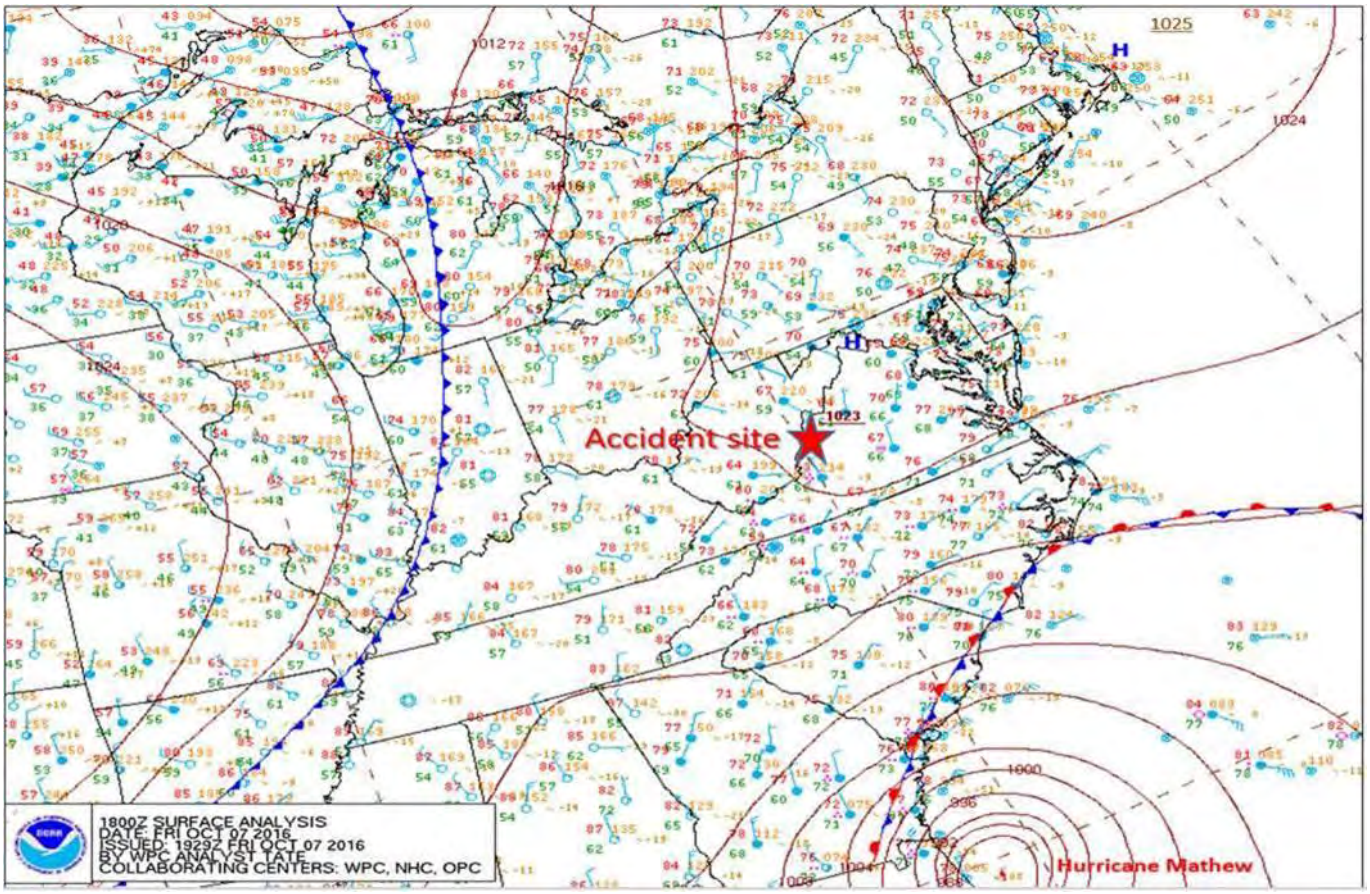
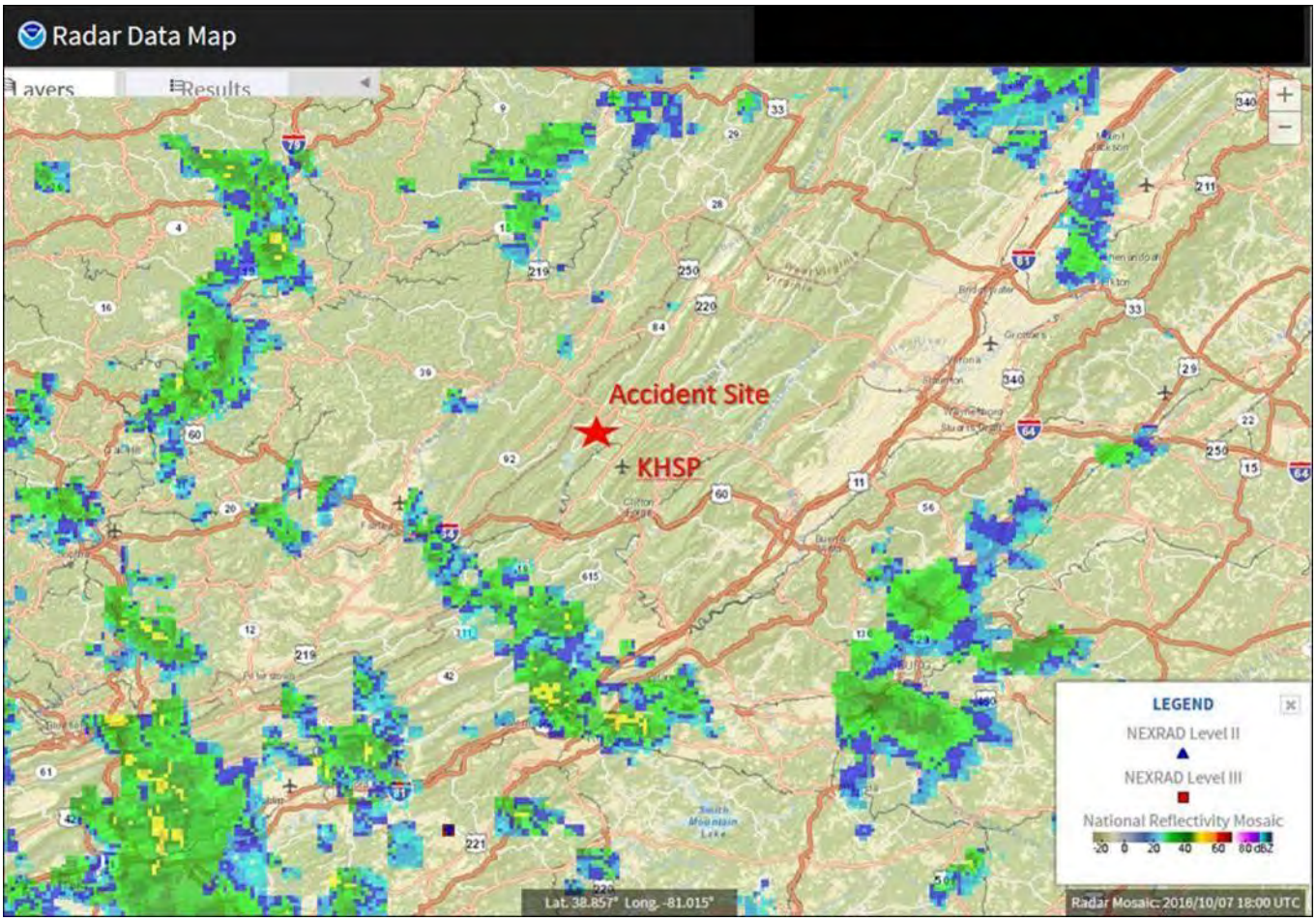
Weather Conditions on October 7, 2016 near Ashwood, Virginia

