



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 12, 2018

Group Chairman's Factual Report

METEOROLOGY

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A. ACCIDENT

Location: Starke, Florida
Date: November 23, 2017
Time: 1515 eastern standard time
2015 coordinated universal time (UTC)
Airplane: Mooney M20C; registration: N6894N

B. METEOROLOGIST

Don Eick
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On November 23, 2017, about 1515 eastern standard time, a Mooney M20, N6894N, impacted terrain near Starke, Florida. Instrument meteorological conditions prevailed at the time and an instrument flight plan was filed for the 14 *Code of Federal Regulations* (CFR) Part 91 personal flight from Ocala International Airport–Jim Taylor Field (OCF), Ocala, Florida to Cecil Airport (VQQ), Jacksonville, Florida. The flight originated about 1500 eastern standard time from OCF.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are eastern standard time (EST) based upon the 24-hour clock, local time is +5 hours to UTC, and UTC=Z. NWS airport and station identifiers use standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus International Air Transport Association (IATA) 3-letter identifiers which deletes the initial country code designator "K" for U.S. airports. Both codes are both used intermittently in this report as reported by the issuer of the report. Directions are referenced to true north and distances in nautical miles. Heights are in feet (ft) above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident site was located at latitude 29.951988° N and longitude 81.979473° W at an elevation of about 195 ft.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

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) located in College Park, Maryland. These are the base products used in describing weather features in preflight planning, weather briefings and in the creation of forecasts and warnings. 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 southeast section of the NWS Surface Analysis Chart issued by NCEP for 1600 EST on November 23, 2017 is included as figure 1 with the approximate accident site marked by a red star. The chart depicted a low-pressure system at 1007-hectopascals (hPa)¹ near Tampa, Florida along a frontal wave with a cold front extending south-southwestward from the low and a stationary front extending eastward across central Florida and then northeastward to a second low pressure system at 1008-hPa off the Georgia coast, where a warm front was depicted to the northeast of the low. In the warm air sector south of the front over Florida, a secondary trough of low pressure was identified extended south-southwest across central and south Florida into the Gulf of Mexico. The accident site was located north of the stationary front in the cool air sector of the front, in a location favorable for overrunning clouds and precipitation.

¹ Hectopascals (hPa) is the new standard reference used for referring to sea level pressure and is interchangeable with the term millibar (mb) with the same units. Standard sea level pressure is 1013.25-hPa at 59° F or 15° Celsius (C).

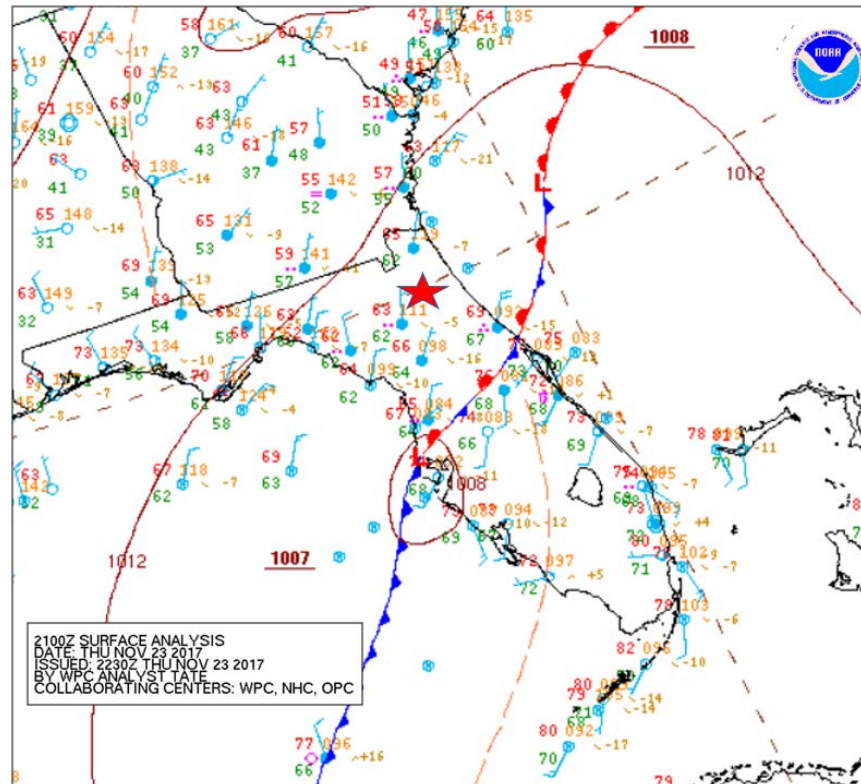


Figure 1 - Southeast section of the NWS Surface Analysis Chart for 1600 EST

The station models surrounding the accident site north of the front depicted northeast winds of 5 to 10 knots, overcast clouds, with visibility restricted in light to moderate rain and mist, with temperatures in the mid 60's degrees Fahrenheit (°F), with the dew point temperatures also in the 60's and with temperature-dew point spreads of 2° F or less immediately along and north of the frontal boundary to southern Georgia. South of the front the winds were generally from the southwest, with partly cloudy with temperatures in the high 60's to 70's, with several stations on the east coast reported rain and thunderstorms. One particular area of thunderstorms, was reported at Melbourne International Airport (KMLB), Melbourne, Florida immediately south of the front and near the trough.

1.2 Weather Depiction

The southeast section of the NWS NCEP Weather Depiction Chart issued for 1400 EST on November 23, 2017, depicting the general flight categories² across the region based on

² As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft agl and/or visibility less than 1 statute mile.
 - Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
 - Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
 - Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

observations is included as figure 2, with the location of the fronts at 1300 EST. The chart depicted a large area of instrument flight rule (IFR) conditions by a shaded contour line over central and northern Florida, southeast Georgia, and extreme southern South Carolina along and north of the frontal boundary, which included the accident site, which is marked by a red star. Marginal visual flight rule (MVFR) conditions were depicted by an unshaded contour line which included most of Florida into central Georgia. The closest visual flight rule (VFR) conditions without a contour were shown over the Florida panhandle, Alabama, northern Georgia, and over southwest Florida.

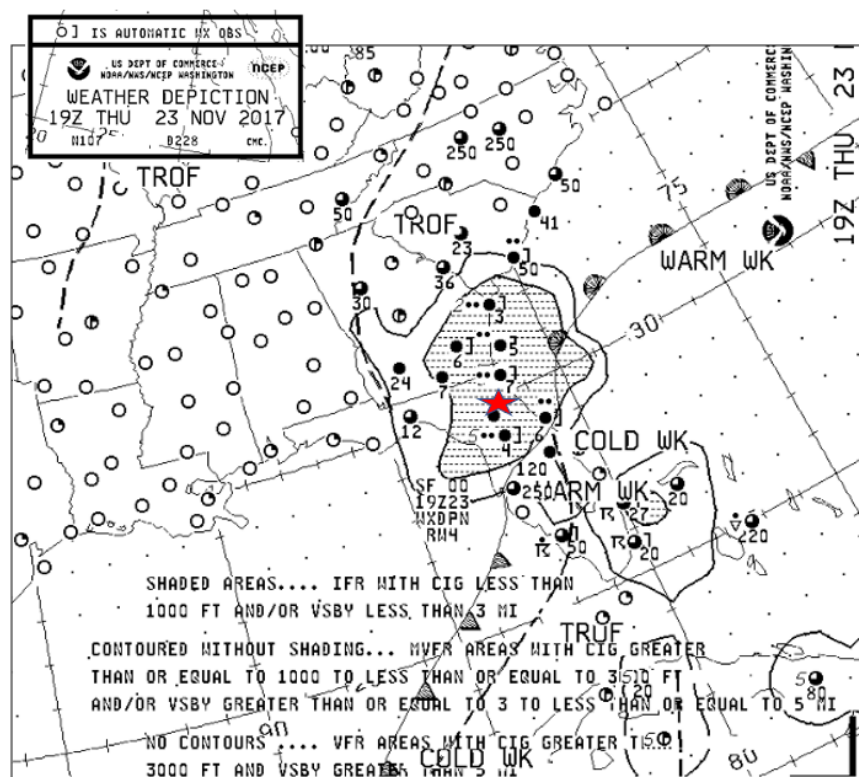


Figure 2 - southeast section of the Weather Depiction Chart for 1400 EST

The station models immediately surrounding the accident site indicated low overcast ceilings from 400 to 700 ft agl with visibility restricted to 5 miles in light continuous rain.

1.3 National Composite Reflectivity Image

The NWS NCEP National Composite Reflectivity Mosaic image for 1515 EST on November 23, 2017, over Florida is included as figure 3 with the accident site marked by a red star. The image depicted a line of echoes of 30 decibels (dBZ³) and greater extending from the Tampa area east-northeast to the Daytona Beach area and then northward into the Jacksonville area and off the coast. Several extreme echoes of 50 dBZ and greater embedded in the line across the central portion of the state, with several other areas along the east coast of Florida. Several scattered areas

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

³ Reflectivity is normally displayed in decibels or the logarithmic function $10 \log Z_e$ (dBZ).

of echoes of 30 dBZ associated with light rain were identified immediately north and southwest of the accident site, with no defined echoes over the accident site.

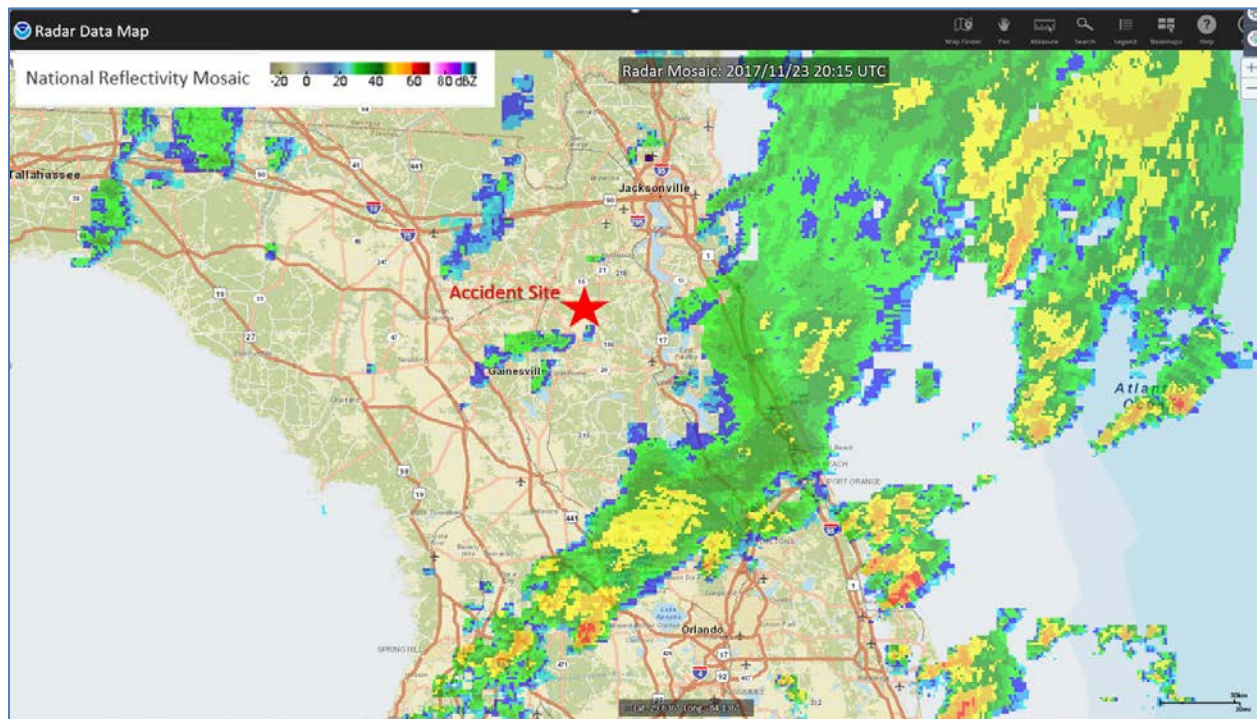


Figure 3 - NWS National Composite Reflectivity Image at 1515 EST

With several small areas of light intensity echoes identified in the immediate vicinity of the accident site, the closest weather surveillance radar will be further reviewed in section 5.0 of this report.

1.4 12-hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart current during the period was issued at 1052 EST on November 23, 2017 and was valid for 0100 EST on November 24, 2017 is included as figure 4. The chart depicted the expected pressure systems, frontal positions, and forecast precipitation expected during the period. The chart continued to depict two low-pressure systems along the front, one in the Gulf of Mexico off Tampa and the other off the east coast at 1011- and 1009-hPa respectively, with a cold front across central Florida to the south of the accident site. Precipitation was expected with less than 50% coverage over northern Florida by the light green shading, with greater coverage in the dark green shading over the Jacksonville area and off the northern Florida coast. Thunderstorms were expected across the region as indicated by the red hatched area, with an enhanced risk south of the front over the southeast Florida.

