National Transportation Safety Board

Office of Aviation Safety
Washington, D.C. 20594-2000
February 19, 2009

METEOROLOGICAL FACTUAL REPORT

CEN09FA099

A. ACCIDENT

Location: North Canton, Ohio
Date: December 19, 2008
Time: Approximately 1753 eastern standard time (2253 UTC[1])
Aircraft: Piper PA-32; registration: N9299N

B. METEOROLOGICAL SPECIALIST

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Operational Factors Division, AS-30
Washington, D.C. 20594-2000

C. SUMMARY

On December 19, 2008, about 1753, a Piper PA-32R-301T, N9299N, received substantial damage on impact with terrain during a precision approach to runway 23. A post crash fire then ensued. The airplane impacted the front lawn of a vacant house about two miles east-northeast from Akron-Canton Regional Airport (KCAK), Akron, Ohio. Night instrument meteorological conditions prevailed at the time of the accident. The pilot was fatally injured and there were no ground injuries. The flight departed from College Park Airport (KCGS) College Park, Maryland, about 1531 and was returning to KCAK at the time of the accident.

During the approach to KCAK, N9299N asked whether there were any reports of icing to which air traffic control (ATC) responded that there were no reports. ATC then instructed N9299N to provide a report of icing if encountered. No reports were received by N9299N. Preliminary radar data shows that the airplane maintained assigned headings and altitudes while en route to KCAK.

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

The airplane received radar vectors to the instrument landing system (ILS) approach to runway 23. The airplane was vectored to intercept the approach about two miles from the outer marker. The airplane was inbound from the outer marker when ATC advised N9299N that it was left of course. ATC asked if N9299N would like to be resequenced and N9299N responded by transmitting "correcting." The airplane altitude was still about 3,200 feet (the intermediate segment altitude for the approach is 3,200 feet). ATC then advised N9299N that it was "well left of the localizer" and if it would like to be resequenced. N9299N responded by transmitting that it would "like to correct." N9299N was about 2 ½ miles from the airport when it then transmitted if it could execute a 360-degree turn. ATC then instructed N9299N to climb and maintain 3,000 feet and queried N9299N's present heading. N9299N transmitted, "heading due north and climbing." N9299N then declared an emergency.

D. DETAILS OF INVESTIGATION

The National Transportation Safety Board's (NTSB) meteorologist specialist was not on scene for this investigation and gathered all the weather data for this investigation from the Washington D.C. office from official National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are Coordinated Universal Time (UTC) based upon the 24 hour clock. Local time of eastern standard time (EST) is +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.

The accident site was located at latitude 40.9337° N and longitude 81.3881° W, at an elevation of 1,163 feet msl.

1.0 Synoptic Situation

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

1.0.1 Surface Analysis Chart

The NWS Surface Analysis Chart for 1900 EST on December 19, 2008 (0000Z on December 20, 2008), is provided as figure 1, with the approximate location of the accident site marked by a red cross. The chart depicted a low pressure system with a central pressure of 1005-hectopascals (hPa) over northern Pennsylvania with an occluded front extending southward and turning to a cold front and stationary front over southern Pennsylvania at the

triple point. The cold front continued southward into Maryland, with a station front bowing southward along the Appalachian Mountains and the extending eastward into Delaware and into the Atlantic, where another low pressure system was located at 1005-hPA and a warm front extending eastward. A trough of low pressure extended from near the center of the low west-southwest across Ohio and then northwestward into northern Indiana. The accident site was located west of the low and occluded front, and in the vicinity of the trough of low pressure.

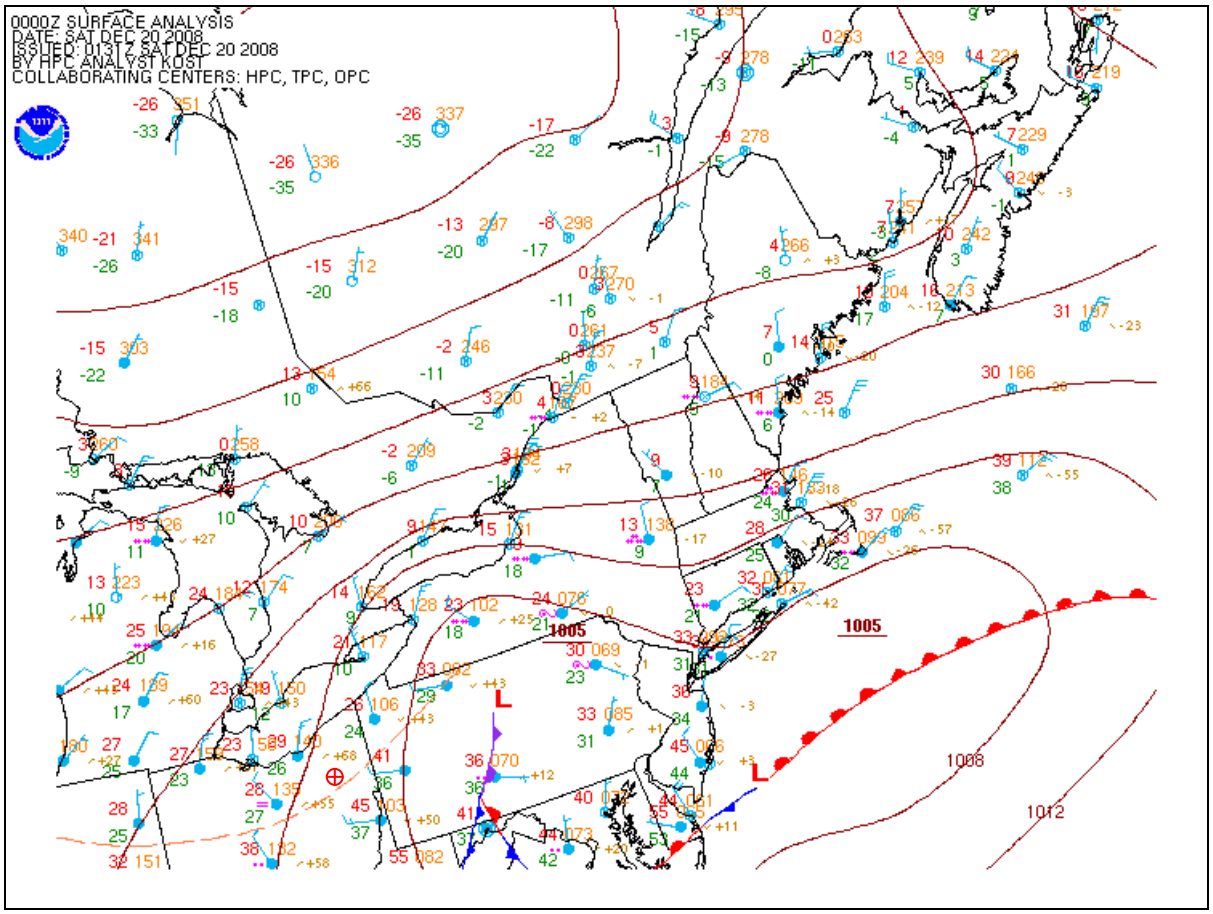

Figure 1 – NWS Surface Analysis Chart for 1900 EST

The station models north of the low pressure and frontal systems indicated an extensive area of clouds and precipitation in the form of snow, freezing rain and drizzle. Over Ohio a cyclonic wind shift was noted between the trough with winds shifting from the west to the north.

1.0.2 Weather Depiction Chart

The NWS Weather Depiction Chart for 1700 EST (2200Z) is included as figure 2, depicting the general flight categories. The chart depicted an area of instrument flight rule (IFR) conditions[2] by a shaded contour line extending north of the warm front across Maryland, Delaware, New Jersey, parts of southern and northern Pennsylvania, New York, and portions of Ohio along the trough of low pressure. Surrounding that area was an area of marginal visual flight rules (MVFR) conditions[3] indicated by an unshaded contour that extended over most all of Ohio and Pennsylvania, and Virginia. The closest visual flight rule (VFR) conditions[4] were depicted without a contour line over extreme southern Ohio and West Virginia, to the south of the accident site. MVFR to IFR conditions prevailed along the route of flight, and the accident site.

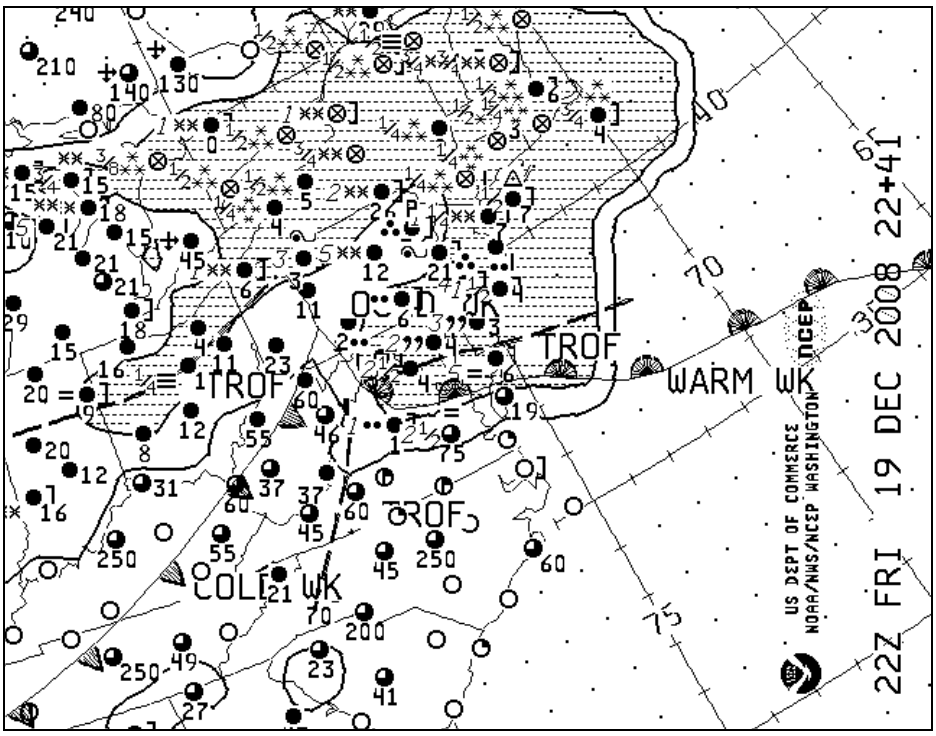

Figure 2 – NWS Weather Depiction Chart for 1700 EST

The station models in the vicinity of the accident site depicted IFR to MVFR conditions with overcast ceilings between at 400 and 1,100 feet agl.

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

[3] MVFR conditions – are defined as a ceiling between 1,000 and 3,000 feet agl inclusive and/or visibility 3 to 5 miles inclusive.

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

1.0.3 Convective Outlook

The NWS Storm Prediction Center's (SPC) graphic Convective Outlook for 1100 EST (1600Z) is included as figure 4 with the bulletin following. The chart depicted an area from Kentucky, eastern Ohio, West Virginia, western Maryland, Pennsylvania, and southern New York for a change of airmass type thunderstorms. No organized areas of severe thunderstorms were forecast for the period.

