



## **NATIONAL TRANSPORTATION SAFETY BOARD**

Office of Aviation Safety  
Washington, D.C. 20594

September 30, 2019

### **Weather Study**

# **METEOROLOGY**

ERA19FA210

## Table Of Contents

|      |                                           |    |
|------|-------------------------------------------|----|
| A.   | ACCIDENT .....                            | 3  |
| B.   | METEOROLOGIST .....                       | 3  |
| C.   | SUMMARY .....                             | 3  |
| D.   | DETAILS OF THE INVESTIGATION .....        | 3  |
| E.   | WEATHER INFORMATION .....                 | 4  |
| 1.0  | Synoptic Conditions.....                  | 4  |
| 1.1  | Surface Analysis Chart .....              | 4  |
| 1.2  | National Composite Radar Mosaic .....     | 5  |
| 2.0  | Observations .....                        | 5  |
| 2.1  | West Palm Beach, Florida.....             | 6  |
| 2.2  | Freeport, Bahamas .....                   | 6  |
| 3.0  | Sounding .....                            | 7  |
| 3.1  | HRRR Numerical Model Sounding.....        | 8  |
| 3.2  | Nassau Sounding.....                      | 9  |
| 4.0  | Satellite Imagery .....                   | 11 |
| 5.0  | Weather Surveillance Radar Imagery .....  | 12 |
| 5.1  | Volume Scanning Strategies .....          | 12 |
| 5.1  | Reflectivity.....                         | 13 |
| 5.2  | Base Reflectivity Image.....              | 14 |
| 6.0  | Pilot Reports.....                        | 14 |
| 7.0  | NWS Forecasts.....                        | 15 |
| 7.1  | Terminal Aerodrome Forecasts.....         | 15 |
| 7.2  | International Area Forecast.....          | 15 |
| 7.3  | Winds and Temperature Aloft Forecast..... | 16 |
| 8.0  | NWS Inflight Weather Advisories.....      | 17 |
| 9.0  | Preflight Weather Briefing.....           | 17 |
| 10.0 | Astronomical Conditions .....             | 17 |
| F.   | LIST OF ATTACHMENTS .....                 | 18 |

## **A. ACCIDENT**

Location: Big Grand Cay, Bahamas  
Date: July 4, 2019  
Time: About 0153 eastern daylight time  
About 0553 Universal Coordinated Time (UTC)  
Airplane: Agusta AW139 helicopter; Registration: N32CC

## **B. METEOROLOGIST**

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

## **C. SUMMARY**

On July 4, 2019, about 0153 eastern daylight time, an Agusta AW139, N32CC, owned and operated by Challenger Management LLC, was substantially damaged when it impacted the Atlantic Ocean near Big Grand Cay, Abaco, Bahamas. The commercial pilot, airline transport pilot rated copilot, and five passengers were fatally injured. The helicopter was being operated under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight. Night visual meteorological conditions prevailed at the time and an instrument flight rules flight plan was filed for a flight from Walker's Cay Airport (MYAW), Walker's Cay, Bahamas, to Fort Lauderdale/Hollywood International Airport (KFLA), Fort Lauderdale, Florida. The flight departed from a concrete pad at Big Grand Cay, which was located about 5 nautical miles (nm) southeast from MYAW, about 1 minute prior to the accident.

## **D. DETAILS OF THE INVESTIGATION**

The National Transportation Safety Board's Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are eastern daylight time (EDT) based upon the 24-hour clock, local time is -4 hours from UTC, and UTC=Z. 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. Directions are referenced to true north and distances in nautical miles. Heights are in feet (ft) above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident site was located at latitude 27.238056° N and longitude 78.304444° W.

## E. WEATHER INFORMATION

### 1.0 Synoptic Conditions

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

### 1.1 Surface Analysis Chart

The southeast section of the NWS Surface Analysis Chart for 0200 EDT on July 4, 2019 is included in figure 1 with the approximate accident site marked by a red star. The chart depicted the Azores-Bermuda high pressure ridge extended over the Bahamas into southern Florida. Except for a low pressure system at 1013-hectopascals (hPa) over central South Carolina with a trough of low pressure extending northeast and southwest from the low, there were no frontal boundaries identified over the southeastern United States or the Bahamas.

