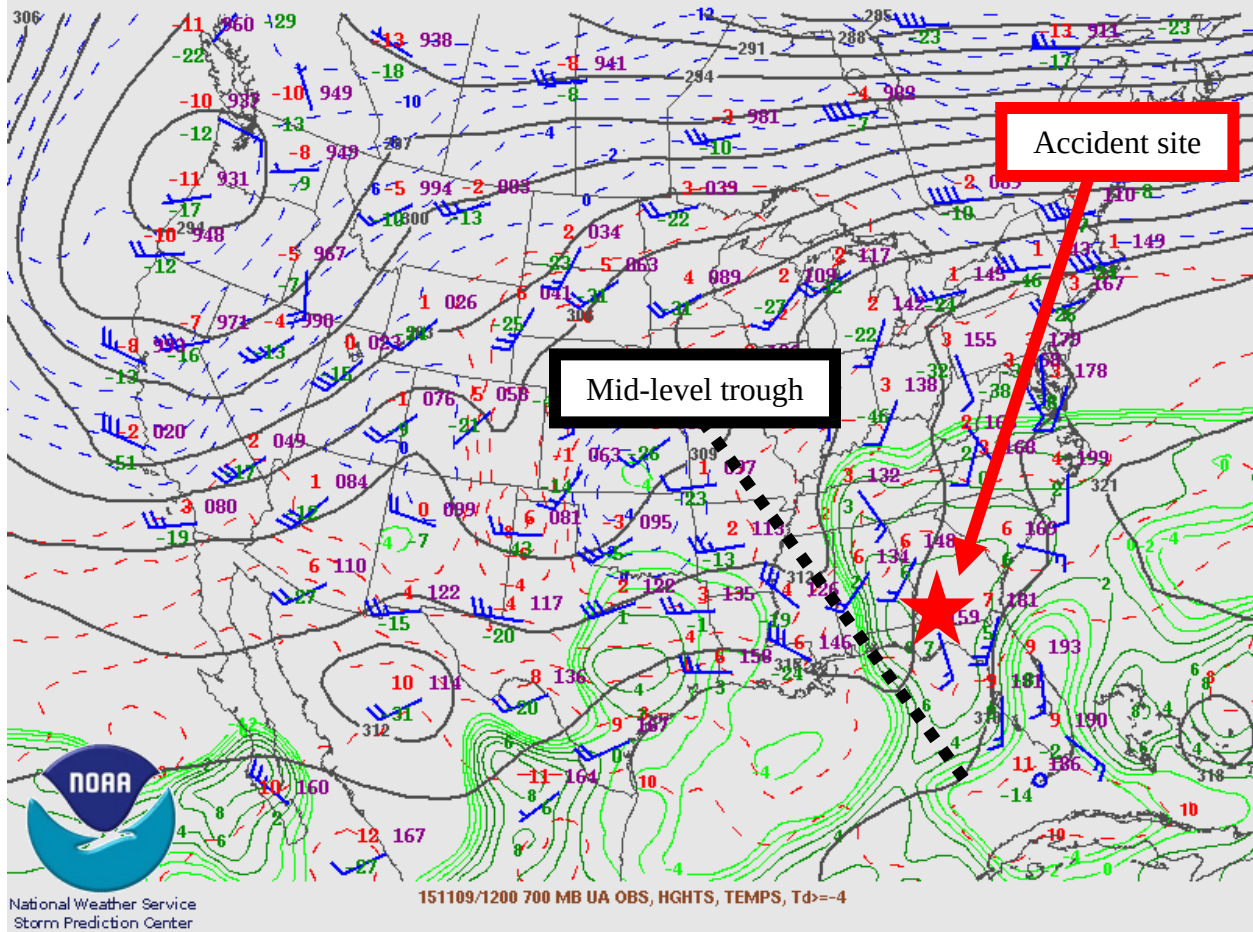


Figure 4 – 700-hPa Constant Pressure Chart for 0700 EST

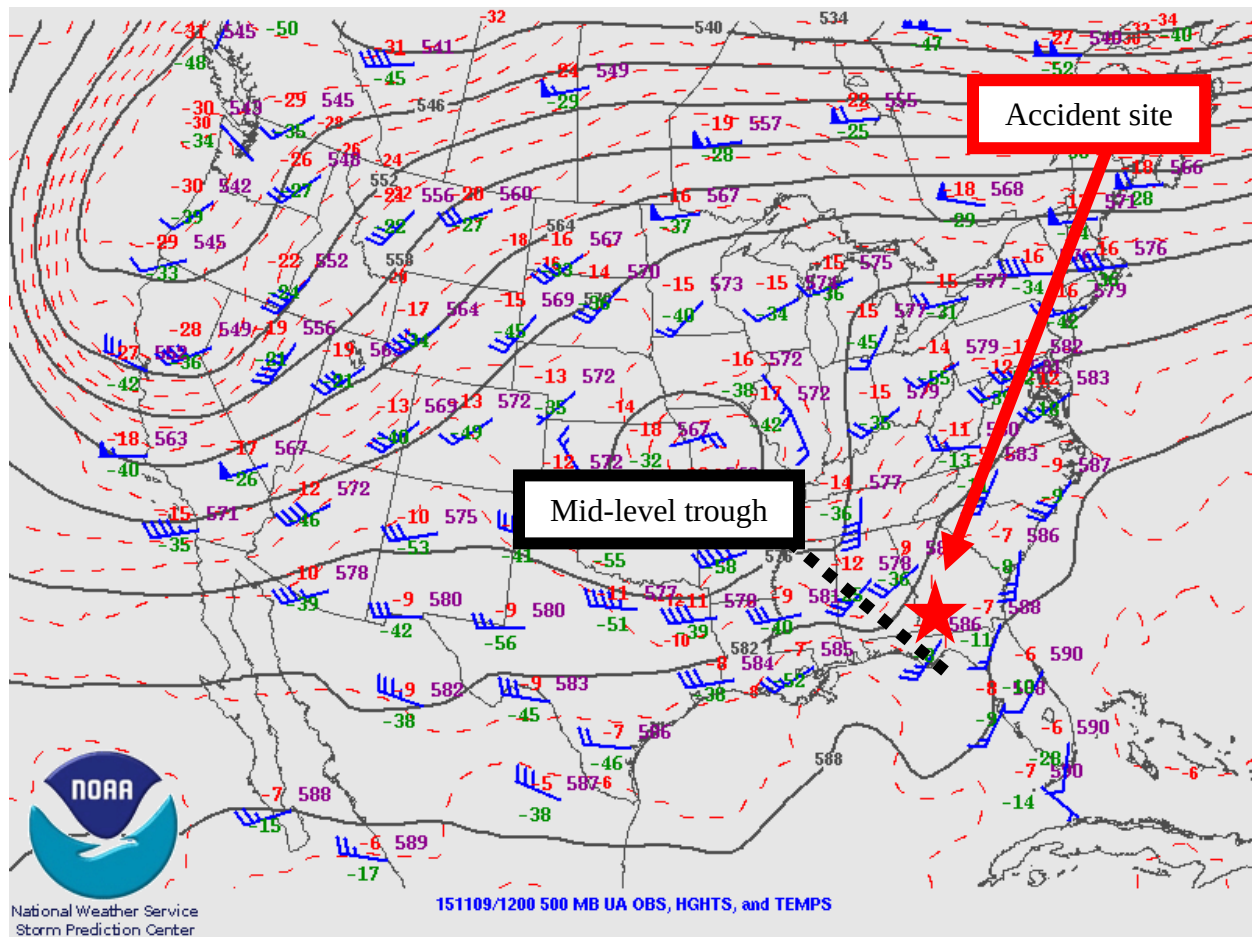


Figure 5 – 500-hPa Constant Pressure Chart for 0700 EST

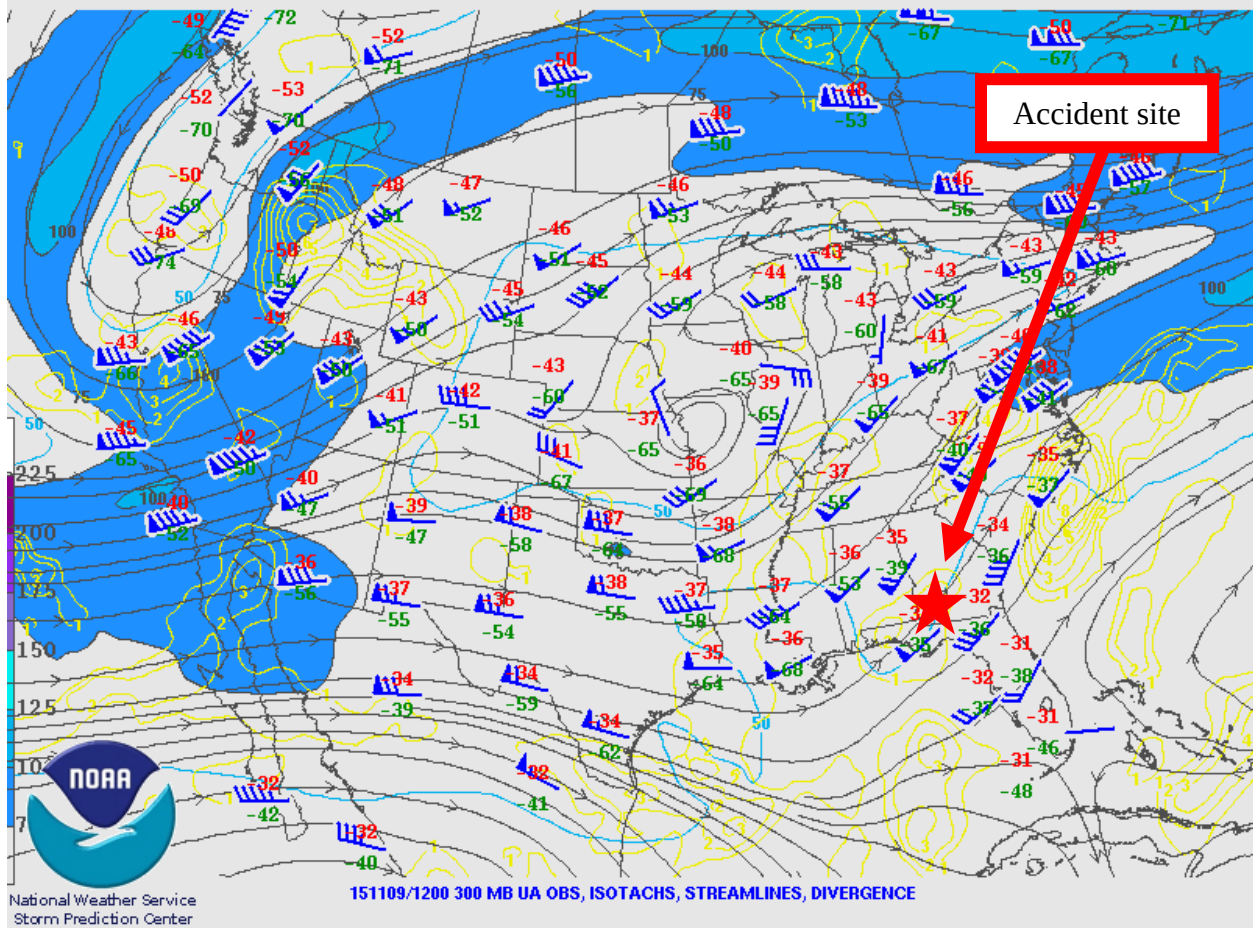


Figure 6 – 300-hPa Constant Pressure Chart for 0700 EST

2.0 Storm Prediction Center Products

SPC issued the following Day 1 Convective Outlook at 0740 EST (figure 7) with areas of general (non-severe) thunderstorms forecast for the accident site during the accident day:

SPC AC 091240

DAY 1 CONVECTIVE OUTLOOK
NWS STORM PREDICTION CENTER NORMAN OK
0640 AM CST MON NOV 09 2015

VALID 091300Z - 101200Z

...THERE IS A MRGL RISK OF SVR TSTMS ALONG THE NC COAST...

...SUMMARY...

A MARGINAL THREAT FOR A BRIEF TORNADO WILL EXIST ALONG THE NORTH CAROLINA COAST TODAY INTO TONIGHT.

...SYNOPSIS...

A POWERFUL MID TO UPPER-LEVEL TROUGH ALONG THE PACIFIC COAST WILL

PROGRESS EWD/SEWD INTO THE INTERIOR WEST WHILE A DOWNSTREAM CLOSED LOW ALONG THE KS-MO BORDER EVOLVES INTO AN OPEN WAVE OVER THE OH VALLEY. THE LATTER UPPER-AIR SYSTEM WILL BE LOOSELY LINKED TO A LOW-LATITUDE TROUGH WHICH WILL PROGRESS THROUGH THE SERN U.S.

AT THE SURFACE...AN AREA OF LOW PRESSURE OBSERVED OVER THE NERN GULF OF MEXICO THIS MORNING WILL WEAKEN WHILE DEVELOPING NEWD ALONG AN ASSOCIATED FRONT WHICH WILL ATTEMPT TO PIVOT NWWD THROUGH SERN GA AND ONTO THE SC/NC COASTS. ELSEWHERE...A BROAD AREA OF LOW PRESSURE OVER THE NRN HIGH PLAINS WILL CONSOLIDATE INTO A DEEPENING CYCLONE WHICH WILL LINK WITH A LEE TROUGH STRETCHING SWD TO ALONG THE NM-TX BORDER.

...COASTAL CAROLINAS...

VARIABILITY EXISTS IN LATEST MODEL GUIDANCE WITH REGARD TO THE TRACK AND STRENGTH OF THE SURFACE LOW MENTIONED ABOVE...HOW FAR INLAND THE ASSOCIATED FRONT WILL DEVELOP OVER THE CAROLINAS...AND CHARACTERISTICS OF A POSSIBLE SECONDARY LOW WHICH MAY FORM ALONG THE FRONT OVER ERN NC TONIGHT. BASED ON CURRENT MOSAIC RADAR DATA WHICH INDICATE CONSIDERABLE CONVECTION ALREADY PRESENT ALONG THE LENGTH OF THE FRONT...ITS INLAND PROGRESS MAY BE IMPEDED...ESPECIALLY SINCE THE UPSTREAM CYCLONE WILL BE FILLING.

WEAK LAPSE RATES ARISING FROM THE WIDESPREAD CLOUDS AND PRECIPITATION WILL LIMIT THE POTENTIAL FOR ANY MORE THAN MEAGER BUOYANCY TO DEVELOP. AND WHILE A BRIEF TORNADO AND/OR WATERSPOUT IS POSSIBLE INVOF THE SURFACE FRONT WHERE LOW-LEVEL SHEAR IS MAXIMIZED...ORGANIZED SEVERE WEATHER POTENTIAL SHOULD REMAIN QUITE LOW.

