NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 14, 2021

Specialist's Factual Report

METEOROLOGY

ERA21LA036

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A. ACCIDENT

Location: Fernandina Beach, Florida
Date: November 1, 2020
Time: 1400 eastern standard time
1900 Coordinated Universal Time (UTC)
Airplane: Raytheon 400A; Registration: N456FL

B. METEOROLOGIST

Paul Suffern
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist did not travel for this investigation and gathered the weather data for this investigation from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources and also from the National Centers for Environmental Information (NCEI). This specialist factual contains the meteorological factors pertinent to the weather surrounding the accident time. All times are eastern standard time (EST) on November 1, 2020, and are based upon the 24-hour clock, where local time is -5 hours from UTC, and UTC=Z (unless otherwise noted). Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS airport and station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports.

The accident site was located at latitude 30.6118° N, Longitude 81.4612° W, with an approximate elevation of 15 feet (ft).

D. FACTUAL INFORMATION

1.0 Synoptic Situation

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction and the Weather Prediction Center, located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular "Aviation Weather Services", AC 00-45H.[1]

1.1 Surface Analysis Chart

A southeast section of the NWS Surface Analysis Chart for 1300 EST is provided as figure 1 with the approximate location of the accident site marked within the red circle. The chart identified a low pressure system over the northeastern Gulf of Mexico with a pressure of 1017-hectopascals (hPa). A trough[2] stretched from the low pressure system northeastward and immediately west of the accident site and off the coast of the Carolinas. Troughs can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present.

The station models around the accident site depicted air temperatures near 80 degrees Fahrenheit (°F), dew point temperatures in the low 70's °F with temperature-dew point spreads of 8°F or less, a southeast wind of 5 to 10 knots, and partly cloudy sky cover. Heavy rain was reported at the station model immediately north of the accident site in southeastern Georgia.

[1] https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

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

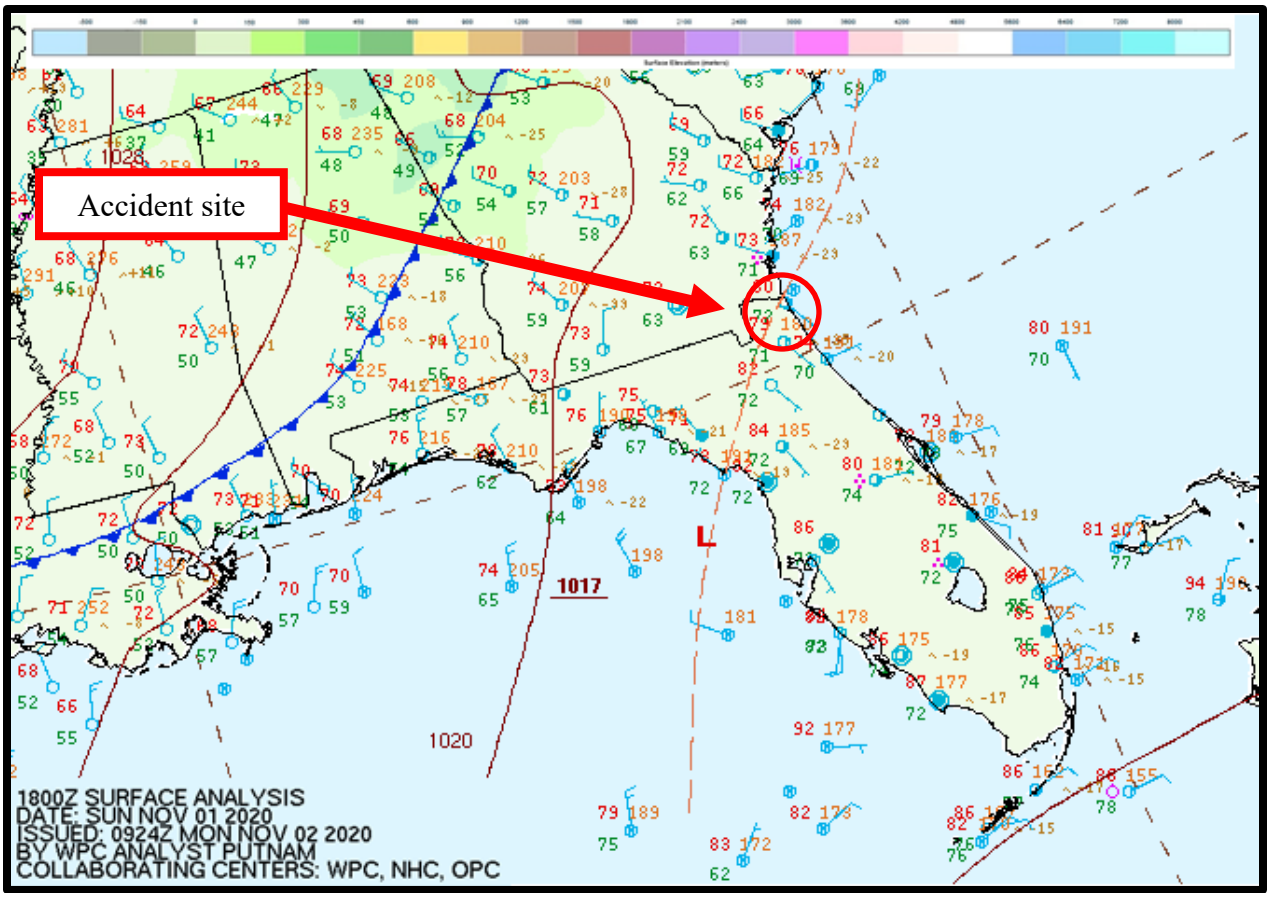

Figure 1 – NWS Surface Analysis Chart for 1300 EST.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1900 EST at 925-, 850- and 700-hPa are presented in figures 2 through 4. A low-level trough was located near the accident site stretching from central Georgia northeastward into New York. There was a west wind at 25 knots at 925-hPa with the wind becoming west-southwesterly at 35 knots by 700-hPa.

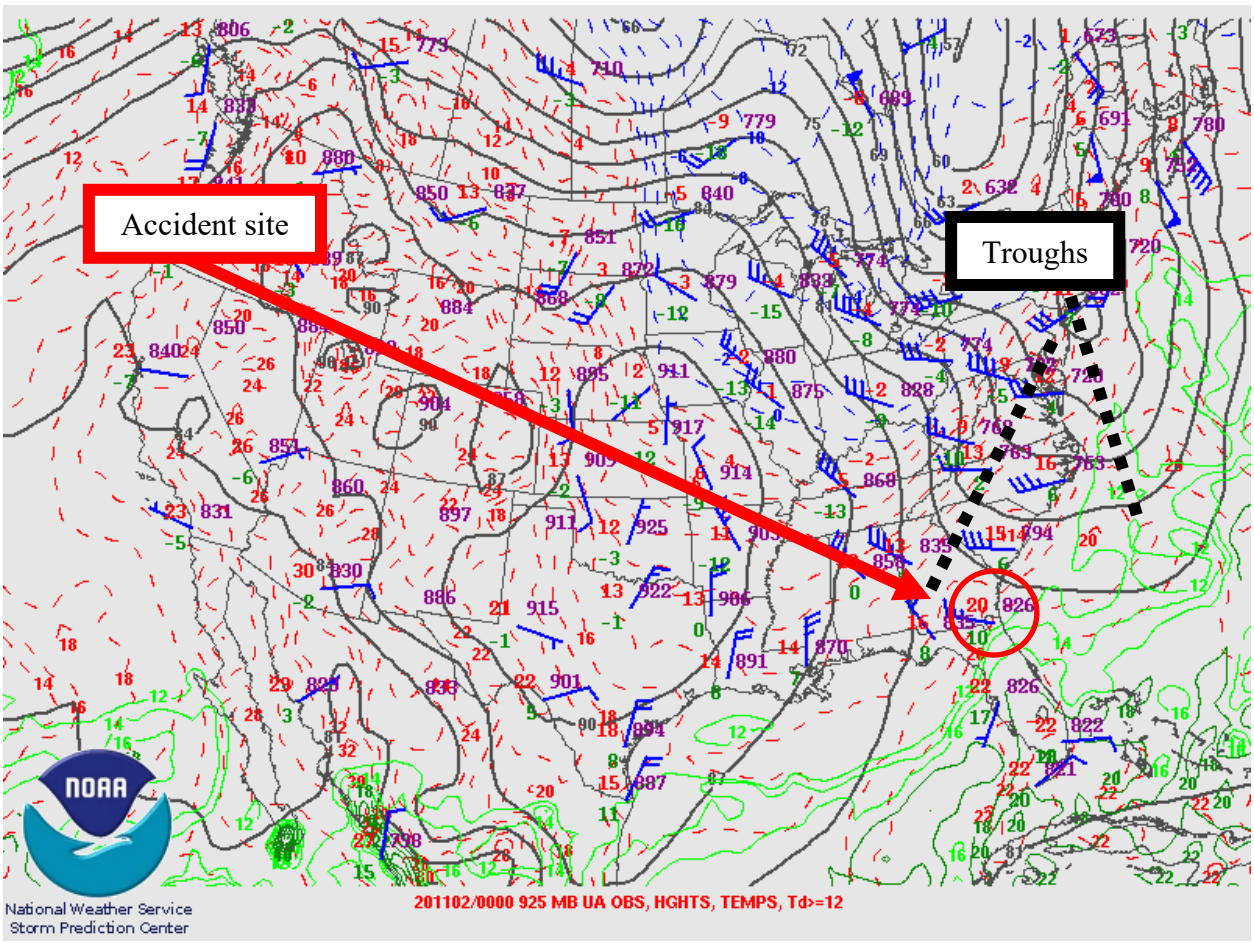

Figure 2 – 925-hPa Constant Pressure Chart for 1900 EST.

