



NATIONAL TRANSPORTATION SAFETY BOARD

**Office of Aviation Safety
Washington, D.C. 20594**

February 24, 2014

Group Chairman's Factual Report

METEOROLOGY

CEN14FA099

Table Of Contents

CEN14FA099	1
A. ACCIDENT	3
B. METEOROLOGY GROUP	3
C. SUMMARY	3
D. DETAILS OF THE INVESTIGATION	3
E. FACTUAL INFORMATION	4
1.0 Synoptic Situation	4
1.1 Surface Analysis Chart	4
1.2 Weather Radar Mosaic	6
1.3 Constant Pressure Charts	7
2.0 Topography Maps	9
3.0 Surface Observations	11
3.1 Aspen-Pitkin County Airport-Sardy Field (KASE), Aspen, Colorado	11
3.2 Eagle County Airport (KEGE), Eagle, Colorado	14
3.3 Lake County Airport (KLXV), Leadville, Colorado	15
3.4 Copper Mountain (KCUU), Red Cliff Pass, Colorado	17
4.0 MesoWest Plot	18
5.0 Upper Air Data	19
6.0 Aircraft Sounding	21
7.0 Satellite Data	22
8.0 Pilot Reports	25
9.0 Terminal Aerodrome Forecast	25
10.0 Forecast Discussion	26
11.0 Forecasters Statement	28
12.0 Model Data	29
13.0 Area Forecast	29
14.0 In-Flight Weather Advisories	30
15.0 Winds and Temperature Aloft	32
16.0 Astronomical Data	33
F. LIST OF ATTACHMENTS	33

A. ACCIDENT

Location: Aspen, Colorado
Date: January 5, 2014
Time: About 1222 mountain standard time (1922 UTC¹)
Airplane: Bombardier Challenger 600; registration N115WF

B. METEOROLOGY GROUP

Donald E. Eick
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C. 20594-2000

C. SUMMARY

On January 5, 2014, at 1222 mountain standard time (MST), a Bombardier Challenger CL600, N115WF, crashed while attempting to land on runway 15 at Aspen-Pitkin County Airport/Sardy Field (KASE). There were two crewmembers and a deadheading pilot onboard, one crewmember was fatally injured and two crewmembers received serious injuries. The airplane sustained substantial damage to the right wing, vertical stabilizer and the right upper flightdeck structure. The airplane was registered to the Bank of Utah Trustee and operated by Vineland Corporation Company under the provisions of 14 Code of Federal Regulations Part 91. Instrument meteorological conditions prevailed for the flight, which operated on an instrument flight rules flight plan. The flight originated from Tuscon International Airport (KTUS), Tuscon, Arizona, at 1004.

According to preliminary information from the Federal Aviation Administration, the flight was in radio contact with the local air traffic control at KASE. At 1210, N115WF utilized the localizer DME-E approach into KASE. Local ATC reported winds as 290° at 19 knots, with winds gusting to 25 knots to the crew before landing. The crew executed a missed approach, and then requested to be vectored for a second attempt. On the second landing attempt N115WF briefly touched down on the runway, then bounced into the air and descended rapidly impacting with the ground at midfield. No further communications were received by local ATC from the accident airplane.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Climatic Data Center (NCDC).

¹ UTC – is an abbreviation for Coordinated Universal Time.

All times are mountain standard time (MST) based upon the 24 hour clock, local time +7 hours to UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS airport and station identifiers use standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus International Air Transport Association (IATA) 3-letter identifiers which deletes the initial country code designator “K” for U.S. airports. Both codes are both used intermittently in this report.

The accident site was located at latitude 39.2219° N and longitude 106.8683° W at an elevation of approximately 7,840 feet.

E. FACTUAL INFORMATION

1.0 Synoptic Situation

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

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart for 1100 MST (1800Z) on January 5, 2014 is included as figure 1 and depicted the primary synoptic weather conditions impacting the country approximately an hour prior to the accident. The chart depicted the most significant features as low pressure system over the boot heel of Missouri and along the Indiana/Kentucky border low pressure systems at 1004 and 1003-hectopascals (hPa)² along a cold front that extended southwestward into the Gulf of Mexico, that was associated with a developing winter storm. Multiple cold-core high pressure systems at 1050-hPa were located over Alberta, Canada into Montana, with a ridge of high pressure extending southeastward into the northern Plains associated with an arctic airmass which was responsible for record breaking cold temperatures. A stationary front bordered west of these highs and extended from British Columbia, Montana, Idaho, Wyoming, and into extreme northern Colorado immediately north of the accident site.

² Hectopascals (hPa) is the new standard for pressure and is interchangeable with millibars (mb) with the same units, with 1013.25-hPa the standard sea level pressure.

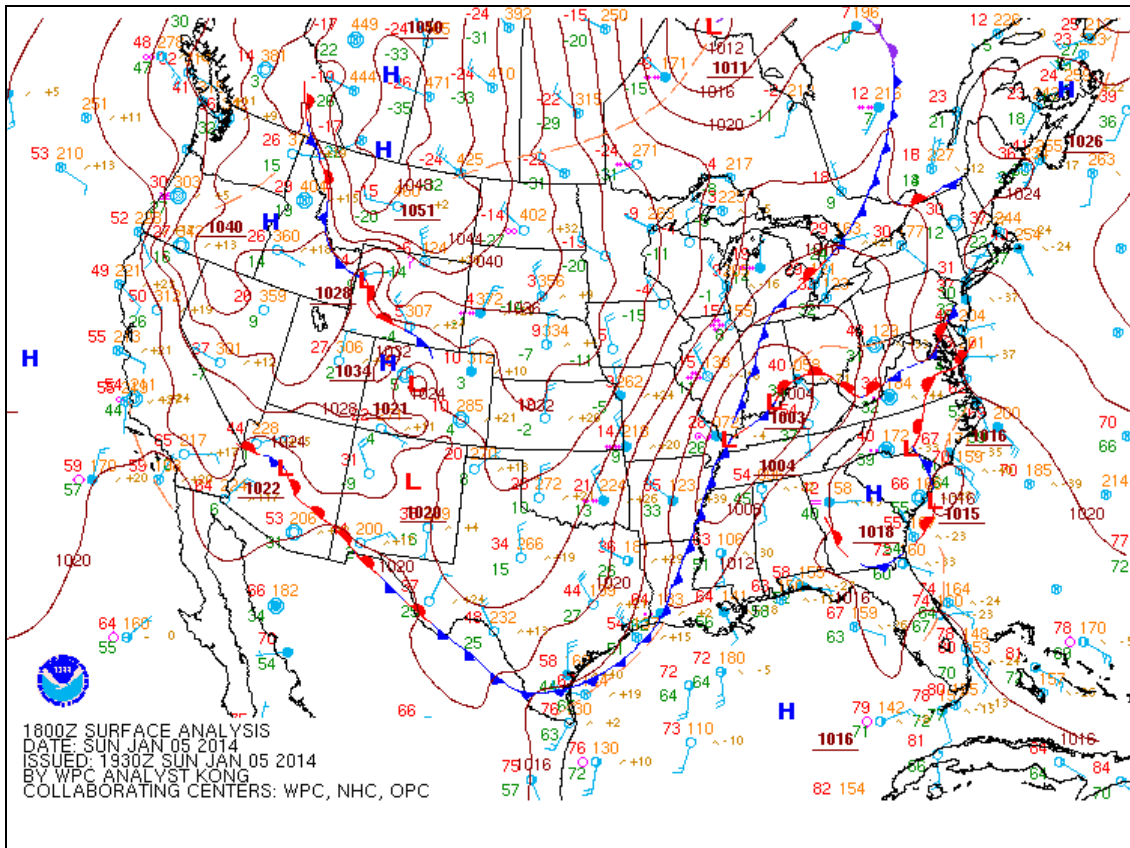


Figure 1 - NWS Surface Analysis Chart for 1100 MST

Figure 2 is a higher resolution image of the NWS Surface Analysis Chart for 1100 MST centered over Colorado with the approximate accident site noted. The chart depicted a secondary low pressure system at 1021-hPa over central Colorado located in the vicinity of the Aspen area with a high pressure system at 1034-hPa over northwest Colorado. A second low pressure system was located over New Mexico at 1020-hPa. No frontal systems were associated with these low pressure systems over Colorado and New Mexico. Further north and west, a stationary front was depicted from extreme northern Colorado, Wyoming into Idaho. The station models on the chart depicted northerly winds over the region, with broken to overcast clouds over central and northeastern Colorado with several stations reporting light snow, and temperatures from 7° to 12° Fahrenheit (F).

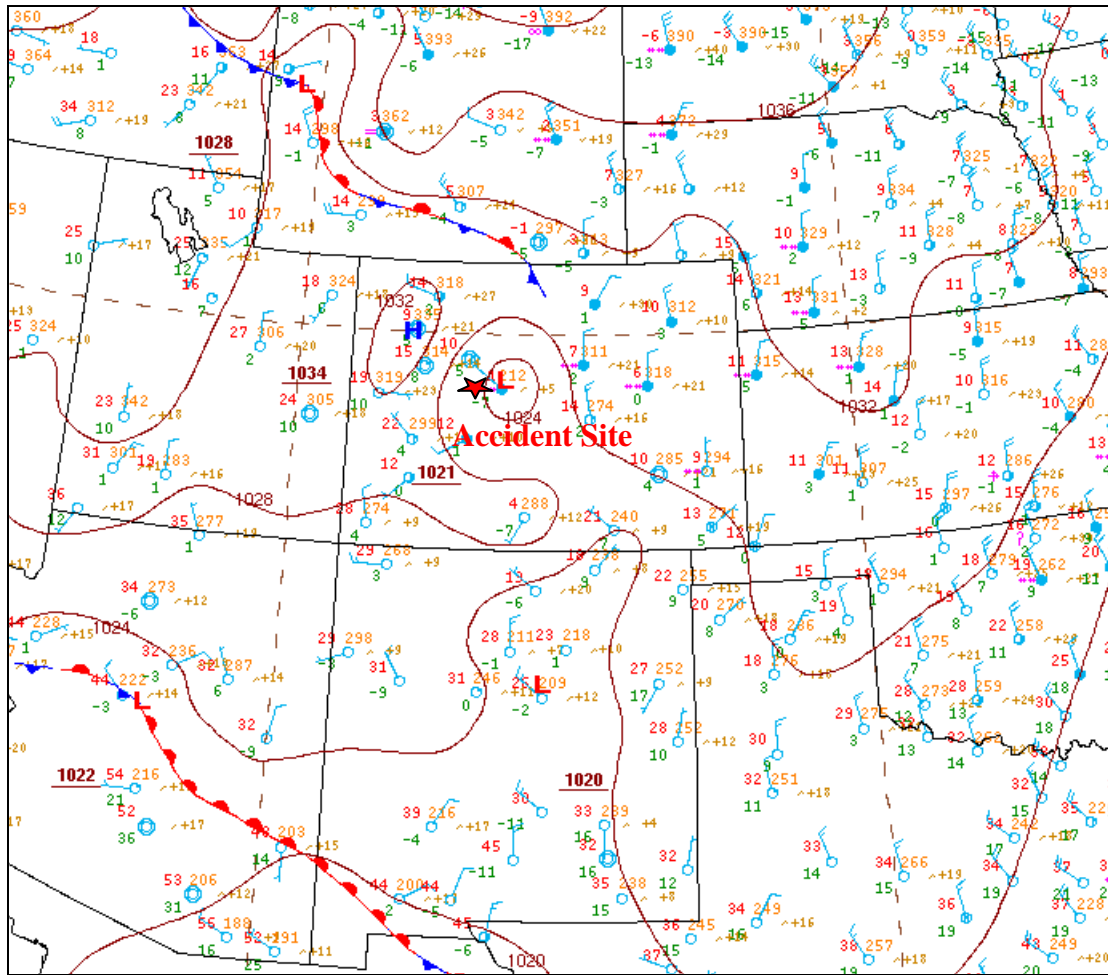


Figure 2- NWS high resolution Surface Analysis Chart for 1100 MST

1.2 Weather Radar Mosaic

The NWS regional radar mosaic for the area for 1220 MST is included as figure 3 and depicted no significant meteorological echoes over the airport, and light echoes associated with snow showers west and north of the airport, and with several bands of echoes of the Denver area. Due to the high terrain and mountainous terrain surrounding the Aspen area, the NWS weather radar coverage at low altitudes is not very accurate across the region and often fails to display many low altitude weather events.

