NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

October 24, 2017

Group Chairman's Factual Report

METEOROLOGY

ERA17FA190

Table Of Contents

A. AIRCRAFT ACCIDENT

Location: New Castle, Delaware
Date: May 25, 2017
Time: 1153 eastern daylight time
1553 Universal Coordinated Time (UTC)
Airplane: Eurocopter Deutschland GMBH EC 135 P2; Registration: N62UP

B. METEOROLOGIST

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

C. SUMMARY

On May 25, 2017, at 1153 eastern daylight time, a Eurocopter Deutschland GMBH EC 135 P2, N62UP, was destroyed when it impacted terrain near New Castle, Delaware. The airline transport pilot was fatally injured. The helicopter was registered to the University of Pennsylvania and operated by Metro Aviation as a *14 Code of Federal Regulations* Part 91 flight. Instrument meteorological conditions prevailed about the time of the accident, and the flight was operated on an instrument flight rules (IFR) flight plan. The flight originated from Atlantic City International Airport (ACY), Atlantic City, New Jersey, about 1115.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are eastern 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 at latitude 39.659167° N and longitude 75.601111° W, at an elevation of about 20 feet (ft).

E. FACTUAL INFORMATION

1.0 Synoptic Situation

The synoptic or large scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction (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 00-45H.

1.1 Surface Analysis Chart

The northeast section of the NWS Surface Analysis Chart for 1100 EDT (1500Z) on May 25, 2017 is included as figure 1 with the accident site marked by a red star. The chart depicted a low pressure system at 998-hectopascals (hPa)[1] over the northern Chesapeake Bay in Maryland, with an occluded front extending eastward across eastern Maryland, northern Delaware, southern New Jersey into the Atlantic Ocean. Off the New Jersey coast the occluded front split at the triple point, to a cold front to the south and a warm front extending to the east-northeast. To the west another low pressure system at 995-hPa was located over Ohio with a trough of low pressure extending between the two lows over Ohio, southern Pennsylvania, and Maryland. The accident site was located immediately north of the occluded front, which was slowly moving northward with time.

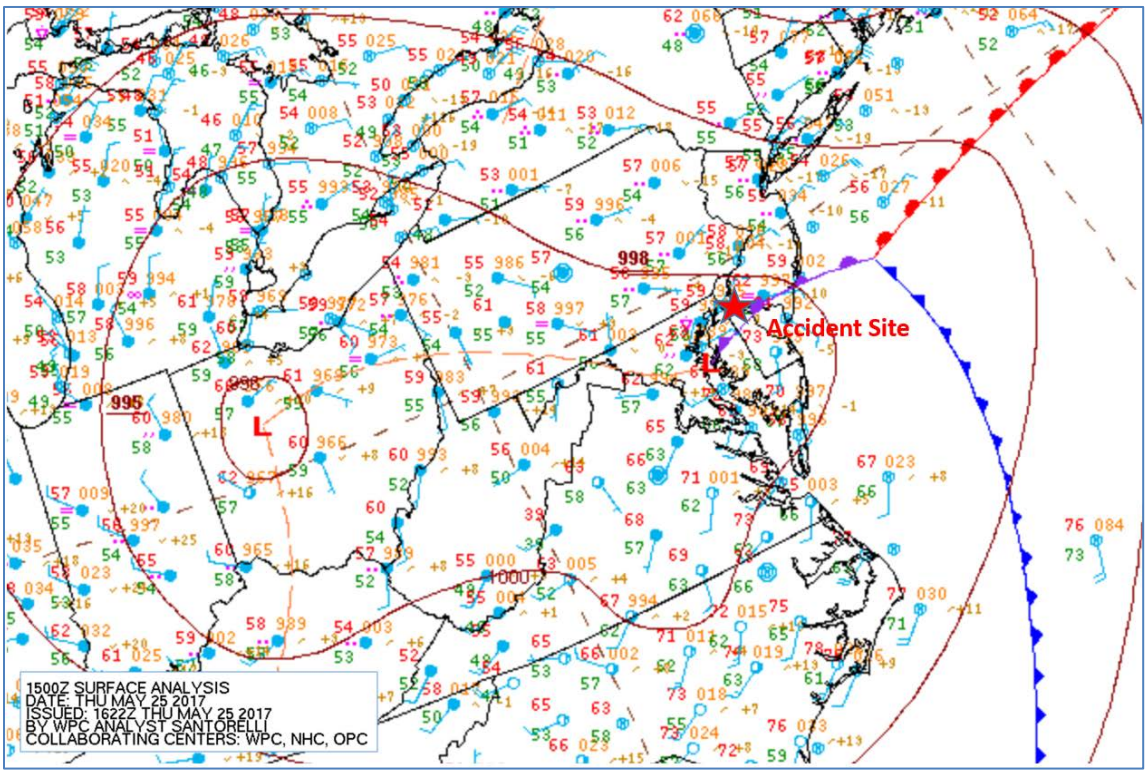

Figure 1 - Section of the NWS Surface Analysis Chart for 1100 EDT

[1] Hectopascals (hPa) is the new standard reference to report sea level pressure and is interchangeable with the older term millibar (mb), which has the same units. The standard sea level pressure is 1013.25-hPa at 15° Celsius (C).

The station models on the chart depicted east to northeasterly winds north of the occluded front, with overcast cloud cover, rain and fog, and with temperatures in the high 50's degrees Fahrenheit (°F), and with temperature-dew point spreads less than 3°F along and north of the front. To the south of the occluded front the winds were from the southeast to southwest, with an area of clear to scattered clouds immediately south of the front, with broken to overcast clouds further west of the low over western Maryland, Virginia, and West Virginia. The station model for New Castle – Wilmington, Delaware, indicated wind from the east-northeast at 10 knots, visibility restricted in mist, overcast skies, temperature and dew point 58° F, with a sea level pressure of 1000.0-hPa.

1.2 National Composite Radar

The northeast section of the National Composite Radar for 1155 EDT on May 25, 2017 is included as figure 2 with the accident site marked by the red star. The chart depicted a small band of light intensity radar echoes over central and northern New Jersey, and over northeast Pennsylvania, and southeastern New York. No significant echoes were identified over the route of flight or the accident site.

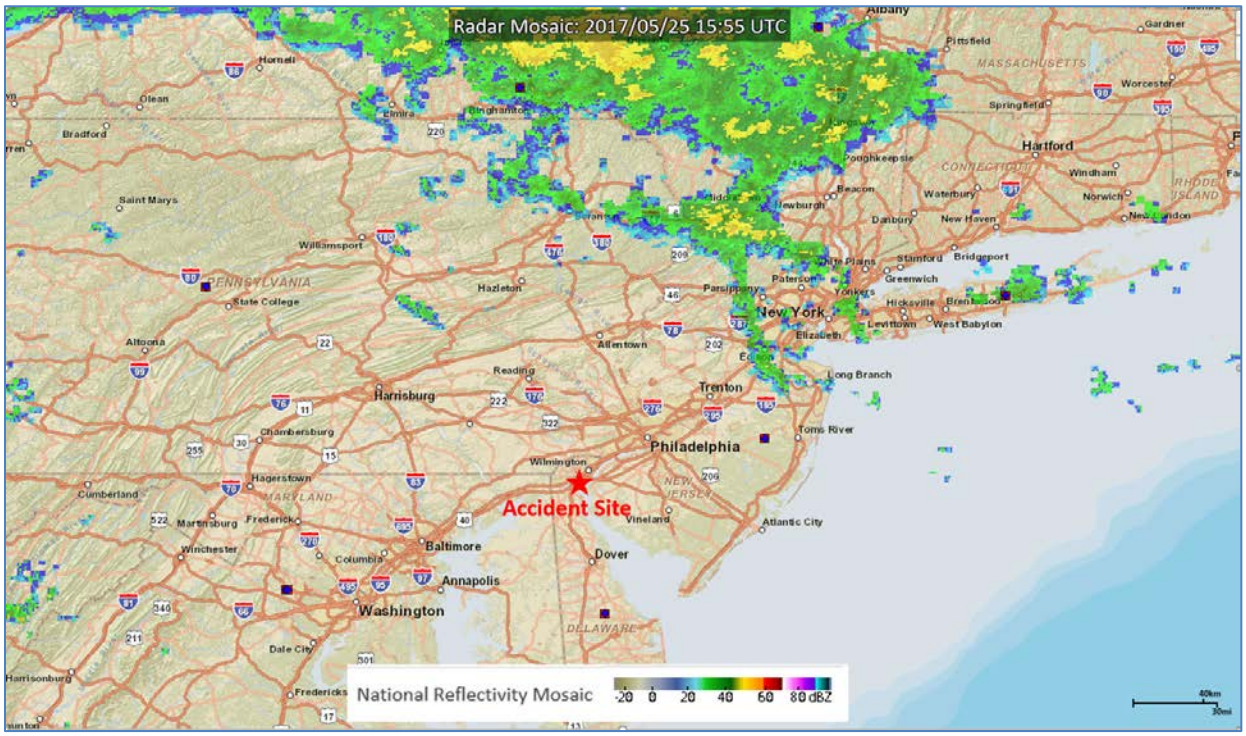

Figure 2 - National Composite Radar image at 1155 EDT

1.3 12-hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart valid for 2000 EDT on May 25, 2017 is included as figure 3, the chart depicted the expected movement of the pressure systems and the associated frontal systems, and the expected precipitation during the period. The chart depicted the low pressure system associated with the occluded front having moved northeastward into southern New Jersey with the second low having moved eastward into the Ohio and Pennsylvania border. The occluded front extending over New Jersey and into Long Island, New York. Several troughs

of low pressure extended south-southwestward from the two lows, with one continuing to be depicted over the region. A large area of precipitation with a greater than 50% coverage was depicted by dark green shading on the chart over New Jersey, Delaware, Pennsylvania, West Virginia, and eastern Ohio. With a chance of thunderstorms indicated by the red hatching over Delaware, eastern Pennsylvania, New Jersey, and southeast New York, and over eastern Ohio, and western Pennsylvania near the low pressure system. More scattered precipitation in rain with less than 50% coverage was indicated by the light green shading over Maryland, Virginia, North Carolina, and Ohio. The chart depicted weather impacts continuing in the New Castle and Atlantic City area through the period.

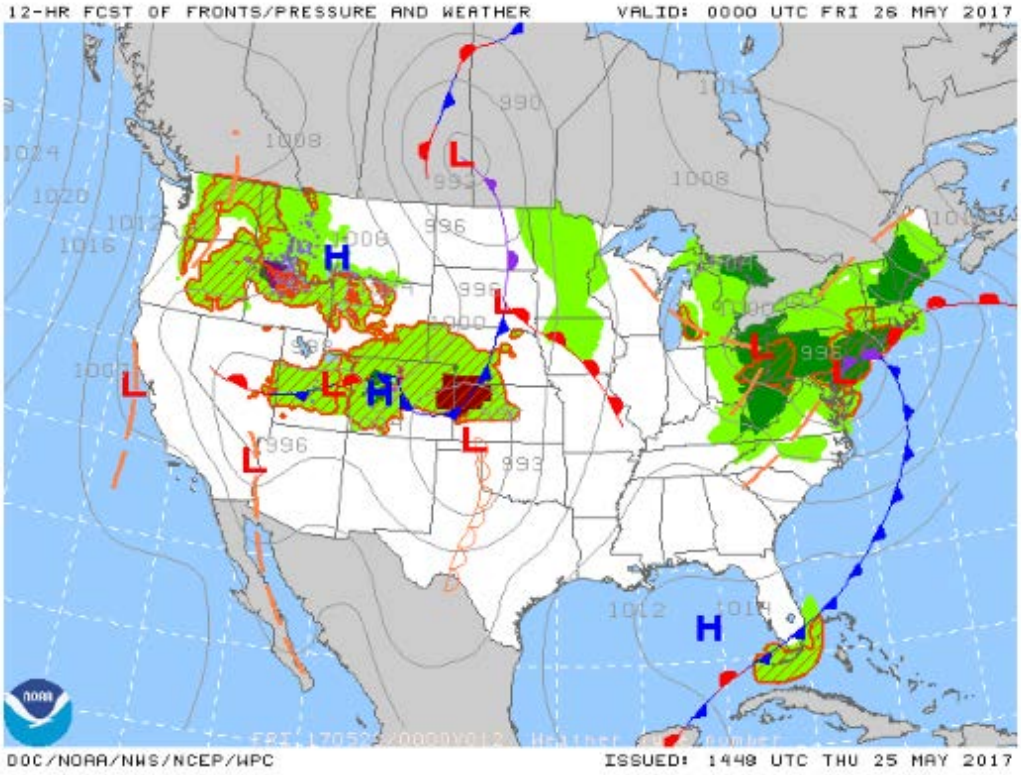

Figure 3 - 12-hour Surface Prognostic Chart

1.4 12-hour Low-Level Significant Weather Prognostic Chart

The 12-hour Low Level Significant Weather Prognostic Chart that was current at the time of the accident had a valid time for 1400 EDT[2] and is included as figure 4. The chart depicted the general flight categories[3], freezing level heights, and turbulence below 24,000 ft expected during

[2] This chart was issued earlier than the WPC 12-hour Surface Prognostic Chart, and was the chart being disseminated for the period at the time of the accident.