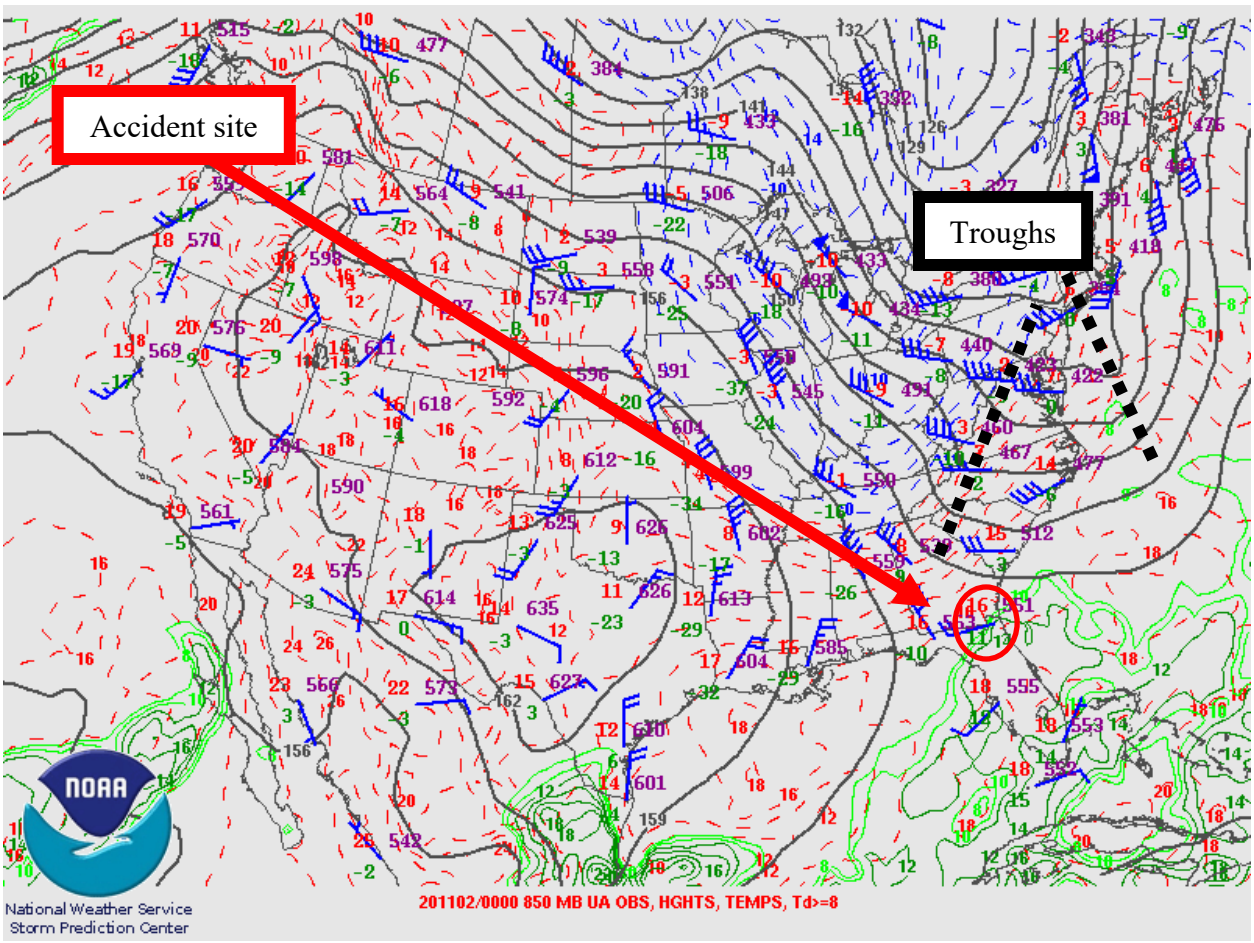

Figure 3 – 850-hPa Constant Pressure Chart for 1900 EST.

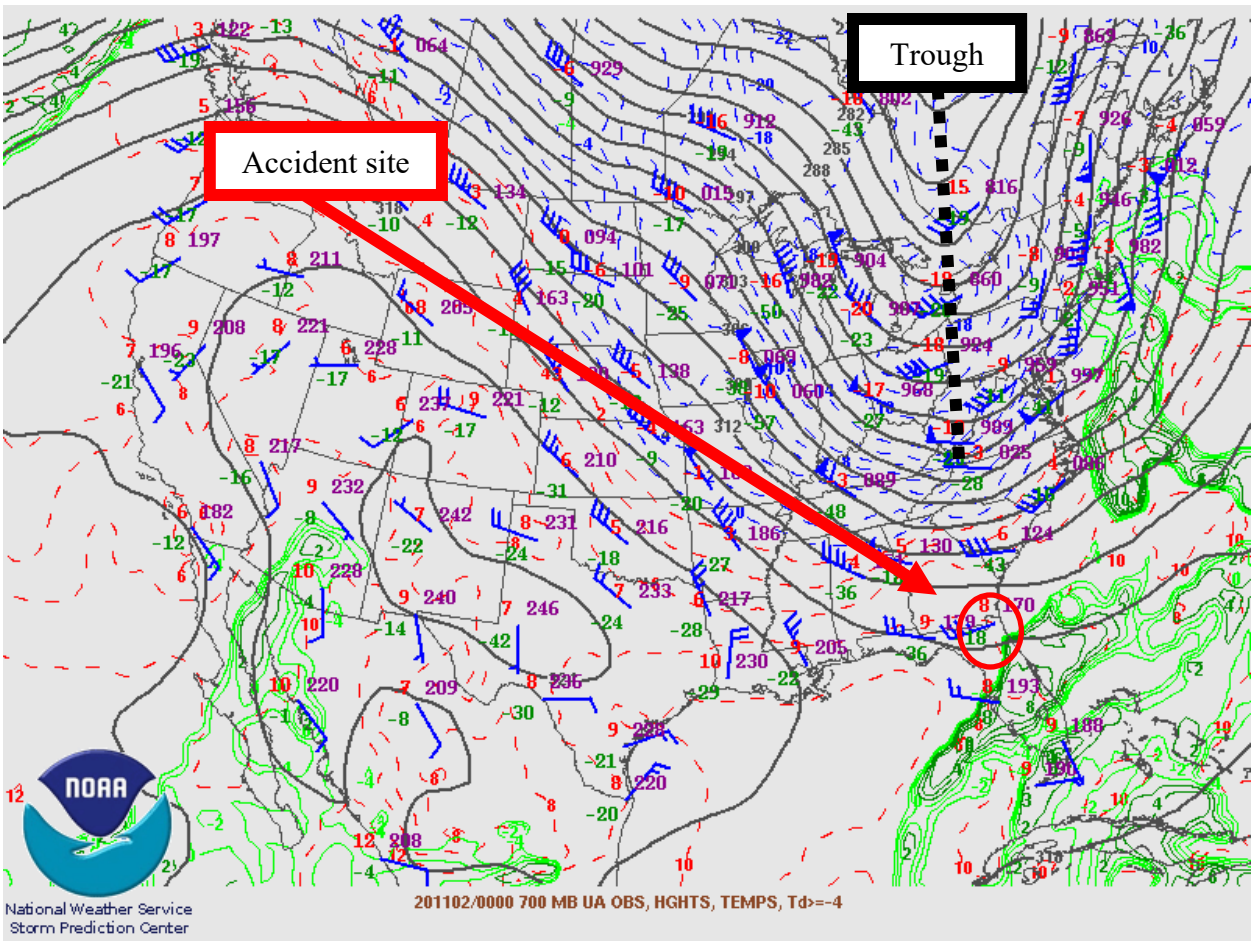

Figure 4 – 700-hPa Constant Pressure Chart for 1900 EST.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language. Figure 5 is a local sectional chart with the accident site and the closest weather reporting location marked.

Figure 5 – Sectional map of the accident area with the location of the accident site and surface observation site.

Fernandina Beach Municipal Airport (KFHB) had the closest official weather station to the accident site. KFHB had an Automated Weather Observing System (AWOS[3]) whose reports were not augmented, and issued observations every 20-minutes. KFHB AWOS was located within a mile of the accident site, at an elevation of 16 ft, and had a 7° westerly magnetic variation[4]. The following automated longline[5] observations were disseminated during the times surrounding the accident:[6]

[1235 EST] METAR KFHB 011735Z AUTO 15009KT 10SM -RA SCT027 BKN034 OVC065 26/22 A3008 RMK AO2 T02560219=

[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 12,000 feet, and altimeter setting. AWOS are maintained by the FAA.

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

[5] "Longline" refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station's Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline-dissemination of weather observations is the primary vehicle through which the general global public has access to surface weather observations, particularly outside of the aviation community.

[6] The bold sections in this NWS product and the rest of the products in this report are intended to highlight the sections that directly reference the weather conditions that affected the accident location around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times around the accident time.

