NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

September 28, 2015

Group Chairman's Weather Study Report

METEOROLOGY

CEN15FA400

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A. ACCIDENT

Location: 10 miles west-southwest of Silverton, Colorado
Date: September 5, 2015
Time: approximately 1408 mountain daylight time (2008 UTC[1])
Aircraft: Cessna 310H, registration: N1099Q

B. METEOROLOGY GROUP

Paul Suffern
Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
Washington, D.C. 20594-2000

C. SUMMARY

For a summary of the accident, refer to the *Accident Summary* report, which is available in the docket for this investigation.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Meteorologist was not on scene for this investigation and gathered all the weather data for this investigation from the NTSB's Washington D.C. office and from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are mountain daylight time (MDT) on September 5, 2015, and are based upon the 24-hour clock, where local time is -6 hours from UTC, and UTC=Z (unless otherwise noted). 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.

The accident site was located at latitude 37.76° N, longitude 107.84° W, elevation: 11,500 feet.

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

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), and the Weather Prediction Center (WPC) located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the, joint NWS and Federal Aviation Administration (FAA) Advisory Circular "Aviation Weather Services", AC-0045G CHG 1.

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart for 1500 MDT is provided as figure 1 with the approximate location of the accident site marked. The chart depicted a surface trough[2] stretched from southern New Mexico northeastward into central Nebraska. A stationary front was located over central Nevada stretched northeastward into central Wyoming. A surface high pressure center with a pressure of 1016-hectopascals (hPa) was located just southeast of the accident site with another surface high pressure center located in central Arizona with a pressure of 1017-hPa. A surface low pressure center with a pressure of 1006-hPa was located in eastern Nevada. The station models around the accident site depicted air temperatures in the mid 60's to mid 70's Fahrenheit (F), with temperature-dew point spreads of 16° F or more, a variable wind between 5 and 10 knots, partly cloudy skies, and thunderstorms reported north of the accident site at 1500 MDT. With the large temperature-dew point spreads located around the accident area, gusty winds would be expected with any thunderstorm or rain shower in the mountainous terrain.

[2] Trough – An elongated area of relatively low atmospheric pressure or heights.

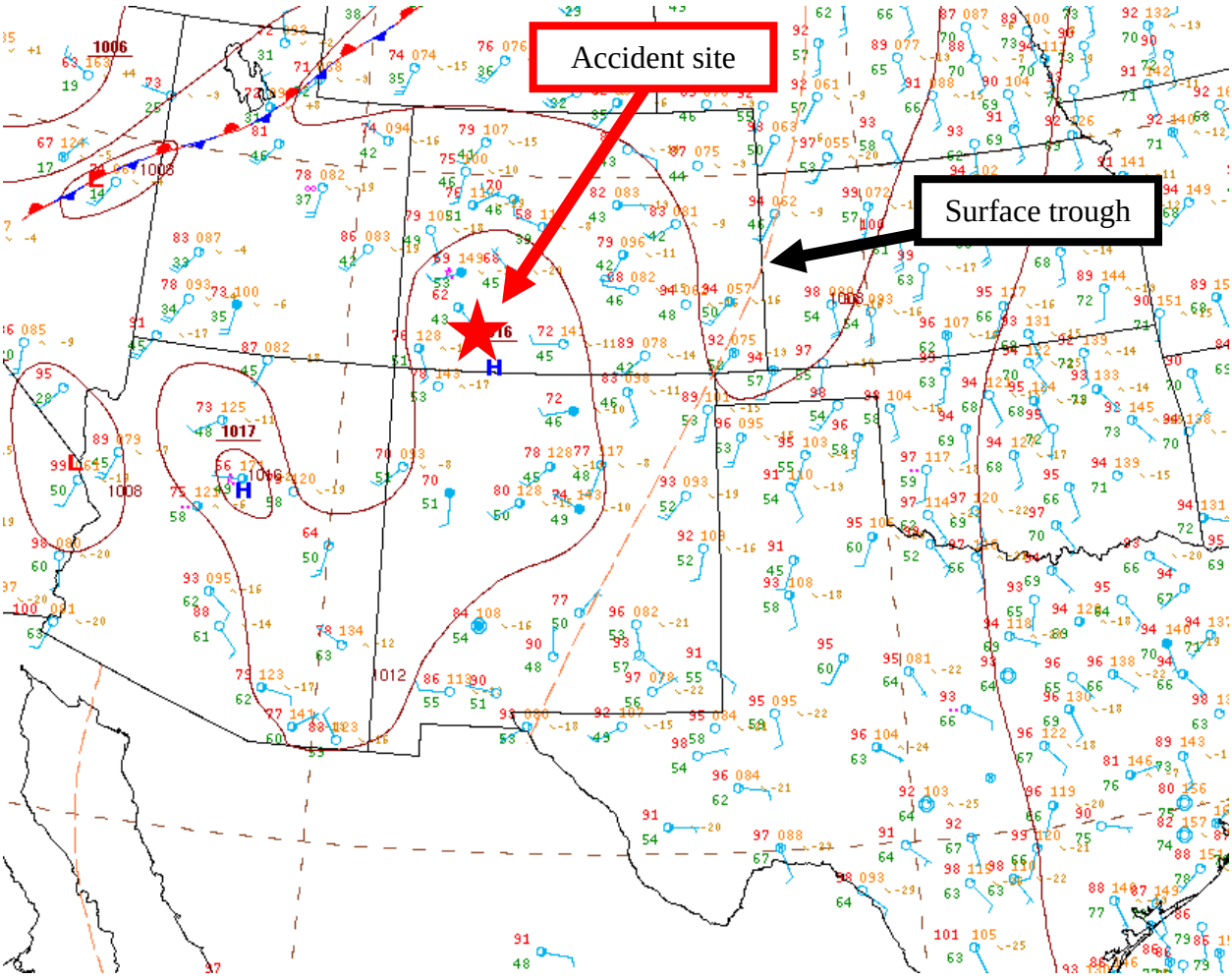

Figure 1 – NWS Surface Analysis Chart for 1500 MDT

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1800 MDT at 850-, 700-, 500-, and 300-hPa are presented in figures 2 through 5. The upper air charts indicated an environment favorable for clouds and precipitation with mid-level troughs near the accident site at 700- and 500-hPa (figures 3 and 4). Areas near troughs and low pressure centers are considered favorable locations for upward motion and therefore clouds and precipitation, especially in mountainous terrain. The wind remained light from the south at 850- and 700-hPa, with the wind increasing in speed to near 30 knots by 500-hPa while turning to the southwest (figure 4). The wind remained out of the southwest through 300-hPa with the wind speed near the accident site at 300-hPa between 60 and 90 knots (figure 5). The strong southwest wind at 500- and 300-hPa would help any rain shower or thunderstorm that formed over the mountainous terrain to move from southwest to northeast.

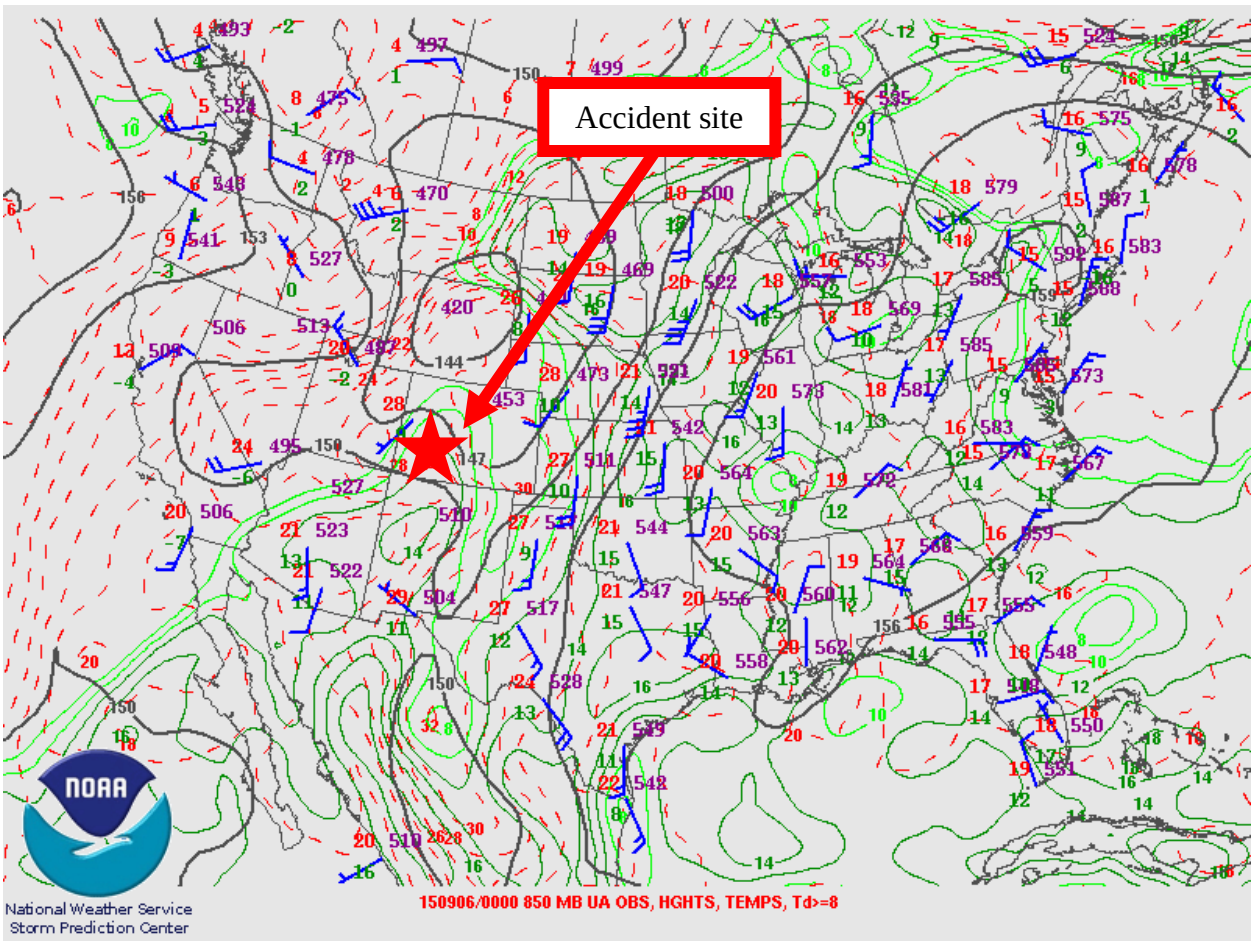

Figure 2 – 850-hPa Constant Pressure Chart for 1800 MDT

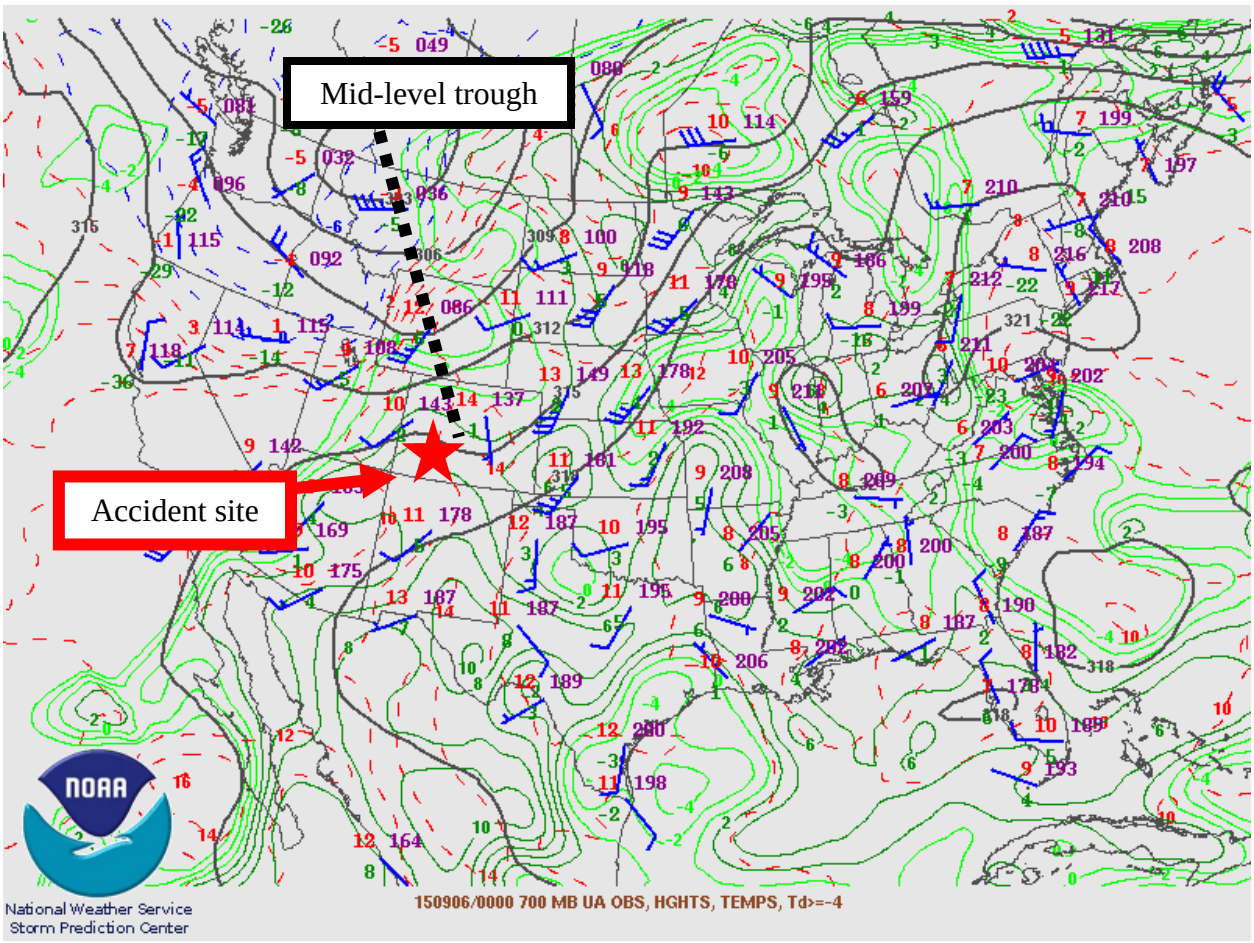

Figure 3 – 700-hPa Constant Pressure Chart for 1800 MDT

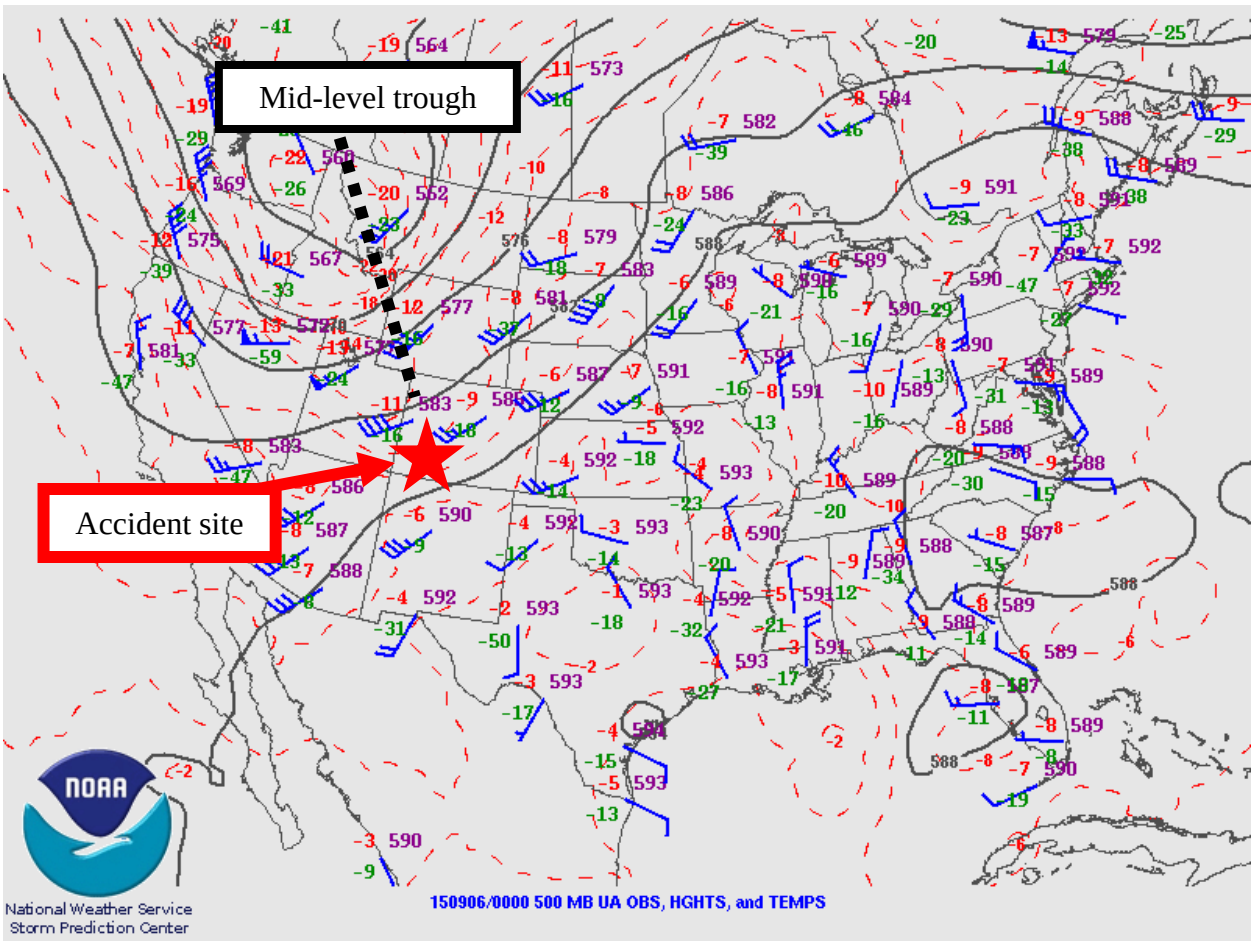

Figure 4 – 500-hPa Constant Pressure Chart for 1800 MDT

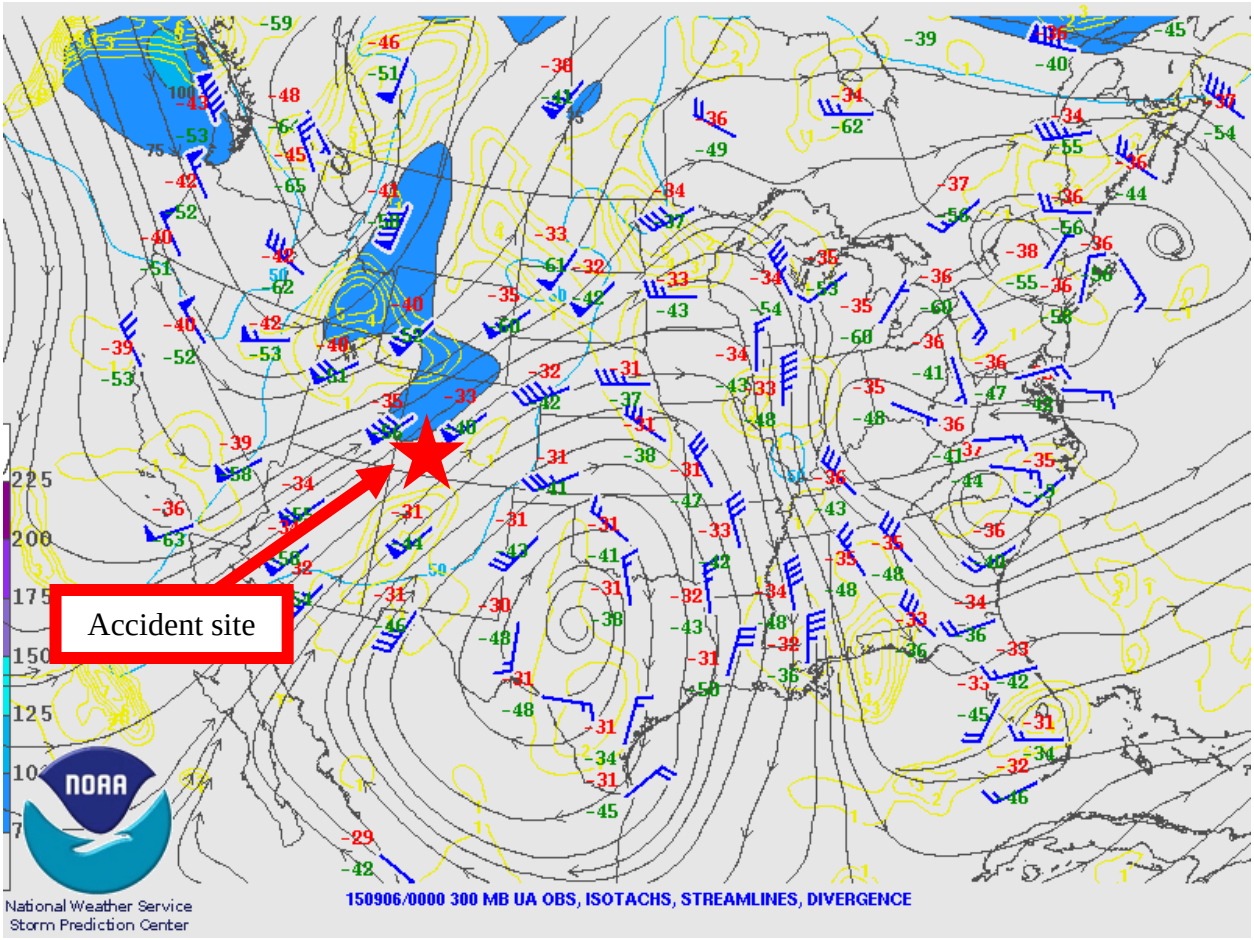

Figure 5 – 300-hPa Constant Pressure Chart for 1800 MDT

2.0 Storm Prediction Center Products

SPC issued the following Day 1 Convective Outlook at 1356 MDT (figure 6) with areas of thunderstorms forecast for the accident site. Severe thunderstorms were not forecast. The previous Day 1 Convective Outlook was issued at 1026 MDT with no differences in forecast for the accident site at the accident time:

SPC AC 051956

DAY 1 CONVECTIVE OUTLOOK
NWS STORM PREDICTION CENTER NORMAN OK
0256 PM CDT SAT SEP 05 2015

VALID 052000Z - 061200Z

...THERE IS A SLGT RISK OF SVR TSTMS OVER PARTS OF SOUTHEAST MT AND FAR SOUTHWEST ND...