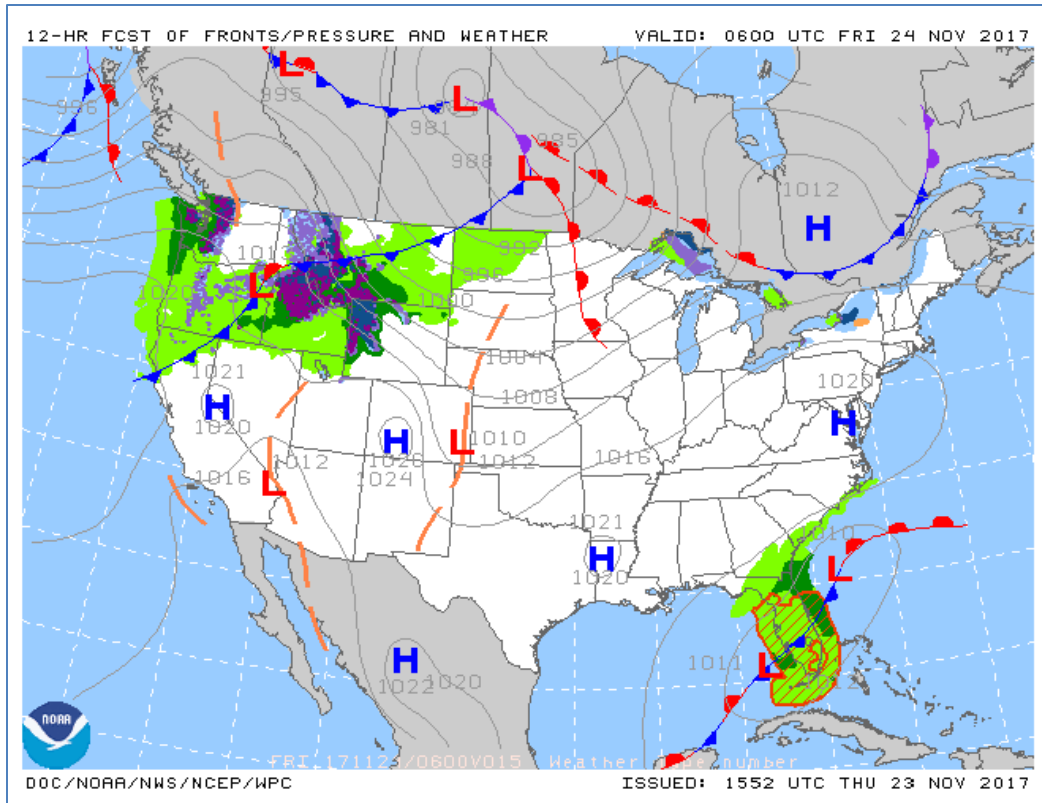


Figure 4 – NWS WPC 12-hour Surface Weather Prognostic Chart

1.5 12-hour Low-Level Significant Weather Prognostic Chart

The NWS 12-hour Low-Level Significant Weather Prognostic Chart which was current at the time of departure is included as figure 5 and was valid for 1900 EST on November 23, 2017. The chart depicted the general flight categories, freezing level, and areas of expected low-level turbulence. The chart depicted an area of IFR conditions by a red contour over central Florida into southeast Georgia with a larger area of MVFR conditions by a blue scalloped line over all but the extreme western panhandle of Florida, and into southeast Georgia and South Carolina. The freezing level was depicted above 12,000 ft, and an area of moderate clear air turbulence (CAT) from the surface to 24,000 ft was depicted off the Jacksonville coast.

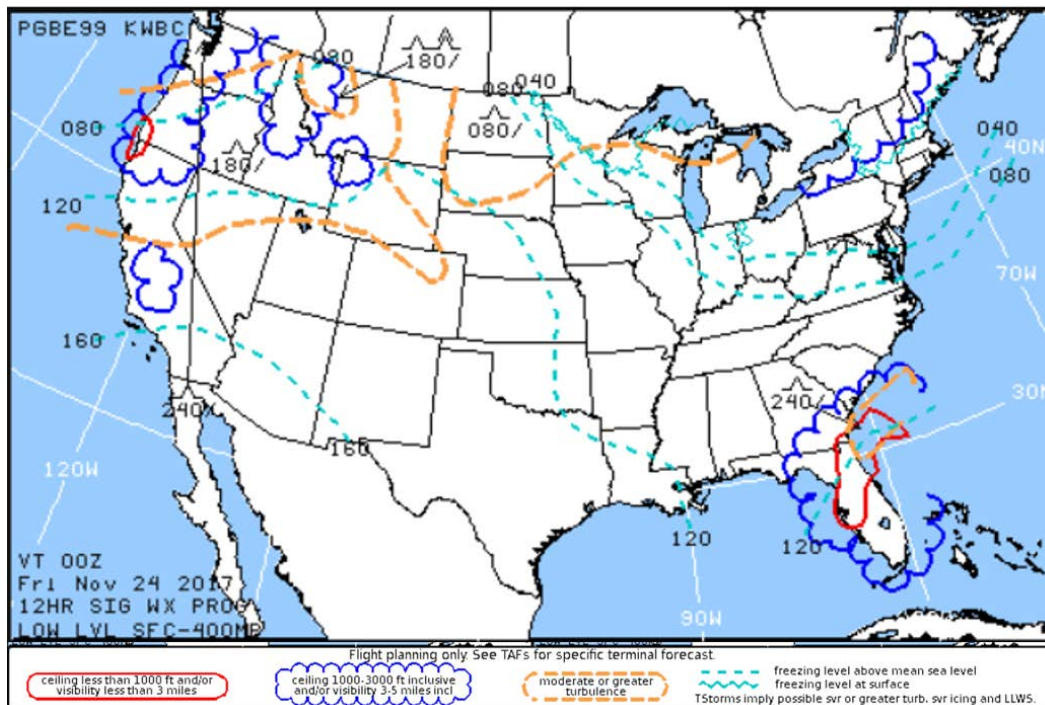


Figure 5 - NWS 12-hour Low-Level Significant Weather Prognostic Chart

1.6 Convective Outlook

The NWS Storm Prediction Center's (SPC) 24-hour Convective Outlook graphic and text products highlighting where there is a high likelihood for general and severe thunderstorms for the period is included as figure 6, followed by the text bulletin which corresponded with the chart. The chart depicted a marginal risk of thunderstorms over most of central and southern Florida, where a few strong to severe thunderstorms were expected mainly near the frontal boundary.

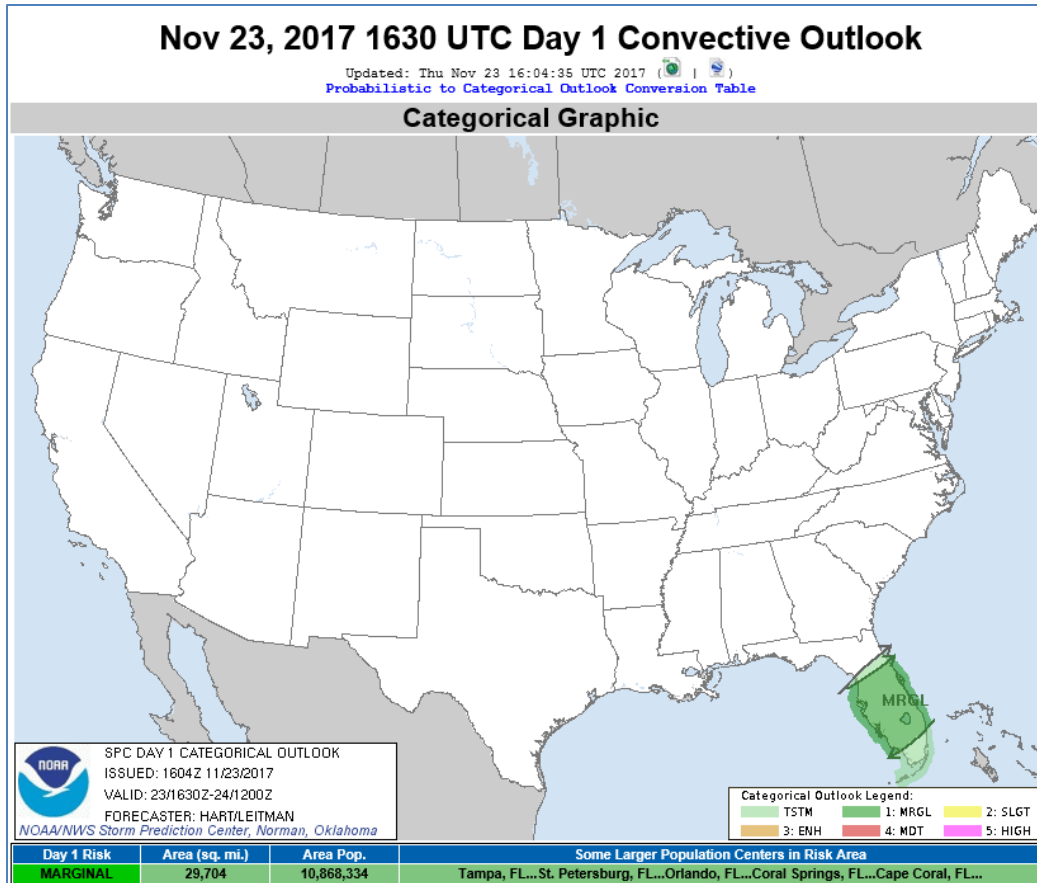


Figure 6 - Convective Outlook issued at 1104 EST

ACUS01 KWNS 231939
SWODY1
SPC AC 231937

Day 1 Convective Outlook
NWS Storm Prediction Center Norman OK
0137 PM CST Thu Nov 23 2017

Valid 232000Z - 241200Z

...THERE IS A MARGINAL RISK OF SEVERE THUNDERSTORMS ACROSS PARTS OF THE FLORIDA PENINSULA...

...SUMMARY...

A few strong to severe thunderstorms are possible across the central and southern Florida peninsula today.

...FL...

Showers and thunderstorms continue to affect the FL peninsula today, as an upper trough moves across the region. The strongest upper forcing and vertical shear is occurring in vicinity of the surface baroclinic zone from north of TPA to north of MLB. Isolated cells may occasionally intensify to strong/severe levels in this corridor today with gusty winds, small hail, and perhaps a tornado. Vertical shear profiles will slowly weaken through the day as cyclogenesis occurs off the east coast, veering and weakening low level winds. This combined with substantial cloud cover and only weak CAPE lead to maintenance of the MRGL risk category. Farther south, parameters are less

favorable for organized severe storms. However, slightly higher instability values and more favorable diurnal timing of convection may lead to a few strong cells capable of gusty winds. Therefore no changes to the outlook have been made to this area.

The convective outlook indicated that strong upper level forcing⁴ and vertical wind shear near the frontal zone was enhancing the potential for a few strong to severe thunderstorms during the period, with conditions also favorable further south of the front with strong afternoon heating and unstable airmass allowing for organized thunderstorms. North of the stationary front or cold front there was weaker support for any strong or severe storm formation.

2.0 Observations

The area was documented using official NWS Meteorological Aerodrome Reports (METARs) and special reports (SPECI) across the region. Cloud heights are reported above ground level (agl) in the following section. The magnetic variation over the area was estimated as 5° West based on the local sectional chart and the isogonic lines.

2.1 Departure Area – Ocala International Airport-Jim Taylor Field, Ocala, FL

The accident airplane departed from Ocala International Airport-Jim Taylor Field (KOCF), Ocala, FL, at about 1419 EST for the approximately 65 mile flight. The airport lists an elevation of 90 feet and had an Automated Weather Observation System (AWOS) and reported the following conditions at the time of departure:

KOCF weather observation at 1351 EST (1851Z), wind from 010° at 4 knots, visibility 5 miles in light rain and mist, ceiling broken at 400 ft, overcast at 3,400 ft, temperature 18° C, dew point temperature 17° C, altimeter 29.84 inches of mercury (Hg). Remarks; automated observation system with a precipitation discriminator, sea level pressure 1010.8-hPa, hourly precipitation 0.12 inches, temperature 17.8° C, dew point 17.2° C.

The following general flight categories and raw observation were reported during the period from 0950 through 1700 EST, with the flight categories color coded (purple for LIFR, red for IFR, blue for MVFR, and black for VFR conditions). The significant remarks of variable ceiling were considered in the color coding and general classification, which were as follows:

LIFR METAR KOCF 231451Z VRB06KT 2 1/2SM RA BR OVC005 18/17 A2992 RMK AO2 LTG DSNT SE CIG 004V008 SLP135 P0012 60150 T01780172 50002=

LIFR METAR KOCF 231551Z 03006KT 2 1/2SM +RA BR OVC005 17/17 A2992 RMK AO2 CIG 004V008 SLP136 P0039 T01720172=

LIFR METAR KOCF 231651Z VRB05KT 2 1/2SM +RA BR OVC005 17/17 A2990 RMK AO2 CIG 004V008 SLP126 P0033 T01720172=

⁴ Upper level forcing refers to favorable upper level support at 300-hPa from the jet stream interaction and favorable upper level divergence, which enhances low-level inflow and convergence into the system supporting strong vertical motions and lifting.

