

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety Washington, D.C. 20594

May 15, 2019

Weather Study

METEOROLOGY

ERA19FA116

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A. ACCIDENT

Location: Fellsmere, Florida
Date: March 5, 2019
Time: 0703 eastern standard time 1203 Universal Coordinated Time (UTC)
Airplane: Piper PA28; Registration: N556PU

B. METEOROLOGIST

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

C. SUMMARY

On March 5, 2019, at 0703 eastern standard time, a Piper PA-28-161, N556PU, was substantially damaged when it impacted trees and terrain near Fellsmere, Florida. The student pilot was fatally injured. The airplane was registered to and operated by FlightSafety International (FSI) Inc. under the provisions of Title 14 *Code of Federal Regulations* Part 91. Instrument meteorological conditions prevailed at the time of the accident. No flight plan was filed for the cross-country flight that departed Vero Beach Regional Airport (VRB), Vero Beach, Florida, about 0657, and destined for the Palm Beach County Glades Airport (PHK), Pahokee, Florida.

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 standard time (EST) based upon the 24-hour clock, local time is -5 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.

Accident location was at latitude 27.71500 N and longitude 80.527222 W, and an elevation of approximately 20 ft.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (NCEP) located in College Park, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts and all the other weather products documented in this report 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 0700 EST is included as figure 1 with the approximate accident site marked by a red star. The chart depicted a cold front extending across southern Florida south of the accident site. A low-pressure system at 1013-hectopascals (hPa) was located off the South Carolina coast with a trough of low pressure extending southwestward across central Florida parallel to the front and north of the accident site. The accident site was located in the cold airmass north of the front in an area of a weak pressure gradient with westerly wind speeds of 10 knots or less over the area.



Figure 1 - Southeast section of the Surface Analysis Chart for 0700 EST

The station model for Vero Beach, Florida, on the surface analysis chart indicated a west wind of 5 knots, visibility restricted in mist, overcast cloud cover, temperature of 65° Fahrenheit, a dew point temperature of 63° F, and a sea level pressure of 1016.8-hPa. Other surrounding stations across central Florida also reported visibility restrictions in fog or mist. Over northern Florida and southeast Georgia and South Carolina light to heavy rain was indicated.

1.2 National Composite Radar Mosaic

The southeast section of the National Composite Radar Mosaic for 0705 EST is included as figure 2 with the approximate accident site marked by a red star. The image depicted an extensive band of precipitation extending from South Carolina, southeastern Georgia, northern Florida, into the Gulf of Mexico. Another area of scattered precipitation was noted over and west of the Tampa Bay area. No precipitation echoes were depicted in the area of the accident site.



Figure 2 - National Composite Radar Mosaic for 0705 EST

2.0 Observations

The surrounding area was documented using official Meteorological Aerodrome Reports (METAR) and Specials (SPECI) reports. The area had a magnetic variation of 7° West based on the sectional chart for the area. Cloud heights are reported in height above ground level (agl) in the following section.

2.1 Vero Beach, Florida

The closest weather reporting location to the accident site was from the departure of Vero Beach Regional Airport (KVRB), Vero Beach, Florida, which was approximately 3 miles southeast of the accident site at an elevation of 24 ft. The airport had a federally installed and maintained Automated Surface Observation System (ASOS) which was augmented by air traffic control personnel through a Limited Aviation Weather Reports Station (LAWRS) agreement during the hours of operation (0700 through 2200 local). The following weather conditions were reported surrounding the time of the accident:

KVRB weather observation at 0653 EST, automated, wind from 260° at 7 knots, visibility 8 miles in light rain, ceiling broken at 500 ft agl, overcast at 900 ft, temperature 19° C, dew point temperature 18° C, altimeter 30.03 inches of mercury (Hg). Remarks: automated station with a precipitation discriminator, sea level pressure 1016.8-hPa, hourly precipitation a trace¹, 6-hour rainfall a trace, 24-hour precipitation total 0.01 inch, temperature 18.9° C, dew point 17.8° C, 6-hour maximum temperature 18.9° C, 6-hour minimum temperature 18.3° C, 3-hour pressure tendency risen 2.2-hPa.

KVRB special weather observation at 0703 EST, wind from 250° at 8 knots, visibility 6 miles in light rain and mist, ceiling overcast at 400 ft agl, temperature 19° C, dew point temperature 18° C, altimeter 30.03 inches of Hg. Remarks: automated station with a precipitation discriminator, hourly precipitation (since 0653 EST) a trace, temperature 18.9° C, dew point 17.8° C.