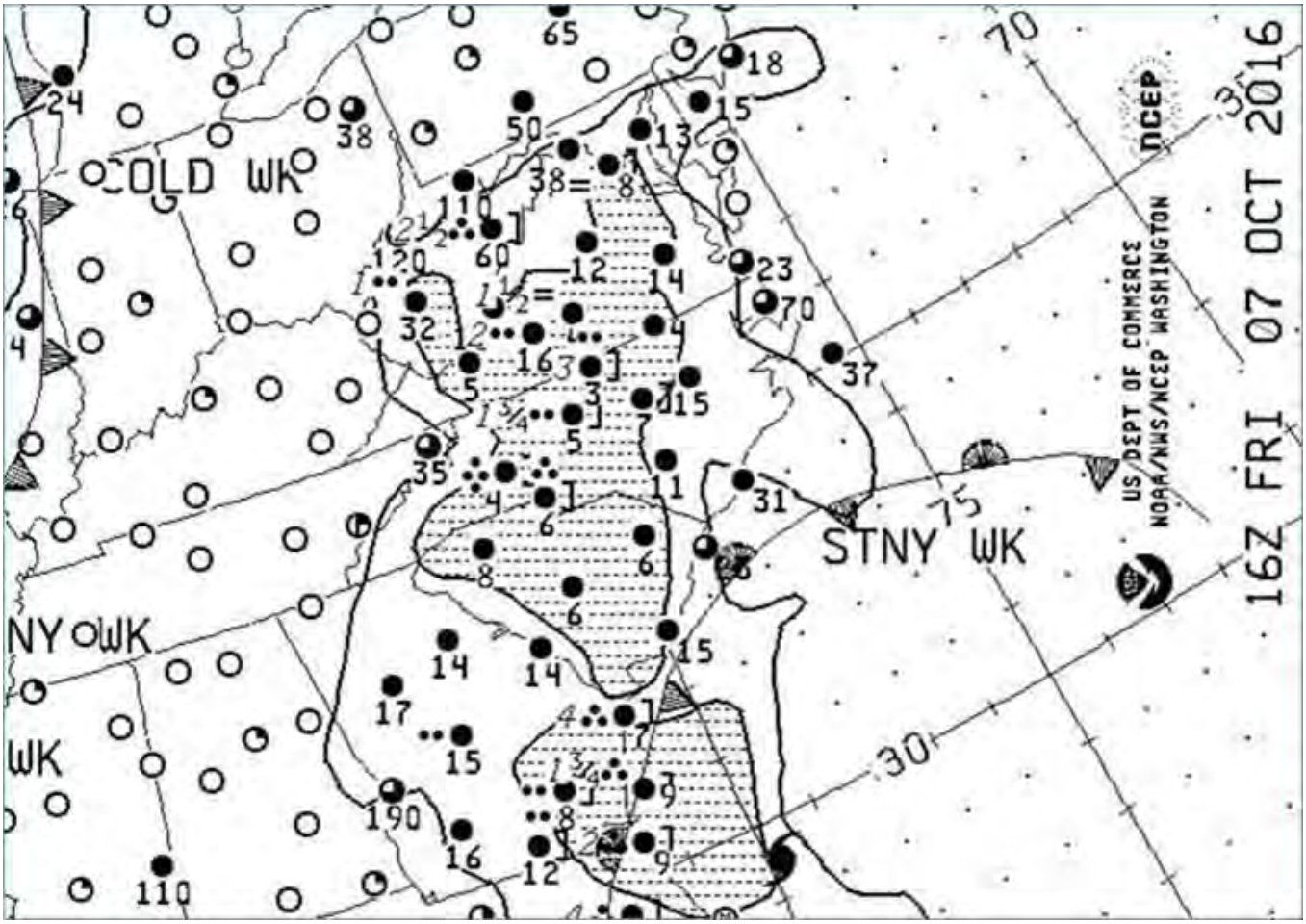
Synoptic Conditions – The National Weather Service (NWS) Surface Analysis Chart for 1400 EDT (1800Z) on October 7, 2016 is included below and depicted the primary synoptic conditions occurring at the approximate time of the accident. The chart depicted Hurricane Mathew located off the Florida coast moving northward with a stationary frontal system along the southeast coastal section from Georgia to North Carolina. Two high pressure system were depicted over Massachusetts and over extreme eastern West Virginia at 1025- and 1023-hectopascals (hPa) respectively with a ridge of high pressure extending southwestward over the region of the accident site. Further west a strong cold front was depicted from a low pressure system over the Great Lakes with the front southward through Michigan, Indiana, southern Illinois, extreme southeast Missouri, into Arkansas. In the vicinity of the accident site the chart depicted a relatively weak pressure gradient was indicated with northeast winds of 10 knots to the east and over West Virginia winds from the southeast at 10 knots or less, with several station models reporting rain and mist, with temperatures in the 60's degrees Fahrenheit (F), with dew point temperatures also in the 60's with spreads of 4° F or less.