IFR METAR KOCF 231751Z VRB04KT 2 1/2SM +RA BR BKN006 BKN035 OVC045 17/17 A2986 RMK AO2
SLP113 P0029 60251 T01720167 10189 20172 58021

LIFR SPECI KOCF 231802Z 05007KT 2 1/2SM RA BR BKN004 BKN008 OVC038 17/17 A2984 RMK AO2
P0004

LIFR METAR KOCF 231851Z 01004KT 5SM -RA BR BKN004 OVC034 18/17 A2984 RMK AO2 SLP108
P0012 T01780172

LIFR METAR KOCF 231951Z VRB04KT 5SM BR BKN004 OVC034 18/18 A2983 RMK AO2 RAE30 SLP102
P0002 T01830178

IFR SPECI KOCF 231958Z VRB05KT 10SM OVC006 18/18 A2982 RMK AO2

Accident 2015Z

IFR METAR KOCF 232051Z 04005KT 10SM OVC006 19/18 A2981 RMK AO2 SLP098 60014 T01890178
56016=

IFR METAR KOCF 232151Z 03006KT 10SM OVC006 19/18 A2982 RMK AO2 SLP102 T01890178=

2.2 Destination – Cecil Field, Jacksonville, FL

The planned destination was Cecil Airport (KVQQ), Jacksonville, FL, and was located about 18 miles north-northeast of the accident site at an elevation of 80 feet. The following conditions were reported at the approximate time of the accident:

KVQQ special weather observation at 1511 EST (2011Z), wind from 030° at 12 knots, visibility 2 miles in mist, ceiling overcast at 900 ft, temperature and dew point 17° C, altimeter 29.87 inches of Hg.

The general flight categories and raw weather observations were reported between 0950 through 1700 EST were as follows:

IFR METAR KVQQ 231550Z 03016KT 3SM RA OVC006 17/17 A2995=

IFR METAR KVQQ 231650Z 03016KT 3SM RA BKN007 OVC011 17/17 A2994=

IFR METAR KVQQ 231750Z 03016KT 3SM RA BKN008 OVC012 17/17 A2990

IFR METAR KVQQ 231850Z 04009KT 3SM -RA BKN008 BKN013 OVC024 17/17 A2987

IFR METAR KVQQ 231950Z 03012KT 3SM BR OVC007 17/17 A2987

IFR SPECI KVQQ 232011Z 03012KT 2SM BR OVC009 17/17 A2987

Accident 2015Z

IFR METAR KVQQ 232050Z 03006KT 2SM -RA OVC008 17/17 A2987=

IFR METAR KVQQ 232150Z 03012KT 2 1/2SM BR OVC008 17/17 A2987=

2.3 Closest Reporting Site - Keystone Airpark, Keystone Heights, FL

The closest weather reporting site to the accident site was from Keystone Airpark (K42J), Keystone Heights, FL, located about 8 miles south-southwest of the accident site at an elevation of 196 feet. The airport had an AWOS and issued reports every 20-minutes. The conditions reported at the time of the accident were as follows:

K42J weather observation at 1515 EST (2015Z), automated, wind from 040° at 8 knots, visibility 10 miles or more, ceiling broken at 800 ft, overcast at 1,100 ft, temperature and dew point 18° C, altimeter 29.85 inches of Hg. Remarks; automated weather observation without a precipitation discriminator⁵, thunderstorm sensor inoperative.

The categorical flight outlook and raw observations were as follows:

IFR METAR K42J 231735Z AUTO 04007KT 4SM SCT001 OVC006 17/17 A2989 RMK AO1 TSNO=

IFR METAR K42J 231755Z AUTO 04007KT 4SM FEW001 OVC006 17/17 A2989 RMK AO1 TSNO=

IFR METAR K42J 231815Z AUTO 04009G14KT 3SM SCT001 OVC006 17/17 A2987 RMK AO1 TSNO=

IFR METAR K42J 231835Z AUTO 06008KT 4SM SCT001 OVC006 17/17 A2986 RMK AO1 TSNO=

IFR METAR K42J 231855Z AUTO 06005G14KT 8SM FEW001 OVC008 17/17 A2986 RMK AO1 TSNO=

IFR METAR K42J 231915Z AUTO 07008KT 8SM OVC008 17/17 A2986 RMK AO1 TSNO=

IFR METAR K42J 231935Z AUTO 06007KT 8SM OVC008 17/17 A2985 RMK AO1 TSNO=

IFR METAR K42J 231955Z AUTO 06008KT 360V360 9SM BKN008 OVC011 17/17 A2985 RMK AO1 TSNO=

Accident 2015Z

IFR METAR K42J 232015Z AUTO 04008KT 10SM BKN008 OVC011 18/18 A2985 RMK AO1 TSNO=

IFR METAR K42J 232035Z AUTO 05007KT 1 3/4SM OVC006 18/18 A2985 RMK AO1 TSNO=

IFR METAR K42J 232055Z AUTO 04007KT 1 1/2SM SCT001 BKN006 OVC010 18/18 A2985 RMK AO1 TSNO=

LIFR METAR K42J 232115Z AUTO 05010G17KT 1 1/4SM BKN001 OVC008 17/17 A2985 RMK AO1 TSNO=

LIFR METAR K42J 232135Z AUTO 05009KT 1 3/4SM BKN001 BKN008 OVC012 17/17 A2986 RMK AO1
TSNO=

LIFR METAR K42J 232155Z AUTO 04009G14KT 1 3/4SM BKN001 OVC008 17/17 A2986 RMK AO1 TSNO=

LIFR METAR K42J 232215Z AUTO 04006KT 2 1/2SM BKN001 BKN008 OVC013 17/17 A2987 RMK AO1
TSNO=

⁵ AWOS without a precipitation discriminator can not report weather type or precipitation that may be occurring.

IFR METAR K42J 232235Z AUTO 04007G14KT 9SM FEW001 BKN008 OVC015 17/17 A2987 RMK AO1 TSNO=

MVFR METAR K42J 232255Z AUTO 04009KT 7SM SCT008 BKN015 OVC022 17/17 A2987 RMK AO1 TSNO=

IFR METAR K42J 232315Z AUTO 03010G14KT 4SM BKN008 OVC015 17/17 A2987 RMK AO1 TSNO=

IFR METAR K42J 232335Z AUTO 03008KT 3SM OVC006 17/17 A2987 RMK AO1 TSNO=

IFR METAR K42J 232355Z AUTO 03010G16KT 5SM FEW001 OVC006 17/17 A2987 RMK AO1 TSNO=

2.4 METAR Display

The NWS Aviation Weather Center (AWC) display of the METARs⁶ at 1520 EST (2020Z) on November 23, 2017, is included as figure 7. The station model depiction is included below the image and provides color coded station models, with visibility and ceiling height in ft agl. Temperature and dew point temperatures are depicted in degrees F. The image depicted an extensive area of IFR conditions over Florida and southern Georgia, the closest MVFR conditions were reported over Jacksonville Naval Air Station (KNIP), Jacksonville and Mayport Naval Station (KNRB), Mayport, Florida to the northeast of the accident site.

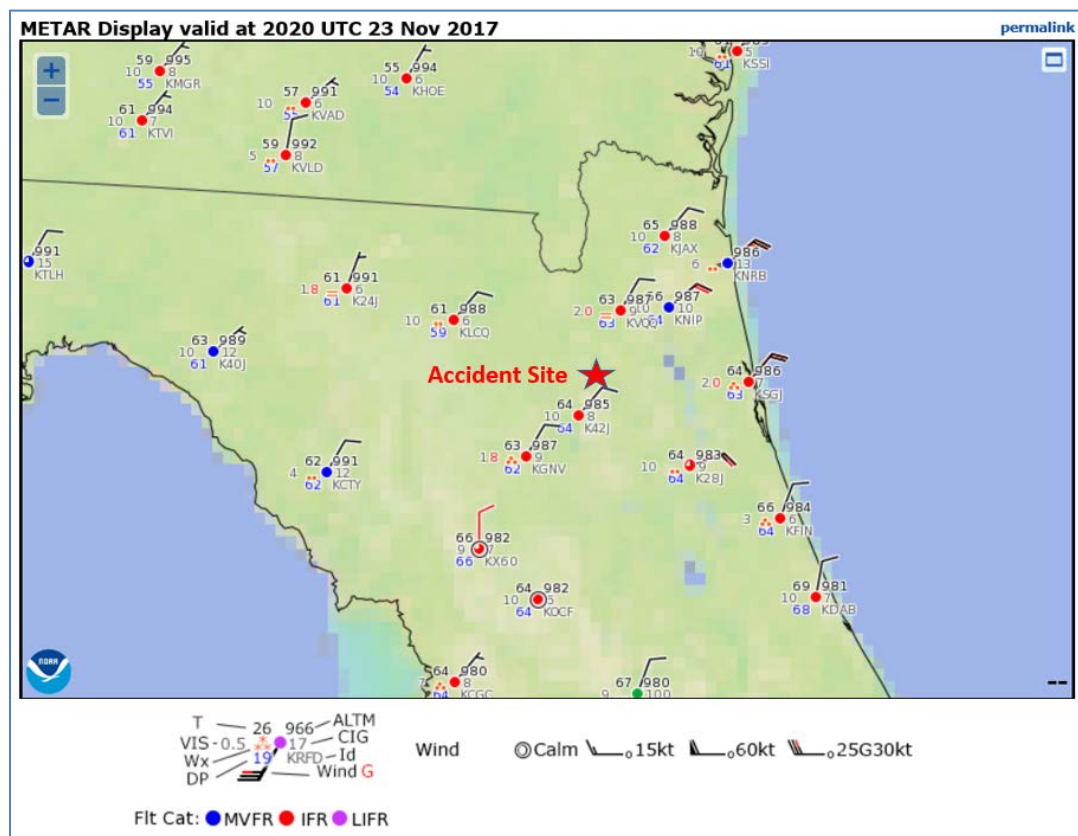


Figure 7 - NWS AWC METAR display at 1520 EST

⁶ METAR display obtained from NWS AWC web site (<http://aviationweather.gov/metar>)

3.0 Upper Air Sounding

The closest upper air observation or sounding was from the NWS Jacksonville (KJAX) Weather Forecast Office (WFO), site number 72206, located approximately 35 miles north-northeast of the accident site at an elevation of 30 ft. The 1900 EST sounding (0000Z on November 24, 2017) was plotted on a standard Skew T log P diagram⁷ from the surface to 500-hPa or approximately 18,000 ft utilizing RAOB software⁸ and is included as figure 8.

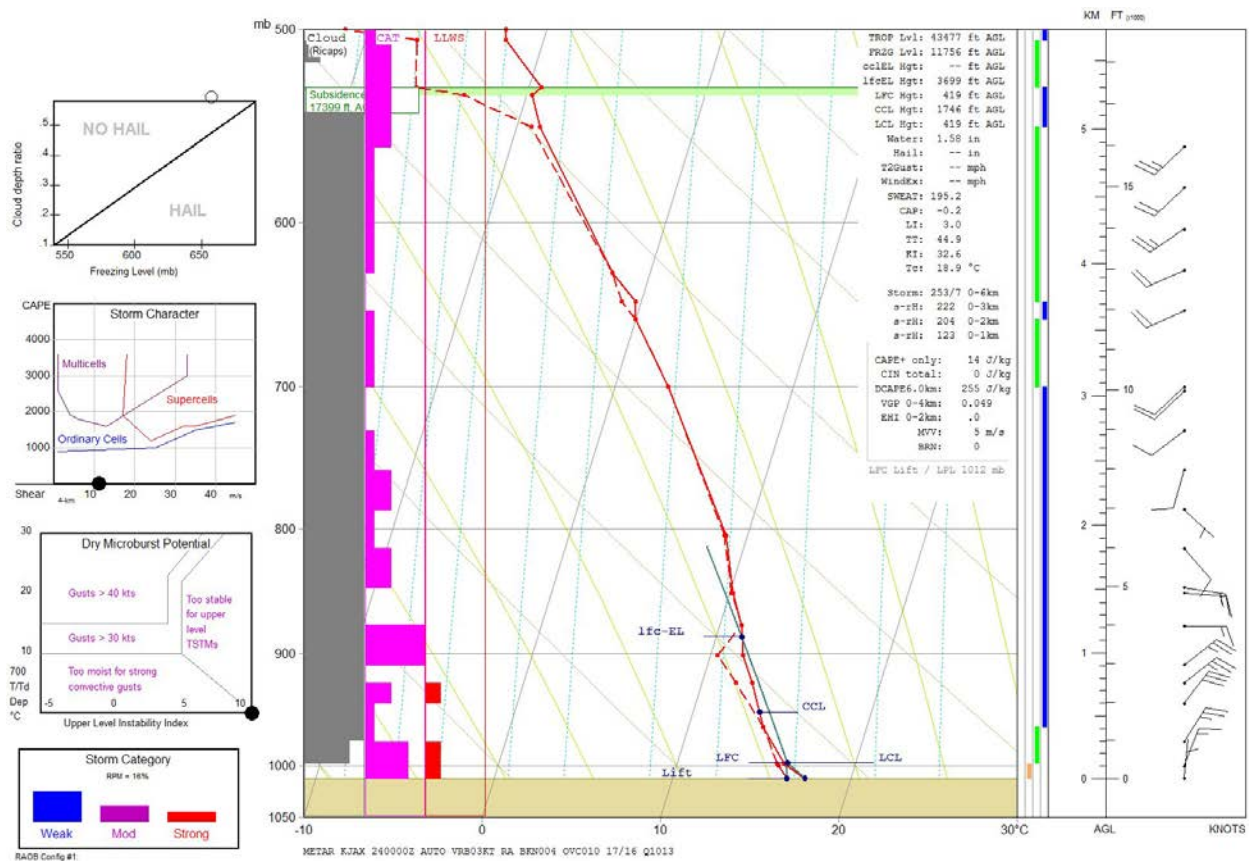


Figure 8 – NWS Jacksonville 1900 EST upper air sounding to 18,000 ft

The KJAX 1900 EST sounding depicted a moist low-level environment with a surface temperature of 17.4° C (63° F), a dew point of 16.4° C (62° F), with a relative humidity of 94%.