..MEAD/COOK.. 11/09/2015

CLICK TO GET WUUS01 PTSDY1 PRODUCT

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 1630Z

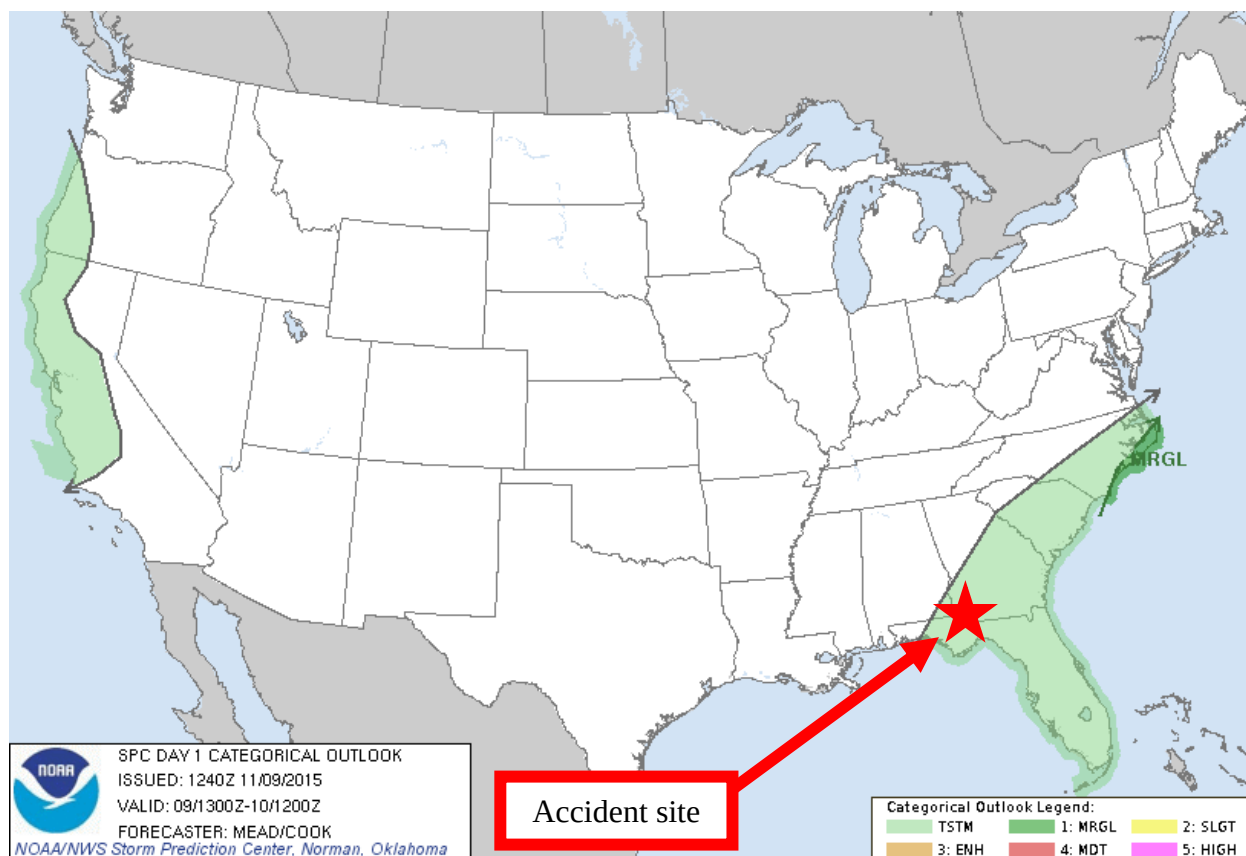
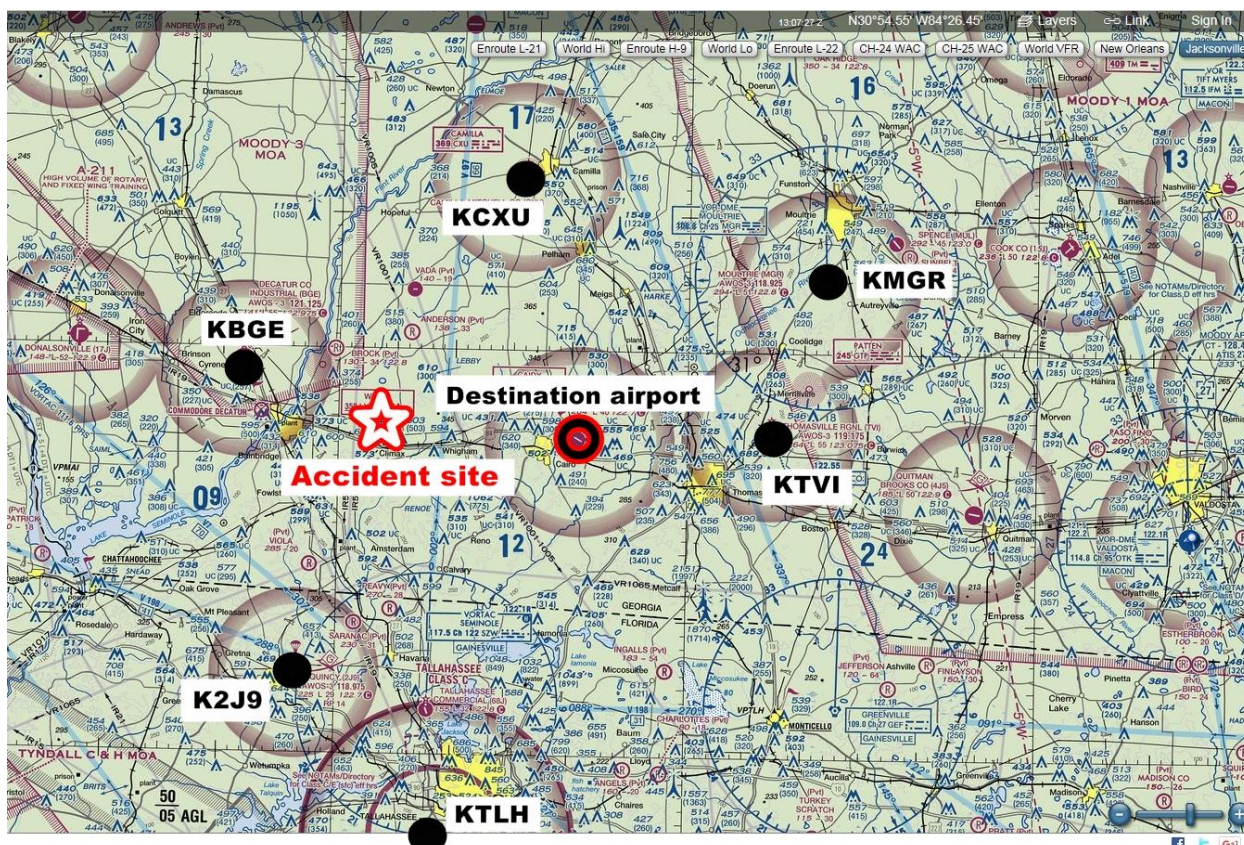


Figure 7 – Storm Prediction Center day 1 Convective Outlook valid at the time of the accident

3.0 Surface Observations

The area surrounding the accident site was documented utilizing official NWS Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language with visibility reported in statute miles for this section.



Decatur County Industrial Air Park (KBGE) was the closest official weather station to the accident site located 6 miles northwest of Bainbridge, Georgia, and had an Automated Weather Observing System (AWOS₃) whose reports were not supplemented. KBGE was located 11 miles west-northwest of the accident site, at an elevation of 141 feet, and had a 4° westerly magnetic variation⁴ (figure 8). The following observations were taken and disseminated during the times surrounding the accident:⁵

[0835 EST] KBGE 091335Z AUTO 05009G14KT 10SM OVC004 15/15 A3002 RMK AO2=

[0855 EST] KBGE 091355Z AUTO 01009G15KT 10SM OVC004 15/15 A3003 RMK AO2=

[0915 EST] KBGE 091415Z AUTO 03005KT 10SM OVC004 15/15 A3004 RMK AO2=

[0935 EST] KBGE 091435Z AUTO 03009KT 5SM -RA OVC004 15/15 A3003 RMK AO2=

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.

5 The bold sections in this NWS product and the rest of products in the weather factual report are to highlight the individual sections that directly reference the weather conditions that are or will affect the accident location around the accident time.

[0955 EST] KBGE 091455Z AUTO 04007KT 5SM BR OVC004 15/15 A3004 RMK AO2=

[1015 EST] KBGE 091515Z AUTO 05010KT 3SM BR OVC004 16/15 A3004 RMK AO2=

ACCIDENT TIME 1017 EST

[1035 EST] KBGE 091535Z AUTO 05008KT 2SM BR OVC004 15/15 A3004 RMK AO2=

***[1055 EST] KBGE 091555Z AUTO 05008KT 1 1/2SM BR OVC004 16/15 A3003 RMK
AO2=***

[1115 EST] KBGE 091615Z AUTO 04007KT 2SM BR OVC004 16/15 A3003 RMK AO2=

[1135 EST] KBGE 091635Z AUTO 05008KT 2SM BR OVC004 15/15 A3002 RMK AO2=

***[1155 EST] KBGE 091655Z AUTO 03006KT 2 1/2SM BR OVC004 15/15 A3002
RMK AO2=***

KBGE weather at 0955 EST was reported as wind from 040° at 7 knots, 5 miles visibility, mist, an overcast ceiling at 400 feet above ground level (agl), temperature of 15° C, dew point temperature of 15° C, and an altimeter setting of 30.04 inches of mercury. Remarks, automated station with precipitation discriminator.

KBGE weather at 1015 EST was reported as wind from 050° at 10 knots, 3 miles visibility, mist, an overcast ceiling at 400 feet agl, temperature of 16° C, dew point temperature of 15° C, and an altimeter setting of 30.04 inches of mercury. Remarks, automated station with precipitation discriminator.

KBGE weather at 1035 EST was reported as wind from 050° at 8 knots, 2 miles visibility, mist, an overcast ceiling at 400 feet agl, temperature of 15° C, dew point temperature of 15° C, and an altimeter setting of 30.04 inches of mercury. Remarks, automated station with precipitation discriminator.

KBGE weather at 1055 EST was reported as wind from 050° at 8 knots, 1 and a half miles visibility, mist, an overcast ceiling at 400 feet agl, temperature of 16° C, dew point temperature of 15° C, and an altimeter setting of 30.03 inches of mercury. Remarks, automated station with precipitation discriminator.

Thomasville Regional Airport (KTVI) was the closest official weather station to the destination airport located 6 miles northeast of Thomasville, Georgia, and had an AWOS whose reports were not supplemented. KTVI was located 29 miles east of the accident site, at an elevation of 264 feet, and had a 2° westerly magnetic variation. The following observations were taken and disseminated during the times surrounding the accident:

[0835 EST] KTVI 091335Z AUTO 11008KT 10SM -RA OVC004 15/15 A3002
RMK AO2 LTG DSNT S AND SW=

[0855 EST] KTVI 091355Z AUTO 13011G16KT 7SM -RA OVC004 16/16 A3001
RMK AO2=

[0915 EST] KTVI 091415Z AUTO 12005G10KT 5SM RA OVC004 16/16 A3002
RMK AO2=

[0935 EST] KTVI 091435Z AUTO 33008KT 7SM RA OVC004 16/16 A3005 RMK
AO2 LTG DSNT S AND SW=

***[0955 EST] KTVI 091455Z AUTO 36007KT 7SM -RA BKN004 OVC008 16/16 A3006
RMK AO2=***

[1015 EST] KTVI 091515Z AUTO 36004KT 10SM -DZ OVC008 17/17 A3005 RMK AO2=

ACCIDENT TIME 1017 EST

[1035 EST] KTVI 091535Z AUTO 02004KT 10SM OVC008 17/17 A3004 RMK AO2=

***[1055 EST] KTVI 091555Z AUTO 01003KT 10SM BKN003 OVC008 17/17 A3004
RMK AO2 LTG DSNT E=***

[1115 EST] KTVI 091615Z AUTO 04004KT 10SM OVC003 17/17 A3003 RMK AO2=

[1135 EST] KTVI 091635Z AUTO 02005KT 10SM OVC003 17/17 A3003 RMK AO2=

[1155 EST] KTVI 091655Z AUTO 04007KT 10SM OVC003 17/17 A3002 RMK AO2=

KTVI weather at 0955 EST was reported as wind from 360° at 7 knots, 7 miles visibility, light rain, a broken ceiling at 400 feet agl, overcast skies at 800 feet agl, temperature of 16° C, dew point temperature of 16° C, and an altimeter setting of 30.06 inches of mercury. Remarks, automated station with precipitation discriminator.

KTVI weather at 1015 EST was reported as wind from 360° at 4 knots, 10 miles visibility, light drizzle, an overcast ceiling at 800 feet agl, temperature of 17° C, dew point temperature of 17° C, and an altimeter setting of 30.05 inches of mercury. Remarks, automated station with precipitation discriminator.

KTVI weather at 1035 EST was reported as wind from 020° at 4 knots, 10 miles visibility, an overcast ceiling at 800 feet agl, temperature of 17° C, dew point temperature of 17° C, and an altimeter setting of 30.04 inches of mercury. Remarks, automated station with precipitation discriminator.

KTVI weather at 1055 EST was reported as wind from 010° at 3 knots, 10 miles visibility, a broken ceiling at 300 feet agl, overcast skies at 800 feet agl, temperature of 17° C, dew point temperature of 17° C, and an altimeter setting of 30.04 inches of mercury. Remarks, automated station with precipitation discriminator, lightning distant⁶ east.

Camilla-Mitchell County Airport (KCXU) was located 2 miles southwest of Camilla, Georgia, and had an AWOS whose reports were not supplemented. KCXU was located 21 miles northeast of the accident site, at an elevation of 176 feet, and had a 5° westerly magnetic variation (figure 8). The following observations were taken and disseminated during the times surrounding the accident:

[0835 EST] KCXU 091335Z AUTO 02003KT 10SM BKN004 OVC008 14/14
A3005 RMK AO2 T01440144=

[0855 EST] KCXU 091355Z AUTO 00000KT 10SM BKN003 OVC008 14/14
A3005 RMK AO2 T01420142=

[0915 EST] KCXU 091415Z AUTO 02005KT 7SM OVC003 14/14 A3006 RMK
AO2 T01410141=

[0935 EST] KCXU 091435Z AUTO 03003KT 7SM OVC003 14/14 A3006 RMK
AO2 T01400140=

***[0955 EST] KCXU 091455Z AUTO 02003KT 7SM OVC003 14/14 A3006 RMK
AO2 T01370137=***

***[1015 EST] KCXU 091515Z AUTO 05003KT 5SM OVC003 14/14 A3006 RMK
AO2 T01400140=***

ACCIDENT TIME 1017 EST

***[1035 EST] KCXU 091535Z AUTO 03005KT 4SM OVC003 14/14 A3005 RMK
AO2 T01370137=***

***[1055 EST] KCXU 091555Z AUTO 00000KT 4SM OVC003 14/14 A3005 RMK
AO2 T01370137=***

[1115 EST] KCXU 091615Z AUTO 04003KT 4SM OVC003 14/14 A3004 RMK
AO2 T01400140=

[1135 EST] KCXU 091635Z AUTO 02004KT 5SM OVC003 14/14 A3004 RMK
AO2 T01400140=

⁶ Distant indicated that the lightning was beyond 10 miles but less than 30 miles from the center of the airport (or airport location point, ALP).

[1155 EST] KCXU 091655Z AUTO 05005KT 5SM OVC003 14/14 A3003 RMK
AO2 T01410141=

KCXU weather at 0955 EST was reported as wind from 020° at 3 knots, 7 miles visibility, an overcast ceiling at 300 feet agl, temperature of 14° C, dew point temperature of 14° C, and an altimeter setting of 30.06 inches of mercury. Remarks, automated station with precipitation discriminator, temperature 13.7° C, dew point temperature 13.7° C.

KCXU weather at 1015 EST was reported as wind from 050° at 3 knots, 5 miles visibility, an overcast ceiling at 300 feet agl, temperature of 14° C, dew point temperature of 14° C, and an altimeter setting of 30.06 inches of mercury. Remarks, automated station with precipitation discriminator, temperature 14.0° C, dew point temperature 14.0° C.

KCXU weather at 1035 EST was reported as wind from 030° at 5 knots, 4 miles visibility, an overcast ceiling at 300 feet agl, temperature of 14° C, dew point temperature of 14° C, and an altimeter setting of 30.05 inches of mercury. Remarks, automated station with precipitation discriminator, temperature 13.7° C, dew point temperature 13.7° C.

