



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 7, 2022

Specialist's Factual Report

METEOROLOGY

CEN22FA069

A. ACCIDENT

Location: Steamboat Springs, Colorado
Date: December 10, 2021
Time: 1809 mountain standard time (MST)
0109 universal coordinated time (UTC) on December 11, 2021
Airplane: Piper PA-46-500TP; Registration: N744Z

B. METEOROLOGY SPECIALIST

Donald Eick
Senior Meteorologist
National Transportation Safety Board
Washington, D.C.

C. 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 remotely, collecting data from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). All times are reported as MST based upon the 24-hour clock, local time is -7 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.

This report documents the factual conditions associated with the weather conditions surrounding the flight. The accident site is based on the coordinates of latitude 40.459893° N, longitude 106.85728° W, at an elevation of 8,172 ft on the side of Quarry Mountain.

D. FACTUAL 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 (NCEP) and the WPC located in College Park, Maryland. These are the base products used in describing weather features and in the creation of forecasts and warnings. Reference to these charts can be found in the joint NWS and Federal Aviation Administration (FAA) Advisory Circular “Aviation Weather Services”, AC 00-45H change 2¹.

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart for 1700 CST (0000Z on December 11, 2021) with the general topography and the approximate accident site marked by the red star is included as figure 1. The chart depicted a low-pressure system at 993-hectopascals² over northern Missouri with a cold front extending southwestward into Kansas, Oklahoma, the Texas Panhandle, and then into southern New Mexico. A cold-core high-pressure³ system at 1027-hPa was located over Nevada with a ridge of high-pressure extending eastward into Colorado. The accident site was located on the cold air side of the front and north of the high-pressure ridge’s axis. The station models surrounding the accident site depicted westerly winds, with scattered to overcast clouds, with temperatures in the teen’s degrees Fahrenheit (F). Several stations in the higher elevations of the Rocky Mountains to the southeast through south of the accident site depicted light to heavy snow. Snow was also depicted over southeastern Wyoming and most of Nebraska and Kansas.

¹ https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1030235

² Hectopascals (hPa) is the standard term for reporting sea-level pressure and is interchangeable with the former term millibar with the same units. Standard sea-level pressure is 1013.25-hPa at 59° Fahrenheit (F) or 15° Celsius (C).

³ A cold-core high is one which the temperature on the horizontal plane decreases towards the center of the high. The pressure decreases rapidly with height. In the vertical, cold-core high’s slope towards the cold air aloft. Because these highs are quite shallow, it is common for an upper level low-pressure system to exist above a cold-core high.

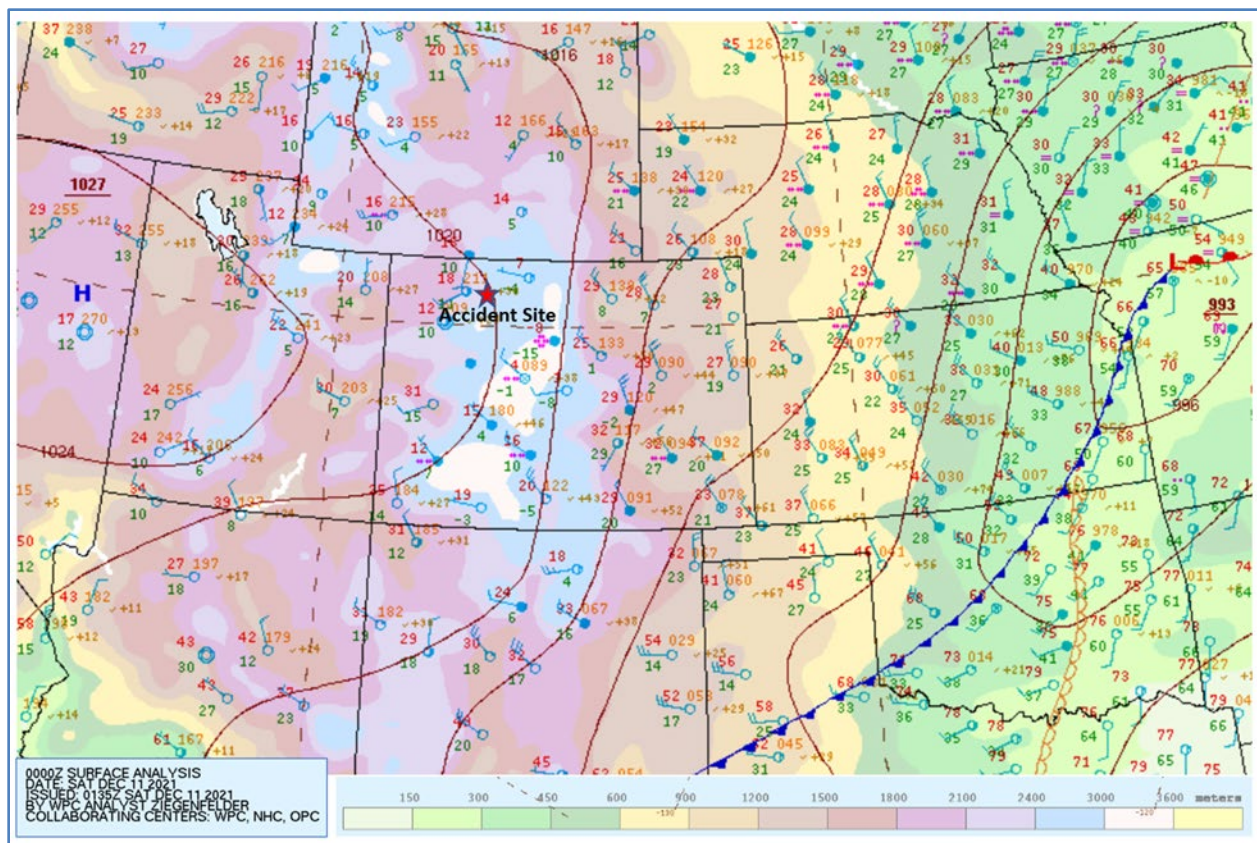


Figure 1 - NWS Surface Analysis Chart for 1700 MST centered over Colorado.

1.2 National Reflectivity Image

A regional view of the NWS National Composite Radar Mosaic for 1805 MST centered over northern Colorado with the approximate accident site marked by the red star and the two closest weather reporting locations is included as figure 2. The image depicted no significant echoes over the accident site with only light reflectivities of 0 to 15 dBZ about 40 miles east of the accident site over the eastern slopes of the Rockies. The radars in the area were unable to detect any low-level echoes over the accident area due to the distance from the Denver WSR-88D radar site and the high terrain surrounding the accident site.

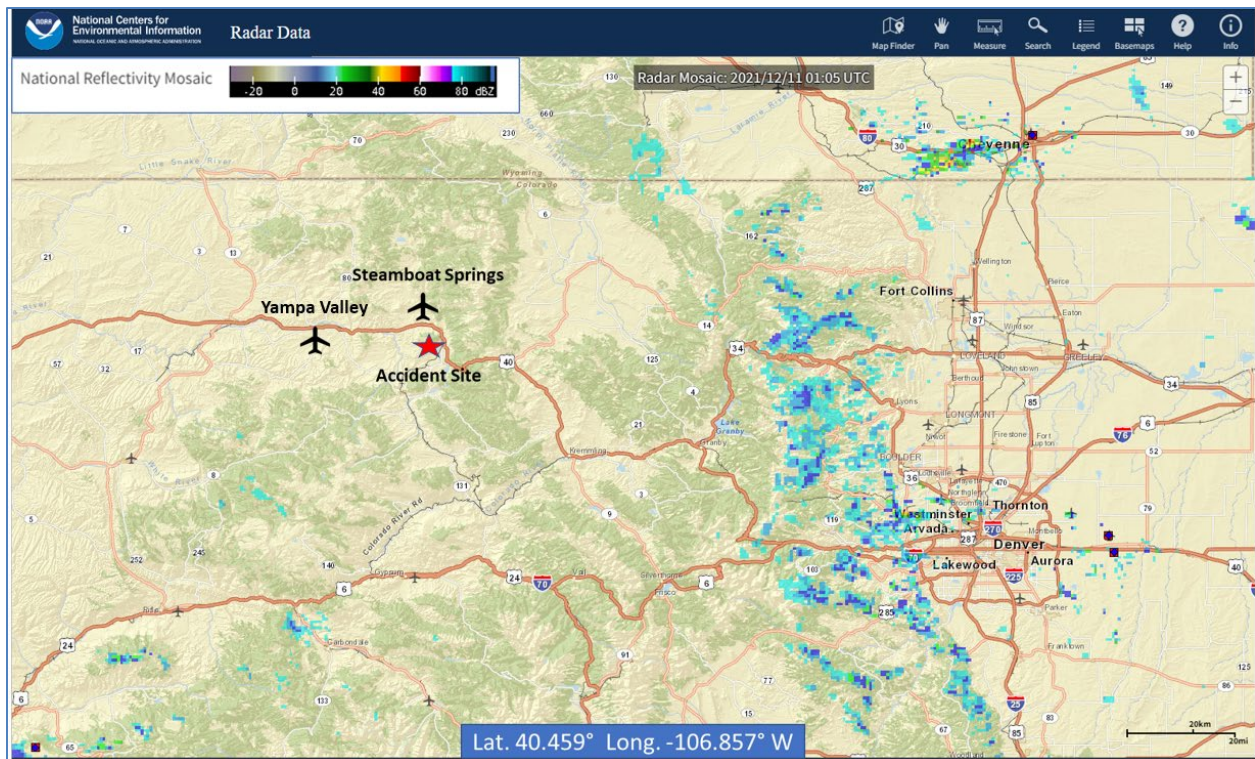


Figure 2 - National Reflectivity Mosaic for 1805 MST with accident site marked by the red star.

2.0 Surface Observations

The official observations issued surrounding the accident site were documented using Aviation Routine Weather Reports (METAR⁴) and Aviation Select Special Weather Reports (SPECI). Cloud heights are reported above ground level (agl) in the following section, and the magnetic variation was estimated at 9° east based on the latest sectional chart for the area.

2.1 Steamboat Springs, Colorado

The accident airplane was on approach into Steamboat Springs Airport/Bob Adams Field (KSBS), in Steamboat Springs, Colorado, when the accident occurred. The airport was located approximately 7 miles north of the accident site at an elevation of 6,882 ft. and had an Automated Weather Observation System (AWOS), which issued observations every 20-minutes and whose reports were not augmented by any human observer. The following conditions were reported at the approximate time the accident airplane was cleared for the approach and the accident.

⁴ METAR is an abbreviation for Meteorological Aerodrome Report.

