



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 20, 2019

Specialist's Factual Report

METEOROLOGY

CEN19FA008

Table Of Contents

A.	ACCIDENT.....	3
B.	METEOROLOGIST	3
C.	SUMMARY	3
D.	DETAILS OF THE INVESTIGATION	3
E.	WEATHER INFORMATION	4
1.0	Synoptic Conditions	4
1.1	Surface Analysis Chart.....	4
1.2	Regional Radar Mosaic Image	5
1.3	Constant Pressure Charts.....	6
1.4	12-hour Surface Prognostic Chart	8
2.0	Observations	9
2.1	Double Eagle II Airport.....	10
2.2	Albuquerque International Airport.....	11
2.3	Grants-Milan Municipal Airport	12
2.4	METAR Display	13
3.0	Sounding.....	14
4.0	Satellite Imagery.....	16
5.0	Weather Surveillance Radar Imagery	17
5.1	Reflectivity	17
5.2	Base Reflectivity Imagery	19
5.3	Dual-Polarization Weather Radar Data.....	21
6.0	Pilot Reports	22
7.0	Forecasts & Advisories.....	24
	The following aviation forecast products were reviewed and documented over the region.....	24
7.1	Terminal Aerodrome Forecast	24
7.2	Area Forecast Discussion	24
7.3	Graphic Forecast for Aviation.....	26
7.4	Current Icing Product.....	27
7.5	Inflight Weather Advisories	29
7.6	Winds and Temperatures Aloft Forecast.....	31
8.0	Preflight Weather Briefing	32
9.0	Witness Statements.....	32
10.0	Astronomical Conditions.....	32
F.	LIST OF ATTACHMENTS	33

A. ACCIDENT

Location: Canoncito, New Mexico
Date: October 16, 2018
Time: 1622 mountain daylight time
2222 Universal Coordinated Time (UTC)
Airplane: Cessna 182P; Registration: N9326G

B. METEOROLOGIST

Don Eick
NTSB Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On October 16, 2018, about 1622 mountain daylight time, a Cessna 182P airplane, N9326G, collided with terrain during a forced landing near Canoncito, New Mexico. The commercial pilot and his pilot-rated passenger were fatally injured, and the airplane was substantially damaged. The airplane was owned by the pilot and operated under Title 14 *Code of Federal Regulations* (CFR) Part 91 while on an instrument flight plan. Day visual meteorological conditions prevailed at the accident site. The personal cross-country flight departed Lake Havasu City Airport (HII), near Lake Havasu City, Arizona, about 1234 with the intended destination of Double Eagle II Airport (AEG), near Albuquerque, New Mexico.

D. DETAILS OF THE INVESTIGATION

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

The accident site was located at latitude 35.071111° N and longitude 107.03528° W, at an elevation of approximately 5,640 ft.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

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

1.1 Surface Analysis Chart

The southwest section of the NWS Surface Analysis Chart for 1500 MDT (2100Z) is included as figure 1 with a star proving the approximate location of the accident site. The chart depicted two low pressure systems over the region, the first low pressure system was located to the north-northwest near the four corners area of Utah, Colorado, Arizona, and New Mexico at 1018-hectopascals (hPa)¹ with a trough of low pressure extending northeast across Colorado. The second low pressure system was over southern Arizona at 1012-hPa. No defined frontal boundaries were identified over the region or in the vicinity of the accident site.

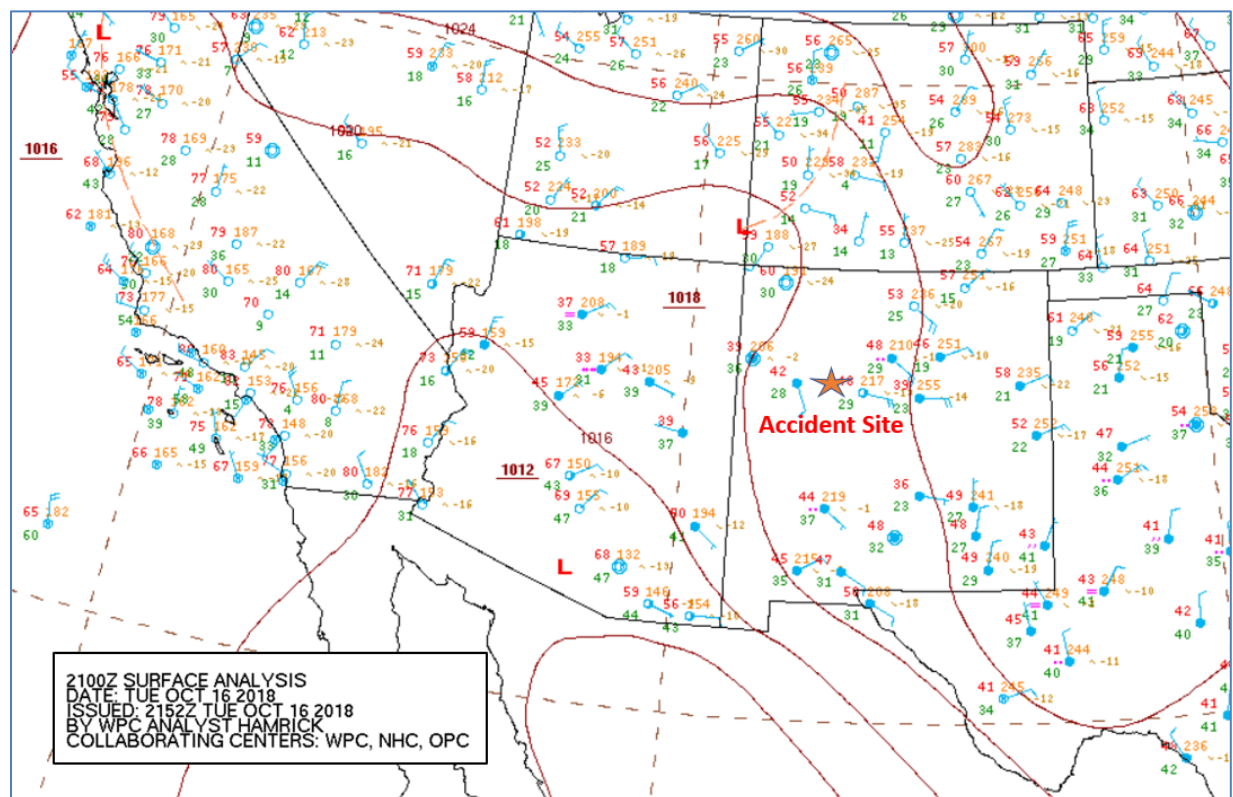


Figure 1 - Southwest section of the NWS Surface Analysis Chart for 1500 MDT

¹ Hectopascal - abbreviated hPa is the standard term for reporting sea level pressure and is interchangeable with the term millibar (mb) with the same units. The International Standard Atmosphere (ISA) is based on a sea level pressure of 1013.25-hPa with a temperature of 15° Celsius (C) or 59° Fahrenheit (F).

The station models on the Surface Analysis Chart for 1500 MDT surrounding the accident site indicated northeasterly winds of 15 knots near the departure area near Lake Havasu City, Arizona, and from the south at 10 knots at Grants, New Mexico, immediately west of the accident site and from the east-southeast at 15 knots over the Albuquerque area to the east of the accident site. The stations depicted broken to overcast cloud cover over the route, with several stations reporting light rain to the northeast and south of the accident site. The closest reporting station from Albuquerque immediately east of the accident site reported a temperature of 48° Fahrenheit (F), with dew point temperatures near 29° F.

1.2 Regional Radar Mosaic Image

The NWS NCEI National Composite Radar Mosaic centered over the region at 1620 MDT (2220Z) is included as figure 2 with the approximate accident site marked by a red star. The image depicted an area of light to moderate precipitation echoes surrounding the accident site with several west-to-east oriented bands located west and south of the accident site, with no echoes immediately over the accident site at the time of the image.