KCXU weather at 1055 EST was reported as wind calm, 4 miles visibility, an overcast ceiling at 300 feet agl, temperature of 14° C, dew point temperature of 14° C, and an altimeter setting of 30.05 inches of mercury. Remarks, automated station with precipitation discriminator, temperature 13.7° C, dew point temperature 13.7° C.

Quincy Municipal Airport (K2J9) was located 2 miles northeast of Quincy, Florida, and had an AWOS whose reports were not supplemented. K2J9 was located 19 miles south-southwest of the accident site, at an elevation of 225 feet, and had a 1° westerly magnetic variation (figure 8). The following observations were taken and disseminated during the times surrounding the accident:

[0835 EST] K2J9 091335Z AUTO 1SM 18/18 A3000 RMK AO1=

[0855 EST] K2J9 091355Z AUTO 2 1/2SM 18/18 A3003 RMK AO1=

[0915 EST] K2J9 091415Z AUTO 8SM 18/17 A3004 RMK AO1=

[0935 EST] K2J9 091435Z AUTO 9SM 17/17 A3003 RMK AO1=

[0955 EST] K2J9 091455Z AUTO 4SM 17/17 A3003 RMK AO1=

[1015 EST] K2J9 091515Z AUTO 5SM 17/17 A3004 RMK AO1=

ACCIDENT TIME 1017 EST

[1035 EST] K2J9 091535Z AUTO 2SM 18/18 A3003 RMK AO1=

[1055 EST] K2J9 091555Z AUTO 10SM 18/18 A3002 RMK AO1=

[1115 EST] K2J9 091615Z AUTO 8SM 18/18 A3001 RMK AO1=

[1135 EST] K2J9 091635Z AUTO 4SM 18/18 A3001 RMK AO1=

[1155 EST] K2J9 091655Z AUTO 2SM 18/18 A3000 RMK AO1=

K2J9 weather at 0955 EST was reported as 4 miles visibility, temperature of 17° C, dew point temperature of 17° C, and an altimeter setting of 30.03 inches of mercury. Remarks, automated station without precipitation discriminator.

K2J9 weather at 1015 EST was reported as 5 miles visibility, temperature of 17° C, dew point temperature of 17° C, and an altimeter setting of 30.04 inches of mercury. Remarks, automated station without precipitation discriminator.

K2J9 weather at 1035 EST was reported as 2 miles visibility, temperature of 18° C, dew point temperature of 18° C, and an altimeter setting of 30.03 inches of mercury. Remarks, automated station without precipitation discriminator.

K2J9 weather at 1055 EST was reported as 10 miles visibility, temperature of 18° C, dew point temperature of 18° C, and an altimeter setting of 30.02 inches of mercury. Remarks, automated station without precipitation discriminator.

Moultrie Municipal Airport (KMGR) was located 6 miles south of Moultrie, Georgia, and had an AWOS whose reports were not supplemented. KMGR was located 35 miles east-northeast of the accident site, at an elevation of 294 feet, and had a 5° westerly magnetic variation (figure 8). The following observations were taken and disseminated during the times surrounding the accident:

[0835 EST] KMGR 091335Z AUTO 10009KT 3SM RA OVC002 15/15 A3002
RMK AO2 LTG DSNT S AND SW=

[0855 EST] KMGR 091355Z AUTO 11008KT 4SM RA OVC002 15/15 A3001
RMK AO2 LTG DSNT SW=

[0915 EST] KMGR 091415Z AUTO 31006KT 7SM RA OVC002 16/15 A3006
RMK AO2 LTG DSNT SW=

[0935 EST] KMGR 091435Z AUTO 00000KT 10SM -RA OVC002 16/15 A3006
RMK AO2 LTG DSNT SW=

**[0955 EST] KMGR 091455Z AUTO 35003KT 10SM -DZ BKN004 OVC010 16/15
A3006 RMK AO2=**

**[1015 EST] KMGR 091515Z AUTO 02003KT 10SM -RA BKN004 OVC010 16/15
A3005 RMK AO2=**

ACCIDENT TIME 1017 EST

***[1035 EST] KMGR 091535Z AUTO 01003KT 10SM BKN002 OVC010 16/16 A3005
RMK AO2=***

[1055 EST] KMGR 091555Z AUTO 02007KT 10SM OVC004 16/16 A3004 RMK AO2=

[1115 EST] KMGR 091615Z AUTO 02006KT 10SM OVC004 16/15 A3004 RMK AO2=

[1135 EST] KMGR 091635Z AUTO 04007KT 10SM OVC004 16/15 A3004 RMK AO2=

[1155 EST] KMGR 091655Z AUTO 04005KT 10SM OVC004 15/14 A3004 RMK AO2=

KMGR weather at 0955 EST was reported as wind from 350° at 3 knots, 10 miles visibility, light drizzle, a broken ceiling at 400 feet agl, overcast skies at 1,000 feet agl, temperature of 16° C, dew point temperature of 15° C, and an altimeter setting of 30.06 inches of mercury. Remarks, automated station with precipitation discriminator.

KMGR weather at 1015 EST was reported as wind from 020° at 3 knots, 10 miles visibility, light rain, a broken ceiling at 400 feet agl, overcast skies at 1,000 feet agl, temperature of 16° C, dew point temperature of 15° C, and an altimeter setting of 30.05 inches of mercury. Remarks, automated station with precipitation discriminator.

KMGR weather at 1035 EST was reported as wind from 010° at 3 knots, 10 miles visibility, a broken ceiling at 200 feet agl, overcast skies at 1,000 feet agl, temperature of 16° C, dew point temperature of 16° C, and an altimeter setting of 30.05 inches of mercury. Remarks, automated station with precipitation discriminator.

KMGR weather at 1055 EST was reported as wind from 020° at 7 knots, 10 miles visibility, light drizzle, an overcast ceiling at 400 feet agl, temperature of 16° C, dew point temperature of 16° C, and an altimeter setting of 30.04 inches of mercury. Remarks, automated station with precipitation discriminator.

The observations from the surface observations sites around the accident site indicated LIFR⁷ to IFR⁸ ceilings around the accident site at the accident time. The cloud ceilings and visibility restrictions were persistent during the time of the pilot weather briefing, before the time of takeoff, accident time, and after the accident time.

⁷ Low Instrument Flight Rules – Refers to the general weather conditions pilots can expect at the surface. LIFR criteria means a ceiling below 500 feet agl and/or less than 1 miles visibility.

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

4.0 Upper Air Data

The closest official upper air sounding to the accident site was from Tallahassee, Florida, (KTLH), located 31 miles south-southeast of the accident site (figure 8), with a site number 72214, and an elevation of 59 feet. The 0700 EST sounding from KTLH was plotted on a standard Skew-T log P diagram⁹ with the derived stability parameters included in figure 9 (with data from the surface to 650-hPa, or 12,000 feet msl.) This data was analyzed utilizing the RAOB¹⁰ software package. The sounding depicted the Lifted Condensation Level (LCL)¹¹ at 184 feet msl, a Convective Condensation Level (CCL)¹² of 5,214 feet, and a Level of Free Convection (LFC)¹³ at 184 feet. The freezing level was located at 14,654 feet. The precipitable water value was 2.17 inches.

⁹ 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.

¹⁰ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

¹¹ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹² Convective Condensation Level (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.

¹³ Level of Free Convection (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.

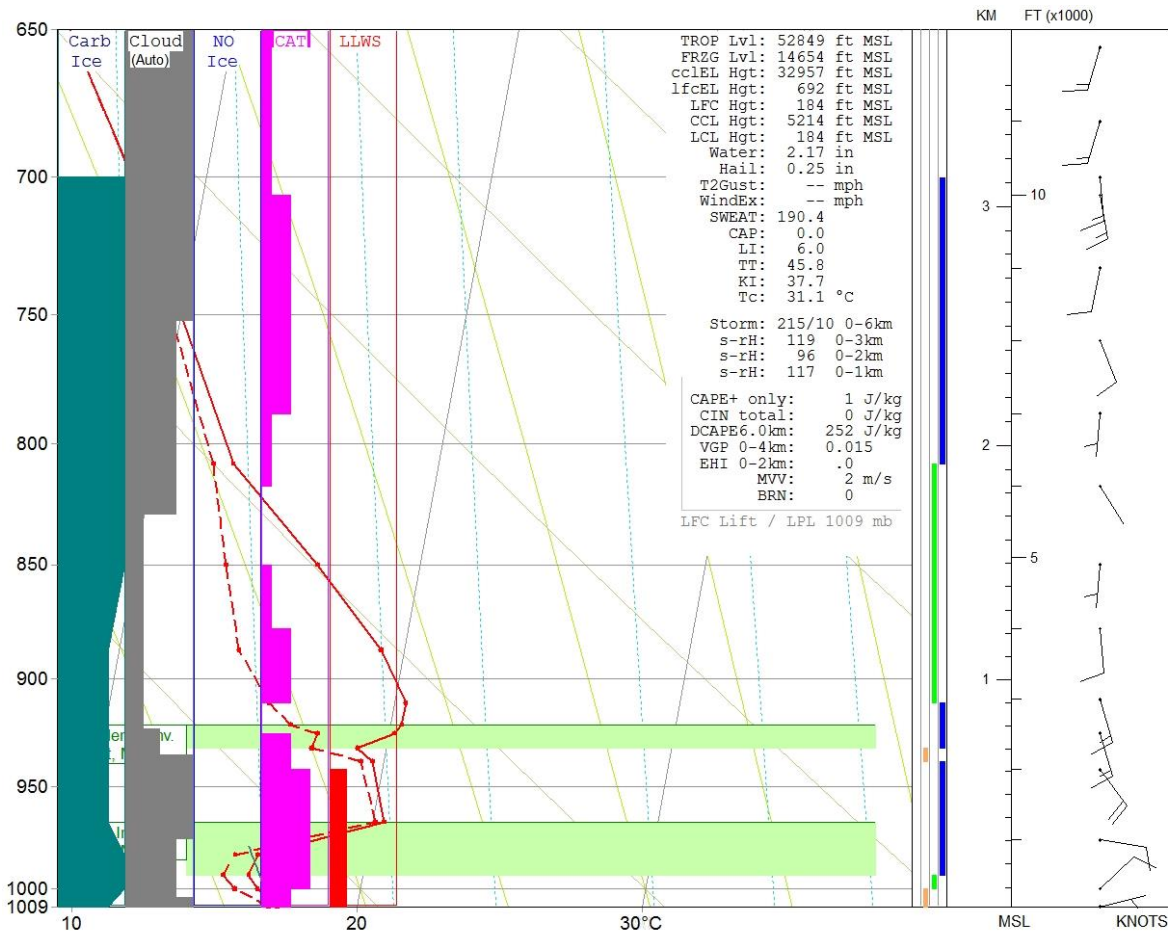


Figure 9 – 0700 EST KTLH sounding

The 0700 EST KTLH sounding indicated a very moist vertical environment from the surface through 3,000 feet msl, with a relatively dry layer from 3,000 feet to 5,500 feet msl, then another moist layer from 5,500 through 12,000 feet msl. The vertical environment had record moisture for that date with the 2.17 inches of precipitable water.¹⁴ In addition, 2.17 inches of precipitable water was the third highest precipitable water value for all of November with records going back to 1948 for the 1200 UTC balloon soundings. This environment would have been conducive of cloud formation as indicated by RAOB from the surface to 3,000 feet, with scattered layered clouds from 3,000 to 5,500 feet, then another solid cloud layer from 5,500 through 12,000 feet msl. No icing was indicated by RAOB below 10,000 feet. There was an inversion at 1,000 feet and inversions can make it difficult for any cloud layer to dissipate throughout the day.

¹⁴ Data taken from the SPC Sounding Climatology Page where 2.17 inches is above the 90 percentile moving average and above the max moving average for the 1200 UTC sounding data going back to 1991 from KTLH and back to 1948 for KAQQ/KAFF.

The sounding wind profile indicated there was a surface wind from 075° at 3 knots and the wind remained out of the east to northeast around 10 knots below 1,000 feet msl. Above 1,000 feet msl the wind turned around to the south and increased in speed to 20 knots by 2,000 feet msl. The wind remained out of the south at or below 20 knots through 12,000 feet msl. Low-level wind shear (LLWS) was indicated by RAOB in the lowest 2,000 feet due to the wind speed increase and change in wind direction with height. Several layers of possible clear-air turbulence were identified by RAOB from the surface through 12,000 feet.

5.0 Satellite Data

Visible and infrared data from the Geostationary Operational Environmental Satellite number 13 (GOES-13) was obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison (UW) in Madison, Wisconsin, and processed using the Safety Board's Man-computer Interactive Data Access System (McIDAS) software. Visible and infrared imagery (GOES-13 bands 1 and 4) at a wavelength of 0.65 microns (μm) and 10.7 μm retrieved brightness temperatures for the scene. Satellite imagery surrounding the time of the accident, from 0800 EST through 1200 EST 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-13 visible imagery from 0945 and 1015 EST at 2X magnification with the accident site highlighted with a red square. Inspection of the visible imagery indicated a general west to east movement of the clouds over the accident site at the accident time with several layers of clouds. Figure 12 presents the GOES-13 infrared imagery from 1015 EST at 6X magnification with the accident site highlighted with a red square. Inspection of the infrared imagery indicated abundant clouds over the accident site at the accident time. The more enhanced bands (yellows and greens, higher cloud tops) were over and to east of the accident site around the accident time. Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the 0700 EST KTLH sounding, the approximate cloud-top heights over the accident site were 13,000 feet at 1015 EST.

