



# National Transportation Safety Board

Office of Aviation Safety  
Washington, D.C. 20594-2000  
July 30, 2009

## METEOROLOGICAL FACTUAL REPORT CEN09PA348

### A. ACCIDENT

Location: Santa Fe, New Mexico  
Date: June 9, 2009  
Time: 2135 Mountain Daylight Time (0335 UTC<sup>1</sup> June 10, 2009)  
Aircraft: Agusta Spa A-109E helicopter, registration N606SP

### B. METEOROLOGICAL SPECIALIST

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

### C. SUMMARY

On June 9, 2009, about 2135 mountain daylight time, an Agusta S.p.A. A-109E helicopter, N606SP, was destroyed after impacting terrain following flight into instrument meteorological conditions near Santa Fe, New Mexico. The commercial pilot and one passenger were fatally injured. A second passenger, the spotter, was seriously injured. The public use flight was being conducted under the provisions of Title 14 Code of Federal Regulations Part 91 without a flight plan. The local flight originated at the Santa Fe Municipal Airport (SAF), Santa Fe, New Mexico. Instrument meteorological conditions prevailed at the time of the accident.

The helicopter, N606SP, was owned by the New Mexico Department of Public Safety and operated by the New Mexico State Police. The commercial pilot and a highway patrolman, acting as a spotter, were conducting a search and rescue mission. They were searching for a lone hiker who was lost near Santa Fe Baldy Mountain in the Pecos Wilderness Area, northeast of Santa Fe, New Mexico.

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<sup>1</sup> UTC – is an abbreviation for Coordinated Universal Time.

The spotter stated they located the hiker just before dark and landed in an open area near her. The pilot shut down the helicopter and went into the forest to bring her back to the helicopter. While the pilot was gone the weather deteriorated and it started sleeting. When the pilot returned he was carrying the hiker on his back. The spotter strapped the passenger in the right, rear, forward facing passenger seat and he was seated in the left, rear, forward facing passenger seat. The pilot pointed out a "valley in the clouds" and took off towards it. After becoming airborne the clouds closed in around the helicopter. Sometime later the pilot pulled the helicopter up abruptly and the spotter felt the helicopter hit something, shutter and start running roughly. Based on recorded radio transmissions, where the pilot reported "we hit a mountain," the helicopter continued to fly for at least one minute before impacting a steep ridgeline in a "controlled, but hard landing." The helicopter rolled approximately 800 feet down a steep and rock covered hillside before stopping. The pilot and passenger had been ejected during the descent.

Witnesses staying at nearby Stewart Lake observed the helicopter flying in the area, land, and then takeoff about a mile away. After takeoff, they saw the helicopter fly to the south and then turn to the north. They thought the helicopter was northbound on the west side of Santa Fe Baldy Mountain when they heard a change in the pitch of the rotor blades and saw the lights of the helicopter descending until it went out of sight behind a ridgeline. They then saw a flash of light from behind the ridge and heard a sound like an explosion. They described the weather as strong, gusty winds, and heavy rain started at their camp around 2200.

Examination of the helicopter wreckage showed the tail boom and rotors had separated from the fuselage. The cockpit was fragmented and the rotor mast and transmission were pushed into the fuselage.

## **D. DETAILS OF INVESTIGATION**

The National Transportation Safety Board's (NTSB) meteorologist specialist was not on scene for this investigation and gathered all the weather data for this investigation from the Washington D.C. office from official National Weather Service (NWS) sources including the National Climatic Data Center (NCDC). All times are Coordinated Universal Time (UTC) based upon the 24 hour clock. Local time of mountain daylight time (MDT) is +6 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.

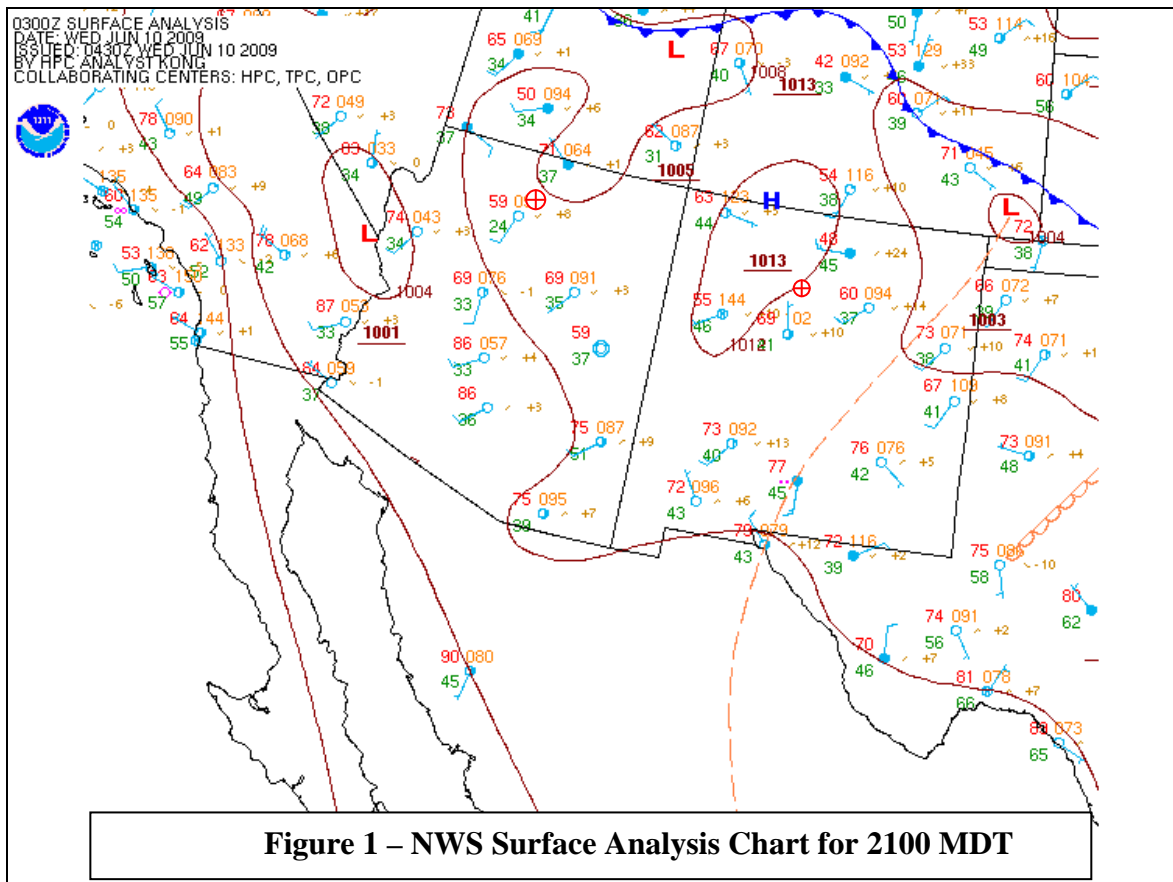
The site of the passenger pickup for the initial estimate of the weather conditions was based on the located at latitude 35.8136° N and longitude 105.7423° W, at approximately 11,035 feet. The accident site was estimated at 35.8406° N and 105.7455° W, at an elevation of 11,477 feet with terrain near 12,400 feet immediately southwest along the ridge of Sante Fe Baldy Mountain.

### **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) 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.

### 1.0.1 Surface Analysis Chart

The NWS Surface Analysis Chart for the southwestern United States at 2100 MDT (0300Z) on June 9, 2009, is included as figure 1 with the approximate accident site marked. The chart depicted a high pressure system with a central pressure of 1013-hectopascals (hPa) over southern Colorado and northern New Mexico border. A low pressure system at 1003-hPa was located in southeastern Colorado with a trough of low pressure extending southwest into eastern New Mexico, and into central Mexico. Further to the west along the California and Arizona boarder a thermal low pressure system<sup>2</sup> with a central pressure of 1001-hPa was located.



<sup>2</sup> A thermal low pressure system is a warm core low pressure system, not associated with any migratory frontal boundaries.

## 1.0.2 Weather Depiction Chart

The NWS Weather Depiction Chart for the southwestern United States for 1900 MDT (0100Z) is included as figure 2. No shaded contour lines were depicted to indicate any instrument flight rule (IFR) conditions<sup>3</sup> over the region. An area of marginal visual flight rules (MVFR) conditions<sup>4</sup> indicated by an unshaded contour was depicted over portions of central and western New Mexico associated with thunderstorms. Visual flight rule (VFR) conditions<sup>5</sup> were depicted over the area prior to the accident without a contour line.

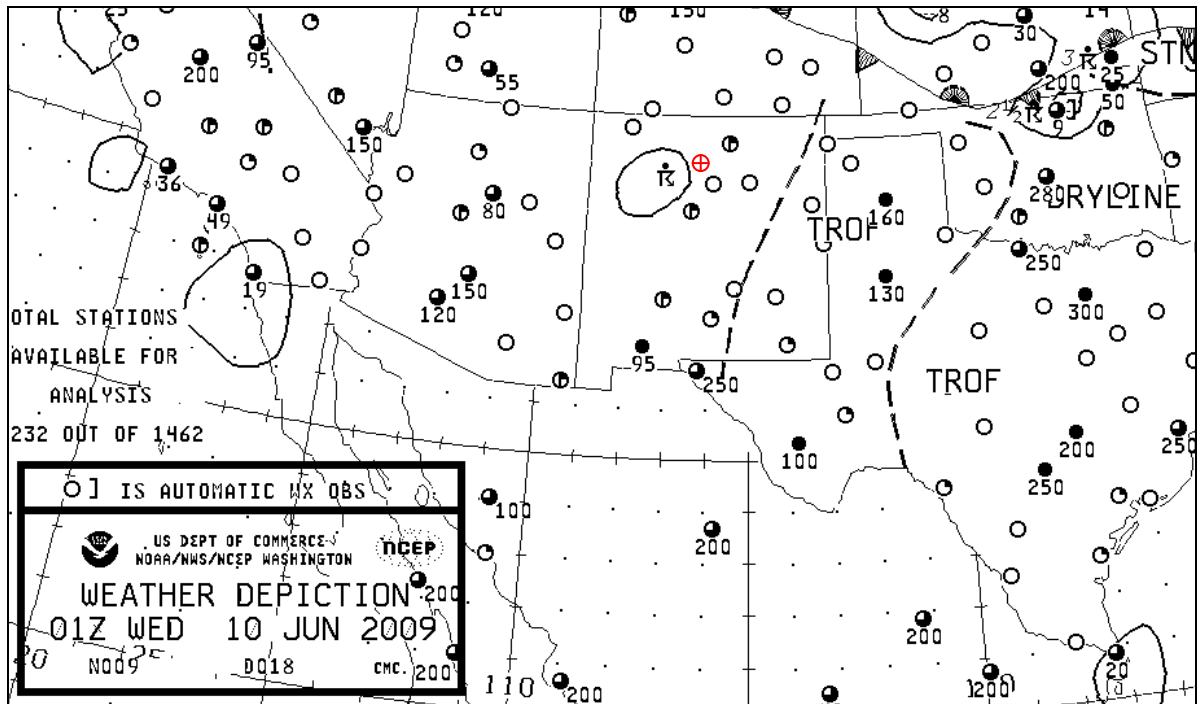


Figure 2 – NWS Weather Depiction Chart for 1900 MDT

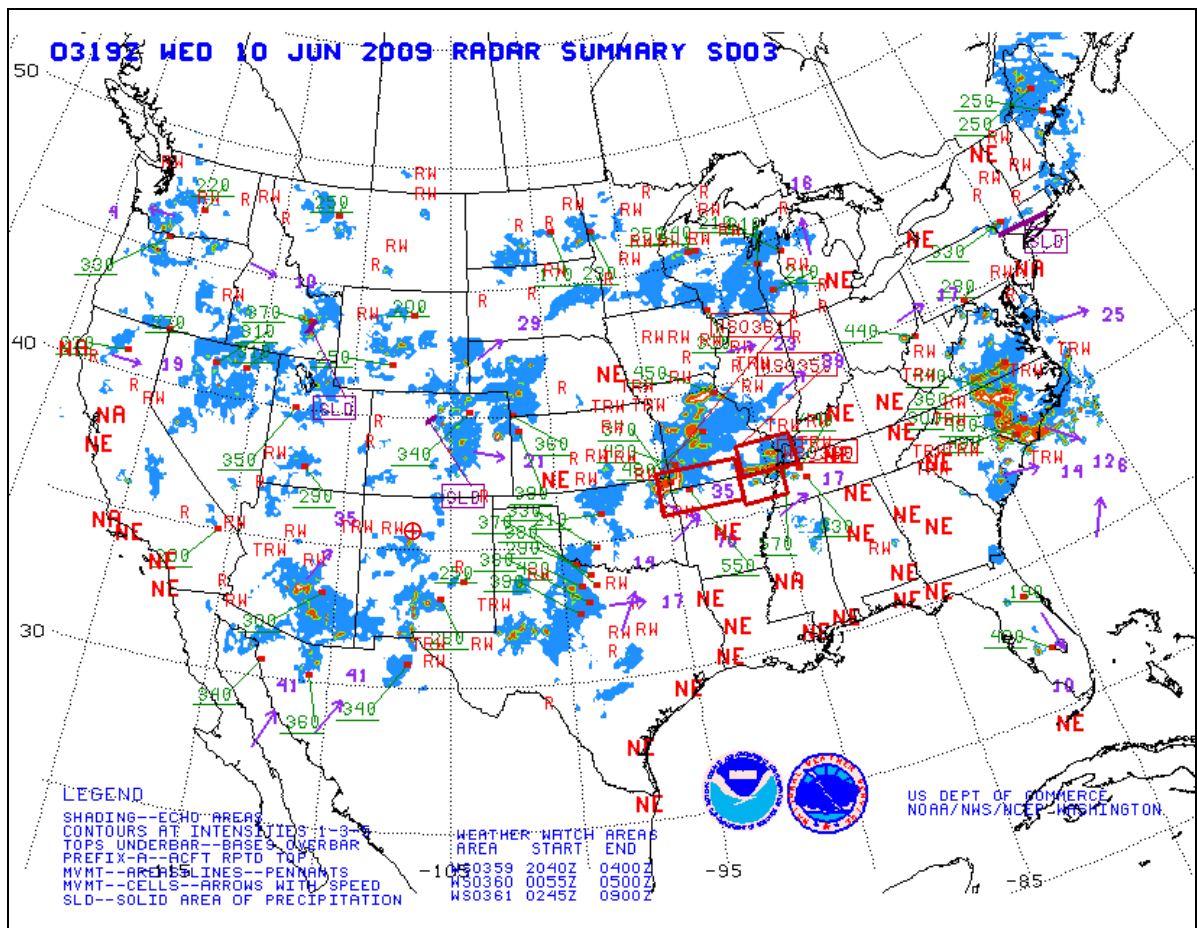
## 1.0.3 Radar Summary Chart

The NWS Radar Summary Chart for 2119 MDT (0319Z) is included as figure 3. The chart depicted an area of widely scattered echoes associated with rain showers and thunderstorms over the southwest over Arizona, Mexico and New Mexico.