⁷ Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram 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.

⁸ RAOB software – The complete Rawinsonde Observation program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania, for plotting and analyzing upper air data.

The lifted condensation level (LCL)⁹ and level of free convection (LFC)¹⁰ were identified at 419 ft agl and represented the base of the clouds, with the convective condensation level (CCL)¹¹ at 1,746 ft agl. The sounding had a relative humidity greater than 90% from the surface to 16,500 ft or the approximate top of the cloud layer. A temperature inversion was identified immediately above this level at 17,400 ft. The sounding also supported several other layers of clouds above 18,000 ft, which were not displayed. The freezing level was identified at approximately 11,790 ft, and supported icing in clouds above that level. The precipitable water content was 1.58 inches. The Lifted Index (LI) was 3.0, and indicated a stable atmosphere and supported nimbostratus type clouds below 18,000 ft.

The sounding wind profile indicated a surface wind from the north or from 005° at 3 knots with winds veering or changing clockwise to the east through 5,000 ft with wind speeds increasing in this layer. A low-level jet stream¹² was identified at 2,000 ft with winds from 030° at 30 knots. Above 5,000 ft the wind veered to the southeast and southwest at 9,000 ft through the depth of the sounding. The mean 0 to 6 kilometer (km) or 18,000 ft steering wind was from 223° at 10 knots. The maximum wind associated with the jet stream was identified at 41,000 ft from 225° at 95 knots, with the tropopause at 43,500 ft.

A table of the observed height, pressure, temperature (T), dew point temperature (Td), relative humidity (RH%), wind direction and speed, and derived clear air turbulence (CAT), low-level wind shear (LLWS), and icing potential are included in figure 9 from the surface through 12,000 ft.

⁹ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁰ 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.

¹¹ Convective Condensation Level (CCL) - The height to which a parcel of air, if heated sufficiently from below, will rise adiabatically until condensation starts. This is typically used to identify the base of cumuliform clouds, which are normally produced from surface heating and thermal convection.

¹² Low-level jet stream – is simply any lower-tropospheric maximum in the vertical wind profile of the horizontal winds, with wind speeds above 24 knots. The low-level jet often transports low-level moisture into areas and increases the low-level convergence at the nose of the jet, and thus increasing vertical motion. It is often observed at night and above nocturnal inversions, and most common in along the Gulf coast and in the central plains.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGW/C method)
30	1012	17.4	16.4	94	5 / 3	SVR	LIGHT	
365	1000	16.2	15.7	97	20 / 16			
421	998	16.0	15.6	97		SVR	LIGHT	
1000	977				30 / 26			
1387	964	14.2	14.2	100		LGT		
2000	943				35 / 30	MDT	LIGHT	
2531	925	12.8	11.9	94	50 / 27			
3000	909				50 / 25			
3256	901	11.8	10.4	91		XTR		
4030	876	11.2	11.2	100	90 / 13			
4856	850	10.2	10.1	99	95 / 14			
5000	846				100 / 13	MDT		
6000	815				140 / 9			
6341	805	8.8	8.7	99		LGT		
7000	786				135 / 4	MDT		
8000	757				195 / 9	LGT		
9000	729				230 / 10			
10000	703				225 / 10			
10106	700	3.0	3.0	100	225 / 10			
11786	657	0.0	0.0	100		LGT		LGT Rime
12000	652				245 / 18			
12230	646	-0.3	-1.1	94				MDT Clear

Figure 9 - KJAX sounding variables through 12,000 ft

The wind profile and table of observed and derived sounding parameters indicated a high potential for low-level turbulence below 7,000 ft, with several layers of moderate and greater turbulence. The sounding indicated a 100% probability of moderate and greater turbulence below the low-level jet at 2,000 ft, due to the strong vertical wind shears, with a slight potential for LLWS. The CAT and LLWS are also displayed in the sounding profile on the left side of figure 8 with turbulence in pink and LLWS in red, with the anticipated cloud layer in gray.

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) data was obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. Both the infrared long wave and visible band imagery were obtained surrounding the time of the accident and reviewed. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns (μm) provided standard satellite image with radiative cloud top temperatures with a resolution of 2.0 km. The visible imagery (band 2) at a wavelength of 0.64 μm provided a resolution of 0.5 km.

Figure 10 is the GOES-16 infrared image at 1513 EST (2013Z) on November 23, 2017, at 4X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops typically associated with deep convection and with the surface pressure and frontal systems overlaid. The image depicted enhanced clouds along the frontal zone with a defined cumulonimbus cloud near Cape Canaveral. Over the accident site multiple layers of low to mid-altitude clouds were observed with a radiative cloud top temperature of 251° Kelvin or -22° C, which corresponded to cloud tops near 23,600 ft based on the KJAX sounding.

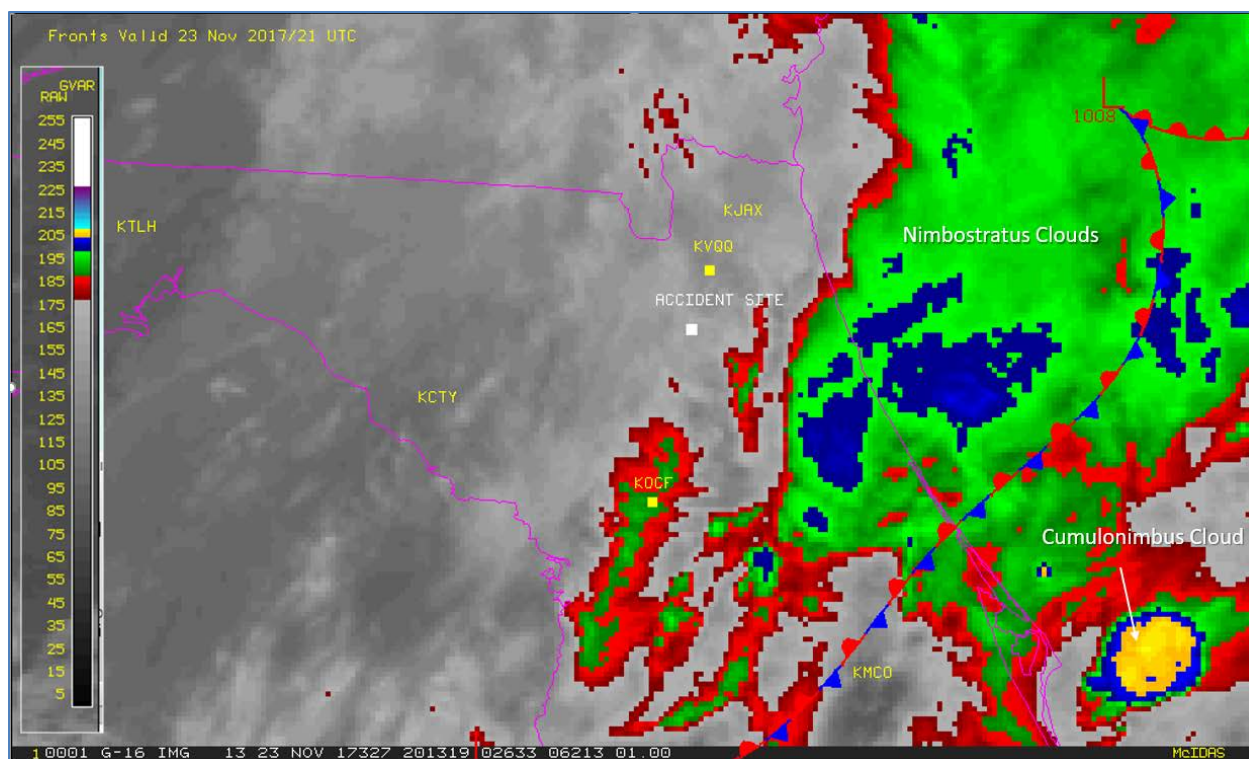


Figure 10 - GOES-16 infrared image at 1513 EST with surface fronts

The GOES-16 visible image for the same period of 1513 EST on November 23, 2017, is included as figure 11 at 1X magnification with the reporting airports across the region and the position of the pressure and frontal systems overlaid. The image depicted overcast cloud cover over the route and the accident site with nimbostratus type clouds.

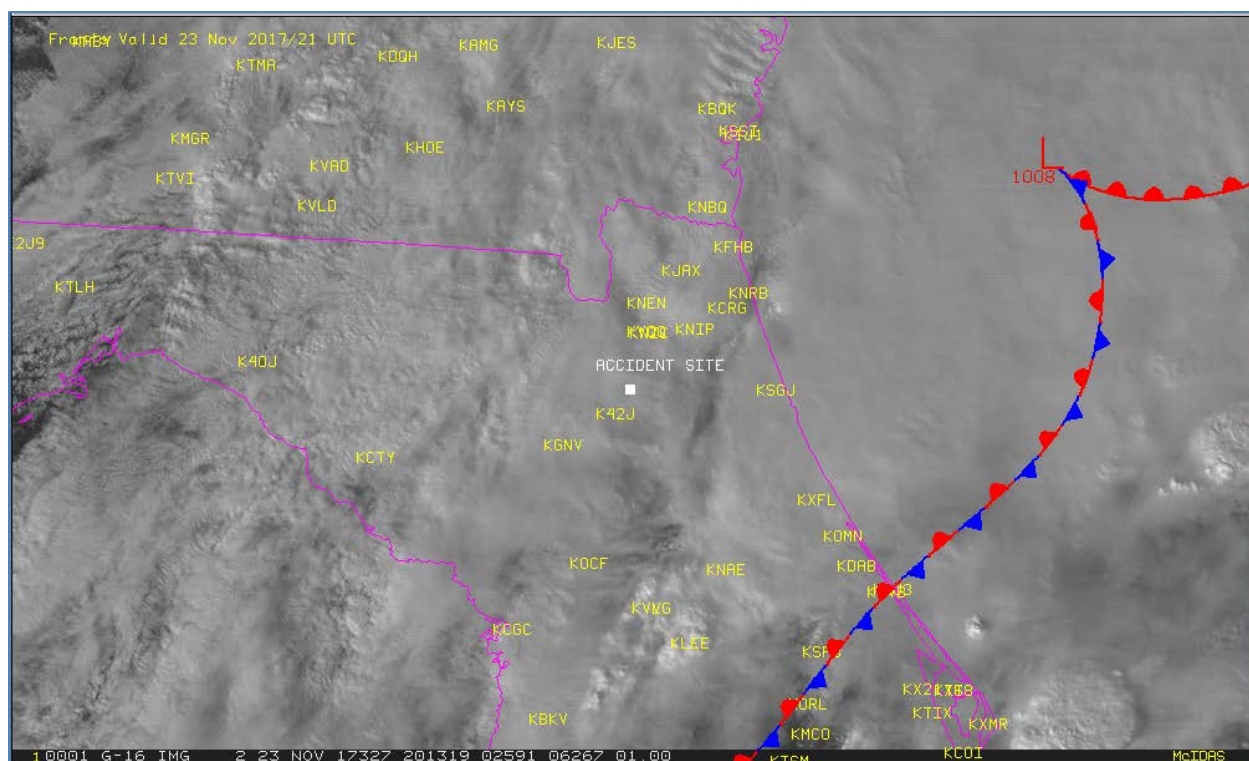


Figure 11 - GOES-16 visible image at 1513 EDT with fronts

5.0 Weather Surveillance Radar

The closest Weather Surveillance Radar-1988, Doppler (WSR-88D) to the accident site was the NWS KJAX site. The level II archive data was obtained from the NCEI using the Hierarchical Data Storage System and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

The WSR-88D is a S-band 10-centimeter wavelength radar with a power output of 750,000 watts, with a 28-foot parabolic antenna concentrating the energy into a 0.95° beam width. The radar produces three basic types of products reflectivity, radial velocity, and spectral width.

5.1 Radar 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 and can take between 4 to 10-minutes depending on the scan being utilized. The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has multiple scanning strategies, which are used when significant weather echoes are present or severe weather is occurring or is anticipated. The most common is the non-severe convective mode where the radar makes 9 elevation scans from 0.50° to 19.5° every six minutes. This particular scanning strategy is documented as volume coverage pattern 21 (VCP-21) and was being used at the time of the accident.

5.2 Beam height Calculations

Assuming standard refraction¹³ of the 0.95° radar beam of the KJAX WSR-88D with an antenna height of 160 ft and a distance of 35 miles from the radar, the following table shows the approximate beam height and width information of the radar display over the site of the accident. The heights have been rounded to the nearest 10 ft.