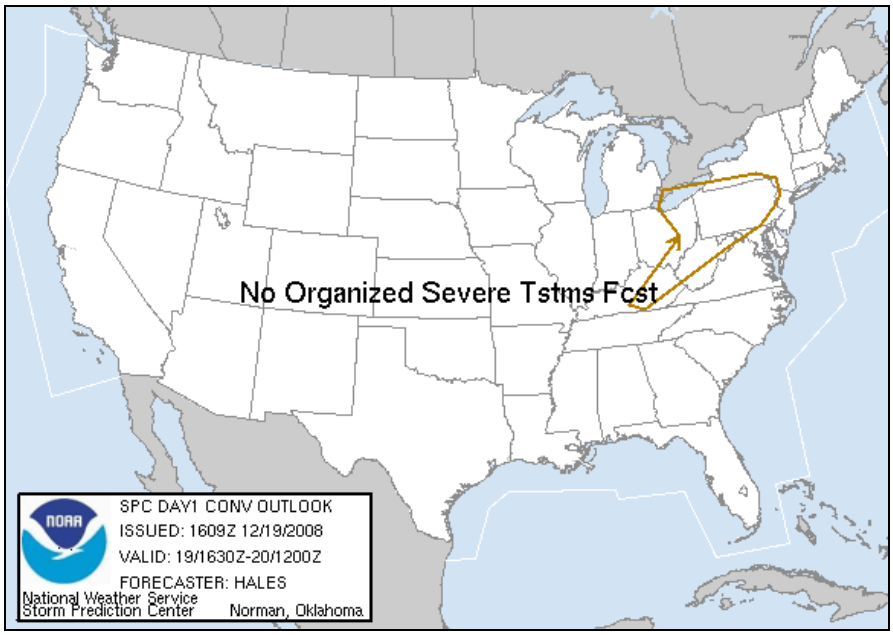

Figure 3 – NWS Convective Outlook

SPC AC 191609
DAY 1 CONVECTIVE OUTLOOK
NWS STORM PREDICTION CENTER NORMAN OK
1009 AM CST FRI DEC 19 2008
VALID 191630Z - 201200Z
...NO SVR TSTM AREAS FORECAST...
STRONG/RAPIDLY MOVING UPPER TROUGH AND ASSOCIATED SURFACE LOW CURRENTLY OH VALLEY/LOWER GREAT LAKES WILL ZIP EWD TO OFFSHORE BY EARLY TONIGHT. VERY STRONG LOW LEVEL JET...70KT AT 850MB OH VALLEY... TRANSPORTING A MOIST AND WEAKLY UNSTABLE WARM SECTOR ACROSS SHALLOW COLD DOME OF RETREATING WARM FRONT AHEAD OF SURFACE LOW. THIS HAS LED TO WEAK ELEVATED EMBEDDED THUNDERSTORMS THIS AM IN THE STRONG ASCENT E OF SURFACE LOW.

THIS CONVECTIVE PATTERN SHOULD SHIFT RAPIDLY EWD WITH ANY THUNDER PRIMARILY REMAINING AHEAD OF SURFACE SYSTEM/N OF THE WARM FRONT. OVERALL THUNDERSTORM COVERAGE SHOULD GRADUALLY DIMINISH AS SYSTEM QUICKLY OUTRUNS THE STRONGER MOIST INFLOW FROM OFF THE GULF OF MEXICO.
..HALES.. 12/19/2008

The bulletin was updated at 1445 EST (1945Z) and removed the forecast for convection over the Ohio Valley. The bulletin was as follows:

SPC AC 191945
DAY 1 CONVECTIVE OUTLOOK
NWS STORM PREDICTION CENTER NORMAN OK
0145 PM CST FRI DEC 19 2008
VALID 192000Z - 201200Z
...NO TSTM AREAS FORECAST...
FAST MOVING...COMPACT SHORT WAVE TROUGH...CURRENTLY TRAVERSING LOWER GREAT LAKES/UPPER OH VALLEY PER SATELLITE IMAGERY...WILL MOVE EWD AWAY FROM THE NRN ATLANTIC COAST LATER THIS EVENING. LIGHTNING TRENDS HAVE CONTINUED TO DIMINISH SIGNIFICANTLY AS THE STORM SYSTEM OUTRUNS THE STRONGER MOIST INFLOW FROM OFF THE GULF OF MEXICO. A FEW LIGHTNING STRIKES REMAIN POSSIBLE ALONG THE TRACK OF THE COMPACT TROUGH WHERE ASCENT WILL BE GREATEST AIDING IN A FEW EMBEDDED TSTMS WITHIN BANDS OF WINTER PRECIPITATION.
HOWEVER...OVERALL AREAL COVERAGE IS EXPECTED TO BE LESS THAN 10 PERCENT RESULTING IN A NO TSTM OUTLOOK.
..PETERS.. 12/19/2008

2.0 Surface Observations

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

2.0.1 Akron-Canton Regional Airport (KCAK), Akron, Ohio

The accident site was located approximately 2 miles east-northeast of Akron-Canton Regional Airport (KCAK), Akron, Ohio, at an elevation of 1,228 feet msl. The airport was equipped with an Automated Surface Observation System (ASOS) and reported the following conditions surrounding the time of the accident:

KCAK weather observation at 1751 EST (2251Z), wind from 300 degrees at 11 knots, visibility 9 miles, ceiling[5] broken at 500 feet agl, overcast at 1,000 feet, temperature 1 degree Celsius (C), dew point temperature -1 degree C, altimeter setting 29.78 inches of Mercury (Hg). Remarks; automated observation system, sea level pressure 1009.5-hPa, temperature 1.1 degrees C, dew point –0.6 degrees C.

KCAK special weather observation at 1809 EST (2309Z), winds from 300 degrees at 10 knots, visibility 2 1/2 miles in mist, ceiling overcast at 400 feet, temperature 1 degree C, dew point –1 degree C, altimeter 29.80 inches of Hg.

[5] Ceiling – is defined as the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration.

Visibility continued to deteriorate and at 1815 EST (2315Z) was reported at 1 1/2 miles in mist.

The full text of the observations surrounding the period were as follows:

METAR KCAK 192151Z 30017KT 10SM SCT007 BKN011 OVC014 02/00 A2972 RMK AO2 PK WND 30032/2117 SLP075 T00220000

SPECI KCAK 192235Z 28009KT 10SM BKN007 OVC014 01/M01 A2977 RMK AO2

METAR KCAK 192251Z 30011KT 9SM BKN005 OVC010 01/M01 A2978 RMK AO2 SLP095 T00111006

SPECI KCAK 192309Z 30010KT 2 1/2SM BR OVC004 01/M01 A2980 RMK AO2

SPECI KCAK 192315Z 29011KT 1 1/2SM BR OVC004 01/M01 A2981 RMK AO2 PRESRR

METAR KCAK 192351Z 32013KT 3SM BR OVC003 01/M01 A2984 RMK AO2 SLP116 8/6// T00061011 10072 20006 51059

2.0.2 Akron Fulton International Airport (KAKR), Akron, Ohio

The next closest weather reporting facility was from Akron Fulton International Airport (KAKR) located approximately 7 miles northwest of the accident site in Akron, at an elevation of 1,067 feet msl. The airport was equipped with an ASOS and reported the following conditions during the period:

KAKR 192054Z AUTO 30014G30KT 10SM OVC014 04/02 A2967 RMK AO2 PK WND 30030/2046 SLP055 T00440022 53041

SPECI KAKR 192232Z AUTO 29010KT 9SM OVC004 01/00 A2978 RMK AO2 CIG 003V007 PRESRR

METAR KAKR 192254Z AUTO 31008KT 5SM BR OVC002 01/01 A2979 RMK AO2 SLP097 T00110006

SPECI KAKR 192340Z AUTO 33011KT 8SM OVC004 00/M01 A2985 RMK AO2

The observation closest to the time of the accident indicated:

KAKR weather observation at 1754 EST (2254Z), automated, wind from 310 degrees at 8 knots, visibility 5 miles in mist, ceiling overcast at 200 feet, temperature and dew point 1 degree C, altimeter 29.76 inches of Hg. Remarks; automated observation system, sea level pressure 1009.7-hPa, temperature 1.1 degree C, dew point 0.6 degree C.

3.0 Upper Air Data

The closest upper air sounding or rawinsonde observation (RAOB) was from the NWS Pittsburgh (KPIT), Pennsylvania, site number 72520, located approximately 60 miles east-southeast of the accident site at an elevation of 1,224 feet msl. The 1900 EST (0000Z

December 20, 2008) sounding from KPIT plotted on a standard Skew-T log P diagram[6] with the observed and derived stability parameters and is included as figure 4 from the surface to 500-mb or 18,000 feet. The KPIT sounding had a surface temperature of 6.3 degrees C, and a dew point of 5.3 degrees C, which resulted in a lifted condensation level (LCL)[7] at 947-hPa or 451 feet agl (1,675 feet msl), a level of free convection (LFC)[8] at 930-hPa or 932 feet msl (2,156 feet msl), and a convective condensation level (CCL)[9] at 862-hPa or 2,953 feet agl (4,177 feet msl). Several shallow temperature inversions were noted below 18,000 feet associated with a front at approximately 6,000 feet and due to subsidence at 10,500 feet. The sounding had a relative humidity of 75 percent or more at the surface and between approximately 2,000 to 7,500 feet, with drier air aloft above the inversions. The precipitable water value was 0.42 inches. The freezing level was identified at 3,906 feet msl, with the temperature profile supporting a light rain to snow mixture at the surface. The temperature and moisture structure of the sounding also supported a high probability of light to moderate rime icing conditions between the freezing level at 3,906 feet and 7,500 feet. The liquid water content (LWC) between these layers varied from 0.148 to 0.458 g/m³, with relative humidity from 92 to 94 percent.

The stability parameters indicated a Lifted Index (LI)[10] of 11.6 and indicated a stable atmosphere, supporting rime type icing and stratiform type clouds.

The sounding wind profile indicated surface wind from 280 degrees at 10 knots, with little variation in height through 18,000 feet with increasing wind speeds immediately above the boundary layer, which indicated a potential for low-level wind shear (LLWS) and turbulence. A low-level wind maximum was identified at 4,500 feet with winds from 275 degrees at 45 knots, and winds exceeding 50 knots above 7,000 feet. The wind data was lost above 33,000 feet with a maximum wind speed from 285 degrees at 141 knots. The wind profile supported several layers of moderate and greater turbulence below 10,000 feet.

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

[8] Level of Free Convection (LFC) -The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

[9] Convective Condensation Level (CCL) - The height to which a parcel of air, if heated sufficiently from below, will rise adiabatically until condensation starts. This is typically used to identify the base of cumuliform clouds, which are normally produced from surface heating and thermal convection.