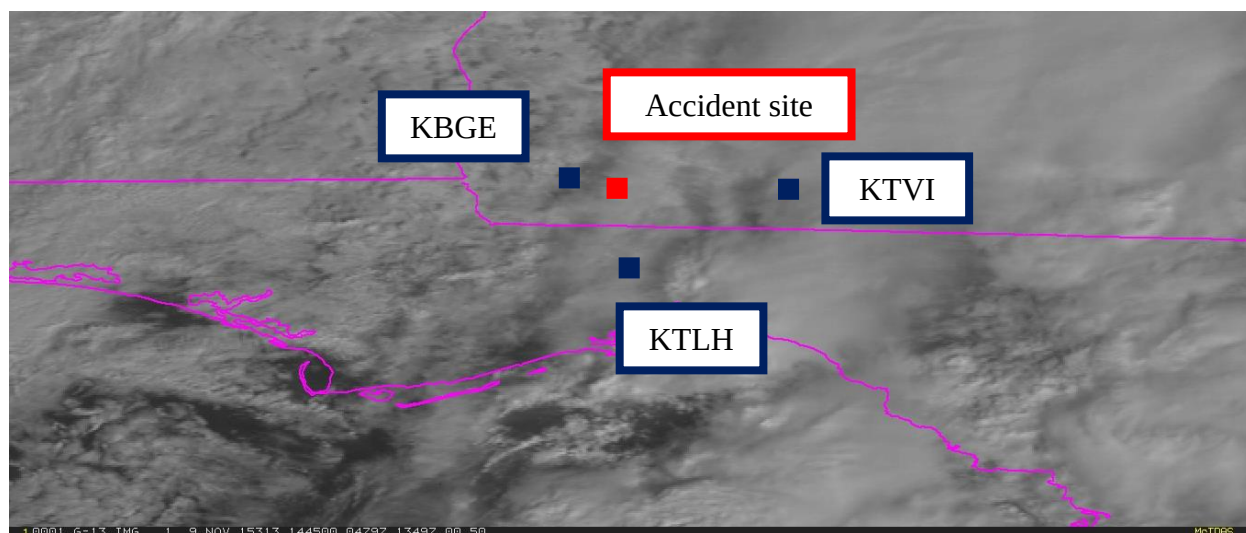


Figure 10 – GOES-13 visible image at 0945 EST

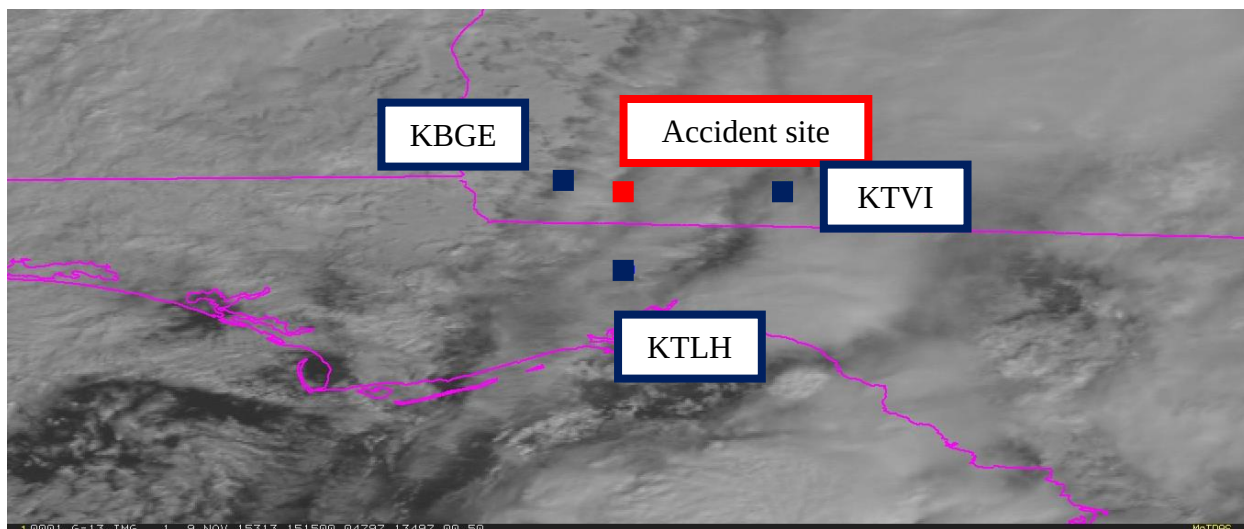


Figure 11 – GOES-13 visible image at 1015 EST

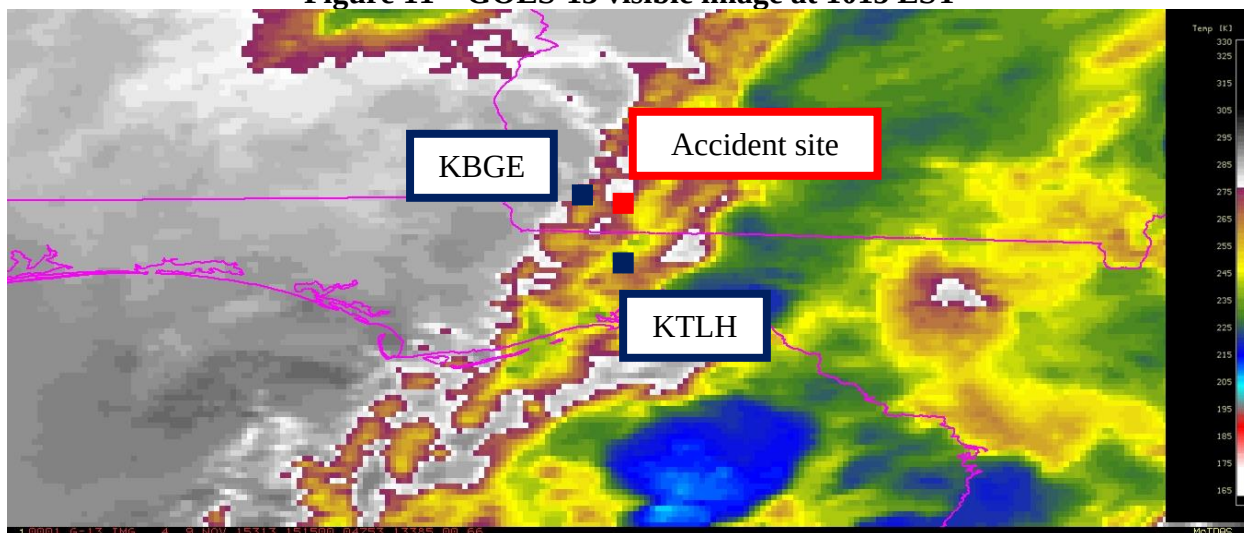


Figure 12 – GOES-13 infrared image at 1015 EST

6.0 Radar Imagery Information

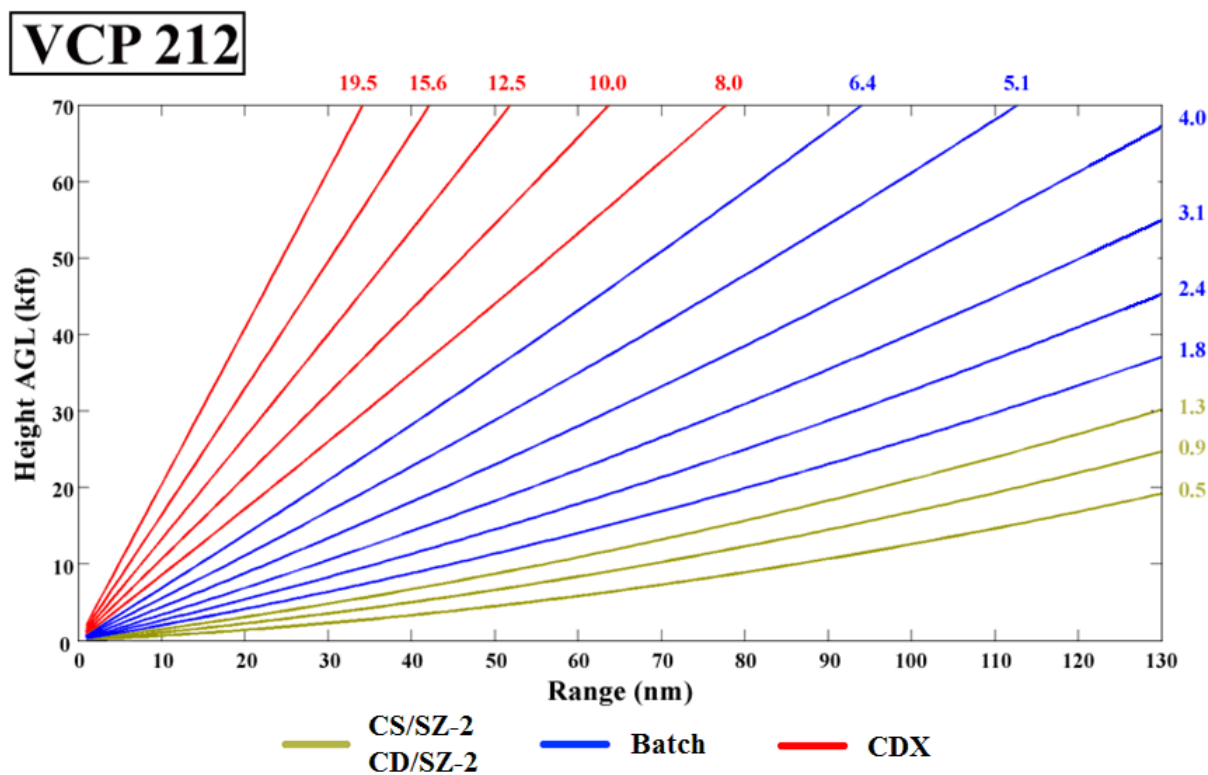
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)¹⁵ was KTLH. Level II and III archive radar data was obtained from the NCDC utilizing the NEXRAD Data Inventory Search and displayed using the NOAA's Weather and Climate Toolkit software.

¹⁵ 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.

6.1 Volume Scan Strategy

The WSR-88D is a computer-controlled radar system, which automatically creates a complete series of specific scans in a specific sequence known as a volume scan. Individual elevation scans are immediately available on the WSR-88D's Principle Users Processor (PUP). Products that require data from multiple elevation scans are not available until the end of the five to ten minute volume scan.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has three common scanning strategies. The most common is where the radar makes 14 elevation scans from 0.5° to 19.5° every four and a half minutes. This particular scanning strategy is documented as volume coverage pattern 212 (VCP-212). Mode B is the clear-air mode, where the radar makes 5 elevation scans during a ten minute period. During the period surrounding the accident, the KTLH WSR-88D radar was operating in the precipitation mode (Mode A, VCP-212). The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.



VCP-212 Precipitation Mode Scan Strategy

6.2 Beam Height Calculation

Assuming standard refraction¹⁶ of the WSR-88D 0.95° wide radar beam, the following table shows the approximate beam height and width¹⁷ information¹⁸ of the radar display over the site of the accident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.5°	2,400 feet	870 feet	3,930 feet	3,060 feet

Based on the radar height calculations, the 0.5° elevation scan depicted the conditions between 870 feet and 3,930 feet msl over the accident site at the accident time and these are the closest altitudes to the accident site.¹⁹

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors²⁰ it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ²¹), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

¹⁶ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

¹⁷ Beam width – A measure of the angular width of a radar beam.

¹⁸ Beamwidth values are shown for legacy resolution products. Super resolution products would an effective beamwidth that would be approximately half these values.

¹⁹ For more information see the ATC data contained in the docket for this accident.

²⁰ Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glazed ice.

²¹ dBZ – A non-dimensional "unit" of radar reflectivity which represents a logarithmic power ratio (in decibels , or dB) with respect to radar reflectivity factor, Z.

NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0	< 5	
	1	5 to 9	
	2	10 to 14	
1 Very Light	3	15 to 19	.01 in/hr
	4	20 to 24	.02 in/hr
	5	25 to 29	.04 in/hr
2 Light to Moderate	6	30 to 34	.09 in/hr
	7	35 to 39	.21 in/hr
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr
6 Extreme	11	55 to 59	>5.67 in/hr
	12	60 to 64	
	13	65 to 69	
	14	70 to 74	
	15	> 75	

FAA Advisory Circular AC 00-24B, “Thunderstorms,” dated January 2, 1983, also defines the echo intensity levels and potential weather phenomena associated with those levels. If the maximum VIP Level is 1 “weak” and 2 “moderate”, then light to moderate turbulence is possible with lightning. VIP Level 3 is “strong” and severe turbulence is possible with lightning. VIP Level 4 is “very heavy” and severe turbulence is likely with lightning. VIP Level 5 is “intense” with severe turbulence, lightning, hail likely, and organized surface wind gusts. VIP Level 6 is “extreme” with severe turbulence, lightning, large hail, extensive surface wind gusts and turbulence.

6.4 Base Reflectivity and Lightning Data

Figures 13, 14, 15, 16, 17, 18, 19, and 20 present the KTLH WSR-88D base reflectivity images for the 0.5° elevation scan with a resolution of 0.5° X 250 m at 0947, 0952, 0952, 1006, 1016, 1018, 1021, 1023 EST. The accident flight did not fly through any base reflectivity values above 0 dBZ throughout the flight after 0947 EST. A developing rain shower is indicated by figures 17 through 20 right at the end of the accident flight track right around the accident time. There were no lightning strikes near the accident site at the accident time.

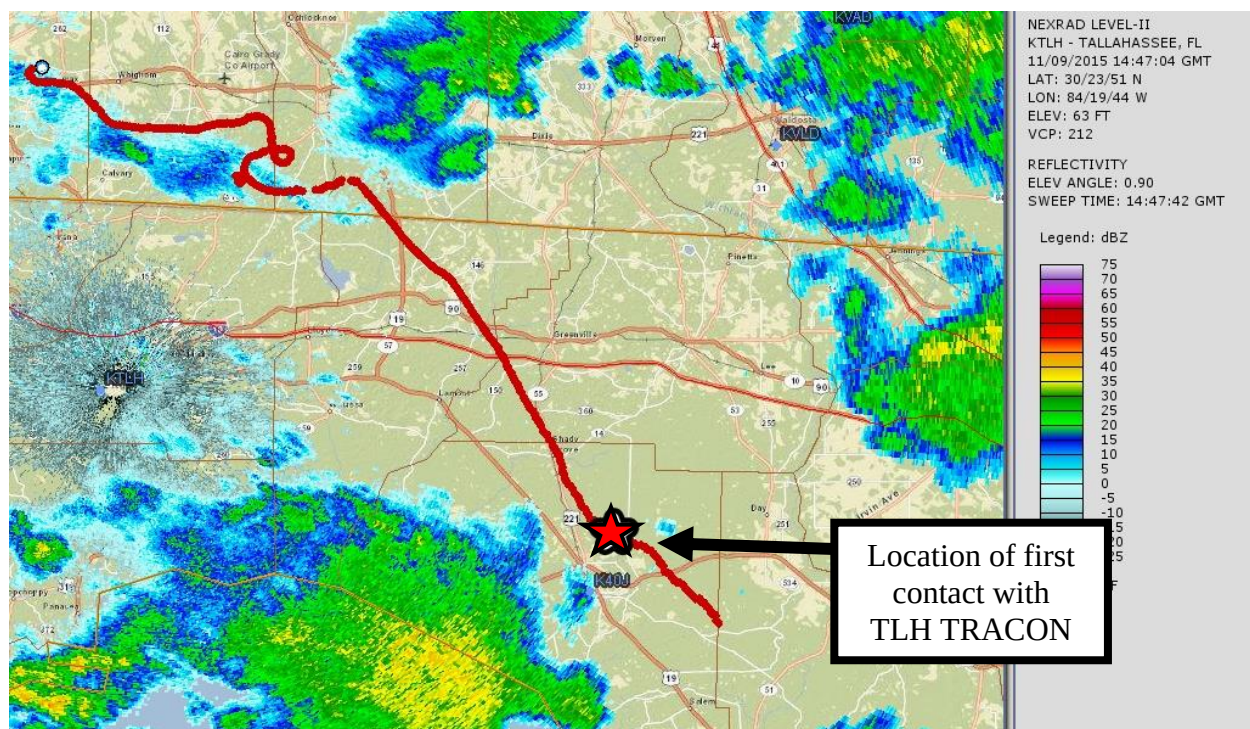


Figure 13 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 0947 EST with accident flight track

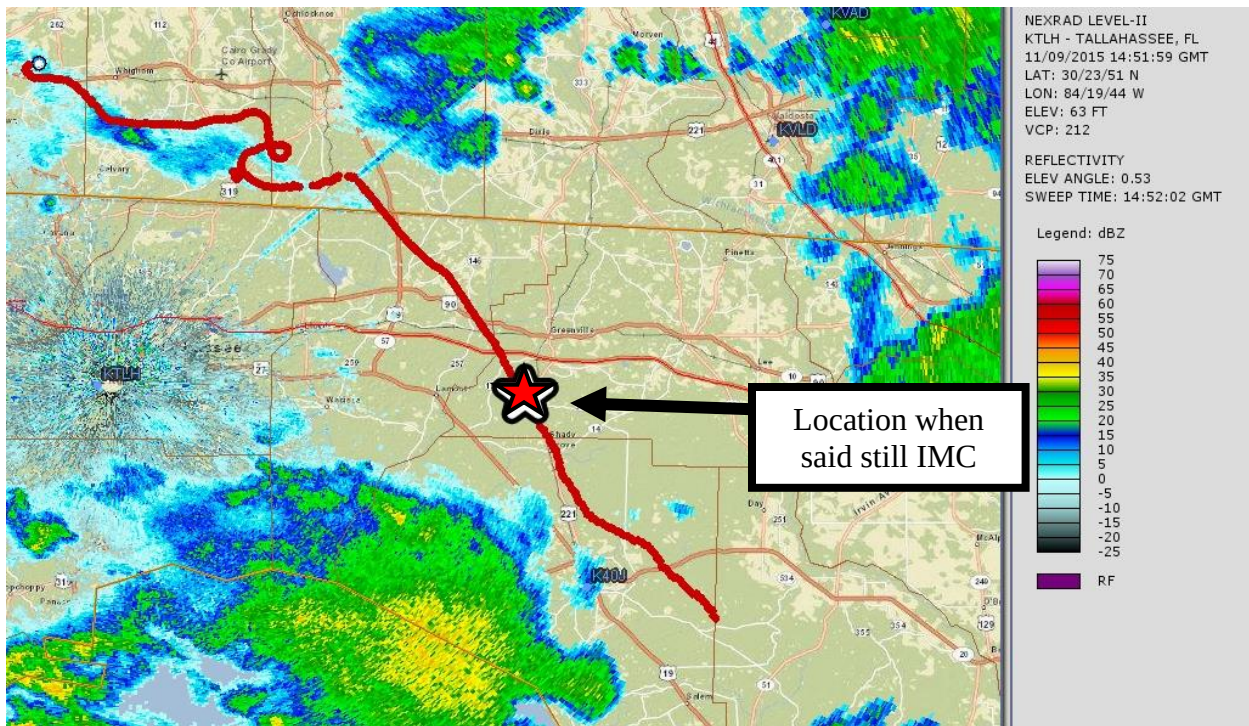


Figure 14 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 0952 EST with accident flight track