[1255 EST] METAR KFHB 011755Z AUTO 15009KT 10SM SCT029 BKN037 BKN065 27/22 A3007 RMK AO2 T02670220 10276 20194=

[1315 EST] METAR KFHB 011815Z AUTO 15010KT 10SM SCT031 SCT039 BKN065 26/22 A3005 RMK AO2 T02620216=

[1335 EST] METAR KFHB 011835Z AUTO 15012KT 10SM BKN039 OVC045 26/22 A3004 RMK AO2 T02550219=

[1355 EST] METAR KFHB 011855Z AUTO 14004G18KT 1SM +RA BR BKN026 BKN031 OVC042 24/23 A3006 RMK AO2 VIS 1/2V5 P0017 T02370227=

ACCIDENT TIME 1400 EST

[1415 EST] METAR KFHB 011915Z AUTO 35008KT 7SM -RA SCT012 BKN025 OVC048 21/21 A3006 RMK AO2 P0006 T0209////=

[1435 EST] METAR KFHB 011935Z AUTO 36003KT 5SM -RA SCT027 SCT045 OVC065 21/ A3004 RMK AO2 P0007 T0211////=

KFHB weather at 1355 EST, automated, wind from 140° at 4 knots with gusts to 18 knots, visibility 1 mile, heavy rain, mist, broken ceiling at 2,600 ft above ground level (agl), broken skies at 3,100 ft agl, overcast skies at 4,200 ft agl, temperature of 24°Celsius (C), dew point temperature of 23°C, and an altimeter setting of 30.06 inches of mercury (inHg). Remarks: automated station with a precipitation discriminator, visibility varying between a half mile and 5 miles, 0.17 inches of precipitation since 1255 EST, temperature 23.7°C, dew point temperature 22.7°C.

KFHB weather at 1415 EST, automated, wind from 350° at 8 knots, visibility 7 miles, light rain, scattered clouds at 1,200 ft agl, broken ceiling at 2,500 ft agl, overcast skies at 4,800 ft agl, temperature of 21°C, dew point temperature of 21°C, and an altimeter setting of 30.06 inHg. Remarks: automated station with a precipitation discriminator, 0.06 inches of precipitation since 1355 EST, temperature 20.9°C.

The observations from KFHB surrounding the accident time indicated VFR[7] conditions prevailing with temporary IFR conditions in heavy rain between 1355 and 1415 EST. In addition, the winds rapidly shifted from the southeast with wind gusts to 18 knots at 1355 EST, to a northwest wind gusting to 23 knots at 1400 EST (attachment 1), and the northwest wind gusts to 24 knots continued through 1410 EST (attachment 1).

3.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR)[8] model sounding was created for the accident site for 1400 EST using a surface elevation of 0 ft.[9] The 1400 EST HRRR sounding was plotted on a standard Skew-T Log P diagram[10] with the derived stability parameters included in figure 6 with data from the surface to 600-hPa (or approximately 14,000 ft msl). These data were analyzed using the RAOB[11] software package. The sounding depicted the lifted condensation level (LCL)[12] at 929 ft agl, the level of free convection (LFC)[13] at 1,771 ft agl, and the convective condensation level (CCL)[14] at 3,157 ft agl. The freezing level was located at 15,845 ft above msl. The precipitable water value was 1.34 inches.

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

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

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

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

[8] The HRRR is a NOAA real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one hour period.

[9] HRRR sounding was created using NOAA Air Resource Laboratory: https://ready.arl.noaa.gov/READYamet.php

[10] Skew T log P diagram – is a standard meteorological plot using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

[11] RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Eosonde Research Services, The Villages, Florida.

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

[13] 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.

[14] 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.

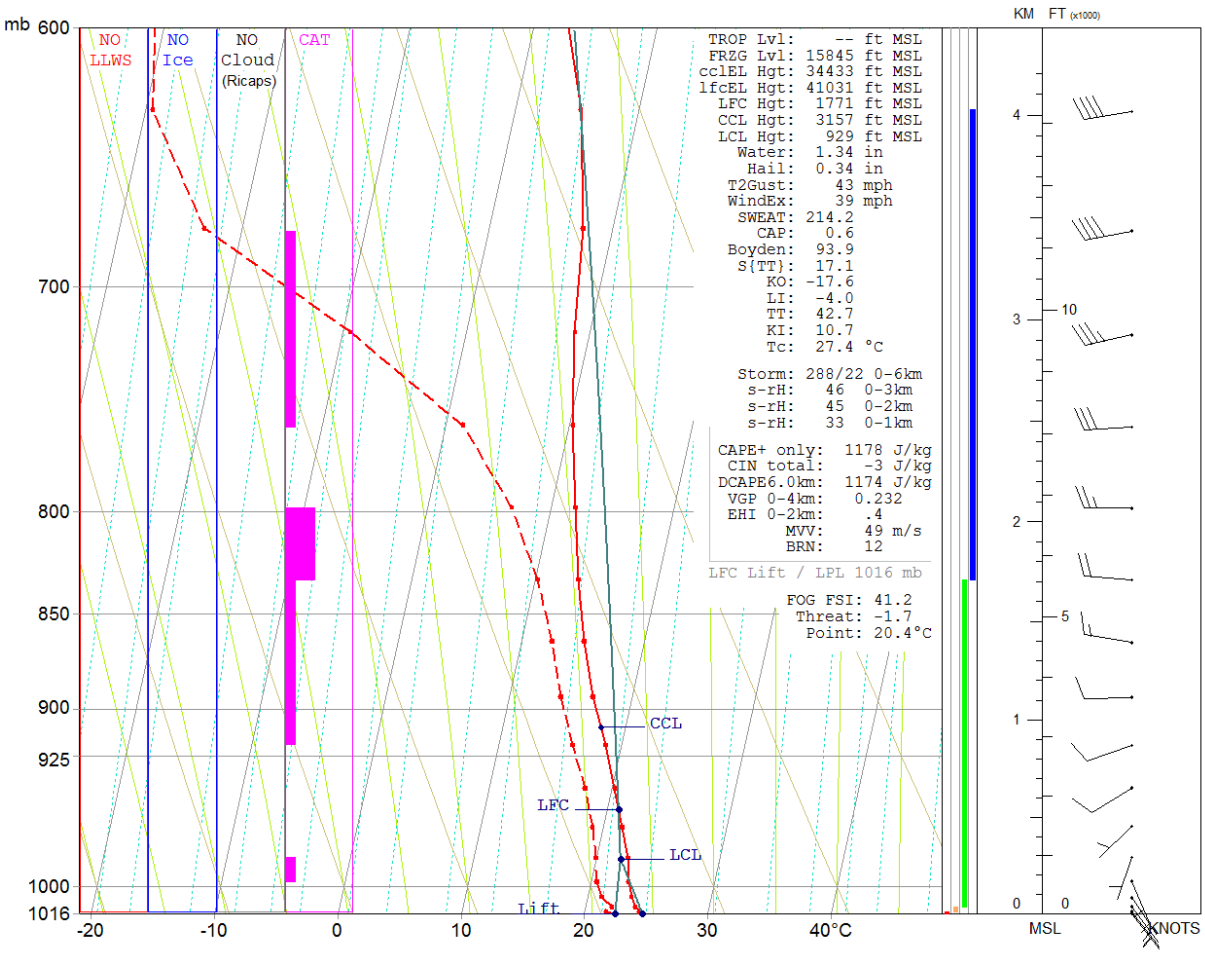


Figure 6 – 1400 EST HRRR sounding.

The 1400 EST HRRR sounding indicated a conditionally unstable environment from the surface through 6,000 ft above msl. The sounding provided 1,178 Joules/kilogram (J/kg) of CAPE[15] were indicated on the sounding and the maximum vertical velocity (MVV) for this atmosphere was calculated as 49 meters/second (about 9,646 ft per minute).[16] Downdraft CAPE (DCAPE; 6 kilometers agl)[17] was measured at 1,174 J/kg. If rain showers or thunderstorms formed in this environment, the 1400 EST HRRR sounding indicated that the strongest wind speeds possible at the surface (due to, for example, a microburst, outflow boundary, or gust front) would have been 43 mph (37 knots) according to the WindEx and T2Gust parameters.

[15] Convective Available Potential Energy (CAPE) – CAPE is a measure of the amount of energy available for convection and is directly related to the maximum potential vertical speed within an updraft.

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

[17] The DCAPE can be used to estimate the potential strength of rain-cooled downdrafts within thunderstorm convection, and is similar to CAPE. Larger DCAPE values are associated with stronger downdrafts.

The 1400 EST HRRR sounding wind profile indicated a near surface wind from 144° at 6 knots with the wind veering[18] to the west through 4,000 ft. The wind speed increased to 20 knots by 6,000 ft msl and 40 knots by 13,500 ft. RAOB did not indicate the possibility of low-level wind shear (LLWS) outside of a rain shower or thunderstorm activity. RAOB did indicated the possibility of light clear air turbulence in several layers between 500 ft and 12,000 ft above msl.

4.0 Satellite Data

The Geostationary Operational Environmental Satellite number 16 (GOES-16) visible and infrared data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System software. Visible and infrared imagery (GOES-16 bands 2 and 13) at wavelengths of 0.64 microns (µm) and 10.3 µm, respectively, were retrieved for the period from 1100 EST through 1700 EST and reviewed, and the closest images to the time of the accident were documented.