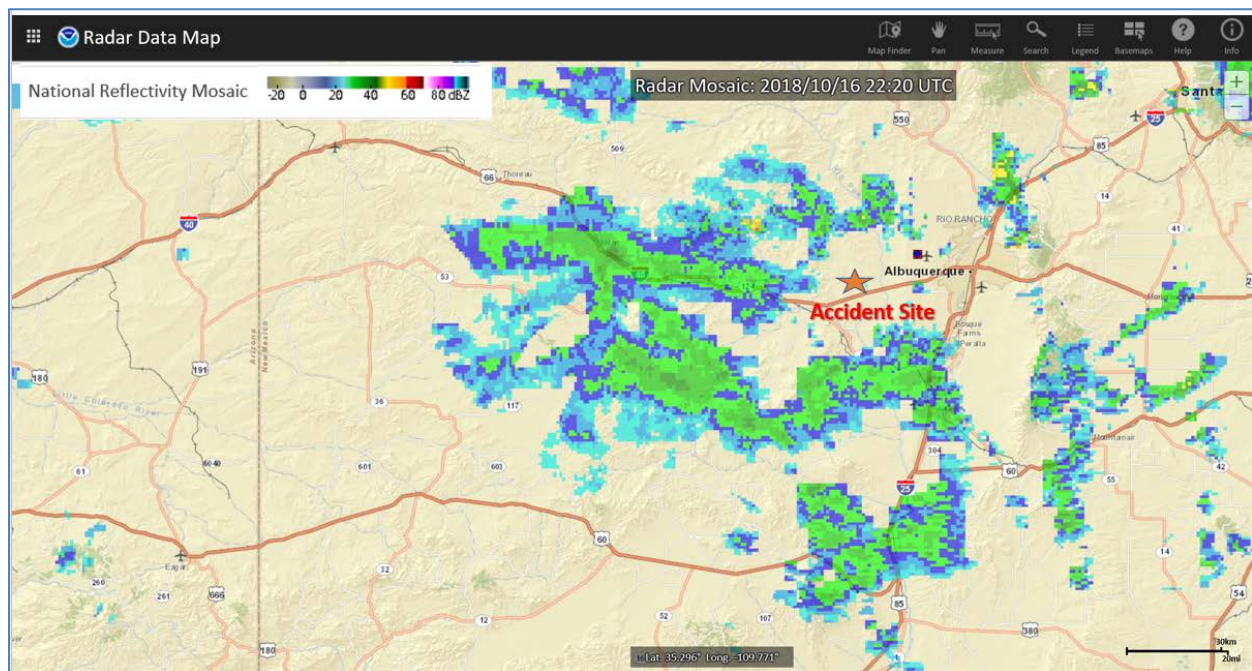


Figure 2 - NWS National Composite Radar Mosaic over the region at 1620 MDT

Based on the National Composite Radar image above the closest NWS weather surveillance radar imagery will be documented in section 5.0 below to determine if the accident airplane encountered any significant echoes along their flight path leading up to the time of the accident.

1.3 Constant Pressure Charts

The NWS Storm Prediction Center (SPC) forecast upper air constant pressure charts² for 700-, 500-, and 300-hPa for 1800 MDT (0000Z on October 17, 2018) are included as figures 3 through 5 respectively, and depict the conditions at approximately 10,000 ft, 18,000 ft, and 30,000 ft. The chart has been annotated with the location of the accident and to define upper level low's, high's, and troughs for clarity. The charts depict contour lines of equal height, isotherms of equal temperature (red dashed lines), temperature-dew point spreads less than 4° C on the 700-hPa chart, and isotachs or lines of equal wind speed on the 300-hPa chart to depict the jet stream. Wind flow typically flows parallel to the contour lines on constant pressure charts.

The charts depicted an upper level low pressure system over Arizona which tilted to the north or the colder air with altitude, with a long wave trough extending to the southwest of the low. The accident site was located ahead or east of the low, typical an area of upward vertical motion and the formation of clouds and precipitation. The station model on the 700-hPa chart for Albuquerque sounding (KABQ) depicted wind from the southeast at 25 knots, with a temperature of -1° Celsius (C), and a temperature-dew point spread of 2° C. The 500-hPa charts station model for KABQ indicated southerly wind at 25 knots with a temperature of -16° C, and temperature-dew point spread of 3° C and also near saturated conditions. While the 300-hPa chart depicted south-southwesterly winds at 70 knots with a weak polar jet stream moving northeastward around the upper level low, with a slight diffluent³ wind flow over northern New Mexico.

² The SPC upper air maps are produced by using the available 0000Z rawinsonde observations with a first guess from the 1800Z North American Mesoscale (NAM) numerical model 6-hour forecast of the objective analysis. Errors may result if NAM model data is not available, or if sounding data is late or erroneous.

³ Diffluence – is a pattern of wind flow in which air moves outward (in a “fan-out” pattern) away from a central axis that is oriented parallel to the general direction of the flow. It is the opposite of confluence. Upper-level diffuence induces low-level convergence and upward vertical motion over the area.

