NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 14, 2015

Group Chairman's Factual Report

METEOROLOGY

DCA15MA029

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A. ACCIDENT

Location: Gaithersburg, Maryland
Date: December 8, 2014
Time: About 1041 eastern standard time (1541 UTC[1])
Airplane: Embraer EMB-500 Phenom 100; registration N100EQ

B. METEOROLOGY GROUP

Donald E. Eick
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C. 20594-2000

C. SUMMARY

On December 8, 2014, at about 1041 Eastern Standard Time, an Embraer EMB-500 "Phenom" business jet, N100EQ, crashed and impacted trees and homes about 4,000 feet from Runway 14 at the Montgomery County Airpark (GAI) in Gaithersburg, Maryland. The airline transport rated pilot and both passengers on board were killed in the crash, as well as three persons on the ground. The flight departed from Horace Williams Airport Chapel Hill (IGX), North Carolina and was destined to the Montgomery County Airpark on an Instrument Flight Rules (IFR) flight plan. Marginal visual meteorological conditions prevailed at the time of the accident. The flight was operated as a Part 91 corporate flight.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was launched and arrived on scene on the afternoon of December 8, 2014 and began the investigation at the scene of the accident site, and at the planned destination airport. The remainder of the meteorology phase of the investigation will be conducted from the NTSB office in Washington D.C., collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center and the National Climatic Data Center (NCDC).

All times are eastern standard time (EST) based upon the 24 hour clock, local time +5 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. NWS airport and station identifiers use standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus International Air Transport

[1] UTC – is an abbreviation for Coordinated Universal Time.

Association (IATA) 3-letter identifiers which deletes the initial country code designator "K" for U.S. airports. Both codes are both used intermittently in this report.

The coordinates of the main accident site was located at latitude 39.1801° N and longitude 77.1803° W at an elevation of approximately 474 feet.

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 College Park, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular "Aviation Weather Services", AC 00-45G.

1.1 Surface Analysis Chart

A section of the NWS Surface Analysis Chart for 1000 EST (1500Z) on December 8, 2014 centered over the mid-Atlantic region is in included as figure 1 with the approximate location of the accident site indicated by a red star. The chart depicted a cold-core high pressure system at 1046-hectopascals (hPa)[2] over Maine with a high pressure ridge extending southward over the region. To the west-southwest of the accident site an east-to-west oriented stationary front was depicted over southern Indiana and into Kentucky. Off the North Carolina coast to the southeast of the accident site, a low pressure system at 1011-hPa with an associated occluded frontal system was beginning to be the dominant weather system, which was moving westward towards the coast and expected to influence the area with precipitation during the evening and into the day on December 9, 2014. A col or neutral area in the pressure and wind field was identified over southwestern Virginia and western North Carolina.

The station models on the chart depicted winds from the north-northeast over the region at less than 10 knots, overcast skies, with temperatures in the 30's degrees Fahrenheit (F). Light snow showers were depicted to the west-northwest over the Atlantic City, New Jersey. Further southwest over the Chapel Hill, North Carolina area northerly wind, overcast clouds, and temperatures in the 30's were also indicated.

[2] Hectopascal (hPa) is the new standard reference for sea level pressure and replaces the older term millibars (mb), with the same units.

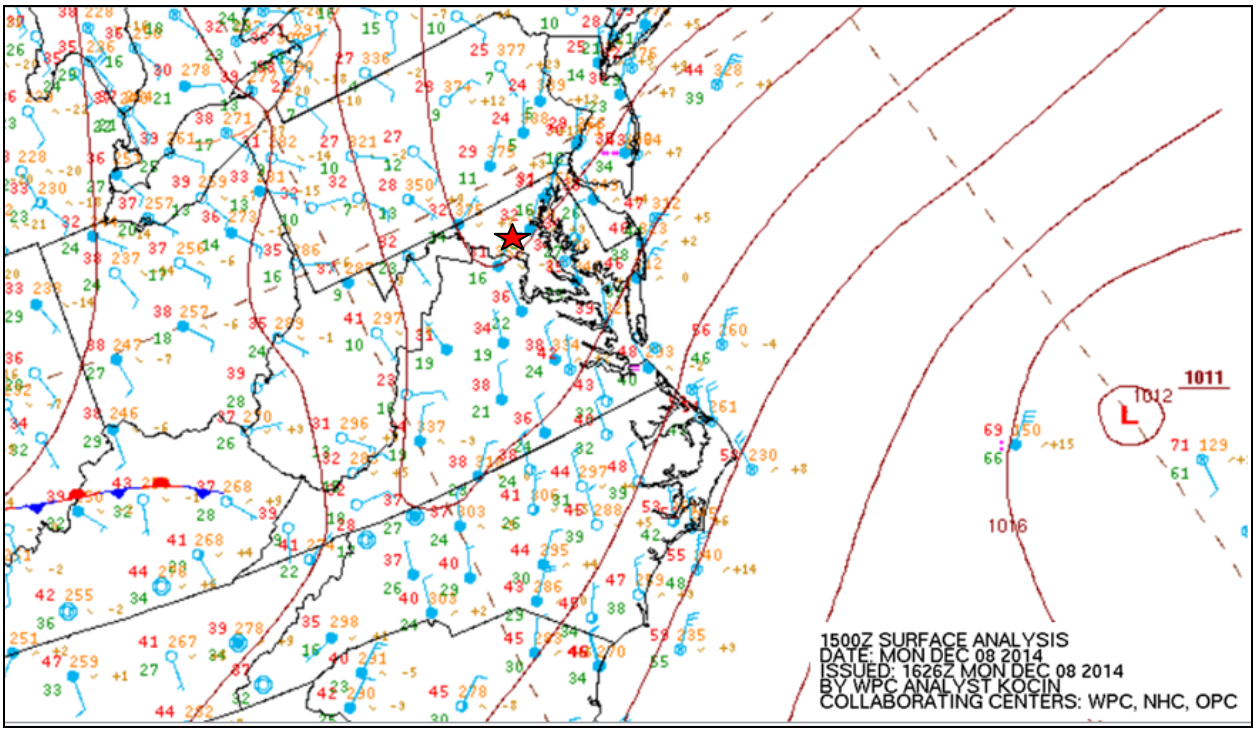


Figure 1 - NWS Surface Analysis for 1000 EST

1.2 Weather Depiction Chart

The eastern section of the NWS Weather Depiction Chart for 1100 EST (1600Z) is included as figure 2. The chart depicted an area of instrument flight rule (IFR) conditions[3] by a shaded contour line over extreme southern New Jersey and Delaware east of the accident site, with another small area over southern Virginia. The area was enclosed by a larger area of marginal visual flight rule (MVFR) conditions[4] indicated by an unshaded contour extended from New England southward through Pennsylvania, Maryland, and eastern Virginia, bordering the accident site with a break over western Maryland and Virginia and the Carolinas to the south. A second area of MVFR conditions was depicted over Virginia, southwestward into North Carolina, and western South Carolina, most all of Georgia and Florida. Visual flight rule (VFR) conditions[5] were depicted without any contour and were reported in the Washington, DC area immediately south.

[3] IFR conditions – are defined as a ceiling or lowest layer of clouds reported as broken, overcast, or the vertical visibility into a surface based obscuration of less than 1,000 feet agl, and/or visibility less than 3 statute miles.

[4] MVFR conditions – are defined as a ceiling greater than 1,000 feet agl to 3,000 feet, and/or visibility between 3 and 5 statute miles. MVFR is a subset of VFR.

[5] VFR conditions – are defined as no ceiling or a ceiling greater than 3,000 feet agl and visibility greater than 5 miles.

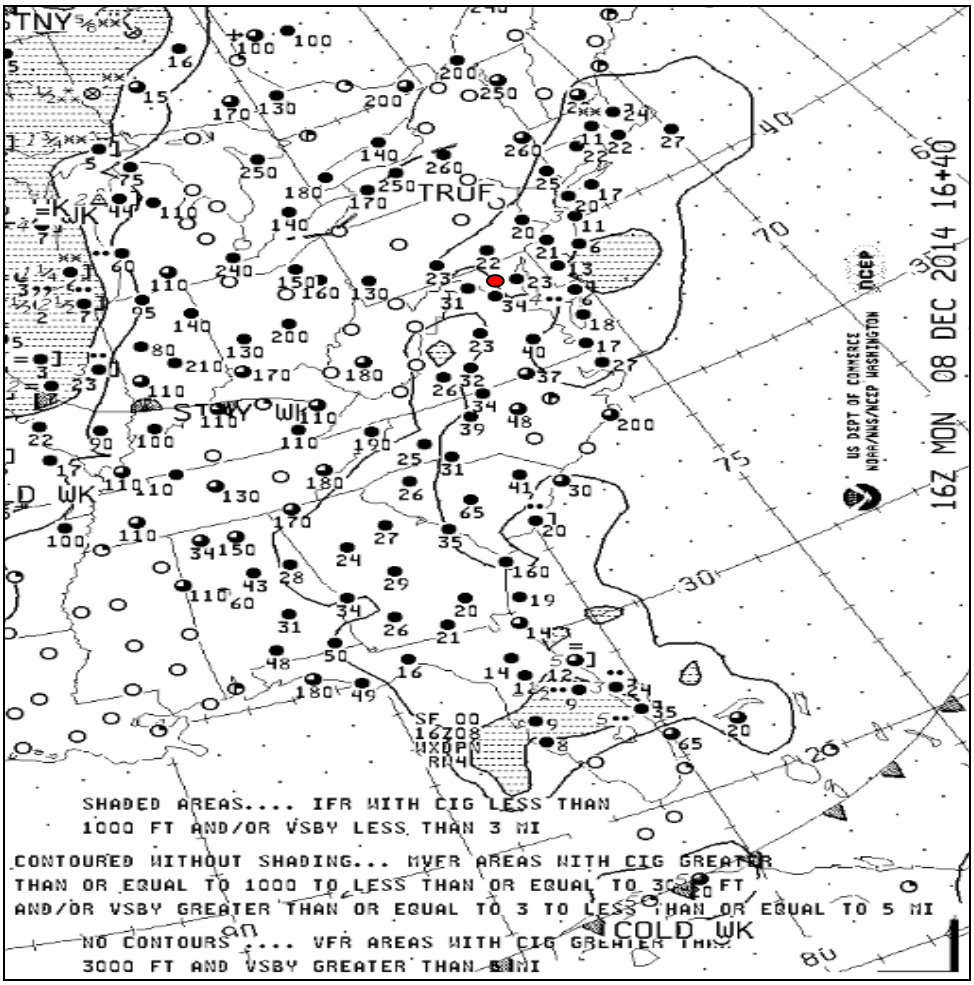


Figure 2 – NWS Weather Depiction chart for 1100 EST

1.3 Weather Radar Mosaic

The NOAA National Climatic Data Center (NCDC) National radar mosaic for 1040 EST on December 8, 2014 is included as figure 3. The image depicted several bands of very light intensity echoes over the area, with the most defined band running north to south immediately west of the airport and along the flight path of N100EQ. The echoes were consistent with a snow squall, which were reported by several witnesses.

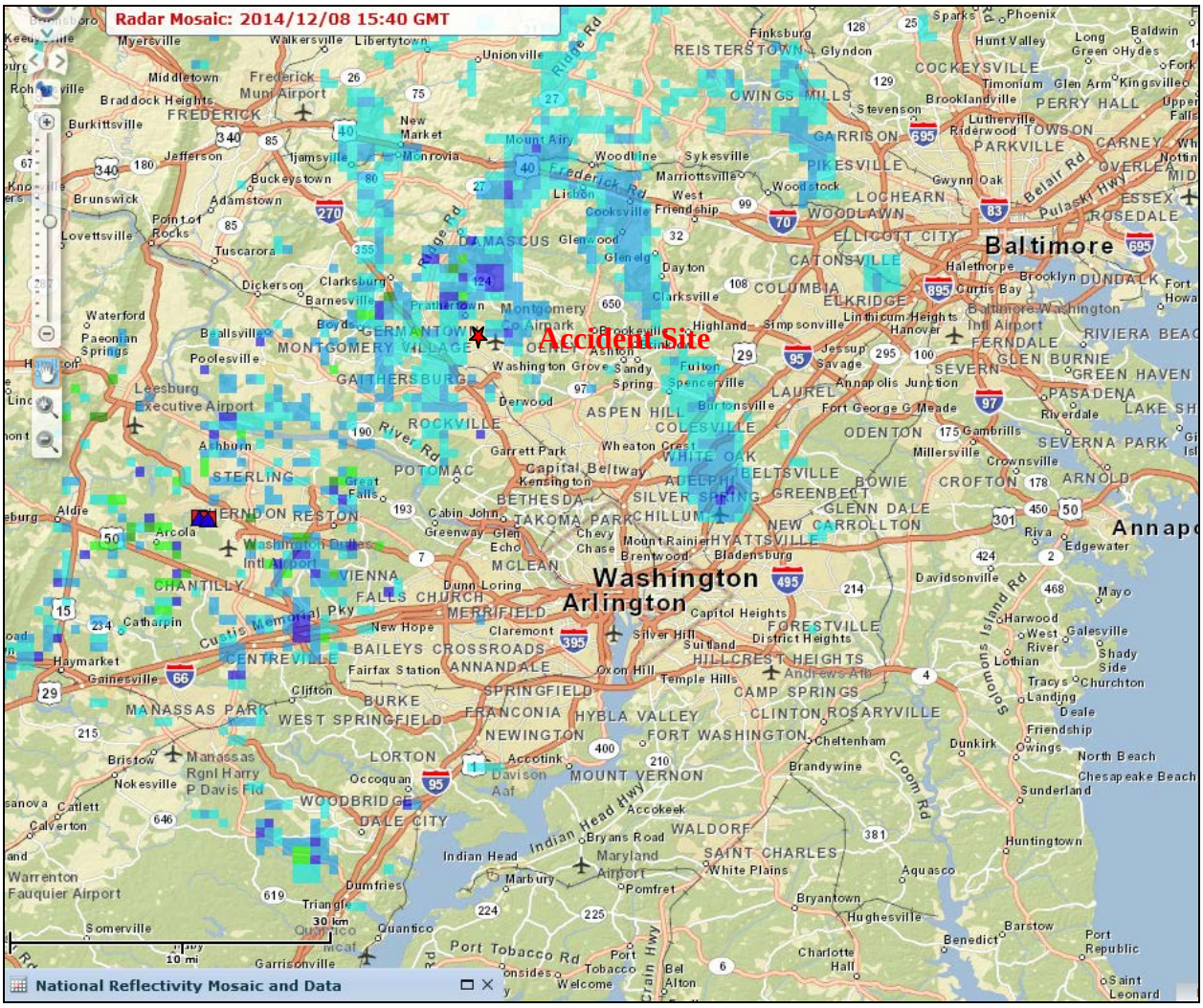


Figure 3 - NWS Radar Mosaic image for 1040 EST

The closest NWS weather surveillance radar will be further documented in section 6.0 of this report.

1.4 Low-level Significant Weather Prognostic Chart

The NWS 12 and 24 hour low-level significant weather prognostic chart that was valid during the period is included as figure 4, with the 12 hour forecast on the left valid at 1300 EST on December 8, 2014 and the 24 hour forecast on the right valid for 0300 EST on December 9, 2014. The 12 hour surface forecast on the bottom left side of the chart depicted no significant boundaries or precipitation over Maryland during the period. The top left side of the chart depicted the general flight categories, turbulence, and freezing level data and indicated that at 1300 EST and indicated that MVFR conditions were expected along the entire eastern United States and included the route of flight and the accident site. The freezing level was indicated between the surface and 4,000 feet. The 24 hours valid for 0300 EST on the right side of the chart depicted a coastal low pressure system and associated front was expected to influence the

area with scattered rain and snow showers over the region. MVFR conditions were expected to continue with the freezing level at the surface.

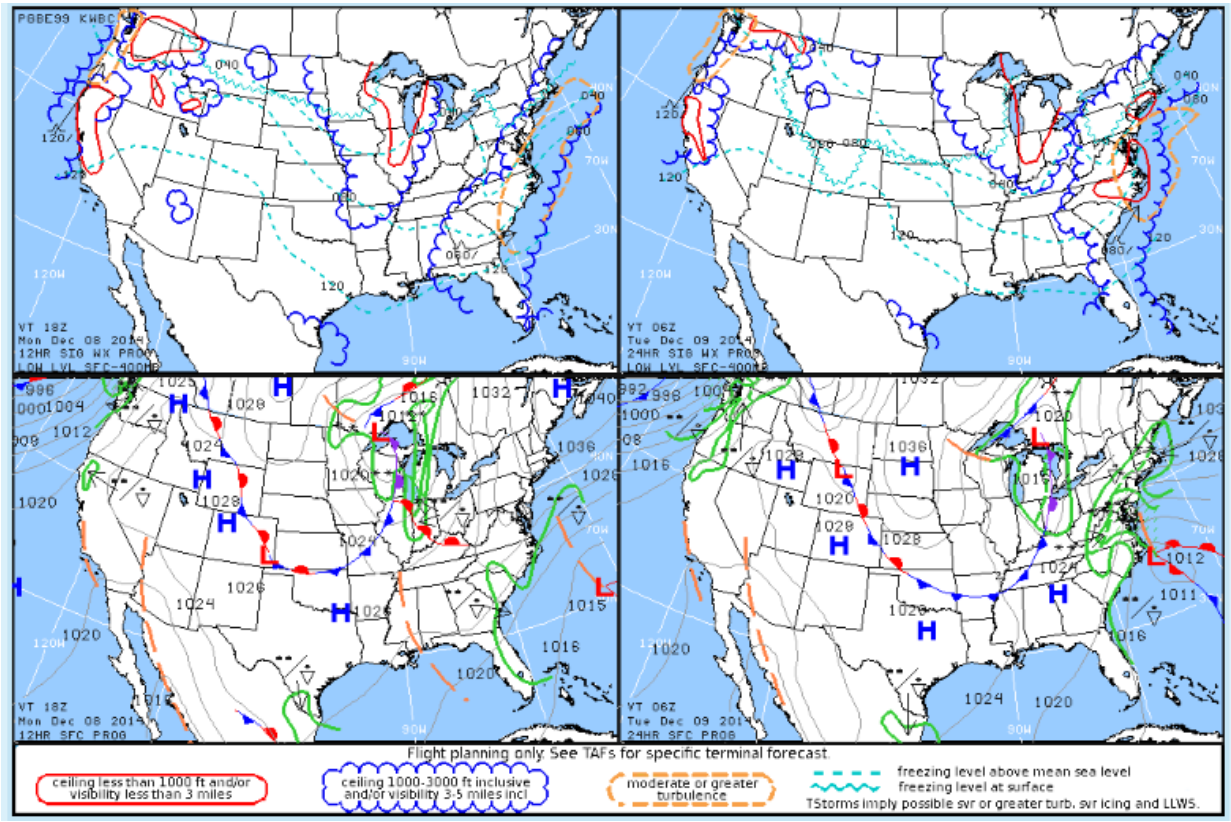


Figure 4 - NWS Surface Prognostic Chart valid for the period

1.5 500-hPA Constant Pressure Chart

The NWS 500-hPa Constant Pressure Chart valid for 0700 EST on December 8, 2014 is included as figure 5 and depicted the mean atmosphere at approximately 18,000 feet. The chart depicted a long wave trough of low pressure extending southward across Minnesota, Iowa, Missouri, Arkansas into Louisiana to the west of the accident site and indicated by a dash line. To the east-southeast a cut off upper level low pressure system was identified off the coast.

The station models over the mid-Atlantic region in the vicinity of the accident site depicted wind from the southwest at 25 knots, a temperature of -20° Celsius (C), and the temperature-dew point spread over 20° C.

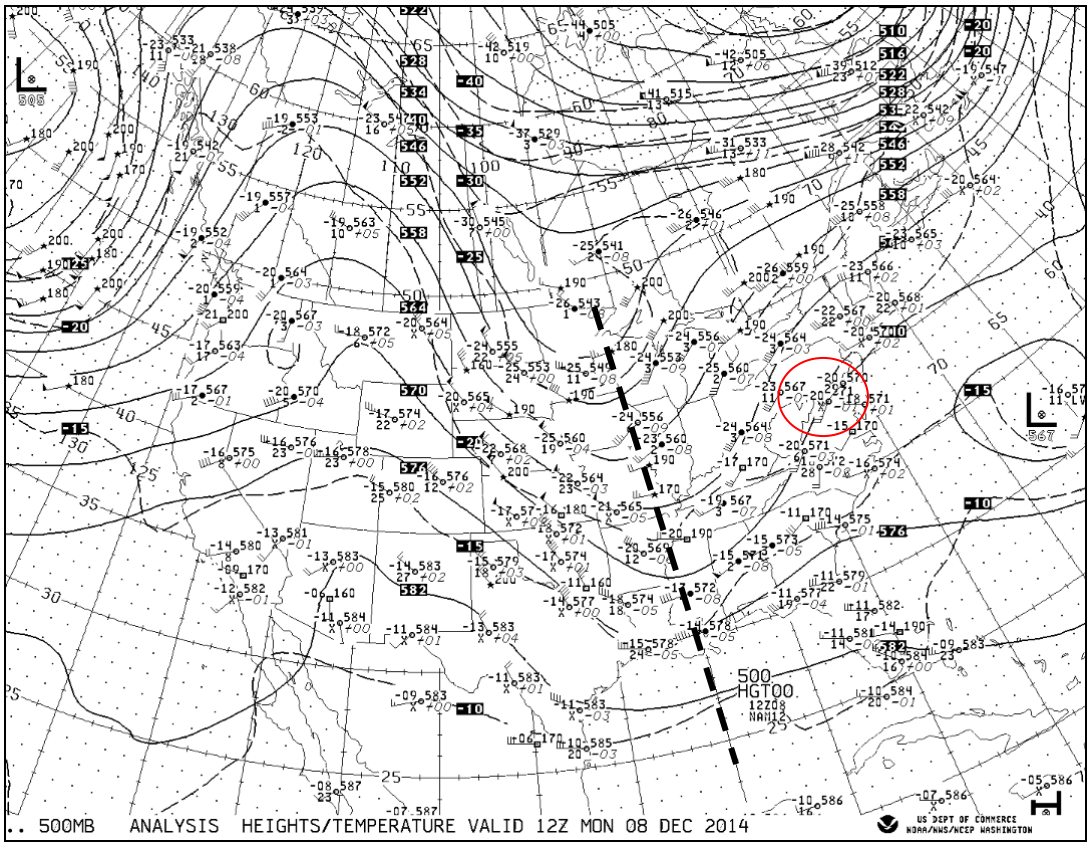


Figure 5 - NWS 500-hPa Constant Pressure Chart for 0700 EST

2.0 Surface Observations

The official NWS Meteorological Aerodrome Reports (METARs) and special reports (SPECIs) surrounding the period were documented for the departure and the closest airport to the accident site. The cloud heights are reported above ground level (agl).

2.1 Montgomery County Airpark (KGAI), Gaithersburg, Maryland

The closest official NWS reporting location to the accident site was from Montgomery County Airpark (KGAI), Gaithersburg, approximately 1/2 mile southeast of the accident site at an elevation of 539 feet, and lists a magnetic variation of 9° W. The airport had a nonfederal owned and operated Automated Weather Observation System (AWOS), which was located near midfield and immediately east of the runway and 0.95 mile from the accident site which is identified in figure 6. The AWOS did not have a precipitation discriminator installed to determine the type of weather phenomena and issued observations every 20 minutes for dissemination.