Antenna Elevation	Beam Center	Beam Base	Beam Top	Beam Width
0.5°	2,830 ft	1,060 ft	4,590 ft	3,530 ft

5.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors, 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 (dBZ) and is a general measure of echo intensity. The following table is referenced for pilots in Advisory Circular AC 00-24C – “Thunderstorms”.

Reflectivity (dBZ) Ranges	Weather Radar Echo Intensity Terminology
< 30 dBZ	Light
30 – 40 dBZ	Moderate
>40 – 50 dBZ	Heavy
>50 dBZ	Extreme

5.4 Base Reflectivity Images

Figure 12 is an image of the KJAX WSR-88D 0.5° base reflectivity image for 1513 EST on November 23, 2011¹⁷, with the flight track of N6894N overlaid. The image depicted very light intensity echoes over the general route of flight associated with light precipitation and clouds. The extent of the area of echoes was not evident in the NCEI National composite reflectivity image in figure 3.

¹³ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

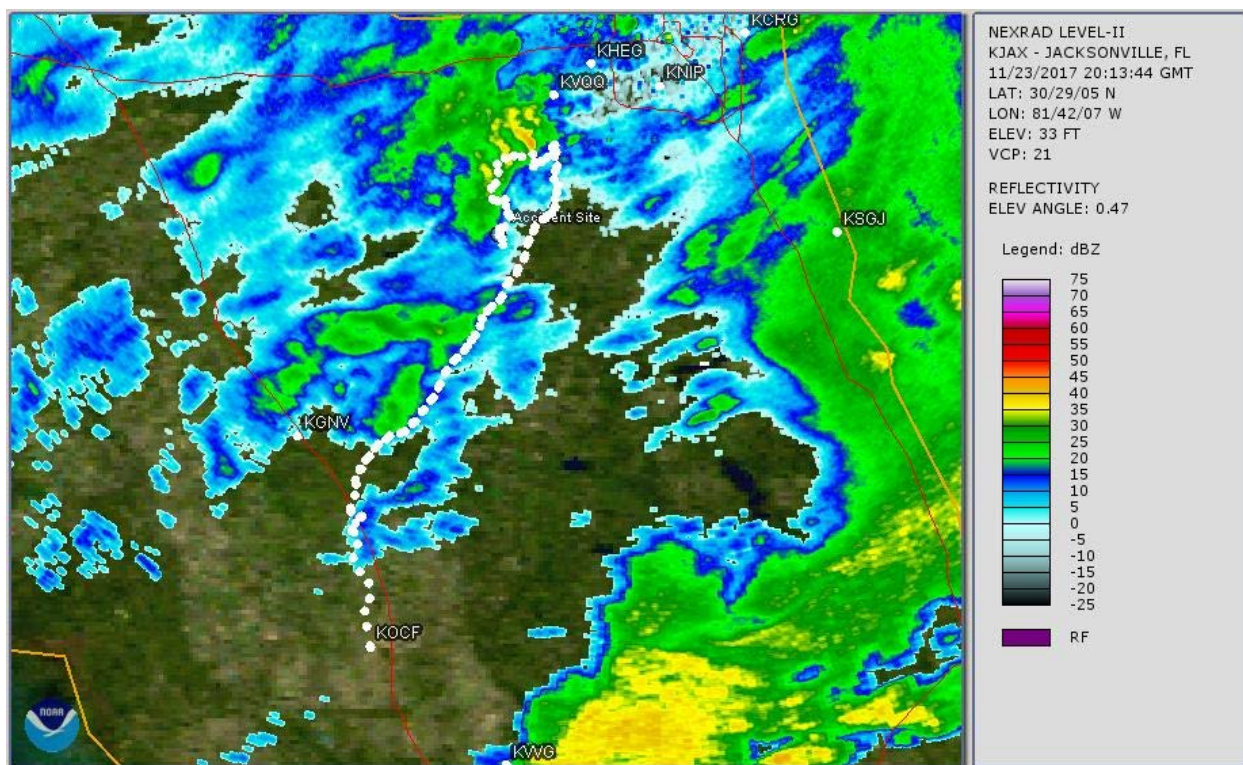


Figure 12 - KJAX WSR-88D 0.5° base reflectivity image for 1513 EST with flight track of N6894N overlaid

Figures 13 through 16 are closeup images of the KJAX WSR-88D 0.5° base reflectivity images with the corresponding flight track at 1502, 1508, 1513, and 1519 EST on November 23, 2017. The images depict an area of echoes intensifying over the region during the period with N6894N reversing course near the leading edge of the area of echoes, and as it reverses course to the southwest and south encounters echoes of 30 to 40 dBZ moderate intensity echoes, and exits the area when the accident occurs. The images also indicate that light reflectivity echoes were over the majority of the flight's duration after departing from KOCF and increased in intensity and coverage as the flight approached the planned destination.

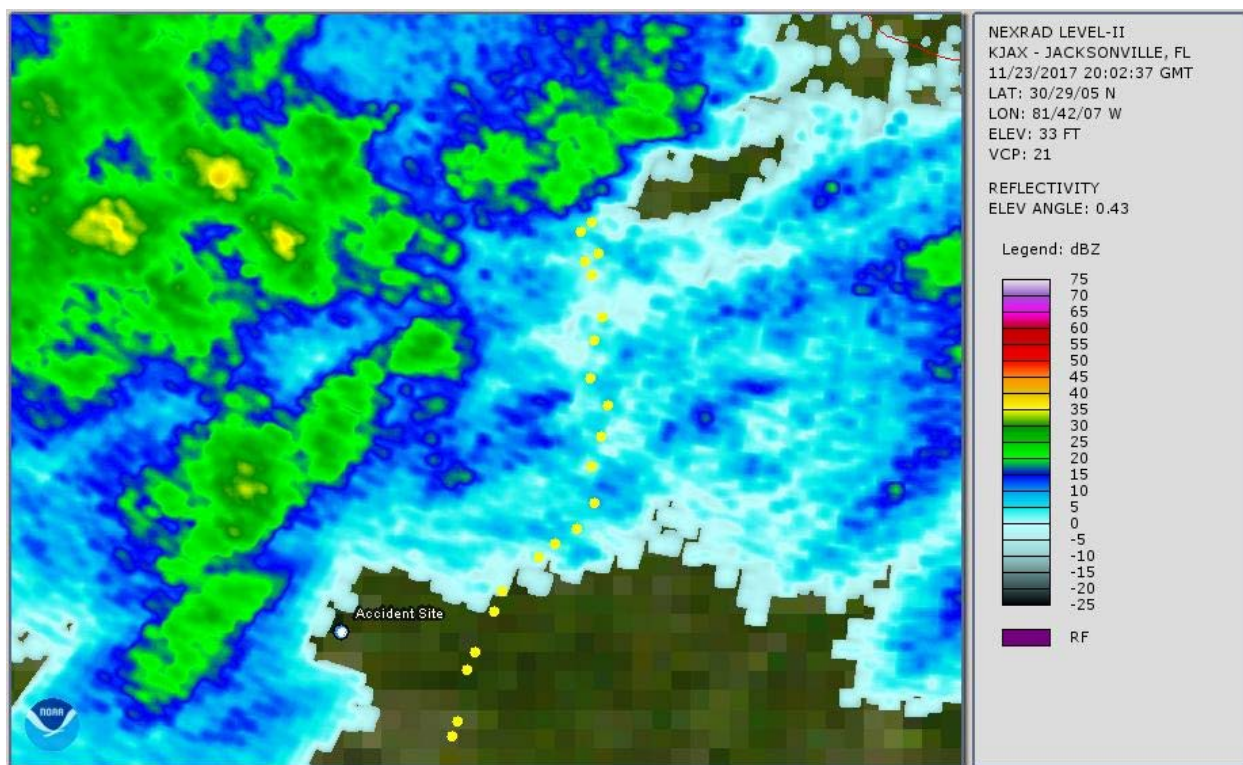


Figure 13 - KJAX WSR-88D 0.5° base reflectivity image and flight track at 1502 EST

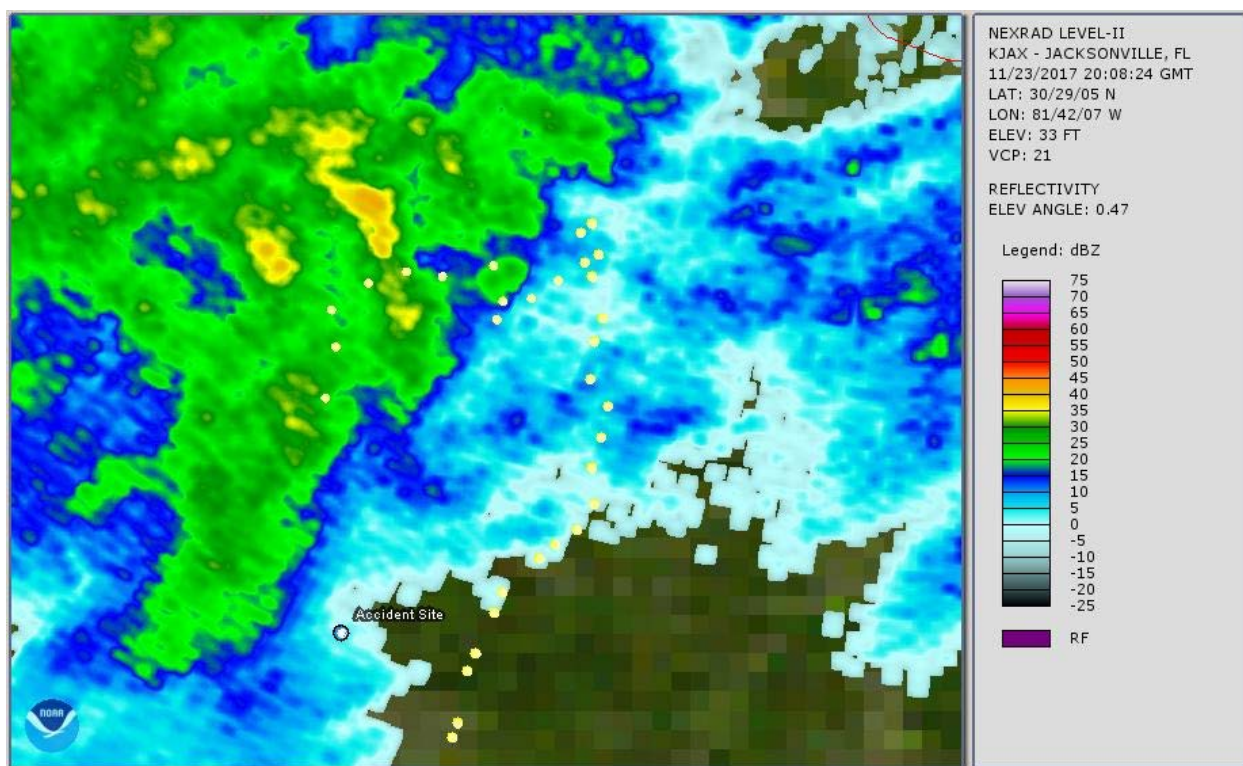


Figure 14 - KJAX WSR-88D 0.5° base reflectivity image and flight track at 1508 EST

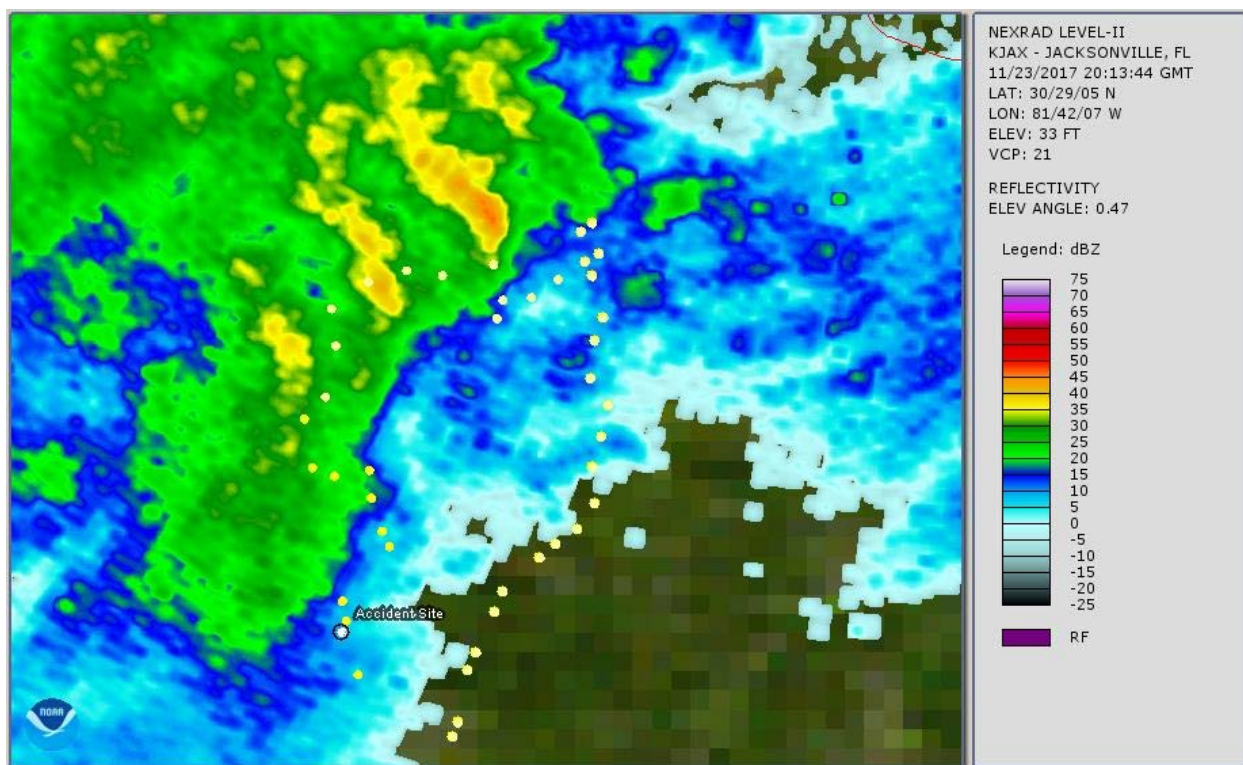


Figure 15 - KJAX WSR-88D 0.5° base reflectivity image and flight track at 1513 EST