Figures 7 and 8 present the GOES-16 visible imagery from 1400 and 1410 EST at 2X magnification with the accident site highlighted with a red square. The cloud cover was moving from west to east and the cloud cover was cumuliform in nature (attachment 2). Figure 9 presents the GOES-16 infrared imagery from 1400 EST at 6X magnification with the accident site highlighted with a red square. The lower brightness temperatures (yellow colors; higher cloud tops) were located southwest of the accident site. Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the 1400 EST HRRR sounding, the approximate cloud-top heights over the accident site were 15,000 ft msl at 1400 EST (276 Kelvin). It should be noted these figures have not been corrected for any parallax error.

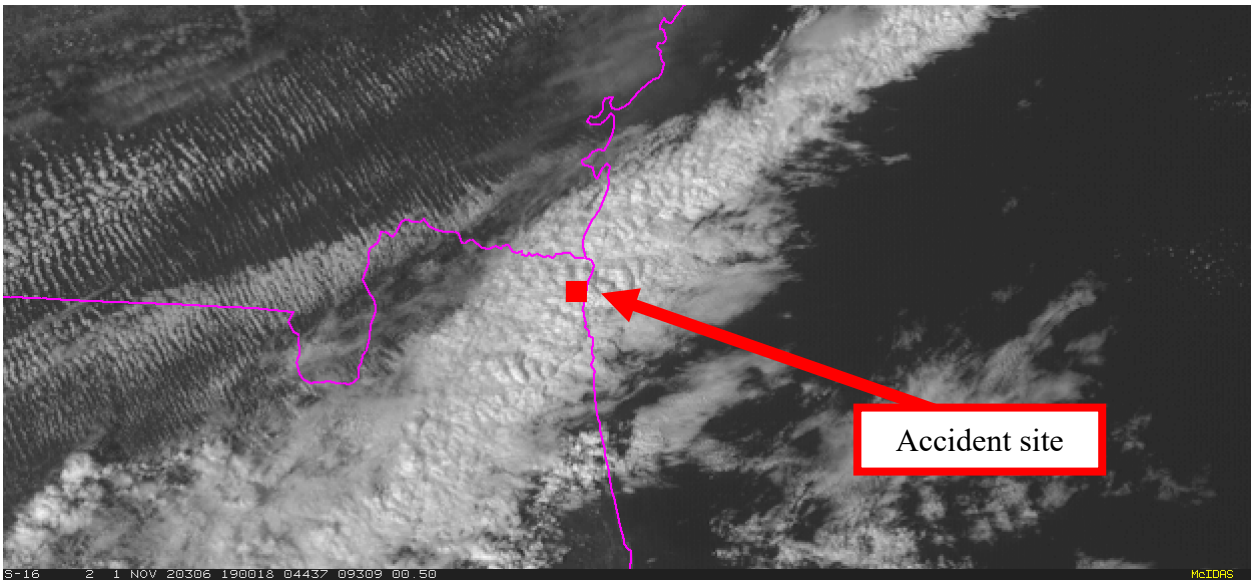


Figure 7 – GOES-16 visible image at 1400 EST.

[18] A clockwise turning of the wind with height in the northern hemisphere.

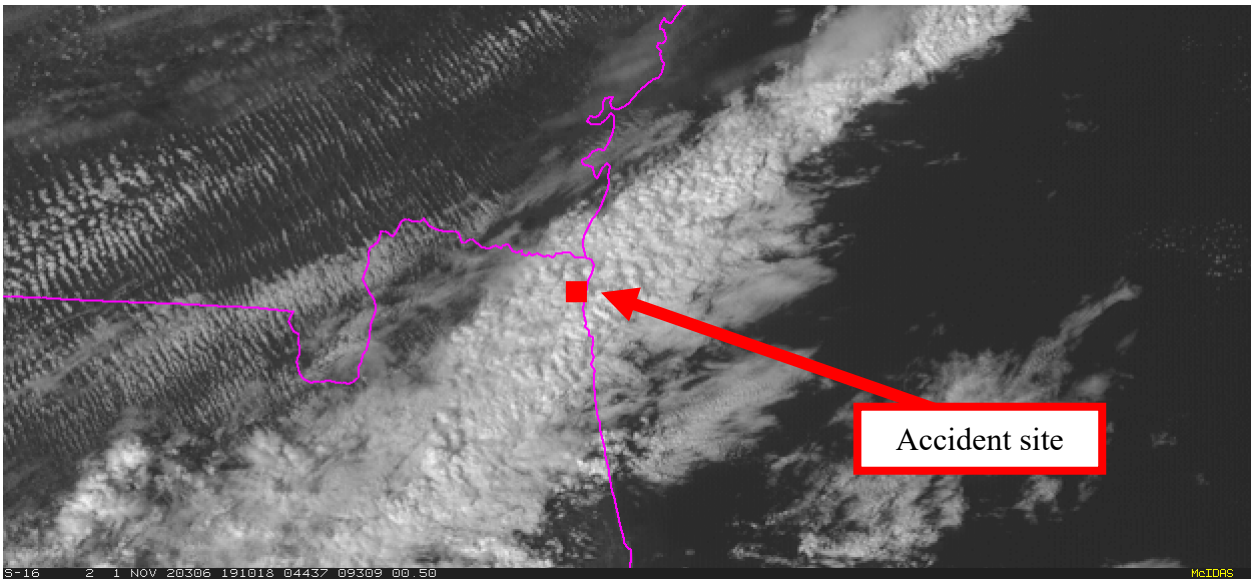


Figure 8 – GOES-16 visible image at 1410 EST.

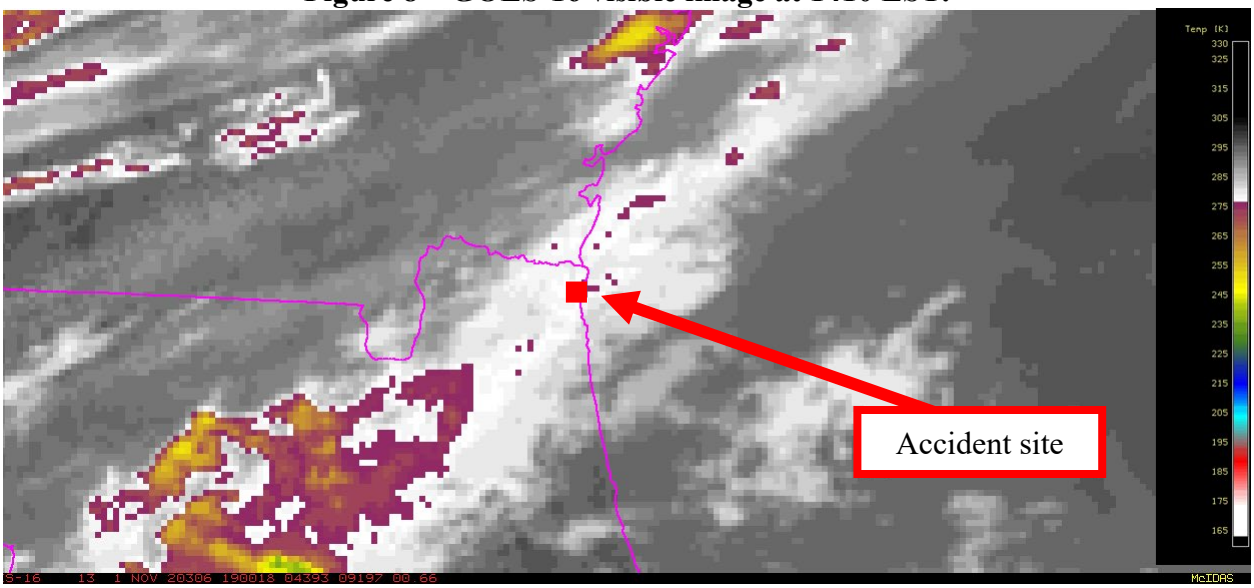


Figure 9 – GOES-16 infrared image at 1400 EST.

5.0 Regional Radar Imagery Information

A regional view of the NWS national composite radar mosaic is included as figure 10 for 1400 EST with the approximate location of the accident site marked within a red circle. The image depicted echoes from 20 to 40 decibels (dBZ[19]) above the accident site.

[19] 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.

