



# National Transportation Safety Board

Office of Aviation Safety  
Washington, D.C. 20594-2000  
December 14, 2009

## METEOROLOGICAL FACTUAL REPORT

ERA09FA389

### A. ACCIDENT

Location: Gulf of Mexico near Port Richey, Florida  
Date: July 8, 2009  
Time: 1452 eastern daylight time (1852 UTC<sup>1</sup>)  
Aircraft: Cessna 421C, registration N4467D

### B. METEOROLOGICAL SPECIALIST

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Washington, D.C. 20594-2000

### C. SUMMARY

On July 8, 2009, at 1452 eastern daylight time, a Cessna 421C, N4467D, was destroyed after it impacted the waters of the Gulf of Mexico, about 25 nautical miles northwest of Port Richey, Florida. The instrument-rated commercial pilot and 4 passengers were fatally injured. Instrument meteorological conditions prevailed in the area of the accident and an instrument flight rules flight plan had been filed for the flight, which departed Collin County Regional Airport (KTKI), McKinney, Texas, destined for Tampa International Airport (KTPA), Tampa Florida. The business flight was conducted under the provisions of 14 Code of Federal Regulations Part 91.

Preliminary information provided by the Federal Aviation Administration (FAA), showed the pilot was in communication with Jacksonville Air Route Traffic Control Center (ARTCC) when the pilot reported that they had encountered turbulence. One of the radio transmissions to ATC from the pilot included the phrase that the airplane was “upside down”. Radio and radar contact were lost soon thereafter as the airplane descended through

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<sup>1</sup> UTC – is an abbreviation for Coordinated Universal Time.

6,000 feet.

## **D. DETAILS OF INVESTIGATION**

The National Transportation Safety Board's (NTSB) meteorologist specialist was not on scene for this investigation and gathered all the weather data for this investigation from the Washington D.C. office from official National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are eastern daylight time (EDT) based upon the 24 hour clock, local time is +4 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 accident site was located by the United States Coast Guard under 43 feet of water at latitude 28° 26.73' N and longitude 083° 7.35' W.

### **1.0 Synoptic Situation**

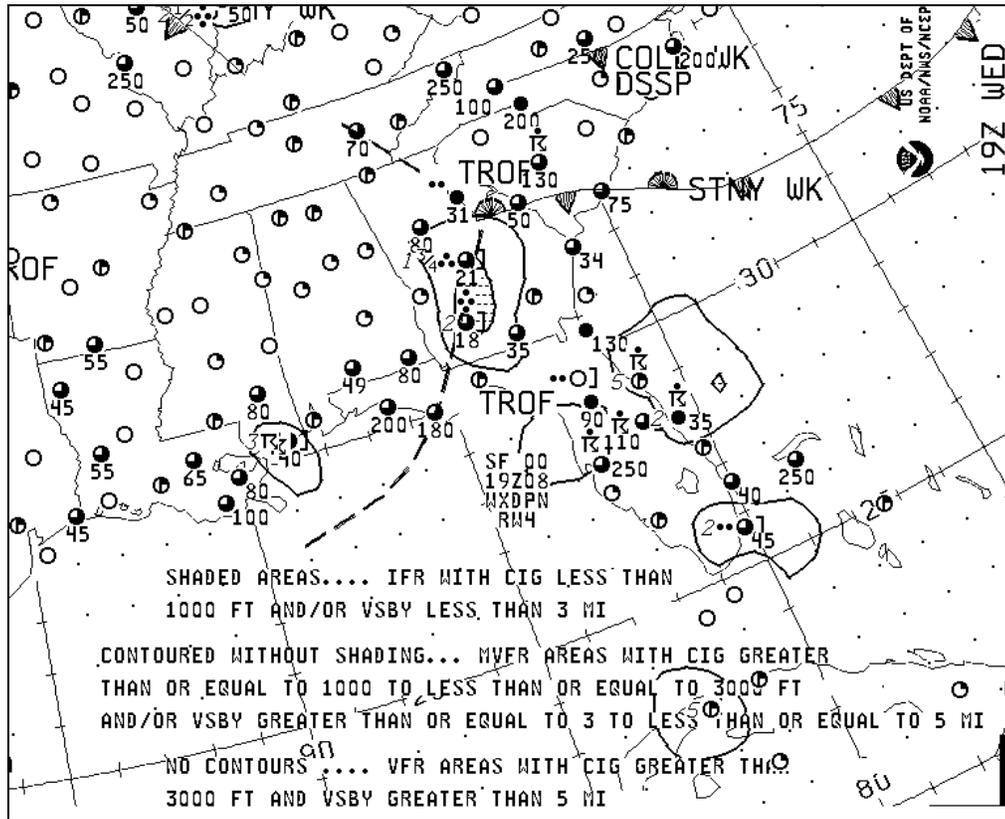
The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (NCEP) located in Camp Springs, Maryland. These are the base products used in describing weather features and in the creation 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 00-45.

#### **1.0.1 Surface Analysis Chart**

The southeast section of the NWS Surface Analysis Chart for 1400 EDT (1800Z) on July 8, 2009, is included as figure 1 with the approximate accident location indicated by a cross. The chart depicted a low pressure system with a central pressure of 1009-hectopascals (hPa) over central Georgia with a stationary front extending eastward into South Carolina and into the Atlantic. To the south-southwest of the low a trough or "trof" of low pressure extended across Georgia, into the Florida panhandle and into the Gulf of Mexico. A ridge of high pressure extended over the Bahamas and across south Florida. The accident site was located north of the ridge axis and ahead of the trough of low pressure in a maritime tropical airmass.



closest visual flight rule (VFR) conditions<sup>4</sup> were depicted over the Florida Panhandle, portions of northern and central Florida without a contour line.



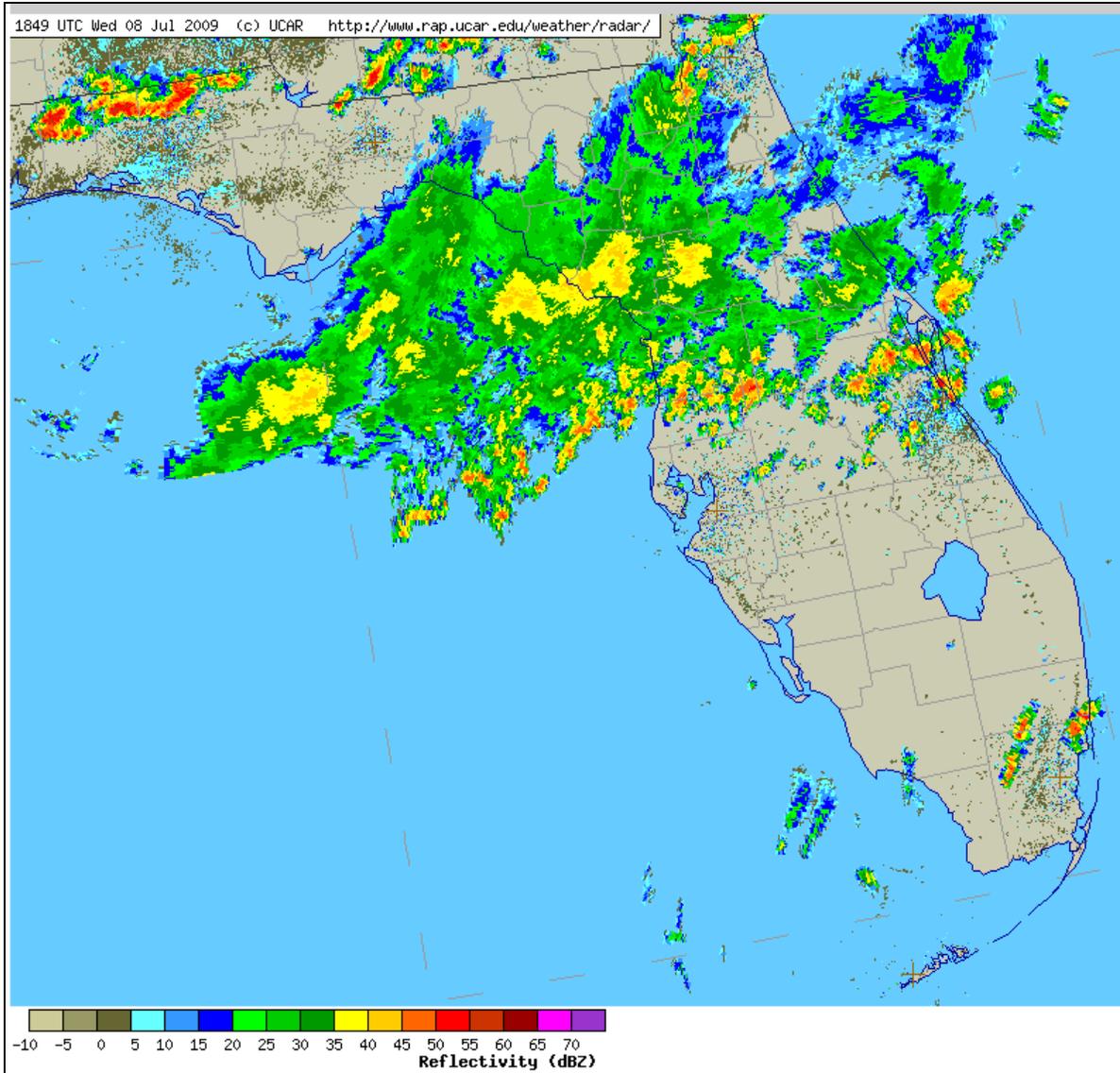
**Figure 2 – NWS Weather Depiction Chart for 1500 EDT**

### 1.0.3 Regional Radar Mosaic Chart

The National Center for Atmospheric Research (NCAR) Regional Radar Mosaic Chart for 1449 EDT (1849Z) is included as figure 3. The chart depicted a band of “intense to extreme” intensity echoes extended across the Alabama and Florida panhandle into southern Georgia associated with strong to potentially severe thunderstorms. A second east-to-west band of echoes associated with thunderstorms and rain showers extending from the east to west coast of central Florida into the Gulf of Mexico. This band was characterized as a broken area of strong to intense cells along the southern portion with an extensive area of stratiform precipitation of light to moderate intensity echoes extending northward. The accident site was located near of the stronger cells on the southern side of the band of echoes.

Based on the radar summary chart depicted the potential for echoes in the vicinity of the accident site, the closest NWS weather surveillance radar was documented and is included in section 5.0 of this report.

<sup>4</sup> VFR conditions – are defined as no ceiling or a ceiling greater than 3,000 feet agl and visibility greater than 5 miles.