Routine weather observation for KSBS at 1755 MST, automated, wind from 260° at 5 knots, visibility 1 statute mile, ceiling overcast at 1,200 ft agl, temperature -9° C (15° F), dew point temperature -9° C (15° F), altimeter setting 29.95 inches of mercury (inHg). Remarks; automated station without a precipitation discriminator⁵, temperature -9.2° C, dew point temperature -9.2° C.

The general flight categories⁶ and raw METAR observations surrounding the period from 1300 through 2015 MST were as follows. The KSBS lists nonprecision approach procedures⁷ for the airport.

MVFR METAR KSBS 102015Z AUTO 23010G15KT 3SM SCT016 BKN026 OVC050 M09/M11 A2979
RMK AO1 T10901107=
LIFR METAR KSBS 102035Z AUTO 24007KT 1/2SM BKN006 OVC011 M09/M10 A2980 RMK AO1
T10881099=
IFR METAR KSBS 102055Z AUTO 25008KT 1 1/2SM SCT006 OVC011 M09/M10 A2981 RMK AO1
T10861100=
MVFR METAR KSBS 102115Z AUTO 24006KT 5SM SCT011 BKN024 OVC048 M08/M10 A2982 RMK
AO1 T10851105=
IFR METAR KSBS 102135Z AUTO 23008KT 2 1/2SM SCT007 BKN017 OVC025 M09/M10 A2984 RMK
AO1 T10861097=
MVFR METAR KSBS 102155Z AUTO 24010G17KT 7SM SCT013 BKN021 OVC046 M09/M11 A2985
RMK AO1 T10861114=
MVFR METAR KSBS 102215Z AUTO 24011KT 4SM SCT021 BKN041 OVC048 M09/M10 A2986 RMK
AO1 T10891104=
VFR METAR KSBS 102235Z AUTO 25013G19KT 10SM SCT024 BKN042 OVC048 M09/M12 A2987
RMK AO1 T10861125=
VFR METAR KSBS 102255Z AUTO 24006KT 10SM BKN044 OVC050 M09/M11 A2989 RMK AO1
T10921115=
VFR METAR KSBS 102315Z AUTO 23006KT 7SM BKN045 OVC050 M09/M11 A2991 RMK AO1
T10921111=
VFR METAR KSBS 102335Z AUTO 22004KT 7SM SCT026 SCT041 OVC047 M09/M11 A2992 RMK
AO1 T10931110=
VFR METAR KSBS 102355Z AUTO 24005KT 10SM BKN047 OVC060 M09/M10 A2993 RMK AO1
T10951105 11085 21095=

⁵ The precipitation discriminator allows the system to determine precipitation type, without it the system does not report weather type.

⁶ 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 the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration 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.

⁷ According to the Airport Facility Directory for KSBS the airport has a runway 14/32 at 4,452 ft x 100 ft, with non-precision approach procedures runway to 32. The RNAV (GPS)-E lists the category A minimums of a decision height of 8,140 ft msl (1258 ft agl) and visibility 1 ¼ mile for the approach.

IFR METAR KSBS 110015Z AUTO 25006KT 1SM SCT010 OVC016 M09/M09 A2994 RMK AO1
T10951095=
IFR METAR KSBS 110035Z AUTO 26006KT 1SM OVC014 M09/M09 A2995 RMK AO1 T10921092=
IFR **METAR KSBS 110055Z AUTO 26005KT 1SM OVC012 M09/M09 A2995 RMK AO1**
T10921092=
Accident 0109Z
IFR METAR KSBS 110115Z AUTO 24009KT 1SM OVC014 M09/M09 A2996 RMK AO1 T10911092=
IFR METAR KSBS 110135Z AUTO 26010KT 2 1/2SM SCT014 SCT020 OVC025 M09/M11 A2997 RMK
AO1 T10931106=
MVFR METAR KSBS 110155Z AUTO 25009KT 5SM BKN024 BKN030 BKN035 M10/M11 A2998 RMK
AO1 T10981112=
MVFR METAR KSBS 110215Z AUTO 25009KT 7SM SCT011 BKN022 BKN036 M10/M12 A3000 RMK
AO1 T11001117=
MVFR METAR KSBS 110235Z AUTO 26009KT 5SM SCT011 BKN042 OVC055 M10/M12 A3000 RMK
AO1 T10971117=
MVFR METAR KSBS 110255Z AUTO 27008KT 7SM BKN030 OVC039 M10/M12 A3002 RMK AO1
T10961117=
MVFR METAR KSBS 110315Z AUTO 25008KT 5SM BKN029 OVC037 M10/M12 A3002 RMK AO1
T10961116=

2.2 Walton Peak, Colorado

The next closest weather reporting facility to the accident site was the Walton Peak (KC07) AWOS, which was located approximately 10 miles southeast of the accident site near the summit of the Walton Peak at an elevation of 10,577 ft. The AWOS is part of the Department of Colorado weather camera program with a co-located AWOS system and reported the following conditions.

Weather observation at 1755 MST for KC07, automated, wind from 280° at 8 knots gusting to 18 knots, wind 250 variable 310, altimeter 29.80 inHg. Remarks; automated station with a precipitation discriminator, precipitation identifier information not available (PWINO).

The general flight conditions and raw observations surrounding the period were as follows. After 1215 MST, the KC07 precipitation discriminator that reports visibility and type of precipitation failed and resulted in the visibility and weather being omitted from the reports thereafter. After 1515 MST, the reports indicated that the sky conditions also went missing, thus unknown flight categories (UNK) are indicated below. An examination of early reports from 0000 through 1155 MST reported moderate to heavy snow occurring during that period.

LIFR METAR KC07 101855Z AUTO 28011G16KT 1/4SM SN OVC001 A2962 RMK AO2
LIFR METAR KC07 101915Z AUTO 28009G15KT OVC001 A2961 RMK AO2 PWINO
LIFR METAR KC07 101935Z AUTO 28009G17KT 210V300 OVC001 A2961 RMK AO2 PWINO
LIFR METAR KC07 101955Z AUTO 27010G19KT 230V300 OVC001 A2961 RMK AO2 PWINO
LIFR METAR KC07 102015Z AUTO 29012G20KT OVC001 A2961 RMK AO2 PWINO
LIFR METAR KC07 102035Z AUTO 28010G19KT 240V300 OVC001 A2962 RMK AO2 PWINO
LIFR METAR KC07 102055Z AUTO 28006G21KT OVC001 A2965 RMK AO2 PWINO

LIFR METAR KC07 102115Z AUTO 29010G20KT 240V310 OVC001 A2966 RMK AO2 PWINO
 LIFR METAR KC07 102135Z AUTO 28010G21KT 220V310 OVC001 A2968 RMK AO2 PWINO
 LIFR METAR KC07 102155Z AUTO 28010G20KT 240V310 OVC001 A2969 RMK AO2 PWINO
 LIFR METAR KC07 102215Z AUTO 30010G18KT BKN001 A2970 RMK AO2 PWINO
 UNK METAR KC07 102235Z AUTO 30009G19KT 230V340 A2971 RMK AO2 PWINO
 UNK METAR KC07 102255Z AUTO 29008G24KT 240V340 A2973 RMK AO2 PWINO
 UNK METAR KC07 102315Z AUTO 29010G17KT 270V330 A2974 RMK AO2 PWINO
 UNK METAR KC07 102335Z AUTO 28006KT A2976 RMK AO2 PWINO
 UNK METAR KC07 102355Z AUTO 31008G19KT A2977 RMK AO2 PWINO
 UNK METAR KC07 110015Z AUTO 29008G15KT 250V340 A2978 RMK AO2 PWINO
 UNK METAR KC07 110035Z AUTO 28007G16KT 200V320 A2979 RMK AO2 PWINO
UNK METAR KC07 110055Z AUTO 28008G18KT 250V310 A2980 RMK AO2 PWINO
Accident 0109Z
 UNK METAR KC07 110115Z AUTO 28007G16KT A2981 RMK AO2 PWINO
 UNK METAR KC07 110135Z AUTO 29009G19KT 260V320 A2982 RMK AO2 PWINO
 UNK METAR KC07 110155Z AUTO 30007G21KT A2982 RMK AO2 PWINO
 UNK METAR KC07 110215Z AUTO 30007G14KT 250V360 A2982 RMK AO2 PWINO
 UNK METAR KC07 110235Z AUTO 28009G17KT 230V340 A2983 RMK AO2 PWINO

2.3 Hayden, Colorado

The next closest weather reporting facility was Yampa Valley Airport (KHDN), Hayden, Colorado, which was located approximately 16 miles west of the accident site and KSBS at an elevation of 6,606 ft. KHDN was also listed as the next closest airport to KSBS with an instrument approach. The airport had an AWOS whose observations were not augmented and reported the following conditions surrounding the period.

Weather observation for KHDN at 1756 MST, automated, wind from 260° at 14 knots, visibility 10 miles or more, scattered clouds at 4,500 ft agl, ceiling overcast at 6,000 ft, temperature -8° C, dew point temperature -12° C, altimeter 30.00 inHg. Remarks: automated station with a precipitation discriminator, snow ended at 1714 MST, sea-level pressure 1021.4-hPa, hourly precipitation less than 0.01 inches, temperature -8.3° C, dew point temperature -11.7° C, freezing rain sensor inoperative.

The general flight categories and raw METAR observations surrounding the period from 1256 through 1956 MST were as follows.