Accident 0703 EST

KVRB special weather observation at 0719 EST, wind from 270° at 11 knots, visibility 1 3/4 miles in light rain and mist, ceiling overcast at 400 ft agl, temperature 19° C, dew point temperature 18° C, altimeter 30.03 inches of Hg. Remarks: automated station with a precipitation discriminator, hourly precipitation (since 0653 EST) a trace.

The following general flight categories (color coded) and the raw observation in standard code and abbreviations surrounding the period were reported between about 0500 through 1100 EST.

- VFR METAR KVRB 050953Z AUTO 28005KT 10SM -RA OVC090 19/17 A2999 RMK AO2 SLP154 P0000 T01890172=
- VFR METAR KVRB 051053Z AUTO 23004KT 10SM -RA SCT027 BKN100 18/17 A3000 RMK AO2 SLP157 P0000 T01830172
- MVFR SPECI KVRB 051131Z AUTO 26006KT 10SM -RA FEW006 BKN019 BKN048 19/17 A3002 RMK AO2 P0000 T01890172
- *IFR* SPECI KVRB 051145Z AUTO 27007KT 9SM -RA BKN005 BKN019 OVC048 19/18 A3003 RMK AO2 P0000 T01890178
- *IFR METAR KVRB 051153Z AUTO 26007KT 8SM -RA BKN005 OVC019 19/18 A3003 RMK AO2 SLP168 P0000 60000 70001 T01890178 10189 20183 53022*

¹ A trace of precipitation is defined as less than 0.01 inches.

LIFR SPECI KVRB 051203Z 25008KT 6SM -RA BR OVC004 19/18 A3003 RMK AO2 P0000 T01890178

Accident 1204Z

LIFR SPECI KVRB 051219Z 27011KT 1 3/4SM -RA BR OVC004 19/18 A3003 RMK AO2 P0000

- LIFR SPECI KVRB 051233Z 27008KT 2SM -RA BR OVC003 18/18 A3003 RMK AO2 P0000 T01830178
- LIFR METAR KVRB 051253Z 27007KT 2SM RA BR OVC003 18/18 A3004 RMK AO2 SLP170 P0000 T01830178
- *IFR* SPECI KVRB 051257Z 27006KT 2 1/2SM -RA BR OVC005 18/18 A3004 RMK AO2 P0000
- *IFR* SPECI KVRB 051307Z 25007KT 4SM -RA BR OVC005 18/18 A3003 RMK AO2 P0000 T01830178
- *IFR METAR KVRB 051353Z 23007KT 10SM -RA OVC008 19/18 A3004 RMK AO2 SLP172 P0000 T01940178\$*
- *IFR METAR KVRB 051453Z 27015KT 10SM BKN008 OVC080 A3007 RMK AO2 RAEMM SLP183 P0000 60000 53015\$*
- *IFR METAR KVRB 051553Z 28013KT 10SM BKN008 OVC075 20/18 A3008 RMK AO2 SLP184*

MVFR SPECI KVRB 051600Z 29013KT 10SM BKN014 21/16 A3008 RMK AO2 T02110161

The 5-minute observation data from the KVRB ASOS was obtained from NWS archive data for the period approximately 30-minutes prior to and after the accident to better identify the trend and rate the visibility and ceilings lowered during the period surrounding the accident. The hourly METAR and special observations issued also appear in the data and in bold type.

KVRB 051130Z AUTO 26007KT 10SM -RA FEW006 SCT019 BKN048 19/17 A3002 RMK T01900170 SPECI KVRB 051131Z AUTO 26006KT 10SM -RA FEW006 BKN019 BKN048 19/17 A3002 RMK AO2 P0000 T01890172

KVRB 051135Z AUTO 26007KT 10SM -RA SCT006 BKN019 BKN048 19/17 A3002 RMK T01900170 KVRB 051140Z AUTO 25007KT 10SM -RA BKN006 BKN019 OVC048 19/17 A3003 RMK T01900170 KVRB 051145Z AUTO 27007KT 9SM -RA BKN005 BKN019 OVC048 19/18 A3003 RMK AO2 P0000 T01890178 KVRB 051150Z AUTO 26007KT 8SM -RA BKN004 OVC019 19/18 A3003 RMK T01900180 **METAR KVRB 051153Z AUTO 26007KT 8SM -RA BKN005 OVC019 19/18 A3003 RMK AO2 SLP168 P0000** 60000 70001 T01890178 10189 20183 53022

