NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 14, 2016

Group Chairman's Factual Report

METEOROLOGY

CEN16MA036

Table Of Contents

A. ACCIDENT

Location:	Akron, Ohio
Date:	November 10, 2015
Time:	1452 eastern standard time (1952 UTC[1])
Airplane:	BAE Hawker 125-700; registration N237WR

B. METEOROLOGY GROUP

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C. SUMMARY

On November 10, 2015, about 1452 eastern standard time (EST), Execuflight flight 1526, a British Aerospace HS 125-700A, N237WR, departed controlled flight while on approach to landing at Akron Fulton International Airport (AKR) and impacted a 4-plex apartment building in Akron, Ohio. The pilot, copilot, and seven passengers died; no ground injuries were reported. The airplane was destroyed by the crash and a postcrash fire. The airplane was registered to Rais Group International NC LLC and operated by Execuflight under the provisions of 14 Code of Federal Regulations Part 135 as an on-demand charter flight. Instrument meteorological conditions prevailed, and an instrument flight rules flight plan was filed. The flight departed from Dayton-Wright Brothers Airport (MGY), Dayton, Ohio, about 1413 EST and was destined for AKR.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the National Center for Environmental Information (formerly known as the National Climatic Data Center) and the Weather Prediction Center (WPC). All times are eastern standard time (EST) based upon the 24 hour clock, local time 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. NWS airport and station identifiers use standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus International Air Transport 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.

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

The accident site was located at latitude 41.0547° N and longitude 81.4236° W or approximately 1.7 miles northeast of the airport at an elevation of 1,098 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 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.

1.1 Surface Analysis Chart

A section of the National Weather Service (NWS) Surface Analysis Chart for 1600 EST (2100Z) on November 10, 2015 centered over the region is included as figure 1, with the approximate accident site marked by a red star. The chart depicted the conditions immediately after the accident with a low pressure system over Delaware and southern the New Jersey coastal section at 1008-hectopascals (hPa)[2] with a warm front extending eastward and a cold front extending southward off the east coast. A trough of low pressure extended northwest of the low across Pennsylvania and into the Great Lakes region immediately east of the accident site. A slight cyclonic circulation was noted over northeast Ohio, likely associated with a weak or dissipating low pressure system. This low pressure system and associated frontal system was the primary cause of the wide spread area of low ceilings and visibilities across the northeastern United States into the Ohio valley.

The station models on the surface analysis depicted a large area of precipitation and visibility restrictions in fog or mist over the northeast into Ohio. In the general vicinity of the accident site, the stations reported westerly winds of 10 knots or less, rain and mist, overcast clouds, with temperatures in the upper 40's to low 50's degrees Fahrenheit (F), with temperature-dew point spreads of 4° F or less.

[2] Hectopascal (hPa) is the new standard unit for reporting sea level pressure and replaces millibars (MB) with the same units.

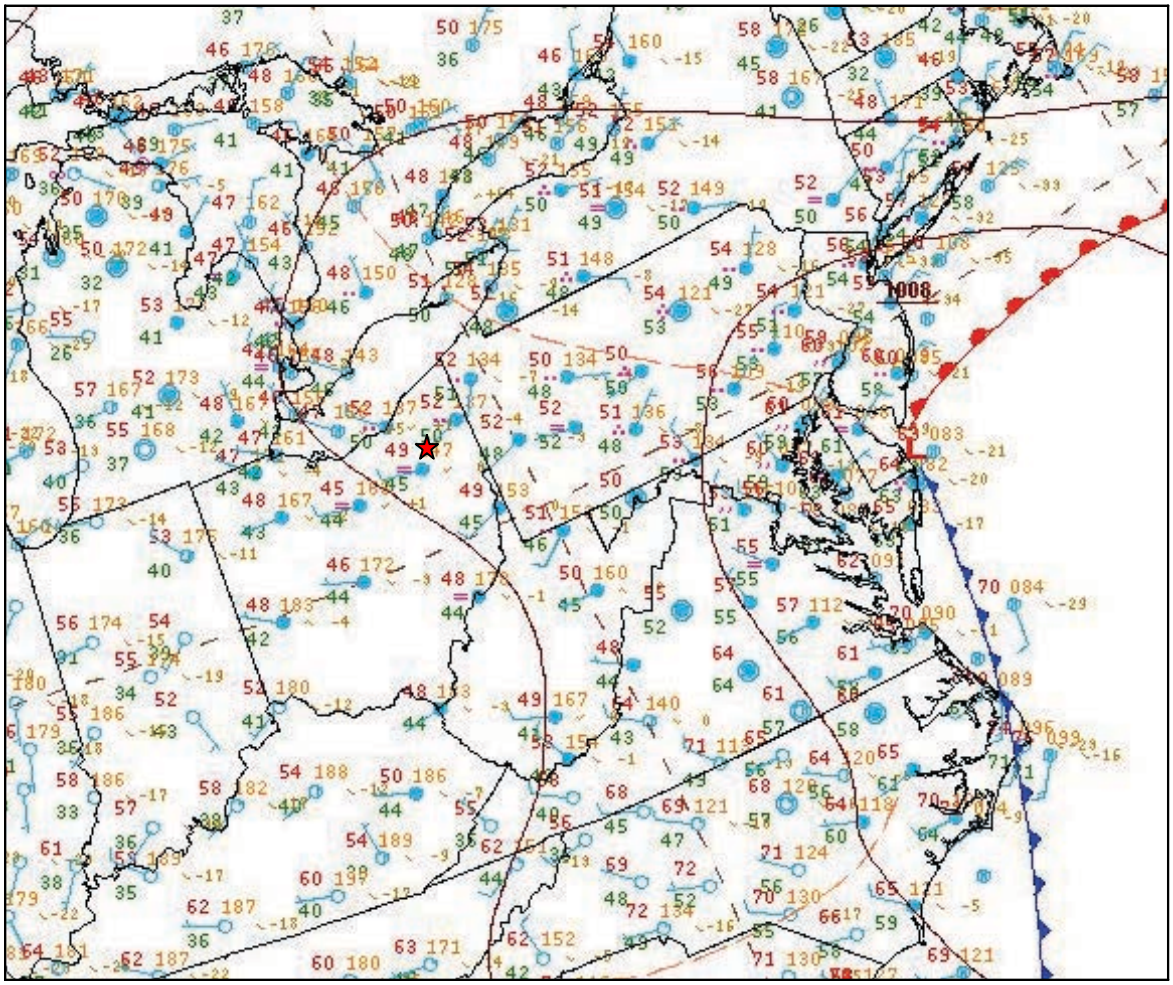

Figure 1 - NWS Surface Analysis Chart for 1600 EST on November 10, 2015

1.2 Weather Radar Mosaic

The NWS regional radar mosaic for 1600 EST (2000Z) obtained from the University Center for Atmospheric Research's (UCAR) website is included as figure 2, with the approximate accident site marked by a red star. The regional radar image showed a large area of very light to moderate intensity echoes over extreme northeast Ohio, New York, Pennsylvania, into western Maryland. No significant echoes were identified over the Akron, Ohio area associated with any strong convective activity. The closest NWS weather radar has been further documented in section 5.0 of this report, to document any potential echoes along the flight track.

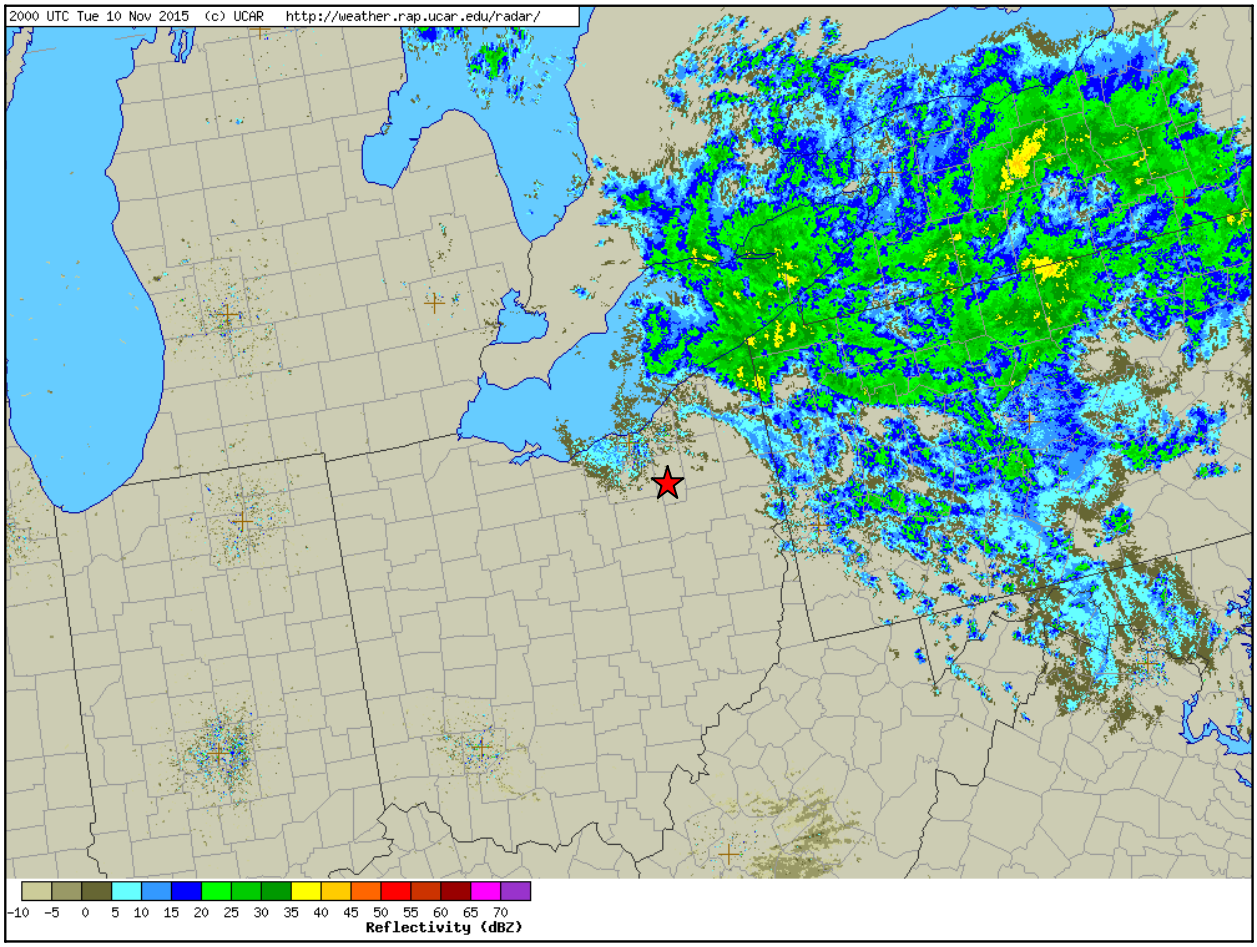

Figure 2 - Regional radar mosaic for 1500 EST on November 10, 2015

1.3 NWS Low-Level Significant Weather Prognostic Chart

The NWS 12 and 24 hour Low-Level Significant Weather Prognostic Chart valid during the period for conditions at 1900 and 0700 EST on November 11, 2015 is included as figure 3. The left portion of the chart is the forecast for 1900 EST and depicted a large area of instrument flight rule (IFR) conditions over eastern Ohio, western New York, Pennsylvania, New Jersey, Maryland, and Delaware by a red enclosed line. The area was surrounded by a large area of marginal visual flight rule (MVFR) conditions depicted by a blue scalloped line over most of Ohio, Michigan, New York, Connecticut, West Virginia, and Virginia. The freezing level at 4,000 feet intervals was depicted by a dashed blue line and indicated the freezing level from 10,000 to 12,000 feet over Ohio. An area of moderate turbulence was depicted over region by a brown dashed line below 24,000 feet.

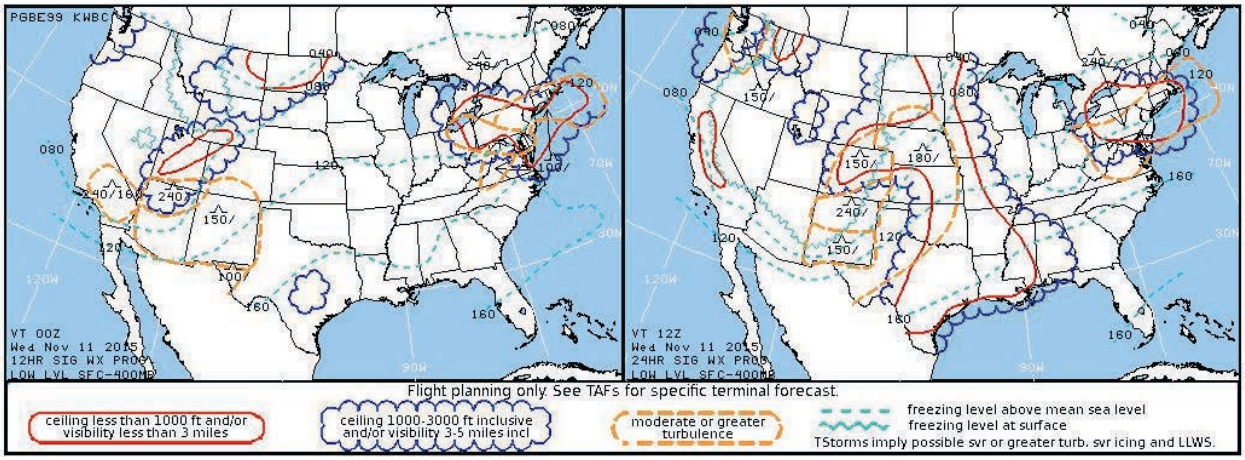

Figure 3 - Low-Level Significant Weather Prognostic Chart valid for 1900 and 0700 EST

1.4 Constant Pressure Charts

The NWS Constant Pressure Charts for 850- and 700-hPA for 0700 EST (1200Z) on November 10, 2015 are included as figures 4 and 5 respectively, and depict the conditions at approximately 5,000 and 10,000 feet. Both charts depicted an upper level low pressure system over Ohio sloping to the west with height with a long wave trough extending to the south. The station models depicted a defined cyclonic or counter clockwise wind flow associated with the low over Ohio. The 850-hPa chart station model for Pittsburg, PA immediately east depicted a southerly wind of 35 knots and a temperature of 10° Celsius (C), with a temperature-dew point spread of zero indicating saturated conditions or clouds at that level. Over the western sections of Ohio, the winds were from the north at 15 knots with a temperature of 5° C.