IFR METAR KHDN 101956Z AUTO 27018G23KT 1 1/4SM -SN BR BKN015 OVC019 M08/M10 A2983
 RMK AO2 SLP139 P0000 T10781100 FZRANO=
 IFR SPECI KHDN 102009Z AUTO 26014G20KT 1 1/4SM -SN BR BKN013 OVC019 M08/M11 A2984
 RMK AO2 P0000 FZRANO=
 IFR SPECI KHDN 102016Z AUTO 26017G21KT 2SM -SN OVC016 M08/M11 A2983 RMK AO2 P0000
 FZRANO=
 IFR SPECI KHDN 102027Z AUTO 26014G21KT 1 1/2SM -SN BKN015 BKN023 OVC028 M08/M11
 A2984 RMK AO2 P0000 FZRANO=
 IFR METAR KHDN 102056Z AUTO 27021G24KT 1SM -SN BKN015 OVC021 M08/M11 A2985 RMK
 AO2 SLP148 P0000 60000 T10781106 52004 FZRANO=

IFR SPECI KHDN 102101Z AUTO 26018G24KT 2SM -SN OVC015 M08/M11 A2985 RMK AO2 VIS
 1V5 P0000 FZRANO=
IFR SPECI KHDN 102110Z AUTO 27016G25KT 1SM -SN OVC015 M08/M11 A2987 RMK AO2 P0000
 FZRANO=
LIFR SPECI KHDN 102125Z AUTO 27018KT 1/2SM -SN FZFG SCT010 OVC015 M08/M10 A2988 RMK
 AO2 P0000 FZRANO=
LIFR SPECI KHDN 102131Z AUTO 27016KT 1/2SM SN FZFG FEW005 BKN010 OVC015 M08/M10
 A2989 RMK AO2 CIG 008V013 P0000 FZRANO=
LIFR SPECI KHDN 102135Z AUTO 27019G24KT 1/4SM SN FZFG BKN008 OVC015 M08/M10 A2989
 RMK AO2 CIG 004V010 P0000 FZRANO=
LIFR SPECI KHDN 102153Z AUTO 28013G21KT 1/2SM -SN FZFG BKN008 OVC012 M08/M10 A2991
 RMK AO2 CIG 004V009 P0000 FZRANO=
LIFR METAR KHDN 102156Z AUTO 28015KT 1/2SM -SN FZFG BKN008 OVC014 M08/M10 A2991
 RMK AO2 CIG 004V010 SLP171 P0000 T10831100 FZRANO=
LIFR SPECI KHDN 102159Z AUTO 28016G22KT 3/4SM -SN BR SCT006 OVC014 M08/M10 A2991
 RMK AO2 P0000 FZRANO=
IFR SPECI KHDN 102209Z AUTO 28011KT 1 1/4SM -SN BR FEW006 BKN014 OVC024 M08/M10
 A2991 RMK AO2 P0000 FZRANO=
IFR SPECI KHDN 102217Z AUTO 28013KT 1 1/4SM -SN BR SCT013 BKN018 OVC024 M08/M11
 A2992 RMK AO2 P0000 FZRANO=
IFR SPECI KHDN 102219Z AUTO 27010KT 1SM -SN BR BKN013 BKN018 OVC024 M08/M11 A2992
 RMK AO2 P0000 FZRANO=
IFR SPECI KHDN 102228Z AUTO 26007KT 2SM -SN BR SCT013 BKN019 OVC031 M08/M10 A2992
 RMK AO2 P0000 FZRANO=
MVFR SPECI KHDN 102235Z AUTO 26009KT 9SM -SN FEW011 BKN027 OVC031 M08/M10 A2992
 RMK AO2 P0000 FZRANO=
MVFR METAR KHDN 102256Z AUTO 26016G22KT 8SM -SN BKN021 BKN027 OVC033 M07/M11
 A2993 RMK AO2 SLP180 P0000 T10721111 FZRANO=
VFR SPECI KHDN 102334Z AUTO 27014G22KT 9SM SCT025 OVC035 M08/M11 A2996 RMK AO2
 SNE34 P0000 FZRANO=
VFR METAR KHDN 102356Z AUTO 27015G23KT 9SM -SN FEW028 OVC036 M08/M11 A2997 RMK
 AO2 SLP201 P0000 60000 T10781106 11072 21083 53018 FZRANO=
VFR **METAR KHDN 110056Z AUTO 26014KT 10SM SCT045 OVC060 M08/M12 A3000 RMK**
AO2 SNE14 SLP214 P0000 T10831117 FZRANO=
Accident 0109Z
VFR METAR KHDN 110156Z AUTO 28008KT 10SM BKN035 BKN050 M09/M12 A3004 RMK AO2
 SLP230 T10941122 FZRANO=
VFR METAR KHDN 110256Z AUTO 28009KT 10SM FEW033 M11/M13 A3006 RMK AO2 SLP247
 60000 T11061133 51025 FZRANO=

2.4 METAR Display

A display of the METARs from the NWS Aviation Weather Center's (AWC) website Helicopter Emergency Medical Service (HEMS) Tool⁸ for 1805 MST is included as figure 3, with the general flight categories overlaid and the approximate accident site marked by the red star. The HEMS weather tool allowed for a topographical display as well as

⁸<https://www.aviationweather.gov/hemst>

a plot of the basic METAR observations over the area. KSBS is depicted immediately north with IFR conditions around it and the accident site. KSBS is depicted as reporting a west wind of 5 knots, visibility of 1 mile, overcast clouds at 1,200 ft agl, temperature and dew point temperature 15° F. Other stations east and west of KSBS reported VFR conditions at the time of the accident, with KC07 reporting missing data.

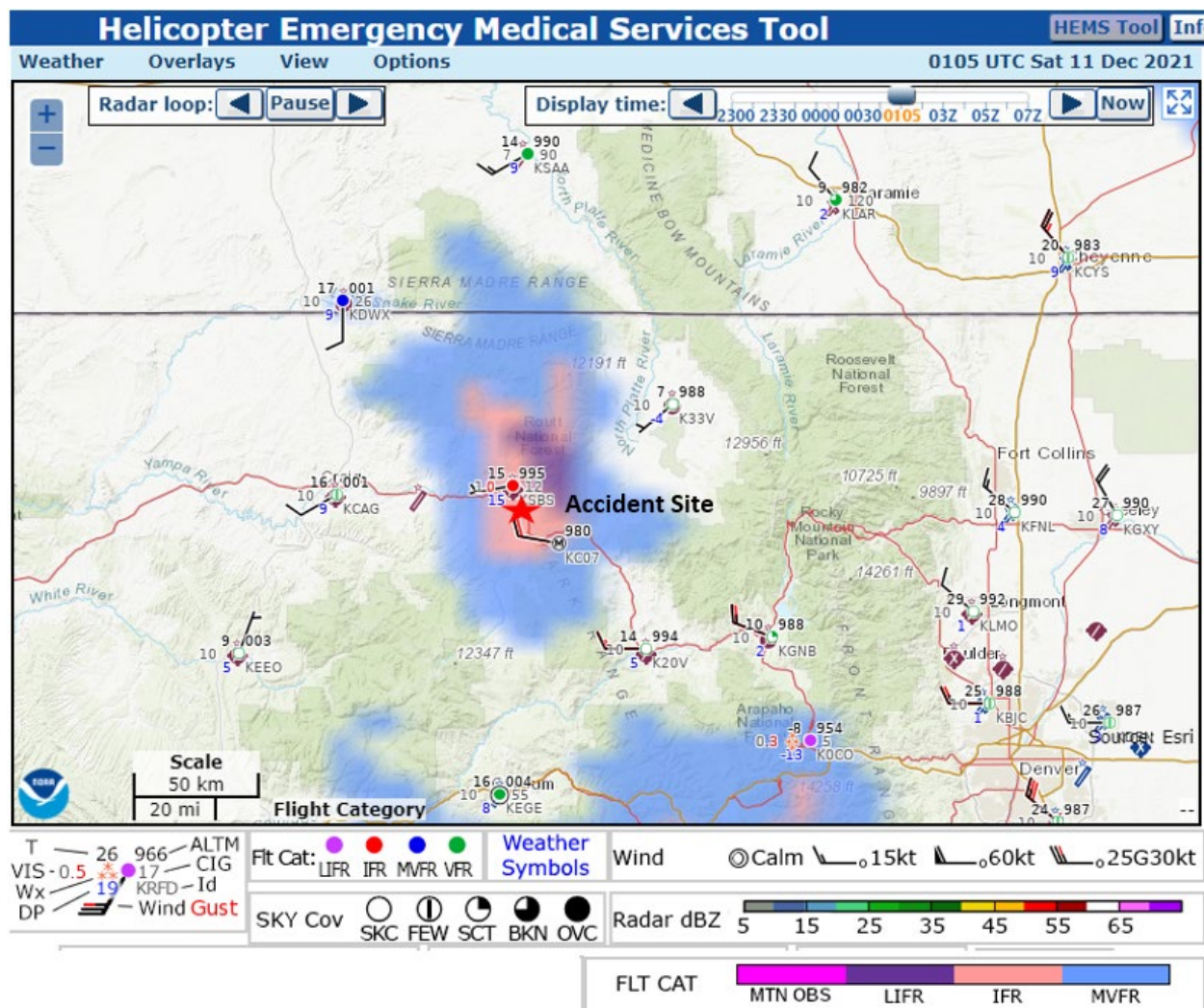
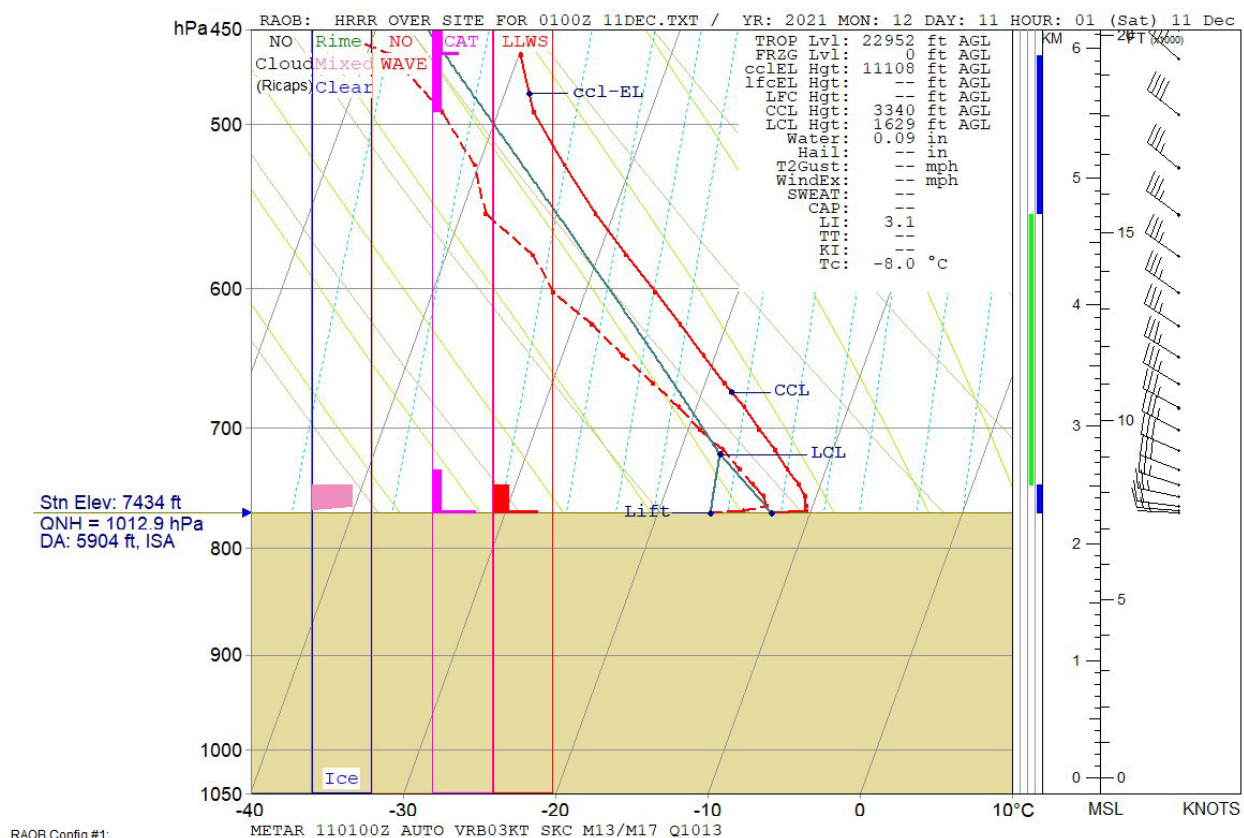


Figure 3 - NWS AWC HEMS Weather Tool display at 1805 MST depicting the METARs over the region, general flight categories with the approximate accident site marked by the red star.