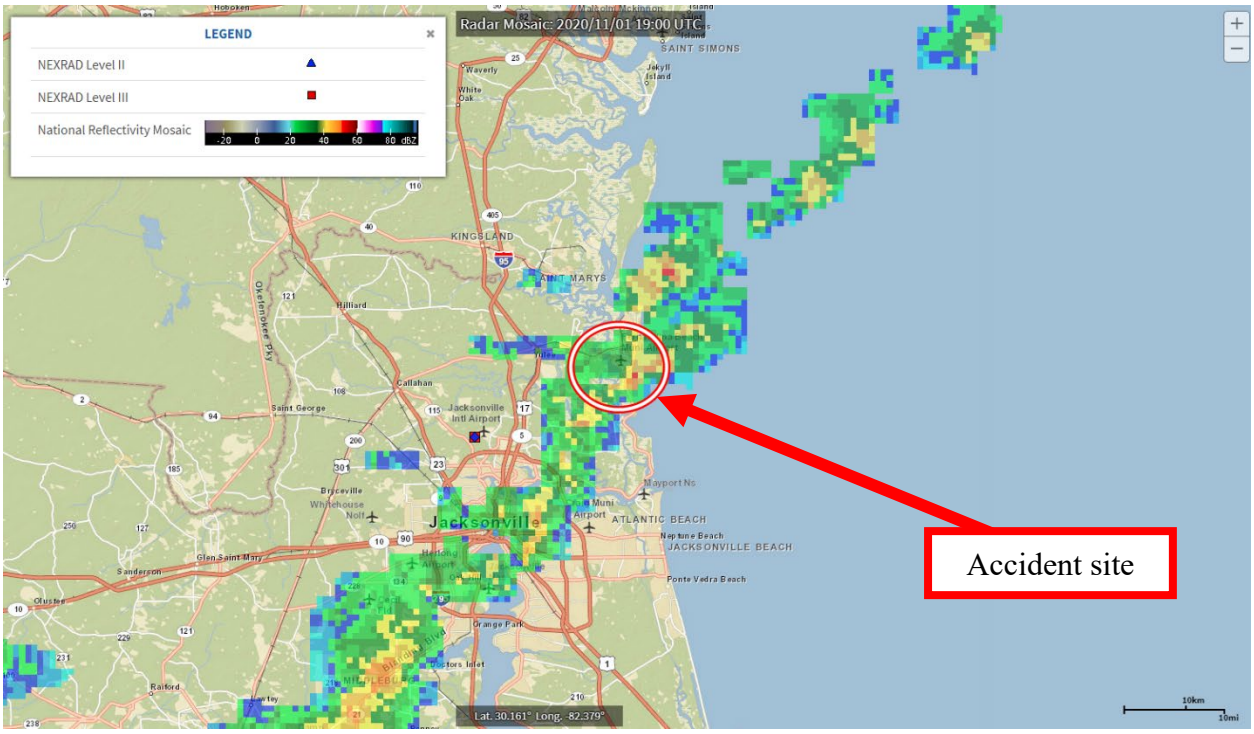


Figure 10 – Regional Composite Reflectivity image for 1400 EST.

6.0 Radar Imagery Information

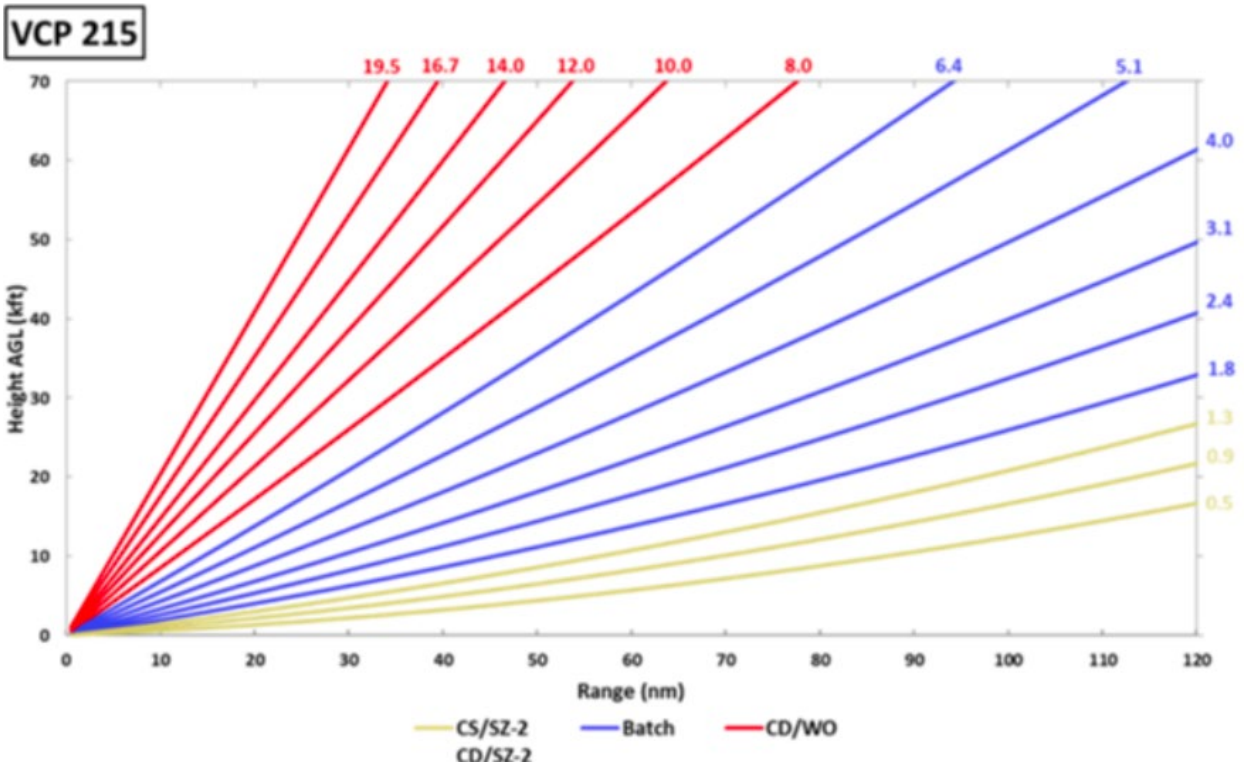
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)[20] to the accident site was Jacksonville, Florida (KJAX) located 15 miles southwest of the accident site. Level II archive radar data were obtained from the NCEI utilizing the NEXRAD Data Inventory Search and displayed using the NOAA's Weather and Climate Toolkit software.

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. Products that require data from multiple elevation scans are not available until the end of the five to ten minute volume scan.

[20] 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.

The WSR-88D operates in two different main scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has three common scanning strategies[21]. The most common is where the radar makes 15 elevation scans from 0.5° to 19.5° every six minutes. This particular scanning strategy is documented as volume coverage pattern 215 (VCP-215). Mode B is the clear-air mode, where the radar makes 9 elevation scans during a ten-minute period. During the period surrounding the accident, the KJAX WSR-88D radar was operating in the precipitation mode VCP-215. 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-215 Precipitation Mode Scan Strategy.

[21] Contiguous Surveillance (CS)--The low Pulse Repetition Frequency (PRF) scan of the split cut. Gives a high R_{max} value to determine proper target location and intensity, but a low V_{max} value limits the velocities that can be measured. Contiguous Doppler (CD)--The high PRF scan of the split cut. Gives a low R_{max} value causing more range folded (multiple trip) echoes, but a high V_{max} value to get higher, more accurate velocity values.
Batch Mode – Uses alternating low and high PRFs on each radial for one full rotation at each elevation angle. The two resulting data sets (low PRF and high PRF) are combined to resolve range ambiguity. Used in the middle elevation angles.
W – With range unfolding (W)
WO – Without range unfolding (WO)

6.2 Beam Height Calculation

Assuming standard refraction[22] of the KJAX WSR-88D radar beam with the antenna elevation at 159 ft, and considering a beamwidth[23] of 0.95°, the following table shows the approximate heights for the radar beam center, base, and top for antenna elevations over the accident site. These heights have been rounded to the nearest 10 ft.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP
KJAX 0.5°	1,120 ft	380 ft	1,860 ft

Based on the radar height calculations, the elevation scans from KJAX listed in the above table depicted the conditions between 380 ft and 1,860 ft above msl over the accident site and these scans "saw" the closest altitudes to the surface.

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[24] 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 dBZ and is a general measure of echo intensity. FAA Advisory Circular AC 00-24C[25], "Thunderstorms," dated February 19, 2013, also defines the echo intensity levels and weather radar echo intensity terminology associated with those levels. For dBZ values less than 30 the weather radar echo intensity terminology should be "light." For dBZ values between 30 and 40, the terminology should be "moderate." "Heavy" terminology is used for dBZ values greater than 40 dBZ but less than 50 dBZ, inclusive. Finally, any dBZ values above 50 dBZ shall be described as "extreme."

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

[23] Beamwidth - the angular separation between the half power points on the antenna radiation pattern, where the gain is one half the maximum value.

[24] 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.

[25] https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1020774

6.4 Base Reflectivity and Lightning Data

Figures 11 through 14 present the KJAX WSR-88D base reflectivity images for the 0.5° elevation scans initiated at 1344:43, 1351:33, 1358:08, and 1404:42 EST, with a resolution of 0.5° X 250 m. Reflectivity values between 30 and 50 dBZ were located over the KFHB airport surrounding the period prior to the accident and indicative of moderate to heavy intensity precipitation (section 6.3), with light to moderate precipitation extending along the flight track on approach into KFHB. The band of precipitation was moving from west to east over the accident site at the accident time (attachment 3).