<sup>3</sup> IFR conditions – are defined as a ceiling or lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration of less than 1,000 feet above ground level (agl) and/or visibility less than 3 statute miles.

<sup>4</sup> MVFR conditions – are defined as a ceiling between 1,000 and 3,000 feet agl inclusive and/or visibility 3 to 5 miles inclusive.

<sup>5</sup> VFR conditions – are defined as no ceiling or a ceiling greater than 3,000 feet agl and visibility greater than 5 miles.

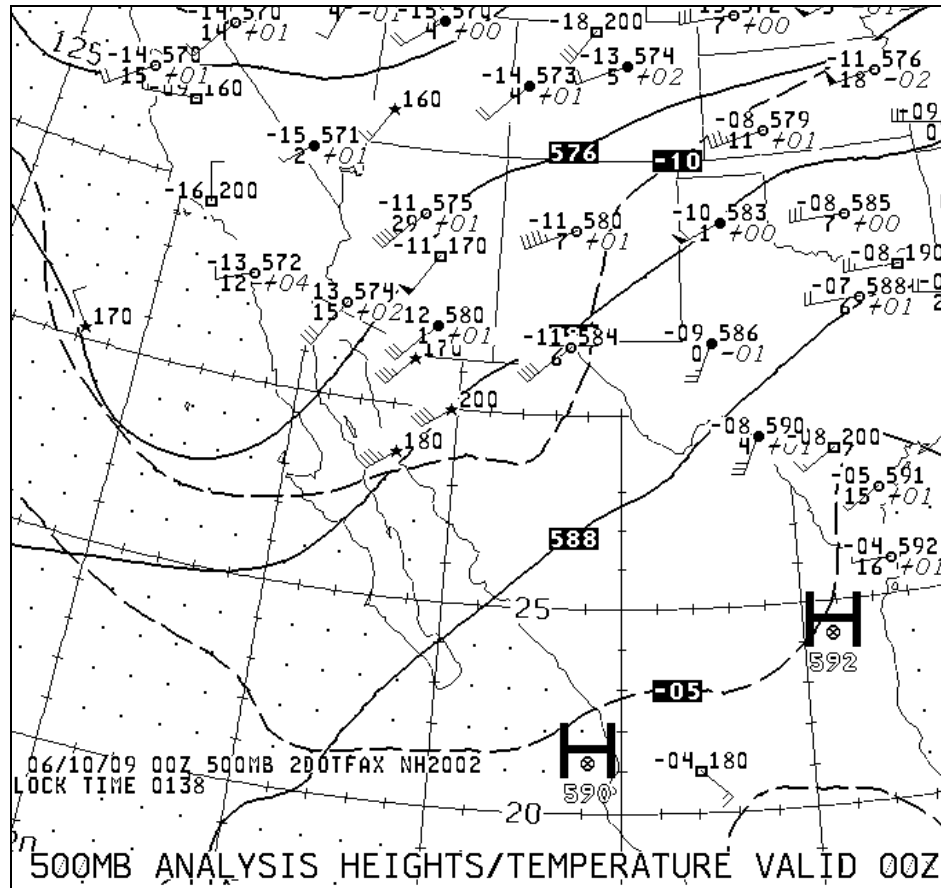


Figures 3 - NWS Radar Summary Chart for 2119 MDT

Based on the radar summary chart depicted the potential for echoes in the vicinity of the accident site, the closest weather surveillance radar was documented and is included in section 5.0 of this report.

### 1.0.4 Upper Air Chart

The southwest section of the NWS 500-hPa Constant Pressure Chart for 2200 MDT (0000Z on June 10, 2009) is included as figure 4. The chart depicted a short wave trough over the west coast wind, with southwesterly wind flow over New Mexico. The station model for Albuquerque indicated winds from the southwest at 45 knots, temperature of -11° Celsius (C), and temperature-dew point spread of 7° C. Further west over Arizona an aircraft based report indicated winds from the southwest at 50 knots at 17,000 feet.



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

## 2.0 Surface Observations

The surrounding area was documented utilizing official NWS Meteorological Aerodrome Reports (METARs) and Specials (SPECIs). The following observations provide cloud heights reported above ground level (agl).

### 2.0.1 Santa Fe Municipal Airport (KSAF), Santa Fe, New Mexico

The closest NWS weather reporting facility to the accident site was from Santa Fe Municipal Airport (KSAF), Santa Fe, New Mexico, located approximately 21 miles southwest of the accident site at an elevation of 6,348 feet msl. The airport was equipped with an automated surface observation system (ASOS). The pilot received the emergency call at approximately 1750 MDT, and it was reported that at first the pilot refused the mission sighting the high winds, but later accepted the mission and departed at 1850 MDT. The following conditions were reported from the time of the initial call through the period surrounding the accident:

KSAF weather observation at 1753 MDT (2353Z), automated observation, wind from 290° at 12 knots gusting to 21 knots, visibility unrestricted at 10 miles, a few clouds at 7,500 feet, temperature 21° C, dew point temperature 4° C, altimeter setting 30.09 inches of Mercury (Hg). Remarks: automated observation system, peak wind from 270° at 31 knots occurred at 1730 MDT, sea level pressure 1011.2-hPa, temperature 20.67° C, dew point 3.9° C, 6-hour maximum temperature 23.3° C, 6-hour minimum temperature 20.6° C, 3-hour pressure tendency has fallen 0.6-hPa.

KSAF weather observation at 1853 MDT (0053Z), automated observation, wind from 240° at 8 knots, visibility unrestricted at 10 miles, sky clear below 12,000 feet, temperature 20° C, dew point 3° C, altimeter setting 30.08 inches of Hg. Remarks: automated observation system, sea level pressure 1010.0-hPa, temperature 20.0° C, dew point 3.3° C.

KSAF weather observation at 1953 MDT (0153Z), automated observation, wind from 230° at 4 knots, visibility unrestricted at 10 miles, sky clear below 12,000 feet, temperature 18° C, dew point 4° C, altimeter setting 30.09 inches of Hg. Remarks: automated observation system, sea level pressure 1010.3-hPa, temperature 17.8° C, dew point 3.9° C.

KSAF weather observation at 2053 MDT (0253Z), automated observation, wind from 290° at 3 knots, visibility 10 miles in light rain, ceiling<sup>6</sup> broken at 7,500 feet, overcast at 9,000 feet, temperature 17° C, dew point temperature 4° C, altimeter setting 30.12 inches of Hg. Remarks: automated observation system, rain began at 2035 MDT, sea level pressure 1010.8-hPa, hourly precipitation trace, 6-hour rainfall less than 0.01 inches, temperature 16.7° C, dew point 3.9° C, 3-hour pressure tendency risen 0.8-hPa.

KSAF weather observation at 2153 MDT (0353Z), automated observation, wind from 010° at 16 knots gusting to 21 knots, visibility 10 miles, a few clouds at 6,000 feet, scattered at 7,500 feet, ceiling broken at 11,000 feet, temperature 14° C, dew point 8° C, altimeter setting 30.14 inches of Hg. Remarks: automated observation system, rain ended at 2105 MDT, sea level pressure 1012.1-hPa, hourly precipitation trace<sup>7</sup>, temperature 13.9° C, dew point 7.8° C.

The raw METAR observations from 0953 through 2353 MDT were as follows:

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METAR KSAF 091553Z 25007KT 10SM FEW110 19/M03 A3014 RMK AO2 SLP116 T01941033
METAR KSAF 091653Z 24014G20KT 10SM CLR 21/M03 A3014 RMK AO2 SLP116 T02061033
METAR KSAF 091753Z 22016G19KT 10SM FEW100 22/M03 A3014 RMK AO2 SLP114 T02171028
10222 20089 50004
METAR KSAF 091853Z 25018G23KT 10SM SCT095 22/M02 A3013 RMK AO2 PK WND 21028/1754
SLP117 T02171022
METAR KSAF 091953Z 23015G25KT 180V260 10SM CLR 23/M02 A3013 RMK AO2 PK WND
22029/1934 SLP113 T02281017
METAR KSAF 092053Z 24016G26KT 10SM CLR 21/M01 A3011 RMK AO2 PK WND 22026/2047
SLP109 T02111006 58007
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<sup>6</sup> Ceiling – is defined as the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration.

<sup>7</sup> Trace – is precipitation of less than 0.01 inches.

METAR KSAF 092153Z 23014G19KT 10SM CLR 22/02 A3009 RMK AO2 SLP106 T02220022  
 METAR KSAF 092253Z 24011G25KT 10SM FEW070 23/02 A3009 RMK AO2 SLP101 T02280022  
 METAR KSAF 092353Z 29012G21KT 10SM FEW075 21/04 A3009 RMK AO2 PK WND 27031/2330  
 SLP112 T02060039 10233 20206 55006  
 METAR KSAF 100053Z 24008KT 10SM CLR 20/03 A3008 RMK AO2 SLP100 T02000033  
 METAR KSAF 100153Z AUTO 23004KT 10SM CLR 18/04 A3009 RMK AO2 SLP103 T01780039  
 METAR KSAF 100253Z AUTO 29003KT 10SM -RA BKN075 OVC090 17/04 A3012 RMK AO2 RAB35  
 SLP108 P0000 60000 T01670039 53008  
 METAR KSAF 100353Z AUTO 01016G21KT 10SM FEW060 SCT075 BKN110 14/08 A3014 RMK AO2  
 RAE05 SLP121 P0000 T01390078  
 METAR KSAF 100453Z AUTO 34008KT 10SM -RA OVC060 12/08 A3018 RMK AO2 RAB41 SLP135  
 P0000 T01220078  
 METAR KSAF 100553Z AUTO 02009KT 10SM SCT075 BKN090 BKN120 11/09 A3016 RMK AO2 LTG  
 DSNT W RAE28 SLP127 P0002 60002 T01110094 10211 20111 50010

## 2.0.2 Los Alamos Airport (KLAM), Los Alamos, New Mexico

The next closest official weather reporting site was from Los Alamos Airport (KLAM), Los Alamos, located approximately 26 miles west of the accident site at an elevation of 7,171 feet. The airport is located on the lee slopes of Jemez Mountains, with Redondo Peak at 11,258 feet approximately 16 miles west. The airport had an automated weather observation system (AWOS-3) and reported the following conditions at the approximate time of the accident:

KLAM weather at 2130 MDT (0330Z), automated observation, wind calm, visibility unrestricted at 10 miles, scattered clouds at 10,000 feet, temperature 13° C, dew point 5° C, altimeter setting 30.19 inches of Hg. Remarks: automated observation system.

The station also reported a period of strong southwesterly to westerly winds gusting to 30 knots during the day. Rain was reported at the station after the accident between 2300 and 0030 MDT, with VFR conditions prevailing during the period. The raw observations were as follows:

METAR KLAM 092250Z AUTO 20008KT 10SM BKN070 BKN090 18/M01 A3015 RMK AO2  
 METAR KLAM 092310Z AUTO 26021G30KT 10SM BKN070 SCT085 18/00 A3015 RMK AO2  
 METAR KLAM 092330Z AUTO 27018G22KT 10SM SCT080 BKN095 17/01 A3016 RMK AO2  
 METAR KLAM 092350Z AUTO 25012G15KT 10SM SCT080 BKN110 16/02 A3016 RMK AO2  
 METAR KLAM 100010Z AUTO 00000KT 10SM SCT080 BKN110 16/02 A3013 RMK AO2  
 METAR KLAM 100030Z AUTO 00000KT 10SM SCT100 16/01 A3013 RMK AO2  
 METAR KLAM 100050Z AUTO 00000KT 10SM CLR 17/01 A3013 RMK AO2  
 METAR KLAM 100110Z AUTO 23006KT 10SM CLR 17/00 A3013 RMK AO2  
 METAR KLAM 100130Z AUTO 23004KT 10SM CLR 17/01 A3014 RMK AO2  
 METAR KLAM 100150Z AUTO 00000KT 10SM SCT065 SCT080 BKN090 17/01 A3016 RMK AO2  
 METAR KLAM 100210Z AUTO 25007KT 10SM SCT055 SCT070 OVC090 16/02 A3017 RMK AO2  
 METAR KLAM 100230Z AUTO 27008KT 10SM SCT050 SCT065 OVC120 15/04 A3017 RMK AO2  
 METAR KLAM 100250Z AUTO 29004KT 10SM SCT120 14/04 A3019 RMK AO2  
 METAR KLAM 100310Z AUTO 00000KT 10SM CLR 14/04 A3020 RMK AO2  
 METAR KLAM 100330Z AUTO 00000KT 10SM SCT100 13/05 A3019 RMK AO2  
 METAR KLAM 100350Z AUTO 00000KT 10SM BKN110 13/05 A3020 RMK AO2  
 METAR KLAM 100410Z AUTO 06008KT 10SM BKN110 11/07 A3020 RMK AO2  
 METAR KLAM 100430Z AUTO 04007KT 10SM SCT080 BKN110 10/06 A3021 RMK AO2  
 METAR KLAM 100450Z AUTO 05008KT 10SM BKN090 BKN120 10/06 A3021 RMK AO2



*METAR KLAM 100510Z AUTO 07005KT 10SM -RA SCT060 BKN080 OVC090 10/06 A3022 RMK AO2  
METAR KLAM 100530Z AUTO 22003KT 10SM RA BKN050 OVC070 10/07 A3024 RMK AO2  
METAR KLAM 100550Z AUTO 23003KT 7SM -RA BKN045 OVC050 10/07 A3023 RMK AO2 P0003  
METAR KLAM 100610Z AUTO 00000KT 10SM SCT046 BKN075 OVC110 10/07 A3021 RMK AO2  
METAR KLAM 100630Z AUTO 00000KT 7SM RA SCT024 BKN042 OVC075 10/07 A3019 RMK AO2  
P0003*

### **2.0.3 Las Vegas Municipal Airport (KLVS), Las Vegas, New Mexico**

Las Vegas Municipal Airport (KLVS), Las Vegas, New Mexico, was located approximately 31 miles east-southeast of the accident site at an elevation of 6,877 feet. The airport is located on the southeast lee slope of the Sangre de Cristo Mountains. The airport had an ASOS and reported the following conditions:

KLVS weather at 1753 MDT (2353Z), automated observation, wind from 240° at 23 knots gusting to 32 knots, visibility unrestricted at 10 miles, sky clear below 12,000 feet, temperature 21° C, dew point 1° C, altimeter setting 30.06 inches of Hg. Remarks: automated observation system, peak wind from 230° at 32 knots occurred at 1749 MDT, sea level pressure 1007.9-hPa, temperature 21.1° C, dew point 0.6° C, 6-hour maximum temperature 21.7° C, 6-hour minimum temperature 19.4° C, 3-hour pressure tendency had fallen 1.2-hPa.