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

- Low Instrument Flight Rules (LIFR*) – ceiling or lowest layer of clouds reported as broken, overcast or the vertical visibility into a surface based obscuration below 500 ft agl and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.

the period. The chart depicted an area of IFR conditions by a red line over most of all of Pennsylvania, central and northern New Jersey, southern New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Maine, and eastern Michigan, with another separate area of IFR conditions over Kentucky. Surrounding those areas was a larger area of MVFR conditions by a blue scalloped line which extended the northeast states and included Delaware, Maryland, Virginia, and southern New Jersey. The freezing level was noted above 12,000 ft and was indicated by a thin blue dashed line. Turbulence was indicated by a brown dashed line and light to moderate turbulence from the surface to 24,000 ft was expected over eastern United States and over the accident site.

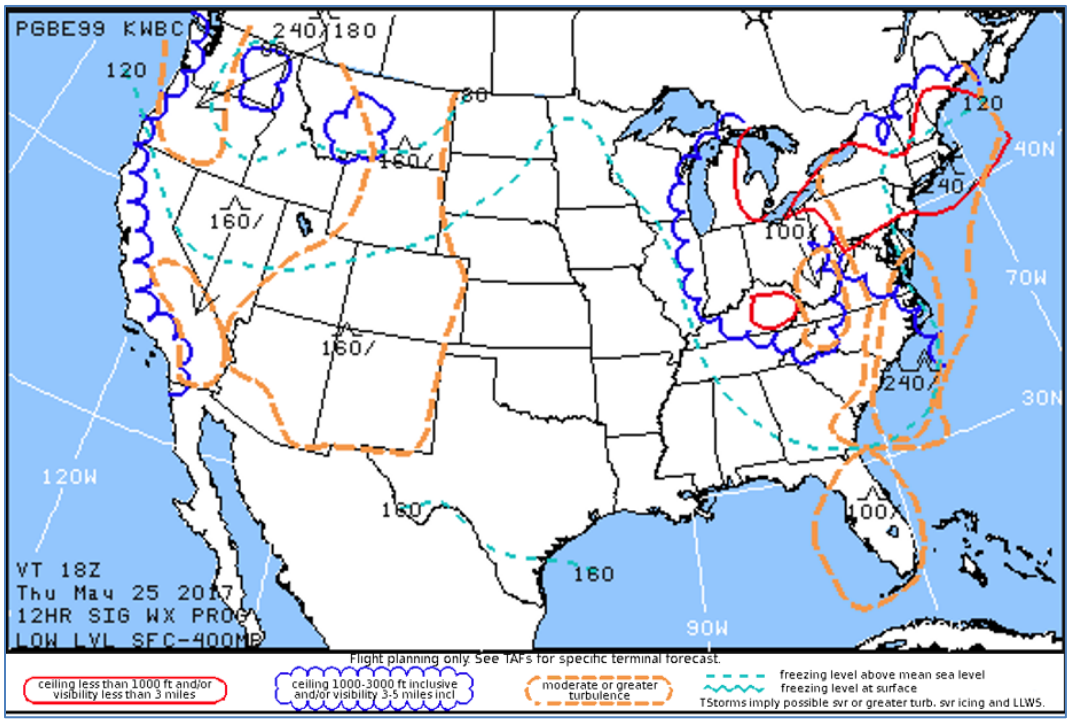

Figure 4 - Low-Level Significant Weather Prognostic Chart valid for 1400 EDT

2.0 Surface Observations

The area was documented using the official NWS Meteorological Aerodrome Reports (METARs) and special reports (SPECI). Cloud heights are reported above ground level (agl) in the following section.

- 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.

2.1 Wilmington, Delaware

The accident helicopter was on approach into New Castle Airport (KILG), Wilmington, Delaware, when the accident occurred. The airport lists an elevation of 80 ft, and a magnetic variation of 12° W based on the latest sectional chart for the area, and had a federally installed and maintained Automated Surface Observation System (ASOS), which was augmented by NWS certified observers and/or tower controllers. The accident site was located about 1 mile south of the airport center point. The following conditions were reported surrounding the time of accident:

KILG weather observation at 1151 EDT, wind from 050° at 7 knots, visibility 2 ½ miles in mist, ceiling[4] overcast at 500 ft agl, temperature and dew point 16° C, altimeter 29.53 inches of mercury (Hg). Remarks; automated observation system with a precipitation discriminator, rain began at 1100 and ended at 1130 EDT, sea level pressure 999.8-hPa, hourly precipitation 0.01 inches, temperature 16.1° C, dew point 15.6° C.

KILG special weather observation at 1159 EDT, wind from 060° at 8 knots, visibility 2 ½ miles in mist, ceiling overcast at 400 ft agl, temperature and dew point 16° C, altimeter 29.53 inches of Hg.

The raw observations and general flight categories surrounding the period reported IFR to LIFR due to ceilings between 400 to 500 ft agl, and visibility 2 ½ miles in mist. The raw observations were as follows:

IFR SPECI KILG 251210Z 08011G18KT 2 1/2SM -RA BR BKN008 OVC019 13/13 A2957 RMK AO2 P0002 T01280128

IFR SPECI KILG 251220Z 08009KT 5SM -RA BR OVC008 13/13 A2957 RMK AO2 P0002 T01280128

IFR SPECI KILG 251235Z 07012G17KT 1 3/4SM -RA BR OVC007 13/13 A2956 RMK AO2 P0002 T01330128

IFR METAR KILG 251251Z 07010KT 3/4SM R01/3000VP6000FT +RA BR OVC008 13/13 A2956 RMK AO2 SLP009 P0019 T01280128

IFR SPECI KILG 251259Z 08010KT 1SM R01/3500V5500FT +RA BR SCT006 OVC012 13/13 A2956 RMK AO2 P0008 T01330128

MVFR SPECI KILG 251321Z 07010KT 3SM -RA BR FEW007 BKN012 OVC019 13/13 A2956 RMK AO2 P0017 T01330128

IFR SPECI KILG 251330Z 07010KT 2 1/2SM RA BR BKN008 OVC013 13/13 A2955 RMK AO2 P0018 T01330133

IFR SPECI KILG 251344Z 07011KT 4SM -RA BR BKN007 OVC013 14/13 A2954 RMK AO2 CIG 005V010 P0019 T01390133

IFR METAR KILG 251351Z 07011KT 4SM -RA BR OVC007 14/13 A2954 RMK AO2 SLP002 P0019 T01390133

[4] A ceiling is defined as the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration.

IFR SPECI KILG 251426Z 07009KT 2 1/2SM -RA BR OVC005 14/14 A2953 RMK AO2 P0000 T01390139

IFR SPECI KILG 251436Z 07013KT 4SM -RA BR OVC005 14/14 A2952 RMK AO2 P0000 T01440139

IFR METAR KILG 251451Z 07008KT 5SM BR OVC005 14/14 A2953 RMK AO2 RAE38 SLP000 P0000 60038 T01440144 56010

IFR SPECI KILG 251506Z 08008KT 2 1/2SM -RA BR OVC005 15/14 A2953 RMK AO2 RAB00 P0000 T01500144

IFR METAR KILG 251551Z 05007KT 2 1/2SM BR OVC005 16/16 A2953 RMK AO2 RAB00E30 SLP998 P0001 T01610156

Accident 1553Z

LIFR SPECI KILG 251559Z 06008KT 2 1/2SM BR OVC004 16/16 A2953 RMK AO2 T01610156

LIFR SPECI KILG 251607Z VRB06KT 3SM BR OVC004 16/16 A2953 RMK AO2 T01610156

LIFR METAR KILG 251651Z 05009KT 9SM OVC004 17/17 A2952 RMK AO2 SLP995 T01720167

2.2 Atlantic City, New Jersey

The accident helicopter departed from Atlantic City International Airport (KACY), Atlantic City, New Jersey, at about 1117 EDT. The airport lists an elevation of 75 ft and a similar 10° W magnetic variation. The airport had an ASOS and reported the following conditions at the time of departure:

KACY special weather observation at 1114 EDT, wind from 100° at 7 knots, tower visibility 2 miles in mist, ceiling overcast at 300 ft agl, temperature 17° C, dew point 16° C, altimeter 29.55 inches of Hg. Remarks: automated observation system with a precipitation discriminator, surface visibility 6 miles, temperature 16.7° C, dew point 15.6° C.

The raw observations and general flight categories surrounding the period reported LIFR conditions with ceilings between 300 to 400 ft agl, and visibility from 1 ¾ to 3 miles in mist. The raw reports were as follows:

LIFR METAR KACY 251258Z 07011KT 1 3/4SM RA BR OVC004 14/13 A2958 RMK AO2 PRESFR P0001 T01440128

LIFR SPECI KACY 251312Z 10007KT 2SM RA BR OVC004 14/13 A2959 RMK AO2 VIS 1 1/4V5 P0006 T01440133

LIFR SPECI KACY 251337Z 07008KT 1 3/4SM RA BR OVC004 14/13 A2957 RMK AO2 RAE22B28 P0008 T01440133

LIFR SPECI KACY 251343Z 07010KT 3SM -RA BR OVC004 15/13 A2957 RMK AO2 RAE22B28 P0008 T01500133

LIFR METAR KACY 251354Z 08010KT 9SM OVC004 15/14 A2956 RMK AO2 RAE22B28E52 SLP010 P0008 T01500139

LIFR SPCI KACY 251401Z 09010KT 1 3/4SM RA BR OVC004 15/14 A2956 RMK AO2 TWR VIS 2 RAB1355 P0002 T01500139

LIFR SPECI KACY 251420Z 10008KT 3SM -RA BR BKN004 OVC010 16/14 A2956 RMK AO2 RAB1355 P0010 T01560144

LIFR SPECI KACY 251444Z 09011KT 9SM OVC004 16/15 A2955 RMK AO2 RAB1355E27 P0010 T01560150

LIFR SPECI KACY 251514Z 10007KT 2SM BR OVC003 17/16 A2955 RMK AO2 SFC VIS 6 T01670156=

Departed 1517Z
Accident 1553Z

LIFR METAR KACY 251554Z 12007KT 2SM BR OVC003 18/17 A2954 RMK AO2 SFC VIS 4 SLP002 T01780167=

LIFR SPECI KACY 251631Z 15008KT 1 1/4SM BR OVC003 18/17 A2953 RMK AO2 TWR VIS 2 T01830172=

LIFR METAR KACY 251654Z 18006KT 1 1/2SM BR OVC003 19/18 A2952 RMK AO2 TWR VIS 2 SLP997 T01890178=

LIFR SPECI KACY 251731Z 16006KT 5SM BR OVC004 20/18 A2952 RMK AO2 T02000178=

3.0 Sounding

A combination of numerical model and aircraft derived sounding data were used to document the vertical structure of the atmosphere in the vicinity of the accident site.

3.1 Numerical Model Sounding

A High Resolution Rapid Refresh (HRRR) numerical model was obtained from archive data from the NOAA Air Resource Laboratory database for the approximate location of the accident at 1200 EDT (1600Z) and is included as figure 5. The model sounding was plotted on a standard Skew-T log P diagram[5] from the surface to 500-hPa or 18,000 ft utilizing RAOB software[6]. The sounding predicted a surface temperature of 15.0° C, a dewpoint temperature of 13.9° C, with a relative humidity of 93%. The sounding expected a relative humidity greater than 90% from the surface to 4,500 ft, and indicated saturated conditions at the surface in fog with stratiform to nimbostratus type clouds with tops to that level. The precipitable water content was 0.98 inches. The model sounding indicated a convective condensation level (CCL)[7] at 22 ft agl, with the lifted

[5] 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.

[6] RAOB software – The complete Rawinsonde Observation program is an interactive sounding analysis program developed by Environmental Research Services, Matamopras, Pennsylvania.

[7] Convective Condensation Level (CCL) - The height to which a parcel of air, if heated sufficiently from below, will

condensation level (LCL)[8] at 460 ft agl, and the level of free convection (LFC)[9] immediately above it at 500 ft agl, indicating the base of the clouds. A frontal inversion was noted immediately above the surface to 2,200 ft with another inversion at about 5,500 ft, where temperature increased with height and produced a stable layer. Dry air was indicated above 5,500 ft with the temperature and dew points spreads of more than 10° C. The freezing level or 0° C isotherm was identified 12,220 ft and no icing conditions were indicated. The fog point or formation temperature for fog was 13.7° C, with the Fog Stability Index (FSI) of 37.2 which indicated a moderate risk of radiation type fog, while the fog threat index of 3.2 indicated a low threat of radiation type fog.