...THERE IS A MRGL RISK OF SVR TSTMS OVER PARTS OF THE NORTHERN PLAINS...

...SUMMARY...

A FEW STRONG TO SEVERE STORMS WILL BE POSSIBLE OVER A PORTION OF THE NORTHERN PLAINS INTO THE UPPER MISSISSIPPI VALLEY SATURDAY AFTERNOON AND EVENING. THE GREATEST THREAT CURRENTLY APPEARS TO CONCENTRATE THIS AFTERNOON INTO EARLY EVENING FROM SOUTHEASTERN MONTANA TOWARD WESTERN NORTH DAKOTA.

...NRN HIGH PLAINS INTO THE UPPER MS VALLEY...
ONLY MINOR CHANGES WERE MADE TO THE PREVIOUS OUTLOOK. LATEST OBSERVATIONAL AND MODEL TRENDS CONTINUE TO HIGHLIGHT A CORRIDOR ACROSS SERN MT INTO FAR WRN ND FOR ISOLATED SVR TSTM POTENTIAL THIS AFTERNOON AND EVENING. A PERSISTENT AREA OF STRATUS IS ERODING FROM THE S...AND TSTMS ARE EXPECTED TO DEVELOP AND STRENGTHEN ACROSS FAR NRN WY INTO SERN MT. ISOLATED LARGE HAIL AND DMGG WINDS STILL APPEAR TO BE THE MAIN THREAT. FARTHER E...SCATTERED TSTM DEVELOPMENT IS STILL EXPECTED BY EARLY EVENING...WHERE ONE OR TWO CLUSTERS CAPABLE OF STRONG WIND GUSTS AND HAIL ARE POSSIBLE ACROSS NRN MN TONIGHT.

..ROGERS.. 09/05/2015

.PREV DISCUSSION... /ISSUED 1126 AM CDT SAT SEP 05 2015/

FEW CHANGES HAVE BEEN MADE TO THE ONGOING FORECAST. WIDESPREAD CLOUDS OVER THE DAKOTAS SIGNIFICANTLY LIMIT THE CONFIDENCE IN STRONG THUNDERSTORMS...BUT WILL MAINTAIN A MARGINAL RISK OVER PARTS OF WESTERN MN AND EASTERN ND WHERE SOME HEATING MAY OCCUR LATER TODAY.

A CLUSTER OF THUNDERSTORMS CONTINUES TO APPEAR LIKELY TO DEVELOP OVER SOUTHEAST MT LATE THIS AFTERNOON...TRACKING INTO WESTERN ND AFTER DARK. SUFFICIENT DEEP LAYER SHEAR AND CAPE SUGGEST SOME RISK OF ROTATING STORMS CAPABLE OF HAIL AND GUSTY/DAMAGING WINDS. THEREFORE HAVE LEFT THE SLIGHT RISK AREA UNCHANGED.

CLICK TO GET WUUS01 PTSDY1 PRODUCT

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 0100Z

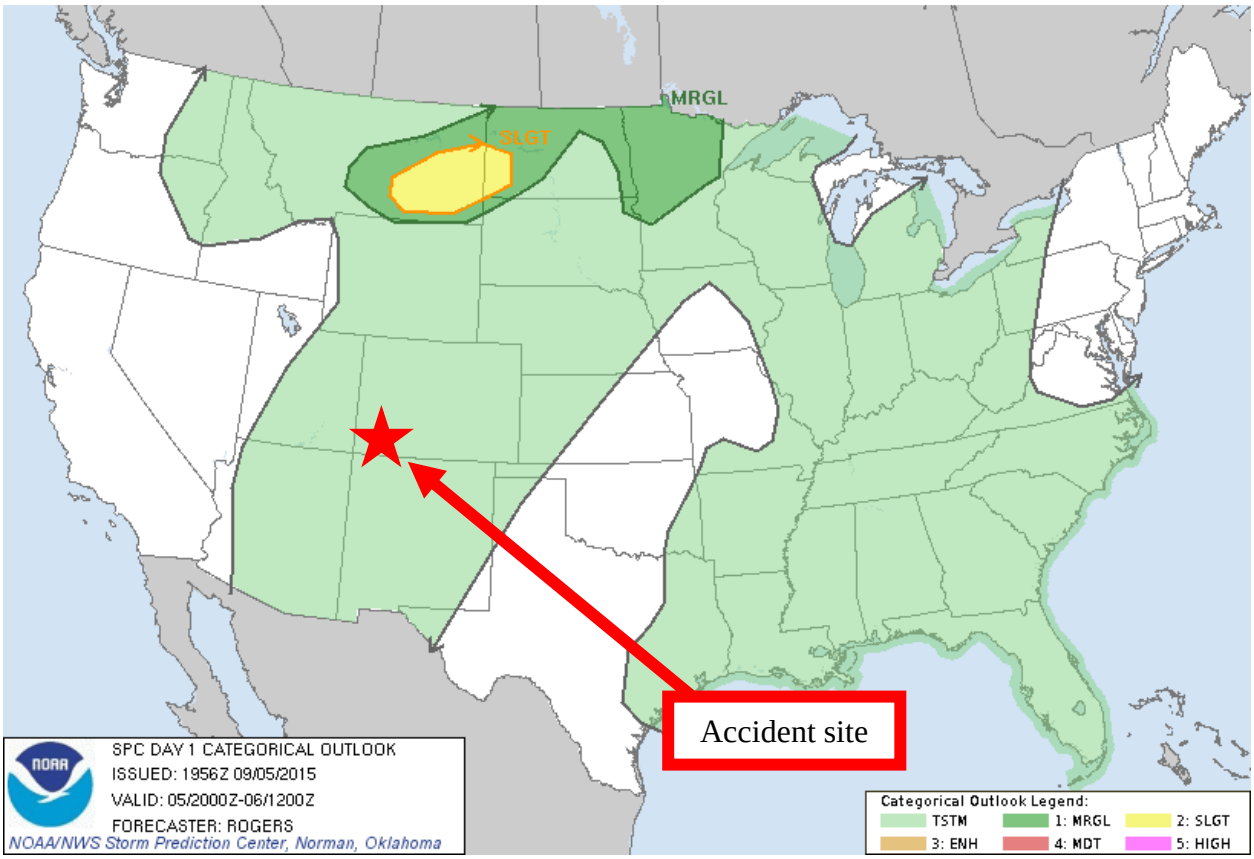

Figure 6 – Storm Prediction Center day 1 Convective Outlook valid at the time of the accident

3.0 Surface Observations

The area surrounding the accident site was documented utilizing official NWS Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations were taken from standard code and are provided in plain language.

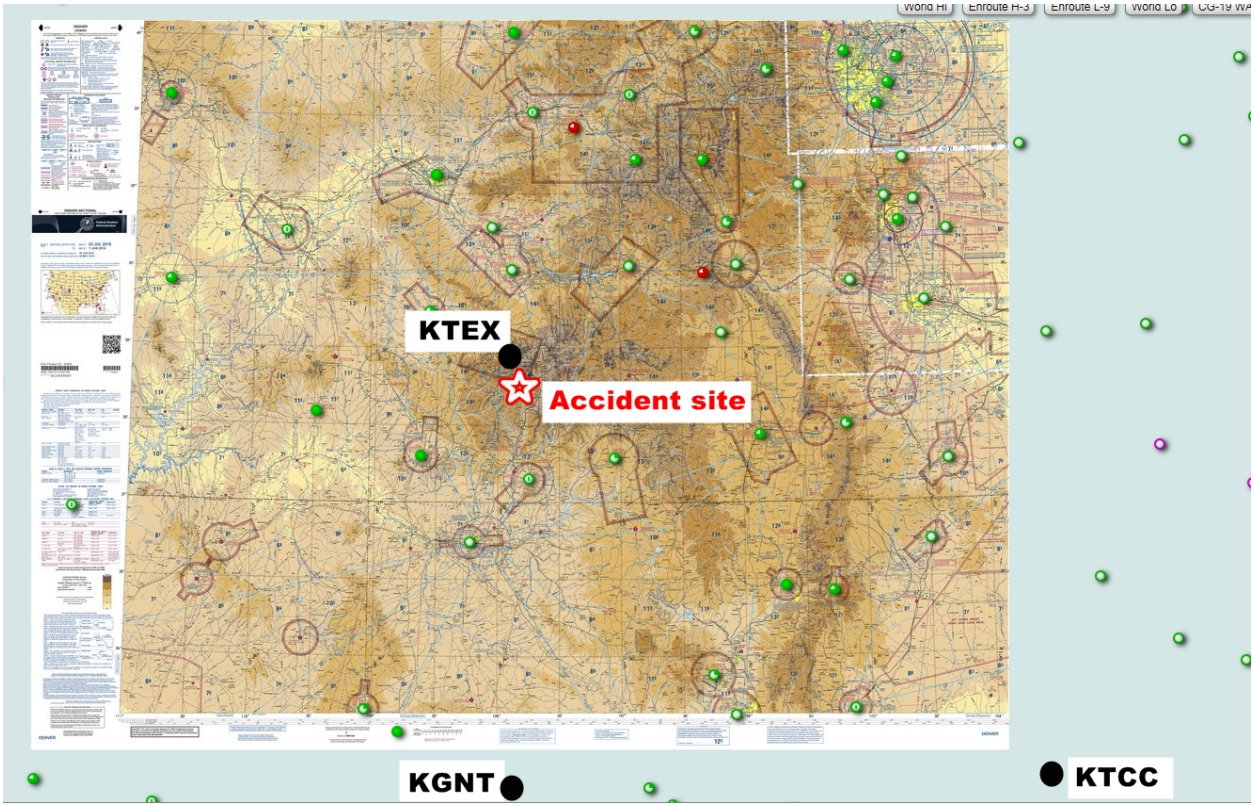

Figure 7 – Sectional Chart with the location of the accident site and surface observation sites

Telluride Regional Airport (KTEX) was the closest official weather station to the accident site. KTEX was located 5 miles west of Telluride, Colorado, and had an Automated Weather Observing System (AWOS[3]) whose reports were not supplemented. KTEX was located 12 miles north-northwest of the accident site, at an elevation of 9,070 feet, and had a 12° easterly magnetic variation (figure 7). The following observations were taken and disseminated during the times surrounding the accident: [4]

[1235 MDT] KTEX 051835Z AUTO 16003KT 10SM SCT055 SCT065 SCT100
16/07 A3036 RMK AO2 LTG DSNT NW T01590069=

[1255 MDT] KTEX 051855Z AUTO 07003KT 10SM SCT070 SCT080 BKN100
16/08 A3036 RMK AO2 T01630076=

[1315 MDT] KTEX 051915Z AUTO 18006KT 10SM SCT039 SCT047 BKN070
16/07 A3035 RMK AO2 T01630070=

[3] AWOS – Automated Weather Observing System is equipped with meteorological instruments to observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to twelve thousand feet, and altimeter setting.

[4] The bold sections in this NWS product and the rest of products in the weather study report are to highlight the individual sections that directly reference the weather conditions that are or will affect the accident location around the accident time.

[1335 MDT] KTEX 051935Z AUTO 15006KT 10SM SCT047 SCT060 BKN070 17/07 A3035 RMK AO2 LTG DSNT N AND NW T01650071=

[1355 MDT] KTEX 051955Z AUTO 11005KT 10SM SCT050 BKN060 BKN070 17/07 A3034 RMK AO2 T01730074=

ACCIDENT TIME 1408 MDT

[1415 MDT] KTEX 052015Z AUTO 19005KT 10SM VCTS SCT047 BKN060 BKN070 17/07 A3034 RMK AO2 LTG DSNT NW T01740066=

[1435 MDT] KTEX 052035Z AUTO 16008G15KT 10SM SCT050 SCT060 BKN080 17/06 A3034 RMK AO2 LTG DSNT W AND NW T01660059=

[1455 MDT] KTEX 052055Z AUTO 14007G20KT 10SM SCT050 SCT065 BKN110 17/06 A3034 RMK AO2 LTG DSNT NW T01670063=

[1515 MDT] KTEX 052115Z AUTO 16006KT 10SM SCT055 BKN075 OVC110 17/06 A3034 RMK AO2 LTG DSNT N AND NW T01680057=

[1535 MDT] KTEX 052135Z AUTO 14009KT 090V160 10SM SCT060 OVC075 17/05 A3034 RMK AO2 LTG DSNT W T01660054=

[1555 MDT] KTEX 052155Z AUTO 00000KT 10SM SCT060 OVC075 17/06 A3034 RMK AO2 LTG DSNT SE T01650055=

KTEX weather at 1335 MDT, wind from 150° at 6 knots, 10 miles visibility, scattered clouds at 4,700 feet above ground level (agl), scattered clouds at 6,000 feet agl, broken ceiling at 7,000 feet agl, temperature of 17° Celsius (C), dew point temperature of 7° C, and an altimeter setting of 30.35 inches of mercury. Remarks: automated station with a precipitation discriminator, lightning distant[5] north and northwest, temperature 16.5° C, dew point temperature 7.1° C.

KTEX weather at 1355 MDT, wind from 110° at 5 knots, 10 miles visibility, scattered clouds at 5,000 feet agl, broken ceiling at 6,000 feet agl, broken skies at 7,000 feet agl, temperature of 17° C, dew point temperature of 7° C, and an altimeter setting of 30.34 inches of mercury. Remarks: automated station with a precipitation discriminator, temperature 17.3° C, dew point temperature 7.4° C.

[5] Distant indicated that the lightning was beyond 10 miles but less than 30 miles from the center of the airport (or airport location point, ALP).

KTEX weather at 1415 MDT, wind from 190° at 5 knots, 10 miles visibility, vicinity[6] thunderstorms, scattered clouds at 4,700 feet agl, broken ceiling at 6,000 feet agl, broken skies at 7,000 feet agl, temperature of 17° C, dew point temperature of 7° C, and an altimeter setting of 30.34 inches of mercury. Remarks: automated station with a precipitation discriminator, lightning distant northwest, temperature 17.4° C, dew point temperature 6.6° C.

KTEX weather at 1435 MDT, wind from 160° at 8 knots with gusts to 15 knots, 10 miles visibility, scattered clouds at 5,000 feet agl, scattered clouds at 6,000 feet agl, broken ceiling at 8,000 feet agl, temperature of 17° C, dew point temperature of 6° C, and an altimeter setting of 30.34 inches of mercury. Remarks: automated station with a precipitation discriminator, lightning distant west and northwest, temperature 16.6° C, dew point temperature 5.9° C.

Grants-Milan Municipal Airport (KGNT) was the closest official site to where the accident flight makes it turns north[7] around 1300 MDT. KGNT was located 3 miles northwest of Grants, New Mexico, and had an AWOS whose reports were not supplemented. KGNT was located 156 miles south of the accident site, at an elevation of 6,537 feet, and had an 11° easterly magnetic variation (figure 7). The following observations were taken and disseminated during the times surrounding the accident:

[1235 MDT] KGNT 051835Z AUTO 18006KT 10SM SCT035 SCT042 SCT120 20/13 A3027 RMK AO2 T02030133=

[1255 MDT] KGNT 051855Z AUTO 15005KT 10SM SCT033 SCT044 22/13 A3026 RMK AO2 T02210127=

[1315 MDT] KGNT 051915Z AUTO 19009KT 10SM SCT046 SCT120 22/11 A3024 RMK AO2 T02200105=

[1335 MDT] KGNT 051935Z AUTO 21006KT 10SM SCT120 21/11 A3024 RMK AO2 T02130107=

[1355 MDT] KGNT 051955Z AUTO 19003KT 10SM BKN110 22/11 A3024 RMK AO2 T02150113=

ACCIDENT TIME 1408 MDT

[1415 MDT] KGNT 052015Z AUTO 19009G14KT 10SM SCT050 OVC120 22/11 A3024 RMK AO2 T02180106=

[1435 MDT] KGNT 052035Z AUTO 17007KT 10SM SCT050 OVC110 21/10 A3024 RMK AO2 T02100103=

[6] In the vicinity of the airport is defined as a weather phenomenon within 5-10 miles of the airfield, but not over the airfield.
[7] For more information please see the ATC data.

[1455 MDT] KGNT 052055Z AUTO 18008KT 10SM SCT080 OVC100 21/11 A3024 RMK AO2 T02100105=

[1515 MDT] KGNT 052115Z AUTO 19008KT 10SM SCT055 OVC100 21/10 A3024 RMK AO2 T02050101=

[1535 MDT] KGNT 052135Z AUTO 21008KT 10SM SCT055 SCT080 OVC100 20/09 A3026 RMK AO2 T02020088=

[1555 MDT] KGNT 052155Z AUTO 17005KT 10SM OVC100 20/09 A3026 RMK AO2 T01960090=

KGNT weather at 1335 MDT, wind from 210° at 6 knots, 10 miles visibility, scattered clouds at 12,000 feet agl, temperature of 21° C, dew point temperature of 11° C, and an altimeter setting of 30.24 inches of mercury. Remarks: automated station with a precipitation discriminator, temperature 21.3° C, dew point temperature 10.7° C.

KGNT weather at 1355 MDT, wind from 190° at 3 knots, 10 miles visibility, broken ceiling at 11,000 feet agl, temperature of 22° C, dew point temperature of 11° C, and an altimeter setting of 30.24 inches of mercury. Remarks: automated station with a precipitation discriminator, temperature 21.5° C, dew point temperature 11.3° C.

KGNT weather at 1415 MDT, wind from 190° at 9 knots with gusts to 14 knots, 10 miles visibility, scattered clouds at 5,000 feet agl, an overcast ceiling at 12,000 feet agl, temperature of 22° C, dew point temperature of 11° C, and an altimeter setting of 30.24 inches of mercury. Remarks: automated station with a precipitation discriminator, temperature 21.8° C, dew point temperature 10.6° C.

KGNT weather at 1435 MDT, wind from 170° at 7 knots, 10 miles visibility, scattered clouds at 5,000 feet agl, an overcast ceiling at 11,000 feet agl, temperature of 21° C, dew point temperature of 10° C, and an altimeter setting of 30.24 inches of mercury. Remarks: automated station with a precipitation discriminator, temperature 21.0° C, dew point temperature 10.3° C.

Tucumcari Municipal Airport (KTCC) was the enroute airport the accident pilot requested weather conditions from during the weather briefing (see attachment 1) from Lockheed Martin Flight Service (LMFS). The accident pilot mentioned that KTCC could be a possible spot to stop for gas. KTCC was located 6 miles east of Tucumcari, New Mexico, and had an Automated Surface Observing System (ASOS[8]) whose reports were not supplemented. KTCC was located 256 miles southeast of the accident site, at an elevation of 4,065 feet, and had a 12° easterly magnetic variation (figure 7). The following observations were taken and disseminated during the times surrounding the accident:

[0953 MDT] KTCC 051553Z AUTO 23009KT 10SM BKN120 27/12 A3009 RMK AO2 SLP125 T02670122=

[8] ASOS – Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, ceiling, temperature, dewpoint, altimeter, and barometric pressure.