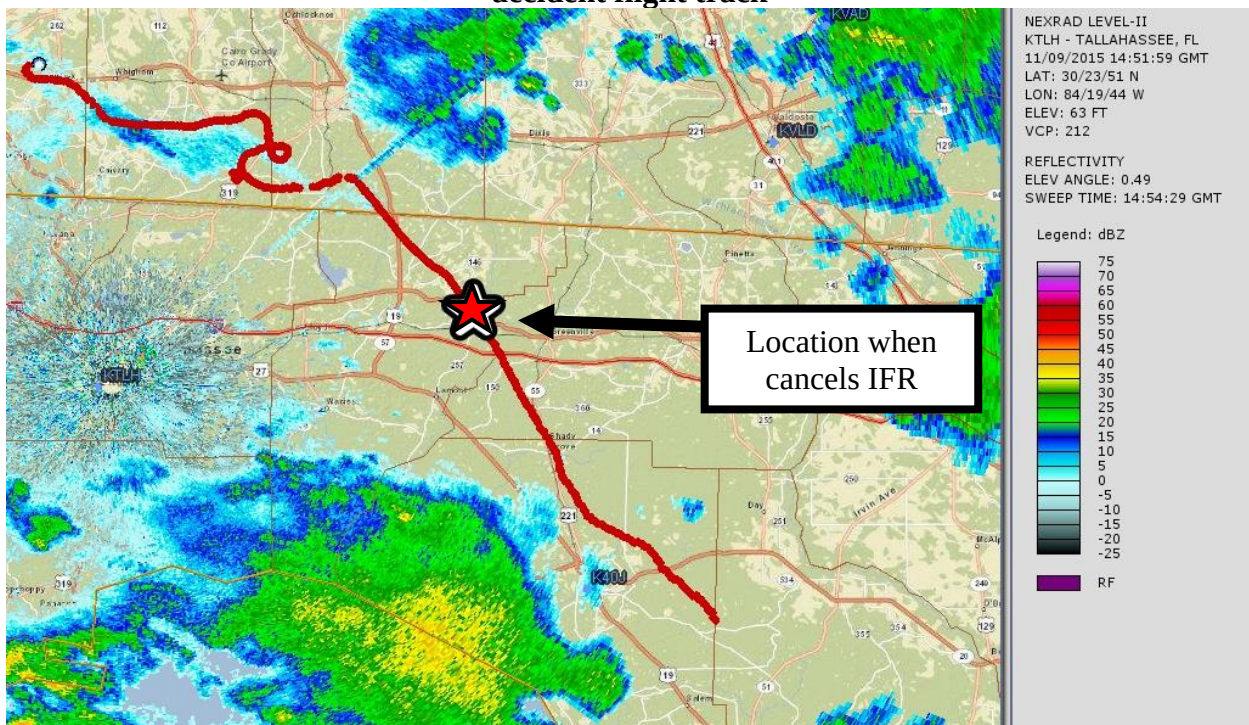


Figure 15 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 0952 EST with accident flight track

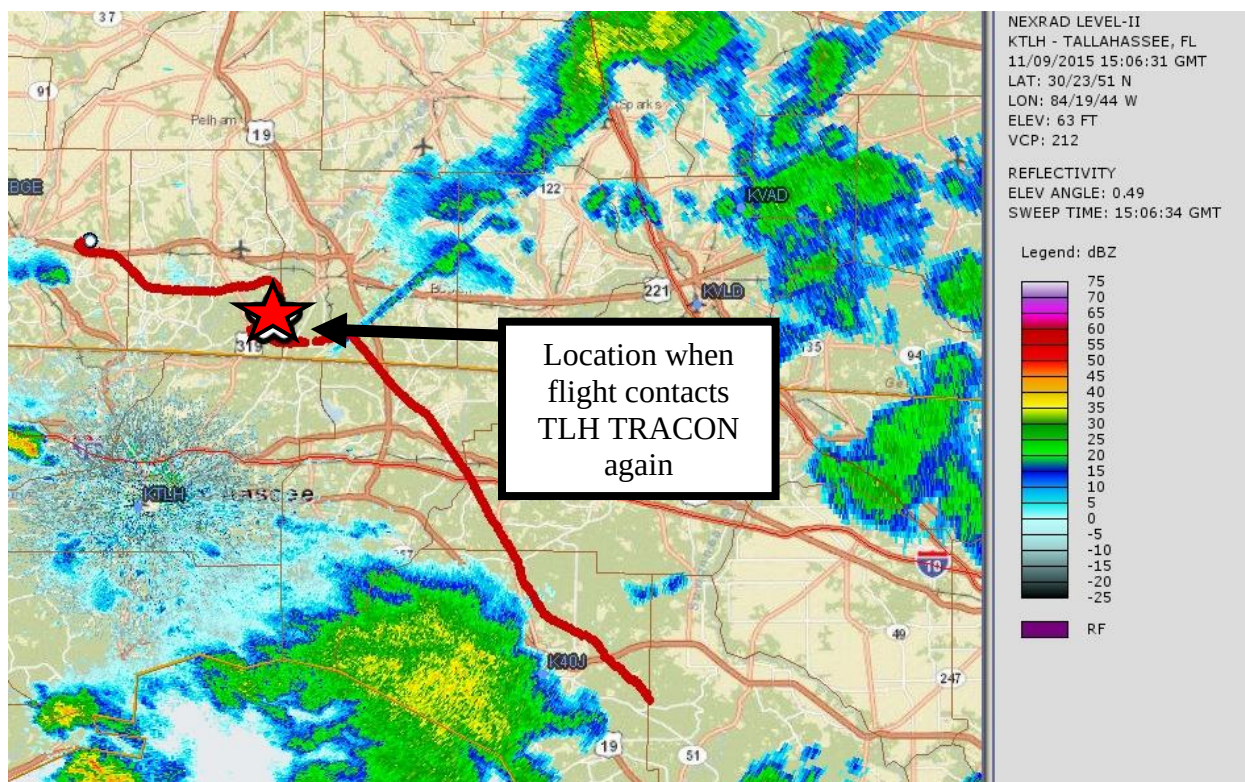


Figure 16 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 1006 EST with accident flight track

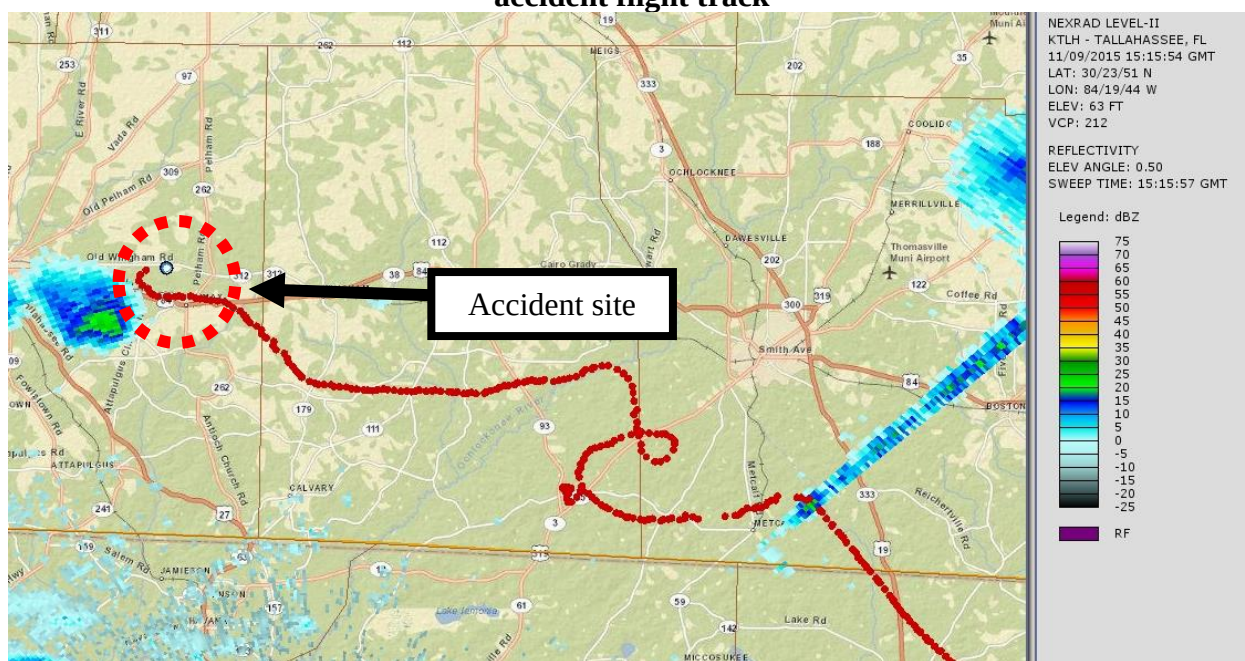


Figure 17 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 1016 EST with accident flight track

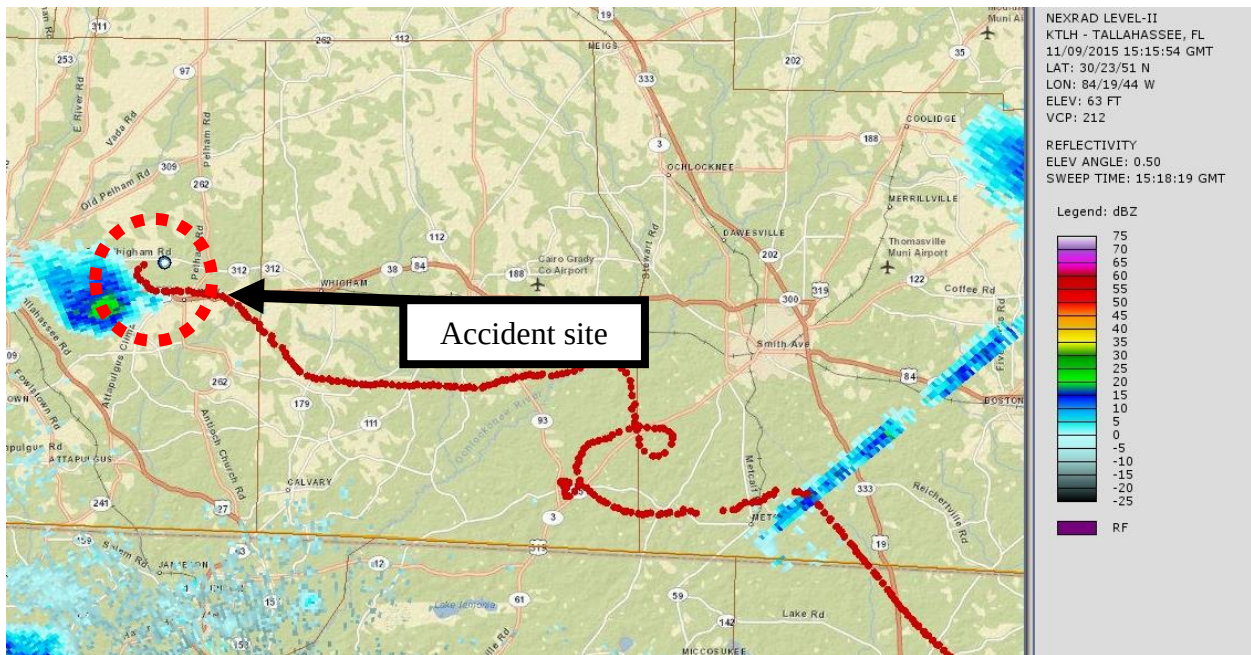


Figure 18 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 1018 EST with accident flight track

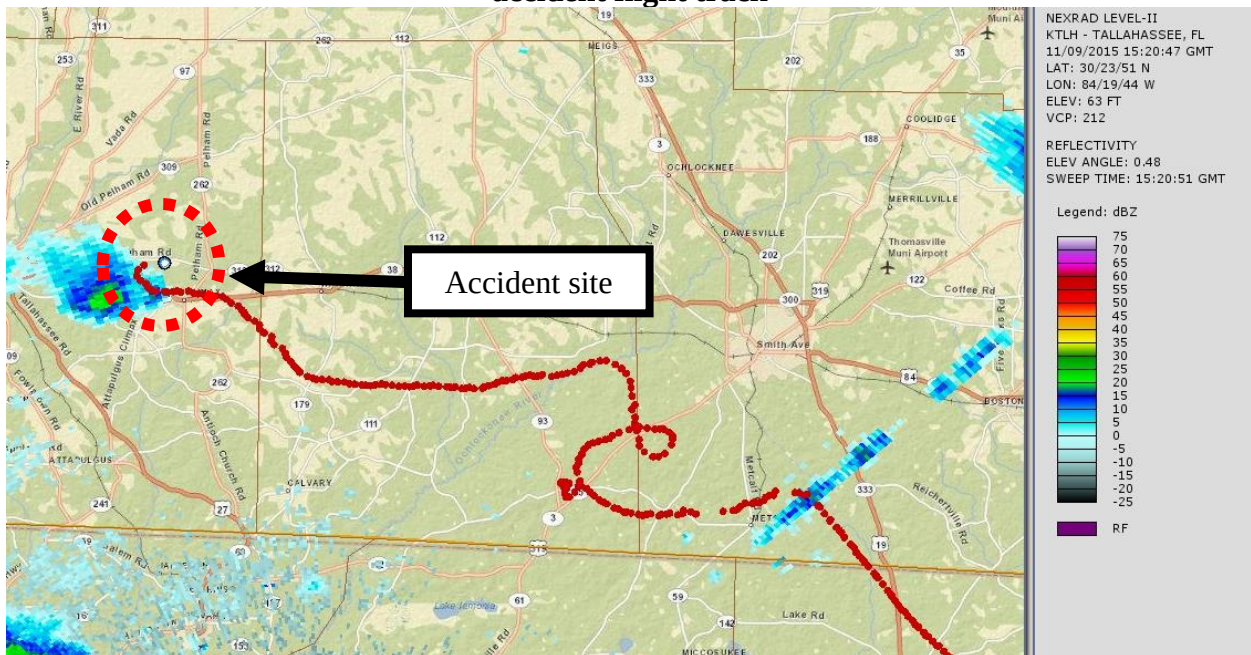


Figure 19 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 1021 EST with accident flight track

