NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 19, 2021

Factual Report

METEOROLOGY

WPR19FA154

Table Of Contents

A. ACCIDENT

Location: Grover, Utah
Date: May 24, 2019
Time: about 1116 mountain daylight time
1716 Universal Coordinated Time (UTC)
Airplane: Cirrus SR22; Registration: N809SR

B. METEOROLOGIST

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National Transportation Safety Board

C. SUMMARY

On May 24, 2019, about 1116 mountain daylight time, a Cirrus SR22 airplane, N809SR, impacted terrain about 6 miles southeast of Grover, Utah. The private pilot and one passenger died, and the airplane was destroyed. The airplane was registered to Tierra Grande Aviation LLC, and operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed in the vicinity of the accident site, and the flight was operated on an instrument flight rules flight plan. The flight departed Canyonlands Field Airport (KCNY), Moab, UT about 1042 and was destined for Henderson Executive Airport (KHND), Las Vegas, Nevada.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are mountain daylight time (MDT) based upon the 24-hour clock, local time is -6 hours from UTC, and UTC=Z. NWS airport and station identifiers use the standard International Civil Aviation Organization 4-letter station identifiers versus the International Air Transport Association 3-letter identifiers, which deletes the initial country code designator "K" for U.S. airports. Directions are referenced to true north and distances in nautical miles. Heights are in feet (ft) above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident site plotted in this report are based on the coordinates of latitude 38.174401° N and longitude 111.248496° W, at an elevation of approximately 7,630 ft.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

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 located in College Park, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts and all the other weather products documented in this report can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular "Aviation Weather Services", AC 00-45H change 1.

1.1 Surface Analysis Chart

The southwest section of the NWS Surface Analysis Chart for 1200 MDT is included as figure 1 with topographic features colored to show elevation, the planned direct route of flight marked by a light blue line and the approximate accident site marked by a red star. The chart depicted a high pressure system at 1017-hectopascals (hPa)[1] over southwestern Colorado with a ridge extending west-southwest over northern Arizona. A weak pressure gradient existed over Utah and Nevada with light southerly winds of 10 knots or less depicted along the route of flight.

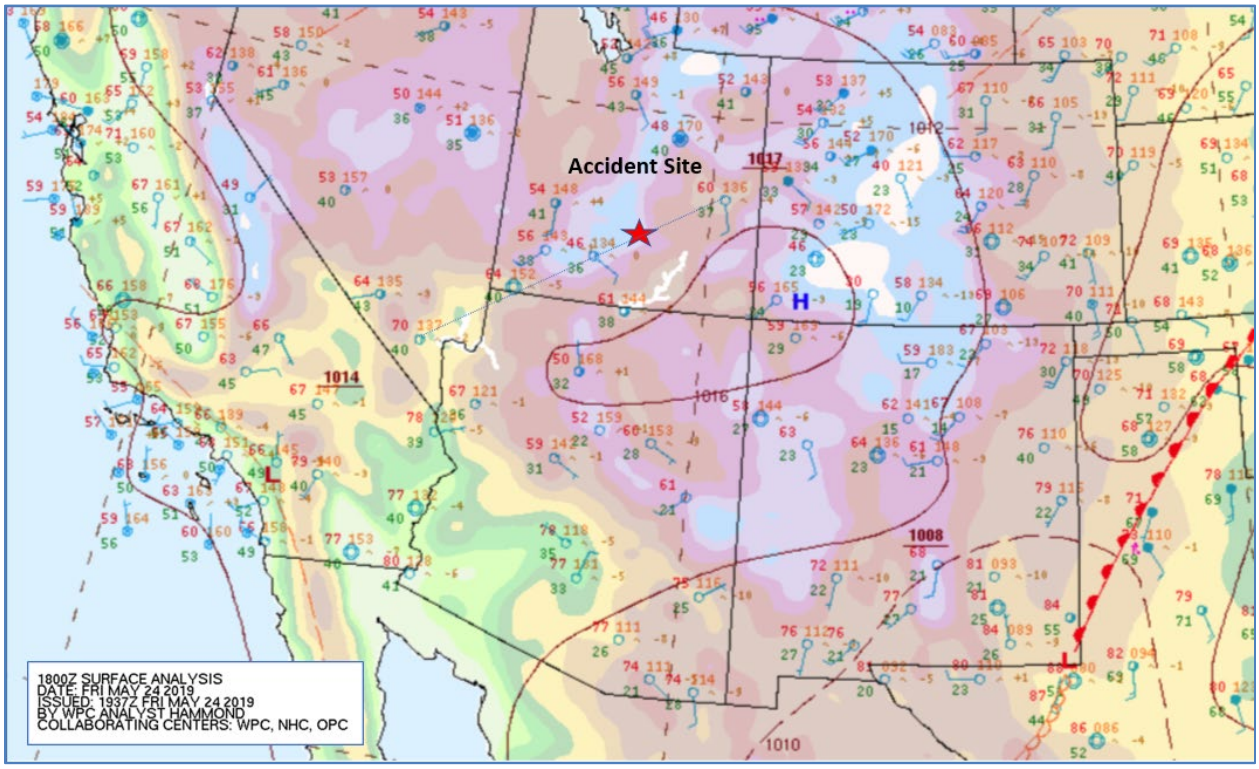

Figure 1 - Southwest section of the NWS Surface Analysis Chart for 1200 MDT with the general route of flight and accident site marked

[1] Hectopascals (hPa) is the new standard term for reporting sea-level pressure and is interchangeable with the term millibar with the same units. Standard sea-level pressure s 1013.25-hPa at 15º Celsius (C) or 59º Fahrenheit (F).

The station model depicted at the departure location of Moab, Utah, with light southerly winds at 10 knots, clear skies, with a temperature of 60° F, a dew point of 37° F. Near Bryce Canyon, Utah, immediately southwest of the accident site, the station model depicted a southeast wind of 10 knots, broken cloud cover, a temperature of 46° F, and a dew point of 36° F. In the vicinity of the planned destination of Las Vegas, Nevada, calm winds were depicted with scattered to broken clouds, temperature of 70° F, and a dew point of 40° F.

1.2 Constant Pressure Chart

The NWS Storm Prediction Centers (SPC) Constant Pressure Charts for 0600 MDT for 700-, and 500-hPa are included as figures 2 and 3 and depict the conditions at approximately 10,000 ft and 18,000 ft respectively. Due to technical issues on the day of the accident the charts were not analyzed or depicted the contours or lines of equal height of the respective pressure surfaces, and the isotherms or lines of equal temperature. The charts have been annotated with the corresponding low and high pressure systems and short-wave troughs as appropriate.

The 700-hPa chart (figure 2) depicted an upper level low over Montana with a short-wave trough extending southwestward through Idaho, Nevada, into central California. The accident site was located ahead of the upper trough in an area favorable for upward motion and the formation of clouds and precipitation, depending on the availability of moisture. The station models surrounding the accident site indicated west-southwest winds between 10 and 20 knots, with temperatures below freezing near -2° C. The 500-hPa chart (figure 3) depicted the conditions of the mean atmosphere at 18,000 ft and continued to depict an upper level low over Montana with a trough extending southwestward. The conditions surrounding the accident site at 18,000 ft indicated southwesterly winds of 25 to 40 knots, with a temperature near -16° C.

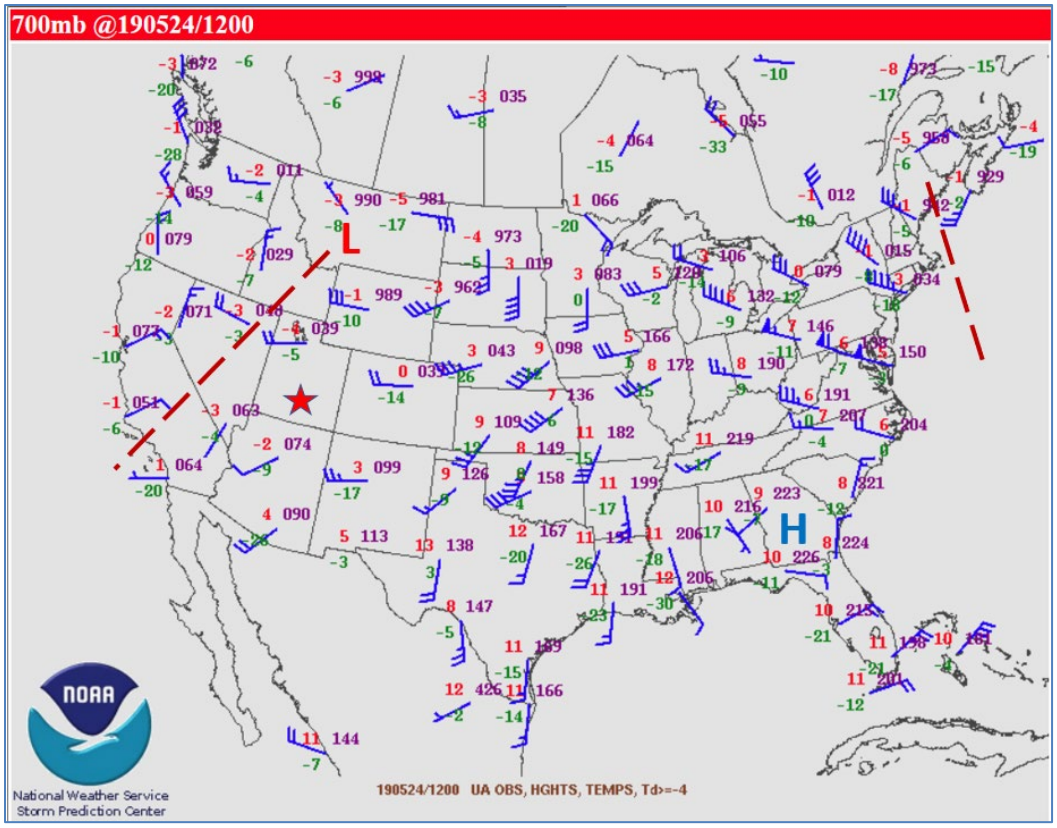

Figure 2 - 700-hPa Constant Pressure Chart for 0600 MDT

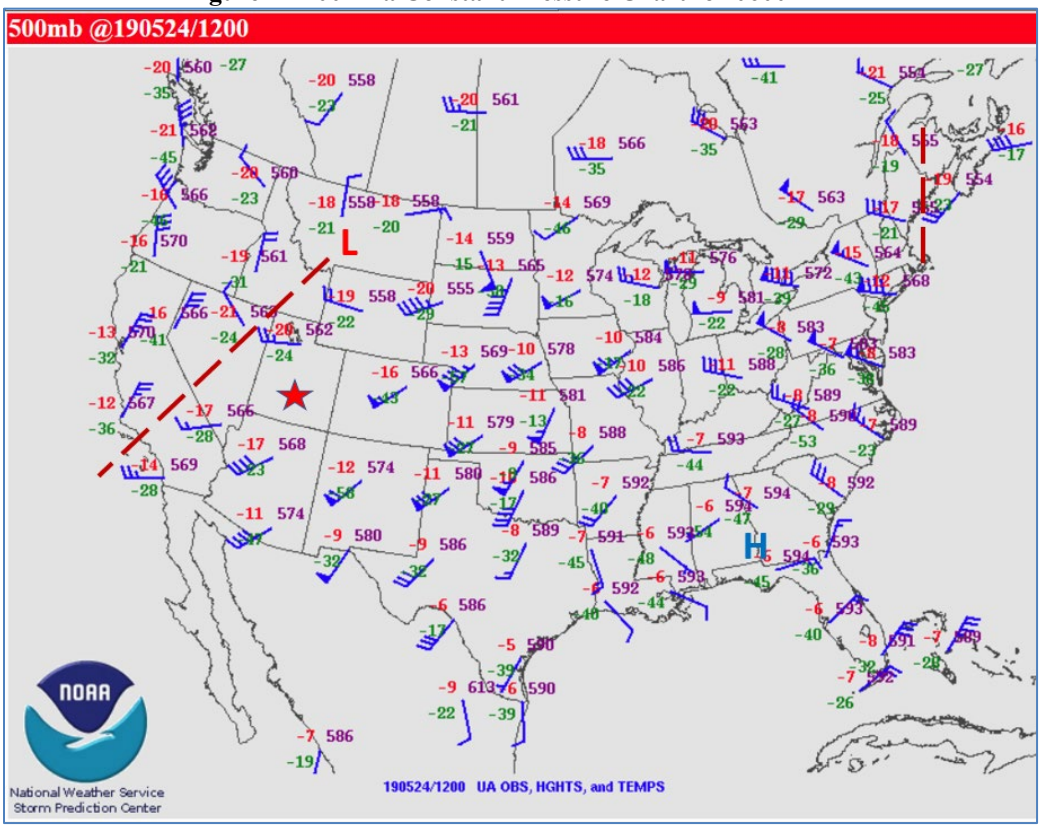

Figure 3 - 500-hPa constant pressure chart for 0600 MDT

1.3 National Composite Radar Mosaic

The National Composite Radar mosaic for 1120 MDT is included as figure 4 with the accident site and relevant airports used in this report annotated. The chart depicted a few scattered very light intensity echoes surrounding the Bryce Canyon (KBCE) area and near some of the higher terrain north and northeast of the Las Vegas area, otherwise no well-organized areas of precipitation along the route of flight.