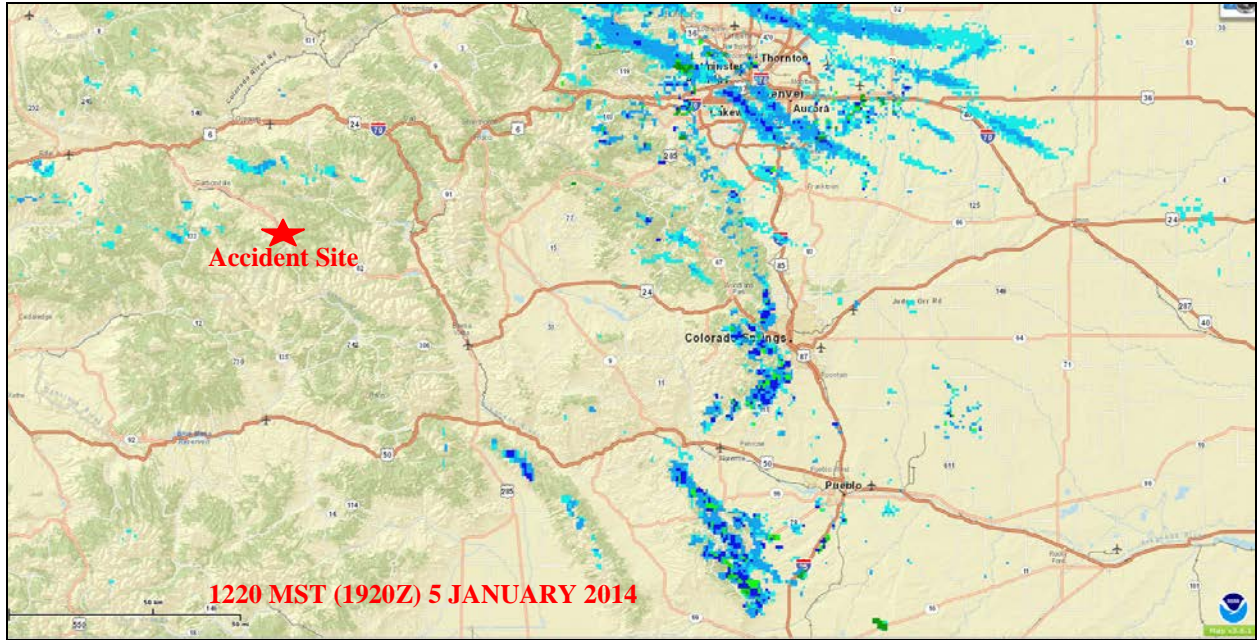


Figure 3 - NWS Radar Mosaic for 1220 MST

1.3 Constant Pressure Charts

The NWS Constant Pressure Charts for 700-, 500-, and 200-hPa on January 5, 2014 at 0500 MST (1200Z) are included as figures 4 through 6 respectively. The 700-hPa chart depicting conditions at approximately 10,000 feet and indicated winds from the northwest at 20 knots, with temperatures between -16° to -18° Celsius (C) over Colorado. The chart for 500-hPa depicted the conditions of the mean atmosphere by pressure at 18,000 feet, and continued to depicted winds from the northwest of 30 to 60 knots over the region, with temperature of -34° C. The 200-hPa chart depicted the conditions at 29,000 feet and helped identify the location and strength of the jet stream with winds from the north-northwest at 60 to 80 knots over Colorado.

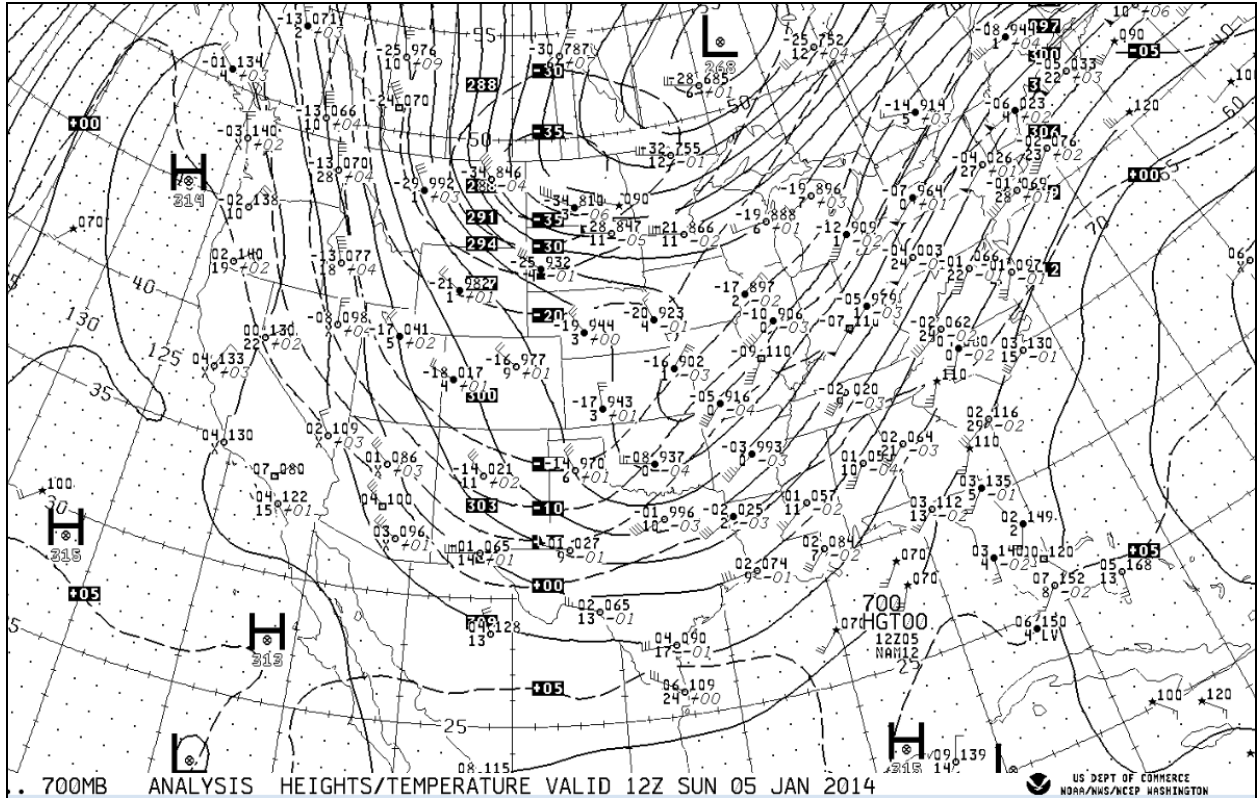


Figure 4 - NWS 700-hPa Constant Pressure Chart for 0500 MST

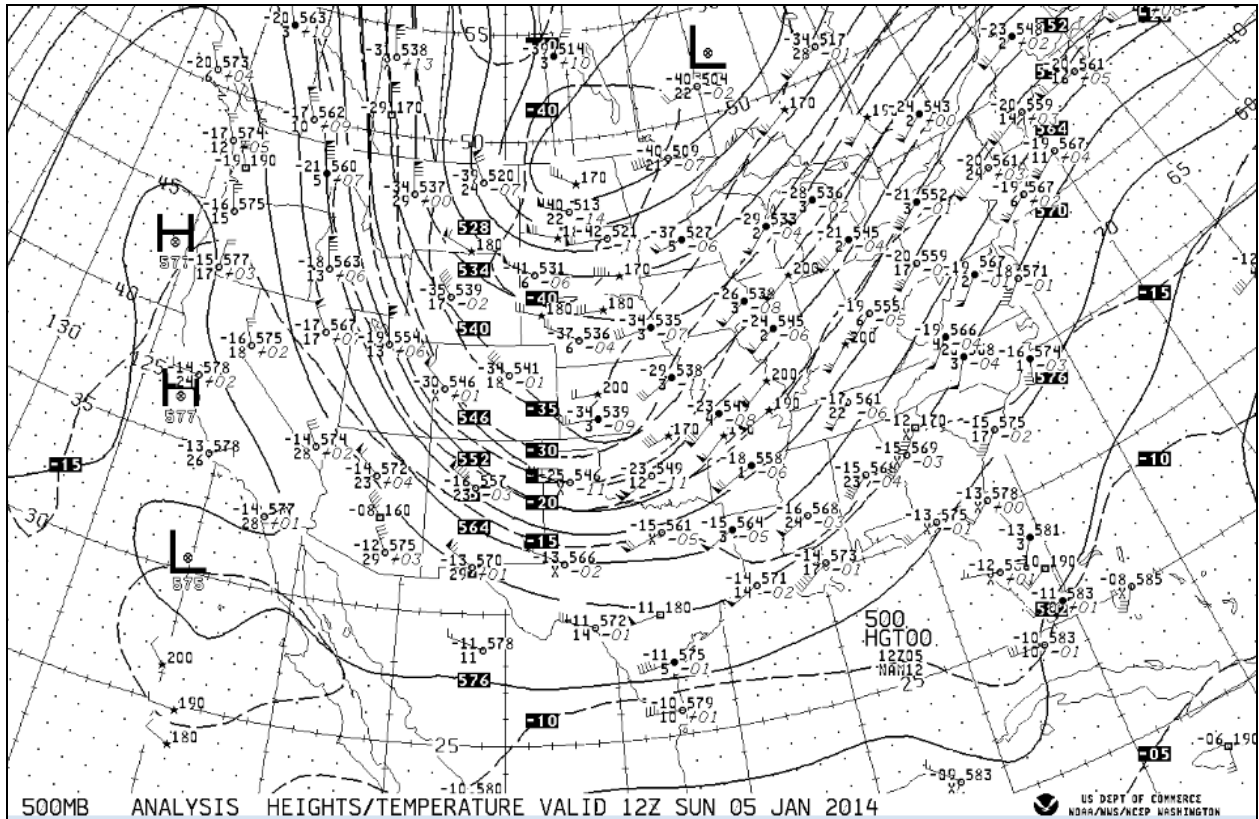


Figure 5 - NWS 500-hPa Constant Pressure Chart for 0500 MST

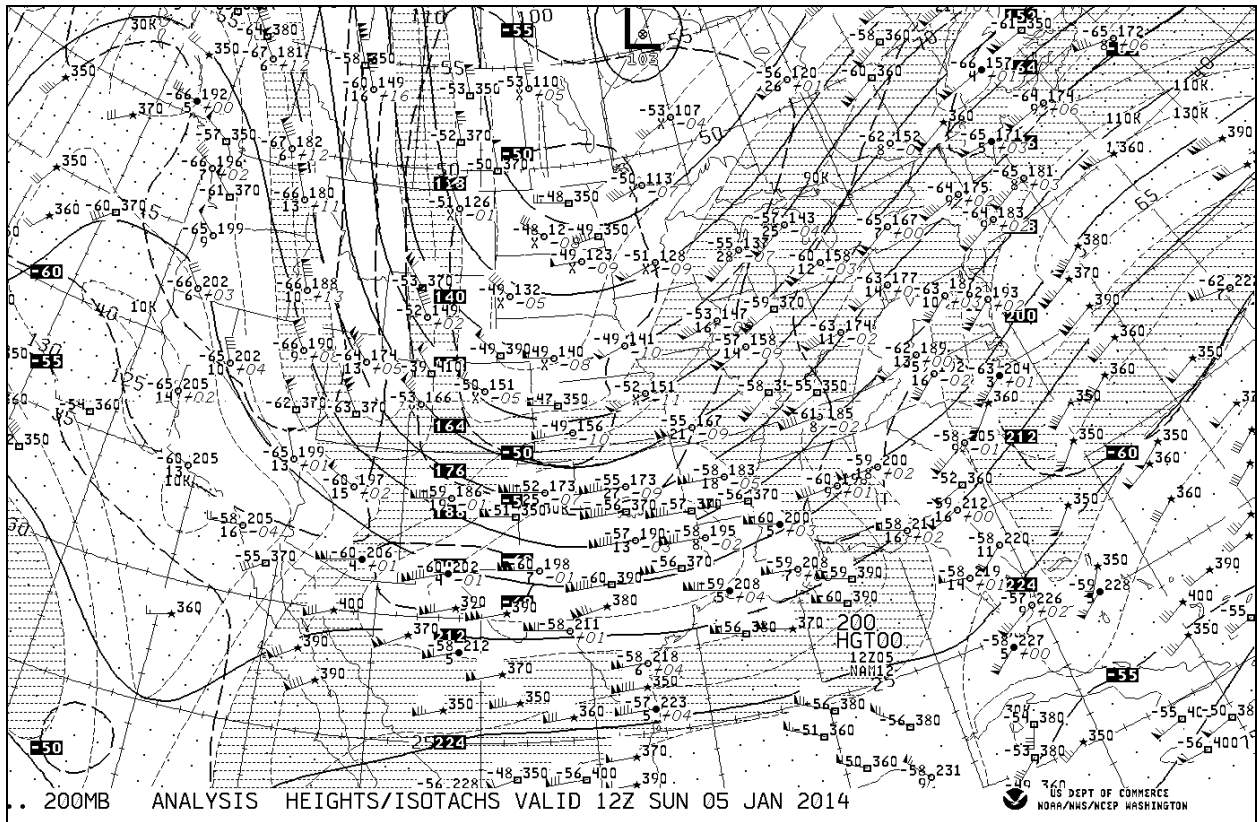


Figure 6 - NWS 200-hPa Constant Pressure Chart for 0500 MST

2.0 Topography Maps

The Aspen area is located in a remote area of the Rocky Mountains' Sawatch Range and Elk Mountains, along the Roaring Fork River at an elevation of approximately 8,000 feet. The airport was also located approximately 11 miles west of the Continental Divide and is located in the valley adjacent to the river with higher terrain surrounding the airport on all sides. The topographical map included in figure 7 provides an idea of the terrain within a 10 mile radius of the airport, with the Aspen runway 15/33 indicated by the red line. Figure 8 is a further close up of the terrain surrounding the airport and depicts high terrain immediately northwest of the runway.