 60000 /0001 1018901/8 10189 20183 53022

 KVRB 051155Z AUTO 26007KT 7SM -RA OVC004 19/18 A3003 RMK T01900180

 KVRB 051200Z AUTO 25009KT 7SM -RA OVC004 19/18 A3003 RMK T01900180

 SPECI KVRB 051203Z 25008KT 6SM -RA BR OVC004 19/18 A3003 RMK AO2 P0000 T01890178

 KVRB 051205Z AUTO 26007KT 6SM -RA BR OVC004 19/18 A3004 RMK T01900180

 KVRB 051210Z AUTO 26010KT 5SM -RA BR OVC004 19/18 A3004 RMK T01900180

 KVRB 051215Z AUTO 25011KT 3SM -RA BR OVC004 19/18 A3004 RMK T01900180

 SPECI KVRB 051219Z 27011KT 1 3/4SM -RA BR OVC004 19/18 A3003 RMK AO2 P0000 T01890178

 KVRB 051220Z AUTO 27010KT 1 1/2SM -RA BR OVC004 19/18 A3003 RMK T01900180

 KVRB 051220Z AUTO 27009KT 1 1/2SM -RA BR OVC004 18/18 A3003 RMK T01900180

 KVRB 051230Z AUTO 26007KT 1 1/2SM -RA BR OVC004 18/18 A3003 RMK T01800180

 KVRB 051230Z AUTO 26007KT 1 1/2SM -RA BR OVC004 18/18 A3003 RMK T01800180

 KVRB 051230Z AUTO 26007KT 1 1/2SM -RA BR OVC003 18/18 A3003 RMK T01800180

 KVRB 051230Z AUTO 26007KT 1 1/2SM -RA BR OVC003 18/18 A3003 RMK T01800180

 KVRB 051235Z AUTO 26009KT 2 1/2SM -RA BR OVC003 18/18 A3003 RMK T01800180

 KVRB 051240Z AUTO 26009KT 2 1/2SM -RA BR OVC003 18/18 A3003 RMK T01800180

 KVRB 051240Z AUTO 26008KT 3SM -RA BR OVC003 18/18 A3003 RMK T01800180

 KVRB 051240Z AUTO 26008KT 3SM -RA BR OVC003 18/18 A3003 RMK T01800180

 KVRB 051240Z AUTO 26008KT 3SM -RA BR OVC003 18/18 A3003 RMK T01800180

 KVRB 051245Z AUTO

The observations indicated light rain was occurring during the period with low ceilings developing after 0640 EST immediately prior to the time the aircraft departed KVRB, with LIFR conditions with ceiling overcast between 300 to 400 ft between 0650 through 0757 EST and visibilities less than 2 miles in light rain and mist, and temperature-dew point spreads less than 1° C. Conditions began to improve to MVFR conditions after 1100 EST.

2.2 Fort Pierce, Florida

Treasure Coast International Airport (KFPR), Fort Pierce, Florida, was located approximately 10 miles south of KVRB and 13 miles south of the accident site at an elevation of 23 ft. The airport had an ASOS and was also augmented during the hour of tower operations. The following conditions were reported at the approximate time of the accident.

KFPR special weather observation at 0715 EST, wind from 270° at 7 knots, visibility 2 1/2 miles in mist, ceiling overcast at 300 ft, temperature 19° C, dew point 18° C, altimeter 30.04 inches of Hg. Remarks: automated station with a precipitation discriminator, temperature 18.9° C, dew point 17.8° C.

The general flight categories and raw observations surrounding the period were as follows:

- VFR METAR KFPR 051053Z AUTO 26004KT 8SM FEW004 SCT019 18/16 A3000 RMK AO2 SLP159 T01780161
- MVFR SPECI KFPR 051100Z AUTO 27005KT 8SM FEW004 BKN019 18/17 A3001 RMK AO2 T01780167
- *LIFR* SPECI KFPR 051133Z AUTO 25007KT 7SM BKN004 OVC018 18/17 A3002 RMK AO2 T01830172
- *LIFR METAR KFPR 051153Z AUTO 27007KT 6SM BR OVC003 18/17 A3003 RMK AO2 SLP168 T01830172 10189 20167 53022*

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LIFR SPECI KFPR 051215Z 27007KT 2 1/2SM BR OVC003 19/18 A3004 RMK AO2 T0189

- LIFR SPECI KFPR 051250Z 26007KT 3SM BR OVC004 18/17 A3004 RMK AO2 CIG 002V006
- *LIFR METAR KFPR 051253Z 26006KT 3SM BR OVC004 19/17 A3004 RMK A02 SLP170 T01890172*
- MVFR SPECI KFPR 051326Z 26005KT 7SM SCT006 OVC011 19/17 A3004 RMK A02 T01890172
- *IFR* SPECI KFPR 051339Z 23004KT 9SM OVC009 19/17 A3003 RMK A02 CIG 005V012 T01940172
- *IFR* METAR KFPR 051353Z 25006KT 10SM OVC009 20/17 A3004 RMK AO2 CIG 006V011 SLP172 T02000172
- *IFR METAR KFPR 051453Z 27011KT 10SM OVC007 21/18 A3006 RMK AO2 PRESRR SLP179 T02110178 53008*
- MVFR SPECI KFPR 051545Z 28013KT 10SM OVC010 21/17 A3008 RMK AO2 CIG 007V013 T02110167