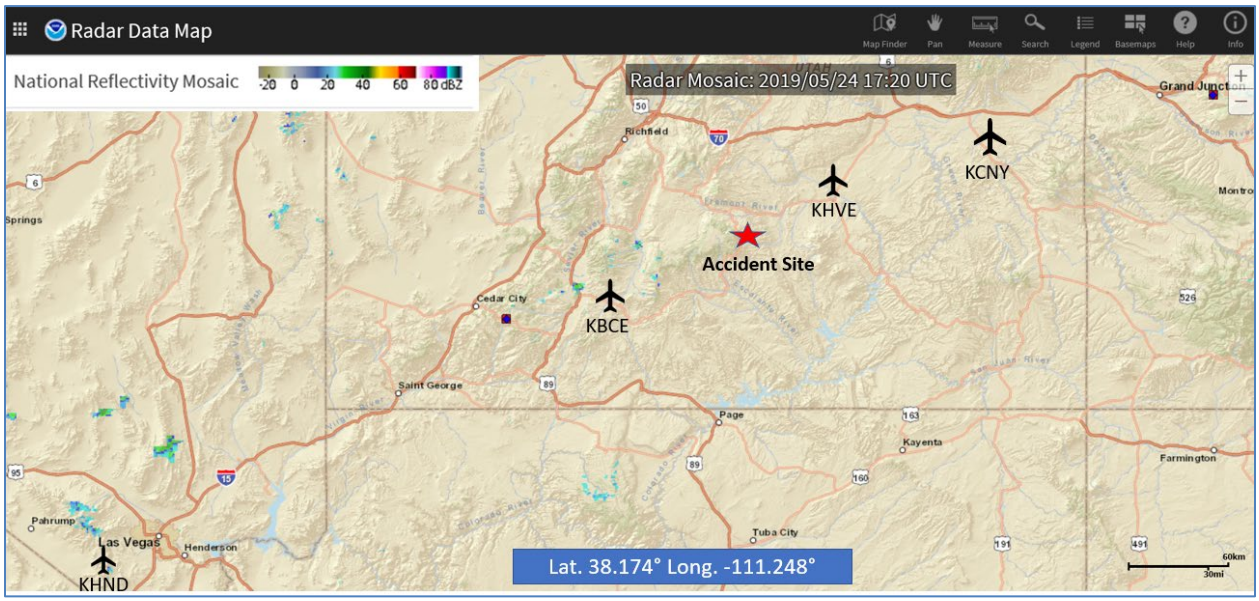

Figure 4 - National Composite Radar Mosaic for 1120 MDT

1.4 12-hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart issued during the morning and valid for 1200 MDT is included as figure 5, depicting the expected pressure systems and precipitation during the period. The chart depicted high pressure systems over Colorado and over northern Arizona with a chance of scattered rain showers and thunderstorms over Utah and northern Nevada, with increasing probabilities of rain over Idaho and Washington.

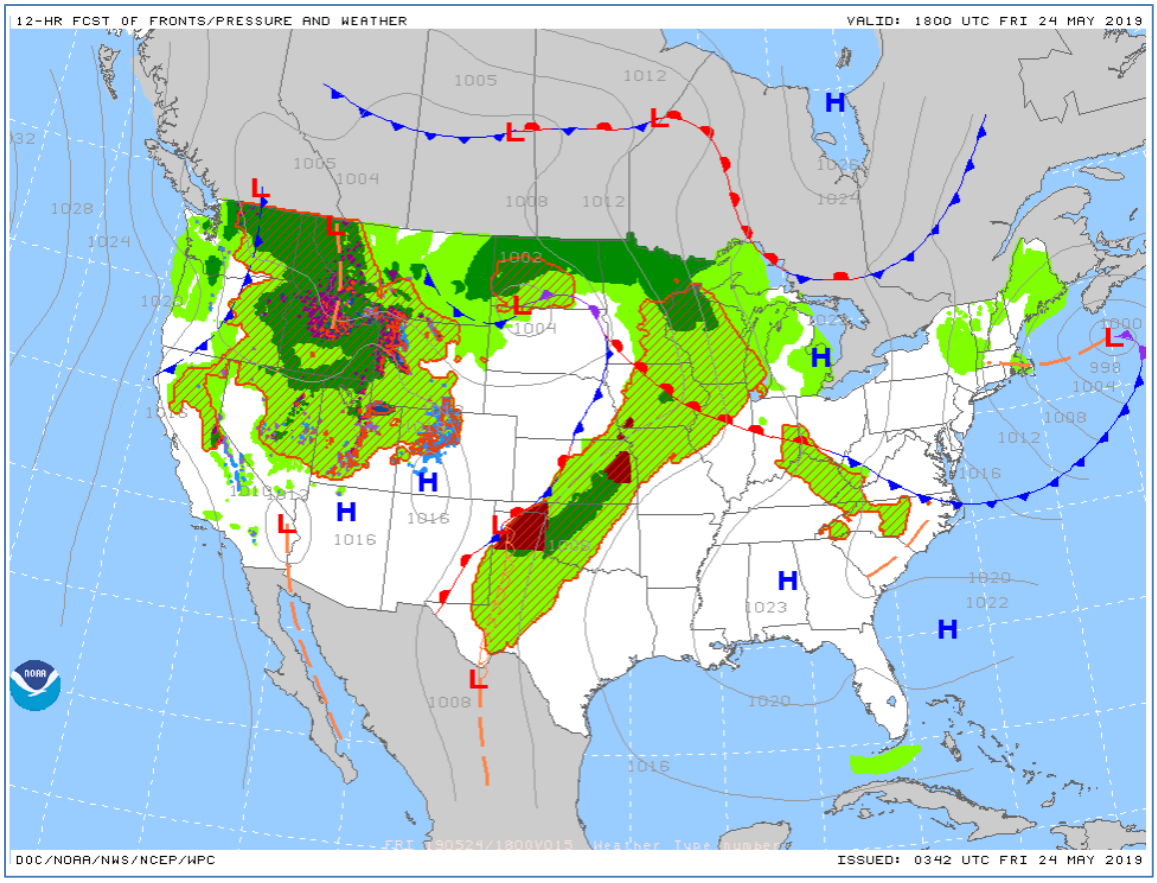

Figure 5 - NWS 12-hour Surface Prognostic Chart valid for 1200 MDT

2.0 Observations

The surrounding area was documented using official Meteorological Aerodrome Reports (METAR) and Specials (SPECI) reports. The area had a magnetic variation of 11° East based on the sectional chart for the area. Cloud heights are reported in height above ground level (agl) in the following section.

2.1 Hanksville, Utah

The closest weather reporting location was Hanksville Airport (KHVE), Hanksville, Utah, located approximately 30 miles northeast of the accident site at an elevation of 4,454 ft. The airport had an Automated Weather Observation System (AWOS), which issued observations every 20-minutes. The following conditions were reported at the approximate time of the accident.

KHVE weather observation at 1115 MDT, automated, wind from 200° at 7 knots, wind from 170° variable 230°, visibility 10 miles or more, sky clear below 12,000 ft, temperature 15° C, dew point temperature 3° C, altimeter 30.05 inches of mercury (Hg). Remarks: automated station with a precipitation discriminator.

The following conditions were reported surrounding the period from 0955 through 1315 MDT.

METAR KHVE 241555Z AUTO 08003KT 10SM CLR 12/02 A3006 RMK AO2=

METAR KHVE 241615Z AUTO 17004KT 10SM CLR 13/03 A3005 RMK AO2=

METAR KHVE 241635Z AUTO 17004KT 10SM SCT090 13/02 A3005 RMK AO2=

METAR KHVE 241655Z AUTO 17006KT 10SM CLR 15/02 A3005 RMK AO2=

METAR KHVE 241715Z AUTO 20007KT 170V230 10SM CLR 15/03 A3005 RMK AO2=

Accident 1716Z

METAR KHVE 241735Z AUTO 18005KT 10SM CLR 15/02 A3005 RMK AO2=

METAR KHVE 241800Z AUTO 18009KT 10SM CLR 16/02 A3004 RMK AO2=

METAR KHVE 241815Z AUTO 17008KT 10SM SCT050 17/02 A3004 RMK AO2=

METAR KHVE 241835Z AUTO 15009G16KT 10SM SCT050 SCT090 17/02 A3003 RMK AO2=

METAR KHVE 241855Z AUTO 15006G16KT 10SM SCT060 BKN075 BKN110 17/02 A3003 RMK AO2=

METAR KHVE 241915Z AUTO 17011G17KT 10SM SCT060 SCT065 OVC110 18/01 A3003 RMK AO2=

2.2 Bryce Canyon, Utah

The next closest station to the accident site was from Bryce Canyon Airport (KBCE), Bryce Canyon, Utah, which was located approximately 50 miles southwest of the accident site at an elevation of 7,590 ft. The airport had an Automated Surface Observation System (ASOS), which was not augmented by any human observers during the period. The following conditions were reported at the time of the accident.

KBCE weather observation at 1053 MDT, automated, wind from 130° at 12 knots, visibility 10 miles or more, scattered clouds at 2,400 ft agl, ceiling broken at 3,100 ft, overcast at 4,800 ft, temperature 7°, dew point temperature 2° C, altimeter 30.11 inches of Hg. Remarks; automated station with a precipitation discriminator, sea level pressure 1013.8-hPa, temperature 6.7° C, dew point 2.2° C.

The conditions reporting surrounding the period from about 0900 through 1400 MDT were as follows:

METAR KBCE 241453Z AUTO 00000KT 10SM SCT012 BKN020 OVC055 04/01 A3011 RMK AO2 SLP144 T00390006 51006

SPECI KBCE 241507Z AUTO 21006KT 10SM FEW012 SCT020 BKN055 04/01 A3011 RMK AO2 T00440006=

METAR KBCE 241553Z AUTO 15006KT 10SM FEW023 SCT027 BKN034 05/02 A3011 RMK AO2 SLP143 T00500017=

METAR KBCE 241653Z AUTO 13012KT 10SM SCT024 BKN031 OVC048 07/02 A3011 RMK AO2 SLP138 T00670022=

Accident 1716Z

METAR KBCE 241753Z AUTO 12011KT 10SM SCT020 08/02 A3010 RMK AO2 SLP134 T00780022 10078 20022 58000=

METAR KBCE 241853Z AUTO 13012KT 10SM BKN040 08/02 A3011 RMK AO2 SLP134 T00780017=

METAR KBCE 241953Z AUTO 14013KT 10SM OVC060 08/01 A3009 RMK AO2 SLP129 T00830011

A review of the 24-hour observations indicated light rain, snow, and unknown precipitation was reported at KBCE and ended at approximately 2000 MDT on May 23, 2019.

2.3 METAR Display

The NWS Aviation Weather Center (AWC) METAR display showing the general flight categories, with the radar composite for 1130 MDT is included as figure 6 with the approximate accident site marked by the red star. The display shows generally VFR conditions[2] being reported over the region with clear skies over the eastern portion of Utah with broken to overcast cloud cover over the western portion of the station.