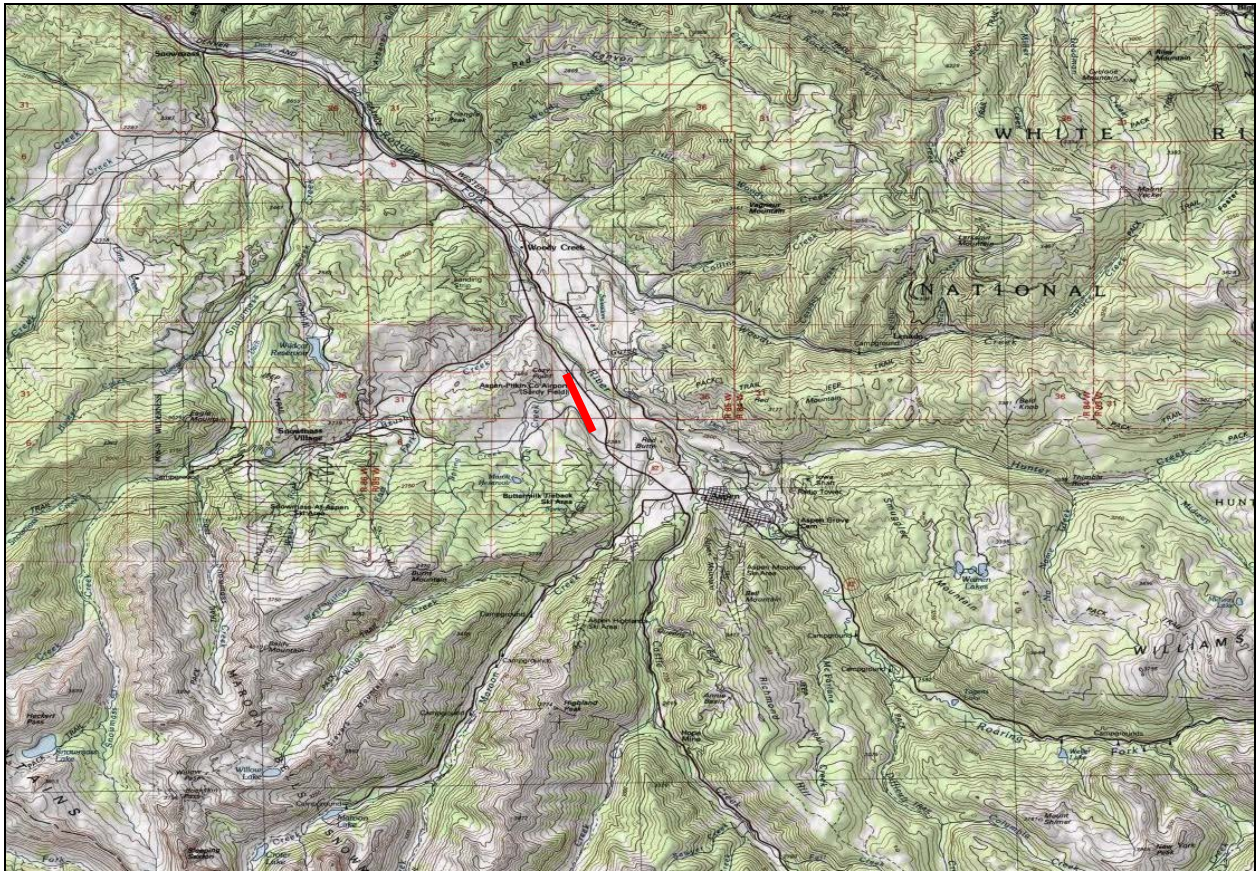


Figure 7 - Topographical features in a 10 mile area surrounding the Aspen area

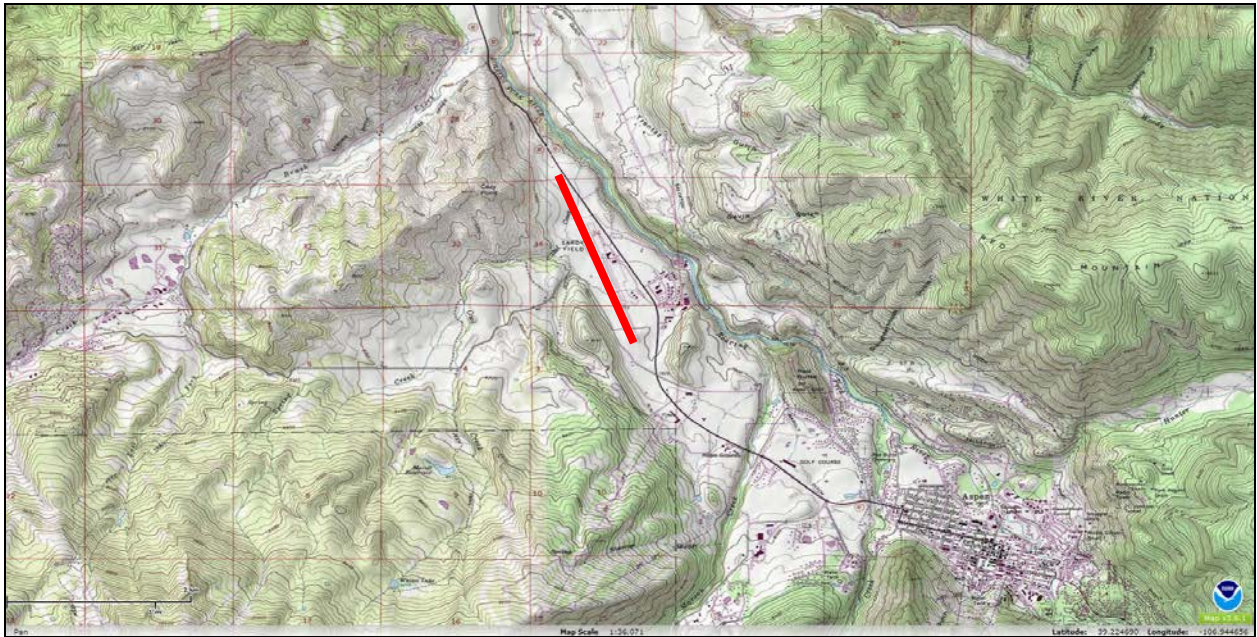


Figure 8- Aspen area centered over the airport

3.0 Surface Observations

The official NWS Meteorological Aerodrome Report (METAR) and special reports surrounding the period were documented. Cloud heights are reported above ground level (agl) in the following sections.

3.1 Aspen-Pitkin County Airport-Sardy Field (KASE), Aspen, Colorado

The accident occurred as the airplane attempted to land at Aspen-Pitkin County Airport-Sardy Field (KASE), in Aspen, Colorado, at an elevation of 7,838 feet and a magnetic variation of 9° E. The airport had a federally installed and maintained Automated Surface Observation System (ASOS) located east of the touchdown zone of runway 15. The system was augmented by air traffic controllers in the tower as necessary from 0700 to 2300 local. The following conditions were officially reported prior to the accident:

Aspen-Pitkin County Airport/Sardy Field weather at 1153 MST, wind from 310° true at 9 knots gusting to 28 knots, wind variable from 270° to 360, visibility 9 miles in haze, a few clouds at 3,500 feet agl, ceiling broken at 4,600 feet, overcast at 5,000 feet, temperature -11° C, dew point temperature -20° C, altimeter 30.07 inches of mercury (Hg). Remarks: automated surface observation system, peak wind from 320° at 28 knots occurred at 1150 MST, sea level pressure 1024.3-hPa, temperature -11.1° C, dew point -12.0° C, and maintenance indicator³.

For conditions at the time of the accident see section 3.1.1 ASOS high resolution, 5-minute observation.

The raw observations indicate that the first report of wind gusts occurs at 1153 MST (1853Z) and continue with the highest gust to 30 knots which was reported after the accident at 1250 MST (1950Z). The raw observations and the general flight category⁴ were as follows surrounding the period:

IFR METAR KASE 051153Z AUTO 34003KT 1 3/4SM -SN BR OVC019 M14/M16 A2999 RMK AO2 SLP210 P0000 60000 70004 T11441161 11133 21161 53007 \$=

³ The maintenance indicator (\$) – advises the user that the system is out of calibration, out of service, or needs requires servicing from a maintenance technician. The NWS indicated that this particular maintenance flag for KASE was due to the wind and dew point (hygrothermometer) sensors or on this particular day.

⁴ NWS defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling or lowest layer of clouds reported as broken, overcast or the vertical visibility into a surface based obscuration below 500 feet agl and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 feet agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 feet agl and visibility greater than 5 miles.

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

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

IFR SPECI KASE 051228Z AUTO 33004KT 2SM -SN BR OVC017 M14/M16 A3000 RMK AO2 P0000
T11441161 \$=

IFR METAR KASE 051253Z AUTO 35003KT 2SM -SN BR OVC022 M14/M16 A3001 RMK AO2 SLP216
P0000 T11441156 \$=

IFR SPECI KASE 051305Z AUTO VRB03KT 2 1/2SM -SN BR OVC024 M14/M16 A3001 RMK AO2 P0000
T11391156 \$=

MVFR SPECI KASE 051327Z AUTO 30003KT 4SM -SN BR BKN029 OVC070 M14/M16 A3001 RMK AO2
P0000 T11391156 \$=

VFR SPECI KASE 051340Z 30004KT 7SM SCT029 OVC070 M14/M16 A3001 RMK AO2 SNE30 P0000
T11441161 \$=

VFR METAR KASE 051353Z COR 31003KT 10SM BKN075 M14/M16 A3001 RMK AO2 SNE30 SLP222
P0000 T11441161 \$=

VFR METAR KASE 051453Z 34003KT 10SM SCT045 BKN055 M15/M16 A3002 RMK AO2 SLP230 60000
T11501161 51009 \$=

VFR METAR KASE 051553Z 35006KT 10SM BR SCT044 OVC060 M14/M16 A3006 RMK AO2 SLP243
T11391156 \$=

VFR METAR KASE 051653Z 35011KT 6SM HZ SCT044 BKN060 M12/M17 A3008 RMK AO2 SLP253
T11221172 \$=

VFR METAR KASE 051753Z 35013KT 6SM HZ BKN043 BKN050 M12/M17 A3008 RMK AO2 SLP250
60000 T11171172 11117 21161 51015 \$=

VFR METAR KASE 051853Z 31009G28KT 270V360 9SM HZ FEW035 BKN046 OVC050 M11/M20 A3007
RMK AO2 PK WND 33028/1851 SLP243 T11111200 \$=

Accident 1922Z

VFR METAR KASE 051953Z 31016G30KT 7SM HZ BKN037 OVC048 M12/M20 A3008 RMK AO2 PK WND
32030/1950 SNB40E50 SLP248 P0000 T11221200 \$=

VFR METAR KASE 052053Z 34016G23KT 10SM SCT042 M12/M22 A3008 RMK AO2 PK WND 32027/2004
SLP257 60000 T11171217 55000 \$=

VFR METAR KASE 052153Z 34015G24KT 10SM CLR M12/M22 A3010 RMK AO2 SLP259 T11221222 \$=

VFR METAR KASE 052253Z 34011KT 10SM BKN070 M12/M22 A3013 RMK AO2 SLP266 T11171217 \$=

VFR METAR KASE 052353Z 33006KT 10SM OVC050 M12/M21 A3015 RMK AO2 SLP277 60000
T11221206 11111 21122 53018 \$=

3.1.1 High Resolution ASOS Data

A review of the KASE ASOS 5-minute observations and available to the controller and for local distribution between 1155 through 1240 MST were as follows:

KASE 051855Z 32012G28KT 290V360 9SM HZ BKN046 OVC055 M11/M20 A3008 7680 48 6400 320/12G28

280V350 RMK AO2 T1111200 \$

KASE 051900Z 33014G28KT 9SM HZ BKN047 OVC060 M12/M21 A3007 7680 48 6300 320/14G28 RMK AO2 T11171206 \$

KASE 051905Z 33016G26KT 10SM HZ FEW045 BKN055 OVC070 M11/M21 A3007 7680 46 6400 320/16G26 RMK AO2 PK WND 33026/1904 T1111206 \$

KASE 051910Z 32012G26KT 10SM HZ FEW046 BKN055 M11/M21 A3007 7690 44 6400 310/12G26 RMK AO2 PK WND 33026/1904 T1111211 \$

KASE 051915Z 33017G24KT 280V360 10SM HZ FEW046 BKN055 M12/M21 A3007 7690 46 6300 320/17G24 270V350 RMK AO2 PK WND 33026/1904 T11171211 \$

KASE 051920Z 32014G25KT 280V360 10SM HZ SCT047 BKN060 M12/M21 A3007 7680 48 6300 320/14G25 270V350 RMK AO2 PK WND 33026/1904 T11171206 \$

KASE 051925Z 33014G25KT 10SM HZ SCT047 BKN065 M12/M20 A3008 7680 50 6300 320/14G25 RMK AO2 PK WND 33026/1904 T11171200 \$

KASE 051930Z 33012G22KT 10SM HZ SCT044 BKN055 M12/M20 A3008 7680 50 6300 320/12G22 RMK AO2 PK WND 33026/1904 T11171200 \$

KASE 051935Z 33010G22KT 10SM HZ BKN040 BKN050 M12/M19 A3008 7680 55 6300 320/10G22 RMK AO2 PK WND 33026/1904 T11221194 \$

KASE 051940Z 32019G26KT 6SM -SN HZ BKN037 BKN048 M12/M19 A3008 7680 55 6300 320/19G26 RMK AO2 PK WND 33026/1939 SNB40 P0000 T11221194 \$

The conditions for KASE at the approximate time of the accident at 1220 MST indicated wind from 320° at 14 knots gusting to 25 knots, wind variable from 280° to 360°, visibility 10 statute miles in haze, scattered clouds at 4,700 feet agl, ceiling broken at 6,000 feet, temperature -12° C, dew point -21° C, altimeter 30.07 inches of Hg, pressure altitude 7,680 feet, relative humidity 48%, density altitude 6,300 feet, magnetic wind 320° at 14 knots gusting to 25 knots, wind 270° variable 350°, remarks automated observation system, peak wind from 330° at 26 knots occurred at 1204 MST, temperature -11.1° C, dew point -20.6° C, maintenance indicator.