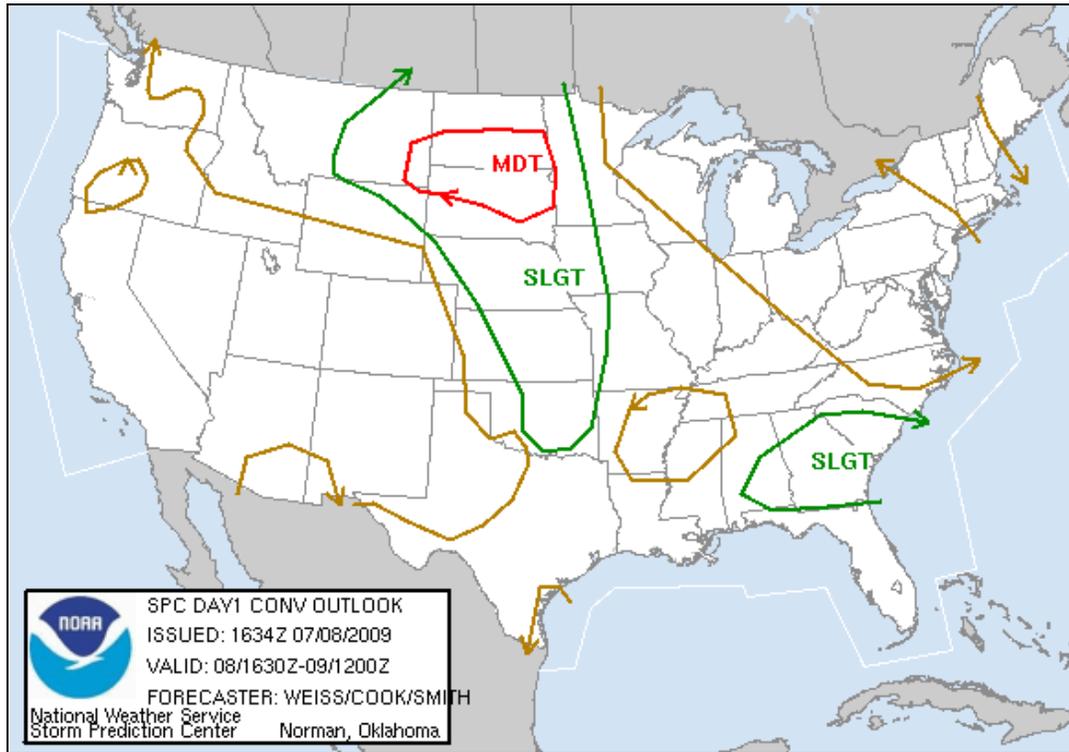


**Figure 3 – Regional Radar Mosaic Chart for 1449 EDT**

#### **1.0.4 Convective Outlook**

The NWS Convective Outlook issued by the Severe Storm Prediction Center (SPC) located in Norman, Oklahoma, valid at the time of the accident was issued at 1234 EDT (1634Z) for regions of organized severe and non-severe thunderstorms is included as figure 4. The chart depicted a slight chance of severe thunderstorms over eastern Alabama, Georgia, and South Carolina, and general thunderstorm activity from central Texas through Florida. The narrative issued with the chart for the southeast indicated a band of strong thunderstorms was occurring over the Gulf of Mexico and eastward into northern Florida. North of this band, thunderstorms were expected to redevelop within the moist and unstable air mass from Alabama into Georgia and South Carolina. The storm intensity was expected to be enhanced by dynamic forcing from an upper level short wave trough of low pressure.

The forecast wind profile resulted in favorable vertical shear profiles for organized severe thunderstorm development, with the stronger cells having a high potential for wet microburst and possible hail. The environmental conditions and storm warnings applied to the band of echoes along the Alabama, Florida panhandle, and into Georgia, and not directly to the activity in the Gulf of Mexico in the vicinity of the accident site; however, some of the same atmospheric conditions still applied such as the dynamic forcing and unstable airmass.



**Figure 4 – NWS Convective Outlook**

The narrative which accompanied the graphic chart was as follows:

*SPC AC 081634  
DAY 1 CONVECTIVE OUTLOOK  
NWS STORM PREDICTION CENTER NORMAN OK  
1134 AM CDT WED JUL 08 2009  
VALID 081630Z - 091200Z*

*...THERE IS A MDT RISK OF SVR TSTMS OVER SERN MT...SRN ND AND NRN/CENTRAL SD...*

*...THERE IS A SLGT RISK OF SVR TSTMS OVER PARTS OF CENTRAL/SRN PLAINS...*

*...THERE IS A SLGT RISK OF SVR TSTMS OVER PARTS OF THE SERN STATES...*

*...ERN MT/NERN WY ACROSS THE NRN PLAINS...*

*WIDESPREAD SEVERE THUNDERSTORM EPISODE EXPECTED LATE THIS AFTERNOON AND TONIGHT...*

*UPPER SHORT WAVE TROUGH NOW EVIDENT IN WATER VAPOR IMAGERY OVER ERN PARTS OF WA AND OREGON IS FORECAST TO MOVE ENEWD ACROSS MT AND INTO WRN ND BY THE END OF THE PERIOD. A STRONG MID/UPPER LEVEL JET STREAK OVER THE NRN GREAT BASIN/INTERMOUNTAIN REGION IS EXPECTED TO TRANSLATE ENEWD ACROSS THE NRN ROCKIES THIS AFTERNOON AND INTO THE NRN HIGH PLAINS TONIGHT. AS THE UPPER LEVEL JET PROGRESSES ENEWD...AN INTENSIFYING SOUTHERLY LOW LEVEL JET WILL DEVELOP LATE THIS AFTERNOON INTO TONIGHT OVER THE CENTRAL/NRN PLAINS.*

*A SURFACE COLD FRONT CURRENTLY EXTENDS FROM ERN MT SWD INTO A LOW OVER NERN WY...CONTINUING SWWD INTO NRN UT. THE LOW AND COLD FRONT WILL MOVE SLOWLY EWD LATER THIS AFTERNOON AND EVENING TOWARD THE WRN DAKOTAS BORDER...THEN ACCELERATING SOMEWHAT INTO THE ERN DAKOTAS BY THE END OF THE PERIOD. LOW LEVEL CONVERGENCE NEAR THE LOW AND FRONT IS EXPECTED TO PROVIDE THE PRIMARY FOCUS FOR SEVERE STORMS LATER THIS AFTERNOON AND TONIGHT.*

*IN RESPONSE TO THE DEVELOPING LOW LEVEL JET...MOISTURE IS LIKELY TO BE TRANSPORTED NWD IN ADVANCE OF THE COLD FRONT WITH SURFACE DEW POINTS IN THE LOW/MID 60S EXPECTED THIS AFTERNOON. PLUME OF STEEP MID LEVEL LAPSE RATES EVIDENT IN THE RAP AND RIW SOUNDINGS IS EXPECTED TO SPREAD EWD ACROSS PARTS OF THE NRN PLAINS...AND WHEN COUPLED WITH INCREASING MOISTURE AND STRONG DIABATIC HEATING FROM SERN MT INTO THE DAKOTAS WILL RESULT IN MODERATE INSTABILITY WITH MLCAPE FROM 1500-2500 J/KG.*

*ISOLATED STRONG ELEVATED THUNDERSTORMS ARE OCCURRING THIS MORNING OVER NERN MT AND EXTREME WRN ND. THESE STORMS WILL BE MONITORED AS THEY PROGRESS EWD THROUGH THE LATE MORNING HOURS AS THEY HAVE POTENTIAL TO PRODUCE HAIL AND POSSIBLE STRONG WIND GUSTS. PRIMARY SEVERE THREAT IS EXPECTED TO DEVELOP LATER THIS AFTERNOON AND EVENING...WITH INITIAL DISCRETE CELLS DEVELOPING OVER PARTS OF SOUTH CENTRAL/ERN MT AND NERN WY. THESE STORMS WILL BE ON THE NOSE OF THE UPPER LEVEL JET...AND WITHIN AN ENVIRONMENT CHARACTERIZED BY 35-45 KT OF DEEP LAYER SHEAR THAT WILL BE SUPPORTIVE OF SUPERCELLS. THESE WILL BE CAPABLE OF LARGE HAIL...DAMAGING WIND GUSTS AND A FEW TORNADOES. THUNDERSTORMS ARE EXPECTED TO GRADUALLY SPREAD EWD INTO THE WRN DAKOTAS THIS EVENING...WITH ACTIVITY LIKELY GROWING UPSCALE INTO A FORWARD PROPAGATING MCS WITH EMBEDDED BOW ECHO STRUCTURES. ALTHOUGH POTENTIAL FOR LARGE HAIL AND ISOLATED TORNADOES WILL CONTINUE...THE PRIMARY SEVERE WEATHER THREAT IS EXPECTED TO TRANSITION TO WIDESPREAD DAMAGING WIND GUSTS AS THE BOW ECHO SYSTEM MOVES EWD ACROSS PARTS OF THE DAKOTAS.*

*...CENTRAL/SRN PLAINS...*

*ELEVATED STRONG THUNDERSTORMS CONTINUE TO MOVE SSEWD ACROSS SERN NEB AND PARTS OF NRN/ERN OK WITHIN BAND OF STRONGER NWLY FLOW ALOFT. RADAR ANALYSIS INDICATES THAT UPDRAFT CORES HAVE BEEN PULSING TO SOME EXTENT. HOWEVER...OVERALL PERSISTENCE OF CONVECTION INTO THE LATE MORNING SUGGESTS THAT STORMS HAVE POTENTIAL TO BECOME SURFACE-BASED THIS AFTERNOON. HAIL AND POSSIBLY STRONG WIND GUSTS WILL BE POSSIBLE WITH THE STORMS.*

*ADDITIONAL CONVECTION IS EXPECTED TO DEVELOP ALONG THE LEE TROUGH OVER THE HIGH PLAINS OF NEB AND POSSIBLY NWRN KS LATE THIS AFTERNOON*

*AND EVENING...AND WOULD MOVE SEWD ACROSS PARTS OF THE CENTRAL PLAINS INTO THE OVERNIGHT HOURS. LARGE HAIL AND DAMAGING WIND WILL BE POSSIBLE WITH STRONGER CELLS GIVEN ENVIRONMENT CHARACTERIZED BY MLCAPE OF 1500-2000 J/KG AND DEEP LAYER SHEAR OF 40-45 KT.*

*...SERN STATES...*

*A BAND OF STRONG STORMS IS OCCURRING OVER THE NRN GULF OF MEXICO AND EWD INTO NRN FL. NORTH OF THIS ACTIVITY...STORMS ARE LIKELY TO REDEVELOP WITHIN VERY MOIST AIR MASS FROM PARTS OF AL EWD INTO GA AND SC. STORM INTENSITY WILL BE ENHANCED BY DYNAMIC FORCING IN ADVANCE OF A SHORT WAVE TROUGH MOVING EWD FROM THE LOWER MS VALLEY. THERE IS SUFFICIENT WESTERLY FLOW ALOFT AND VERTICAL SHEAR TO AID IN STORM ORGANIZATION...WITH STRONGER CELLS CAPABLE OF PRODUCING WET MICROBURSTS AND POSSIBLY HAIL.*

*..WEISS/COOK/SMITH.. 07/08/2009*

## **2.0 Surface Observations**

The surrounding area was documented utilizing official NWS Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations are taken from standard code provided in plain language, with cloud heights reported above ground level.

### **2.0.1 Hernando County Airport (KBKV)**

The closest weather reporting facility to the accident site was from Hernando County Airport (KBKV), in Brooksville, Florida, located approximately 35 miles east of the accident site at an elevation of 76 feet msl. The airport was equipped with an Automated Surface Observation System (ASOS) and reported the following weather conditions surrounding the time of the accident:

KBKV special weather observation at 1346 EDT (1746Z), automated, wind from 010° at 9 knots, visibility 10 miles with thunderstorms in the vicinity<sup>5</sup>, scattered clouds at 1,700 feet agl, ceiling broken at 2,300 feet, and broken at 2,800 feet, temperature 27° Celsius (C), dew point temperature 23° C, altimeter setting 29.95 inches of Mercury (Hg). Remarks: automated observation system, lightning distant all quadrants, thunderstorms began at 1311 EDT.