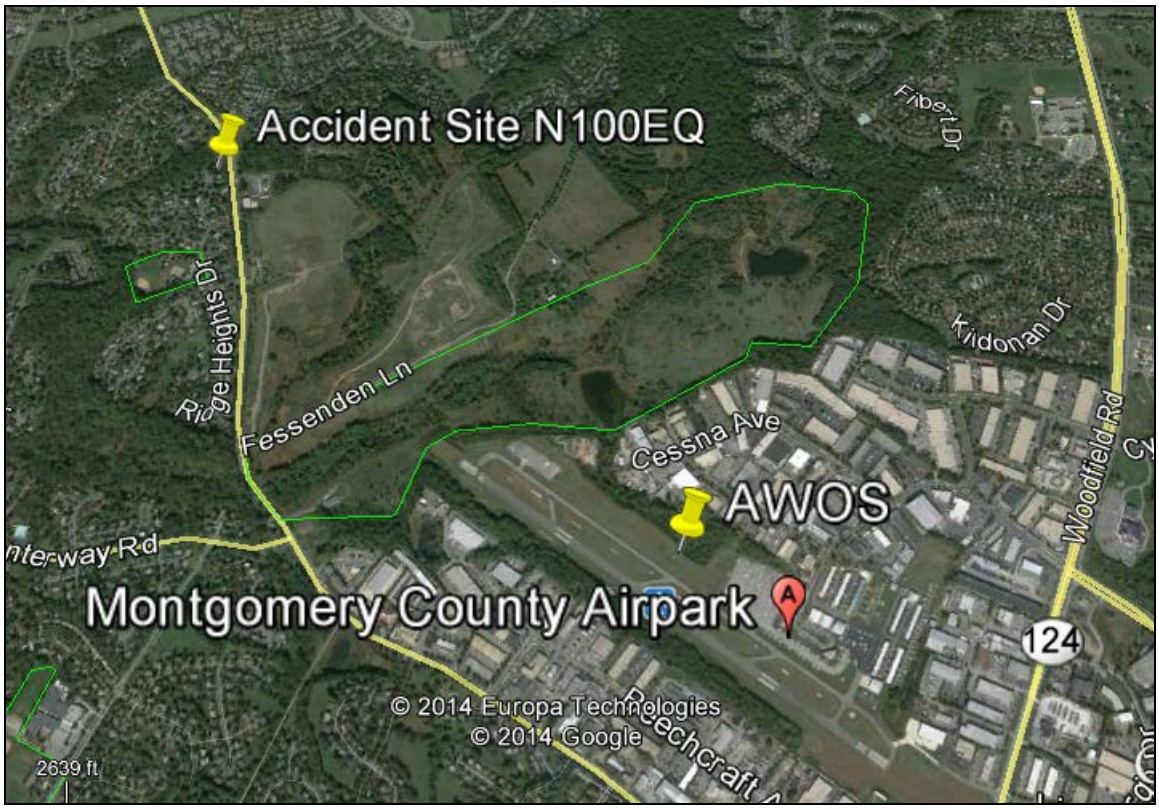


Figure 6 - AWOS location at Montgomery County Airpark and accident site

The Montgomery County Airpark AWOS reported the following weather conditions at the time of the accident:

Montgomery County Airpark (KGAI) weather observation at 1035 EST, wind from 040° at 6 knots, visibility unrestricted at 10 miles, a few clouds at 2,100 feet agl, ceiling overcast 3,200 feet, temperature -1° C, dew point temperature -7° C, altimeter 30.61 inches of mercury (Hg). Remarks: automated observation system without a precipitation discriminator.

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

VFR METAR KGAI 081015Z 03003KT 10SM CLR M03/M11 A3058 RMK AO1=

VFR METAR KGAI 081035Z 04003KT 10SM CLR M03/M10 A3059 RMK AO1=

VFR METAR KGAI 081055Z 00000KT 10SM SCT028 M03/M11 A3059 RMK AO1=

MVFR METAR KGAI 081115Z 00000KT 10SM OVC028 M02/M11 A3059 RMK AO1=

MVFR METAR KGAI 081135Z 00000KT 10SM OVC026 M02/M12 A3061 RMK AO1=

MVFR METAR KGAI 081155Z 00000KT 10SM OVC026 M02/M11 A3061 RMK AO1 11010 21030 52010=

MVFR METAR KGAI 081215Z 00000KT 10SM OVC026 M02/M11 A3061 RMK AO1=

MVFR METAR KGAI 081235Z 03004KT 10SM OVC026 M02/M12 A3061 RMK AO1=

MVFR METAR KGAI 081255Z 04003KT 10SM OVC026 M02/M11 A3060 RMK AO1=

MVFR METAR KGAI 081315Z 03003KT 10SM OVC026 M02/M11 A3060 RMK AO1=

MVFR METAR KGAI 081335Z 04006KT 10SM OVC026 M02/M11 A3060 RMK AO1=

MVFR METAR KGAI 081355Z 03004KT 10SM OVC026 M02/M11 A3061 RMK AO1=

MVFR METAR KGAI 081415Z 02004KT 10SM OVC026 M01/M09 A3061 RMK AO1=

MVFR METAR KGAI 081435Z 03006KT 10SM OVC026 M01/M09 A3061 RMKAO1=

MVFR METAR KGAI 081455Z 04005KT 10SM OVC028 M01/M09 A3062 RMK AO1 52003=

MVFR METAR KGAI 081515Z 05005KT 10SM FEW023 OVC030 M01/M08 A3061 RMK AO1=

VFR METAR KGAI 081535Z 04006KT 10SM FEW021 OVC032 M01/M08 A3061 RMK AO1=

Accident 1541Z

VFR METAR KGAI 081555Z 05005KT 10SM OVC032 M01/M08 A3060 RMKAO1=

MVFR METAR KGAI 081615Z 08003KT 10SM SCT023 BKN028 OVC032 M01/M07 A3060 RMK AO1

VFR METAR KGAI 081635Z 03003KT 10SM SCT020 OVC037 00/M05 A3058 RMK AO1

VFR METAR KGAI 081655Z 03003KT 10SM OVC035 00/M06 A3057 RMK AO1

The eastern region FAA inspector responsible for the AWOS was Mr. Joseph Burns. Mr. Burns was contacted regarding the availability of any high resolution AWOS data surrounding the period; however, it was determined that this system does not have that capability and only archives the regular 20 minute observations. No sensor errors were noted during the period and the system had its last quarterly inspected was on October 29, 2014, and no problems or issues with the system being identified. Mr. Burns also indicated that the system is scheduled for an upgrade in 2015 depending on funding.

The AWOS system hardware was also documented and the physical layout of the equipment on the field was located east of the runway near mid field.

The KGAI AWOS data provided by the FAA in tabular form was as follows:

Station	Julian	Time	Wind	Vis	Sky cover	T/Td	Alt	D-alt	/Day
KGAI	*342*	*1440Z*	*000/00*	*10+*	*OVC026*	*-1/ -9*	*3061*	*749*	*D*
KGAI	*342*	*1500Z*	*050/ 5*	*10+*	*OVC028*	*-1/ -9*	*3062*	*749*	*D*
KGAI	*342*	*1520Z*	*060/ 4*	*10+*	*FEW023 OVC030*	*-1/ -9*	*3061*	*749*	*D*
KGAI	*342*	*1540Z*	*060/ 4*	*10+*	*FEW021 OVC032*	*-1/ -8*	*3061*	*749*	*D*
Accident		***1541Z***							
KGAI	*342*	*1600Z*	*070/ 3*	*10+*	*OVC032*	*-1/ -8*	*3060*	*749*	*D*
KGAI	*342*	*1620Z*	*080/ 6*	*8*	*BKN021 OVC032*	*-1/ -7*	*3060*	*749*	*D*
KGAI	*342*	*1640Z*	*050/ 3*	*10+*	*SCT020 OVC037*	*0/ -6*	*3057*	*749*	*D*

The FAA provided data were consistent with the transmitted observations at the time of the accident, but did include an observation after the accident at 1120 EST (1620Z) which differed from the other documented observations. At 1120 EST the visibility decreased to 8 miles and the lowest ceiling broken during the period at 2,100 feet agl was reported by the system. The conditions were likely associated with the snow showers moving across the region, and did not last long with cloud conditions reported as scattered 20 minutes later.

2.2 Surrounding Area Observations

The attached figures 7 through 10 are the NWS observation at 1000 EST (1500Z) and 1100 EST (1600Z) surrounding the area at various ranges from the NWS Aviation Weather Center's (AWC) display system. The station circles are color coded to depict the general flight category; where blue depicts MVFR, red IFR, pink LIFR conditions, green undetermined and white VFR conditions. Montgomery County Airpark (KGAI) is identified by the red star and in the circle in the zoomed in images. The screen shots depicted general wind from the north at approximately 5 knots or less, visibility prevailing at 10 statute miles, overcast skies with temperatures in the 30's degrees Fahrenheit (F) across the region with general MVFR conditions prevailing across the area.

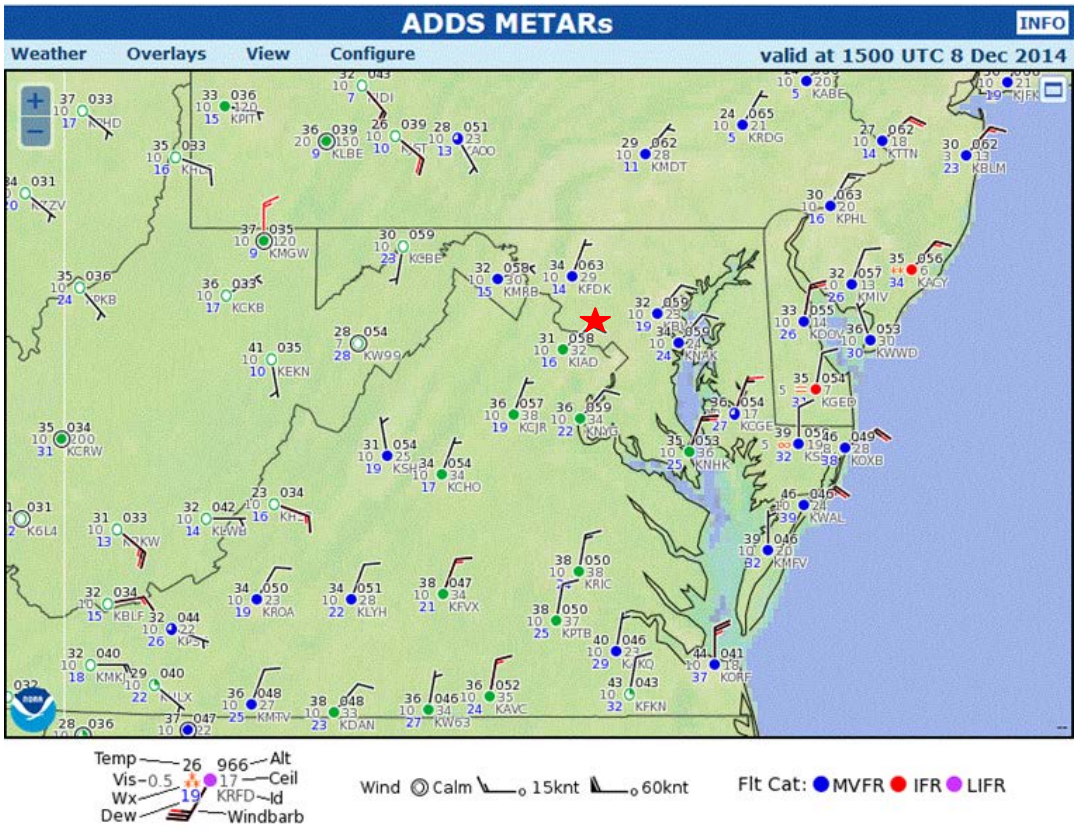


Figure 7 – Surrounding observations at 1000 EST

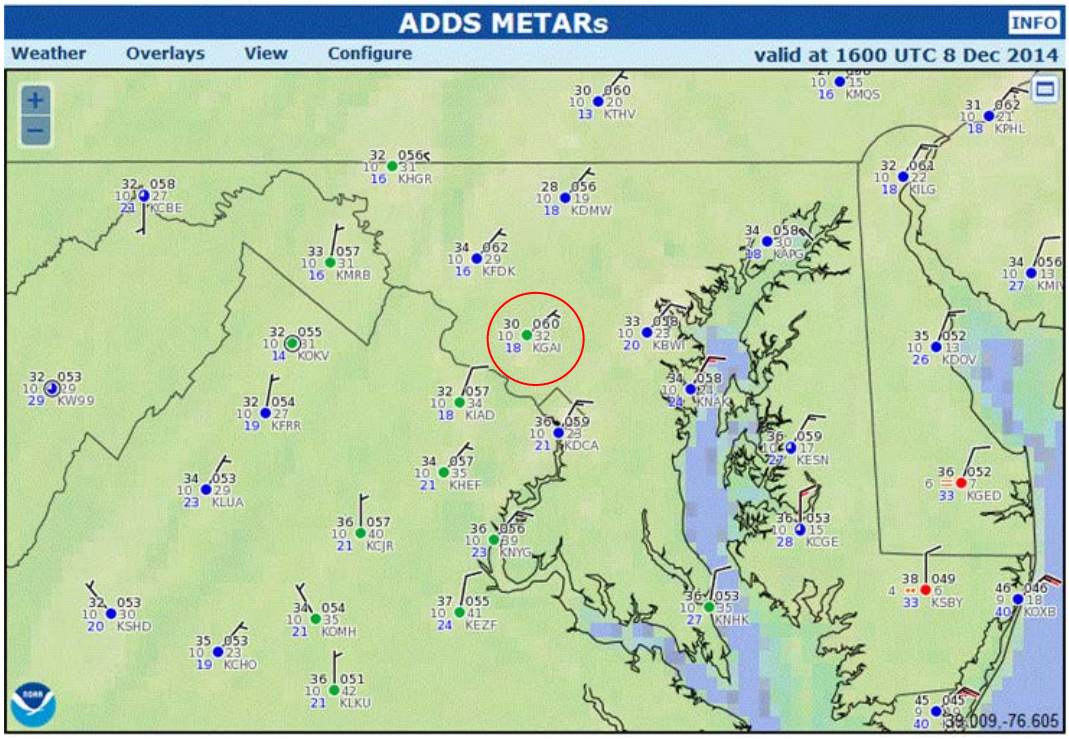


Figure 8 - Observations for 1100 EST

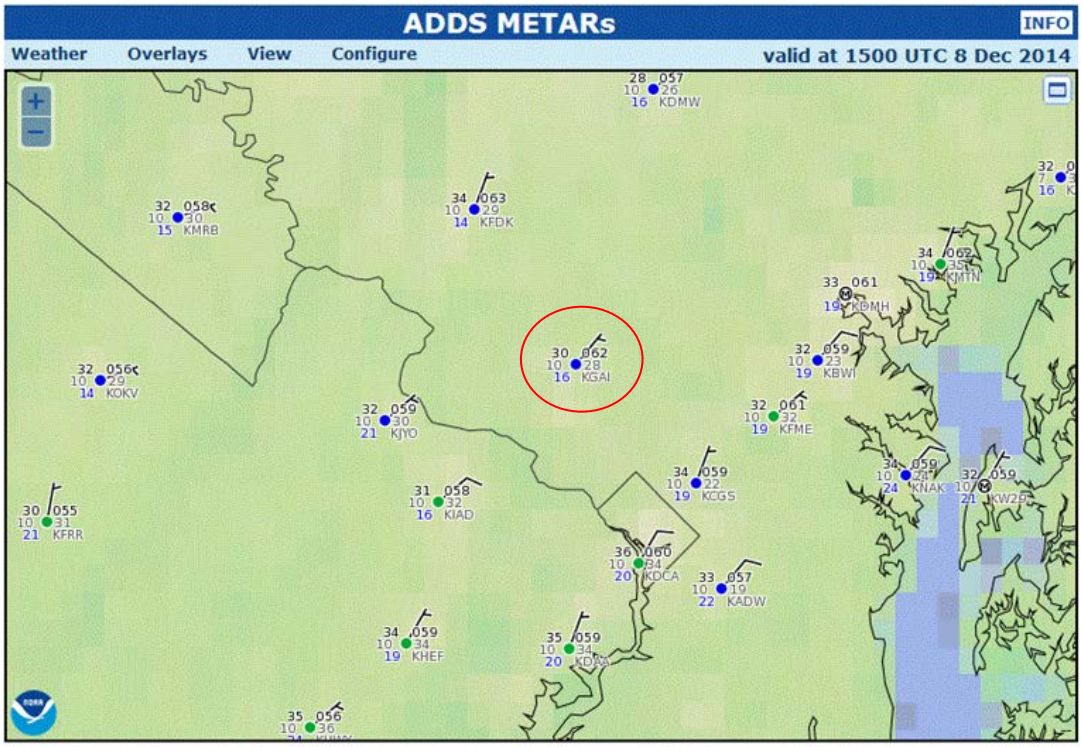


Figure 9 – Zoomed in image at 1000 EST

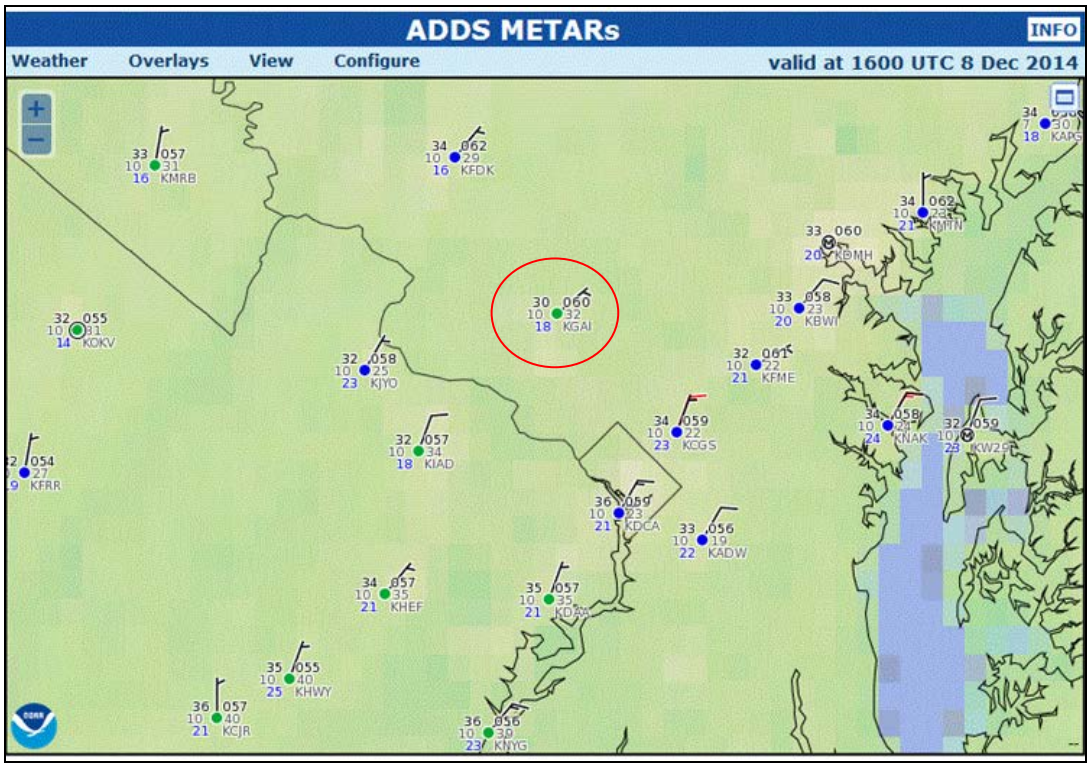


Figure 10 - Zoomed in image at 1100 EST

3.0 Upper Air Data

The closest NWS upper air sounding or rawinsonde observation (RAOB) was obtained from Washington Dulles Airport (KIAD), Virginia, site number 72403, located approximately 20 miles southwest of the accident site at an elevation of 322 feet. The 0700 EST (1200Z) sounding was plotted on a standard Skew-T log P diagram[6] utilizing RAOB[7] software is included as figure 11 from the surface to 500-hPa or 18,000 feet.

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

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

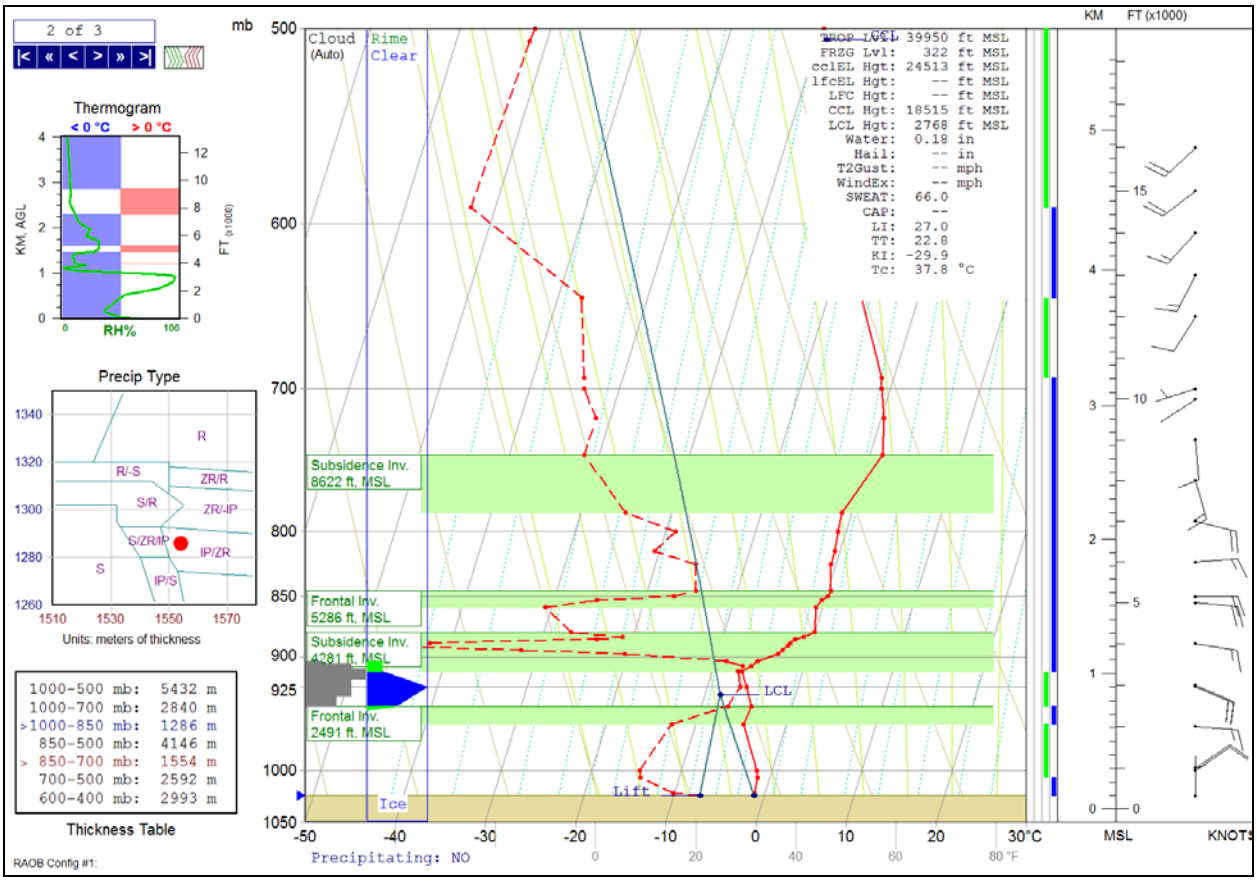


Figure 11 - Washington Dulles 0700 EST sounding

The sounding depicted a surface wind from the north or 360° at 4 knots, a temperature of -1.1° C, and a dew point of -7.1° C. Several low level temperature inversions were noted below 9,000 feet. The sounding had a lifted condensation level (LCL)[8] at approximately 2,400 feet agl, and had a relative humidity greater than 80% between the LCL and 3,600 feet suggesting a cloud layer. The freezing level was at the surface and the profile remained below freezing through the depth of the sounding. The Lifted Index (LI)[9] was 27, which indicated an absolutely stable atmosphere. The precipitable water indicated 0.18 inches of water, and the precipitation type at the surface favored freezing rain and ice pellets. The tropopause was identified at 39,950 feet.

The wind profile indicated the wind veer to the east immediately above the surface through 7,000 feet, and then veered to the south and then southwest with height. A low level wind maximum was identified at 5,000 feet with a wind from 095° at 21 knots. The mean 0 to 18,000

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

[9] Lifted Index (LI) - A common measure of atmospheric instability. Its value is obtained by computing the temperature that air near the ground would have if it were lifted to 500-hPa or approximately 18,000 feet and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms.

feet wind was identified from 188° at 9 knots. The level of maximum wind was identified immediately above the tropopause at 41,000 feet from a wind from 270° at 87 knots.

The following table (figure 12) is the observed sounding parameters and derived clear air turbulence (CAT), low level wind shear (LLWS), and icing potential. The sounding indicated a high probability of icing conditions between 2,400 through 3,600 feet, with the most severe icing potential at 2,900 feet with a liquid water content of 1.9 grams per cubic meter, a temperature of -5.7° C, dew point -6.4° C, and a relative humidity of 94%.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD/FF (deg/kts)	CAT (AF)	LLWS	Icing - Type (S-F clouds)
322	1024	-1.1	-7.1	64	360/4			
373	1022	-1.1	-10.1	50				
760	1007	-1.3	-14.3	36			LIGHT	
942	1000	-1.7	-14.7	36	55/11	L-M	LIGHT	
2056	958	-4.7	-12.7	54	95/17			
2491	942	-4.5	-7.1	82		L-M		LGT Rime
2961	925	-5.7	-6.4	95	115/20			SVR Clear
3325	912	-6.7	-7.1	97				TRC Clear
3466	907	-5.9	-6.8	93				TRC Rime
3580	903	-5.3	-8.8	76				TRC Rime
3752	897	-3.3	-20.3	26				
3839	894	-2.9	-31.9	9		L-M		
3956	890	-2.5	-50.5	1	100/14			
4015	888	-2.3	-42.3	3				
4103	885	-1.9	-23.9	17				
4162	883	-1.1	-21.1	20				
4281	879	0.0	-27.0	11				
4885	859	-0.7	-30.7	8		L-M		
5069	853	-0.3	-25.3	13	95/21			
5162	850	0.2	-16.8	27	90/21			
5286	846	0.4	-14.6	31				
5946	825	-0.5	-15.5	31	85/15			
6266	815	-0.5	-20.5	20				
6753	800	-0.9	-18.9	24		L-M		
7000	792				105/20			
7215	786	-1.1	-25.1	14		L-M		

Figure 12 - Observed and derived sounding parameters

4.0 Aircraft Sounding

A search of the NOAA Earth System Research Laboratory/Global Systems Division (ESRL/GSD) website (http://amdar.noaa.gov/) for Aircraft Meteorological Data Reports (AMDAR) provided an aircraft equipped with a moisture sensor near the time of the accident. The aircraft identified as #11050 departed from Baltimore (KBWI) at 1141 EST (1641Z) provided the following ascent sounding in figure 13. The sounding depicted a defined temperature inversion with a saturated layer between 1,600 and 4,300 feet with temperatures ranging from -2.8° to -6° C.