MVFR METAR KFPR 051553Z 28012KT 10SM OVC012 21/17 A3008 RMK AO2 SLP184 T02110167

MVFR SPECI KFPR 051626Z 30014KT 10SM SCT016 BKN021 BKN055 22/16 A3007 RMK AO2 T02220161

The observations for KFPR indicated light winds, with temperature-dew point spreads of 1° C, prior to the accident with IFR to LIFR conditions developing due to low ceilings and mist between approximately 0630 and 1045 EST.

2.3 Melbourne, Florida

The next available weather reporting facility to the accident site was from Melbourne International Airport (KMLB), Melbourne, Florida, which was located approximately 29 miles north of KVRB and 26 miles of the accident site at an elevation of 33 ft. The airport also had an ASOS and was augmented by air traffic control personnel. The following conditions were reported at the approximate time of the accident.

KMLB weather observation at 0653 EST, wind from 270° at 10 knots, visibility 1 1/2 miles in mist, ceiling overcast at 300 ft agl, temperature 18° C, dew point temperature 17° C, altimeter 30.02 inches of Hg.

The general flight categories and raw observations surrounding the period were as follows.

- MVFR METAR KMLB 050953Z AUTO 20004KT 10SM BKN011 BKN080 OVC100 19/17 A2997 RMK AO2 SLP149 T01940167=
- VFR SPECI KMLB 051005Z AUTO 21003KT 10SM SCT011 BKN080 OVC100 19/17 A2997 RMK AO2 T01940167=
- MVFR SPECI KMLB 051022Z AUTO 30005KT 10SM BKN011 OVC080 19/17 A2999 RMK AO2 T01940167=
- MVFR METAR KMLB 051053Z 28008KT 10SM OVC010 19/17 A3001 RMK AO2 SLP160 T01890167=
- *IFR* SPECI KMLB 051113Z 26008KT 10SM OVC009 19/17 A3001 RMK AO2 TOPS 2200FT T01890167=
- LIFR SPECI KMLB 051120Z 27009KT 1SM R09R/P6000FT BR OVC004 19/17 A3002 RMK AO2 TOPS 2200FT T01890167=
- *LIFR* SPECI KMLB 051144Z 27013KT 1/2SM R09R/P6000FT FG OVC003 18/17 A3002 RMK A02 TOPS 2200FT T01830172=
- LIFR METAR KMLB 051153Z 27010KT 1 1/2SM BR OVC003 18/17 A3002 RMK AO2 SLP166 70001 01780167 10194 20178 53017=

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- *LIFR METAR KMLB 051253Z 24005KT 2SM BR OVC004 18/17 A3001 RMK AO2 SLP163 T01780167=*
- *IFR* SPECI KMLB 051337Z 17010KT 2SM BR OVC005 19/17 A3000 RMK A02 T01890167=
- *IFR* METAR KMLB 051353Z 27014KT 2SM BR OVC005 19/17 A3006 RMK AO2 PRESRR SLP178 T01940172=

- *IFR* SPECI KMLB 051400Z 28019KT 3SM BR OVC005 19/17 A3007 RMK AO2 PRESRR T01890167=
- *IFR* SPECI KMLB 051408Z 29018KT 3SM BR OVC005 18/17 A3008 RMK AO2 WSHFT 1348 T01830167=
- *MVFR* SPECI KMLB 051449Z 29014KT 5SM HZ BKN010 BKN015 OVC044 19/14 A3009 RMK AO2 WSHFT 1348=
- MVFR METAR KMLB 051453Z 30012KT 5SM HZ BKN010 BKN015 OVC044 19/15 A3008 RMK AO2 WSHFT 1348 SLP185 T01940150 50022=
- VFR SPECI KMLB 051530Z 30009KT 10SM SCT015 OVC039 20/14 A3007 RMK AO2 T02000144=
- *IFR* METAR KMLB 051553Z 31010KT 10SM -RA BKN007 BKN033 OVC043 18/15 A3010 RMK AO2 RAB42 SLP191 P0000 T01830150=
- MVFR SPECI KMLB 051608Z 30010KT 8SM -RA BKN010 BKN031 OVC043 17/14 A3010 RMK AO2 P0001 T01720144=

The observations from KMLB indicated rapidly developing IFR to LIFR conditions between 0600 and 0945 EST with low ceilings and fog or mist.