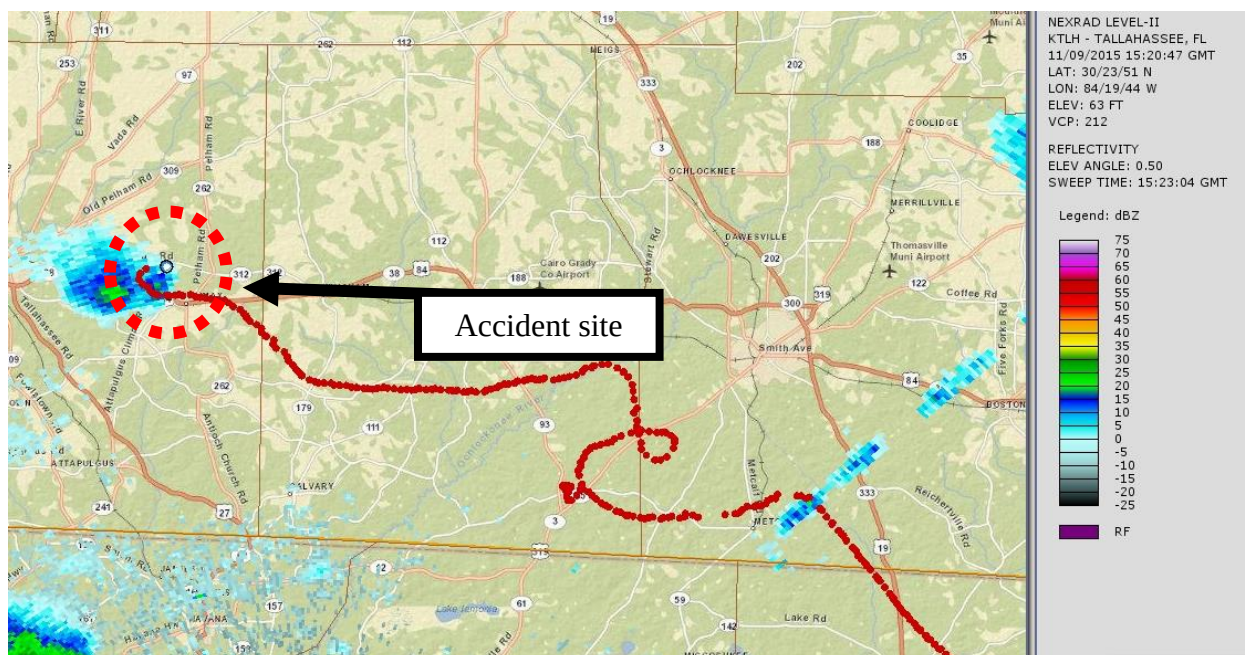


Figure 20 – KTLH WSR-88D reflectivity for the 0.5° elevation scan initiated at 1023 EST with accident flight track

7.0 Pilot Reports

All pilot reports (PIREPs) were reviewed close to the accident site from around two hours prior to the accident time to around two hours after the accident time and the PIREPs displayed below are the PIREPs valid below 10,000 feet with altitude heights in feet msl:

TLH UA /OV TLH /TM 1605 /FLUNKN /TP C680 /SK OVC005 /RM DURD 1/2NM FAP RWY 36=

Routine pilot report (UA); Over Tallahassee, Florida; Time – 1105 EST (1605Z); Altitude – Unknown; Type aircraft – Cessna 680; Sky – Overcast ceiling at 500 feet; Remarks – during descent a half mile from FAP runway 36.

While on scene at TLH ATCT the NTSB meteorologist reviewed the ATC recordings and interactions before, during, and after the accident flight. The ATC recordings revealed that ATC did not solicit nor provide any PIREPs to the accident flight or any flights within a 1.5 hour period surrounding the accident time which was not in accordance with the FAA JO Order 7110.65, Air Traffic Control.²²

8.0 SIGMET and CWSU Advisories

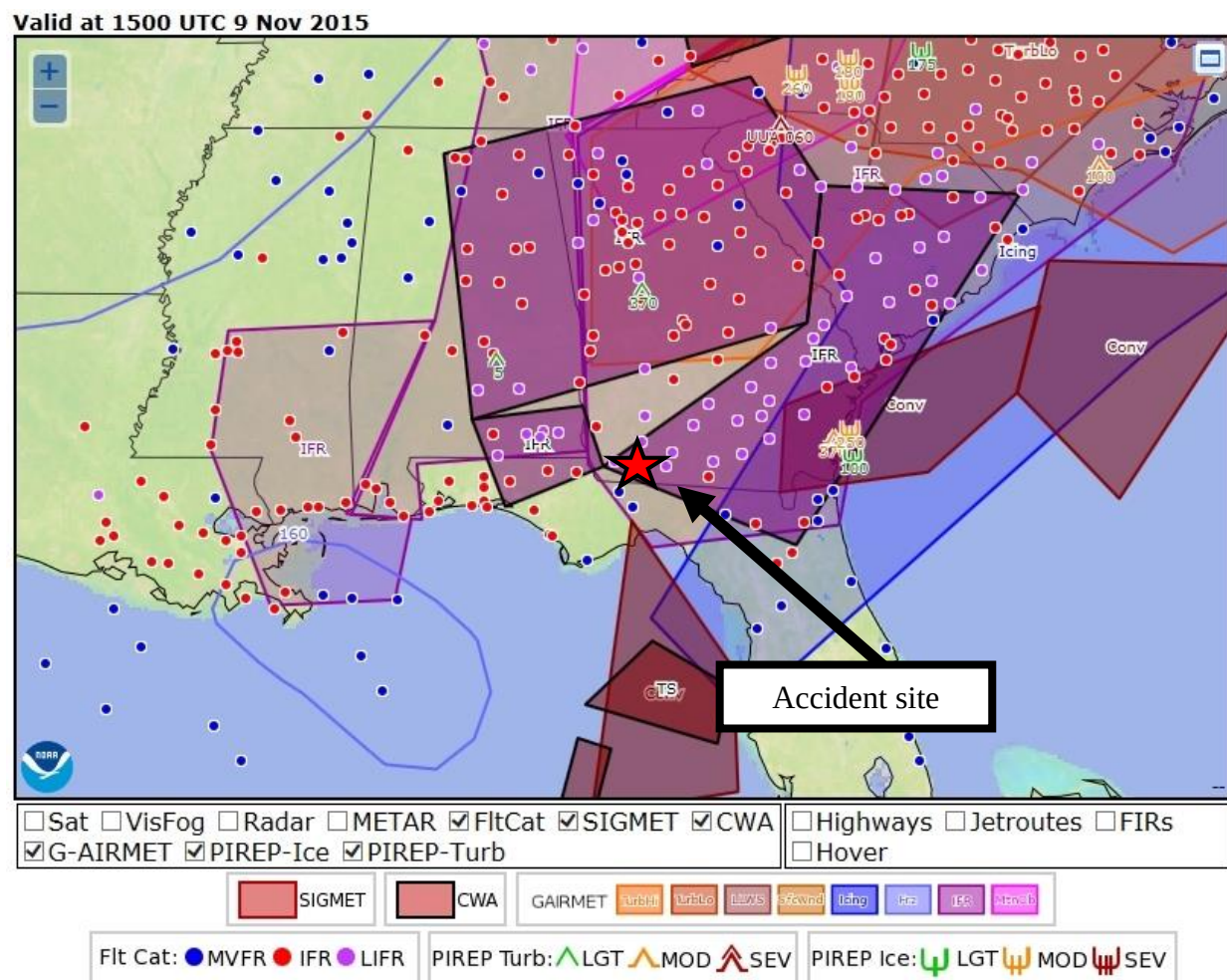
No Significant Meteorological Information (SIGMET) advisory was valid for the accident site at the accident time.

²² For more information see the ATC data contained in the docket of this accident.

There was a Center Weather Service Unit (CWSU) Advisory (CWA) valid for the accident site at the accident time which forecast areas of LIFR conditions with ceilings below 500 feet agl in mist, fog, and precipitation. LIFR conditions were forecast to end after 1100 EST. A similar CWA was also valid at the time of the pilot weather briefing (figures 21, 22, 23, and 24):

FAUS22 KZJX 091329
 ZJX2 CWA 091330
 ZJX CWA 202 VALID UNTIL 091530
FROM 40W PZD-30NW SZW-35SE CEW-40N CEW-40W PZD
AREA OF LIFR CONDS. CIGS BLW 005 IN BR/FG/PCPN.
CONDS FCST TO END AFT 16Z.
 =

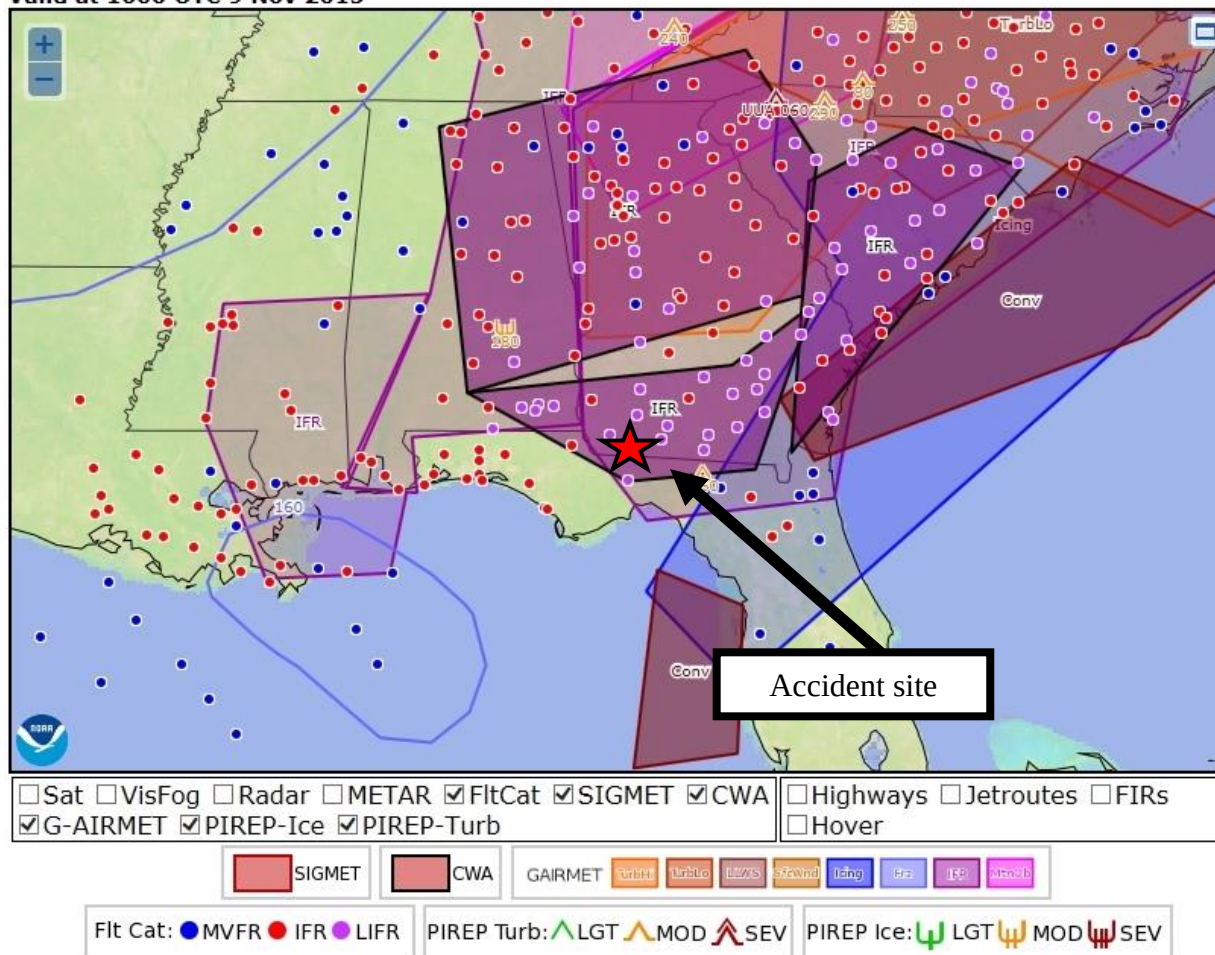
No Meteorological Impact Statement (MIS) was valid for the accident site at the accident time.



Disclaimer: International SIGMET locations approximated. Please refer to SIGMET text for full details

Figure 21 – AIRMETs and CWAs valid for the accident area at 1000 EST

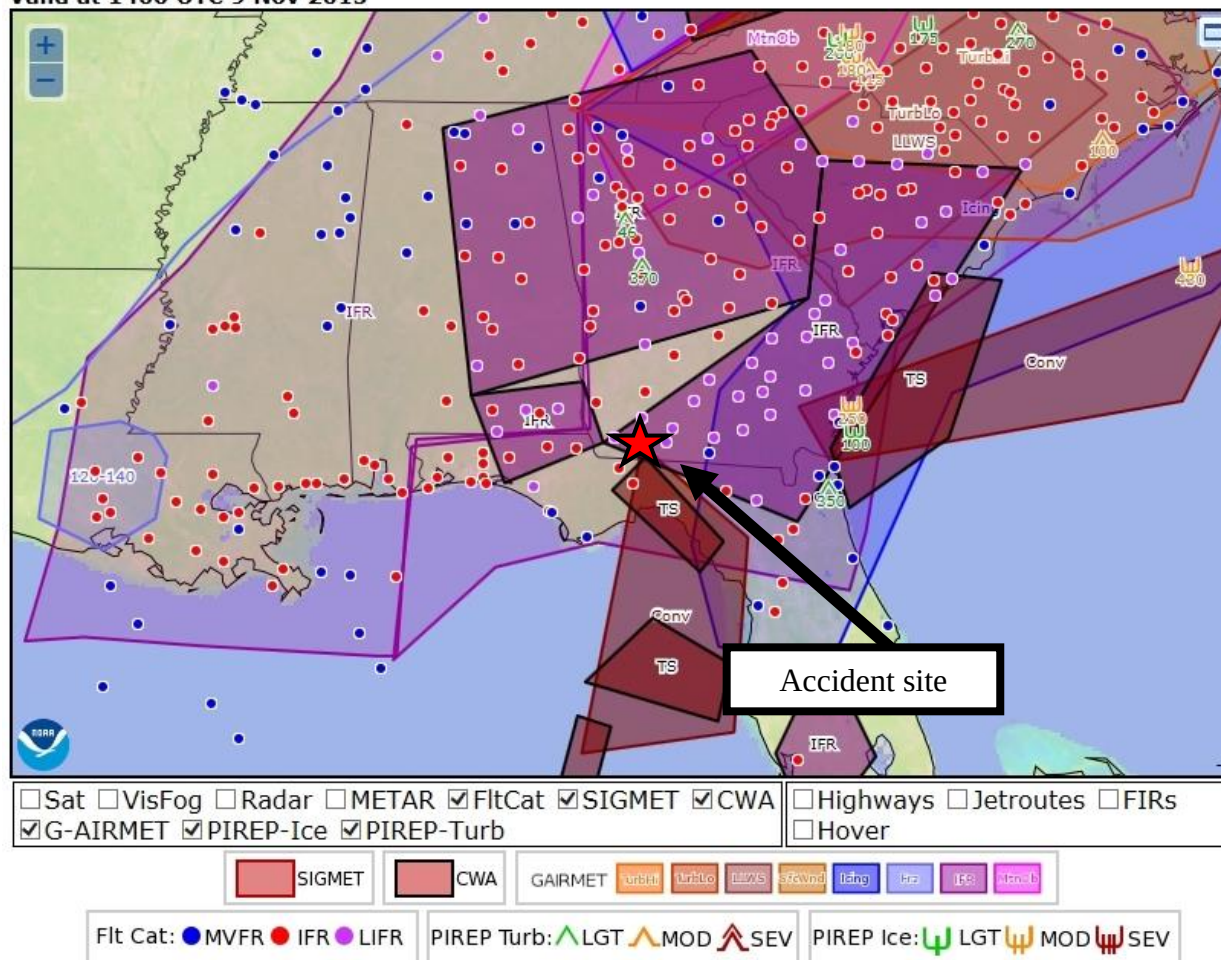
Valid at 1600 UTC 9 Nov 2015



Disclaimer: International SIGMET locations approximated. Please refer to SIGMET text for full details