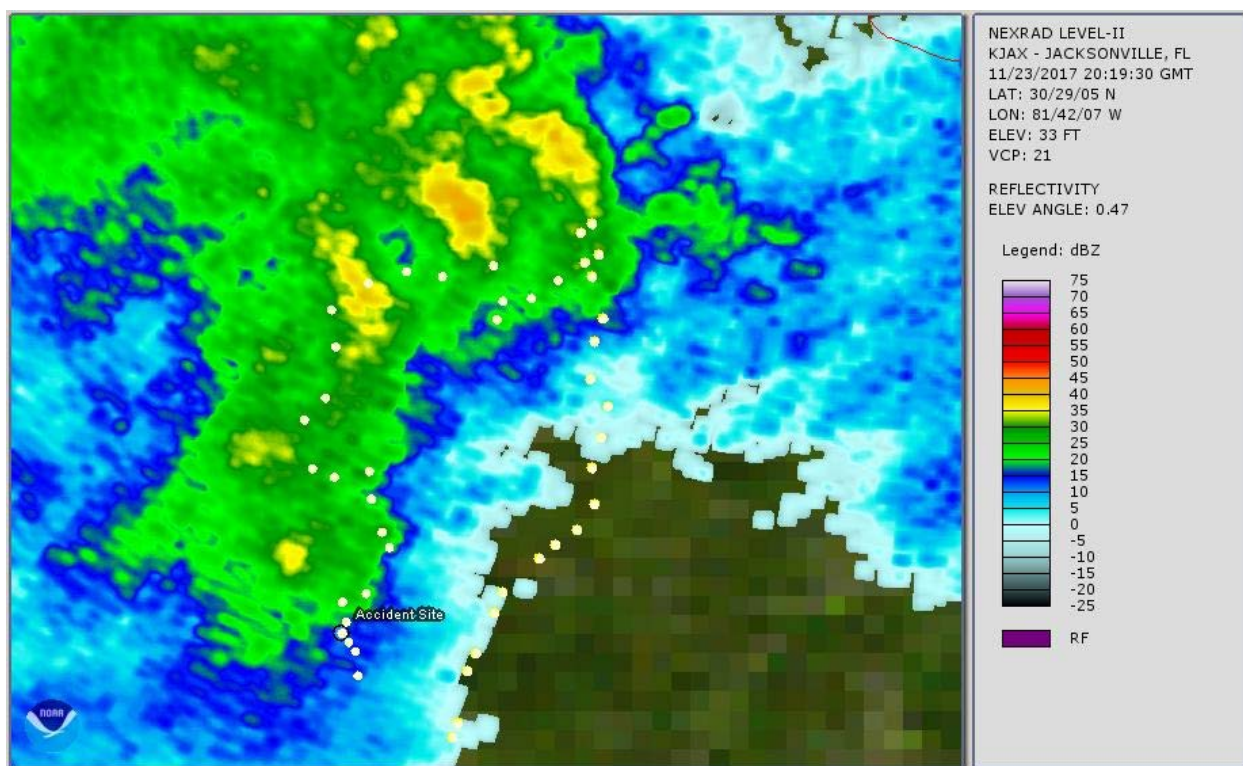


Figure 16 - KJAX WSR-88D 0.5° base reflectivity image and flight track at 1519 EST

6.0 Pilot Reports

The following pilot reports or PIREPs were reported surrounding the period from 1000 to 1900 EST relevant to the north and central Florida area. Reports below 18,000 ft have been included below, and urgent reports. The reports have been decoded from standard code and abbreviations with time converted to local time. The reports include the general closest airport and the location relevant to that location, and were as follows:

Jacksonville International Airport (JAX) routine pilot report (UA); Over – JAX; Time – 1018 EST; Altitude – 700 ft; Type aircraft – Piper Cherokee (PA28) single-engine airplane; Sky cover – departed JAX with bases at 700 ft.

Daytona Beach International Airport (DAB) urgent pilot report (UUA); Over –160° azimuth and 15 miles from Ormond Beach VORTAC¹⁴ (OMN); Time – 1028 EST; Altitude – 30,000 ft; Type aircraft – Rockwell Aero Commander (AC95) multi-engine turboprop airplane; Turbulence – severe; Remarks – no damage to aircraft or injuries.

Orlando International Airport (MCO) routine pilot report (UA); Over – 097° azimuth and 29 miles from Orlando VORTAC; Time – 1035 EST; Altitude – 16,000 ft; Type aircraft – Aircraft type unknown; Temperature – minus 8 C; Turbulence – moderate chop; Icing – moderate mixed type icing.

Daytona Beach International Airport (DAB) routine pilot report (UA); Over – 4 miles east of DAB; Time – 1040 EST; Altitude – 1,200 ft; Type aircraft – McDonald Douglas MD83 air carrier jet; Sky cover – bases at 1,200 ft overcast; Remarks – no wind shear encountered.

Orlando International Airport (MCO) routine pilot report (UA); Over – 5 miles north of the airport; Time – 1122 EST; Altitude – 1,500 ft; Type aircraft – Boeing 737 air carrier jet; Sky cover – broken clouds at 2,000 ft.

Tampa International Airport (TPA) routine pilot report (UA); Over – 30 miles northeast of TPA; Time – 1253 EST; Altitude – 13,000 ft; Type aircraft – Airbus A321 air carrier jet; Turbulence – moderate.

Vero Beach Regional Airport (VRB) routine pilot report (UA); Over – 10 miles west of VRB; Time – 1355 EST; Altitude – 4,000 ft; Type aircraft – Bombardier Challenger (CL60) corporate jet; Sky cover – visual meteorological conditions (VMC) and clear.

Orlando International Airport (MCO) routine pilot report (UA); Over – runway 17L; Time – 1400 EST; Altitude – 1,500 ft; Type aircraft – Airbus A321 air carrier jet; Sky cover – cloud bases at 1,500 ft.

Melbourne International Airport (MLB) routine pilot report (UA); Over – 210° azimuth and 10 miles from Melbourne VORTAC; Time -1406 EST; Altitude – 3,000 ft; Type aircraft – Cirrus (SR22) single-engine airplane; Sky cover – overcast clouds bases 2,900 ft; Weather – light rain; Turbulence – moderate at 3,000 ft.

Melbourne International Airport (MLB) urgent pilot report (UUA); Over – MLB; Time -1436 EST; Altitude – 33,000 ft; Type aircraft – Embraer (E190) regional jet; Turbulence – severe.

Jacksonville International Airport (JAX) routine pilot report (UA); Over – JAX; Time – 1439 EST; Altitude – 1,000 ft; Type aircraft – Embraer (E75L) narrow body medium range air carrier jet; Sky cover – broken cloud bases at 800 ft.

Melbourne International Airport (MLB) urgent pilot report (UUA); Over – 214° azimuth and 5 miles from Melbourne VORTAC; Time -1500 EST; Altitude – 8,000 ft; Type aircraft – Beechcraft Baron (BE58T) multi-engine airplane; Weather – moderate rain; Turbulence – severe.

¹⁴ VORTAC – is a very high frequency (VHF) omnidirectional range (VOR) beacon collocated with a tactical air navigation beacon (TACAN) or distance measuring equipment (DME) that provides azimuth and distance information from the station to for navigational purposes to pilots. Unless otherwise noted, the navigation aid is collocated with the city in the report.

Jacksonville International Airport (JAX) routine pilot report (UA); Over – St Augustine VORTAC (SGJ); Time – 1519 EST; Altitude – 1,000 ft; Type aircraft – Embraer (E145) air carrier regional jet; Sky cover – broken cloud bases at 700 ft.

Orlando Executive Airport (ORL) routine pilot report (UA); Over – 080° azimuth and 50 miles from Orlando VORTAC; Time – 1605 EST; Altitude – 14,000 ft; Type aircraft – Airbus A319 air carrier jet; Turbulence – moderate.

Melbourne International Airport (MLB) routine pilot report (UA); Over – 270° azimuth and 5 miles from Melbourne VORTAC; Time - 1638 EST; Altitude – 9,000 ft; Type aircraft – Boeing 737 air carrier jet; Sky cover – scattered clouds with bases at 2,500 ft and tops at 9,000 ft.

Vero Beach Regional Airport (VRB) routine pilot report (UA); Over – 70 miles south-southwest (210° azimuth) of VRB; Time – 1639 EST; Altitude – 16,000 ft; Type aircraft – Embraer (E190) air carrier regional jet; Turbulence – moderate.

Jacksonville International Airport (JAX) routine pilot report (UA); Over – JAX; Time – 1645 EST; Altitude – 900 ft; Type aircraft – Bombardier (CRJ2) air carrier regional jet; Sky cover – broken cloud bases at 900 ft; Remarks – on final for runway 8.

Jacksonville International Airport (JAX) routine pilot report (UA); Over – Ocala (OCF); Time – 1650 EST; Altitude – 700 ft; Type aircraft – North American Rockwell Aero Commander (AC50) multi-engine airplane; Sky cover – broken cloud bases at 700 ft; Remarks – on final for runway 36.

Jacksonville International Airport (JAX) routine pilot report (UA); Over – Northeast Florida Regional Airport (SGJ); Time – 1714 EST; Altitude – 1,100 ft; Type aircraft – EPIC single engine turboprop; Sky cover – broken cloud bases at 1,100 ft with tops at 2,600 ft.

Melbourne International Airport (MLB) urgent pilot report (UUA); Over – 032° azimuth and distance of 100 miles from West Palm Beach VORTAC; Time – 1740 EST; Altitude – 26,000 ft; Type aircraft – Gulfstream V corporate jet; Turbulence – severe.

Daytona Beach International Airport (DAB) routine pilot report (UA); Over – BARBS intersection; Time – 1830 EST; Altitude – 11,000 ft; Type aircraft – Beechcraft Super King Air (BE350) multi-engine turboprop airplane; Weather – in instrument meteorological conditions (IMC); Turbulence – light chop.

7.0 NWS Forecasts and Advisories

The following aviation forecasts and advisories were applicable for the area during the period.

7.1 Terminal Aerodrome Forecast

The NWS KJAX Weather Forecast Office (WFO) was responsible for the KVQQ Terminal Aerodrome Forecast (TAF). The forecast issued prior to the flight departure and available for preflight planning was issued at 0656 EST on November 23, 2017, and current for a 24-hour period and was as follows:

*TAF KVQQ 231156Z 2312/2412 01009KT 3SM RA BR BKN005 OVC015
TEMPO 2313/2317 1SM +RA BR BKN006 OVC010
FM231700 05010G15KT 5SM -RA BR SCT009 BKN015 OVC030
FM240100 36006KT 5SM -RA BR BKN005 OVC009=*

The forecast valid from 0700 through 1200 EST expected IFR conditions to prevail due to moderate to heavy rain, and ceilings broken from 500 to 600 ft. After 1200 through 2000 EST, the forecast expected general MVFR conditions with wind from 050° at 10 knots gusting to 15 knots, with visibility 5 miles in light rain and mist, scattered clouds at 900 ft agl, ceiling broken at 1,500 ft, overcast at 3,000 ft. The forecast was amended at 0816 EST with minor changes to cloud heights in the first part of the forecast, and continued to expect MVFR conditions during the period, with LIFR conditions after 2000 through 0700 EST and was as follows:

*AMD TAF KVQQ 231316Z 2313/2412 03012KT 3SM RA BR BKN005 OVC030
TEMPO 2313/2317 1SM +RA BR BKN005 OVC010
FM231700 06010G15KT 5SM -RA BR SCT010 BKN015 OVC030
FM240100 36006KT 5SM -RA BR BKN005 OVC010=*

The next scheduled forecast was issued at 1220 EST eliminated the MVFR conditions and continued the IFR conditions, due to ceiling broken at 800 ft agl with light rain through 2000 EST, with LIFR conditions with ceilings at 500 ft agl between 2000 and 0900 EST the next morning and was as follows:

*TAF KVQQ 231720Z 2318/2418 04012G18KT 5SM -RA BKN008 OVC015
TEMPO 2318/2322 SCT008 OVC015
FM240100 36008KT 4SM -RA BR BKN005 OVC010
TEMPO 2407/2411 2SM BR OVC005
FM241400 02010KT P6SM SCT005 OVC015=*

No TAFs were issued for the departure airport KOCF.