[1053 MDT] KTCC 051653Z AUTO 20011KT 10SM CLR 31/13 A3009 RMK AO2 SLP119 T03060128=

[1153 MDT] KTCC 051753Z AUTO 21010KT 10SM FEW120 32/13 A3007 RMK AO2 SLP113 T03220133 10328 20150 58002=

[1253 MDT] KTCC 051853Z AUTO 22009G22KT 10SM SCT100 32/13 A3005 RMK AO2 SLP108 T03220133=

[1353 MDT] KTCC 051953Z AUTO 23016G21KT 10SM CLR 33/11 A3003 RMK AO2 RAB15E21 SLP101 P0000 T03280106=

ACCIDENT TIME 1408 MDT

[1453 MDT] KTCC 052053Z AUTO 22014G22KT 10SM CLR 34/11 A3001 RMK AO2 SLP093 60000 T03390111 56019=

[1553 MDT] KTCC 052153Z AUTO 20012KT 10SM CLR 35/10 A2999 RMK AO2 SLP086 T03500100=

[1653 MDT] KTCC 052253Z AUTO 23011KT 10SM CLR 35/09 A2999 RMK AO2 SLP088 T03500094=

[1753 MDT] KTCC 052353Z AUTO 21010KT 10SM CLR 34/10 A2998 RMK AO2 SLP089 60000 T03390100 10361 20306 56007=

[1853 MDT] KTCC 060053Z AUTO 22007KT 10SM CLR 30/11 A2998 RMK AO2 SLP092 T03000106=

[1953 MDT] KTCC 060153Z AUTO 21005KT 10SM CLR 27/11 A2999 RMK AO2 SLP094 T02670106=

KTCC weather at 1253 MDT, wind from 220° at 9 knots with gusts to 22 knots, 10 miles visibility, scattered clouds at 10,000 feet agl, temperature of 32° C, dew point temperature of 13° C, and an altimeter setting of 30.05 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 1010.8 hPa, temperature 32.2° C, dew point temperature 13.3° C.

KTCC weather at 1353 MDT, wind from 230° at 16 knots with gusts to 21 knots, 10 miles visibility, clear skies below 12,000 feet agl, temperature of 33° C, dew point temperature of 11° C, and an altimeter setting of 30.03 inches of mercury. Remarks: automated station with a precipitation discriminator, rain began at 1315 MDT and ended at 1321 MDT, sea level pressure 1010.1 hPa, one-hourly precipitation of a trace, temperature 32.8° C, dew point temperature 10.6° C.

KTCC weather at 1453 MDT, wind from 220° at 14 knots with gusts to 22 knots, 10 miles visibility, clear skies below 12,000 feet agl, temperature of 34° C, dew point temperature of 11° C, and an altimeter setting of 30.01 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 1009.3 hPa, 6-hourly precipitation of a trace, temperature 33.9° C, dew point temperature 11.1° C, 3-hourly pressure decrease of 1.9 hPa.

KTCC weather at 1553 MDT, wind from 200° at 12 knots, 10 miles visibility, clear skies below 12,000 feet agl, temperature of 35° C, dew point temperature of 10° C, and an altimeter setting of 29.99 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 1008.6 hPa, temperature 35.0° C, dew point temperature 10.0° C.

In addition to the official surface observation sites above, there were several non-official surface observations sites reporting wind and precipitation conditions around the accident site at the accident time and these sites are documented below:

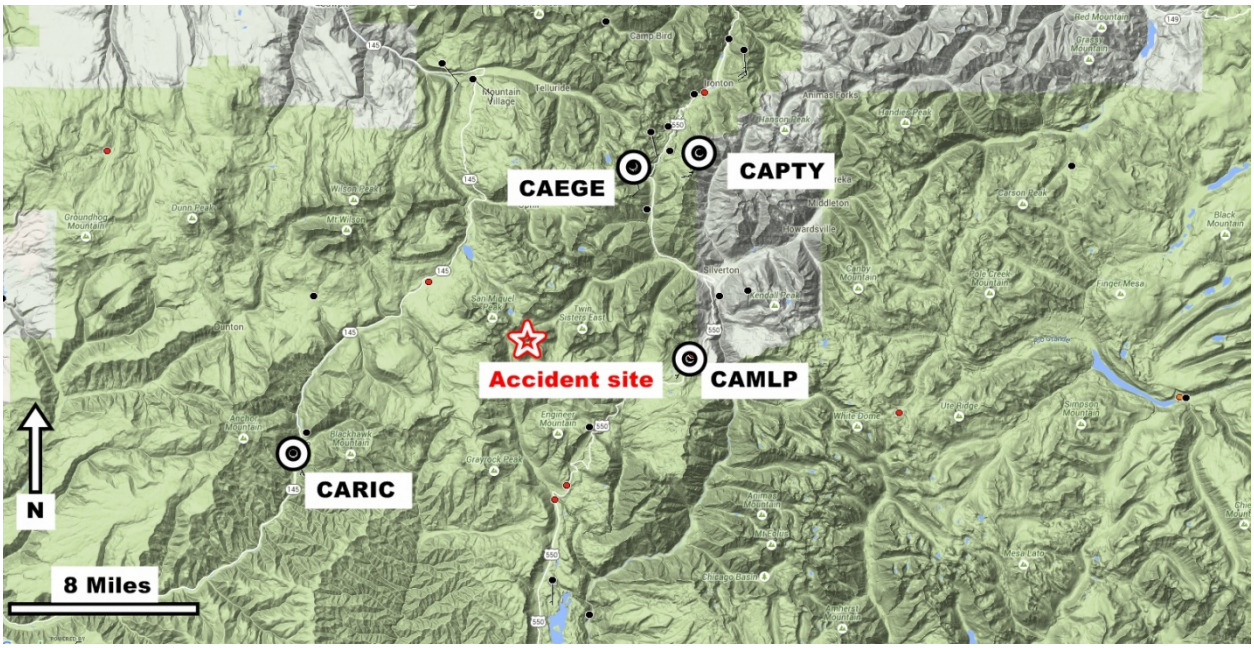

Figure 8 – Map of the accident site with the location of the non-official surface observation sites

Molas Pass (CAMLP) was a Colorado Avalanche Information Center (CAIC) station and was the closest non-official surface observation site to the accident site that reported wind conditions. CAMLP was located 7 miles east of the accident site at an elevation of 10,801 feet (figure 8) and figure 9 contains the observations surrounding the accident time:

ID = CAMLP	TMP ° F	RELH %	SKNT mp	GUST mp	DRCT °	QFLG	SNOW in	DWP °F
9-6-2015 12:00 MDT	52.3	60	4.6	14.1	207	OK	185.6	38.9
9-6-2015 11:00 MDT	52.3	64	3.7	11	127	OK	185.6	40.4
9-6-2015 10:00 MDT	49.5	76	2.2	6	110	OK	185.6	42.4
9-6-2015 9:00 MDT	44.4	88	1.6	5.5	105	OK	185.6	41.1
9-6-2015 8:00 MDT	40.8	91	1.3	4.5	27	OK	185.6	38.3
9-6-2015 7:00 MDT	39.7	93	1.3	4.6	1	OK	185.6	37.9
9-6-2015 6:00 MDT	39.7	93	1.8	6.1	342	OK	185.6	37.9
9-6-2015 5:00 MDT	41.6	88	3.8	8	279	OK	185.6	38.3
9-6-2015 4:00 MDT	41.9	89	3.8	8.3	240	OK	185.6	38.9
9-6-2015 3:00 MDT	42.6	91	3.9	6.6	251	OK	185.6	40.1
9-6-2015 2:00 MDT	43.1	93	4.3	8.2	243	OK	185.6	41.3
9-6-2015 1:00 MDT	43.6	91	5.2	10.1	250	OK	185.6	41.2
9-6-2015 0:00 MDT	42.5	95	2.9	8.5	246	OK	185.6	41.1
9-5-2015 23:00 MDT	41.6	97	1	3.2	319	OK	185.6	40.9
9-5-2015 22:00 MDT	41.4	97	1.5	3.2	260	OK	185.6	40.6
9-5-2015 21:00 MDT	41.8	97	1.5	4.2	13	OK	185.6	41
9-5-2015 20:00 MDT	42.6	96	3.3	12.8	319	OK	185.6	41.6
9-5-2015 19:00 MDT	46.4	85	7	20.5	249	OK	185.6	42.1
9-5-2015 18:00 MDT	49.2	76	6.4	13.6	238	OK	185.6	42.1
9-5-2015 17:00 MDT	51	73	8.8	19.6	227	OK	185.6	42.7
9-5-2015 16:00 MDT	50.1	78	9.7	20.3	228	OK	185.6	43.5
9-5-2015 15:00 MDT	49.6	82	7.8	17.1	225	OK	185.6	44.3
9-5-2015 14:00 MDT	48.5	86	7.5	16.3	218	OK	185.6	44.5
9-5-2015 13:00 MDT	46.8	89	7.2	15.1	224	OK	165.7	43.8
9-5-2015 12:00 MDT	46.5	88	6.4	14.5	217	OK	185.6	43.2

MesoWest Disclaimer

Data provided by: Colorado Avalanche Information Center & Meteorological Assimilation Data Ingest System (MADIS)

Contact MesoWest

Figure 9 – List of hourly observations from CAMLP surrounding the accident time

CAMLP weather at 1300 MDT was reported as wind from 224° at 7.2 mph with gusts to 15.1 mph, temperature of 46.8° F, dew point temperature of 43.8° F.

CAMLP weather at 1400 MDT was reported as wind from 218° at 7.5 mph with gusts to 16.3 mph, temperature of 48.5° F, dew point temperature of 44.5° F.

CAMLP weather at 1500 MDT was reported as wind from 225° at 7.8 mph with gusts to 17.1 mph, temperature of 49.6° F, dew point temperature of 44.3° F.

CAMLP weather at 1600 MDT was reported as wind from 228° at 9.7 mph with gusts to 20.3 mph, temperature of 50.1° F, dew point temperature of 43.5° F.

Eagle (CAEGE) was a CAIC site. CAEGE was located 9 miles northeast of the accident site at an elevation of 12,851 feet (figure 8) and figure 10 contains the observations surrounding the accident time:

ID = CAEGE	TMP ° F	RELH %	SKNT mp	GUST mp	DRCT °	QFLG	DWP °F
9-6-2015 12:00 MDT	43.5	70	6.1	14.6	167	OK	34.5
9-6-2015 11:00 MDT	43.8	74	5.2	15.9	172	OK	36
9-6-2015 10:00 MDT	40.5	84	4.5	12.3	112	OK	35.9
9-6-2015 9:00 MDT	38.9	82	4.6	16.1	290	OK	33.9
9-6-2015 8:00 MDT	37.1	84	3.8	13.9	278	OK	32.6
9-6-2015 7:00 MDT	35.8	87	3.7	7.5	227	OK	32.5
9-6-2015 6:00 MDT	36.3	83	10.2	22.4	255	OK	31.5
9-6-2015 5:00 MDT	36.6	80	6.7	18.2	236	OK	30.9
9-6-2015 4:00 MDT	36.6	82	12.2	21.9	210	OK	31.5
9-6-2015 3:00 MDT	36.6	85	15.5	26.2	195	OK	32.7
9-6-2015 2:00 MDT	36.3	89	10.5	23.5	193	OK	33.5
9-6-2015 1:00 MDT	36.7	90	4.6	14.3	234	OK	34
9-6-2015 0:00 MDT	37.1	88	9.4	26.6	203	OK	33.8
9-5-2015 23:00 MDT	37.1	90	8.5	21.3	202	OK	34.5
9-5-2015 22:00 MDT	36.6	92	7.8	20.8	211	OK	34.4
9-5-2015 21:00 MDT	34.8	99	7.8	17.3	166	OK	34.6
9-5-2015 20:00 MDT	34.1	98	7.3	16.5	180	OK	33.7
9-5-2015 19:00 MDT	36.7	94	7.5	14.6	186	OK	35.2
9-5-2015 18:00 MDT	39.1	93	4.7	10.7	162	OK	37.2
9-5-2015 17:00 MDT	40.1	89	7	13.2	167	OK	37.2
9-5-2015 16:00 MDT	40.1	83	8.2	16.7	173	OK	35.5
9-5-2015 15:00 MDT	38.5	88	12.5	28.3	186	OK	35.4
9-5-2015 14:00 MDT	39	94	9.2	21	167	OK	37.5
9-5-2015 13:00 MDT	37.9	97	8.3	24.5	156	OK	37.2
9-5-2015 12:00 MDT	38.1	97	7	18.5	168	OK	37.3

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Figure 10 – List of hourly observations from CAEGE surrounding the accident time

CAEGE weather at 1300 MDT was reported as wind from 156° at 8.3 mph with gusts to 24.5 mph, temperature of 37.9° F, dew point temperature of 37.2° F.

CAEGE weather at 1400 MDT was reported as wind from 167° at 9.2 mph with gusts to 21 mph, temperature of 39° F, dew point temperature of 37.5° F.

CAEGE weather at 1500 MDT was reported as wind from 186° at 12.5 mph with gusts to 28.3 mph, temperature of 38.5° F, dew point temperature of 35.4° F.

CAEGE weather at 1600 MDT was reported as wind from 173° at 8.2 mph with gusts to 16.7 mph, temperature of 40.1° F, dew point temperature of 35.5° F.

Rico (CARIC) was a CAIC station and was located 10 miles southwest of the accident site at an elevation of 8,931 feet (figure 8) and figure 11 contains the observations surrounding the accident time:

ID = CARIC	TMP ° F	RELH %	SKNT mp	GUST mp	DRCT °	QFLG	SNOW in	DWP °F
9-6-2015 12:00 MDT	60.1	57	1.8	6	162	OK	0	44.6
9-6-2015 11:00 MDT	57.4	66	0.9	4.7	169	OK	0.04	46
9-6-2015 10:00 MDT	51.2	80	0.8	2.8	126	OK	0	45.2
9-6-2015 9:00 MDT	44	91	0.3	2.3	99	OK	0	41.6
9-6-2015 8:00 MDT	43	92	0.2	1	239	OK	0	40.9
9-6-2015 7:00 MDT	43.3	92	0	0.7		OK	0	41.2
9-6-2015 6:00 MDT	42.2	92	0.4	1.8	246	OK	0	40.1
9-6-2015 5:00 MDT	42.8	92	0.4	1.3	259	OK	0.06	40.6
9-6-2015 4:00 MDT	43.6	92	0.5	1.3	257	OK	0	41.4
9-6-2015 3:00 MDT	44.6	92	0.2	0.9	266	OK	0	42.3
9-6-2015 2:00 MDT	45.2	91	0.1	0.7	235	OK	0	42.8
9-6-2015 1:00 MDT	45.4	91	0.2	1.3	292	OK	0	43
9-6-2015 0:00 MDT	45.9	91	0.1	0.9	268	OK	0	43.4
9-5-2015 23:00 MDT	46.8	90	0.1	1	257	OK	0.03	44.2
9-5-2015 22:00 MDT	47.3	90	0.1	1.7	225	OK	0	44.6
9-5-2015 21:00 MDT	47.1	91	0	1.5		OK	0	44.5
9-5-2015 20:00 MDT	47.6	90	0.1	1	305	OK	0	44.8
9-5-2015 19:00 MDT	48.3	88	0.3	2.1	319	OK	0	44.8
9-5-2015 18:00 MDT	52.1	75	1.2	9.9	31	OK	0.12	44.3
9-5-2015 17:00 MDT	58.8	66	1.2	5.9	212	OK	0	47.4
9-5-2015 16:00 MDT	59.9	62	1.7	7.5	163	OK	0	46.7
9-5-2015 15:00 MDT	58	66	1.5	7.8	172	OK	0.04	46.8
9-5-2015 14:00 MDT	60.1	64	2.2	8.3	158	OK	0	47.9
9-5-2015 13:00 MDT	59.1	68	2	7	153	OK	0.2	48.6
9-5-2015 12:00 MDT	53.9	80	1.2	5.2	219	OK	0.01	48

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Figure 11 – List of hourly observations from CARIC surrounding the accident time

CARIC weather at 1300 MDT was reported as wind from 153° at 2 mph with gusts to 7 mph, temperature of 59.1° F, and dew point temperature of 48.6° F.

CARIC weather at 1400 MDT was reported as wind from 158° at 2.2 mph with gusts to 8.3 mph, temperature of 60.1° F, and dew point temperature of 47.9° F.

CARIC weather at 1500 MDT was reported as wind from 172° at 1.5 mph with gusts to 7.8 mph, temperature of 58° F, and dew point temperature of 46.8° F.

CARIC weather at 1600 MDT was reported as wind from 163° at 1.7 mph with gusts to 7.5 mph, temperature of 59.9° F, and dew point temperature of 46.7° F.

Putney (CAPTY) was a CAIC station and was located 11 miles northeast of the accident site at an elevation of 12,326 feet (figure 8) and figure 12 contains the observations surrounding the accident time:

ID = CAPTY	TMP ° F	RELH %	SKNT mp	GUST mp	DRCT °	QFLG	DWP °F
9-6-2015 12:00 MDT	49.9	61	10.4	22.1	231	OK	37.1
9-6-2015 11:00 MDT	46.9	78	10.3	20.7	252	OK	40.5
9-6-2015 10:00 MDT	45.9	68	4	8.8	294	OK	36
9-6-2015 9:00 MDT	39.8	82	4.1	14.4	293	OK	34.8
9-6-2015 8:00 MDT	42.7	80	1.7	5.5	201	OK	36.9
9-6-2015 7:00 MDT	37.2	89	3.7	9.4	194	OK	34.3
9-6-2015 6:00 MDT	36.3	90	6.6	12.5	235	OK	33.7
9-6-2015 5:00 MDT	38	84	4.9	7.9	159	OK	33.7
9-6-2015 4:00 MDT	36.6	94	7.6	13	182	OK	35.2
9-6-2015 3:00 MDT	36.4	90	6.8	12.3	166	OK	33.7
9-6-2015 2:00 MDT	37.2	91	8.5	12.7	196	OK	34.9
9-6-2015 1:00 MDT	38.9	91	8.4	13.4	196	OK	36.5
9-6-2015 0:00 MDT	38.9	92	6.9	14.8	175	OK	36.8
9-5-2015 23:00 MDT	38.8	94	7.6	13.6	170	OK	37.2
9-5-2015 22:00 MDT	37.8	94	5.4	10.1	149	OK	36.3
9-5-2015 21:00 MDT	37.1	99	10.8	25.1	141	OK	36.9
9-5-2015 20:00 MDT	36.1	99	11.6	17.1	173	OK	35.8
9-5-2015 19:00 MDT	37.1	91	9.2	18.5	200	OK	34.8
9-5-2015 18:00 MDT	38.7	93	11.8	18.7	215	OK	36.8
9-5-2015 17:00 MDT	44.4	85	11.3	17.8	200	OK	40.3
9-5-2015 16:00 MDT	43.7	85	10.2	17.1	216	OK	39.4
9-5-2015 15:00 MDT	37.8	88	13.7	27.9	232	OK	34.5
9-5-2015 14:00 MDT	43.9	81	16.2	24.7	200	OK	38.3
9-5-2015 13:00 MDT	37.9	90	18.9	38.7	204	OK	35.1
9-5-2015 12:00 MDT	42	84	12.1	23.1	184	OK	37.6

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Figure 12 – List of hourly observations from CAPTY surrounding the accident time

CAPTY weather at 1300 MDT was reported as wind from 204° at 18.9 mph with gusts to 38.7 mph, temperature of 37.9° F, and dew point temperature of 35.1° F.

CAPTY weather at 1400 MDT was reported as wind from 200° at 16.2 mph with gusts to 24.7 mph, temperature of 43.9° F, and dew point temperature of 38.3° F.

CAPTY weather at 1500 MDT was reported as wind from 232° at 13.7 mph with gusts to 27.9 mph, temperature of 37.8° F, and dew point temperature of 34.5° F.

CAPTY weather at 1600 MDT was reported as wind from 216° at 10.2 mph with gusts to 17.1 mph, temperature of 43.7° F, and dew point temperature of 39.4° F.

The observations from KTEX indicated VFR[9] ceilings at the surface at the time of the accident with no visibility restrictions. KTEX also reported cloud cover as low as 13,000 feet msl and the cloud ceiling around 15,000 feet msl. Lightning distant and vicinity thunderstorms was reported at KTEX which indicated thunderstorm and rain shower activity in the area of the accident site and the location of these thunderstorms and rain showers will be further discussed in sections 6.4 through 6.6. At the time of the accident flight's turn northward (around 1300 MDT) near KGNT scattered clouds were located between 10,000 and 12,000 feet msl. Ceilings and visibilities remained unrestricted at KTCC throughout the flight with a gusty southwest wind. Closer to the accident site, observations from the non-official surface stations within 12 miles of the accident site reported gusty winds between 8 and 39 mph. The strongest winds were at the non-official surface stations closest to the accident site altitude and near the tops of the mountains between 10,000 and 12,000 feet. In addition, the non-official surface stations, close to the accident site with rain showers in the vicinity had relative humidity values greater than 80 percent around the accident time. These stations were above 10,000 feet, and the high relatively humidity values likely indicated cloud cover at or above 10,000 feet and mountain obscuration due to clouds, precipitation, and mist. The accident flight likely encountered instrument meteorological conditions (IMC) while flying into rain shower activity in the mountainous terrain (sections 6.5 and 6.6).