Figure 22 – AIRMETs and CWAs valid for the accident area at 1100 EST

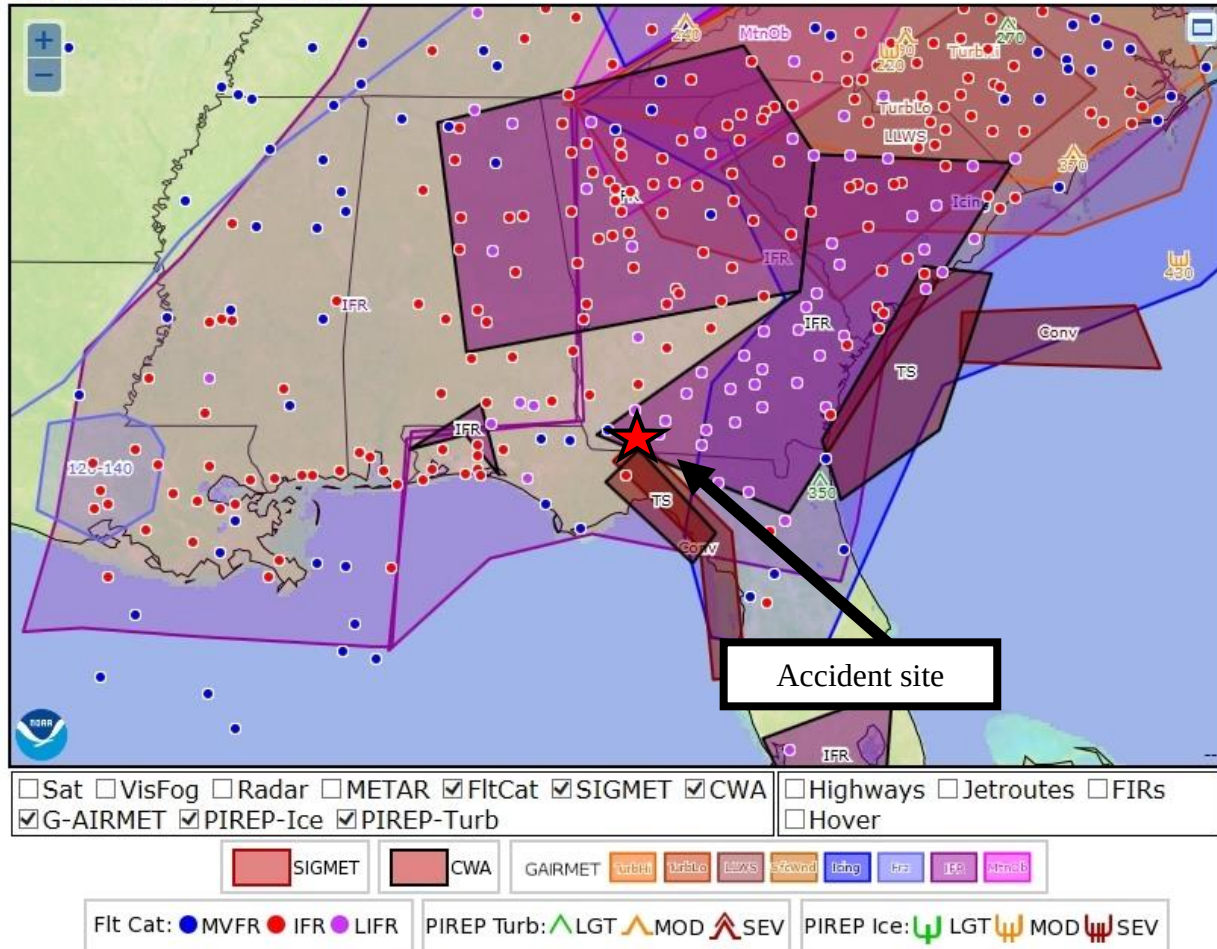
Valid at 1400 UTC 9 Nov 2015



Disclaimer: International SIGMET locations approximated. Please refer to SIGMET text for full details

Figure 23 – AIRMETs and CWAs valid for the accident area at 0900 EST

Valid at 1300 UTC 9 Nov 2015



Disclaimer: International SIGMET locations approximated. Please refer to SIGMET text for full details

Figure 24 – AIRMETs and CWAs valid for the accident area at 0800 EST

9.0 AIRMETs

Airmen's Meteorological Information (AIRMET) Sierra issued at 0945 EST, and valid at the accident time, was the only AIRMET valid for the accident site at the accident time at the accident flight level (figures 21, 22, 23, and 24). AIRMET Sierra forecasted IFR conditions with ceiling below 1,000 feet agl, visibility below 3 miles in precipitation and mist. The same conditions were forecast at the time of the pilot weather briefing:

WAUS42 KKCI 091445

WA2S

_MIAS WA 091445

AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 092100

AIRMET IFR...NC SC GA FL WV MD VA AND CSTL WTRS

FROM 30SE DCA TO 30ENE ECG TO 100E ILM TO 40S ILM TO 40SSE SAV

TO 30NW ORL TO 80SSW CEW TO 40W CEW TO 50SW PZD TO GQO TO HMY TO

40S HNN TO 30SE DCA

CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

.
AIRMET MTN OBSCN...NC SC GA WV MD VA
FROM 30N EKN TO 40NW CSN TO 40N LYH TO CLT TO 40ESE ODF TO ATL
TO GQO TO HNV TO HNN TO 30N EKN
MTNS OBSC BY PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

.
OTLK VALID 2100-0300Z
AREA 1...IFR NC SC GA FL PA OH WV MD DC DE VA AND CSTL WTRS
BOUNDED BY 30WNW APE-40WSW SIE-60E ORF-70E ILM-30SE ILM-60E CHS-
20SSE SAV-30ESE CRG-40SSE TLH-50SW PZD-GQO-HMV-HNN-CVG-30WNW APE
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 03Z.

.
AREA 2...MTN OBSCN NC SC GA PA WV MD VA
BOUNDED BY 20WSW PSB-30NE HAR-20NNW GSO-CLT-ATL-GQO-HMV-HNN-
20WSW PSB
MTNS OBSC BY PCPN/BR. CONDS CONTG THRU 03Z.

....

10.0 Area Forecast

The Area Forecast issued at 0545 EST valid at the accident time forecasted an overcast ceiling from 1,000 feet to 2,000 feet msl with tops at 16,000 feet and widely scattered light rain showers and isolated thunderstorms with cumulonimbus tops to FL340²³:

FAUS42 KPCI 090945
FA2W
_MIAC FA 090945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 100400
CLDS/WX VALID UNTIL 092200...OTLK VALID 092200-100400
NC SC GA FL AND CSTL WTRS E OF 85W

.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.

.
SYNOPSIS...SEVERAL MID/UPR LVL IMPULSES CNTRL APPALACHIANS-SE US
WILL CONT SLOLY NEWD THRU PD. OTRW..UPR LVL TROF WILL APCH
WRN/CNTRL OH VLY DURG OTLK. WLY FLOW NRN PTN..SW FLOW SRN PTN. HI
PRES RIDGE NERN US WILL DMNT NRN RGN THRU OTLK. STNR FNT SRN GA
AND ADJACENT CSTL WTRS WILL BECM WRM FNT 15-18Z AND APCH NE NC
AND ADJACENT CSTL WTRS BECMG STNR SC GA CSTLN THRU 04Z. CDFNT FL
PNHDL-CNTRL GULF MEX WILL APCH NRN FL PEN-ERN GULF MEX 22-00Z AND
WRN FL PEN THRU 04Z.

.
NC
MTNS...BKN-OVC025 OVC040 LYRD FL240. VIS 3-5SM BR. SCT -SHRA.

²³ Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 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.

OTLK...IFR CIG SHRA BR.
 PIEDMONT...BKN020-025 OVC040 LYRD FL260. OCNL VIS 3-5SM BR. WDLY
 SCT -SHRA. BECMG 1315 BKN-OVC015-020 OVC035. OCNL VIS 3-5SM
 BR. SCT -SHRA. OTLK...IFR CIG SHRA BR.
 CSTL PLAINS...BKN020 OVC035 LYRD FL270. OCNL VIS 3-5SM BR. SCT
 -SHRA. BECMG 1214 OVC010-020. VIS 3-5SM BR. SCT -SHRA/ISOL
 -TSRA. CB TOP FL320. OTLK...IFR CIG SHRA BR.
 .
 SC
 MTNS...OVC020-025 LYRD FL220. OCNL VIS 3-5SM BR. SCT -SHRA.
 OTLK...IFR CIG SHRA BR.
 PIEDMONT...OVC010-020 LYRD FL200. OCNL VIS 3-5SM BR. WDLY SCT
 -SHRA. OTLK...IFR CIG SHRA BR.
 CSTL PLAINS...OVC010-015 LYRD FL220. OCNL VIS 3-5SM BR. SCT
 -SHRA/ISOL -TSRA. CB TOP FL330. OTLK...MVFR CIG SHRA BR.
 .
 GA
 N HLF...OVC010-015 TOPS 160. VIS 3-5SM BR. WDLY SCT -SHRA.
 OTLK...IFR CIG SHRA BR.
**S HLF...OVC010-020 TOPS 160. WDLY SCT -SHRA/ISOL -TSRA. CB TOP
 FL340. OTLK...IFR CIG SHRA BR.**
 .
 FL
 PNHDL...OVC010-020 TOPS 120. VIS 3-5SM BR. WDLY SCT -SHRA/ISOL
 -TSRA. CB TOP FL350. BECMG 1820 OVC015-020 TOPS 080. ISOL
 -SHRA/-TSRA. OTLK...MVFR CIG SHRA.
 NRN PEN...BKN-OVC010-020 OVC035 LYRD FL200. OCNL VIS 3-5SM BR.
 WDLY SCT -SHRA/ISOL -TSRA. CB TOP FL380. BECMG 1719 BKN020-025
 OVC040 LYRD FL260. WDLY SCT -SHRA/-TSRA. CB TOP FL400.
 OTLK...MVFR CIG SHRA.
 CNTRL PEN...SCT020-025 SCT-BKN040 TOPS 070 BKN CI. ISOL
 -SHRA/-TSRA. CB TOP FL400. BECMG 1618 SCT035 SCT050 BKN CI.
 ISOL -SHRA/-TSRA. OTLK...VFR SHRA TSRA.
 SRN PEN...FEW-SCT025-030 OCNL SKC. BECMG 1416 SCT035 SCT050.
 ISOL -SHRA. 18Z ISOL -TSRA/-SHRA. CB TOP FL420. OTLK...VFR
 SHRA TSRA.
 .
 CSTL WTRS
 ATLC WTRS...
 CRG-NWD...BKN020-025 BKN-OVC040-060 LYRD FL270. SCT -SHRA/ISOL
 -TSRA. CB TOP FL400. OTLK...MVFR CIG SHRA TSRA.
 S CRG...SCT025 SCT050 SCT CI. ISOL -SHRA/-TSRA. CB TOP FL420.
 OTLK...VFR SHRA TSRA.
 GULF WTRS E OF 85W...
 SRQ-NWD...BKN015-025 OVC040 LYRD FL250. WDLY SCT -SHRA/-TSRA.
 CB TOP FL410. OTLK...MVFR CIG SHRA TSRA.
 S SRQ...SCT030 SCT050 SCT CI. ISOL -SHRA/-TSRA. CB TOP FL420.
 OTLK...VFR SHRA TSRA.

11.0 Terminal Aerodrome Forecast

KTLH was the closest site with a NWS TAF (figure 8). The TAF valid at the time of the accident was issued at 0716 EST and was valid for a 24-hour period beginning at 0800 EST. The TAF for KTLH was as follows:

TAF AMD KTLH 091216Z 0912/1012 07008KT 5SM RA OVC006
TEMPO 0912/0914 VRB10G20KT 2SM TSRA SCT005 OVC010CB
FM091500 13010KT 5SM -RA OVC010
FM091900 09008KT P6SM BKN015
FM100400 33005KT P6SM BKN008=

The forecast valid at the accident time expected a wind from 130° at 10 knots, 5 miles visibility, light rain, and an overcast ceiling at 1,000 feet agl.

12.0 National Weather Service Area Forecast Discussion

The National Weather Service Office in Tallahassee, Florida, issued an Area Forecast Discussion (AFD) at 0328 EST. The aviation section of the AFD mentioned rain and IFR ceilings and visibilities were forecast to continue at all the TAF sites through the morning hours. The rain was at least forecast to come to an end from west to east into the afternoon, but low ceilings were likely to persist into the evening and tonight period:

FXUS62 KTAE 090828

AFDTAE

AREA FORECAST DISCUSSION

NATIONAL WEATHER SERVICE TALLAHASSEE FL

328 AM EST MON NOV 9 2015

.Near Term [Through Today]...

A 1012mb low is located about 40 miles south of the Florida Panhandle this morning, slowly moving northeast. The low is riding along a stationary front stretching from the far southeastern Big Bend west across the northeastern Gulf. Southerly flow above the surface is lifting the moist and unstable airmass over the front, generating a large area of light to moderate rain across the Panhandle, spreading into SE Alabama and SW Georgia. In addition, thunderstorms are firing offshore near the low, and along/south of the stationary boundary.

Through the morning hours, the surface low is forecast to continue moving northeast, with the stationary boundary beginning to slide back north as a warm front. This may allow some of the thunderstorms (and associated heavier rain) to impact areas south of I-10 through mid-morning. Thereafter, the forcing is expected to weaken and shift eastward, with rain ending from west to east from late morning through the afternoon. Will let the ongoing Flood Watches continue through 15Z.

Temperatures will be tricky today south of I-10 where the frontal boundary will be oscillating north and south. Expect to see temperatures only reach the lower 60s across the north, with areas south of the front approaching 80 this afternoon.

.Short Term [Tonight Through Wednesday]...

At the start of the short term period, the surface low pressure area will be moving just east of Tallahassee. Drier air will slowly move in behind the low pressure area as surface high pressure builds across the Mid South. By Tuesday afternoon, the large surface high pressure area will build across the Southeast. With a drier airmass in place, expect a greater diurnal range in temperatures than seen of late. High temperatures on Tuesday will

generally be in the mid 70s and then in the upper 70s to near 80 on Wednesday. The notable change will be with respect to overnight lows, which by Tuesday morning will drop into the upper 50s and then even cooler on Wednesday morning when lows in the upper 40s to near 50 are expected across the region.

.Long Term [Wednesday Night Through Monday]...

While the long term period will generally be a stretch of drier conditions, some significant changes in the airmass across the region is expected by the weekend.

Warm conditions at the start of the period on Thursday will continue as high pressure moves east of the Florida Peninsula. On Friday, model guidance is in good agreement that a generally dry cold front will move across the forecast area. As this cold front moves through the area, the first noteworthy shot of cold air this season will begin to arrive. As the upper pattern amplifies as a trough drops out of the Great Lakes on Saturday, the cooler airmass will become established across the Southeast into the first of next week.

High temperatures on Saturday-Monday will struggle even in full sunshine to reach 70. In fact, some areas across South Georgia/Alabama will likely not get out of the mid 60s. Overnight lows will also be notably colder. While the operational guidance has trended colder this cycle, particularly the 00z GFS, the overall pattern presented by the global models doesn't appear supportive of temperatures by Sunday morning dropping into the 30s as the high pressure center is predicted to remain well to the north of the region across Tennessee. With that in mind, however, still did adjust the overall low temperature forecast through the weekend down a couple of degrees. This results in low temperatures generally in the low to mid 40s on Sunday morning, which should be the coldest of the weekend.

&&

.Aviation...

[Through 06Z Tuesday] Rain and IFR cigs/vis will continue at all terminals through the morning hours. Conditions will improve slightly from west to east during the afternoon with the rain coming to an end. However, the low cigs will likely persist into tonight.