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

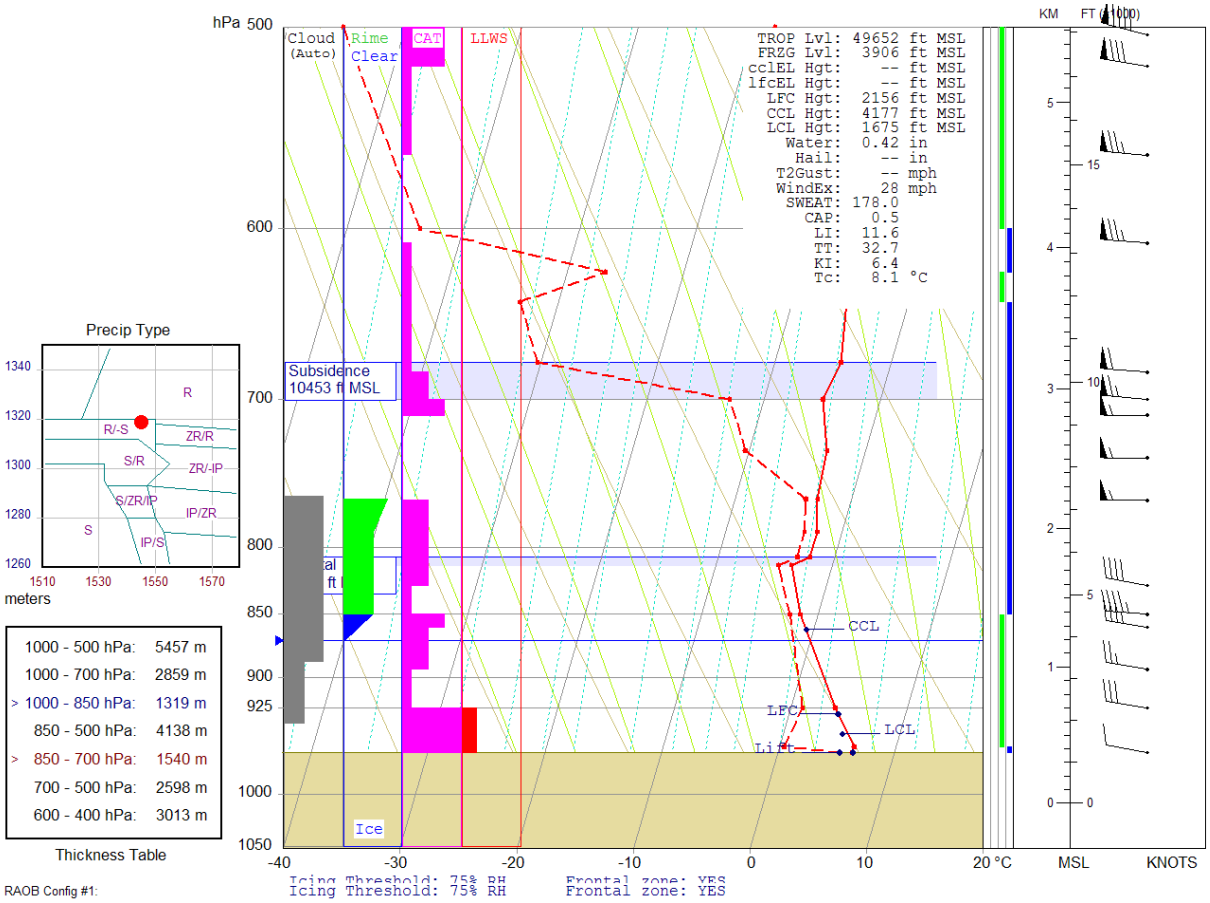


Figure 4 –KPIT sounding for 1900 EST

The sounding provided the following data:

Height (ft-msl)	Pres (hPa)	T (ºC)	Td (ºC)	RH (%)	Wind (deg/kts)	CAT	LLWS	Icing (intensity-type)
1224	963.0	6.4	5.3	93	280/10			
1364	958.0	6.4	0.4	65		XTR	LIGHT	
2304	925.0	3.8	1.0	82	280/28	LGT		Base:871-hPa
3224	893.4				280/24	MDT		
4224	860.2				280/33	SVR		
4539	850.0	-1.5	-2.4	94	275/45	LGT		LGT Clear
5224	828.0				280/41			
5699	813.0	-3.5	-4.6	92				LGT Rime
5892	807.0	-2.1	-3.2	92				LGT Rime
6481	789.0	-2.1	-3.2	92		MDT		LGT Rime
7224	766.8				270/54			
7252	766.0	-2.9	-3.9	93				MDT Rime
8224	737.9				270/55			
8397	733.0	-3.3	-10.3	58				
9224	710.0				270/55	SVR		
9590	700.0	-4.9	-12.9	53	275/67	MDT		

Notes: intensity codes are LGT – light, MDT – moderate, SVR – severe, XTR - extreme

4.0 Aircraft Meteorological Data Relay (AMDAR) Sounding

A descent sounding was obtained from an Aircraft Meteorological Data Relay (AMDAR) equipped aircraft identified as #8671, which had landed at KCAK at 1828 EST (2328Z) from Detroit (KDTW). Figure 5 is the Skew-T log P diagram with the observed temperature and wind structure from the flight.

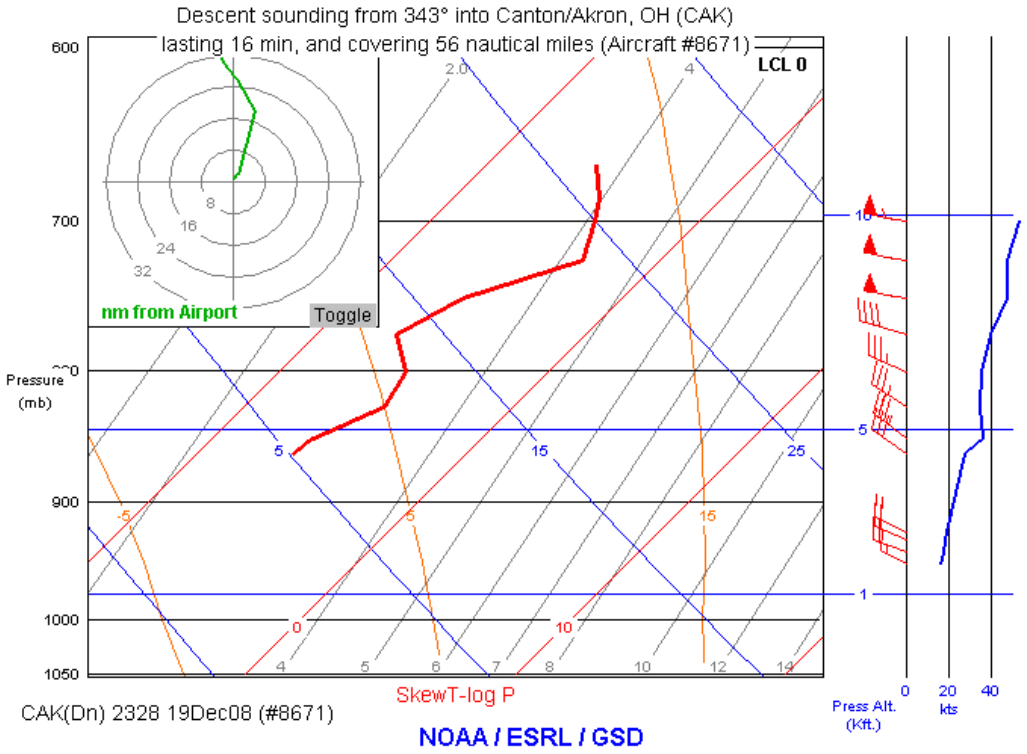


Figure 5 – AMDAR sounding at 1828 EST

The data from the AMDAR descent profile is as follows:

P_alt (ft)	hPa	T/Td (°C)	Wind (deg/kts)	Time (UTC)	Bng/Rng (nm)	AGL (ft)
1740	951	----/-----	296°/017	2327	36°/001	98762
2030	941	----/-----	289°/018	2327	42°/002	98762
2330	931	----/-----	293°/019	2327	44°/002	98762
2500	925	----/-----	294°/020			
4400	862	-6.4/-----	304°/028	2321	18°/018	98762
4760	851	-6.3/-----	307°/037	2320	14°/020	98762
4781	850	-6.3/-----	307°/037			
5540	826	-4.8/-----	303°/035	2320	7°/023	98762
6360	801	-5.3/-----	293°/036	2319	3°/025	98762

5.0 Satellite Data

The Geostationary Operations Environmental Satellite number 13 (GOES-13) data[11] was obtained from the National Climatic Data Center (NCDC) and displayed on the National Transportation Safety Board's Man-computer Interactive Data Access System (McIDAS) software. Both the long and short wave infrared imagery were obtained surrounding the time of the accident, and documented below. The infrared band 4 longwave imagery had a wavelength of 10.7 microns (μm), while the band 2 shortwave imagery at a wavelength of 3.9 μm both with a 4-kilometer (km) resolution with radiative cloud top temperatures.

Figure 6 is the GOES-13 infrared band 2 image at 1802 EST (2302Z) at 8X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops associated with deep convection. The image depicts an extensive area of low stratiform type clouds over the route of flight. The radiative cloud top temperature over the accident site was observed at 268.0 degrees Kelvin (K) or –5.6 degrees C, which according to the AMDAR sounding over KCAK indicated cloud tops in the range of 6,500 feet.

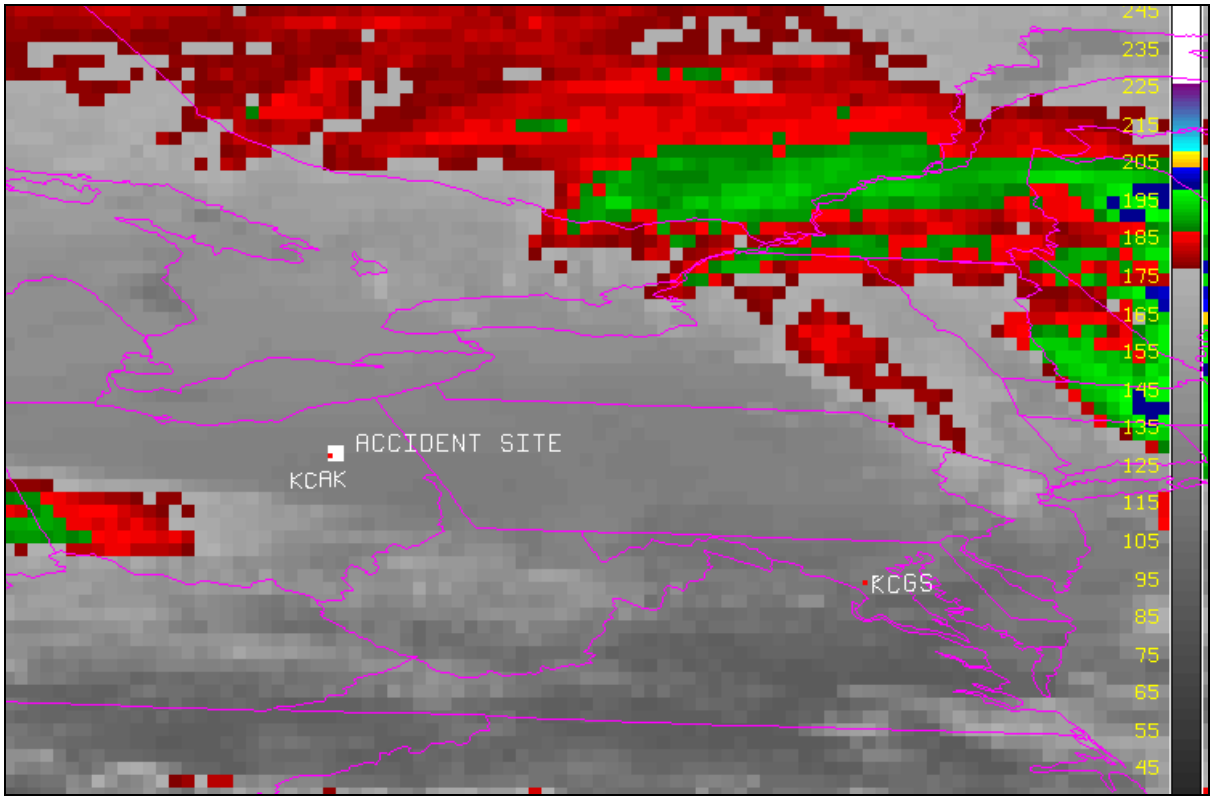


Figure 6 – GOES-13 infrared image at 1802 EST

[11] GOES-13 is the backup satellite for the primary GOES-12 satellite, which was not available during the period surrounding the accident.