4.0 Upper Air Data

The closest official upper air sounding to the accident site was from Grand Junction, Colorado, (KGJT), located 87 miles north-northwest of the accident site, with a site number 72476, at an elevation of 4,839 feet. The 1800 MDT KGJT sounding was plotted on a standard Skew-T log P diagram[10] with the derived stability parameters included in figure 13 (with the chart plotted from the surface to 400-hPa, or 24,000 feet msl). This data was analyzed utilizing the RAOB[11] software package. The sounding depicted the Lifted Condensation Level (LCL)[12] at 12,606 feet msl, a Convective Condensation Level (CCL)[13] of 12,872 feet, and a Level of Free Convection (LFC)[14] at 12,606 feet. The freezing level was located at 14,329 feet. The precipitable water value was 0.90 inches.

[9] Visual Flight Rules – Refers to the general weather conditions pilots can expect at the surface. VFR criteria means a ceiling greater than 3,000 feet agl and greater than 6 miles visibility.

[10] 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.

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

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

[13] Convective Condensation Level (CCL) – The level in the atmosphere to which an air parcel, if heated from below, will rise dry adiabatically, without becoming colder than its environment just before the parcel becomes saturated.

[14] Level of Free Convection (LFC) – The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

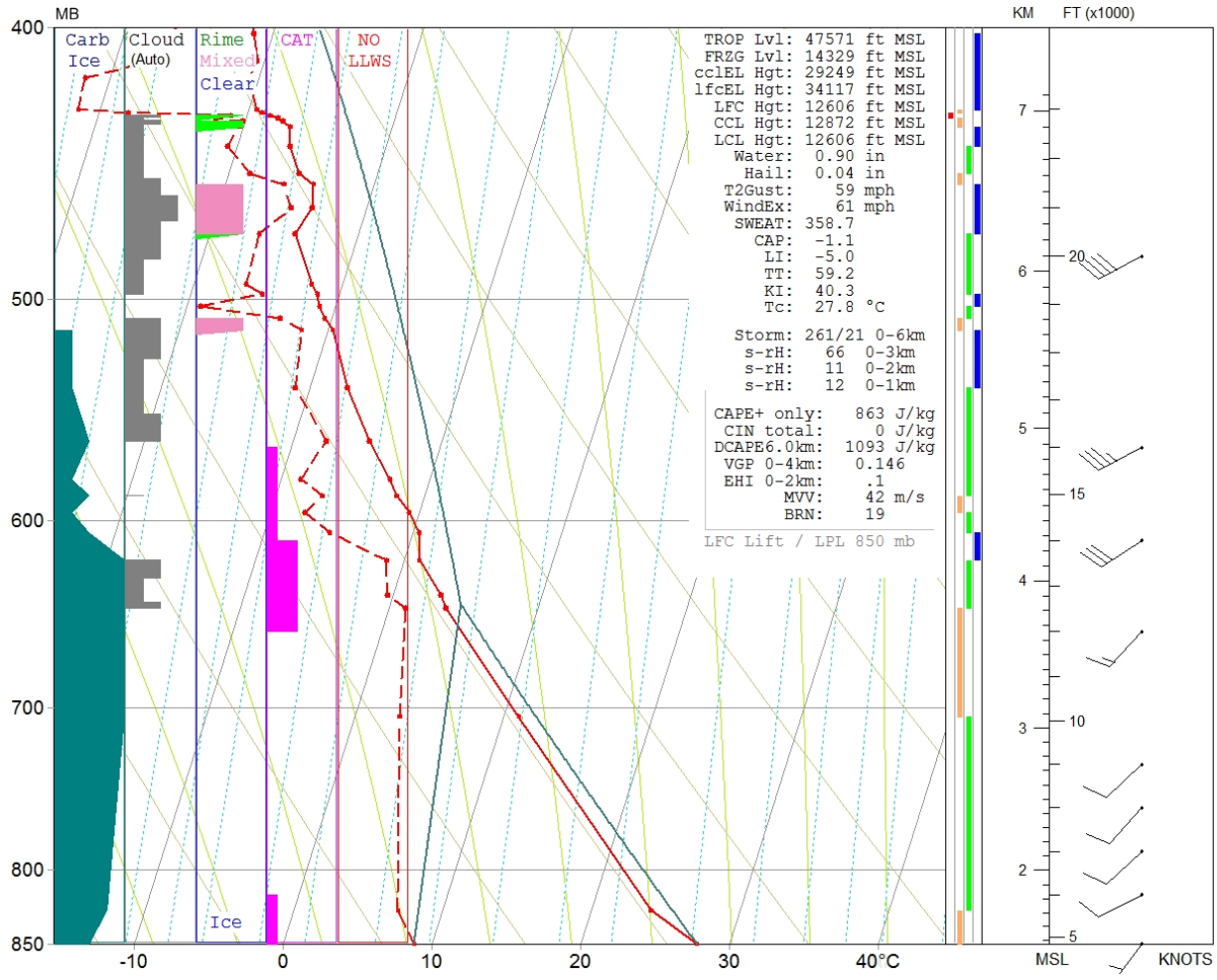


Figure 13 – 1800 MDT KGJT sounding

The 1800 MDT KGJT sounding indicated a conditionally unstable environment with 863 J/kg of CAPE[15] lifting a parcel from the ground. This environment would have been supportive of cloud formation, rain showers, and thunderstorms, especially with the lifting mechanisms in the area of the accident site at the accident time (section 1.1 and 1.2). The maximum vertical velocity (MVV) possible within rain showers or thunderstorm updrafts was 42 meters per second (m/s) or 82 knots given the 1800 MDT KGJT sounding environment. RAOB identified the possibility of clouds in several layers between the 13,000 feet msl and 23,000 feet msl. No areas of icing were likely below 17,000 feet. With rain showers and thunderstorms possible given the environment, the KGJT sounding indicated the strongest wind speeds possible with a microburst, outflow boundary, or downburst (section 18.0) would have likely been 59 mph as indicated by the T2Gust parameter or 61 mph as indicated by the WindEx parameter. The surface wind observations (section 3.0) indicated similar wind gust speeds conditions as the indicated by the KGJT sounding.

[15] Convective Available Potential Energy (CAPE) – CAPE is a measure of the amount of energy available for convection and is directly related to the maximum potential vertical speed within an updraft.

The sounding wind profile indicated a surface wind from 215° at 6 knots with the wind remaining out of the southwest through 24,000 feet msl. Between the surface and 12,000 feet msl the wind speed remained at or below 15 knots. The possibility of low-level wind shear (LLWS) was not indicated by RAOB for the environment outside of rain showers or thunderstorms, but a layer of possible clear-air turbulence was indicated near the surface and again between 13,000 and 15,000 feet msl. Given the background wind environment the accident aircraft would likely have had only turbulence or wind shear issues when near any rain shower or thunderstorm activity.

5.0 Satellite Data

Visible and infrared data from the Geostationary Operational Environmental Satellite number 15 (GOES-15) data was obtained from the NCDC and processed with the NTSB's Man-computer Interactive Data Access System (McIDAS) workstation. Visible and infrared imagery (GOES-15 band 1 and 4) at wavelengths of 0.65 microns (μm) and 10.7 μm retrieved brightness temperatures for the scene. Satellite imagery surrounding the time of the accident, from 1100 MDT through 1600 MDT at approximately 15-minute intervals, was reviewed and the closest images to the time of the accident are documented here.

Figures 14 and 15 present the GOES-15 visible imagery from 1400 and 1411 MDT at 3X magnification with the accident site marked by a red square. The visible imagery indicated abundant cloud cover over and around the accident site at the accident time with the cloud cover moving generally from southwest to northeast (attachment 2). In addition, attachment 2 presents an animation of the visible imagery from 1200 MDT through 1411 MDT at 1X magnification with the accident site marked with a red square, KFLG (the departure airport) being the left blue square, KABQ (Albuquerque International Sunport Airport) being the middle blue square, and KTCC being the right blue square. The visible imagery from 1200 through 1411 MDT showed the cloud cover moving from southwest to northeast with the most abundant high and mid-level cloud cover west and north of KABQ. East of KABQ the cloud cover coverage dropped of significantly through KTCC. Figures 16 and 17 present the GOES-15 infrared imagery from 1400 and 1411 MDT at 3X magnification. Inspection of the infrared imagery indicated cloud cover over the accident site at the accident time. The more enhanced clouds (blue and green colors, higher cloud tops) were over and mainly oriented southwest to northeast from southern Arizona to northern Colorado. In addition, the highest cloud tops remained west and north of KABQ (attachment 3) from 1230 through 1430 MDT. Based on the brightness temperatures above the accident site and the vertical temperature profile provided by the KGJT sounding, the approximate cloud-top heights over the accident site were 28,000 feet at 1411 MDT.

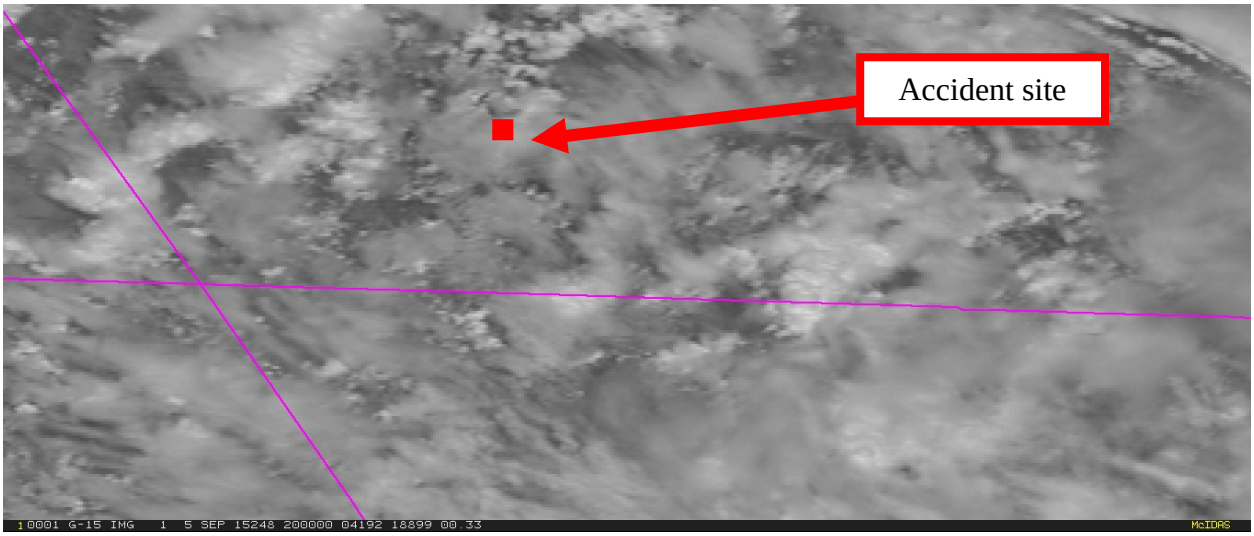


Figure 14 – GOES-15 visible image at 1400 MDT

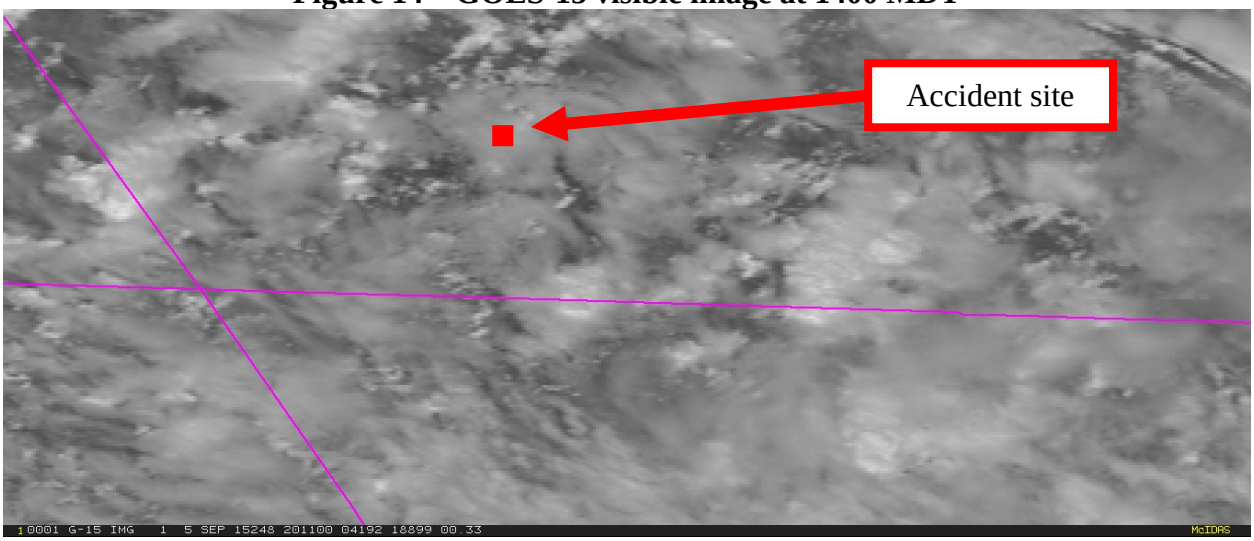


Figure 15 – GOES-15 visible image at 1411 MDT

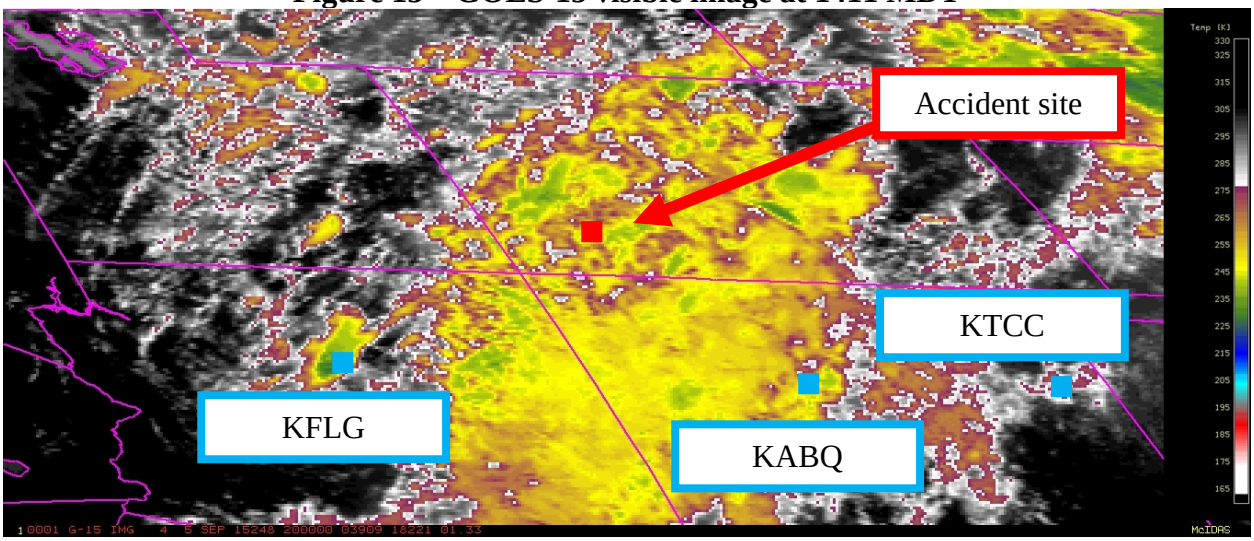


Figure 16 – GOES-15 infrared image at 1400 MDT

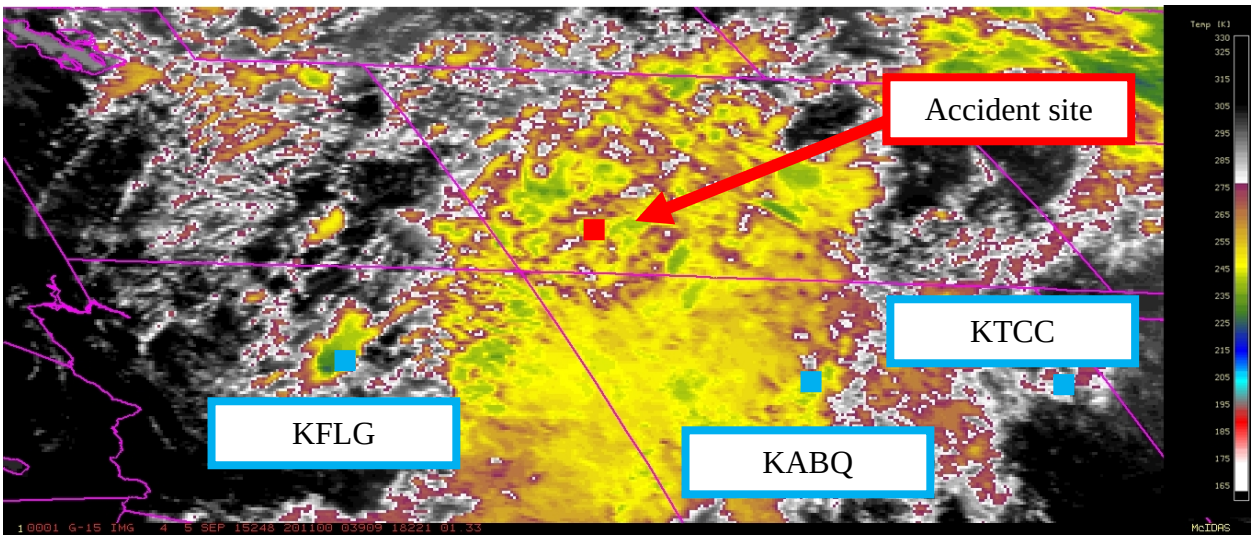


Figure 17 – GOES-15 infrared image at 1411 MDT

6.0 Radar Imagery Information

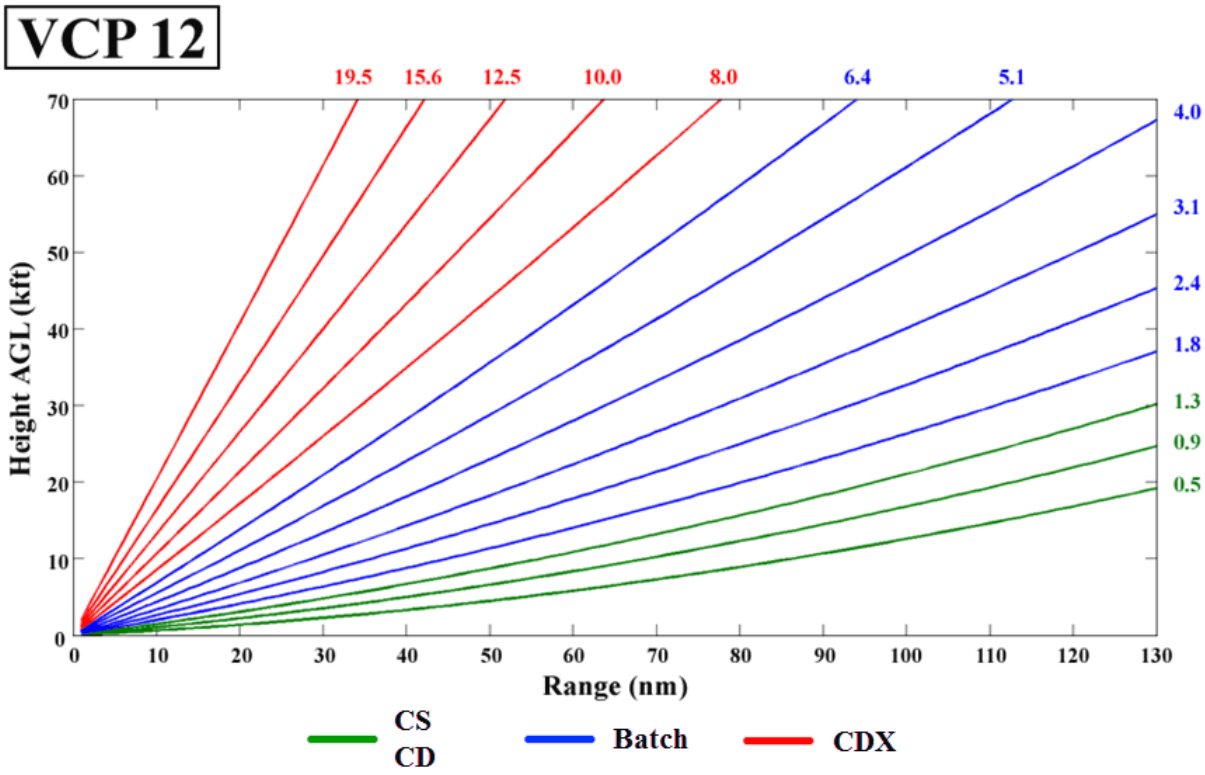
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D)[16] was from Grand Junction, Colorado, (KGJX) located 80 miles north-northwest of the accident site with an elevation of 9,992 feet. Level II and III archive radar data was obtained from the NCDC utilizing the NEXRAD Data Inventory Search and displayed using the NOAA's Weather and Climate Toolkit software.

6.1 Volume Scan Strategy

The WSR-88D is a computer-controlled radar system, which automatically creates a complete series of specific scans in a specific sequence known as a volume scan. Individual elevation scans are immediately available on the WSR-88D's Principle Users Processor (PUP). Products that require data from multiple elevation scans are not available until the end of the five to ten minute volume scan.