KLVS weather at 1853 MDT (0053Z), automated observation, wind from 270° at 14 knots gusting to 20 knots, visibility unrestricted at 10 miles, sky clear below 12,000 feet, temperature 20° C, dew point 1° C, altimeter setting 30.08 inches of Hg. Remarks: automated observation system, peak wind from 250° at 27 knots occurred at 1803 MDT, sea level pressure 1008.8-hPa, temperature 20.0° C, dew point 1.1° C.

KLVS weather at 1953 MDT (0153Z), automated observation, wind from 250° at 10 knots, visibility unrestricted at 10 miles, sky clear below 12,000 feet, temperature 17° C, dew point 2° C, altimeter setting 30.09 inches of Hg. Remarks: automated observation system, sea level pressure 1008.7-hPa, temperature 17.2° C, dew point 2.2° C.

KLVS weather at 2053 MDT (0253Z), automated observation, wind from 230° at 13 knots, visibility unrestricted at 10 miles, sky clear below 12,000 feet, temperature 16° C, dew point 3° C, altimeter setting 30.11 inches of Hg. Remarks: automated observation system, sea level pressure 1009.4-hPa, temperature 15.6° C, dew point 2.8° C, and 3-hour pressure tendency had raised 1.4-hPa.

KLVS weather at 2153 MDT (0353Z), automated observation, wind from 210° at 8 knots, visibility unrestricted at 10 miles, a few clouds at 9,000 feet, scattered at 11,000 feet, temperature 14° C, dew point 3° C, altimeter setting 30.16 inches of Hg. Remarks: automated observation system, sea level pressure 1011.3-hPa, temperature 13.9° C, and dew point 2.8° C.

A review of the observations on June 9, 2009, indicated VFR conditions prevailing during the period with southwesterly winds gusting to 37 knots and clear skies prior to the accident. The raw observations were as follows:

METAR KLVS 091353Z AUTO 27008KT 10SM CLR 17/M04 A3009 RMK AO2 SLP083 T01721044  
 METAR KLVS 091453Z AUTO 24016G24KT 10SM CLR 20/M06 A3008 RMK AO2 PK WND  
 24027/1439 SLP081 T02001056 50005  
 METAR KLVS 091553Z AUTO 24022G26KT 10SM CLR 20/M06 A3011 RMK AO2 PK WND 26030/1523  
 SLP090 T02001056  
 METAR KLVS 091653Z AUTO 24024G32KT 10SM CLR 20/M04 A3011 RMK AO2 PK WND  
 24032/1649 SLP090 T02001044  
 METAR KLVS 091753Z AUTO 23022G30KT 10SM CLR 22/M02 A3011 RMK AO2 PK WND 24035/1728  
 SLP086 T02171022 10217 20117 50007  
 METAR KLVS 091853Z AUTO 24027G35KT 10SM CLR 20/M02 A3013 RMK AO2 PK WND 23038/1800  
 SLP104 T02001017  
 METAR KLVS 091953Z AUTO 23028G37KT 10SM CLR 19/M01 A3012 RMK AO2 PK WND 23039/1859  
 SLP106 T01941011  
 METAR KLVS 092053Z AUTO 25021G27KT 10SM CLR 20/M01 A3010 RMK AO2 PK WND 25036/1957  
 SLP098 T02001011 58001  
 METAR KLVS 092153Z AUTO 24023G30KT 10SM CLR 21/M01 A3009 RMK AO2 PK WND 22033/2140  
 SLP091 T02061006  
 METAR KLVS 092253Z AUTO 26021G28KT 10SM CLR 21/00 A3006 RMK AO2 PK WND 24029/2207  
 SLP080 T02110000  
 METAR KLVS 092353Z AUTO 24023G32KT 10SM CLR 21/01 A3006 RMK AO2 PK WND 23032/2349  
 SLP079 T02110006 10217 20194 55012  
 METAR KLVS 100053Z AUTO 27014G20KT 10SM CLR 20/01 A3008 RMK AO2 PK WND 25027/0003  
 SLP088 T02000011  
 METAR KLVS 100153Z AUTO 25010KT 10SM CLR 17/02 A3009 RMK AO2 SLP087 T01720022  
 METAR KLVS 100253Z AUTO 23013KT 10SM CLR 16/03 A3011 RMK AO2 SLP094 T01560028 53014  
 METAR KLVS 100353Z AUTO 21008KT 10SM FEW090 SCT110 14/03 A3016 RMK AO2 SLP113  
 T01390028  
 METAR KLVS 100453Z AUTO 25006KT 10SM FEW120 13/03 A3015 RMK AO2 SLP113 T01280033

#### **2.0.4 Taos Regional Airport (KSKX), Taos, New Mexico**

Taos Regional Airport (KSKX), Taos, New Mexico, was located approximately 39 miles north of the accident site at an elevation of 7,095 feet. The airport had an AWOS-3 installed and reported the following conditions:

KSKX weather at 2055 MDT (0255Z), automated observation, wind from 270° at 14 knots gusting to 24 knots, visibility 9 miles, weather missing, ceiling broken at 4,600 feet, overcast at 5,000 feet, temperature 9° C, dew point 7° C, altimeter setting 30.24 inches of Hg. Remarks: automated observation system without a precipitation discriminator, hourly precipitation 0.05 inches, 6-hour precipitation 0.05 inches, 3-hour pressure tendency had raised 2.4-hPa.

KSKX weather at 2115 MDT (0315Z), automated observation, wind from 010° at 8 knots, visibility 10 miles, weather missing, scattered clouds at 4,600 feet, ceiling broken at 5,000 feet, temperature 9° C, dew point 7° C, altimeter setting 30.21 inches of Hg. Remarks: automated observation system without a precipitation discriminator, hourly precipitation 0.04 inches.

KSKX weather at 2135 MDT (0335Z), automated observation, wind from 110° at 7 knots, visibility 10 miles, weather missing, a few clouds at 5,000 feet, few clouds at 6,500 feet,

temperature 9° C, dew point 7° C, altimeter setting 30.22 inches of Hg. Remarks: automated observation system without a precipitation discriminator, hourly precipitation 0.04 inches.

The raw observations from KSKX during the period were as follows:

*METAR KSKX 091535Z AUTO 28013KT 10SM CLR 18/M04 A3014 RMK AO1*  
*METAR KSKX 092035Z AUTO 26017G27KT 10SM BKN080 21/M01 A3011 RMK AO1*  
*METAR KSKX 092055Z AUTO 25019G25KT 10SM BKN080 BKN120 21/M01 A3010 RMK AO1*  
*METAR KSKX 092115Z AUTO 24015G22KT 10SM SCT090 OVC110 21/M01 A3010 RMK AO1*  
*METAR KSKX 092135Z AUTO 25016G26KT 10SM OVC090 20/M01 A3010 RMK AO1*  
*METAR KSKX 092155Z AUTO 22018G21KT 10SM BKN090 21/M01 A3010 RMK AO1*  
*METAR KSKX 092215Z AUTO 22011G28KT 10SM BKN090 21/M01 A3010 RMK AO1*  
*METAR KSKX 092235Z AUTO 24017G24KT 10SM BKN090 19/M01 A3010 RMK AO1*  
*METAR KSKX 092255Z AUTO 26014G26KT 10SM BKN080 19/00 A3011 RMK AO1*  
*METAR KSKX 092315Z AUTO 26019G25KT 10SM SCT075 OVC090 18/01 A3013 RMK AO1*  
*METAR KSKX 092335Z AUTO 30017G28KT 10SM FEW065 SCT075 OVC090 15/04 A3016 RMK AO1*  
*METAR KSKX 092355Z AUTO 30020G26KT 10SM BKN075 OVC090 13/05 A3017 RMK AO1 52024*  
*METAR KSKX 100015Z AUTO 30009KT 10SM SCT065 BKN070 OVC100 12/07 A3016 RMK AO1*  
*METAR KSKX 100035Z AUTO 00000KT 10SM FEW065 BKN120 14/05 A3014 RMK AO1*  
*METAR KSKX 100055Z AUTO 09004KT 10SM SCT080 SCT120 16/04 A3013 RMK AO1*  
*METAR KSKX 100115Z AUTO 16009KT 10SM OVC080 14/07 A3014 RMK AO1*  
*METAR KSKX 100135Z AUTO 17003KT 10SM BKN080 13/06 A3015 RMK AO1*  
*METAR KSKX 100155Z AUTO 18003KT 10SM SCT070 12/06 A3015 RMK AO1*  
*METAR KSKX 100215Z AUTO 17004KT 10SM FEW065 SCT100 BKN120 12/06 A3017 RMK AO1 LTG*  
*DSNT W*  
*METAR KSKX 100235Z AUTO 30009KT 10SM FEW031 BKN050 OVC090 11/08 A3020 RMK AO1*  
*METAR KSKX 100255Z AUTO 27014G24KT 9SM BKN046 OVC050 09/07 A3024 RMK AO1 P0005*  
*60005 52024*  
*METAR KSKX 100315Z AUTO 01008KT 10SM SCT046 BKN050 09/07 A3021 RMK AO1 P0004*  
*METAR KSKX 100335Z AUTO 11007KT 10SM FEW050 FEW065 09/07 A3022 RMK AO1 P0004*  
*METAR KSKX 100355Z AUTO 12009KT 10SM FEW065 08/07 A3021 RMK AO1 P0004*  
*METAR KSKX 100415Z AUTO 16008KT 10SM CLR 08/07 A3021 RMK AO1*

## **2.0.5 Angel Fire (KAXX), Angel Fire, New Mexico**

Angle Fire Airport (KAXX), Angel Fire, New Mexico, was located approximately 43 miles north-northeast of the accident site at an elevation of 8,380 feet. The airport is located in a mountain valley with rising terrain in all direction. The airport had an AWOS-3 installed and reported the following conditions surrounding the time of the accident:

KAXX weather at 1750 MDT (2350Z), automated observation, wind from 240° at 19 knots gusting to 27 knots, visibility 10 miles, scattered clouds at 6,000 feet, ceiling broken at 7,500 feet, overcast at 8,500 feet, temperature 14° C, dew point 1° C, altimeter 30.18 inches of Hg.

KAXX weather at 1810 MDT (0010Z), automated observation, wind from 250° at 23 knots gusting to 34 knots, visibility 10 miles, scattered clouds at 4,100 feet, ceiling broken at 5,500 feet, overcast at 7,000 feet, temperature 11° C, dew point 3° C, altimeter 30.20 inches of Hg.

KAXX weather at 1830 MDT (0030Z), automated observation, wind from 260° at 18 knots gusting to 26 knots, visibility 10 miles in light rain, scattered clouds at 3,000 feet, ceiling

broken at 3,900 feet, overcast at 5,500 feet, temperature 8° C, dew point 5° C, altimeter 30.20 inches of Hg.

KAXX weather at 1850 MDT (0050Z), automated observation, wind from 240° at 7 knots gusting to 19 knots, visibility 10 miles in light rain, scattered clouds at 2,200 feet, scattered at 3,000 feet, ceiling broken at 4,100 feet, temperature 8° C, dew point 5° C, altimeter 30.20 inches of Hg.

KAXX weather at 1910 MDT (0110Z), automated observation, wind from 230° at 7 knots, visibility 10 miles, sky clear below 12,000 feet, temperature 8° C, dew point 5° C, altimeter 30.19 inches of Hg.

Clear conditions with visibility unrestricted, with winds less than 10 knots continued to be reported through 2030 MDT, when conditions changed again, and the following conditions were reported:

KAXX weather at 2050 MDT (0250Z), automated observation, wind from 220° at 4 knots, visibility 10 miles in moderate drizzle, scattered clouds at 4,800 feet, ceiling broken at 6,500 feet, broken at 8,000 feet, temperature 7° C, dew point 3° C, altimeter 30.22 inches of Hg. Remarks: automated observation.

KAXX weather at 2110 MDT (0310Z), automated observation, wind from 260° at 18 knots gusting to 27 knots, visibility 5 miles in moderate rain, scattered clouds at 1,700 feet, ceiling broken at 2,400 feet, overcast at 4,900 feet, temperature 7° C, dew point 5° C, altimeter 30.25 inches of Hg. Remarks: automated observation, hourly precipitation 0.01 inches.

KAXX weather at 2130 MDT (0330Z), automated observation, wind from 270° at 15 knots gusting to 33 knots, visibility 4 miles in moderate rain, ceiling broken at 2,100 feet, overcast at 2,700 feet, temperature 6° C, dew point 3° C, altimeter 30.18 inches of Hg. Remarks: automated observation, hourly precipitation 0.06 inches.