On the 700-hPa chart the wind over Pittsburg, PA from the south at 20 knots with a temperature of 2° C, and a zero temperature-dew point spread, indicating saturated conditions or clouds at that level. The temperatures over western Ohio were at or below freezing and indicated the freezing level near 10,000 feet over the central portion of the state, moving eastward with the low with time.

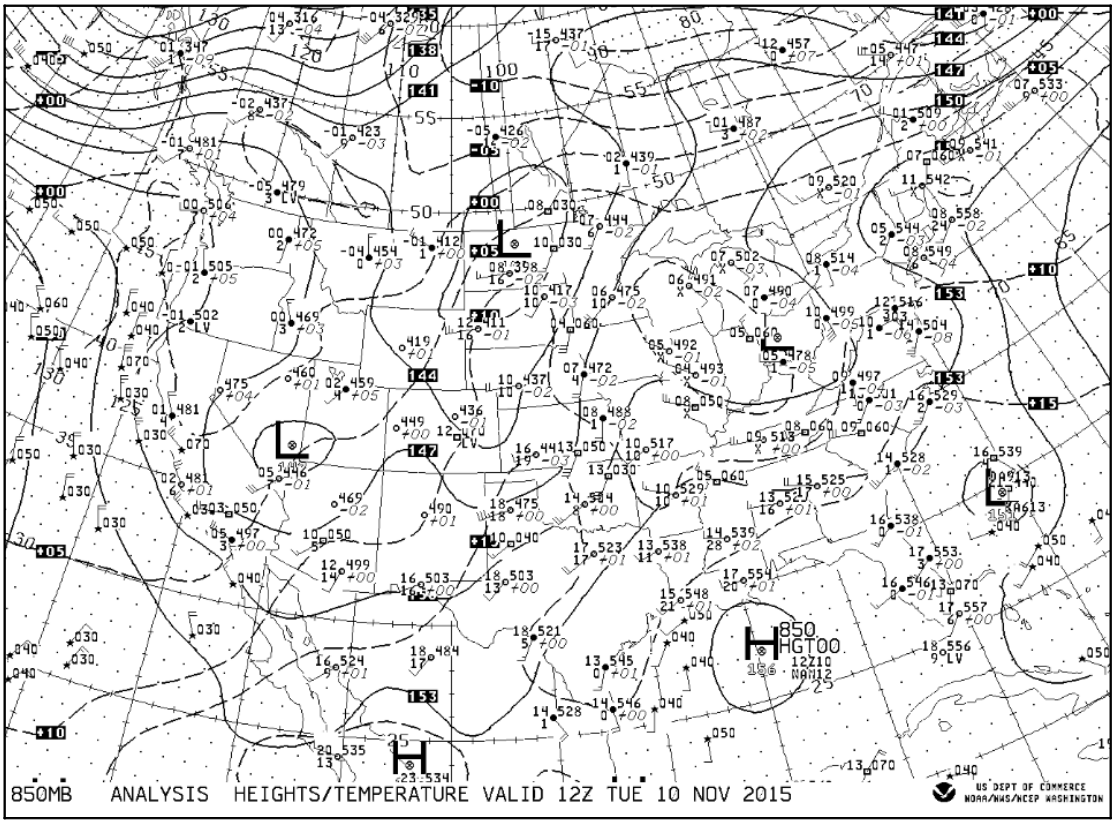

Figure 4 - NWS Constant Pressure Chart for 850-hPa for 0700 EST

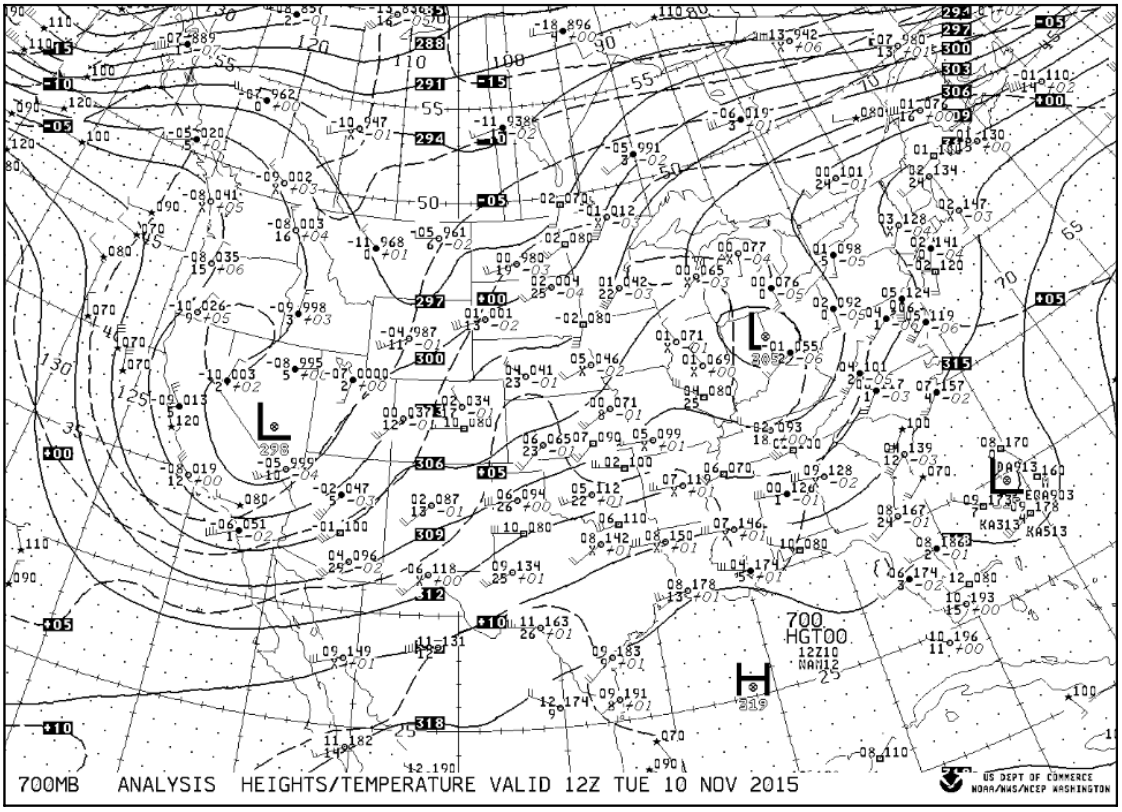

Figure 5 - NWS Constant Pressure Chart for 700-hPa for 0700 EST

2.0 Surface Observations

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

2.1 Akron-Fulton International Airport, Akron, Ohio

The accident airplane was on approach into Akron-Fulton International Airport (KAKR), Akron, Ohio, and was located 1.7 miles northeast from the accident site. The airport lists an elevation of 1,068 feet and a magnetic variation of 7° W. The airport had a federally owned and operated Automated Surface Observation System (ASOS) and reported[3] the following conditions surrounding the time of the accident at 1452 EST:

Akron-Fulton International Airport special weather observation at 1431 EST, automated, wind from 250° at 8 knots, visibility 1 1/2 statute mile in mist, ceiling overcast at 500 feet, temperature 11° Celsius (C), dew point 9° C, altimeter 29.95 inches of mercury (Hg). Remarks: automated observation system, ceiling 300 feet variable 900 feet agl, temperature 11.1° C, dew point 9.4° C.

Akron-Fulton International Airport weather observation at 1454 EST, automated, wind from 240° at 7 knots, visibility 1 1/2 statute mile in mist, ceiling broken at 400 feet agl, overcast at 900 feet, temperature 11° C, dew point 9° C, altimeter 29.95 inches of Hg. Remarks: automated observation system, sea level pressure 1014.2-hPa, temperature 10.6° C, dew point 9.4° C.

Akron-Fulton International Airport special weather observation at 1505 EST, automated, wind from 240° at 11 knots, visibility 1 1/4 statute mile in light rain and mist, ceiling overcast at 600 feet agl, temperature 11° C, dew point 9° C, altimeter 29.95 inches of Hg. Remarks: automated observation system, rain began at 2005 EST, ceiling 300 variable 900 feet agl, hourly precipitation less than 0.01 inches or a trace, temperature 10.6° C, dew point 9.4° C.

The primary change in conditions surrounding the period was a ragged or changing base of the ceiling, which varied from 300 to 600 feet during the 30 minute period. The observations and flight categories[4] reported surrounding the period were as follows:

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[3] The ASOS makes regular routine observations and will issue specials when specific criteria are met for longline transmission to weather circuits for ATC and pilot weather briefing purposes. The ASOS is constantly monitoring weather conditions and issues observations every minute, which are broadcasted for pilots in the local area but are not recorded. The 1-minute ASOS observations are similar to the 5-minute reports with the magnetic wind direction and main body weather conditions and the density altitude information; however, no other remarks are included in the broadcast.

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

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

IFR *METAR KAKR 101354Z AUTO 00000KT 2SM -RA BR OVC005 12/11 A3000 RMK AO2 SLP159 P0000 T01170106=*

IFR *SPECI KAKR 101413Z AUTO 19003KT 4SM -RA BR OVC005 12/11 A2999 RMK AO2 P0000 T01220106=*

IFR *SPECI KAKR 101445Z AUTO 18003KT 2SM -RA BR OVC005 12/11 A2999 RMK AO2 P0000 T01220106=*

IFR *METAR KAKR 101454Z AUTO 00000KT 2SM -RA BR OVC005 12/11 A2998 RMK AO2 SLP154 P0000 60003 T01220111 58005=*

IFR *SPECI KAKR 101517Z AUTO 17003KT 3SM -RA BR OVC005 12/11 A2998 RMK AO2 P0000 T01220111=*

IFR/LIFR *METAR KAKR 101554Z AUTO 22003KT 6SM -RA BR OVC006 13/11 A2997 RMK AO2 CIG 004V010 SLP150 P0000 T01280111=*

IFR/LIFR *METAR KAKR 101654Z AUTO 24006KT 3SM -RA BR OVC007 12/11 A2997 RMK AO2 CIG 004V010 SLP147 P0000 T01220106=*

IFR *METAR KAKR 101754Z AUTO 23006KT 6SM -RA BR OVC008 12/10 A2995 RMK AO2 CIG 005V011 SLP142 P0000 60003 T01170100 10128 20106 58012=*

IFR *SPECI KAKR 101828Z AUTO 24008KT 2 1/2SM BR OVC008 11/09 A2994 RMK AO2 RAE16 CIG 005V011 P0000 T01110094=*

IFR/LIFR *METAR KAKR 101854Z AUTO 22009KT 2 1/2SM BR OVC008 11/10 A2994 RMK AO2 RAE16 CIG 004V011 SLP140 P0000 T01110100=*

IFR/LIFR *SPECI KAKR 101931Z AUTO 25008KT 1 1/2SM BR OVC005 11/09 A2995 RMK AO2 CIG 003V009 T01110094=*

Accident 1952Z

LIFR *METAR KAKR 101954Z AUTO 24007KT 1 1/2SM BR BKN004 OVC009 11/09 A2995 RMK AO2 SLP142 T01060094=*

IFR/LIFR *SPECI KAKR 102005Z AUTO 24011KT 1 1/4SM -RA BR OVC006 11/09 A2995 RMK AO2 RAB05 CIG 003V009 P0000 T01060094=*

LIFR *SPECI KAKR 102014Z AUTO 26013KT 1 3/4SM -RA BR OVC004 11/09 A2995 RMK AO2 RAB05 CIG 003V007 P0000 T01060089=*

IFR/LIFR *SPECI KAKR 102016Z AUTO 27012KT 2SM BR OVC006 11/09 A2995 RMK AO2 RAB05E16 CIG 003V009 P0000 T01060089=*

· Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 feet agl and/or visibility 3 to 5 miles.
· Visual Flight Rules (VFR) – ceiling greater 3,000 feet agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 feet agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.
**By definition, VFR is a ceiling greater than or equal to 3,000 feet agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

IFR SPECI KAKR 102024Z AUTO 28010G17KT 3SM BR SCT006 OVC010 11/09 A2995 RMK AO2 RAB05E16 CIG 008V012 P0000 T01060089=

IFR/LIFR SPECI KAKR 102033Z AUTO 28009KT 4SM BR OVC008 10/08 A2995 RMK AO2 RAB05E16 CIG 004V012 P0000 T01000083=

IFR METAR KAKR 102054Z AUTO 29009KT 5SM BR OVC008 10/08 A2995 RMK AO2 RAB05E16 CIG 006V012 SLP145 P0000 60000 T01000083 53001=

2.2 Akron-Fulton International Airport ASOS 5-minute Observations

The KAKR 5-minute ASOS observations taken during the period were documented surrounding the period. The 5-minute observations identify the conditions being broadcasted locally by the ASOS locally and provide a timelier breakdown of the conditions over the area. The ASOS conditions at the time the pilots obtained the ASOS weather at 1438 EST and immediately surrounding the accident were as follows:

5-minute Akron-Fulton International Airport weather observation at 1435 EST, automated, wind from 230° at 7 knots, visibility 1 1/2 mile in mist, ceiling overcast at 500 feet agl, temperature 11° C, dew point 9° C, altimeter 29.95 inches of Hg, pressure altitude 1,050 feet, relative humidity 89%, density altitude 900 feet, magnetic wind from 240° at 7 knots. Remarks: automated observation system, ceiling 300 variable 900 feet, temperature 11.1° C, dew point 9.4° C.