A review of the observations from KSBS indicated that IFR conditions prevailed at the time of the accident. The AWOS at KSBS did not have a precipitation discriminator and could not report weather type; however, based on the temperature and dew point temperatures, and 100% saturation suggested light snow and fog restricting visibility at the time of the accident. The conditions at KC07 and KHDN also reported a period of IFR conditions prior to the accident in snow and freezing fog and had improved to VFR conditions at the time of the accident.

3.0 Sounding

To determine the conditions over the accident site a High-Resolution Rapid Refresh (HRRR)⁹ numerical model was obtained from the NOAA Air Research Laboratory's archive for the nearest grid point¹⁰ to the accident site for 1800 MST. The model data was then plotted on a standard skew T log P diagram¹¹ using the RAOB analysis software¹² from the surface to 450-hPa or approximately 20,000 ft and is included as figure 4.



relative humidity of 72%, and a density altitude of 5,904 ft. The sounding depicted a surface-based temperature inversion to approximately 100 ft agl where the temperature warmed to -10° C and then decreased with height. The lifted condensation level (LCL)¹³ was identified at 1,629 ft agl, with the convective condensation level (CCL)¹⁴ at 3,340 ft agl. The precipitable water content was 0.09 inches. The freezing level was identified at the surface, with temperatures remaining below freezing through the depth of the sounding. The atmosphere was characterized as stable with a Lifted Index (LI)¹⁵ of 3.1, with the layer below 15,000 ft characterized as conditionally unstable (as noted by the green bar on right vertical axis). The HRRR wind profile indicated a surface wind from the west or from 275° at 3 knots with winds veering to the northwest with height with slowly increasing winds speeds. The mean 0 to 6 kilometer (or 18,000 ft) wind was from 320° at 43 knots. The level of maximum wind was identified near 25,000 ft from 335° at 68 knots, with the tropopause height near 30,380 ft.

A table of the HRRR parameters of height, pressure, temperature (T), dew point temperature (Td), relative humidity (RH), wind, potential Clear Air Turbulence (CAT), Low-Level Wind Shear (LLWS), icing (type and intensity), and mountain wave potential below 25,000 ft is included below.

Height Pres (ft-msl)(hPa)	T (C)	Td (C)	RH (%)	Wind (deg/kts)	CAT (FAA)	LLWS (FAA)	Icing (AFGWS)	Wave/x-W-Turb (nm fpm max)
7434	769	-12.5	-16.5	72	274/ 3	SVR	STRNG	
7500	767	-10.3	-14.4	72	275/ 13	LGT	LIGHT	
7632	763	-10.4	-13.0	81	278/ 18	LGT	LIGHT	LGT Mixed
7898	755	-10.7	-13.4	80	283/ 23	LGT	LIGHT	LGT Mixed
8234	745	-11.4	-14.4	78	289/ 27	LGT		LGT Mixed
8642	733	-12.5	-15.6	78	294/ 30			
9194	717	-13.8	-17.2	75	296/ 32			
9755	701	-15.3	-19.2	72	299/ 33			
10362	684	-16.8	-21.1	69	301/ 33			
11017	666	-18.7	-23.4	66	303/ 33			
11760	646	-20.7	-26.0	62	304/ 33			
12597	624	-23.0	-28.8	59	306/ 33			
13456	602	-25.4	-32.1	54	307/ 34			
14419	578	-28.2	-34.3	56	308/ 35			
15496	552	-31.2	-38.4	49	310/ 36			
16743	523	-34.4	-40.3	55	311/ 37			
18089	493	-37.7	-43.7	53	311/ 38	LGT		
19503	463	-39.9	-48.4	40	315/ 42	MDT		

¹³ Lifted Condensation Level (LCL) - the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

¹⁴ Convective Condensation Level (CCL) - is the height at which a parcel of air, when heated sufficiently from below, rises and becomes saturated. It is where newly forming convective clouds should form bases.

¹⁵ 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.

20899	435	-40.7	-58.5	13	322/ 49	MDT			
22277	409	-40.4	-67.6	4	329/ 56	LGT	4.85	553	LIGHT
23576	386				334/ 62		5.92	266	LIGHT
23686	384	-40.9	-65.7	5		LGT	6.81	467	LIGHT
24954	363				336/ 68				

The HRRR sounding parameters and wind profile indicated a high probability of moderate and greater turbulence and low-level wind shear below 100 ft agl due to strong vertical shear of 10 knots/1,000 ft. The soundings thermal and wind profile also support mountain wave development over the area, with no specific dominate waves below 20,000 ft based on the RAOB mountain parameters set to default for a maximum wave. The sounding also supported a layer of light mixed icing conditions below 1,000 ft agl or below 8,500 ft msl. At the last reported altitude of N744Z at 8,175 ft the sounding indicated a temperature of -11° C, with wind from about 290° at 27 knots. The HRRR sounding and RAOB analysis program failed to detect any low-altitude clouds over the accident site coordinates.

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) data were obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. The GOES-16 infrared band 13 image for 1806 MST at 4X magnification with a standard temperature enhancement curve applied is included as figure 5. Due to the low sun angle, the higher resolution visible imagery were not available at the time of the accident. The infrared image depicted an overcast area of low to mid-level clouds over KSBS and the accident site, with a radiative cloud top temperature of 255 Kelvin or -18.16° C, which according to the HRRR sounding corresponded to cloud top temperatures near 11,000 ft.

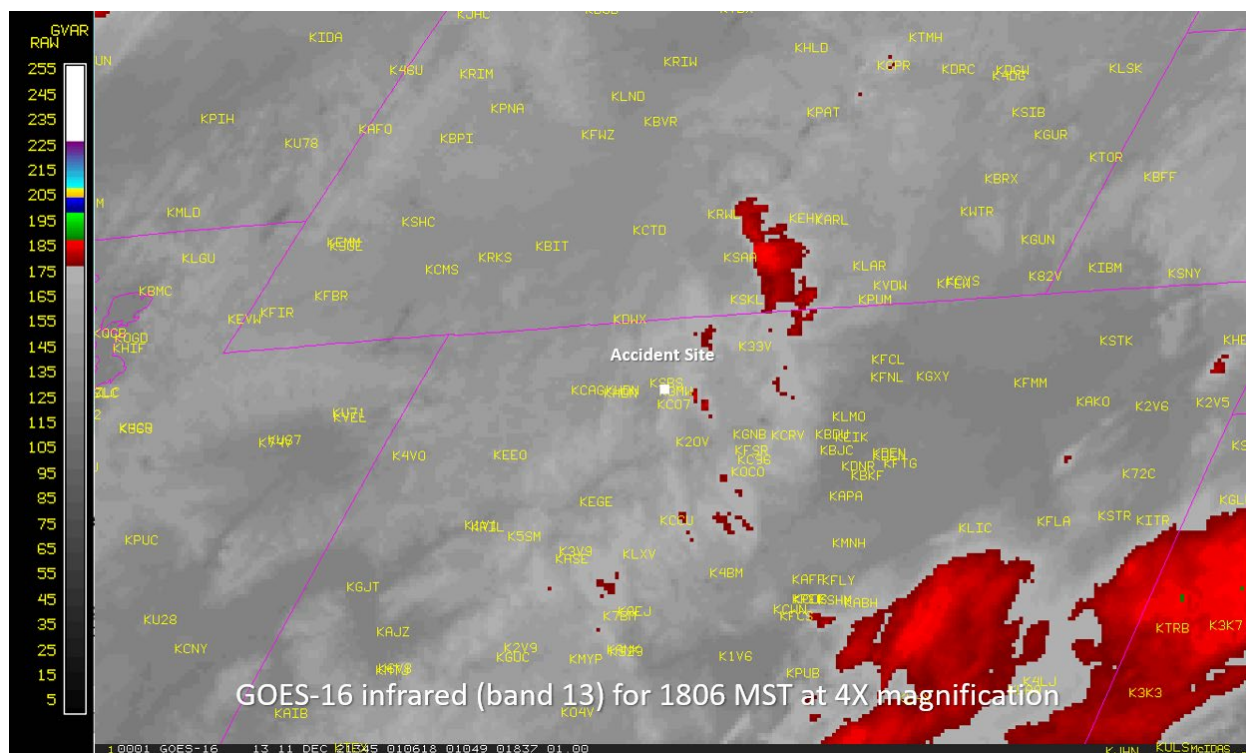


Figure 5 - GOES-16 infrared image for 1806 MST at 4X magnification with the accident site marked by the white square.

5.0 Pilot Reports

The following pilot reports or PIREPs¹⁶ were reported within 100 miles of the accident site between 1300 through 2100 MST. The reports are in standard code and abbreviations with cloud heights referenced to msl, with the time of the accident added in bold italic type. The reports were as follows.

DEN UA /OV 20 NW DEN/TM 2004/FL150/TP CRJ2/TA -5/IC LGT RIME/RM 150-120 DURD
ASE UA /OV ASE270010/TM 2008/FL170/TP C25B/TB LGT CHOP/IC LGT RIME/RM DURC
LAR UA /OV LAR180030/TM 2011/FL430/TP CL30/RM MOD MTN WAVE +/-30KTS +/-300FPM
BJC UUA /OV FNL/TM 2035/FL100/TP EA50/TB MOD-SEV
BJC UUA /OV BJC/TM 2041/FL060/TP EA50/RM LLWS +15 SHORT FINAL RWY 30R
DEN UA /OV 40SW DEN/TM 2320/FL190/TP B737/TB MOD/RM 190-160
DEN UUA /OV DEN260045/TM 2344/FL190/TP B737/TB MOD/RM BORDERLINE EXTREME...ZDV
DEN UUA /OV DEN255050/TM 2346/FL210/TP G150/TB SEV/RM 40KT LOSS OF AIRSPEED...ZDV
DEN UA /OV BJC200035/TM 0016/FL140/TP B350/TB MOD

Accident 0109Z

EGE UA /OV RLG085035/TM 0240/FL220/TP E75L/TB MTN WAVE +300FT -200FT/RM ZDVFD

¹⁶ Includes PIREPs making into the NWS database and may not include "ride reports" or other reports made on radio frequency to air traffic control and not formally entered as a PIREP into the national database.