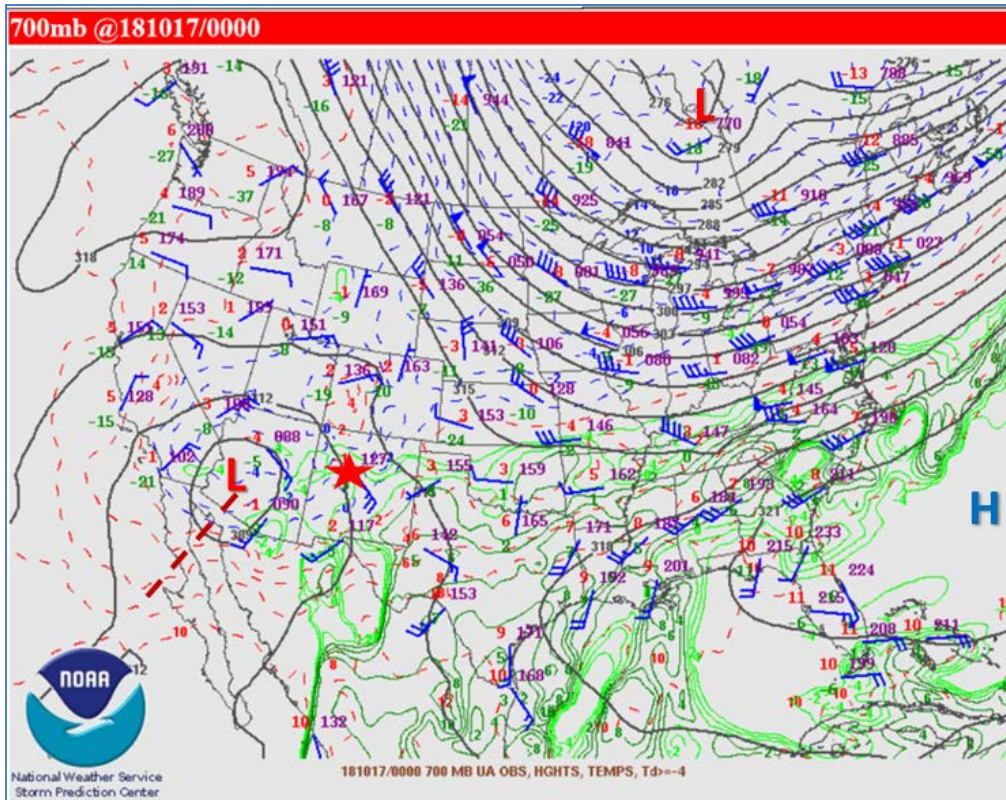


Figure 3 - 700-hPa upper air chart for 1800 MDT

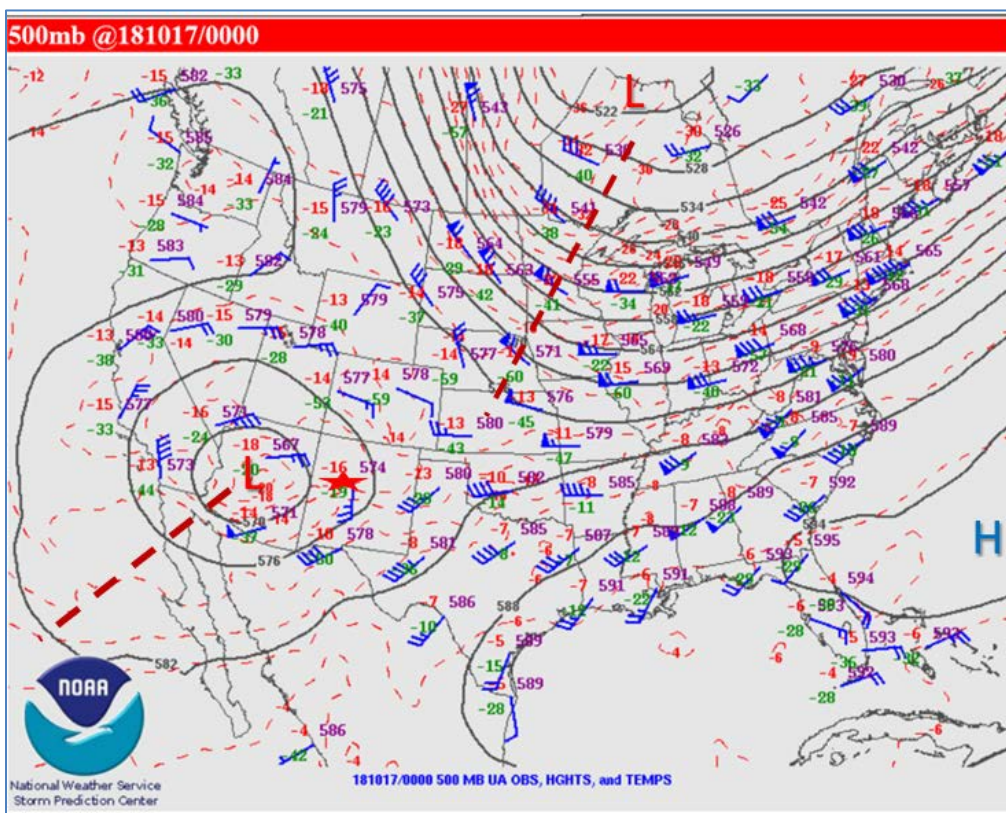


Figure 4 - 500-hPa upper air chart for 1800 MDT

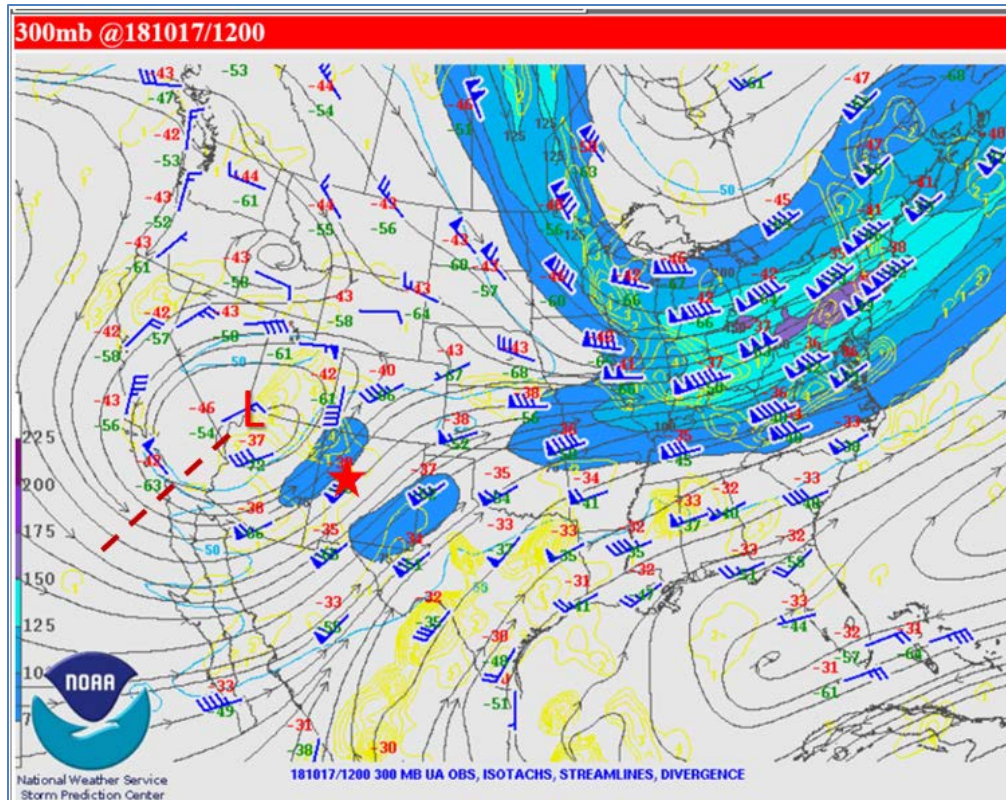


Figure 5 - 300-hPa upper air chart for 1800 MDT

1.4 12-hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart current during the period is included as figure 6 and depicted the forecast conditions expected at 2400 MDT (0600Z on October 17, 2018) or midnight local. A red circle encloses the accident site. The chart depicted no frontal boundaries over the planned route of flight other than a trough of low pressure extending north-to-south over Arizona. A large area of rain, mixed precipitation, snow, and ice was expected scattered over Arizona and New Mexico, and along the general route of flight. The precipitation probability ranged from a chance, which was defined as a chance of measurable precipitation ($\geq 0.01''$) or a 30 to 60% probability, to likely measurable precipitation or greater than 60% probability of occurrence.

12 Hours Surface Prognostic

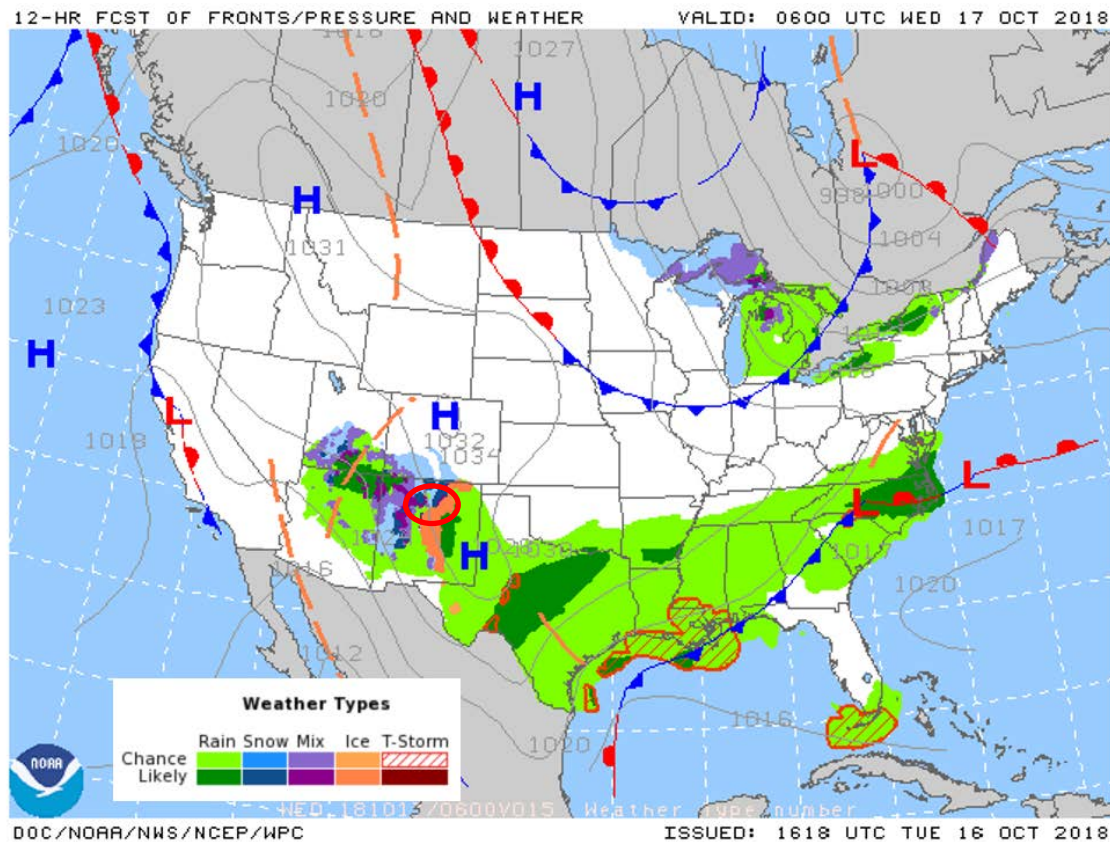


Figure 6 – NWS 12-hour Surface Prognostic Chart valid for 2400 MDT

2.0 Observations

The surrounding Albuquerque, New Mexico, area was documented using Meteorological Aerodrome Reports (METAR) and Specials observations (SPECI). The area had a magnetic variation of 9° East based on the sectional chart for the area as shown in figure 7. Cloud heights are reported in height above ground level (agl) in the following section.