[2] 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 below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

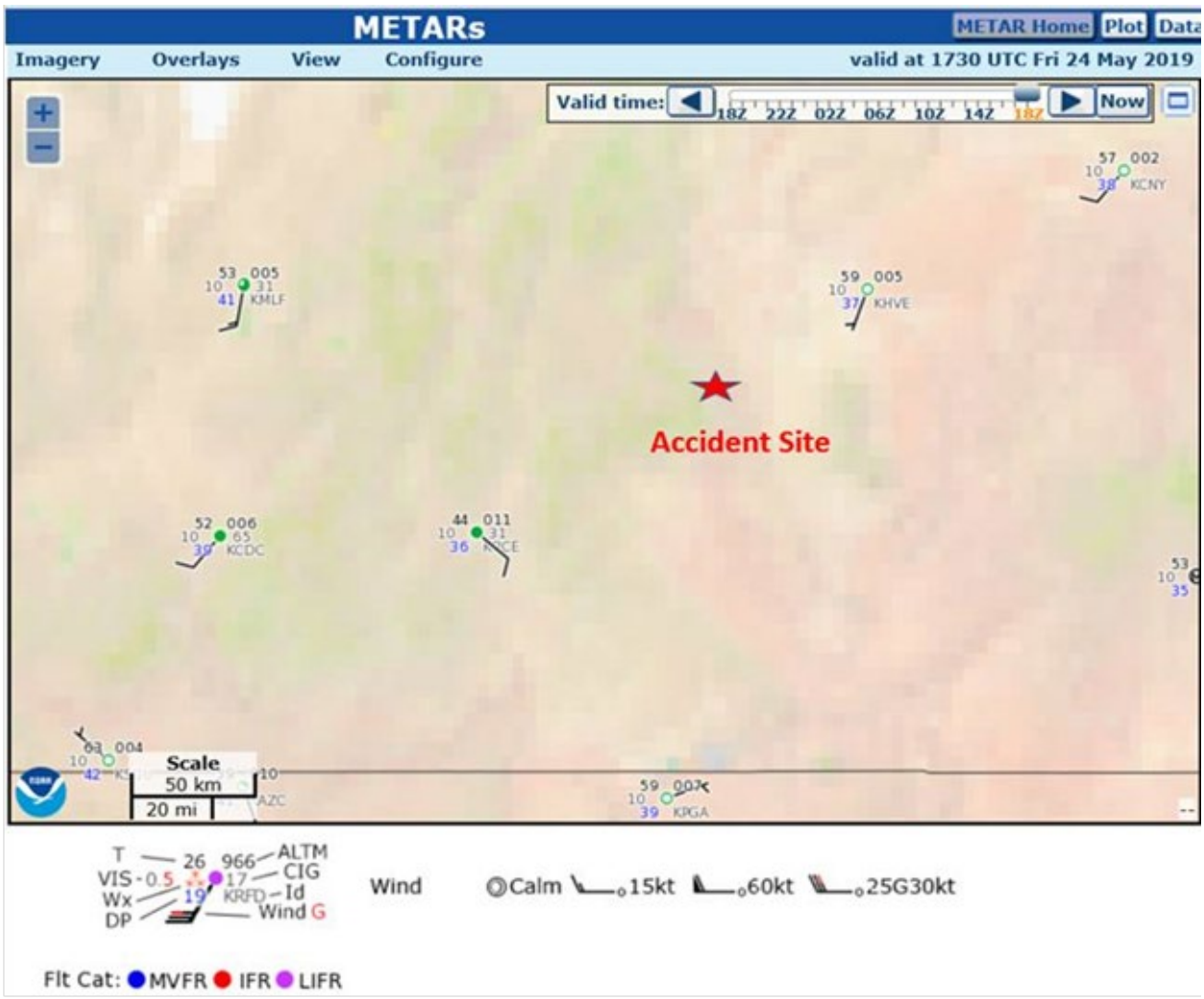

Figure 6 - METAR display at 1130 MDT

3.0 Sounding Data

A High-Resolution Rapid Refresh (HRRR)[3] numerical model data was obtained from archive data from the NOAA Air Resource Laboratory (ARL) and plotted on a standard Skew T log P diagram[4] over the accident site coordinates from the surface to 450-hPa or approximately 21,000 ft using the complete Rawinsonde Observation RAOB program software[5], and is included as figure

[3] The HRRR is a National Oceanic and Atmospheric Administration (NOAA) real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour period.

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

[5] RAOB software – The complete RAwinsonde OBservation program is an interactive sounding analysis program developed by Environmental Research Services, Matamopras, Pennsylvania, for plotting and analyzing upper air data.

7. The HRRR 1100 MDT sounding indicated a lifted condensation level (LCL) and level of free convection (LFC) at 3,581 ft agl (10,858 ft msl), with the convective condensation level (CCL) at 3,735 ft agl (11,012 ft msl). The sounding was saturated between the LCL and approximately 15,000 ft supporting cumulus type clouds. The freezing level was identified at 9,755 ft (blue horizontal line across sounding) and supported icing in-clouds above this level. The icing potential is depicted on the left side of the sounding with the type of icing (blue – clear ice, pink – mixed ice, and green – rime ice). The RAOB program indicated that at approximately 13,700 ft the HRRR sounding indicated a 98% probability of moderate mixed icing with a temperature of -10º C, a relative humidity of 100%, and a liquid water content (LWC) of 0.001 g/m³.

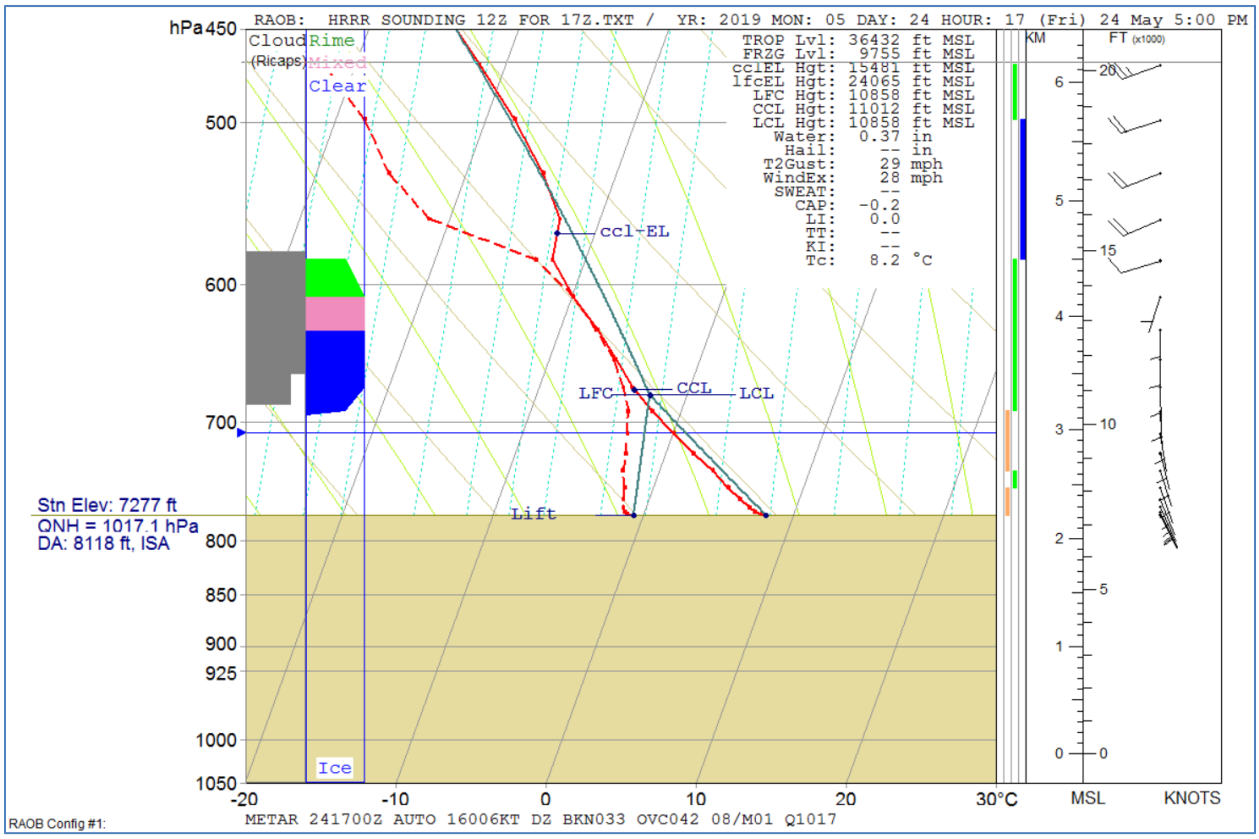

Figure 7 - HRRR numerical model sounding for 1100 MDT

The HRRR sounding indicated a surface wind from the south-southeast at 6 knots, with wind slowly veering to the west-southwest with height, and wind speeds above 20 knots above 17,000 ft. The mean 0 to 6 kilometer or 18,000 ft wind was from 240° at 19 knots. The RAOB program indicated a potential for moderate turbulence between 13,600 ft and 15,000 ft due to direction and speed shears associated with the wind shift, with a probability of turbulence ranging from 98% to 75% in that layer.

Figure 8 is a table of the HRRR model parameters of height, pressure (Pres), temperature (T), dew point temperature (Td), relative humidity (RH%), wind direction and speed, and RAOB derived potential for clear air turbulence (CAT), LLWS, and icing from the surface through 21,000 ft. The conditions at the accident airplanes cruising altitude at approximately 14,100 ft indicated a wind from 220° at 7 knots with a temperature of -10.8° C, with conditions favorable for icing.

Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
7277	777	8.2	-0.6	54	155 / 6			
7312	776	7.9	-1.1	53	156 / 6			
7382	774	7.4	-1.3	54	156 / 7			
7522	770	6.9	-1.5	55	158 / 7			
7768	763	6.1	-1.7	57	160 / 7			
8122	753	5.0	-1.9	61	162 / 7			
8624	739	3.6	-2.4	65	164 / 7			
9132	725	1.9	-2.6	72	168 / 7			
9721	709	0.1	-3.0	80	172 / 7			
10396	691	-1.9	-3.5	89	177 / 7			LGT Clear
11083	673	-3.8	-4.4	96	179 / 7			MDT Clear
11903	652	-5.6	-5.7	99	181 / 7			MDT Clear
12744	631	-7.5	-7.6	99	180 / 6			MDT Clear
13689	608	-9.9	-9.9	100	197 / 4	MDT		MDT Mixed
14748	583	-12.2	-13.3	91	251 / 11	MDT		LGT Rime
15892	557	-12.7	-21.4	48	245 / 18			
17178	529	-14.9	-25.2	41	247 / 20			
18668	498	-18.1	-28.1	41	250 / 22			
20180	468	-21.8	-32.2	38	249 / 24			
21714	439	-25.7	-34.8	42	248 / 27			

Figure 8 - Table of the HRRR model parameters height, pressure, temperature, dew point, relative humidity, wind, turbulence, wind shear, and icing potential

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 17 (GOES-17) data was obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. The infrared long wave and visible imagery were obtained surrounding the time of the accident, with the images closest to the time of the accident documented below. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns (μm) provided radiative cloud top temperatures with a nominal spatial resolution of 2 km. The visible (band 2) at a wavelength of 0.64 μm images at a resolution of 0.5 km.

Figure 9 is the GOES-17 infrared image at 4X magnification for 1111 MDT, which depicted a broken to overcast layer of clouds with some vertical development over the accident site with a radiative cloud top temperature of 264° Kelvin or -11° C, which corresponded to cloud tops near 15,000 ft. Figure 10 is the GOES-17 visible image at 2X magnification for the same period, which depicted towering cumulus to cumulus congestus clouds type clouds over the accident site. The imagery also indicated that prior to this period the flight had been operating in relatively clear conditions or in visual meteorological conditions (VMC) until the last 15 miles of flight when clouds extended over the route of flight and reached the flight level of the accident airplane. Figure 11 is the GOES-17 visible image at 1111 MDT at 4X magnification with the clouds indicated over and in the vicinity of the accident site.