The 1-minute wind observations⁵ made by the system during the period and the computed crosswind and tailwind components for runway 15 based on the peak wind were as follows:

<u>TIME</u>	<u>WIND</u>	<u>GUST</u>	<u>CROSS</u>	<u>TAILWIND.</u>
1918Z	333° 15KT	345° 20KT	5KT	19KT
1919Z	323° 15KT	339° 22KT	0KT	22KT
1920Z	324° 14KT	324° 25KT	7KT	24KT
1921Z	333° 15KT	338° 22KT	1KT	22KT
1922Z	333° 14KT	328° 17KT	3KT	17KT Accident
1923Z	324° 13KT	330° 20KT	3KT	20KT
1924Z	331° 14KT	325° 17KT	5KT	20KT
1925Z	331° 14KT	308° 21KT	11KT	18KT

⁵ 2-minute average wind issued every minute

3.1.2 ASOS Wind Sensor

The KASE ASOS uses a sonic anemometer or ice free wind sensor (IFWS) that samples the wind every second and creates a running average of 3-second data, including a 3-second peak wind. Then the ASOS every 5 seconds, the average of the most recent 5-seconds of data is computed, producing a discrete 5-second average. The most recent 24 five second wind observations are then used to compute the 2-minute average wind direction and speed. The 2-minute average wind is the quantity reported in the routine observations such as the METAR. The three second peak wind values are stored by the ASOS for up to ten minutes for the purposes of determining wind gusts. If the current 2-minute average wind speed is equal or greater than 9 knots and the greatest 3-second peak wind speed (during the last minute) exceeds the current 2-minute average speed by 5 knots or more, then the greatest 3-second peak wind speed observed during the past minute is stored in memory as a gust. The peak wind is determined from the highest 3-second peak wind speed that exceeds 25 knots since the last generated METAR, whether transmitted or not.

3.2 Eagle County Airport (KEGE), Eagle, Colorado

Eagle County Regional Airport (KEGE) was located 25 miles north of Aspen at an elevation of 6,547 feet. The airport had an Automated Weather Observation System (AWOS) and reported the following conditions at the approximate time of the accident:

Eagle County Regional Airport weather at 1150 MST, automated, wind 280° at 18 knots gusting to 21 knots, visibility 8 miles with showers in the vicinity, a few clouds at 9,000 feet agl, temperature -21° C, dew point -22° C, altimeter 30.11 inches of Hg. Remarks: automated weather observation system without a precipitation discriminator⁶.

A review of the observations showed a sudden increase in wind speeds near the time of the accident with a peak wind gust of 21 knots. The following flight categories and raw weather observations were recorded surrounding the period:

VFR METAR KEGE 051235Z AUTO 0000KT 9SM FEW090 M21/M22 A3011 RMK AO1=

VFR METAR KEGE 051255Z AUTO 0000KT 10SM CLR M21/M23 A3010 RMK AO1=

VFR METAR KEGE 051315Z AUTO 13005KT 10SM CLR M22/M23 A3011 RMK AO1=

VFR METAR KEGE 051335Z AUTO 12005KT 10SM CLR M21/M23 A3011 RMK AO1=

VFR METAR KEGE 051350Z 0000KT 10SM FEW050 M21/M23 A3011=

VFR METAR KEGE 051450Z VRB03KT 10SM FEW050 M21/M23 A3013=

VFR METAR KEGE 051550Z 0000KT 10SM VCSH SCT060 M18/M19 A3016=

VFR METAR KEGE 051650Z 0000KT 10SM BKN050 M16/M17 A3018=

VFR METAR KEGE 051750Z 0000KT 10SM VCSH FEW060 SCT080 M12/M15 A3018=

⁶ AWOS without a precipitation discriminator is unable to report weather type or

VFR METAR KEGE 051850Z 28018G21KT 8SM VCSH FEW050 BKN070 M08/M15 A3017=

Accident 1922Z

VFR METAR KEGE 051950Z 31010G18KT 8SM VCSH SCT040 BKN060 M07/M17 A3018=

VFR METAR KEGE 052050Z 26008KT 10SM BKN055 M08/M19 A3018=

VFR METAR KEGE 052150Z 28010G14KT 10SM SCT080 M08/M21 A3019=

VFR METAR KEGE 052250Z 24013KT 10SM BKN070 M08/M18 A3021=

VFR METAR KEGE 052350Z 26006G14KT 10SM BKN065 M09/M18 A3023=

3.3 Lake County Airport (KLXV), Leadville, Colorado

Lake County Airport (KLXV), located in Leadville, Colorado, approximately 25 miles east of KASE at an elevation of 9,934 feet. The airport had an ASOS and reported the following conditions surrounding the period:

Lake County Airport weather at 1218 MST, automated, wind from 290° at 20 knots gusting to 31 knots, visibility 3/4 mile in light snow, ceiling broken at 2,200 feet agl, broken at 3,500 feet, overcast at 4,200 feet, temperature -17° C, dew point -23° C, altimeter 29.89 inches of Hg. Remarks: automated observation system, peak wind from 300° at 31 knots recorded at 1214 MST, hourly precipitation 0.02 inches, temperature -11.7° C, dew point -22.8° C.

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

IFR METAR KLXV 051653Z AUTO 31010G18KT 2SM -SN BKN022 OVC031 M17/M22 A2991 RMK AO2
SLP211 P0000 T11721222=

MVFR SPECI KLXV 051720Z AUTO 31011G21KT 3SM -SN BKN027 OVC035 M17/M22 A2992 RMK AO2
P0000 T11721222=

IFR SPECI KLXV 051727Z AUTO 30008KT 2SM -SN BKN027 OVC035 M17/M22 A2992 RMK AO2 P0000
T11721222=

IFR SPECI KLXV 051736Z AUTO 29013KT 1 1/4SM -SN BKN022 BKN027 OVC035 M17/M22 A2991 RMK
AO2 P0000 T11721217=

IFR METAR KLXV 051753Z AUTO 31010G21KT 1 1/4SM -SN BKN020 OVC028 M17/M22 A2991=

IFR SPECI KLXV 051809Z AUTO 31011G18KT 3/4SM -SN BKN016 OVC026 M17/M21 A2991 RMK AO2
P0000 T11721211=

IFR SPECI KLXV 051816Z AUTO 30016G20KT 1/2SM SN VV013 M17/M21 A2991 RMK AO2 P0000
T11721211=

IFR SPECI KLXV 051824Z AUTO 30013G21KT 280V340 1SM -SN BKN015 OVC029 M17/M22 A2990 RMK
AO2 P0000 T11721217=

IFR SPECI KLXV 051845Z AUTO 29012G20KT 1/2SM SN BKN015 OVC028 M17/M21 A2990 RMK AO2

P0000 T11721211=

IFR METAR KLXV 051853Z AUTO 32009G18KT 1/2SM SN BKN013 OVC028 M17/M21 A2990 RMK AO2
SLP211 P0000 T11721206=

IFR SPECI KLXV 051908Z AUTO 31017G25KT 1SM -SN BKN016 OVC028 M17/M22 A2990 RMK AO2
P0002 T11721217=

IFR SPECI KLXV 051918Z AUTO 29020G31KT 3/4SM -SN BKN022 BKN035 OVC042 M17/M23 A2989 RMK
AO2 PK WND 30031/1914 P0002 T11721228=

Accident 1922Z

LIFR SPECI KLXV 051937Z AUTO 31012G17KT 1/4SM +SN BKN014 OVC039 M17/M21 A2990 RMK AO2
PK WND 30031/1914 P0002 T11721206=

IFR METAR KLXV 051953Z AUTO 31013G19KT 1/2SM SN VV011 M17/M21 A2990 RMK AO2 PK WND
30031/1914 SLP206 P0003 T11721211=

LIFR SPECI KLXV 052022Z AUTO 31010KT 1/4SM +SN BKN011 BKN017 OVC021 M17/M21 A2991 RMK
AO2 P0000 T11721206=

IFR SPECI KLXV 052036Z AUTO 30014G22KT 1SM -SN BKN013 OVC026 M17/M22 A2991 RMK AO2
P0001 T11721222=

IFR SPECI KLXV 052050Z AUTO 30014G21KT 1 1/2SM -SN BKN019 OVC026 M17/M23 A2992 RMK AO2
P0001=

IFR METAR KLXV 052053Z AUTO 32014G20KT 1 1/2SM -SN BKN019 BKN026 OVC034 M18/M22 A2992
RMK AO2 VIS 3/4V4 SLP214 P0001 60004 T11781222 53005=

IFR SPECI KLXV 052115Z AUTO 32010KT 1/2SM SN BKN015 OVC031 M17/M21 A2992 RMK AO2 P0000
T11721211=

IFR SPECI KLXV 052129Z AUTO 30010G18KT 3/4SM -SN VV013 M17/M21 A2993 RMK AO2 P0000
T11721211=

IFR SPECI KLXV 052141Z AUTO 30011KT 1SM -SN VV016 M18/M22 A2993 RMK AO2 P0000 T11781217=

MVFR SPECI KLXV 052151Z AUTO 30011G17KT 3SM -SN BKN020 OVC035 M18/M22 A2994 RMK AO2
P0000=

MVFR METAR KLXV 052153Z AUTO 31014G19KT 3SM -SN BKN020 OVC035 M18/M22 A2994 RMK AO2
SLP215 P0000 T11781222=

IFR SPECI KLXV 052201Z AUTO 32011G19KT 1 3/4SM -SN BKN020 OVC035 M18/M23 A2994 RMK AO2
P0000 T11781228=

MVFR SPECI KLXV 052229Z AUTO 32017G25KT 3SM -SN BKN029 BKN035 OVC043 M18/M24 A2995 RMK
AO2 P0000 T11781239=

VFR SPECI KLXV 052245Z AUTO 31007G19KT 7SM BKN033 OVC045 M18/M24 A2996 RMK AO2
UPB39E41SNE39B41E42 P0000 T11781244=

IFR METAR KLXV 052253Z AUTO 31011G16KT 2 1/2SM -SN BKN025 OVC035 M18/M23 A2996 RMK AO2
UPB39E41SNE39B41 SLP224 P0000 T11781228=

IFR SPECI KLXV 052300Z AUTO 31009G16KT 3/4SM -SN BKN019 OVC041 M18/M22 A2996 RMK AO2 P0000 T11781222=

IFR SPECI KLXV 052317Z AUTO 30008KT 1SM -SN VV017 M18/M21 A2996 RMK AO2 P0001 T11831211=

IFR METAR KLXV 052353Z AUTO 31013G22KT 1 1/2SM -SN OVC022 M18/M23 A2998 RMK AO2 SLP235 P0001 60005 T11831228 11167 21183 51014=

3.4 Copper Mountain (KCUU), Red Cliff Pass, Colorado

A remote Automated Weather Observation System (AWOS) was installed on Copper Mountain, near Red Cliff Pass, located 36 miles east-northeast of Aspen and 17 miles northeast of KLXV at an elevation of 12,070 feet. The system reported the following conditions at the approximate time of the accident:

Copper Mountain weather at 1235 MST, automated, wind from 280° at 27 knots gusting to 42 knots, visibility missing, ceiling overcast at 200 feet agl, temperature -20° C, dew point -25° C, and altimeter 29.75 inches of Hg.