The raw METARs during the period are as follows:

*METAR KAXX 091650Z AUTO 25022G34KT 10SM CLR 13/M03 A3018 RMK AO2  
METAR KAXX 091710Z AUTO 25023G34KT 10SM CLR 15/M02 A3018 RMK AO2  
METAR KAXX 091730Z AUTO 26019G34KT 10SM CLR 15/M03 A3018 RMK AO2  
METAR KAXX 091750Z AUTO 25022G30KT 10SM CLR 15/M02 A3018 RMK AO2  
METAR KAXX 091810Z AUTO 27019G32KT 10SM CLR 15/M03 A3018 RMK AO2  
METAR KAXX 091830Z AUTO 26018G33KT 10SM CLR 15/M02 A3018 RMK AO2  
METAR KAXX 091850Z AUTO 25014G28KT 10SM CLR 16/M02 A3018 RMK AO2  
METAR KAXX 091910Z AUTO 23015G28KT 10SM CLR 16/M02 A3018 RMK AO2  
METAR KAXX 091930Z AUTO 23016G33KT 10SM CLR 17/M02 A3017 RMK AO2  
METAR KAXX 091950Z AUTO 25017G29KT 10SM CLR 16/M01 A3018 RMK AO2  
METAR KAXX 092010Z AUTO 23023G30KT 10SM CLR 16/M01 A3018 RMK AO2  
METAR KAXX 092030Z AUTO 22017G30KT 10SM CLR 16/M01 A3017 RMK AO2  
METAR KAXX 092050Z AUTO 22017G29KT 200V260 10SM SCT070 15/00 A3017 RMK AO2  
METAR KAXX 092110Z AUTO 24013G23KT 10SM SCT070 16/00 A3017 RMK AO2  
METAR KAXX 092130Z AUTO 23018G25KT 10SM SCT070 SCT090 15/M01 A3017 RMK AO2  
METAR KAXX 092150Z AUTO 23017G25KT 10SM SCT070 SCT090 16/M01 A3017 RMK AO2*

METAR KAXX 092210Z AUTO 23015G27KT 10SM SCT070 15/00 A3016 RMK AO2  
 METAR KAXX 092230Z AUTO 23005G18KT 10SM SCT070 BKN080 15/00 A3015 RMK AO2  
 METAR KAXX 092250Z AUTO 22017G24KT 10SM BKN070 15/00 A3015 RMK AO2  
 METAR KAXX 092310Z AUTO 24014G24KT 10SM OVC070 14/00 A3017 RMK AO2  
 METAR KAXX 092330Z AUTO 25014G27KT 10SM OVC075 13/00 A3018 RMK AO2  
 METAR KAXX 092350Z AUTO 24019G27KT 10SM SCT060 BKN075 OVC085 14/01 A3018  
 METAR KAXX 100010Z AUTO 25023G34KT 10SM SCT041 BKN055 BKN070 11/03 A3020  
 METAR KAXX 100030Z AUTO 26018G26KT 10SM -RA SCT030 BKN039 OVC055 08/05 A3020  
 METAR KAXX 100050Z AUTO 24007G19KT 10SM -RA SCT022 SCT030 BKN041 08/05 A3020  
 METAR KAXX 100110Z AUTO 23007KT 10SM CLR 08/05 A3019 RMK AO2  
 METAR KAXX 100130Z AUTO 23006KT 10SM CLR 08/04 A3019 RMK AO2  
 METAR KAXX 100150Z AUTO 19003KT 10SM CLR 08/04 A3020 RMK AO2  
 METAR KAXX 100210Z AUTO 00000KT 10SM CLR 07/03 A3020 RMK AO2  
 METAR KAXX 100230Z AUTO 22004KT 10SM CLR 07/03 A3020 RMK AO2  
 METAR KAXX 100250Z AUTO 22004KT 10SM DZ SCT048 BKN065 BKN080 07/03 A3022 RMK AO2  
 METAR KAXX 100310Z AUTO 26018G27KT 5SM RA SCT017 BKN024 OVC049 07/05 A3025 RMK  
 AO2 P0001  
 METAR KAXX 100330Z AUTO 27015G33KT 4SM RA BKN021 OVC027 06/03 A3026 RMK AO2  
 P0006  
 METAR KAXX 100350Z AUTO 25010G20KT 10SM SCT016 SCT024 SCT040 06/03 A3024 RMK  
 AO2 P0006

## 2.0.5 Albuquerque International Sunset Airport (KABQ), Albuquerque, New Mexico

Albuquerque International Sunset Airport (KABQ) was located approximately 63 miles southwest of the accident site at an elevation of 5,355 feet. The airport had an ASOS installed and reported the following conditions:

KABQ weather observation at 1956 MDT (0156Z), wind from 180° at 6 knots, visibility 10 miles in light rain, a few clouds at 6,500 feet, ceiling broken at 8,000 feet, temperature 22° C, dew point 4° C, altimeter 30.04 inches of Hg. Remarks: automated observation system, rain began at 1953 MDT, sea level pressure 1009.3-hPa, hourly precipitation trace, temperature 22.2° C, dew point 3.9° C.

KABQ special weather observation at 2030 MDT (0230Z), wind from 340° at 6 knots, visibility unrestricted at 10 miles, a few clouds at 4,900 feet, ceiling broken at 8,000 feet, temperature 20° C, dew point 5° C, altimeter 30.06 inches of Hg. Remarks: automated observation system, rain ended at 2006 MDT, virga<sup>8</sup> northeast and southwest, mountains obscured northeast through east, hourly precipitation trace.

KABQ weather at 2056 MDT (0256Z), wind from 350° at 4 knots, visibility unrestricted at 10 miles, ceiling broken at 8,000 feet, temperature 21° C, dew point 5° C, altimeter 30.07 inches of Hg. Remarks: automated observation system, rain ended at 2006 MDT, sea level pressure 1010.2-hPa, virga south through southwest, hourly precipitation trace, 6-hour precipitation less than 0.01 inches, temperature 20.6° C, dew point 5.0° C, 3-hour pressure tendency risen 1.0-hPa.

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<sup>8</sup> Virga – is precipitation that is falling but is evaporating before it reaches the surface.

KABQ weather at 2156 MDT (0356Z), wind from 310° at 9 knots, visibility unrestricted at 10 miles, ceiling broken at 8,500 feet, overcast at 11,000 feet, temperature 21° C, dew point 4° C, altimeter 30.10 inches of Hg. Remarks: automated observation system, sea level pressure 1011.4-hPa, temperature 20.6° C, and a dew point 4.4° C.

The KABQ ASOS was augmented by NWS certified weather observers and at several periods during the day reported altocumulus standing lenticular (ACSL) and stratocumulus standing lenticular (SCSL) clouds, which are indicative of mountain wave activity. The observations surrounding the period are as follows:

*METAR KABQ 091456Z 24005KT 10SM FEW090 BKN110 OVC170 20/M02 A3012 RMK AO2 SLP111  
ACSL NE T02001022 53006*

*METAR KABQ 091556Z 20005KT 10SM BKN100 OVC140 21/M03 A3012 RMK AO2 SLP113 VIRGA E-S  
AND W T02061028*

*METAR KABQ 091656Z 21006KT 10SM BKN100 OVC140 21/M02 A3012 RMK AO2 SLP114 VIRGA  
ACSL NE T02111022*

*METAR KABQ 091756Z 19013KT 10SM FEW080 OVC100 21/M01 A3014 RMK AO2 SLP125 VIRGA  
T02061006 10211 20161 53006*

*METAR KABQ 091856Z 20014KT 10SM BKN080 OVC130 21/00 A3013 RMK AO2 SLP122 T02060000*

*METAR KABQ 091956Z 22018G22KT 10SM SCT075 BKN140 OVC250 22/03 A3011 RMK AO2 SLP122  
T02170028*

*METAR KABQ 092056Z 17015KT 10SM FEW075 SCT110 BKN160 BKN250 22/03 A3009 RMK AO2  
SLP110 T02170028 58014*

*METAR KABQ 092156Z 22009KT 10SM FEW080 SCT150 BKN250 23/03 A3006 RMK AO2 SLP101  
VIRGA W-NW SCSL NE T02280028*

*METAR KABQ 092256Z 23006KT 10SM SCT080 SCT150 SCT250 22/03 A3005 RMK AO2 SLP102 VIRGA  
N-NE SCSL NE T02170028*

*METAR KABQ 092356Z 26003KT 10SM SCT090 SCT150 22/03 A3003 RMK AO2 SLP089 T02220033  
10233 20206 56017*

*METAR KABQ 100056Z 00000KT 10SM SCT080 SCT150 22/03 A3003 RMK AO2 SLP091 VIRGA W  
T02220033*

*METAR KABQ 100156Z 18006KT 10SM -RA FEW065 BKN080 22/04 A3004 RMK AO2 RAB53 SLP093  
P0000 T02220039*

*SPECI KABQ 100230Z 34006KT 10SM FEW049 BKN080 20/05 A3006 RMK AO2 RAE06 VIRGA NE AND  
SW MTNS OBSC NE-E P0000*

*METAR KABQ 100256Z 35004KT 10SM BKN080 21/05 A3007 RMK AO2 RAE06 SLP102 VIRGA S-SW  
P0000 60000 T02060050 53010*

*METAR KABQ 100356Z 31009KT 10SM BKN085 OVC100 21/04 A3010 RMK AO2 SLP114 T02060044*

*SPECI KABQ 100417Z 36011KT 10SM BKN085 OVC100 18/08 A3012 RMK AO2 WSHFT 0357*

*METAR KABQ 100456Z 01014KT 10SM BKN080 BKN120 17/07 A3009 RMK AO2 WSHFT 0357  
RAB27E45 SLP115 P0000 T01720072*

*METAR KABQ 100556Z 35007KT 10SM BKN080 17/07 A3009 RMK AO2 SLP117 60000 T01720067  
10228 20172 51007*

*METAR KABQ 100656Z 03003KT 10SM SCT080 OVC100 18/07 A3007 RMK AO2 SLP108 T01780072  
402330156*

### 3.0 Topographical Features

A plot of the observation sites in 2.0 above and the topography of the area from the University of Utah's MesoWest site is included as figure 5, with the approximate accident site marked. The search of MesoWest provided no remote weather stations or RAWs sites in the

immediate vicinity of the accident site. Wind direction and speed, temperature in °F, and peak gust in mph are plotted.