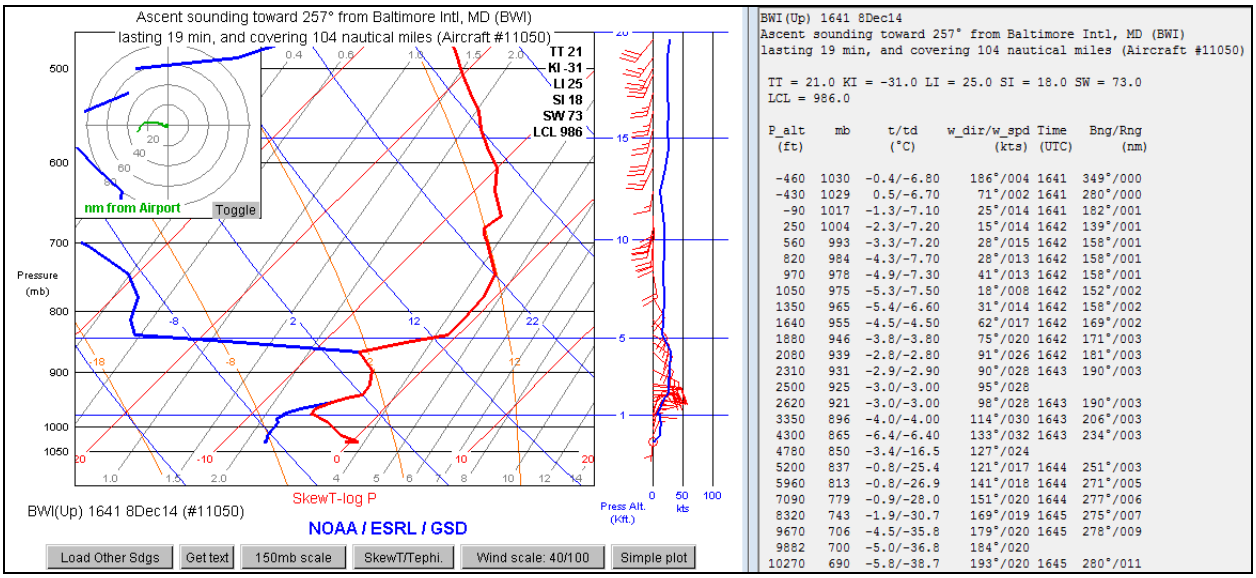


Figure 13 - Aircraft sounding at 1141 EST departing Baltimore, MD

5.0 Satellite Data

The Geostationary Operational Environmental Satellite number 13 (GOES-13) data was obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison (UW) in Madison, Wisconsin, and processed using the Safety Board's 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 for 1045 EST at 4X magnification with a standard MB temperature enhancement curve applied is included in figure 14. The image depicted an extensive layer of low stratiform clouds over the region with higher cirriform clouds above. Over the accident site the radiative cloud top temperature was observed at 233° Kelvin or -40.16° C, which corresponded to cirrus clouds with tops near 28,500 feet.

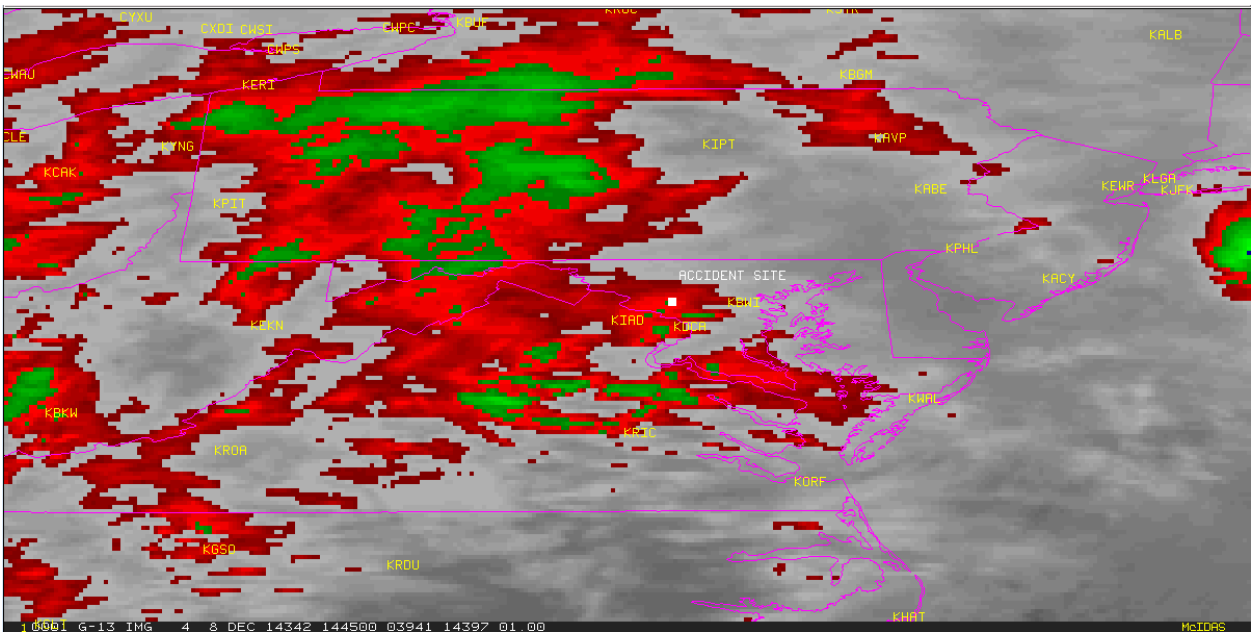


Figure 14 - GOES-13 infrared image at 1045 EST

The GOES-13 visible image at 1045 EST is included as figure 15 and depicted an extensive layer of stratiform clouds over the regions, with several bands of high cirrus clouds overlaying an overcast layer of low stratiform clouds.

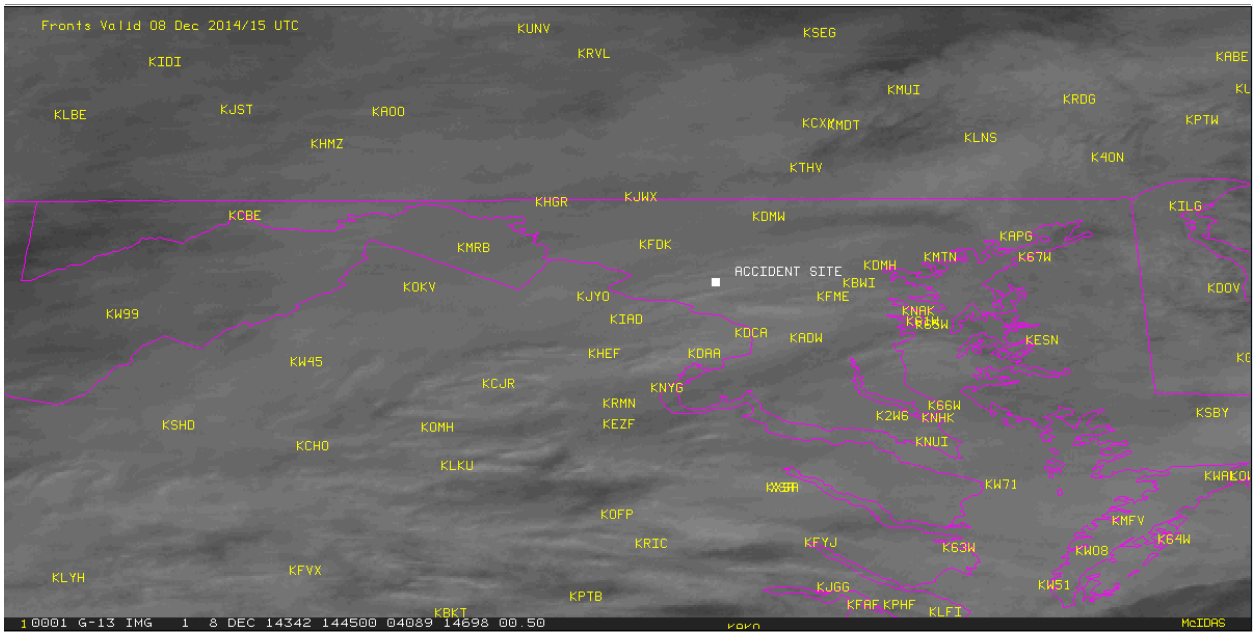


Figure 15 - GOES-13 visible image at 1045 EST

6.0 Weather Radar Information

The closest Weather Surveillance Radar-1988, Doppler (WSR-88D) to the accident site was from the NWS Sterling (KLWX) office located approximately 20 miles south of the accident

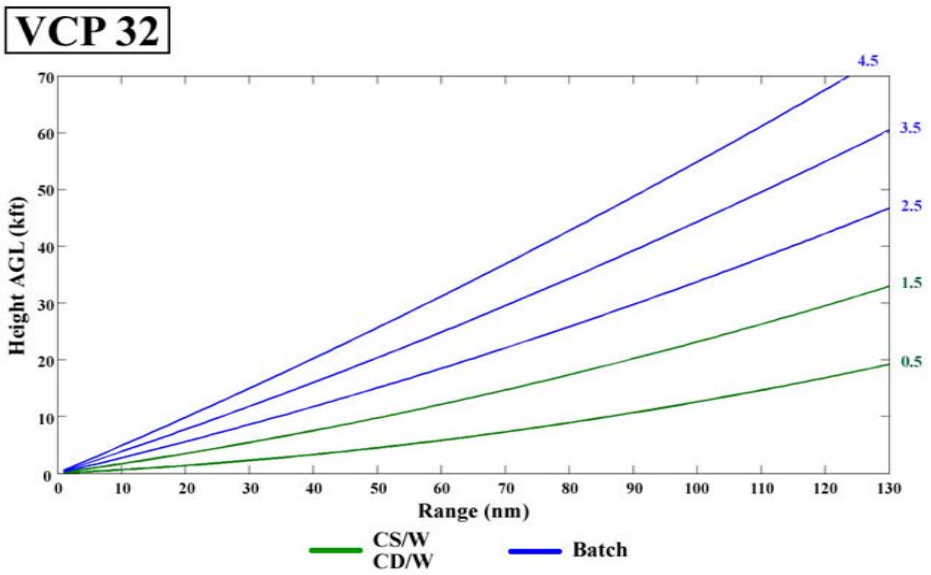
site. The level II archive data was obtained from the National Climatic Data Center (NCDC) utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

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

6.1 Volume Scan Strategy

The WSR-88D is a computer controlled radar system, which automatically creates a complete series of specific scans in a specific sequence known as a volume scan. Individual elevation scans are immediately available on the WSR-88D's Principle Users Processor (PUP). Products that require data from multiple elevation scans are not available until the end of the volume scan.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has three common scanning strategies. The most common is the non-severe convective mode where the radar makes 9 elevation scans from 0.50° to 19.5° every six minutes. Mode B is the clear air mode, where the radar makes 5 elevation scans during a ten minute period. During the period surrounding the accident the KLWX WSR-88D radar was operating in the clear air mode identified as VCP-32. This mode is typically used by the NWS during periods when snow and light stratiform precipitation is expected. The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.



6.2 Beam Height Calculation

Assuming standard refraction[10] of the 0.95° radar beam of the KLWX WSR-88D with an antenna height of 405 feet and a distance of 19 miles and an azimuth of 48° from the radar, the following table shows the approximate beam height and width information of the radar display over the site of the accident. The heights have been rounded to the nearest 10 feet.

Antenna Elevation	Beam Center	Beam Base	Beam Top	Beam Width
0.53°	1,710 feet	750 feet	2,670 feet	1,910 feet

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[11] it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ[12]), and is a general measure of echo intensity.

Figure 16 is the lowest 0.53° base reflectivity elevation scan completed at 1041:52 EST, which depicted several bands of very light intensity echoes associated with light precipitation or snow over the area. The echoes extended over the flight track during the descent on approach with echoes ranging from -10 to 30 dBZ.

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

[11] Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glaze ice.

[12] dBZ - 10 log Ze

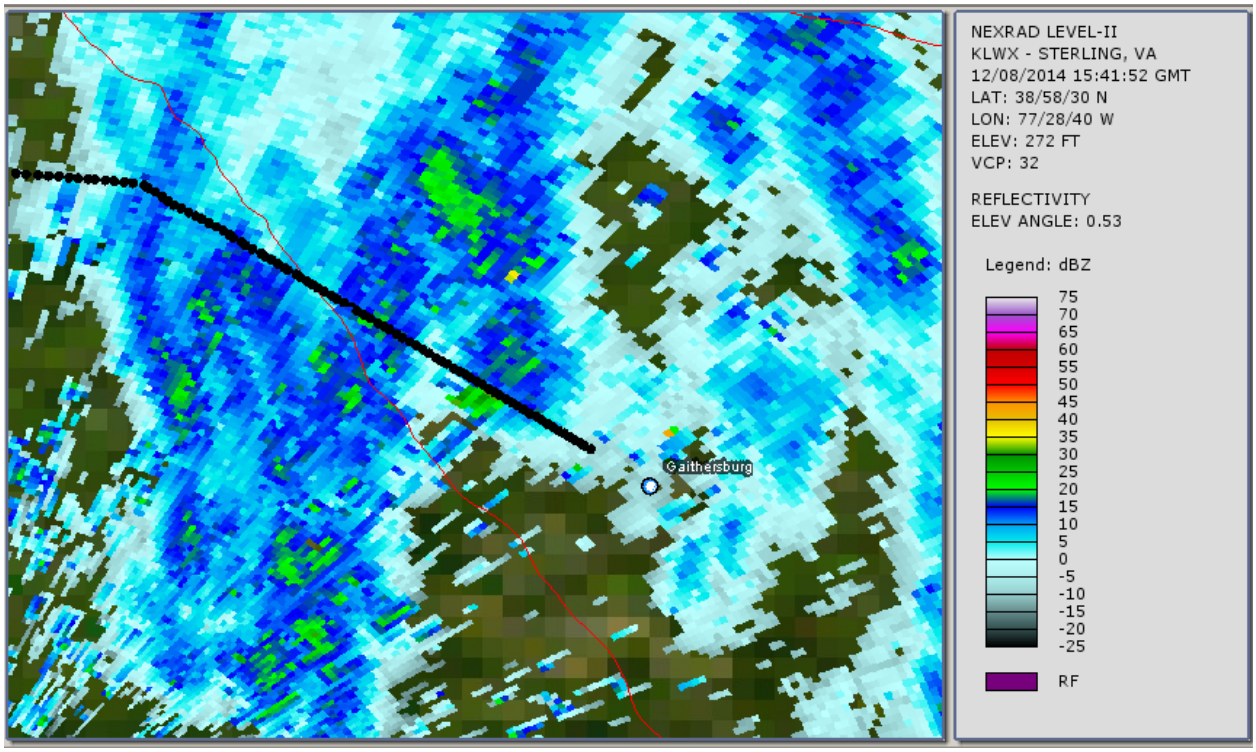


Figure 16 - KLWX WSR-88D 0.5° base reflectivity image at 1041 EST

6.4 Differential Reflectivity

The differential reflectivity (ZDR) product is the logarithm ratio of the horizontal power return to vertical power return, and provides an estimate of the mean drop size diameter of the dominant echoes. A negative value of ZDR indicates that there is more vertical power return than horizontal power return, which means the dominant hydrometeors are larger in the vertical than in the horizontal. Near zero values of ZDR indicate that both the horizontal and vertical power return from the volume scanned are of similar values, and indicated that the hydrometeors are of similar size in both the horizontal and vertical.

The KLWX differential reflectivity image in figure 17 for 1041 EST depicted droplet sizes from -2 to 2.0 consistent with snow with increasing wetness.

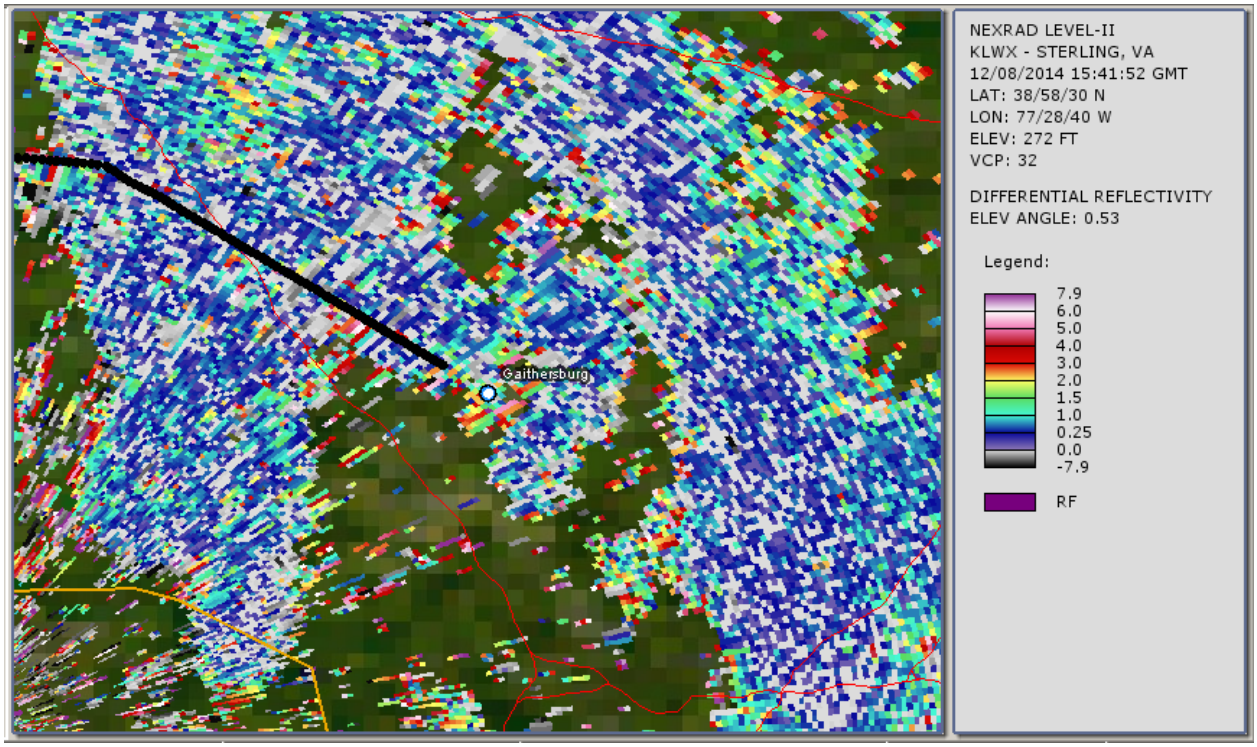


Figure 17 - KLWX WSR-88D 0.5° differential reflectivity image for 1041 EST

6.5 Correlation Coefficient Product

The correlation coefficient (CC) product provides a measure of the horizontal and vertical returns and provides information about the diversity of hydrometers, and range from 0 to 1. Meteorological echoes tend to have CC values greater than 0.80, and with values of 0.96 indicating that the meteorological targets within the volume scan are all of very similar size, shape, and type (liquid versus solid), and orientation. Non-meteorological echoes typically have values less than 0.80.

The KLWX WSR-88D correlation coefficient (CC) image for 1041 EST is included as figure 18, and indicated values of 0.8 to 1.0 along the flight track consistent with snow with decreasing variable wetness.

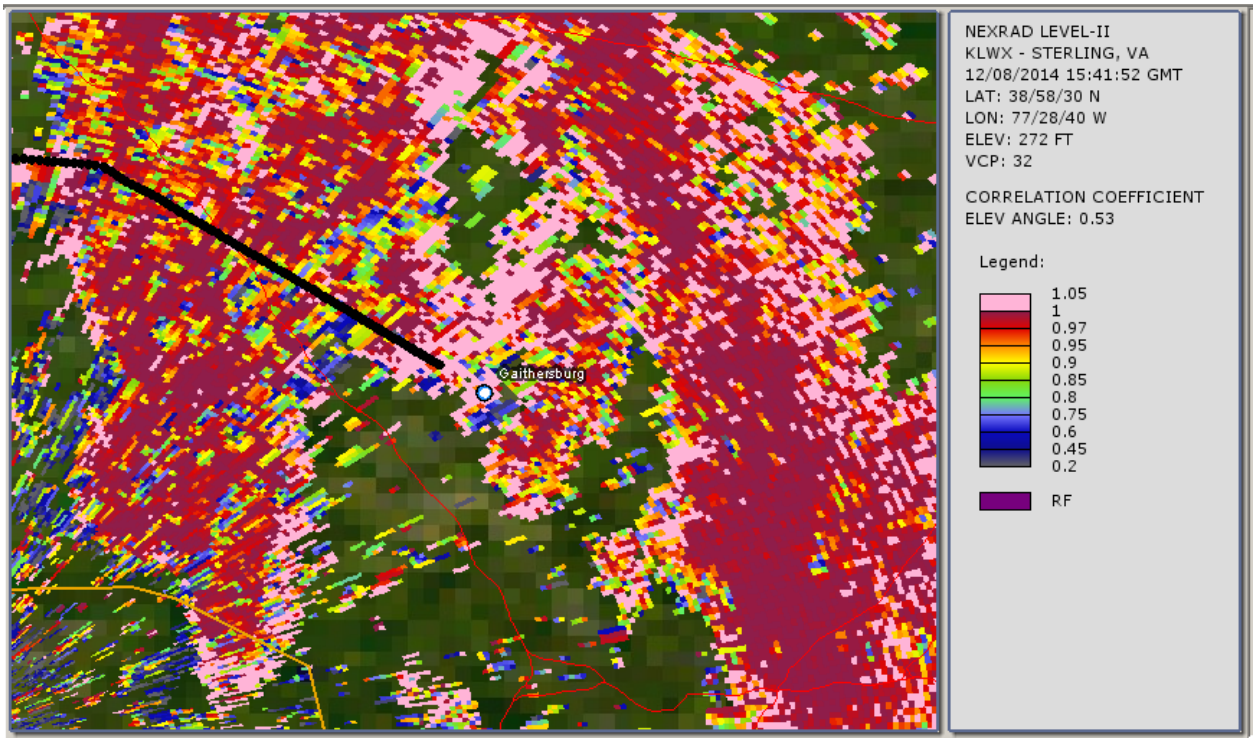


Figure 18 - KLWX WSR-88D correlation coefficient image at 1041 EST

7.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over the Washington, DC area during the period from 0700 through 1500 EST on December 8, 2014. The reports are in plain language taken from standard code and abbreviations, and converted into local time. The location identifiers match the city's unless otherwise noted. The reports in the NWS data base surrounding the accident were as follows:

Joint Base Andrews (ADW) routine pilot report (UA); Over – 3 miles east of Andrews VORTAC[13], Camp Springs, MD; Time – 0702 EST; Flight level – 5,000 feet; Type aircraft – Gulfstream corporate business jet (GLF5); Sky condition – broken clouds at 2,000 feet with tops at 5,000 feet, sky clear above; Temperature - +1° C; Wind – from 150° at 20 knots; Remarks – reported during climb.

Joint Base Andrews (ADW) routine pilot report (UA); Over – 7 miles southeast of Ronald Reagan Washington National Airport (DCA); Time – 0708 EST; Flight level – 2,500 feet; Type aircraft – Canadair Regional Jet (CRJ2); Sky condition – overcast clouds at 3,000 feet, overcast at 4,500 feet; Remarks – reported during descent from 6,000 to 2,500 feet.

Washington Dulles International Airport (IAD) routine pilot report (UA); Over – 8 miles west of Washington Dulles International Airport; Time – 0708 EST; Flight level – 3,500 feet; Type aircraft - Canadair Regional Jet (CRJ2);Temperature - +1° C; Icing – light rime icing between 3,000 to 4,000 feet.

[13] VORTAC – is a VHF omnidirectional range (VOR) beacon and a tactical air navigation system (TACAN) beacon for distance measuring. The system provides both azimuth and distance for air navigation.

Philadelphia International Airport (PHL) routine pilot report (UA); Over – 10 miles southwest of Philadelphia International Airport, PA; Time – 0722 EST; Flight level – 2,000 feet; Type aircraft – Canadair Regional Jet (CRJ2); Sky condition – overcast clouds at 2,400 feet; Remarks – reported during descent.

Linden Airport (LDJ) routine pilot report (UA); Over – 20 miles southwest of Newark Liberty International Airport (EWR), NJ; Time -0733 EST; Flight level – 3,000 feet; Type aircraft – Embraer EMB-145 regional commuter jet (E145); Temperature – minus 10° C; Icing – light rime icing; Remarks – current flight conditions instrument meteorological conditions (IMC).

Sussex Airport (FWN) routine pilot report (UA); Over – Sparta VORTAC, NJ; Time -0733 EST; Flight level – 6,000 feet; Type aircraft – Embraer EMB-145 regional commuter jet (E145); Sky cover – skies clear; Turbulence – negative; Remarks – smooth ride.