The general flight category reported by the system and raw observations surrounding the period were as follows:

IFR METAR KCCU 051235Z AUTO 28021G28KT OVC005 M20/M24 A2974 RMK AO2 PWINO=

IFR METAR KCCU 051255Z AUTO 28021G31KT OVC005 M20/M24 A2972 RMK AO2 PWINO=

IFR METAR KCCU 051315Z AUTO 28025G31KT OVC007 M20/M24 A2973 RMK AO2 PWINO=

MVFR METAR KCCU 051335Z AUTO 27023G29KT SCT007 BKN014 OVC020 M20/M24 A2973 RMK AO2 PWINO=

MVFR METAR KCCU 051355Z AUTO 27025G30KT SCT007 BKN013 OVC022 M20/M25 A2973 RMK AO2 PWINO=

MVFR METAR KCCU 051415Z AUTO 28022G30KT SCT006 BKN010 OVC021 M20/M25 A2974 RMK AO2 PWINO=

IFR METAR KCCU 051435Z AUTO 27024G29KT BKN008 OVC019 M20/M24 A2974 RMK AO2 PWINO=

IFR METAR KCCU 051455Z AUTO 28016G33KT BKN008 BKN012 OVC019 M20/M24 A2975 RMK AO2 PWINO=

IFR METAR KCCU 051515Z AUTO 28026G37KT BKN008 OVC014 M20/M24 A2975 RMK AO2 PWINO=

IFR METAR KCCU 051535Z AUTO 28024G31KT OVC006 M20/M24 A2976 RMK AO2 PWINO=

IFR METAR KCCU 051555Z AUTO 28021G34KT BKN006 OVC014 M20/M24 A2976 RMK AO2 PWINO=

IFR METAR KCCU 051615Z AUTO 28021G45KT BKN006 OVC010 M20/M24 A2977 RMK AO2 PWINO=

IFR METAR KCCU 051635Z AUTO 28038G45KT BKN006 OVC012 M20/M24 A2975 RMK AO2 PWINO=

IFR METAR KCCU 051655Z AUTO 28025G31KT 1/2SM -SN OVC006 M20/M24 A2977 RMK AO2=
 LIFR METAR KCCU 051715Z AUTO 27025G40KT 1/4SM SN OVC006 M20/M24 A2978 RMK AO2=
 LIFR METAR KCCU 051735Z AUTO 27027G43KT 1/4SM SN OVC004 M20/M24 A2978 RMK AO2=
 LIFR METAR KCCU 051755Z AUTO 26032G40KT 1/4SM SN OVC004 M20/M24 A2977 RMK AO2=
 LIFR METAR KCCU 051815Z AUTO 28020G34KT 1/4SM SN OVC004 M20/M24 A2977 RMK AO2=
 LIFR METAR KCCU 051835Z AUTO 28022G30KT OVC002 M20/M25 A2977 RMK AO2 PWINO=
 LIFR METAR KCCU 051855Z AUTO 28020G30KT OVC002 M20/M24 A2977 RMK AO2 PWINO=
 LIFR METAR KCCU 051915Z AUTO 29021G31KT OVC002 M20/M24 A2976 RMK AO2 PWINO=
 Accident 1922Z
 LIFR METAR KCCU 051935Z AUTO 28027G42KT OVC002 M20/M25 A2975 RMK AO2 PWINO=
 LIFR METAR KCCU 051955Z AUTO 28032G40KT OVC004 M20/M25 A2976 RMK AO2 PWINO=
 IFR METAR KCCU 052015Z AUTO 28029G46KT OVC006 M20/M25 A2976 RMK AO2 PWINO=
 LIFR METAR KCCU 052035Z AUTO 28032G41KT 1/4SM -SN OVC008 M20/M25 A2977 RMK AO2=
 IFR METAR KCCU 052055Z AUTO 29026G39KT 1/2SM -SN BKN007 OVC012 M20/M24 A2978 RMK AO2=
 LIFR METAR KCCU 052115Z AUTO 28027G34KT 1/4SM SN OVC006 M20/M25 A2978 RMK AO2=
 IFR METAR KCCU 052135Z AUTO 28010G30KT BKN006 OVC012 M20/M25 A2980 RMK AO2 PWINO=
 IFR METAR KCCU 052155Z AUTO 27026G33KT BKN006 OVC011 M20/M25 A2980 RMK AO2 PWINO=
 IFR METAR KCCU 052215Z AUTO 28028G40KT BKN006 OVC011 M21/M25 A2980 RMK AO2 PWINO=
 IFR METAR KCCU 052235Z AUTO 29025G37KT BKN008 OVC015 M20/M25 A2980 RMK AO2 PWINO=
 MVFR METAR KCCU 052255Z AUTO 29029G40KT BKN010 OVC017 M21/M26 A2981 RMK AO2 PWINO=
 IFR METAR KCCU 052315Z AUTO 29025G40KT BKN008 OVC016 M21/M26 A2981 RMK AO2 PWINO=
 IFR METAR KCCU 052335Z AUTO 27025G38KT BKN006 OVC014 M21/M25 A2982 RMK AO2 PWINO=
 IFR METAR KCCU 052355Z AUTO 28033G40KT BKN006 OVC012 M20/M25 A2981 RMK AO2 PWINO=

4.0 MesoWest Plot

A plot of the Mesowest data at 1230 MST from the University of Utah website for the Aspen area is included as figure 9, with wind direction and speed provided by the pendant and the peak wind gust in miles per hour (mph) in the box next to the stations. Aspen Airport reported a wind gust of 32 mph at the time. Observations from Cooper Mountain and Leadville both reported

wind gusts to 36 mph at the time. Other remote weather stations are also plotted across the region.

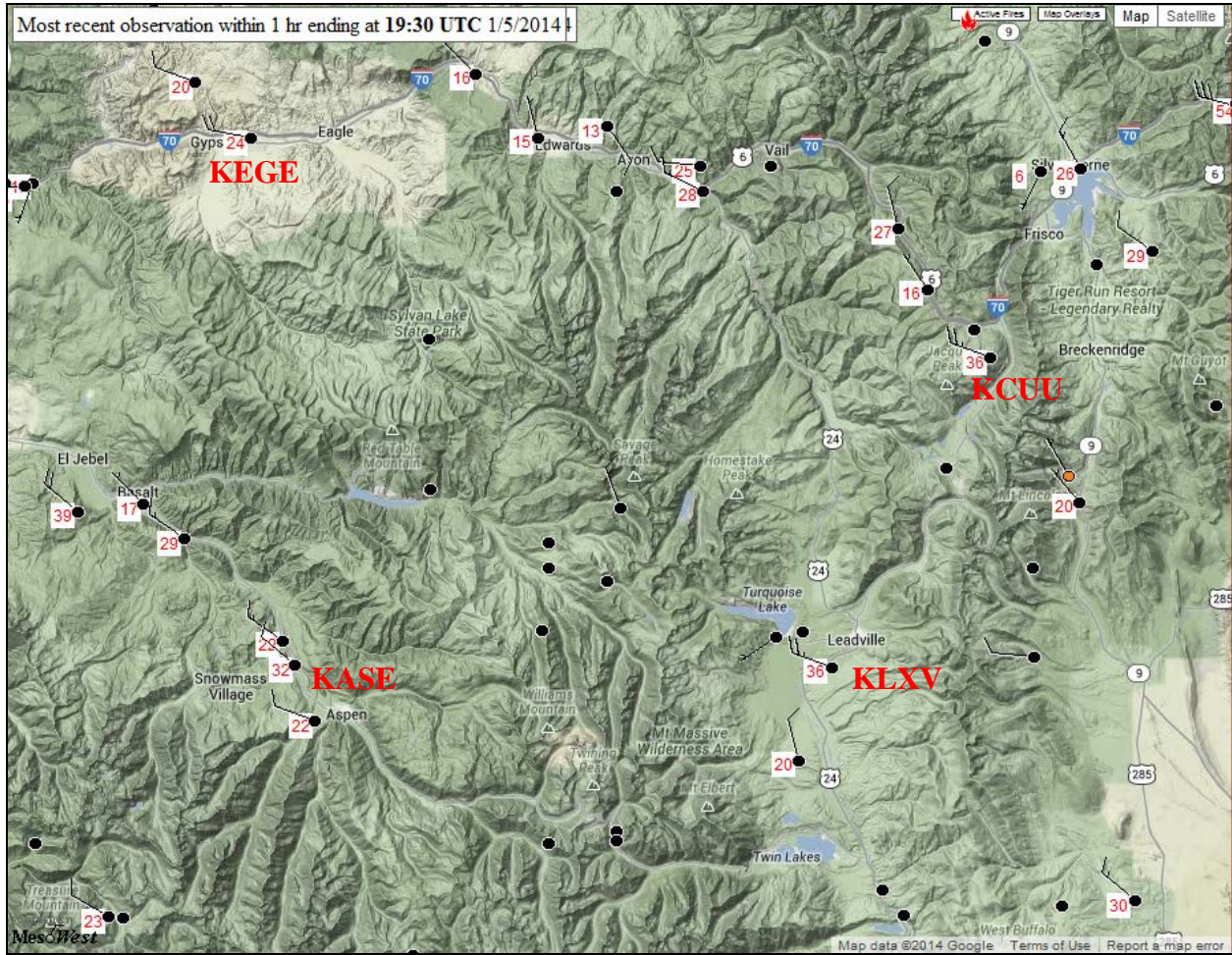


Figure 9 - Mesowest plot at 1230 MST

5.0 Upper Air Data

The closest upper air sounding or rawinsonde observation (RAOB) was from the NWS Grand Junction (KGJT), Colorado, site number 72476, located 78 miles west of the accident site at an elevation of 4,839 feet. The 0500 MST (1200Z) sounding was plotted on a standard Skew-T log P diagram⁷ utilizing RAOB⁸ software is included as figure 10 from the surface to 500-hPa or 18,000 feet.

⁷ Skew T log P diagram – is a standard meteorological plot using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

⁸ RAOB – (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania.

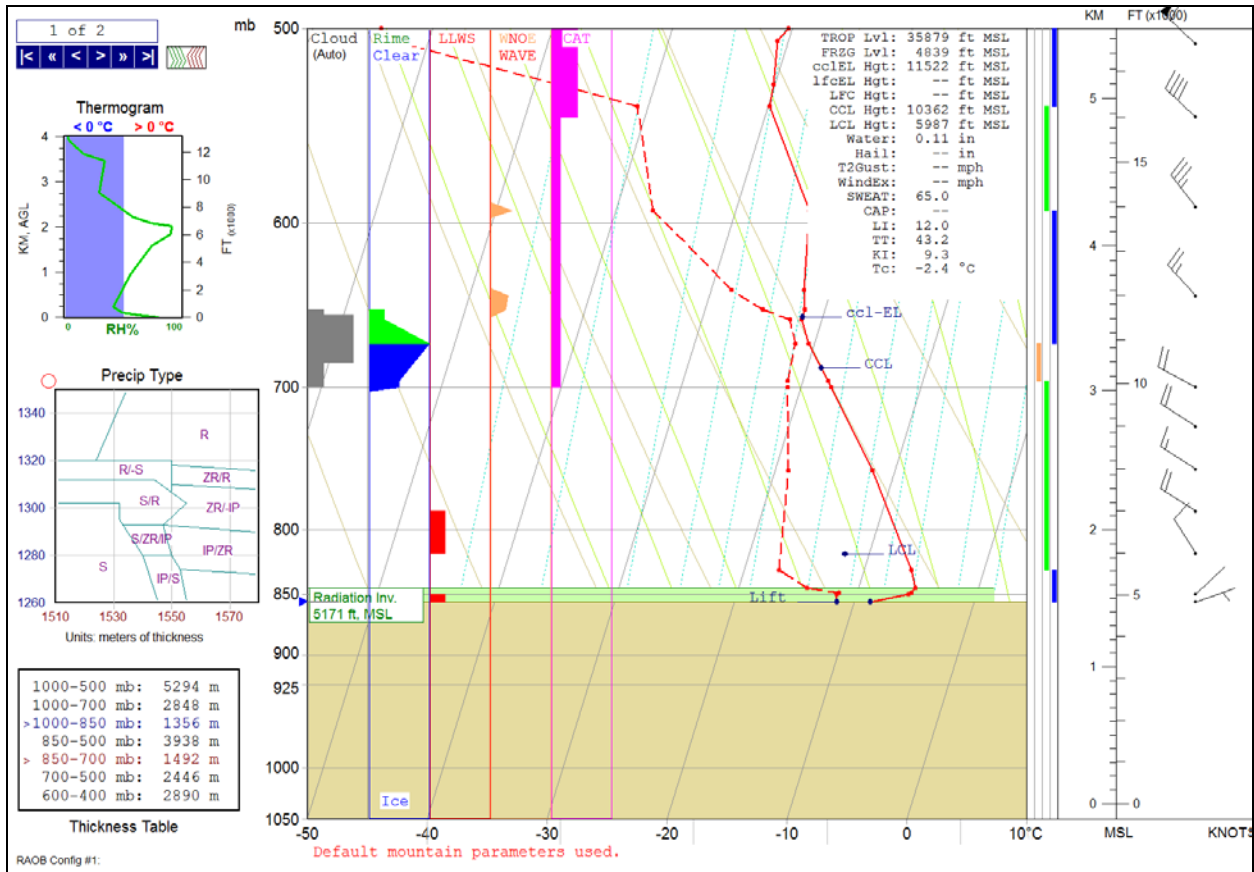


Figure 10 - NWS KGJT 0500 MST upper air sounding

The sounding depicted a surface based temperature inversion to 330 feet agl, even with the inversion the entire depth of the sounding was below freezing. The lifted condensation level (LCL)⁹ was identified at 818-hPa or at 1,148 feet agl, with the convective condensation level (CCL)¹⁰ at 687-hPa or 5,523 feet agl. The equilibrium level (EL)¹¹ or expected top of the clouds was at 11,522 feet. The sounding had a relative humidity of greater than 75% at the surface and between 10,000 and 11,600 feet. The tropopause was identified at approximately 35,900 feet. The atmosphere was characterized as stable based on the Lifted Index (LI) of 12.0 and support stratiform type clouds.

The wind profile indicated a surface wind from the east-northeast or from 070° at 4 knots, with wind shifting abruptly to the northwest above the temperature inversion and with increasing wind speed with height. The mean 0 to 6 kilometer or 18,000 feet wind was from 324° at 39

⁹ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁰ Convective Condensation Level (CCL) - The height to which a parcel of air, if heated sufficiently from below, will rise adiabatically until condensation starts. This is typically used to identify the base of cumuliform clouds, which are normally produced from surface heating and thermal convection.

¹¹ Equilibrium Level (EL) - On this sounding, is the level above the convective condensation level at which the temperature of a rising air parcel again equals the temperature of the environment.

knots. The level of maximum wind was identified at 33,000 feet with wind from 325° at 145 knots.