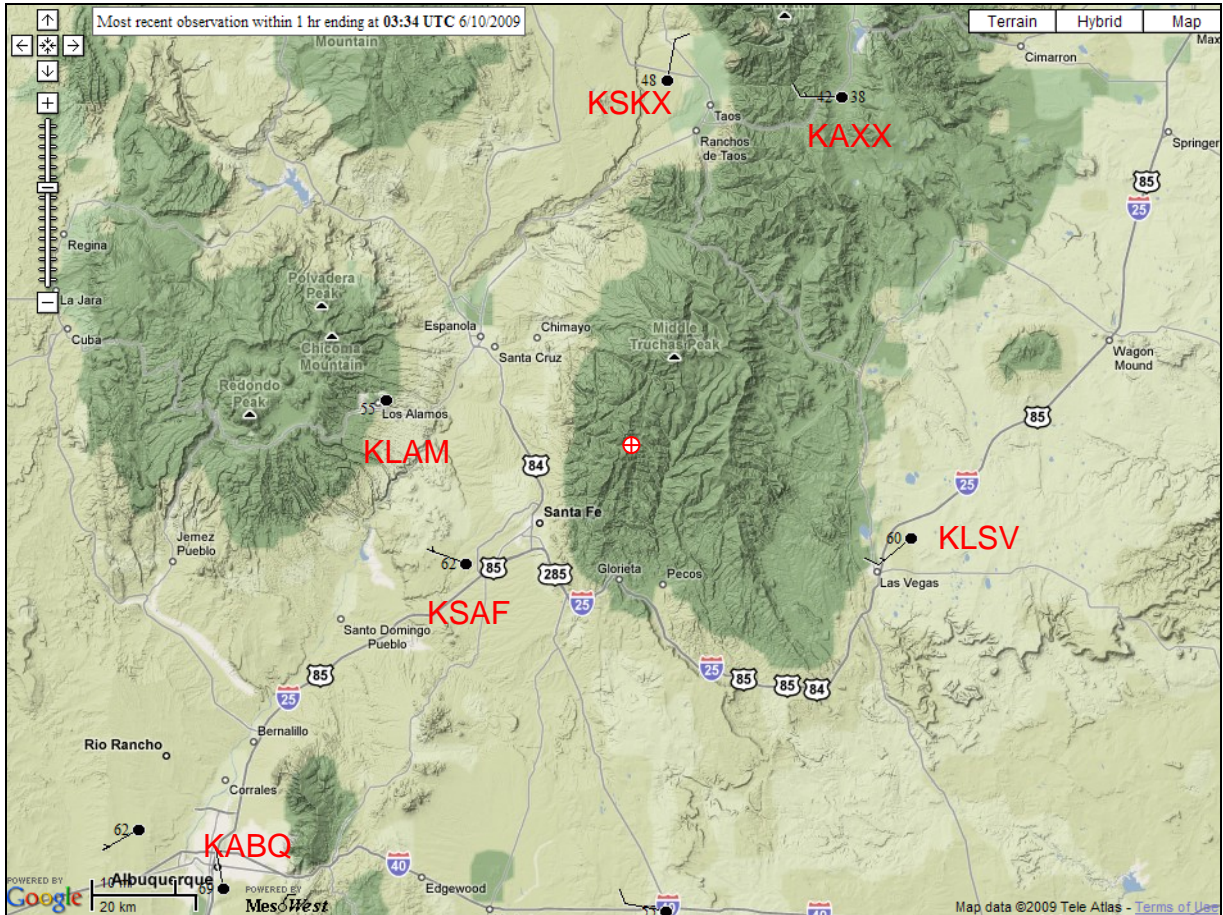


Figure 5 – MesoWest plot at 2135 MDT

#### 4.0 Upper Air Data

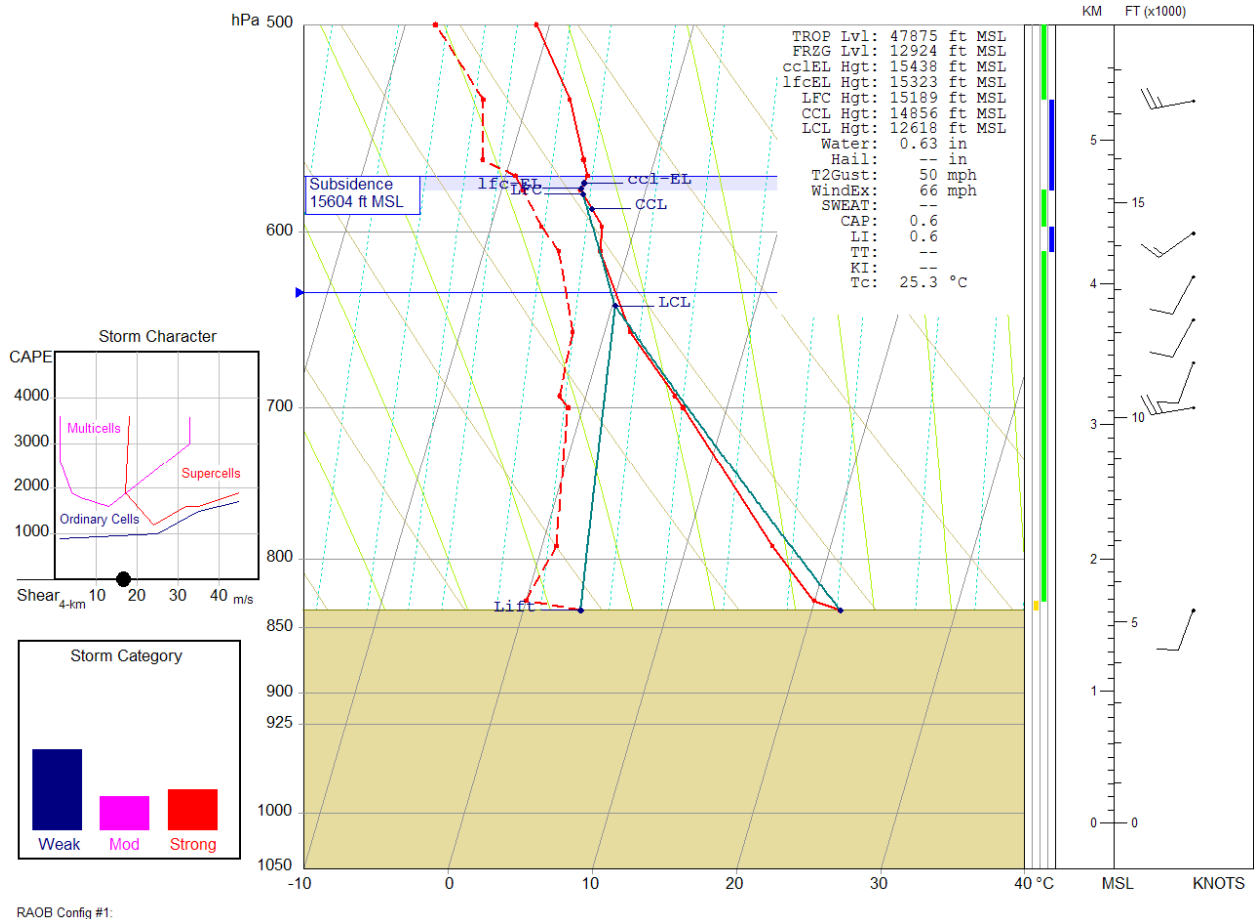
The closest upper air sounding or rawinsonde observation (RAOB) was from the NWS Albuquerque (KABQ), New Mexico, site number 72365, located approximately 65 miles southwest of the accident site at an elevation of 5,292 feet. The 1800 MDT (0000Z) sounding on June 9, 2009, from KABQ plotted on a standard Skew-T log P diagram<sup>9</sup> with the observed and derived stability parameters is included as figure 6 from the surface to 500-mb or 18,000 feet. The sounding depicted a dry low-level environment with the lifted condensation level (LCL)<sup>10</sup> at 640-hPa or at 7,326 feet agl, a convective condensation level (CCL)<sup>11</sup> at 588-hPa or

<sup>9</sup> 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.

<sup>10</sup> Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.



9,564 feet agl, and a level of free convection (LFC)<sup>12</sup> at 580-hPa or 9,897 feet agl. A shallow inversion associated with subsidence was identified at 10,312 feet, immediately above the LFC. The sounding had a relative humidity of 75 percent or more from LCL to 14,000 feet, with the freezing level identified at 7,632 feet agl or 12,924 feet msl. The equilibrium level (EL)<sup>13</sup> or expected top of convective clouds was 575-hPa or 15,400 feet. The tropopause height was identified at 47,875 feet. The precipitable water value was 0.63 inches.



**Figure 6 –KABQ 1800 MDT sounding**

<sup>11</sup> 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.

<sup>12</sup> 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.

<sup>13</sup> Equilibrium Level (EL) - On a sounding, the level above the level of free convection (LFC) at which the temperature of a rising air parcel again equals the temperature of the environment. The height of the EL is the height at which thunderstorm updrafts no longer accelerate upward. Thus, to a close approximation, it represents the height of expected (or ongoing) thunderstorm tops. However, strong updrafts will continue to rise past the EL before stopping, resulting in storm tops that are higher than the EL. This process sometimes can be seen visually as an overshooting tops or anvil dome. The EL typically is higher than the tropopause, and is a more accurate reference for storm tops.



The sounding parameters indicated a Lifted Index (LI)<sup>14</sup> and Showalter Index (SI) of 0.6 indicating a conditionally unstable atmosphere, supporting scattered low topped rain showers and thunderstorms.

The sounding wind profile indicated surface winds from 200° at 11 knots with winds slowly veering to the west-southwest with height. The mean 0 to 6 kilometer (km) wind was from 248° at 26 knots, with the level of maximum wind from 235° at 121 knots located immediately below the tropopause at 47,000 feet. The wind profile supported mountain wave conditions.

Level	Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AF @ 75% RH)	Wave/X---W---Turb nm fpm max
1	5292	837.0	22.0	4.0	31	200 / 11				
2	5530	830.0	20.0	0.0	26					
3	6881	791.0	16.0	1.0	36		LGT			
4	10235	700.0	7.0	-1.0	57	260 / 23				
5	10506	693.0	6.2	-1.8	56		XTR			
6	11292	672.9				200 / 11				
7	12013	655.0	1.8	-2.2	75			Base:633 mb		
8	12292	648.1				210 / 10				
9	13292	623.9				210 / 12				2.42 395 LIGHT
10	13886	610.0	-1.9	-4.8	81		LGT	LGT Rime		
11	14292	600.6				235 / 14				
12	14449	597.0	-2.3	-6.5	73					2.49 481 LT-MD
13	15289	578.0	-4.5	-8.5	74					
14	15604	571.0	-4.3	-9.3	68					2.20 425 LT-MD
15	15969	563.0	-4.9	-11.9	58		LGT			
16	17292	534.8				260 / 23				
17	17329	534.0	-7.1	-13.1	62		SVR			

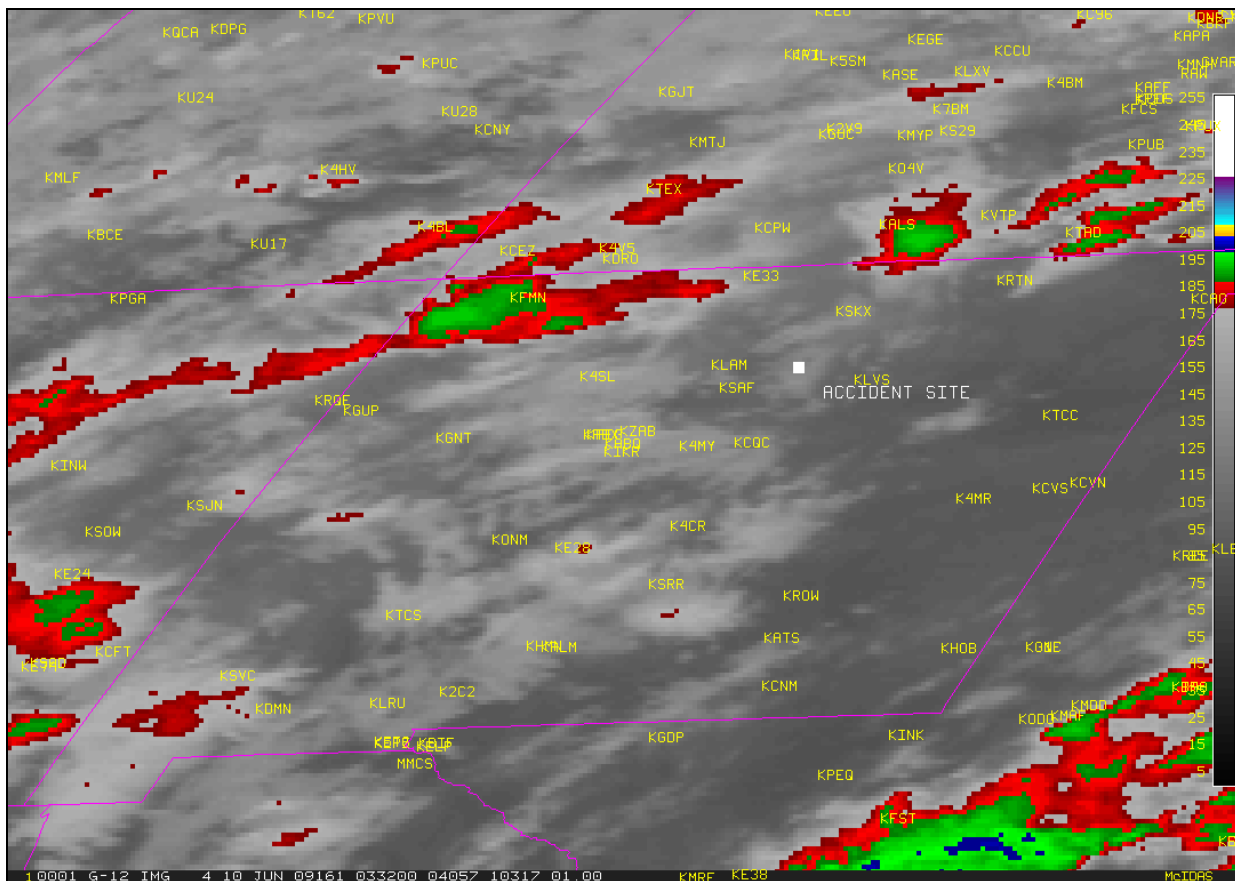
## 5.0 Satellite Data

The Geostationary Operations Environmental Satellite number 12 (GOES-12) data was obtained from the National Climatic Data Center (NCDC) and displayed on the National Transportation Safety Board's Man-computer Interactive Data Access System (McIDAS) workstation. Both visible and infrared imagery was obtained surrounding the time of the accident. The infrared band 4 longwave image at a wavelength of 10.7 microns (µm) and band 2 shortwave at 3.9 µm provided a 4-kilometer (km) resolution with radiative cloud top temperatures. The satellite imagery surrounding the time of the accident from 1900 through 2200 MDT, at approximately every 15-minutes were reviewed and the closest images documented below.

Figure 7 is the GOES-12 infrared band 4 image at 2133 MDT (0332Z) at 4X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder

<sup>14</sup> Lifted Index (LI) - A common measure of atmospheric instability. Its value is obtained by computing the temperature that air near the ground would have if it were lifted to 18,000 feet and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms.

cloud tops associated with deep convection. The image depicted an area of low to mid-level clouds extending over the accident site and most of the Sangre de Cristo Mountain Range, and did not extend over the surrounding stations of KLAM, KSAF, or KLVS. The radiative cloud top temperature over the accident site was observed at  $264.60^{\circ}$  Kelvin (K) or  $-8.5^{\circ}$  C, which according to the KABQ sounding indicated cloud tops in the range of 18,000 feet. No significant cumulonimbus clouds were identified within 40 miles of the accident site, while outside that range significant convective activity with the enhanced cloud tops was observed over northwestern and extreme northern New Mexico, and southern Colorado, and over southwestern Texas.



**Figure 7 – GOES-12 infrared image at 2132 MDT**

## 6.0 Weather Radar Information

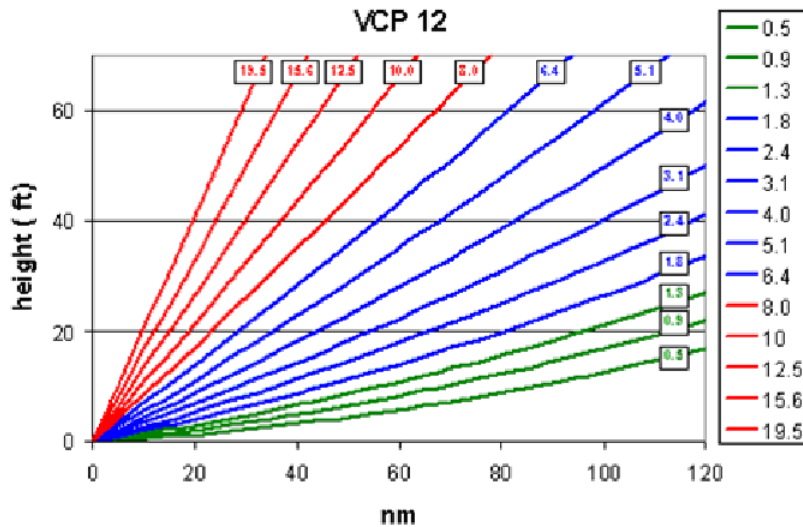
The closest NWS Weather Surveillance Radar-1988, Doppler (WSR-88D) was located at Albuquerque (KABX), approximately 65 miles southeast of the accident site. The level II and III archive data was obtained from the National Climatic Data Center (NCDC) utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

The WSR-88D is an S-band 10 centimeter wavelength radar with a power output of 750,000 watts, with a 28-foot parabolic antenna concentrating the energy into a 0.95-degree beam width. The radar produces three basic types of products reflectivity, radial velocity, and spectral width.

### 6.0.1 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 six 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 9 elevation scans from 0.50 degrees to 19.5 degrees every six minutes. This particular scanning strategy is documented as volume coverage pattern 21 (VCP-21). Mode B is the clear air mode, where the radar makes 5 elevation scans during a ten minute period. During the period surrounding the accident the KABX WSR-88D radar was operating in the normal precipitation mode (Mode A, VCP-12). VCP-12 has a dense vertical sampling at lower elevation angles provides better vertical definition of storms, improves the detection capability of radars impacted by terrain blockage for better rainfall and snowfall estimates, results in more storms being identified, and provides quicker updates. This VCP has 14 elevation angles and completes 17 azimuthal scans in about 4.5 minutes.



### 6.0.2 Beam Height Calculation

Assuming standard refraction<sup>15</sup> of the 0.95 degree radar beam of the KABX WSR-88D, an antenna height of 5,951 feet, at a distance of 65 miles, the following table shows the approximate beam height and width information 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	12,200 feet	8,920 feet	15,470 feet	6,550 feet
1.5	19,090 feet	15,810 feet	22,360 feet	6,550 feet

Based on the radar height calculations, the 0.5 degree elevation scan depicts the conditions encompassing the altitude from 8,920 to 15,470 feet over the accident site. Terrain blockage from the mountains was likely occurring in the vicinity of the accident site.