KBKV weather observation at 1353 EDT (1753Z), automated, wind from 010° at 7 knots gusting to 15 knots, visibility 8 miles with thunderstorms in the vicinity and light rain at the airport, ceiling broken at 1,900 feet, broken at 2,700 feet, and broken at 5,000 feet, temperature 26° C, dew point 23° C, altimeter 29.95 inches of Hg. Remarks: automated observation system, lightning distant all quadrants, thunderstorm began at 1311 and rain

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<sup>5</sup> Vicinity – is defined by the NWS as not at the aerodrome, but within 5 to 10 miles of the center of the airport complex.

began at 1352 EDT, sea level pressure 1014.0-hPa, hourly precipitation 0.01- inches, 6-hour precipitation 0.22-inches, temperature 26.1° C, dew point 23.3° C, 6-hour maximum temperature 31.1° C, 6-hour minimum temperature 23.9° C, 3-hour pressure tendency risen 0.5-hPa.

KBKV weather observation at 1453 EDT (1853Z), automated, wind from 340° at 9 knots, visibility 1 3/4 miles in thunderstorms and light rain and mist, a few clouds at 200 feet, ceiling broken at 2,600 feet, overcast at 3,400 feet, temperature 24° C, dew point 23° C, altimeter 29.98 inches of Hg. Remarks: automated observation system, lightning distant all quadrants, pressure rising rapidly, sea level pressure 1015.1-hPa, hourly precipitation 0.20-inches, temperature 24.4° C, dew point 22.8° C.

KBKV special weather observation at 1455 EDT (1855Z), automated, wind calm, visibility 3/4 mile in thunderstorms and heavy rain and mist, a few clouds at 200 feet, ceiling broken at 2,400 feet, overcast at 3,400 feet, temperature 24° C, dew point 23° C, altimeter 29.98 inches of Hg. Remarks: automated observation system, lightning distant all quadrants, hourly precipitation 0.11-inches (between 1853 and 1855 EDT).

KBKV special weather observation at 1457 EDT (1857Z), automated, wind calm, visibility 1/2 mile in thunderstorms and heavy rain and fog, a few clouds at 200 feet, scattered clouds at 1,000 feet, ceiling overcast at 2,400 feet, temperature 24° C, dew point 23° C, altimeter 29.98 inches of Hg. Remarks: automated observation system, lightning distant all quadrants, thunderstorms ended at 1456 and began again at 1457 EDT, hourly precipitation 0.18-inches (between 1853 and 1857 EDT).

The total precipitation reported at KBKV between 1311 and 1559 EDT was 0.99 inches. The raw METAR observations during the period were as follows:

*KBKV SPECI 081541Z AUTO 27019G28KT 1 1/2SM +RA FEW015 SCT032 BKN040 25/22 A2996 RMK AO2 PK WND 26028/1538 RAB38 PRESRR P0009*

*KBKV 081553Z AUTO VRB04KT 3SM -TSRA SCT020 SCT032 BKN042 24/22 A2996 RMK AO2 PK WND 26028/1538 LTG DSNT N TSB49RAB38 SLP141 P0018 T02440217*

*KBKV SPECI 081620Z AUTO 27007G22KT 3SM -TSRA FEW012 25/21 A2995 RMK AO2 LTG DSNT NE TSE18B20RAE1557B14 P0003*

*KBKV 081653Z AUTO 26013G18KT 10SM CLR 31/25 A2994 RMK AO2 LTG DSNT NW-E TSE18B20E47RAE1557B14E27 SLP135 P0003 T03060250*

*KBKV SPECI 081717Z AUTO 24009G16KT 10SM VCTS FEW026 30/24 A2994 RMK AO2 LTG DSNT NW-E TSB11*

*KBKV SPECI 081746Z AUTO 01009KT 10SM VCTS SCT017 BKN023 BKN028 27/23 A2995 RMK AO2 LTG DSNT ALQDS TSB11*

*KBKV 081753Z AUTO 01007G15KT 8SM VCTS -RA BKN019 BKN027 BKN050 26/23 A2995 RMK AO2 LTG DSNT ALQDS TSB11RAB52 SLP140 P0001 60022 T02610233 10311 20239 51005*

*KBKV 081853Z AUTO 34009KT 1 3/4SM -TSRA BR FEW002 BKN026 OVC034 24/23 A2998 RMK AO2 LTG DSNT ALQDS PRESRR SLP151 P0020 T02440228*

*KBKV SPECI 081855Z AUTO 00000KT 3/4SM +TSRA BR FEW002 BKN024 OVC034 24/23 A2998 RMK  
AO2 LTG DSNT ALQDS P0011*

*KBKV SPECI 081857Z AUTO 00000KT 1/2SM +TSRA FG FEW002 SCT010 OVC024 24/23 A2998 RMK  
AO2 LTG DSNT ALQDS TSE56B57 P0018*

## **2.0.2 St. Petersburg-Clearwater International Airport (KPIE)**

The next weather reporting location was from St. Petersburg-Clearwater International Airport (KPIE), located in St. Petersburg-Clearwater approximately 39 miles southeast (bearing 140°) of the accident site at an elevation of 11 feet msl. The airport had an ASOS and was augmented by NWS certified weather observers. The following conditions were reported surrounding the period:

KPIE weather observation at 1353 EDT (1753Z), wind from 220° at 18 knots gusting to 25 knots, visibility 10 miles, a few clouds at 2,800 feet, temperature 32° C, dew point 24° C, altimeter 29.94 inches of Hg. Remarks: automated observation system, sea level pressure 1013.9-hPa, temperature 31.7° C, dew point 23.9° C, 6-hour maximum temperature 32.8° C, 6-hour minimum temperature 26.7° C, 3-hour pressure tendency risen 0.4-hPa.

KPIE weather observation at 1453 EDT (1853Z), wind from 230° at 16 knots gusting to 22 knots, visibility 10 miles, a few clouds at 2,800 feet, scattered at 3,500 feet, temperature 32° C, dew point 23° C, altimeter 29.95 inches of Hg. Remarks: automated observation system, lightning distant northwest through northeast, sea level pressure 1014.0-hPa, temperature 32.2° C, dew point 22.8° C.

KPIE weather observation at 1553 EDT (1953Z), wind from 230° at 13 knots gusting to 19 knots, visibility 10 miles, scattered clouds at 2,900 feet, scattered at 3,900 feet, and scattered at 5,000 feet, temperature 32° C, dew point 24° C, altimeter 29.93 inches of Hg. Remarks: automated observation system, lightning distant west through north, sea level pressure 1013.6-hPa, temperature 32.2° C, dew point 23.9° C.

KPIE special weather observation at 1646 EDT (2046Z), wind from 330° at 20 knots gusting to 28 knots, visibility 5 miles in light rain, scattered clouds at 2,000 feet, scattered at 2,800 feet, ceiling broken at 3,600 feet, temperature 27° C, dew point 23° C, altimeter 29.96 inches of Hg. Remarks: automated observation system, peak wind from 340 at 28 knots occurred at 1645 EDT, wind shift occurred at 1626 EDT, rain began at 1644 EDT, hourly precipitation less than 0.01 inches (trace).

KPIE special weather observation at 1650 EDT (2050Z), wind from 320° at 16 knots gusting to 28 knots, visibility 2 1/2 miles in moderate rain, a few clouds at 1,400 feet, ceiling broken at 2,800 feet, overcast at 3,600 feet, temperature 26° C, dew point 23° C, altimeter 29.97 inches of Hg. Remarks: automated observation system, peak wind from 340 at 28 knots occurred at 1645 EDT, wind shift occurred at 1626 EDT, visibility 1 variable 5 miles, lightning distant southwest, rain began at 1644 EDT, pressure rising rapidly, hourly precipitation 0.01 inches.

The raw observations during the period are as follows:

*KPIE 081753Z 22018G25KT 10SM FEW028 32/24 A2994 RMK AO2 SLP139 T03170239 10328 20267 51004*

*KPIE 081853Z 23016G22KT 10SM FEW028 SCT035 SCT043 32/23 A2995 RMK AO2 LTG DSNT NW-NE SLP140 T03220228*

*KPIE 081953Z 23013G19KT 10SM SCT029 SCT039 SCT050 32/24 A2993 RMK AO2 LTG DSNT W- N SLP136 T03220239*

*KPIE SPECI 082046Z 33020G28KT 5SM -RA SCT020 SCT028 BKN036 27/23 A2996 RMK AO2 PK WND 34028/2045 WSHFT 2026 RAB44 P0000*

*SPECI KPIE 082050Z 32016G28KT 2 1/2SM RA FEW014 BKN028 OVC036 26/23 A2997 RMK AO2 PK WND 34028/2045 WSHFT 2026 VIS 1V5 LTG DSNT SW RAB44 PRESRR P0001*

### **2.0.3 Tampa International Airport (KTPA)**

Tampa International Airport (KTPA) was the next closest weather reporting location approximately 43 miles southeast (bearing 129°), in Tampa, Florida, at an elevation of 26 feet msl. The airport had an ASOS that was also augmented by NWS certified observers. The following conditions were reported:

KTPA weather observation at 1353 EDT (1753Z), wind from 230° at 12 knots, visibility 10 miles, scattered at 2,800 feet in cumulonimbus clouds (CB), scattered clouds at 11,000 feet, ceiling broken at 25,000 feet, temperature 32° C, dew point 24° C, altimeter 29.94 inches of Hg. Remarks: automated observation system, sea level pressure 1013.7-hPa, cumulonimbus west and north, moving northeast, temperature 32.2° C, dew point 24.4° C, 6-hour maximum temperature 32.2° C, 6-hour minimum temperature 26.7° C, 3-hour pressure tendency risen 0.2-hPa.

KTPA weather observation at 1453 EDT (1853Z), wind from 240° at 14 knots, visibility 9 miles, scattered clouds at 2,900 feet, scattered clouds at 11,000 feet, ceiling broken at 25,000 feet, temperature 32° C, dew point 24° C, altimeter 29.95 inches of Hg. Remarks: automated observation system, sea level pressure 1014.0-hPa, temperature 32.2° C, dew point 24.4° C.

KTPA weather observation at 1553 EDT (1953Z), wind from 250° at 13 knots, visibility 10 miles, scattered clouds at 3,500 feet in towering cumulus clouds, ceiling broken at 11,000 feet, temperature 32° C, dew point 24° C, altimeter 29.93 inches of Hg. Remarks: automated observation system, sea level pressure 1013.6-hPa, cumulonimbus clouds (CB) distant west moving east, towering cumulus clouds (TCU) east through southwest, temperature 31.7° C, dew point 24.4° C.

KTPA special weather observation at 1647 EDT (2047Z), wind from 330° at 14 knots, visibility 9 miles, scattered clouds at 1,900 feet, ceiling broken at 3,500 feet in towering cumulus clouds, overcast at 4,000 feet, temperature 26° C, dew point 22° C, altimeter 29.96

inches of Hg. Remarks: automated observation system, towering cumulus clouds all quadrants with rain showers in the distant west.

KTPA weather observation at 1653 EDT (2053Z), wind from 320° at 16 knots gusting to 22 knots, visibility 9 miles, a few clouds at 800 feet, scattered clouds at 1,900 feet, ceiling broken at 2,600 feet in towering cumulus clouds, overcast at 13,000 feet, temperature 26° C, dew point 22° C, altimeter 29.96 inches of Hg. Remarks: automated observation system, sea level pressure 1014.3-hPa, towering cumulus clouds all quadrants with rain showers in the vicinity west, temperature 26.1° C, dew point 22.2° C, 3-hour pressure tendency risen 0.4-hPa.