The WSR-88D operates in several different scanning modes, identified as Mode A and Mode B. Mode A is the precipitation scan and has two common scanning strategies. The most common is where the radar makes 14 elevation scans from 0.5° to 19.5° about every four minutes. This particular scanning strategy is documented as volume coverage pattern 12 (VCP-12). Mode B is the clear-air mode, where the radar makes 5 elevation scans during a ten minute period (VCP-32). During the period surrounding the accident, the KGJX WSR-88D radar was operating in the precipitation mode (Mode A, VCP-12). The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.

[16] The WSR-88D is an S-band 10-centimeter wavelength radar with a power output of 750,000 watts, and with a 28-foot parabolic antenna that concentrates the energy between a 0.87° and 0.96° beam width. The radar produces three basic types of products: base reflectivity, base radial velocity, and base spectral width.



VCP-12 Precipitation Mode Scan Strategy

6.2 Beam Height Calculation

Assuming standard refraction[17] of the WSR-88D 0.95° wide radar beam, the following table shows the approximate beam height and width[18] information[19] of the radar display over the site of the accident. The heights have been rounded to the nearest 10 feet.

ANTENNA ELEVATION	BEAM CENTER	BEAM BASE	BEAM TOP	BEAM WIDTH
0.5°	18,870 feet	14,930 feet	22,820 feet	7,890 feet

Based on the beam heights, the 0.5° elevation scan depicted the conditions between 14,930 feet and 22,820 feet msl over the accident site and these are the closest altitudes to the ground before the accident occurred.

[17] Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.
[18] Beam width – A measure of the angular width of a radar beam.
[19] Beamwidth values are shown for legacy resolution products. Super resolution products would an effective beamwidth that would be approximately half these values.

6.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[20] it is a function of the drop size distribution, number of particles per unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ[21]), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0 1 2	< 5 5 to 9 10 to 14	
1 Very Light	3 4 5	15 to 19 20 to 24 25 to 29	.01 in/hr .02 in/hr .04 in/hr
2 Light to Moderate	6 7	30 to 34 35 to 39	.09 in/hr .21 in/hr
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr
6 Extreme	11 12 13 14 15	55 to 59 60 to 64 65 to 69 70 to 74 > 75	>5.67 in/hr

[20] Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface; also, any water particles blown by the wind from the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glazed ice.

[21] dBZ – A non-dimensional "unit" of radar reflectivity which represents a logarithmic power ratio (in decibels , or dB) with respect to radar reflectivity factor, Z.

The Federal Aviation Administration (FAA) Advisory Circular AC 00-24B titled "Thunderstorms" dated January 2, 1983, also defines the echo intensity levels and potential weather phenomena associated with those levels. If the maximum VIP Level is 1 "weak" and 2 "moderate", then light to moderate turbulence is possible with lightning. VIP Level 3 is "strong" and severe turbulence is possible with lightning. VIP Level 4 is "very heavy" and severe turbulence is likely with lightning. VIP Level 5 is "intense" with severe turbulence, lightning, hail likely, and organized surface wind gusts. VIP Level 6 is "extreme" with severe turbulence, lightning, large hail, extensive surface wind gusts and turbulence.

6.4 Radar Summary

Figure 18 provides a radar summary image from 1415 MDT with reflectivity values over the southern United States, with the accident site located in an with no dBZ greater than 20 dBZ values. It is likely the radar summary image missed capturing some of the weather radar echoes that were located at the accident site at the accident time (section 6.5) due to the compositing nature of the radar summary image.

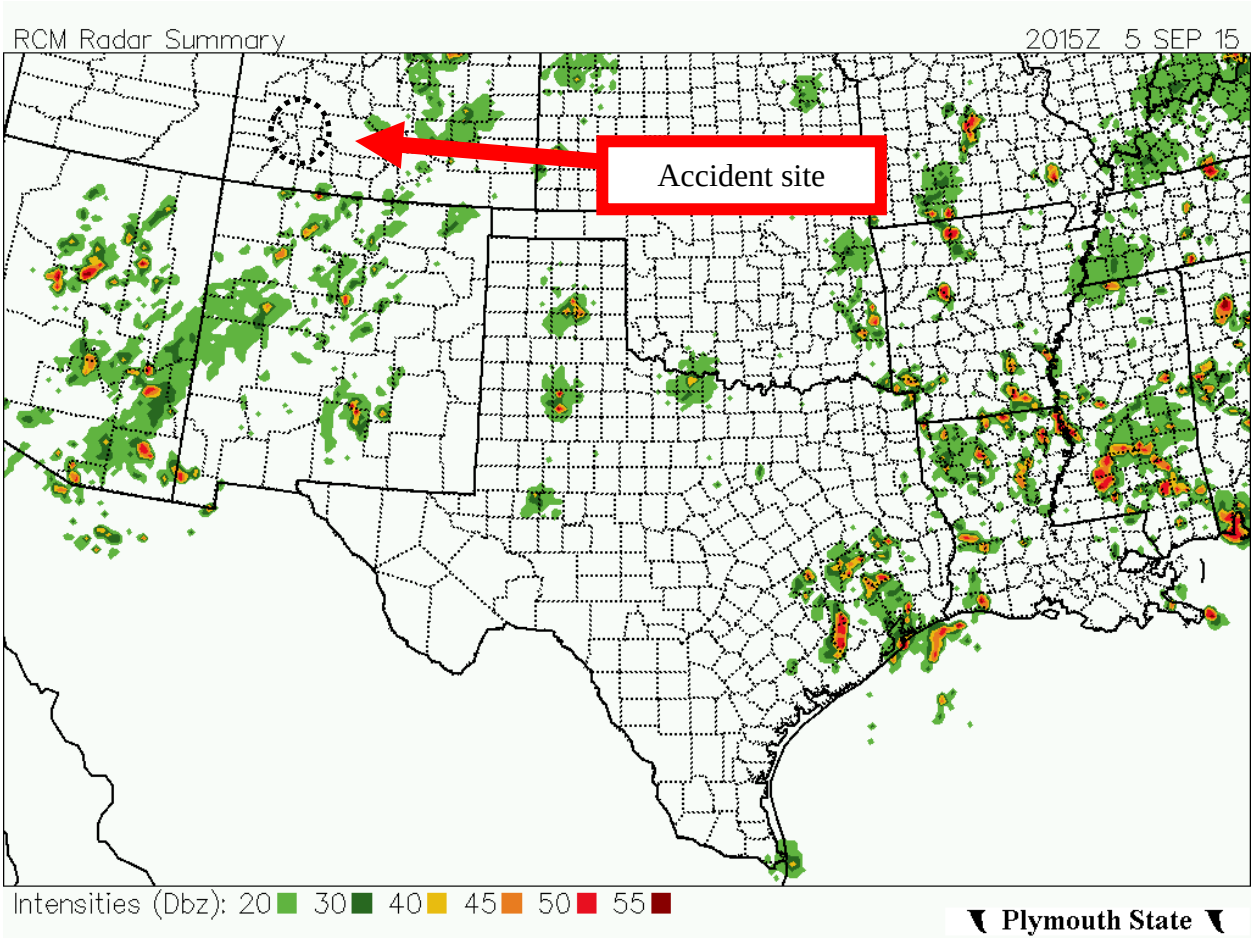


Figure 18 – Radar summary image for 2115 MDT with the accident site

6.5 Base Reflectivity

Figures 19, 20, 21, and 22 present the KGJX WSR-88D base reflectivity images for the 0.5° elevation scans initiated at 1402, 1406, 1409, and 1412 MDT with a resolution of 0.5° X 250 m. All the lightning flashes[22] and strikes were north and west of the accident between 1300 and 1500 MDT (black dots on figures 19 through 22). The accident site was located in an area of 15 to 35 dBZ reflectivity values at the accident time, with those reflectivity values increasing in areal coverage and moving northeastward with time. These reflectivity values are indicative of rain shower activity in the mountainous terrain with light to moderate turbulence and with mountain obscuration and IMC due to clouds and precipitation. LLWS was also likely given the increasing areal coverage of the rain shower activity and likely growth of those rain shower cells within the mountainous terrain.

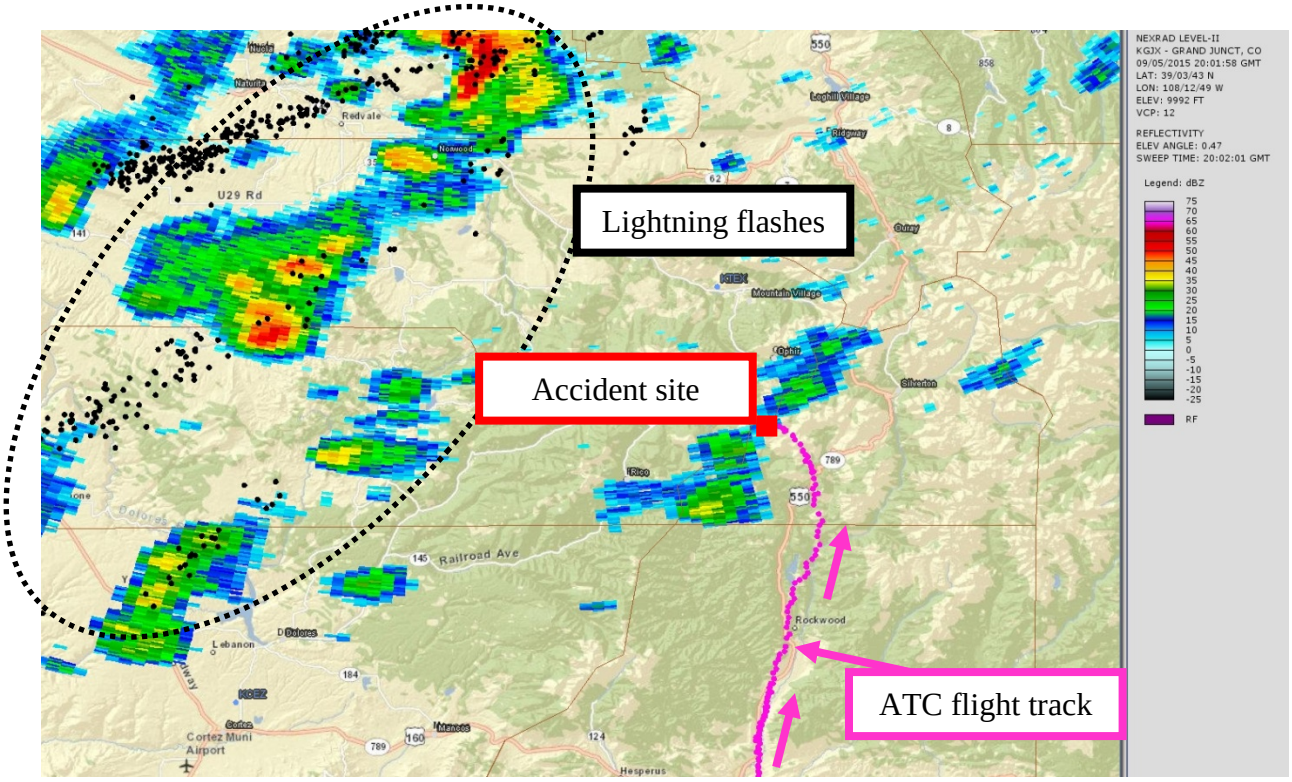


Figure 19 – KGJX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1402 MDT with the lightning data

[22] Lightning Flash – This is one contiguous conducting channel and all the current strokes/pulses that flow through it. There are two types of flashes: ground flashes and cloud flashes.

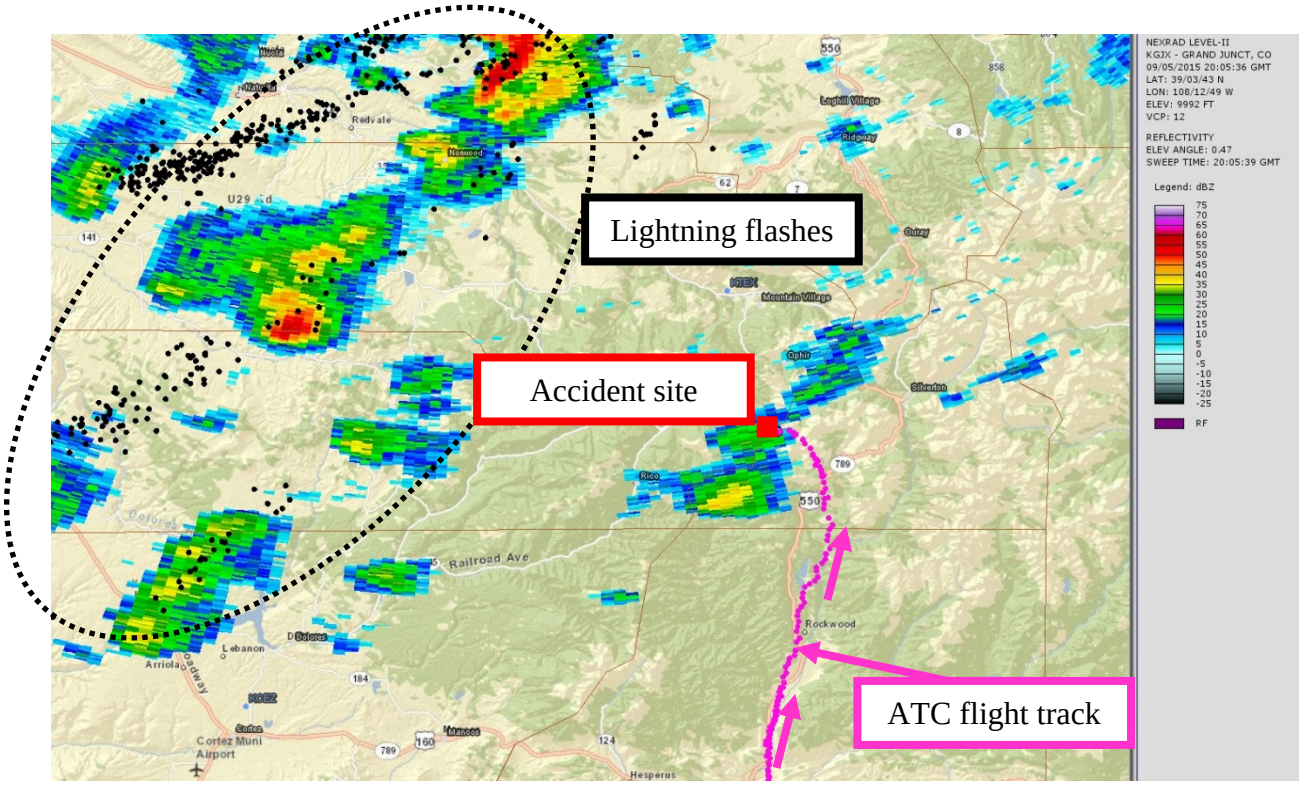


Figure 20 – KGJX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1406 MDT with the lightning data

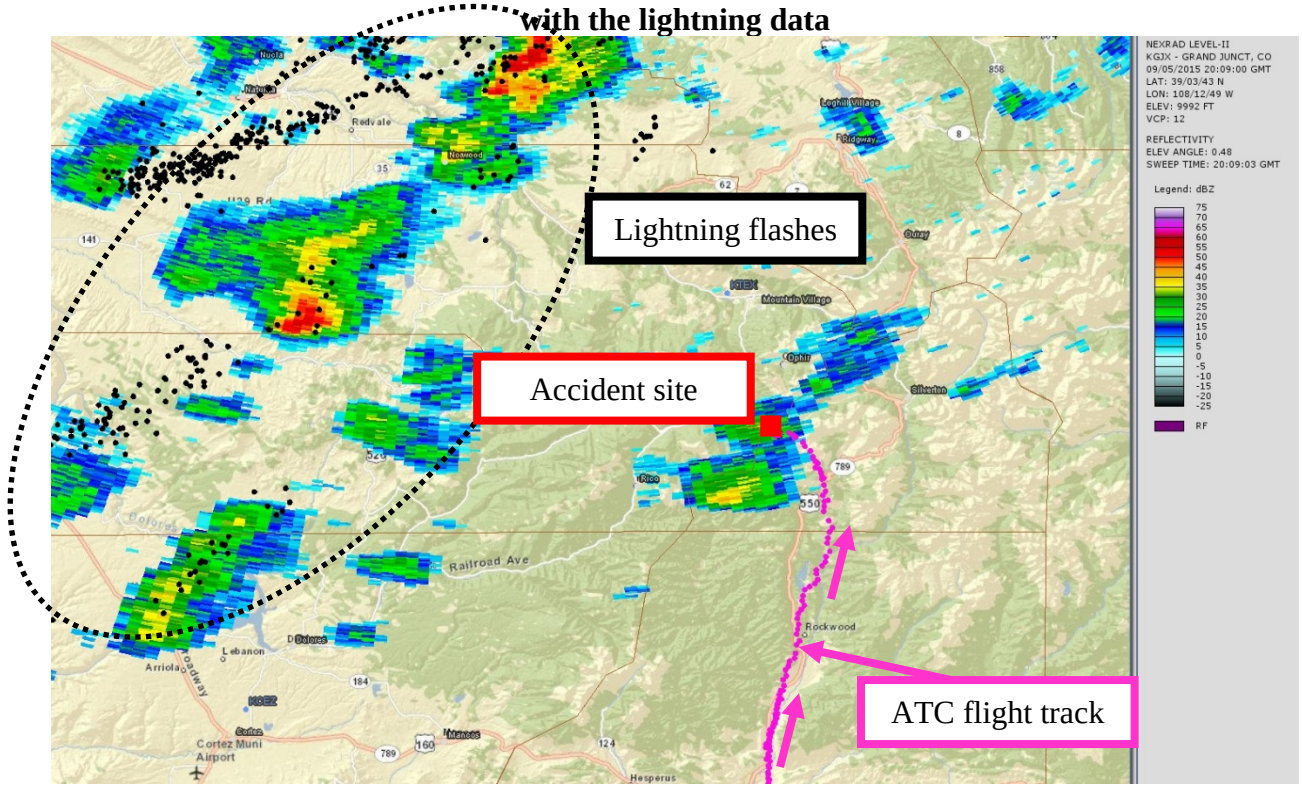


Figure 21 – KGJX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1409 MDT with the lightning data

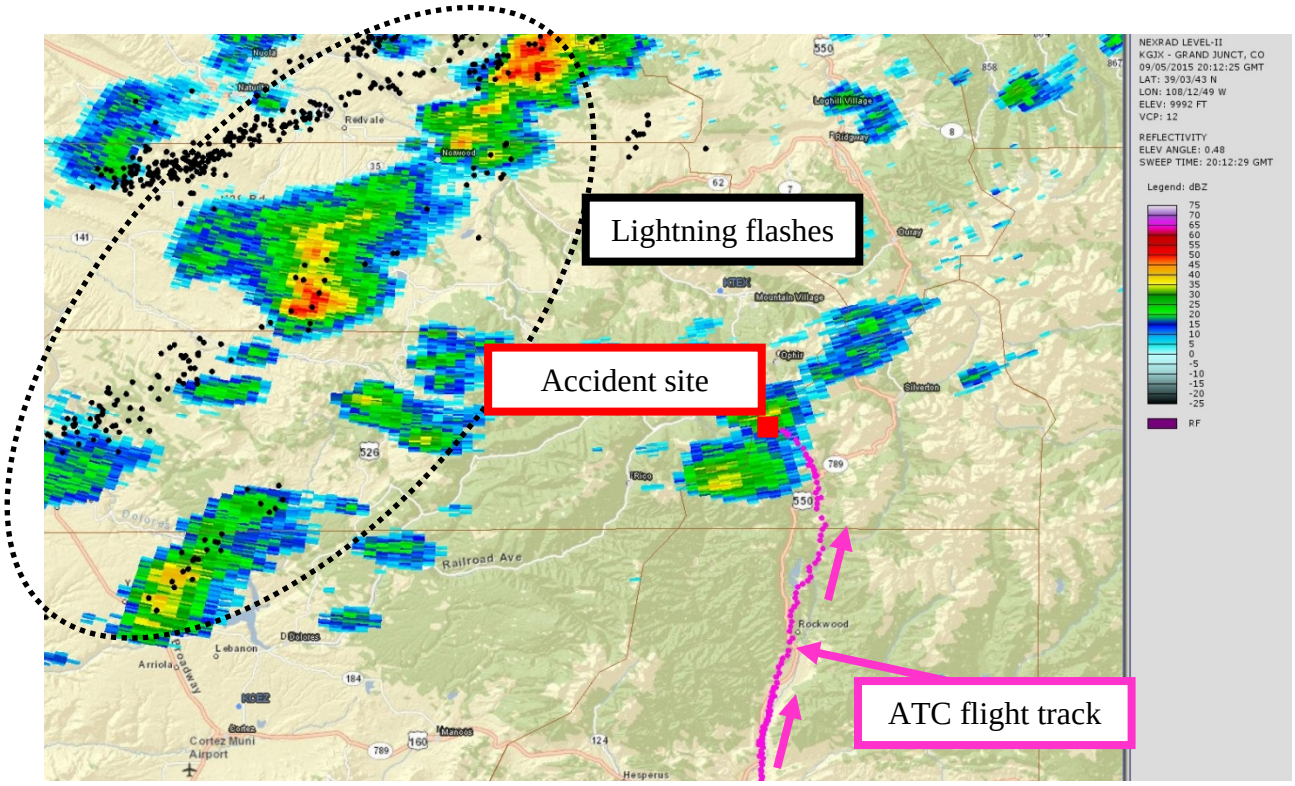


Figure 22 – KGJX WSR-88D reflectivity for the 0.5° elevation scan initiated at 1412 MDT with the lightning data

6.6 3-Dimensional Radar Reflectivity Data

Figures 23 through 28 present a 3-dimensional view of the KGJX WSR-88D base reflectivity for the elevation scans initiated at 1406 MDT (figures 23, 25, and 27) and 1409 MDT (figures 24, 26, and 28). The accident aircraft's flight track obtained from ATC[23] was also plotted on the Google Earth image for a time comparison with the base reflectivity images. The images showed the accident flight located within greater than 20 dBZ values at 1409 MDT. The areal coverage of greater than 20 dBZ values increased between 1406 and 1409 MDT with the overall coverage of the base reflectivity moving from southwest to northeast. It is likely the accident flight encountered precipitation, mist, and mountain obscuration near the end of the flight with the rain shower activity moving across the accident site from southwest to northeast at the accident time.