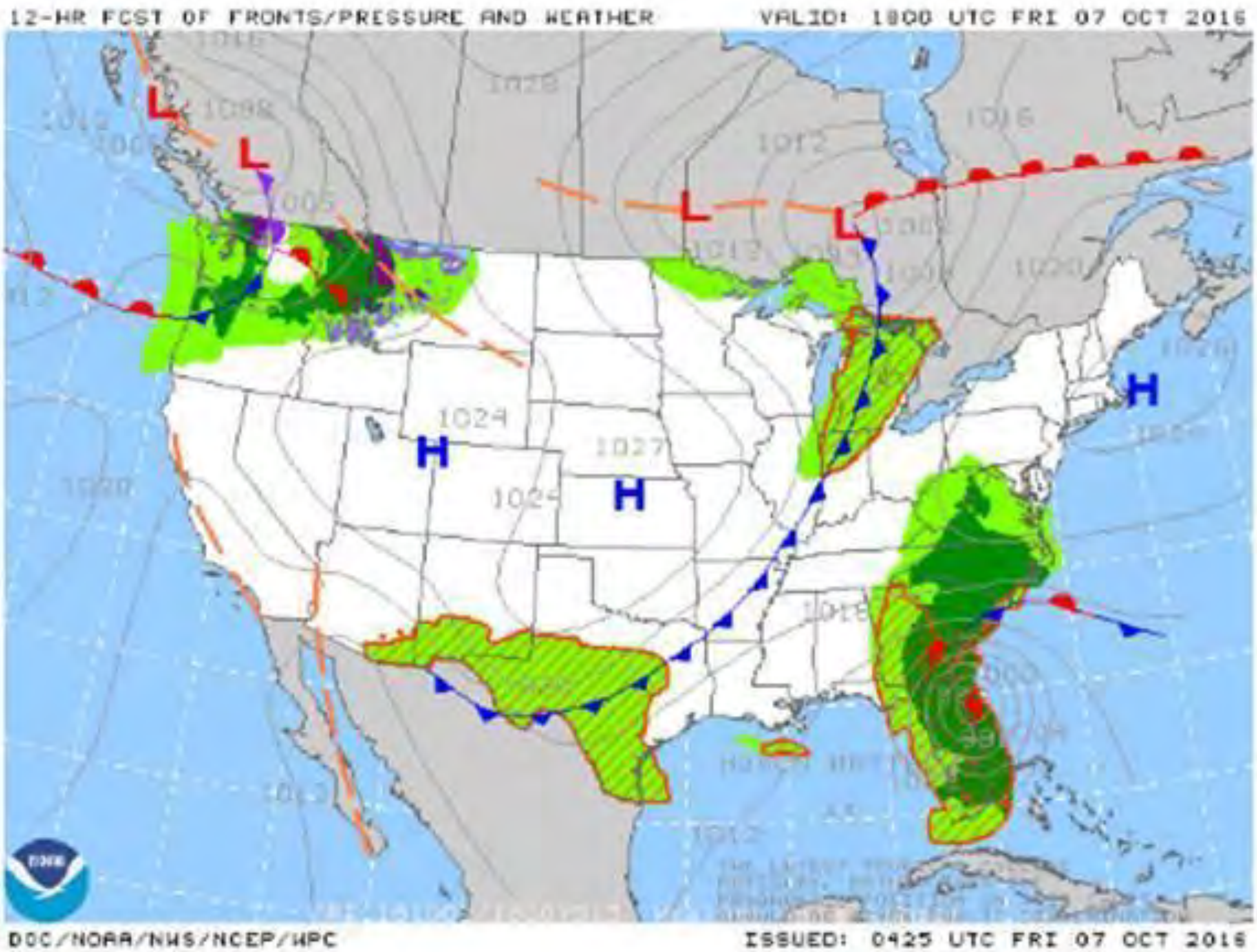
The NWS National Composite Radar Mosaic for 1400 EDT is included below and depicted scattered rain showers over the region, with no echoes over the accident site at the time.



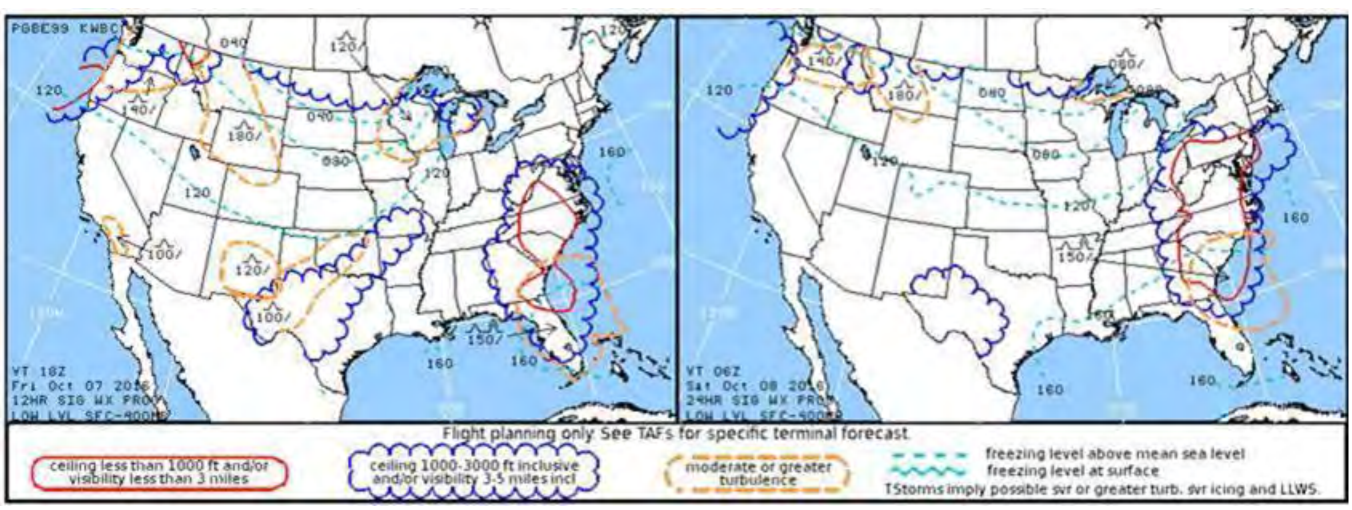
The eastern central section of the NWS Weather Depiction Chart for 1200 EDT (1600Z) depicting the general flight categories of IFR, MVFR, and VFR conditions over the intended route of flight is included below. The chart depicted MVFR conditions over the accident site prior to the accident with areas of IFR conditions over West Virginia to the west and over Virginia and Maryland to the east along the intended route.