5-minute Akron-Fulton International Airport weather observation at 1450 EST, automated, wind from 240° at 7 knots, visibility 1 3/4 mile in mist, ceiling broken at 600 feet, overcast at 900 feet, temperature 11° C, dew point 9° C, altimeter 29.95 inches of Hg, pressure altitude 1,040 feet, relative humidity 93%, density altitude 800 feet, magnetic wind from 240° at 7 knots. Remarks: automated observation system, ceiling 300 variable 800 feet, sea level pressure 1014.2-hPa, temperature 10.6° C, dew point 9.4° C.

5-minute Akron-Fulton International Airport weather observation at 1455 EST, automated, wind from 240° at 7 knots, visibility 1 ½ mile in mist, ceiling broken at 400 feet, overcast at 900 feet, temperature 11° C, dew point 9° C, altimeter 29.95 inches of Hg, pressure altitude 1,050 feet, relative humidity 93%, density altitude 800 feet, magnetic wind from 250° at 7 knots. Remarks: automated observation system, temperature 10.6° C, dew point 9.4° C.

The raw 5-minute observations from 1400 through 1535 EST were as follows:

11/10/15 14:00:31 5-MIN KAKR 101900Z AUTO 23008KT 2SM BR OVC008 11/09 A2994 1050 89 900 230/08 RMK AO2 CIG 004V009 T01110094

11/10/15 14:05:31 5-MIN KAKR 101905Z AUTO 23008KT 2SM BR BKN005 OVC009 11/09 A2994 1050 89 900 240/08 RMK AO2 CIG 004V007 T01110094

11/10/15 14:10:31 5-MIN KAKR 101910Z AUTO 24008KT 2SM BR OVC007 11/09 A2994 1050 89 900 240/08 RMK AO2 CIG 004V009 T01110094

11/10/15 14:15:31 5-MIN KAKR 101915Z AUTO 24008KT 2 1/2SM BR OVC007 11/09 A2994 1050 89 900 250/08 RMK AO2 CIG 004V009 T01110094

11/10/15 14:20:31 5-MIN KAKR 101920Z AUTO 24009KT 2SM BR OVC007 11/09 A2994 1050 89 900 250/09 RMK AO2 CIG 004V009 T01110094

11/10/15 14:25:31 5-MIN KAKR 101925Z AUTO 24007KT 1 3/4SM BR OVC007 11/09 A2995 1050 89 900 250/07 RMK AO2 CIG 004V009 T01110094

11/10/15 14:30:31 5-MIN KAKR 101930Z AUTO 25007KT 1 3/4SM BR OVC005 11/09 A2995 1050 89 900 260/07 RMK AO2 CIG 004V009 T01110094

11/10/15 14:35:31 5-MIN KAKR 101935Z AUTO 23007KT 1 1/2SM BR OVC005 11/09 A2995 1050 89 900 240/07 RMK AO2 CIG 003V009 T01110094

Flight tuned to ASOS 1438 EST/1938Z

11/10/15 14:40:31 5-MIN KAKR 101940Z AUTO 24008KT 1 1/2SM BR BKN006 OVC009 11/09 A2995 1040 93 800 250/08 RMK AO2 CIG 003V008 T01060094

11/10/15 14:45:31 5-MIN KAKR 101945Z AUTO 23006KT 1 3/4SM BR BKN006 OVC009 11/09 A2995 1040 93 800 240/06 RMK AO2 CIG 003V007 T01060094

11/10/15 14:50:31 5-MIN KAKR 101950Z AUTO 24007KT 1 3/4SM BR BKN006 OVC009 11/09 A2995 1040 93 800 240/07 RMK AO2 CIG 003V008 SLP142 T01060094

Accident 1452 EST/1952Z

11/10/15 14:55:31 5-MIN KAKR 101955Z AUTO 24007KT 1 1/2SM BR BKN004 OVC009 11/09 A2995 1050 93 800 250/07 RMK AO2 T01060094

11/10/15 15:00:31 5-MIN KAKR 102000Z AUTO 24007KT 1 1/4SM BR OVC006 11/09 A2995 1050 93 800 250/07 RMK AO2 CIG 003V009 T01060094

11/10/15 15:05:31 5-MIN KAKR 102005Z AUTO 24011KT 1 1/4SM -RA BR OVC006 11/09 A2995 1040 93 800 250/11 RMK AO2 RAB05 CIG 003V009 P0000 T01060094

11/10/15 15:10:31 5-MIN KAKR 102010Z AUTO 27011G16KT 1 1/2SM -RA BR OVC004 11/09 A2995 1040 89 800 280/11G16 RMK AO2 RAB05 CIG 003V007 P0000 T01060089

11/10/15 15:15:31 5-MIN KAKR 102015Z AUTO 26011KT 2SM -RA BR OVC004 11/09 A2995 1040 89 800 270/11 RMK AO2 RAB05 CIG 003V009 P0000 T01060089

11/10/15 15:20:31 5-MIN KAKR 102020Z AUTO 28012KT 3SM BR OVC006 11/09 A2995 1040 89 800 280/12 RMK AO2 RAB05E16 CIG 003V009 P0000 T01060089

11/10/15 15:25:31 5-MIN KAKR 102025Z AUTO 27010G17KT 4SM BR SCT006 OVC010 11/09 A2995 1040 89 800 280/10G17 RMK AO2 RAB05E16 CIG 008V012 P0000 T01060089

11/10/15 15:30:31 5-MIN KAKR 102030Z AUTO 28012KT 3SM BR OVC008 10/08 A2995 1040 89 700 290/12 RMK AO2 RAB05E16 CIG 003V012 P0000 T01000083

11/10/15 15:35:31 5-MIN KAKR 102035Z AUTO 28009KT 4SM BR OVC008 10/08 A2995 1040 89 700 290/09 RMK AO2 RAB05E16 CIG 004V012 P0000 T01000083

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

The next closest weather reporting facility to the accident site was from Akron-Canton Regional Airport (KCAK), Akron, Ohio, located approximately 7 miles south of the accident site at an elevation of 1,226 feet. The airport had an ASOS and was augmented by a human observer, and listed the same magnetic variation of 7° W. The following conditions were reported:

Akron-Canton Regional Airport weather observation at 1451 EST, wind from 250° at 7 knots, visibility 1 ½ miles in light rain and mist, ceiling overcast at 400 feet agl, temperature 11° C, dew point 9° C, altimeter 29.95 inches of Hg.

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

IFR *METAR KCAK 101751Z 25009KT 2 1/2SM BR BKN007 OVC019 11/09 A2996 RMK AO2 SFC VIS 3 RAE28 SLP145 P0001 60017 T01110089 10122 20111 58012=*

IFR *METAR KCAK 101851Z 25010KT 2SM BR BKN005 OVC015 11/08 A2995=*

LIFR *SPECI KCAK 101930Z 26009KT 1 1/2SM -DZ BR BKN004 OVC013 10/08 A2995 RMK AO2 TWR VIS 2 DZB22 BKN OVC P0000 T01000083=*

LIFR *METAR KCAK 101951Z 25007KT 1 1/2SM -RA BR OVC004 11/09 A2995=*

IFR *SPECI KCAK 102038Z 28011KT 1 1/2SM BR OVC005 09/08 A2996 RMK AO2 SFC VIS 3 RAE37 P0001 T00940078=*

METAR *KCAK 102051Z 28011KT 1 1/2SM BR OVC005 09/07 A2996 RMK AO2 SFC VIS 3 RAE37 SLP147 P0001 60002 T00940072 53000=*

2.4 Dayton-Wright Brothers Airport (KMGY), Dayton, Ohio

The accident airplane departed from Dayton-Wright Brothers Airport (KMGY), Dayton, Ohio, located over 145 miles west-southwest of the destination at approximately 1413 EST. The airport lists an elevation of 957 feet and a magnetic variation of 4° W. The airport had an ASOS and reported the following weather conditions surrounding the period:

Dayton-Wright Brothers Airport weather observation at 1353 EST, automated, wind from 270° at 7 knots, visibility 10 statute miles, ceiling broken at 1,000 feet agl, overcast at 1,900 feet, temperature 8° C, dew point 6° C, altimeter 30.07 inches of Hg. Remarks: automate observation system, ceiling 800 feet variable 1,300 feet agl, sea level pressure 1018.5-hPa, temperature 8.3° C, dew point 6.1° C.

The raw observations and general flight categories were as follows:

MVFR/IFR *METAR KMGY 101753Z AUTO 29005KT 9SM OVC010 08/06 A3007 RMK AO2 RAE18 CIG 005V014 SLP186 P0000 60000 T00830061 10083 20067 58007=*

MVFR/IFR *METAR KMGY 101853Z AUTO 27007KT 10SM BKN010 OVC019 08/06 A3007 RMK AO2 CIG 008V013 SLP185 T00830061=*

MVFR *METAR KMGY 101953Z AUTO 29007KT 10SM BKN010 OVC014 08/06 A3006 RMK AO2 SLP181 T00830056=*

2.5 NWS – Display of Observations

The NWS Aviation Weather Center METAR display over the area at 1452 EST (1952Z) and at 1515 EST (2015Z) are included as figures 6 and 7, with the station models color coded to depict the general flight category. The image at 1515 EST has the regional radar mosaic has also been overlaid and depicted very light intensity echoes northwest through northeast over Ohio, with no significant echoes in the immediately area. The images depicted IFR to LIFR conditions surrounding the area with visibility restricted in mist and light rain, overcast skies.

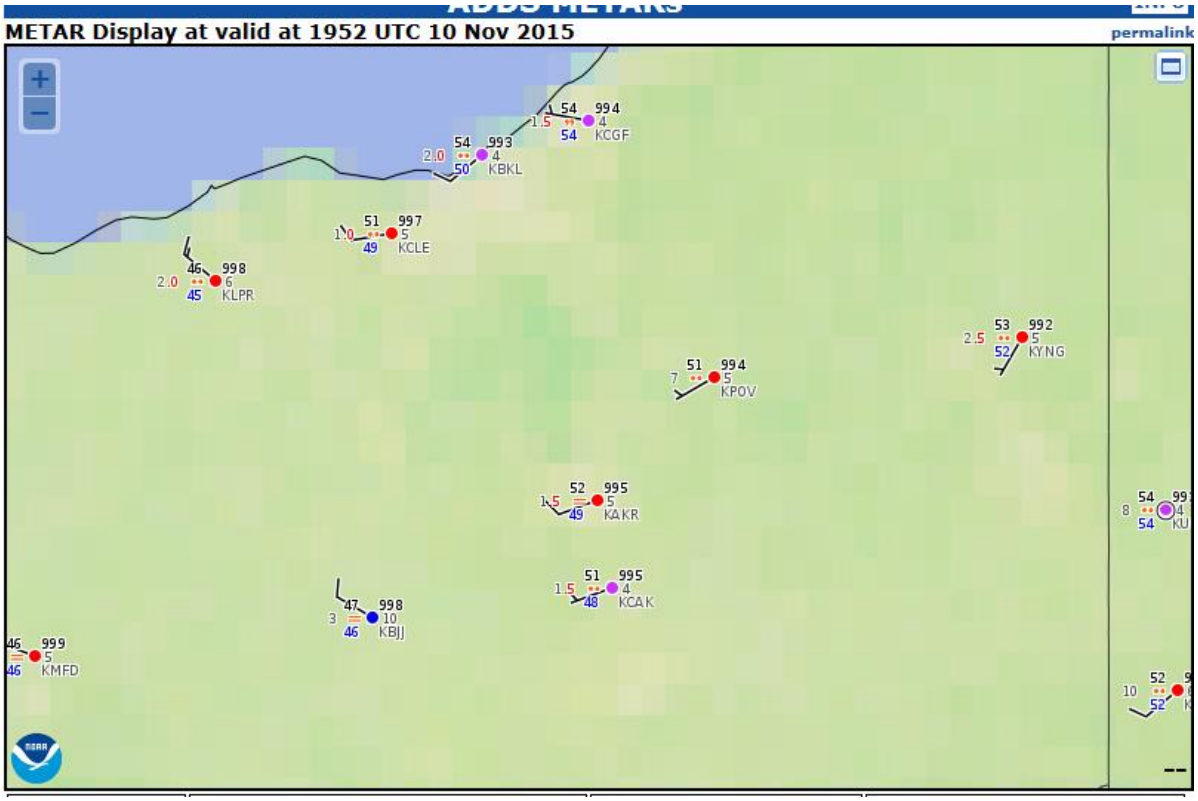

Figure 6- NWS Aviation Weather Center observation display at 1452 EST (1952Z)