&&

.Marine...

Southerly flow at 20kts will continue across the Florida Panhandle waters through this morning before the pressure gradient relaxes this afternoon. By Tuesday, tranquil conditions will return as high pressure builds over the marine area. Offshore winds and seas will increase late in the week as a cold front approaches the marine area.

&&

.Fire Weather...

No concerns.

&&

.Hydrology...

A large area of rain moving into the Florida Panhandle/Western Big Bend this morning is producing rainfall rates of 1-2" hour near the coast, with occasional rates nearing 3" across Southern Liberty County. These areas nearer the coast can handle the heavier rainfall rates, however, should the focus for heavier

rains shift further inland toward I-10, flooding concerns would increase, particularly around Tallahassee.

With the heavy rain this morning missing the Choctawhatchee Basin, flooding in the lower Choctawhatchee should not be as significant as initially thought, with Caryville only likely to reach minor flood by Wednesday as flows from Southern Alabama arrive. Bruce will remain at flood stage for some time, and in the moderate flood category through at least Thursday.

Elsewhere, the bulk of the rainfall today is expected to fall in the lower portions of the Chipola/Apalachicola/Ochlockonee River basins, which will limit overall river flood potential. Will need to monitor the Sopchoppy River with this morning's rainfall as steady rises continue there following Sunday's rain. However, several inches of additional rain would be needed in the basin to result in any river flooding.

&&

.Preliminary Point Temps/PoPs...

Tallahassee	77	60	75	51	80	/	90	20	0	0	0
Panama City	75	58	74	54	78	/	60	10	0	0	0
Dothan	63	51	72	48	77	/	50	10	0	0	0
Albany	62	53	74	49	77	/	80	20	0	0	0
Valdosta	70	60	74	51	78	/	80	30	10	0	0
Cross City	80	66	80	54	82	/	70	40	10	0	0
Apalachicola	81	63	75	57	76	/	90	10	0	0	0

&&

.TAE WATCHES/WARNINGS/ADVISORIES...

FL...Flood Watch until 10 AM EST this morning FOR Coastal Jefferson-Inland Jefferson-Madison.

High Rip Current Risk through late tonight FOR Coastal Bay-Coastal Franklin-Coastal Gulf-South Walton.

Flash Flood Watch until 10 AM EST /9 AM CST/ this morning FOR Calhoun-Central Walton-Coastal Bay-Coastal Franklin-Coastal Gulf-Coastal Wakulla-Gadsden-Holmes-Inland Bay-Inland Franklin-Inland Gulf-Inland Wakulla-Jackson-Leon-Liberty-North Walton-South Walton-Washington.

GA...Flood Watch until 10 AM EST this morning FOR Baker-Ben Hill-Berrien-Brooks-Calhoun-Clay-Colquitt-Cook-Decatur-Dougherty-Early-Grady-Irwin-Lanier-Lee-Lowndes-Miller-Mitchell-Quitman-Randolph-Seminole-Terrell-Thomas-Tift-Turner-Worth.

AL...Flood Watch until 9 AM CST this morning FOR Coffee-Dale-Geneva-Henry-Houston.

GM...Small Craft Advisory until 1 PM EST this afternoon FOR Coastal waters from Apalachicola to Destin FL out 20 NM-Waters from Apalachicola to Destin FL from 20 to 60 NM.

&&

\$\$

13.0 Pilot Weather Briefing

The accident pilot did receive an official weather briefing from Lockheed Martin Flight Service (LMFS) by phone at 0830 EST. While receiving the phone weather briefing from LMFS the accident pilot and the briefer discussed that the accident pilot had “looked up” the latest weather conditions. They also discussed a SIGMET valid just south of the destination location and KTLH (figure 24) with the outflow from that affecting the destination location, a CWA for rain and embedded thunderstorms (figure 24), a CWA for the descent portion of the flight into the destination airport warning of LIFR conditions forecast to end after 1100 EST (figure 24), and AIRMETs (figure 24). The LMFS weather briefer told the accident pilot that “it’s pretty bad out there.” The accident pilot then requested the closest TAF which was the TAF for KTLH (section 11.0). The briefer provided the TAF for KTLH and the TAF for Southwest Georgia Regional Airport (KABY) to the north of the destination airport. The accident pilot mentioned they might “give it an hour before taking off, as it sounds like things are clearing out.” For more information please see attachment 1. There is no record of the accident pilot receiving or retrieving any additional weather information before the accident flight.

14.0 Visit to the National Weather Service in Tallahassee

The ATC group and NTSB meteorologist visited the Tallahassee National Weather Service on November 12 to discuss local aviation weather and local ATC/weather interactions. The group had a lengthy discussion with the meteorologist in charge (MIC) as well as a few of the weather forecasters including the local aviation focal point for the NWS Tallahassee office. At the time of the accident the NWS Tallahassee office had no interaction with the local towers or tracons in their area of responsibility. They never receive calls from the TLH ATCT either in request for weather information nor does TLH ATCT provide NWS Tallahassee PIREP or other information from flights. The NWS Tallahassee office would happily support any and all ATC request (schedule dependent). The NWS Tallahassee acknowledged that they are there to provide support to the towers and tracons, but they have had no request from towers or tracons to do so, nor have they reached out to the towers or tracons to let ATC know what kind of information could be provided. The NWS Tallahassee office acknowledged that after their office moved from the TLH airport area to the Florida State University Campus that the NWS Tallahassee and TLH ATCT interaction dropped off rapidly even with the two locations only 7 miles away from each other. When asked if the NWS could provide local specific weather support/training to the TLH ATCT, the NWS responded that they would be happy to do so and would provide examples and data directly applicable to TLH ATCT. The NWS Tallahassee office would be happy to provide once or twice daily calls with TLH ATCT about the local weather conditions to provide situational awareness or further information on the exact details behind the KTLH TAF.

15.0 Center Weather Service Weather Graphics

The CWSU from Jacksonville Air Route Traffic Control Center (ARTCC ZJX) sent the following weather graphics they produced at the morning stand up briefing for ATC personnel at ZJX. The weather graphics valid for 1100 and 1400 EST depicted areas of rain showers for the accident site around the accident time with possible thunderstorm activity (figures 25 and 26). The thunderstorm activity was forecast to have only 20 percent or less areal coverage with rain tops to FL200 and thunderstorm tops between FL350 and FL400.

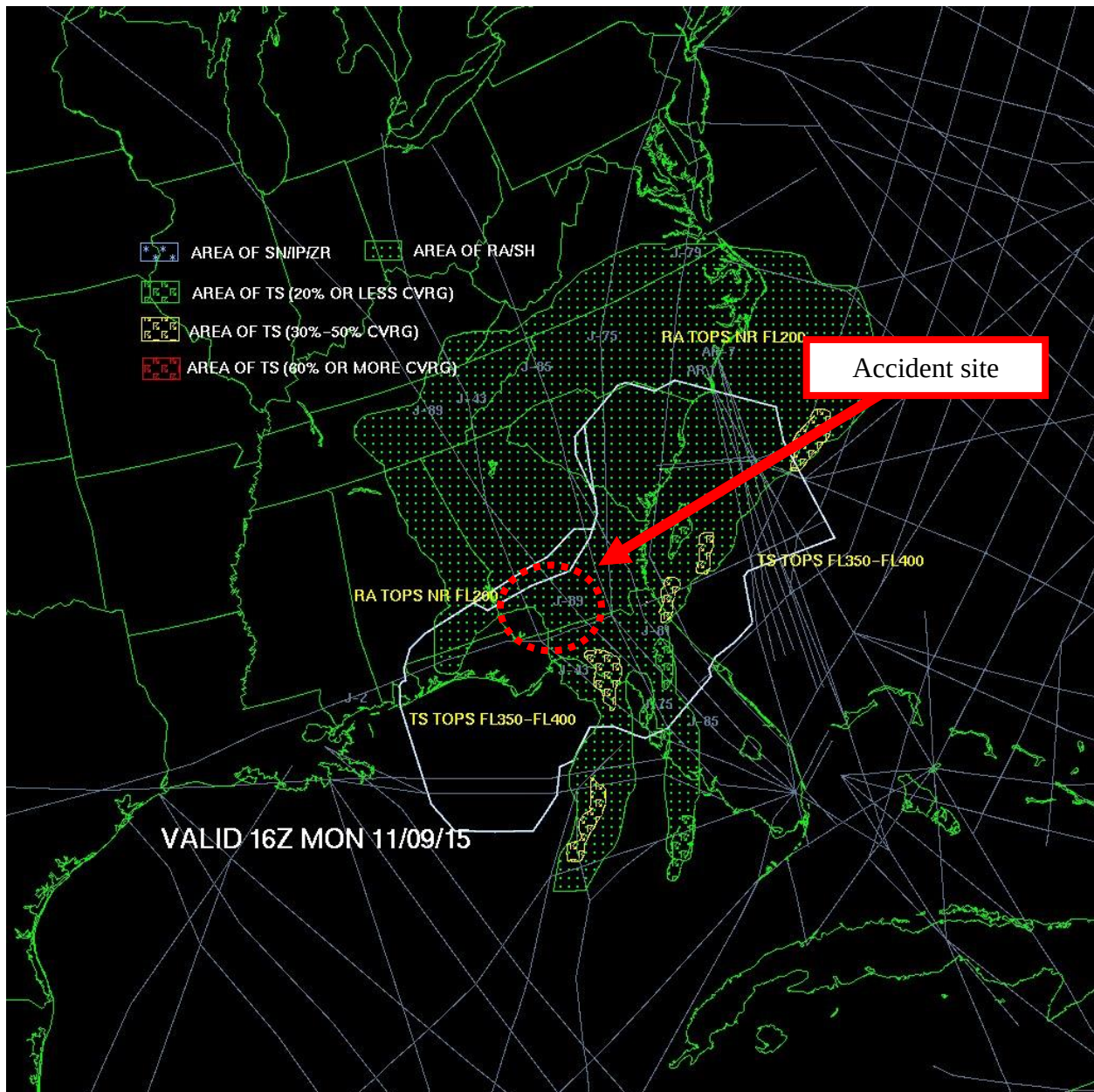


Figure 25 – ZJX CWSU weather graphic produced for ZJX ATC personnel for morning of the accident. Graphic valid for 1100 EST

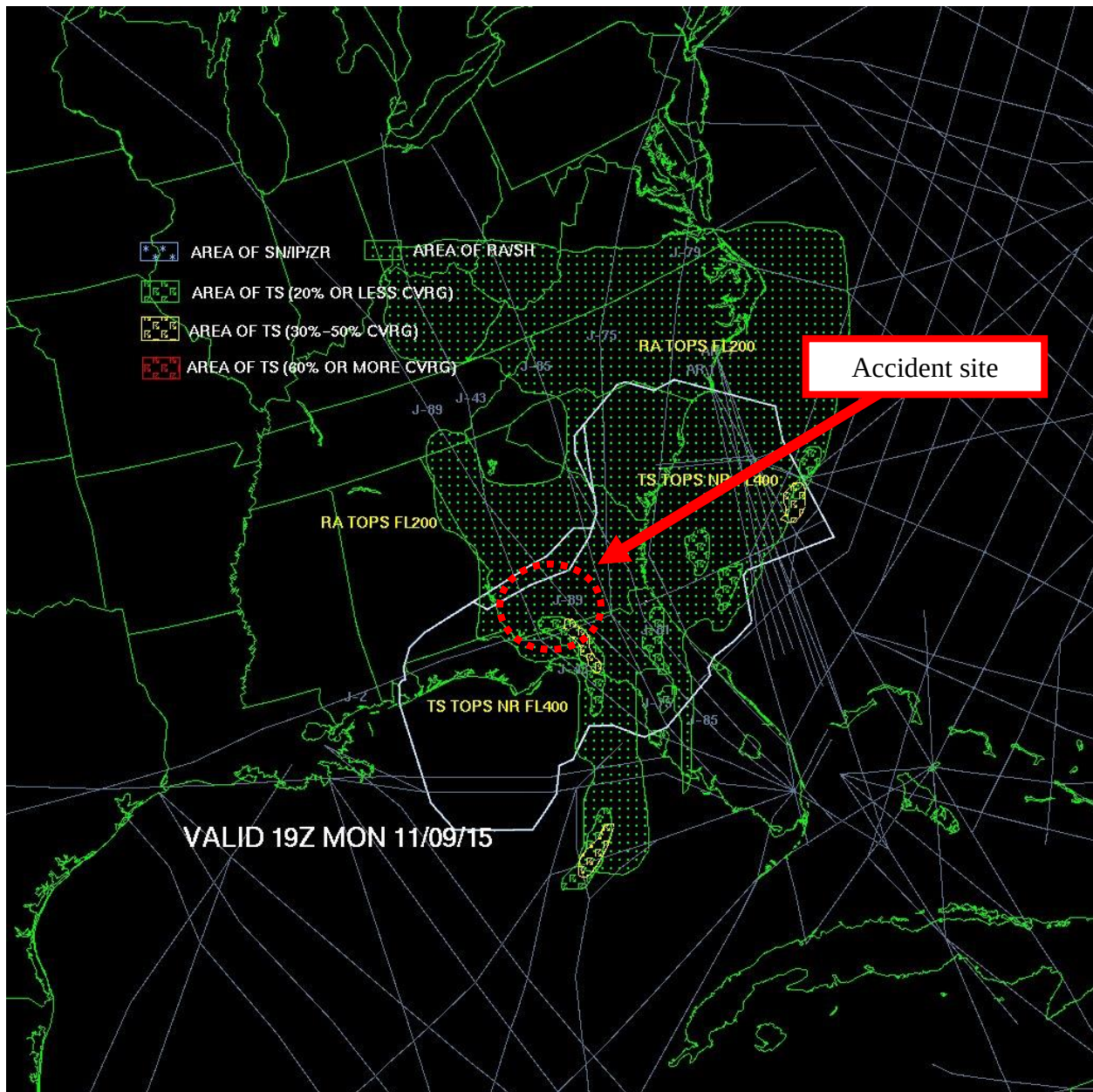


Figure 26 – ZJX CWSU weather graphic produced for ZJX ATC personnel for morning of the accident. Graphic valid for 1400 EST

16.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on November 9, 2015, indicated the following:

SUN

Begin civil twilight	0634 EST
Sunrise	0659 EST
Sun transit	1222 EST
Sunset	1744 EST
End civil twilight	1809 EST

17.0 Witness Information

One of the persons' waiting to be picked up for the proposed return flight was at the destination airport, Cairo-Grady County Airport, before, at, and after the accident time. Figures 27 through 31 are images taken from the witness at Cairo-Grady County Airport between 0939 EST and 1001 EST. The images from 0939 to 1001 EST indicated low stratus and strato-cumulus clouds with rain having fallen at the airport recently. There are indications of mist in the trees on the southeastern end of the runway at 1001 EST (figures 30 and 31). Several other witnesses were located at Cairo-Grady County Airport around the accident time and they conveyed that the ceiling was overcast at 250 feet agl (attachment 2).



Figure 27 – Witness image taken at 0939 EST from Cairo-Grady County Airport looking eastward



Figure 28 – Witness image taken at 0939 EST from Cairo-Grady County Airport looking east-southeastward



Figure 29 – Witness image taken at 0942 EST from Cairo-Grady County Airport looking southeastward



Figure 30 – Witness image taken at 1001 EST from Cairo-Grady County Airport looking southeastward



Figure 31 – Witness image taken at 1001 EST from Cairo-Grady County Airport looking east-southeastward

F. LIST OF ATTACHMENTS

Attachment 1 – LMFS weather briefing provided to the accident pilot at 0830 EST

Attachment 2 – Record of Conversation with Witness

Paul Suffern
NTSB, AS-30