There were no lightning flashes[26] near the accident site at the accident time.[27]

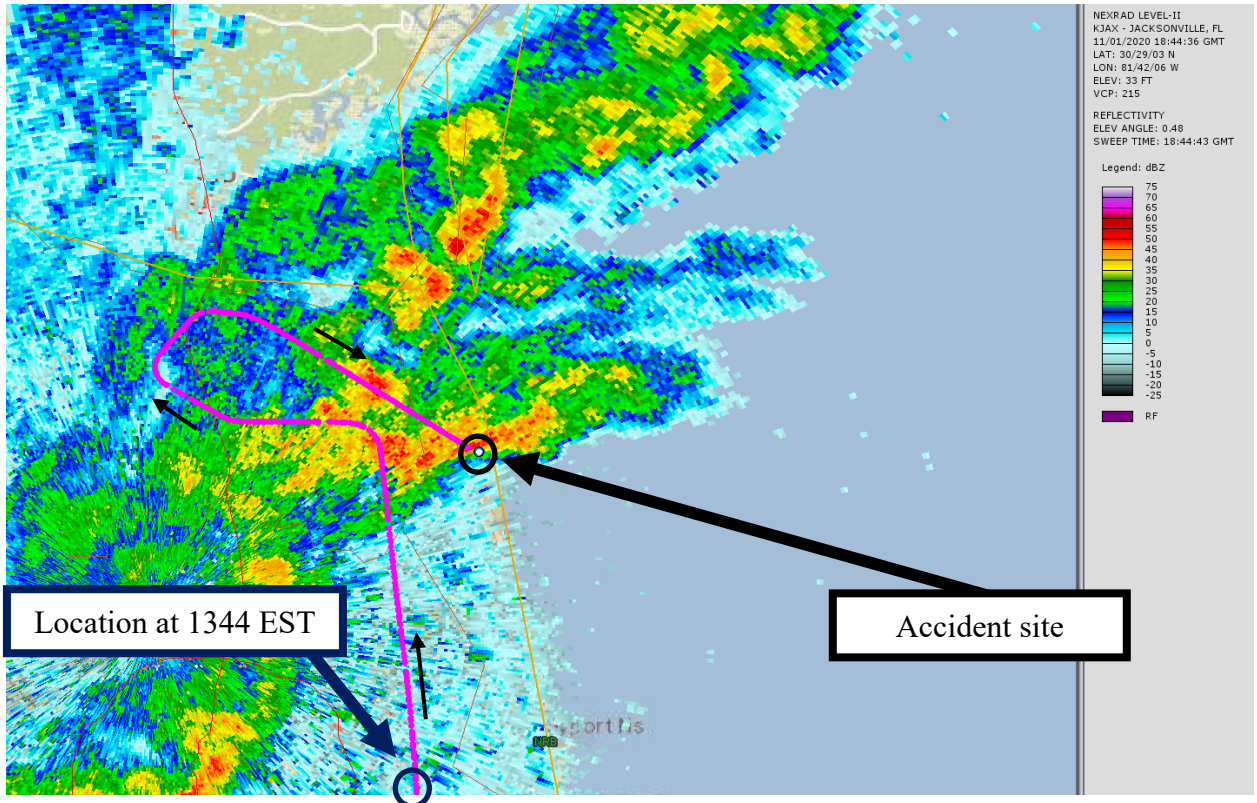


Figure 11 – KJAX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1344:43 EST with the accident site marked with black circle and the accident flight track in pink with arrows pointing in the direction of travel.

[26] Lightning Flash – This is one contiguous conducting channel and all the current strokes/pulses that flow through it. There are two types of flashes: ground flashes and cloud flashes.
[27] A review of Earth Networks Total Lightning network was done.

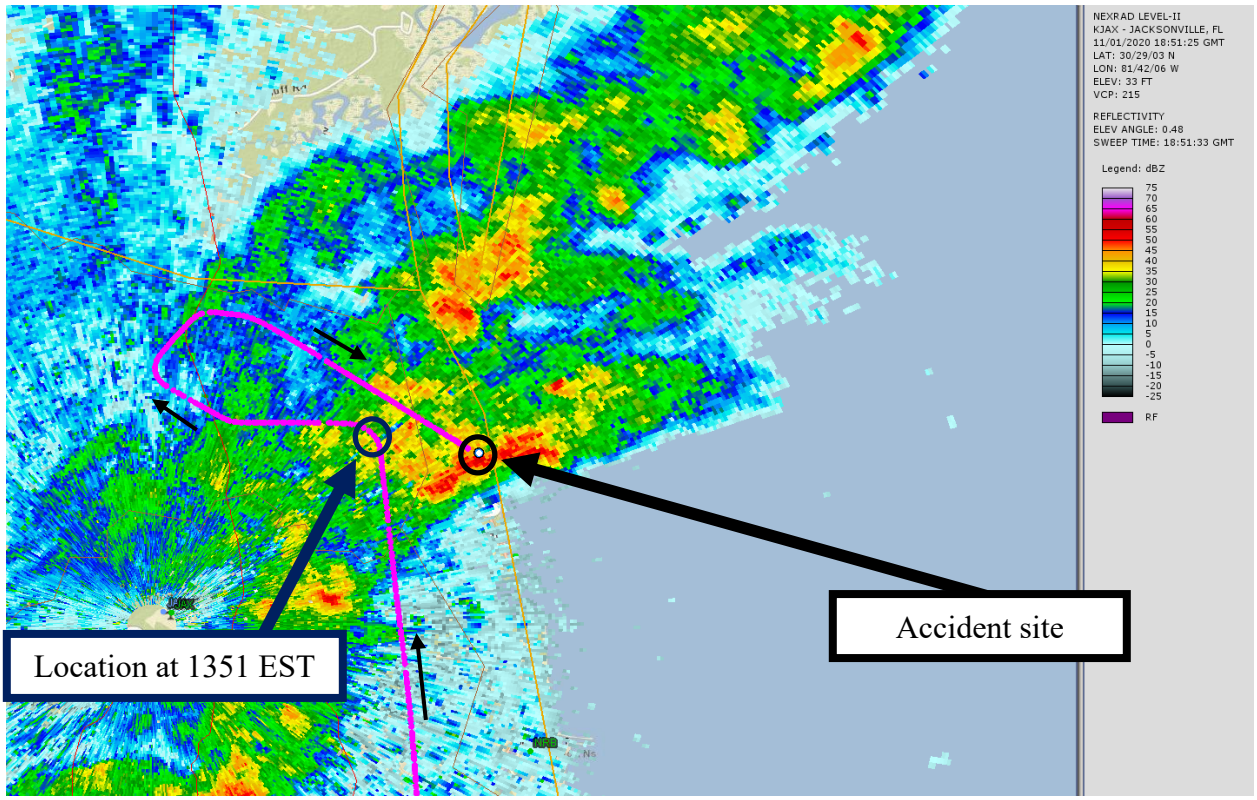


Figure 12 – KJAX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1351:33 EST with the accident site marked with black circle and the accident flight track in pink with arrows pointing in the direction of travel.

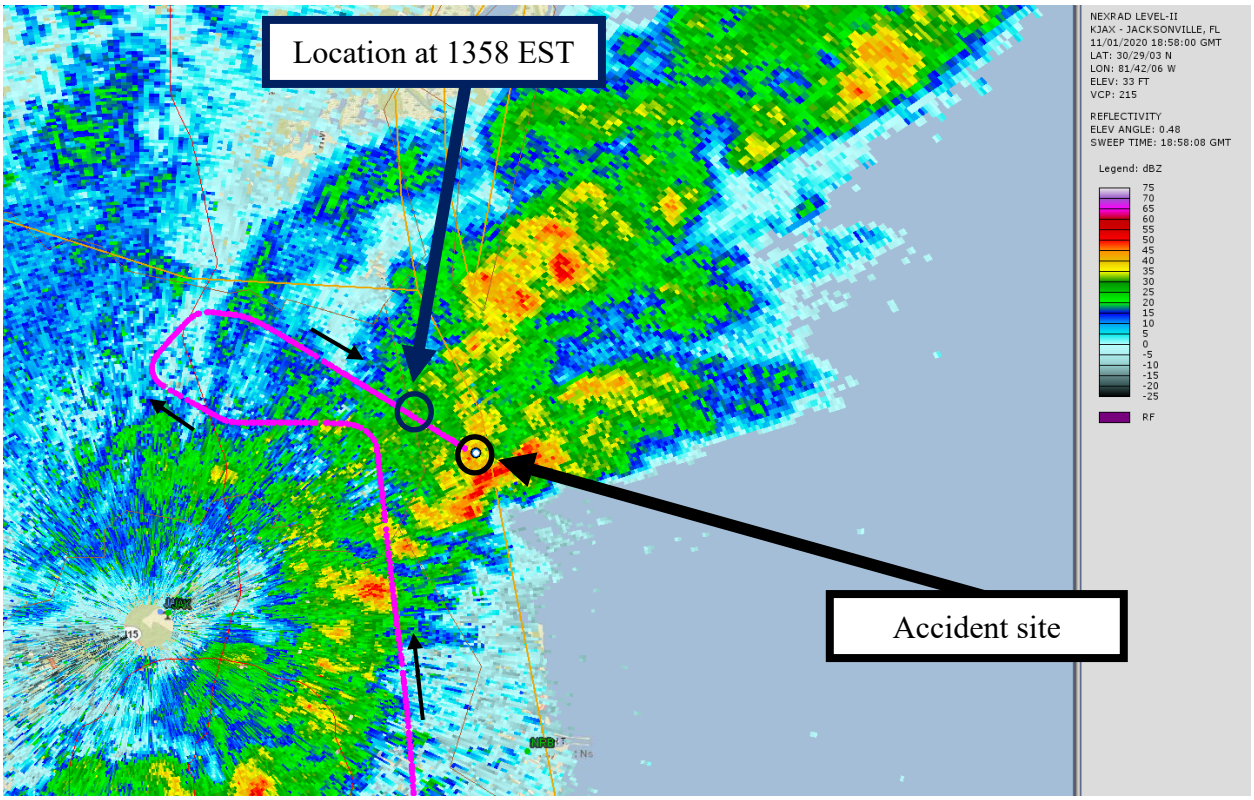


Figure 13 – KJAX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1358:08 EST with the accident site marked with black circle and the accident flight track in pink with arrows pointing in the direction of travel.