### 6.0.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors<sup>16</sup> 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<sup>17</sup>), 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	< 5	
	1	5 to 9	
	2	10 to 14	
1 Very Light	3	15 to 19	.01 in/hr
	4	20 to 24	.02 in/hr
	5	25 to 29	.04 in/hr
2 Light to Moderate	6	30 to 34	.09 in/hr
	7	35 to 39	.21 in/hr

<sup>15</sup> Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

<sup>16</sup> 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 glaze ice.

<sup>17</sup> dBZ - 10 log Ze

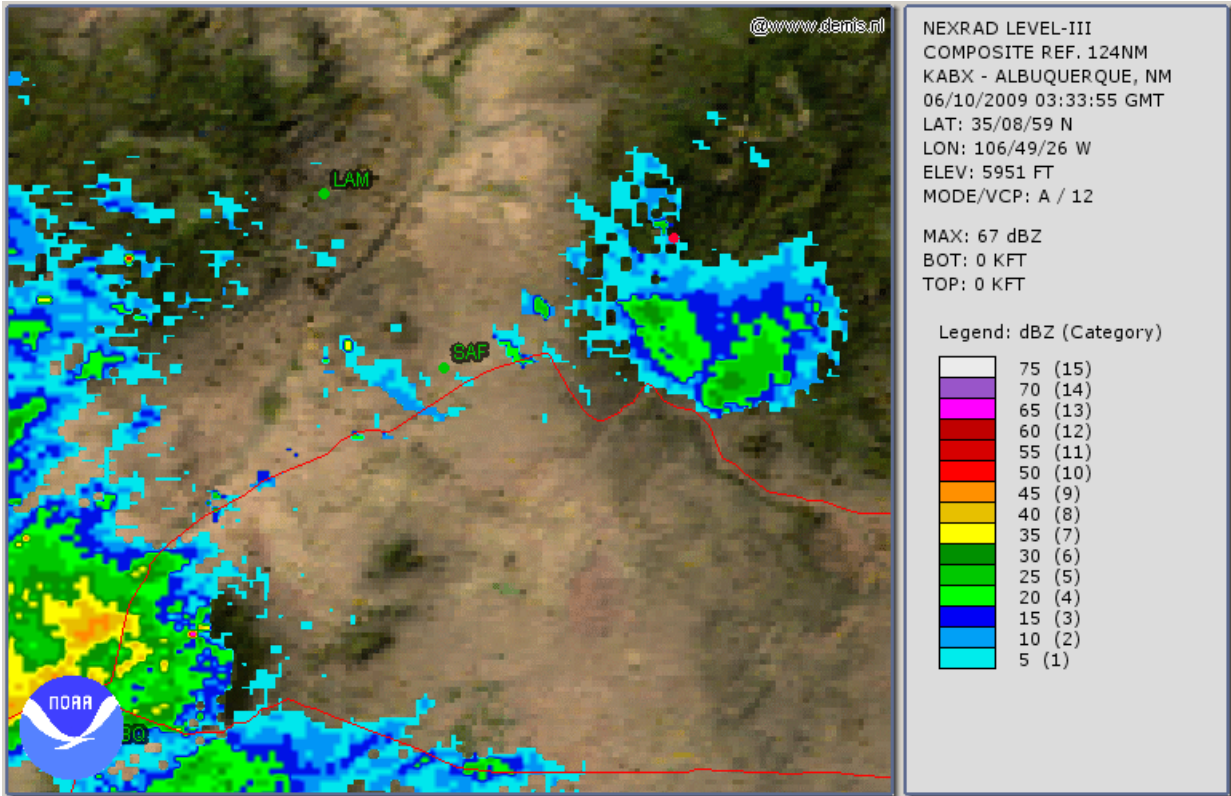
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr
6 Extreme	11 12 13 14 15	55 to 59 60 to 64 65 to 69 70 to 74 > 75	>5.67 in/hr

Air traffic control (ATC) weather display systems also use radar weather processors with the ability to determine precipitation intensity, with controllers instructed to describe the intensity to pilots based on the following scale:

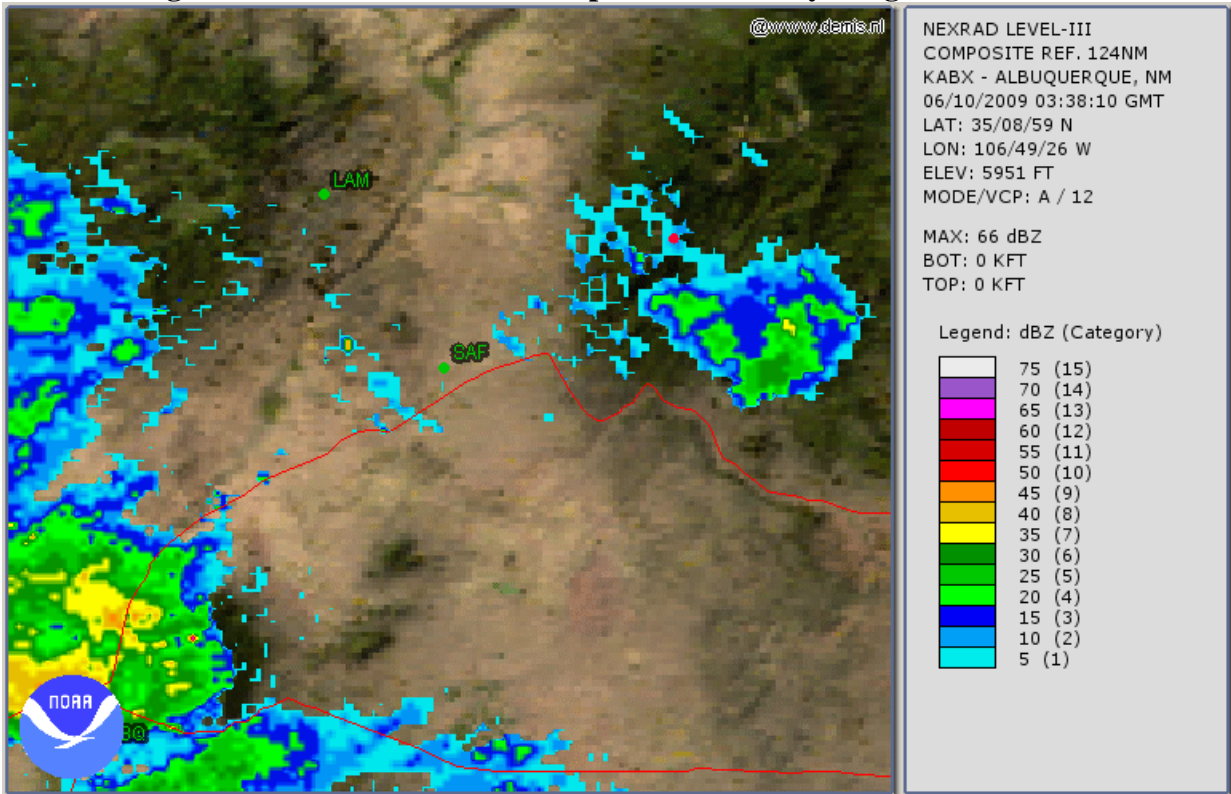
- (a) "Light" (< 30 dBZ)
- (b) "Moderate" (30 to 40 dBZ)
- (c) "Heavy" (> 40 to 50 dBZ)
- (d) "Extreme" (> 50 dBZ)

#### 6.0.4 Composite Reflectivity

Figure 8 and 9 are the KABX WSR-88D composite reflectivity images for 2133 (0333Z) and 2138 (0338Z) MDT respectively. Composite reflectivity displays the maximum echo intensity from each elevation scan to create a composite of the maximum echoes over a location. The images depict an area of echoes with maximum reflectivity of 25 to 35 dBZ “light to moderate” intensity echoes moving eastward across the area between Santa Fe and the accident site. Over the accident site echoes of 5 to 15 dBZ or “very light” intensity were observed. A second area of echoes was depicted over the KABQ area with a maximum reflectivity of 45 dBZ.



**Figure 8 – KABX WSR-88D composite reflectivity image for 2133 MDT**



**Figure 9 – KABX WSR-88D composite reflectivity image for 2138 MDT**



## 7.0 Pilot Reports

The only low-level pilot report (PIREP) was located in the immediate vicinity of the accident site. The report is in standard format but in narrative form versus standard code and abbreviations. The report is as follows:

Albuquerque (ABQ) routine pilot report (UA); Over – 55 miles northwest of ABQ; Time – 1535 MDT (2135Z); Flight level – 18,000 feet; Type aircraft – Beechcraft King Air (BE9L) multiengine turboprop business aircraft; Temperature – minus 6 C; Icing – light to moderate mixed icing; Remarks – entered from Albuquerque Center (ZAB) Traffic Management Unit (TMU).

## 8.0 Area Forecast

The Area Forecast (FA) is a forecast of visual flight rule (VFR) 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 region that covers New Mexico is under the Salt Lake City (KSLC) regional forecast. The forecast valid for this accident was issued at 1635 MDT (2235Z), and was valid until 0200 MDT on June 10, 2009. The forecast was as follows:

*FAUS45 KPCI 092235 AAA*

*FA5W*

*-SLCC FA 092235 AMD*

*SYNOPSIS AND VFR CLDS/WX*

*SYNOPSIS VALID UNTIL 101400*

*CLDS/WX VALID UNTIL 100800...OTLK VALID 100800-101400*

*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..AT 20Z ELONGATED LOW CENTERED OVER SRN MANITOBA WITH TROF TO NERN MT-NRN ID. WEAK TROF SRN NV-SRN CA CSTL WTRS. BY 14Z WEAK TROF SRN MANITOBA-NERN MT-NRN ID. WEAK LOW WRN OR WITH TROF TO CNTRL CA-SRN CA CSTL WTRS. SFC..AT 20Z STNR FNT SRN ID-WEAK LOW CNTRL WY..CONTG AS STNR FNT TO SERN WY-WRN KS. WEAK LOW N CNTRL NV. WEAK HIGH NERN AZ. BY 14Z WEAK LOW SWRN ID WITH STNR FNT TO CNTRL WY-E CNTRL CO..BECMG CDFNT E CNTRL CO-NERN NM. TROF TX PNHDL-SERN NM. HIGH NWRN NM.*

*NM*

*PLAINS...*

*N HLF...BKN150 LYRD FL220. TIL 03Z WND SW G25-30KT. OTLK...VFR.*

*S HLF...BKN120 LYRD FL220. TIL 03Z ISOL -SHRA. OTLK...VFR.  
MTNS/WEST...BKN140 LYRD FL220. WDLY SCT -SHRA. ISOL -TSRA. CB TOP FL300. WND SW  
G25KT. 03Z BKN140. OTLK...VFR.*

The forecast for the mountains and western New Mexico was for broken clouds at 14,000 feet layered to 22,000 feet, with widely scattered light rain showers and isolated thunderstorms and light rain, with cumulonimbus cloud tops to 30,000 feet, with winds from the southwest gusting to 25 knots until 2100 MDT. The outlook from 0200 through 0800 MDT was for VFR conditions to prevail.

The next schedule forecast was issued at 2045 MDT:

*FAUS45 KPCI 100245  
FA5W  
-SLCC FA 100245  
SYNOPSIS AND VFR CLDS/WX  
SYNOPSIS VALID UNTIL 102100  
CLDS/WX VALID UNTIL 101500...OTLK VALID 101500-102100  
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...03Z TROF SW SASK-SE BC. TROF SW AZ-N BAJA CSTL WTRS. 21Z TROF CNTRL MT-  
SE OR. TROF NW NV-S CA. TROF S CNTRL CO-SE NM. ...SFC...03Z WRMFNT FM LOW NERN OR ACRS  
S ID-SW WY CONTG AS STNR FNT CNTRL WY-N CNTRL CO CONTG AS CDFNT SE CO-SW KS CONTG  
E. TROF FM LOW 40SE EED SSEWD INTO MEXICO. 21Z STNR FNT S CNTRL  
BC-NERN OR THRU LOW SW ID CONTG W CNTRL WY-SE WY-N CNTRL CO-XTRM NERN NM CONTG  
E. TROF FM LOW XTRM S NV SSEWD INTO MEXICO. LOW N UT. HIGH NW NM.*

*.  
NM  
PLAINS...SCT150 BKN-OVC CI. OTLK...VFR.  
MTNS AND WEST...SCT100 BKN140 TOP FL250. WDLY SCT -SHRA/ISOL -TSRA. CB TOP FL380.  
OTLK...VFR SHRA TSRA.*

The forecast for the mountains and western New Mexico expected scattered clouds at 10,000 feet, broken clouds at 14,000 feet with tops to 25,000 feet, with widely scattered light rain showers and isolated thunderstorms and light rain, with cumulonimbus cloud tops to 38,000 feet continuing through 0900 MDT on June 10, 2009.

## **9.0 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 following advisories were issued surrounding the period:

### **Convective SIGMETs**

Convective SIGMET<sup>18</sup> 7W was issued at 1955 MDT (0155Z) and valid until 2155 MDT (0355Z) for portions of Colorado and New Mexico, and extended from 30 miles southwest of Alamosa (ALS) to 40 miles north of Albuquerque (ABQ). The advisory warned of a diminishing line of thunderstorms 30 miles wide, moving from 250 at 30 knots, with tops to 36,000 feet. The advisory was as follows:

*MKCW WST 100155  
CONVECTIVE SIGMET 7W  
VALID UNTIL 0355Z  
CO NM  
FROM 30SW ALS-40N ABQ  
DMSHG LINE TS 30 NM WIDE MOV FROM 25030KT. TOPS TO FL360.*

The forecast was not updated at the next scheduled issuance at 2055 or 2155 MDT (0255Z).

**AIRMETS** – The following AIRMET<sup>19</sup> series were issued at 2045 MDT (0245Z), for the Salt Lake City region:

*WAUS45 KKCI 100245  
WA55  
-SLCS WA 100245  
AIRMET SIERRA FOR IFR AND MTN OBSCN VALID UNTIL 100900  
.  
AIRMET IFR...MT WY CO  
FROM 70SW DIK TO 70SW RAP TO BFF TO GLD TO 40SE LAA TO 40NNW LAA TO 30NNE DEN TO  
20ENE LAR TO 30WSW DDY TO 20ENE SHR TO 70SW DIK  
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS DVLPG 06-09Z. CONDS CONTG BYD 09Z THRU 15Z.  
.  
AIRMET MTN OBSCN...ID MT WY UT CO  
FROM 20NE BIL TO 20NE SHR TO CYS TO 30SW DEN TO 40N ALS TO 40ENE DVC TO 20S OCS TO 30N  
PIH TO 40SSE DLN TO 20NE BIL  
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 09Z THRU 15Z.  
.  
OTLK VALID 0900-1500Z*

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<sup>18</sup> Convective SIGMETs (SIGNificant METeological Information) are issued hourly in the conterminous U.S. for hazardous thunderstorm activity. The advisory is issued for severe thunderstorms capable of producing strong surface winds of 50 knots or more, hail 3/4 inch in diameter or more, or tornadoes, embedded thunderstorms, lines of thunderstorms, or thunderstorms greater than or equal to VIP level 4 affecting 40 percent or more of an area at least 3,000 square miles. Any Convective SIGMET implies severe or greater turbulence, severe icing, and low level wind shear. A Convective SIGMET may be issued for any convective situation, which the forecaster feels is hazardous to all categories of aircraft. Bulletins are issued hourly at Hour+55. The text of the bulletin consists of either an observation and a forecast or just a forecast. The forecast is valid for up to 2 hours.