7.2 Area Forecast Discussion

The KJAX Area Forecast Discussion (AFD) issued at 1357 EST regarding the conditions over the region was as follows:

*FXUS62 KJAX 231857
AFDJAX*

*Area Forecast Discussion
National Weather Service Jacksonville FL
157 PM EST Thu Nov 23 2017*

.SHORT TERM...Tonight and Friday...Surface lows near Daytona Beach and Tampa along frontal boundary will move northeast into the western Atlantic tonight which will end the heavy rain threat for ne Fl this evening. Instability for strong storms remains south of our area...with storms possible across mainly central Fl. As low pressure shifts east of the area drier air in the mid and upper levels will gradually end the rain chances from west to east late tonight over se Ga with rain ending across ne Fl on Friday. Low level moisture will linger longer so expect clouds to hang over the area until Friday afternoon/evening when upper trough shifts towards the area.

*.SHORT TERM.../FRIDAY NIGHT-SUNDAY/...
The upper level short wave will continue digging southeast into the eastern Gulf of Mexico with the last of the rainfall moving over the coastal waters. A weak onshore flow will advect some low level ocean cloudiness over the coastal areas early in the evening. Over the weekend a stronger upper level short wave dives south reinforcing the earlier impulse and pushing strong surface high pressure into the lower Mississippi River Valley. This high will ridge over the area on Saturday and*

Sunday with clearing conditions. Temperatures will be slightly below climo on Friday and near climo over the weekend.

.LONG TERM.../MONDAY-THURSDAY/...

The surface high pressure center shifts to the Cape Hatteras area on Monday and offshore on Tuesday with a return flow now coming in from off the ocean. Late in the day on Tuesday a coastal trough/front will set up over the coastal waters with a few showers moving onshore in the coastal counties. On Wednesday a sharp upper trough will dig south into the lower Mississippi River Valley with a low developing near Memphis and a surface cold front extending south to the Mobile area. This system will sweep eastward on Thursday with a line of showers and thunderstorms along the front. Temperatures will be near to slightly above normal for the period.

&&

.AVIATION...Low clouds and rain will continue through tonight into Friday morning. IFR/LIFR conditions expected until at least 14z Friday with MVFR cigs expected thereafter. Northeast winds 10 to 15 knots this afternoon will become more northerly tonight and Friday as low pressure moves from eastern Gulf into the Atlantic.

&&

.MARINE...Advisory conditions will continue over the waters through Friday with northeast winds becoming northerly tonight. Winds and seas will decrease Friday evening as the pressure gradient weakens. No headlines expected this weekend into early next week as high pressure settles over the area.

Rip Currents: Moderate risk through Friday.

&&

.JAX WATCHES/WARNINGS/ADVISORIES...

FL...None.

GA...None.

AM...Small Craft Advisory until 10 PM EST Friday for Waters from Altamaha Sound GA to Fernandina Beach FL from 20 to 60 NM-Waters from Fernandina Beach to St. Augustine FL from 20 to 60 NM-Waters from St. Augustine to Flagler Beach FL from 20 to 60 NM.

Small Craft Advisory until 10 AM EST Friday for Coastal waters from Altamaha Sound to Fernandina Beach FL out 20 NM-Coastal waters from Fernandina Beach to St. Augustine FL out 20 NM-Coastal waters from St. Augustine to Flagler Beach FL out 20 NM.

7.3 Graphic Forecast for Aviation (GFA)

The NWS AWC Graphic Forecast for Aviation (GFA) cloud height and top forecast issued at 1400 EST on November 23, 2017, is included as figure 17 for the expected conditions at 1600 EST. The cloud height forecast near Jacksonville expected overcast clouds with bases at 1,000 ft with cloud tops near 11,000 ft, further west over northern Florida the cloud heights were expected at 500 ft with tops near 8,000 ft.

Figure 18 is the GFA wind, expected weather, and general flight categories expected for 1600 EST and depicted northeast winds near 10 knots, with predominantly MVFR with small areas of IFR conditions prevailing in moderate rain.

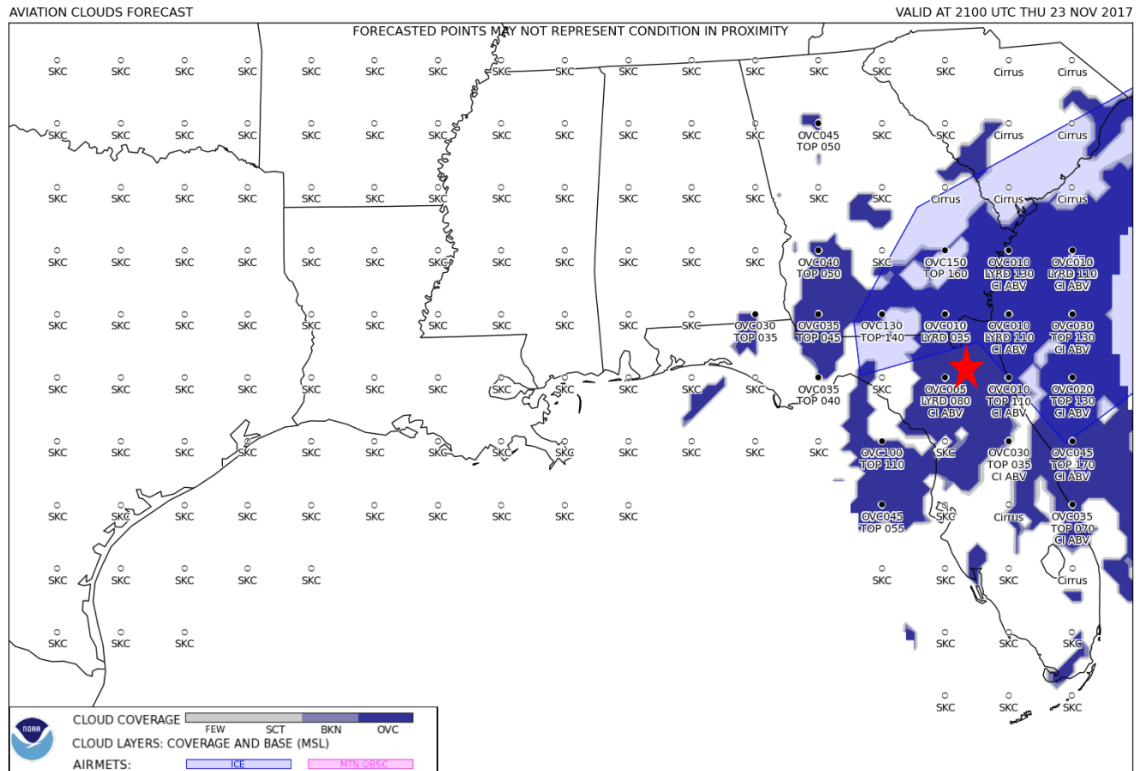


Figure 17 - Graphic Forecast for Aviation cloud base and tops forecast current during the period

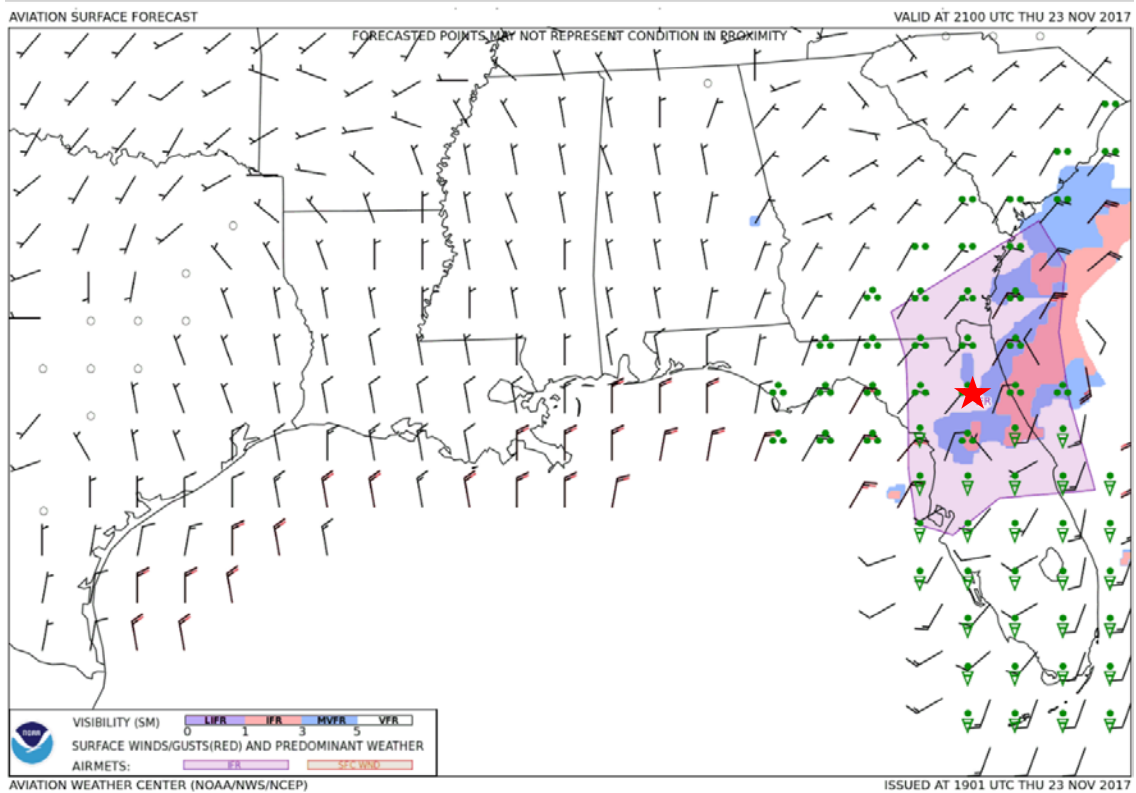


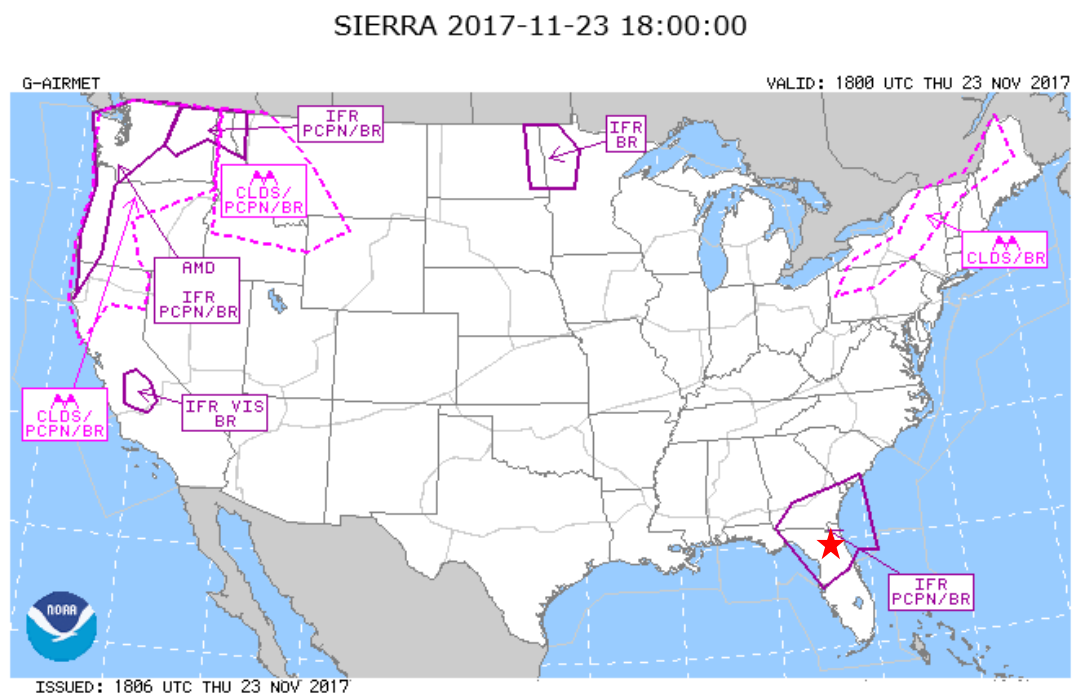
Figure 18 - Graphic Forecast for Aviation wind, weather, and flight category

7.4 Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA Air Route Traffic Control Center's (ARTCCs).

There are four basic types of inflight aviation weather advisories: the Significant Meteorological Advisory (SIGMET), the Convective SIGMET, AIRMET, and the Center Weather Advisory (CWA). The following advisories were issued chronologically surrounding the period.

AIRMET Sierra update 3 for IFR conditions is depicted in figure 19 with the following text advisory, which included the route of flight and accident site.



WAUS42 KPCI 231742 AAA

WA2S

-MIAS WA 231742 AMD

AIRMET SIERRA UPDT 3 FOR IFR VALID UNTIL 232100

.