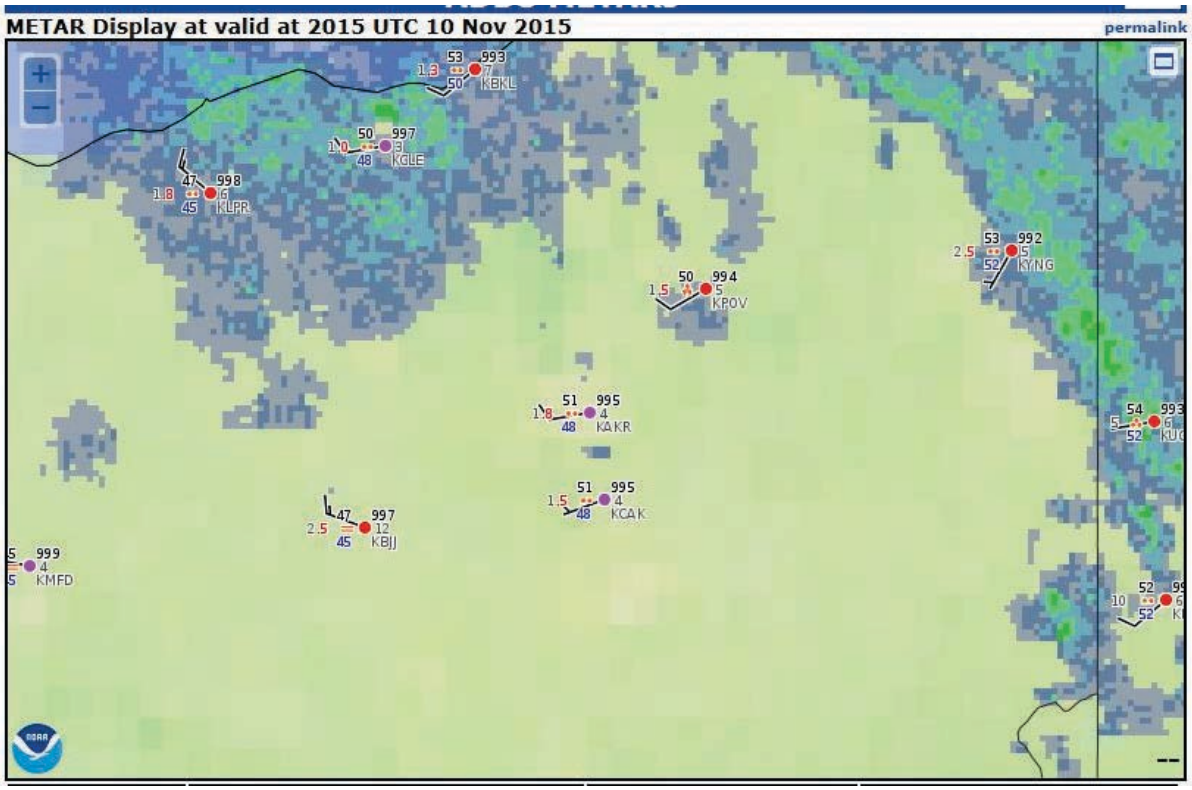

Figure 7 – NWS Aviation Weather Center observation display at 1615 EST (2015Z)

3.0 Upper Air Data

The NOAA Air Resource Laboratory (ARL) archive numerical weather prediction data was used to plot an upper air sounding over the Akron Airport for 1300 EST (1800Z) on November 10, 2015. The North American Mesoscale (NAM) numerical weather model data was plotted on a standard Skew-T log P diagram[5] from the surface to 500-hPa or 18,000 feet utilizing RAOB[6] software and is included as figure 8.

The NAM model sounding depicted a surface temperature of 11.3° C (52° F), a dew point temperature of 10.5° C (51° F). The lifted condensation level (LCL)[7] or approximate base of the clouds was identified at 963-hPa or 332 feet agl, a level of free convection (LFC)[8] at 962-hPa or

[5] 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.

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

[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.

373 feet agl, and a convective condensation level (CCL)[9] at 931-hPa or 1,250 feet agl. A near isothermal layer with little or no change in temperature with height was noted between 3,000 and 7,000 feet and resulted in a stable atmosphere with a Lifted Index (LI)[10] of 8.0, supporting nimbostratus type clouds. The sounding had a relative humidity greater than 90% from the surface to 9,000 feet msl and greater than 80% through 14,000 feet support clouds and is indicated on the left side of the diagram by the gray shading. The freezing level was identified at 8,573 feet msl (indicated by a blue horizontal line on the sounding) and supported a trace to light icing near the cloud tops through 14,000 feet (indicated by the green bar on the left of the sounding).

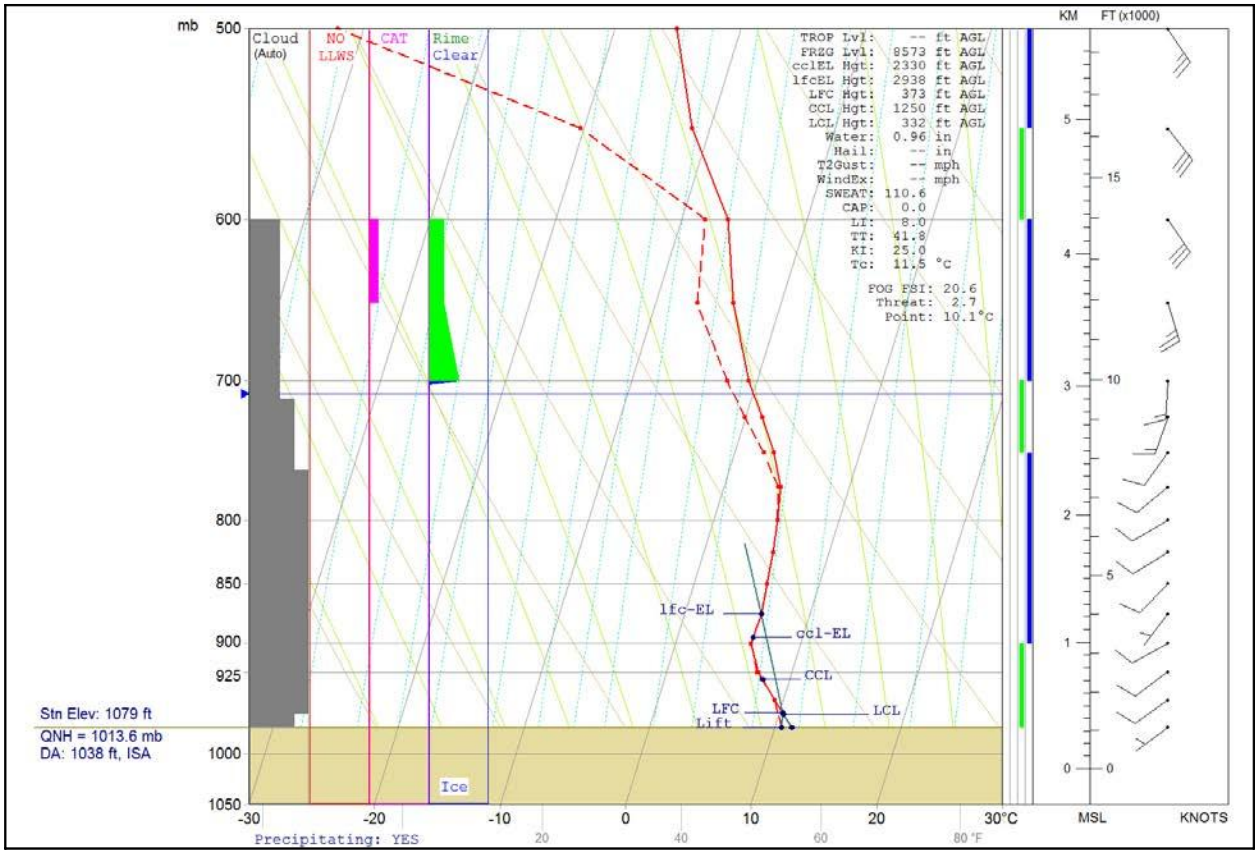

Figure 8 - NAM model sounding for 1300 EST (1800Z) over the Akron area

The sounding wind profile indicated a surface wind from 230° at 3 knots, with little variation with direction with height through 8,000 feet, with winds speeds of 11 knots or less. Winds

[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 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.

backed or turned to the south-southeast and increased in speed to 30 knots above 10,000 feet. The mean 0 to 6 kilometer or 18,000 feet wind was from 170° at 16 knots. No strong wind shears were identified in the profile below 18,000 feet to produce any significant turbulence.

Figure 9 is the NAM model sounding data below 18,000 feet, and derived model data for clear air turbulence (CAT), low-level windshear (LLWS), and icing conditions.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD/FF (deg/kts)	CAT (AF)	LLWS	Icing - Type (S-F clouds)
1079	975	11.3	10.5	95	231/3			
1790	950	9.3	9.3	100	232/9			
2514	925	7.3	7.2	99	231/11			
3254	900	6.0	6.0	100	239/10			
4013	875	6.1	6.1	100	215/6			
4794	850	5.8	5.8	100	222/8			
5597	825	5.5	5.5	100	236/8			
6424	800	5.1	5.1	100	238/8			
7275	775	4.5	4.3	99	228/8			
8151	750	3.1	2.3	94	214/10			
9051	725	1.3	-0.1	90	198/13			
9976	700	-0.7	-2.4	88	183/17			LGT Clear
11910	650	-3.8	-6.7	80	164/25	LGT		TRC Rime
13977	600	-6.3	-8.1	87	148/28			TRC Rime
16190	550	-11.4	-20.3	48	143/31			
18572	500	-15.1	-42.1	8	147/25	LGT		

Figure 9 - NAM model data and derived turbulence, windshear, and icing potential

4.0 In-Situ Aircraft Observation

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 observed sounding near the time of the accident. An aircraft derived sounding was obtained from a flight identified as #1942 that departed Cleveland-Hopkins International Airport (KCLE) located approximately 30 miles northwest of the accident site at 1443 EST (1943Z) and departed to the southeast towards the Akron area. Figure 10 is the ascent sounding from aircraft #1942, which depicted a similar vertical temperature structure as the NAM sounding, with a defined isothermal layer above the surface indicating a stable atmosphere. The aircraft sounding depicted the freezing level at 9,900 feet. The aircraft did not have a moisture sensor and was therefore not able to provide information on the base or top of clouds, or any potential for icing conditions on its departure.

The aircraft sounding wind profile showed significant variation in wind direction with height than the model sounding and indicated a low-level maximum near 2,000 feet with a wind from approximately 300° at 20 knots.

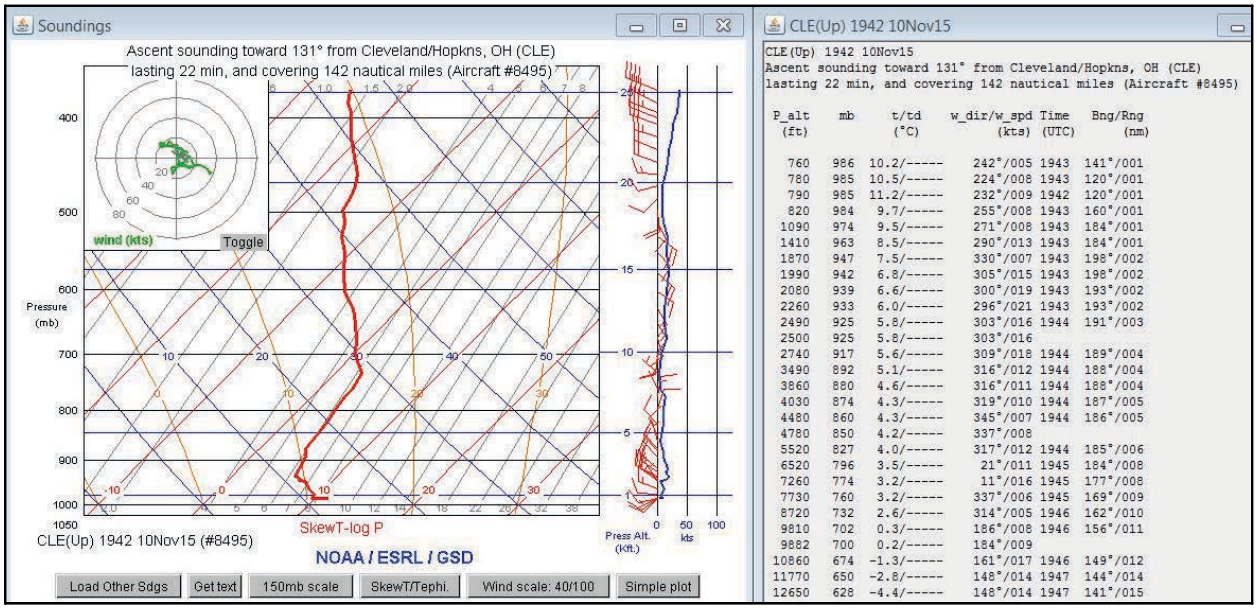

Figure 10 - Aircraft ascent sounding at 1443 EST (1943Z) from KCLE

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.

Figure 11 is the GOES-13 infrared satellite imagery at 1500 EST (2000Z) at 2X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops associated with deep convection. The frontal positions at 1600 EST (2100Z) have also been added to show the primary surface features and a yellow square over the Akron Airport. The image depicted a large cyclonic cloud pattern associated with a typical occluded frontal system over the northeastern United States, with the cloud shield extending westward into Ohio with low stratiform to nimbostratus type clouds. The radiative cloud top temperature over KAKR at the time of the image was 268° Kelvin (K) or -5.16° C, which corresponded to cloud tops near 13,500 feet. No cumulonimbus clouds were identified along the route of flight or in the vicinity of the accident site.

Figure 12 is the GOES-12 visible image at normal magnification for 1500 EST (2000Z) depicting the low stratiform cloud cover.