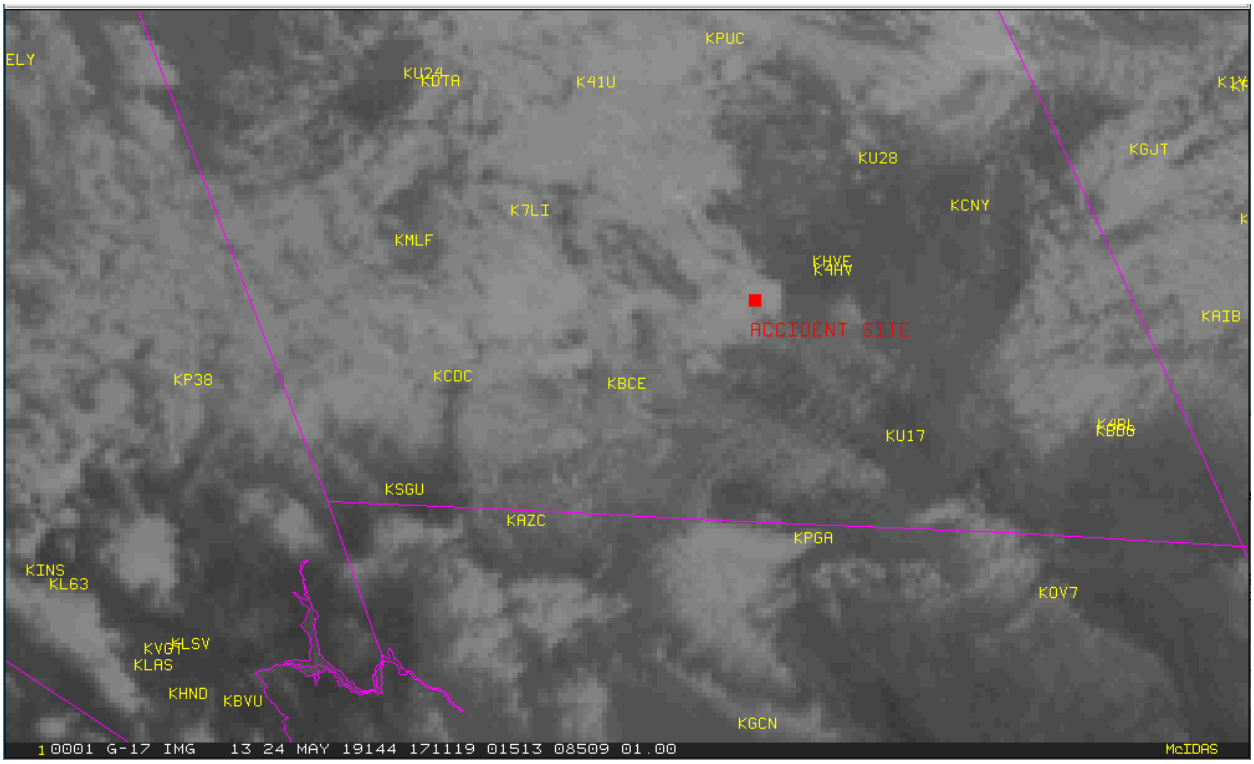

Figure 9 - GOES-17 infrared image at 4X magnification for 1111 MDT

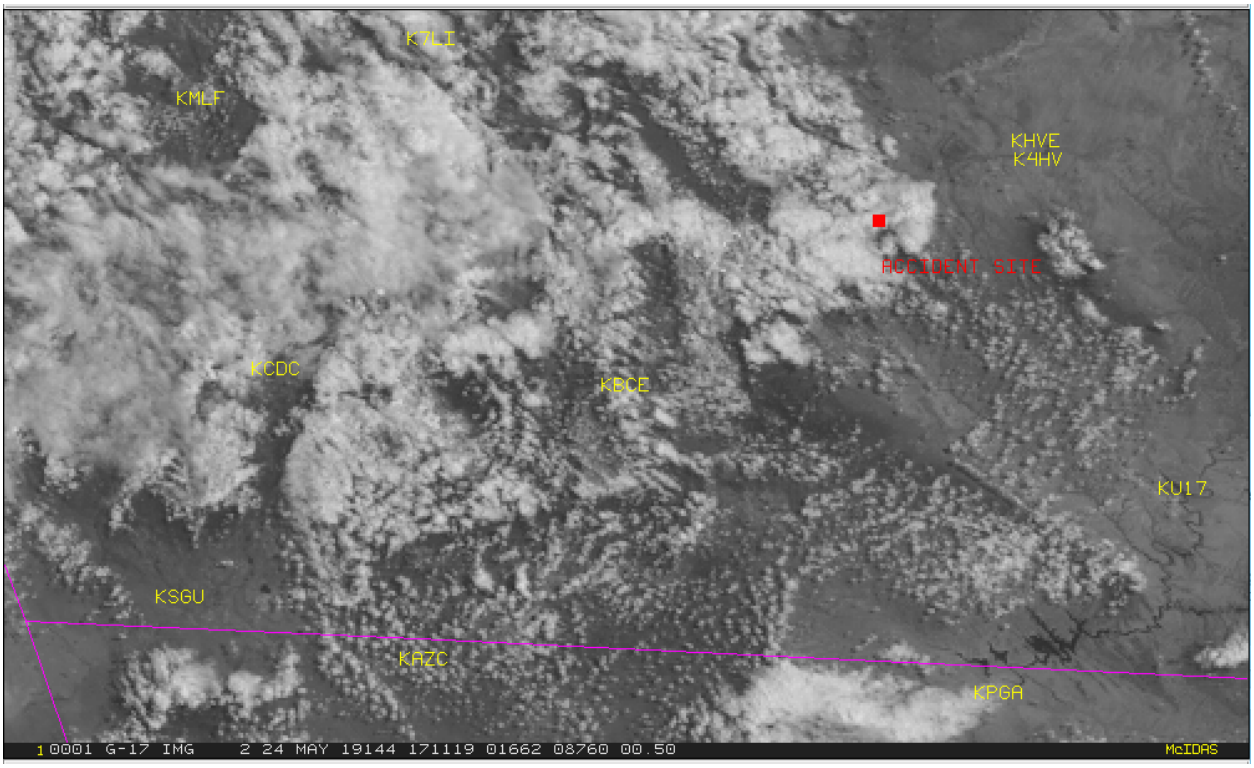

Figure 10 - GOES-17 visible image at 1111 MDT

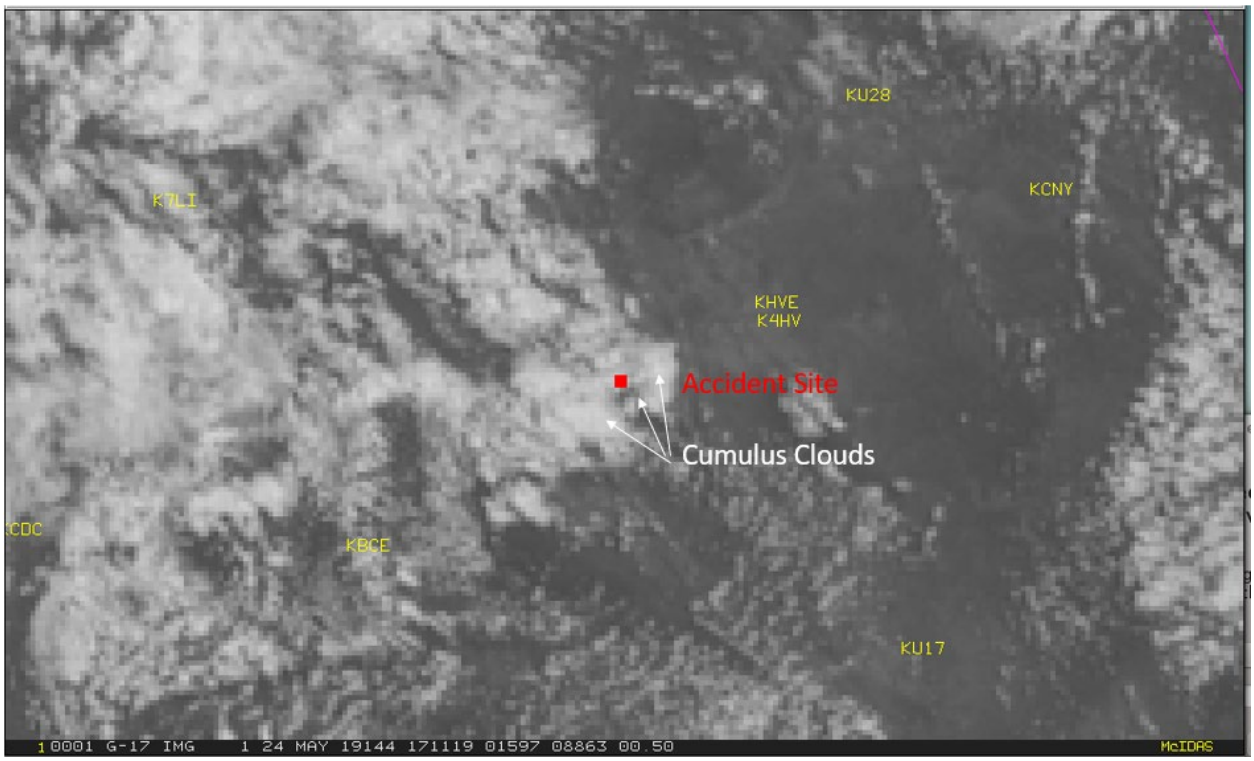

Figure 3 - GOES-17 visible image at 4X magnification for 1111 MDT

5.0 Weather radar Imagery

The closest NWS Weather Surveillance Radar 1988 Doppler (WSR-88D) was located approximately 84 miles west-southwest of the accident site in Cedar City (KICX), Utah. The level II archive data was obtained from the NCEI using the Hierarchical Data Storage System and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software to take a closer look for any significant precipitation echoes along the flight path.

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. During the period the KICX WSR-88D was operating in the precipitation mode, volume coverage pattern (VCP) 215 where the radar makes 15 different elevation scans in approximately every 6-minutes. The KICX WSR-88D with an antenna height of 10,757 ft. The following table provides the approximate elevation scan and the altitude of the beam over the accident site rounded to the nearest 10 ft.

Elevation	Center of Beam	Base of Beam	Top of Beam	Beam Width
0.22º	17,390 ft	13,160 ft	21,620 ft	8,460 ft
0.53º	20,150 ft	15,920 ft	24,390 ft	8,460 ft

Based on the beam height calculations the KICX 0.22º base reflectivity scan best covered the accident airplanes altitude between 13,800 and 14,400 ft immediately prior to the accident.

Reflectivity in dBZ provides basic intensity information and is referenced for pilots in Advisory Circular AC 00-24C - "Thunderstorm". The following table provides the basic reflectivity (dBZ) and echo intensity values. The FAA Air Route Traffic Control Center (ARTCC) have weather radar processors installed to allow controllers to display moderate, heavy, and extreme precipitation values according to the same reflectivity values.

Reflectivity (dBZ) Ranges	Weather Radar Echo Intensity Terminology
< 30 dBZ	Light
30 – 40 dBZ	Moderate
>40 – 50 dBZ	Heavy
>50 dBZ	Extreme

The flight track of N809SR was obtained from the Safety Board's Air Traffic Control Specialist working on the case and is included as attachment 1. The last radar contact of N809SR occurred at 1114:39 MDT with the aircraft reaching 14,400 ft before it was lost from radar. The accident site was located about 1/4 mile southwest of the last radar target.

Figures 12 and 13 are the KICXWSR-88D 0.22º base reflectivity image at 1110 MDT with the flight track of N809SR overlaid. The images depicted several small areas of light to moderate intensity echoes of 25 to 35 dBZ scattered over the area, with most of the echoes within 25 miles of the radar site in the range of 10 to 15 dBZ or very light intensity. The zoomed in image (figure 13) shows the flight track passing through one of these small cells or area of echoes with a maximum intensity of 25.5 dBZ immediately before the aircraft was lost off radar at 1114:38 MDT. A review of the area indicated that this small cell developed at 1056 MDT and reached an echo intensity of 25.5 dBZ before dissipating by 1129 MDT and was depicted on 2 different elevation scans to 0.53º.