Of the 10 reports recorded over the region during the period, 5 of the reports were urgent PIREPs. Turbulence dominated the reports with 7 pilots reporting turbulence which included light chop (1), moderate (3), moderate-to-severe (1), severe (1), and one of those reports remarked that the turbulence was "borderline extreme". While other PIREPs remarked about moderate mountain wave activity (2), and (1) reported LLWS conditions. While 2 reports also indicated light rime type icing had been encountered.

6.0 NWS Forecasts

The NWS local and aviation weather forecast products over the region were documented and included below.

6.1 Terminal Aerodrome Forecast

The NWS does not issue a Terminal Aerodrome Forecast (TAF) for KSBS. The closest TAF to the accident site was from KHDN, which was located 16 miles west of KSBS. While a TAF is only current for a 5-mile radius surrounding the airport center, it provides a forecast of winds, visibility, weather, and sky conditions and is often referred to in preflight weather briefings for the nearest forecast conditions. The TAF for KHDN current at the time of the accident, which was an amended forecast issued by the NWS Grand Junction (KGJT) Weather Forecast Office (WFO) at 1558 MST, as well as the next scheduled TAF for KHDN issued at 1639 MST, were as follows. The forecast periods applicable to the accident flight are in bold italic type.

***AMD TAF KHDN 102258Z 1023/1118 26009KT 6SM -SN BR SCT011 OVC030
TEMPO 1100/1101 27012G22KT 1SM -SN BR OVC020
FM110100 28012KT P6SM VCSH OVC050
FM110400 31006KT P6SM BKN050
FM110800 08006KT P6SM SCT250=***

The KHDN TAF issued at 1558 MST expected from 1600 through 1800 MST terminal wind from 260° at 9 knots, visibility 6 miles in light snow and mist, scattered clouds at 1,100 ft agl, ceiling overcast at 3,000 ft agl, with a temporary¹⁷ period between 1700 and 1800 MST of wind from 270° at 12 knots gusting to 22 knots, visibility 1 mile in light snow and mist, ceiling overcast at 2,000 ft agl. From 1800 through 2100 MST, the TAF expected a wind from 280° at 12 knots, visibility better than 6 miles, with showers in the vicinity, and a ceiling overcast at 5,000 ft agl.

TAF KHDN 102339Z 1100/1124 26016G22KT P6SM SCT020 BKN035

¹⁷ TEMPO group is used to indicate to identify significant weather conditions that may temporarily differ from the prevailing conditions. The TEMPO group implies a greater than 50% chance of occurrence, with the temporary conditions expected to last less than one hour, and the total duration is less than half the forecast period.

FM110200 25009KT P6SM VCSH FEW035 BKN050
FM110900 21005KT P6SM FEW045 FEW180
FM111200 13006KT P6SM FEW250=

The next forecast was issued at 1639 MST or immediately prior to the accident airplane's departure from Cody, WY, at 1700 MST and was the forecast current at the time of the accident. The updated forecast for KHDN expected from 1700 through 1900 MST of wind from 260° at 16 knots gusting to 22 knots, visibility better than 6 miles, scattered clouds at 2,000 ft agl, with a ceiling broken at 3,500 ft agl.

6.2 Area Forecast Discussion

The NWS Area Forecast Discussions (AFD) are issued by each WFO to describe the short-term weather conditions within their region with an aviation section that includes the general conditions as they relate to the creation of the TAF. These are useful for additional aviation-related issues that cannot be encoded into the TAF and provide some reasoning behind the forecast. These are generated roughly every 6 hours and correspond to the release of the latest TAFs for that office. The AFD short term, and aviation sections issued by the KGJT WFO at 1543 MST were as follows.

*FXUS65 KGJT 102243 CCA
AFDGJT*

*Area Forecast Discussion...CORRECTED
National Weather Service Grand Junction CO
343 PM MST Fri Dec 10 2021*

*.CORRECTION...
Issued at 343 PM MST Fri Dec 10 2021
Corrected issuance times for the short and long term discussions.*

*.SHORT TERM...(Today through Saturday)
Issued at 248 PM MST Fri Dec 10 2021*

Despite the cold front having exited the region, we're not done yet as we're now on the cold side of the storm. It's not disappointing either. Before we get to that, let's talk snowfall amounts from last night and this morning. The winner, so far, is Coal Bank Pass coming in with 27 inches of new snow as of mid-morning. The good news is that it looks like all mountains did really well with over a foot of new snow and many locations seeing considerably more than that. Can't forget the valleys either with the northern valleys reporting around 6 inches and the southern valleys coming in with 5 inches to over a foot around the Pagosa Springs area. So as mentioned, the front has moved through and now much colder air is moving in. If you've been outside, you've felt it. Post frontal winds have also picked up with gusts of 20 to 40 mph being common across the CWA. While colder air has moved in at the surface, much colder air is also moving in at mid-levels. This cold pool aloft is increasing instability and has caused plenty of banded precip to form and is keeping snowfall going across the Divide but also for the northern valleys, Steamboat Springs, and portions of the San Juans from time to time...looking at you Ouray. Hi-res guidance keeps this convectively active weather going through 00Z (6PM) and then really drops it off. Since the remaining Winter Storm Warnings also fall off at 00Z, will keep them going until then though

wouldn't be surprised if things start slowly tapering off from here on out. Low temperatures will drop to below normal overnight, especially so for those areas that clear out and decent radiational cooling kicks in. Some patchy fog is also possible for the overnight, in the usual low lying areas and especially for those areas that received any precip or saw melting snow.

Saturday will bring a return to more sunny skies albeit cold with temperatures still below normal. Some inversions will likely set up for those locations that have snowpack. A few mid to high level clouds may make an appearance but all in all, a nice day in store. Enjoy.

.AVIATION...(For the 18Z TAFS through 18Z Saturday afternoon)
Issued at 1028 AM MST Fri Dec 10 2021

Winds are already beginning to pick up behind this system, with sustained northwesterly winds of 20-30 knots expected, and gusts up to 45 knots possible. Slow improvement as far as CIGS and VIS is ongoing from west to east, with eastern Utah TAF sites already up to VFR with clearing skies. Do expect lingering IFR/MVFR conditions for KASE, KHDN, possibly also KTEX, KEGE, and KGUC through the afternoon hours as instability snow showers forming on the higher terrain pick up. All sites should come up to VFR and above ILS breakpoints by tomorrow morning. Gusty winds will continue through the overnight hours but finally taper off by daybreak tomorrow.

.GJT WATCHES/WARNINGS/ADVISORIES...

CO...Winter Storm Warning until 6 PM MST this evening for COZ002>005-009-010-012>014-017>019.

UT...None.

SHORT TERM...TGR
LONG TERM...MDA
AVIATION...TGJT

6.3 Graphic Forecast for Aviation

The NWS Graphic Forecast for Aviation (GFA) is a graphical depiction of surface wind, thunderstorms, precipitation, color coded general flight categories, and cloud cover bases and tops, from graphical output from the NWS's National Digital Forecast Data (NDFD) with the Graphic-Airmen's Meteorological Information (G-AIRMET)¹⁸ for IFR conditions, mountain obscuration, icing conditions, and strong surface wind overlaid. The GFA provides a forecast for the enroute phase of flight and for locations without a TAF. The GFA is available at the NWS AWC website and through other weather briefing services. The 3-hour GFA surface and cloud forecast charts issued at 1501 MST and valid at the time of the accident are included as figures 6 and 7, with the approximate accident site marked by the red star. The GFA surface forecast expected

¹⁸ AIRman's METeorological Information (AIRMET) is a concise description of weather phenomena that are occurring or may occur (forecast) along an air route that may affect aircraft safety. Compared to SIGMETs, AIRMETs cover less severe weather: moderate turbulence and icing, sustained surface winds of 30 knots or more, low-level wind shear, or widespread restricted visibility.

isolated areas of restricted visibility with a chance of snow showers, with winds from the west-northwest at 15 to 20 knots. The GFA cloud forecast depicted broken to overcast sky cover at 9,000 ft msl to 12,000 ft msl (approximately 1,000 ft to 4,000 ft agl over the accident site) with tops to 20,000 ft. The GFA cloud chart also depicted a G-AIRMET for mountain obscuration extending over the accident site and most of western and central Colorado, and a G-AIRMET for icing over eastern Colorado and Wyoming generally to the east of the route of flight and the accident site.

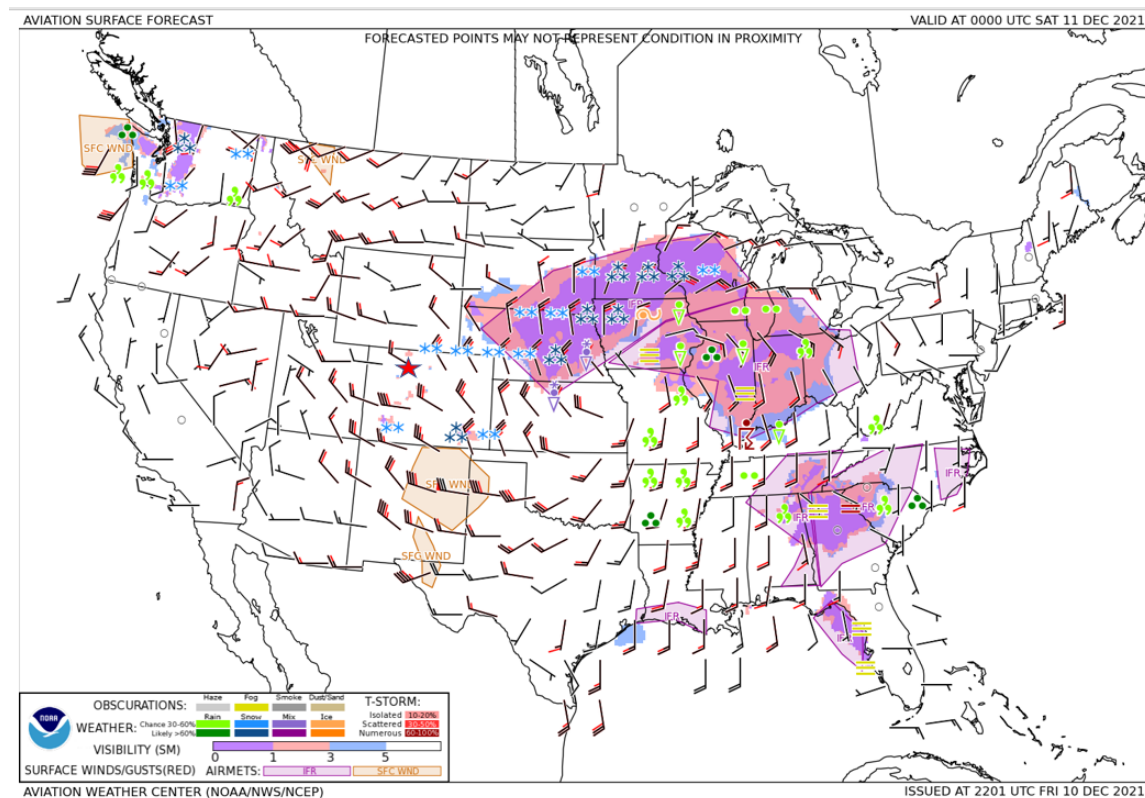


Figure 6 - Graphic Forecast for Aviation 3-hour Surface Forecast valid for 1700-2000 MST.