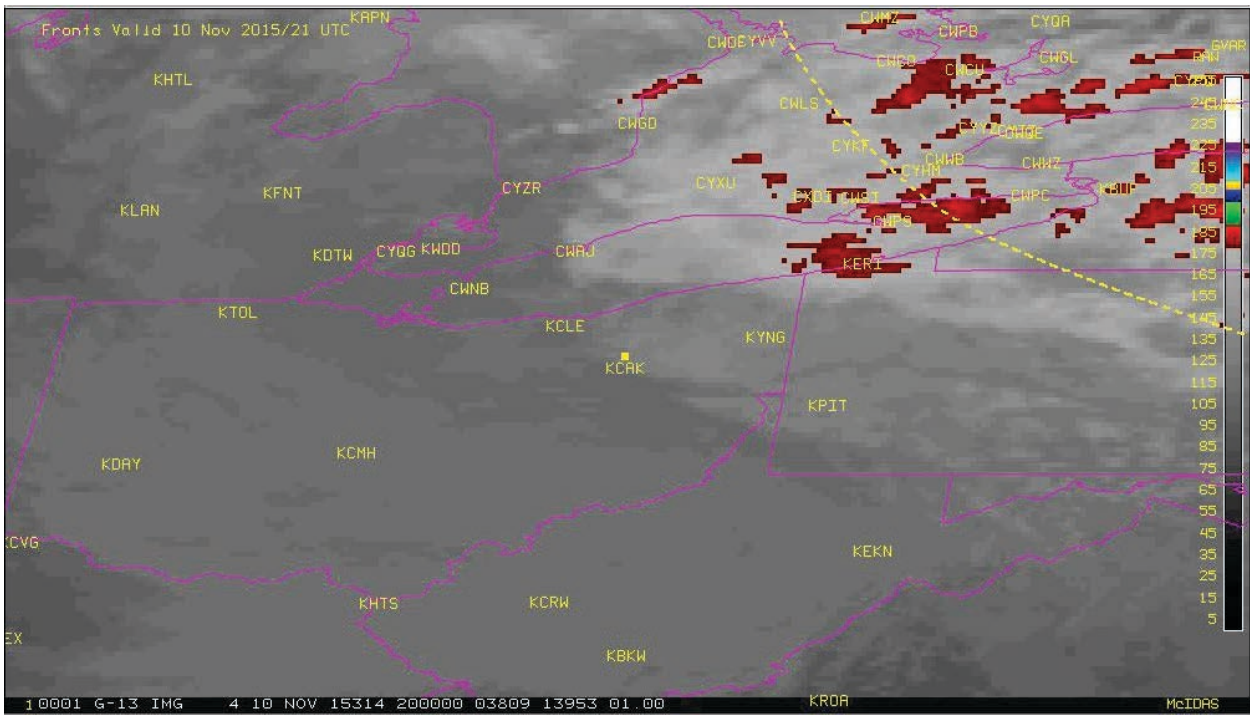

Figure 11- GOES-13 infrared image at 1500 EST at 2X magnification

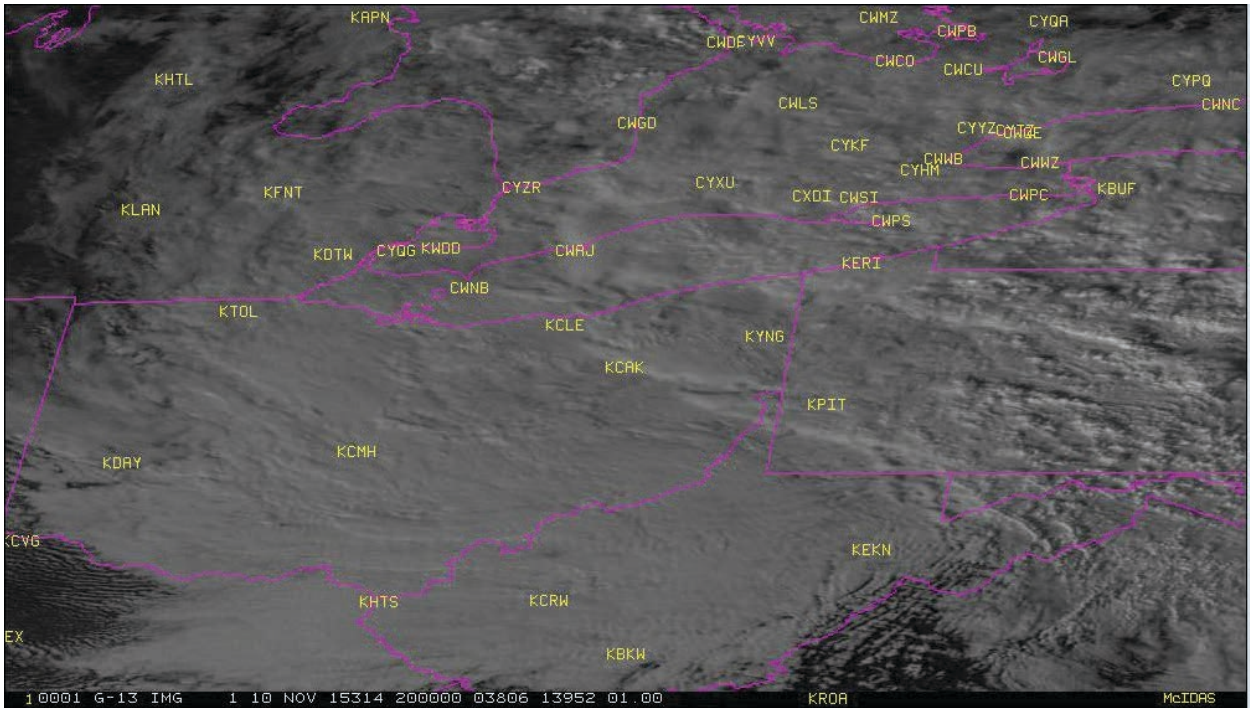

Figure 12 - GOES-13 visible image at 1500 EST

Figures 13 and 14 are the GOES-13 visible imagery at 2X magnification with the flight track of N23TW overlaid. The imagery depict the extensive cloud cover and confirm that the descent and approach to land into KAKR was conducted in solid instrument meteorological conditions (IMC) below 13,500 feet.

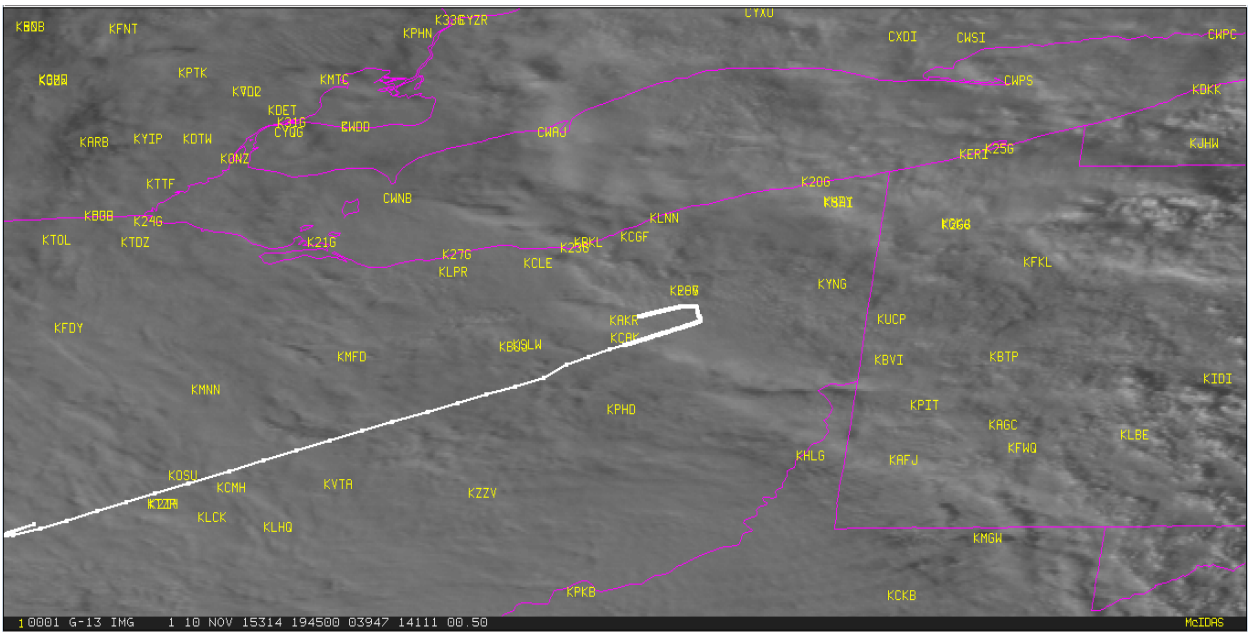

Figure 13 - GOES-13 visible image at 1445 EST at 2X magnification with flight track

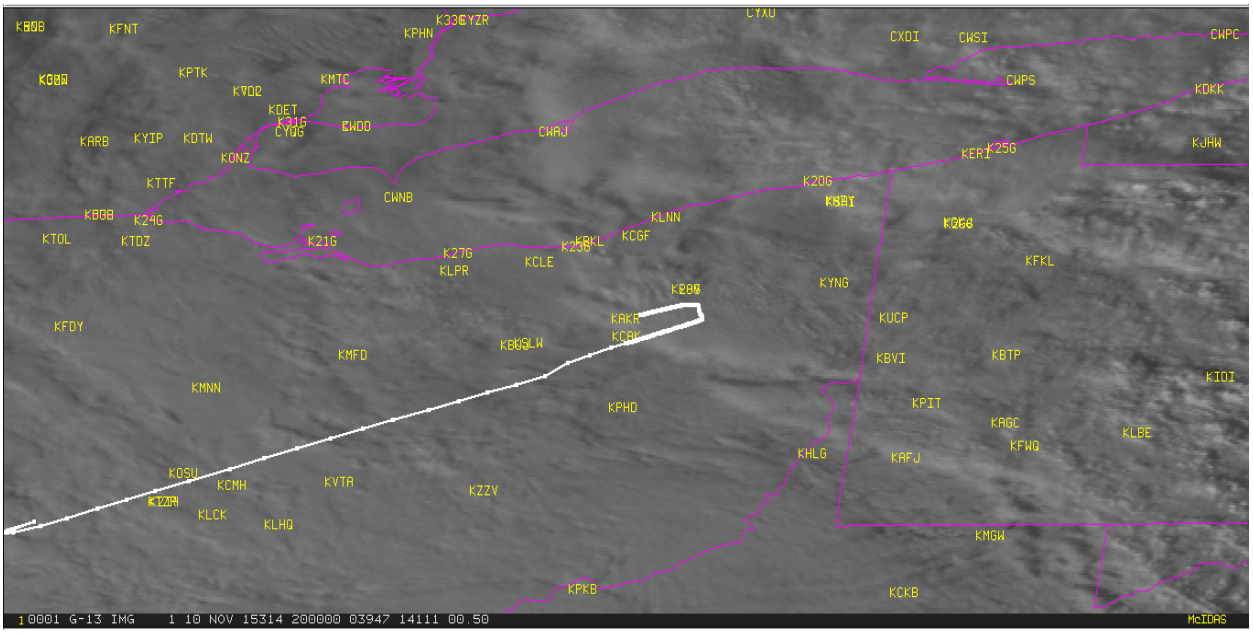

Figure 14 - GOES-13 visible image for 1500 EST at 2X magnification with flight track

6.0 Weather Radar Information

The closest Weather Surveillance Radar-1988, Doppler (WSR-88D) to the accident site was from the NWS Cleveland (KCLE) located approximately 28 miles northwest of the accident site. The level II and III 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 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 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. 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 precipitation mode VCP-121 where the radar makes 9 different elevation scans in 5 1/2 minutes. This mode is typically used by the NWS during periods when widespread stratified precipitation events are expected or are occurring. Figure 15 is a depiction of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.

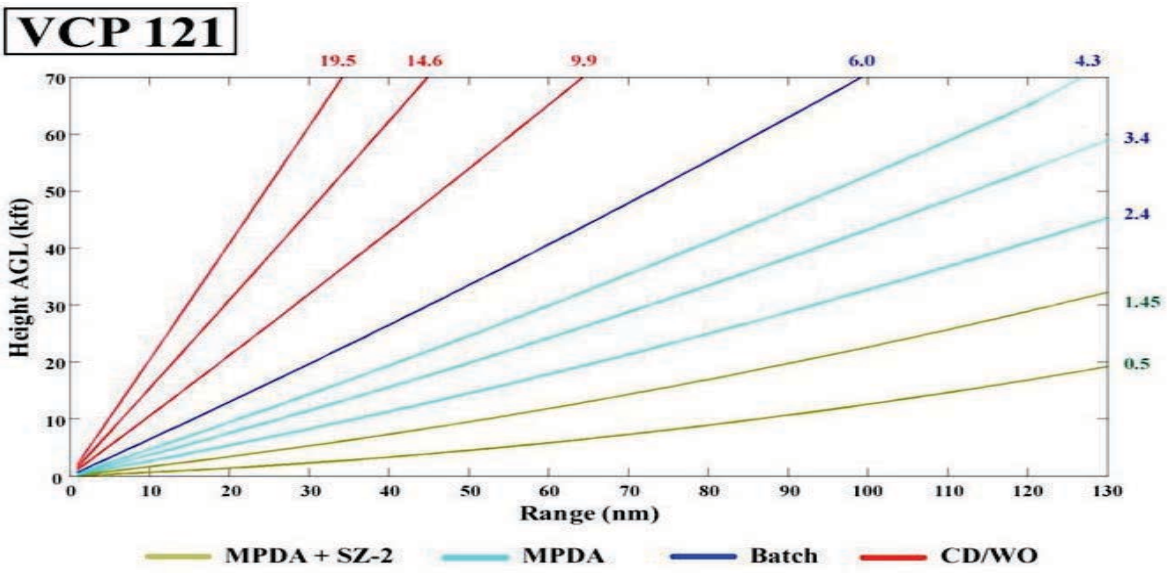

Figure 15 - VCP-121 scanning mode

6.2 Beam Height Calculation

Assuming standard refraction[11] of the 0.95° radar beam of the KCLE WSR-88D with an antenna height of 860 feet and a distance of 28 miles and an azimuth of 138° 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
0.5°	2,920 feet	1,480 feet	4,360 feet	2,880 feet

Based on the radar height calculations, the 0.5° elevation scan depicts the conditions encompassing the altitude between 1,480 and 4,360 feet over the accident site.

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[12] 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[13]), 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.

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

[12] 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.

[13] 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, NWS VIP level 1 not displayed)
(b) "Moderate" (30 to 40 dBZ, NWS VIP level 2)
(c) "Heavy" (> 40 to 50 dBZ, NWS VIP level 3 and 4)
(d) "Extreme" (> 50 dBZ, NWS VIP level 5 and 6)

6.4 Base Reflectivity

Figure 16 is the NWS Cleveland WSR-88D 0.5° base reflectivity image at 1451:45 EST with the flight track of N237WR overlaid. The image depicted a large band of light to moderate reflectivity's over extreme northeast Ohio, northwestern Pennsylvania, and Lake Erie, with echoes less than 15 dBZ or very light intensity echoes over the KAKR area and a portion of the final approach path into the airport. Figure 17 is the zoomed in image over the airport at the same period, the image shows echoes less than 15 dBZ as N237WR turns base to final in the descent and indicates light precipitation was likely encountered during the approach to land. Figure 18 is the next 0.5° base reflectivity volume scan completed at 1456:46 EST, a small area of 10 dBZ echoes is approaching the KAKR airport and echoes of 5 dBZ over the flight track.