6.0 Weather Radar Information

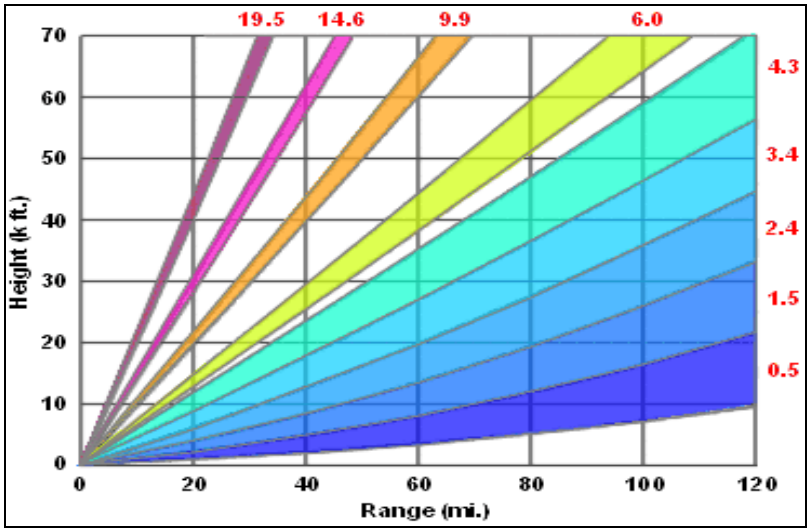
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D) was located at Cleveland (KCLE), approximately 35 miles northwest of the accident site. The level II archive data was obtained and displayed using the Safety Board's McIDAS software.

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

6.0.1 Volume Scan Strategy

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

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has two common scanning strategies. The most common is where the radar makes 9 elevation scans from 0.50 degrees to 19.5 degrees every six minutes. This particular scanning strategy is documented as volume coverage pattern 21 (VCP-21). Mode B is the clear air mode, where the radar makes 5 elevation scans during a ten minute period. During the period surrounding the accident the KCLE WSR-88D radar was operating in the normal precipitation mode (Mode A, VCP-21). The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.



VCP-21 Precipitation Mode Scan Strategy

6.0.2 Beam Height Calculation

Assuming standard refraction[12] of the 0.95 degree radar beam of the KCLE WSR-88D at an elevation of 860 feet msl, the following table shows the approximate beam height and width information of the radar display over the site of the accident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.5	3,530 feet	1,760 feet	5,290 feet	3,530 feet

6.0.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[13] 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[14]), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

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

[13] 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.

[14] dBZ - 10 log Ze

NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0	< 5	
	1	5 to 9	
	2	10 to 14	
1	3	15 to 19	.01 in/hr
Very Light	4	20 to 24	.02 in/hr
	5	25 to 29	.04 in/hr
2	6	30 to 34	.09 in/hr
Light to	7	35 to 39	.21 in/hr
Moderate			
3	8	40 to 44	.48 in/hr
Strong			
4	9	45 to 49	1.10 in/hr
Very Strong			
5	10	50 to 54	2.49 in/hr
Intense			
6	11	55 to 59	>5.67 in/hr
Extreme	12	60 to 64	
	13	65 to 69	
	14	70 to 74	
	15	> 75	

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

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

6.0.4 Base Reflectivity

Figure 7 is the KCLE WSR-88D base reflectivity image for the 0.5 degree elevation scan completed at 1744 EST (2244Z) provided at 4X magnification and with a resolution of 1° X 1 kilometers. The image depicts an area of echoes to the west and south of Cleveland (KCLE) and over Lorain (KLPR), Ohio, with maximum reflectivities of 45 to 50 dBZ. A small echo is observed near the accident site, to the north of KCAK likely associated with Raleigh scattering near the edges of some cumuliform type cloud. The accident site was free of echoes between 1,764 and 5,290 feet.

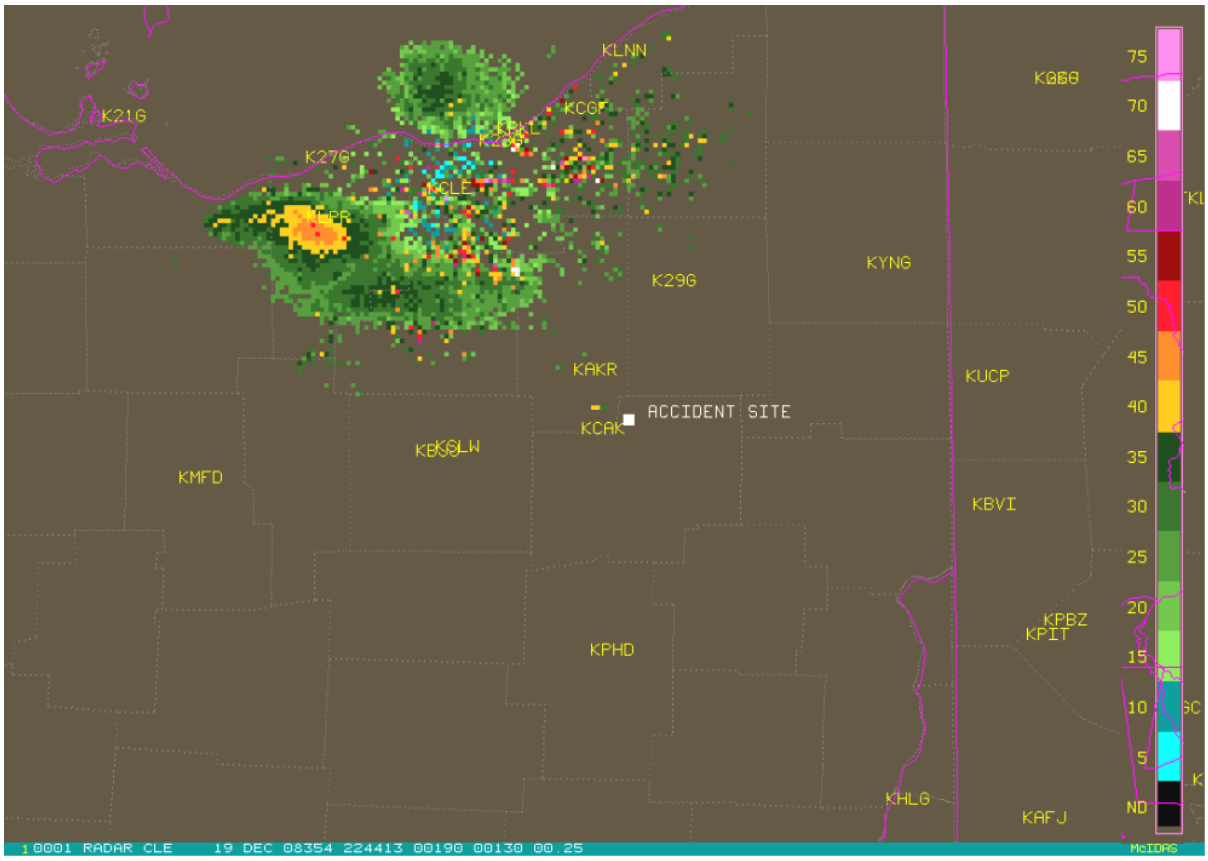


Figure 7 – KCLE WSR-88D 0.5 degree elevation scan for 1744 EST

7.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over Ohio surrounding the time of the accident. The reports are in standard format but in narrative form, and are as follows:

Dayton (DAY) routine pilot report (UA); Over – Dayton (DAY); Time – 1115 EST (1615Z); Flight level – 4,000 feet; Type aircraft – Canadaire Regional Jet (CRJ2) airliner; Wind – from 270 degrees at 60 knots.

Ohio State University (OSU) urgent routine pilot report (UUA); Over – Ohio State University (OSU); Time – 1350 EST (1850Z); Flight level – unknown; Type aircraft – Cessna Citation (C560) corporate jet; Sky cover – broken clouds at 2,000 feet msl; Remarks – low-level wind shear (LLWS) loss/gain of 10 knots on final approach to runway 27L.

Zanesville (ZZV) routine pilot report (UA); Over – Zanesville (ZZV); Time – 1434 EST (1934Z); Flight level – 13,000 feet; Type aircraft – Piper Malibu (PA46) single engine turboprop; Temperature minus 1 degree C; Icing – trace of rime ice; Remarks – cloud tops between 11,000 and 11,500 feet.

Dayton (DAY) routine pilot report (UA); Over – 5 miles southwest of Dayton (DAY); Time – 1508 EST (2008Z); Flight level – 9,000 feet; Type aircraft – Canadaire Regional Jet (CRJ1) airliner; Sky cover – overcast base unknown tops at 5,600 feet; Wind – from 294 degrees at 58 knots; Icing – negative; Temperature - unknown.

Cleveland (CLE) routine pilot report (UA); Over – Cleveland (CLE); Time – 1509 EST (2009Z); Flight level – 4,000 feet; Type aircraft – Dassault Falcon 20 (FA20) business jet; Sky cover – overcast clouds bases at 1,000 feet with tops at 4,000 feet.

Findlay (FDY) routine pilot report (UA); Over – 10 miles east of Findlay (FDY); Time – 1638 EST (2138Z); Flight level – 6,000 feet; Type aircraft – Piper (PA31); Sky cover – overcast clouds bases at 2,000 feet tops at 4,800 feet, second overcast layer at 5,800 feet tops unknown; Temperature – 0 degrees C; Icing – light mixed icing at 6,000 feet; Remarks – presently in instrument meteorological conditions (IMC); Temperature – minus 1 degree C at 3,000 feet.