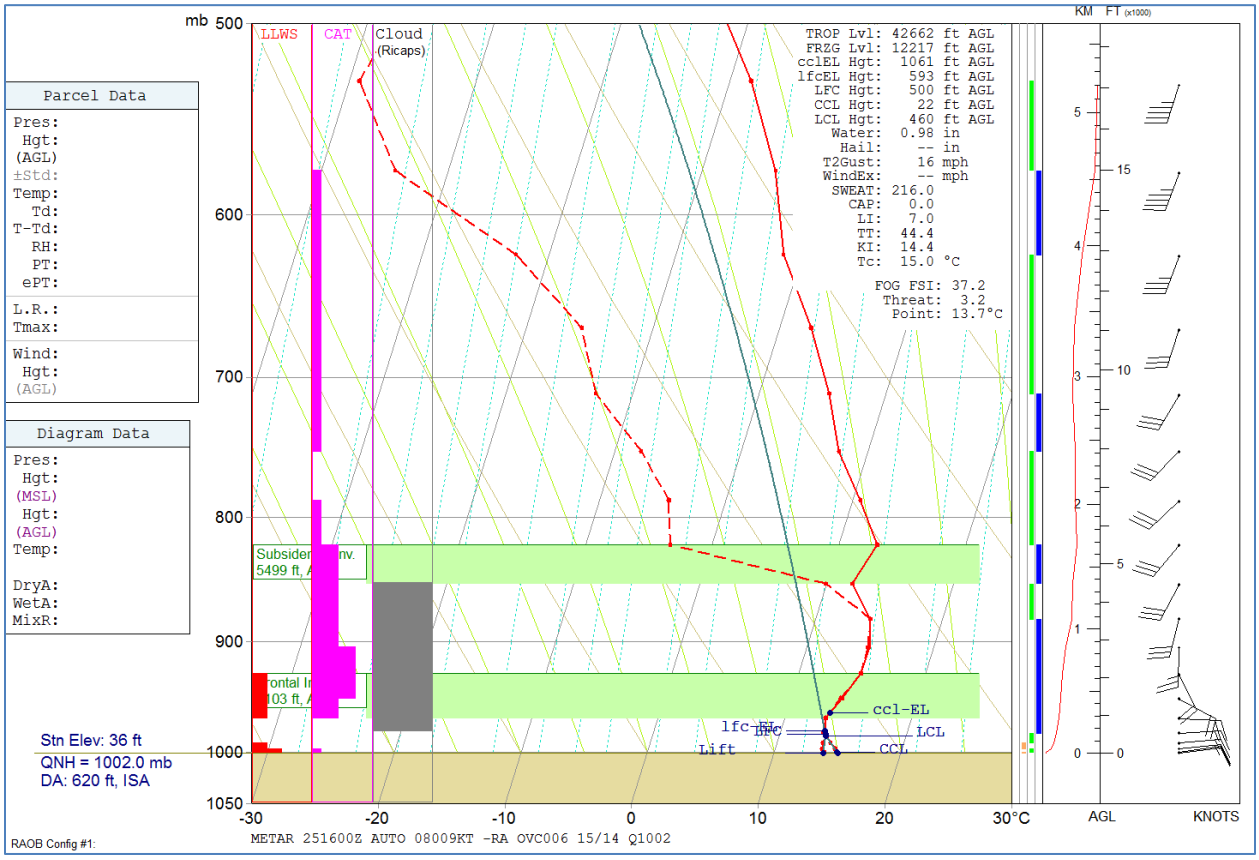

Figure 5 - HRRR numerical model sounding at 1200 EDT

The model sounding wind profile indicated easterly winds below the frontal inversion, with winds veering to the south and southwest abruptly above the inversion with increasing wind speeds. The change in wind direction and speed with height near the frontal inversion resulted in the RAOB software indicated a greater than 90% probability of moderate and greater turbulence and wind shear between the layer from 970 ft through 4,500 ft, with the most severe potential of

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.

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

[9] 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.

turbulence between 1,400 and 2,140 ft. The turbulence potential is indicated on the left hand side of the diagram in purple, and the wind shear in red. The gray area is the expected cloud layer between 570 ft agl with tops near 4,500 ft. The accident helicopter's cruising altitude was at 4,000 ft over the route, and was at about 1,600 ft on the ILS approach when it was lost off radar on approach into KILG.

A table of the derived height, pressure (Pres), temperature (T), dew point (Td), relative humidity (RH), wind direction and speed, clear air turbulence (CAT), low-level wind shear (LLWS), and icing potential based on the HRRR model data is included below in figure 6.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
36	1001	15.0	13.9	93	82 / 9			
64	1000	14.9	13.9	94	82 / 9	LGT	MODRT	
148	997	14.7	13.7	94	84 / 13		LIGHT	
316	991	14.2	13.6	96	84 / 15			
569	982	13.5	13.4	99	87 / 17			
967	968	13.2	13.2	100	93 / 19	MDT	LIGHT	
1487	950	14.0	13.9	99	120 / 20	SVR	LIGHT	
2139	928	14.9	14.9	100	155 / 21	SVR		
2839	905	14.9	14.8	99	181 / 24	MDT		
3587	881	14.3	14.3	100	193 / 28	MDT		
4514	852	12.0	9.9	87	206 / 29	MDT		
5535	821	13.0	-3.3	32	217 / 32	LGT		
6696	787	10.6	-4.5	34	225 / 31			
7969	751	7.7	-7.9	32	222 / 31	LGT		
9443	711	5.5	-12.9	25	209 / 29	LGT		
11106	668	2.5	-15.6	25	196 / 30	LGT		
12941	623	-1.5	-22.6	18	199 / 36	LGT		
15024	575	-4.2	-34.2	8	199 / 45			
17103	530				197 / 47			
17211	528	-8.3	-39.2	6				

Figure 6 – HRRR numerical model parameters at 1200 EDT

3.2 Aircraft Meteorological Data and Relay Observations

A review of the Aircraft Meteorological Data and Relay (AMDAR) or in situ reports from special instrumented aircraft operating over the region and available to the NWS during the period were also documented. Several aircraft operated into the Philadelphia International Airport (KPHL) located about 20 miles northeast of the accident site provided real time observations of the structure of the atmosphere and observed winds immediately surrounding the time of the accident.

An ascent sounding from aircraft identified as #278 that departed from KPHL at 1020 EDT or approximately 1 ½ hours prior to the accident is included as figure 7. The sounding depicted a temperature inversion to isothermal layer, where temperature remained constant with height between 1,800 through 5,000 ft. The wind profile indicated surface wind from the east at 9 knots with winds veering clockwise from the east to the south through the inversion and then to the southwest above 5,000 ft, with increasing wind speeds with height. A low-level wind maximum was identified at the top of the first inversion at 3,290 ft with a wind from 190° at 39 knots.

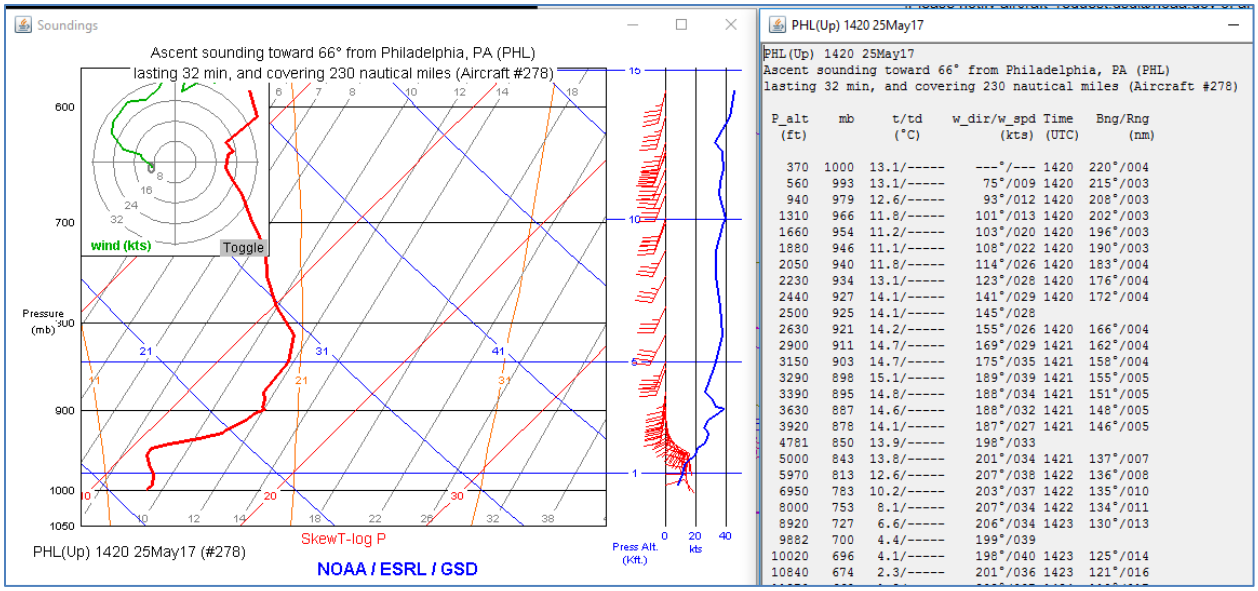

Figure 7 – AMDAR aircraft #278 ascent sounding from KPHL at 1020 EDT

Another aircraft identified as #9841 provided a descent sounding into PHL landing at 1046 EDT, and is included as figure 8. The aircraft also depicted the temperature inversion to isothermal layer between 1,150 ft through 4,900 ft. The aircraft also had a moisture sensor and reported a saturated environment from 4,000 ft to the surface with a relative humidity greater than 97%. The wind profile also indicated easterly winds near the surface and veering to the south at 3,000 ft at 31 knots.

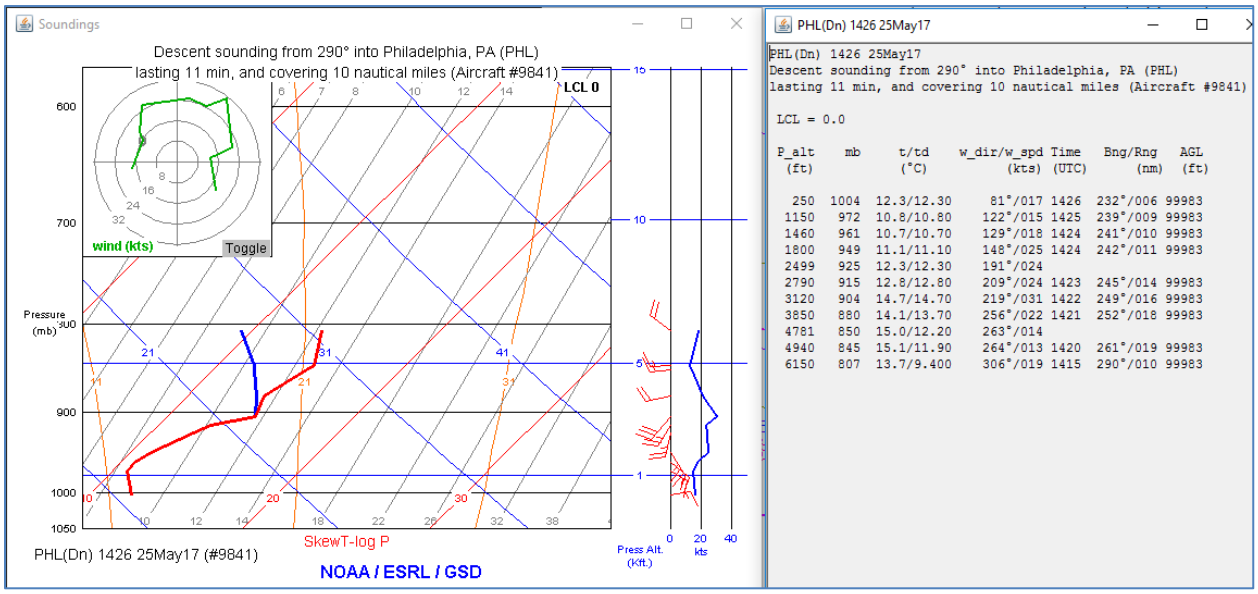

Figure 8 – AMDAR aircraft #9841 descent sounding from KPHL at 1026 EDT

An additional instrumented aircraft #9361 departed from KPHL at 1054 EDT or about an hour prior to the accident, and is included as figure 9. The sounding continued to depict an inversion to isothermal layer to 5,000 ft, with the wind profile showing easterly winds veering to the

southwest with height. A low-level wind maximum was identified at 2,800 ft from 150° at 31 knots.