Williamsburg-Jamestown Airport (JGG), Williamsburg, VA routine pilot report (UA); Over – 50 miles west of Norfolk VORTAC; Time – 0742 EST; Flight level – 23,000 feet; Type aircraft – Canadair air carrier regional jet (CR7); Turbulence – light clear air turbulence (CAT) between 17,500 and 23,500 feet.

Philadelphia International Airport (PHL) routine pilot report (UA); Over – 10 miles southwest of PHL; Time – 0752 EST; Flight level – 2,300 feet; Type aircraft – Embraer regional air carrier jet (E190); Sky condition – overcast clouds at 2,300 feet; Remarks – reported during descent into PHL.

New Castle Airport (ILG), Wilmington, DE routine pilot report (UA); Over – 12 miles west of PHL; Time – 0803 EST; Flight level – 4,000 feet; Type aircraft – De Havilland Dash 8 turboprop (DH8D); Temperature – minus 5° C; Icing – light rime icing between 4,000 to 2,000 feet.

Reading Regional Airport (RDG), Reading, PA routine pilot report (UA); Over – 15 miles west of Pottstown VORTAC; Time – 0803 EST; Flight level – 8,000 feet; Type aircraft – Canadair regional jet (CRJ2); Temperature – minus 1° C.

Ronald Reagan Washington National Airport (DCA) routine pilot report (UA);Over – 10 miles north of DCA; Time – 0804 EST; Flight level – 5,000 feet; Type aircraft – Boeing 737 air carrier jet (B738); Sky cover – overcast clouds at 3,000 feet with tops at 4,300 feet.

Linden Airport (LDJ) routine pilot report (UA); Over – 20 miles southwest of Newark Liberty International Airport (EWR), NJ; Time -0804 EST; Flight level – 3,000 feet; Type aircraft – Embraer regional air carrier jet (E145); Temperature – minus 10° C; Icing – light rime icing; Remarks – current flight conditions instrument meteorological conditions (IMC).

Manassas Regional Airport (HEF), Manassas, VA routine pilot report (UA); Over – 5 miles southwest of HEF; Time – 0824 EST; Flight level – 3,500 feet; Type aircraft – Cessna 310 multiengine airplane (C310); Sky cover – overcast clouds at 3,500 feet.

Altoona-Blair County Airport (AOO), Altoona, PA routine pilot report (UA); Over – between St. Thomas and Altoona, PA; Time – 0834 EST; Flight level -10,000 feet; Type aircraft – Piper Malibu single engine turboprop (PA46); Turbulence – moderate.

Montgomery County Airpark (GAI), Gaithersburg, MD routine pilot report (UA); Over – 15 miles northwest of Baltimore VORTAC; Time – 0845 EST; Flight level – 4,000 feet; Type aircraft – Boeing 737 air carrier jet (B737); Temperature – minus 3° C; Icing – light clear type icing.

Philadelphia International Airport (PHL) routine pilot report (UA); Over – 6 miles west of PHL; Time – 0854EST; Flight level – 6,000 feet; Type aircraft – De Havilland Dash 8 multiengine turboprop (DH8C); Temperature – minus 5° C; Icing – light rime type icing.

Altoona-Blair County Airport (AOO), PA, routine pilot report (UA); Over – 10 miles northwest of AOO; Time – 0858 EST; Flight level -7,500 feet; Type aircraft – light single engine experimental airplane (HXA); Remarks – plus/minus 30 knots of windshear.

Reading Regional Airport (RDG), NJ routine pilot report (UA); Over – 5 miles south of RDG; Time – 0920 EST; Flight level – 2,000 feet; Type aircraft – Cessna Skylane single engine airplane (C182); Temperature – minus 6° C; Icing – light rime type icing.

Ronald Reagan Washington National Airport (DCA) routine pilot report (UA);Over – 10 miles north-northwest of Baltimore VORTAC; Time – 0930 EST; Flight level – 2,500 feet; Type aircraft – Boeing 737 air carrier jet (B737); Temperature – minus 3° C; Icing – light rime type icing between 5,000 and 2,500 feet.

Philadelphia International Airport (PHL) routine pilot report (UA); Over – 5 miles south of PHL; Time – 0935EST; Flight level – 10,000 feet; Type aircraft – De Havilland Dash 8 multiengine commuter turboprop (DH8C); Temperature – plus 2° C; Turbulence – negative; Remarks – smooth visual meteorological conditions (VMC).

Washington Dulles International Airport (IAD) routine pilot report (UA); Over – 7 miles west-southwest of Armel VORTAC, Herndon, VA; Time – 0942 EST; Flight level – 10,000 feet; Type aircraft - Canadair Regional Jet (CRJ7);Sky cover – overcast clouds at 3,700 feet with tops at 5,300 feet.

Langley Air Force Base (LFI), Hampton, VA routine pilot report (UA); Over – 5 miles east of Newport News/Williamsburg International Airport (PHF); Time – 0943 EST; Flight level – 6,000 feet; Type aircraft – Gates Learjet corporate business jet (LR35); Sky cover – overcast clouds at 2,400 feet with tops at 5,500 feet.

Ronald Reagan Washington National Airport (DCA) routine pilot report (UA);Over – Washington VORTAC; Time – 0944 EST; Flight level – 5,500 feet; Type aircraft – Canadair regional jet (CRJ2); Sky cover – overcast clouds at 2,800 feet with tops at 5,000 feet.

St. Mary's County Regional Airport(2W6), Leonardtown, MD routine pilot report (UA); Over – 35 miles south of Washington VORTAC; Time – 0944 EST; Flight level – 19,000 feet; Type aircraft – Boeing 737 air carrier jet (B737); Turbulence – light chop.

Hagerstown Regional Airport (HGR), MD routine pilot report (UA); Over – 10 miles east of HGR; Time – 0947 EST; Flight level – 3,500 feet; Type aircraft – Beechcraft Baron multiengine airplane (BE58); Temperature – minus 2° C; Icing – light rime type icing below 3,500 feet.

Washington Dulles International Airport (IAD) routine pilot report (UA); Over – 5 miles southwest of Armel VORTAC; Time – 1005 EST; Flight level – unknown; Type aircraft –McDonald Douglas MD-80 air carrier jet (MD88); Sky cover – overcast clouds tops 5,300 feet.

Accomack County Airport (MFV), Melfa, VA routine pilot report (UA); Over – Cape Charles VORTAC; Time – 1012 EST; Flight level -6,000 feet; Type aircraft – Beechcraft Baron multiengine airplane (BE58); Sky cover – overcast clouds tops at 5,500 feet; Weather – flight visibility 99 miles;

Temperature – plus 8° C; Turbulence – negative; Remarks – very smooth flight conditions, clouds breaking o broken coverage south.

Tipton Airport (FME), Fort Meade, MD routine pilot report (UA); Over – 10 miles south of Baltimore VORTAC; Time – 1014 EST; Flight level – 4,000 feet; Type aircraft – Boeing 717 air carrier jet (B712); Temperature – minus 3° C; Icing – light rime type icing.

Easton/Newnam Field Airport (ESN), Easton, MD routine pilot report (UA); Over – 30 miles southeast of Baltimore VORTAC; Time – 1023 EST; Flight level – 6,000 feet; Type aircraft – British Aerospace Hawker HS-125 corporate business jet (H25B) business jet; Temperature – plus 2° C; Icing – negative; Remarks – in instrument meteorological conditions.

Newport News/Williamsburg International Airport (PHF) routine pilot report (UA); Over – PHF; Time – 1029 EST; Flight level -1,000 feet; Type aircraft – Cessna Skyhawk single engine airplane (C172); Sky cover – broken clouds at 1,000 feet.

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Frederick Municipal Airport (FDK), Frederick, MD routine pilot report (UA); Over – 4 miles northwest of Fredrick VORTAC; Time – 1045 EST; Flight level – 4,000 feet; Type aircraft – De Havilland Dash 8 multiengine commuter turboprop (DH8C); Temperature – minus 7° C; Icing – moderate mixed type icing between 4,000 and 5,000 feet.

Philadelphia International Airport (PHL) routine pilot report (UA); Over – PHL; Time – 1047 EST; Flight level – unknown; Type aircraft – Airbus A-320 air carrier jet (A321); Sky cover – overcast clouds bases at 2,600 feet; Temperature – minus 1° C.

Northeast Philadelphia Airport (PNE) routine pilot report (UA); Over – PNE; Time – 1057 EST; Flight level -2,400 feet; Type aircraft – British Aerospace Hawker HS-125 corporate business jet (H25B); Sky cover – overcast clouds at 2,400 feet; Temperature – minus 4° C; Icing – negative; Remarks – during descent into PNE.

Mid-State Airport (PSB), Philipsburg, PA routine pilot report; Over – 25 miles west of Philipsburg VORTAC; Time – 1104 EST; Flight level - 24,000 feet; Type aircraft – Canadair regional jet (CRJ2); Temperature – minus 16° C; Icing – light rime type icing.

Felker Army Airfield (FAF), Fort Eustis, VA routine pilot report (UA); Over – 7 miles west of Newport News/Williamsburg International Airport; Time – 1112 EST; Flight level – unknown; Type aircraft – Beechcraft Bonanza single engine airplane (H35); Sky cover – broken clouds at 1,800 feet; Remarks – on 7 mile final approach to runway 7.

Ronald Reagan Washington National Airport (DCA) routine pilot report (UA);Over – Washington VORTAC; Time – 1113 EST; Flight level – 5,000 feet; Type aircraft – Embraer regional jet (E170); Sky cover – overcast clouds at 2,200 feet with tops to 5,000 feet; Remarks – during climb.

Sussex Airport (FWN), Sussex, NJ routine pilot report (UA); Over – Sparta VORTAC; Time – 1142 EST; Flight level – 7,000 feet; Type aircraft – Boeing 737 air carrier jet (B737); Temperature – 0° C; Wind – 180° at 77 knots; Icing – negative.

Lehigh Valley International Airport(ABE), Allentown, PA , routine pilot report (UA); Over – Allentown VORTAC; Time – 1147 EST; Flight level – 6,000 feet; Type aircraft – Piper Navajo multiengine airplane (PA31); Sky cover – overcast clouds at 4,000 feet with tops at 5,000 feet with skies clear above.

Warrenton-Fauquier Airport (HWY), Warrenton, VA , routine pilot report (UA); Over - Casanova VORTAC; Time – 1152 EST; Flight level – 23,000 feet; Type aircraft – Boeing 737 air carrier jet (B737); Turbulence – moderate.

Washington Dulles International Airport (IAD) routine pilot report (UA); Over –7 miles west of Armel VORTAC; Time – 1153 EST; Flight level – 4,000 feet; Type aircraft – Canadair regional jet (CRJ7); Sky cover – overcast clouds at 4,000 feet with tops 5,500 feet.

Leesburg Executive Airport (JYO), Leesburg, VA, routine pilot report (UA); Over – JYO; Time – 1203 EST, Flight level – 1,200 feet; Type aircraft – Cessna Skyhawk singe engine airplane (C172); Sky cover – estimating overcast clouds at 3,000 feet; Weather – flight visibility 3 miles in light snow; Temperature – 0° C; Turbulence – negative; Icing – negative.

Patuxent River Naval Air Station (NHK), Patuxent River, MD routine pilot report (UA); Over – NHK; Time – 1250 EST; Flight level – 5,200 feet; Type aircraft – Lockheed Hercules military turboprop transport (C130); Sky cover – overcast clouds at 1,400 feet with tops at 5,200 feet.

Ronald Reagan Washington National Airport (DCA) routine pilot report (UA);Over – 10 miles northwest of Washington VORTAC; Time 1255 EST; Flight level – 7,000 feet; Type aircraft –Canadair regional jet (CRJ7); Sky cover – overcast clouds at 2,200 feet with tops at 6,400 feet; Temperature – minus 9° C; Icing – negative.

New Castle Airport (ILG), Wilmington, DE routine pilot report (UA); Over – 12 miles west of PHL; Time – 1258 EST; Flight level – unknown; Type aircraft – Airbus A-319 air carrier jet; Sky cover – overcast at 2,400 feet.

Philadelphia International Airport (PHL) routine pilot report (UA); Over – 10 miles west of PHL; Time – 1300 EST; Flight level – 3,000 feet; Type aircraft – Airbus A319 air carrier jet; Temperature – unknown; Icing – light rime type icing.

Richmond International Airport (RIC) routine pilot report (UA); Over – Richmond VORTAC; Time – 1318 EST; Flight level – unknown; Type aircraft – Embraer EMB-145 regional jet (E145); Sky cover – overcast clouds at 3,000 feet; Remarks – on final approach to runway 2.

Sussex Airport (FWN) routine pilot report (UA); Over – between Stillwater VORTAC to Sparta VORTAC, NJ; Time – 1230 EST; Flight level – 5,000 feet; Type aircraft – unknown; Temperature – minus 6° C; Icing – light rime type icing; Remarks – reported by all types of aircraft.

Allentown Queen City Municipal Airport (XLL), Allentown, PA routine pilot report (UA); Over – 5 miles southeast of East Texas, PA VORTAC; Time – 1450 EST; Flight level – 3,000 feet; Type aircraft - De Havilland Dash 8 multiengine commuter turboprop (DH8C); Temperature – minus 4° C; Turbulence – negative; Icing – light rime type icing; Remarks – in instrument meteorological conditions and smooth conditions.

Richmond International Airport (RIC) routine pilot report (UA); Over – 3 miles north of Richmond VORTAC; Time – 1408 EST; Flight level – 2,100 feet; Type aircraft – Embraer EMB-145 regional jet (E145); Sky cover – overcast clouds at 2,100 feet with tops 4,100 feet; Remarks – tops scattered.

Sussex Airport (FWN) routine pilot report (UA); Over – Sparta VORTAC; Time – 1414 EST; Flight level – 7,000 feet; Type aircraft – Boeing 757-200 air carrier jet; Turbulence – negative; Remarks – skies clear above 7,000 feet smooth ride.

Leesburg Executive Airport (JYO), Leesburg, VA routine pilot report (UA); Over – 6 miles northwest of Washington Dulles International Airport; Time – 1420 EST; Flight level – unknown; Type aircraft – Cessna Golden Eagle multiengine airplane (C421); Sky cover – overcast clouds with tops 5,800 feet; Temperature – unknown; Icing – light rime type icing between 5,000 and 5,800 feet; Remarks – during climb to 9,000 feet rime in clouds.

Pocono Mountains Municipal Airport (MPO), Mount Pocono, PA routine pilot report (UA); Over – 10 miles south of Wilkes Barre/Scranton VORTAC; Time – 1451 EST; Flight level – 5,000 feet; Type aircraft – Beechcraft Super King Air multiengine turboprop (B350); Temperature – minus 1° C; Icing – moderate mixed type icing; Remarks – in instrument meteorological conditions.

Virginia Tech/Montgomery Executive Airport (BCB), Blacksburg, VA routine pilot report; Over – 20 miles east of Lynchburg VORTAC; Time – 1457 EST; Flight level – 7,000 feet; Type aircraft – Beechcraft Duchess multiengine airplane (BE76); Temperature – minus 4° C; Icing – moderate rime type icing.

Carroll County Regional Airport (DMW), Westminster, MD routine pilot report (UA); Over – 20 miles north-northeast of Frederick VOR; Time – 1500 EST; Type aircraft – Piper Navajo multiengine airplane (PA31); Temperature – minus 2° C; Icing – light rime type icing.

Richmond International Airport (RIC)routine pilot report (UA); Over – 4 miles south of Richmond VORTAC; Time – 1515 EST; Flight level – 1,900 feet; Type aircraft – Cirrus single engine airplane (SR22); Sky cover – overcast clouds at 900 feet.

Millville Municipal Airport (MIV), Millville, NJ urgent pilot report (UUA); Over – MIV; Time – 1519 EST; Flight level – unknown; Type aircraft – Cessna multiengine airplane (C340); Remarks – low-level wind shear (LLWS) loss of 10 knots below 1,000 feet during descent to runway 10 at MIV.

Tappahannock-Essex County Airport (XSA), Tappahannock, VA routine pilot report (UA); Over – XSA; Time – 1519 EST; Flight level – 6,000 feet; Type aircraft – Beechcraft Bonanza single engine airplane (BE35); Temperature – plus 1° C; Icing – negative; Remarks – no icing in clouds from the surface to 6,000 feet, instrument meteorological conditions from 2,000 to 6,000 feet, temperature 1° C during descent.

Luray Caverns Airport (LUA), Luray, VA routine pilot report (UA); Over – 20 miles north of Charlottesville-Albemarle Airport; Time – 1523 EST; Flight level – 7,000 feet; Type aircraft – Saab 340 turboprop (SF34), Sky cover – overcast clouds with tops to 5,000 feet, sky clear above; Turbulence – negative; Remarks – smooth conditions.

Leesburg Executive Airport (JYO) routine pilot report (UA); Over – 10 miles north-northwest of Armel VORTAC; Time – 1523 EST; Flight level – 3,400 feet; Type aircraft – De Havilland Dash 8 multiengine commuter turboprop (DH8B); Sky cover – overcast clouds at 2,700 feet; Turbulence – negative.

Lynchburg Regional Airport(LYH) routine pilot report (UA); Over – 19 miles south-southwest of Lynchburg VORTAC; Time – 1546 EST; Flight level – 6,000 feet; Type aircraft – Mooney single engine airplane (M20P); Temperature – 0° C; Icing – light rime type icing.

Washington Dulles International Airport (IAD) routine pilot report (UA); Over –3 miles north-northwest of Armel VORTAC; Time –1604 EST; Flight level – 3,000 feet; Type aircraft – Cessna Citation 5 business jet (C750); Sky cover – broken clouds at 2,300 feet with tops 5,700 feet.

Of the 60 pilot reports made during the period, approximately 1/3 of the reports indicated icing conditions. The majority of the icing encounters were of light rime type icing conditions between 2,500 and 5,000 feet. There 2 reports of moderate icing conditions and included clear to mixed icing types, which reported in the immediate vicinity of the accident site and near the time of the accident. A plot of the icing pilot reports immediately surrounding the accident is included in figure 19.

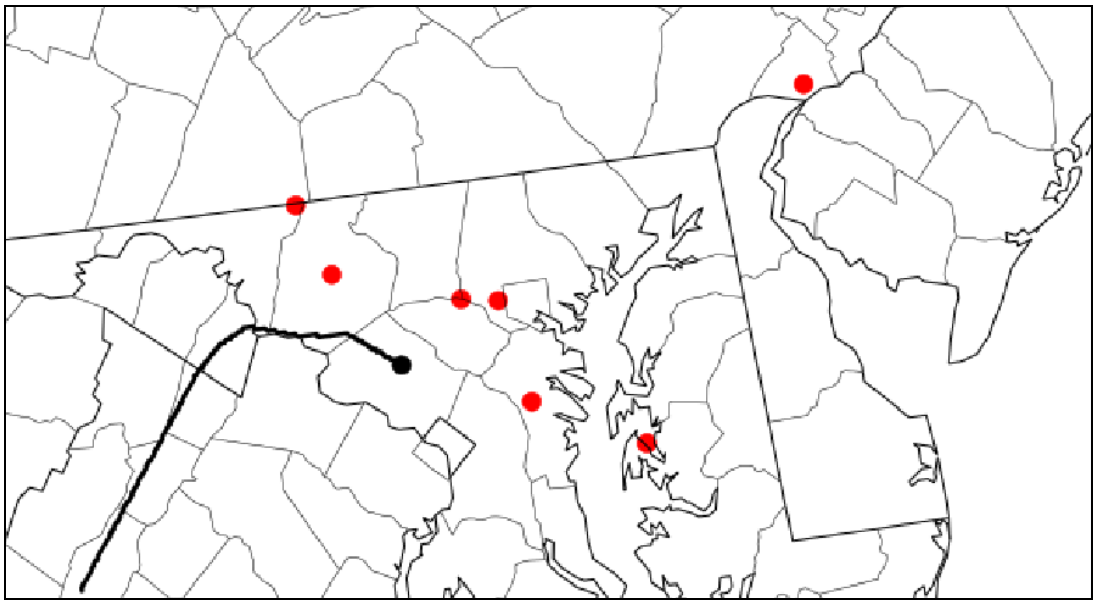


Figure 19 - Icing pilot reports

8.0 Terminal Aerodrome Forecast

The closest NWS Terminal Aerodrome Forecast (TAF) to the accident site was issued for Washington Dulles International Airport (KIAD) located approximately 19 miles southwest of the accident site at an elevation of 313 feet. While a TAF is only current for a 5 mile radius of the airport center point, it usually provides a more complete time specific forecast of wind, visibility, weather phenomena, and sky cover than the Area Forecast, as amended by AIRMET Sierra for IFR conditions. The forecasts issued surrounding the period were issued at 0647, 0809, and 0934 EST respectively and are included below.

*TAF KIAD 081147Z **0812/0918 03007KT P6SM SCT250***
FM081800 07008KT P6SM BKN050
FM090000 04005KT P6SM OVC015
FM090100 03010KT 6SM -RA OVC015
FM090600 01011KT 6SM -RA OVC008
FM091200 35010KT 5SM -RA OVC003
FM091500 34010G20KT 6SM -RA BKN008=

*TAF AMD KIAD **081309Z 0813/0918 03007KT P6SM OVC030***
FM081800 07008KT P6SM OVC025
FM090000 04005KT P6SM OVC015
FM090100 03010KT 6SM -RA OVC015
FM090600 01011KT 6SM -RA OVC008
FM091200 35010KT 5SM -RA OVC003
FM091500 34010G20KT 6SM -RA BKN008=

*TAF AMD KIAD **081434Z 0815/0918 03007KT P6SM OVC030***
FM081800 06008KT P6SM OVC025
FM090000 04005KT P6SM OVC015
FM090200 03010KT 6SM -RA OVC015
FM090600 01011KT 6SM -RA OVC008
FM091200 35010KT 5SM -RA OVC003
FM091500 34010G20KT 6SM -RA BKN008=

The first forecast issued at 0647 EST and assumed to be the one current during any preflight weather briefing indicated north-northeast wind at 7 knots, with visibility unrestricted and scattered high cirrus clouds at 25,000 feet. VFR conditions were initially predicted until 1900 EST when MVFR conditions were expected with light precipitation after 2000 EST and continuing into the December 9, 2014 with IFR to LIFR conditions after midnight.

The forecast was amended again at 0809 EST changing the basic flight conditions to MVFR and amended the sky cover to a ceiling overcast at 3,000 feet, with the rest of the forecast unchanged. The forecast was again amended at 0934 EST immediately prior to the flights departure modified the start of the precipitation to after 2100 EST.

Similar forecasts were issued for the next closest forecast station of Baltimore International Airport (KBWI) to the east:

TAF KBWI 081147Z 0812/0918 03010KT P6SM SCT250
FM082100 04010KT P6SM OVC050
FM090000 05007KT P6SM OVC015
FM090100 04010KT 6SM -RA OVC015
FM090600 02013KT 6SM -RA OVC008
FM091200 36012KT 3SM -RA OVC003
FM091500 34012G24KT 6SM -RA OVC008=

TAF AMD KBWI 081309Z 0813/0918 03010KT P6SM OVC030
FM082000 04010KT P6SM OVC020
FM090000 05007KT P6SM OVC015
FM090100 04010KT 6SM -RA OVC015
FM090600 02013KT 6SM -RA OVC008
FM091200 36012KT 3SM -RA OVC003
FM091500 34012G24KT 6SM -RA OVC008=

TAF KBWI 081434Z 0815/0918 03010KT P6SM OVC030
FM082000 04010KT P6SM OVC020
FM090000 05007KT P6SM OVC015
FM090300 04010KT 6SM -RA OVC015
FM090600 02013KT 6SM -RA OVC008
FM091200 36012KT 3SM -RA OVC003
FM091500 34012G24KT 6SM -RA OVC008

9.0 Area Forecast

The Area Forecast (FA) is a forecast of visual Flight Rules (VFR) clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra (IFR) bulletin for the same area in order to get a complete picture of the weather. The area forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports which do not have a terminal forecast (TAF) issued. The NWS Aviation Weather Center (AWC) located in Kansas City, Missouri, issues the FA at regular intervals and issues specials reports as necessary usually in the form of an AIRMET. The Boston (KBOS) and Miami (KMIA) regional forecasts that were current at the time of the accident were issued at 0445 EST and valid through 1700 EST on December 8, 2014. The forecasts were as follows:

FAUS41 KKCI 080945 2014342 0939
FA1W
-BOSC FA 080945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 090400
CLDS/WX VALID UNTIL 082200...OTLK VALID 082200-090400
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...RIDGE OF HIGH PRES EXTDS FROM NEW ENG SWWD INTO SERN US. BY 04Z...LOW PRES SYS WILL BE OVR THE CSTL SXNS OF NRN NC. A WRMFNT WILL EXTD ESEWD FROM LOW INTO THE ATLC. A STNRY FNTL SYS WILL EXTD SWD FROM LOW INTO ATLC. AN OCCLD FNT WILL EXTD FROM A LOW NR SSM SWD THRU LH AND EXTRM SERN PTNS OF LWR MI INTO WRN OH. A CDFNT WILL CONT FROM WRN OH SWWD INTO WRN TN AND CNTRL AR.
.
VA MD DC DE
SWRN VA...BKN150 TOPS FL200 OVC CI. OTLK...VFR BECMG 0104 MVFR CIGS RA BR.
NWRN VA/WRN MD/DC...SCT035-050 BKN-OVC CI. BECMG 1922 BKN-OVC035-050 TOPS 080-100. OTLK...MVFR CIGS RA BR.
ERN VA/ERN MD/DE...SCT-BKN020-030 TOPS 050 BKN CI ABV. BECMG 1316 BKN-OVC015-025 TOPS 035-050. OTLK...MVFR CIGS RA BR.
.
FAUS42 KKCI 080945
FA2W
-MIAC FA 080945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 090400
CLDS/WX VALID UNTIL 082200...OTLK VALID 082200-090400
NC SC GA FL AND CSTL WTRS E OF 85W
.
SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.
TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.
NON MSL HGTS DENOTED BY AGL OR CIG.
.
SYNOPSIS...NO SGFNT FNTL SYS IN AREA. RIDGE OF HIGH PRES EXTDS FROM NEWENG SWWD INTO SERN US. BY 04Z...LOW PRES SYS WILL BE OVR THE CSTL SXNS OF NRN NC. A WRMFNT WILL EXTD ESEWD FROM LOW INTO THE ATLC. A STNRY FNTL SYS WILL EXTD SWD FROM LOW INTO ATLC.