The observed and derived clear air turbulence (CAT), low-level wind shear (LLWS), icing, and mountain wave potential from the sounding is indicated on the sounding plot and are included in the following table, provided in figure 11.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD/FF (deg/kts)	CAT (AF)	LLWS	Icing - Type (S-F clouds)	Wave/x—W—Turb nm fpm max
4839	856	-8.7	-11.5	80	70/4		LIGHT	TRC Rime	
5019	850	-5.7	-11.7	63	45/2				
5049	849	-5.5	-11.5	63					
5171	845	-5.3	-14.3	49					
5601	831	-6.1	-17.1	41					
6000	818				330/9		LIGHT		
7000	786				305/18				
7970	757	-11.9	-18.9	56	305/17				
9000	726				305/18				
9915	700	-17.5	-21.1	73	300/21			LGT Clear	
10056	696	-17.9	-21.3	75				LGT Clear	
10913	672	-20.5	-21.6	91				SVR Clear	
11460	657	-21.7	-22.7	92				TRC Rime	
11682	651	-21.7	-25.2	73		LGT		TRC Rime	2.31 414 LIGHT
12000	642				320/25				3.34 535 LT-MD
12131	639	-22.3	-28.3	58		LGT			
13927	593	-23.9	-36.9	29	325/35	LGT			4.09 679 LT-MD
16000	543				315/38				
16231	538	-29.9	-40.9	34					
16714	527	-30.1	-48.1	16					
17662	506	-30.9	-62.9	3		MDT			
17940	500	-30.3	-64.3	2	315/61				
18128	496	-29.7	-64.7	2					3.47 524 LT-MD

Figure 11 - KGJT Sounding data

6.0 Aircraft Sounding

A search of Aircraft Meteorological Data Reports (AMDAR) or specialized instrumented equipped aircraft operating in the area surrounding the period of the accident, provided a flight departing Eagle County Regional Airport (KEGE), Eagle, Colorado, located approximately 25 miles north of the accident site at 1348 MST. Figure 12 is a sounding plot of temperature and winds from the aircraft identified as #2835 as it departed, and the observed data by height.

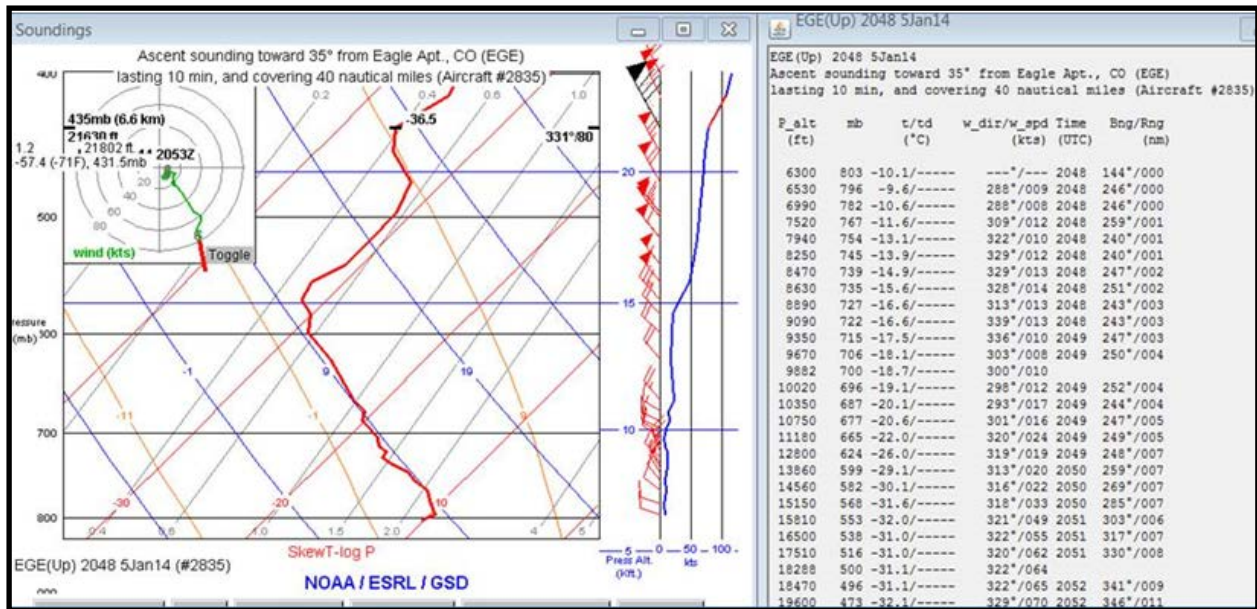


Figure 12 – KEGE AMDAR ascent sounding at 1348 MST

The ascent sounding depicted winds from the west backing to the northwest with height. A defined inversion or isothermal layer where temperature remained constant with altitude existed between 15,000 and 19,600 feet.

At the approximate time of aircraft #2835's departure, the KEGE METAR reported wind from 260° at 8 knots, visibility 10 miles, ceiling broken at 5,500 feet agl, with a surface temperature of -8° C.

7.0 Satellite Data

The NWS Geostationary Operational Environmental Satellite number 15 (GOES-15) data was obtained from an archive at the Space Science Engineering Center (SSEC) at the University of Wisconsin-Madison (UW) in Madison, Wisconsin, and processed using the Safety Board's Man-computer Interactive Data Access System (McIDAS) software. Both the infrared long wave and visible band imagery were obtained surrounding the time of the accident. The infrared long wave imagery (band 4) at a wavelength of 10.7 microns (μm) provided standard satellite image with radiative cloud top temperatures with a resolution of 4 km. The visible imagery (band 1) at a wavelength of 0.65 μm provided a resolution of 1 km.

Figure 13 is the GOES-15 infrared image at 4X magnification centered over the Aspen area, at 1215 MST with the frontal and pressure systems from 1100 MST overlaid. Aspen (KASE) was located between the high and low pressure system. The image depicted a layer of low to mid-level cloud cover over the area with several defined northwest-to-southeast cloud bands oriented parallel to the upper level wind. The image also depicted a large area of snow cover on the ground and over the higher mountain ranges (gray) with the clouds above (whiter shades). The radiative cloud top temperature over the accident site was 247° Kelvin or -26.16° C, which corresponded to cloud tops near 15,000 feet.

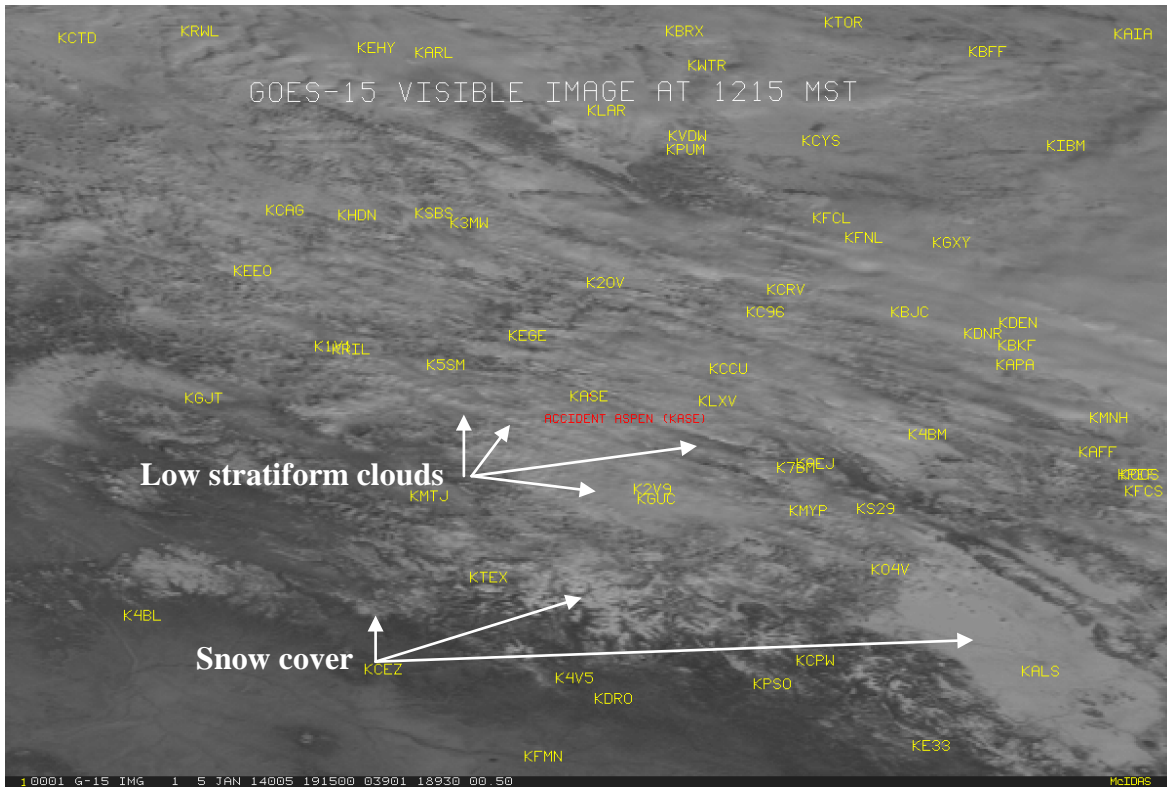


Figure 12 - GOES-15 visible image at 1215 MST

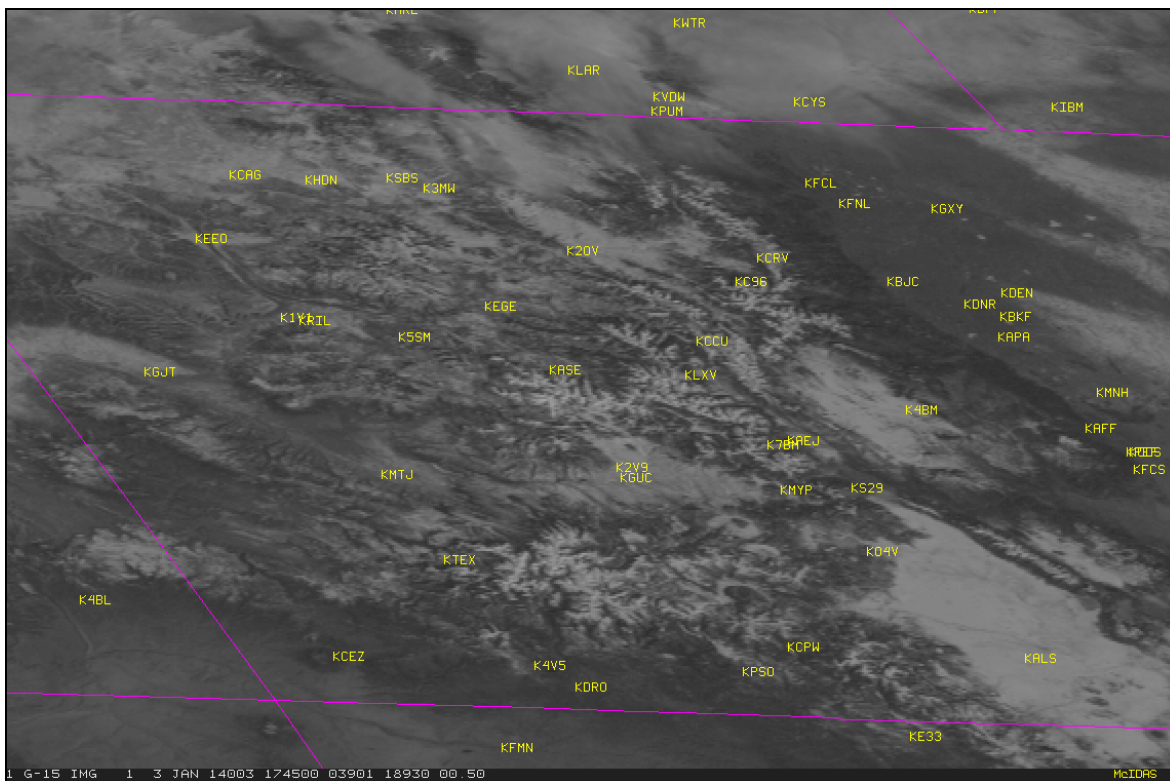


Figure 13 - GOES-15 visible image on January 3, 2014 showing snow cover

8.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over Colorado surrounding the period between 1030 and 1330 MST. The reports were as follows:

ARP UAL408 3748N 10855W 1730 F350 TB MOD CHOP RM A320 OV DVC SMOOTH FL310

DEN UA /OV DVC077025/TM 1745/FL380/TP B763/TB MOD/RM FROM ZDV

PUB UA /OV PUB/TM 1750/FL410/TP LJ60/SK SKC/TA M51/WV 30091KT/TB NEG/RM SMTH

VEL UA /OV MTU090050/TM 1802/FL380/TP B737/WV 317122KT/TB CONT MOD/RM AWC-WEB/SWA

MTJ UA /OV MTJ270013/TM 1846/FL095/TP C172/SK SCT110/TB INTMT LGT/RM MTNS OBSCD EAST OF MTJ

HDN UA /OV CHE260050/TM 1858/FL380/TP GL5T/TB MDT TURB/RM ZDV

ASE UUA /OV ASE/TM 1902/FLUNKN/TP LJ35/RM LLWS-10KTS 2MI FAP R15

04V UA /OV HBU125039/TM 1918/FL250/TP C425/SK BKNUNKN/SKC/TA M30/WV 318135KT/TB NEG/RM MOUNTAINS OBSCURED BELOW

Accident 1922Z

GUC UA /OV HBU215030/TM 2007/FL370/TP A319/TB MOD CHOP/RM FROM ZDV

DEN UA /OV HBU215030/TM 2008/FL390/TP B752/TB CONT LIGHT OCNL MOD TURB/RM FROM ZDV

GUC UA /OV HBU125015/TM 2020/FL360/TP A320/RM MOD CHOP-ZDV.ZDV.ZDV

The pilot reports noted one urgent pilot report at 1202 MST over Aspen from a flightcrew operating a Lear 35 corporate jet who reported encountering low-level wind shear with a 10 knot loss of airspeed on final approach to runway 15.