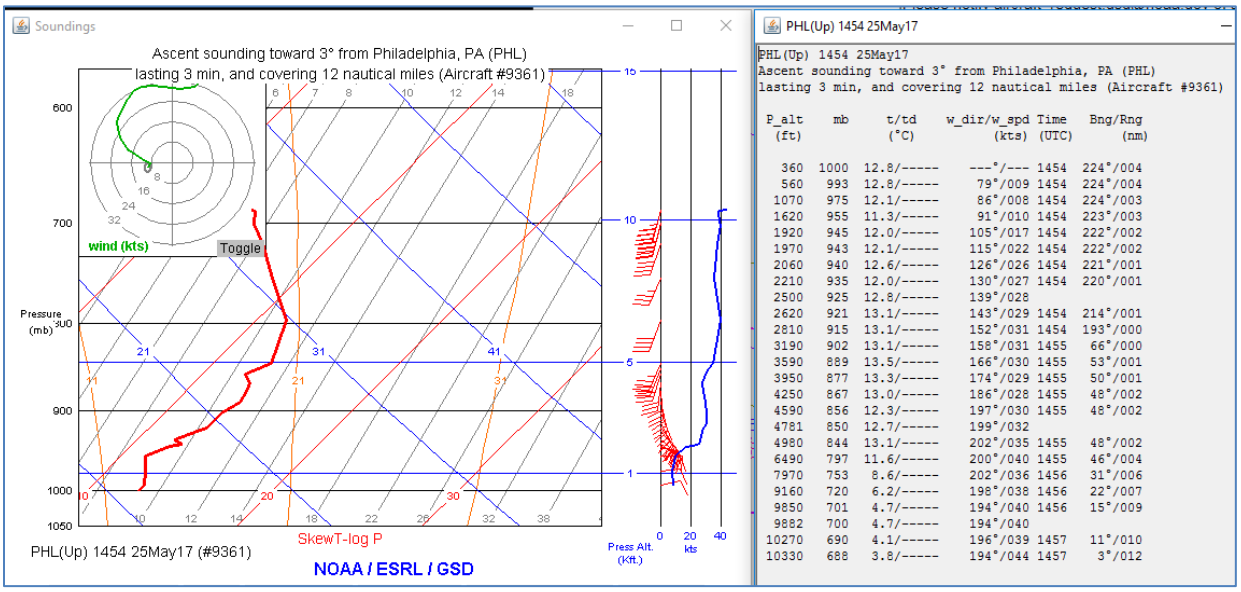

Figure 9 - AMDAR aircraft #9361 ascent sounding from KPHL at 1054 EDT

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 13 (GOES-13) 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. Both the infrared long wave and visible band imagery were obtained surrounding the time of the accident. The infrared long wave imagery (band 4) at a wavelength of 10.7 microns (µm) provided standard satellite image with radiative cloud top temperatures with a resolution of 4 km. The visible imagery (band 1) at a wavelength of 0.65 µm provided a resolution of 1 km.

The GOES-13 infrared image at 1200 EDT at 2X magnification with the frontal boundaries at 1100 EDT overlaid is included as figure 10. The satellite image depicted an extensive area of clouds associated with the low pressure system and the occluded front with multiple layers of clouds over the area north of the frontal boundary. The image depicted stratiform to nimbostratus type clouds over the accident site, with a thin layer of altostratus type clouds above. The radiative cloud top temperature over the accident site was 276° Kelvin or 2.84° C, which corresponded to tops near 11,000 feet based on the HRRR model sounding.

Figures 11 and 12 are the GOES-13 visible images at 1145 EDT and 1200 EDT respectively at 2X magnification. The images depict low stratiform type clouds over the accident site or over KILG with clearing conditions in the mid to higher clouds to the south over southern Delaware and southeast Maryland. Some low-level circulation features were noted in the clouds over the Chesapeake associated with the low pressure center.

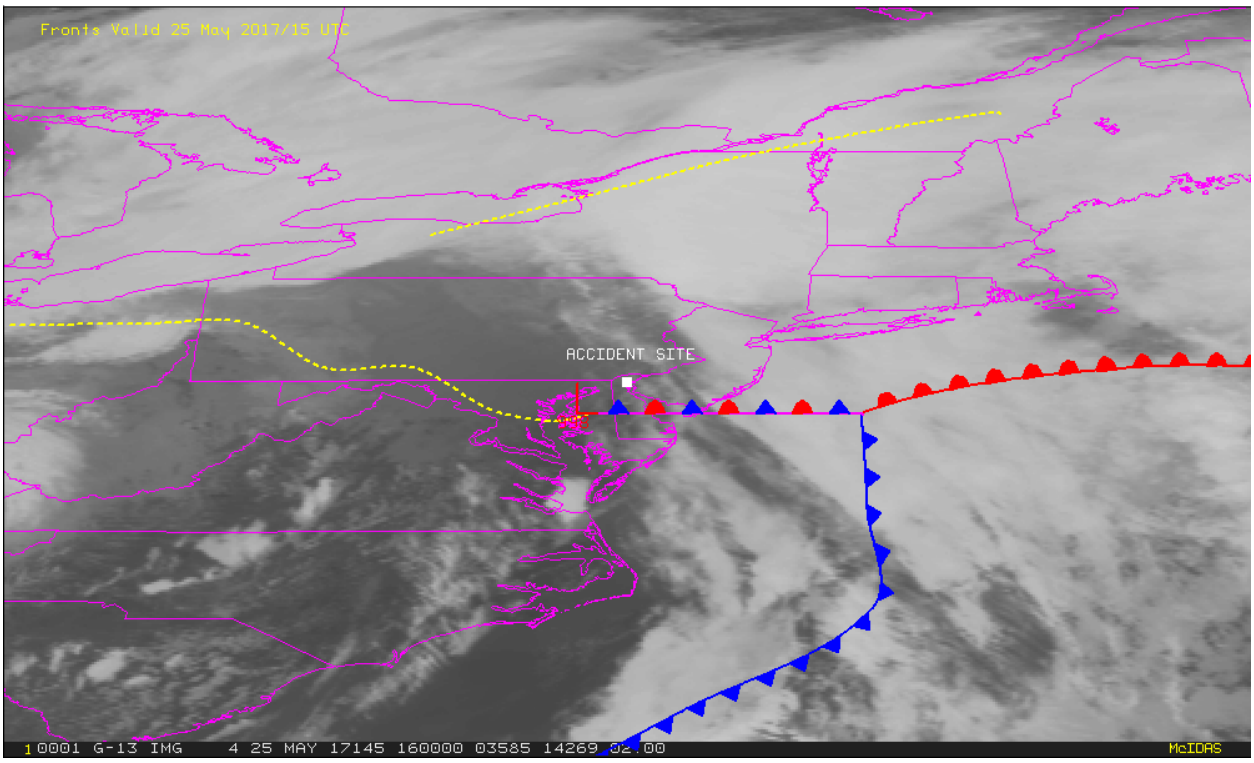

Figure 10 - GOES-13 infrared image at 1200 EDT with fronts overlaid

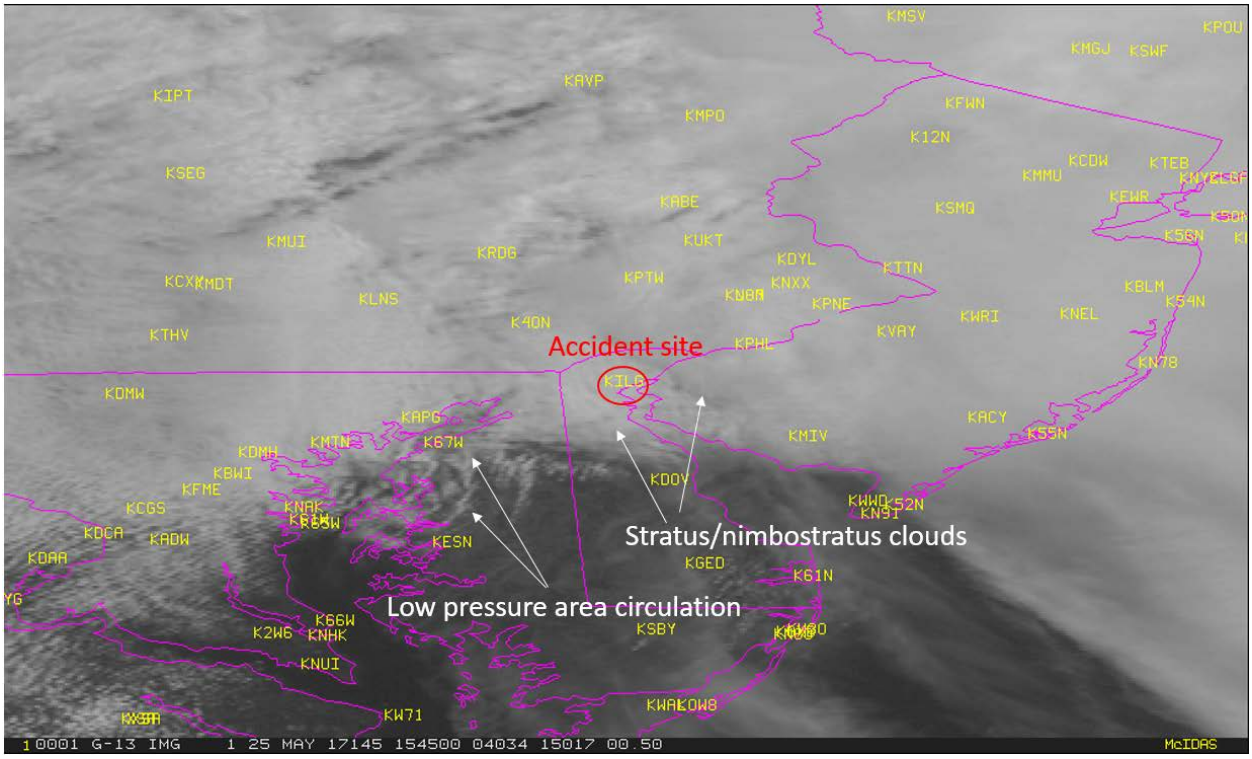

Figure 11 - GOES-13 visible image at 1145 EDT

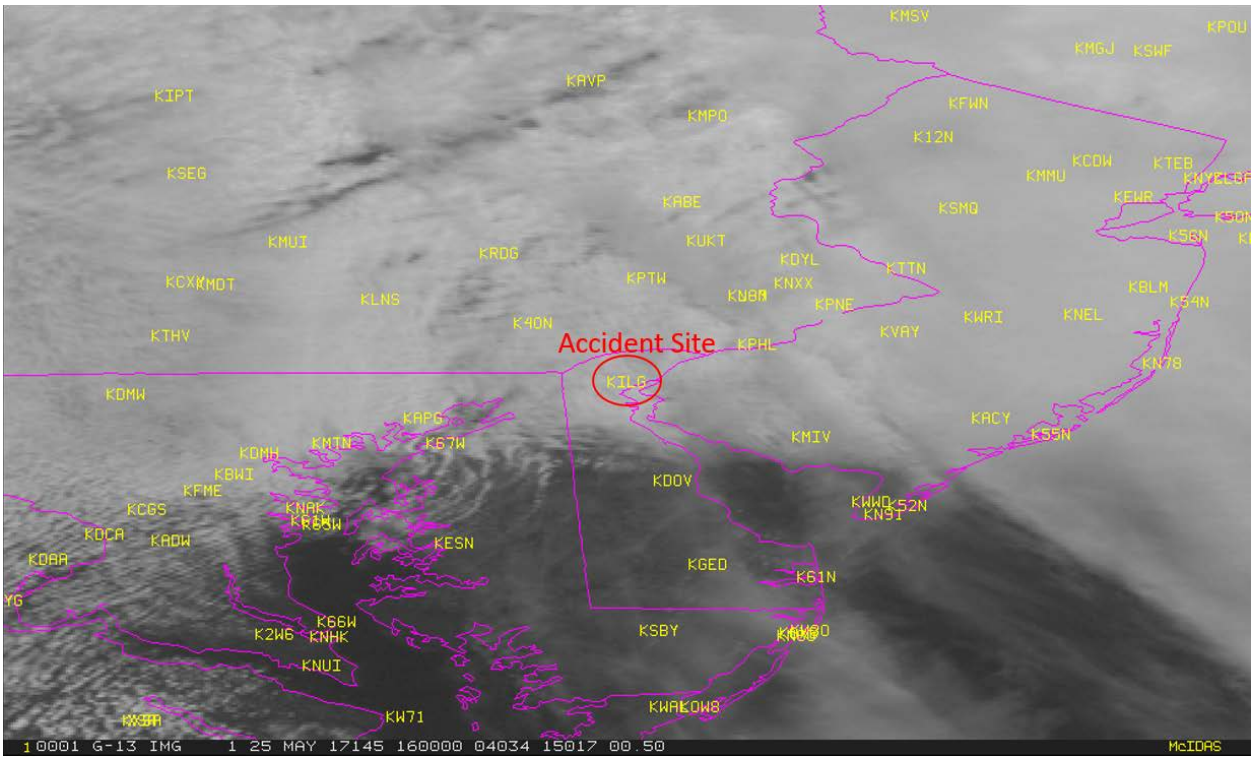

Figure 12 - GOES-13 visible image at 1200 EDT

5.0 Pilot Reports

The following pilot reports or PIREPs were recorded with 100 miles of the accident site between 0600 and 1400 EDT. The reports have been transcribed from standard code and abbreviations, with time converted from UTC to local EDT. While there were several reports of moderate to severe turbulence and icing at higher altitudes over the region, only the reports below 18,000 ft have been included below. The reports were as follows:

Philadelphia International Airport (PHL), Philadelphia, PA, routine pilot report (UA); Over – 2 miles east of PHL; Time – 0630 EDT; Altitude – 600 ft; Type aircraft – Canadair Bombardier Regional Jet (CRJ7); Sky cover – overcast clouds; Remarks – bases at 600 ft.