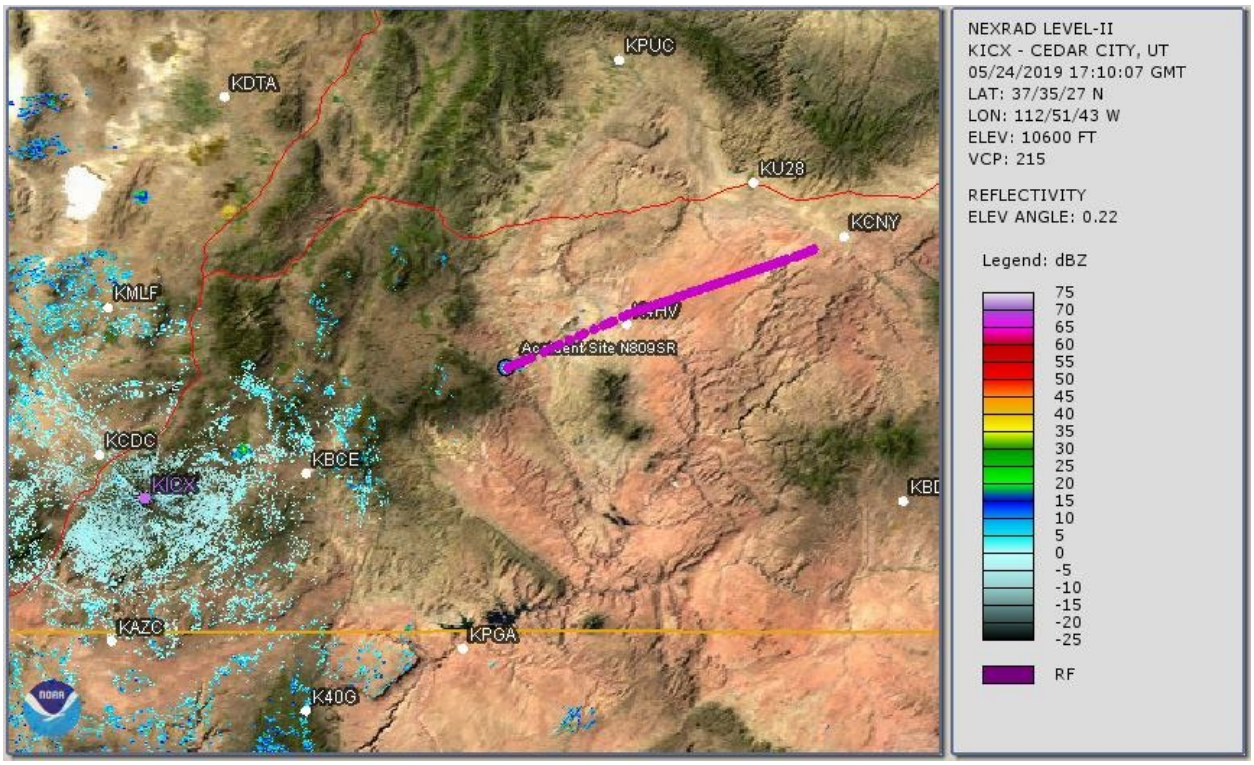

Figure 12– KICX WSR-88D 0.22º base reflectivity image at 1110 MDT

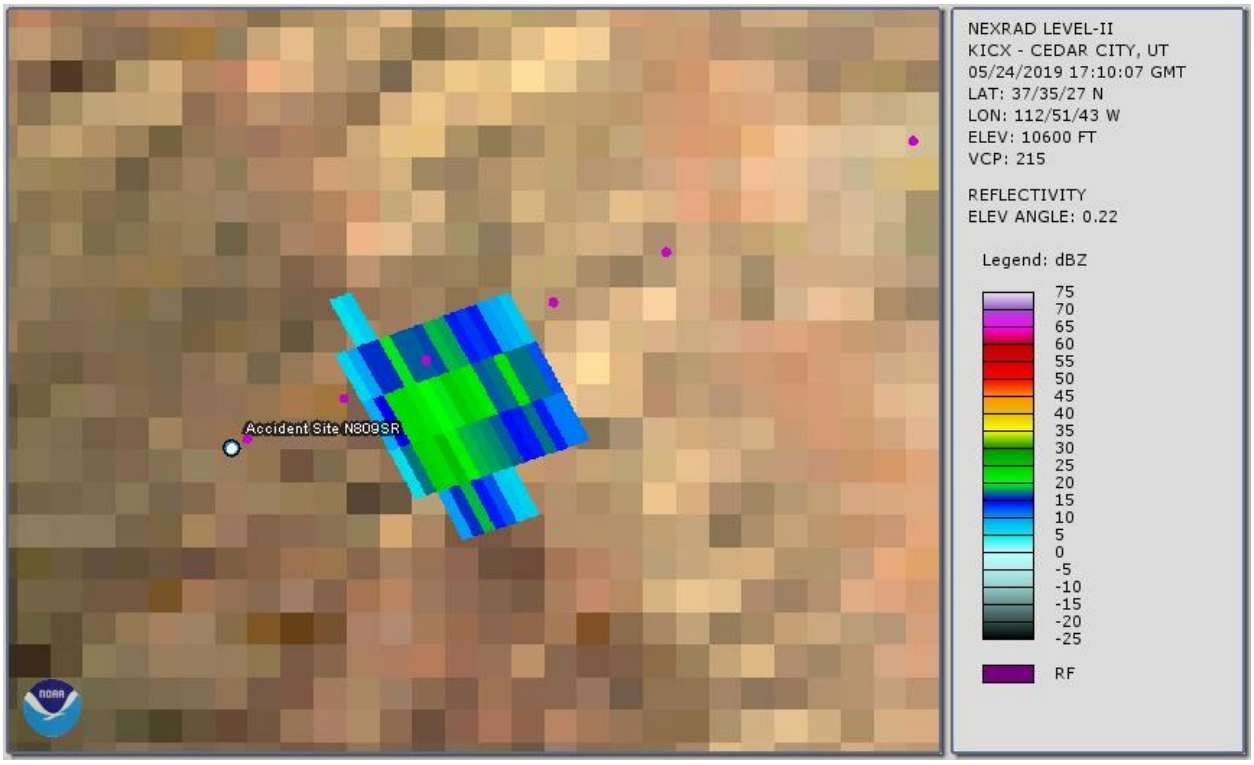

Figure 4 - KICX WSR-88D 0.22º base reflectivity image closeup over the flight track at 1110 MDT

6.0 Pilot Reports

A search of the pilot reports or PIREPs over the area indicated multiple reports of occasional light to moderate chop type turbulence above 30,000 ft. The only two reports below 18,000 ft relevant to the accident were the ones included below and are included in their original form with code and abbreviations, and then decoded in plain language.

LAS UA /OV LAS045035/TM 1345/FL120/TP C56X/TA M12/IC LGT CLR ICE

Las Vegas International Airport (LAS) routine pilot report (UA); Over – LAS VORTAC[6] 045° azimuth at a distance of 35 miles; Time – 0745 MDT; Altitude – 12,000 ft; Type aircraft – Cessna Citation light business jet; Temperature – minus 12° C; Icing – light clear type icing; Remarks – entered by Salt Lake City (ZLC) Center.

BCE UA /OV BCE045045/TM 1747/FL150/TP SR22/TA M11/IC LGT MIXED/RMK ZLC

Bryce Canyon Airport (BCE) routine pilot report (UA); Over – BCE VORTAC 045° azimuth at a distance of 45 miles; Time – 1147 MDT; Altitude – 15,000 ft; Type aircraft – Cirrus SR22 high performance single engine airplane; Temperature – minus 11° C; Icing – light mixed type icing; Remarks – entered by ZLC Center.

7.0 NWS Forecasts

The standard NWS forecasts and advisories issued for preflight planning and aviation users use issued surrounding the period were documented.

7.1 Terminal Aerodrome Forecast

The NWS Salt Lake City, Utah, Weather Forecast Office (WFO) was responsible for the issuance of the Terminal Aerodrome Forecast (TAF) for KBCE. A TAF is a concise statement of the expected meteorological conditions at an airport during a specified period (usually 24 hours). TAFs are valid for a 5 mile radius around an airport's center point. The forecasts issued surrounding the period relevant to the preflight planning and the time of the accident were as follows with clouds reported in agl heights.

AMD TAF KBCE 241505Z 2415/2512 15006KT P6SM VCSH SCT010 BKN023
FM241600 15006KT P6SM SCT025 BKN050
FM242000 22011KT P6SM VCSH SCT060 BKN090
FM250300 27005KT P6SM VCSH SCT060 BKN090=

The TAF available prior to the accident airplanes departure was an amended issued at 0905 MDT for KBCE and expected from 1000 through 1400 MDT a surface wind from 150° at 6 knots, visibility better than 6 miles, scattered clouds at 2,500 ft agl, ceiling broken at 5,000 ft. Rain showers were expected in the vicinity of the station prior to 1000 MDT and again after 1400 MDT. The next scheduled TAF was issued at 1120 MDT and continued to expect VFR conditions prevailing during the period and re-introduced the potential for rain showers in the vicinity of the station, and slight adjustment in the cloud heights.

[6] VORTAC - very-high frequency omnidirectional radio range/tactical air navigation beacon which provides azimuth and distance from the station.

TAF KBCE 241720Z 2418/2518 15008KT P6SM VCSH SCT020 BKN040
FM242000 22008KT P6SM VCSH SCT030 BKN060
FM250300 27006KT P6SM SCT060 BKN150=

7.2 Winds and Temperatures Aloft Forecast

The NWS Winds and Temperature Aloft forecast current for the route of flight is included below. The forecast was valid at 1200 MDT and for use between 0800 and 1500 MDT.

WINDS ALOFT FORECASTS
DATA BASED ON 241200Z
VALID 241800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	*3000*	*6000*	*9000*	*12000*	*18000*	*24000*	*30000*	*34000*	*39000*	*45000*	*53000*
GJT			*2311+02*	*2218-05*	*2428-19*	*2437-31*	*238542*	*239150*	*238252*	*235153*	*203057*
BCE				*2406-06*	*2519-18*	*2628-29*	*244443*	*234852*	*235854*	*234354*	*221956*
LAS		*9900+08*	*9900+01*	*9900-05*	*2811-16*	*2625-26*	*252844*	*242552*	*243255*	*243356*	*241757*

The stations along the route of flight were Grand Junction (GJT), Colorado, Bryce Canyon (BCE), Utah, and Las Vegas (LAS), Nevada. The forecast most representative of the wind segment near the accident was for BCE, which expected at 12,000 ft a wind from 240° at 6 knots with a temperature of -6° C, and at 18,000 ft the wind from 250° at 19 knots with a temperature of -18° C.

7.3 Graphic Forecast for Aviation

The Graphic Forecast for Aviation (GFA) replaced the Area Forecast for providing enroute weather conditions and cloud cover with bases and tops. The GFA static forecast for "Aviation Surface Forecast" issued by the AWC during the period for wind, visibility, and weather phenomena, with the Graphic AIRMET[7] (G-AIRMET) Sierra for IFR conditions and G-Tango for strong gusty surface winds are included as figures 14 and 15 with the general direct route and the accident site overlaid. The forecasts for 0900 MDT expected light westerly winds of 5 knots, visibility better than 5 miles with scattered rain showers to snow showers, and by 1200 MDT winds from the south at 5 to 10 knots, visibility better than 5 miles with chance of scattered rain showers and thunderstorms over the region.

[7] Airmen's Meteorological Information (AIRMET) is a concise description of weather phenomena that are occurring or may occur (forecast) over an area of at least 3,000 square miles that may affect aircraft safety. AIRMETs are issued for moderate turbulence or icing, sustained surface winds of 30 knots or more, Low-Level Wind Shear (LLWS), widespread restricted visibility below 3 statute miles and/or ceilings less than 1,000 ft agl or IFR conditions and mountain obscuration conditions.