The 12-hour Surface Prognostic Chart for expected conditions issued on the morning of October 7, 2016 was as follows, and depicted an extensive area of rain spreading over the southeast to mid-Atlantic coastal areas and included the accident site. The dark green area represents a greater than 50% probability of precipitation.



The 12- and 24-hour flight weather conditions forecast is included below. The panel on the left is the forecast conditions for 1400 EDT (1800Z) and depicts a large area of IFR and MVFR conditions over the southeast to mid-Atlantic area and includes the accident site.



Observations – the closest weather reporting location to the accident site was also the airport the flight was attempting to divert too, **Ingalls Field Airport (KHSP)**, located in Hot Springs, Virginia approximately 2 miles southeast from the accident site at an elevation of 3,793 feet. The airport had an Automated Weather Observation System (AWOS) and listed a magnetic variation of 8° West. The following conditions were reported immediately prior to the accident:

Ingalls Field Airport weather at 1335 EDT, automated, wind from 100° at 6 knots, visibility less than 1/4 statute miles in heavy rain, ceiling overcast at 100 feet agl, temperature and dew point 9° Celsius (C), altimeter 30.23 inches of mercury (Hg). Remarks; automated observation system, hourly precipitation 0.02 inches.

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

LIFR METAR KHSP 071436Z AUTO 09010G18KT M1/4SM RA OVC001 10/10 A3024 RMK AO2 P0008=
LIFR METAR KHSP 071456Z AUTO 08009G14KT M1/4SM +RA OVC001 10/10 A3024 RMK AO2 P0010=
LIFR METAR KHSP 071515Z AUTO 09010G14KT M1/4SM RA OVC001 10/10 A3024 RMK AO2 P0005=
LIFR METAR KHSP 071535Z AUTO 08007KT M1/4SM RA OVC001 10/10 A3025 RMK AO2 P0008=
LIFR METAR KHSP 071635Z AUTO 08007KT M1/4SM RA OVC001 10/10 A3024 RMK AO2 P0005=
LIFR METAR KHSP 071655Z AUTO 08008KT M1/4SM RA OVC001 09/09 A3024 RMK AO2 P0005=
LIFR METAR KHSP 071735Z AUTO 10006KT M1/4SM +RA OVC001 09/09 A3023 RMK AO2 P0002=
Accident 1800Z
LIFR METAR KHSP 071915Z AUTO 08007KT M1/4SM +RA OVC001 09/09 A3021 RMK AO2 P0001=
LIFR METAR KHSP 071935Z AUTO 09007KT M1/4SM RA OVC001 09/09 A3021 RMK AO2 P0001=
LIFR METAR KHSP 072015Z AUTO 10010KT M1/4SM RA OVC001 09/09 A3020 RMK AO2=

The observations indicated low-instrument flight rule conditions with visibility restricted to less than 1/4 mile in rain, with overcast clouds at 100 feet.

Greenbrier Valley Airport (KLWB) was the next closest weather reporting station located approximately 27 miles west of KHSP and listed an elevation of 2,301 feet. The airport listed the same magnetic variation the airport had an AWOS which issued observations every 20 minutes. The following conditions were reported at the approximate time of the accident:

Greenbrier Valley Airport weather at 1355 EDT, automated, wind from 080° at 3 knots, visibility 4 miles in heavy rain, scattered clouds at 700 feet agl, ceiling overcast at 1,200 feet, temperature 17° C, dew point 16° C, altimeter 30.19 inches of Hg. Remarks: automated observation system, hourly precipitation 0.07 inches, 6-hour precipitation 0.08 inches, temperature 17.1° C, dew point 15.5° C.

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

MVFR METAR KLWB 071555Z AUTO 05007KT 7SM OVC013 16/15 A3021 RMK AO2 T01610151
MVFR METAR KLWB 071615Z AUTO 05006KT 7SM OVC013 17/16 A3020 RMK AO2 T01650155
MVFR METAR KLWB 071635Z AUTO 04004KT 7SM SCT010 BKN015 OVC021 17/16 A3020 RMK AO2 T01700158
MVFR METAR KLWB 071655Z AUTO 09003KT 10SM BKN013 OVC017 17/16 A3020 RMK AO2 T01670156
MVFR METAR KLWB 071715Z AUTO 05005KT 7SM SCT010 OVC013 17/16 A3019 RMK AO2 T01680156
MVFR METAR KLWB 071735Z AUTO 08005KT 7SM OVC013 17/16 A3019 RMK AO2 T01710156
MVFR METAR KLWB 071755Z AUTO 08003KT 4SM +RA SCT007 OVC012 17/16 A3019 RMK AO2 P0007 60008 T01710155 10172 20140
Accident 1800Z

MVFR METAR KLWB 071815Z AUTO 09003KT 3SM -RA OVC013 17/16 A3018 RMK AO2 P0002 T01670156
MVFR METAR KLWB 071835Z AUTO 10003KT 10SM OVC013 17/16 A3018 RMK AO2 P0002 T01700159
MVFR METAR KLWB 071855Z AUTO 07004KT 10SM OVC013 17/16 A3017 RMK AO2 P0002 T01700155
MVFR METAR KLWB 071915Z AUTO 06003KT 7SM +RA OVC013 17/16 A3017 RMK AO2 P0002 T01700157
MVFR METAR KLWB 071935Z AUTO 08003KT 7SM SCT008 BKN013 OVC018 17/16 A3017 RMK AO2 P0007 T01700159
MVFR METAR KLWB 071955Z AUTO 00000KT 10SM OVC014 17/16 A3016 RMK AO2 P0007 T01700160
MVFR METAR LWB 072015Z AUTO 05003KT 7SM OVC014 17/16 A3016 RMK AO2 T01700158
MVFR METAR KLWB 072035Z AUTO 06003KT 5SM BR OVC012 17/16 A3015 RMK AO2 P0002 T01680159 T01700161

The observations indicated east to northeast winds of 5 knots or less during the period with MVFR conditions in rain, drizzle, and mist with ceiling overcast at 1,200 to 1,400 feet agl.