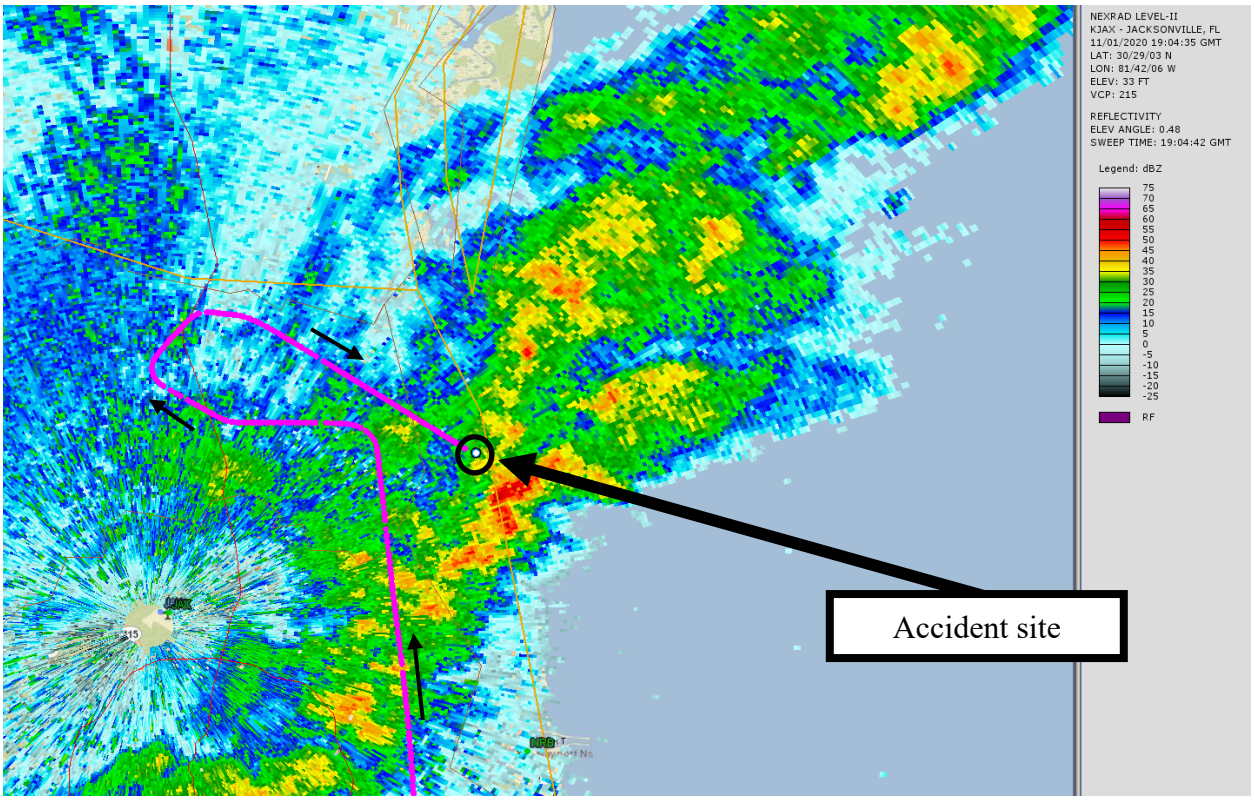


Figure 14 – KJAX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1404:42 EST with the accident site marked with black circle and the accident flight track in pink with arrows pointing in the direction of travel.

7.0 Pilot Reports[28]

The following are the publicly longline-disseminated pilot reports[29] (PIREPs) distributed into the national airspace (NAS) within 75 miles of the accident site from about two hours prior to the accident time to two hours after the accident time for below 18,000 ft above msl. The ATC PIREP forms for the 1402 and 1535 EST PIREPs were also obtained and are located in attachment 4.

SSI UA /OV SSI360025/TM 1732/FL020/TP M20A/SK BASE024=

AYS UA /OV AYS/TM 1808/FL013/TP BE36/SK BASE 013=

JAX UA /OV CRG030015/TM 1902/FL110/TP C130/WX -RA/TB MD/IC NEG=

SSI UA /OV SSI180030/TM 1912/FL110/TP C310/TB OCNL MOD=

JAX UA /OV OCF ARR RWY 36/TM 2035/FLDURD/TP C172/SK OVC006/RM TOPS UNK=

[28] Only pilot reports with the World Meteorological Organization headers UBFL and UBGA** were considered.
[29] These do not include pilot reports only broadcast via radio.

8.0 SIGMET

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

9.0 CWSU Advisories

The Jacksonville (ZJX) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. The ZJX CWSU did not issue a Meteorological Impact Statement (MIS) for the accident area around the accident time. ZJX CWSU issued a Center Weather Advisory (CWA) 202 at 1254 EST valid until 1500 EST for the accident site which warned of an areas of scattered rain showers and isolated thunderstorms with the CWA box moving from 280° at 20 knots (figure 15). Isolated tops to FL300 were forecast with moderate to heavy precipitation and an expansion of coverage and intensity over the Florida Peninsula was expected through 1500 EST. The ZJX CWSU weather briefing information for the accident day is contained in attachment 5.

FAUS22 KZJX 011754
ZJX2 CWA 011800
ZJX CWA 202 VALID UNTIL 012000
FROM 45E AMG-60NE CRG-35NE ORL-20SSW CTY-45E AMG
AREA SCT SHRA/ISOLD TS MOV FM 28020KT. ISOLD
TOPS FL300. MOD TO HVY PCPN. EXP GRAD INCR
IN CVRG/INTST OVR FL PEN THRU PD.

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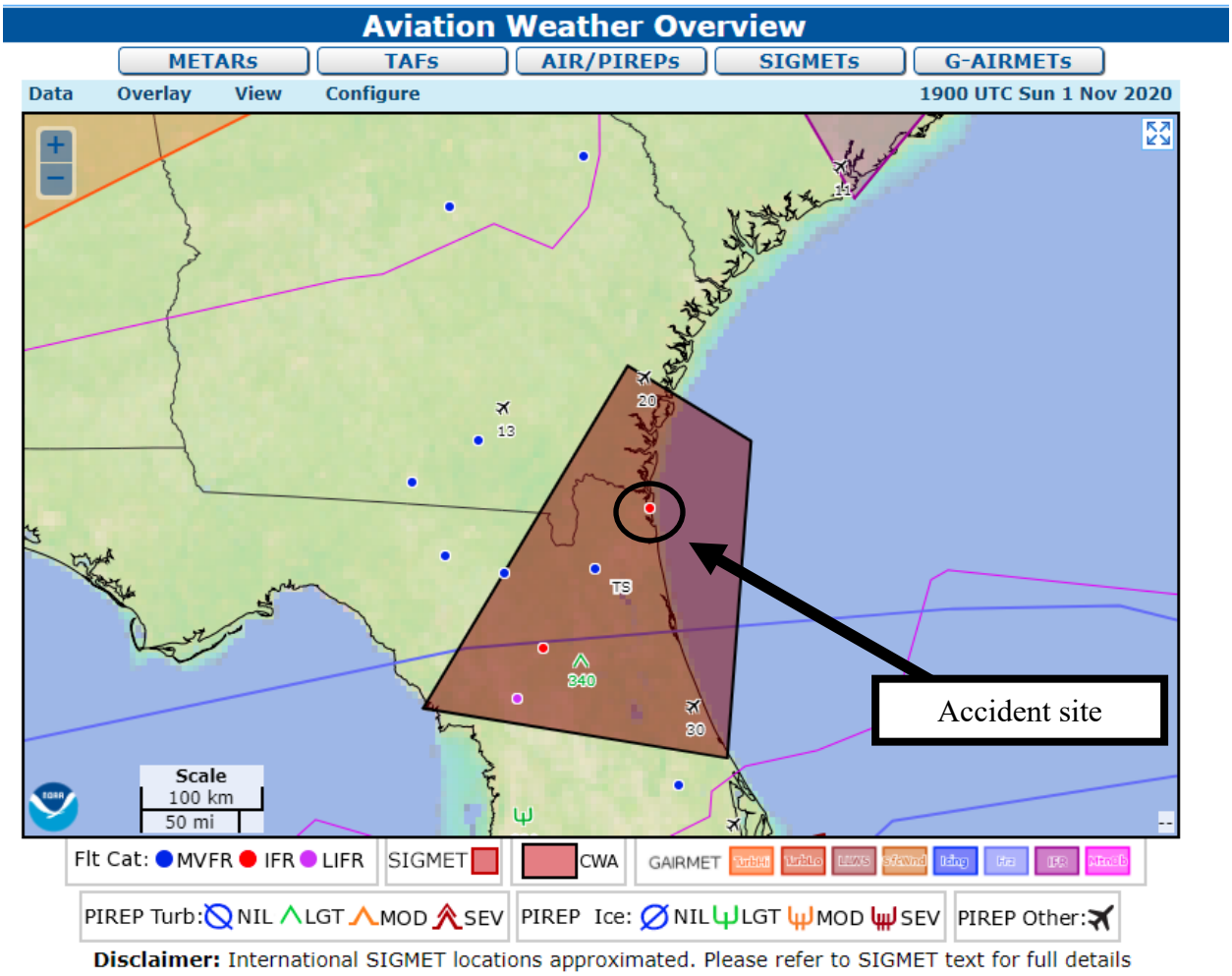

Figure 15 – SIGMETs, PIREPs, and CWAs valid at 1400 EST.