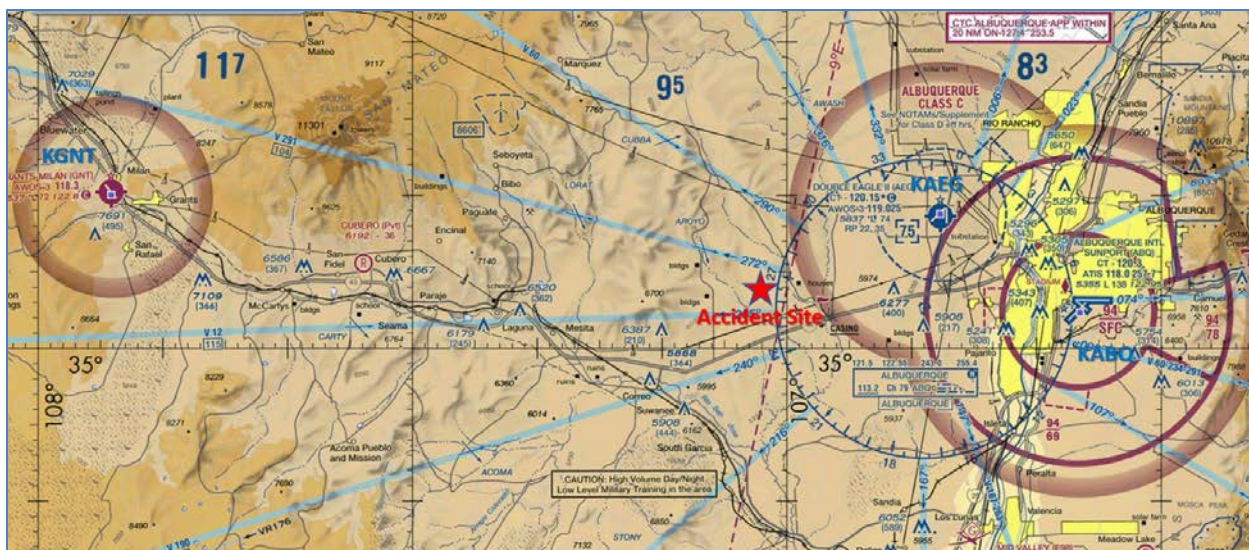


Figure 7 - Sectional chart over the area depicting the closest weather reporting stations and the accident site

2.1 Double Eagle II Airport

The closest weather reporting facility to the accident site was from Double Eagle II Airport (KAEG), Albuquerque, New Mexico, located 13 miles northeast of the accident site at an elevation of 5,837 ft. The airport had an Automated Weather Observation System (AWOS) which was augmented by air traffic control observers from approximately 0600 through 2200 MDT through a Limited Aviation Weather Reporting System (LAWRS) agreement. At the time of the accident the following conditions were being reported:

KAEG special weather observation at 1618 MDT (2218Z), wind from 140° at 17 knots gusting to 23 knots, visibility 10 miles in light rain, ceiling overcast at 4,700 ft agl, temperature 7° Celsius (C), dew point -3° C, altimeter 30.25 inches of mercury (Hg).

The raw observations transmitted during the period from 1349 through 1747 MDT were as follows:

METAR KAEG 161949Z 12026G29KT 10SM BKN050 BKN100 10/M04 A3025=

METAR KAEG 162050Z 13018KT 10SM BKN050 OVC060 08/M01 A3023=

METAR KAEG 162148Z 13015G25KT 10SM OVC045 07/M02 A3025=

SPECI KAEG 162218Z 14017G23KT 10SM RA- OVC047 07/M03 A3025=

Accident 2222Z

METAR KAEG 162249Z 14017G23KT 10SM -RA OVC047 08/M03 A3026=

METAR KAEG 162347Z 12021G28KT 10SM OVC049 07/M03 A3027=

The observations surrounding the period indicated that VFR conditions⁴ prevailed with light rain and ceiling overcast between 4,500 to 4,700 ft agl. There were no supplementary remarks added to the observations during the period.

2.2 Albuquerque International Airport

The next closest reporting location was from Albuquerque International Airport (KABQ), Albuquerque, New Mexico, located 21 miles east of the accident site at an elevation of 5,355 ft. The airport had a Federally installed and maintained Automated Surface Observation System (ASOS) and was augmented by observers. At the approximate time of the accident the following conditions were being reported:

KABQ routine observation at 1552 MDT, wind from 110° at 24 knots gusting to 30 knots, visibility 10 miles or more, a few clouds at 4,000 ft agl, ceiling overcast at 5,500 ft, temperature 9° C, dew point -3° C, altimeter 30.23 inches of Hg. Remarks: automated observation system with a precipitation discriminator, peak wind from 110° at 36 knots occurred at 1520 MDT, sea level pressure 1022.1-hPa, stratocumulus standing lenticular (SCSL)⁵ clouds northeast through southeast, mountain tops obscured northeast and southeast, temperature 8.9° C, dew point -3.3° C.

The raw observation surrounding the period from 1352 through 1752 MDT were as follows:

METAR KABQ 161952Z 10025G35KT 10SM FEW040 FEW055 BKN100 11/M03 A3022 RMK AO2 PK WND 11037/1930 SLP212 VCSH NE-E MTN TOPS OBSC NE AND SE T01061033=

METAR KABQ 162052Z 10020G28KT 10SM FEW040 BKN060 09/M02 A3022 RMK AO2 PK WND 11039/2028 SLP217 SCSL NE-SE MTN TOPS OBSC NE AND SE T00891017 55013=

METAR KABQ 162152Z 11024G30KT 10SM FEW040 OVC055 09/M03 A3023 RMK AO2 PK WND 11036/2120 SLP221 SCSL NE-SE MTN TOPS OBSC NE AND SE T00891033=

Accident 2222Z

METAR KABQ 162252Z 11023G30KT 10SM FEW035 OVC055 09/M04 A3025 RMK AO2 PK WND 12032/2158 SLP224 MTNS OBSC NE AND SE T00941039=

METAR KABQ 162352Z 14013KT 10SM FEW035 BKN055 BKN080 08/M03 A3028 RMK AO2 PK WND 12029/2313 SLP240 VCSH NE SHSN DSNT SE-S MTNS OBSC NE-SE T00831028 10117 20078 53017=

The observations indicated VFR conditions prevailing during the period. The reports included supplemental remarks indicating mountain obscuration northeast and southeast of the station and stratocumulus standing lenticular clouds over the area.

⁴ Visual Flight Rule (VFR) conditions are defined as no ceiling or a ceiling above 3,000 ft agl and visibility greater than 5 statute miles.

⁵ Stratocumulus standing lenticular (SCSL) clouds are the lowest type of lenticular clouds which are stationary clouds, and usually form perpendicular to the wind flow at that level. They are often comparable in appearance to a lens or saucer. The clouds are a visual indication of the existence of mountain wave conditions.

2.3 Grants-Milan Municipal Airport

Grant-Milan Municipal Airport (KGNT), located in Grants, New Mexico, was 42 miles west of the accident site at an elevation of 6,537 ft. The airport had an AWOS that issued observations every 20-minutes for dissemination and was not augmented by human observers. At the time of the accident the following conditions were reported:

KGNT weather observation at 1615 MDT, automated⁶, wind from 140° at 15 knots gusting to 18 knots, visibility 10 miles or more in unknown precipitation⁷, scattered clouds at 2,900 ft agl, ceiling broken at 3,700 ft, overcast at 4,700 ft, temperature 4° C, dew point -1° C, altimeter 30.26 inches of Hg. Remarks: automated weather observation system with a precipitation discriminator, temperature 4.2° C, dew point -0.8° C.

The raw observations reported surrounding the period were as follows:

METAR KGNT 161955Z AUTO 16008KT 10SM OVC040 06/M02 A3024 RMK AO2 T00561022

METAR KGNT 162015Z AUTO 16010G19KT 10SM OVC040 06/M02 A3023 RMK AO2 T00571024

METAR KGNT 162035Z AUTO 16012G17KT 10SM OVC040 06/M02 A3023 RMK AO2 T00551024

METAR KGNT 162055Z AUTO 16012G17KT 10SM OVC040 06/M02 A3024 RMK AO2 T00571024

*METAR KGNT 162115Z AUTO 14013G22KT 10SM SCT035 BKN042 OVC048 05/M01 A3024 RMK AO2
T00471011*

*METAR KGNT 162135Z AUTO 15011G20KT 10SM BKN040 OVC050 04/M01 A3024 RMK AO2 T00421006
T00431009*

***METAR KGNT 162215Z AUTO 14015G18KT 10SM UP SCT029 BKN037 OVC047 04/M01 A3026 RMK AO2
T00421008***

Accident 2222Z

*METAR KGNT 162235Z AUTO 16012G19KT 7SM -RA SCT016 BKN023 OVC036 03/00 A3027 RMK AO2
T00270001*

METR KGNT 162255Z AUTO 16009KT 10SM RA SCT015 BKN020 OVC048 03/01 A3027 RMK AO2 T00250008

*METAR KGNT 162315Z AUTO 16011KT 3SM -SN SCT010 BKN014 OVC024 02/01 A3028 RMK AO2 P0001
T00180005*

*METAR KGNT 162335Z AUTO 17011G15KT 10SM -RA BKN010 OVC014 02/01 A3028 RMK AO2 P0002
T00180011*

⁶ AUTO – automated indicates that there was no human logged onto the system and did not augmentation the observation.