KTPA special weather observation at 1701 EDT (2101Z), wind missing, visibility 1 3/4 miles in heavy rain and mist, a few clouds at 1,200 feet, ceiling broken at 2,500 feet, overcast at 4,800 feet, temperature 25° C, dew point 23° C, altimeter 29.95 inches of Hg. Remarks: automated observation system, rain began at 1655 EDT, hourly precipitation 0.01-inches.

The raw observations were as follows:

*KTPA 081753Z 23012KT 10SM SCT028CB SCT110 BKN250 32/24 A2994 RMK AO2 SLP137 CB W  
AND N MOV NE T03220244 10322 20267 51002*

*KTPA 081853Z 24014KT 9SM SCT029 SCT110 BKN250 32/24 A2995 RMK AO2 SLP140 T03220244*

*KTPA 081953Z 25013KT 10SM SCT035TCU BKN110 32/24 A2993 RMK AO2 SLP136 CB DSNT W  
MOV E TCU E-SW T03170244*

*KTPA SPECI 082047Z 33014KT 9SM SCT019 BKN026TCU OVC040 26/22 A2996 RMK AO2 TCU  
ALQDS SHRA DSNT W*

*KTPA 082053Z 32016G22KT 9SM FEW008 SCT019 BKN026TCU OVC130 26/22 A2996 RMK AO2  
SLP143 TCU ALQDS VCSH W T02610222 53004*

*KTPA SPECI 082101Z 1 3/4SM +RA BR FEW012 BKN025 OVC048 25/23 A2995 RMK AO2 RAB2055  
P0001*

*KTPA SPECI 082102Z 33015KT 2SM +RA BR FEW009 BKN025TCU OVC040 25/23 A2995 RMK AO2  
SFC VIS 3 RAB2055 TCU ALQDS P0003*

*KTPA SPECI 082121Z 34019KT 6SM -RA BR FEW009 SCT023TCU OVC080 24/23 A2996 RMK AO2  
RAB2055 TCU E SW P0015*

*KTPA 082153Z 36009KT 10SM FEW009 SCT022 SCT070 BKN250 25/23 A2997 RMK AO2  
RAB2055E42 SLP147 CB DSNT E W MOV E P0017 T02500233*

### 3.0 Upper Air Data

The closest upper air sounding or rawinsonde observation (RAOB) was from the NWS Tampa Bay Area (KTBW), Weather Service Forecast Office (WSFO), site number 72210, located approximately 43 miles southeast of the accident site at an elevation of 43 feet msl. The 0800 EDT (1200Z) sounding on July 8, 2009, from KTBW plotted on a standard Skew-T log P diagram<sup>6</sup> utilizing RAOB<sup>7</sup> software with the observed and derived stability parameters and is included as figure 5 from the surface to 500-mb or 18,000 feet.

The KTBW sounding depicted a moist low-level environment with the lifted condensation level (LCL)<sup>8</sup> at 1001-hPa or at 470 feet agl, a convective condensation level (CCL)<sup>9</sup> at 886-hPa or 3,981 feet agl, and a level of free convection (LFC)<sup>10</sup> at 862-hPa or 4,751 feet agl. The sounding had a relative humidity of 75 percent or more from the surface to approximately 3,000 feet. The equilibrium level (EL)<sup>11</sup> or expected top of convective clouds was 162-hPa or 45,131 feet. The tropopause height was identified at 51,521 feet. The precipitable water value was 1.72 inches. The sounding also supports the potential for 0.25 inch hail from some of the convective storms.

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<sup>6</sup> 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.

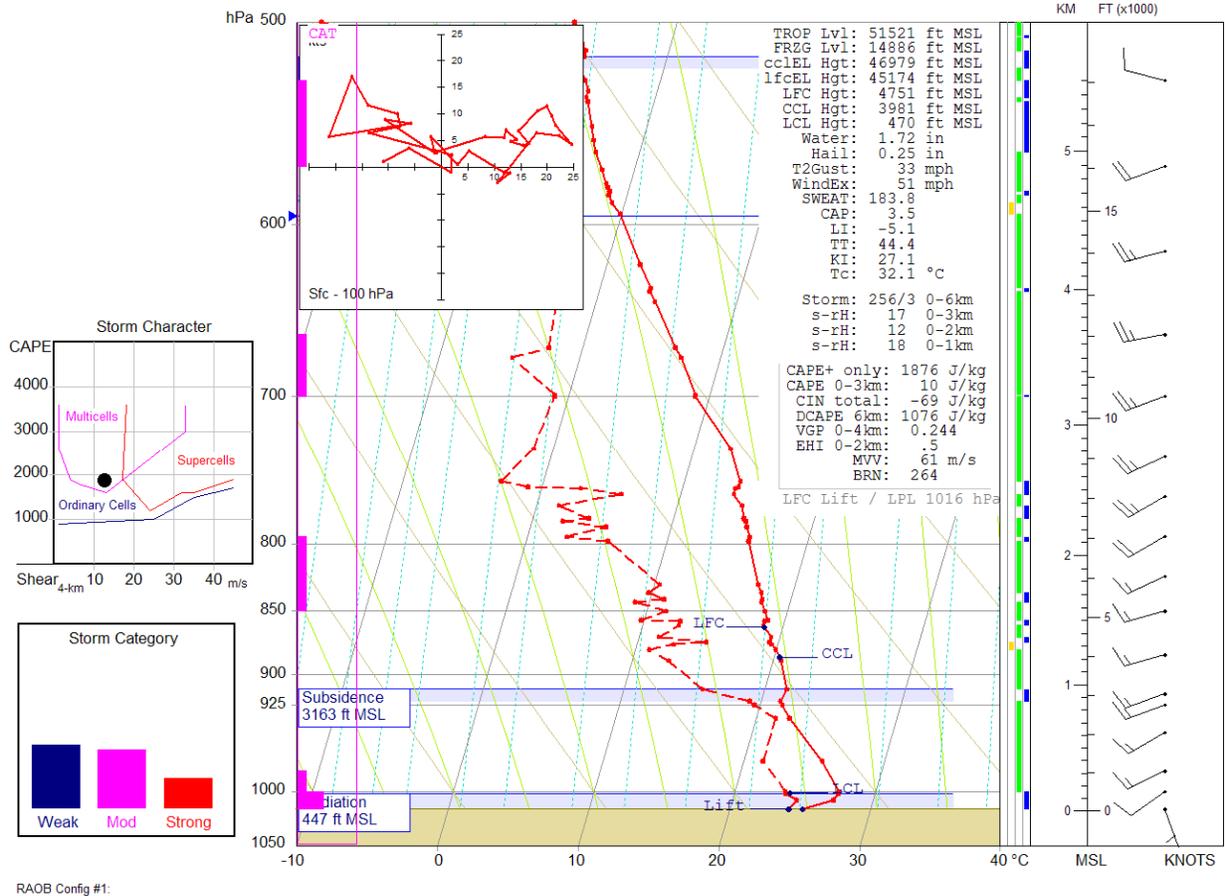
<sup>7</sup> RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

<sup>8</sup> Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

<sup>9</sup> 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.

<sup>10</sup> 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.

<sup>11</sup> Equilibrium Level (EL) - On a sounding, the level above the level of free convection (LFC) at which the temperature of a rising air parcel again equals the temperature of the environment. The height of the EL is the height at which thunderstorm updrafts no longer accelerate upward. Thus, to a close approximation, it represents the height of expected (or ongoing) thunderstorm tops. However, strong updrafts will continue to rise past the EL before stopping, resulting in storm tops that are higher than the EL. This process sometimes can be seen visually as an overshooting tops or anvil dome. The EL typically is higher than the tropopause, and is a more accurate reference for storm tops.



**Figure 5 –KTBW 0800 EDT sounding**

The stability parameters indicated the warm moist low-level environment from the surface to 850-mb with a Lifted Index (LI)<sup>12</sup> of -5.1 and the most unstable lifted index of -6.8, which both indicated an unstable environment favorable for thunderstorm development. The K-index<sup>13</sup> was 27.1 and indicated an approximately 40 percent chance of air mass type thunderstorms. The Total-Totals Index (TT) was 44.4, which indicated a moderate risk of thunderstorms. The energy analysis of the sounding indicated a Convective Available Potential Energy (CAPE)<sup>14</sup> of 1,876 Joules per kilogram (J/kg) and a most unstable CAPE (MUCAPE) of 3,007 J/kg, which also supported a moderate risk of multicellular

<sup>12</sup> Lifted Index (LI) - A common measure of atmospheric instability. Its value is obtained by computing the temperature that air near the ground would have if it were lifted to some higher level (around 18,000 feet, usually) and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms.

<sup>13</sup> K-Index - The measure of thunderstorm potential based on the vertical temperature lapse rate, the moisture content of the lower atmosphere and the vertical extent of the moist layer. The higher the K-Index, the greater the probability of air mass type thunderstorms development.

<sup>14</sup> CAPE - Convective Available Potential Energy. A measure of the amount of energy available for convection. CAPE is directly related to the maximum potential vertical speed within an updraft; thus, higher values indicate greater potential for severe weather.

thunderstorms. The maximum vertical velocity (MVV) of the potential convective updrafts in the thunderstorms was determined to vary between 61 and 78 meters per second (m/s) or from 122 to 156 knots. The WINDEX or microburst potentials measure of the downdraft instability estimated outflow wind near 44 knots.

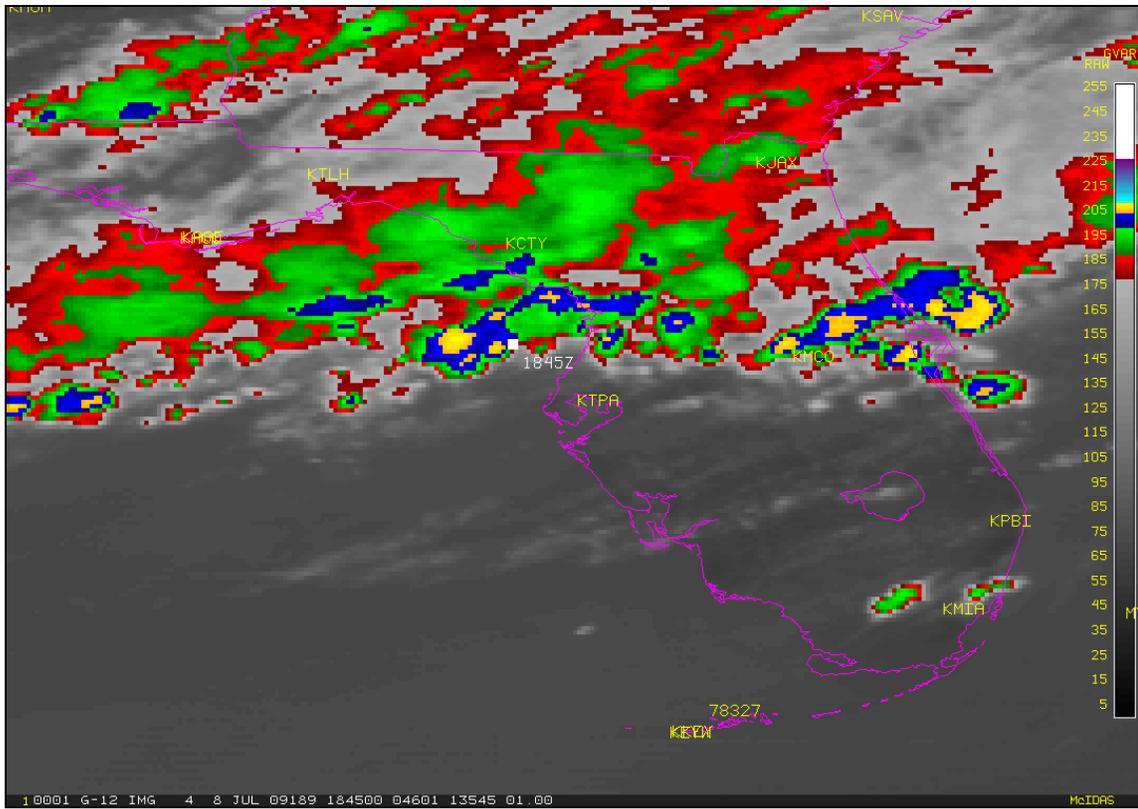
The sounding wind profile indicated surface wind from 160° at 3 knots that veered to the southwest immediately above the surface. The mean 0-6 km wind was from 253° at 18 knots. The level of maximum wind was identified in the stratosphere at 84,000 feet with wind from 090° at 46 knots.