Another pilot report prior to the accident at 1218 MST reported the mountain tops obscured east of the Montrose (MTJ) area. The majority of the other pilot reports surrounding the period were of encounters with moderate turbulence at altitudes above 32,000 feet.

9.0 Terminal Aerodrome Forecast

The NWS Grand Junction Weather Forecast Office was responsible for issuing the terminal aerodrome forecast (TAF) for Aspen and Eagle. The forecasts available for preflight planning by the flight crew of N115WF were issued at 0429 MST with the next scheduled update at 1024 MST, with both valid for a 24 hour period. The forecast expected the wind from 350° at 10 knots, visibility better than 6 miles with snow showers in the vicinity, scattered clouds at 4,000 feet agl, and a ceiling broken at 6,000 feet.

The forecast was amended at 1211 MST following the first report of wind gusts at KASE and made adjustments in the wind direction and speed, and sky cover. The amended forecast

changed the wind to 310° at 10 knots gusting to 30 knots, with a broken ceiling at 4,000 feet, and overcast clouds at 5,000 feet. The raw forecasts were as follows with the applicable time period of the accident in bold print:

*TAF KASE 051129Z 0512/0612 02005KT 2SM -SN BR OVC023
TEMPO 0512/0515 4SM -SN BR SCT023 BKN050
FM051500 VRB03KT P6SM VCSH SCT040 BKN050
FM051900 34011KT P6SM VCSH SCT040 BKN050
FM060200 21006KT P6SM FEW050 SCT070=*

***TAF KASE 051724Z 0518/0618 35010KT P6SM VCSH SCT040 BKN060**
FM052100 34012KT P6SM BKN040 OVC060
FM060300 21006KT P6SM FEW050 SCT070
FM060900 19010KT P6SM SCT100=*

***TAF AMD KASE 051911Z 0519/0618 31010G30KT P6SM VCSH BKN040 OVC050**
FM052100 34012KT P6SM BKN040 OVC060
FM060300 21006KT P6SM FEW050 SCT070
FM060900 19010KT P6SM SCT100=*

A review of the TAFs issued for Eagle (KEGE) located 25 miles north during the same period were as follows:

*TAF KEGE 051129Z 0512/0612 VRB03KT P6SM VCSH SCT050 BKN090
FM051800 25014G21KT P6SM VCSH FEW050 BKN080
FM060100 09005KT P6SM SCT050
FM060600 00000KT P6SM SKC
AMD LTD TO CLD VIS AND WIND TIL 051400=*

*TAF KEGE 051724Z 0518/0618 00000KT P6SM VCSH BKN050
FM052000 25012G20KT P6SM BKN080
FM060100 09005KT P6SM SCT080
FM060600 00000KT P6SM SKC=*

*TAF AMD KEGE 051912Z 0519/0618 28015G25KT P6SM VCSH BKN070
FM052000 25012G20KT P6SM BKN080
FM060100 09005KT P6SM SCT080
FM060600 00000KT P6SM SKC=*

10.0 Forecast Discussion

The NWS Grand Junction WFO issued an Area Forecast Discussion (AFD), which also includes an aviation discussion. The product is intended to provide a well-reasoned discussion of the meteorological thinking which went into the preparation of the NWS forecast products. The forecaster will try to focus on the most particular challenges of the forecast, with the discussion written in plain language and with NWS contractions. At the end of the discussion, there will be a list of all advisories, non-convective watches and warnings over the area. With an intermediate discussion issued when significant forecast updates are being made. The discussion issued prior to the accident at 0938 MST was as follows:

FXUS65 KGJT 051638

AFDGJT

AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE GRAND JUNCTION CO
938 AM MST SUN JAN 5 2014

.UPDATE...
ISSUED AT 854 AM MST SUN JAN 5 2014

WITH THE MAJORITY OF SNOWFALL HAVING ENDED...THE ADVISORIES AND WARNINGS WILL BE ALLOWED TO EXPIRE THIS MORNING. THE NORTHERN MOUNTAINS AND FLATTOPS MAY SEE ANOTHER INCH OR TWO OF NEW SNOW THROUGH THIS EVENING AS NWLY FLOW KEEPS FAVORABLE OROGRAPHICS IN THE PICTURE. ASIDE FROM THAT...COLD WILL BE THE WORD TODAY AND ESPECIALLY TONIGHT WITH SUB-ZERO READINGS BEING COMMON EXCEPT FOR THE SOUTHERN VALLEYS WHICH SHOULD DROP TO THE SINGLE DIGITS.

.SHORT TERM...(TODAY THROUGH MONDAY)
ISSUED AT 352 AM MST SUN JAN 5 2014

THE WESTERN EDGE OF THE PROGRESSING TROUGH WORKS THROUGH THE REGION TODAY WITH A 115KT JET OVERHEAD THIS AFTERNOON. THIS KEEPS A NW-SE ORIENTED DEFORMATION AXIS ALONG THE EASTERN EDGE OF THE FORECAST AREA THROUGH THE AFTERNOON THAT WILL HELP WITH SNOW PRODUCTION THERE. WEAK COLD ADVECTION CONTINUES THIS MORNING AT 700MB/MOUNTAIN TOP LEVEL...BUT WARM ADVECTION IS ALREADY OCCURRING AT AND ABOVE 500MB. THUS THE COLD MOIST SNOW-MAKING LAYER OVER NW COLORADO WILL SHRINK FROM THE TOP DOWN THROUGH THE DAY. WILL KEEP THE NW COLORADO MOUNTAIN HIGHLIGHTS GOING WITH THE MORNING FORECAST PACKAGE. SNOWFALL IS EXPECTED TO BE PERSISTENT BUT LIGHT THROUGH THE AFTERNOON.

OTHERWISE COLD IS THE SCREAMING MESSAGE. TEMPERATURES WILL BE 10-20 DEGREES BELOW NORMAL TODAY AND TONIGHT. IN ADDITION...NW BRISK GRADIENT WINDS WILL MIX INTO MOST VALLEYS THIS AFTERNOON. AFTERNOON WIND CHILL VALUES WILL BE IN THE 5-15F RANGE FOR THE VALLEYS... EXCEPT AT OR BELOW ZERO ON THE NW CO PLATEAU AND IN THE MTNS. HAVE FURTHER UNDERCUT GUIDANCE TEMPERATURES TONIGHT...BUT COLDER YET IS POSSIBLE.

A RIDGE BUILDS IN FROM THE WEST TONIGHT AND MONDAY. THIS CONTINUES THE STABILIZATION AND WARMING AT AND ABOVE 700MB. STRONG INVERSIONS FORM IN THE VALLEYS TONIGHT. FOG OR EVEN ICE FOG IS POSSIBLE IN THE SNOW COVERED NORTHERN AND CENTRAL VALLEYS TONIGHT INTO MONDAY MORNING. FOG WILL BE MOST LIKELY NEAR RIVERS. MOST FOG IS EXPECTED TO DISSIPATE BY MONDAY AFTERNOON BUT VALLEYS WILL REMAIN COLD. MOST MOUNTAIN SLOPES WILL BE WARMER THAN THE VALLEYS BELOW MONDAY AFTERNOON. TO BEAT THE CHILL...CLIMB THE HILL.

.LONG TERM...(MONDAY NIGHT THROUGH SATURDAY)
ISSUED AT 352 AM MST SUN JAN 5 2014

TALE OF TWO EXTENDED MODELS PLAYING OUT ONCE AGAIN AS FAIRLY PRONOUNCED SPLIT REMAINS BETWEEN THE ECMWF AND GFS MODELS. ENSEMBLE SOLUTIONS LEANING MORE TOWARD THE SPLITTING EC SOLUTION...WHICH SIGNIFIES AN END OF OUR PERSISTENT NORTHWEST FLOW BY MIDWEEK...WITH A LOW CLOSING OFF OVER THE SOUTHWEST U.S. THIS WOULD KEEP THE FORECAST AREA IN BETWEEN STREAMS WITH DRY CONDITIONS ANTICIPATED FOR MOST AREAS AS THE LOW DROPS SOUTH INTO THE BAJA REGION. THE GFS HAS BECOME MORE CONSOLIDATED AND PROGRESSIVE WITH WESTERN RIDGE HOLDING AND NW FLOW MAINTAINING SOME PRESENCE ACROSS THE FORECAST AREA. WITH SUCH DIVERGING SOLUTIONS...CONFIDENCE IN THE EXTENDED BEYOND DAY 5 DROPS MARKEDLY. WILL BROAD BRUSH MOUNTAIN POPS INTO THE LOW CHANCE CATEGORIES TO CLOSE OUT THE WEEK...BUT EXPECT ADJUSTMENTS AS THE MODELS COME INTO BETTER ALIGNMENT.

BEFORE WE EVEN GET TO THE PROBLEM PERIODS LATER IN THE WEEK...WE WILL BE SEEING AT LEAST ONE MORE WAVE PUSHING THROUGH THE NORTHERN AND CENTRAL ZONES TUESDAY NIGHT AND WEDNESDAY. THIS SYSTEM NOT QUITE AS ROBUST AS THE ONE THIS WEEKEND...BUT SHOULD SEE LIGHT TO MODERATE ACCUMULATIONS ACROSS THE FAVORED NORTHWEST FACING SLOPES BY WEDNESDAY AFTERNOON. VALLEY INVERSIONS WILL BE STRENGTHENING WITH STRONG WAA ALOFT PUSHING ACROSS THE REGION. HAVE UNDERCUT MOS TEMPS FOR BOTH MAX AND MINS TO START OFF THE PERIOD... WITH SLOW MODERATION BEYOND THAT.

*.AVIATION...(FOR THE 18Z TAFS THROUGH 18Z MONDAY AFTERNOON)
ISSUED AT 934 AM MST SUN JAN 5 2014*

EXPECT VFR CONDITIONS FOR MOST AERODROMES WITH MAIN CONCERNS BEING FOR THE NORTHERN MOUNTAINS AND SURROUNDING AREAS TO INCLUDE KSBS...KCAG AND KHDN. SNOW SHOWERS WILL CONTINUE FOR THOSE AREAS DROPPING FLIGHT CONDITIONS TO MVFR...POSSIBLY IFR...FROM TIME TO TIME FOR THE REMAINDER OF THE DAY. KASE AND KEGE MAY ALSO SEE SOME SHOWERY TYPE ACTIVITY BUT EXPECT WORST CONDITIONS TO STAY NORTH OF AIRPORTS. SOME PATCHY FOG IS ALSO POSSIBLE OVERNIGHT ESPECIALLY NEAR ANY RIVERS.

.GJT WATCHES/WARNINGS/ADVISORIES..

CO...NONE.

UT...NONE.

*.
UPDATE...TGR*

SHORT TERM...JOE

LONG TERM...JDC

AVIATION...TGR

The discussion that light snow showers was the primary concern for the area. The discussion also noted a 115 knot jet stream over the area and a northwest-to-southeasterly deformation zone over the area and noted that a localized strong northwest pressure gradient existed and was expected to increase wind speeds into most valleys during the afternoon hours. While the aviation discussion did not highlight any problems for KASE other than light snow showers expected during the evening hours. No weather alerts or warnings were current over Colorado during the period.

11.0 Forecasters Statement

The NWS Grand Junction Senior Meteorologist responsible for issuing the short term forecast and TAFs for eastern Utah and western Colorado airports, which included Aspen, provided a statement regarding his actions on the day of the accident. His statement is included as Attachment 1.

In his statement he indicated that for the 1100 MST (1800Z) KASE TAF wind gusts were not included mainly because of the airport's location in the valley or "bowl" surrounded by high terrain, which is typically sheltered from the wind. He also cited that the jet stream was moving eastward and with diminishing winds with time, and the model guidance only predicted wind at 10 to 12 knots. He did expect some occasional wind gusts from passing snow showers, but did not expect the wind gusts to have a long duration or of significant magnitude to be included in the TAF. His forecast included a wind from the northwest at 10 knots, visibility of greater than 6 miles with showers in the vicinity, scattered clouds at 4,000 feet and a broken cloud deck at 6,000 feet.

He further indicated that shortly before 1200 MST he started receiving the ASOS reports of wind gusts up to 30 knots at KASE. He stated reviewed the webcams and satellite imagery across the area for current conditions, and about this time he received a pilot report over KASE of low-level wind shear (LLWS) of plus to minus 10 knots of airspeed. He then amended the TAF at 1210 MST to include northwest wind at 10 knots gusting to 30 knots, which were being reported during that time.

He was notified of the accident from the Denver Center Weather Service Unit (CWSU) at 1240 MST, and shortly afterwards from the Aspen tower. He then notified the NWS ASOS Operations and Monitoring Center (AOMC) to request that they archive the data for KASE.