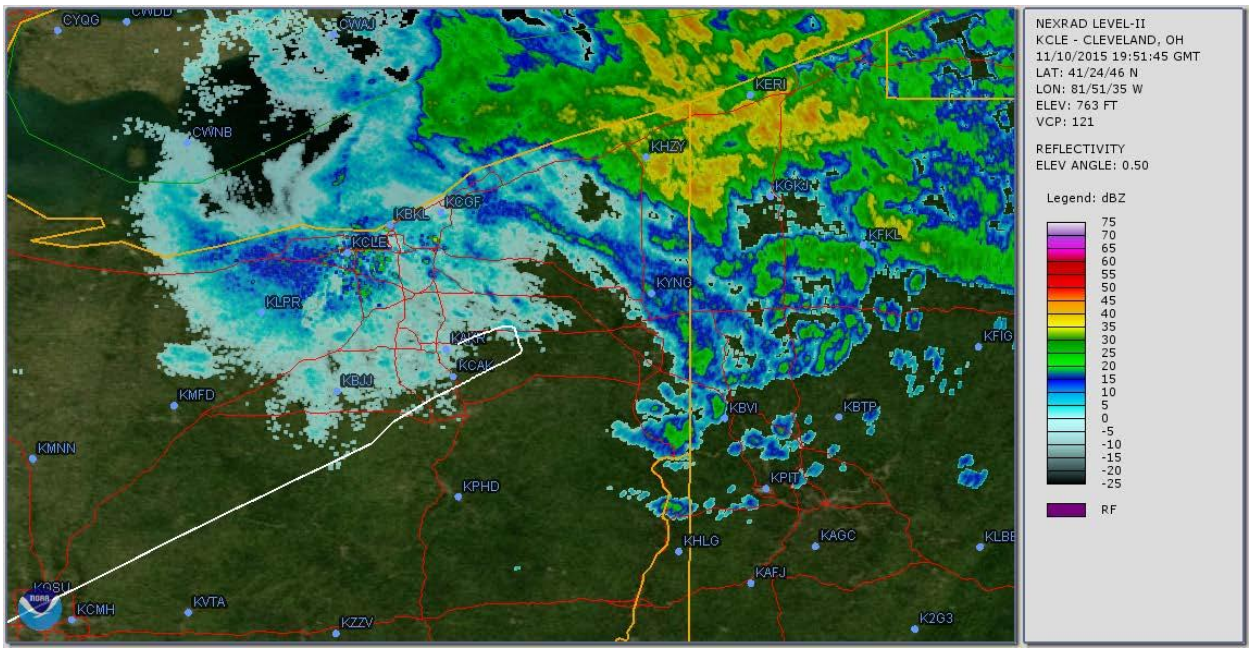

Figure 16 – NWS KCLE WSR-88D 0.5° base reflectivity image at 1451:45 EST with the flight track overlaid of N237WR

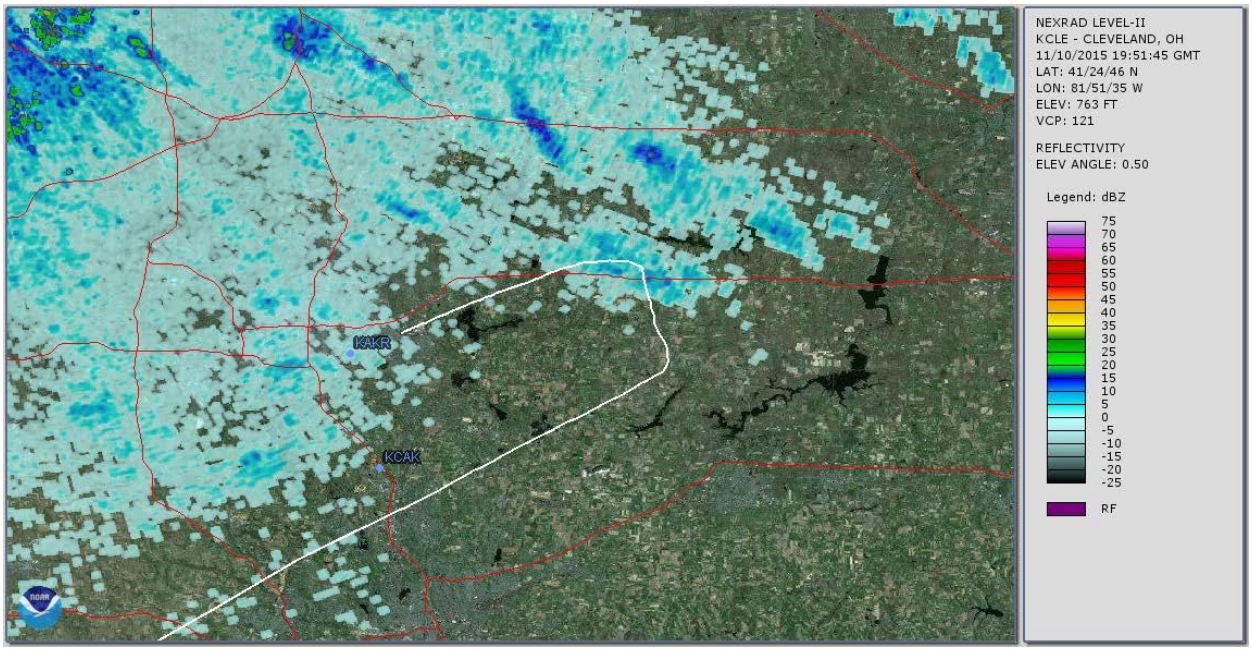

Figure 17 – Close-up of the KCLE WSR-88D 0.5° base reflectivity image at 1451:45 EST

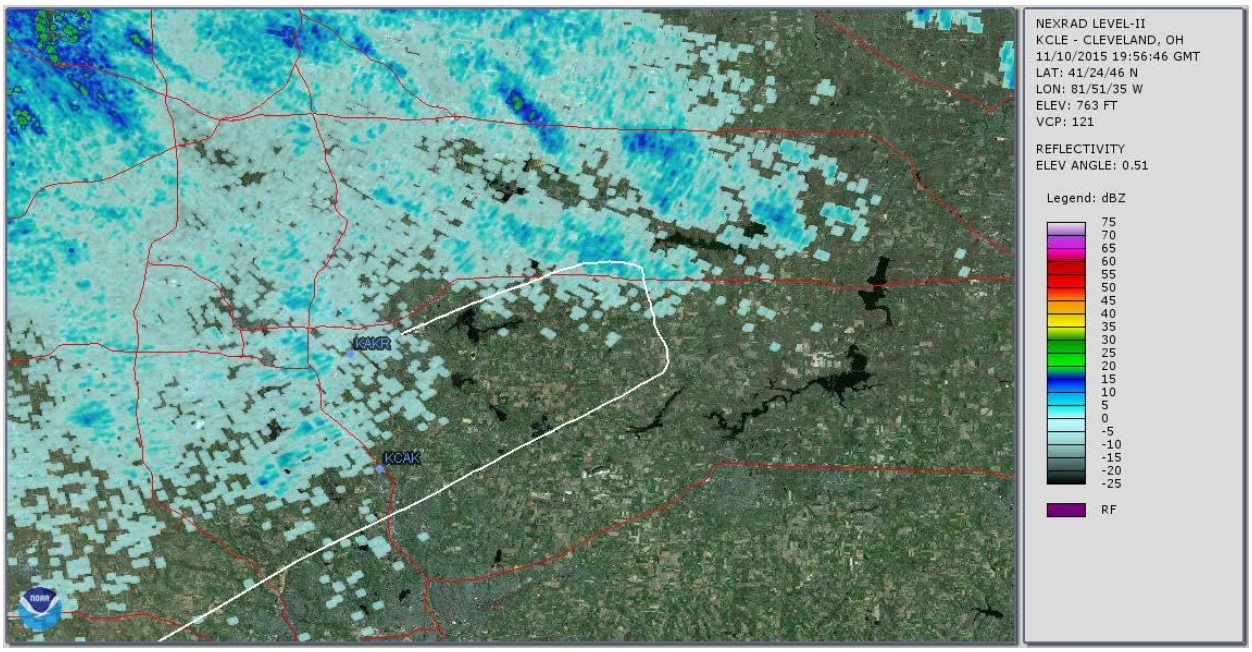

Figure 18 - KCLE WSR-88D 0.5° base reflectivity image at 1456:46 EST

7.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over Ohio surround the period from 1200 through 1800 EST on November 10, 2015, below 18,000 feet. The reports are translated from standard code and abbreviations, and times converted to local EST. Cloud heights are reported in msl heights unless otherwise noted. The reports were as follows:

Neil Armstrong Airport (AXV), Wapakoneta, OH routine pilot report (UA); Over – AXV; Time – 1216 EST; Flight level – 9,000 feet; Type aircraft – Cirrus (SR-22) single engine airplane; Weather – mist; Remarks – VFR conditions between layers at 9,000 feet, instrument meteorological conditions at 7,000 feet during descent.

James M. Cox - Daytona International Airport (DAY), Daytona, OH routine pilot report (UA); Over – DAY; Time – 1220 EST; Flight level – 5,000 feet; Type aircraft – Canadair Bombardier Regional Jet (CRJ-200); Sky cover – overcast at 2,000 feet with tops 4,500 feet, broken at 5,500 feet with tops at 6,500 feet; Temperature - +2° C; Remarks – during climb scattered layer above.

Cincinnati Municipal Airport – Lunken Field (LUK), Cincinnati, OH routine pilot report (UA); Over – LUK; Time – 1220 EST; Flight level – during descent; Type aircraft – Cessna Citation business jet (C550); Sky cover – overcast bases at 1,900 feet with tops 5,000 feet.

Newark-Heath Airport (VTA), Newark, OH routine pilot report (UA); Over – 15 miles east of Columbus (CMH); Time – 1234 EST; Flight level – unknown; Type aircraft – Boeing 737 commercial jet; Sky cover – Overcast at 1,200 feet with tops 7,200 feet, with sky clear above; Remarks – during descent into CMH.

Ohio State University Airport (OSU), Columbus, OH routine pilot report (UA); Over – 7 miles northwest of CMH; Time – 1253 EST; Flight level – unknown; Type aircraft – Embraer (EMB-145) regional commuter jet; Sky cover – overcast bases unknown with tops at 10,500 feet; Remarks – during climb.

Cincinnati Municipal Airport – Lunken Field (LUK), Cincinnati, OH routine pilot report (UA); Over – 10 miles east of Cincinnati-North Kentucky International Airport (CVG), Covington, KY; Time – 1307 EST; Flight level – unknown; Type aircraft – Canadair Bombardier Regional Jet (CRJ-700); Sky cover – overcast bases at 2,700 feet with tops 3,500 feet; Remarks – during climb out.

Cincinnati/Northern Kentucky International Airport (CVG), Cincinnati, OH routine pilot report (UA); Over – 5 miles north of CVG; Time – 1330 EST; Flight level – unknown; Type aircraft – Airbus A320 air carrier jet; Sky cover – overcast bases at 2,600 feet with tops 4,200 feet; Wind – from 290° at 16 knots; Remarks – during descent.

Cincinnati/Northern Kentucky International Airport (CVG), Cincinnati, OH routine pilot report (UA); Over – 5 miles southeast of CVG; Time – 1350 EST; Flight level – unknown; Type aircraft – Embraer (EMB-145) regional commuter jet; Sky cover – broken bases at 3,000 feet with tops 4,000 feet, and clear above; Remarks – during climb.

Mid-Ohio Valley Regional Airport (PKB), Parkersburg, OH routine pilot report (UA); Over – PKB; Time – 1355 EST; Flight level – 3,000 feet; Type aircraft – Piper Malibu (P46T) single engine turboprop; Sky cover – overcast bases at 1,300 feet with tops 5,000 feet, and clear above; Temperature - +02° C; Icing – negative..

Bolton Field Airport (TZR), Columbus, OH routine pilot report (UA); Over – 3 miles southwest of TZR; Time – 1410 EST; Flight level – 1,700 feet; Type aircraft – Cessna Citation 5 (C560); Sky cover – overcast at 1,700 feet; Weather – 3 miles visibility.

Akron Fulton International Airport (AKR), Akron, OH routine pilot report (UA); Over – Akron VORTAC (ACO); Time – 1520 EST; Flight level – 14,000 feet; Type aircraft – Beechcraft Super King Air (B35) multiengine turboprop; Temperature – minus 10° C; Icing – light rime icing conditions.

Youngstown-Warren Regional Airport (YNG), Youngstown, OH routine pilot report (UA); Over – YNG; Time – 1547 EST; Flight level – unknown; Type aircraft – Beechcraft Super King Air (BE20) multiengine turboprop; Sky cover – broken at 1,500 feet with tops 6,300 feet; Remarks – during climb.

Akron-Canton Regional Airport (CAK), Akron, OH routine pilot report (UA); Over – CAK; Time – 1611 EST; Flight level – 6,000 feet; Type aircraft – Mitsubishi Marquise (MU2) multiengine turboprop; Sky cover – overcast clouds at 1,600 feet; Remarks – 400 to 500 feet cloud bases for final approach for runway 23.

Ohio State University Airport (OSU), Columbus, OH routine pilot report (UA); Over – 3 miles east of OSU; Time – 1725 EST; Flight level – 1,900 feet; Type aircraft – Cessna Citation (C56X) light business jet; Sky cover – overcast at 1,900 feet; Remarks - ceilings ragged.