.
NC
WRN NC...BKN CI. BECMG 1316 BKN035-050 TOPS 060. BECMG 1619 TOPS 080-100.
OTLK...MVFR CIGS.
CNTRL AND ERN NC...OVC020-025 TOPS 050-060. CLD TOPS INCRSG TO 100 DURG PD.
OTLK...MVFR CIGS RA BECMG 0104 IFR CIGS RA.

The Area Forecast for the DC and Maryland and Virginia area expected scattered clouds at 3,500 to 5,000 feet with higher broken to overcast cirrus clouds above. Lower ceilings at 3,500 to 5,000 feet were not expected until after 1400 EST. With conditions over central North Carolina overcast at 2,000 to 2,500 feet with tops to 5,000 to 6,000 feet.

10.0 In-Flight Weather Advisories

The NWS issues in-flight weather advisories designated as Severe Weather Forecast Alerts (AWW's), Convective SIGMET's (WST's), SIGMET's (WS's), Center Weather Advisories (CWA's), and AIRMET's (WA's). In-flight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions, which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft.

No SIGMETs, Convective SIGMETs, Severe Weather Forecast Alerts, or Center Weather Advisories were current surrounding the period. The following AIRMETs were issued by the NWS Aviation Weather Center (AWC) surrounding the period, with no significant icing, turbulence, low-level wind shear over the Gaithersburg area:

WAUS41 KKCI 080845
WA1S
-BOSS WA 080845
AIRMET SIERRA UPDT 1 FOR IFR AND MTN OBSCN VALID UNTIL 081500
.
NO SGFNT IFR EXP OUTSIDE OF CNVTV ACT.
.
OTLK VALID 1500-2100Z...MTN OBSCN PA WV MD VA NC SC GA
BOUNDED BY JST-EMI-40SSW LYH-CLT-ODF-GQO-HMV-JST
MTNS OBSC BY CLDS. CONDS CONTG THRU 21Z.
.
WAUS41 KKCI 070845 2014341 0843
WA1T
-BOST WA 070845
AIRMET TANGO UPDT 1 FOR TURB AND STG SFC WNDS VALID UNTIL 071500
.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA LE AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 60WSW YSJ TO 60S HTO TO 20E CYN TO 20N EWC TO 20WSW YYZ TO 100WSW YOW TO YOW TO YSC TO 70NW PQI
MOD TURB BTN FL240 AND FL370. CONDS CONTG BYD 15Z THRU 21Z.
.
AIRMET TURB...ME NH VT MA RI CT NY NJ PA MD DC DE VA NC AND CSTL WTRS

FROM 100SSE BGR TO 130ESE ACK TO 210SSE HTO TO 120E ORF TO 130SSE ILM TO 40SW ILM TO CSN TO 40W ALB TO 100SSE BGR
MOD TURB BLW 070. CONDS CONTG BYD 15Z THRU 21Z.
.
AIRMET STG SFC WNDS...ME NH MA RI NY NJ MD DE VA NC SC AND CSTL WTRS
FROM 90SSE BGR TO 130ESE ACK TO 210S ACK TO 160SE SIE TO 190ESE ECG TO 130SSE ILM TO 60S ILM TO 40SSE ECG TO 60E ORF TO 50SE JFK TO 90SSE BGR
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 15Z THRU 21Z.
.
OTLK VALID 1500-2100Z
AREA 1...TURB ME NH VT MA RI CT NY NJ PA AND CSTL WTRS
BOUNDED BY 70NW PQI-60NE PQI-60SW YSJ-160S ACK-60ESE SIE-30SW CYN-40NNW ETX-40N PLB-YSC-70NW PQI
MOD TURB BTN FL240 AND FL370. CONDS CONTG THRU 21Z.
.
AREA 2...STG SFC WNDS ME NH MA RI NY NJ MD DE VA NC SC GA FL AND CSTL WTRS
BOUNDED BY 80SSE BGR-160SE ACK-200S ACK-160SE SIE-190ESE ECG-130SSE ILM-220SE CHS-140ENE OMN-60ESE SAV-60S ECG-70SSE SBY-30SSE HTO-80SSE BGR
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG THRU 21Z.
....
WAUS41 KKCI 070845 2014341 0841
WA1Z
-BOSZ WA 070845
AIRMET ZULU UPDT 1 FOR ICE AND FRZLVL VALID UNTIL 071500
.
AIRMET ICE...ME NH MA RI CT NY NJ MD DE VA NC AND CSTL WTRS
FROM 60SW YSJ TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO 130SE ILM TO SIE TO 20SE SAX TO 40S CON TO 60SW YSJ
MOD ICE BTN FRZLVL AND FL200. FRZLVL 030-090. CONDS CONTG BYD 15Z ENDG 18-21Z.
.
AIRMET ICE...OH WV VA
FROM 50SSW AIR TO 30E EKN TO 40SSE PSK TO HMV TO HNN TO 50SSW AIR
MOD ICE BTN 020 AND 060. CONDS ENDG 12-15Z.
.
FRZLVL...RANGING FROM SFC-095 ACRS AREA
MULT FRZLVL BLW 090 BOUNDED BY 50ESE BOS-50SE ACK-70SSW ECG-30WSW RDU-HMV-HNN-CVG-FWA-30ESE JHW-50ESE BOS
SFC ALG 50WSW BKW-40NE PSK-20SW CSN-20SSW SAX-80S BGR-90SSW YSJ
040 ALG 20NE ECG-70SSE HTO-70E ACK-140ENE ACK
080 ALG 160SE SIE-170SSE HTO-150ESE ACK
....

A plot of AIRMET Zulu is included as figure 20. The advisory did not extend over the interior section of Maryland, or impact the route of flight.

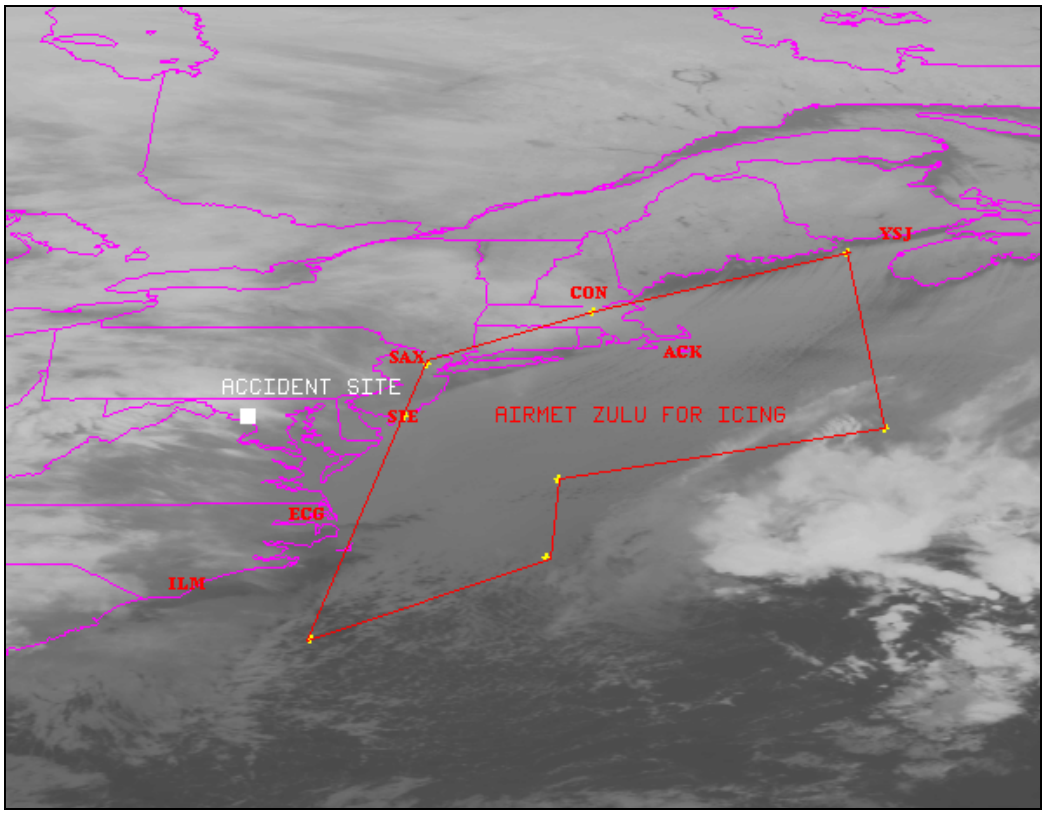


Figure 20 - AIRMET ZULU 1 issued at 0345 EST and valid until 1000 EST

The advisories were updated approximately an hour prior to the accident:

WAUS41 KKCI 081445 *2014342 1452*
WA1S
-BOSS WA 081445
AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 082100
.
AIRMET IFR...NJ PA MD DC DE VA AND CSTL WTRS
FROM 20WSW JFK TO 80ESE SBY TO 30SSE SBY TO 30NNE RIC TO 20WSW DCA TO 40ESE EMI TO 20WSW JFK
CIG BLW 010/VIS BLW 3SM BR. CONDS DVLPG 18-21Z. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET MTN OBSCN...PA WV MD VA NC SC GA
FROM 50SE JST TO EMI TO 20ENE LYH TO 20NE GSO TO CLT TO 20SE ODF TO GQO TO HMV TO 40SSW JST TO 50SE JST
MTNS OBSC BY CLDS. CONDS CONTG BYD 21Z THRU 03Z.
.
OTLK VALID 2100-0300Z
AREA 1...IFR RI CT NY NJ PA WV MD DC DE VA NC SC AND CSTL WTRS
BOUNDED BY 20S PVD-90E ECG-90SSE ECG-90ESE ILM-60ENE CHS-20S FLO-40N FLO-50W GSO-20SSE BKW-50S EKN-20ESE LYH-40WNW RIC-20WSW DCA-50SSW ETX-20N JFK-20S PVD
CIG BLW 010/VIS BLW 3SM BR. CONDS CONTG THRU 03Z.
.
AREA 2...MTN OBSCN ME NH VT MA NY PA WV MD VA NC SC GA
BOUNDED BY YSC-40WSW BGR-CON-30N BDL-HAR-CLT-ATL-GQO-HMV-20SW BKW-20SW EKN-30W SLT-40W HNK-60SSW PLB-YSC
MTNS OBSC BY CLDS. CONDS CONTG THRU 03Z.

....

WAUS41 KKCI 081445 2014342 1450
WA1T
-BOST WA 081445
AIRMET TANGO UPDT 2 FOR TURB AND STG SFC WNDS VALID UNTIL 082100
.
AIRMET TURB...NY PA OH LE WV
FROM 30W YYZ TO 30SSW BUF TO 40SW SYR TO 50NW ETX TO 30E EWC TO 30NW EKN TO HNN TO CVG TO FWA TO 30SE ECK TO 30W YYZ
MOD TURB BLW 080. CONDS DVLPG 15-18Z. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET STG SFC WNDS...MA RI NY NJ MD DE VA NC SC AND CSTL WTRS
FROM 60ESE HTO TO 150ESE ACK TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO 130SE ILM TO 130SSE ILM TO 80ESE CHS TO 70ENE ILM TO 150SE SIE TO 60ESE HTO
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS ENDG 15-18Z.
.
OTLK VALID 2100-0300Z
AREA 1...TURB VT NY LO PA OH LE WV
BOUNDED BY 60W YSC-20N ALB-60SW HNK-30E EWC-20NW EKN-HNN-CVG-FWA-20NE DXO-30SE ECK-20NW YYZ-60NE YYZ-YOW-60W YSC
MOD TURB BLW 080. CONDS CONTG THRU 03Z.
.
AREA 2...TURB NJ MD DE VA NC SC GA FL AND CSTL WTRS
BOUNDED BY 50SSE DCA-40ESE SBY-160SE SIE-190ESE ECG-130SSE ILM-160ENE OMN-80SSE CHS-60S ILM-60SE ECG-20WNW ORF-50SSE DCA
MOD TURB BLW 080. CONDS CONTG THRU 03Z.
.

WAUS41 KKCI 081445 2014342 1453
WA1Z
BOSZ WA 081445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 082100
.
NO SGFNT ICE EXP OUTSIDE OF CNVTV ACT.
.
OTLK VALID 2100-0300Z
AREA 1...ICE WV VA NC AND CSTL WTRS
BOUNDED BY 50E EKN-40S RIC-60SSW ECG-60SE ILM-40N FLO-20NNE CLT-30E HMV-BKW-50E EKN
MOD ICE BTN FRZLVL AND 140. FRZLVL SFC-040. CONDS DVLPG 21-00Z.
CONDS CONTG THRU 03Z.
.
AREA 2...ICE OH LE
BOUNDED BY 30SE ECK-40E CVG-CVG-FWA-30SE ECK
MOD ICE BTN FRZLVL AND 140. FRZLVL 020-040. CONDS DVLPG 00-03Z. CONDS CONTG THRU 03Z.
.
FRZLVL...RANGING FROM SFC-090 ACRS AREA
MULT FRZLVL BLW 090 BOUNDED BY YOW-30E HNK-50NNE ACK-140SS BGR-200SE ACK-140SSE ACK-130SSE HTO-20S ORF-HMV-20S AIR-30SE ECK-YOW
SFC ALG 60WSW YYZ-20NE ERI-50SSE EWC-50ESE EKN-140SSE BGR-150ENE ACK
040 ALG 60SW DXO-30W CLE-30S AIR-30SW EKN-20E HMV
040 ALG 50NE RDU-80ESE SIE-120S ACK-150SE ACK-160ESE ACK
080 ALG 90E ORF-180ESE SIE
....

The following graphic of G-AIRMETs were issued for the period by the AWC and are included as figure 21 through 23:

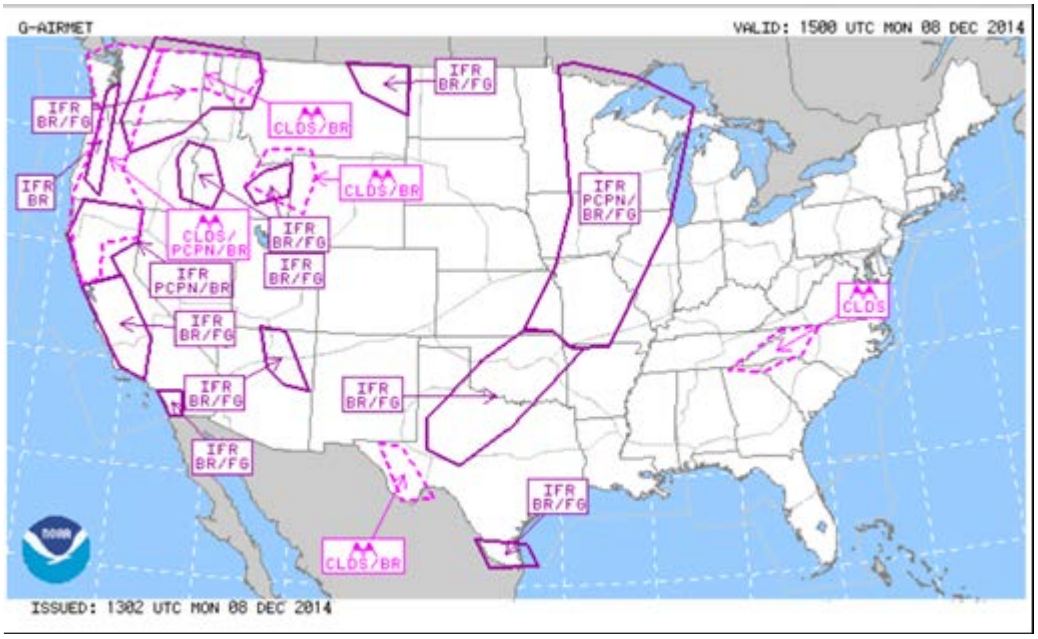


Figure 21 – G-AIRMET for IFR conditions valid for 1000 EST

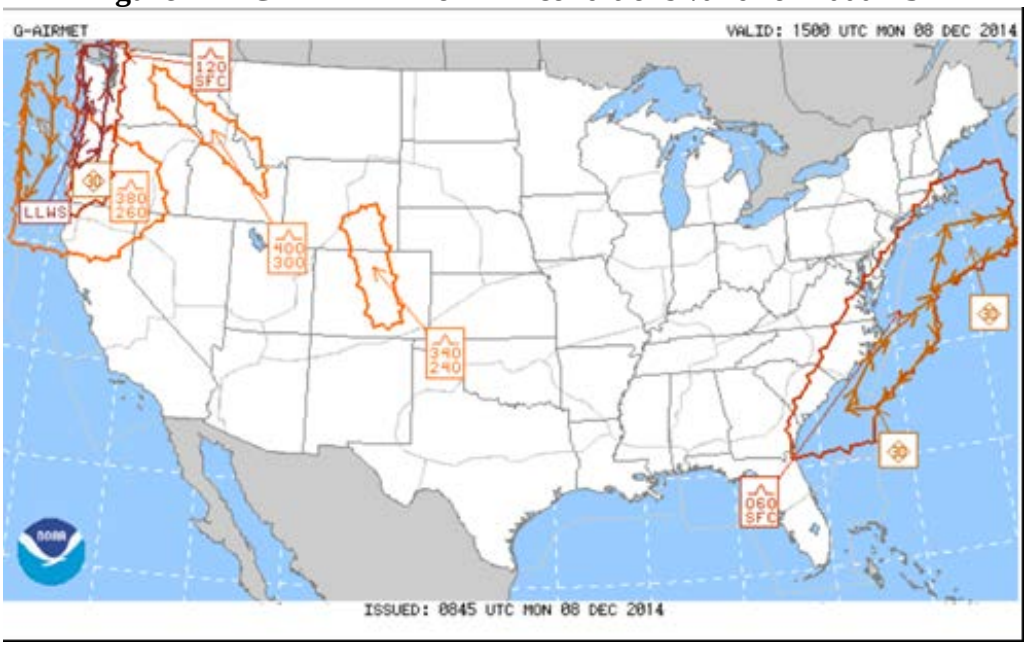


Figure 22 – G-AIRMET Tango for turbulence at 1000 EST

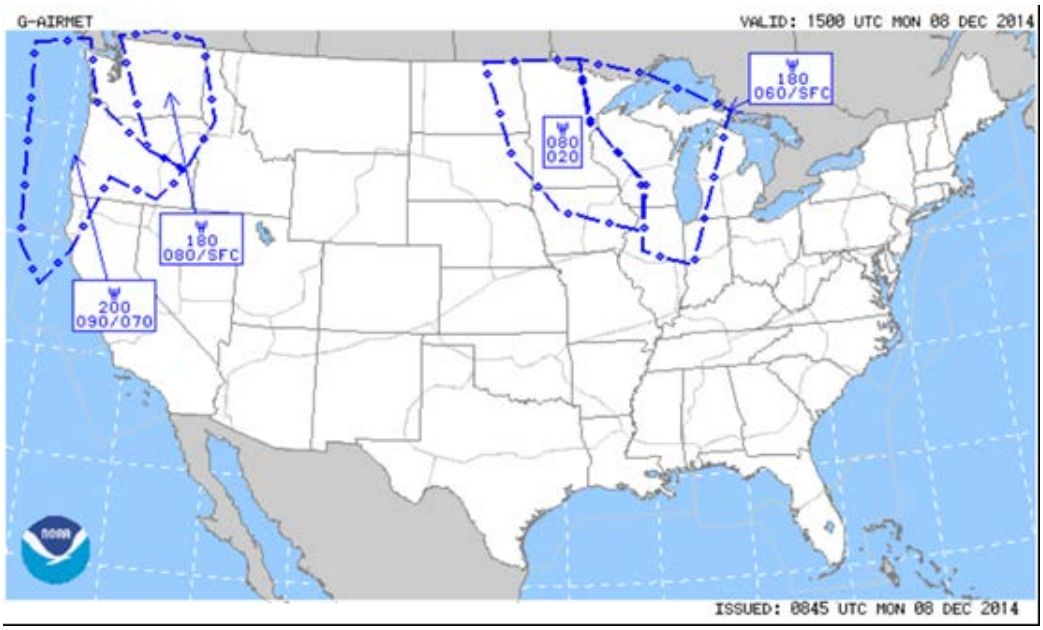


Figure 23 – G-AIRMET Zulu for icing at 1000 EST

11.0 Preflight Weather Briefing

There was no record of the pilot obtaining any weather briefing from the FAA contract Automated Flight Service Center (AFSS) or from any of the Direct User Access Terminal System (DUATS) providers. It is no known what source the pilot used to obtain his preflight weather briefing, the time he obtained, or what information he had obtained. However, no NWS advisories or forecasts would have restricted the flight from operating, and no alternate airport was required. A review of pilot reports and freezing level data would have indicated to the pilot that light icing conditions could be reasonably expected in the clouds descending into the Gaithersburg area.

12.0 Winds and Temperature Aloft Forecast

The following winds and temperature aloft forecast was valid at the time:

DATA BASED ON 081200Z
VALID 081800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT 3000 6000 9000 12000 18000 24000 30000 34000 39000 45000 53000
RDU 0830 1813+01 1520-01 1622-04 2024-20 2339-28 257245 257753 257860 256661 265065
ROA 0909 1518+02 1615-02 1722-06 2039-20 2340-29 235847 247454 257260
RIC 0932 1515+04 1517-01 1614-05 2023-19 2338-30 245146 256653 257362 256361 264864
ORF 0832 1415+04 1315+00 1416-04 2016-18 2435-29 255245 256453 267362

13.0 Witness Statements

Several certified flight instructors (CFI's) who were providing instruction at Gaithersburg Airport witnesses the accident and provided statements regarding the weather conditions surrounding the period.

13.1 Mr. Kenneth Ansorge, Cessna 172, N5215E

Mr. Ansorge a CFI with approximately 350 hours total time was in the traffic pattern downwind with his student when he observed N100EQ appear on short final with his landing light on. Almost immediately he observed the accident airplane in what he described as uncontrolled S-turns, banking left almost 90°, then right 90°, and then back to the left when it went inverted and hit the ground, and he observed the fireball. Mr. Ansorge then reported on frequency that the airplane had crashed short of the runway.

He described the weather conditions at the time of the accident, as a ceiling from 1,500 to 2,000 feet, with the ceiling lower to the northwest. He estimated the visibility as 5 to 7 miles, and reported light snow flurries near the time of the accident. The wind was from the northeast at approximately 6 knots. He reported no turbulence and generally smooth conditions, with the clouds above the pattern altitude.

13.2 Ms. Hadar Shapiro, Cessna 172, N52632

Ms. Shapiro was also CFI for instruments (CFII) and was with a student in the pattern when she heard N100EQ call in on frequency he was 10 miles and then 7 miles out. Upon landing she had radioed to another instructor at 1041:25 EST who was preparing to depart advising him that some weather was approaching the airport. They were on the ground when they heard N100EQ make a call that he was three miles out. They had just parked when she heard the other aircraft report the accident.

Ms. Shaprio indicated that she was planning on leaving the traffic pattern with her student, but as they were climbing to approximately 2,000 feet she saw a wall of snow coming towards them and she decided to return to the airport and land. She described a band of snow between them and Fredrick to the northwest, and said that it wasn't snowing at the airport when she landed, and the wind was less than 5 knots, and there was no turbulence. She also indicated that while they were in the traffic pattern and heard N100EQ make his position reports she was unable to see the airplane at the 10 or 7 mile positions.