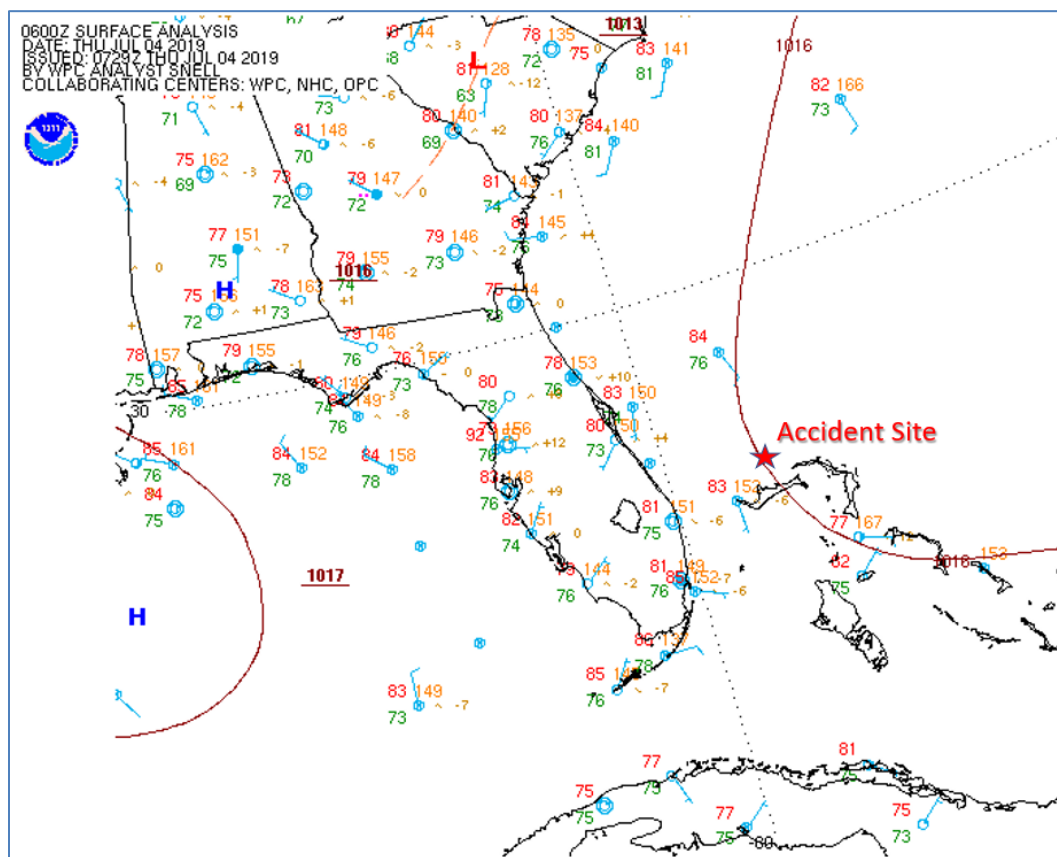


Figure 1 - Southeast section of the Surface Analysis Chart for 0200 EDT

The closest station model to the southwest of the accident site indicated a light southerly wind near 5 knots, no restrictions to visibility, scattered clouds, with a temperature of 83° Fahrenheit (F), and a dew point temperature of 76° F.

## 1.2 National Composite Radar Mosaic

The southeast section of the National Composite Radar Mosaic for 0155 EDT extending over eastern Florida to the Bahamas is included as figure 2 with the approximate accident site marked by a red star. The radar mosaic depicted an isolated echo south of Freeport, Bahamas and the accident site, with no other echoes detected along the route.

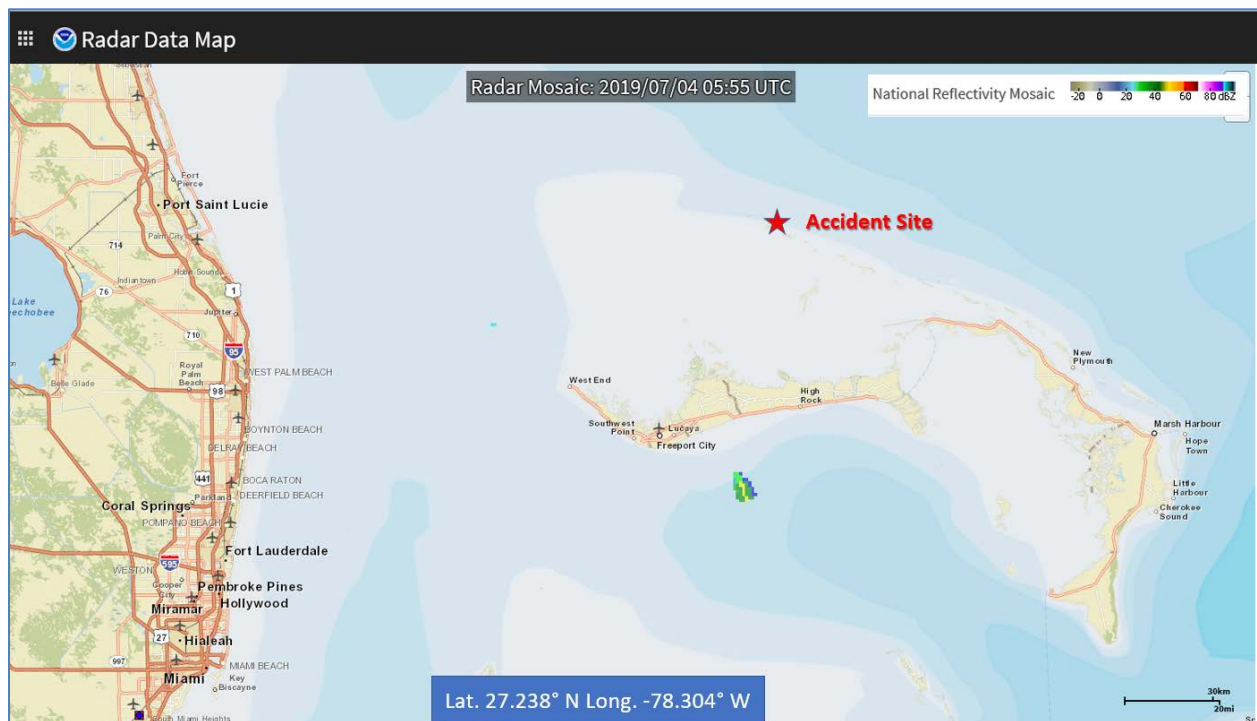


Figure 2 - Section of the National Composite Radar Mosaic for 0155 EDT

The closest weather radar was located approximately 136 miles from the accident site, the normal range of the radar is typically 125 miles as the radar beam extends over 12,000 ft at this distance. Section 5.0 will further document the closest weather radar data.

## 2.0 Observations

The official observations issued surrounding the accident site were documented using standard meteorological aerodrome reports (METARs) and specials (SPECI). Cloud heights are reported above ground level (agl) in the following section, and the magnetic variation was estimated at 7° West based on the latest sectional chart for the area.