Baltimore/Washington International Thurgood Marshall Airport (BWI), Baltimore, MD, routine pilot report (UA); Over – 5 miles west or 280° radial from Baltimore (BAL) VORTAC[10]; Time – 0635 EDT; Altitude – 600 ft; Type aircraft – Boeing 767 heavy air carrier jet; Remarks – bases at 600 ft with overcast clouds.

New Castle Airport (KILG), Wilmington, DE routine pilot report (UA); Over – KILG; Time – 0645 EDT; Altitude – 800 ft; Type aircraft – Flacon 50 corporate jet (FA50); Sky cover – broken sky cover; Remarks – spotty at 800 ft.

BWI routine pilot report (UA); Over – unknown; Time – 0700 EDT; Flight level – 40,000 ft; Type aircraft – Boeing 737 air carrier jet; Remarks – cloud tops at 7,500 ft reported by Airbus A320.

[10] VORTAC – is a navigation aid consisting of a co-located VHF omnidirectional range (VOR) beacon and a distance measuring equipment (DME), which provides azimuth and range information. Unless otherwise noted the station name is collocated with the city.

Harrisburg International Airport (MDT), Harrisburg, PA routine pilot report (UA); Over – 1 mile from departure from MDT; Time – 0710 EDT; Altitude – 1,000 ft; Type aircraft – Airbus A320 air carrier jet; Sky cover – bases reported at 1,000 ft.

Lancaster Airport (LNS), Lancaster, PA, routine pilot report (UA); Over – 5 miles west or 260° radial from Lancaster VORTAC (LRP); Time – 0740 EDT; Altitude – 16,000 ft; Type aircraft – Beechcraft 1900 multiengine turbine airplane (B190); Temperature – minus 3° C; Icing – light mixed icing between 12,500 through 16,000 ft.

BWI routine pilot report (UA); Over – 1 mile west of runway 10 at BWI; Time – 0752 EDT; Altitude 300 ft; Type aircraft – Boeing 737 air carrier jet; Sky cover – broken clouds; Remarks – heavy rain.

BWI routine pilot report; Over – BWI; Time – 0814 EDT; Altitude – 4,000 ft; Type aircraft – Cessna Caravan single engine turbine airplane (C208); Sky cover – bases at 500 ft.

BWI routine pilot report; Over – Baltimore VORTAC (BAL); Time- 0911 EDT; Altitude – 8,500 ft; Type aircraft – Boeing 737 air carrier jet; Sky cover – tops broken clouds at 4,500 ft; Turbulence – smooth conditions; Remarks – clear above.

Easton/Newman Field Airport (KESN), Easton, MD, routine pilot report (UA); Over – KESN; Time – 0942 EDT; Altitude 700 ft; Type aircraft – Embraer Phenom 100 corporate jet (E50); Sky cover – broken clouds with bases at 700 ft; Weather – flight visibility 7 miles; Remarks – during climb.

BWI routine pilot report (UA); Over – 9 miles south-southeast or 150° azimuth from BWI; Time – 1011 EDT; Altitude – 6,000 ft; Type aircraft – Boeing 737 air carrier jet; Turbulence – light chop.

Northeast Philadelphia Airport (KPNE) routine pilot report (UA); Over – 1 mile southwest of PNE; Time – 1032 EDT; Altitude – 700 ft; Type aircraft – Piper Navajo multiengine airplane (PA31); Sky cover – overcast clouds with bases at 700 ft.

KPNE routine pilot report (UA); Over 1 miles southwest of PNE; Time – 1052 EDT; Altitude – 600 ft; Type aircraft – Beechcraft Super King Air multiengine turboprop aircraft (BE20); Sky cover – overcast clouds with bases at 600 ft. Remarks – on RNAV runway 6 approach.

Accident 1153 EDT

MDT routine pilot report (UA); Over – 1 mile departure from runway 13; Time – 1205 EDT; Altitude – 400 ft; Type aircraft – Canadair Bombardier Regional Jet (CRJ) air carrier jet; Sky cover – broken clouds with bases at 700 ft, overcast at 1,200 ft; Remarks – bases reported 400 ft.

BWI routine pilot report (UA); Over – 4 miles south-southwest or 200° azimuth from BWI; Time – 1210 EDT; Altitude – 3,500 ft; Type aircraft – Airbus A319 air carrier jet; Weather – clear at 3,500 ft; Turbulence – smooth conditions; Remarks – tops of clouds at 2,000 ft and clear above.

PNE routine pilot report (UA); Over – 1 mile northeast or 060° azimuth from PNE; Time – 1232 EDT; Altitude – 500 ft; Type aircraft – Cirrus SR22 single engine airplane; Sky cover – overcast clouds with bases at 500 ft; Weather – flight visibility 1 mile.

ACY routine pilot report (UA); Over – on final approach into ACY; Time – 1251 EDT; Altitude – unknown; Type aircraft – Cessna 182 single engine airplane; Sky cover – overcast clouds with bases at 200 ft; Remarks – bases ragged at 250 ft.

Reading Regional Airport Carl A. Spaatz Field (RDG), Reading, PA, routine pilot report (UA); Over – 4 miles northwest or 315° azimuth from RDG; Time -1328 EDT; Altitude – 1,300 ft; Type aircraft – Lear Jet 60 corporate jet; Sky cover – overcast clouds with bases at 1,400 ft and tops at 5,000 ft.

RDG routine pilot report (UA); Over – 4 miles east of RDG or 090° azimuth; Time – 1235 EDT; Altitude – 2,500 ft; Type aircraft – Falcon 2000 corporate jet (F2TH); Sky cover – overcast with bases at 1,200 ft.

Lehigh Valley International Airport (ABE), Allentown, PA, routine pilot report (UA); Over – 4 miles west or 270° radial from East Texas (ETX) VORTAC; Time – 1340 EDT; Altitude – 4,500 ft; Type aircraft – Piper Cherokee single engine airplane (P32R); Sky cover – in instrument meteorological conditions (IMC).

BWI routine pilot report (UA); Over - 5 miles east or 100° radial from BAL; Time – 1356 EDT; Altitude – 5,000 ft; Type aircraft – Canadair Bombardier Regional Jet (CRJ2); Sky cover – bases at 1,900 feet broken with tops at 4,800 ft.

6.0 Terminal Forecast

The Terminal Aerodrome Forecast issued by the NWS Philadelphia/Mt. Holly (KPHI), New Jersey, Weather Forecast Office (WFO) issued the following forecasts for KILG and KACY at 0732 EDT. Cloud heights are reported in agl and were as follows:

TAF KILG 251132Z 2512/2612 08012G20KT 4SM -SHRA BR OVC008
FM251400 09010KT P6SM OVC012
FM251800 15008KT P6SM BKN035
PROB30 2522/2602 TSRA OVC025CB
FM260200 VRB06KT 5SM BR OVC080
FM260600 27008KT P6SM BKN050=

TAF KACY 251132Z 2512/2612 07012KT 5SM -SHRA BR OVC006
FM251400 09010KT P6SM -SHRA OVC012
FM251600 09010KT P6SM BKN015
FM251900 13008KT P6SM BKN045
PROB30 2522/2602 TSRA OVC025CB
FM260400 23008KT P6SM BKN060
FM260800 27012KT P6SM BKN060=

The forecast for KILG at 0800 EDT expected wind from 080° at 12 knots gusting to 20 knots, visibility 4 miles in light rain showers and mist, ceiling overcast at 800 ft, with conditions expected to improve by 1000 EDT with wind from 090° at 10 knots, visibility better than 6 miles, with a ceiling overcast at 1,200 ft. With VFR conditions at 1400 EDT, with visibility better than 6 miles and ceiling broken at 3,500 ft. A 30% probability of thunderstorms was expected between 1800 and 2200 EDT. There was no mention of low-level wind shear in the forecast.

The forecast for KACY expected wind from 070° at 12 knots, visibility 5 miles in light rain showers and mist, with ceiling overcast at 600 feet. At 1000 EDT, wind from 090° at 10 knots, visibility better than 6 miles in light rain, ceiling overcast at 1,200 ft. After 1500 EDT VFR conditions were expected with visibility unrestricted and ceiling broken at 4,500 ft. With the same 30% probability of thunderstorms expected between 1800 and 2200 EDT.

The KACY forecast was amended at 1010 EDT, and expected the wind from 090°at 10 knots, visibility 2 miles in light rain, with ceiling overcast at 400 ft agl. After 1130 EDT, the visibility was expected to improve to 5 miles in mist, ceiling overcast at 800 ft agl. At 1300 EDT, visibility unrestricted with ceiling broken at 1,500 ft. After 1500 EDT, visibility unrestricted with a ceiling broken at 4,500 ft. Between 1900 and 2300 a 30% probability of thunderstorms continued to be

expected with ceiling overcast at 2,500 ft in cumulonimbus clouds (CB). The amended forecast in raw form was follows:

AMD TAF KACY 251410Z 2514/2612 09010KT 2SM -SHRA OVC004
FM251530 09010KT 5SM BR OVC008
FM251700 09010KT P6SM BKN015
FM251900 13008KT P6SM BKN045
PROB30 2523/2603 TSRA OVC025CB
FM260400 23008KT P6SM BKN060
FM260800 27012KT P6SM BKN060=

According to NWS Instruction 10-813 "Terminal Aerodrome Forecasts" which is the standard guidance on issuing and amended forecasts, any change in flight category typically requires an amendment. In addition, if LLWS is expected or reported with shears of 30 knots within 2,000 ft of the surface, or if pilot reports of plus/minus 20 knots were received, wind shear should be included in the forecast.

7.0 Area Forecast Discussion

The NWS KPHI forecast discussion regarding the conditions forecast over the regions issued at 0614 EDT was as follows:

FXUS61 KPHI 251014
AFDPHI

Area Forecast Discussion
National Weather Service Mount Holly NJ
614 AM EDT Thu May 25 2017

.SYNOPSIS...
Low pressure will move from the Ohio Valley to the eastern Great Lakes region today. Meanwhile, a warm front will lift northward into parts of our region today into tonight while new low pressure develops along it. This low pressure system then strengthens as it tracks away from our area tonight and Friday. Weak high pressure may briefly build in for Saturday, then low pressure and its associated fronts move through later Sunday. A secondary cold front moves through during Tuesday.

.NEAR TERM /UNTIL 6 PM THIS EVENING/...
A pair of mid level lows were located over the Ohio and Tennessee River Valleys early this morning. The feature will progress eastward with the two centers reaching western Pennsylvania and Virginia early this evening.

There were two surface lows early this morning, as well. One was located in western Ohio and the other in southwestern Virginia. A warm front extended eastward from the Virginia low. The two low pressure systems are forecast to merge into a broad surface low over Pennsylvania and Maryland early this evening. The warm front is anticipated to lift slow northward into north-eastern Maryland, Delaware, extreme southeastern Pennsylvania and southern New Jersey today.

The initial band of rain associated with the warm advection will continue to lift northward through our region this morning. The back edge of the steady rain was into the far upper Delmarva and southern New Jersey around 6:00 AM. It is expected to work its way from south to

north through the remainder of our forecast area before 9:00 AM. Rainfall totals in the steady precipitation should range from about a third to three quarters of an inch.

A mostly cloudy sky and showers are anticipated for the balance of the day to the north of the warm front. As the front reaches our southern counties there should be some substantial breaks in the cloud cover as those location get into the warm sector.