Youngstown (YNG) routine pilot report (UA); Over – Youngstown (YNG); Time – 1646 EST (2146Z); Flight level – 2,200 feet; Type aircraft – Lockheed Hercules (C130) military 4 engine turboprop cargo aircraft; Sky cover – overcast clouds bases at 2,200 feet tops at 4,000 feet.

Toledo (TOL) routine pilot report (UA); Over – Toledo (TOL); Time – 1725 EST (2225Z); Flight level – 8,000 feet; Type aircraft – Beechcraft Baron (BE58) multiengine corporate aircraft; Sky cover – overcast clouds tops 6,300 feet; Temperature – minus 2 degrees C; Icing – light rime icing; Remarks – during climb.

Cleveland (CLE) routine pilot report (UA); Over – Cleveland (CLE); Time – 1752 EST (2252Z); Flight level – unknown; Type aircraft – Boeing 737 airliner; Sky cover – overcast clouds bases at 800 feet tops 6,000 feet; Icing – trace of mixed ice; Temperature – unknown.

Cleveland (CLE) routine pilot report (UA); Over – Cleveland (CLE); Time – 1807 EST (2307Z); Flight level – unknown; Type aircraft – Boeing 737 airliner; Temperature – minus 1 degree C; Icing – moderate clear icing; Remarks – during climb from Southwest Airlines.

Akron (CAK) routine pilot report (UA); Over – Akron (CAK); Time – 1829 EST (2329Z); Flight level – 2,000 feet; Type aircraft – Cessna Caravan (C208); Sky cover – overcast bases at 2,000 feet with tops at 6,700 feet; Temperature – minus 3 degrees C; Icing – light mixed icing.

8.0 Area Forecast

The Area Forecast (FA) is a forecast of Visual Flight Rules (VFR) clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra (IFR) bulletin for the same area in order to get a complete picture of

the weather. The area forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports which do not have a terminal forecast (TAF) issued. The NWS 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 region that covers Ohio was under the Boston (KBOS) regional forecast. The forecast valid for this accident was issued at 1345 EST (1845Z) on December 19, 2008, and was valid until 0200 EST on December 20, 2008.

BOSC FA 191845
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 201300
CLDS/WX VALID UNTIL 200700...OTLK VALID 200700-201300
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...19Z LOW PRES SYS OVR NERN OH...WRMFNT SEWD TO NC CSTL WTRS...CDFNT SWWD TO NRN KY. 00Z LOW OVR N CNTRL PA...WRMFNT SEWD TO NJ CSTL WTRS...CDFNT SWWD TO XTRM WRN NC. 06Z LO OVR NJ CSTL WTRS...WRMFNT EXTD EWD TO INTL WTRS...CDFNT SWWD TO NRN GA. 12Z LO OVR NY/NJ CSTL WTRS...CDFNT SWWD TO NRN GA.
.
OH LE
SW...BKN080 TOP 100. 21Z BKN015 TOP 060. OTLK...MVFR CIG.
NW...OVC015 TOP 060. 05Z OVC035. OTLK...MVFR CIG.
NE...OVC020 TOP 060. VIS 3-5SM -RA/-FZRA BR. ISOL -TSRA. CB TOPS FL300. 05Z OVC025. OTLK...MVFR CIG.
SE...BKN-OVC020 TOP 060. VIS 3-5SM BR. WDLY SCT -SHRA/-ISOL TSRA. CB TOPS FL300. 03Z OVC-BKN025. OTLK...MVFR CIG.

The forecast for northeast Ohio was for overcast clouds at 2,000 feet msl with tops to 6,000 feet, visibility 3 to 5 miles in light rain and light freezing rain and mist, with isolated thunderstorms, with cumulonimbus clouds to 30,000 feet to 2400 EST (0500Z). The outlook from 0200 to 0800 EST (0700Z to 1300Z) was for MVFR conditions to prevail due to ceilings.

9.0 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.

NWS had AIRMETS current for IFR conditions, icing below 6,000 feet, and the potential for moderate turbulence below 12,000 feet. Advisories are as follows:

BOSS WA 192045
AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 200300
.
AIRMET IFR...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS
FROM 60W YSC TO 50ESE BGR TO 40ESE ACK TO 50SSE HTO TO 30SE ECG TO 40NE LYH TO 30NNW CSN TO AIR TO FWA TO DXO TO 60W YSC
VIS BLW 3SM PCPN/BR/FG. CONDS CONTG BYD 03Z THRU 09Z.
.
AIRMET MTN OBSCN...ME NH VT MA NY PA WV MD VA
FROM YSC TO 20S BGR TO 30SSE CON TO 20ESE HNK TO 40SW CSN TO 30NNE GSO TO HMV TO HNN TO AIR TO JHW TO MSS TO YSC
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

BOST WA 192045
AIRMET TANGO UPDT 4 FOR TURB VALID UNTIL 200300
.
...SEE SIGMET OSCAR SERIES...
.
AIRMET TURB...MA RI CT NY LO NJ PA OH LE WV MD DC DE VA NC AND CSTL WTRS
FROM SYR TO ALB TO 30ESE SAX TO 170SE ACK TO 140SE SIE TO 200ESE ECG TO HMV TO HNN TO CVG TO FWA TO DXO TO SYR
MOD TURB BTN FL200 AND FL400. CONDS CONTG BYD 03Z THRU 09Z.
.
AIRMET TURB...NY LO NJ PA OH LE WV MD DC DE VA NC SC
FROM 60NNW SYR TO 20NNE ALB TO SAX TO FLO TO HMV TO HNN TO CVG TO FWA TO DXO TO 60NNW SYR
MOD TURB BLW 120. CONDS CONTG BYD 03Z THRU 09Z.

BOSZ WA 192045
AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 200300
.
AIRMET ICE...ME NH VT MA RI CT NY LO NJ PA LE MD DC DE VA AND CSTL WTRS
FROM 70SE YQB TO 40WSW YSJ TO 200SE ACK TO 150SE SIE TO 20SE RIC TO 40E PSB TO JHW TO YYZ TO MSS TO YSC TO 70SE YQB
MOD ICE BTN FRZLVL AND FL200. FRZLVL SFC-100. CONDS CONTG BYD 03Z THRU 09Z.
.
AIRMET ICE...CT NY LO NJ PA OH LE WV
FROM YYZ TO JHW TO 40E PSB TO 20SSW HAR TO 20SW APE TO 20N CVG TO FWA TO DXO TO YYZ
MOD ICE BLW 060. CONDS CONTG BYD 03Z THRU 09Z.
.
OTLK VALID 0300-0900Z...ICE ME NH VT MA RI CT NY LO NJ PA OH LE WV AND CSTL WTRS
BOUNDED BY 20ENE MSS-60SSW PLB-160ENE ACK-150ESE ACK-20SSE ACK-20E JFK-40NW CVG-20N FWA-DXO-20ENE MSS
MOD ICE BLW 060. CONDS CONTG THRU 09Z.
.
FRZLVL...RANGING FROM SFC-125 ACRS AREA
MULT FRZLVL 060-100 BOUNDED BY 20N SLT-SAX-30E JFK-40ESE JST-20N SLT
MULT FRZLVL 050-110 BOUNDED BY 30NNW CLE-20WNW EMI-HNN-CVG-FWA-30SW DXO-30NNW CLE

SFC ALG 50SW ROD-20NNW JST-ETX-100NE ACK-150ENE ACK
040 ALG 20W HNN-20SSW JST-20NNE CYN-40SSE ACK-150ESE ACK
080 ALG 40W BKW-20WNW DCA-80ESE SIE-130SSE ACK-200SE ACK
120 ALG 30E HMV-50ESE LYH-20NE ECG

SIGMET Oscar 1 was issued at 1525 EST (2025Z) for severe turbulence over a portion of the area, and was as follows:

WSUS01 KKCI 192025
WS1O
BOSO WS 192025
SIGMET OSCAR 1 VALID UNTIL 200025
PA WV VA DE DC
FROM HAR TO RIC TO PSK TO 50WSW BKW TO HNN TO AIR TO HAR
OCNL SEV TURB BLW 110. RPRTD BY ACFT. CONDS ENDG 0025Z.

A plot of the advisories over the GOES-13 infrared satellite image for 1730 EST is included as figure 8. AIRMETs for IFR conditions, moderate turbulence, and moderate icing conditions existed over the accident site. The AIRMET for mountain obscuration and SIGMET for occasional severe icing also extended over a portion of the route of flight.

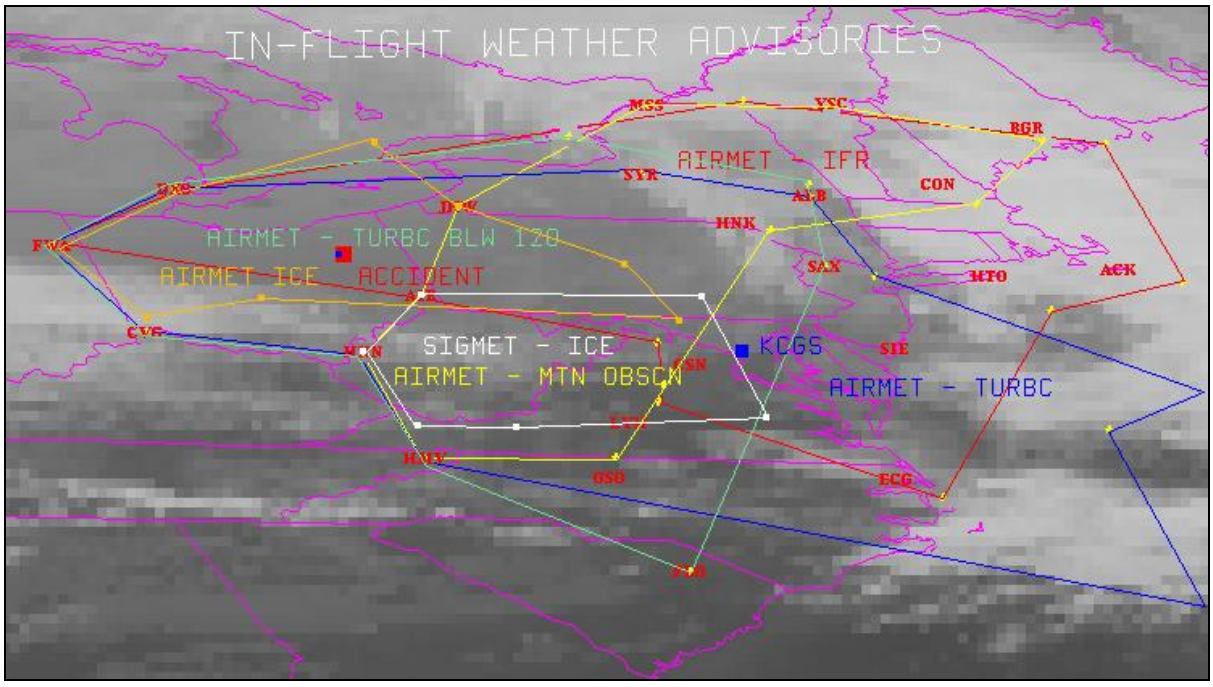


Figure 8 – NWS in-flight weather advisories current over the route

10.0 Terminal Aerodrome Forecast (TAF)

The NWS Cleveland (KCLE) Weather Service Forecast Office (WSFO) had forecast responsibility for Akron-Canton Regional Airport (KACK). The following Terminal Aerodrome Forecast (TAFs) and amendments were issued from the time of the preflight weather briefing to the accident.