## 2.1 West Palm Beach, Florida

The accident helicopter departed from Palm Beach International Airport (KPBI), West Palm Beach, Florida, at approximately 0100 EDT for Walker's Cay Airport (MYAW), Walker's Cay, Bahamas. KPBI had a listed elevation of 20 ft and had an Automated Surface Observation System (ASOS) that was augmented by tower personnel during the period. The following conditions were reported at the approximate time the accident helicopter departed for the Bahamas.

*KPBI weather observation at 0053 EDT, wind calm, visibility 10 miles or more, scattered clouds at 2,100 ft, ceiling broken at 25,000 ft, temperature 27° Celsius (C), dew point 24° C, altimeter 29.98 inches of Hg. Remarks: automated station with a precipitation discriminator, sea-level pressure 1015.3-hPa, temperature 26.7° C, dew point 24.4° C, 24-hour maximum temperature 32.8° C, 24-hour minimum temperature 26.7° C, maintenance indicator<sup>1</sup>.*

The general flight categories and raw observations reported from approximately 2000 through 0500 EDT surrounding the period were as follows.

VFR METAR KPBI 032353Z 31005KT 10SM FEW024 BKN250 28/24 A2995 RMK AO2 SLP142 T02830244  
10317 20283 53004 \$

VFR METAR KPBI 040053Z 00000KT 10SM BKN250 28/24 A2996 RMK AO2 SLP143 T02830244 \$

VFR METAR KPBI 040153Z 00000KT 10SM SCT250 28/24 A2997 RMK AO2 SLP148 T02780244 \$

VFR METAR KPBI 040253Z 26005KT 10SM SCT250 27/24 A3000 RMK AO2 SLP158 T02720244 53015 \$

VFR METAR KPBI 040353Z 00000KT 10SM SCT023 BKN250 27/24 A2999 RMK AO2 SLP155 T02670244 \$

**VFR METAR KPBI 040453Z 00000KT 10SM SCT021 BKN250 27/24 A2998 RMK AO2 SLP153 T02670244  
403280267 \$**

**Departed 0500Z to Walker's Cay**

VFR METAR KPBI 040553Z 00000KT 10SM FEW025 SCT250 27/24 A2998 RMK AO2 SLP151 T02720239  
10283 20267 56006 \$

**Accident 0553Z**

VFR METAR KPBI 040653Z 00000KT 10SM FEW025 SCT250 27/24 A2997 RMK AO2 SLP148 T02670239 \$

VFR METAR KPBI 040753Z 33003KT 10SM SCT021 SCT250 26/24 A2996 RMK AO2 SLP145 T02610244 \$

VFR METAR KPBI 040853Z 32005KT 10SM FEW022 SCT250 26/24 A2997 RMK AO2 SLP149 T02560239  
55002 \$

A review of the observations indicated that scattered low clouds at 2,100 to 2,500 ft were reported the area with higher scattered to broken clouds at 25,000 ft. No thunderstorms or visibility restrictions were reported at the surface during the period.

## 2.2 Freeport, Bahamas

The closest weather reporting location to the accident site was from Grand Bahama International Airport (MYGF), Freeport, Bahamas, located approximately 45 miles south of the accident site, at an elevation of 6 ft. The airport had an Automated Weather Observation System (AWOS) which was augmented during normal tower hours. However, no observations were disseminated after

---

<sup>1</sup> The maintenance indicator means that one or more sensors are reporting problems that require maintenance on the system.

2000 EDT through 0800 EDT. The last observation transmitted prior to the accident was issued almost 6 hours prior to the accident and was as follows:

*MYGF weather observation at 2000 EDT, wind from 160° at 4 knots, visibility 10 kilometers or more, a few clouds at 2,500 ft, ceiling broken at 25,000 ft, temperature 29° C, dew point temperature 25° C, altimeter 29.95 inches of mercury (Hg).*

The general flight categories<sup>2</sup> and raw observations from approximately 1700 through 0200 EDT were as follows:

VFR METAR MYGF 032100Z VRB02KT 9999 FEW018TCU BKN200 31/24 A2994=  
VFR METAR MYGF 032200Z 14006KT 9999 SCT025 BKN250 31/23 A2992=  
VFR METAR MYGF 032300Z 16005KT 110V190 9999 FEW025 BKN250 30/24 A2992=  
**VFR METAR MYGF 040000Z 16004KT 9999 FEW025 BKN250 29/25 A2995=**  
METAR MYGF 040100Z NIL=  
METAR MYGF 040200Z NIL=  
METAR MYGF 040300Z NIL=  
METAR MYGF 040400Z NIL=  
METAR MYGF 040500Z NIL=  
**Accident 0553Z**  
METAR MYGF 040600Z NIL=

The observations indicated scattered low clouds at approximately 2,500 ft with higher broken clouds at 25,000 ft similar to the KPBI observations, with visibility reported as unrestricted. The winds were from the south at 5 knots or less.

### 3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site, a High-Resolution Rapid Refresh (HRRR)<sup>3</sup> numerical model data was retrieved from the NOAA Air Resources Laboratory and plotted on a standard Skew T log P diagram<sup>4</sup> using the complete

---

<sup>2</sup> As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories based on weather conditions reported:

- 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.

<sup>3</sup> The HRRR is a National Oceanic and Atmospheric Administration (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.

<sup>4</sup> Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to



The HRRR model wind profile indicated a surface wind from the southeast which veered to the south through 3,000 ft with magnitude of 13 knots or less. At about 4,000 ft the wind was from the north and veered to the east through 10,000 ft, and then backed to the north above 10,000 ft. The wind profile supported a potential for light turbulence between 1,000 ft and 4,000 ft, where the winds increased and shifted in direction. However, no strong vertical shears were identified to suggest any significant turbulence hazard to the helicopter flight.