We will continue to mention a chance of thunderstorms for this afternoon. Locations in the warm sector will become unstable with mixed layer CAPE values rising into the 600 to 1000 J/Kg range. The approach of the mid level low and some elevated instability will spread the potential for thunder to the north of the warm front. The Storm Prediction Center has southeastern Pennsylvania, southern New Jersey, Delaware and northeastern Maryland under a marginal risk for severe weather for today.

Today's temperature forecast is one of low confidence. The actual temperatures will depend upon where the warm front settles and how much clearing takes place over our southern counties. Generally, highs should range from around 60 in the Poconos to near 80 in southern Delaware.

The wind is forecast to remain from the east to the north of the warm front. It should veer to the southeast and south once the front passes. Speeds are expected to favor the 8 to 12 MPH range with some gusts of 15 to 20 MPH possible.

.SHORT TERM /6 PM THIS EVENING THROUGH 6 AM FRIDAY/...
The mid level low is forecast to pass over our region tonight, reaching southern New England toward daybreak on Friday. The surface low will likely follow a similar pattern.

We are expecting a mostly cloudy sky and showers for tonight. Thunderstorms may linger into the evening. The wind is anticipated to become light and variable tonight in much of eastern Pennsylvania and northern and central New Jersey before settling into the west around 5 to 10 MPH. A southwest wind around 10 MPH is anticipated to shift to the west on the upper Delmarva and in southern New Jersey.

Low temperatures are expected to favor the 50s for tonight.

.LONG TERM /FRIDAY THROUGH WEDNESDAY/...
Summary...Unsettled at times, however warmer temperatures are expected.

Synoptic Setup...A significant closed low is forecast to shift up into New England Friday then move out Friday night into Saturday. Some brief weak ridging should slide into the east Saturday, however the next trough amplifies from the Midwest and Great Lakes later Saturday and Sunday. This trough looks to close off and be slow to shift eastward through Wednesday, sending a slow moving low pressure system well to our north while a series of cold fronts cross our area. Timing and therefore the details are a bit less certain given an amplified pattern with the idea of a closed low involved. We used a model/continuity blend for Friday through Saturday night, then blended in the 00z WPC Guidance thereafter. Some adjustments were then made following additional collaboration with our neighboring offices.

For Friday...Strengthening low pressure moves away during Friday, and therefore after some possible low clouds and a shower to start improving conditions are expected. However, cyclonic flow combined with another short wave and a surface trough reflection should result in some showers. The northern areas have a higher chance for some showers than farther south, but overall coverage looks to be isolated to scattered. A west-northwest wind will increase and become gusty for a time as the pressure gradient tightens and cooling occurs aloft allowing for better mixing. The winds diminish at night along with any showers dissipating early, and lingering clouds should thin out.

For Saturday and Sunday...The flow turns generally more zonal with a weak but brief ridge in the east by later Saturday. The model guidance overall shows a short wave within this flow although the timing is a little uncertain, however this may ultimately track just to our south where a frontal zone will be located. A closed low centered north of the Great Lakes is forecast to amplify south and eastward gradually by late in the weekend. This will drive a cold front eastward and across our area later Sunday, however the model guidance overall suggests low pressure develops along a triple point as the main surface low to our west and north occludes. This may end up enhancing the showers and some thunder during Sunday, especially during the afternoon and evening. Backing up some, Saturday may end up being dry as enough ridging is in place, and short wave energy runs to our west and southwest. We will carry some more clouds Saturday but keep it basically dry, and therefore Saturday lookslike the better of the two weekend days. The flow looks to turn more southeasterly in the lower levels Sunday, and therefore while still mild it will turn cooler along the coast.

For Monday and Tuesday...A closed low is forecast to expand across the Great Lakes, Midwest to the Ohio Valley and gradually into the Northeast. This will drive surface low pressure eastward mainly north of the Great Lakes. An initial surface low should be moving away from the Mid Atlantic coast early Monday as a frontal zone sits offshore. The main cold front is forecast to move across our area Tuesday and shift offshore Tuesday night. The second half of Tuesday may be convectively active as a cold front arrives, however this will depend on short wave timing and potential convective development to our west. The timing overall is less certain given the scope of the closed low to our north-northwest and plenty of short wave energy revolving around it. Kept chance PoPs for Monday then slight chance to chance PoPs on Tuesday. We are anticipating warmer temperatures ahead of the cold front.

For Wednesday...As the center of the closed low gradually shifts across eastern Canada, the overall trough becomes more established across the Northeast and into the Mid Atlantic. The main surface low is forecast to be east of James Bay Canada with its trailing cold front east of our coast to start Wednesday. A cyclonic flow will be in place and a surface trough should be sliding across the Great Lakes region. While less likely at this time, a few showers still cannot be ruled out given the synoptic setup. For now, kept some slight chance PoPs across the northern and western areas. Given the core of the closed low well to our north, keeping the colder air aloft there, daytime temperatures look to be on the warmer side.

.AVIATION /10Z THURSDAY THROUGH MONDAY/...
The following discussion is for KPHL, KPNE, KTTN, KABE, KRDG, KILG, KMIV, KACY and surrounding areas.

Deteriorating conditions are expected for early this morning in rain. IFR conditions are likely to prevail. The main band of rain should lift to the north of our TAF sites this morning. However, conditions should improve only into the low end of the MVFR category with showers. KMIV and KACY could improve to VFR but it is a low confidence forecast. There is a chance of thunderstorms for this afternoon and evening.

Conditions are forecast to remain in the MVFR and perhaps the IFR range for tonight with additional showers. An improvement to VFR is possible at KACY, KMIV, KILG and perhaps at KPHL and KPNE.

An east wind around 8 to 12 knots this morning is expected to veer toward the southeast and south at KACY, KMIV, KILG, KPHL and KPNE as the day progresses. The wind may become light and variable for a time tonight before settling into the west at 5 to 10 knots.

OUTLOOK...
Friday...Possible MVFR/IFR ceilings early, otherwise improving to VFR. Isolated to scattered showers should develop during the day before dissipating in the evening. West-northwest winds increase with gusts up to 25 knots, then diminishing in the evening.

Saturday...VFR overall. Light northwest winds turning southerly toward evening. Clouds increase at night and possibly lower.

Sunday...MVFR/IFR conditions possible with showers and some possible thunderstorms, especially in the afternoon and evening.

Monday...Sub-VFR conditions possible at times with a chance of showers and afternoon/evening thunderstorms.

.MARINE...
A warm front is expected to lift slowly over the waters of Delaware and New Jersey today. Low pressure from the west and southwest should pass across the waters tonight.

Wave heights on our ocean waters are expected to remain in the 4 to 7 foot range for today and tonight. As a result, the Small Craft Advisory will stay in effect. The wind is anticipated to work its way gradually around from the east to the south to the west during the period. Speeds should favor the 10 to 20 knot range with some gusts around 25 knots on our ocean waters.

RIP CURRENTS...
The flow is expected to veer from the east to the south today along the coasts of Delaware and New Jersey with wind speeds mainly in the 10 to 20 knot range. As a result, we will keep the moderate risk for the development of dangerous rip currents.

The wind flow is forecast to become westerly for Friday. As a result, the rip current risk is anticipated to transition to low at that time.

OUTLOOK...
Friday...Small Craft Advisory extended through 22z for the ocean zones as elevated seas gradually subside with an offshore flow. Some wind gusts may reach 25 knots during the day especially nearshore, however confidence is not high enough to issue an advisory for Delaware Bay.

Saturday through Monday...Conditions are forecast to be below advisory criteria, however winds may gust to around 20 knots at times especially on Sunday.

.TIDES/COASTAL FLOODING...
The astronomical tides with the new moon are particularly high with the evening high tide cycle. Positive tidal departures near 1 foot are anticipated again for today. As a result, we may see some spotty minor coastal flooding this morning with more widespread coastal flooding expected with this evening's high tide. We will continue the Coastal Flood Advisory for this evening in the coastal counties of New Jersey and Delaware, as well as for the counties along Delaware Bay and Raritan Bay.

.PHI WATCHES/WARNINGS/ADVISORIES...
PA...None.
NJ...Coastal Flood Advisory from 7 PM this evening to 1 AM EDT Friday for NJZ012>014-020>027.
DE...Coastal Flood Advisory from 7 PM this evening to 1 AM EDT Friday for DEZ002>004.
MD...None.
MARINE...Small Craft Advisory until 6 PM EDT Friday for ANZ450>455.

Synopsis...Gorse
Near Term...Iovino
Short Term...Iovino

Long Term...Gorse
Aviation...Gorse/Iovino
Marine...Gorse/Iovino
Tides/Coastal Flooding...Iovino

The AFD indicated that there were no advisories current for fog or mist, or any other hazards over the region during the period.

8.0 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 AWC located in Kansas City, Missouri, issues the FA at regular intervals and issues specials reports as necessary usually in the form of an AIRMET. The forecasts current at the time of the accident was issued at 0445 EDT and was valid through 1700 EDT, and was as follows:

FAUS41 KKCI 250845
FA1W
-BOSC FA 250845
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 260300
CLDS/WX VALID UNTIL 252100...OTLK VALID 252100-260300
ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS
.
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...09Z OCFNT FM LOW PRES NW OH-LOW PRES NW VA. CDFNT NW VA-SCNTRL VA-SE NC-OMN-SRQ. WRMFNT NW VA-SBY-CSTL WTRS. HI PRES RDG NB-SRN ME-SE NY. 03Z LOW PRES ECNTRL PA. OCFNT TO ACK. CDFNT ACK-180S ACK. WRMFNT ACK EWD THRU CSTL WTRS. TROF ECNTRL PA-NERN OH. TROF ECNTRL PA-ERN VA-ERN NC-ERN SC.
.
NY LO NJ
WRN NY/WRN LO...BKN030 OVC070 TOP FL250. SCT -SHRA. 12Z VIS 3-5SM -RA. 16Z OVC020. VIS 3SM RA. OTLK...MVFR CIG SHRA.
NCNTRL NY/ERN LO...BKN100 LYRD FL250. 13Z OVC070. OCNL -RA. 15Z OVC045. OCNL -RA. 18Z OVC025. VIS 3-5SM RA. OTLK...MVFR CIG RA.
SCNTRL NY...SCT035 BKN080 TOP FL180. 13Z OVC060 TOP FL250. OCNL -RA. 15Z OVC040. VIS 3-5SM -RA BR. OTLK...MVFR CIG 03Z IFR CIG RA BR.
NERN NY...SKC. 13Z SCT080 BKN120 TOP FL200. 14Z OVC080. SCT -SHRA. 16Z OVC060 TOP FL250. VIS 3-5SM -RA BR. OTLK...MVFR CIG SHRA WND.
ECNTRL NY...BKN CI. 12Z OVC080 TOP FL200. WDLY SCT -SHRA. 15Z OVC050. OCNL -RA. OTLK...IFR CIG RA BR.
SE NY...SCT025 BKN040 OVC100 TOP FL250. ISOL -SHRA. 14Z OVC010-020. OCNL -RA. OTLK...MVFR CIG DZ BR.
LONG ISLAND-NRN NJ...BKN010-020 OVC080 TOP FL250. VIS 3-5SM -RA BR. OTLK...IFR CIG SHRA BR.

SRN NJ...OVC010 TOP FL250. VIS 3-5SM -RA BR. 19Z BKN035. WDLY SCT -SHRA/-TSRA. CB TOP FL350. OTLK...VFR SHRA TSRA.

.
PA
WRN...OVC020-025 TOP FL250. OCNL VIS 3-5SM -RA BR. 17Z OVC030-035. SCT -SHRA. OTLK...MVFR CIG SHRA 03Z IFR CIG SHRA.
CNTRL...OVC030-040 TOP FL250. OCNL VIS 3-5SM -RA BR. 20Z BKN050. OTLK...VFR SHRA 03Z MVFR CIG SHRA.
NERN...OVC020 TOP FL250. TIL 19Z VIS 3-5SM -RA BR. OTLK...MVFR CIG SHRA TSRA BR.
SE...OVC010-015 TOP FL250. VIS 3-5SM -RA BR. OTLK...IFR CIG RA TSRA BR 01Z MVFR SHRA BR.
.
WV MD DC DE VA
ERN WV PNHDL/MD PNHDL/NW VA...CIG OVC010-020 TOP FL250. VIS 3-5SM -RA BR. OTLK...MVFR CIG SHRA 01Z VFR.
RMNDR NRN WV...BKN080 TOP FL250. SCT -SHRA. 12Z BKN035-040. SCT -SHRA. 19Z BKN050-060. WDLY SCT -SHRA. OTLK...VFR SHRA.
SRN WV/FAR SW VA...BKN050 OVC070 TOP 100. 15Z BKN060 TOP 120. 18Z WDLY SCT -TSRA. CB TOP FL320. OTLK...VFR TSRA 01Z IFR CIG.
RMNDR MD/DC/DE/NERN VA...OVC010 TOP FL250. VIS 3-5SM -RA BR. 18Z SCT015 BKN040. SCT -SHRA. OTLK...MVFR CIG SHRA 02Z VFR.
RMNDR SW VA...CIG BKN010-020 OVC080 TOP FL250. OCNL VIS 3-5SM -RA BR. 14Z BKN080 TOP 150. 16Z BKN070. WDLY SCT -SHRA. OTLK...MVFR CIG.
SE VA...OVC010-020 TOP FL250. VIS 3-5SM -RA BR. ISOL EMBD -TSRA. CB TOP FL350. 15Z BKN040 TOP 160. 18Z BKN060. WDLY SCT -SHRA. OTLK...VFR.
.