13.3 Mr. Alexander King, Cessna 172, N9400L

Mr. Alexander King was also a CFII and multiengine instructor with approximately 1,170 hours, and he was providing instruction to a student in a Cessna 172 that was in the run-up area preparing for takeoff on runway 14 facing in the direction of the accident site. He heard N100EQ make 10, 7, and 3 mile position reports and shortly thereafter, he observed the aircraft emerge from the clouds with his landing light on and in a stable attitude. After first observing the aircraft his attention was diverted back into the cockpit, when he looked back up he observed N100EQ making uncontrollable S-turns. He indicated the aircraft looked like it was coming out

of one turn and then rolled into the opposite direction before descending and disappearing behind the trees. Mr. King then broadcasted that the aircraft had gone down. He next called Potomac TRACON and made a report with them. He then departed and flew over the accident site and took some pictures and video, and landed.

Mr. King indicated he thought the airplane was going too slowly, but couldn't be sure. Regarding the weather conditions, he estimated the ceiling height between 1,700 and 2,000 feet agl, and estimated the visibility as 4 to 6 miles. He also indicated that a line of snow showers was coming in from the northwest, but had not yet reached the airport at the time of the accident. He also indicated that light snow flurries were present, but nothing of significance. When he departed and circled the accident site he indicated his altitude was above the pattern altitude of 1,500 feet and was still 500 to 700 feet below the clouds.

Mr. King also indicated that there was no bird activity in the direction of the accident airplanes approach.

13.4 Security Camera Videos

Several security cameras at the airport, and first responders videos were also reviewed which might have captured the accident. Of the cameras reviewed several of them indicated intermittent light snow flurries and an overcast cloud cover surrounding the time period of the accident.

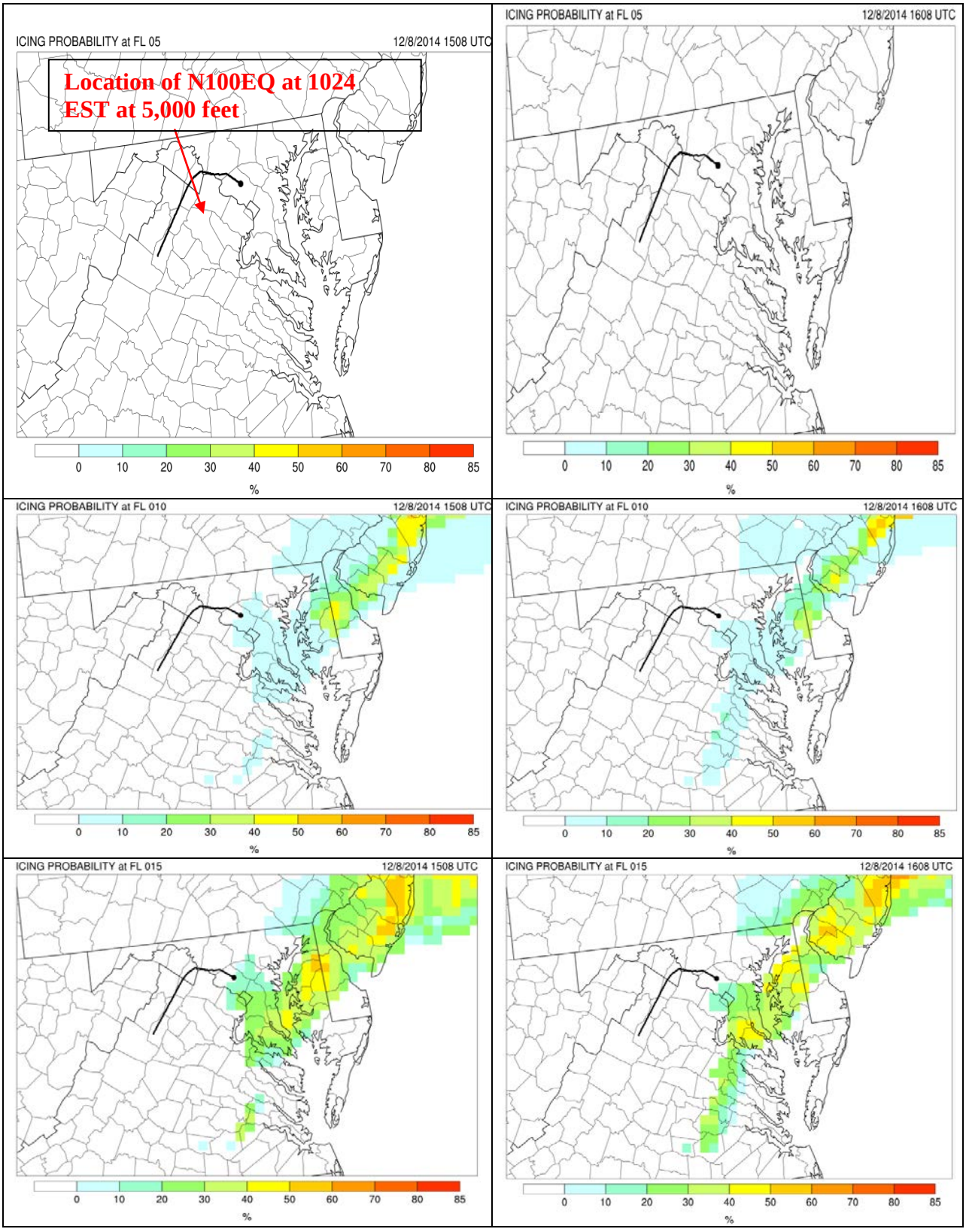
14.0 Astronomical Data

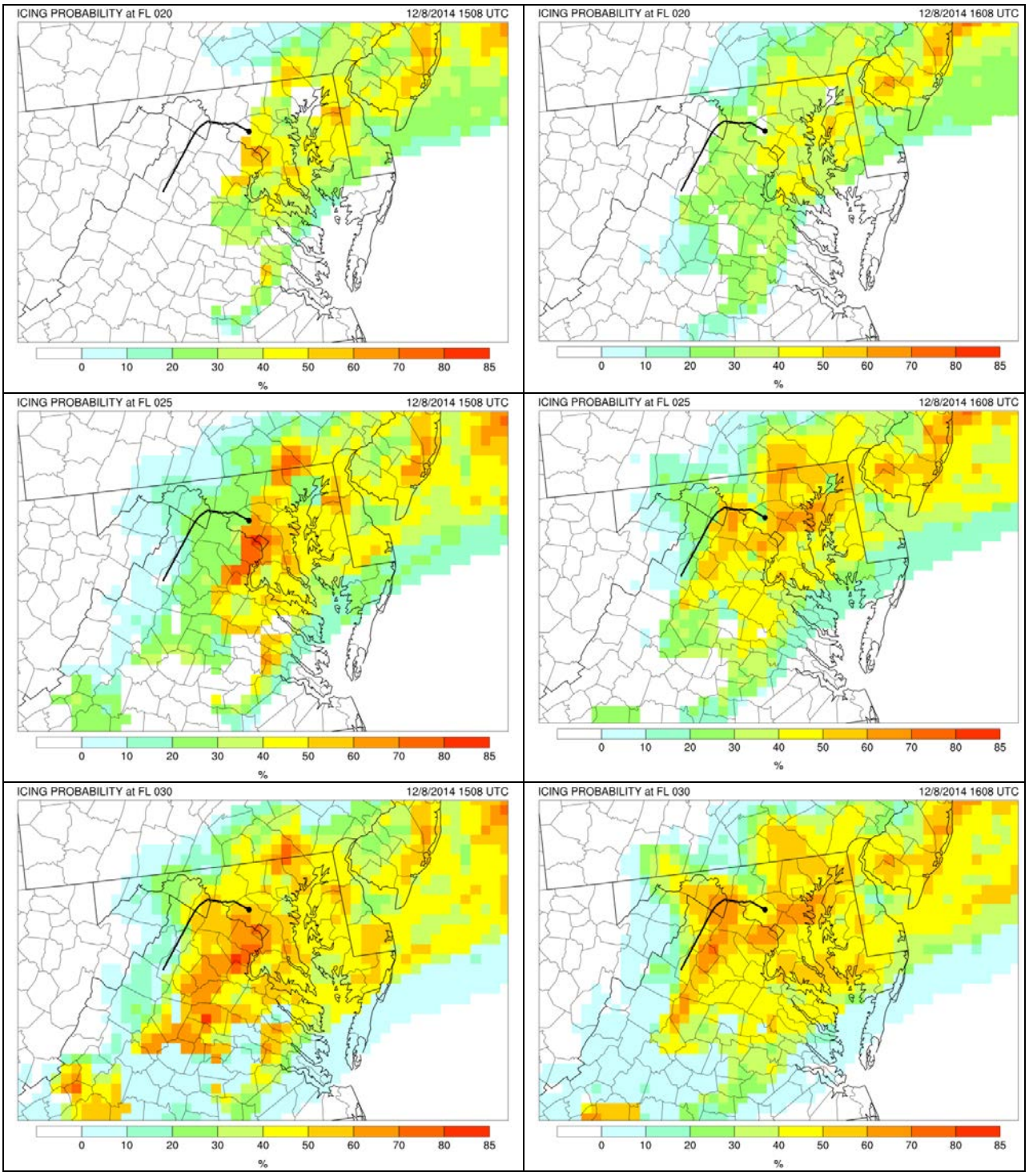
The United Stated Naval Observatory website provided the following astronomical data for Gaithersburg on December 8, 2014:

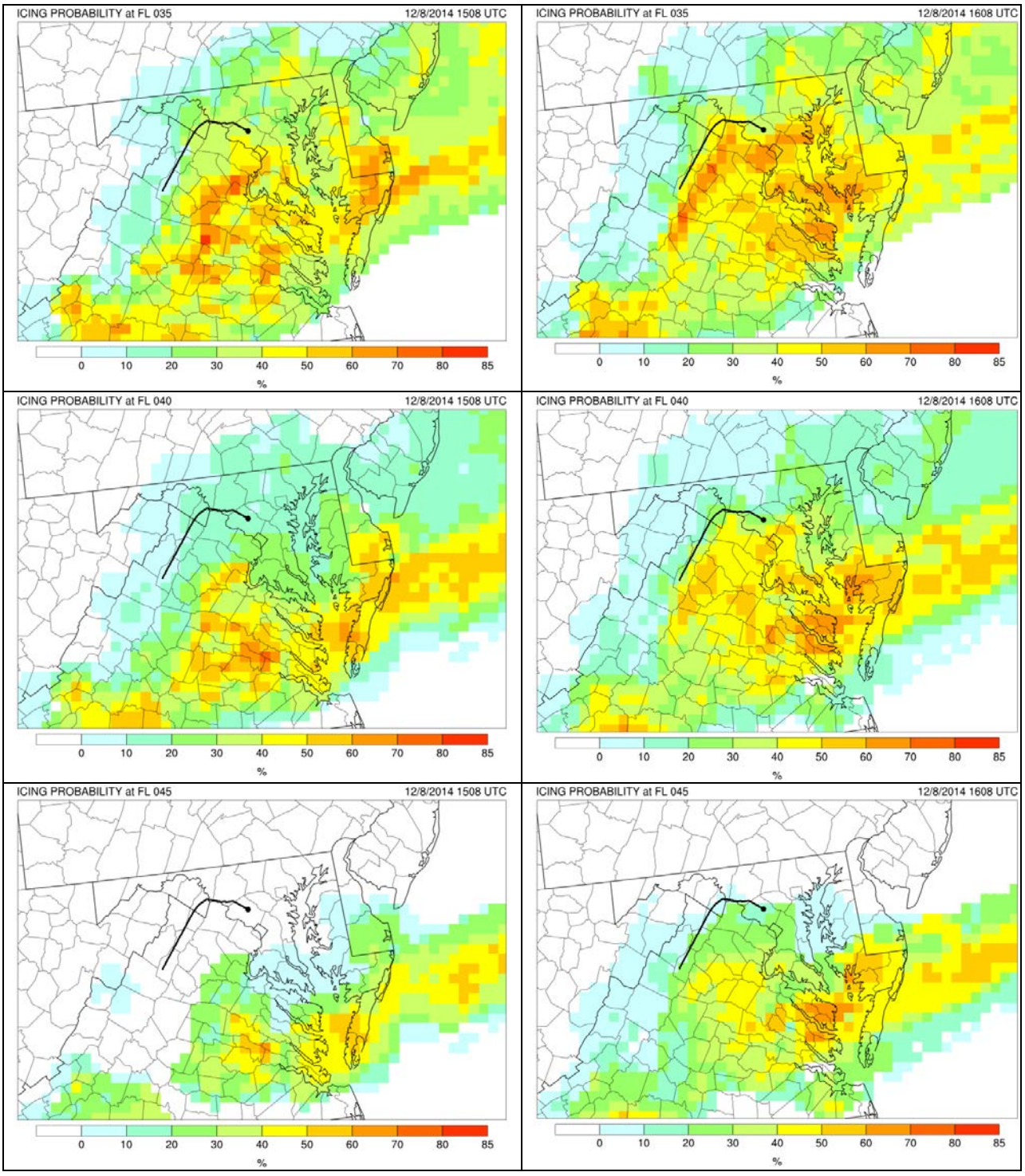
SUN	
Beginning of civil twilight	0647 EST
Sunrise	0716 EST

15.0 Current Icing Product

The National Center for Atmospheric Research (NCAR) scientists who created the Current Icing Product (CIP) and continue to refine and develop the product were asked to rerun the model for the period of 1000 and 1100 EST for the area between the surface and 5,000 feet. The following images in figure 24 are the probability in percent for structural icing conditions at every 500 feet increments from 500 to 5,000 feet over the region, with the flight track of N100EQ overlaid. The flight track of N100EQ begins at approximately 1015 EST descending from 16,400 feet and is at approximately 5,000 feet at 1024 EST crossing the Maryland/Virginia border and begins the turn to the east-southeast at 4,800 feet. The final position is at the accident site at 1051 EST short of the airport. The images indicated an approximately 40 to 70% likelihood of icing conditions between 2,000 and 3,500 feet along the flight track of N100EQ.


ICING PROBABILITY at FL 05
12/8/2014 1508 UTC
Location of N100EQ at 1024 EST at 5,000 feet
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 05
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 010
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 010
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 015
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 015
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%


ICING PROBABILITY at FL 020
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 020
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 025
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 025
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 030
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 030
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%


ICING PROBABILITY at FL 035
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 035
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 040
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 040
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 045
12/8/2014 1508 UTC
0 10 20 30 40 50 60 70 80 85
%
ICING PROBABILITY at FL 045
12/8/2014 1608 UTC
0 10 20 30 40 50 60 70 80 85
%

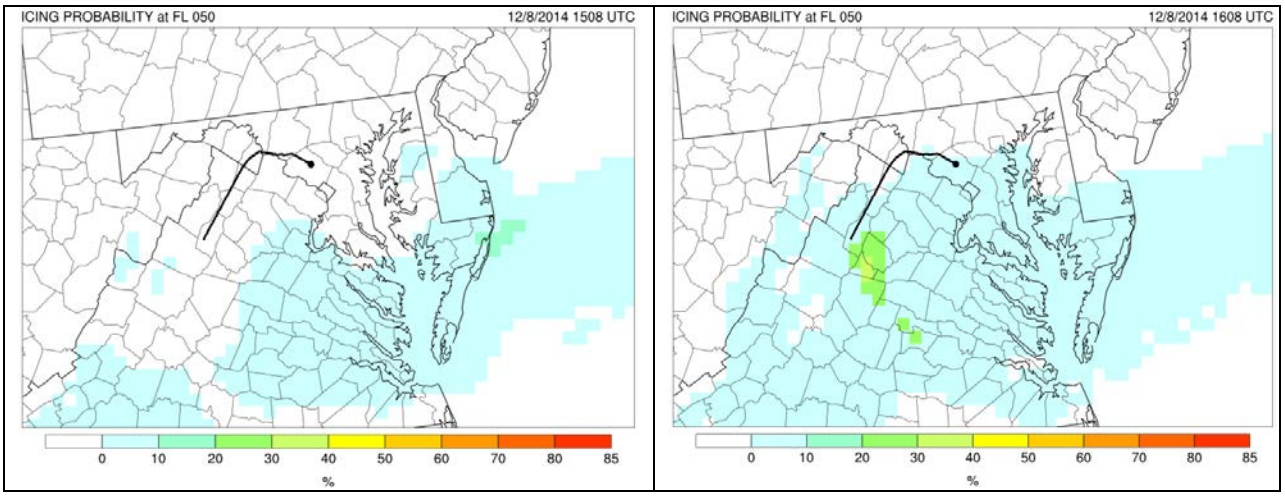
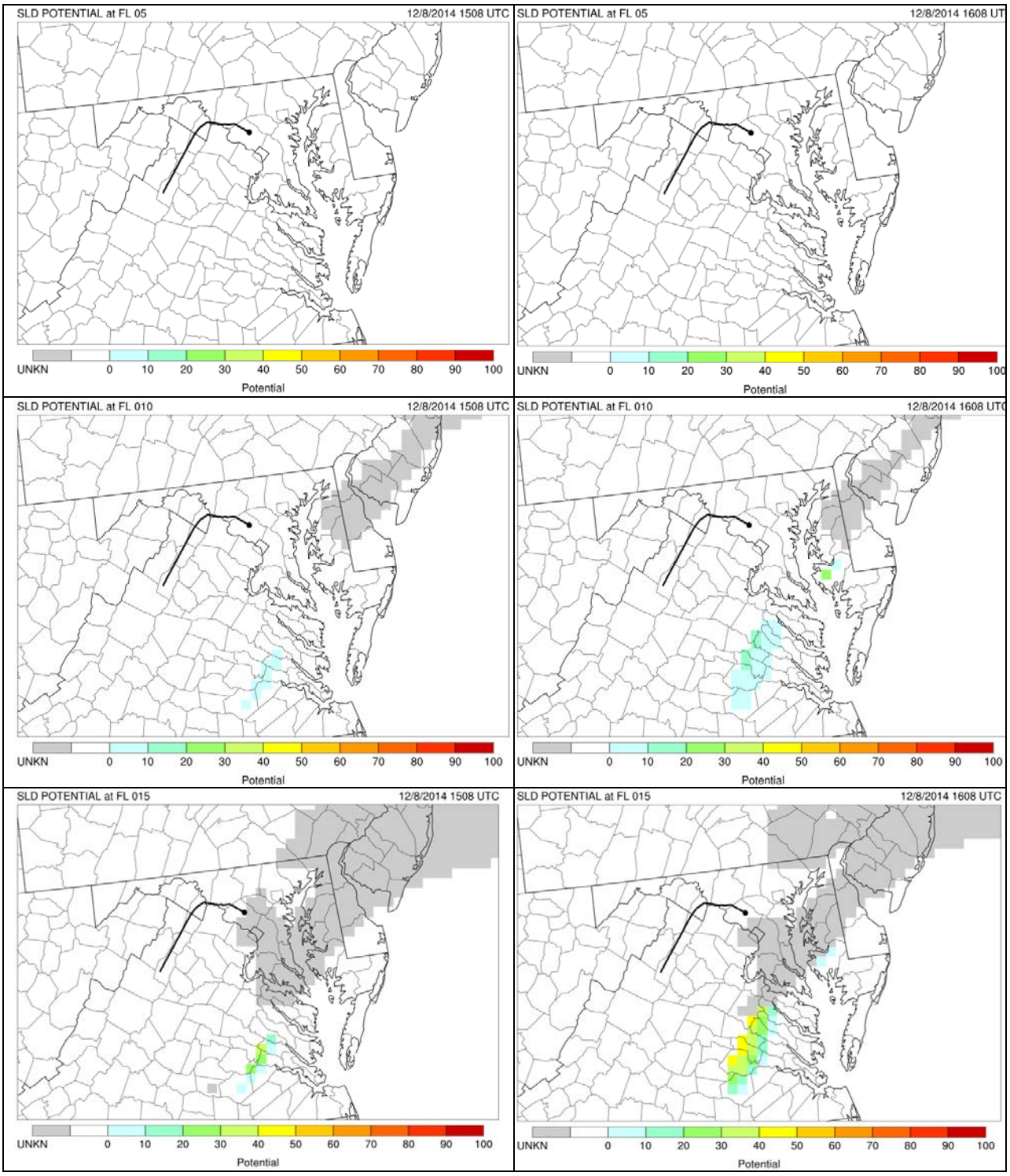
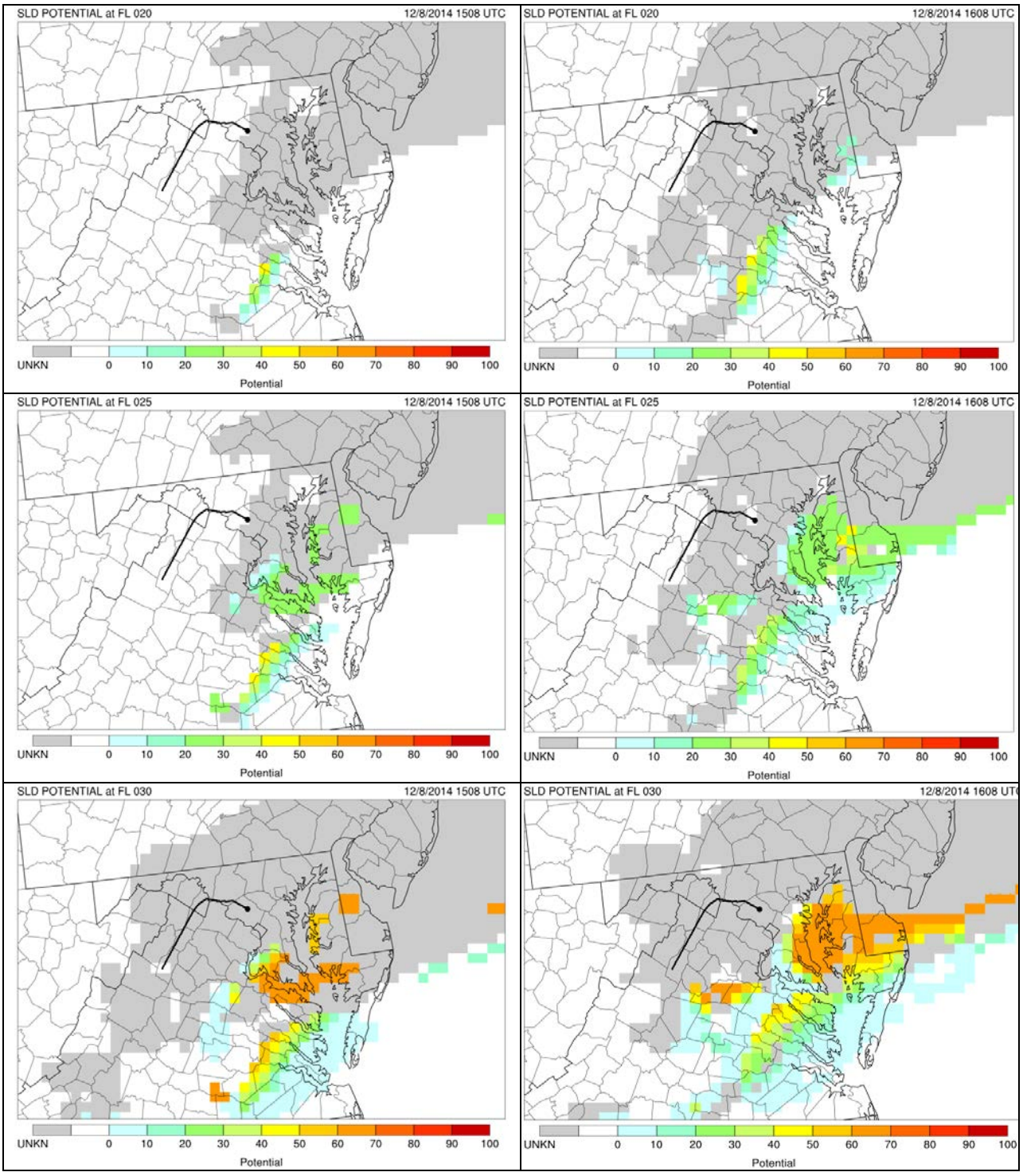
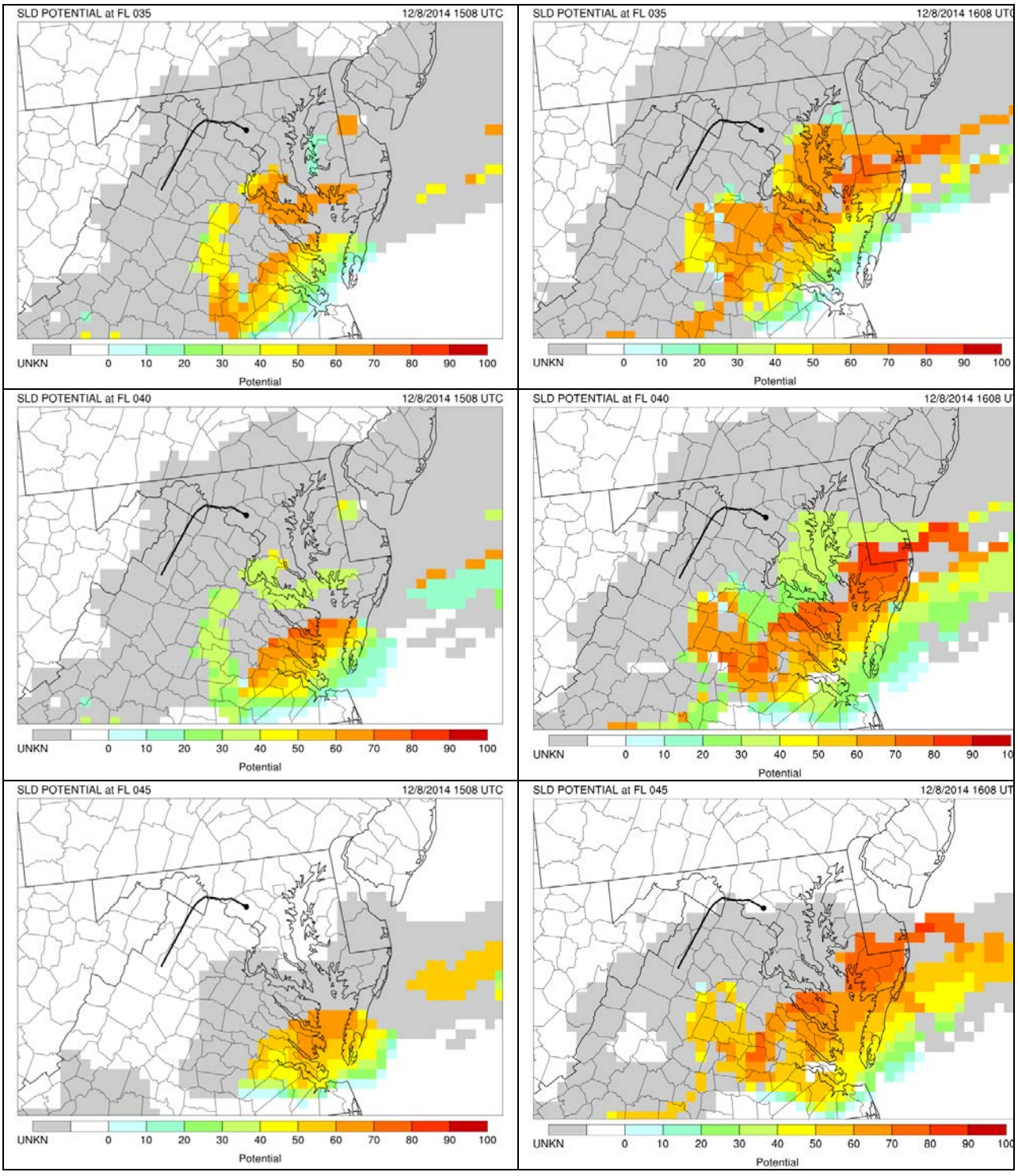


Figure 24 – Probability of Icing for 1000 (1500Z) and 1100 EST (1600Z) from 500 to 5,000 feet

Figure 25 are the probability of supercooled large droplets (SLD) conditions for the same period of 1000 and 1100 EST. The images depicted an area of potential SLD conditions develop over Maryland and Delaware to the east and southeast of the flight track, but not over the flight track.