The **Terminal Aerodrome Forecast (TAF)** issued for KLWB for the period was an amended forecast issued at 1012 EDT and was as follows:

AMD TAF KLWB 071412Z 0714/0812 06006KT 6SM –RA BR OVC012
TEMPO 0714/0716 4SM –RA BR OVC008
FM072000 09005KT 6SM –RA BR OVC012
FM080200 09005KT 3SM RA OVC007

The forecast expected MVFR to IFR conditions to prevail during the period with winds from the northeast at 6 knots, visibility 6 miles in light rain and mist, with ceiling overcast at 1,200 feet agl, with a temporary period from 1000 to 1200 EDT with visibility 4 miles in light rain and ceilings at 800 feet agl.

Shenandoah Valley Regional Airport (KSHD) was located approximately 48 miles northeast of KHSP serving the cities of Staunton, Waynesboro and Harrisonburg, Virginia and also had an AWOS. The following conditions were reported surrounding the period:

IFR METAR KSHD 071515Z AUTO 01005KT 10SM OVC008 16/15 A3025 RMK AO2 T01640149
MVFR METAR KSHD 071535Z AUTO 35005KT 10SM BKN010 OVC013 17/15 A3025 RMK AO2 T01650150
MVFR METAR KSHD 071555Z AUTO 02007KT 7SM DZ OVC013 17/15 A3025 RMK AO2 T01650150
MVFR METAR KSHD 071615Z AUTO 02005KT 7SM OVC015 17/15 A3024 RMK AO2 T01660151
MVFR METAR KSHD 071635Z AUTO 01004KT 5SM -RA OVC013 17/16 A3023 RMK AO2 P0002 T01660155 T01680156
MVFR METAR KSHD 071715Z AUTO 36004KT 10SM SCT010 OVC017 17/16 A3023 RMK AO2 T01700157
MVFR METAR KSHD 071735Z AUTO 35004KT 7SM SCT010 OVC017 17/16 A3022 RMK AO2 T01730160
MVFR METAR KSHD 071755Z AUTO 02003KT 7SM SCT010 OVC017 18/16 A3022 RMK AO2 60004 T01750161 10175 20147
Accident 1800Z
MVFR METAR KSHD 071815Z AUTO 00000KT 10SM BKN010 OVC017 18/16 A3021 RMK AO2 T01780160
MVFR METAR KSHD 071835Z AUTO 00000KT 10SM BKN010 OVC017 18/16 A3021 RMK AO2 T01800159
MVFR METAR KSHD 071855Z AUTO 00000KT 10SM OVC014 18/16 A3020 RMK AO2 T01800159
MVFR METAR KSHD 071915Z AUTO 00000KT 10SM OVC014 18/16 A3020 RMK AO2 T01810162
MVFR METAR KSHD 071935Z AUTO 31003KT 10SM OVC014 18/16 A3020 RMK AO2 T01800162
MVFR METAR KSHD 071955Z AUTO 32004KT 10SM OVC014 18/16 A3020 RMK AO2 T01780160
MVFR METAR KSHD 072015Z AUTO 33004KT 10SM OVC014 18/16 A3020 RMK AO2 T01820161

IFR conditions were reported at the station prior to 1130 EDT and then consistent MVFR conditions with a broken to overcast ceiling from 1,000 to 1,400 feet with rain and drizzle reported at times during the period.

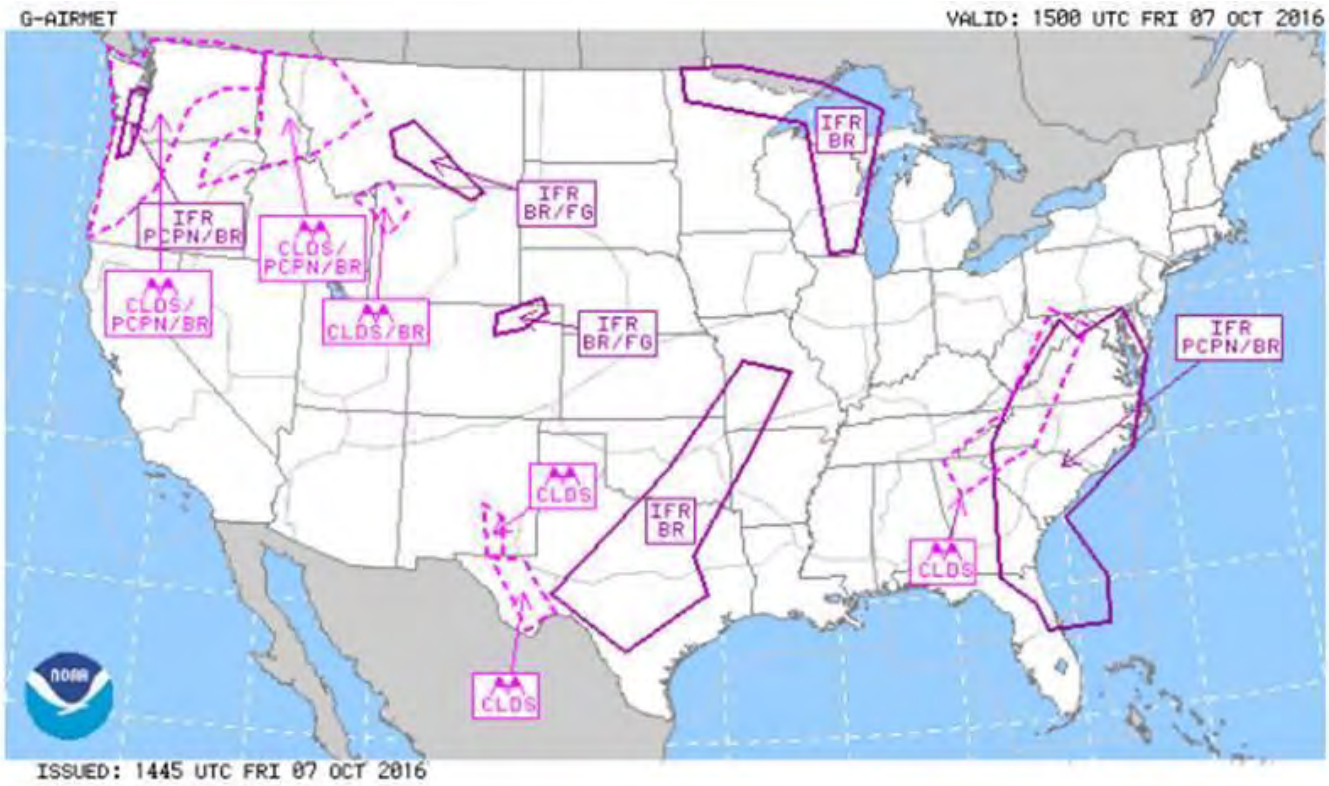
Area Forecast (FA) that covered the enroute forecast for the route of flight were as follows as amended by AIRMET Sierra series:

FAUS43 KKCI 070945
FA3W
-CHIC FA 070945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 080400
CLDS/WX VALID UNTIL 072200...OTLK VALID 072200-080400
ND SD NE KS MN IA MO WI LM LS MI LH IL IN KY
.
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...CDFNT OVR WRN LS-WRN WI-SERN IA-SWRN MO BY 04Z OVR WRN OH-E CNTRL KY.
.
IN KY
N HLF IN...SCT CI. 15Z SCT060. *20Z BKN040-050 TOP 120. WDLY SCT -SHRA. OTLK...VFR SHRA 00Z MVFR CIG SHRA.*
S HLF IN/WRN-CNTRL KY...SKC. TIL 14Z OCNL VIS 3SM BR. 18Z SCT050 SCT CI. OTLK...VFR.
ERN KY...SCT050. OCNL VIS 3SM BR. 12Z BKN-SCT050 TOP 100. OTLK...MVFR CIG SHRA.
....
FAUS41 KKCI 071745
FA1W
-BOSC FA 071745
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 081200
CLDS/WX VALID UNTIL 080600...OTLK VALID 080600-081200
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...AT 17Z...SFC HI PRES EXTENDED FM NRN ME SWWD THRU PA. CDFNT LOCATED FM WRN LWR MI INTO WRN IN. AT 06Z..THE HI WL MOV OFFSHORE AND OUT INTO THE ATLC WHILE THE CDFNT PUSHES EWD ACRS WRN NY AND FAR ERN OH INTO WV.
WDLY SCT -SHRA WL OCCUR FM PTNS VA AND WV INTO WRN PTNS MD/PA AND ERN OH.
.
OH LE
ERN PTNS OH/LE...SCT-BKN045 TOP 120. SERN OH OCNL BKN035. ISOL -SHRA*. BECMG 0003 BKN-OVC030. WDLY SCT -SHRA. OTLK...IFR CIG SHRA.*
RMNDR OH/LE...SKC-SCT050. *BECMG 0003 SCT-BKN040 TOP 100. ISOL -SHRA. OTLK...VFR.*
.
WV
ERN HLF...CIG OVC-BKN020-030 TOP 140. WDLY SCT -SHRA. BECMG 0003 CIG OVC010-020. AREAS VIS 3-5SM BR. WDLY SCT -SHRA.
OTLK...IFR CIG SHRA BR.
WRN HLF...SCT050 BKN090 TOP 140. ISOL -SHRA. BECMG 0104 BKN-OVC040. ISOL -SHRA. AREAS VIS 3-5SM BR. OTLK...IFR CIG SHRA BR.
.
MD DC DE VA
ERN 1/4 MD/DE...SCT030. BECMG 0306 BKN-OVC015-025 TOP 060. AREAS VIS 3-5SM BR. OTLK...IFR CIG BR.

RMNDR MD/VA/DE...CIG BKN-OVC010-020 LYRD FL250. WDLY SCT -SHRA. AREAS VIS 3-5SM BR. *OTLK...IFR CIG SHRA BR.*

The general forecast of the region was for MVFR conditions with ceilings broken to overcast between 1,000 to 2,000 feet layered to 25,000 feet, with widely scattered light rain showers and areas of visibility 3 to 5 miles in mist. The forecast was amended by AIRMET Sierra below.

Inflight Weather Advisories current for the route included AIRMET Sierra for IFR conditions and Mountain Obscuration, which is depicted in the following G-AIRMET issued at 1100 EDT and valid through the time of the accident. A VFR flight would not have recommended from eastern West Virginia to Maryland due to the forecast conditions.



The full advisories were as follows:

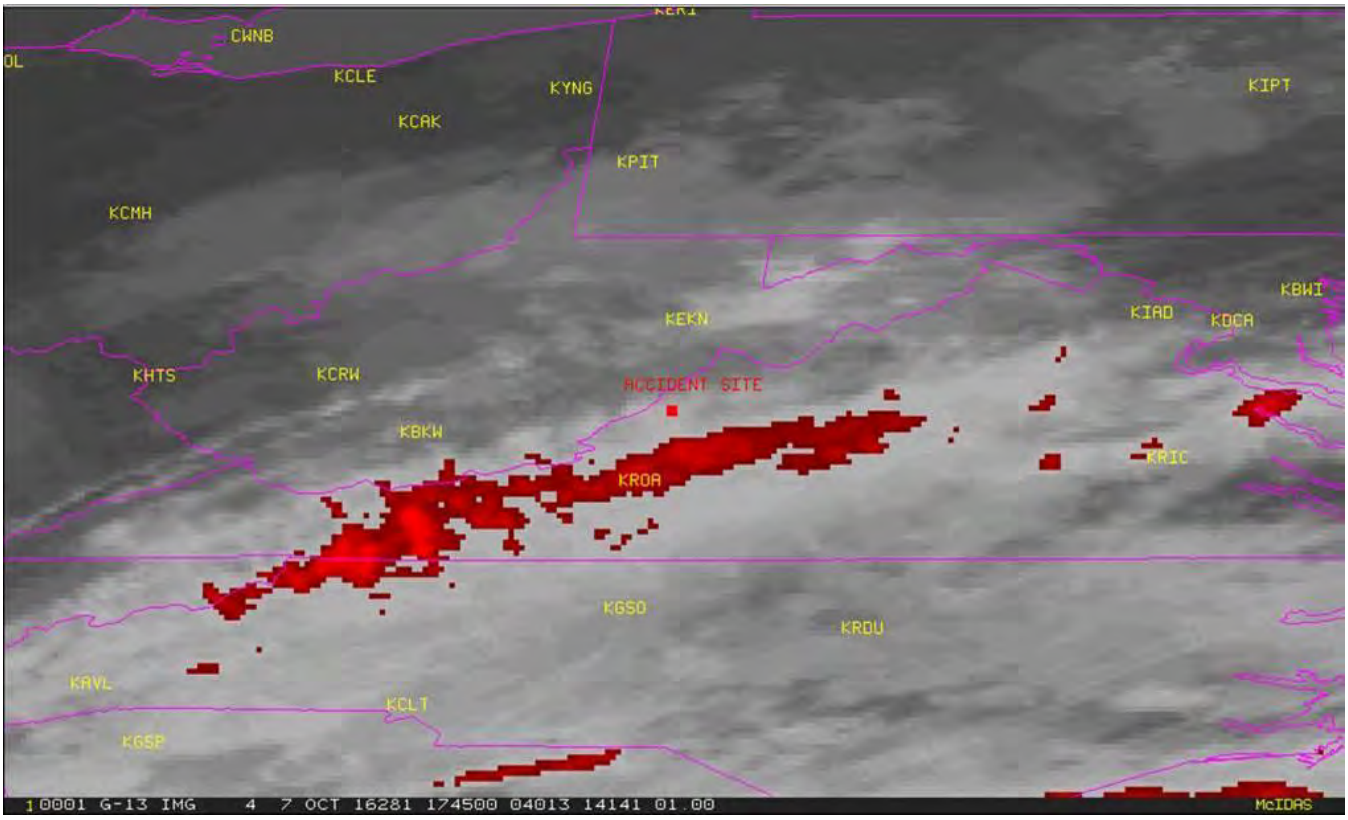
WAUS41 KKCI 071445
WA1S
BOSS WA 071445
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN *VALID UNTIL 072100*
.
AIRMET IFR...WV MD DC DE VA NC SC GA FL AND CSTL WTRS
FROM 50SSW ETX TO 30SSE SBY TO 90S ECG TO 50E CHS TO 170ENE OMN TO 110ENE TRV TO 30SSE ORL TO 30W OMN TO 60E TLH TO
40NNE ODF TO 40NNE HMV TO 40SSW JST TO 30NW CSN TO 50SSW ETX
CIG BLW 010/VIS BLW 3SM PCPN/BR*. CONDS CONTG BYD 21Z THRU 03Z.*
.
AIRMET MTN OBSCN...PA WV MD VA NC SC GA
FROM 40WSW JST TO 40WSW EMI TO 20SSE CLT TO ATL TO GQO TO HMV TO 40SSE AIR TO 40WSW JST

MTNS OBSC BY CLDS. CONDS CONTG BYD 21Z THRU 03Z.

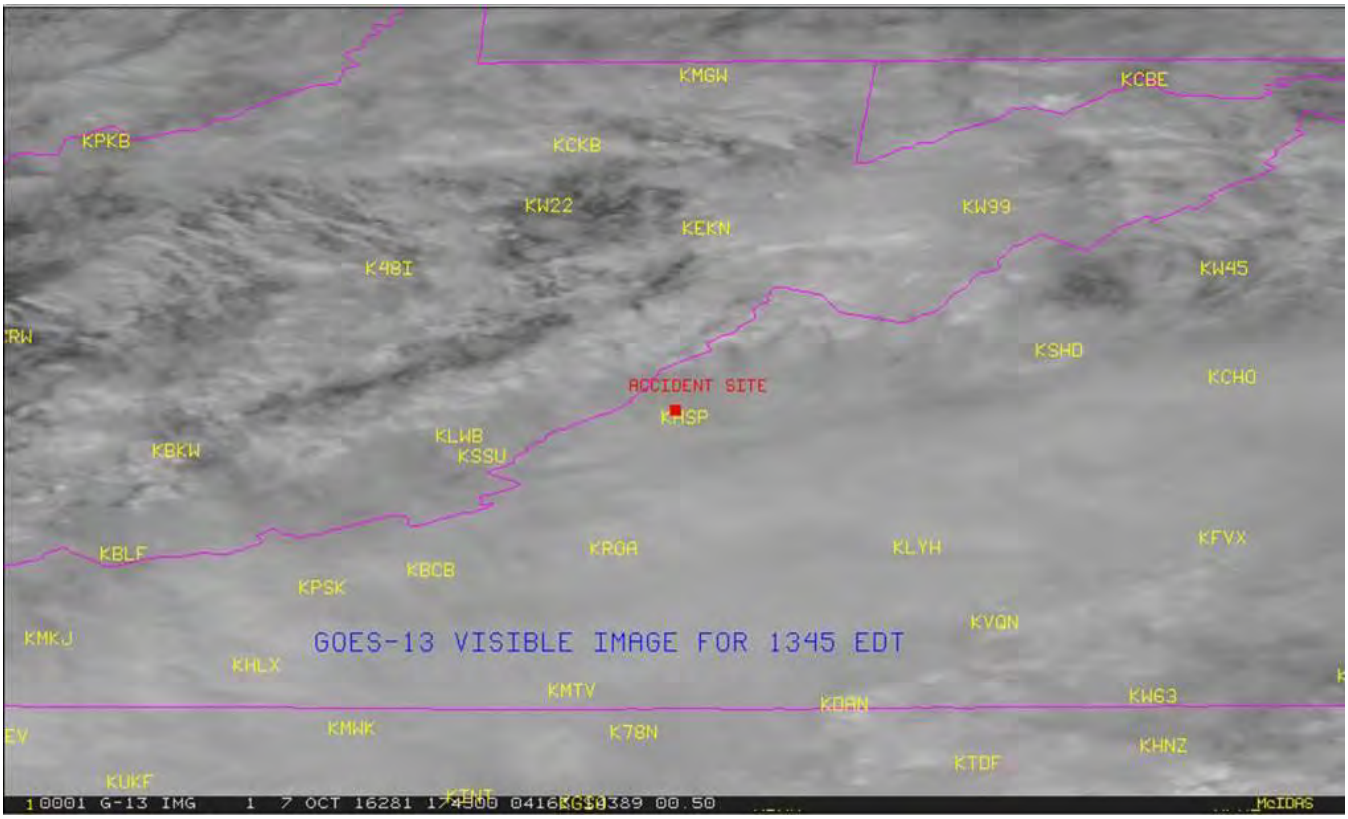
.
OTLK VALID 2100-0300Z...IFR PA OH WV MD DC VA NC SC GA FL AND CSTL WTRS
BOUNDED BY 30WSW EWC-20S SBY-90SSE ECG-60SSW ILM-170ENE OMN-150E OMN-40ESE ORL-40SW CRG-40NNW AMG-20S ODF-
HMV-HNN-30WSW EWC
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 03Z.