The forecast for southern New Jersey, expected general overcast clouds at 1,000 ft with tops to 25,000 ft, with visibility 3 to 5 miles in light rain and mist through 1500 EDT, then lifting to broken at 3,500 ft with widely scattered light rain showers and thunderstorms, with tops to 35,000 ft. The forecast for Delaware and northern Maryland also expected general overcast clouds at 1,000 ft with tops to 25,000 ft, with visibility 3 to 5 miles in light rain and mist. After 1400 EDT scattered clouds at 1,500 ft, and broken clouds at 4,000 ft were expected with scattered light rain showers. The forecast was amended by AIRMET Sierra current at the time.

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 Air Route Traffic Control Center's (ARTCCs).

There are four basic types of inflight aviation weather advisories: the Significant Meteorological Advisory (SIGMET), the Convective SIGMET, the Airmen's Meteorological Information (AIRMET), and the Center Weather Advisory (CWA). These advisories use the same location identifiers (either VORs, airports, or well−known geographic areas) to describe the hazardous weather areas. The Severe Weather Watch Bulletins (WWs), with the associated Alert Messages (AWW) supplements these advisories.

The primary advisories current at the time of the accident were a series of AIRMET Sierra and Tango update 3, which were issued at 1045 EDT for a wide area of IFR conditions, moderate

turbulence, and low-level wind shear (LLWS), which was expected to continue through 1700 EDT. AIRMET Sierra update 3 and AIRMET Tango were as follows (Graphic-AIRMETs are included as figures 13 and 14 respectively). AIRMET Zulu also issued during the period is included as figure 15, which did not expect any icing conditions over the route of flight.

WAUS41 KKCI 251445
BOSS WA 251445
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 252100
AIRMET IFR...ME NH VT MA RI CT NY NJ PA WV MD DC DE VA AND CSTL WTRS
FROM 50SW YSJ TO 170ESE ACK TO 80ESE CYN TO 30NE ORF TO 20SW LYH
TO 40NE EKN TO 20SSW SYR TO 50E SYR TO 30WNW CON TO 50WSW BGR TO 50SW YSJ
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
OTLK VALID 2100-

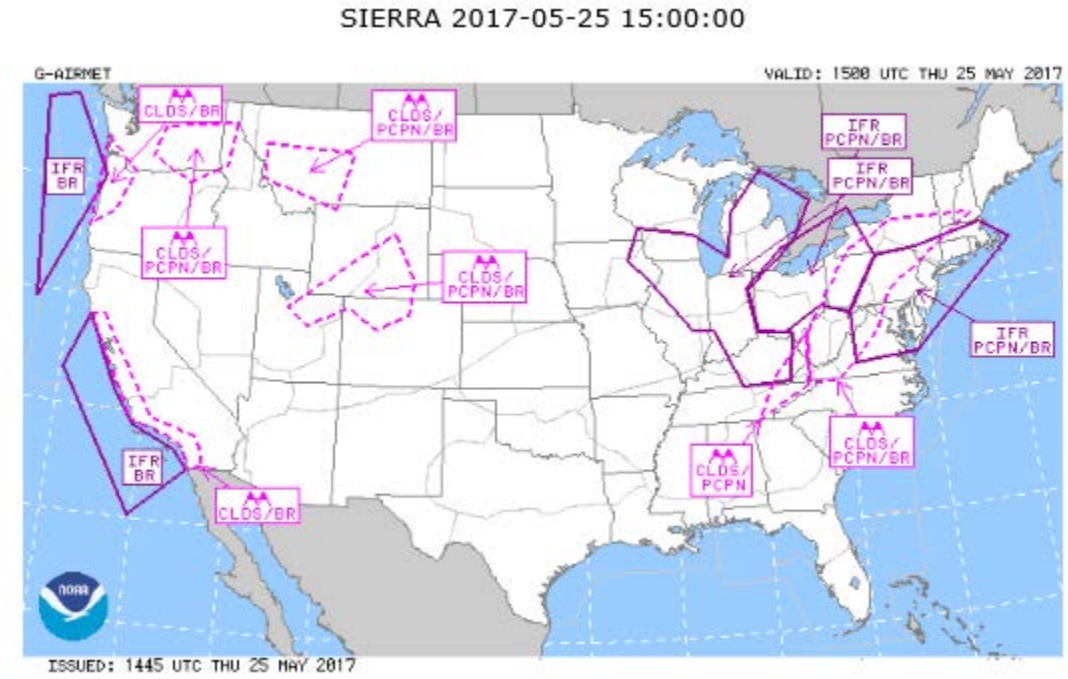

Figure 13 - AIRMET Sierra valid for 1100 EDT for IFR conditions

WAUS41 KKCI 251445
WA1T
-BOST WA 251445
AIRMET TANGO UPDT 3 FOR TURB STG WNDS AND LLWS VALID UNTIL 252100
.
...SEE SIGMET OSCAR SERIES...
.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA
NC SC GA FL AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO
130SSE ILM TO 180E PBI TO 70ENE PBI TO 100ESE PBI TO 50SW RSW TO 40E PZD
TO BKW TO 30NNW ERI TO 20NE YOW TO YSC TO 70NW PQI
MOD TURB BTN FL180 AND FL430. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA LE MD DE VA AND CSTL WTRS

FROM 50E YQB TO 40WSW YSJ TO 200SE ACK TO 160SE SIE TO 20NE ECG TO 40NNE RDU TO 30NNE RIC TO 20WNW HAR TO 20SSW YYZ TO 20WSW YOW TO YSC TO 50E YQB
MOD TURB BLW 150. CONDS CONTG BYD 21Z THRU 03Z.

.

AIRMET TURB...OH WV VA NC SC GA
FROM 50WSW ROD TO 50SW AIR TO 20NE EKN TO 30NNE RIC TO 40NNE RDU TO 30NW FLO TO GQO TO HMV TO HNN TO CVG TO 50WSW ROD
MOD TURB BLW 100. CONDS DVLPG 15-18Z. CONDS CONTG BYD 21Z THRU 03Z.

.

AIRMET TURB...OH LE WV VA NC SC GA FL AND CSTL WTRS
FROM 30SE ECK TO 30NNW ERI TO BKW TO 40E PZD TO 50SW RSW TO 100ESE PBI TO 150SE MIA TO 100WSW EYW TO 90WSW PIE TO 40W CEW TO 50SW PZD TO GQO TO HMV TO HNN TO CVG TO FWA TO 30SE ECK
MOD TURB BTN FL240 AND FL400. CONDS CONTG BYD 21Z THRU 03Z.

.

AIRMET STG SFC WNDS...ME NH MA CSTL WTRS
FROM 70SSE BGR TO 110SE BGR TO 140ENE ACK TO 50ESE BOS TO 20ESE ENE TO 70SSE BGR
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS DVLPG 15-18Z. CONDS CONTG BYD 21Z THRU 03Z.

.

LLWS POTENTIAL...ME NH VT MA RI CT NY LO NJ PA DE AND CSTL WTRS
BOUNDED BY 50ESE MSS-60SW BGR-30E BOS-30ENE ACK-60SSW HTO-40SSE CYN-40SSE PSB-20NE BUF-20NNW SYR-60SSW YOW-50ESE MSS
LLWS EXP. CONDS CONTG BYD 21Z THRU 03Z.

.

OTLK VALID 2100-0300Z
AREA 1...TURB NY LO PA OH LE WV MD VA NC SC GA FL AND CSTL WTRS
BOUNDED BY 70NW SYR-20NNE CSN-30WSW RIC-60W ECG-170SE ECG-130SSE ILM-190ENE PBI-40ESE CRG-50SE MCN-GQO-HMV-HNN-CVG-FWA-30SE ECK-70NW SYR
MOD TURB BTN FL240 AND FL400. CONDS CONTG THRU 03Z.

.

AREA 2...STG SFC WNDS ME NH MA CSTL WTRS
BOUNDED BY 70SSW YSJ-150ENE ACK-40SE BOS-20S ENE-50ENE ENE-40SSE BGR-70SSW YSJ
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG THRU 03Z.

.

AREA 3...STG SFC WNDS NJ MD DE VA NC SC CSTL WTRS
BOUNDED BY 160SSE ACK-220S ACK-160SE SIE-190ESE ECG-130SSE ILM-80E CHS-40ESE ILM-70ESE ECG-90ESE SBY-130ESE SIE-160SSE ACK
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG THRU 03Z.

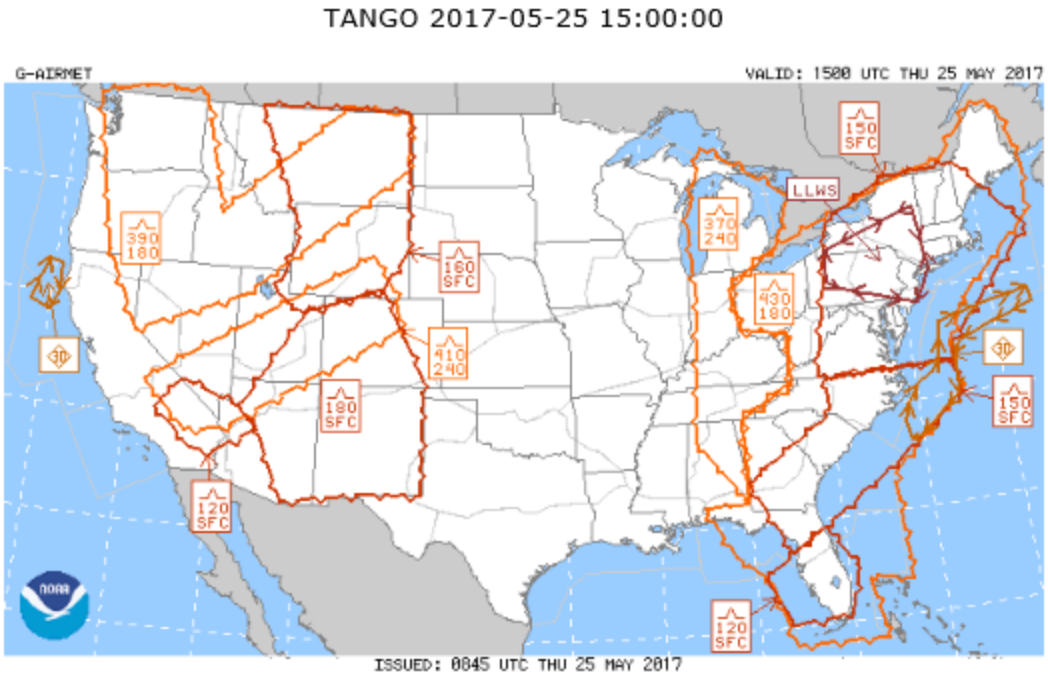

Figure 14 - AIRMET Tango for turbulence and LLWS valid for 1100 EDT

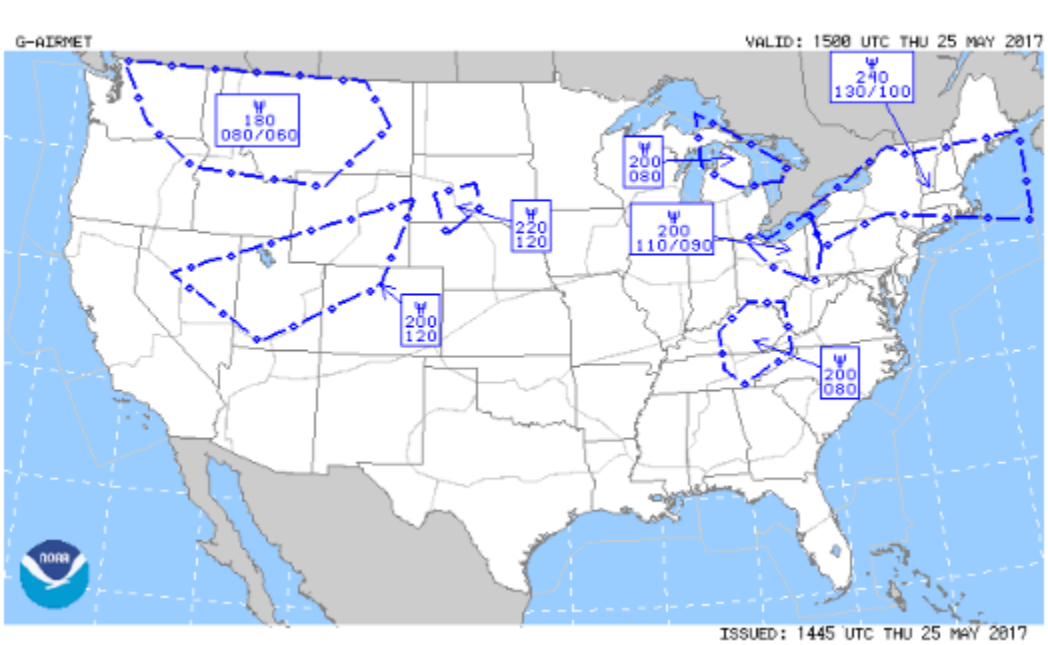

Figure 15 - AIRMET Zulu valid for at 1100 EDT

There were no Convective SIGMETs, or Center Weather Advisories current over the area surrounding the period. The NWS also had SIGMET Oscar current for higher altitudes and did not impact the helicopter. The advisory was as follows:

WSUS01 KKCI 251436
BOSO WS 251436

SIGMET OSCAR 1 VALID UNTIL 251836
VT MA CT NY NJ PA MD DE VA AND CSTL WTRS
FROM 30W SYR TO 30ENE ALB TO 80ESE SIE TO 40NE RIC TO 30W SYR
OCNL SEV TURBC BTN FL180 AND FL300. DUE TO WNDSHR ASSOCD JTSTRM.
RPTD BY LJ60 AND LJ70. CONDS CONTG BYD 1836Z.