⁷ Unknown Precipitation (UP) – depending on the size and speed of the descending particles observed by the Light Emitting Diode Weather Identifier (LEDWI) sensor of the AWOS/ASOS system it is often unable to differentiate the precipitation type. This often occurs during period of mixed freezing precipitation such as with rain and snow, freezing drizzle and ice pellets.

A review of the observations indicated that VFR to MVFR conditions⁸ prevailed during the period with a mixture of precipitation occurring prior to and after the accident, and multiple layers of broken to overcast clouds.

2.4 METAR Display

A display from the NWS Aviation Weather Center's website of the METAR observations graphically depicted with the National Composite Radar image at 1620 MDT is included as figure 8 with the approximate accident location indicated by the red star. The station depicted VFR conditions prevailing with a large area of precipitation extending westward along the general route of flight across western New Mexico.

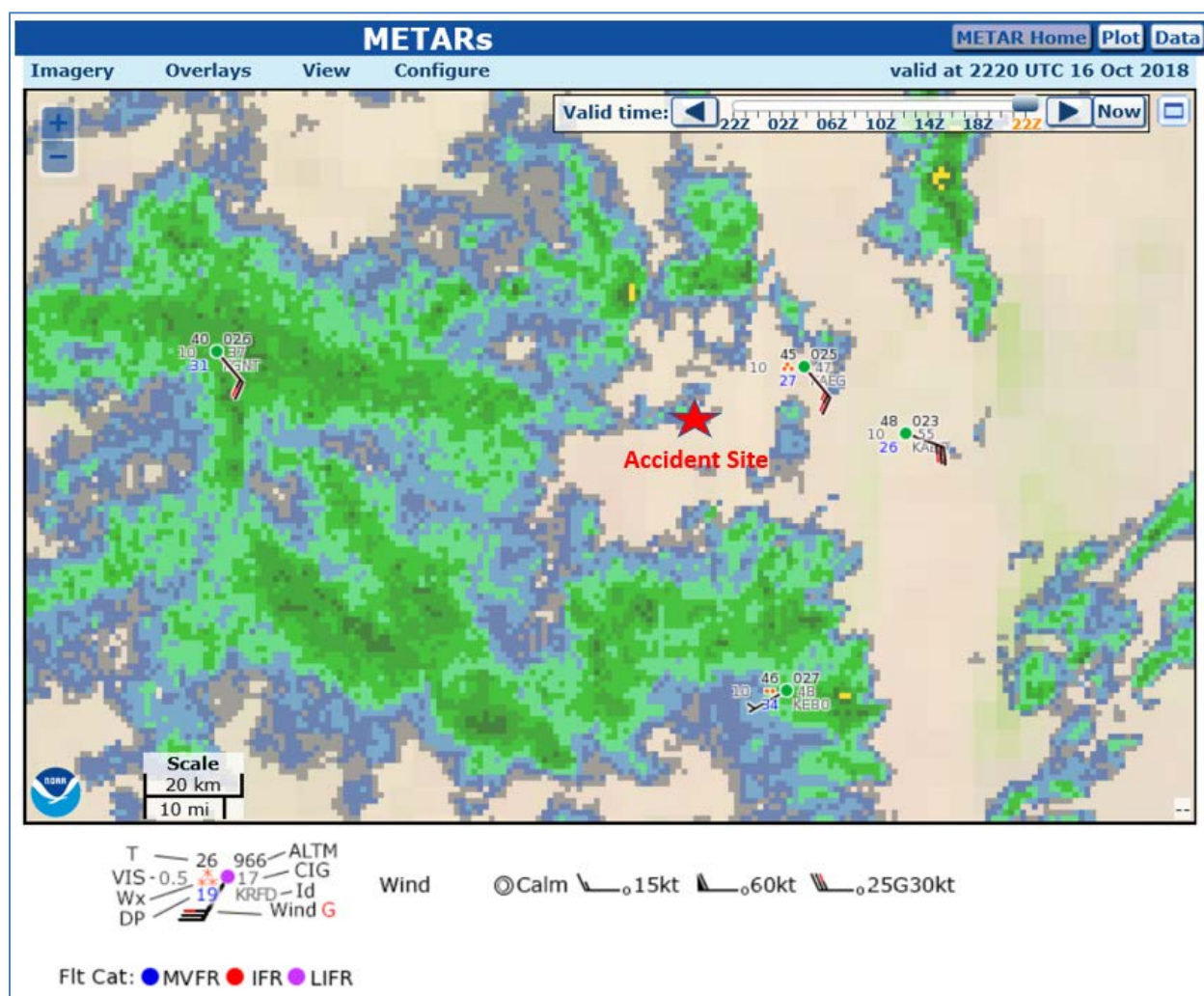


Figure 8 - METAR display at 1620 MDT

⁸ Marginal Visual Flight Rule (MVFR) conditions – are defined as a ceiling between 1,000 and 3,000 ft inclusive, and/or visibility between 3 and 5 statute miles inclusive.

3.0 Sounding

The NWS KABQ⁹, site number 72365, upper air observation for 1800 MDT (0000Z) plotted on a standard Skew T log P diagram¹⁰ using the complete Rawinsonde Observation RAOB program software¹¹ from the surface through 450-hPa (or approximately 21,000 ft) is included as figure 9. The sounding launch was from the NWS Weather Forecast Office (WFO) located at KABQ approximately 21 miles east of the accident site.

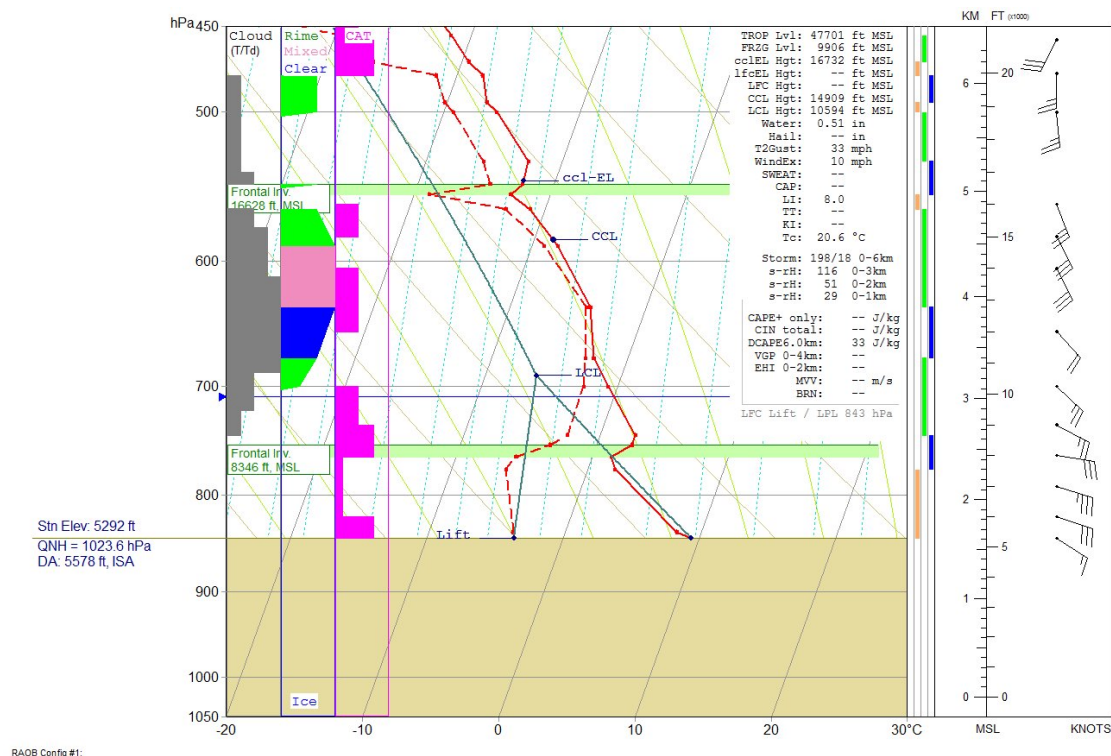


Figure 9 - Albuquerque upper air sounding for 1800 MDT

The 1800 MDT sounding indicated a surface temperature of 9.4° C, a dew point of -3.6° C, with a relative humidity of 40%. The station elevation was 5,292 ft and the calculated density altitude was 5,578 ft. A low-level temperature inversion was noted at 3,054 ft agl (8,346 ft msl) where temperature increased with height, with another shallow inversion at 11,336 ft. The lifted condensation level (LCL)¹² was located above the inversion at 5,302 ft agl (or 10,594 ft msl) and

⁹ The NWS Albuquerque Weather Forecast Office (WFO) is collocated on the western side of the KABQ airport and launched the balloon from that location.