KCAK 191736Z 1918/2018 16010KT 1SM -RA OVC004
TEMPO 1918/1922 4SM -RA OVC008
FM192200 01010KT 5SM -RA BR OVC008
FM192300 01012KT 4SM -FZDZSN BR OVC007
FM200000 35012KT 5SM BR OVC007
FM200600 03008KT 6SM BR OVC015
FM200900 04007KT P6SM OVC018
FM201400 04008KT P6SM OVC024=

AMD 1 *KCAK 2007Z 1920/2018 27012G22KT 5SM -RA OVC006*
TEMPO 1920/1924 1 1/2SM -RA OVC012
FM200000 01012KT 4SM -FZDZSN BR OVC007
FM200200 35012KT 5SM BR OVC007
FM200600 03008KT 6SM BR OVC015
FM200900 04007KT P6SM OVC018
FM201400 04008KT P6SM OVC024=

AMD 2 *KCAK 192116Z 1921/2018 28018G28KT P6SM OVC012*
TEMPO 1921/2001 5SM -DZ BR OVC008
FM200100 01012KT 4SM -FZDZ BR OVC006
FM200300 35012KT 6SM -SN BR OVC004
FM200600 03008KT 6SM BR OVC012
FM200900 04007KT P6SM OVC018
FM201400 04008KT P6SM OVC024=

AMD 3 *KCAK 192159Z 1922/2018 30018G28KT P6SM OVC012*
TEMPO 1922/2001 5SM -DZ BR OVC008
FM200100 01012KT 4SM -FZDZ BR OVC006
FM200300 35012KT 6SM -SN BR OVC004
FM200600 03008KT 6SM BR OVC012
FM200900 04007KT P6SM OVC018
FM201400 04008KT P6SM OVC024=

All the forecasts expected IFR to MVFR conditions due to light drizzle and mist. The forecasts expected precipitation changing back to freezing drizzle from 1800 to 2000 EST, each forecast amendment backing the freezing precipitation back to some extent. The forecast current at the time of the accident expected winds from 300 degrees at 18 knots gusting to 28 knots, visibility better than 6 miles, ceiling overcast at 1,200 feet agl.

Temporarily between 1700 and 2000 EST (2200Z and 0100Z), visibility 5 miles in light drizzle and mist, ceiling overcast at 800 feet agl.

11.0 NWS Area Forecast Discussion

The NWS Area Forecast Discussion (AFD) issued by the Cleveland WSFO at 1549 EST (2049Z) provided a synopsis of conditions impacting the area, a short term forecast, and the immediately after the accident indicated the following:

FXUS61 KCLE 192049
AFDCLE
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE CLEVELAND OH
349 PM EST FRI DEC 19 2008
.SYNOPSIS...
LOW PRESSURE IN NORTHWEST PENNSYLVANIA WILL MOVE TO THE EAST THEN A RIDGE OF HIGH PRESSURE WILL MOVE ACROSS THE EASTERN LAKES SATURDAY. AN ELONGATED LOW WILL MOVE ACROSS THE REGION EARLY SUNDAY AND INTO NEW YORK BY LATE SUNDAY LEAVING A TROUGH EXTENDING BACK WEST INTO THE AREA INTO MONDAY MORNING. HIGH PRESSURE WILL MOVE UP THE OHIO VALLEY MONDAY NIGHT. ANOTHER LOW IS EXPECTED TO MOVE ACROSS THE REGION WEDNESDAY.
&&
.NEAR TERM /UNTIL 6 AM SATURDAY MORNING/...
PESKY STORM SYSTEM WILL NOT GIVE IN AS SOME RESIDUAL FREEZING DRIZZLE AND FREEZING RAIN OCCUR OVER NORTHWEST OHIO AND NORTHWEST PENNSYLVANIA. CAUSE OF THIS ACTIVITY IS DUE TO TEMPERATURES BEING BELOW FREEZING AND NO MID LEVEL CLOUDS TO SUPPLY THE SEEDER FEEDER PROCESS TO MAKE THE PRECIPITATION ALL SNOW. HOWEVER...LATEST SATELLITE SHOWS AN AREA OF MID LEVEL CLOUDS MOVING SOUTHEAST OUT OF MICHIGAN INTO THE REGION. THIS MID LEVEL CLOUD DECK SHOULD PROVIDE THE NECESSARY ICE CRYSTALS ALOFT TO PRECIPITATE OUT AS EITHER FLURRIES OR LIGHT SNOW LATER THIS EVENING. THIS IS SUPPORTED BY SNOW FALLING OVER MICHIGAN AT THIS TIME UNDER THE MID AND LOW CLOUD DECKS. I ANTICIPATE ALL OF THE FREEZING PRECIPITATION WILL BE GONE BY LATER THIS EVENING SO WILL EXTEND WINTER WEATHER ADVISORIES UNTIL 8 PM. REST OF THE FORECAST AREA SEEING THE SAME PROCESSES GOING ON BUT TEMPERATURES ARE ABOVE FREEZING SO ONLY SOME PATCHY DRIZZLE IS EXPECTED THIS EVENING. ALL OF THE PRECIPITATION WILL COME TO END FOR MUCH OF THE AREA BUT WILL KEEP A LINGERING CHANCE OF SNOW SHOWERS IN THE NORTHEAST OVERNIGHT AS WRAP AROUND MOISTURE AND LAKE ENHANCEMENT AFFECTS THIS REGION DURING THE NIGHT. AS LOW PULLS AWAY FROM THE AREA...SOME COLDER AIR WILL SPILL INTO THE REGION TONIGHT AND I AM EXPECTING TEMPERATURES TO DROP WELL INTO THE 20S OVERNIGHT.
&&
.SHORT TERM /6 AM SATURDAY MORNING THROUGH MONDAY NIGHT/...
A BRIEF LULL IN THE WEATHER DEPARTMENT TAKES PLACE ON SATURDAY AS RIDGE EXTENDING SOUTH ACROSS THE AREA TAKES CONTROL OF THE WEATHER ACROSS THE REGION. ANOTHER STORM SYSTEM APPROACHES FROM THE WEST AND THIS STORM WILL TRACK WELL SOUTH OF THE REGION. MODELS ARE IN AGREEMENT IN THIS FEATURE KEEPING MUCH OF THE WARM AIR WELL SOUTH OF THE REGION AS WELL. THIS SHOULD KEEP PRECIPITATION IN THE FORM OF ALL SNOW. SNOW SHOULD BEGIN TO SPREAD INTO THE REGION SATURDAY NIGHT AND CONTINUE INTO SUNDAY MORNING. LOW SHIFTS TO THE NORTHEAST AND BECOMES SITUATED OVER EASTERN LAKE ERIE BY SUNDAY AFTERNOON. A

STRONG COLD FRONT WILL RACE EAST ACROSS THE REGION DURING THE DAY PLUMMETING TEMPERATURES DURING THE LATE AFTERNOON. FLOW BECOMES WELL ALIGNED BY SUNDAY NIGHT ALONG THE LAKE SHORE AND WILL SET UP SOME LAKE EFFECT SNOW BANDS. THE BANDS ARE EXPECTED TO SHIFT FURTHER INLAND BY MONDAY MORNING. THE POTENTIAL EXISTS FOR ANOTHER SIGNIFICANT LAKE EFFECT SNOW EVENT SUNDAY NIGHT INTO MONDAY. THE SHARPLY COLDER TEMPERATURES AND TIGHT GRADIENT OVER THE REGION WILL ALSO CAUSE PROBLEMS FOR DANGEROUSLY COLD WIND CHILLS SUNDAY NIGHT. THE GUSTY WINDS WILL CAUSE PROBLEMS WITH SIGNIFICANT BLOWING AND DRIFTING OF THE SNOW. WE WILL HAVE TO CONTINUE TO MONITOR THIS SITUATION FOR POSSIBLE LAKE EFFECT SNOW WATCHES AND WARNINGS. THE VERY COLD AIR AND GUSTY WINDS WILL CAUSE DANGEROUSLY COLD WIND CHILLS ACROSS THE ENTIRE FORECAST AREA SUNDAY NIGHT INTO MONDAY. THE SNOW IS EXPECTED TO CONTINUE IN THE NORTHEAST AS LAKE EFFECT WHILE THE REST OF THE AREA BEGINS TO SEE THE INFLUENCE OF SOME WRAP AROUND MOISTURE AND ASSOCIATED PVA INTO THE FORECAST AREA. THE SYNOPTIC MOISTURE WILL HELP TO ENHANCE THE LAKE EFFECT ALREADY ONGOING DURING THE MONDAY NIGHT PERIOD. ALL GUIDANCE TEMPERATURES LEANING TOWARD THE SHARPLY COLDER TEMPERATURE TREND THROUGH THIS PERIOD AND WILL NOT BE DEVIATING TOO MUCH FROM THEM THIS GO AROUND.
&&
.LONG TERM /TUESDAY THROUGH FRIDAY/...
NO BIG CHANGES ANTICIPATED FOR THE LONG RANGE TUESDAY THRU THURSDAY. HIGH PRESSURE ON TUESDAY GIVES WAY TO AN APPROACHING COLD FRONT. WILL CONTINUE WITH SNOW AS THE PCPN TUESDAY NIGHT AND MIX RAIN AND SNOW WEDNESDAY. AT LEAST IT WILL BE DRY FOR THE MOST PART THURSDAY...THEN ANOTHER SYSTEM APPROACHES FRIDAY WITH MORE SNOW.
&&
.AVIATION /21Z FRIDAY THROUGH WEDNESDAY/...
LOW PRESSURE OVER WESTERN OHIO TRACKING SWIFTLY EASTWARD TOWARDS PENNSYLVANIA. SCATTERED MIXED PRECIP WITH IFR WEATHER CONDS WILL BECOME MORE MVFR BY EVENING. PCPN EXPECTED TO TRANSITION BACK TO SOME LIGHT SNOW/FRZ DRIZZLE THIS AFTN. CIGS SHOULD LIFT TO MVFR THIS EVENING AND OVERNIGHT WITH VSBY BECOMING UNRESTRICTED.
OUTLOOK...HIGH PRESSURE MOVES ACROSS THE AREA SATURDAY AND WE COULD SEE SOME PARTIAL CLEARING...BUT MVFR CIGS WILL LIKELY PREVAIL WITH MOISTURE TRAPPED BELOW INVERSION. MVFR AND IFR CONDITIONS LIKELY LATE SATURDAY NIGHT AND SUNDAY AS MOISTURE AND MIXED BAG OF PRECIP WORKS INTO THE AREA LATE SATURDAY NIGHT...CHANGING TO ALL SNOW SHOWERS ON SUNDAY. MVFR AND IFR CONDS MONDAY ESPECIALLY NORTHEAST OHIO VFR CONDITIONS MONDAY NIGHT AND EARLY TUESDAY. LATE TUESDAY BACK TO MVFR/IFR CONDS.