[23] For more information see the ATC data contained in the docket for this accident.

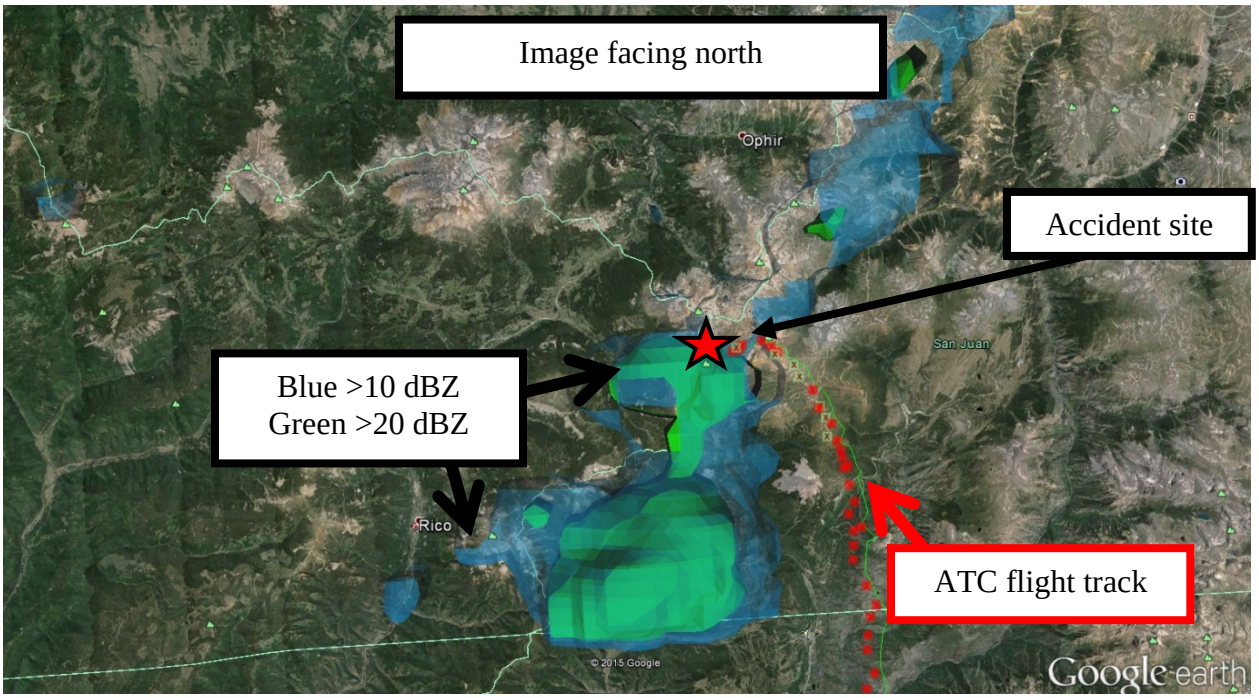


Figure 23 – 3-dimensional KGJX WSR-88D base reflectivity from the scan initiated at 1406 MDT and the ATC Flight Track

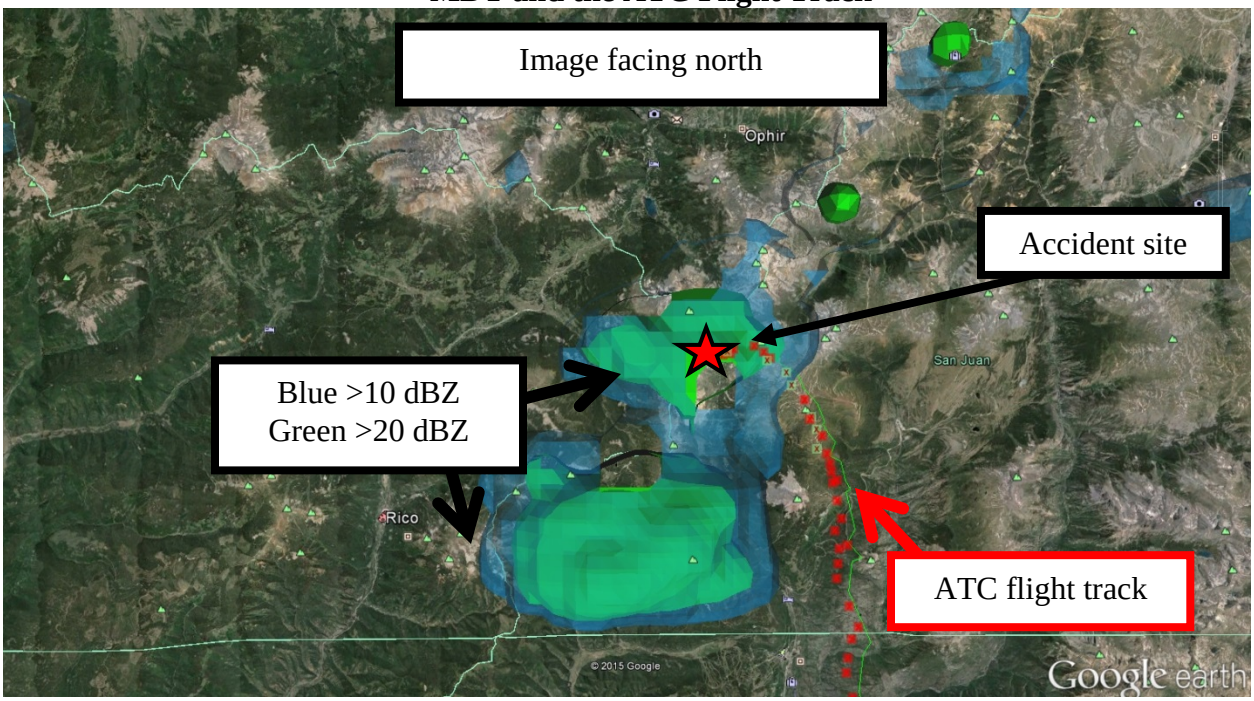


Figure 24 – 3-dimensional KGJX WSR-88D base reflectivity from the scan initiated at 1409 MDT and the ATC Flight Track

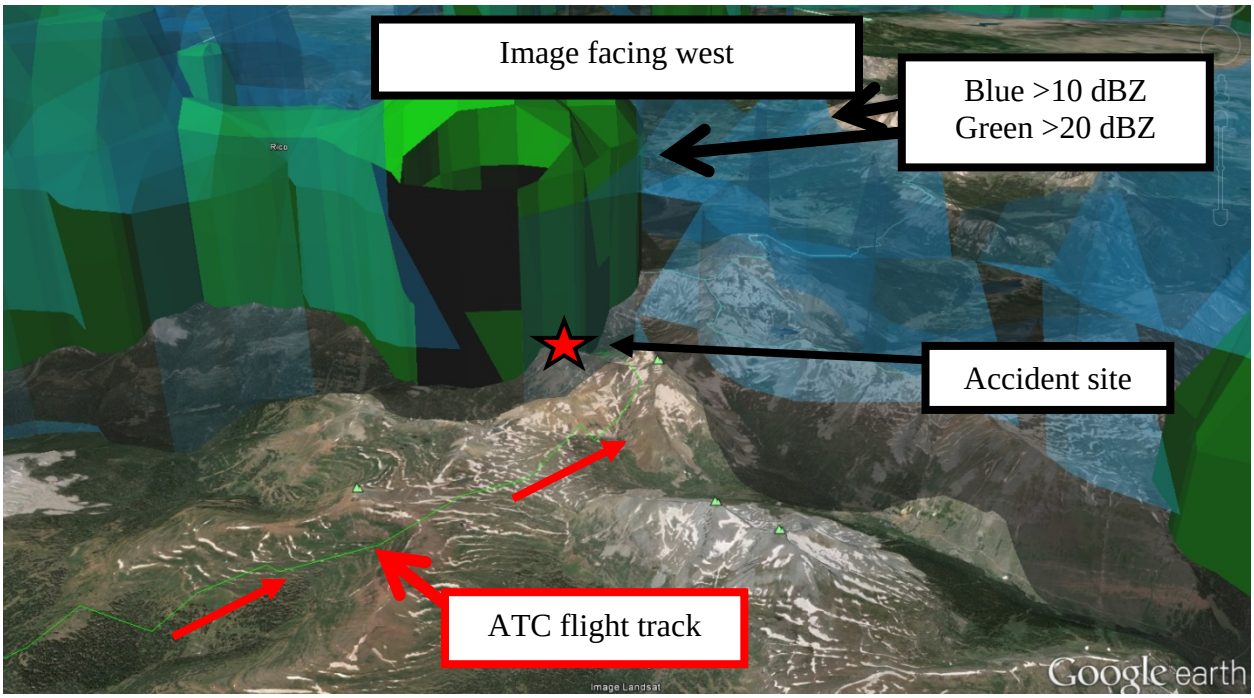


Figure 25 – 3-dimensional KGJX WSR-88D base reflectivity from the scan initiated at 1406 MDT and the ATC Flight Track

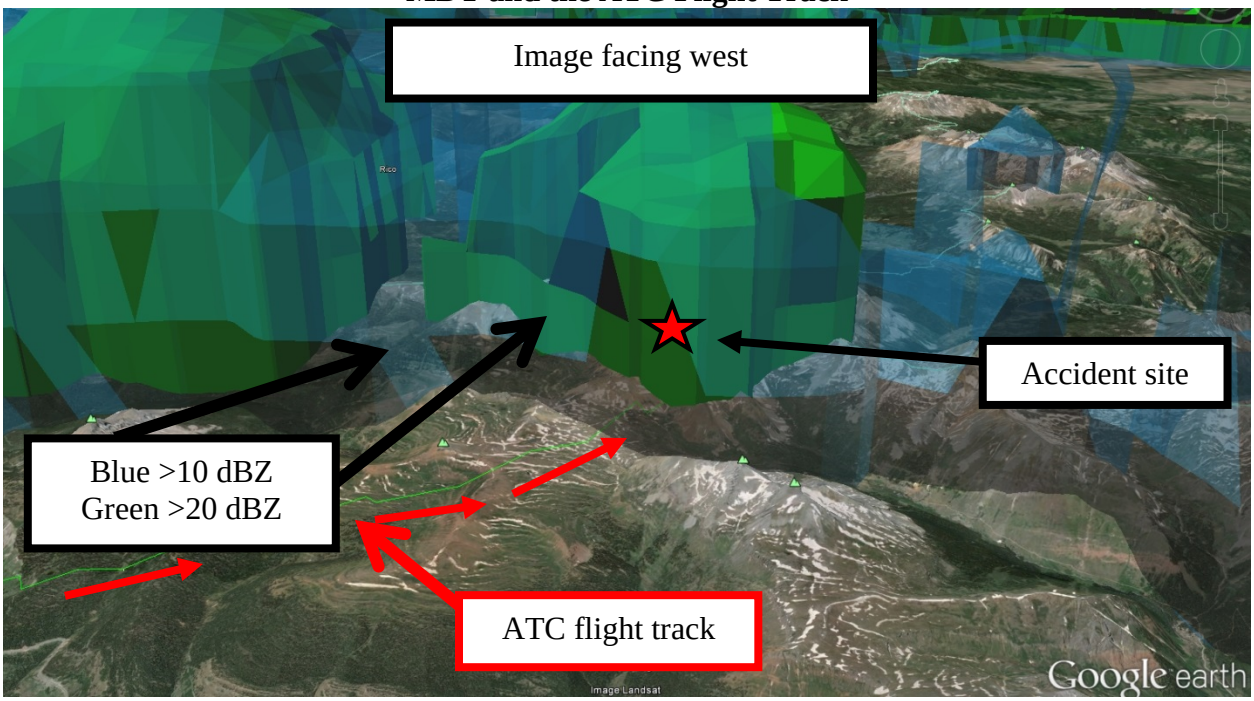


Figure 26 – 3-dimensional KGJX WSR-88D base reflectivity from the scan initiated at 1409 MDT and the ATC Flight Track

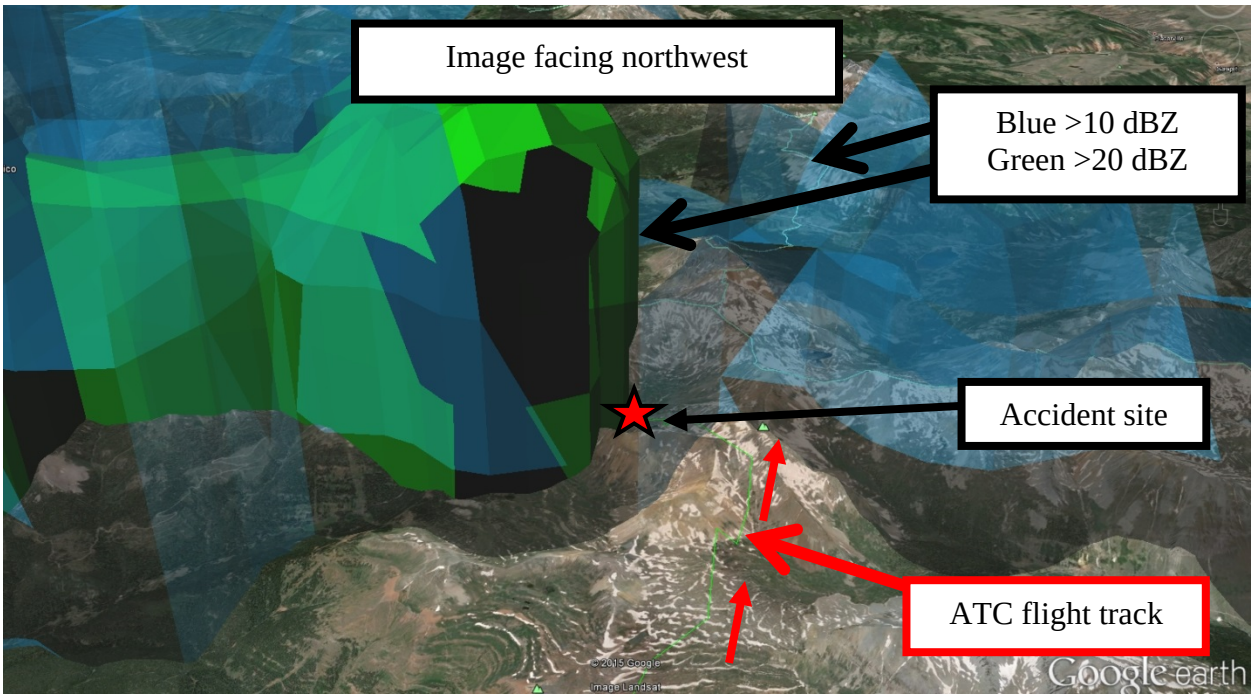


Figure 27 – 3-dimensional KGJX WSR-88D base reflectivity from the scan initiated at 1406 MDT and the ATC Flight Track

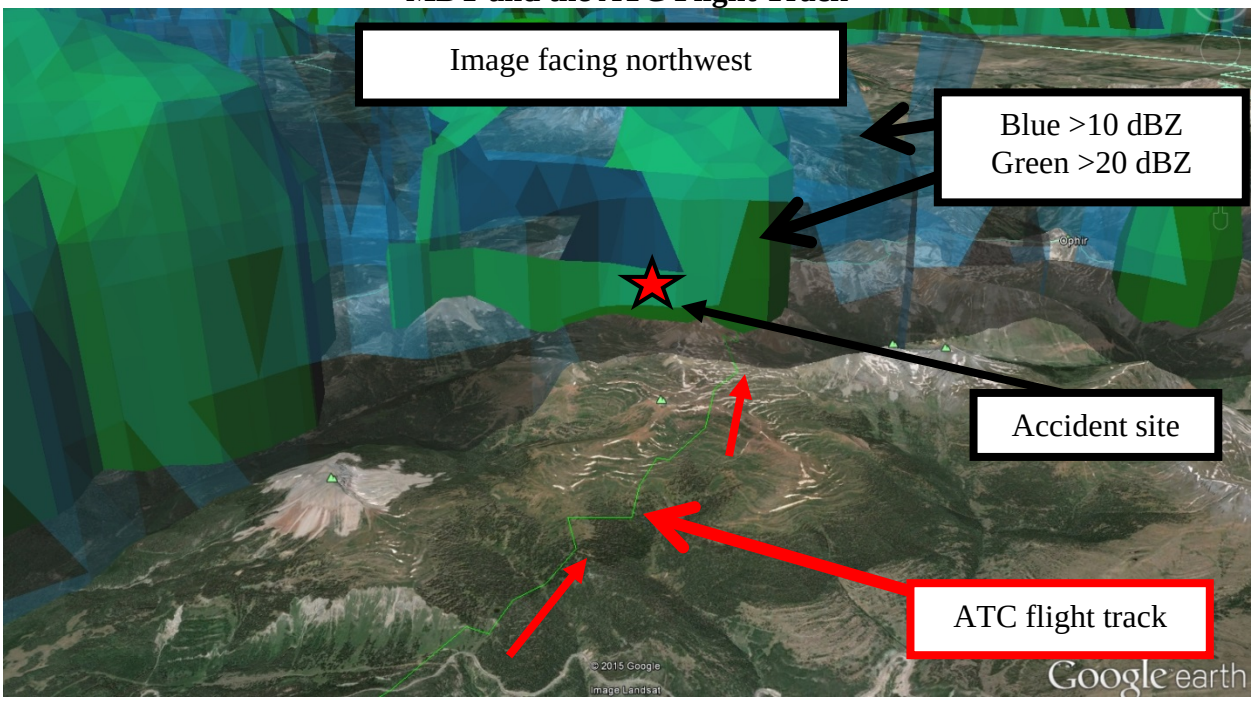


Figure 28 – 3-dimensional KGJX WSR-88D base reflectivity from the scan initiated at 1409 MDT and the ATC Flight Track

7.0 Pilot Reports

All pilot reports (PIREPs) were reviewed close to the accident site from around three hours prior to the accident time to around four hours after the accident time and are displayed below:

RIL UA /OV RIL180020 /TM 1900 /FL200 /TP P46T /SK SCT140-TOP180 /WX FV99SM /TA M08 /WV 21637KT /TB LGT OCNL MOD 160-180 NEG 200 /RM TOP 160-180 EXCEPT CONVECTION TOPS=

AFF UA /OV DEN200040 /TM 2008 /FL195 /TP CRJ7 /TA M13 /TB MOD /IC LGT RIME=

ASE UA /OV DBL129009/TM 2226/FL170/TP BE55/TA M05/IC LGT MIXED/RM ZDV=

ONM UA /OV ONM /TM 2113 /FL075 /TP C180 /SK SCT-BKN100 /TA 99 /TB LGT=

Routine pilot report (UA); 20 miles from Rifle, Colorado, on the 180° radial; Time – 1300 MDT (1900Z); Altitude – FL200[24]; Type aircraft – Piper PA-46; Sky – Scattered 14,000 feet with tops at FL180; Weather – Unrestricted visibility; Temperature – -8° C, Wind – From 216° at 37 knots; Turbulence – Light with occasional moderate between 16,000 feet and FL180, turbulence negative at FL200; Remarks – Tops 16,000 feet to FL180 except convection tops.

Routine pilot report (UA); 40 miles from Denver, Colorado, on the 200° radial; Time – 1408 MDT (2008Z); Altitude – FL195; Type aircraft – Canadair Regional Jet CRJ-700; Temperature – -13° C, Turbulence – Moderate; Icing – Light rime.

Routine pilot report (UA); 9 miles from Eagle, Colorado, on the 129° radial; Time – 1826 MDT (2226Z); Altitude – 17,000 feet; Type aircraft – Beechcraft 55 Baron; Temperature – -5° C, Icing – Light mixed.