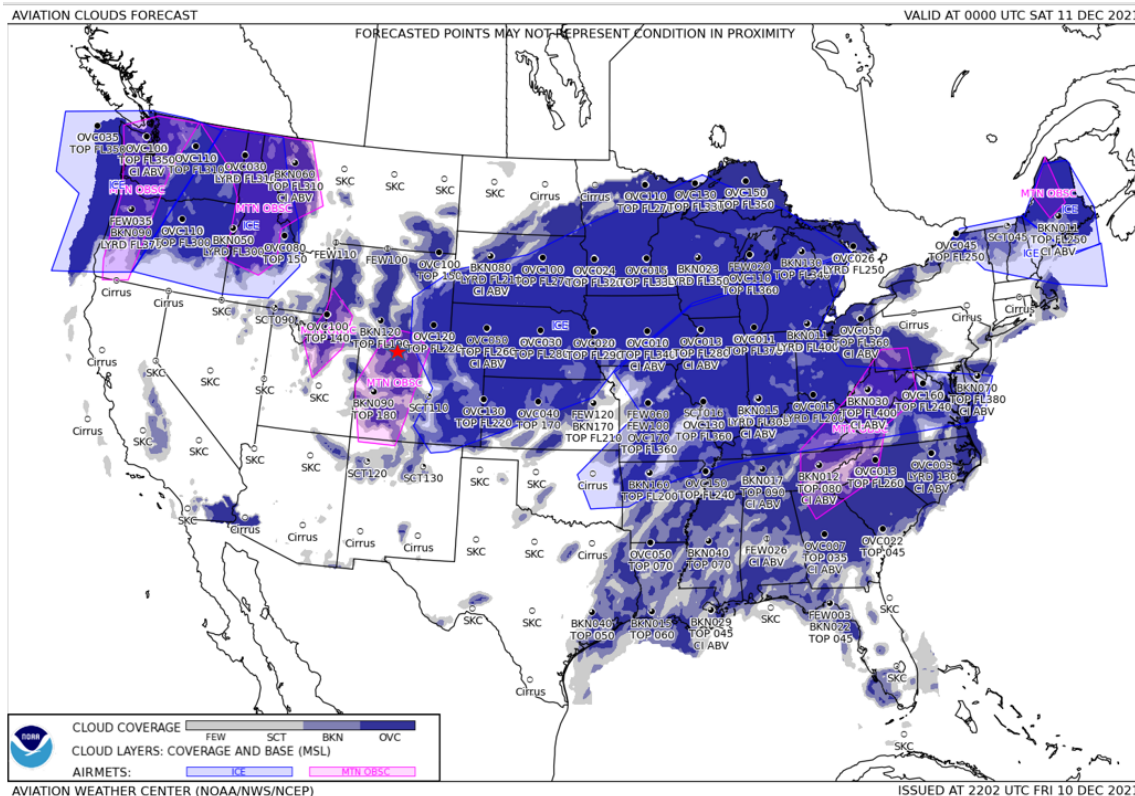


Figure 7 - Graphic Forecast for Aviation 3-hour Cloud Forecast valid from 1700-2000 MST.

6.4 Graphical Turbulence Guidance

The Graphical Turbulence Guidance (GTG) was developed by the National Center for Atmospheric Research (NCAR) and is now run operationally at NOAA's NCEP and is available to users on the AWC website¹⁹ from the surface to FL450²⁰ through 18-hours. The current GTG version 3.0 model (GTG3) is generated from the NOAA Rapid Refresh numerical model with a horizontal spacing of 13.5 kilometers with 50 vertical levels, and provides a computer-generated four-dimensional forecast related to the expected intensity of atmospheric turbulence provided in eddy dissipation rate (EDR)²¹. NCAR defines the following EDR values to various aircraft weight classes and turbulence intensities and is included as figure 8. The accident airplane fits into the "light" aircraft weight category²².

¹⁹ <https://www.aviationweather.gov/turbulence/gtg>

²⁰ Flight Level (FL) is altitude based on constant pressure levels reported in hundreds of feet, when aircraft operate above the transition level, typically 18,000 ft when aircraft altimeter is set to 29.92 inHg.

²¹ Eddy Dissipation Rate (EDR) is defined as $EDR = \epsilon^{1/3}$

²² ICAO Light weight class is less than 15,500 pounds maximum takeoff weight.

AC weight class	Estimated EDR Threshold * 100			
	Light	Moderate	Severe	Extreme
Light	13	16	36	64
Medium (Large)	15	20	44	79
Heavy	17	24	54	96

Figure 8 - EDR values versus turbulence intensity for various aircraft weight classes.

The GTG color coded legend for light aircraft weight category EDR values and typical associated turbulence intensity is depicted in figure 9, with values of EDR from 16-36 typically associated with moderate turbulence, and values between 36-64 associated with severe turbulence, and EDR values greater than 64 are associated with extreme intensity.

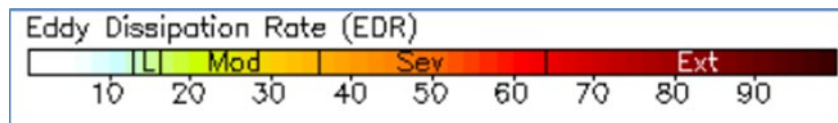


Figure 9 - EDR values for a light category aircraft.

The GTG 0-hour maximum forecast product for all altitudes valid for 1800 MST is included as figure 10 with the approximate accident site marked by a red star. The GTG indicated EDR values of 30 to 45 over the accident site, consistent with moderate-to-severe turbulence. While the conditions below 10,000 ft could not be further defined due to the resolution and terrain features, the image confirmed a high potential of turbulence conditions at some altitudes over the region.

GTG - Max combined intensity (1000 ft. MSL to FL500)

00 hr forecast valid 0100 UTC Sat 11 Dec 2021

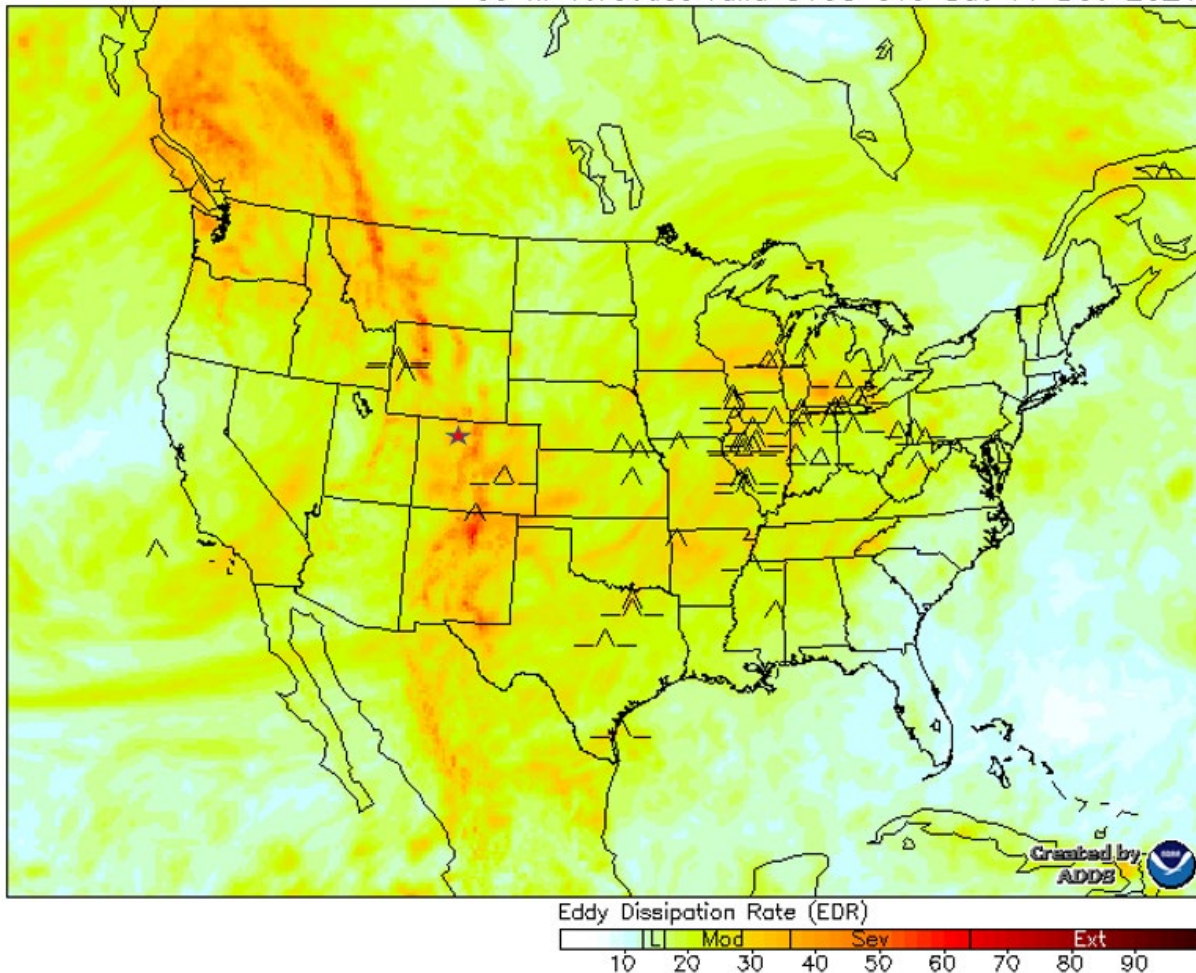


Figure 10 - Graphic Turbulence Guidance valid for 1800 MST with accident site marked by star.