#### **4.0 Satellite Data**

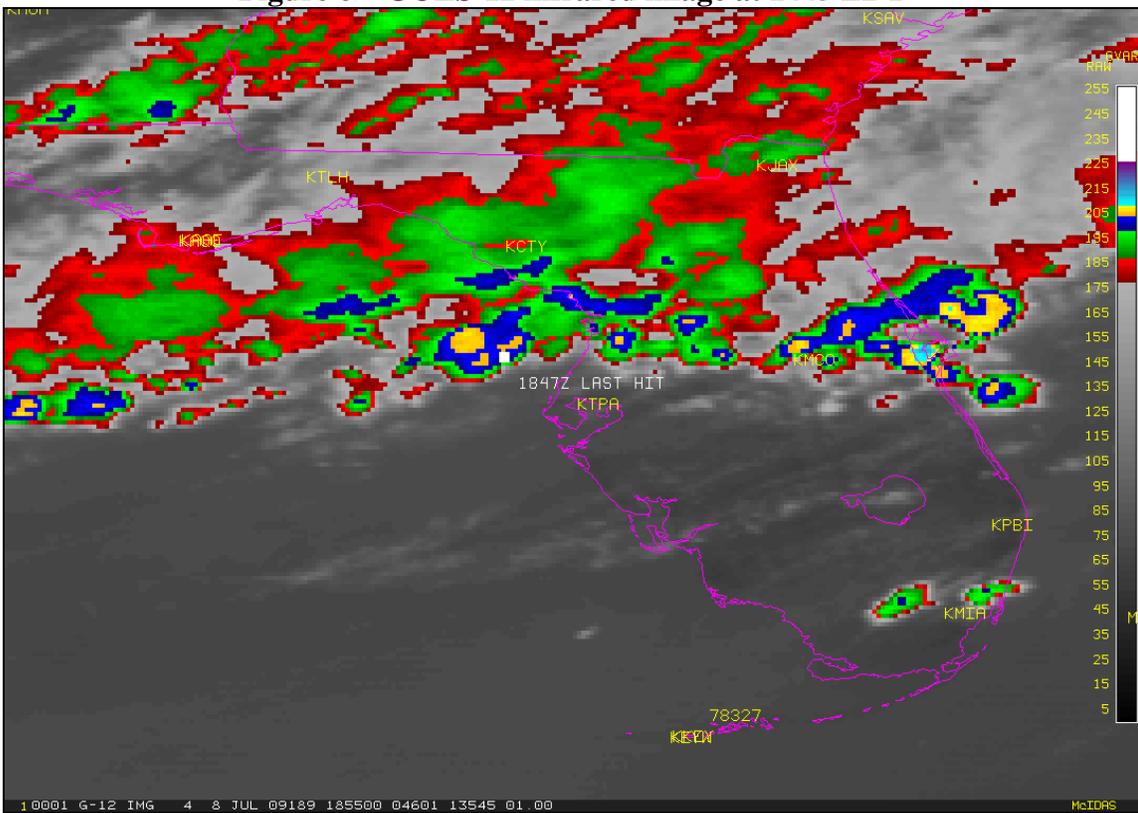
The Geostationary Operations Environmental Satellite number 12 (GOES-12) data was obtained from the National Climatic Data Center (NCDC) and displayed on the National Transportation Safety Board's Man-computer Interactive Data Access System (McIDAS) workstation. Both visible and infrared imagery was obtained surrounding the time of the accident. The infrared imagery (band 4) at a wavelength of 10.7 microns ( $\mu\text{m}$ ) provided a 4-kilometer (km) resolution with radiative cloud top temperatures. The visible imagery (band 1) at a wavelength of 0.65  $\mu\text{m}$  provided a resolution of 1 km. The satellite imagery surrounding the time of the accident from 1400 through 1515 EDT, at approximately every 15-minutes were reviewed and the closest images documented below.

Figures 6 and 7 are the GOES-12 infrared band 4 images at 1445 EDT (1845Z) and 1455 EDT (1855Z) at 4X magnification respectively with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops associated with deep convection. The images depicts an extensive area of enhanced clouds associated with convective clouds extending over southern Alabama and Georgia, with another band that extends east-to-west over the Gulf of Mexico into northern and central Florida into the Atlantic. The location of the accident site is marked by a white square and is located under the leading edge of the convective activity. The radiative cloud top temperature over the accident site was observed at 214.20° Kelvin (K) or  $-58.96^{\circ}$  C, which according to the KTBW sounding indicated cloud tops in the range of 43,000 feet.

Figures 8 through 10 are the GOES-12 visible images at 1425, 1445, and 1455 EDT respectively at 2X magnification, with the accident site marked by a red square on all 3 images. The flight path is also included on the 1445 EDT image (figure 9). The images depict the rapid development of several cumulonimbus clouds after 1425 EDT along the southern edge of the band of clouds. The flight path of N4467D is through a large area of stratiform precipitation extending northwestward from the leading edge and enters a defined cumulonimbus cloud with a pronounced anvil and overshooting cloud top at 1445 EDT. At 1455 EDT the cumulonimbus cloud remains over the accident site. In both the 1445 and 1455 EDT images, shadows of the higher cumulonimbus anvil is observed on the lower portions of the cloud mass showings its vertical development.

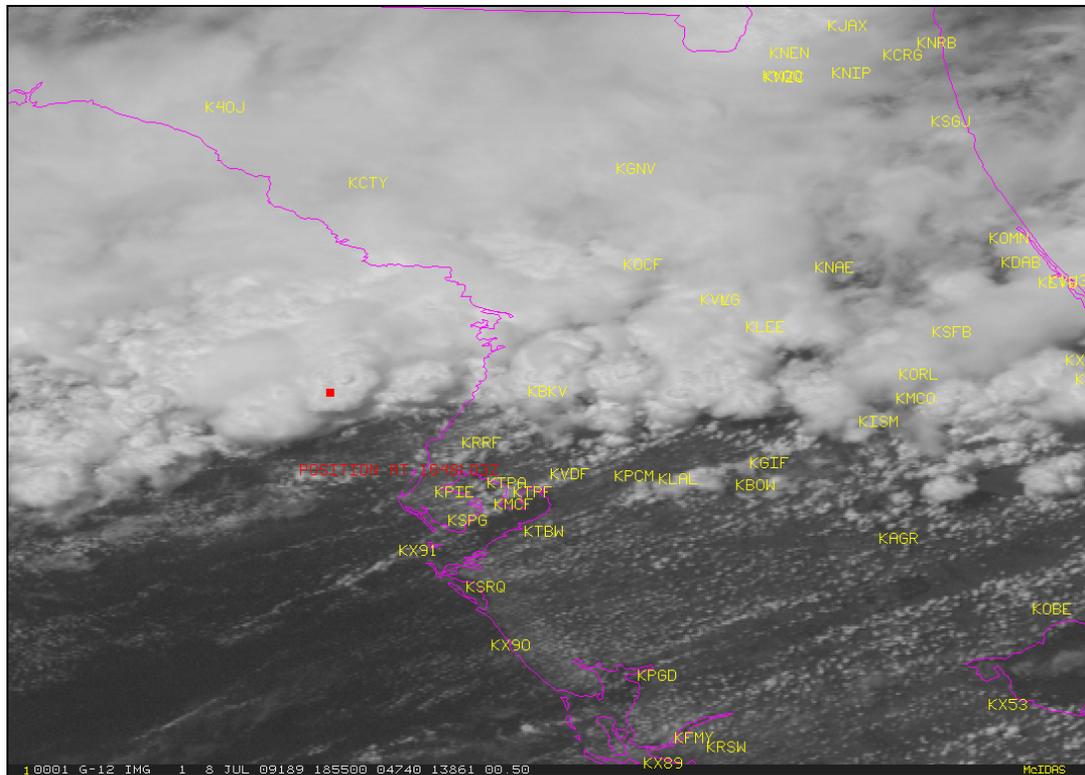


**Figure 6 – GOES-12 infrared image at 1445 EDT**



**Figure 7 – GOES-12 infrared image at 1455 EDT**





**Figure 10 – GOES-12 visible image at 1455 EDT**

## **5.0 Weather Radar Information**

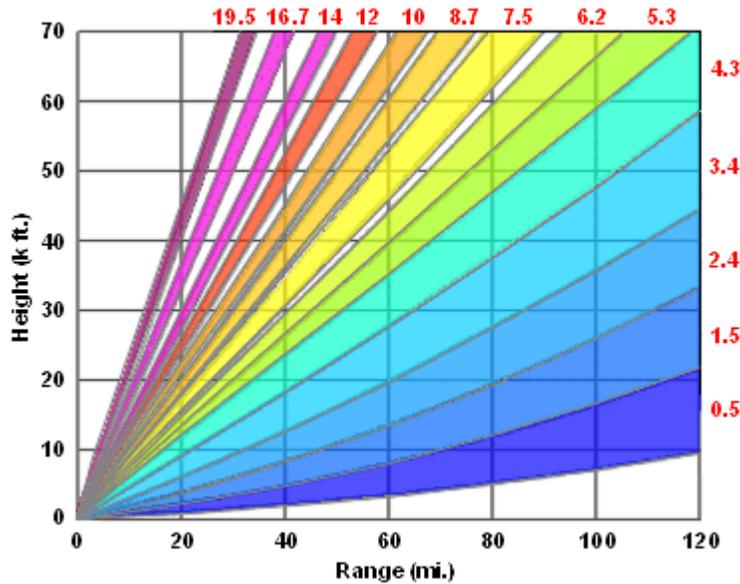
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D) was located at Tampa Bay (KTBW), approximately 43 miles southeast of the accident site. The level II archive data was obtained from the National Climatic Data Center (NCDC) utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

The WSR-88D is an 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-degree beam width. The radar produces three basic types of products reflectivity, radial velocity, and spectral width.