2.4 METAR Display

A display of the METAR observations with the radar overlaid was obtained immediately after the accident from the NWS Aviation Weather Centers website² for 0630 EST and 0730 EST and are included as figure 3 and 4 respectively. The approximate accident site is marked by a red star, and temperature and dew point temperatures are provided in °F. The displays show VFR conditions reported at KVRB at 0630 EST prior to the flight's departure with stations immediately north at KMLB and KCOF³, and KSEF⁴ reporting LIFR and IFR conditions due to mist and low ceilings.

² https://aviationweather.gov/metar

³ Patrick Air Force Base (KCOF), Cocoa Beach, FL.

⁴ Sebring Regional Airport (KSEF), Sebring, FL.



Figure 3 - METAR display form NWS AWC at 0630 EST



Figure 4 - METAR display from NWS AWC at 0730 EST

3.0 Sounding

A High-Resolution Rapid Refresh (HRRR)⁵ numerical model data was obtained from archive data from the NOAA Air Resource Laboratory (ARL) was obtained for 0700 EST over the accident site coordinates. The model data was then plotted on a standard Skew T log P diagram⁶ from the surface to 450-hPa or approximately 21,000 ft using the complete Rawinsonde Observation RAOB program software⁷ and is included as figure 5.

The HRRR 0700 EST model sounding depicted a surface temperature of 18.1° C (64.4° F), with a dew point temperature of 16.9° C (62.4° F), with a relative humidity of 93%. A defined frontal inversion was noted immediately above the surface to approximately 2,092 ft where temperature increases or remained constant with height. The lifted condensation level (LCL) was identified at

⁵ 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.

⁶ Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

⁷ RAOB software – The complete RAwinsonde OBservation program is an interactive sounding analysis program developed by Environmental Research Services, Matamopras, Pennsylvania, for plotting and analyzing upper air data.

504 ft agl, with convective condensation level (CCL) at about 3,300 ft. The sounding had a relative humidity greater than 90% from the surface to approximately 4,500 ft with the sounding characterized as stable with a lifted index of 3.0 the that support low stratiform clouds and fog formation. The freezing level was at identified above 14,000 ft with no threat of low-level icing or frost formation.



Figure 5 - HRRR numerical model sounding over the accident site for 0700 EST

The HRRR wind profile indicated westerly winds at approximately 10 knots below the inversion and slowly increasing in speed with height with little directional variation. Wind speeds above 15,000 ft where in excess of 50 knots, which resulted in the mean 0 to 6 kilometer (or 18,000 ft) wind was from 250° at 34 knots. No strong low-level wind shear values were noted below 2,000 ft.

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 and visible imagery were 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

(μ m) provided radiative cloud top temperatures with a nominal spatial resolution of 2 km. The visible (band 2) at a wavelength of 0.64 μ m images at a resolution of 0.5 km.

Figures 6 and 7 are the GOES-16 visible images at 2X magnification for 0702 and 0707 EST respectively, which depicted an extensive layer of low stratiform type clouds over the coastal section of central and southern Florida and extend over the accident site. The GOES-16 infrared image during the period indicated a radiative cloud top temperature of 287° Kelvin or 13.84° C, which corresponded to cloud tops near 4,800 ft based on the HRRR sounding.



Figure 6 - GOES-16 visible image at 0702 EST



Figure 7 - GOES-16 visible image at 0707 EST

5.0 Pilot Reports

The following pilot reports (PIREPs) were recorded in the vicinity of the accident site and along the planned route of flight surrounding the time of the accident. The reports are provided decoded with time converted from UTC to local, along with the raw reports in standard format and code.

MCO UA /OV MCO/TM 0712/FLDESC/TP B753/SK BASES OVC012

Orlando International Airport routine pilot report; Over – MCO; Time – 0212 EST; Altitude – during descent; Type aircraft – Boeing B757 air carrier jet; Sky cover – bases of overcast clouds at 1,200 ft.

MCO UA /OV MCO/TM 0800/FL020/TP C208/SK TOPS OVC018

Orlando International Airport routine pilot report; Over – MCO; Time – 0300 EST; Altitude – 2,000 ft; Type aircraft – Cessna Caravan single engine turboprop aircraft; Sky cover – tops of overcast clouds at 1,800 ft.

MLB UA /OV MLB/TM 1118/FL025/TP BE20/SK BASES BKN005 TOPS BKN022/WX FV05SM

Melbourne International Airport routine pilot report (UA); over – MLB; Time – 0618 EST; Altitude – 2,500 ft; Type aircraft – Beechcraft King Air multiengine turboprop aircraft; Sky cover – bases broken at 500 ft with tops at 2,200 ft; Weather – flight visibility 5 statute miles.