.CLE WATCHES/WARNINGS/ADVISORIES...
OH...WINTER WEATHER ADVISORY UNTIL 8 PM EST THIS EVENING FOR OHZ003-006>008.
PA...WINTER WEATHER ADVISORY UNTIL 8 PM EST THIS EVENING FOR PAZ001>003.
MARINE...GALE WARNING UNTIL 10 PM EST THIS EVENING FOR LEZ061-142>14-162>169.

The aviation section of the discussion indicated that the low pressure system over western Ohio was moving eastward and continuing to produce scattered mixed freezing precipitation with IFR conditions across the area, with ceilings expected to improve to MVFR conditions by evening. The precipitation was expected to change back to light snow and light freezing drizzle before ending. The discussion ended indicating that Winter Weather Advisories were in effect until 2000 EST.

The forecast discussion was updated immediately after the accident at 1814 EST, and was as follows:

FXUS61 KCLE 192314
AFDCLE
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE CLEVELAND OH
614 PM EST FRI DEC 19 2008
.SYNOPSIS...
LOW PRESSURE IN NORTHWEST PENNSYLVANIA WILL MOVE TO THE EAST THEN A RIDGE OF HIGH PRESSURE WILL MOVE ACROSS THE EASTERN LAKES SATURDAY. AN ELONGATED LOW WILL MOVE ACROSS THE REGION EARLY SUNDAY AND INTO NEW YORK BY LATE SUNDAY LEAVING A TROUGH EXTENDING BACK WEST INTO THE AREA INTO MONDAY MORNING. HIGH PRESSURE WILL MOVE UP THE OHIO VALLEY MONDAY NIGHT. ANOTHER LOW IS EXPECTED TO MOVE ACROSS THE REGION WEDNESDAY.
&&
.NEAR TERM /UNTIL 6 AM SATURDAY MORNING/...
PESKY STORM SYSTEM WILL NOT GIVE IN AS SOME RESIDUAL FREEZING DRIZZLE AND FREEZING RAIN OCCUR OVER NORTHWEST OHIO AND NORTHWEST PENNSYLVANIA. CAUSE OF THIS ACTIVITY IS DUE TO TEMPERATURES BEING BELOW FREEZING AND NO MID LEVEL CLOUDS TO SUPPLY THE SEEDER FEEDER PROCESS TO MAKE THE PRECIPITATION ALL SNOW. HOWEVER...LATEST SATELLITE SHOWS AN AREA OF MID LEVEL CLOUDS MOVING SOUTHEAST OUT OF MICHIGAN INTO THE REGION. THIS MID LEVEL CLOUD DECK SHOULD PROVIDE THE NECESSARY ICE CRYSTALS ALOFT TO PRECIPITATE OUT AS EITHER FLURRIES OR LIGHT SNOW LATER THIS EVENING. THIS IS SUPPORTED BY SNOW FALLING OVER MICHIGAN AT THIS TIME UNDER THE MID AND LOW CLOUD DECKS. I ANTICIPATE ALL OF THE FREEZING PRECIPITATION WILL BE GONE BY LATER THIS EVENING SO WILL EXTEND WINTER WEATHER ADVISORIES UNTIL 8 PM. REST OF THE FORECAST AREA SEEING THE SAME PROCESSES GOING ON BUT TEMPERATURES ARE ABOVE FREEZING SO ONLY SOME PATCHY DRIZZLE IS EXPECTED THIS EVENING. ALL OF THE PRECIPITATION WILL COME TO END FOR MUCH OF THE AREA BUT WILL KEEP A LINGERING CHANCE OF SNOW SHOWERS IN THE NORTHEAST OVERNIGHT AS WRAP AROUND MOISTURE AND LAKE ENHANCEMENT AFFECTS THIS REGION DURING THE NIGHT. AS LOW PULLS AWAY FROM THE AREA...SOME COLDER AIR WILL SPILL INTO THE REGION TONIGHT AND I AM EXPECTING TEMPERATURES TO DROP WELL INTO THE 20S OVERNIGHT.
&&
..AVIATION /23Z FRIDAY THROUGH WEDNESDAY/...
CONDITIONS MVFR TO IFR ACROSS THE AREA WITH LIFR AT KMFD IN FOG AND LOW CIGS. SURFACE LOW IN NORTH CENTRAL PA SRN NY BORDER AT 23Z WITH A TROF EXTENDING SOUTHWEST THROUGH KYNG VICINITY AND SOUTH OF KMNN. FLOW IS NORTHERLY ACROSS THE AREA BEHIND THE TROF WITH COLDER AIR NOW FILLING IN. PRECIP WITH THE MAIN SYSTEM HAS PULLED EAST OF THE AREA. SLIGHTLY DRIER AIR WILL SLOWLY FILL IN DURING THE PERIOD AND WITH THAT EXPECT CIGS TO SLOWLY LIFT THROUGH THE NIGHT AND SATURDAY. THROUGH THE EVENING WILL LIFT CONDITIONS FROM IFR TO MVFR ALTHOUGH KMFD COULD TAKE MUCH OF THE NIGHT. BY SATURDAY EXPECT ALL AREAS MVFR CIGS WITH VISIBILITIES UNRESTRICTED.
.
CLE WATCHES/WARNINGS/ADVISORIES...
OH...WINTER WEATHER ADVISORY UNTIL 8 PM EST THIS EVENING FOR OHZ003-006>008.
PA...WINTER WEATHER ADVISORY UNTIL 8 PM EST THIS EVENING FOR PAZ001>003.
MARINE...GALE WARNING UNTIL 10 PM EST THIS EVENING FOR LEZ061-142>149

The advisory was updated after the accident and indicated that MVFR to IFR conditions were continuing across the forecast area, with LIFR conditions at KMFD due to fog. The low pressure system and associated occluded front was in northern central Pennsylvania moving eastward, with a trough of low pressure extended southwestward from the low across the area. Northerly flow of cold drier air was behind the trough and was expected to lift ceilings to MVFR conditions with visibilities unrestricted. Winter Weather Advisories continued to be in effect until 2000 EST.

12.0 Weather Briefing

The pilot of N9299N received a preflight weather briefing from the Raleigh Federal Contract facility (FCF)/Automated Flight Service Station (AFSS) between 1427 and 1446 EST on December 19, 2008. The transcript of that briefing is included as attachment 1. The briefing included the AIRMETs for IFR and mountain obscuration, turbulence, and icing conditions.

There was no mention of the NWS Forecast Icing Product (FIP)[15] being used in the briefing. The Current Icing Product (CIP) and FIP are available on the NWS Aviation Digital Data Service (ADDS) website (http://adds.aviationweather.gov/).

13.0 Icing Potential

The NWS Current Icing Product (CIP)[16] obtained from the NCDC Operational Model Archive and Distribution System (MODIS) for 2,000, 3,000 and 4,000 feet for 1800 EST (2300Z) on December 19, 2008, are included as figures 9 through 11 respectively. The charts indicated a greater than 70 percent probability of encountering icing conditions at 2,000 feet, and increased to 80 percent or more at 3,000 feet, and decreasing to 30 percent at 4,000 feet.

Figure 12 is the Supercooled Large Droplet (SLD) threat for 3,000 feet for 1800 EST.

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[15] The Forecast Icing Potential (FIP) is an automatically-generated forecast of icing potential. FIP examines numerical weather prediction model output (from the Rapid Update Cycle, RUC) to calculate the potential for in-flight aircraft icing conditions. This icing potential demonstrates the confidence that an atmospheric location, represented by a three-dimensional model grid box, will contain supercooled liquid water that is likely to form ice on an aircraft. By FAA policy, FIP is classified as a restricted supplementary weather product, authorized for use by meteorologists and dispatchers only.

[16] The Current Icing Product (CIP) is a supplementary (for increased situational awareness) weather product that provides a graphical view of the current icing environment. Input from weather sensors is provided to software models to produce this automatically generated graphical weather product. The CIP is updated hourly, and provides current information via icing severity graphics and icing probability graphics. It is important to note that all CIP products are not forecasts, but presentations of current conditions at the time of the analysis ("Nowcast" information).