10.0 AIRMETs

There were no Airmen's Meteorological Information (AIRMET) advisories valid for the accident site at the accident time.

11.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products made available before the accident flight and valid at 1300 EST are shown in attachment 6. The GFA surface forecast products indicated VFR surface visibilities with a chance (between 30 and 60 percent) of rain showers and a surface wind from the west at 10 knots. The GFA cloud forecast valid before departure for around the accident time indicated a broken ceiling at 2,200 to 6,000 ft above msl, with cloud tops to 8,000 ft above msl. For more information please see attachment 6.

12.0 Terminal Aerodrome Forecast

KJAX was the closest airport to the accident site with an NWS[30] Terminal Aerodrome Forecast (TAF). The KJAX TAF valid at the time of the accident was issued at 1227 EST and was valid for a 24-hour period beginning at 1300 EST. The 1227 EST TAF for KJAX was as follows:

TAF KJAX 011727Z 0118/0218 **26005KT P6SM VCSH SCT025 BKN050**
TEMPO 0118/0120 VRB12G23KT 3SM SHRA BR BKN020 OVC040
FM012230 32007KT P6SM SCT030 BKN060
FM020500 34011KT P6SM SKC
FM021500 01014G21KT P6SM SKC=

After 1300 EST, the forecast expected a wind from 260° at 5 knots, greater than 6 miles visibility, vicinity[31] showers, scattered clouds at 2,500 ft agl, and a broken ceiling at 5,000 ft agl. Temporary conditions[32] were forecast between 1300 and 1500 EST which forecast a variable wind at 12 knots with gusts to 23 knots, 3 miles visibility, moderate rain showers and mist, a broken ceiling at 2,000 ft agl, and overcast skies at 4,000 ft agl.

13.0 NWS Area Forecast Discussion

The NWS office in Jacksonville, Florida, (WFO JAX) issued the following Area Forecast Discussion (AFD) at 1245 EST (closest AFD to the accident time with an aviation section). The aviation section of the AFD discussed a line of showers causing reduced visibility conditions and gusty winds through 1700 EST:

FXUS62 KJAX 011745
AFDJAX

Area Forecast Discussion
National Weather Service Jacksonville FL
1245 PM EST Sun Nov 1 2020

.AVIATION...
[Through 18Z Monday]

VFR cigs at this time but broken line of showers from near BQK to 10SM west of GNV-CITY, preceding a cold front, are poised to push through the TAF sites through 22Z today. Good chances of MVFR cigs/vsby and gusty winds to about 20-25 kt will be possible as the showers push through until about 22Z. A very low threat of a brief t-storm next 2-3 hours, mainly from GNV to SGJ southward but too low to include in the forecast attm. Improving sky conditions expected in the wake of the showers / behind the front, with prevailing VFR and clearer skies expected by 23Z. Increasing northwest and then north winds overnight, but especially on Monday

[30] According to NWS Instruction 10-813: "A NWS TAF consists of the expected meteorological conditions significant to aviation at an airport for a specified time period. For the U.S., this is the area within five (5) statute miles (SM) of the center of an airport's runway complex." www.nws.noaa.gov/directives/sym/pd01008013curr.pdf
[31] In the vicinity of the airport is defined as a weather phenomenon within 5-10 statute miles of the airfield.
[32] Temporary conditions - fluctuations to forecast conditions which are expected to last less than one hour in each instance and, in the aggregate, to cover less than half of the indicated period.

with winds of 10-15 kt and gusts near 20-25 kt. Stronger wind at SGJ after 13Z Monday with northerly winds near 18G30kt.

&&

.PREV DISCUSSION [830 AM EST]...

.NEAR TERM [Through Tonight]...

An upper level short wave digging into the Great Lakes this morning will amplify troughing over the eastern CONUS today and push a (mostly) dry cold front through the area this afternoon. The trough will push off the east coast tonight, with low level ridging beginning to push into the region late tonight/early Monday morning. Scattered showers will move through the area today ahead of the front, but should exit by the evening hours. Highs today ahead of the front will be near to slightly above normal, in the upper 70s and low 80s. A much colder air mass will begin to work its way in overnight, so temperatures are expected to drop into the low-mid 40s in SE GA, upper 40s to low 50s in NE FL.

.SHORT TERM [Monday Through Tuesday]...

In the first post-fropa day, surface ridge will be over the ArkLaMiss region Monday and Monday night, with dry conditions forecast with prevailing northerly flow prevailing. Colder and drier conditions will be prevalent during the period. This pattern will bring NW flow and the coldest temperatures of the season. Afternoon high temperatures will be coolest on Monday, peaking in the mid 60s in SE GA, mid to upper 60s in NE FL, and near 70 across north central FL. Lows Tuesday morning will be in the upper 30s across SE GA to mid/upper 40s coastal Georgia, over northeast FL mostly in the 40s, with NE FL beaches in lower 50s. Temperatures will moderate gradually Tuesday and Wednesday as heights rise as winds turn northeasterly. The aforementioned surface high will slide eastward to the northern Gulf coast states Tuesday and the over the mid Atlantic coast on Wednesday. Temperatures warming slightly Tuesday to upper 60s in SE GA and into the low to mid 70s for NE FL, and then warming into the mid to upper 70s area wide on Wednesday. Lows on Wednesday morning will range from low 40s NW of Waycross to 45-50 degrees from Waycross south to Gainesville inland, 50s along the SE GA coast and St Johns river basin and the upper 50s to near 60 over the NE FL coast.

.LONG TERM [Wednesday Through Sunday]...

The surface high will move northeast of the region Thursday and Friday over the Mid Atlantic states, and then surface high will push just off the eastern seaboard at the end of the week. Easterly onshore flow from the Atlantic gradually modifying the airmass and incrementally increasing moisture levels each day. Scattered showers are forecast to move onshore over the NE FL coast Thursday. Showers are expected to increase in coverage

slightly on Friday into the SE GA coast with scattered showers for most of the area on Saturday as mid level shortwave energy approaches the region from the west and PWATs increase to near 1.5 inches. Temperatures will trend to above near normal Wednesday night, and will be near seasonal values from Thursday through Saturday.

.MARINE...

Southeast winds will slacken this morning briefly ahead of a cold front passage this afternoon. Behind the front tonight, however, north winds will build to around 20-25 knots with frequent gusts to gale force across our coastal waters late tonight and lasting into Monday afternoon. After that, east winds around 10 to 15 knots will prevail through mid week.

Rip Currents: NE FL- Moderate Risk Today, High Monday
SE GA- Moderate Risk Today, High Monday

&&

.PRELIMINARY POINT TEMPS/POPS...

AMG 43 63 38 69 44 / 0 0 0 0 0
SSI 50 63 47 70 54 / 0 0 0 0 0
JAX 50 64 47 71 52 / 0 0 0 0 0
SGJ 57 67 54 72 60 / 10 0 0 0 0
GNV 50 66 42 72 49 / 0 0 0 0 0
OCF 52 68 46 74 52 / 10 0 0 0 0

&&

.JAX WATCHES/WARNINGS/ADVISORIES...
FL...None.
GA...None.
AM...Gale Watch from late tonight through Monday afternoon 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-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.

&&

14.0 Winds and Temperature Aloft Forecast

The NWS 0854 EST Winds and Temperature Aloft forecast valid for the closest point to the accident site is included below:

```
FBUS31 KWNO 011354
FD1US1
DATA BASED ON 011200Z
VALID 011800Z   FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT  3000    6000    9000   12000   18000   24000  30000  34000  39000
JAX 2510 2512+12 2631+08 2534+05 2539-07 2646-20 276635 277043 267054
```

The accident site was located closest to the Jacksonville, Florida, (JAX) forecast point. The 0845 EST JAX forecast for use between 0900 EST and 1600 EST indicated a wind at 3,000 ft from 250° at 10 knots, a wind at 6,000 ft from 250° at 12 knots with a temperature of 12°C, and a wind at 9,000 ft from 260° at 31 knots with a temperature of 8°C.

15.0 Pilot Weather Briefing

The accident pilot did not request a weather briefing from Flight Service Leidos.

A search of archived ForeFlight information indicated that the accident pilot did not request weather information. The accident pilot stated the morning of the accident they checked the weather conditions via aviationweather.gov. In addition, before departure of the accident flight, the accident pilot briefed the First Officer that there would be low-level showers in the vicinity of the arrival airport. For more information please see attachment 7.

16.0 Astronomical Data

The astronomical data obtained for the accident site on November 1, 2020, indicated the following:

SUN	
Begin civil twilight	0616 EST
Sunrise	0641 EST
Sun transit	1209 EST
Accident time	**1400 EST**[33]
Sunset	1738 EST
End civil twilight	1802 EST

E. LIST OF ATTACHMENTS

Attachment 1 – 5-minute KFHB AWOS observations

Attachment 2 – GOES-16 Visible imagery from 1306 to 1506 EST

Attachment 3 – KJAX base reflectivity animation from 1337 to 1404 EST

Attachment 4 – ATC PIREP forms from 1402 and 1535 EST

[33] Inserted accident time for reference and context.

Attachment 5 – ZJX CWSU weather briefings for the accident day

Attachment 6 – GFA valid for the accident site at accident time

Attachment 7 – Accident pilot weather information

Submitted by:

_____
Paul Suffern
Senior Meteorologist