PBI UA /OV PBI100005/TM 1120/FL010/TP B757/SK BASES OVC014

Palm Beach International Airport, West Palm Beach, routine pilot report (UA); Over – 5 miles southeast of PBI VORTAC; Time – 0620 EST; Altitude – 1,000 ft; Type aircraft – Boeing 757 air carrier jet; Sky cover – overcast cloud bases 1,400 ft.

PBI UA /OV PBI350030/TM 1149/FL010/TP RV10/SK BASES OVC003

Palm Beach International Airport, routine pilot report (UA); Over – 30 miles north of PBI VORTAC; Time – 0649 EST; Altitude – 1,000 ft; Type aircraft – Vans RV-10 light kit aircraft; Sky cover – overcast cloud bases 300 ft.

VRB UA /OV TRV120003/TM 1220/FL060/TP CL60/RM TOPS 030

Vero Beach Regional Airport routine pilot report (UA); Over – 3 miles southeast of Treasure (TRV) VORTAC; Time – 0720 EST; Altitude 6,000 ft; Type aircraft – Canadair Challenger business jet; Remarks – cloud tops at 3,000 ft.

SUA UA /OV SUA/TM 1255/FL010/TP LJ60/SK BKN004-TOPS020

Witham Field Airport, Stuart, routine pilot report (UA); Over – Stuart; Time – 0755 EST; Altitude 1,000 ft; Type aircraft – Learjet business jet; Sky cover – broken clouds bases at 400 ft with tops at 2,000 ft.

VRB UA /OV 5NM NW VRB/TM 1304/FL030/TP C404/SK BASES OVC004 TOPS OVC018/WX VMC ABOVE 018

Vero Beach Regional Airport routine pilot report (UA); Over -5 miles northwest of VRB; Time -0804 EST; Altitude 3,000 ft; Type aircraft - Cessna Titan multiengine airplane; Sky cover - overcast cloud bases at 400 ft with tops at 1,800 ft; Weather - visual meteorological conditions above 1,800 ft.

VRB UA /OV TRV120003/TM 1313/FL004/TP P28A/SK OVC004

Vero Beach Regional Airport routine pilot report (UA); Over – 3 miles southeast of Treasure VORTAC; Time – 0813 EST; Altitude 400 ft; Type aircraft – Piper Cherokee single engine airplane; Sky cover – overcast cloud bases at 400 ft.

6.0 Terminal Aerodrome Forecast

The NWS Melbourne (KMLB) Weather Forecast Office (WFO) was responsible for the issuance of the KVRB Terminal Aerodrome Forecast (TAF) and local weather alerts for the area. 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 TAFs issued for KVRB surrounding the period were as follows:

TAF KVRB 050544Z 0506/0606 35006KT P6SM SCT015 FM050800 VRB03KT P6SM BKN015 FM051400 29008KT P6SM SCT015 BKN020 FM051800 30010KT P6SM VCSH SCT020 BKN040 FM060000 30007KT P6SM26 SCT040=

TAF KVRB 051132Z 0512/0612 VRB03KT P6SM BKN015 FM051400 29008KT P6SM SCT015 BKN025 FM051800 30010KT P6SM VCSH SCT020 BKN040 FM060000 30007KT P6SM SCT040=

The forecast available hours prior to the flight's departure was issued at 0044 EST and expected MVFR conditions to prevail between 0300 and 0900 EST with variable winds of 3 knots, visibility unrestricted at 6 miles or more, with broken clouds at 1,500 ft agl. The next scheduled TAF issuance was at 0632 EST immediately prior to the flight's departure with no change in the forecast

through 0900 EST. Between 0900 and 1300 EST the forecast expected wind from 290° at 8 knots, visibility unrestricted at 6 miles or more, scattered clouds at 1,500 ft, ceiling broken at 2,500 ft.

The forecast was amended after the accident at 0741 EST and expected a temporary period between 0700 and 0900 EST of visibility of 2 miles in mist with a ceiling overcast at 300 ft.

AMD TAF KVRB 051241Z 0513/0612 27008KT P6SM SCT003 BKN015 TEMPO 0512/0514 2SM BR OVC003 FM051400 29008KT P6SM SCT015 BKN025 FM051800 30010KT P6SM VCSH SCT020 BKN040 FM060000 30007KT P6SM SCT040

7.0 Area Forecast Discussion

The NWS Area Forecast Discussion (AFD) describe the weather conditions as they relate to a specific TAF or a group of TAFs and provide additional aviation weather related issues that cannot be encoded in the TAF, such as the reasoning behind the forecast. AFD's are issued approximately every 6-hours corresponding to the issuance of TAFs from the respective NWS WFO. The KMLB AFD issued at about 0500 EST was as follow:

FXUS62 KMLB 051004 AFDMLB Area Forecast Discussion National Weather Service Melbourne FL 504 AM EST Tue Mar 5 2019

.DISCUSSION...