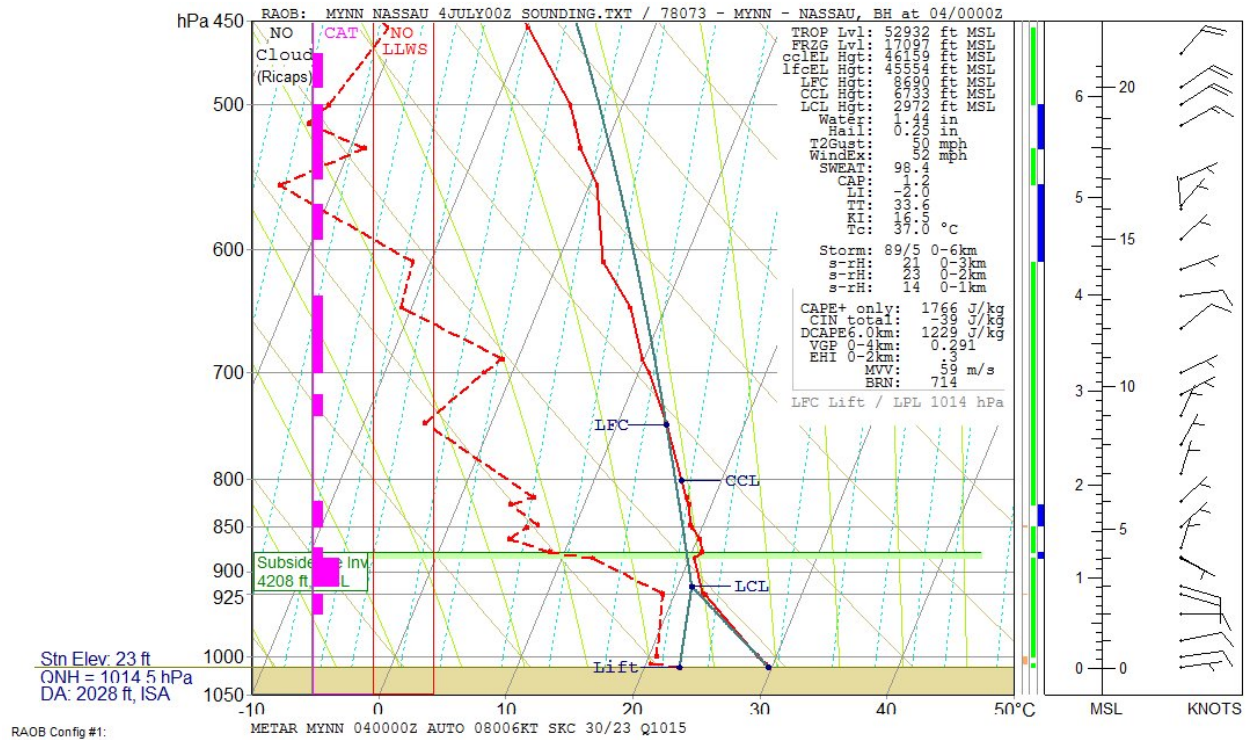
Figure 4 is a table of the HRRR model parameters of height, pressure (Pres), temperature (T), dew point temperature (Td), relative humidity (RH), wind direction and speed (DD/FF), RAOB derived Clear Air Turbulence (CAT), Low-Level Wind Shear (LLWS) and icing potential.

| Height<br>(ft-MSL) | Pres<br>(hPa) | T<br>(C) | Td<br>(C) | RH<br>(%) | DD / FF<br>(deg / kts) | CAT<br>(FAA) | LLWS  | Icing - Type<br>(AFGWC method) |
|--------------------|---------------|----------|-----------|-----------|------------------------|--------------|-------|--------------------------------|
| 0                  | 1016          | 27.1     | 24.7      | 87        | 132 / 8                |              |       |                                |
| 29                 | 1015          | 27.1     | 24.2      | 84        | 133 / 8                |              | LIGHT |                                |
| 115                | 1012          | 27.0     | 23.7      | 82        | 133 / 10               |              |       |                                |
| 288                | 1006          | 26.6     | 23.3      | 82        | 135 / 10               |              |       |                                |
| 549                | 997           | 26.4     | 21.5      | 74        | 140 / 12               |              |       |                                |
| 959                | 983           | 25.6     | 20.8      | 75        | 152 / 13               | LGT          |       |                                |
| 1494               | 965           | 24.6     | 19.2      | 72        | 166 / 10               | LGT          |       |                                |
| 2158               | 943           | 24.0     | 15.7      | 60        | 174 / 5                | LGT          |       |                                |
| 2898               | 919           | 22.7     | 15.8      | 65        | 197 / 2                |              |       |                                |
| 3686               | 894           | 21.3     | 14.2      | 64        | 350 / 1                | LGT          |       |                                |
| 4689               | 863           | 20.0     | 11.3      | 57        | 4 / 4                  |              |       |                                |
| 5689               | 833           | 18.4     | 9.4       | 56        | 21 / 6                 |              |       |                                |
| 6893               | 798           | 16.1     | 6.7       | 54        | 36 / 6                 |              |       |                                |

Figure 4 - HRRR model parameters

### 3.2 Nassau Sounding

Figure 5 is the Nassau (MYNN), Bahamas observed sounding for 2000 EDT on July 3, 2019. One of the significant differences in the sounding was a defined temperature inversion at approximately 4,200 ft associated with subsidence. The lifted condensation level (LCL) was identified at 2,972 ft agl. The atmosphere was also characterized as conditional unstable with a Lifted Index of -2.0, a CAPE of 1,766 J/kg, and a precipitable water content of 1.44 inches. The wind profile indicated easterly winds below the inversion and shifting to the north and northeast above the inversion at 4,200 ft. The sounding also supported light turbulence near the inversion below 4,000 ft.