SLD POTENTIAL at FL 05
12/8/2014 1508 UTC
SLD POTENTIAL at FL 05
12/8/2014 1608 UT
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential
SLD POTENTIAL at FL 010
12/8/2014 1508 UTC
SLD POTENTIAL at FL 010
12/8/2014 1608 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential
SLD POTENTIAL at FL 015
12/8/2014 1508 UTC
SLD POTENTIAL at FL 015
12/8/2014 1608 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential


SLD POTENTIAL at FL 020
12/8/2014 1508 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential
SLD POTENTIAL at FL 020
12/8/2014 1608 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential
SLD POTENTIAL at FL 025
12/8/2014 1508 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential
SLD POTENTIAL at FL 025
12/8/2014 1608 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential
SLD POTENTIAL at FL 030
12/8/2014 1508 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential
SLD POTENTIAL at FL 030
12/8/2014 1608 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential


SLD POTENTIAL at FL 035
12/8/2014 1508 UTC
SLD POTENTIAL at FL 035
12/8/2014 1608 UTC
SLD POTENTIAL at FL 040
12/8/2014 1508 UTC
SLD POTENTIAL at FL 040
12/8/2014 1608 UTC
SLD POTENTIAL at FL 045
12/8/2014 1508 UTC
SLD POTENTIAL at FL 045
12/8/2014 1608 UTC
UNKN 0 10 20 30 40 50 60 70 80 90 100
Potential

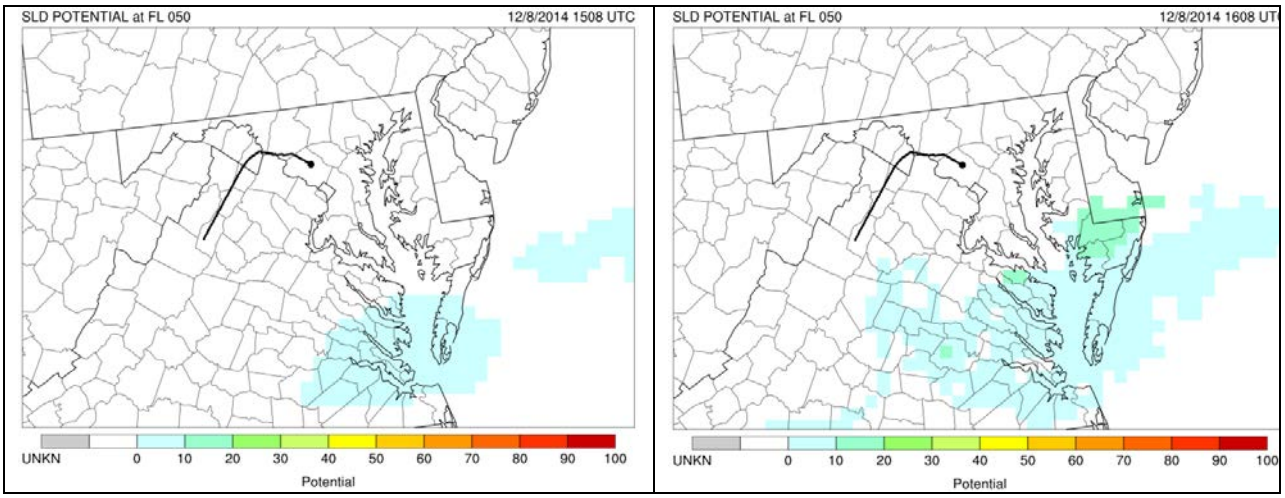
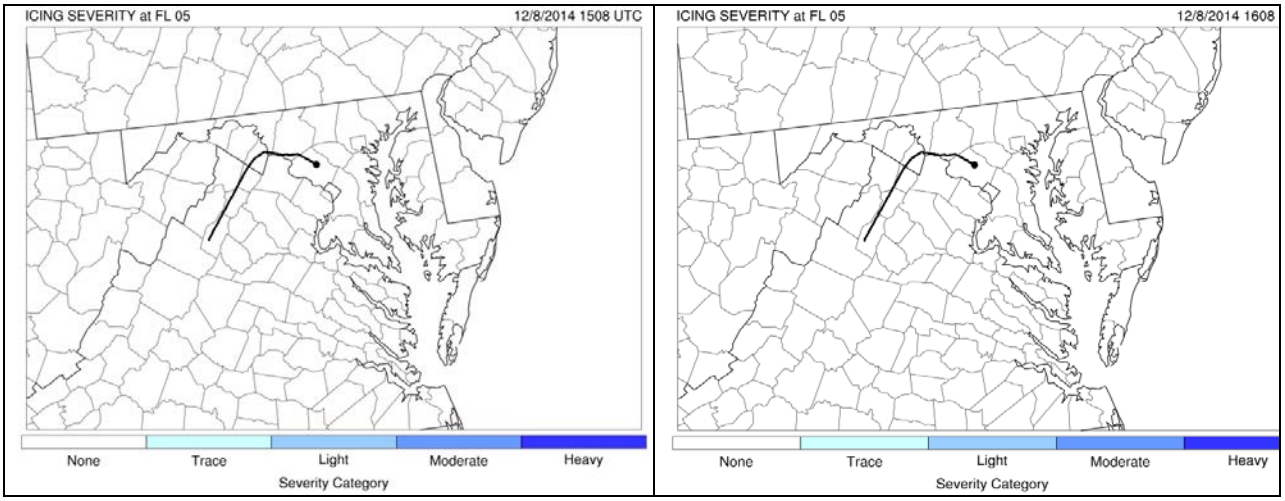
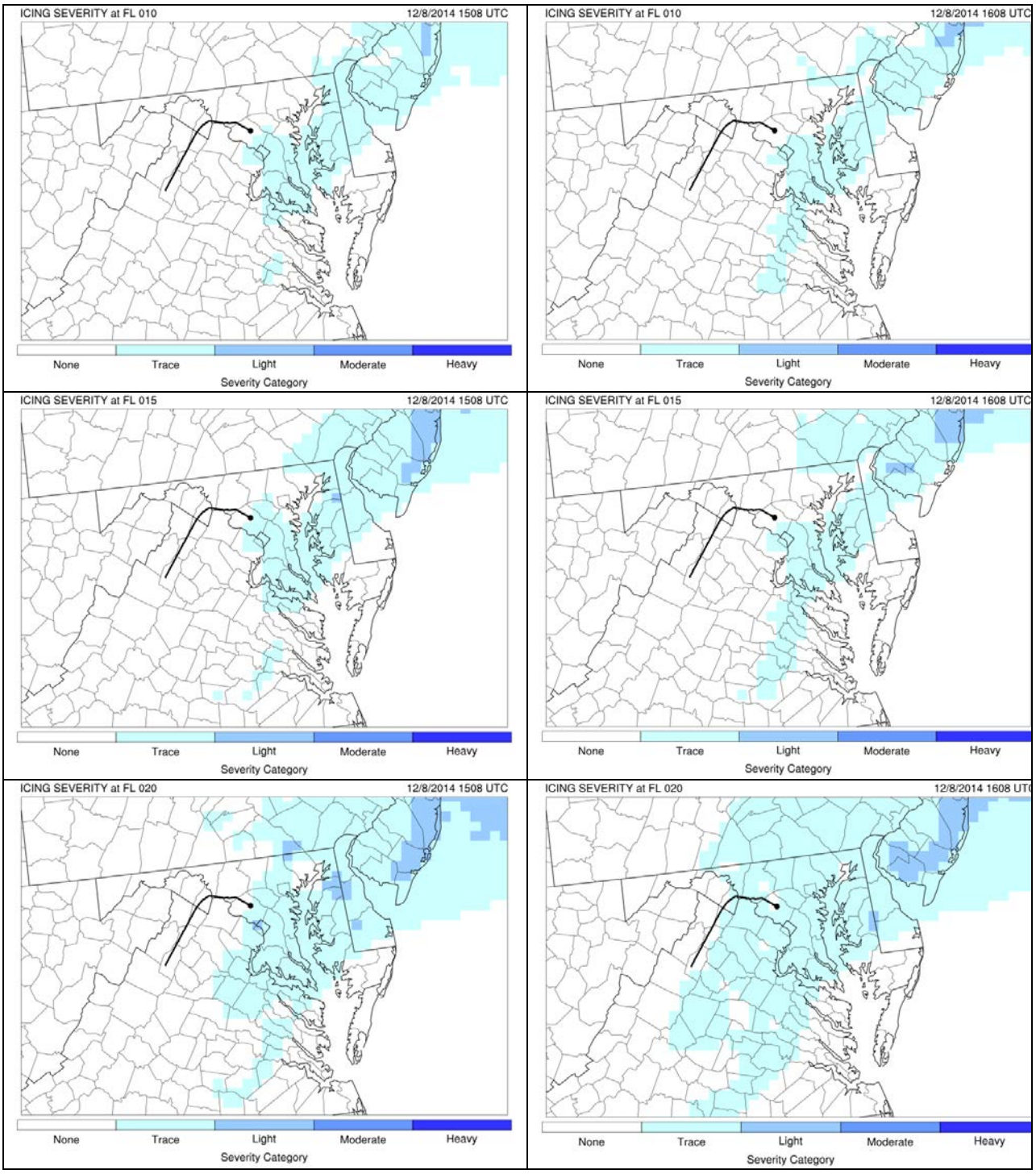
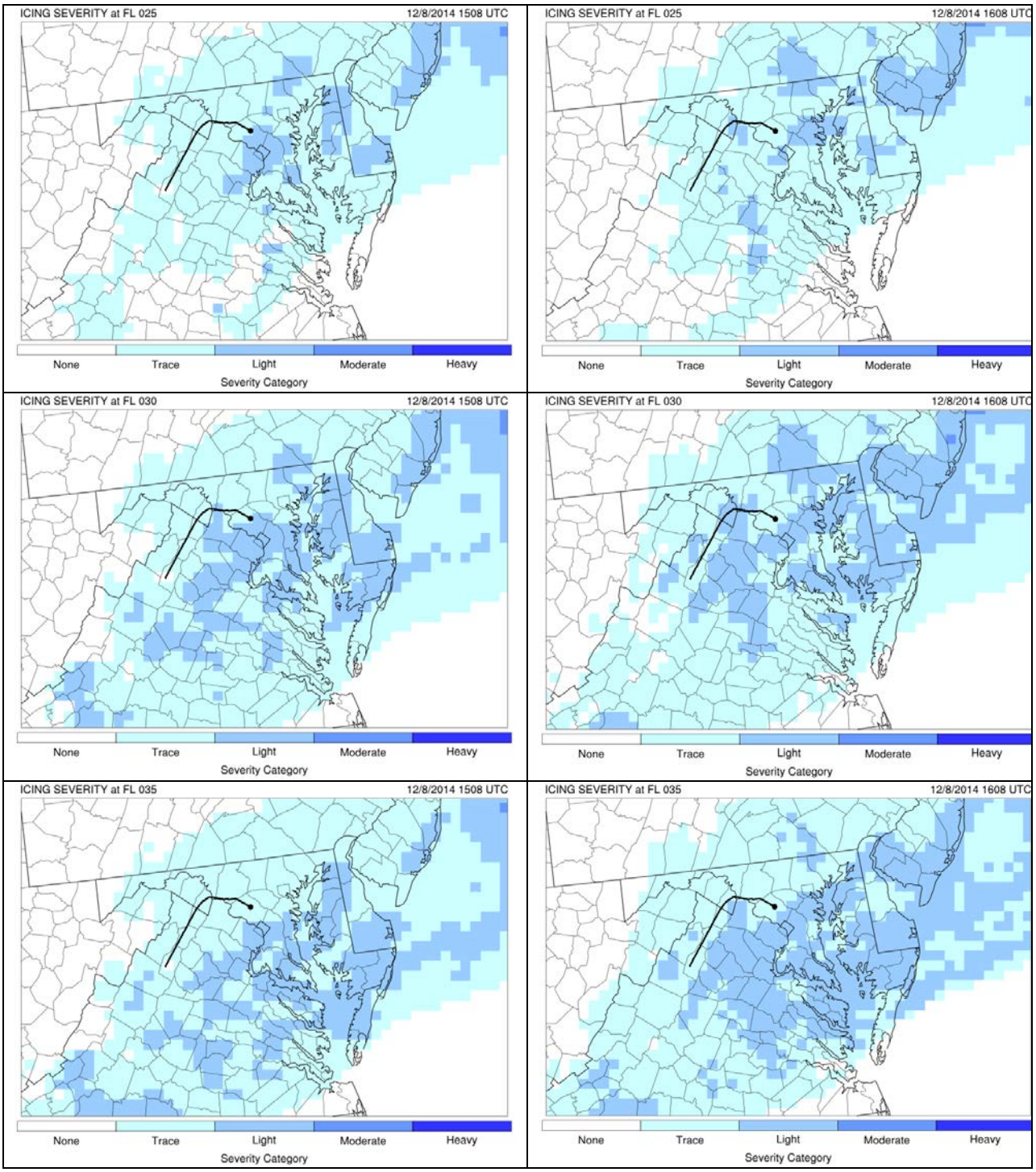


Figure 25 – Supercooled Large Droplet (SLD) Potential for 1000 (1500Z) and 1100 EST (1600Z)

Figure 26 is the icing severity images for 1000 and 1100 EST for the same levels. The icing intensity images depicted only a trace to light probability of icing conditions along the track of N100EQ between approximately 2,500 to 3,500 feet. No areas of moderate or heavy were identified over the region during the period. Section 16.0 follows defining common icing intensity terms, and heavy is typically interchangeable with the term "severe".




ICING SEVERITY at FL 010
12/8/2014 1508 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 010
12/8/2014 1608 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 015
12/8/2014 1508 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 015
12/8/2014 1608 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 020
12/8/2014 1508 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 020
12/8/2014 1608 UT
None
Trace
Light
Moderate
Heavy
Severity Category


ICING SEVERITY at FL 025
12/8/2014 1508 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 025
12/8/2014 1608 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 030
12/8/2014 1508 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 030
12/8/2014 1608 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 035
12/8/2014 1508 UTC
None
Trace
Light
Moderate
Heavy
Severity Category
ICING SEVERITY at FL 035
12/8/2014 1608 UTC
None
Trace
Light
Moderate
Heavy
Severity Category

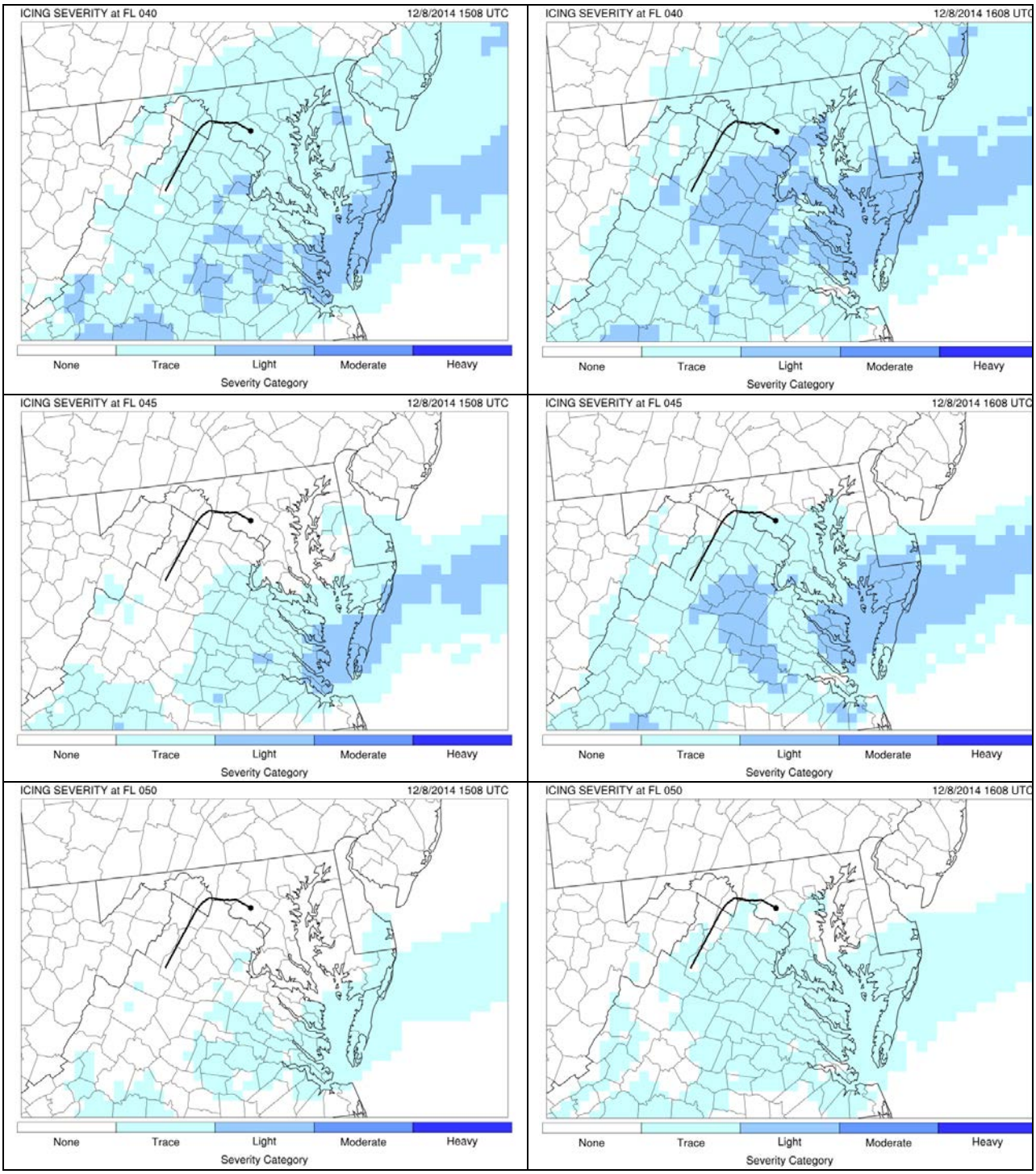


Figure 26 – Icing Intensity for 1000 (1500Z) and 1100 EST (1600Z)

16.0 Icing References

The FAA defines icing intensity classified as a trace, light, moderate, or severe. The following table is referenced in the FAA Aeronautical Information Manual (AIM) section 7-1-21

pilot reports and is also included in FAA 7110.10W - Flight Services for air traffic control regarding icing intensity reports.

Icing Intensity	Airframe Ice Accumulation
Trace	Ice becomes perceptible. Rate of accumulation slightly greater than rate of sublimation. Deicing/anti-icing equipment is not utilized unless encountered for extended period of time over an hour.
Light	The rate of accumulation may create a problem if flight is prolonged in this environment over 1 hour. Occasional use of the deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if deicing/anti-icing equipment is used.
Moderate	The rate of accumulation is such that even short encounters become potentially hazardous, and use of the de-icing/anti-icing equipment or diversion is necessary.
Severe	The rate of accumulation of ice is such that de-icing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary.