... Turning Sharply Colder Tonight...

Today-Tonight...Northwest winds will persist at the surface today behind cold front now south of Lake Okeechobee. However, just off the surface in the low to mid levels winds out of the W/SW will lead to overrunning moisture and weak isentropic lift north of the front. Models are in fairly good agreement showing bands of light rain or showers initially crossing northern central Florida into the morning and shifting south of the I-4 corridor and weakening into the afternoon. Have PoPs ranging from 30 percent across Okeechobee County and the Treasure Coast, to 40 percent farther north. Stratus has developed over much of the area early this morning and satellite imagery shows additional widespread cloud cover moving in from the east. This will keep skies cloudy to mostly cloudy through much of the day. This combined with continued northwest flow will keep temperatures quite cool, with highs forecast to only reach the low to mid 60s from Orlando northward, and in the upper 60s to low 70s farther south, except mid 70s along the southern Treasure Coast.

Reinforcing stronger cold front will move through the area late this afternoon into tonight, ending rain chances and rapidly decreasing cloud cover from north to south. Temperatures will become much colder behind this boundary, with lows dropping into the 40s over much of the area and in the mid to upper 30s near to northwest of the I-4 corridor overnight. These chilly temperatures combined with northerly winds around 10 mph will make it feel even colder, with wind chill values in the low to mid 30s (possibly upper 20s) across northern portions of east central Florida late tonight through early Wednesday morning. May need a Wind Chill Advisory, especially for Lake and Volusia counties where lowest wind chill values are expected. However, duration looks to be rather short.

Wed-Wed night...High pressure centered over the lower MS valley will build over the area and maintain a very cool and very dry northerly flow. Despite full sunshine on Wed, temperatures will remain much below

normal with highs in the low to mid 60s most areas, except coastal Volusia which will likely not get out of the 50s. These temperatures will be 10-15 degrees below normal for early March.

.AVIATION...Predominant MVFR cigs expected to linger through this morning across much of the area, with localized IFR cigs possible. Model guidance not having a very good handle on this low cloud cover currently, but generally expect a slow rise in these cigs through the day, but likely not rising to VFR levels until mid to late afternoon. Bands of light rain or isolated to scattered showers will cross the region, producing mainly MVFR visibilities at times, as they initially move through northern TAF sites into the morning and shift south and decrease in coverage through the afternoon.

Cloud cover is expected to gradually clear from north to south from late afternoon into tonight as reinforcing cold front ushers in drier/colder airmass, with VFR conditions expected area-wide after 00z.

8.0 Graphic Forecast for Aviation

The NWS Aviation Weather Center's (AWC) Graphic Forecast for Aviation (GFA) static forecast for "Aviation Surface Forecast" issued during the period for wind, visibility, and weather phenomena, with the Graphic AIRMET⁸ (G-AIRMET) Sierra for IFR conditions and G-Tango for strong gusty surface winds are included as figures 8 and 9. Figure 8 is the chart issued at about 0200 EST and valid for 0700 EST which depicted northwesterly winds near 5 knots, a chance⁹ of light rain showers, with visibility 5 miles or more over the area. A G-AIRMET for IFR conditions was depicted over extreme southern Florida with visibilities less than 1 mile in fog. The next issuance at 0500 EST and valid for 0700 EST is included as figure 9 and depicted light winds from the west-northwest with a chance of rain showers over the area, with visibility greater than 5 miles over the accident site, but immediately east of an area of visibility of 3 to 5 miles. A G-AIRMET for IFR conditions was depicted over portions of central and southern Florida and now extended over the accident site.

The GFA "Aviation Cloud Forecast" provided cloud coverage, bases, layers, and tops with the G-AIRMET Sierra for mountain obscuration and G-AIRMET Zulu for icing conditions issued at 0200 EST and at 0500 EST valid for 0700 EST are included as figure 10 and 11 respectively. Cloud heights are in msl heights in this product. The chart issued at about 0200 EST depicted overcast clouds with bases at 1,000 ft with tops to 4,500 ft, which the chart issued at 0500 EST depicted an extensive area of overcast clouds with bases at 1,000 ft with tops to 8,000 ft over the area. A G-AIRMET for icing extended over northern Florida, Georgia, and South Carolina, which did not impact the route of flight.