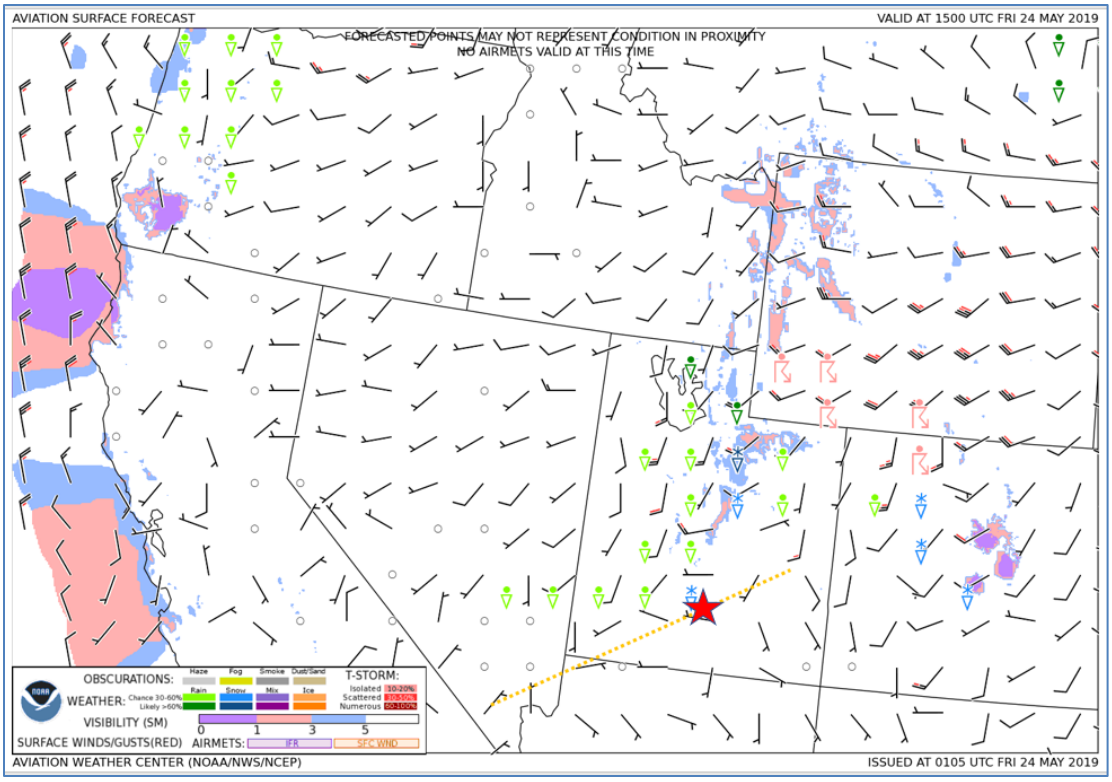

Figure 5 - Graphic Forecast for Aviation Surface Forecast valid for 0900 MDT

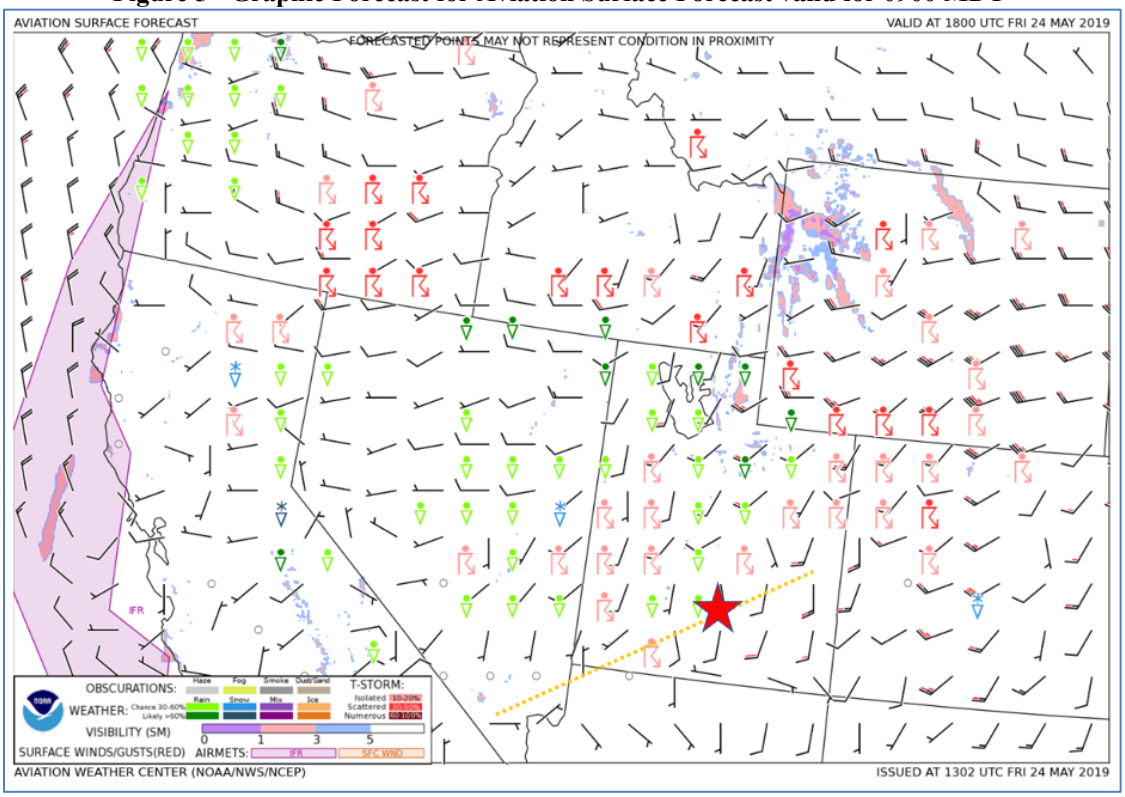

Figure 6 - Graphic Forecast for Aviation Surface Forecast valid for 1200 MDT

The GFA "Aviation Cloud Forecast" provided cloud coverage, bases, layers, and tops with the G-AIRMET Sierra for mountain obscuration and G-AIRMET Zulu for icing conditions valid for 0900 to 1000 MDT is included as figure 16 and for 1000 to 1200 MDT as figure 17. The GFA cloud forecast for 1000 MDT expected a few to scattered clouds at 8,000 ft with tops to 13,000 ft and was located south of an area of broken to overcast cloud layer, with the G-AIRMET for mountain obscuration extended immediately west of the accident site and the G-AIRMET for icing conditions over the area. The forecast valid for 1200 MDT continued to expect a few to scattered clouds at 11,000 ft over the area, with the G-AIRMETs for icing over the route of flight.

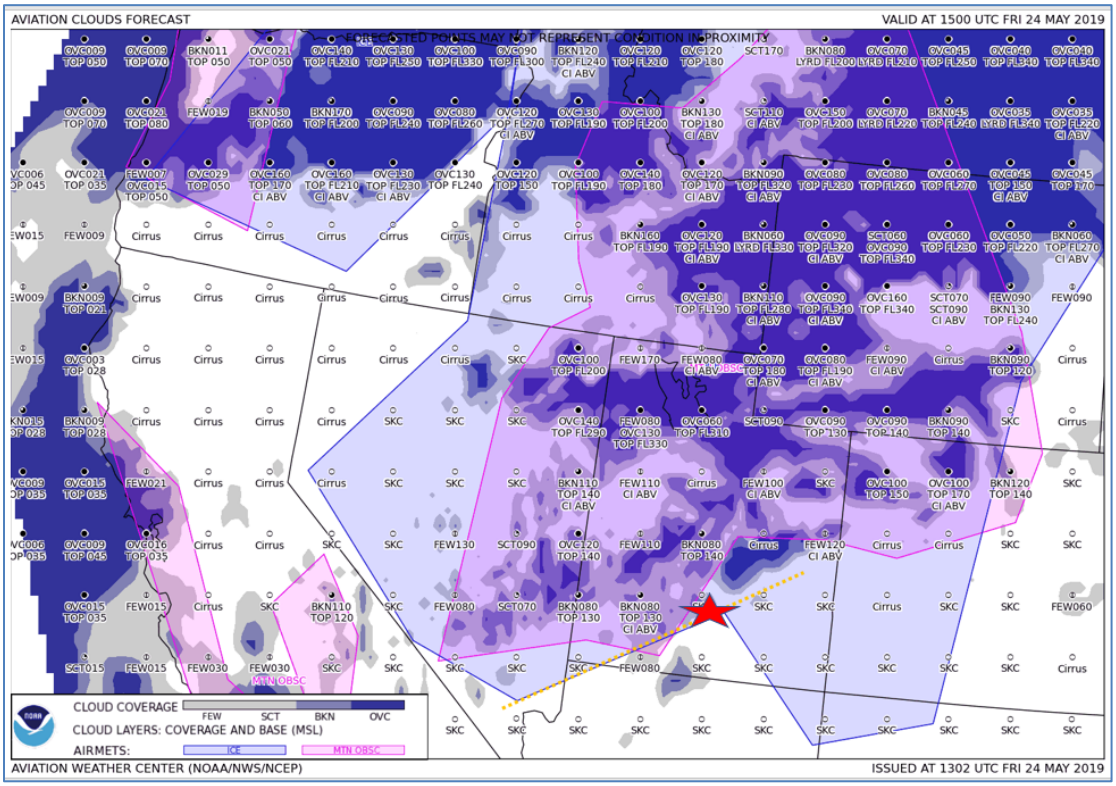

Figure 7 - Graphic Forecast for Aviation Cloud Forecast valid for 0900 MDT

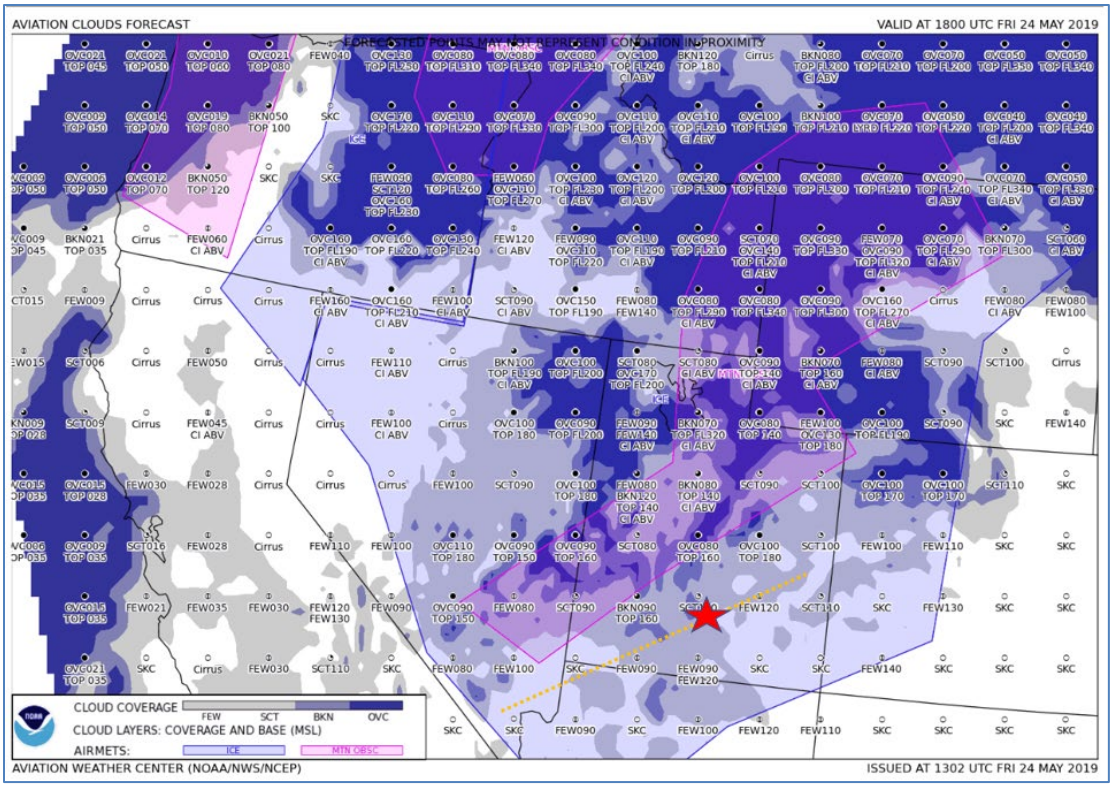

Figure 8 - Graphic Forecast for Aviation Cloud Forecast valid for 1200 MDT

7.4 Current Icing Product

The National Center for Atmospheric Research (NCAR) located in Boulder, Colorado, was contacted and requested to re-run the Current Icing Product (CIP) numerical model on the day of the accident for 1100 MDT and 1200 MDT to determine what the potential icing conditions were being depicted and forecast at the NWS AWC website. Figures 18 through 21 are the CIP data for 1100 MDT providing the general icing probability and icing severity category composite over the region, and the specific icing probabilities and icing severity categories for 14,000 ft and 15,000 ft, with the accident site marked by the black dot. Figures 22 through 25 are the same CIP images for 1200 MDT.