<sup>19</sup> AIRMET (AIRman's METeological Information) advises of weather potentially hazardous to all aircraft but that does not meet SIGMET criteria.

AREA 1...IFR MT WY CO  
BOUNDED BY 80SW DIK-70SW RAP-BFF-GLD-30NNW LAA-60SSW DEN-20NNW LAR-30WSW DDY-  
20WSW CZI-20NE SHR-80SW DIK  
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG THRU 15Z.

AREA 2...MTN OBSCN ID MT WY CO  
BOUNDED BY 20NNE BIL-20NE SHR-CYS-PUB-40E DVC-30S OCS-20N PIH-30SSE DLN-20NNE BIL  
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG THRU 15Z.

WAUS45 KKCI 100245  
WA5T  
-SLCT WA 100245  
AIRMET TANGO FOR TURB VALID UNTIL 100900

AIRMET TURB...WY UT CO AZ NM  
FROM 40E SNY TO 30E LAA TO 50NNW ABQ TO 40S SJN TO 50SW TUS TO 20W BZA TO 20N PGS TO  
30N CHE TO 20ESE CYS TO 40E SNY  
MOD TURB BTN FL280 AND FL400. CONDS CONTG BYD 09Z THRU 15Z.

OTLK VALID 0900-1500Z...TURB UT CO AZ NM  
BOUNDED BY SNY-GLD-50W LBL-30ESE TBE-70SSE TBE-40S FTI-40SW ABQ-30S SJN-30NNW PHX-  
60SSE HVE-30SSW LAR-20ESE CYS-SNY  
MOD TURB BTN FL280 AND FL400. CONDS CONTG THRU 15Z.

WAUS45 KKCI 100245  
WA5Z  
-SLCZ WA 100245  
AIRMET ZULU FOR ICE AND FRZLVL VALID UNTIL 100900

AIRMET ICE...ID MT WY NV UT CO  
FROM 70E DLN TO 40S BIL TO 20NW CZI TO 40WSW RAP TO 40WSW SNY TO MTU TO 50SSW BVL TO  
40ENE BAM TO 50SE BOI TO 50NW PIH TO 70E DLN  
MOD ICE BTN 120 AND FL220. CONDS CONTG BYD 09Z THRU 15Z.

AIRMET ICE...CO AZ NM  
FROM 40WSW ALS TO 50SSW ABQ TO 60S SSO TO 50S TUS TO 90SE BZA TO 40ESE PGS TO 40ESE  
TBC TO 50S DVC TO 40WSW ALS  
MOD ICE BTN 140 AND FL250. CONDS CONTG BYD 09Z THRU 15Z.

OTLK VALID 0900-1500Z...ICE CO AZ NM  
BOUNDED BY 50SW HBU-20NNW ALS-30ESE CIM-30N TCS-60SSE SSO-60SSW TUS-20WNW PHX-20E  
DRK-50S DVC-50SW HBU  
MOD ICE BTN 140 AND FL250. CONDS CONTG THRU 15Z.

FRZLVL...RANGING FROM 065-150 ACRS AREA  
080 ALG 20SSW YXC-60SSE YXC-60SSW HVR-40WSW MLS-80SW DIK  
120 ALG 50ESE BZA-60WSW SJN-30SSW HBU-50SSE CYS-20SE SNY

The only applicable AIRMET over the accident site was for moderate icing conditions above 14,000 feet.

## 10.0 Terminal Aerodrome Forecast (TAF)

The closest Terminal Aerodrome Forecast (TAF) to the accident site was for KSAF. The forecast current at the time of departure was issued by the NWS at 1136 MDT (1736Z). The forecast was as follows:

*KSAF 091736Z 0918/1018 23015KT P6SM SCT100 BKN150  
FM092000 22018G28KT P6SM VCSH SCT080 BKN110  
FM100100 24012G22KT P6SM -SHRA BKN060CB BKN090  
FM100300 VRB06KT P6SM -SHRA SCT050CB BKN070  
FM100600 VRB06KT 6SM -RA BR SCT025 BKN040  
FM101400 01005KT P6SM VCSH SCT030 BKN070=*

The forecast expected VFR conditions to prevail through the period with rain showers in the vicinity after 1400 MDT, and rain expected at the station by 2000 MDT with a ceiling broken at 6,000 feet agl in cumulonimbus clouds. Showers were expected through the evening and into the next day.

The next schedule forecast was issued at 1725 MDT (2325Z) and was the forecast current at the time of the accident, and is as follows:

*KSAF 092325Z 1000/1024 23014G24KT P6SM VCSH SCT080 BKN110  
TEMPO 1000/1004 -SHRA BKN060CB BKN090  
FM100400 VRB06KT P6SM -SHRA SCT040CB OVC060  
FM100800 12008KT 6SM -RA BR SCT025 OVC040  
FM101600 VRB05KT P6SM VCSH SCT030 BKN070  
FM101800 28014G24KT P6SM VCTS SCT040CB BKN080=*

The forecast for KSAF expected winds from 230° at 14 knots gusting to 24 knots, visibility better than 6 miles with showers in the vicinity, scattered clouds at 8,000 feet, ceiling broken at 11,000 feet, with temporary conditions between 1800 and 2200 MDT of light rain showers with ceilings broken at 6,000 feet in cumulonimbus clouds, and broken at 9,000 feet.

## **11.0 Center Weather Service Unit Products and Services**

The Albuquerque (KZAB) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) issued a Center Weather Advisory (CWA) regarding weather impacts to their air space at 1414 (2014Z), valid until 1500 MDT (2100Z), well before the accident. The advisory was as follows:

*FAUS21 KZAB 092014  
ZABI CWA 092011  
ZAB CWA 101 VALID UNTIL 092100  
FROM 45SE MRF TO 25E MRF TO 75NW MRF  
LN WDLY SCT SEV TS. TOPS TO FL460. MOVG FM 24020KTS. LRG HAIL AND WND G55KTS PSBL.*

The advisory warned of a line of widely scattered<sup>20</sup> severe thunderstorms, from 45 miles southeast of Marfa (MRF), Texas, to 25 miles east of MRF to 75 miles northwest of MRF. This

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<sup>20</sup> Widely scattered – coverage less than 25% of the area affected.

places the line of storms over extreme southwestern Texas, far from the accident site. The advisory indicated the thunderstorm tops were above 46,000 feet and moving from 240 at 20 knots. Large hail and wind gusts to 55 knots were possible with these storms.

## 12.0 NWS Short Term Forecast

The NWS Albuquerque Weather Service Forecast Office (WSFO) short term forecasts issued for the northeast plains, northern highlands, and the Sangre de Cristo Mountains, which included the cities of Santa Fe issued at 1331, 1514, 1739, and 1950 MDT were as follows, the forecasts are in plain language:

*FPUS75 KABQ 091931*

*NOWABQ*

*SHORT TERM FORECAST*

*NATIONAL WEATHER SERVICE ALBUQUERQUE NM*

*131 PM MDT TUE JUN 9 2009*

*NMZ004>007-092100-*

*FAR NORTHEAST PLAINS-HARDING COUNTY-NORTHEAST HIGHLANDS-*

*SANGRE DE CRISTO MOUNTAINS-*

*INCLUDING THE CITIES OF...CLAYTON...LAS VEGAS/RATON...ROY...*

*SANTA FE/TAOS/RED RIVER*

*131 PM MDT TUE JUN 9 2009*

*.NOW...*

*THROUGHOUT THE AFTERNOON SOUTHWEST WINDS WILL CONTINUE TO STRENGTHEN*

*IN THE SANGRE DE CRISTO MOUNTAINS AND EASTWARD ACROSS THE NORTHEAST*

*PLAINS. SPEEDS WILL REACH 15 TO 30 MPH WITH OCCASIONAL GUSTS TO 45MPH. EXPECT*

*STRONG CROSSWINDS ON SOUTHEAST TO NORTHWEST ORIENTED ROADWAYS...SUCH AS ROUTE*

*39 FROM LOGAN TO ROY AND U.S. HIGHWAY 64/87 FROM CLAYTON TO RATON.*

*FPUS75 KABQ 092114*

*NOWABQ*

*SHORT TERM FORECAST*

*NATIONAL WEATHER SERVICE ALBUQUERQUE NM*

*314 PM MDT TUE JUN 9 2009*

*NMZ001>004-008>010-092200-*

*MIDDLE RIO GRANDE VALLEY/ALBUQUERQUE METRO AREA-NORTHWEST MOUNTAINS*

*INCLUDING JEMEZ-NORTHWEST PLATEAU-SANDIA/MANZANO MOUNTAINS-SANGRE DE CRISTO*

*MOUNTAINS-UPPER RIO GRANDE VALLEY-WEST CENTRAL MOUNTAINS-*

*INCLUDING THE CITIES OF...ALBUQUERQUE...CHAMA/LOS ALAMOS...ESPANOLA*

*...FARMINGTON...GALLUP/GRANTS...SANDIA PARK/CEDAR CREST...SANTA FE/TAOS/RED RIVER*

*.NOW...*

*THROUGH LATE AFTERNOON SCATTERED SHOWERS AND THUNDERSTORMS WILL CONTINUE TO INCREASE IN COVERAGE AND INTENSITY ACROSS THE WEST CENTRAL MOUNTAINS...*

*NORTHWEST MOUNTAINS...NORTHWEST PLATEAU...MIDDLE RIO GRANDE VALLEY AND THE*

*SANDIA MOUNTAINS. MOST OF THE ACTIVITY WILL MOVE TOWARD THE NORTHEAST AT SPEEDS*

*FROM 35 TO 40 MPH. THROUGH 400 PM ONE CLUSTER OF THUNDERSTORMS WILL MOVE FROM*

*CHACO CANYON TOWARD CUBA...TIERRA AMARILLA AND DULCE. THESE STORMS WILL*

*PRODUCE A BRIEF WETTING RAIN WITH SMALL HAIL...OCCASIONAL CLOUD TO GROUND LIGHTNING AND WIND GUSTS AROUND 50 MPH.*

*FPUS75 KABQ 092340*

*NOWABQ*

*SHORT TERM FORECAST*

*NATIONAL WEATHER SERVICE ALBUQUERQUE NM*

*539 PM MDT TUE JUN 9 2009*

*NMZ001-002-004-008-014-100200-*

*NORTHWEST MOUNTAINS INCLUDING JEMEZ-NORTHWEST PLATEAU-*

*SANGRE DE CRISTO MOUNTAINS-SOUTHWEST MOUNTAINS/UPPER GILA REGION-*

*WEST CENTRAL MOUNTAINS-*

*INCLUDING THE CITIES OF...CHAMA/LOS ALAMOS...FARMINGTON...GALLUP/GRANTS*

*...GLENWOOD...SANTA FE/TAOS/RED RIVER*

*539 PM MDT TUE JUN 9 2009*

*.NOW...*

*SCATTERED SHOWERS AND ISOLATED THUNDERSTORMS WILL CONTINUE THROUGH*

*THE NIGHT OVER WESTERN AND NORTH CENTRAL NEW MEXICO. MOVEMENT WILL*

*BE TO THE NORTHEAST AT 35 MPH. THROUGH 800 PM MOST OF THE RAIN WILL*

*BE FROM PIETOWN AND FENCE LAKE NORTH TO GRANTS AND GALLUP...*

*CROWNPOINT...CHACO CANYON AND DULCE. THE STRONGER STORMS WILL*

*PRODUCE WIND GUSTS TO 50 MPH...DANGEROUS CLOUD TO GROUND LIGHTNING*

*AND BRIEF DOWNPOURS AT A RATE OF ONE QUARTER TO ONE HALF INCH IN*

*AN HOURS TIME.*

*FPUS75 KABQ 100150*

*NOWABQ*

*SHORT TERM FORECAST*

*NATIONAL WEATHER SERVICE ALBUQUERQUE NM*

*750 PM MDT TUE JUN 9 2009*

*NMZ001-002-004-008-014-100400-*

*NORTHWEST MOUNTAINS INCLUDING JEMEZ-NORTHWEST PLATEAU-*

*SANGRE DE CRISTO MOUNTAINS-SOUTHWEST MOUNTAINS/UPPER GILA REGION-*

*WEST CENTRAL MOUNTAINS-*

*INCLUDING THE CITIES OF...CHAMA/LOS ALAMOS...FARMINGTON..GALLUP/GRANTS*

*...GLENWOOD...SANTA FE/TAOS/RED RIVER*

*750 PM MDT TUE JUN 9 2009*

*.NOW...*

*SCATTERED SHOWERS AND ISOLATED THUNDERSTORMS WILL CONTINUE THROUGH*

*THE NIGHT OVER WESTERN AND NORTH CENTRAL NEW MEXICO. MOVEMENT WILL*

*BE TO THE NORTHEAST AT 35 TO 40 MPH. THROUGH 1000 PM MOST OF THE RAIN*

*WILL BE FROM THE ACOMA PUEBLO AND EL MORRO TO GRANTS AND THE LAGUNA*

*PUEBLO. THE OTHER SIGNIFICANT AREA WILL BE FROM LOS ALAMOS AND*

*TIERRA AMARILLA TO EMBUDO...TAOS AND QUESTA. THE STRONGER STORMS WILL*

*PRODUCE WIND GUSTS TO 50 MPH...DANGEROUS CLOUD TO GROUND LIGHTNING*

*AND BRIEF DOWNPOURS AT A RATE OF ONE QUARTER TO ONE HALF INCH IN AN*

*HOURS TIME.*

### **13.0 NWS Area Forecast Discussion**

The KABQ WSFO also issued an Area Forecast Discussion (AFD) at 1517 and immediately after the accident at 2151 MDT. The AFD is intended to provide a well-

reasoned discussion of the meteorological thinking and reasoning that went into the preparation of the zone forecasts and the TAF. An intermediate AFD will be issued when either significant forecast updates are being made or if interesting weather is expected to occur. The AFD is not routinely used by pilots and is not referenced in AC 00-45. The narrative is provided in plain language and abbreviations, and is as follows:

*FXUS65 KABQ 092117*

*AFDABQ*

*AREA FORECAST DISCUSSION*

*NATIONAL WEATHER SERVICE ALBUQUERQUE NM*

*317 PM MDT TUE JUN 9 2009*

*.DISCUSSION..*

*MAIN CHALLENGE CONTINUES TO BE ONGOING PRECIPITATION EVENT WHICH WILL CONTINUE THRU TOMORROW.*

*HIGH BASED LIGHT RAIN SHOWERS THAT WERE LOCATED ACROSS SOUTHERN PARTS OF THE CWA HAVE MOVED NORTHEAST ACROSS THE EASTERN PLAINS. THOUGH...MUCH OF THE PRECIPITATION HAS NOT REACHED THE GROUND DUE TO A DRY SUB-CLOUD LAYER...A FEW SITES HAVE PICKED UP A FEWHUNDREDTHS. CONVECTIVE SHOWERS/STORMS HAVE ALSO INITIATED ACROSS WESTERN PORTIONS OF THE STATE. AS THE SHORTWAVE NEARS AND 100KT UPPER LEVEL JET MOVES INTO WESTERN NM...EXPECT PRECIP TO INCREASE IN COVERAGE TONIGHT. MODELS COMING INTO BETTER AGREEMENT TODAY WITH REGARDS TO LOCATION OF PRECIPITATION OVER THE NEXT 24 HOURS. NAM HAS CONTINUED ITS TREND OF BECOMING WETTER...ESPECIALLY EARLY WEDNESDAY. 12Z GFS ALSO DID QUITE WELL PICKING UP ON LIGHT RAIN OCCURRING OVER THE EASTERN PLAINS...WHICH OTHER MODELS DID NOT PICK UP ON. THEREFORE...HAVE AGAIN SIDED WITH THE GFS WITH REGARDS TO POPS. HAVE INCREASED POPS INTO THE LIKELY CATEGORY ACROSS THE WEST CENTRAL MTNS THIS EVENING...THEN AS THE SHORTWAVE MOVES NORTHEAST ACROSS AZ...HAVE TRENDED HIGHER POPS ACROSS THE NORTHWEST MTNS THRU 18Z WED. BEFORE LOWER LEVELS MOISTEN FURTHER DUE TO TOP-DOWN MOISTENING...STILL THINK THERE IS A POTENTIAL FOR GUSTY WINDS THRU THE EVENING WITH ANY SHOWER/STORM. 12Z SUITES AND HPC GUIDANCE IN GOOD AGREEMENT THAT THE NORTHWEST MTNS WILL HAVE THE BEST CHANCES FOR WETTING RAINS EARLY WED MORNING. BY LATE AFTN ON WED...TROUGH AXIS WILL BE LOCATED NEAR THE NM/TX BORDER...AND AT LEAST WEAK SUBSIDENCE SHOULD BE ACROSS MUCH OF NM. THUS...A DECREASE IN THE COVERAGE OF SHOWERS/STORMS IS STILL ANTICIPATED FROM MID AFTN THRU MID EVENING ON WEDNESDAY. HOWEVER...A WEAK FRONTAL BOUNDARY STILL LOOKS TO DROP INTO NORTHEAST NM WED NIGHT/THURS MORNING. THIS WILL KEEP A SLIGHT CHANCE OF SHOWERS AND TSTMS IN THE FORECAST. AFOREMENTIONED FRONT WILL SLOSH BACK AND FORTH ON FRIDAY. MOISTURE ALONG A DRYLINE MAY MOVE INTO EASTERN NM OVER THE WEEKEND...BUT MUCH OF THE TSTM ACTIVITY SHOULD BE CONFINED TO THE TX/OK PANHANDLES. DRIER AND WARMER CONDITIONS ON TAP FOR EARLY NEXT WEEK. BREEZY TO WINDY CONDITIONS MAY ALSO RETURN AS SW FLOW ALOFT INCREASES DUE TO ANOTHER UPPER LEVEL TROUGH TAKING SHAPE OVER THE WEST COAST AND 998 TO 1000MB SFC LOWS DEVELOP ACROSS SE COLORADO.*

*34*

*&&*

*.AVIATION..*

*CLOUD BASES HAVE LOWERED A FEW THOUSAND FEET ACROSS THE FORECAST AREA. LOOK FOR THAT TREND TO CONTINUE...ESPECIALLY DURING THE OVERNIGHT HOURS DUE TO THE LACK OF SOLAR RADIATION. THUS...CLOUDS OBSCURING MOUNTAIN TOPS WILL BEGIN TO OCCUR ACROSS THE FORECAST AREA LATER TODAY. LOCALIZED MVFR CONDITIONS ASSOCIATED WITH ISOLATED THUNDERSTORMS WILL BE PREVALENT THROUGH THE REST OF THE DAY AND INTO THE EVENING...ESPECIALLY ACROSS WESTERN AREAS. TERMINAL SITES SUCH AS GUP AND FMN COULD BE AFFECTED BY THIS BUT WOULD BE IN SHORT DURATION TIME STAMPS. MORE WIDESPREAD MVFR CONDITIONS WILL DEVELOP TONIGHT AS*

STRATIFORM PRECIPITATION GETS GOING. TERMINALS LIKELY AFFECTED INCLUDE GUP...FMN ...ABQ AND SAF. GUSTY WINDS WITH SUSTAINED READINGS BETWEEN 20 TO 30 KT WILL BE MOST COMMON TO THE EAST OF THE CENTRAL MOUNTAINS TODAY. SOME LOCALIZED GUSTS DUE TO SHOWER AND THUNDERSTORMS IS UP TO 50 KT. NEXT AVIATION DISCUSSION SCHEDULED FOR 09Z.

FXUS65 KABQ 100351

AFDABQ

AREA FORECAST DISCUSSION

NATIONAL WEATHER SERVICE ALBUQUERQUE NM

951 PM MDT TUE JUN 9 2009

.UPDATE...

UPDATE TO TWEAK SOME EVENING AND OVERNIGHT POPS...WX AND SKY. WESTERN AREAS TWEAKED MORE FOR POPS AND WX...EAST MORE FOR CLOUDS. SHOWERS AND ISOLATED STORMS APPEAR TO BE EXPENDING SOMEWHAT ACROSS SE AZ AND FAR SW NM WHICH SHOULD BODE WELL STILL FOR KEEPING SOME NUMEROUS SHOWER WORDING IN SMALL PATCHES ACROSS THE W.

43

&&

.PREV DISCUSSION...317 PM MDT TUE JUN 9 2009...

MAIN CHALLENGE CONTINUES TO BE ONGOING PRECIPITATION EVENT WHICH WILL CONTINUE THRU TOMORROW. HIGH BASED LIGHT RAIN SHOWERS THAT WERE LOCATED ACROSS SOUTHERN PARTS OF THE CWA HAVE MOVED NORTHEAST ACROSS THE EASTERN PLAINS. THOUGH...MUCH OF THE PRECIPITATION HAS NOT REACHED THE GROUND DUE TO A DRY SUB-CLOUD LAYER...A FEW SITES HAVE PICKED UP A FEW HUNDREDTHS. CONVECTIVE SHOWERS/STORMS HAVE ALSO INITIATED ACROSS WESTERN PORTIONS OF THE STATE. AS THE SHORTWAVE NEARS AND 100KT UPPER LEVEL JET MOVES INTO WESTERN NM...EXPECT PRECIP TO INCREASE IN COVERAGE TONIGHT.

MODELS COMING INTO BETTER AGREEMENT TODAY WITH REGARDS TO LOCATION OF PRECIPITATION OVER THE NEXT 24 HOURS. NAM HAS CONTINUED ITS TREND OF BECOMING WETTER...ESPECIALLY EARLY WEDNESDAY. 12Z GFS ALSO DID QUITE WELL PICKING UP ON LIGHT RAIN OCCURRING OVER THE EASTERN PLAINS...WHICH OTHER MODELS DID NOT PICK UP ON. THEREFORE...HAVE AGAIN SIDED WITH THE GFS WITH REGARDS TO POPS. HAVE INCREASED POPS INTO THE LIKELY CATEGORY ACROSS THE WEST CENTRAL MTNS THIS EVENING...THEN AS THE SHORTWAVE MOVES NORTHEAST ACROSS AZ...HAVE TRENDED HIGHER POPS ACROSS THE NORTHWEST MTNS THRU 18Z WED. BEFORE LOWER LEVELS MOISTEN FURTHER DUE TO TOP-DOWN MOISTENING...STILL THINK THERE IS A POTENTIAL FOR GUSTY WINDS THRU THE EVENING WITH ANY SHOWER/STORM. 12Z SUITES AND HPC GUIDANCE IN GOOD AGREEMENT THAT THE NORTHWEST MTNS WILL HAVE THE BEST CHANCES FOR WETTING RAINS EARLY WED MORNING. BY LATE AFTN ON WED...TROUGH AXIS WILL BE LOCATED NEAR THE NM/TX BORDER...AND AT LEAST WEAK SUBSIDENCE SHOULD BE ACROSS MUCH OF NM. THUS...A DECREASE IN THE COVERAGE OF SHOWERS/STORMS IS STILL ANTICIPATED FROM MID AFTN THRU MID EVENING ON WEDNESDAY. HOWEVER...A WEAK FRONTAL BOUNDARY STILL LOOKS TO DROP INTO NORTHEAST NM WED NIGHT/THURS MORNING. THIS WILL KEEP A SLIGHT CHANCE OF SHOWERS AND TSTMS IN THE FORECAST. AFOREMENTIONED FRONT WILL SLOSH BACK AND FORTH ON FRIDAY. MOISTURE ALONG A DRYLINE MAY MOVE INTO EASTERN NM OVER THE WEEKEND...BUT MUCH OF THE TSTM ACTIVITY SHOULD BE CONFINED TO THE TX/OK PANHANDLES. DRIER AND WARMER CONDITIONS ON TAP FOR EARLY NEXT WEEK. BREEZY TO WINDY CONDITIONS MAY ALSO RETURN AS SW FLOW ALOFT INCREASES DUE TO ANOTHER UPPER LEVEL TROUGH TAKING SHAPE OVER THE WEST COAST AND 998 TO 1000MB SFC LOWS DEVELOP ACROSS SE COLORADO.

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.AVIATION...

*CLOUD BASES HAVE LOWERED A FEW THOUSAND FEET ACROSS THE FORECAST AREA. LOOK FOR THAT TREND TO CONTINUE...ESPECIALLY DURING THE OVERNIGHT HOURS DUE TO THE LACK OF SOLAR RADIATION. THUS...CLOUDS OBSCURING MOUNTAIN TOPS WILL BEGIN TO OCCUR ACROSS THE FORECAST AREA LATER TODAY. LOCALIZED MVFR CONDITIONS ASSOCIATED WITH ISOLATED THUNDERSTORMS WILL BE PREVALENT THROUGH THE REST OF THE DAY AND INTO THE EVENING...ESPECIALLY ACROSS WESTERN AREAS. TERMINAL SITES SUCH AS GUP AND FMN COULD BE AFFECTED BY THIS BUT WOULD BE IN SHORT DURATION TIME STAMPS. MORE WIDESPREAD MVFR CONDITIONS WILL DEVELOP TONIGHT AS STRATIFORM PRECIPITATION GETS GOING. TERMINALS LIKELY AFFECTED INCLUDE GUP ...FMN...ABQ AND SAF. GUSTY WINDS WITH SUSTAINED READINGS BETWEEN 20 TO 30 KT WILL BE MOST COMMON TO THE EAST OF THE CENTRAL MOUNTAINS TODAY. SOME LOCALIZED GUSTS DUE TO SHOWER AND THUNDERSTORMS IS UP TO 50 KT. NEXT AVIATION DISCUSSION SCHEDULED FOR 09Z.*

#### **14.0 Statements**

The surviving highway patrol officer, Wesley Cox, who was the spotter on the accident helicopter was interviewed by the Safety Board's investigator in charge and made the following comments regarding the weather conditions. He indicated several times during the interview that the wind was blowing like crazy. Once they landed, and the pilot left the helicopter to help with the rescue of the hiker, he indicated that the weather really began to change. He indicated "it started sleeting like crazy and the wind was insane". When the pilot got back with the hiker, Mr. Cox indicated that it was "still sleeting a little bit, maybe more like snow, but it wasn't sticking to the ground".

A couple camping at Stewart Lake approximately 1 1/2 to 2 miles east-southeast of the accident site reported seeing the helicopter flying in the area, land, and then depart a short period later. They indicated that at the time of the accident, there was a "heavy overcast" with strong gusty winds. They also reported heavy rain occurring after the accident at about 2200 MDT at their location. They observed the helicopter lift off and depart toward the north, and observed the helicopter's light disappear behind a ridgeline, and shortly thereafter observed a flash of light from behind the ridge and heard what they described as explosion.

#### **15.0 Preflight Weather Briefing**

There was no record of the pilot of N606SP obtaining a formal weather briefing with the FAA Automated Flight Service Station (AFSS) or by Direct User Access Terminal Service (DUATS); however, computer internet services were available in the hangar for local weather and routinely used by the pilot.

#### **16.0 Astronomical Data**

The astronomical data for Santa Fe, Santa Fe County, New Mexico, was obtained from the United States Naval Observatory's website for June 9, 2009:

**SUN**



Begin civil twilight	0518 MDT
Sunrise	0548 MDT
Sun transit	1303 MDT
Sunset	2019 MDT
End civil twilight	2049 MDT
Elevation of Sun	more than 12° below the horizon at 2135 MDT

**MOON**

Moonset	0710 MDT
Moonrise	2213 MDT
Moonset	0808 MDT June 10, 2009
Elevation of Moon	7.5° below the horizon at 2135 MDT

The phase of the Moon on June 9, 2009, was a waning gibbous with 96 percent of the Moon's visible disk illuminated. At the time of the accident the Moon was 7.5° below the horizon and did not provide any illumination at the time of the accident.

Donald E. Eick  
NTSB Senior Meteorologist