A comparison of the Nassau and the HRRR model soundings over the accident site is included as figure 6. While the Nassau sounding was taken approximately 6 hours earlier and shows slightly warmer low-level conditions, the general characteristics of the airmass and wind profile were similar. Both soundings showed a general wind shift near 4,000 ft near the identified inversion which was associated with subsidence from the high pressure ridge and the trade winds.

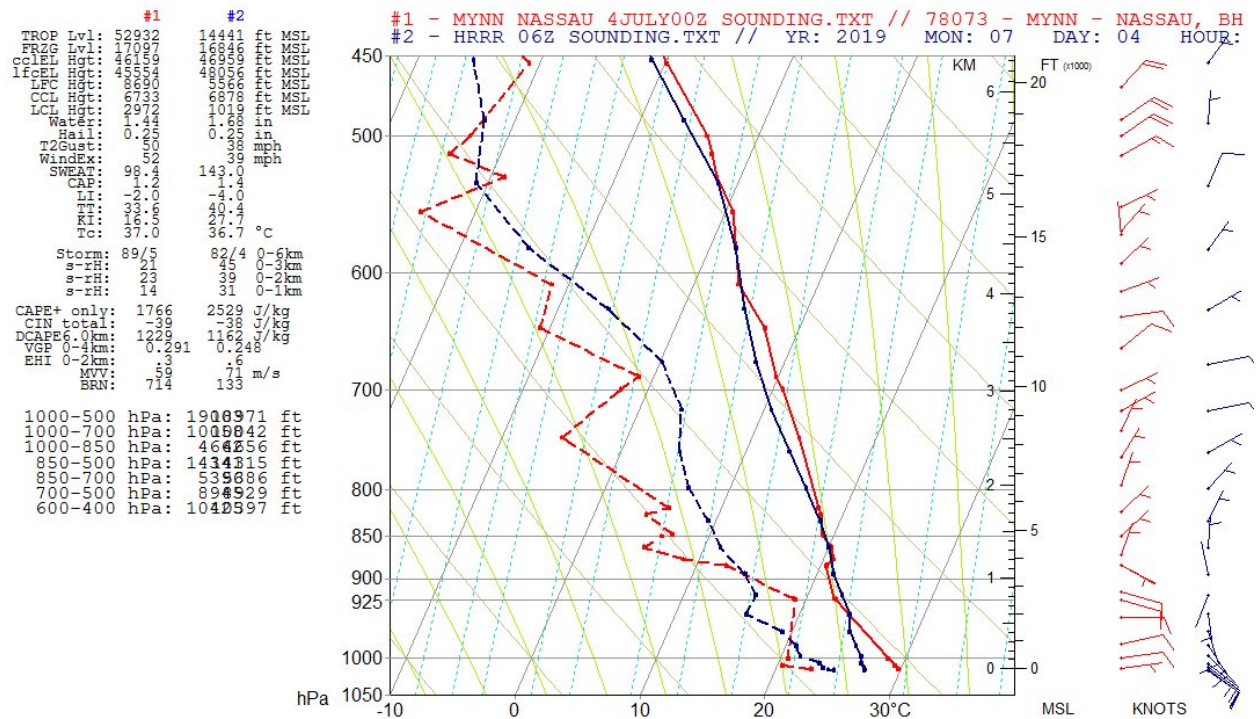


Figure 6 - Comparison of the Nassau and the HRRR model sounding over the accident site

#### 4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) data was obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. The infrared long wave imagery was obtained surrounding the time of the accident, with the images closest to the time of the accident documented below. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns ( $\mu\text{m}$ ) provided radiative cloud top temperatures with a nominal spatial resolution of 2 km.

Figure 7 is the GOES-16 infrared image at 0156 EDT at 3X magnification with a standard MB temperature enhance curve applied. The image depicted several layers of clouds over the route of flight between KPBI and Walker's Cay with some mid-to-high level clouds over the accident site. Several small enhanced areas associated with towering cumulus to cumulus congestus type clouds associated with rain showers were located approximately 30 miles north and 40 miles south of the accident site and were identified by enhanced red areas on the image. A few enhanced clouds tops were also identified off the Florida coast between KPBI and Walkers Cay's associated with cumulus clouds and potential rain showers.