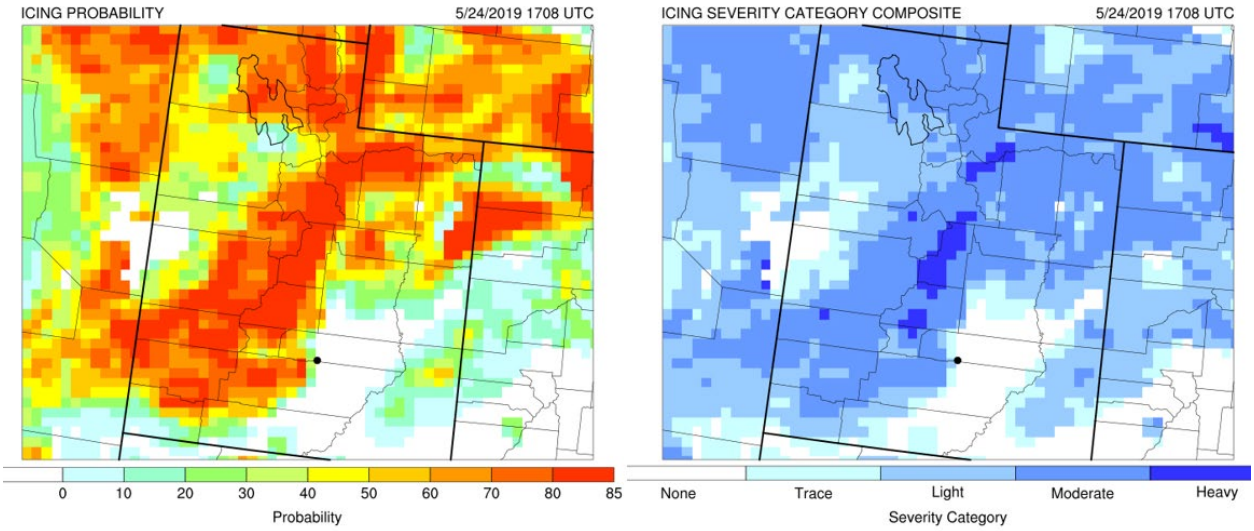

Figure 9 - CIP Maximum Icing Potential and Severity Category for 1100 MDT

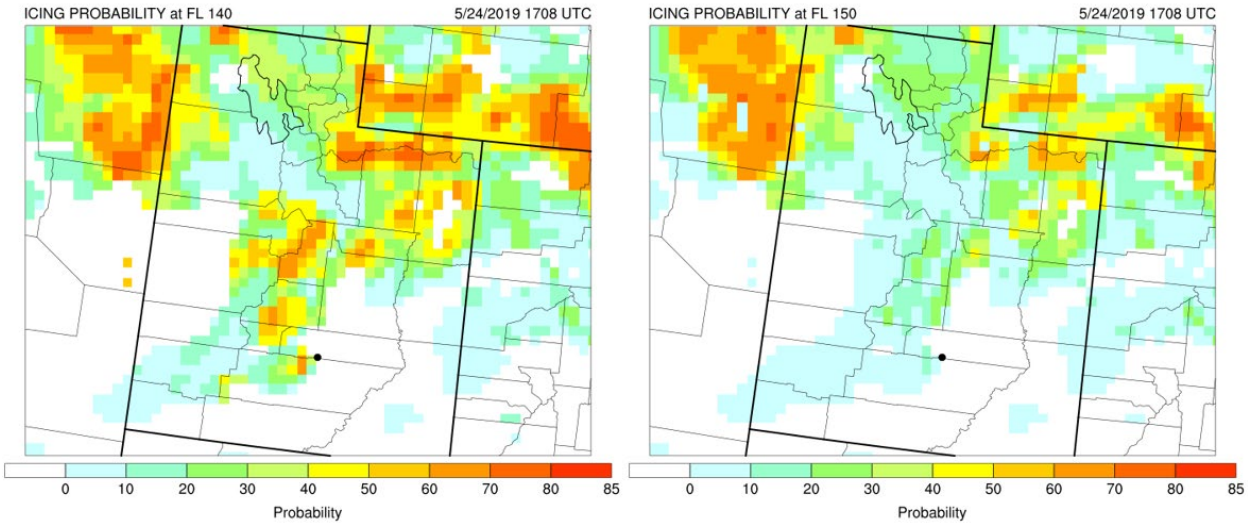

Figure 10 - CIP Icing Probability for 14,000 and 15,000 ft issued at 1100 MDT

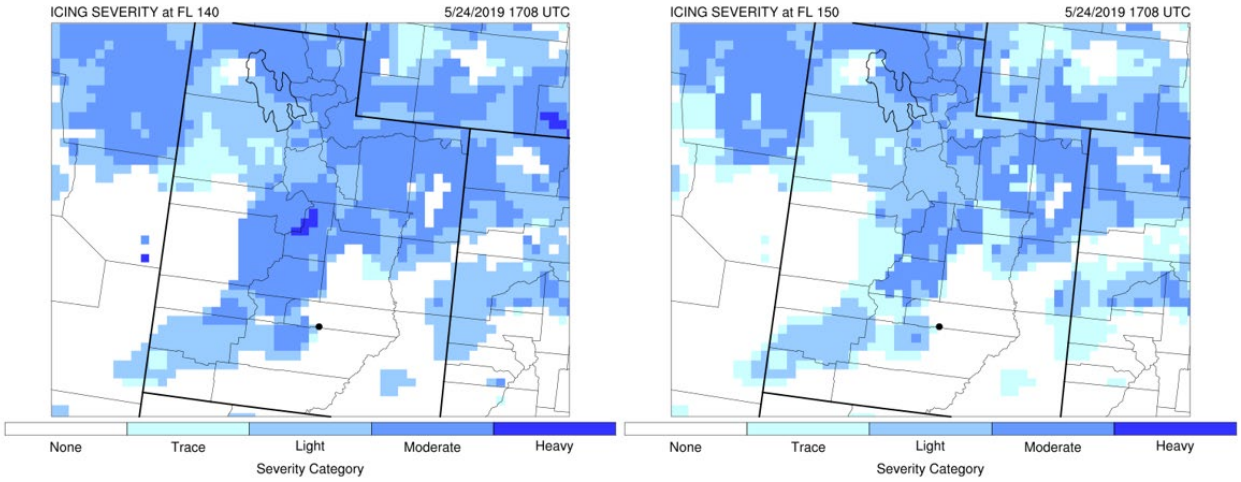

Figure 20- CIP Icing Severity category for 14,000 ft and 15,000 ft at 1100 MDT

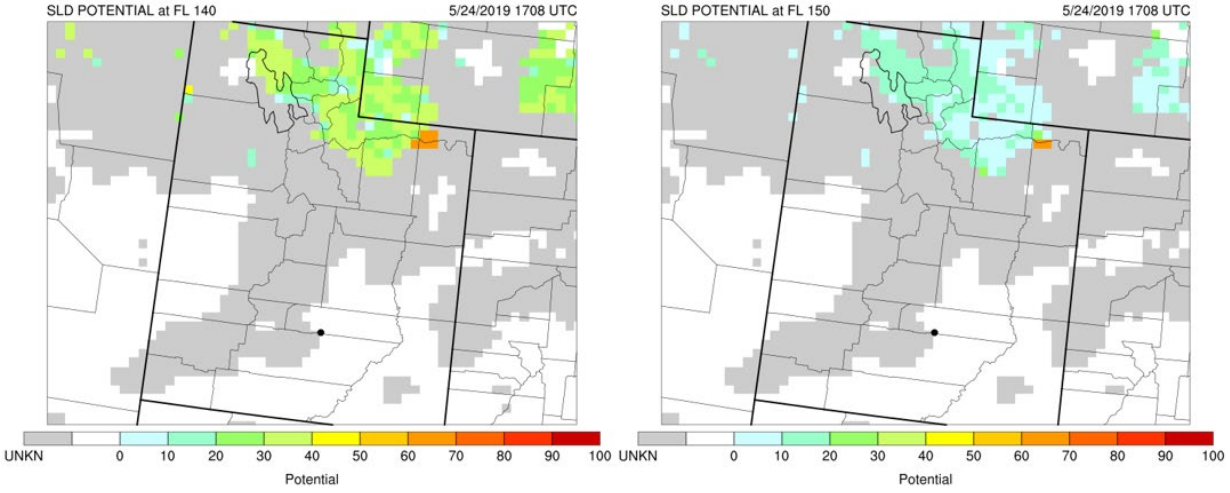

Figure 11 - CIP SLD Potential for 14,000 ft and 15,000 ft at 1100 MDT

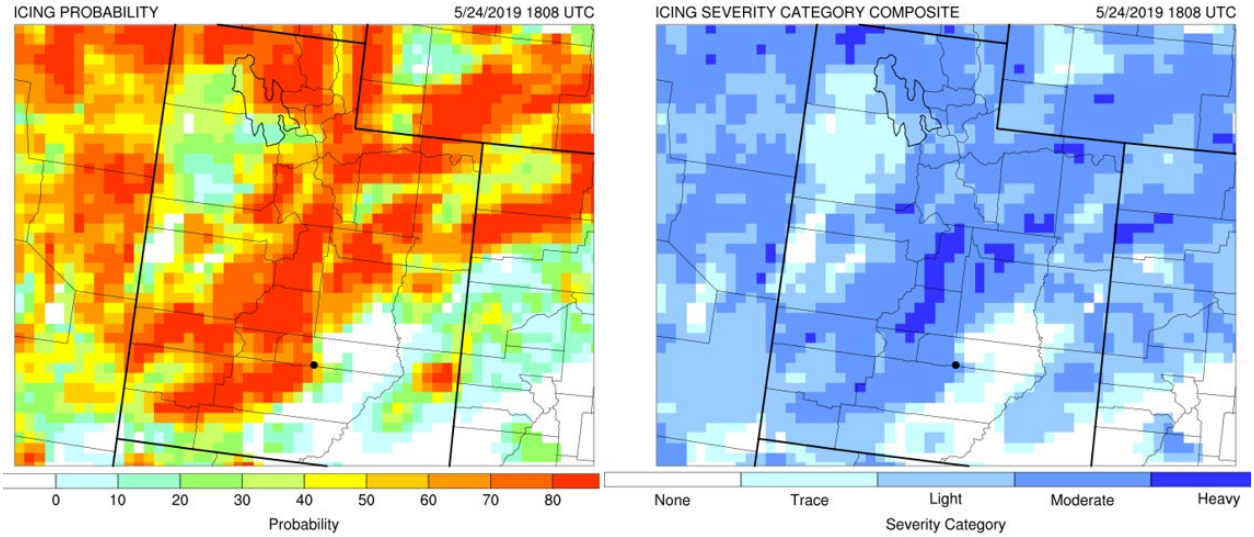

Figure 12 - CIP Maximum Icing Probability and Severity Category for 1200 MDT

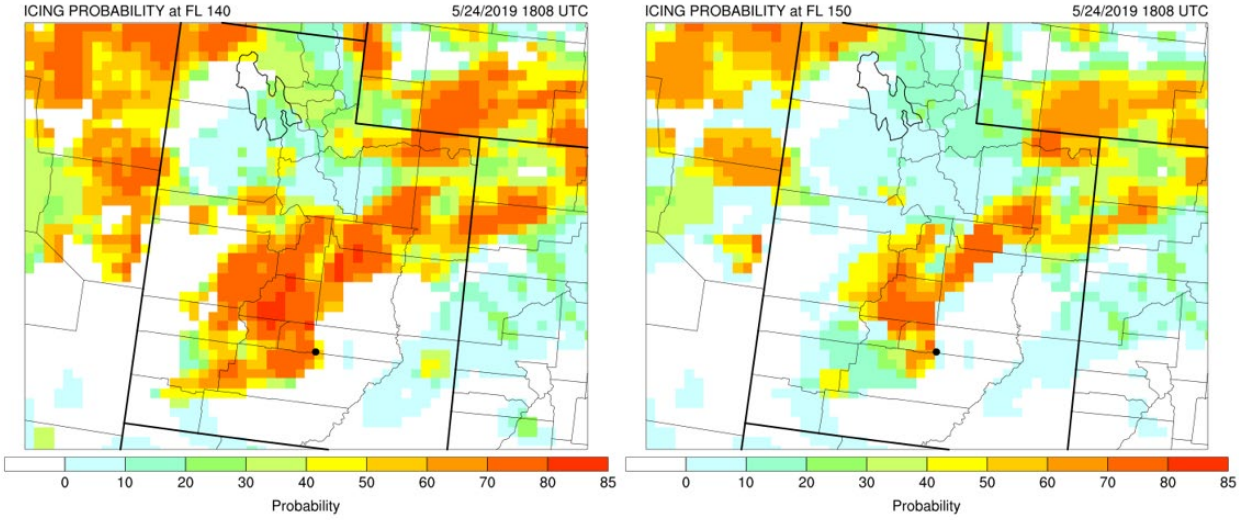

Figure 13 - CIP Icing Probability for 14,000 ft and 15,000 ft at 1200 MDT

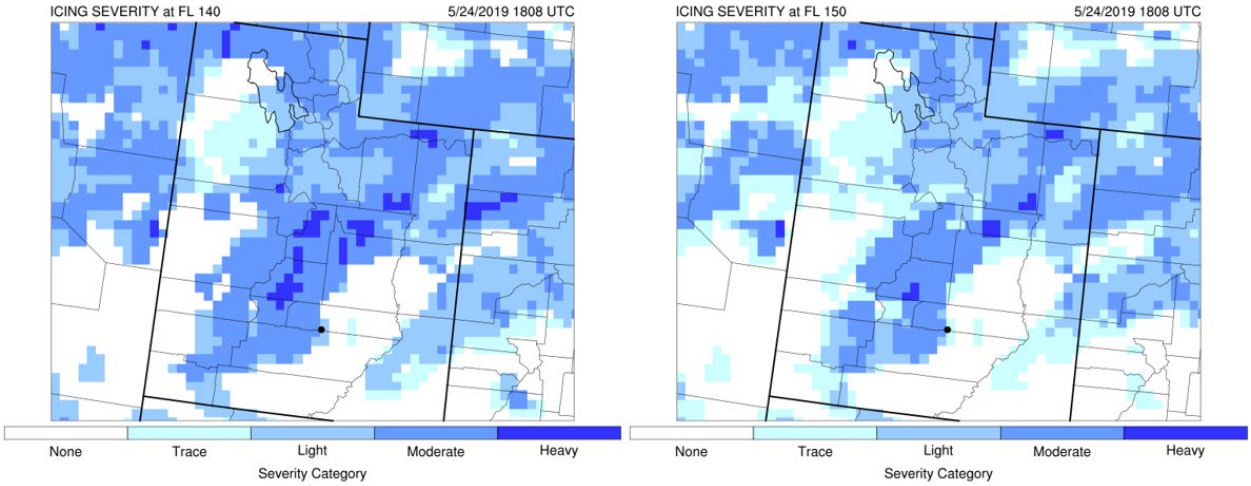

Figure 14 - CIP Icing Severity for 14,000 ft and 15,000 ft at 1200 MDT

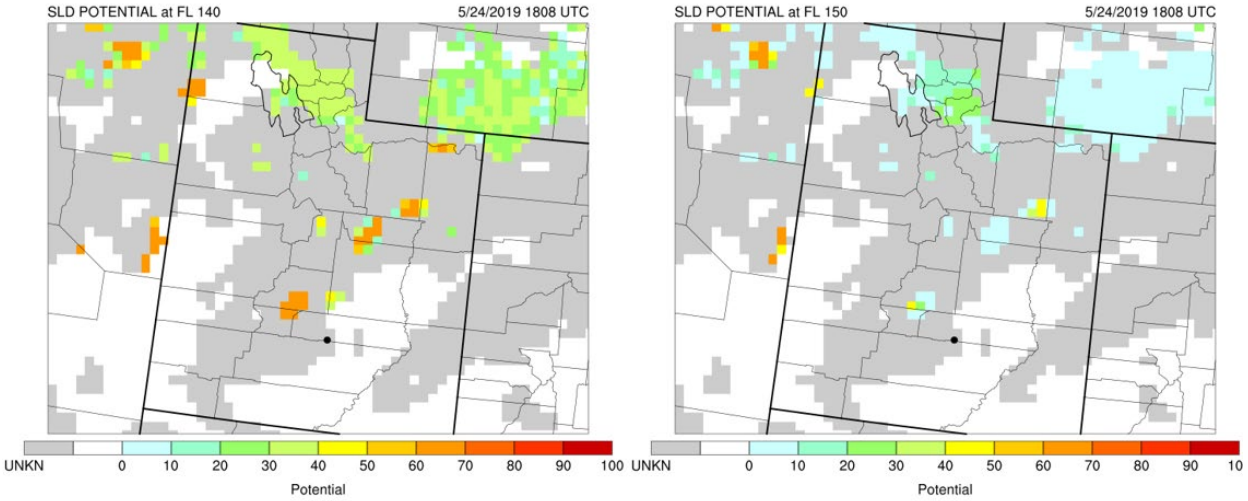

Figure 15 - CIP SLD Potential at 14,000 ft and 15,000 ft at 1200 MDT

8.0 NWS Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA ARTCCs. There are four basic types of inflight aviation weather advisories: the Significant Meteorological Information (SIGMET), the Convective SIGMET, the AIRMET, and the Center Weather Advisory (CWA). Inflight 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. The following advisories were current during the period.

The NWS had AIRMETs Sierra current for mountain obscuration conditions over the mountains immediately west of LAS. AIRMET Tango for moderate turbulence between 24,000-34,000 ft (not applicable for the accident airplanes cruising level), and AIRMET Zulu for moderate icing between the freezing level 7,000/9,000 ft to 21,000 ft. The accident site was located within the boundaries of that advisory. Figures 26 and 27 are the G-AIRMET Sierra and G-AIRMET Zulu for icing current over the accident site.