6.5 Current Icing Product

The Current Icing Product (CIP) and the Forecast Icing Product (FIP) graphics are computer-generated three-dimensional analyses of information related to the likelihood of encountering icing conditions. The CIP/FIP graphics suite is automatically produced with no human modifications and available at the NWS AWC website²³. Information on the graphics is determined from observational data including WSR-88D radar, satellite, pilot weather reports, surface weather reports, lightning and computer model output. The CIP represents the latest analysis of potential icing regions. Besides the most-recent analyses, a forecast of anticipated icing conditions is available in the

²³ <https://www.aviationweather.gov/icing/fip>

FIP product. CIP/FIP provide information on expected probability of icing conditions, the icing severity as five categories: none, trace, light, moderate, and heavy, and the potential for supercooled large droplets (SLD). The severity estimations are roughly based on the accretion rate of ice on an airplane, and the levels are determined by the time it would take for an airfoil to accrete 1/4-inch of ice: trace, 1-hour; light, 15-minutes to 1-hour; moderate, 5-15 minutes; and severe < 5 minutes. The rates are, in turn, estimated from the amount of supercooled liquid water expected with a nominal drop diameter of 15 microns (μm), and are further tuned by nearby pilot reports of encountered severity. These are relative values and the use of which should consider the airframe and the level of icing protection provided by the aircraft. Different aircraft and different flight configurations (airspeed, angle of attack, etc.) will experience variations in accretion rate. These rates have been simulated for a range of aircraft and are a "broad brush" approach to severity prediction.

The NWS CIP/FIP icing probability and severity products at 1800 MST at 1000 ft, 2000 ft and 3000 ft agl are included as figures 11 and 12. The images depicted a 15 to 55 percent probability of icing over KSBS with the highest probability near 3,000 ft agl. The icing severity indicated a light-to-moderate intensity of icing conditions from 1,000 ft to 3,000 ft agl over KSBS and the accident site.

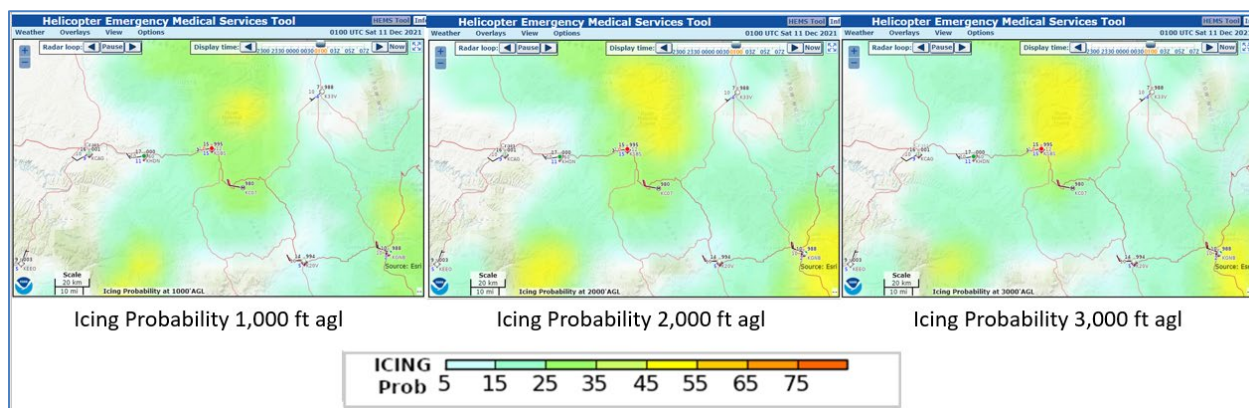


Figure 11 - CIP Icing Probability at 1000 ft (left), 2000 ft (middle), and 3000 ft agl (right).

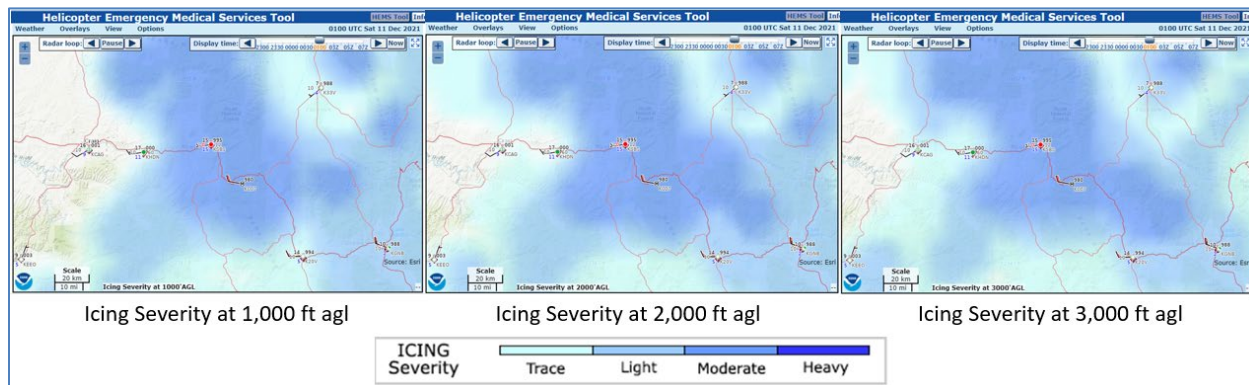


Figure 12 - CIP Icing Severity at 1000 ft (left), 2000 ft (middle), and 3000 ft agl (right).

7.0 NWS Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of the 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 air route traffic control centers (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 based on experience and the operational limits of the aircraft.

The NWS AWC issued AIRMET Sierra at 1345 MST for mountain obscuration conditions that was current through 2000 MST and extended over the accident site. An AIRMET for IFR conditions was also in effect over the accident site and had expired at 1700 MST. An AIRMET Tango for moderate turbulence at altitudes below 18,000 ft extended over the area, with another advisory between FL180 through FL300. Figure 13 is a depiction of the Graphic-AIRMETs that were current below 18,000 ft over the contiguous United States at the time of the accident.

WAUS45 KPCI 102045

WA5S

-SLCS WA 102045

AIRMET SIERRA UPDT 6 FOR IFR AND MTN OBSCN VALID UNTIL 110300

.

...SEE SIGMET NOVEMBER SERIES²⁴...

.

AIRMET IFR...WY CO NM

**FROM 80SSE BOY TO 40W DEN TO 40SSE DBL TO 40SE HBU TO 30NW LAA
TO 40ESE LAA TO 30NW FTI TO 30SSE DVC TO 40NNE JNC TO 80SSE BOY
CIG BLW 010/VIS BLW 3SM PCPN. CONDS ENDG 21-00Z.**

.

AIRMET MTN OBSCN...WY UT CO AZ NM4

**FROM 20WNW DDY TO CYS TO 20WSW TBE TO 20W FTI TO 60W ABQ TO 50E
TBC TO 50SW JNC TO 40NNW JNC TO 20WNW DDY
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.**

WAUS45 KPCI 102333 AAA

WA5T

-SLCT WA 102333 AMD

AIRMET TANGO UPDT 6 FOR TURB STG WND AND LLWS VALID UNTIL 110300

.

AIRMET TURB...ID MT WY UT CO AZ

²⁴ SIGMET November series was issued for a region of blowing dust over Oklahoma, Texas, and New Mexico and was not applicable to the accident or current over Colorado.

**FROM 40SSE YQL TO 50NNW ISN TO 70SW RAP TO 50WNW BFF TO 20N JNC
TO 50SSW TBC TO 20WNW PIH TO 40SSE YQL
MOD TURB BTN FL180 AND FL300. CONDS CONTG BYD 03Z THRU 09Z.**

**AIRMET TURB...WY UT CO AZ NM
FROM 70SW RAP TO GLD TO 50W LBL TO 30ESE TBE TO INK TO ELP TO
50S SSO TO 50SSW TBC TO 20N JNC TO 50WNW BFF TO 70SW RAP
MOD TURB BTN FL180 AND FL450. CONDS CONTG BYD 03Z THRU 09Z.**

**AIRMET TURB...CO NM
FROM 50SSW BFF TO 30ENE LAA TO 50SSE LAA TO 30ESE TBE TO INK TO
60E ELP TO 70WSW CME TO 30N ABQ TO 50ESE RSK TO 30SW LAR TO 50SSW BFF
MOD TURB BLW FL180. CONDS CONTG BYD 03Z THRU 09Z.**

**AIRMET STG SFC WINDS...CO NM
FROM 30ESE ALS TO 20SSW TBE TO 50SE TBE TO INK TO 20E ELP TO
70SSE ABQ TO 40SW ABQ TO 50ENE RSK TO 30ESE ALS
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS ENDG BY 03Z.**

**LLWS POTENTIAL...CO
BOUNDED BY 50WNW DEN-30SSE DEN-50WSW ALS-30ESE DVC-50WNW DEN
LLWS EXP. CONDS DVLPG 00-03Z. CONDS CONTG BYD 03Z THRU 09Z.**

**WAUS45 KPCI 102045
WA5Z
-SLCZ WA 102045
AIRMET ZULU UPDT 4 FOR ICE AND FRZLVL VALID UNTIL 110300**

**AIRMET ICE...MT WY CO NM
FROM 70SW DIK TO 70SW RAP TO GLD TO 50W LBL TO 30ESE TBE TO 60SSE
TBE TO CIM TO 30SSW ALS TO 40SSW HBU TO 30SW DEN TO 40W LAR TO
50NE OCS TO 40WSW CZI TO 70SW DIK
MOD ICE BTN FRZLVL AND FL190. FRZLVL SFC-060. CONDS CONTG BYD 03Z
ENDG BY 06Z.**

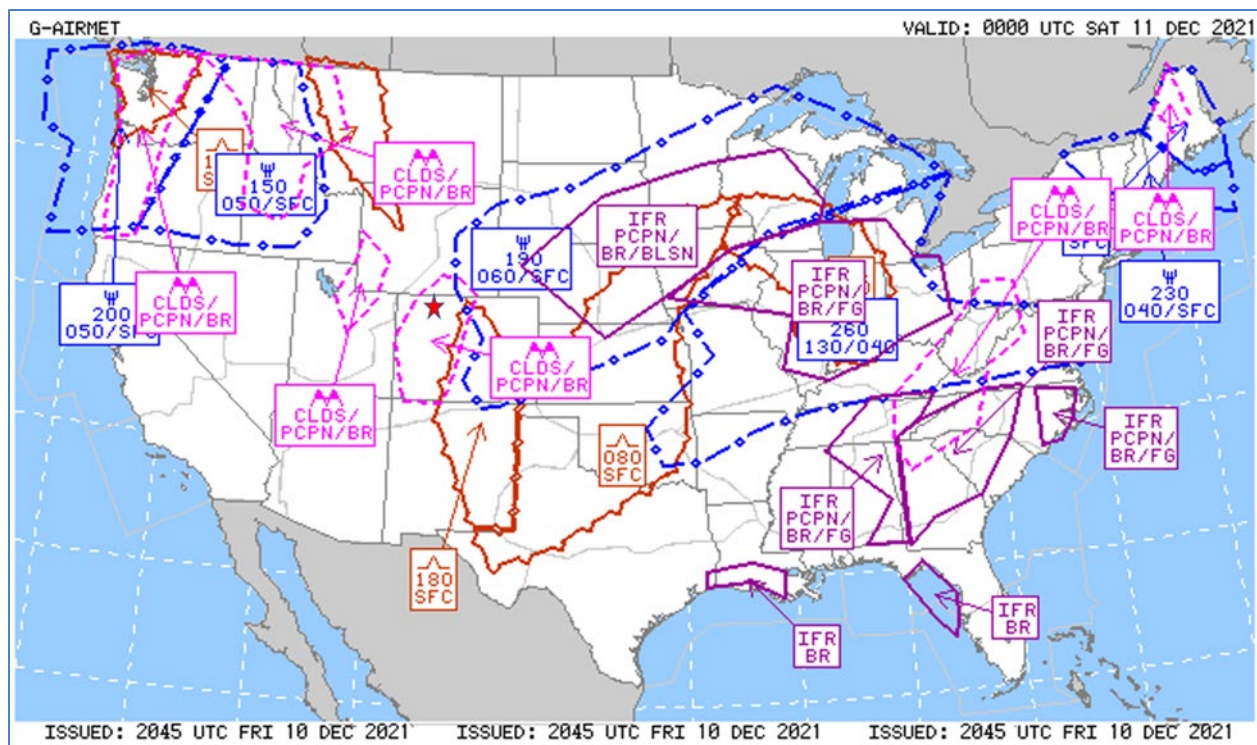


Figure 13 - Depiction of G-AIRMETs current at the time of the accident below 18,000 ft.