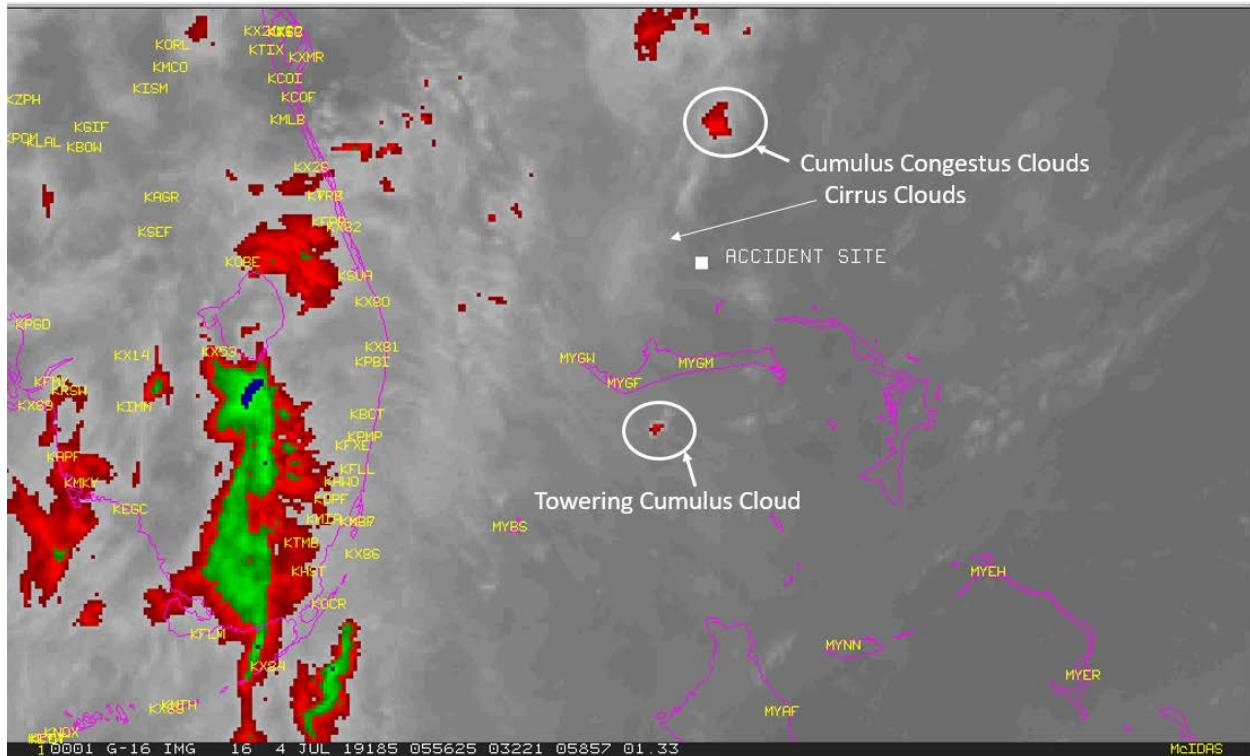


Figure 7 - GOES-16 infrared satellite image at 0156 EDT with a standard temperature enhancement curve

## 5.0 Weather Surveillance Radar Imagery

The closest NWS Weather Surveillance Radar 1988 Doppler (WSR-88D) was located approximately 136 miles northwest of the accident site in Melbourne (KMLB), Florida. The level II archive data were obtained from the NCEI using the Hierarchical Data Storage System and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

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

### 5.1 Volume Scanning Strategies

During the period the KMLB WSR-88D was operating in the precipitation mode volume scan pattern 215 (VCP-215), where the radar makes 15 different elevation scans in 6 minutes. The following chart provides the beam height for the lowest elevation scan based on the distance and the antenna height of 116 ft and assuming standard refraction of the radar beam.

| Elevation | Center of Beam | Base of Beam | Top of Beam | Beam Width |
|-----------|----------------|--------------|-------------|------------|
| 0.44°     | 19,580 ft      | 12,730 ft    | 26,430 ft   | 13,700 ft  |

The lowest KMLB WSR-88D 0.44° elevation scan was sampling the layer between 12,730 through 26,430 ft, with the center of the beam at approximately 19,580 ft over the accident site.

## 5.1 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors, it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ<sup>6</sup>) and is a general measure of echo intensity. Figure 8 relates the NWS former video integrator and processor (VIP) intensity levels (1-6) versus the WSR-88D's display levels (0-15), precipitation mode reflectivity in decibels (DBZ), 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          |             |

Figure 8 - NWS VIP and WSR-88D intensity and rainfall rates

The FAA has taken the NWS previous VIP levels 1 to 6 intensity levels and redefined the intensity levels for pilots in Advisory Circular AC 00-24C - "Thunderstorm". That AC further defines echoes less than 30 dBZ as "light" in intensity, "moderate" echoes 30-40 dBZ, "heavy" with echoes of >40-50 dBZ, and "extreme" intensity with echoes above >50 dBZ. These are the new standard radio phraseology terms used by air traffic controllers to describe weather conditions to pilots as shown in figure 9.

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

Figure 9 - FAA reflectivity scale and precipitation intensity scale

<sup>6</sup> dBZ - 10 log Ze

## 5.2 Base Reflectivity Image

Figure 10 is the KMLB WSR-88D 0.44 base reflectivity image at 0154 EDT with the accident site marked. The image depicted several small areas of scattered light intensity echoes of 20 to 30 dBZ associated with cumulus congestus clouds and rain showers located approximately 25 miles west of the accident location and between the planned destination of KFL and KPBI, with another area of echoes near 40 dBZ south of Freeport or MYGF. The echo tops product depicted the one area halfway between Walker's Cay and KPBI with tops near 12,800 ft. A review of the radar images depicted no significant movement of the echoes with time and confirmed light upper level winds or weak steering winds aloft.