There were no urgent pilot reports noted over Ohio during the period, and all but one report were reporting on the sky conditions and cloud tops, with one report of light icing conditions. There were no reports of low-level windshear or turbulence below 18,000 feet.

8.0 Terminal Aerodrome Forecast

The NWS does not issue a Terminal Aerodrome Forecast (TAF) for Akron-Fulton International Airport, the closest forecast is issued for Akron-Canton Regional Airport (KCAK), Akron, located approximately 7 miles south of KAKR. While a TAF is valid for a 5 miles radius around the airport center point, pilot's will often refer to the closest TAF for specific breakdown in wind, visibility, weather and clouds versus using the Area Forecast. The following forecasts were issued and subsequently updated the previous one issued. The forecasts were as follows:

TAF AMD KCAK 101400Z 1014/1112 15007KT 1 1/2SM -SHRA BR OVC003
FM101600 24007KT 4SM -SHRA BR OVC007
FM101900 28008KT 4SM -DZ BR OVC007
FM110000 27005KT 6SM BR OVC007
FM110500 27005KT P6SM BKN015
FM110900 26005KT P6SM BKN050=

TAF AMD KCAK 101544Z 1016/1112 18007KT 2SM -SHRA BR OVC005
FM101900 28008KT 4SM -DZ BR OVC007
FM110000 27005KT 6SM BR OVC007
FM110500 27005KT P6SM BKN015
FM110900 26005KT P6SM BKN050=

TAF KCAK 101731Z 1018/1118 25006KT 3SM -RA BR OVC004
TEMPO 1018/1022 1 1/2SM -DZ BR OVC006
FM102200 32006KT 4SM -DZ BR OVC006
FM110200 28006KT 5SM BR OVC008
FM110800 27006KT 4SM BR BKN012 OVC035
FM111300 24006KT 6SM BR SCT012
FM111500 21006KT P6SM SCT250=

The forecast current for the estimated time of arrival expected LIFR conditions to prevail with visibility 3 miles in light rain and mist, with ceilings overcast at 400 feet agl, with a temporary period of visibility 1 ½ miles in light drizzle and mist, ceiling overcast at 600 feet.

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) regional forecast that was current at the time of the accident was issued at 1430 EST and valid through 0200 EST on November 11, 2015. The forecast was as follows:

FA US41 KKCI 101930 AAA
FA 1W
BOSC FA 101930 AMD
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 111300
CLDS/WX VALID UNTIL 110700...OTLK VALID 110700-111300
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...LRG LOW PRES CENTERED OVR SRN MD. WRMFNT EXTDG EWD INTO CSTL WTRS. CDFNT EXTDG SWD ACRS SERN VA INTO ERN NC. SFC TROF SERN VA TO NWRN NC. ANOTHER SFC TROF NRN WV TO WRN OH. HI PRES SRN ME. BY 13Z LOW PRES NEW ENGLAND CSTL WTRS. TROF EXTDG WWD ACRS NRN NJ-NERN PA-WRN NY.
.
OH LE
NW OH...BKN025 TOP 120. VIS 3-5SM BR. 00Z BKN040 TOP 100. 04Z SCT040. OTLK...VFR.
S-CNTRL-RMNDR W OH...BKN035 TOP 120. VIS 3-5SM BR. 00Z BKN040 TOP 100. 04Z SCT050. OTLK...VFR.
N CNTRL-SE-NERN OH...OVC020 TOP 080. WDLY SCT -SHRA. 05Z SCT020 VIS 3-5SM BR. OTLK...MVFR BR.
LE...OVC010 TOP 060. VIS 3-5SM DZ BR. 05Z BKN010 TOP 100. OTLK...IFR CIG BR.

The forecast for northeast Ohio expected overcast clouds at 2,000 feet msl with tops to 8,000 feet with widely scattered light rain showers. The forecast visibility was expected to be from 3 to 5 miles in mist over the region, but was mistakenly left out for the period due to a coding error.

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 Convective SIGMETs, Severe Weather Forecast Alerts for strong convection were current for the route, and no SIGMETs or Center Weather Advisories were issued surrounding the period. The only advisories were a series of AIRMETs for IFR and mountain obscuration conditions. Figure 19 is a graphical depiction of the Convective SIGMET and outlook region at the time of the accident, and figures 20 and 21 are the Graphic-AIRMET Sierra and Tango, which were current during the period.

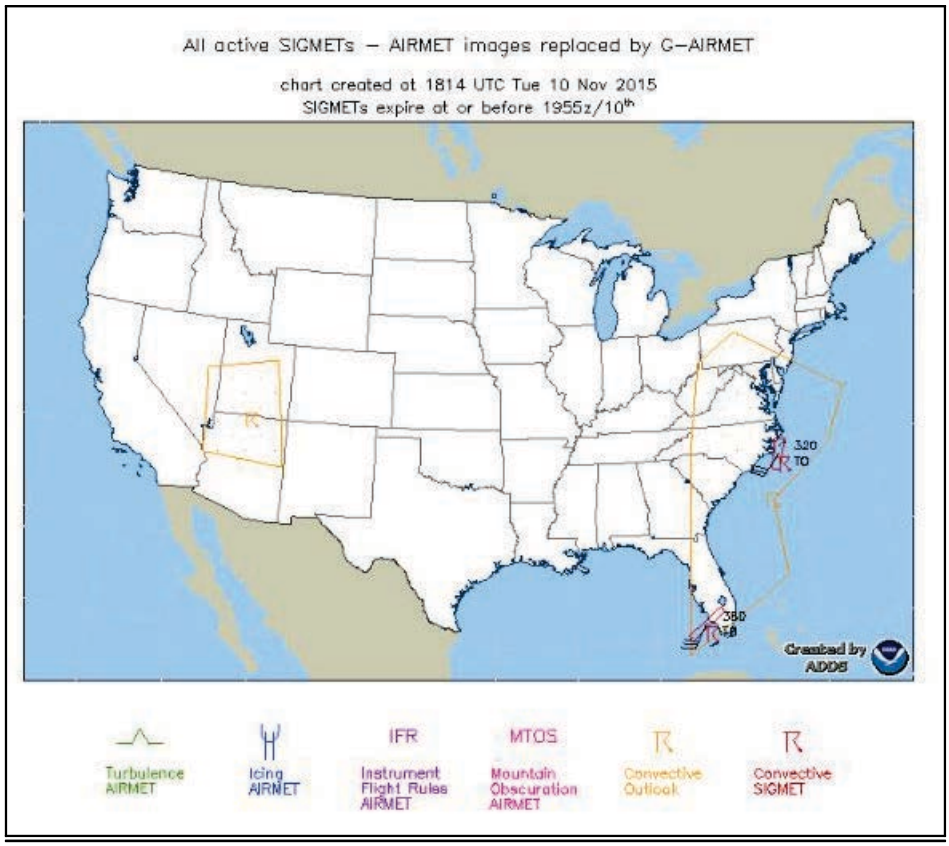

Figure 19 - Convective SIGMET display and outlook areas current at the time of the accident

AIRMETs – the following advisories were current during the period:

WAUS41 KKCI 101445 *2015314 1451*
WA1S
-BOSS WA 101445
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 102100
.
AIRMET IFR...MA RI CT NY LO NJ PA OH LE WV MD DC DE VA NC AND CSTL WTRS
FROM 50ENE YYZ TO 40WSW ALB TO 30WSW HTO TO 40ESE ACK TO 190SSE ACK TO 160SE SIE
TO 30E ECG TO HMV TO HNN TO CVG TO FWA TO 30SE ECK TO 50WSW YYZ TO 50ENE YYZ
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET MTN OBSCN...VT MA NY PA WV MD VA NC SC GA
FROM 50SSW MSS TO 50SW CON TO HAR TO CLT TO 20S ATL TO GQO TO HMV TO HNN TO
JHW TO SYR TO 50SSW MSS
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

.
OTLK VALID 2100-0300Z
AREA 1...IFR ME NH MA RI CT NY LO NJ PA OH LE WV MD DC DE VA AND CSTL WTRS
BOUNDED BY 90WSW YOW-30ENE HNK-30WNW HTO-30SSW PVD-90NE ACK-150SE ACK-160SSE ACK-160SE SIE-20ESE ORF-20SSE APE-20NE DXO-30ESE ECK-90WSW YOW
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 03Z.
.
AREA 2...MTN OBSCN NH VT MA NY PA WV MD VA
BOUNDED BY 40WSW YSC-20WSW CON-20ENE HAR-20N GSO-HMV-HNN-30SSW BUF-20SSE SYR-MSS-40WSW YSC
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG THRU 03Z.
....
WAUS41 KKCI 101445 2015314 1454
WA1T
-BOST WA 101445
AIRMET TANGO UPDT 2 FOR TURB STG WNDS AND LLWS VALID UNTIL 102100
.
AIRMET TURB...ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA NC AND CSTL WTRS
FROM 70NW PQI TO 60NE PQI TO 200SE ACK TO 160SE SIE TO 190ESE ECG TO 160SE ECG TO 50ENE ILM TO 20NNE CSN TO FWA TO 40SSE ECK TO YOW TO YSC TO 70NW PQI
MOD TURB BTN FL180 AND FL390. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET TURB...MA RI CT NY NJ PA OH LE WV MD DE VA AND CSTL WTRS
FROM 20E HNK TO 40SSE BOS TO 150ESE ACK TO 200SE ACK TO 160SE SIE TO 20SE SIE TO 20ENE DCA TO AIR TO ERI TO 50ENE SLT TO 20E HNK
MOD TURB BLW 100. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET STG SFC WNDS...MA RI NY NJ MD DE VA CSTL WTRS
FROM 40ESE HTO TO 50SSE ACK TO 180SSE ACK TO 160SE SIE TO 70SE SIE TO 40SE JFK TO 40ESE HTO
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 21Z THRU 03Z.
.
LLWS POTENTIAL...PA WV MD DC VA
BOUNDED BY 20WSW SLT-40NNE HAR-30S ETX-40E DCA-40WNW CSN-50SW JST-20ENE EWC-20WSW SLT
LLWS EXP. CONDS ENDG 15-18Z.
.
OTLK VALID 2100-0300Z
AREA 1...TURB MA RI CT NY NJ PA MD DE AND CSTL WTRS
BOUNDED BY 20NNE BOS-100NE ACK-140E ACK-200SE ACK-200SSE HTO-90SE HTO-40WNW SIE-40SE JST-40WSW SLT-20ENE HNK-20NNE BOS
MOD TURB BLW 100. CONDS CONTG THRU 03Z.
.
AREA 2...STG SFC WNDS MA RI NY NJ MD DE VA AND CSTL WTRS
BOUNDED BY 120ENE ACK-200SE ACK-170ESE SIE-40SE JFK-40ESE HTO-20WSW ACK-30NE ACK-120ENE ACK
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG THRU 03Z.
....
.
WAUS41 KKCI 101445 2015314 1447
WA1Z
-BOSZ WA 101445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 102100
.
AIRMET ICE...NH MA RI CT NY NJ PA MD DC DE VA AND CSTL WTRS

FROM 40SE SYR TO 30ESE BOS TO 140ENE ACK TO 200SE ACK TO 160SE
SIE TO 180E ECG TO 60SSW RIC TO 30WNW DCA TO 40NW ETX TO 40SE SYR
MOD ICE BTN FRZLVL AND FL260. FRZLVL 120-140. CONDS CONTG BYD 21Z
THRU 03Z.

.

AIRMET ICE...NY LO PA OH LE WV MD
FROM 50NE YYZ TO 40SE SYR TO 40NW ETX TO 30WNW DCA TO 30SSE EWC
TO 40SW CLE TO DXO TO 30SSE ECK TO 50NE YYZ
MOD ICE BTN FRZLVL AND FL200. FRZLVL 090-120. CONDS CONTG BYD 21Z THRU 03Z.

.

OTLK VALID 2100-0300Z...ICE NH VT MA CT NY LO NJ PA OH LE
BOUNDED BY 70WSW YOW-60S MSS-20W CON-20ESE BDL-20SSE SAX-30NNE
HAR-20E JST-30E EWC-30WSW ERI-30S ECK-70WSW YOW
MOD ICE BTN 120 AND FL200. CONDS CONTG THRU 03Z.

.

FRZLVL...RANGING FROM 060-160 ACRS AREA
MULT FRZLVL 100-160 BOUNDED BY 40E EKN-40NE LYH-20ESE PSK-40N HMV-HNN-40E EKN
080 ALG 50E YQB-40ESE PQI
120 ALG 40N HMV-20SE EMI-20SW SAX-20N JFK-60S ACK-100SSE ACK-190SSE ACK

....