¹⁰ Skew T log P diagram – is a standard meteorological plot or thermodynamic diagram using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

¹¹ RAOB software – The complete RAOB program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania, for plotting and analyzing upper air data.

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

the convective condensation level (CCL)¹³ at 9,617 ft agl (14,909 ft msl) with an equilibrium level (EL)¹⁴ at 18,500 ft msl. The sounding indicated a greater than 75% relative humidity between 9,000 ft and 16,000 ft msl supporting broken to overcast clouds. The freezing level was identified at 9,906 ft msl, and the RAOB algorithm indicated favorable conditions for icing with rime, clear, to mixed type icing conditions. The precipitable water content was 0.51 inches.

The surface wind was from 125° at 17 knots with winds from the southeast through 12,000 ft and then backed (counter clockwise) to the south and southwest with height with increasing wind speeds. A low-level wind maximum was identified at approximately 2,000 ft agl (7,000 ft msl) from 110° at 33 knots. The mean 0 to 6-kilometer wind (18,000 ft) was from 168° at 24 knots, with the level of maximum wind at 39,000 ft from 220° at 93 knots. The RAOB algorithm supported several layers below the accident airplanes cruising level at 16,500 ft that supported moderate or greater turbulence due to strong vertical wind shears.

Figure 10 is a table of the KABQ 1800 MDT observed sounding variables observed below 21,000 ft of height, pressure (Pres), temperature (T), dew point temperature (Td), relative humidity (RH), wind direction and speed, and RAOB algorithm derived clear air turbulence (CAT), low-level wind shear (LLWS), icing intensity and type, and mountain wave potential.

Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)	Wave/x--W---Turb nm fpm max
5292	843	9.4	-3.6	40	125 / 17				
5486	837	8.2	-3.8	42		SVR	LIGHT		
6000	821				110 / 29	LGT			
7000	791				110 / 33				
7548	775	2.0	-6.0	55		LGT			
7961	763	1.4	-5.6	60	100 / 32				
8346	752	2.6	-3.4	65					
8666	743	2.6	-2.4	70		SVR			3.77 1659 SEVERE
9000	734				120 / 27	MDT			
10240	700	-0.7	-2.5	88	135 / 23			TRC Rime	
11153	676	-2.5	-3.1	96				LGT Rime	
12000	654				140 / 19				2.63 413 LIGHT
12780	635	-4.1	-4.4	98		MDT		MDT Clear	3.22 572 LT-MD
14000	606				155 / 30				4.98 327 LIGHT
14714	589	-8.1	-9.1	92				MDT Mixed	7.26 486 LIGHT
15000	582				155 / 32				
15859	563	-11.1	-12.9	87		MDT		LGT Rime	
16000	560				160 / 26				
16309	553	-12.9	-18.9	61					
16628	546	-12.3	-14.7	82				LGT Rime	2.21 798 MD-SV
17327	531	-12.5	-15.8	76					3.64 1238 MD-SV
18825	500	-16.1	-19.3	76	175 / 25			LGT Rime	
19123	494	-17.1	-20.2	77				LGT Rime	
19932	478	-18.1	-21.5	75	180 / 23			LGT Rime	
20345	470	-19.5	-26.5	54		SVR			
21000	457				205 / 30				8.05 421 LIGHT

Figure 10 - Albuquerque 1800 MDT sounding parameters

Attachment 1 is the flight track of N9326G from 1603 through 1620 MDT (2203Z-2220Z) obtained from the NTSB Air Traffic Control Specialist which indicated that the accident airplane

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 Equilibrium Level (EL) - is the height where the temperature of a buoyantly rising parcel again reaches equal to the temperature of the environment.

was cruising at 16,500 ft and began a slow descent after 1603 MDT. During the descent profile between 15,000 and 7,000 ft several rapid increases in altitude of several hundred feet were noted in the data.

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) data was obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison in Madison, Wisconsin, and processed using the Man-computer Interactive Data Access System (McIDAS) software. Both the infrared long wave and visible band imagery were obtained surrounding the time of the accident. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns (μm) provided radiative cloud top temperatures with a nominal spatial resolution of 2 km. The visible imagery (band 2) at a wavelength of 0.64 μm provided a nominal spatial resolution of 0.5 km.

Figures 11 and 12 are the GOES-16 infrared and visible images at 1622 MDT at 2X magnification with the accident site marked by a red star. The images depicted an extensive area of clouds over the route of flight. The infrared image at 1622 MDT detected a radiative cloud top temperature over the accident site at 251° Kelvin or -22.16° C, which corresponded to cloud tops near 21,100 ft based on the KABQ sounding.