### **5.0.1 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 six 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 two common scanning strategies. The most common is where the radar makes 9 elevation scans from 0.50 degrees to 19.5 degrees every six minutes. This particular scanning strategy is documented as volume coverage pattern 21 (VCP-21). 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 KTBW WSR-88D radar was operating in the precipitation mode (Mode A, VCP-211), which makes 14 elevation scans within 5 minutes. 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-211 Precipitation Mode Scan Strategy

### 5.0.2 Beam Height Calculation

Assuming standard refraction<sup>15</sup> of the 0.95 degree radar beam of the WSR-88D, and the KTBW antenna at 122 feet, and approximately 43 miles from the accident site, 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 feet.

| ANTENNA ELEVATION | BEAM CENTER | BEAM BASE  | BEAM TOP    | BEAM WIDTH |
|-------------------|-------------|------------|-------------|------------|
| 0.5°              | 5,560 feet  | 2,590 feet | 8,530 feet  | 5,940 feet |
| 1.5°              | 11,810 feet | 8,840 feet | 14,780 feet | 5,940 feet |

<sup>15</sup> Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

Based on the radar height calculations, the 1.5° elevation scan depicts the conditions encompassing the accident airplanes cruising level at 11,000 feet, and depicted the conditions between 8,840 to 14,780 feet above where the accident occurred. The 0.5 scan covered the conditions from 2,590 to 8,530 feet during the last 4 minutes of the flight.

### 5.0.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors<sup>16</sup> 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<sup>17</sup>), 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.

**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<br>Very Light        | 3             | 15 to 19      | .01 in/hr   |
|                        | 4             | 20 to 24      | .02 in/hr   |
|                        | 5             | 25 to 29      | .04 in/hr   |
| 2<br>Light to Moderate | 6             | 30 to 34      | .09 in/hr   |
|                        | 7             | 35 to 39      | .21 in/hr   |
| 3<br>Strong            | 8             | 40 to 44      | .48 in/hr   |
| 4<br>Very Strong       | 9             | 45 to 49      | 1.10 in/hr  |
| 5<br>Intense           | 10            | 50 to 54      | 2.49 in/hr  |
| 6<br>Extreme           | 11            | 55 to 59      | >5.67 in/hr |
|                        | 12            | 60 to 64      |             |
|                        | 13            | 65 to 69      |             |
|                        | 14            | 70 to 74      |             |
|                        | 15            | > 75          |             |

<sup>16</sup> 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 glaze ice.

<sup>17</sup> dBZ - 10 log Ze

The Federal Aviation Administration (FAA) Advisory Circular AC 00-24B titled “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.

Air traffic control (ATC) weather display systems also use radar weather processors with the ability to determine precipitation intensity, with controllers instructed to describe the intensity to pilots based on the following scale:

- (a) "Light" (< 30 dBZ)
- (b) "Moderate" (30 to 40 dBZ)
- (c) "Heavy" (> 40 to 50 dBZ)
- (d) "Extreme" (> 50 dBZ)

#### **5.0.4 Base Reflectivity**

Figures 10 through 11 are the KTBW WSR-88D base reflectivity for 1438, 1443 and 1448 EDT respectively at the 1.5° elevation scan with a resolution of 1° X 1 kilometers, with the track of N4467D overlaid on the images. The images depict N4467D entering an area of echoes of 20 to 30 dBZ as it is descending flying southward (figure 10) avoiding the stronger echoes, and then begins to deviation right to the southeast towards KTPA (figure 11) and approaches an area of echoes of 35 to 40 dBZ or “moderate to heavy” intensity echoes. The flight path then turns towards the south and south-southwest (figure 12) and enters an area of echoes of 45 to 50 dBZ or “heavy to extreme” intensity echoes and rapidly loses altitude.

Figure 12 is the KTBW WSR-88D 0.5° base reflectivity image depicting conditions between 2,590 to 8,530 feet, and continues to depict the flight path entering echoes of 50 to 55 dBZ or “intense to extreme” intensity.

In meteorological terms, the radar images depict a general east-to-west oriented broken line of echoes that was characterized as having an intense leading edge with a trailing area of stratified echoes to the northwest. In the vicinity of the accident site, the band shows a slight wave like patten with the band extending southwestward and the band across central Florida bowing southward. The echoes were observed moving east-northeastward, with echo tops between 35,000 and 45,000 feet.

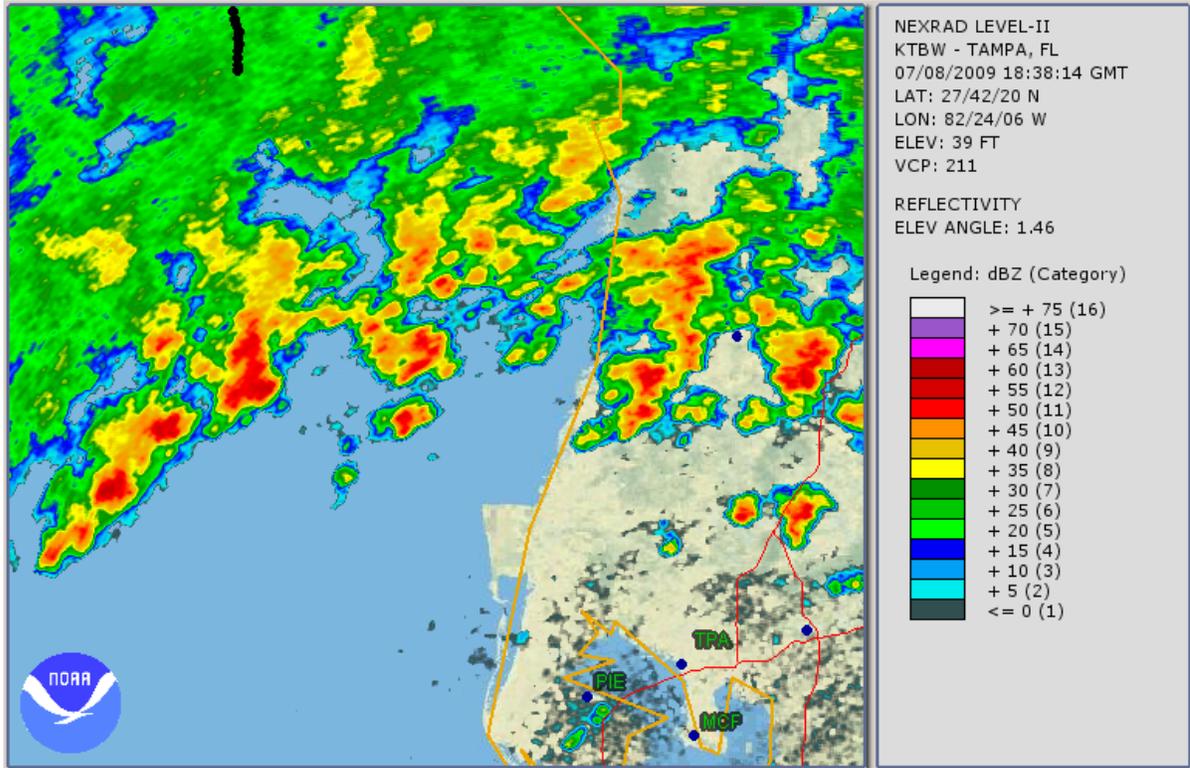


Figure 10 – KTBW WSR-88D 1.5° elevation scan for 1438:14 EDT

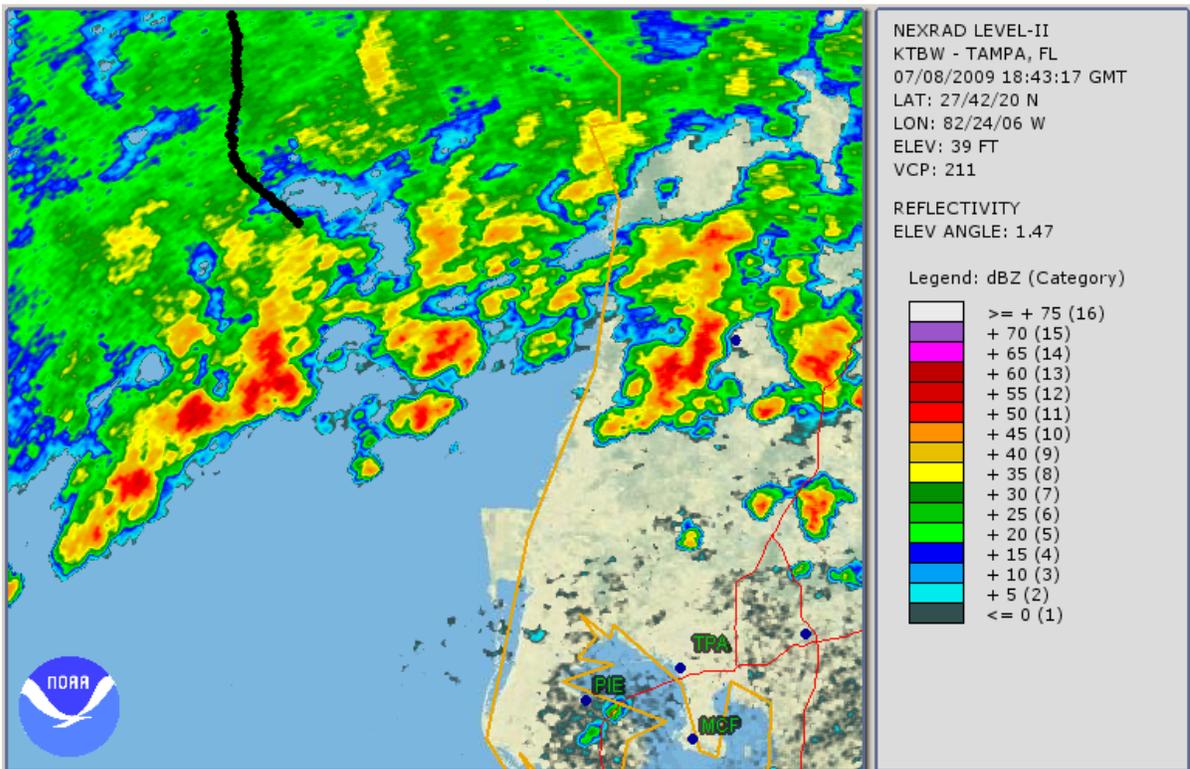


Figure 11 – KTBW WSR-88D 1.5° elevation scan for 1843:17 EDT

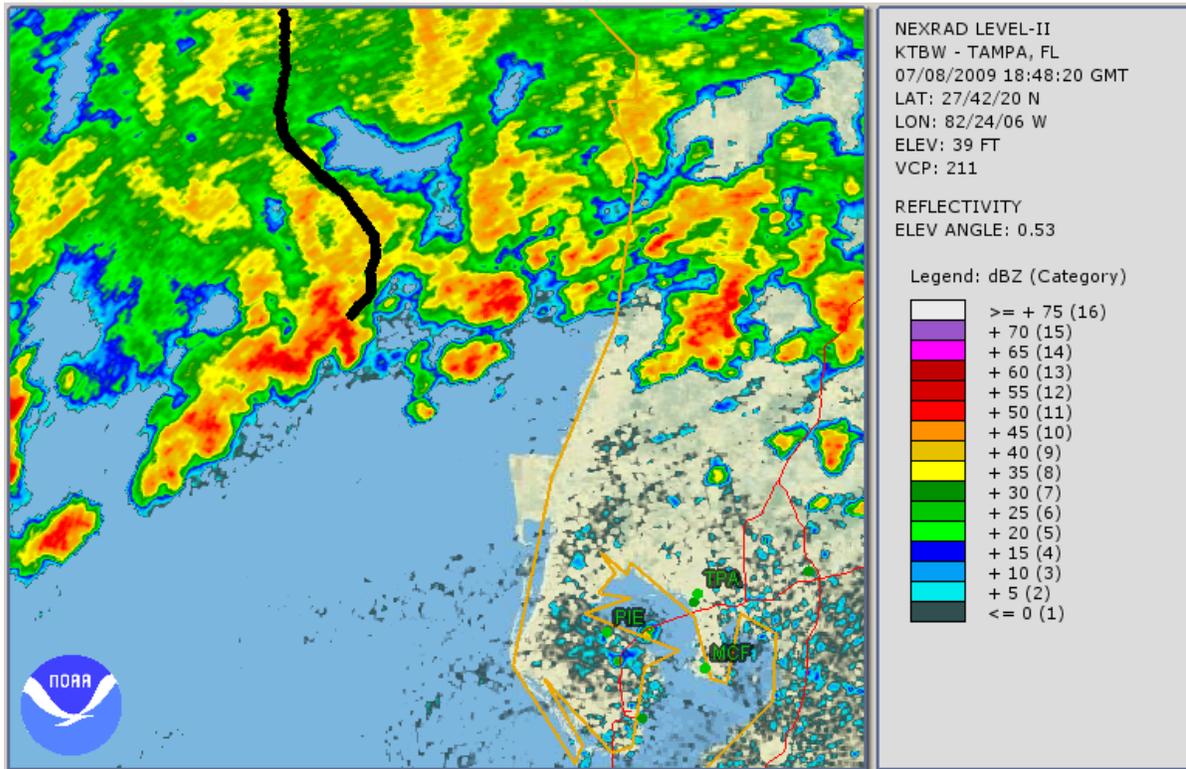


Figure 12 – KTBW WSR-88D 0.5° elevation scan for 1848:20 EDT

## 6.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over Florida surrounding the time of the accident. The reports are in standard format and code. The reports were as follows:

*CEW UA /OV CEW 105040/TM 1412/FL390/TP B752/TB MOD TURB/RM CWSU ZJX=*

*TLH UA /OV KTLH/TM 1415/FL240/TP B738/TB OCNL MOD CHOP 240/RM WIND 256/24 AWC  
 -WEB:COA=*

*NPA UUA /OV NPA090005 /TM 1643 /FL013 /TP BE20 /RM LLWS -30KT DURD RY 25R NPA=*

*TLH UA /OV 70SE TLH/TM 1755/FL190/TP KC35/IC LGT RIME ICG/RM ZJX CWSU=*

*CTY UA /OV CTY 330020/TM 1820/FL170/TP C421/TA 0/IC LGT RIME ICG/RM ZJX CWSU=*

*PIE UA /OV PIE 360040/TM 1908/FL264/TP B190/TB MOD TURB/RM ZJX CWSU=*

*GNV UA /OV LCQ /TM 1915 /FL075 /TP C172 /SK SCT-TOP020 /WX FV15SM -RA /TB NEG=*

*PIE UA /OV PIE 080020/TM 1917/FL270/TP C500/IC LGT RIME ICG/RM ZJX CWSU=*

*PIE UA /OV 55NW PIE/TM 1929/FL250/TP A306/TA -19/IC MOD ICG=*

PIE UA /OV PIE 330050/TM 2012/FL110/TP A320/TB MOD TURB BTN 110-130/RM ZJX CWSU=  
 CTY UA /OV CTY 289046/TM 2048/FL210/TP 737/TB CONT LGT OCNL MOD TURB/RM ZJX CWSU=  
 HST UA /OV ZQA180060 /TM 2056 /FL200 /TP SW4 /WX FV08SM /RM HZ BLO 170=  
 SFB UA /OV SFB /TM 2056 /FL010 /TP PA44 /SK SCT010 /RM SFB ATCT=  
 SFB UA /OV SFB /TM 2147 /FLUNKN /TP MD82 /SK SCT008-TOP014/OVC028-TOPUNKN /RM DURC  
 NW=  
 TLH UA /OV 30NNW TLH/TM 2155/FL330/TP B712/TB MOD TURB/RM ZJX CWSU=

## 7.0 Area Forecast

The Area Forecast (FA) is a forecast of Visual Flight Rules (VFR) clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra (IFR) bulletin for the same area in order to get a complete picture of the weather. The area forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports which do not have a terminal forecast (TAF) issued. The NWS Aviation Weather Center (AWC) located in Kansas City, Missouri, issues the FA at regular intervals and issues special reports as necessary usually in the form of an AIRMET. The region that covers Florida is under the Miami (KMIA) regional forecast. The forecast valid for this accident was issued at 1345 EDT (1745Z) on July 8, 2009, and was valid until 0200 EDT on July 9, 2009. The forecast was as follows:

MIAC FA 081745  
 SYNOPSIS AND VFR CLDS/WX  
 SYNOPSIS VALID UNTIL 091200  
 CLDS/WX VALID UNTIL 090600...OTLK VALID 090600-091200  
 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...BROAD UPR LVL TROF OVR ERN US. QSTNRY FNTL SYS EXTDS  
 FROM SRN ATLC CSTL WTRS ACRS SRN SC CSTLN AND CNTRL GA INTO CNTRL AL-MS. A LOW  
 PRES SYS WAS OVR MID ATLC CSTL WTRS E OF NJ. WKNG CDFNT CURVED FROM THE LOW  
 ACRS SRN VA NR THE VA/NC BRDR. LTL CHG EXPCD DURG FCST PD.  
 .  
 FL  
 PNHDL/NRN HLF FL...CIGS BKN030-050. TOPS 150. BKN CI. SCT TSRA..CB TOPS FL390.  
 TS BECMG WDLY SCT 00Z-03Z...ISOL 03Z-06Z. OTLK...MVFR CIGS BR.  
 SRN HLF FL...SCT-BKN030-050. TOPS 100-120. ISOL TSRA...CB TOPS FL370. OTLK...VFR.  
 .  
 CSTL WTRS  
 GULF WTRS E OF 85W...  
 PNHDL/NRN FL CSTL WTRS...CIGS BKN030-050. TOPS 150. BKN CI. SCT TSRA...CB TOPS FL390.  
 TS BECMG WDLY SCT 00Z-03Z...ISOL 03Z-06Z. OTLK...MVFR CIGS BR.

The forecast for the flight over the Gulf of Mexico was for ceilings broken at 3,000 to 5,000 feet with cloud tops to 15,000 feet, with broken cirrus clouds above. Scattered thunderstorms were also forecast with cumulonimbus cloud tops to 39,000 feet, with thunderstorms becoming widely scattered between 2000 and 2300 EDT, and isolated between 2300 and 0200 EDT. The outlook between 0200 and 0800 EDT on July 9, 2009, was for MVFR conditions to prevail due to low ceilings and visibility in mist.

## 8.0 In-Flight Weather Advisories

The NWS issues in-flight weather advisories designated as Severe Weather Forecast Alerts (AWW's), Convective SIGMET's (WST's), SIGMET's (WS's), Center Weather Advisories (CWA's), and AIRMET's (WA's). In-flight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions, which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft. Figure 13 is a plot of the advisories current at the time of the accident plotted over the 1340 EDT GOES-12 visible satellite image, followed by the text version of the advisories in the following section.

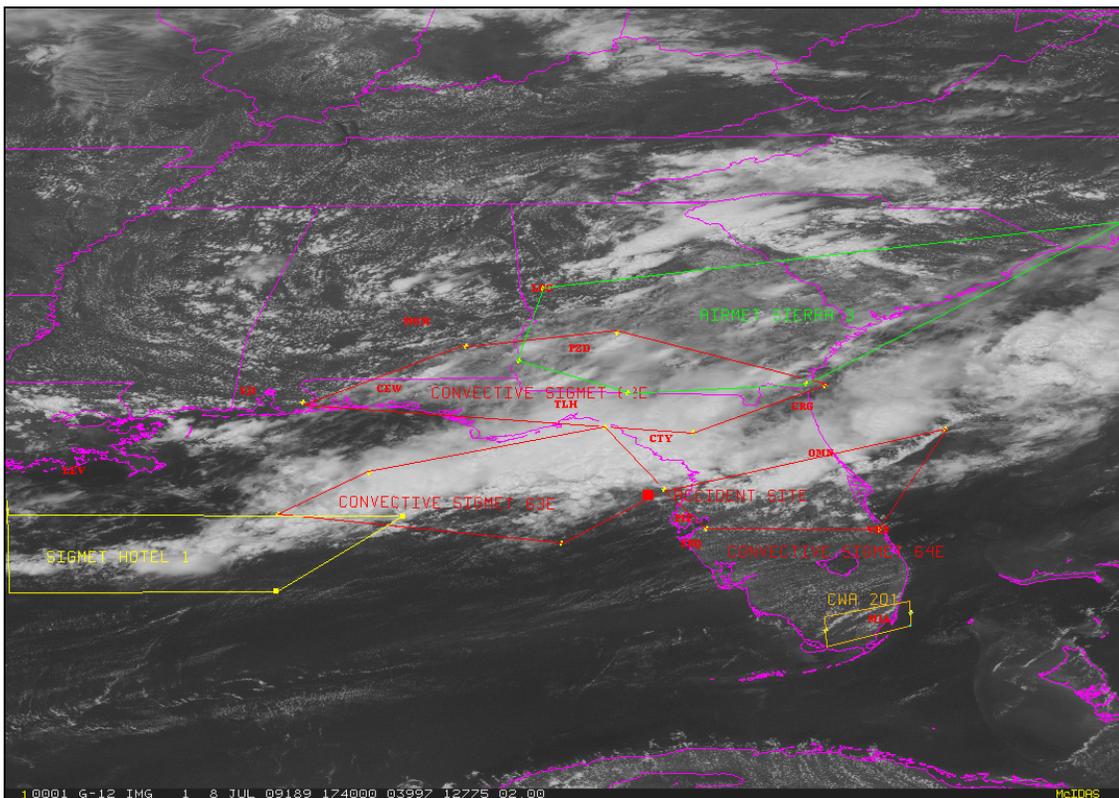


Figure 13 – In-flight weather advisories

## 8.0.1 Convective SIGMET

*MKCE WST 081755  
CONVECTIVE SIGMET 62E  
VALID UNTIL 1955Z  
FL GA AL AND FL GA CSTL WTRS  
FROM 30NE PZD-30NNE CRG-20ENE CTY-40ESE SJI-50SE MGM-30NE PZD  
DVLPG AREA TS MOV FROM 27020KT. TOPS TO FL420.*

*CONVECTIVE SIGMET 63E  
VALID UNTIL 1955Z  
FL CSTL WTRS  
FROM 40WNW CTY-40NNW PIE-80WSW PIE-150ESE LEV-110S CEW-40WNW CTY  
AREA TS MOV FROM 27025KT. TOPS ABV FL450.  
REF INTL SIGMET HOTEL SERIES.*

*CONVECTIVE SIGMET 64E  
VALID UNTIL 1955Z  
FL AND CSTL WTRS  
FROM 80ENE OMN-VRB-20NNE SRQ-40NNW PIE-80ENE OMN  
DVLPG AREA TS MOV FROM 27025KT. TOPS ABV FL450.*

*OUTLOOK VALID 081955-082355  
AREA 1...FROM HMV-GSO-ILM-180SSE ECG-140SSE ILM-220E OMN-70NE VRB-PBI-RSW-SRQ-170S  
CEW-VUZ-HMV  
WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM  
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.  
AREA 2...FROM 50ENE YSC-110ESE ENE-60ENE ACK-PVD-50WSW BDL-HNK-50N SYR-30W MSS-  
YSC-50ENE YSC  
WST ISSUANCES POSS. REFER TO MOST RECENT ACUS01 KWNS FROM STORM PREDICTION  
CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.*

Convective SIGMET number 63E was issued at 1355 EDT (1755Z) and was valid until 1555 EDT over the route of flight and the accident site, the advisory was issued for an area of thunderstorms moving from 270° at 25 knots, with tops to 45,000 feet. The outlook expected the thunderstorms to continue to meet criteria for issuance through 1955 EDT, and advised users to see the latest Convective Outlook (AC) bulletin for further details on the synopsis and meteorological details effecting thunderstorms development.