Near where the accident flight took a northward turn[25] in New Mexico the only PIREP close to the time of the turn or the accident was a routing PIREP from a Cessna 180 as follows. Routine pilot report (UA); Over Socorro, New Mexico; Time – 1513 MDT (2113Z); Altitude – 7,500 feet; Type aircraft – Cessna 180; Sky – Scattered to a broken ceiling at 10,000 feet; Temperature – Unknown, Turbulence – Light.

8.0 SIGMET and CWSU Advisory

SIGMET 18W was issued at 1255 MDT and was valid for just northwest of the accident site at the accident time. SIGMET 18W warned of an area of thunderstorms moving from 230° at 20 knots with tops to FL350. SIGMET 19W was issued at 1355 MDT and was valid for the accident site at the accident time. SIGMET 19W warned of an area of thunderstorms moving from 230° at 20 knots with tops to FL350.:

CONVECTIVE SIGMET 18W
VALID UNTIL 2055Z
CO UT
FROM 40E SLC-50WNW CHE-10S HBU-10SW DVC-40ESE BCE-40E SLC
AREA TS MOV FROM 23020KT. TOPS TO FL350.

[24] Flight Level – A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 inHg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.
[25] For more information see the ATC data contained in the docket for this accident.

CONVECTIVE SIGMET 19W
VALID UNTIL 2155Z
CO WY UT
FROM 40NNE CHE-10S HBU-40SE DVC-40SE BCE-50E SLC-40NNE CHE
AREA TS MOV FROM 23020KT. TOPS TO FL350.

No meteorological impact statement (MIS) was valid for the accident area for the accident time. A Center Weather Advisory (CWA) was issued just before the accident flight turned northward in New Mexico warning of an area of thunderstorm activity just north and northwest of the accident site location. That CWA was valid from 1242 to 1340 MDT and was replaced by SIGMET 18W at 1254 MDT:

FAUS21 KZDV 051854
ZDV1 CWA 051855
ZDV CWA 102 VALID UNTIL 051905
CANCEL ZDV CWA 101. COVERED BY SIGMET 18W.
=

FAUS21 KZDV 051842
ZDV1 CWA 051840
ZDV CWA 101 VALID UNTIL 051940
FROM 5ENE JNC-25W HBU-25ESE DVC-20WNW DVC-25SW JNC-5ENE JNC
AREA TS. MOV FROM 23020KT. TOPS TO FL340.
=

9.0 CCFP and CAWS

The Collaborative Convective Forecast Product (CCFP) guidance is an automated forecasting tool available via the Aviation Weather Center website that forecast areas of convective (thunderstorm) activity for the United States. The CCFP issued at 0900 MDT valid for 1500 MDT forecasted low confidence of sparse coverage of thunderstorm activity for south of the accident site (figure 29). The CCFP forecast issued at 1100 MDT valid for 1300 and 1500 MDT was equally as low confident of thunderstorm activity for the accident site and just south of the accident site with similar sparse areal coverage thunderstorm activity pockets forecast for large portions of New Mexico (figures 30 and 31). A later CCFP forecast from 1300 MDT and valid at 1500 MDT (figure 32) were again equally lowly confident of thunderstorm activity low areal spacial thunderstorm coverage south of the accident area.

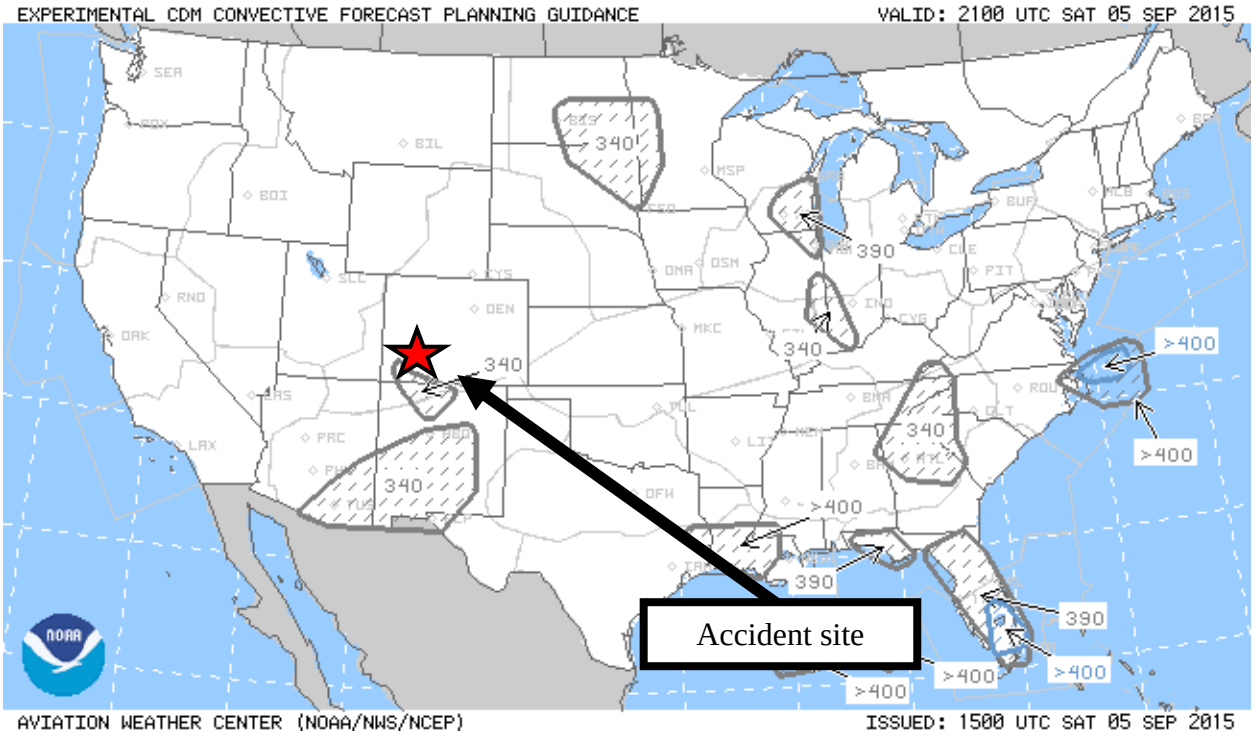


Figure 29 – CCFP issued at 0900 MDT valid at 1500 MDT

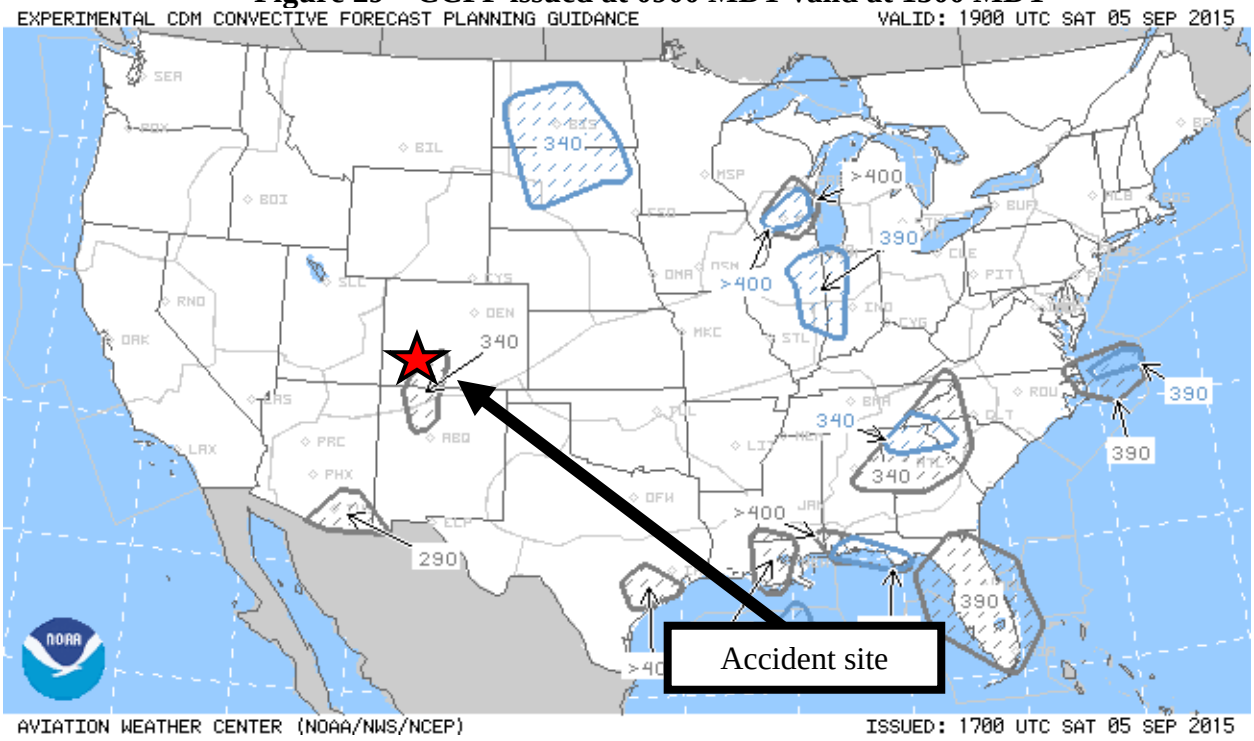


Figure 30 – CCFP issued at 1100 MDT valid at 1300 MDT

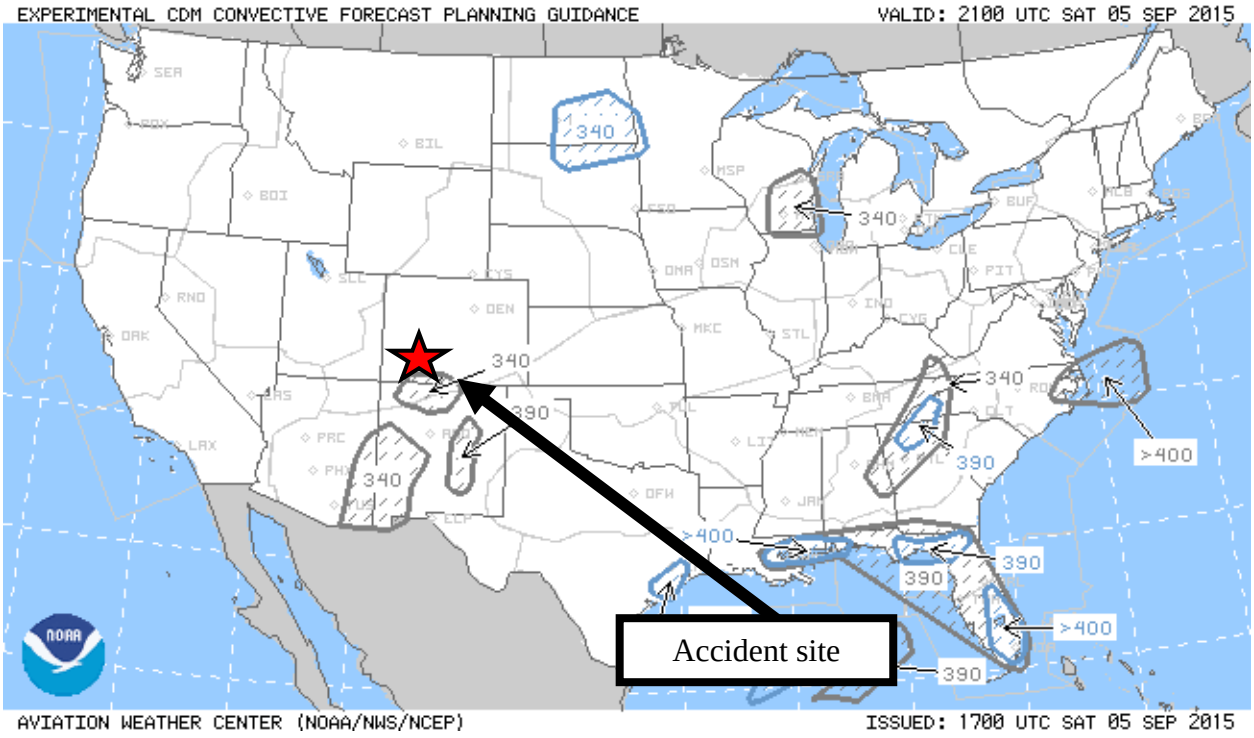


Figure 31 – CCFP issued at 1100 MDT valid at 1500 MDT

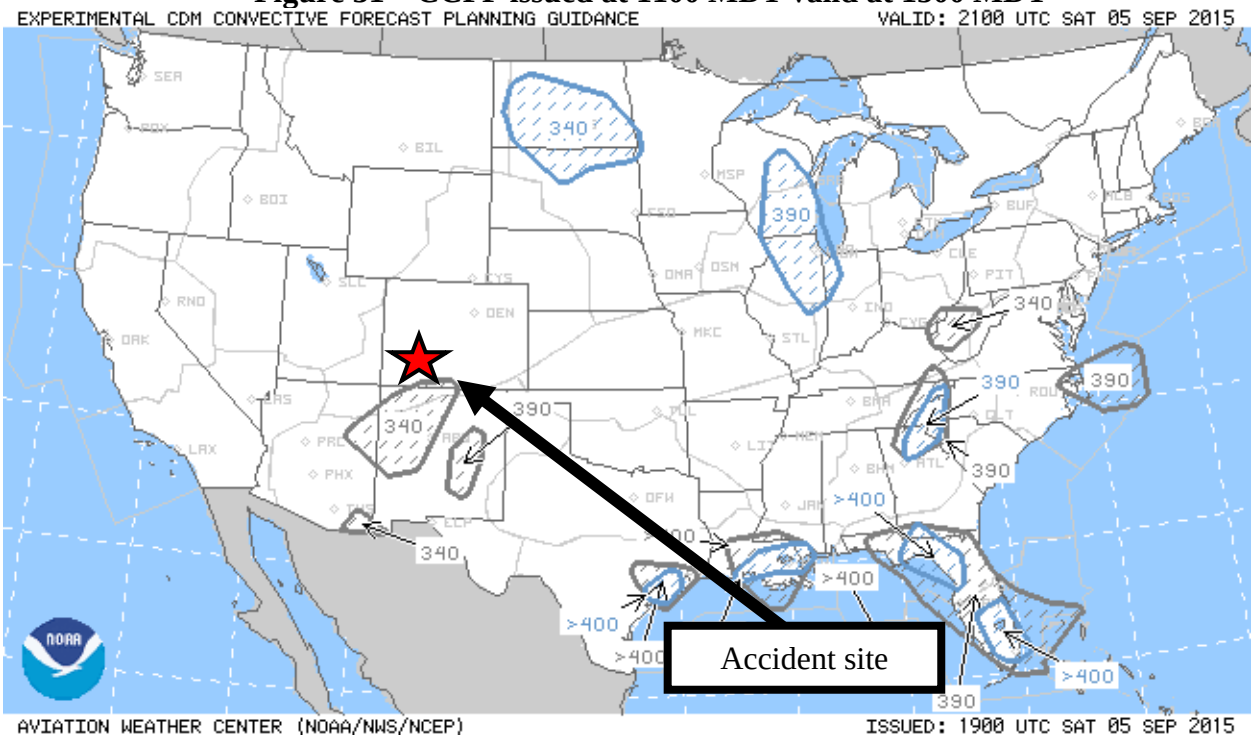


Figure 32 – CCFP issued at 1300 MDT valid at 1500 MDT

No Collaborative Aviation Weather Statements (CAWS)s were valid for the accident site at the accident time nor would any be expected with the accident location being away from most large metropolitan airports.

10.0 AIRMETs

AIRMET Sierra issued at 0845 MDT was valid for the accident site at the accident time. The AIRMET forecasted mountain obscuration conditions due to clouds, precipitation, and mist:

WAUS45 KKCI 051445
WA5S
_SLCS WA 051445
AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 052100
.
AIRMET IFR...MT
FROM 60ESE YXC TO 50NNW ISN TO 80SW DIK TO DLN TO 60S FCA TO
60ESE YXC
CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS ENDG 18-21Z.
.
AIRMET MTN OBSCN...UT CO AZ NM
FROM DEN TO 50S PUB TO DMN TO 40SSE TUS TO 60S PHX TO 60NE TBC
TO 60SW CHE TO DEN
MTNS OBSC BY CLDS/PCPN/BR. CONDS ENDG 15-18Z.
.
AIRMET MTN OBSCN...ID MT WY NV WA OR
FROM 20ENE YDC TO 20N DSD TO 20WNW PDT TO 80WSW YXC TO 40SW YQL
TO BIL TO 40NNW BOY TO 60SE REO TO 30SSE LKV TO 40WNW OED TO HUH
TO 20ENE YDC
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
....

11.0 Area Forecast

The Area Forecast issued at 1345 MDT, valid at the accident time, forecasted scattered clouds to a broken ceiling at 8,000 feet to 10,000 feet msl, broken skies at 15,000 feet msl with tops to 24,000 feet. Widely scattered light rain showers and thunderstorms were forecast with cumulonimbus tops to FL370. The Area Forecast issued at 0445 MDT valid through 1345 MDT forecasted a broken ceiling between 12,000 and 14,000 feet msl with layered clouds through FL250. Between 1300 and 1500 MDT widely scattered light rain showers and thunderstorms were forecast with cumulonimbus tops to FL400:

FAUS45 KKCI 051945
FA5W
_SLCC FA 051945
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 061400
CLDS/WX VALID UNTIL 060800...OTLK VALID 060800-061400
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...UPR LVL LOW PRES SYS WAS OVR ERN WA-OR/ID WITH UPR
TROF EXTDG SWD INTO CNTRL CA. SWLY FLOW ALF OVR CNTRL AND SRN
ROCKIES. NWRLY FLOW ALF ACRS WA/OR/NRN CA. UPR LVL LOW WILL LIFT
NWD INTO SRN CANADA DURG PD. BY 14Z...BROAD UPR LVL TROF WILL

EXTD FROM WA-0R-NRN CA EWD INTO NRN AND CNTRL ROCKIES.
.
ID
NRN...BKN040-050 OVC070 LYRD FL220. WDLY SCT -SHRA BECMG ISOL
02Z-05Z. BECMG 0205 SCT050 BKN070 BKN100 TOPS 170. ISOL -SHRA.
BECMG 0508 SCT120 BKN CI. OTLK...MVFR BR.
CNTRL MTNS...BKN-OVC080-100 LYRD FL220. ISOL -SHRA. OTLK...VFR.
SWRN...BKN-SCT060-080 TOPS 120. BECMG 2302 SCT150. OTLK...VFR.
SERN...SCT080-100 BKN150 TOPS FL220. ISOL -TSRA/-SHRA CB TOPS
FL350. BECMG 2302 SCT130-150. BECMG 0205 SKC. OTLK...VFR.
.
MT
CONTDVD WWD...OVC050 LYRD FL220. WDLY SCT -SHRA/ISOL -TSRA CB
TOPS FL340. BECMG 0205 SCT050 OVC080 ISOL -SHRA. OTLK...VFR.
SWRN MTNS...BKN080-100 TOPS FL220. WDLY SCT -SHRA/ISOL -TSRA CB
TOPS FL330. OTLK...VFR SHRA.
ERN SLOPES OF CONTDVD...BKN-OVC060-080 LYRD FL220. WDLY SCT
-SHRA/ISOL -TSRA CB TOPS FL330. OTLK...VFR SHRA.
CNTRL-ERN...BKN-OVC040-060 LYRD FL220. ISOL -SHRA. OTLK...MVFR
CIGS SHRA.
.
WY
NWRN...SCT080-100 BKN150 TOPS FL220. WDLY SCT -TSRA/-SHRA CB
TOPS FL350. BECMG 2302 SCT130-150. BECMG 0205 SKC. OTLK...VFR.
SWRN...SCT120 BKN150 TOPS FL220 WIND SW 25G35KT. ISOL -TSRA CB
TOPS FL350. BECMG 0205 ISOL -SHRA. WIND W 20G30KT. AFT 05Z
SKC OCNL SCT120-140. OTLK...VFR.
NERN...SKC. WIND SW 20G30KT. AFT 05Z SCT050 BKN CI. OTLK...VFR.
SERN...SCT120 BKN CI. WIND SW 20G30KT DMSHG BY 02Z. AFT 02Z BKN
CI. OTLK...VFR.
.
NV
NWRN...SKC. OCNL SCT150 MAINLY NRN SXNS. OTLK...VFR.
NERN...SCT CI. AFT 02Z SKC. OTLK...VFR.
SRN...SKC OCNL FEW120. OTLK...VFR.
.
UT
SE OF MTU-60SW BCE LN...SCT-BKN080-100 BKN150 TOPS FL220. WDLY
SCT -SHRA/ISOL -TSRA CB TOPS FL350. AFT 02Z SCT150 BKN-SCT CI.
OTLK...VFR.
SE OF SLC-ILC LN...SCT100 BKN150 TOPS FL200. ISOL -SHRA. BECMG
0205 SCT100 SCT150. OTLK...VFR.
NW OF SLC-ILC LN...SCT150 SCT CI. OTLK...VFR.
.
CO
MTNS AND WEST/FOOTHILLS...SCT-BKN080-100 BKN150 TOPS FL240. WDLY
SCT -TSRA/-SHRA CB TOPS FL370. AFT 05Z SCT100 BKN150 TOPS
FL220 BKN CI. OTLK...VFR.
PLAINS...
NRN PTNS...SCT120-140 BKN160 TOPS FL200 BKN CI. BECMG 0508
FEW150 SCT CI. OTLK...VFR.
SRN PTNS...SCT-BKN080-100 BKN150 TOPS FL240. WDLY SCT
-TSRA/-SHRA CB TOPS FL370. AFT 05Z SCT100 BKN150 TOPS
FL220 BKN CI. OTLK...VFR.
.
AZ

NRN HLF...
  WRN PTNS...SCT100 BKN150 TOPS FL200. ISOL -SHRA. BECMG
    0205 SCT100 SCT150. OTLK...VFR.
  CNTRL AND ERN PTNS...SCT-BKN080-100 BKN150 TOPS FL220. WDLY
    SCT -SHRA/ISOL -TSRA CB TOPS FL350. AFT 02Z SCT100 SCT150
    BKN-SCT CI. OTLK...VFR.
SWRN...SCT100-120 SCT-BKN150 TOPS FL200. OTLK...VFR.
SERN...SCT-BKN080-100 BKN150 TOPS FL240. WDLY SCT -TSRA/-SHRA CB
  TOPS FL370. AFT 05Z SCT100 BKN150 TOPS FL220 BKN CI.
  OTLK...VFR.
.
NM
MTNS AND WEST...SCT-BKN080-100 BKN150 TOPS FL240. WDLY SCT
  -TSRA/-SHRA CB TOPS FL370. AFT 05Z SCT100 BKN150 TOPS FL220
  BKN CI. OTLK...VFR.
PLAINS...
  NRN AND CNTRL PTNS...SCT-BKN080-100 BKN150 TOPS FL240. WDLY
    SCT -TSRA/-SHRA CB TOPS FL370. AFT 05Z SCT100 BKN150 TOPS
    FL220 BKN CI. OTLK...VFR.
  SRN PTNS...SCT CI. OTLK...VFR.
....