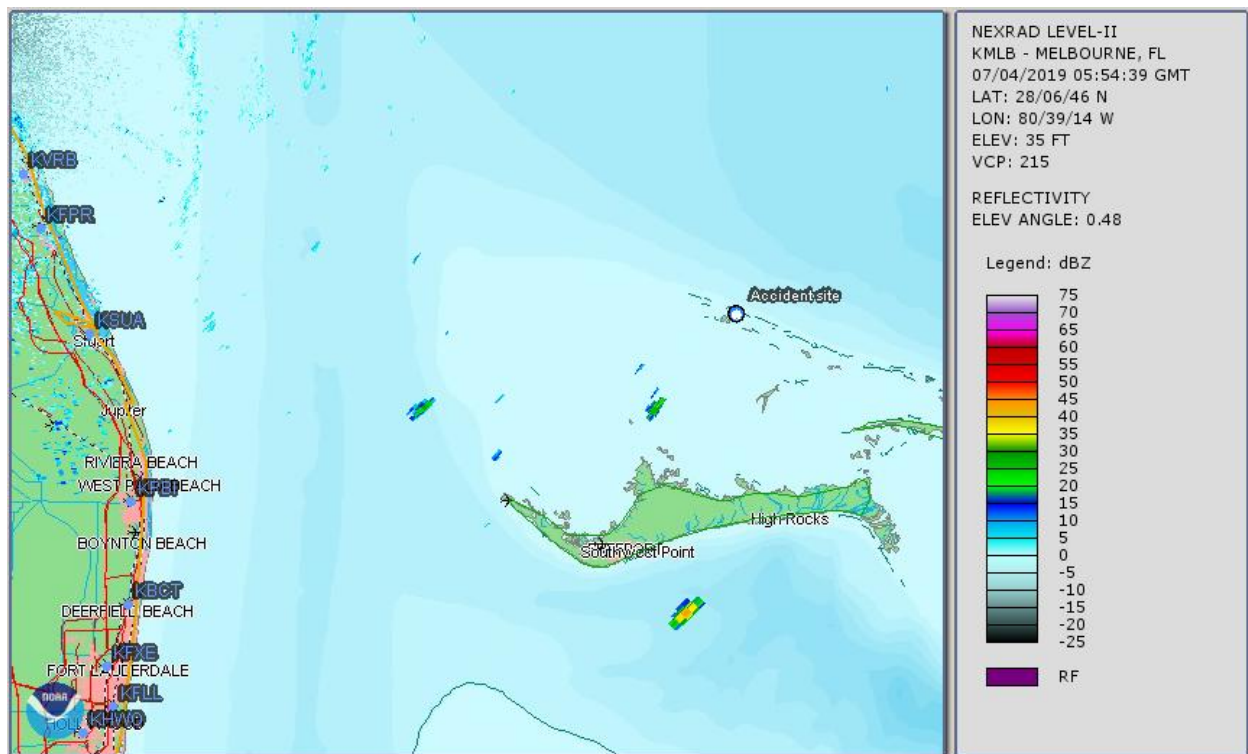


Figure 10 - KMLB WSR-88D 0.44° base reflectivity image at 0154 EDT

A review of the Earth Networks lightning archive indicated no lightning strikes between the Bahamas and the Florida mainland surrounding the period from 0000 through 0200 EDT on July 4, 2019. This confirming that no thunderstorms were present over the area during the period.

## 6.0 Pilot Reports

No pilot reports (PIREPs) were in the NWS data base between 2200 through 0500 EDT over the route of flight.

## 7.0 NWS Forecasts

### 7.1 Terminal Aerodrome Forecasts

A TAF is a concise statement of the expected meteorological conditions at an airport during a specified period (usually 24 hours). TAFs are valid for a 5 mile radius around an airport's center point. The forecasts issued surrounding the period relevant to the preflight planning and the time of the accident are presented here. The TAF issued for MYGF at 1750 EDT was as follows.

*TAF MYGF 032150Z 0400/0424 VRB02KT 9999 FEW018CB BKN200=*

The forecast expected light and variable winds, visibility unrestricted at 10 kilometers or more, a few clouds at 1,800 ft agl with cumulonimbus type clouds, and broken clouds at 20,000 ft.

The next MYGF TAF was issued at 0045 EDT and continued to expect VFR conditions over the area at the time of the accident with light and variable winds, visibility unrestricted, with a few clouds at 2,500 ft, and broken clouds at 25,000 ft.

*TAF MYGF 040445Z 0406/0506 VRB02KT 9999 FEW025 BKN250  
FM041400 14007KT 9999 VCSH FEW018CB SCT020 BKN250=*

### 7.2 International Area Forecast

The International Area forecast for the south Atlantic, Caribbean, and Gulf of Mexico waters issued at 1740 EDT on July 3, 2019 and current at the time of the accident was as follows.

*FACA20 KKCI 032130  
OFAMKC  
INTERNATIONAL OPERATIONS BRANCH  
AVIATION WEATHER CENTER KANSAS CITY MISSOURI  
VALID 032200-041000  
OUTLOOK...041000-042200*

*.  
ATLANTIC S OF 32N W OF 57W...CARIBBEAN...GULF OF MEXICO BTN 22N AND 24N.  
.  
ALL WND SFC. TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS. SFC TO 400MB.  
.  
SYNOPSIS...AT 21Z WDLY SCT TSRA CONT INVOF QSTNR FNT OVER THE WRN ATLC ALONG A  
29N60W-26N69W LN. A NARROW E-W SFC RIDGE CONTS S OF THAT AREA EXTENDING THRU  
THE GLFMEX ALONG 24N. AFTN DIURNAL TSRA WERE WELL UNDERWAY IN CUBA AND  
HISPANIOLA. FRESH TO STG TRADE WINDS CONT OVER THE S CNTRL AND SW CARIB. SHRA  
AND TSRA ARE MOVG INTO THE SERN PTN OF WRN PIARCO FIR AS A STG TRPCL WV  
APPROACHES FROM THE EAST.  
.  
SIGNIFICANT CLD/WX...  
ERN MONTERREY FIR...NRN MERIDA FIR  
W OF 95W...SCT020 BKN120 TOP LYRD ABV FL240. OCNL BKN020.  
SCT SHRA. ISOL TSRA. OTLK...VFR SHRA.  
E OF 95W...SKC-SCT020. OTLK...VFR.  
.  
ATLC SWRN NEW YORK FIR...ATLC MIAMI FIR*