12.0 Model Data

NWS Numerical model data from the North American Mesoscale (NAM) and Model Output Statistics (MOS) guidance used by the NWS forecasters and available to other users for Aspen during the period were as follows:

KASE	NAM		MOS		GUIDANCE								1/05/2014 1200 UTC									
DT	/JAN		5/JAN		6								/JAN 7								/JAN 8	
HR	18	21	00	03	06	09	12	15	18	21	00	03	06	09	12	15	18	21	00	06	12	
N/X																						
TMP	4	6	1	0	-5	-9	-12	-11	7	16	10	7	4	2	2	7	24	30	24	16	12	
DPT	4	3	0	-4	-10	-14	-18	-16	-4	1	2	0	-3	-4	-5	0	11	14	14	8	6	
CLD	OV	BK	SC	SC	SC	SC	SC	SC	SC	BK	BK	SC	SC	SC	BK	BK	OV	OV	OV	BK	BK	
WDR	34	33	34	27	20	19	20	19	27	01	27	20	20	20	20	17	33	34	22	21	18	
WSP	05	10	08	04	05	12	08	03	03	03	03	06	06	07	03	03	02	04	03	04	03	
P06			22		15		1		1		2		2		2		3		3	3	3	
P12						15					2		2		2				3		13	
Q06			0		0		0		0		0		0		0		0		0	0	0	
Q12						0			0		0		0		0		0		0	0	0	
T06			1/ 3		0/ 6		1/ 0		1/ 5		0/ 8		0/ 0		0/ 0		0/ 1		1/ 1	1/ 0		
T12					4/ 6		1/ 5		1/ 5		0/ 8		0/ 8		0/ 1		0/ 1		1/ 4			
SNW						1									0						0	
CIG	6	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	7	8	8
VIS	4	6	4	5	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
OBV	HZ	N	BR	BR	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

Figure 14 - FOUS model data for Aspen

The forecast data for 1100 MST (1800Z) expected temperature and dew point of 4° F, wind from 340° at 5 knots, visibility between 2 to 3 miles in haze, with an overcast cloud layer between 3,100 and 6,500 feet. At 1400 MST (2100Z) the wind was from 330° at 10 knots, and temperature 6° F.

13.0 Area Forecast

The Area Forecast (FA) is a forecast of visual Flight Rules (VFR) clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra (IFR) bulletin for the same area in order to get a complete picture of the weather. The area forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports which do not have a terminal forecast (TAF) issued. The NWS Aviation Weather Center (AWC) located in Kansas City, Missouri, issues the FA at regular intervals and issues special reports as necessary usually in the form of an AIRMET. The Salt Lake City (KSLC) regional forecast that was current at the time of the accident was issued at 0345 MST and valid through 1700 MST on January 5, 2014. The forecast was as follows:

FAUS45 KPCI 051145 2014005 1135
FA5W
SLCC FA 051145
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 060600
CLDS/WX VALID UNTIL 060000...OTLK VALID 060000-060600
ID MT WY NV UT CO AZ NM

.
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...ALF...12Z TROF FM STG LOW NW ONT ACRS NW MN-NRN ND-NERN MT. RDG W BC-OR
CSTL WTRS-CNTRL CA CSTL WTRS. STG N/NW WND S ID/MT/WY/UT/SW CO/NERN AZ/NM. 06Z LARGE
STG TROF WRN GRTLKS-CNTRL GULF CST. RDG S BC-CA/NV-NW MEX. MOD/STG NW WND S
MT/WY/CO/NRN AND ERN NM. ...SFC...12Z STNR FNT SE BC-N ID-EXTRM SW MT-NW WY THRU LOW
30E CYS TO NERN CO. CDFNT FM LOW SW AZ-S CA CSTL SXNS. CDFNT FM LOW SW AZ THRU LOW
SW NM TO TX BIG BEND CONTG ESEWD. STG HIGH SE ALTA. HIGH NW UT. 06Z STNR FNT SW ALTA-
SW MT-NW WY-SE WY. CDFNT SE WY-SE CO-NERN NM-SE PTN NWRN TX. STG HIGHS SW SASK AND
SE MT. HIGH NW MT.

.
CO
NERN PLAINS...OVC060 TOP FL180. VIS 3-5SM -SN BR. 18Z BKN070. VIS 3-5SM SCT -SHSN. WND N
G25KT. OTLK...VFR.
SE PLAINS...SCT080. BECMG 1820 BKN070 TOP 160. OTLK...MVFR CIG.
FOOTHILLS-MTNS E OF CONTDVD...
N 2/3...BKN100 TOP FL180. ISOL -SHSN. 15Z OVC070. VIS 3-5SM -SN BR. OTLK...IFR CIG SN BR BECMG
03Z VFR.
S 1/3...SCT100. OTLK...VFR.
CNTRL CO MTNS...OVC090 TOP FL180. VIS 3-5SM SCT -SHSN. OTLK...MVFR CIG SHSN.
RMNDR N 2/3 MTNS W OF CONTDVD...BKN090 TOP FL180. ISOL -SHSN. OTLK...VFR.
S 1/3 MTNS W OF CONTDVD...BKN080 TOP 150. 15Z SCT100. OTLK...VFR.

.
AZ
N 3/4...SKC. OTLK...VFR.
S 1/4...SCT150 WITH BKN-OVC CI ABV. 18Z SCT CI. OTLK...VFR.

.
The forecast expected broken layer of clouds at 9,000 feet msl with tops to 18,000 feet with isolated light snow showers over the mountains west of the continental divide.

14.0 In-Flight Weather Advisories

The NWS issues in-flight weather advisories designated as Severe Weather Forecast Alerts (AWW's), Convective SIGMET's (WST's), SIGMET's (WS's), Center Weather Advisories (CWA's), and AIRMET's (WA's). In-flight advisories serve to notify en route pilots of the possibility of encountering hazardous flying conditions, which may not have been forecast at the time of the preflight briefing. Whether or not the condition described is potentially hazardous to a particular flight is for the pilot to evaluate on the basis of experience and the operational limits of the aircraft. The advisories current during the period were as follows:

AIRMETS

WAUS45 KPCI 051445 2014005 1454
WA5S
SLCS WA 051445
AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 052100

.
AIRMET IFR...MT WY CO
FROM 20NW LWT TO 30ESE SHR TO 60NNW BFF TO 30E CYS TO 40E SNY TO GLD TO 30E LAA TO
50NE PUB TO 30ENE HBU TO 40ESE JNC TO 50SE OCS TO 40ENE BPI TO 50SSE HLN TO 20NW LWT
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z ENDG 00-03Z.

.
AIRMET MTN OBSCN...ID MT WY UT CO
FROM 50SW HVR TO SHR TO CYS TO TBE TO 20N ALS TO 30ENE DVC TO 50S OCS TO 30ENE SLC TO
20SE DBS TO 40SSE LKT TO 20ESE MLP TO 50SW HVR
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

.
OTLK VALID 2100-0300Z...MTN OBSCN ID MT
BOUNDED BY 50SW YXC-40N FCA-80SSE FCA-70SSE MLP-50SW YXC
MTNS OBSC BY CLDS. CONDS DVLPG 00-03Z. CONDS CONTG THRU 03Z.

....
WAUS45 KPCI 051445 2014005 1444
WA5T
SLCT WA 051445
AIRMET TANGO UPDT 2 FOR TURB VALID UNTIL 052100

.
AIRMET TURB...ID MT WY NV UT CO AZ NM WA OR
FROM 30S YXC TO 60NE GGW TO CYS TO DEN TO 50W LBL TO 30ESE TBE TO INK TO ELP TO 50S TUS
TO 50SE REO TO 40W BOI TO 90ESE YDC TO 30S YXC
MOD TURB BTN FL180 AND FL400. CONDS CONTG BYD 21Z THRU 03Z.

.
AIRMET TURB...UT CO AZ NM
FROM 40S DEN TO TXO TO INK TO ELP TO 30S DMN TO 20W HVE TO JNC TO 40S DEN
MOD TURB BLW FL180. CONDS DVLPG 15-18Z. CONDS CONTG BYD 21Z THRU 03Z.

....
WAUS45 KPCI 051445 2014005 1439
WA5Z
SLCZ WA 051445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 052100

.
NO SGFNT ICE EXP OUTSIDE OF CNVTV ACT.

.
FRZLVL...RANGING FROM SFC-120 ACRS AREA
MULT FRZLVL BLW 110 BOUNDED BY 80SE YDC-50WNW REO-60E FMG-70S
ILC-30SW SJN-70NNE TUS-30W BTY-60SSW FMG-30SE OED-70SSW
YDC-80SE YDC
SFC ALG 20S EED-40WNW PHX-70E ELP
080 ALG 40S EED-50ESE PHX-30NE SSO-40SE DMN

....

No Severe Weather Forecast Alerts, Convective SIGMETs, SIGMETs, or Center Weather Advisories were issued surrounding the period. A plot of the AIRMETS current at the time of the accident is included in figure 16 plotted over the GOES-15 visible satellite image at the time of issuance of the advisories.

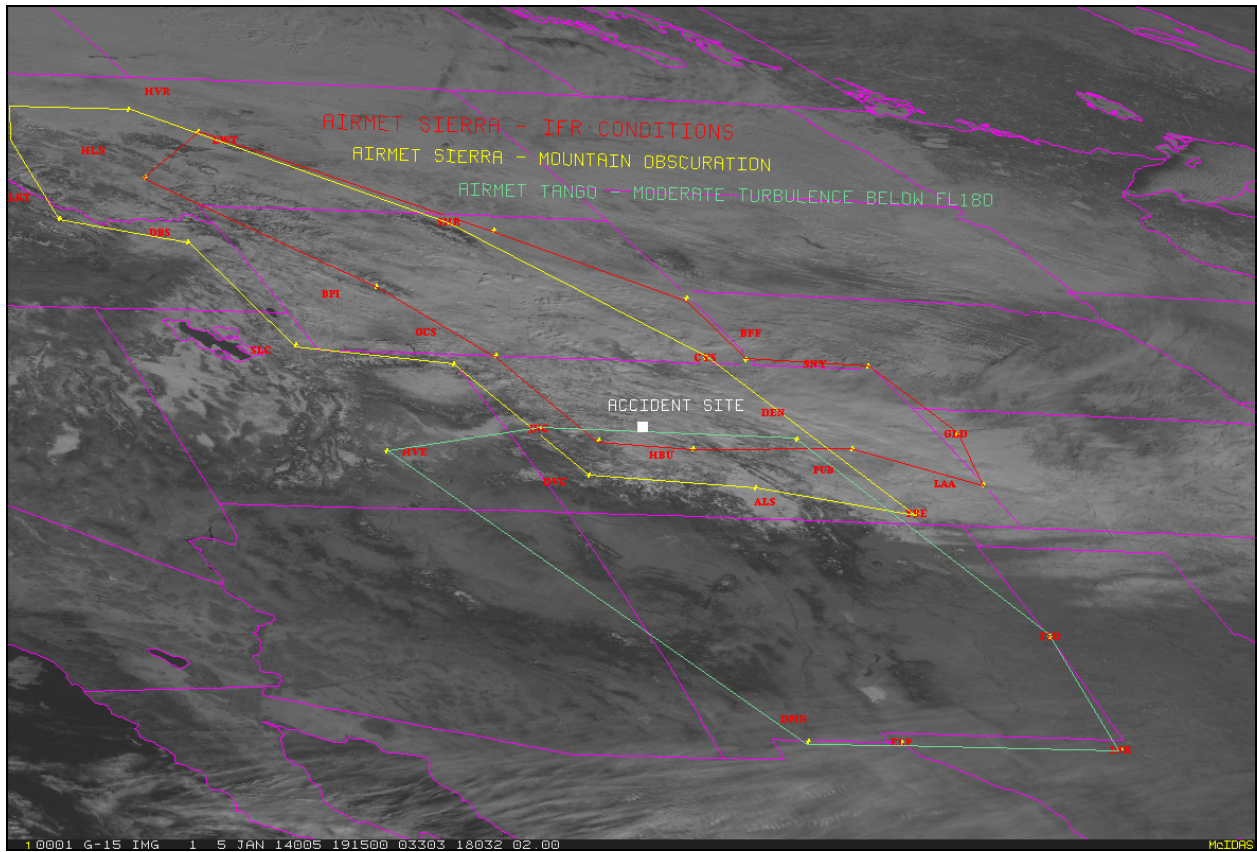


Figure 156 - AIRMETs Sierra for IFR and mountain obscuration conditions

15.0 Winds and Temperature Aloft

The NWS Winds and Temperature Aloft Forecast (FD) model data valid at the time was issued at 0658 MST and valid for 0500, and was intended for use between 0700 and 1400 MST. The wind data is as follows:

```

FBUS31 KWNO 051358                2014005 1358
FDIUS1
DATA BASED ON 051200Z
VALID 051800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000
FT 3000  6000  9000  12000  18000  24000  30000  34000  39000
-GJT          3107-15 3224-21 3370-25 8320-29 832544 832354 822162
DEN          3017-18 3130-24 3143-35 3249-42 328247 328849 327452

```

The wind over Grand Junction at 9,000 feet was expected to be from 310° at 7 knots with a temperature of -15° C. Winds over 120 knots were expected above 20,000 feet. Over Denver at 9,000 feet the forecast expected wind from 300° at 17 knots and a temperature of -18° C. The highest wind over Denver was identified at 34,000 feet and from 320° at 88 knots.

16.0 Astronomical Data

The United States Naval Observatory website provided the following astronomical data for Aspen, Pitkin County, Colorado on January 5, 2014:

SUN

Beginning of civil twilight	0657 MST
Sunrise	0727
Accident	1122
Sun transit	1213
Sunset	1659
End of civil twilight	1729

At the time of the accident the Sun was located 27° above the horizon and at an azimuth of 166° .

F. LIST OF ATTACHMENTS

Attachment 1: NWS Grand Junction Forecasters Statement

Submitted by:

Donald Eick
NTSB Senior Meteorologist