WAUS41 KKCI 071445
WA1T
BOST WA 071445
AIRMET TANGO UPDT 2 FOR TURB VALID UNTIL 072100
.
AIRMET TURB...NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA NC SC GA AND CSTL WTRS
FROM 60WSW YYZ TO 40WSW CON TO 200SE ACK TO 160SE SIE TO 170E ECG TO LGC TO GQO TO HMV TO HNN TO CVG TO
FWA TO 30SE ECK TO 60WSW YYZ
MOD TURB BTN FL250 AND FL400. CONDS CONTG BYD 21Z THRU 03Z.
.
OTLK VALID 2100-0300Z...TURB ME NH VT MA RI CT NY LO NJ PA OH LE WV MD DC DE VA NC SC GA AND CSTL WTRS
BOUNDED BY YOW-140E ACK-200SE ACK-160SE SIE-170E ECG-20S LGC-GQO-HMV-HNN-CVG-FWA-30SE ECK-YOW
MOD TURB BTN FL250 AND FL400. CONDS CONTG THRU 03Z.
....
WAUS41 KKCI 071445
WA1Z
BOSZ WA 071445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 072100
.
NO SGFNT ICE EXP OUTSIDE OF CNVTV ACT.
.
FRZLVL...RANGING FROM 115-165 ACRS AREA
120 ALG 40ESE YQB-50ESE PQI
160 ALG 120E ORF-150ESE SIE-200S ACK
....

Satellite Imagery – the GOES-13 infrared and visible imagery for 1345 EDT (1745Z) centered over the accident site are included below. The infrared image is provided at 4X magnification with a standard temperature enhancement curve applied to highlight the higher and colder cloud tops associated with high cirrus clouds and heavy precipitation areas. The radiative cloud top temperature over the accident site was 245° Kelvin or -28.16° C, which corresponded to cloud tops near 28,000 feet.



The GOES-13 visible image for 1345 EDT at 2X magnification with a resolution of 1 kilometer. The image depicts an overcast layer of clouds extending from eastern West Virginia eastward to Maryland. The accident site is obscured by mid to high level stratiform clouds. While some vertical development associated with rain showers is noted over the region, no defined cumulonimbus clouds were identified in the immediate vicinity of the accident site.



Pilot Reports (PIREPs) across the region surrounding the period:

CHO UA /OV 15 NE CHO/TM 1420/FL040/TP EA50/SK BASES 017 OVC/WV 130 AT 20 KTS=
CHO UA /OV 15 SW CHO/TM 1642/FL050/TP H47/SK OVC015=
LWB UA /OV LWB/TM 1733/FL031/TP E145/RM BASE-031=
CHO UA /OV CHO/TM 1819/FL020/TP BE36/SK BASES OVC017 TOPS OVC080=
CHO UA /OV CHO/TM 1915/FL020/TP CRJ2/SK BASES OVC009=
LWB UA /OV LWB/TM 2007/FL031/TP C550/RM BASE-031=
CHO UA /OV CHO/TM 2020/FL020/TP PC12/WX BASES OVC007 TOPS OVC040=
LWB UA /OV LWB/TM 2216/FL033/TP GLSP/RM BASE-033=

All the pilot reports in the immediate vicinity where from flights operating on IFR flight plans based on their reports and aircraft type and reported IFR to MVFRF ceilings with cloud tops from 3,100 to 8,000 feet. One of the reports also noted winds at 4,000 feet from the southeast or from 130° at 20 knots, while surface winds were noted under 5 knots.

Sounding Review – the closest sounding from Sterling, VA indicated a moist but stable atmosphere with a Lifted Index of +13.0, which supporting stratiform precipitation and stratiform type clouds. The lifted condensation level (LCL) was at 335 feet agl, with the level of free convection (LFC) and convective condensation level (CCL) were at approximately 1,500 feet agl and represented the base of the clouds. A strong frontal inversion was noted at low levels with a top near 2,500 feet agl, with drier air immediately above and supporting multiple layers of clouds. The mean wind was from the south or from 170° at 13 knots; however, a low-level wind maximum was identifed near 2,000 feet from the southeast or from 125° at 20 knots, which was also identified in one of the pilot reports. The freezing level was identified above 15,000 feet.

Summary – The above observations indicated an extensive area of low clouds with a large area of MVFR conditions over the route and the worst conditions of LIFR conditions with visibility less than 1/4 mile and ceilings of 100 feet being reported surrounding the period in the vicinity of the accident site. The NWS had forecast MVFR to IFR conditions over the region and had issued AIRMET Sierra series for IFR and mountain obscuration conditions over the area. No significant convective echoes were identified in the area. Some local strong winds associated with drainage winds were noted in the vicinity of the accident site which result in some low-level turbulence. It is likely the flight encountered deteriorating ceilings and some light precipitation in the area restricting VFR operations. The weather was forecast, and a formal weather briefing would likely have advised that "VFR flight would not be recommended".

Donald E. Eick
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National Transportation Safety Board
Office of Aviation Safety
Operational Factors Division (AS-30)