Prior to the accident the NWS had SIGMET Yankee 2 current over southern Colorado and New Mexico for high-altitude turbulence due to mountain wave activity and strong updrafts and wind shear. The advisory did not extend over the accident site. The advisory was cancelled at 1633 MST when the turbulence intensity subsided, and mostly moderate turbulence was reported.

WSUS05 KPCI 102155
 WS5Y
 SLCY WS 102155
 SIGMET YANKEE 2 VALID UNTIL 110155
 CO NM
 FROM 30ENE PUB TO 30NW TCC TO 40WSW FTI TO 50E HBU TO 30ENE PUB
 OCNL SEV TURB BTN FL310 AND FL410. DUE TO MTN WV ACT AND STG
 UDDFS AND LLWS. RPTD BY ACFT. CONDS CONTG BYD 0155Z.
 .
 WSUS05 KPCI 102333
 WS5Y
 SLCY WS 102333
 CANCEL SIGMET YANKEE 2. CONDS MSTLY MOD.

The NWS Denver Center Weather Service Unit (CWSU) issued a CWA #102 at 1746 MST that was valid until 1945 MST for an area of moderate to isolated severe turbulence centered over the Denver area. The area was located immediately southeast of the accident site. The advisory was as follows and is depicted in figure 14.

FAUS21 KZDV 110046
 ZDV1 CWA 110046
 ZDV CWA 102 VALID UNTIL 110245
 FROM 40NE DEN-40SE DEN-30ESE DBL-50NE DBL-40NE DEN
 AREA MOD ISOL SEV TURB...140-FL250...RPRTD BY AIRCRAFT. CO

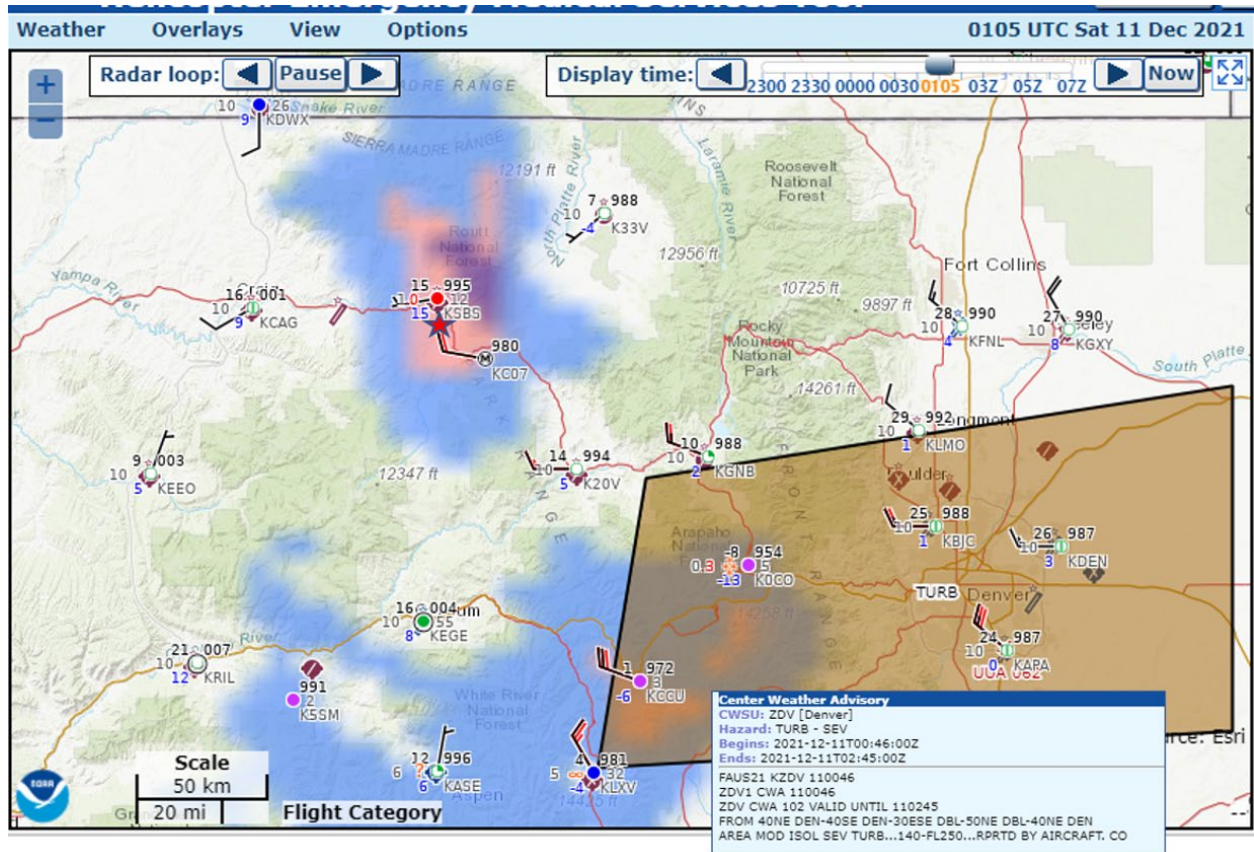


Figure 14 - Depiction of CWA #102 for turbulence issued at 1745 MST

8.0 Astronomical Conditions

The United States Naval Observatory Multiyear Interactive Computer Almanac (MICA) software provided the following astronomical conditions over Steamboat Springs Airport (KSBS), Colorado on the day of the accident. The time of the accident has been included for reference in bold italic type.

Sun	Time (MST)
Begin civil twilight	0649
Sunrise	0719
Culminative	1200
Sunset	1640
End civil twilight	1711

Accident 1809

<u>Moon</u>	<u>Time (MST)</u>
Moonrise	1240
Accident	1809
Moon culmination	1815
Moon set	2358

At the time of the accident the sun was about 15° below the horizon at an azimuth of 252°, and the moon was about 39° above the horizon at an azimuth of 178°. The phase of the moon was a first quarter with 50% of the moon's disk illuminated.

9.0 Weather Briefing Information

A search of the FAA Contract Automated Flight Service Station (AFSS) Leidos indicated that they had no contact with N744Z nor did any 3rd party vendors utilizing the Leidos Flight Service (LFS) system on December 10 or 11th, 2021. A search of ForeFlight²⁵ indicated that they had an account with the accident pilot who filed an IFR flight plan through their system for the flight between KCOD to KSBS. Prior to the accident flight the pilot did not view any weather imagery but did enter the following routes into the app which generated a general route briefing, which is included as Attachment 1.

Date/Time (UTC) Updated Route String

12/10/2021 23:59:11 KCOD KSBS N744Z 25000FT
12/10/2021 23:29:03 KCOD KSBS N744Z 25000FT 20211210T23:40:00Z
12/10/2021 12:40:39 KCOD KSBS N744Z 25000FT 20211210T23:20:00Z
12/10/2021 12:40:25 KCOD KSBS N744Z 19000FT 20211210T23:20:00Z
12/10/2021 12:40:17 KCOD KSBS N744Z 19000FT 20211210T23:30:00Z
12/10/2021 12:40:16 KCOD KSBS N744Z 19000FT 20211210T23:40:00Z
12/10/2021 12:40:04 KCOD KSBS N744Z 19000FT
12/10/2021 12:38:52 KSBS KCOD 20000FT
12/9/2021 2:46:56 KGCC KCOD N744Z 20000FT

Prior to the flight the pilot viewed the following instrument procedures in the app:

Last viewed (UTC) Airport ID - Procedure name

12/11/2021 0:34:09 KSBS - RNAV (GPS)-E (FAA)
12/11/2021 0:33:56 KSBS - AIRPORT DIAGRAM (ForeFlight)

²⁵ ForeFlight is a private company that creates flight planning software and apps for professional and general aviation pilots.

12/10/2021 3:36:41 KCOD - AIRPORT DIAGRAM (ForeFlight)
12/8/2021 15:15:32 KGCC - AIRPORT DIAGRAM (FAA)

Prior to the flight the pilot of N744Z viewed information about the following airports, which included the latest METAR and TAF and other airport information:

Last viewed (UTC) Airport ID

12/11/2021 0:38:57 KHDN

Observations current at that time

[1634 MST] SPECI KHDN 102334Z AUTO 27014G22KT 9SM SCT025 OVC035 M08/M11 2996
RMK AO2 SNE34 P0000 FZRANO=
[1656 MST] METAR KHDN 102356Z AUTO 27015G23KT 9SM -SN FEW028 OVC036 M08/M11
A2997 RMK AO2 SLP201 P0000 60000 T10781106 11072 21083 53018
FZRANO=

12/11/2021 0:06:10 KCOD

[1656 MST] METAR KCOD 102356Z AUTO 25013G21KT 10SM CLR M04/M13 A2985 RMK
AO2 SLP163 T10391133 11006 21039 51014 FZRANO=

12/10/2021 23:28:54 KSBS

[1615 MST] METAR KSBS 102315Z AUTO 23006KT 7SM BKN045 OVC050 M09/M11 A2991
RMK AO1 T10921111=

12/8/2021 22:44:42 KGCC

[1453 MST] METAR KGCC 102153Z AUTO 26010KT 10SM CLR M06/M09 A2978 RMK AO2
SLP126 T10611094=

E. LIST OF ATTACHMENTS

Attachment 1 - ForeFlight Route Briefing generated at 1659 MST on December 10, 2021 between KCOD and KSBS.

Submitted by:

Donald Eick
Senior Meteorologist