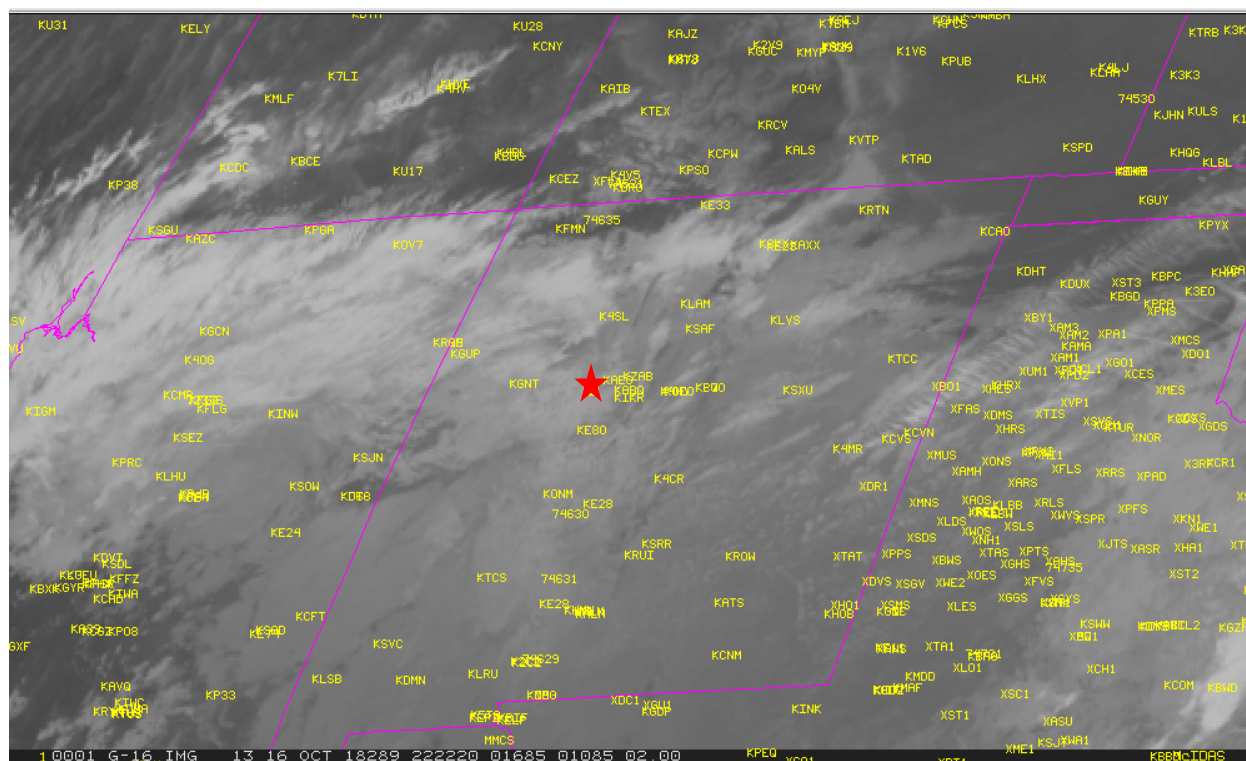


Figure 11 - GOES-16 infrared image at 1622 MDT at 2X magnification

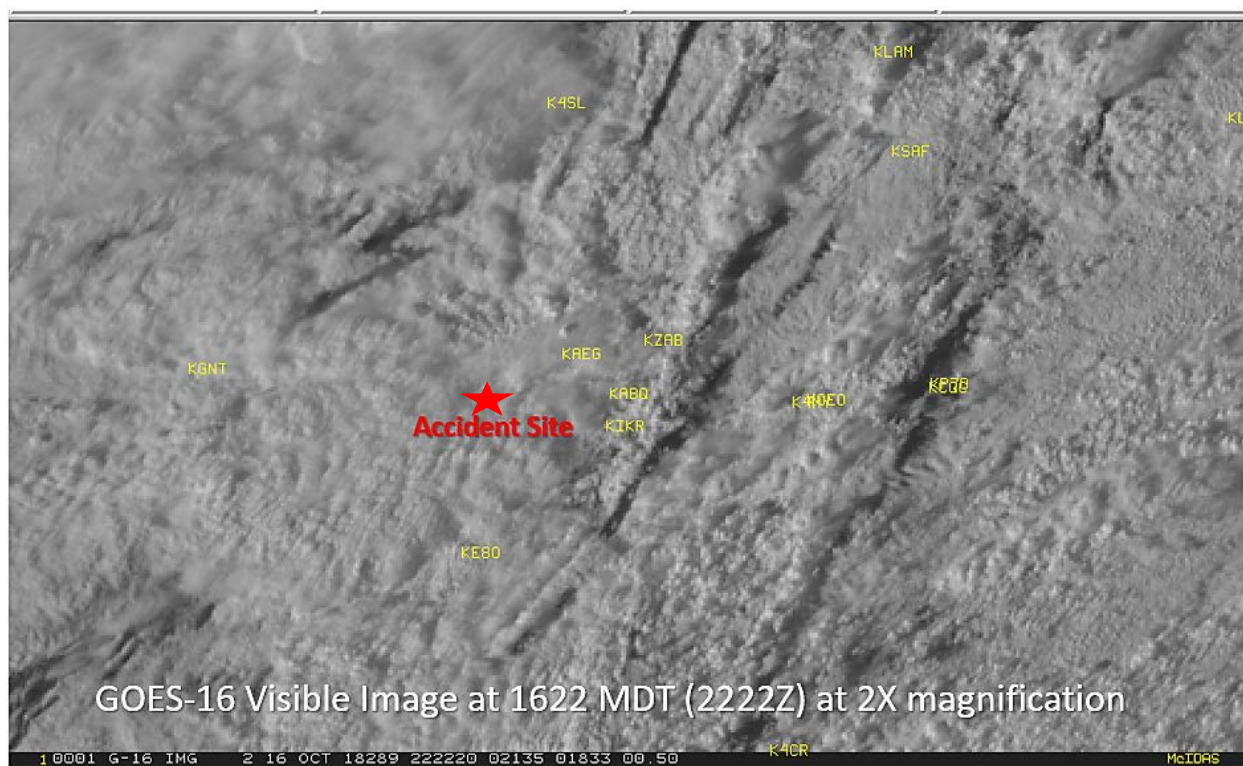


Figure 12 - GOES-16 visible image at 1622 MDT at 2X magnification

5.0 Weather Surveillance Radar Imagery

The closest Weather Surveillance Radar-1988 Doppler (WSR-88D)¹⁵ to the accident site was from the NWS Albuquerque (KABX) antenna site located 12 miles east of the accident site and 6 miles north of KABQ. The level II archive data was obtained from the NCEI using the Hierarchical Data Storage System and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

During the period the KABX WSR-88D was operating in the precipitation mode, volume coverage pattern 215 (VCP-215) where the radar makes 15 different elevation scans in 6 minutes.

5.1 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors¹⁶, it is a function of the drop size distribution, number of particles per

¹⁵ The WSR-88D is a S-band 10-centimeter wavelength radar with a power output of 750,000 watts, with a 28-foot parabolic antenna concentrating the energy into a 0.95° beam width. The radar produces three basic types of products: reflectivity, radial velocity, and spectral width.

¹⁶ Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at 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.

unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ¹⁷) 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
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	55 to 59	>5.67 in/hr
	12	60 to 64	
	13	65 to 69	
	14	70 to 74	
	15	> 75	

Reference to interpreting WSR-88D data and reflectivity rates can be found in Advisory Circular AC 00-24C – “Thunderstorms”. The following table is included in that advisory circular further describing reflectivity ranges and weather echo intensities. 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 table. One exception is that the Air Route Traffic Control Center's weather and radar processor system does not display light intensity echoes below 30 dBZ.

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

(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.

¹⁷ dBZ - 10 log Ze

5.2 Base Reflectivity Imagery

Figures 13 through 15 are the NWS KABX WSR-88D base reflectivity images at 1607, 1614, and 1620 MDT respectively with the corresponding flight track of N9326G overlaid for that scan.

Figure 13 is the KABX WSR-88D 3.12° base reflectivity image at specifically 1607:52 MDT. At the time of this image the accident airplane was 24 miles west of the radar at 15,100 ft and assuming a standard refraction¹⁸ of the WSR-88D 0.95° beam was scanning between from 13,600 to 16,230 ft. The image depicts light to moderate intensity echoes ranging from 20 to 32.5 dBZ over the flight track. Echoes extended to approximately 19,000 ft. The KABX WSR-88D echo tops product at this time indicated the maximum height of 18.5 dBZ to 14,500 ft along the flight track.

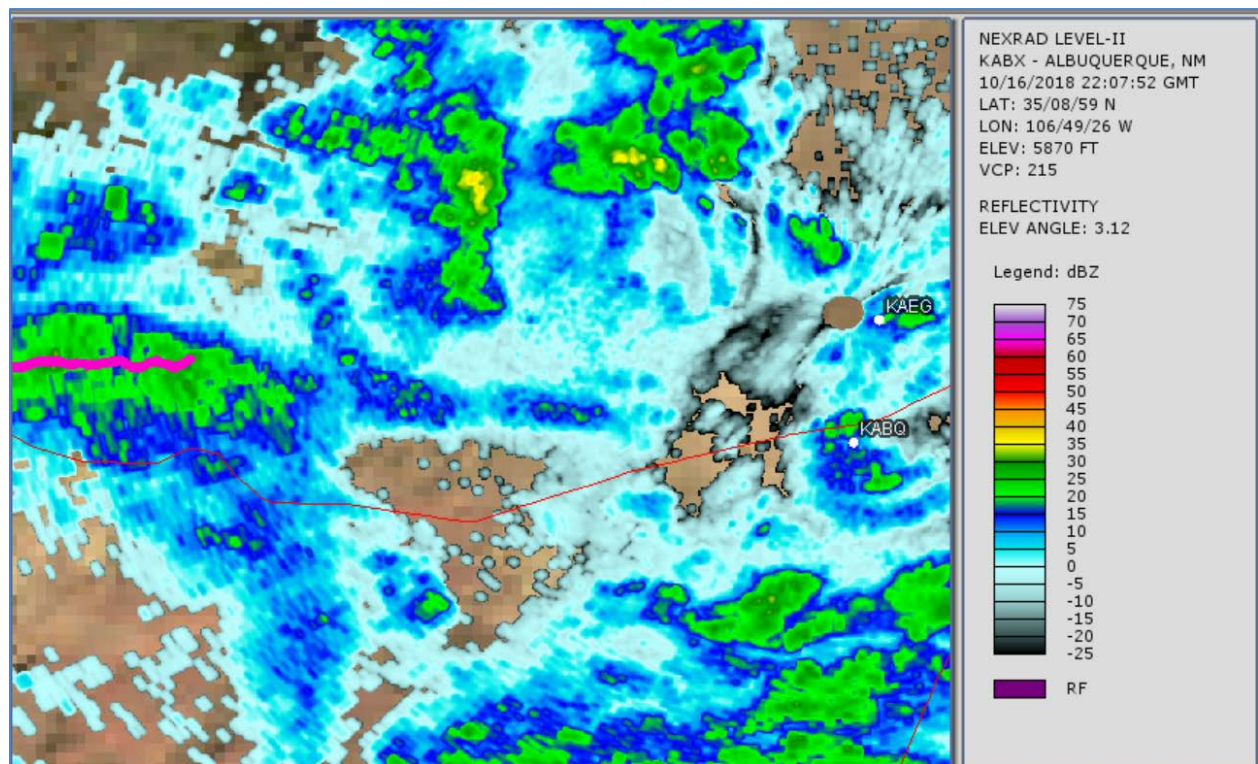


Figure 13 - KABX WSR88D 3.1° base reflectivity image and flight track at 1607:52 MDT

Figure 14 is the KABX WSR-88D 3.12° base reflectivity image at 1614 MDT and depicted the conditions when the accident airplane was 18 miles west of the radar at 12,000 ft. The KABX WSR-88D was scanning between 11,130 to 12,940 ft. The echo intensities along the flight track were decreasing from 30 dBZ down to 5 dBZ. The echo tops continued to be in the range of 13,000 ft.