## 8.0.2 SIGMETS

The NWS issued SIGMET Hotel 1 at 1040 EDT (1440Z) for the Miami and Houston oceanic flight information regions for an area of frequent thunderstorms that were observed at 1040 EDT with tops to 45,000 feet, moving eastward at 15 knots and expected to intensify. The advisory was as follows:

*WSNT08 KKCI 081440  
KZMA SIGMET HOTEL 1 VALID 081440/081840 KKCI-  
MIAMI OCEANIC FIR HOUSTON OCEANIC FIR FRQ TS OBS AT 1440Z WI  
N2815 W09215 - N2800 W08615 - N2645 W08730 - N2630 W09130 - N2815  
W09215. TOP FL450. MOV E 15KT. INTSF.*

### 8.0.3 AIRMETS

The NWS had issued a full series of AIRMETS, expect for an area of IFR conditions over northern Florida, Georgia, South and North Carolina, no turbulence or icing was expected outside of convective activity. The AIRMETS were as follows:

WAUS42 KKCI 081445  
WA2S  
-MIAS WA 081445  
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 082100  
.  
AIRMET IFR...NC SC GA FL AND CSTL WTRS  
FROM 40SW ECG TO 30N CRG TO 40ENE TLH TO 40WSW PZD TO LGC TO 40SW ECG  
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS ENDG 15-18Z.  
.  
AIRMET MTN OBSCN...NC  
FROM 30SW HMV TO SPA TO 30E GQO TO 30SW HMV  
MTNS OBSC BY CLDS/PCPN/BR. CONDS ENDG 15-18Z.  
WAUS42 KKCI 081445  
-MIAT WA 081445  
AIRMET TANGO UPDT 2 FOR TURB VALID UNTIL 082100  
.  
NO SGFNT TURB EXP OUTSIDE OF CNVTV ACT.  
.  
WAUS42 KKCI 081445  
-MIAZ WA 081445  
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 082100  
.  
NO SGFNT ICE EXP OUTSIDE OF CNVTV ACT.  
.  
FRZLVL...RANGING FROM 125-155 ACRS AREA

### 8.0.4 Center Weather Advisory (CWA)

The Miami (KZMA) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) normal hours of operation is from 0600 to 2200 local. At 1423 EDT, the CWSU issued a Center Weather Advisory (CWA) number 201 valid until 1625 EDT regarding hazardous weather in their air space. The advisory was as follows:

FAUS22 KZMA 081823  
ZMA2 CWA 081825  
ZMA CWA 201 VALID UNTIL 082025  
FROM 20ENE MIA TO 35WSW MIA  
AREA OF SCT TS AND SHRA...30NM WIDE...WITH HVY TO EXTRM PCPN MOV  
FROM 24015-20KT. MAX TOPS TO FL450. GRDL INCR IN INTST AND COVG EXPD  
NXT 2 HRS OVR SE FL.  
JW

The advisory warned of an area of scattered<sup>18</sup> thunderstorms and rain showers 30 miles wide extending from 20 miles east-northeast of Miami to 35 miles west-southwest of Miami. The activity had heavy to extreme precipitation moving from 240° at 15 to 20 knots. Maximum tops to 45,000 feet. A gradual increase in intensity and coverage was expected during the next 2 hours over southeast Florida.

No advisories were issued from the Jacksonville (KZJX) CWSU, which was responsible for the airspace over northern and central Florida and the Gulf of Mexico along the route of flight.

## 9.0 Terminal Aerodrome Forecast (TAF)

The closest Terminal Aerodrome Forecast (TAF) to the accident site was from the planned destination airport of KTPA. The forecast available at the time of the pilot's preflight weather briefing was issued at 0726 EDT and was as follows:

*TAF KTPA 081126Z 0812/0912 23008KT P6SM VCTS SCT020CB SCT080 BKN250  
FM081600 24013KT P6SM SCT025CB SCT100 BKN250  
FM090000 VRB06KT P6SM SCT025 SCT100 BKN250=*

The KTPA forecast from 1100 to 2000 EDT was for wind from 240° at 13 knots, visibility better than 6 miles, scattered clouds at 2,500 feet agl in cumulonimbus clouds<sup>19</sup>, scattered clouds at 10,000 feet, and ceiling broken at 25,000 feet.

The next schedule KTPA forecast was issued at 1324 EDT (1724Z) and expected from 1400 EDT wind from 250° at 13 knots, visibility better than 6 miles with thunderstorms in the vicinity, scattered clouds at 2,500 feet agl in cumulonimbus clouds, scattered at 10,000 feet, and ceiling broken at 25,000 feet.

*TAF KTPA 081724Z 0818/0918 25013KT P6SM VCTS SCT025CB SCT100 BKN250  
FM090100 25005KT P6SM FEW040 SCT100 BKN250  
FM091100 24007KT P6SM VCSH SCT025CB SCT100 BKN250=*

The forecast was amended at 1617 EDT (2017Z) immediately after the accident and expected thunderstorms in the vicinity of the airport with temporary conditions between 1600 and 2100 EDT of IFR conditions due to thunderstorms and moderate rain, with winds from 240° at 15 knots gusting to 25 knots. The full forecast is as follows:

*TAF AMD KTPA 082017Z 0820/0918 25013KT P6SM VCTS SCT025CB SCT100 BKN250  
TEMPO 0820/0823 24015G25KT 2SM TSRA BKN020CB BKN100  
FM090100 25005KT P6SM FEW040 SCT100 BKN250  
FM091100 24007KT P6SM VCSH SCT025CB SCT100 BKN250=*

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<sup>18</sup> Scattered – coverage from 25 to 54% of area affected.

<sup>19</sup> Prior to this period, thunderstorms were forecasted to be in the vicinity or not at the airport but within 5 to 10 miles of the station.

## 10.0 Pilot Preflight Weather Briefing

The pilot of N4467D called the Houston FAA contracted Automated Flight Service Station (AFSS) to file an IFR flight plan prior to departure. The flight planned was filed for a cruising level of 19,000 feet, a time enroute of 4 hours 30 minutes, with 5 hours 30 minutes worth of fuel on board, no alternate airport was designated. At that time the AFSS Briefer asked if the pilot needed an updated weather briefing and she indicated “we have quite a bit of convective activity down there in Florida”, the pilot of N4467D indicated that he had checked the weather and had all the data on the weather and that they would go around it as much as possible.

## 11.0 NWS Public Forecast

The NWS Tampa Weather Service Forecast Office (WSFO) issued a Public Hazardous Weather Outlook<sup>20</sup> at 0530 EDT for west central and southwest Florida warning of scattered to numerous thunderstorm were expected over the Tampa Bay area northward. The thunderstorms were expected to produce heavy rainfall and wind gusts to 35 knots, and frequent lightning. Several counties were also under a flood warning with potential 3 to 5 inches of rainfall from the thunderstorms causing localized flooding. The coastal section was also under a rip current alert and mariners warned for a high potential for waterspouts. The full text of the advisory was as follows:

*FLUS42 KTBW 080930  
HWOTBW*

*HAZARDOUS WEATHER OUTLOOK  
NATIONAL WEATHER SERVICE TAMPA BAY RUSKIN FL  
530 AM EDT WED JUL 8 2009*

*FLZ039-042-043-048>052-055>057-060>062-065-081600-  
LEVY-CITRUS-SUMTER-HERNANDO-PASCO-PINELLAS-HILLSBOROUGH-POLK-  
MANATEE-HARDEE-HIGHLANDS-SARASOTA-DE SOTO-CHARLOTTE-LEE-  
530 AM EDT WED JUL 8 2009*

*THIS HAZARDOUS WEATHER OUTLOOK IS FOR WEST CENTRAL AND SOUTHWEST  
FLORIDA.*

*.DAY ONE...TODAY AND TONIGHT.*

*...THUNDERSTORM IMPACT...  
SCATTERED TO NUMEROUS THUNDERSTORMS WILL DEVELOP TODAY WITH THE BEST  
CHANCES FROM THE TAMPA BAY AREA NORTHWARD AT ALMOST ANYTIME. FURTHER SOUTH  
THE STORMS WILL DEVELOP NEAR THE COAST IN THE MORNING AND THEN MOVE INLAND  
DURING THE AFTERNOON. THERE IS A SLIM CHANCE FROM THE TAMPA BAY AREA  
NORTHWARD THAT ONE OR TWO OF THE STORMS COULD BECOME SEVERE AND PRODUCE*

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<sup>20</sup> The Hazardous Weather Outlook is not an aviation product, but is intended to be broadcasted to the general public, marine, and weather radio broadcasts.

*DAMAGING WINDS. OTHERWISE...THE MAIN THREATS FROM ANY STORMS WILL BE LOCALLY HEAVY RAINFALL...GUSTY WINDS UP TO 40 MPH AND FREQUENT LIGHTNING. REMEMBER...IF YOU CAN HEAR THUNDER THEN YOU ARE CLOSE ENOUGH TO THE STORM TO BE STRUCK BY LIGHTNING.*

*...FLOOD IMPACT...*

*A FLOOD WATCH IS IN EFFECT FOR LEVY AND CITRUS COUNTIES. WIDESPREAD RAINFALL TOTALS OF 1 TO 2 INCHES ARE EXPECTED TODAY AND TONIGHT ...WITH LOCALLY 3 TO 5 INCHES WHERE TRAINING OF HEAVIER SHOWERS AND THUNDERSTORMS OCCURS. FLOODING OF STREETS MAY OCCUR...AND SOME MAY BECOME IMPASSIBLE FOR SEVERAL HOURS. FLOOD WATERS MAY APPROACH SOME HOMES IN LOW LYING FLOOD PRONE AREAS.*

*...RIP CURRENT IMPACT...*

*THE BREEZY WEST TO SOUTHWEST FLOW WILL CONTINUE TODAY BETWEEN A STATIONARY FRONT TO THE NORTH AND THE RIDGE AXIS SOUTH OF THE REGION. THIS WILL CAUSE AN INCREASED THREAT FOR RIP CURRENTS AT AREA BEACHES.*

*A RIP CURRENT IS A 10 TO 30 YARD WIDE CHANNEL OF WATER THAT CAN PULL EVEN A STRONG SWIMMER INTO DEEPER WATER. TO AVOID GETTING CAUGHT IN A RIP CURRENT...SWIM AT GUARDED BEACHES AND HEED THE ADVICE OF THE BEACH PATROL. AT UNGUARDED BEACHES AND NEAR PIERS...JETTIES...AND INLETS...DO NOT GO INTO THE SURF MUCH ABOVE YOUR KNEES.*

*...WATERSPOUT IMPACT...*

*SHOWERS AND THUNDERSTORMS OVER THE COASTAL WATERS COULD PRODUCE BRIEF WATERSPOUTS AT ALMOST ANYTIME. MARINERS SHOULD BE ON THE LOOKOUT AND IF THREATENING WEATHER SUDDENLY DEVELOPS OR APPROACHES YOUR LOCATION...BE PREPARED TO MOVE TO SAFE HARBOR QUICKLY.*

Donald E. Eick  
NTSB Senior Meteorologist