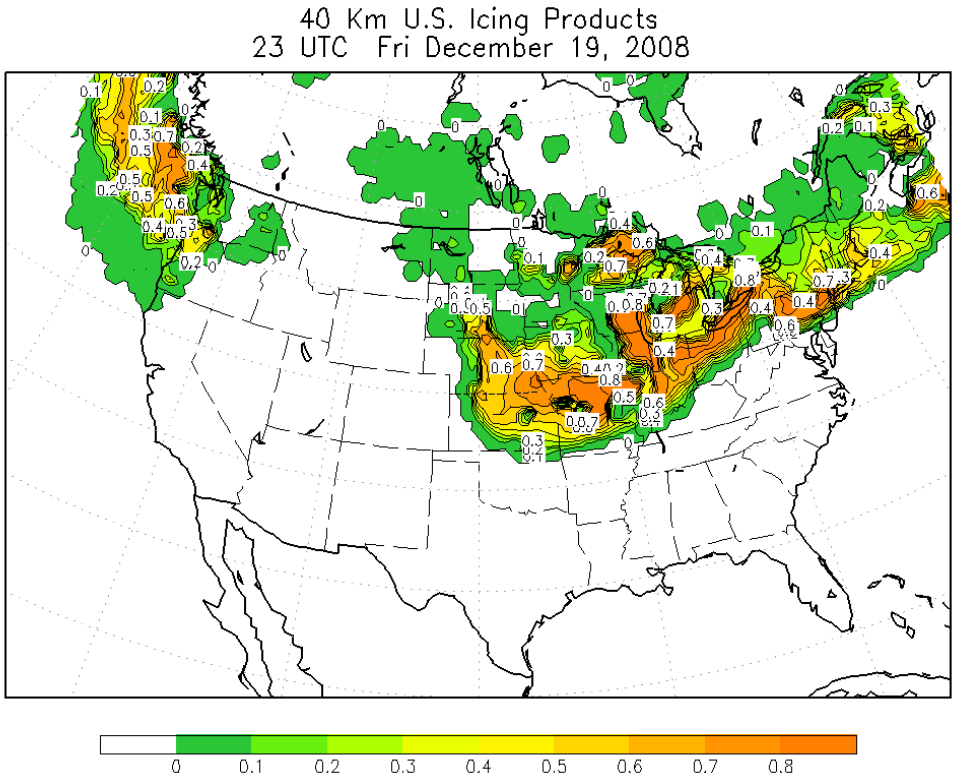

Figure 9 – CIP for 2,000 feet

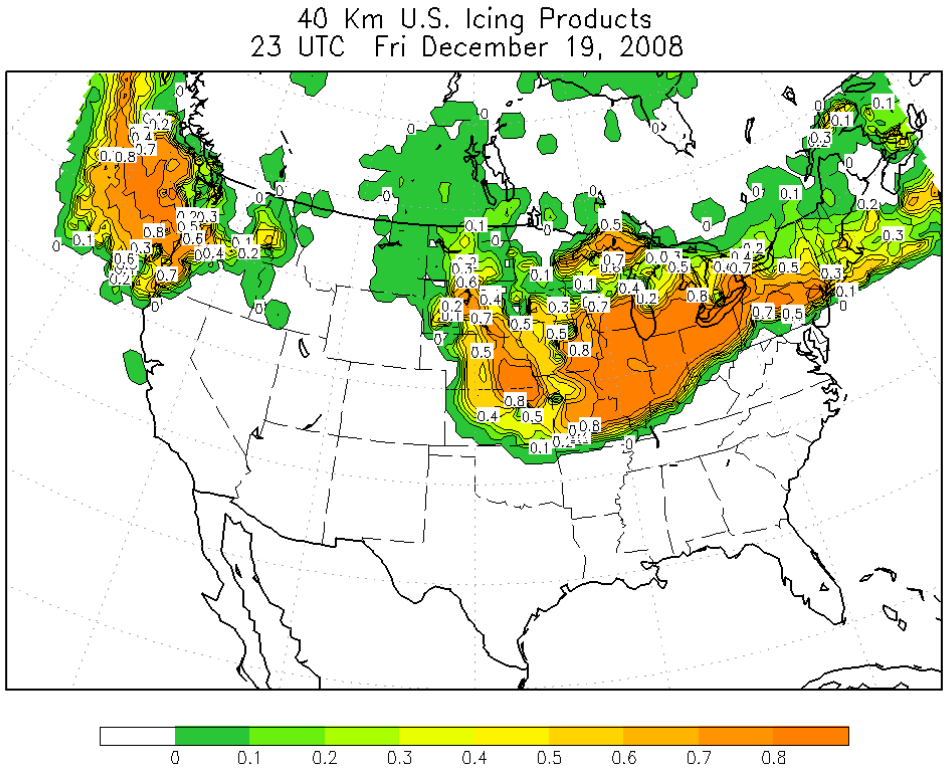

Figure 10 – CIP for 3,000 feet

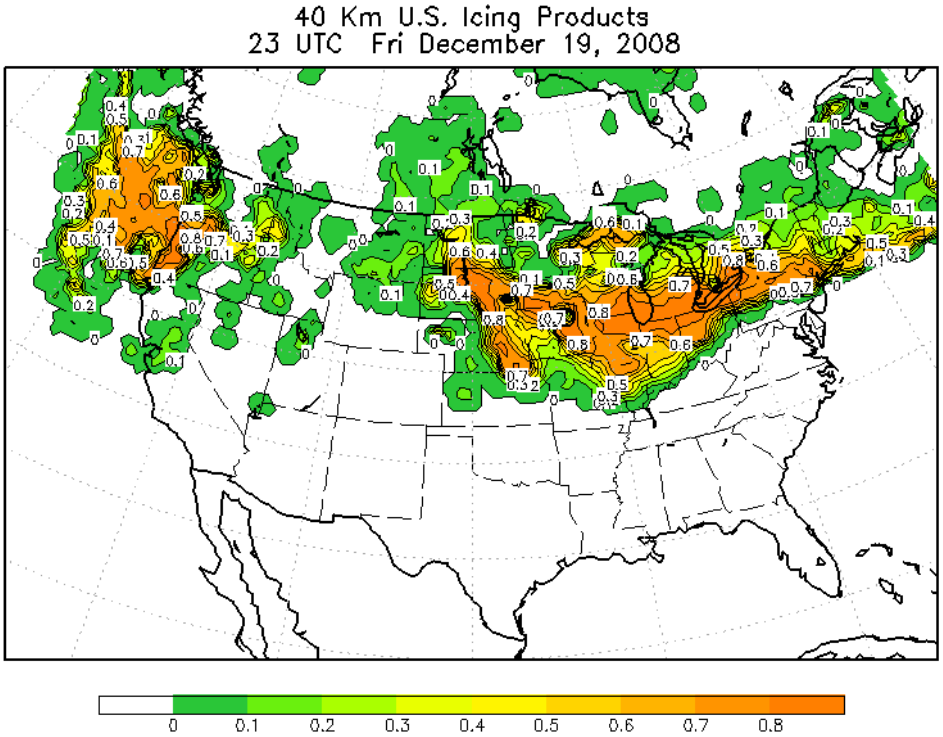

Figure 11 – CIP for 4,000 feet

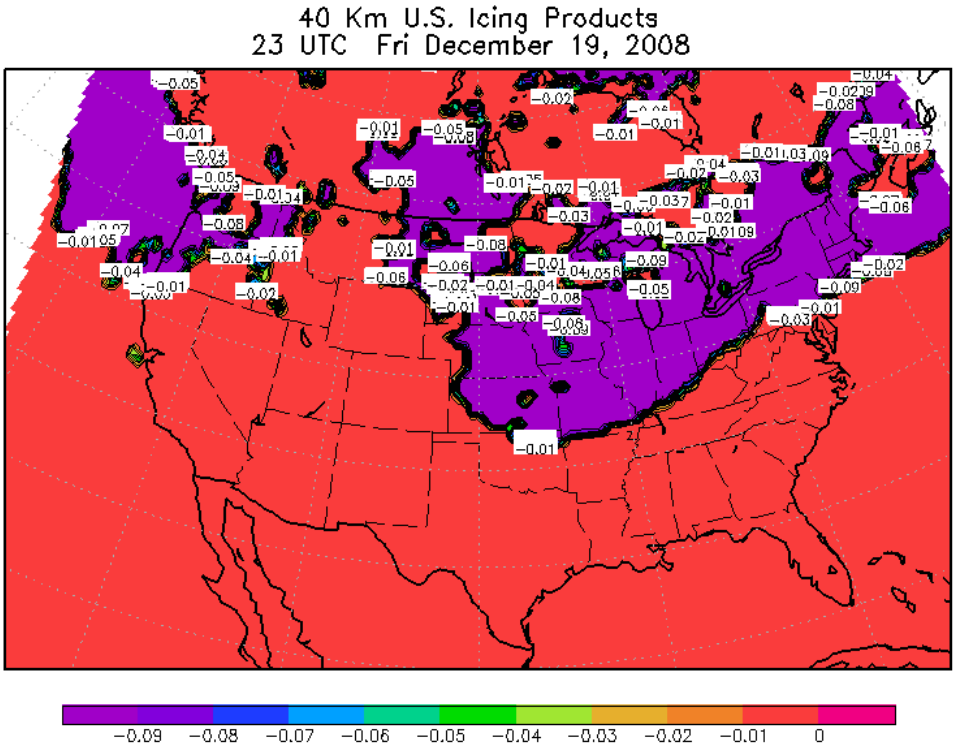

Figure 12 –SLD for 3,000 feet

14.0 Statements

Several pilots who operated into or out of KCAK on the day of the accident provided statements regarding the weather conditions they encountered. Their statements are included in attachment 2, and are abbreviated below with the estimated time of landing.

1312 EST – pilot departed flying a Cessna Caravan (C208B), entered the clouds at 400 feet, and started picking up light, mostly clear ice, in the clouds, with tops at 6,100 feet. At 8,000 feet, noted the temperature of +4 degrees C.

1741 EST – pilot flying a multiengine Beechcraft Baron (BE58) attempted a localizer approach to runway 25 at KAKR, went missed approach and executed an ILS runway 23 approach at KCAK. He indicated at 7,000 feet the temperature was between 5 to 7 degrees C, with cloud tops at 6,500 feet. The aircraft began to accumulate ice entering the clouds from 6,500 feet to the surface, and reported encountering rain in the clouds. At 3,000 feet the temperature was near freezing and he encountered mixed icing, which accumulated very rapidly with 1 1/4 inches of ice on portions of the wing. He broke out of the clouds between 400 and 500 feet agl.

1808 EST – pilot flying a Cessna Citation business jet (C550) flew the approach immediately after the accident airplane. They diverted from Wayne County Airport (KBJJ) located approximately 20 miles east of KCAK due to low ceilings and visibility in fog. He indicated the cloud tops were about 6,000 feet and encountered icing conditions at approximately 3,000 feet down to 400 to 500 feet, and actuated the deicing boots twice on approach. He estimated accumulating up to 1-inch of ice on the approach, and indicated a ceiling of 200 feet agl and visibility 1/2 mile.

Time unknown - Another pilot flying a multiengine Cessna Golden Eagle (C421) near the time of the accident reported cloud tops near 5,000 feet and descended into a solid layer of clouds and began encountering icing "right away" below 3,500 feet, with moderate rime type ice. They had difficulty with the landing gear and had increased power setting to maintain their airspeed, which they attributed to the icing conditions. The aircraft landed hard due to the amount of ice accumulation on the airplane, and estimated 1 to 2 inches of ice on unprotected areas of the airplane, and a lot of ice on the unprotected areas of the windshield. He indicated the ceiling heights as 500 to 600 feet and visibility 2 to 3 miles, when he landed and provided an icing report to the air traffic control tower's ground controller.

15.0 Icing Intensity

The FAA Aeronautical Information Manual (AIM), chapter 7 Safety of Flight – Meteorology, section 7-1-21 advises pilots how to make pilot reports relating to airframe icing. The AIM advises:

> *a. The effects of ice on aircraft are cumulative-thrust is reduced, drag increases, lift lessens, and weight increases. The results are an increase in stall speed and a deterioration of aircraft performance.*

In extreme cases, 2 to 3 inches of ice can form on the leading edge of the airfoil in less than 5 minutes. It takes but 1/2 inch of ice to reduce the lifting power of some aircraft by 50 percent and increases the frictional drag by an equal percentage.

b. A pilot can expect icing when flying in visible precipitation, such as rain or cloud droplets, and the temperature is between +02 and -10 degrees Celsius. When icing is detected, a pilot should do one of two things, particularly if the aircraft is not equipped with deicing equipment; get out of the area of precipitation; or go to an altitude where the temperature is above freezing. This "warmer" altitude may not always be a lower altitude. Proper preflight action includes obtaining information on the freezing level and the above freezing levels in precipitation areas. Report icing to ATC, and if operating IFR, request new routing or altitude if icing will be a hazard. Be sure to give the type of aircraft to ATC when reporting icing. The following describes how to report icing conditions.

*1. **Trace** - Ice becomes perceptible. Rate of accumulation slightly greater than sublimation. Deicing/anti-icing equipment is not utilized unless encountered for an extended period of time (over 1 hour).*

*2. **Light** - The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.*

*3. **Moderate** - The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or flight diversion is necessary.*

*4. **Severe** - The rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.*

16.0 Astronomical Data

The following astronomical data was obtained from the United States naval Observatory's website for North Canton, Stark County, Ohio:

Sunset	1700 EST
End civil twilight	1731 EST
Moon set	1214 EST
Moon rise	0120 EST on December 20, 2008

Both the Sun and the Moon were more than 15 degrees below the horizon.

Donald E. Eick
NTSB Senior Meteorologist