F. Appendices

1. Raw pilot reports in standard code
2. Flight track of N100EQ used in radar and icing plots

Submitted by:

Donald Eick
NTSB Senior Meteorologist

Attachment 1 – Pilot Reports in standard code

ADW UA /OV ADW090003/TM 1202/FL050/TP GLF5/SK BKN020-TOP050/SKC/TA 01/WV 15020KT/RM DURC
ADW UA /OV DCA135007/TM 1202/FL025/TP CRJ2/SK OVC030-OVC045/RM DURD 060-025
IAD UA /OV IAD270008/TM 1208/FL035/TP CRJ7/TA 01/IC LGT RIME 030-040
PHL UA /OV PHL225010/TM 1222/FL020/TP CRJ2/SK OVC024/RM DURD
LDJ UA /OV EWR235020/TM 1233/FL030/TP E145/TA M10/IC LGT RIME/RM IMC
FWN UA /OV SAX/TM 1233/FL060/TP E145/SK SKC/TB NEG/RM SMOOTH RIDE
JGG UA /OV ORF290050/TM 1242/FL230/TP CR7/TB LGT CAT 175-235
PHL UA /OV PHL240010/TM 1252/FL023/TP E190/SK OVC023/RM DURD PHL
ILG UA /OV PHL270012/TM 1303/FL040/TP DH8D/TA M05/IC LGT RIME 040-020
RDG UA /OV PTW270015/TM 1303/FL080/TP CRJ2/TA M01
DCA UA /OV DCA315010/TM 1304/FL050/TP B738/SK OVC030-TOP043
LDJ UA /OV EWR225020/TM 1304/FL030/TP E145/TA M10/IC LGT RIME/RM /SK IMC
HEF UA /OV HEF225005/TM 1324/FL035/TP C310/SK OVC035
AOO UA /OV THS-AOO/TM 1334/FL100/TP PA46/TB MOD TURB
GAI UA /OV BAL315015/TM 1345/FL040/TP B737/TA M03/IC LGT CLR
PHL UA /OV PHL270006 /TM 1354 /FL060 /TP DH8D /TA M05 /IC LGT RIME
AOO UA /OV AOO315010 /TM 1358 /FL075 /TP HXA /RM +/-30KT WS
RDG UA /OV RDG180005/TM 1420/FL020/TP C182/TA M06/IC LGT RIME
HGR UA /OV HGR090010/TM 1427/FL035/TP BE58/TA M02/IC LGT RIME BLO 035
DCA UA /OV BWI340010/TM 1430/FL025/TP B737/TA M03/IC LGT RIME 050-025
DCA UA /OV DCA/TM 1433/FL055/TP CRJ2/SK OVC028-TOP050
PHL UA /OV PHL180005/TM 1435/FL100/TP DH8D/TA 02/TB NEG/RM SMTH VMC
IAD UA /OV AML240007/TM 1442/FL100/TP CRJ7/SK OVC037-TOP053
LFI UA /OV PHF090005/TM 1443/FL060/TP LJ35/SK OVC024-TOP055
2W6 UA /OV DCA180035/TM 1444/FL190/TP B737/TB LGT CHOP
IAD UA /OV AML225005/TM 1505/FLUNKN/TP MD88/SK OVCUNKN-TOP053
MFV UA /OV CCV/TM 1510/FL060/TP BE58/SK OVC-TOP055/WX FV99SM/TA 08/TB NEG/RM VERY SMOOTH/CLOUDS BREAKING TO BKN SOUTH
FME UA /OV BAL180010/TM 1514/FL040/TP B712/TA M03/IC LGT RIME
ESN UA /OV BWI135030/TM 1523/FL060/TP H25B/TA 02/IC NEG/RM IMC
PHF UA /OV PHF/TM 1529/FL010/TP C172/SK BKN010
FDK UA /OV FDK340004/TM 1545/FL040/TP DH8C/TA M07/IC MOD MX 040-050
PHL UA /OV PHL/TM 1547/FLUNKN/TP A321/SK OVC026/TA M01
PNE UA /OV PNE/TM 1557/FL024/TP H25B/SK OVC024/TA M04/IC NEG/RM DURD PNE
PSB UA /OV PSB270025/TM 1604/FL240/TP CRJ2/TA M16/IC LGT RIME
FAF UA /OV PHF270007/TM 1612/FLUNKN/TP H53/SK BKN018/RM 7 MI FINAL RY 7
DCA UA /OV DCA/TM 1613/FL050/TP E170/SK OVC022-TOP050/RM DURC
PHL UA /OV PHL270006/TM 1635/FLUNKN/TP DH8C/SK OVC023/RM DURD
FWN UA /OV SAX/TM 1642/FL070/TP B737/TA 00/WV 18077KT/IC NEG
ABE UA /OV FJC /TM 1647 /FL060 /TP PA31 /SK OVC040-TOP050/ SKC
HWY UA /OV CSN/TM 1652/FL230/TP B737/TB MOD
IAD UA /OV AML225007/TM 1653/FL040/TP CRJ7/SK OVC040-TOP055
JYO UA /OV JYO/TM 1703/FL012/TP C172/SK OVC030/WX FV03SM -SN/TA 00/TB NEG/IC NEG/RM OVC030 EST
NHK UA /OV NHK/TM 1750/FL052/TP C130/SK OVC014-TOP052
DCA UA /OV DCA315010/TM 1755/FL070/TP CRJ2/SK OVC022-TOP064/TA M09/IC NEG
ILG UA /OV PHL270012/TM 1758/FLUNKN/TP A319/SK OVC024
PHL UA /OV PHL270010/TM 1800/FL030/TP A319/TA UNKN/IC LGT RIME
RIC UA /OV RIC/TM 1818/FLUNKN/TP E145/SK OVC030/RM FAP RWY 02
FWN UA /OV STW-SAX/TM 1830/FL050/TP UNKN/TA M06/IC LGT RIME/RM ALL TYPES ACFT
XLL UA /OV ETX135005 /TM 1950 /FL030 /TP DH8A /TA M04 /TB NEG /IC LGT RIME /RM IMC /SMTH
RIC UA /OV RIC360003 /TM 1908 /FL021 /TP E145 /SK OVC021-TOP041 /RM TOPS SCT
FWN UA /OV SAX/TM 1914/FL070/TP B752/TB NEG/RM SKC ABV 070 SMOOTH RIDE
JYO UA /OV IAD315006/TM 1920/FLUNKN/TP C421/SK OVC-TOP058/TA UNKN/IC LGT RIME 050-058/RM DURC TO 090 /RIME IN CLDS
MPO UA /OV LVZ180010 /TM 1951 /FL050 /TP B350 /TA M01 /IC MOD MX /RM IMC
BCB UA /OV LYH090020/TM 1957/FL070/TP BE76/TA M04/IC MOD RIME
DMW UA /OV FDK030020/TM 2000/FL050/TP PA31/TA M02/IC LGT RIME
RIC UA /OV RIC180004/TM 2015/FL019/TP SR22/SK OVC009
MIV UUA /OV MIV/TM 2019/FLUNKN/TP C340/RM LLWS -10KT 010-BLO DURD RY10 MIV

XSA UA /OV XSA/TM 2019/FL060/TP BE35/TA 01/IC NEG/RM NEG ICG SFC-060 IMC 020-060 TA 01 DURD
LUA UA /OV CHO360020 /TM 2023 /FL070 /TP SF34 /SK OVCUNKN-TOP050/ SKC /TB NEG /RM SMTH
JYO UA /OV AML315010/TM 2035/FL034/TP DH8B/SK OVC027/TB NEG
LYH UA /OV LYH021019/TM 2046/FL060/TP M20P/TA 00/IC LGT RIME
IAD UA /OV AML330003/TM 2104/FL030/TP C750/SK BKN023-TOP057

Attachment 2 – Flight Track Data of N100EQ

Time (UTC)	Altitude	Mode	Latitude	Longitude
3:15:04 PM	16400T	4620	38:32:08.49N	78:34:58.86W
3:15:09 PM	16200T	4620	38:32:34.26N	78:34:53.53W
3:15:13 PM	16000T	4620	38:32:59.93N	78:34:47.98W
3:15:18 PM	15800T	4620	38:33:25.47N	78:34:42.16W
3:15:23 PM	15600T	4620	38:33:55.45N	78:34:39.57W
3:15:27 PM	15400T	4620	38:34:25.55N	78:34:35.95W
3:15:32 PM	15200T	4620	38:34:45.49N	78:34:27.98W
3:15:36 PM	15100T	4620	38:35:11.06N	78:34:19.72W
3:15:41 PM	15000T	4620	38:35:31.99N	78:34:07.88W
3:15:46 PM	14900T	4620	38:35:58.02N	78:33:57.03W
3:15:50 PM	15000T	4620	38:36:24.34N	78:33:44.51W
3:15:55 PM	15000T	4620	38:36:41.32N	78:33:26.08W
3:15:59 PM	15000T	4620	38:37:03.55N	78:33:07.84W
3:16:04 PM	15000T	4620	38:37:25.41N	78:32:50.15W
3:16:09 PM	15000T	4620	38:37:42.25N	78:32:30.65W
3:16:13 PM	15000T	4620	38:38:03.38N	78:32:14.06W
3:16:18 PM	15000T	4620	38:38:19.78N	78:31:55.03W
3:16:23 PM	15000T	4620	38:38:40.42N	78:31:38.88W
3:16:27 PM	15000T	4620	38:39:00.93N	78:31:22.56W
3:16:32 PM	15000T	4620	38:39:20.65N	78:31:08.23W
3:16:37 PM	15000T	4620	38:39:31.85N	78:30:47.35W
3:16:41 PM	14900T	4620	38:39:46.86N	78:30:30.68W
3:16:46 PM	14800T	4620	38:40:15.41N	78:30:19.42W
3:16:50 PM	14700T	4620	38:40:35.04N	78:30:03.05W
3:16:55 PM	14600T	4620	38:40:49.48N	78:29:46.76W
3:16:59 PM	14500T	4620	38:41:04.25N	78:29:28.91W
3:17:04 PM	14400T	4620	38:41:23.31N	78:29:12.92W
3:17:09 PM	14300T	4620	38:41:46.79N	78:28:57.93W
3:17:13 PM	14200T	4620	38:42:01.20N	78:28:39.74W
3:17:18 PM	14200T	4620	38:42:20.04N	78:28:22.58W
3:17:23 PM	14100T	4620	38:42:38.54N	78:28:05.99W
3:17:27 PM	14000T	4620	38:42:57.08N	78:27:48.52W
3:17:32 PM	13900T	4620	38:43:15.48N	78:27:30.92W
3:17:36 PM	13800T	4620	38:43:38.33N	78:27:13.34W
3:17:41 PM	13700T	4620	38:43:56.40N	78:26:55.40W
3:17:46 PM	13600T	4620	38:44:14.85N	78:26:35.13W
3:17:50 PM	13500T	4620	38:44:41.65N	78:26:17.03W
3:17:55 PM	13500T	4620	38:45:03.71N	78:25:58.60W
3:17:59 PM	13500T	4620	38:45:25.72N	78:25:39.24W
3:18:04 PM	13500T	4620	38:45:47.52N	78:25:19.63W
3:18:09 PM	13500T	4620	38:46:05.15N	78:24:57.71W
3:18:13 PM	13400T	4620	38:46:26.38N	78:24:38.49W
3:18:18 PM	13400T	4620	38:46:51.59N	78:24:19.56W
3:18:23 PM	13300T	4620	38:47:12.37N	78:23:59.87W
3:18:27 PM	13200T	4620	38:47:36.94N	78:23:41.16W
3:18:32 PM	13100T	4620	38:47:57.40N	78:23:20.26W
3:18:36 PM	13000T	4620	38:48:17.51N	78:22:59.94W
3:18:41 PM	12900T	4620	38:48:41.33N	78:22:40.46W
3:18:46 PM	12900T	4620	38:49:00.86N	78:22:20.47W
3:18:50 PM	12800T	4620	38:49:27.93N	78:22:02.23W

3:18:55 PM	12700T	4620	38:49:43.13N	78:21:40.86W
3:19:00 PM	12600T	4620	38:50:09.66N	78:21:22.05W
3:19:04 PM	12500T	4620	38:50:24.36N	78:21:01.12W
3:19:09 PM	12400T	4620	38:50:50.13N	78:20:43.27W
3:19:14 PM	12300T	4620	38:51:11.96N	78:20:23.57W
3:19:18 PM	12300T	4620	38:51:29.69N	78:20:03.66W
3:19:23 PM	12200T	4620	38:51:50.85N	78:19:45.04W
3:19:27 PM	12100T	4620	38:52:11.83N	78:19:25.43W
3:19:32 PM	12000T	4620	38:52:36.10N	78:19:07.71W
3:19:37 PM	11900T	4620	38:52:56.56N	78:18:47.58W
3:19:41 PM	11800T	4620	38:53:16.64N	78:18:28.80W
3:19:46 PM	11700T	4620	38:53:36.47N	78:18:09.76W
3:19:50 PM	11600T	4620	38:53:59.59N	78:17:51.72W
3:19:55 PM	11500T	4620	38:54:15.36N	78:17:31.86W
3:20:00 PM	11400T	4620	38:54:34.37N	78:17:13.73W
3:20:04 PM	11300T	4620	38:55:00.22N	78:16:55.27W
3:20:09 PM	11200T	4620	38:55:18.72N	78:16:36.68W
3:20:14 PM	11100T	4620	38:55:36.97N	78:16:18.66W
3:20:18 PM	10900T	4620	38:55:58.49N	78:15:59.11W
3:20:23 PM	10800T	4620	38:56:23.10N	78:15:40.98W
3:20:28 PM	10600T	4620	38:56:40.60N	78:15:22.30W
3:20:32 PM	10500T	4620	38:57:01.25N	78:15:01.98W
3:20:37 PM	10300T	4620	38:57:24.97N	78:14:44.51W
3:20:41 PM	10200T	4620	38:57:45.05N	78:14:25.20W
3:20:46 PM	10000T	4620	38:58:04.85N	78:14:07.18W
3:20:51 PM	9900T	4620	38:58:24.39N	78:13:48.18W
3:20:55 PM	9700T	4620	38:58:40.42N	78:13:29.83W
3:21:00 PM	9600T	4620	38:59:02.69N	78:13:10.22W
3:21:04 PM	9400T	4620	38:59:24.71N	78:12:51.87W
3:21:09 PM	9200T	4620	38:59:46.46N	78:12:33.96W
3:21:14 PM	9100T	4620	39:00:04.75N	78:12:16.08W
3:21:18 PM	8900T	4620	39:00:22.76N	78:11:57.24W
3:21:23 PM	8800T	4620	39:00:46.87N	78:11:38.98W
3:21:28 PM	8600T	4620	39:01:04.45N	78:11:21.18W
3:21:32 PM	8500T	4620	39:01:24.80N	78:11:01.98W
3:21:37 PM	8300T	4620	39:01:45.08N	78:10:44.82W
3:21:41 PM	8200T	4620	39:02:01.99N	78:10:27.15W
3:21:46 PM	8000T	4620	39:02:21.68N	78:10:08.75W
3:21:51 PM	7900T	4620	39:02:44.09N	78:09:49.47W
3:21:55 PM	7800T	4620	39:03:03.42N	78:09:32.06W
3:22:00 PM	7700T	4620	39:03:22.48N	78:09:14.40W
3:22:05 PM	7600T	4620	39:03:44.23N	78:08:55.75W
3:22:09 PM	7500T	4620	39:03:59.96N	78:08:39.10W
3:22:14 PM	7400T	4620	39:04:21.39N	78:08:21.44W
3:22:18 PM	7300T	4620	39:04:39.82N	78:08:05.07W
3:22:23 PM	7200T	4620	39:04:54.87N	78:07:47.83W
3:22:28 PM	7100T	4620	39:05:15.69N	78:07:30.14W
3:22:32 PM	7000T	4620	39:05:33.42N	78:07:13.08W
3:22:37 PM	6900T	4620	39:05:51.07N	78:06:56.57W
3:22:42 PM	6800T	4620	39:06:11.46N	78:06:39.55W
3:22:46 PM	6800T	4620	39:06:28.66N	78:06:22.57W
3:22:51 PM	6700T	4620	39:06:45.99N	78:06:06.86W
3:22:56 PM	6600T	4620	39:07:03.12N	78:05:50.93W
3:23:00 PM	6500T	4620	39:07:22.56N	78:05:32.91W
3:23:05 PM	6400T	4620	39:07:39.65N	78:05:18.00W
3:23:09 PM	6300T	4620	39:07:58.83N	78:05:00.17W
3:23:14 PM	6200T	4620	39:08:17.97N	78:04:42.82W
3:23:19 PM	6100T	4620	39:08:32.06N	78:04:29.25W
3:23:23 PM	6000T	4620	39:08:51.00N	78:04:12.14W
3:23:28 PM	5900T	4620	39:09:07.35N	78:03:56.84W
3:23:32 PM	5800T	4620	39:09:23.54N	78:03:41.35W
3:23:37 PM	5700T	4620	39:09:44.88N	78:03:23.47W

3:23:42 PM	5600T	4620	39:09:58.15N	78:03:09.02W
3:23:46 PM	5500T	4620	39:10:16.80N	78:02:52.79W
3:23:51 PM	5400T	4620	39:10:35.00N	78:02:35.59W
3:23:56 PM	5300T	4620	39:10:48.83N	78:02:23.40W
3:24:00 PM	5300T	4620	39:11:06.66N	78:02:05.74W
3:24:05 PM	5200T	4620	39:11:27.55N	78:01:48.24W
3:24:09 PM	5100T	4620	39:11:40.68N	78:01:34.78W
3:24:14 PM	5000T	4620	39:11:56.68N	78:01:20.83W
3:24:19 PM	5000T	4620	39:12:11.95N	78:01:05.31W
3:24:23 PM	5000T	4620	39:12:27.67N	78:00:50.95W
3:24:28 PM	5000T	4620	39:12:45.91N	78:00:35.21W
3:24:33 PM	5000T	4620	39:13:03.67N	78:00:18.57W
3:24:37 PM	5000T	4620	39:13:18.61N	78:00:02.86W
3:24:42 PM	5000T	4620	39:13:29.82N	77:59:46.27W
3:24:46 PM	5000T	4620	39:13:41.53N	77:59:30.89W
3:24:51 PM	5000T	4620	39:13:55.00N	77:59:12.79W
3:24:56 PM	5000T	4620	39:14:06.07N	77:58:56.50W
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3:25:10 PM	5000T	4620	39:14:44.44N	77:58:11.87W
3:25:14 PM	5000T	4620	39:14:58.53N	77:57:55.52W
3:25:19 PM	5000T	4620	39:15:10.33N	77:57:41.11W
3:25:23 PM	5000T	4620	39:15:23.40N	77:57:23.20W
3:25:28 PM	5000T	4620	39:15:34.94N	77:57:08.53W
3:25:33 PM	5000T	4620	39:15:46.35N	77:56:53.70W
3:25:37 PM	5000T	4620	39:15:57.65N	77:56:38.79W
3:25:42 PM	5000T	4620	39:16:08.83N	77:56:23.73W
3:25:47 PM	5000T	4620	39:16:19.88N	77:56:08.55W
3:25:51 PM	5000T	4620	39:16:33.23N	77:55:51.57W
3:25:56 PM	5000T	4620	39:16:42.45N	77:55:38.99W
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3:26:10 PM	5000T	4620	39:17:16.22N	77:54:54.88W
3:26:14 PM	5000T	4620	39:17:25.06N	77:54:41.92W
3:26:19 PM	5000T	4620	39:17:36.56N	77:54:27.61W
3:26:23 PM	5000T	4620	39:17:47.53N	77:54:12.58W
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3:26:37 PM	5000T	4620	39:18:16.20N	77:53:27.16W
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3:26:47 PM	5000T	4620	39:18:28.26N	77:52:54.80W
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3:26:56 PM	5000T	4620	39:18:40.73N	77:52:23.38W
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3:27:10 PM	5000T	4620	39:18:59.05N	77:51:36.50W
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3:27:23 PM	5000T	4620	39:19:21.05N	77:50:45.57W
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3:27:37 PM	5000T	4620	39:19:37.12N	77:50:02.07W
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3:27:47 PM	5000T	4620	39:19:52.14N	77:49:26.42W
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3:27:56 PM	5000T	4620	39:20:02.55N	77:48:59.06W
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3:28:24 PM	5000T	4620	39:20:39.46N	77:47:26.94W

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3:28:37 PM	5000T	4620	39:20:59.50N	77:46:40.72W
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3:28:51 PM	5000T	4620	39:21:05.43N	77:45:55.29W
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3:29:19 PM	4700T	4620	39:20:45.55N	77:44:26.08W
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3:29:42 PM	4500T	4620	39:20:28.08N	77:43:09.97W
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3:30:19 PM	4000T	4620	39:19:57.58N	77:41:00.00W
3:30:24 PM	4000T	4620	39:19:53.12N	77:40:44.51W
3:30:51 PM	3600T	4620	39:19:28.71N	77:39:03.74W
3:30:56 PM	3500T	4620	39:19:24.87N	77:38:46.66W
3:31:01 PM	3500T	4620	39:19:19.00N	77:38:31.77W
3:31:10 PM	3400T	4620	39:19:10.74N	77:37:58.21W
3:31:05 PM	3400T	4620	39:19:15.68N	77:38:12.32W
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3:31:19 PM	3200T	4620	39:19:01.99N	77:37:25.11W
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3:31:28 PM	3100T	4620	39:18:53.39N	77:36:49.98W
3:31:33 PM	3100T	4620	39:18:48.58N	77:36:33.89W
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3:31:42 PM	3000T	4620	39:18:40.36N	77:35:57.25W
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3:32:56 PM	3000T	4620	39:17:53.54N	77:31:40.94W
3:33:06 PM	3000T	4620	39:17:51.55N	77:31:08.33W
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3:35:38 PM	3000T	4620	39:17:11.36N	77:22:49.69W
3:35:43 PM	3000T	4620	39:17:10.34N	77:22:35.27W
3:35:47 PM	3000T	4620	39:17:09.02N	77:22:23.35W
3:35:52 PM	3000T	4620	39:17:07.83N	77:22:08.93W
3:35:56 PM	3000T	4620	39:17:06.34N	77:21:57.04W
3:36:01 PM	3000T	4620	39:17:03.35N	77:21:40.67W
3:36:06 PM	3000T	4620	39:17:00.14N	77:21:36.72W
3:36:10 PM	3000T	4620	39:16:54.40N	77:21:26.22W
3:36:29 PM	3000T	4620	39:16:31.31N	77:20:49.91W
3:36:33 PM	3000T	4620	39:16:25.90N	77:20:39.64W
3:36:15 PM	3000T	4620	39:16:47.43N	77:21:16.20W
3:36:20 PM	3000T	4620	39:16:41.49N	77:21:08.40W
3:36:24 PM	3000T	4620	39:16:36.09N	77:21:00.46W
3:34:43 PM	3000T	4620	39:17:24.88N	77:25:41.19W
3:34:47 PM	3000T	4620	39:17:23.76N	77:25:24.52W
3:34:52 PM	3000T	4620	39:17:22.48N	77:25:07.87W
3:34:56 PM	3000T	4620	39:17:21.49N	77:24:56.01W
3:35:01 PM	3000T	4620	39:17:19.98N	77:24:39.39W
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3:35:10 PM	3000T	4620	39:17:18.00N	77:24:08.38W
3:35:15 PM	3000T	4620	39:17:16.38N	77:23:54.21W
3:35:19 PM	3000T	4620	39:17:15.85N	77:23:39.79W
3:35:24 PM	3000T	4620	39:17:14.02N	77:23:25.62W
3:40:43 PM	1300T	4620	39:11:52.48N	77:12:54.81W
3:40:47 PM	1300T	4620	39:11:47.14N	77:12:46.24W
3:40:52 PM	1200T	4620	39:11:42.64N	77:12:36.77W
3:40:57 PM	1200T	4620	39:11:38.28N	77:12:29.98W
3:41:01 PM	1300T	4620	39:11:32.78N	77:12:21.55W
3:41:06 PM	1100T	4620	39:11:27.69N	77:12:12.68W
3:41:11 PM	1100T	4620	39:11:23.20N	77:12:06.03W
3:41:20 PM	1000T	4620	39:11:15.04N	77:11:51.78W
3:41:25 PM	900T	4620	39:11:09.75N	77:11:43.07W
3:41:29 PM	900T	4620	39:11:07.19N	77:11:37.14W
3:41:34 PM	900T	4620	39:11:02.53N	77:11:30.66W
3:41:15 PM	1000T	4620	39:11:19.59N	77:11:58.37W
3:41:38 PM	800T	4620	39:10:57.55N	77:11:21.54W
3:37:06 PM	3000T	4620	39:15:51.18N	77:19:37.82W
3:37:10 PM	3000T	4620	39:15:44.80N	77:19:25.95W
3:37:15 PM	3000T	4620	39:15:40.17N	77:19:20.73W
3:36:38 PM	3000T	4620	39:16:20.45N	77:20:29.45W
3:36:43 PM	3000T	4620	39:16:16.60N	77:20:21.13W

3:36:47 PM	3000T	4620	39:16:11.04N	77:20:11.08W
3:36:52 PM	3000T	4620	39:16:06.00N	77:20:00.89W
3:36:56 PM	3000T	4620	39:16:00.33N	77:19:51.00W
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3:37:29 PM	3000T	4620	39:15:24.72N	77:18:53.79W
3:37:33 PM	3000T	4620	39:15:19.82N	77:18:43.96W
3:37:38 PM	3000T	4620	39:15:13.76N	77:18:34.76W
3:37:43 PM	3000T	4620	39:15:09.43N	77:18:27.17W
3:37:47 PM	3000T	4620	39:15:05.75N	77:18:21.74W
3:37:52 PM	3000T	4620	39:15:00.00N	77:18:10.04W
3:37:57 PM	3000T	4620	39:14:55.72N	77:18:05.01W
3:38:20 PM	2900T	4620	39:14:30.17N	77:17:20.41W
3:38:24 PM	2900T	4620	39:14:25.54N	77:17:13.29W
3:38:29 PM	2800T	4620	39:14:20.64N	77:17:03.87W
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3:38:38 PM	2700T	4620	39:14:09.64N	77:16:45.94W
3:38:52 PM	2600T	4620	39:13:52.48N	77:16:17.23W
3:38:57 PM	2500T	4620	39:13:47.27N	77:16:08.23W
3:39:01 PM	2500T	4620	39:13:43.40N	77:16:00.84W
3:38:43 PM	2700T	4620	39:14:04.59N	77:16:36.73W
3:38:47 PM	2600T	4620	39:13:58.97N	77:16:27.92W
3:39:10 PM	2400T	4620	39:13:32.25N	77:15:43.48W
3:39:06 PM	2400T	4620	39:13:36.72N	77:15:50.37W
3:39:15 PM	2300T	4620	39:13:26.51N	77:15:32.41W
3:39:20 PM	2300T	4620	39:13:21.07N	77:15:23.70W
3:38:01 PM	3000T	4620	39:14:50.55N	77:17:55.53W
3:38:06 PM	3000T	4620	39:14:46.06N	77:17:48.20W
3:38:10 PM	3000T	4620	39:14:41.54N	77:17:40.92W
3:38:15 PM	3000T	4620	39:14:36.26N	77:17:31.64W
3:39:24 PM	2200T	4620	39:13:16.08N	77:15:14.64W
3:39:29 PM	2200T	4620	39:13:10.55N	77:15:06.07W
3:39:34 PM	2100T	4620	39:13:04.04N	77:14:55.69W
3:39:38 PM	2100T	4620	39:12:59.82N	77:14:48.68W
3:40:01 PM	1800T	4620	39:12:36.38N	77:14:07.92W
3:39:43 PM	2000T	4620	39:12:56.09N	77:14:41.30W
3:39:47 PM	2000T	4620	39:12:49.43N	77:14:31.13W
3:39:52 PM	1900T	4620	39:12:44.63N	77:14:21.99W
3:39:57 PM	1900T	4620	39:12:40.78N	77:14:14.71W
3:40:06 PM	1800T	4620	39:12:31.46N	77:13:58.92W
3:40:10 PM	1800T	4620	39:12:27.50N	77:13:51.75W
3:40:15 PM	1700T	4620	39:12:21.51N	77:13:43.75W
3:40:20 PM	1700T	4620	39:12:16.44N	77:13:34.88W
3:40:24 PM	1600T	4620	39:12:12.36N	77:13:27.85W
3:40:29 PM	1600T	4620	39:12:07.20N	77:13:19.09W
3:40:34 PM	1400T	4620	39:12:01.99N	77:13:10.36W
3:40:38 PM	1400T	4620	39:11:57.79N	77:13:03.44W