⁸ Airmen's Meteorological Information (AIRMET) is a concise description of weather phenomena that are occurring or may occur (forecast) over an area of at least 3,000 square miles that may affect aircraft safety. AIRMETs are issued for moderate turbulence or icing, sustained surface winds of 30 knots or more, Low-Level Wind Shear (LLWS), widespread restricted visibility below 3 statute miles and/or ceilings less than 1,000 ft agl or IFR conditions and mountain obscuration conditions.

⁹ Chance implied a 30 to 50% probability of precipitation.



Figure 8 - GFA Aviation Surface Forecast issued at 0200 EST and valid for 0700 EST



Figure 9 - GFA Aviation Surface Forecast issued at 0500 EST and valid for 0700 EST





Figure 11 - GFA Aviation Cloud Forecast issued at 0500 EST and valid for 0700 EST

9.0 Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA ARTCCs¹⁰. 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 the NWS AWC did not issue any SIGMETs or Convective SIGMETs and indicated that no thunderstorms were expected over the region during the period. The NWS AWC issued a series of AIRMETs for IFR conditions during the period, with no advisories issued for any significant turbulence, strong winds, or low-level wind shear over the area. The AIRMET Sierra series of advisories were as follows:

WAUS42 KKCI 050845 WA2S -MIAS WA 050845 AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 051500

AIRMET IFR...NC SC GA FL AND CSTL WTRS FROM 110E ECG TO 130ESE ILM TO 90SE SAV TO 40SE PZD TO 50SW CEW TO 40W CEW TO 20N PZD TO 20W CAE TO 110E ECG CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z ENDG 18-21Z.

AIRMET IFR...FL AND CSTL WTRS FROM 70NE TRV TO 40WSW PBI TO 20SE MIA TO 60S MIA TO 30NE EYW TO 20SW RSW TO 20WSW ORL TO 70NE TRV CIG BLW 010/VIS BLW 3SM BR. CONDS ENDG 12-15Z.

The advisory warned of ceilings below 1,000 ft and visibilities below 3 miles in mist, with conditions ending between 0700 and 1000 EST (figure 12).

¹⁰ Air Route Traffic Control Centers (ARTCC)



Figure 12 - Plot of AIRMET Sierra 2 issued at 0358 EST and valid until 1000 EST

AIRMET Sierra was amended at 0558 EST to as follows and is displayed in figure 13:

WAUS42 KKCI 051058 AAA WA2S -MIAS WA 051058 AMD AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 051500

AIRMET IFR...NC SC GA FL AND CSTL WTRS...UPDT FROM 110E ECG TO 130ESE ILM TO 40NE CRG TO 30ESE TLH TO 30WSW TLH TO 50ESE MGM TO 50E MCN TO 20W CAE TO 50SSE CLT TO 60SSW ECG TO 110E ECG CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 15Z ENDG 18-21Z.

AIRMET IFR...FL AND CSTL WTRS...UPDT FROM 20W ORL TO 30E TRV TO 70S MIA TO 20W RSW TO 20W ORL CIG BLW 010/VIS BLW 3SM BR. CONDS ENDG 12-15Z.



Figure 13 - Plot of AIRMET Sierra 3 issued at 0558 EST and valid for 1000 EST

The NWS Miami CWSU (KZMA) issued a CWA after the accident at 0733 EST warning of an area of LIFR conditions for over the accident site.

FAUS21 KZMA 051233 ZMA1 CWA 051233 ZMA CWA 101 VALID UNTIL 051433 FROM 40N TRV-20NE PBI-40NE RSW-20SE ORL-40N TRV AREA OF LIFR CONDS WITH CIGS BLW 005/VIS BLW 3SM IN BR. EXP LTL CHG THRU PD. MS

10.0 Astronomical Conditions

The United States Naval Observatory's website¹¹ was used to document the astronomical conditions for Vero Beach, Indian River County, Florida, on the day of the accident. The following data is from that website with the accident site time added for reference in bold italic type.

<u>Sun</u>	
Begin civil twilight	0619 EST
Sunrise	0642 EST
Accident	0703 EST
Sun transit	1233 EST
Sunset	1824 EST
End civil twilight	1848 EST

¹¹ https://aa.usno.navy.mil/data/docs/RS_OneDay.php

11.0 Preflight Weather Briefing

Flight Safety International requires students to obtain their own weather briefing as part of the preflight planning process. They also provide a room for students to call the FAA Automated Flight Service Station (AFSS) or obtain weather briefing via computer (SkyVectors or other system). A search of the Contract AFSS provider Leidos indicated that they had no contact with the accident pilot and no third party vendors who utilize their system recorded any such briefing or received a flight plan to be filed on the day of the accident. It is therefore unknown when or what information the pilot may have reviewed prior to the accident regarding the weather conditions prior to the flight departing KVRB.

Submitted by:

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