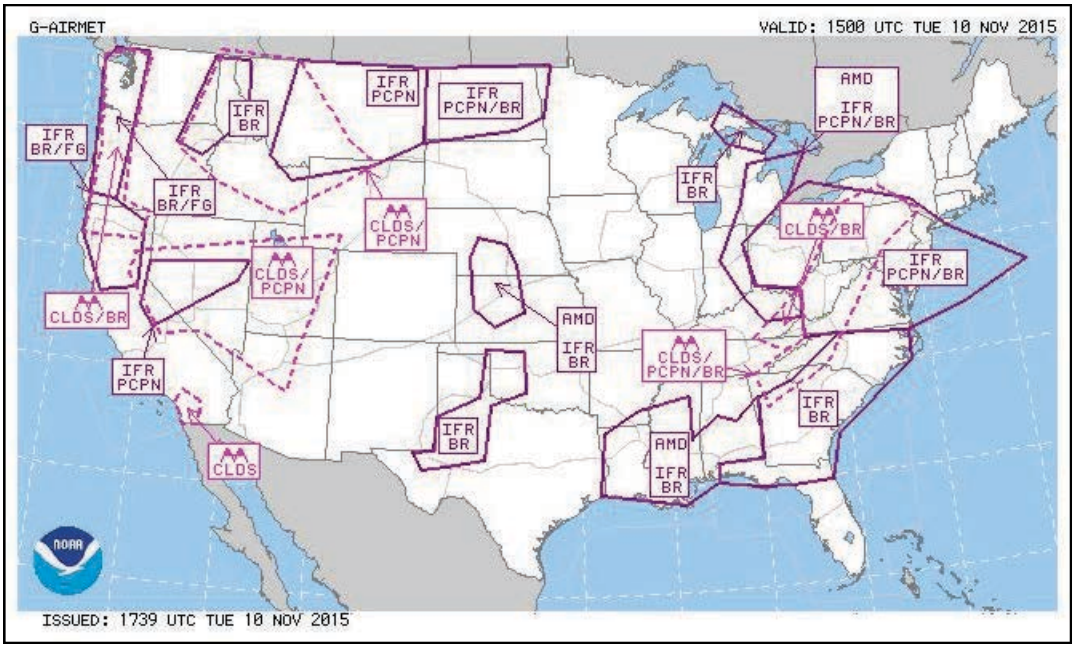

Figure 20 - G-AIRMET Sierra valid for IFR conditions

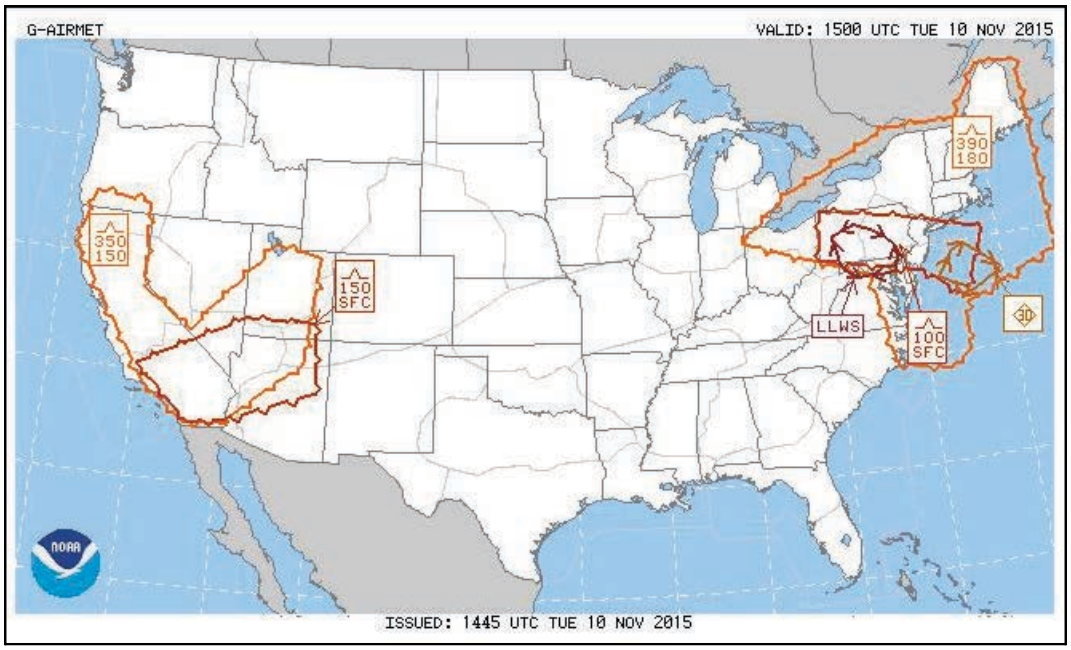

Figure 21 - G-AIRMET Tango for turbulence

11.0 Center Weather Service Unit

The Cleveland (KZOB) ARTCC Center Weather Service Unit (CWSU) issued a Meteorological Impact Statement (MIS) bulleting describing the conditions over the region during the period and was as follows:

FA US20 KZOB 101224 2015314 1224
ZOB MIS 01 VALID 101224-102100
...FOR ATC PLANNING PURPOSES ONLY...
LOW PRES OH MOVG SLOWLY NE. WDSPR LGT-AREAS MOD ICE 100-FL220.. ISOL TOPS TO FL320.. DECREASING SW 2/5 BY 21Z. SE 3/4.. WDSPR IFR.
ISOL MOD TURB BLW FL320 EXCP PATCHY MOD TURB BLW 120 SE 1/4.

FA US20 KZOB 101828 2015314 1828
ZOB MIS 02 VALID 101828-110200
...FOR ATC PLANNING PURPOSES ONLY...
LOW PRES NE OH MOVG NE. NE 3/5.. LGT-AREAS MOD ICE 095-FL220.. ISOL TOPS TO FL320.. SLOWLY DECREASING SW-NE. ISOL MOD TURB BLW FL320 IN +SHRA. SW 2/5.. PATCHY LGT ICE 095-150.. ENDG BY 02Z. E 3/4.. WDSPR IFR.

The advisories indicated a low pressure system was over northeast Ohio moving northeastward and was producing a widespread area of instrument flight rule conditions over the area, with light icing conditions above 10,000 feet and patch to isolated moderate turbulence.

12.0 Winds and Temperature Aloft Forecast

The NWS Winds and Temperature Aloft Forecast current during the period is included below:

WINDS ALOFT FORECASTS
DATA BASED ON 101200Z
VALID 101800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	*3000*	*6000*	*9000*	*12000*	*18000*	*24000*	*30000*	*34000*	*39000*
CVG	*3014*	*3017+05*	*2919+02*	*3021-03*	*2950-08*	*2954-22*	*286038*	*286947*	*286753*
CMH	*3214*	*2712+04*	*2712+00*	*2813-04*	*2940-11*	*2956-21*	*295138*	*285046*	*275051*
FWA	*3208*	*3215+05*	*3309+01*	*3411-02*	*3026-12*	*2944-23*	*284640*	*285148*	*285453*
IND	*2908*	*2906+06*	*3016+03*	*3114-03*	*2942-09*	*2843-23*	*276039*	*287149*	*287353*
CLE	*2507*	*9900+06*	*1914+02*	*1524-04*	*1420-16*	*2516-24*	*283437*	*263546*	*264251*
AGC	*2312*	*2015+07*	*1817+03*	*1723-02*	*1931-15*	*2236-24*	*244137*	*254345*	*255250*

13.0 Preflight Weather Briefing

A search for any weather briefing information indicated that the flight crew did not contact the contract Automated Flight Service Station (AFSS) or Direct Users Access Terminal System (DUATS) for any formal weather briefing. The IFR flight plan that was filed through an internet provider called Flight Plan.com (FltPlan.com) which had a link to the DUATS provider, which was filed at 1133 EST (1633Z). It is likely the pilot used the internet for his weather briefing data and should have provided the pilot with the METARs and TAF reports prior to that time. A review of records from Flight Plan.com indicated that someone accessed the weather option at 0928 EDT (1428Z). While it is not known what specific weather information the pilot reviewed at that time, it is likely that the METARs and TAFs reviewed all were reporting IFR to LIFR conditions over the region during that period.

The flight plan filed between KMGY and KAKR was as follows:

Tail/Call Sign:	*EFT1526*
Flight plan:	*IFR*
FPL Type:	*ICAO*
Type Flight:	*General Aviation*
A/c type:	*H25B*
Wake Category:	*/M*
ICAO Equip:	*SDFGHRWZ/S*
Depart:	*KMGY*
Arrive:	*KAKR*
Departtime (UTC):	*11/10/2015 1830Z*
TAS :	*382 knots*
Cruise Alt:	*17,000*
Route:	*DCT APE DCT TVT DCT DALTS DCT*
ETE:	*0034*
Alternate:	
Item 18:	*PBN/B2B3B4C2C3D2D3 NAV/RNVD1E2A1 REG/N237WR*
Endurance:	*0230*
SOB:	*9*
Color:	*White/Brown*
PIC:	*OSCAR CHAVEZ*
Address:	*(Removed from record)*
Phone no.:	*(Removed from record)*

No destination alternate airport was listed for the route, which indicated an enroute time of 34 minutes at a planned cruising altitude of 17,000 feet.

14.0 Astronomical Data

The United Stated Naval Observatory website provided the following astronomical data for Akron, Ohio on November 10, 2015:

SUN	
Beginning of civil twilight	0638 EST
Sunrise	0707 EST
Accident	1506 EST
Sunset	1712 EST
End of civil twilight	1741 EST

15.0 Reference Material for Observations

The NWS Federal Meteorological Handbook number 1 (FMH-1) and FAA 7900.5C are identical in the governing the process of weather observations and formatting the observation reports. The handbook states that the remarks section of the observations provide clarifying detail that can benefit flight planning and safety of flight. The remarks section at the end of the report can provide information on peak winds, wind shifts, frontal passages, sector visibility, tower or surface visibility if differences are noted, minimum and maximum values of prevailing visibility, beginning and end of any precipitation, thunderstorms, and any tornadic activity, lightning frequency, type and location, precipitation accumulation, or other significant weather phenomena that is observed but not occurring at the station such as fog banks, localized rain, distant thunderstorms, or other operationally significant weather. The remarks section can also include variable ceiling height information, and significant clouds such as cumulonimbus (CB), towering cumulus (TCU), and lenticular clouds associated with mountain waves, volcanic ash, or smoke. Rapidly falling or rising pressures associated with significant boundaries are also included in the remarks section. Following the clarifying weather comments follows temperature and dew point in tenths of degrees, maximum and minimum values, precipitation values and precipitation totals, snow depth, 3-hour pressure tendency, and any automated maintenance indicators such as “thunderstorm sensor inoperative”. The remarks section is also used to identify an aircraft mishap.

The remarks section of the Akron observations surrounding the period identified a variable ceiling which varied from 300 to 900 feet agl, and rain ending during prior to the accident. While the remarks in the observation were transmitted longline with the full observation, the ASOS broadcasts locally on the radio or accessed by telephone removed all the remark data and only included density altitude information.

F. LIST OF APPENDICES

Appendix 1: Pilot Reports in standard format and code with METAR

Submitted by:
Donald Eick
NTSB Senior Meteorologist

Appendix 1 – Pilot Reports and METAR observation

AXV UA /OV AXV/TM 1716/FL090/TP SR22/WX BR/RM VFR BTN LYRS 090 IMC 070 DURD
(METAR KAXV 101713Z AUTO 29005KT 7SM BKN007 OVC013 07/07 A3009 RMK AO2; KAXV elv. 912 ft)

DAY UA /OV DAY /TM 1720 /FL050 /TP CRJ2 /SK OVC020-TOP045/BKN055-TOP065 /TA 02 /RM DURC SCT LYR ABV
(METAR KDAY 101656Z 29010KT 8SM OVC010 08/07 A3010 RMK AO2 SLP197 T00780067; KDAY elv. 1009 ft)

KLUK UA /OV LUK/TM 1720/FLDURGD/TP C550/SK 019OVC050
(METAR KLUK 101653Z 26007KT 10SM OVC019 09/07 A3013 RMK AO2 SLP205 T00890067; KLUK elv. 483 ft)

VTA UA /OV CMH090015/TM 1734/FLUNKN/TP B737/SK OVC012-TOP072/SKC/RM DURD
(METAR KVTA 101725Z AUTO 27007KT 5SM BR BKN009 OVC017 09/09 A3002 RMK AO2 CIG 006V014, KVTA elv.884 ft)

OSU UA /OV CMH330007 /TM 1753 /FLUNKN /TP E145 /SK OVCUNKN-TOP105 /RM DURC
(METAR KOSU 101753Z 29009KT 2 1/2SM -RA BR OVC008 08/07 A3004 RMK AO2 RAB48 CIG 006V010; KOSU elv. 906 ft)

LUK UA /OV CVG090010/TM 1807/FLUNKN/TP CRJ7/SK OVC027-TOP035/RM DURING CLIMBOUT
(METAR KLUK 101753Z 28007KT 10SM OVC018 10/07 A3011, KLUK elv. 483 ft)

CVG UA /OV CVG360005/TM 1830/FLUNKN/TP A320/SK OVC026-TOP042/WV 29016KT/RM DURGD
(METAR KCVG 101752Z 26007KT 10SM BKN019 OVC025 09/06 A3010; KCVG elv. 896 ft)

CVG UA /OV CVG135005/TM 1850/FLUNKN/TP E145/SK BKN030-TOP040/RM DURGC CLR ABV
(METAR KCVG 101852Z 27004KT 10SM BKN027 11/06 A3008 RMK AO2 SLP185 BKN V OVC; KCVG elv. 896 ft)

KPKB UA /OV PKB/TM 1855/FL30/TP P46T/SK OVC013-TOPS050/CLR/TA 02/IC NEG
(METAR KPKB 101853Z 27005KT 7SM SCT010 OVC018 09/07 A3005; KPKB elv. 859 ft)

KTZR UA /OV 3SW/TM 1910/FL017/TP C560/SK 017/WX 3
(METAR KTZR 101850Z 30005KT 7SM OVC007 08/07 A3004; KTZR elv. 904 ft)

AKR UA /OV ACO/TM 2020/FL140/TP B350/TA M10/IC LGT RIME=
(METAR KAKR 102016Z AUTO 27012KT 2SM BR OVC006 11/09 A2995 RMK AO2 RAB05E16 CIG 003V009; KAKR elv.1068)

YNG UA /OV YNG/TM 2047/FLUNKN/TP BE20/SK BKN015-TOP063/RM DURGC AWC-WEB:faa.yng=
(METAR KYNG 102051Z 25011KT 2SM -RA BR OVC005 11/10 A2993; KYNG elv. 1192 ft)

CAK UA /OV KCAK/TM 2111/FL016/TP MU2/SK OVC016/RM 400-500 BASES FINAL FOR RY23
(METAR KCAK 102051Z 28011KT 1 1/2SM BR OVC005 09/07 A2996; KCAK elv. 1225 ft)

OSU UA /OV KOSU090003/TM 2225/FL019/TP C56X/SK OVC019/RM CIG RGD=
(METAR KOSU 102253Z 30006KT 7SM BKN012 OVC018 08/06 A3005; KOSU elv. 906 ft)