FAUS45 KKCI 051045
FA5W
_SLCC FA 051045
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 060500
CLDS/WX VALID UNTIL 052300...OTLK VALID 052300-060500
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..TROF OVR CNTRL WA/OR-NWRN NV-CNTRL CA BY 05Z OVR
NWRN MT-SWRN ID-W CNTRL NV-SRN CA. UPR LOW OVR CNTRL OR BY 05Z
OVR NWRN MT. SFC..QSTNRY FNT OVR NRN WY BECMG CDFNT OVR SERN
ID-NWRN UT-CNTRL NV. BY 05Z CDFNT OVR NWRN SD-SWRN WY-W CNTRL
UT-S CNTRL NV.
.
ID
NRN...BKN060 LYRD FL250. VIS 3-5SM SCT -RA/BR. 21Z ISOL -TSRA. CB
TOP FL300. OTLK...MVFR CIG RA BR TIL 02Z TSRA.
CNTRL MTNS...BKN070 LYRD FL250. SCT -SHRA. 18Z S HLF BKN100 TOP
FL220. WDLY SCT -SHRA/TSRA. CB TOP FL340. OTLK...N HLF MVFR CIG
SHRA S HLF VFR TIL 02Z TSRA.
SWRN...SCT100 BKN150 TOP FL200. ISOL -SHRA. 14Z BKN060. WDLY SCT
-SHRA. 20Z BKN080. WDLY SCT -SHRA/ISOL -TSRA. CB TOP FL320.
OTLK...VFR TIL 01Z SHRA TSRA.
SERN...SCT120 BKN CI. ISOL -TSRA. CB TOP FL320. BECMG 1315 BKN120
TOP FL200. WDLY SCT -SHRA. 18Z TOP FL220. ISOL -TSRA. CB TOP
FL360. WND SW 20G35KT. OTLK...VFR TIL 00Z SHRA TSRA TIL 03Z WND.
.
MT
CONTDVD WWD...BKN060 LYRD FL250. OCNL VIS 3SM -RA/BR. OTLK...MVFR
CIG RA BR 01Z VFR SHRA.

SWRN MTNS...BKN080 TOP FL220. WDLY SCT -SHRA/ISOL -TSRA. CB TOP FL320. 18Z BKN100 LYRD FL250. WDLY SCT -SHRA/TSRA. CB TOP FL360. OTLK...VFR SHRA TIL 04Z TSRA.
ERN SLPS-N CNTRL...BKN040-050 TOP FL220. OCNL VIS 3SM -RA/BR. ISOL -TSRA. CB TOP FL360. OTLK...MVFR CIG RA BR TIL 03Z TSRA.
S CNTRL...BKN050 TOP FL200. ISOL -SHRA. 17Z SCT050 BKN100. 21Z BKN080. WDLY SCT -TSRA. CB TOP FL380. OTLK...VFR TSRA.
NERN...BKN-OVC035-045 LYRD FL250. OCNL VIS 3SM SCT -SHRA/BR. WDLY SCT -TSRA. CB TOP FL400. BECMG 1820 BKN045 TOP FL220. SCT -SHRA. OTLK...MVFR CIG SHRA 00Z TSRA.
SERN...BKN-OVC040 TOP FL220. WDLY SCT -SHRA. 21Z BKN050 TOP FL200. WDLY SCT -SHRA/TSRA. CB TOP FL400. OTLK...VFR SHRA TSRA.
.
WY
ERN PLAINS...BKN120 LYRD FL250. ISOL -SHRA. 17Z SCT120 SCT CI. WND SW 20G30KT. 21Z ISOL -TSRA. CB TOP FL400. OTLK...VFR S HLF TSRA TIL 01Z WND TIL 02Z N HLF TSRA.
MTNS AND W...SCT-BKN120-140 TOP FL200. ISOL -SHRA. 16Z WND SW 20G30KT. BECMG 1921 BKN120-140 TOP FL220. WDLY SCT -SHRA/TSRA. CB TOP FL400. WND SW 20G35KT. OTLK...VFR SHRA TSRA WND 03Z N HLF SHRA WND.
.
NV
NWRN...SCT120. 18Z SKC OR SCT CI. OTLK...VFR.
NERN...SCT100-120 SCT CI. 18Z WND SW G25KT. OTLK...VFR.
SRN...SKC. 21Z WND SW G25KT. OTLK...VFR TIL 04Z WND.
.
UT
W HLF...SCT-BKN120 TOP FL180. 16Z SCT120 SCT CI. WND SW G25KT. BECMG 1820 OCNL VIS 5SM BLDU. WND SW 20G35KT. OTLK...MVFR BLDU WND 01Z VFR TIL 03Z WND.
E HLF...SCT-BKN120 TOP FL200. ISOL -SHRA. 15Z SCT150 SCT CI. 17Z WND SW G25KT. BECMG 1921 BKN120 TOP FL220. WDLY SCT -SHRA/TSRA. CB TOP FL400. WND SW 20G30KT. OTLK...VFR SHRA TSRA TIL 01Z WND.
.
CO
ERN PLAINS/FOOTHILLS...SCT-BKN150 LYRD FL250. 17Z SCT150 BKN CI. BECMG 2022 SCT-BKN120 LYRD FL250. WDLY SCT -SHRA/TSRA. CB TOP FL400. OTLK...VFR SHRA TSRA.
MTNS AND W...BKN120-140 LYRD FL250. TIL 14Z WDLY SCT -SHRA/ISOL -TSRA. CB TOP FL380. 14Z TOP FL220. BECMG 1820 WDLY SCT -SHRA/TSRA. CB TOP FL400. OTLK...VFR SHRA TSRA.
.
AZ
WRN 1/3...SCT100 SCT150 SCT-BKN CI. OTLK...VFR.
ERN 2/3...SCT080-100 BKN-SCT150 TOP FL200 BKN CI. BECMG 1820 SCT-BKN120 LYRD FL250. WDLY SCT -SHRA/TSRA. CB TOP FL420. NRN PTN WND SW G25KT. OTLK...VFR SHRA TSRA TIL 02Z NRN PTN WND 04Z VFR.
.
NM
ERN PLAINS...SCT150 SCT-BKN CI. 15Z SCT150 SCT CI. BECMG 2022 SCT-BKN100-120 LYRD FL250. WDLY SCT -TSRA. CB TOP FL440. OTLK...VFR TSRA.
MTNS AND W...SCT-BKN080 BKN120 TOP FL220. ISOL -SHRA. TIL 13Z OCNL VIS 3SM BR. 15Z SCT080 BKN120. BECMG 1820 BKN120-140 LYRD

FL250. WDLY SCT -TSRA. CB TOP FL440. OTLK...VFR TIL 04Z TSRA.
....

12.0 Terminal Aerodrome Forecast

KTEX was the closest site with a NWS TAF. The TAF valid at the time of the accident was issued at 1120 MDT and was valid for a 24-hour period beginning at 1200 MDT. The TAF for KTEX was as follows:

TAF KTEX 051720Z 0518/0618 **00000KT P6SM VCSH BKN070 OVC090**
TEMPO 0518/0522 VRB20G35KT -TSRA SCT050CB
FM060300 14004KT P6SM VCSH SCT050 BKN120
FM060600 14004KT P6SM FEW200=

The forecast expected wind calm, greater than 6 miles visibility, vicinity showers, a broken ceiling at 7,000 feet agl, and overcast skies at 9,000 feet agl. Temporary conditions of variable wind at 20 knots with gusts to 35 knots, light rain and thunderstorms, and scattered cumulonimbus clouds at 5,000 feet agl were forecast between 1300 and 1700 MDT.

13.0 National Weather Service Area Forecast Discussion

The National Weather Service Office in Grand Junction, Colorado, issued the following Area Forecast Discussion at 1223 MDT (closest AFD to the accident time), which discussed thunderstorms and rain showers across the mountainous terrain already developed by 1220 MDT with gusty winds of 30 to 40 mph expected and some brief heavy rain. The forecaster didn't have confidence that every TAF site would have thunderstorm activity near the airports, however, was confident that every TAF site would have rain shower activity, hence choosing a combination of VCSH and VCTS for the TAF sites:

FXUS65 KGJT 051823
AFDGJT
AREA FORECAST DISCUSSION
NATIONAL WEATHER SERVICE GRAND JUNCTION CO
1223 PM MDT SAT SEP 5 2015
.SHORT TERM...(TODAY THROUGH SUNDAY)
ISSUED AT 347 AM MDT SAT SEP 5 2015
THE LARGE SCALE PATTERN REMAINS SIMILAR WITH LOW PRESSURE OVER THE PACIFIC NORTHWEST AND HIGH PRESSURE OVER THE SOUTHERN PLAINS. SOUTHWEST FLOW BETWEEN THESE FEATURES WILL CONTINUE TO DRAW MONSOON MOISTURE ACROSS THE AREA. THE SOUTHWEST TO NORTHEAST ORIENTED JET STREAK OVER THE FOUR CORNERS...THOUGH A BIT WEAKER AT 75 KTS...SHOULD SUSTAIN SOME SHOWER ACTIVITY ACROSS AREAS ROUGHLY SOUTHEAST OF A KPGA-KSBS LINE BEFORE NOON.
FLOW WILL SHIFT SLIGHTLY MORE TO THE WEST AS A SHORTWAVE EJECTED FROM THE NORTHWEST LOW MOVES ACROSS THE NORTHERN ROCKIES. MODELS SUGGEST THIS WILL BRING ABOUT ROUGHLY A 10 PERCENT REDUCTION IN MOISTURE OVER THE AREA FOR A SLIGHT DECREASE IN THUNDERSTORM COVERAGE. MEANWHILE...A COLD FRONT DRIVEN BY THE SHORTWAVE PREVIOUSLY DESCRIBED...WILL MOVE TO THE EASTERN UINTA MOUNTAINS LATE IN THE DAY. PRE-FRONTAL PACKING OF THE PRESSURE GRADIENT AHEAD OF THE FRONT WILL DRIVE BREEZY SOUTHWEST WINDS FROM THE I-70

CORRIDOR NORTH.
THE COLD FRONT WILL DRIFT SOUTHWARD ACROSS THE EASTERN UINTA BASIN AND NORTHWEST COLORADO DURING THE NIGHT STALLING NORTH OF THE TAVAPUTS AND ROAN PLATEAUS AND THE FLAT TOP MOUNTAINS. THE JET WILL REMAIN OVERHEAD SO EXPECT NOCTURNAL SHOWERS AND THUNDERSTORMS. DRYING CONTINUES SUNDAY AS FLOW REMAINS MORE WESTERLY KEEPING THE MONSOONAL MOISTURE PLUME LARGELY SOUTH OF THE FORECAST AREA. CONSEQUENTLY...IT APPEARS SUNDAY AFTERNOON WILL SEE A FAIRLY SHARP DECREASE IN THUNDERSTORM ACTIVITY.
TEMPERATURES WILL REMAIN SEVERAL DEGREES BELOW NORMAL THIS WEEKEND IN RESPONSE TO CLOUDS AND SHOWERS TODAY. THE COLD FRONT MENTIONED PREVIOUSLY WILL BRING A FEW ADDITIONAL DEGREES OF COOLING TO THE NORTH SUNDAY.
.LONG TERM...(SUNDAY NIGHT THROUGH FRIDAY)
ISSUED AT 347 AM MDT SAT SEP 5 2015
THE REMNANTS OF AN OLD BOUNDARY THAT DRAGGED ACROSS THE AREA SUNDAY WILL REMAIN STATIONARY OVER SW CO AND SE UT SUNDAY NIGHT AND GRADUALLY WASH OUT LATER SUNDAY. IT SHOULD PROVIDE A FOCUS FOR ISOLD TO SHOWERS AND THUNDERSTORMS OVER THE SOUTH MONDAY AFTERNOON. THE REST OF THE AREA WILL SEE THE BEGINNING OF A DRY SPELL THAT WILL LAST THE REST OF THE WEEK.
TUE AND WED WILL SEE DRY WNW FLOW OVER THE AREA WILL LITTLE CHANCE OF RAIN. WED NGT AN IMPULSE WILL PUSH A WEAK COLD FRONT DOWN THE FRONT RANGE AND DRAG THE TAIL OF THE FRONT THROUGH THE FORECAST AREA FROM N TO S. VERY LITTLE MOISTURE IS EXPECTED WITH IT AND ANY SHOWERS SHOULD BE CONFINED TO THE MTS OF THE CONTINENTAL DIVIDE...BUT IT SHOULD TAKE A FEW DEGREES OF THE TEMP. FRIDAY SHOULD REMAIN DRY THOUGH THERE IS A CHANCE OF SHOWERS OVER THE EXTREME SOUTHERN SAN JUAN MTS AS A BIT OF MOISTURE MIGHT SLIP IN FROM THE SE ALONG THE OLD FRONTAL BOUNDARY.
&&
.AVIATION...(FOR THE 18Z TAFS THROUGH 18Z SUNDAY AFTERNOON)
ISSUED AT 1220 PM MDT SAT SEP 5 2015
CONVECTION HAS FIRED THIS AFTERNOON AND WILL CONTINUE TO DO SO. STORMS ARE MOVING AT A GOOD CLIP SO CAN EXPECT GUSTY WINDS OF 30 TO 40 MPH AND SOME BRIEF HEAVY RAIN UNDER THE STRONGER CELLS. NOT SOLD ON VCTS FOR ALL TAF SITES SO INCLUDED FOR MTN TAF SITES AND KMTJ...WITH VCSH FOR OTHERS. CONVECTION WILL DIE DOWN BY 03Z WITH A FEW STRAY SHOWERS/STORMS CONTINUING OVERNIGHT. CIG/VIS MAY DROP ILS BREAKPOINTS FOR THE HIGHER ELEVATION AIRPORTS BUT THEY SHOULD NOT STAY DOWN FOR LONG.
&&
.GJT WATCHES/WARNINGS/ADVISORIES...
CO...NONE.
UT...NONE.
&&
$$

14.0 National Weather Service Hazardous Weather Outlook

The National Weather Service Office in Grand Junction, Colorado, issued a Hazardous Weather Outlook at 0324 MDT, which discussed scattered to numerous showers and thunderstorm activity across the mountainous terrain with gusty winds to 40 mph, small hail, and heavy rain possible:

FLUS45 KGJT 050924
HWOGJT
HAZARDOUS WEATHER OUTLOOK
NATIONAL WEATHER SERVICE GRAND JUNCTION CO
324 AM MDT SAT SEP 5 2015
COZ001>014-017>023-UTZ022>025-027>029-060930-
LOWER YAMPA RIVER BASIN-CENTRAL YAMPA RIVER BASIN-
ROAN AND TAVAPUTS PLATEAUS-ELKHEAD AND PARK MOUNTAINS-
UPPER YAMPA RIVER BASIN-GRAND VALLEY-DEBEQUE TO SILT CORRIDOR-
CENTRAL COLORADO RIVER BASIN-GRAND AND BATTLEMENT MESAS-
GORE AND ELK MOUNTAINS/CENTRAL MOUNTAIN VALLEYS-
CENTRAL GUNNISON AND UNCOMPAHGRE RIVER BASIN-
WEST ELK AND SAWATCH MOUNTAINS-FLATTOPS-
UPPER GUNNISON RIVER VALLEY-UNCOMPAHGRE PLATEAU AND DALLAS DIVIDE-
NORTHWEST SAN JUAN MOUNTAINS-SOUTHWEST SAN JUAN MOUNTAINS-
PARADOX VALLEY/LOWER DOLORES RIVER-
FOUR CORNERS/UPPER DOLORES RIVER-ANIMAS RIVER BASIN-
SAN JUAN RIVER BASIN-SOUTHEAST UTAH-EASTERN UINTA MOUNTAINS-
EASTERN UINTA BASIN-TAVAPUTS PLATEAU-ARCHES/GRAND FLAT-
LA SAL AND ABAJO MOUNTAINS-CANYONLANDS/NATURAL BRIDGES-
324 AM MDT SAT SEP 5 2015
THIS HAZARDOUS WEATHER OUTLOOK IS FOR EASTERN UTAH AND WESTERN
COLORADO.
.DAY ONE...TODAY AND TONIGHT
**SCATTERED SHOWERS WILL MOVE EAST OF THE AREA THIS MORNING...THEN
TO SCATTERED TO NUMEROUS SHOWERS AND THUNDERSTORMS WILL DEVELOP
AGAIN THIS AFTERNOON...WITH HIGHEST AREAL COVERAGE OVER THE
SOUTHERN HALF OF THE FORECAST AREA. THE STRONGEST STORMS WILL BE
CAPABLE OF PRODUCING HEAVY RAIN...SMALL HAIL AND WIND GUSTS TO
40 MPH.**
.DAYS TWO THROUGH SEVEN...SUNDAY THROUGH FRIDAY
SUNDAY WILL BE DRIER WITH ONLY ISOLATED AFTERNOON SHOWERS AND
THUNDERSTORMS OVER THE SOUTHERN MOUNTAINS.
THE REST OF THE WEEK WILL REMAIN RELATIVELY DRY WITH ONLY ISOLATED
MOUNTAIN SHOWERS AND THUNDERSTORMS LATE EACH AFTERNOON.
.SPOTTER INFORMATION STATEMENT...
SPOTTER ACTIVATION WILL NOT BE NEEDED.
$$

15.0 Pilot Weather Briefing

The accident pilot called Lockheed Martin Flight Services (LMFS) from Flagstaff, Arizona, to receive the weather between the departure location of Flagstaff, Arizona, and the destination of Amarillo, Texas (Tradewind Airport, KTDW). The accident pilot said the Amarillo identifier was L51 which was the incorrect identifier for KTDW. The accident pilot requested an abbreviated briefing for the VFR flight. The accident pilot received the latest weather information in the briefing at 1054 MDT including an AIRMET for mountain obscuration, convective outlooks, where the briefer mentioned no convective activity yet, but to stay updated via Flight Watch, the TAF for KAMA, the METARs for KTCC, and the winds aloft at 9,000 and 12,000 feet between the departure and destination. For more information please see attachment 1. There is no record of the accident pilot receiving or retrieving any other weather information before or during the accident flight.

16.0 Astronomical Data

The astronomical data obtained from the United States Naval Observatory for the accident site on September 5, 2015, indicated the following:

SUN	
Begin civil twilight	0618 MDT
Sunrise	0645 MDT
Sun transit	1310 MDT
Sunset	1935 MDT
End civil twilight	2001 MDT

F. LIST OF ATTACHMENTS

Attachment 1 – Recording provided by LMFS of the LMFS weather briefing provided to the accident pilot while the accident pilot was on the ground in Flagstaff, Arizona

Attachment 2 – GOES-15 Visible satellite imagery loop from 1200 MDT through 1411 MDT

Attachment 3 – GOES-15 Infrared satellite imagery loop from 1230 MDT through 1430 MDT

Paul Suffern
NTSB, AS-30