**150NM ESOL 28N60W-21N74W...SCT020 BKN-SCT050 TOP ABV FL240. OCNL BKN020. SCT SHRA. ISOL TO WDLY SCT TSRA. OTLK...VFR SHRA TSRA. ELSW...SCT020 SCT050. ISOL SHRA/TSRA. OTLK...VFR.**

**SAN JUAN FIR**  
**SCT020 SCT050. ISOL SHRA/TSRA. OTLK...VFR.**

**WRN PIARCO FIR**  
**NW 1/2...SCT020 SCT050. LYRS OCNL BKN TOP 070 WINDWARD SIDE OF ISLANDS. ISOL SHRA. OTLK...VFR SHRA TSRA.**  
**SE 1/2...SCT020 SCT-BKN050 TOP 070. OCNL BKN020 TOP LYRD ABV FL240. SCT SHRA. WDLY SCT TSRA. OTLK...VFR SHRA TSRA.**

**NRN MAIQUETIA FIR**  
**SCT020. ISOL SHRA. OTLK...VFR BECMG VFR SHRA TSRA.**

**CURACAO FIR...NRN BARRANQUILLA FIR...NRN PANAMA FIR...KINGSTON FIR...NERN CNTRL AMER FIR**  
**N OF 16N...SCT020. WDLY SCT SHRA/TSRA N OF 18N. ISOL SHRA ELSW. OTLK...VFR SHRA TSRA. S OF 16N...SCT020. ISOL SHRA. WND E 20-25KT. OTLK...VFR WND.**

**SANTO DOMINGO FIR...PORT-AU-PRINCE FIR...HABANA FIR**  
**ISLANDS...SCT020 SCT050. LYRS OCNL BKN TOP ABV FL240 BFR 04Z. SCT TSRA ENDG 02Z-04Z. AFT 06Z OCNL VIS 3-5SM BR. OTLK...OCNL MVFR BR TIL 12Z. OTRW VFR BECMG VFR TSRA 18Z. WTRS S OF CUBA...SCT020. OCNL BKN020 TOP ABV FL240. WDLY SCT TSRA. OTLK...VFR TSRA. RMNDR WTRS...SCT020. ISOL SHRA/TSRA. OTLK...VFR.**

**ICE AND FRZLVL...**  
**NO SGFNT ICE EXP OUTSIDE CNVTV ACT. FRZLVL...150 TO 165.**

**TURB...**  
**NO SGFNT TURB EXP OUTSIDE CNVTV ACT.**

....

### 7.3 Winds and Temperature Aloft Forecast

The NWS Winds and Temperature Aloft Forecast current for the period was issued at about 2000 EDT and valid for 0200 EDT and was for use between 2200 and 0500 EDT. The forecast was as follows.

**FBUS31 KWNO 040201**  
**FD1US1**  
**-DATA BASED ON 040000Z**  
**VALID 040600Z FOR USE 0200-0900Z. TEMPS NEG ABV 24000**

| FT  | 3000 | 6000    | 9000    | 12000   | 18000   | 24000   | 30000  | 34000  | 39000  |
|-----|------|---------|---------|---------|---------|---------|--------|--------|--------|
| MLB | 9900 | 0507+18 | 0509+13 | 0208+08 | 9900-05 | 9900-16 | 041632 | 012342 | 362754 |
| MIA | 9900 | 0805+18 | 0611+13 | 0512+08 | 0609-05 | 0409-16 | 042032 | 032342 | 023154 |

The forecast stations of Melbourne (MLB) and Miami (MIA) both expected light and variable winds at less than 10 knots at 3,000 ft, which was coded as "9900".

## 8.0 NWS Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of the development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA ARTCCs. There are four basic types of inflight aviation weather advisories: the Significant Meteorological Information (SIGMET), the Convective SIGMET, the AIRMET, and the Center Weather Advisory (CWA). Inflight 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.

During the period from 2200 through 0200 EDT the NWS had no SIGMETs, Convective SIGMETs, CWA's, or AIRMETs current for the area between Florida and the Bahamas.

## 9.0 Preflight Weather Briefing

The pilots obtained a weather briefing at 1318 EDT and another briefing later at 1640 EDT for the route between KPBI and Walkers Cay (MYAW). The pilots also obtained a route briefing from MYAW to KFLI at 0145 EDT. The route briefings obtained at 1318 EDT (KPBI to MYAW) is included as attachment 1, the route briefing for 1640 EDT between MYAW and KPBI as attachment 2, and the briefing at 0145 EDT from MYAW to KFLI as attachment 3.

## 10.0 Astronomical Conditions

The United States Naval Observatory's website provided the following astronomical conditions for Grand Cay, Bahamas. The time of the accident are included in bold italic print for reference.

### Sun

Sunset 2011 EDT July 3, 2019

End civil twilight 2037 EDT

***Accident 0153 EDT July 4, 2019***

Begin civil twilight 0557 EDT

Sunrise 0623 EDT

### Moon

Moonset 2116 EDT July 3, 2019

***Accident 0153 EDT July 4, 2019***

At the time of the accident both the Sun and the Moon were more than 15° below the horizon and provided no illumination.

## **F. LIST OF ATTACHMENTS**

Attachment 1 – Route Briefing on July 3rd, at 1318 EDT (1718Z) from KPBI to MYAW

Attachment 2 – Route Briefing on July 3rd, at 1640 EDT (2040Z) from MYAW to KPBI

Attachment 3 – Route Briefing on July 4th, at 0145 EDT (0545Z) from MYAW to KFLI

Submitted by:

---

Don Eick  
Senior Meteorologist