AIRMET IFR...SC GA FL AND CSTL WTRS...UPDT

**FROM CHS TO 90E OMN TO 30ENE TRV TO 40SSW ORL TO SRQ TO 30W TLH
TO 20ENE PZD TO CHS**

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

AIRMET Tango and AIRMET Zulu current at the time for higher altitudes over the route of flight are provided as figures 20 and 21 respectively, followed by the text bulletins.

TANGO 2017-11-23 18:00:00

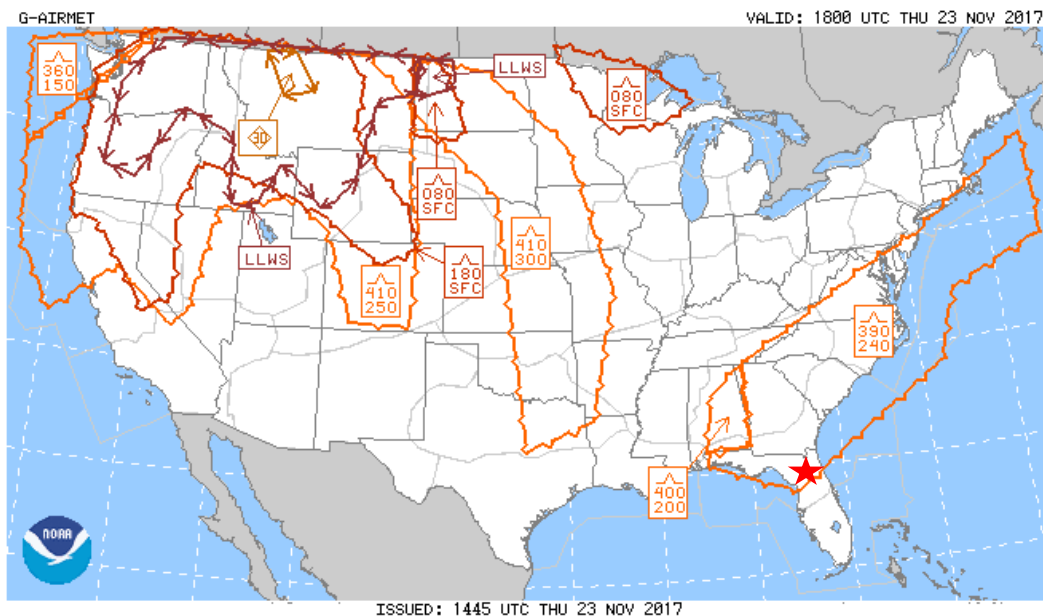


Figure 20 - AIRMET Tango for turbulence

WAUS42 KPCI 231445

WA2S

MIAT WA 231445

AIRMET TANGO UPDT 2 FOR TURB VALID 232100

AIRMET TURB...NC SC GA FL ME NH MA RI CT NY NJ PA WV MD DC DE VA AND CSTL WTRS
FROM 110SSW YSJ TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO 130SSE ILM TO 220SE CHS TO
PIE TO 50SE SJI TO 40W CEW TO 50SW PZD TO GQO TO HNV TO 40W BKW TO BOS TO 110SSW
YSJ

MOD TURB BTN FL230 AND FL390. CONDS CONTG BYD 21Z THRU 03Z.

ZULU 2017-11-23 18:00:00

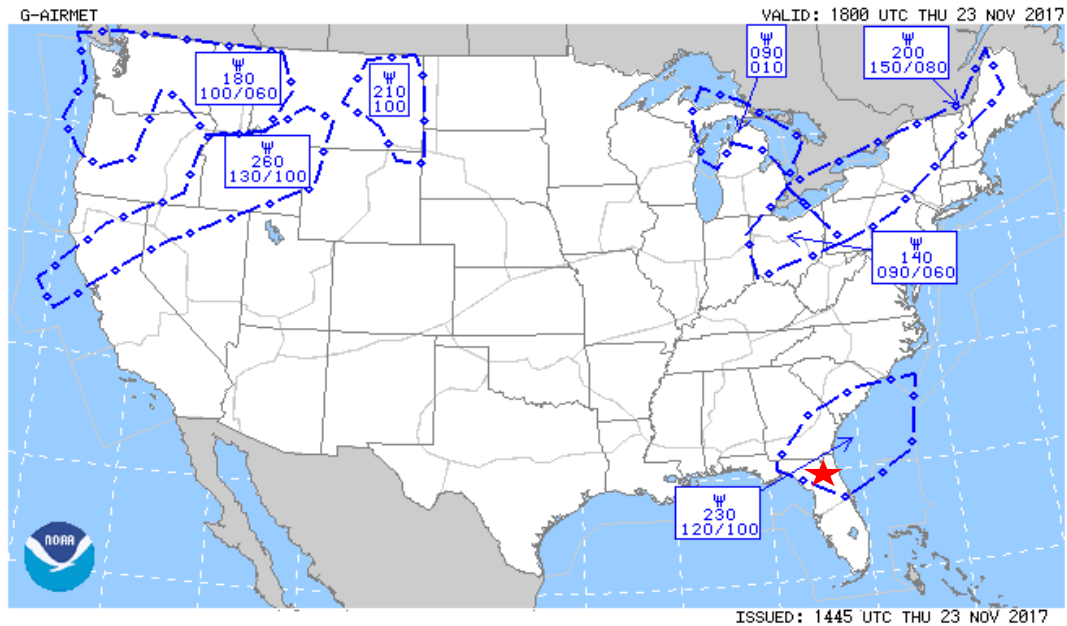


Figure 21 - AIRMET Zulu for icing conditions

WAUS42 KPCI 231445

AIRMEWT ZULU UPDT 2 FOR ICE AND FRZLVL VALID 232100Z

.

AIRMET ICE...NC SC GA FL AND CSTL WTRS

FROM 50ENE ILM TO 150ESE ILM TO 130SSE ILM TO 220SE CHS TO 30ESE PIE TO CTY TO
50WNW TLH TO IRQ TO 40SSW FLO TO 50ENE ILM

MOD ICE BTN FRZLVL AND FL230. FRZLVL 100-120. CONDS CONTG BYD 21Z THRU 03Z.

The graphic plot of the Convective SIGMETs for 1355 EST on November 23, 2017, above are plotted in figure 22, and the advisories issued at 1455 EST are in figure 23 with the text bulletins following.

chart created at 1856 UTC Thu 23 Nov 2017
SIGMETs expire at or before 2055z/23rd



Figure 22 - Convective SIGMETs issued at 1355 EST

WSUS31 KPCI 231855

SIGE

MKCE WST 231855

CONVECTIVE SIGMET 26E

VALID UNTIL 2055Z

FL CSTL WTRS

FROM 60E CRG-150E OMN-60ENE TRV-90ESE OMN-20NNE OMN-60E CRG

AREA EMBD TS MOV FROM 24030KT. TOPS TO FL400.

CONVECTIVE SIGMET 27E

VALID UNTIL 2055Z

FL AND CSTL WTRS

FROM 40NW ORL-20NNE PIE-30W SRQ

LINE EMBD TS 25 NM WIDE MOV FROM 24030KT. TOPS TO FL360.

CONVECTIVE SIGMET 28E

VALID UNTIL 2055Z

FL AND CSTL WTRS

FROM 40SW TRV-20NNW RSW-80W EYW

LINE EMBD TS 25 NM WIDE MOV FROM 25030KT. TOPS TO FL400.

CONVECTIVE SIGMET 29E

VALID UNTIL 2055Z

FL AND CSTL WTRS

FROM 20ENE PBI-20SSE MIA-40WSW MIA-40W PBI-20ENE PBI

AREA EMBD TS MOV FROM 24020KT. TOPS TO FL400.

OUTLOOK VALID 232055-240055

FROM 70SSE CHS-210E OMN-50E MIA-70W EYW-90WSW PIE-40W OMN-70SSE CHS

WST ISSUANCES POSS. REFER TO MOST RECENT ACUS01 KWNS FROM STORM

PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

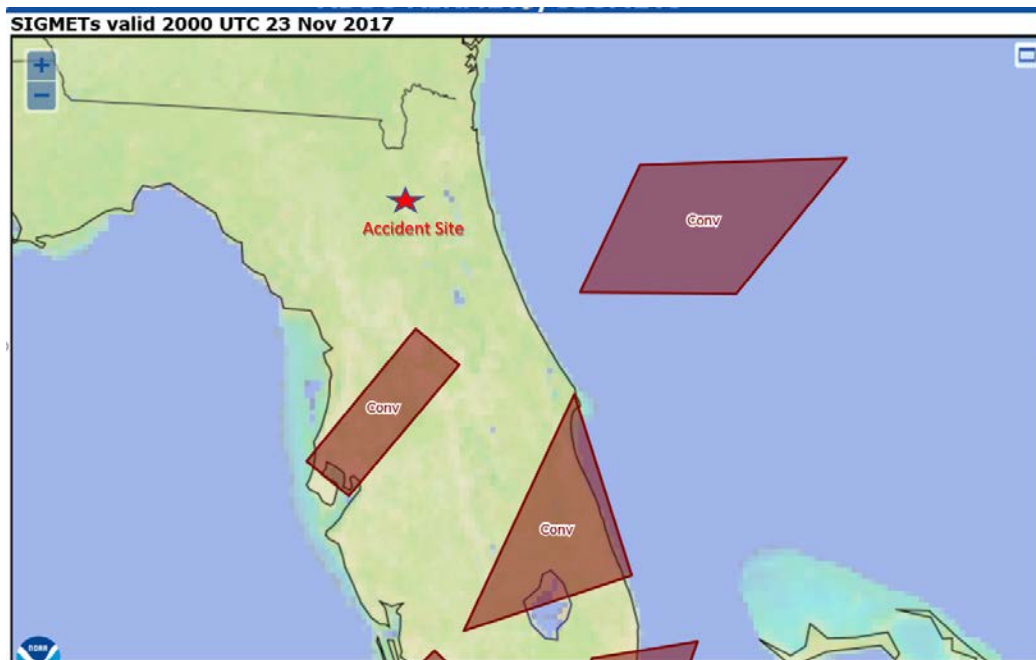


Figure 23 - Convective SIGMETs for 1455 EST

WSUS31 KPCI 231955

SIGE

MKCE WST 231955

CONVECTIVE SIGMET 30E

VALID UNTIL 2155Z

FL CSTL WTRS

FROM 80NE OMN-160ENE OMN-100E OMN-30E OMN-80NE OMN
AREA EMBD TS MOV FROM 24030KT. TOPS TO FL400.

CONVECTIVE SIGMET 31E

VALID UNTIL 2155Z

FL AND CSTL WTRS

FROM 30NW ORL-PIE

DMSHG LINE TS 25 NM WIDE MOV FROM 24032KT. TOPS TO FL300.

CONVECTIVE SIGMET 32E

VALID UNTIL 2155Z

FL AND CSTL WTRS

FROM 40E ORL-30N PBI-20NE RSW-40E ORL

AREA EMBD TS MOV FROM 24025KT. TOPS TO FL420.

CONVECTIVE SIGMET 33E

VALID UNTIL 2155Z

FL AND CSTL WTRS

FROM 10ESE RSW-80WNW EYW

LINE EMBD TS 25 NM WIDE MOV FROM 25030KT. TOPS TO FL380.

REF INTL SIGMET KILO SERIES

CONVECTIVE SIGMET 34E
VALID UNTIL 2155Z
FL AND CSTL WTRS
FROM 30E PBI-80E EYW-50SW MIA-20WSW PBI-30E PBI
AREA EMBD TS MOV FROM 24025KT. TOPS ABV FL450.

OUTLOOK VALID 232155-240155
FROM 70SSE CHS-210E OMN-50E MIA-70W EYW-90WSW PIE-40W OMN-70SSE CHS
WST ISSUANCES POSS. REFER TO MOST RECENT ACUS01 KWNS FROM STORM
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

7.5 Winds and Temperature Aloft

The following winds and temperature aloft forecast was current at the time for the route of flight:

WINDS ALOFT FORECASTS
DATA BASED ON 231800Z
VALID 240000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
PIE	2319	2324+12	2326+07	2328+01	2343-12	2346-23	227939	218349	228855
JAX	0422	3108+09	9900+04	1414+00	2131-11	2234-24	236340	227750	228157

The forecast wind for the period from 1500 through 2200 EST on November 23, 2017, expected over JAX a wind at 3,000 ft from the 040° at 22 knots, at 6,000 ft from 310° at 8 knots, with a temperature of 9° C, and at 9,000 ft light and variable winds less than 10 knots with a temperature of 4° C.

8.0 Preflight Weather Briefing

The pilot of N6894N filed IFR flight plans at 0858 and at 1405 EST on November 23, 2017, with the Contract Automated Flight Service Station provider Leidos, the pilot did not request any weather briefing during those times. There was no contact with any other Direct User Access Terminal Service (DUATS) providers, that would have documented what weather products or advisories the pilot may have familiarized himself with prior to departure.

9.0 Astronomical Conditions

The United States Naval Observatory provided the following astronomical conditions for Starke, Bradford County, Florida on November 23, 2017:

Beginning civil twilight	0635 EST
Sunrise	0700 EST
Accident	1515 EST
Sunset	1729 EST
End of civil twilight	1755 EST

At the time of the accident the sun was 23.6° above the horizon at an azimuth of 226°.

Submitted by:

Don Eick
Senior Meteorologist