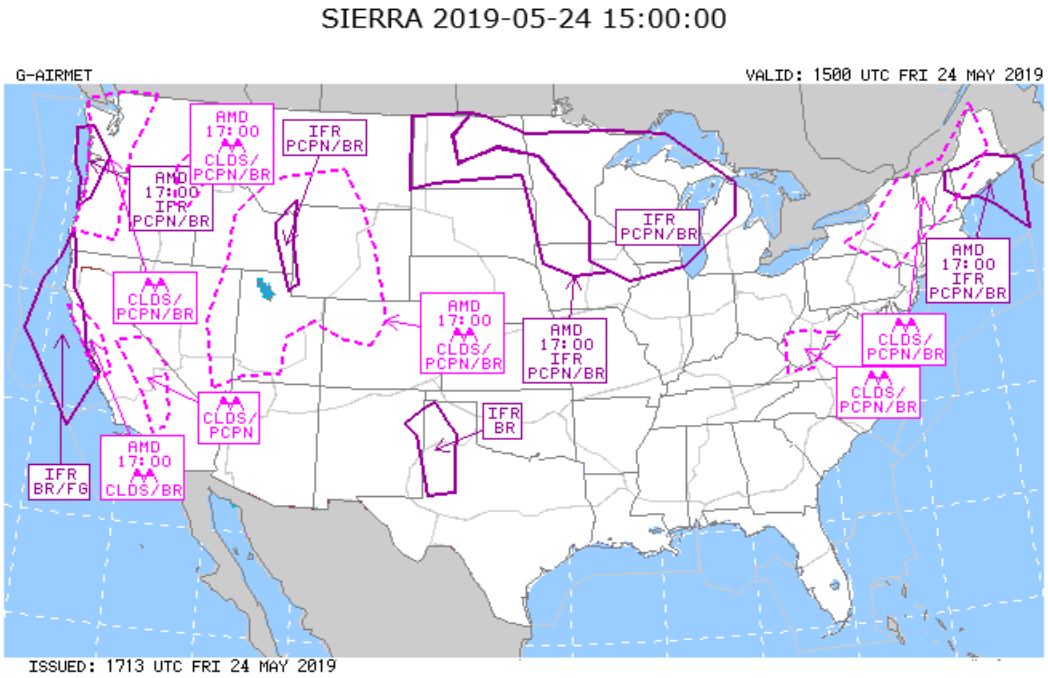

Figure 16 - G-AIRMET Sierra for mountain obscuration valid for the period

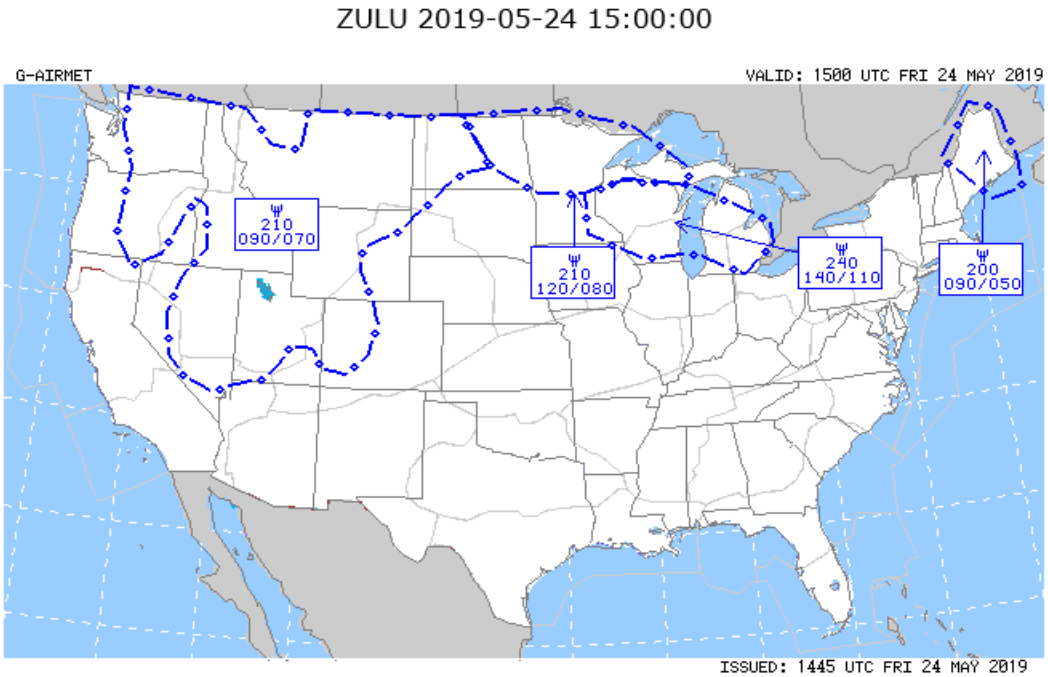

Figure 27- G-AIRMET Zulu for icing conditions between 7,000 to 21,000 ft

9.0 Preflight Weather Briefing

A search of the FAA contract Automated Flight Service Station (AFSS) provider Leidos indicated that they had no record of any contact with the pilot on the day of the accident, while one of the third party venders ForeFlight did provide services. The accident pilot filed an instrument flight rules (IFR) plan through a ForeFlight Mobile link on his computer and received a corresponding route briefing, which is included as attachment 2. He did not specifically request or access any additional weather imagery or briefing material other than what was included in the briefing.

The flight plan estimated a departure time from Moab, UT, at 1000 MDT with an estimated time enroute of 2:13, a requested cruising altitude of 14,000 ft, and 3:30 of fuel on board. No alternate airport was listed for the flight.

10.0 Astronomical Data

The United States Naval Observatory website provided the following astronomical conditions on May 24, 2019 over Grover, Utah. The time of the accident has been added in italic bold print for reference.

Sun	Time
Begin civil twilight	0537 MDT
Sunrise	0608 MDT
Accident	***1116 MDT***
Sun Transit	1322 MDT
Sunset	2036 MDT
End civil twilight	2107 MDT

F. LIST OF ATTACHMENTS

Attachment 1 - Flight Track of N809SR

Attachment 2 - Generated ForeFlight route weather briefing

Submitted by:

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Don Eick
Senior Meteorologist