10.0 Meteorological Impact Statement

The New York (KZNY) CWSU responsible for the airspace issued a Meteorological Impact Statement (MIS) regarding the weather conditions impacting the airspace at 0935 EDT and summarized the basic threat of IFR conditions, turbulence, and icing conditions. The advisory was as follows:

FAUS20 KZNY 251335
ZNY MIS 01 VALID 251330 – 252000
…FOR ATC PLANNING PURPOSES ONLY…
IFR COND IN RA/SHRA MOV THRU MUCH OF ZNY. MOD TURB IS PSBL BLW 150 AND ABV FL180.
…ISOLD SEV IS PSBL. LGT-MOD ICING IS PSBL FM 100-FL240 ESPECIALLY WITHIN PCPN.

11.0 Winds and Temperatures Aloft Forecast

The NWS Winds and Temperature Aloft Forecast current during the period provided the following forecasts for the route of flight:

WINDS ALOFT FORECASTS
DATA BASED ON 250600Z
VALID 251200Z FOR USE 0800-1500Z. TEMPS NEG ABV 24000
.

FT	*3000*	*6000*	*9000*	*12000*	*18000*	*24000*	*30000*	*34000*	*39000*
ACY	*1730*	*1935+12*	*2034+07*	*2034+02*	*2137-10*	*2035-21*	*197735*	*700244*	*711356*
JFK	*1316*	*1622+10*	*1629+04*	*2038+00*	*2245-10*	*2252-20*	*208334*	*219744*	*710455*

The forecast issued about 0800 EDT, based on the 0200 EDT data and valid for the period between 0400 and 1100 EDT expected the Atlantic City (ACY) winds at 3,000 ft to be from the south or 170° at 30 knots, with winds veering to the southwest through 18,000 ft. The maximum wind over ACY during the period was at 39,000 ft from 210° at 113 knots.

The next forecast based on the 0800 EDT upper air data and available at 1000 EDT and valid for the period at 1400 EDT, for use between 1000 to 1700 EDT was as follows:

WINDS ALOFT FORECASTS
DATA BASED ON 251200Z
VALID 251800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000
.

FT	*3000*	*6000*	*9000*	*12000*	*18000*	*24000*	*30000*	*34000*	*39000*
ACY	*2224*	*2323+12*	*2029+05*	*2138+02*	*2053-12*	*2065-26*	*690039*	*682145*	*692753*
JFK	*1720*	*2026+11*	*2025+06*	*1928+01*	*2047-11*	*2055-26*	*690736*	*682544*	*693555*

The wind for ACY at 3,000 ft was forecast to be from 220° at 24 knots with little change in direction from height with increasing wind speeds above 9,000 ft, with the maximum wind at 39,000 ft from 190° at 127 knots. The forecast for John F. Kennedy International Airport (JFK) in New York the next forecast location north of ACY expected a maximum wind at 39,000 ft from 190° at 135 knots.

12.0 Preflight Weather Briefing

The pilot submitted a flight request form to his company at 1043 EDT, which documented the weather products he reviewed prior to the flight departed and indicated he was aware of the reported and the forecasts weather conditions for the route prior to departure. The weather briefing was done through Foreflight at 1026 and at 1042 EDT and included all the required briefing products. The initial preflight briefing and risk assessment is included as Attachment 1.

The weather document reviewed included observations, forecast, and notice to airmen for the departure, destination, and selected enroute stations, and included pilot reports, the Area Forecast, and inflight weather advisories current during the period. No significant issues or missing data were identified with the briefing.

13.0 Helicopter Emergency Medical Services (HEMS) Weather Tool Images

The NWS AWC Helicopter Emergency Medical Services (HEMS) Weather Tool products for the period were documented immediately after the accident. These products provide enhanced high resolution products for short-distance and low-altitude flight weather conditions, which were specifically designed for the HEMS community. Figures 16 through 20 are the HEMS weather display of flight categories (i.e., VFR, MVFR, IFR, LIFR based on visibility and ceiling height) with the reporting stations over the area every 30-minutes between 1000 EDT through 1200 EDT.

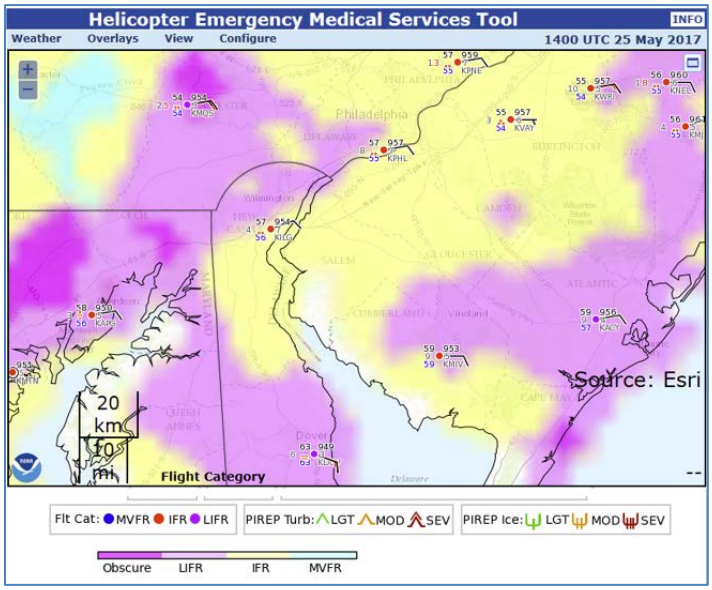

Figure 16 - HEMS Weather Tool image at 1000 EDT with legion

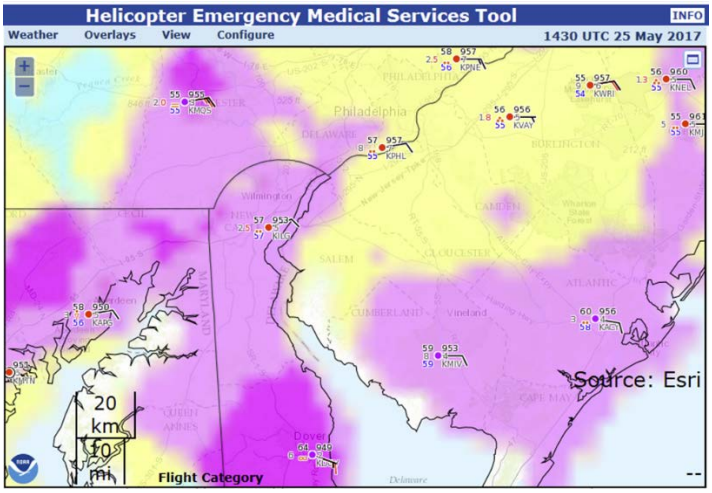

Figure 17 - HEMS Weather Tool image at 1030 EDT

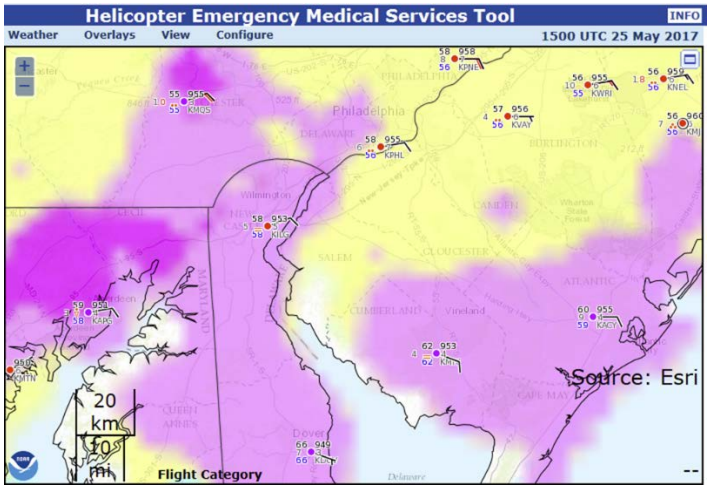

Figure 18 - HEMS Weather Tool image at 1100 EDT

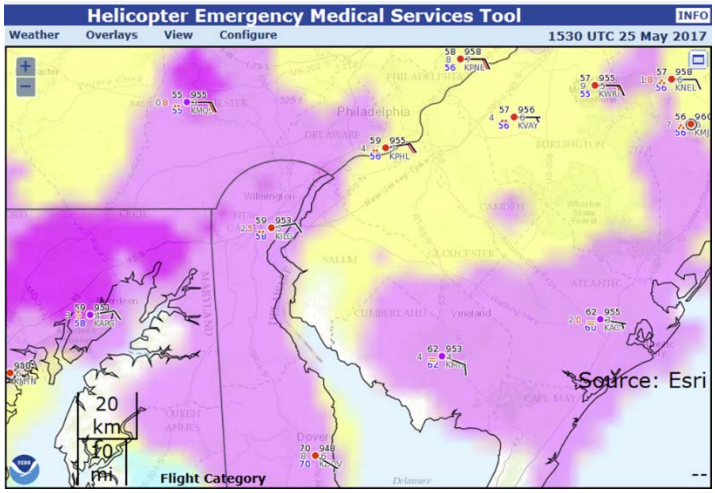

Figure 19 - HEMS Weather Tool image at 1130 EDT

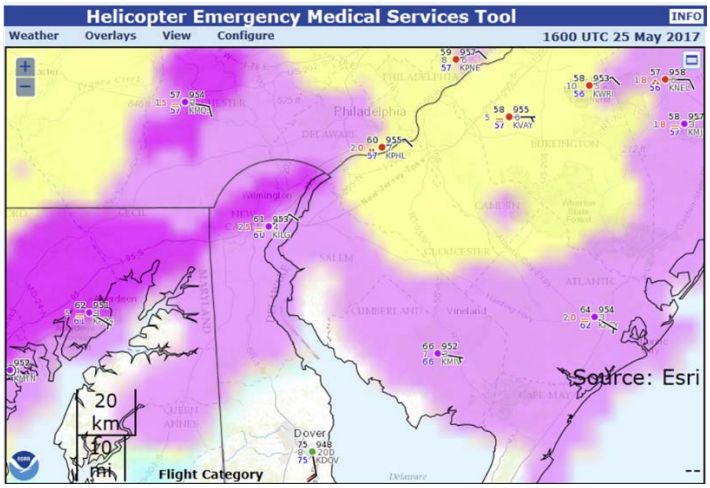

Figure 20- HEMS Weather Tool image at 1200 EDT

14.0 Astronomical Data

The United States Naval Observatory website was used to document the astronomical conditions for New Castle, New Castle County, Delaware on May 25, 2017.

Sun	
Beginning of civil twilight	0509 EDT
Sunrise	0540 EDT
Sunset	2019 EDT
End of civil twilight	2050 EDT

At the time of the accident the sun was 67° above the horizon at an azimuth of 138°.

F. LIST OF ATTACHMENTS

Attachment 1: Weather document and risk assessment form for the flight

Submitted by:

_____

Don Eick
Senior Meteorologist