Figure 15 is the KABX WSR-88D 1.32° base reflectivity scan at 1620 MDT while the flight was 12 miles west at 7,200 ft. Very light intensity echoes of -10 to 10 dBZ continue to be depicted over the flight track with the WSR-88D beam extending from 7,040 to 8,250 ft.

¹⁸ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

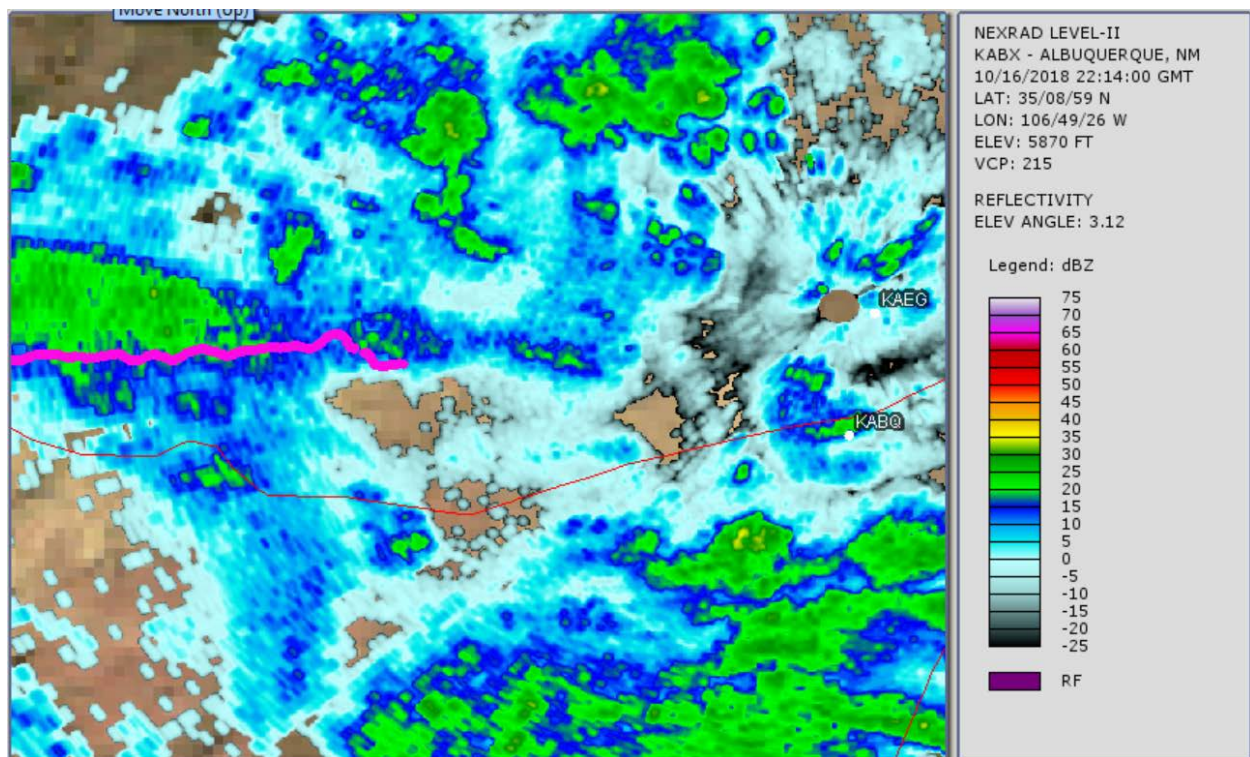


Figure 14 - KABX WSR88D 3.1° base reflectivity image and flight track at 1614:00 MDT

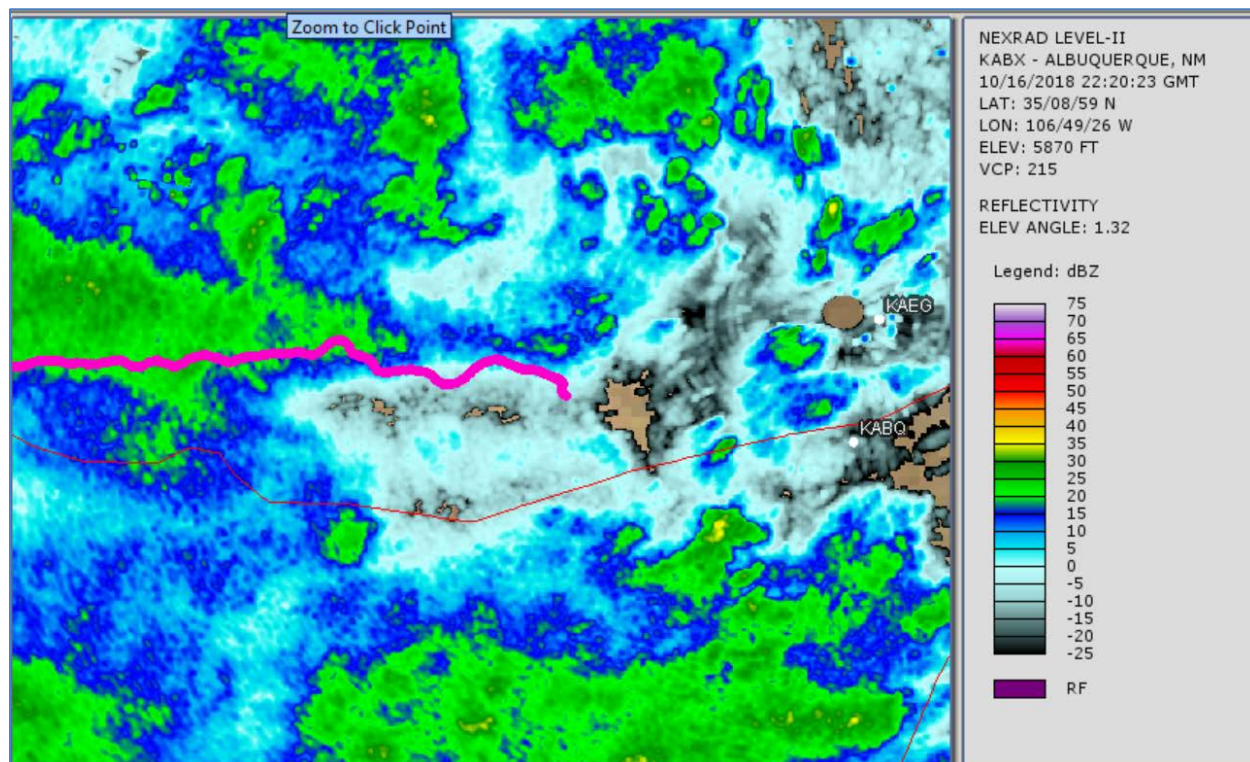


Figure 15 - KABX WSR88D 1.32° base reflectivity image and flight track at 1620:23 MDT

5.3 Dual-Polarization Weather Radar Data

The KABX Dual-Polarization technology was also reviewed; specifically, the differential reflectivity (Zdr)¹⁹ and correlation coefficient (CC)²⁰ data. Figures 16 and 17 are the KABX WSR-88D 3.1° differential reflectivity and correlation coefficient images at 1607:52 and 1614 MDT while the flight had significant echoes over the flight path. The images depicted values of Zdr of 0.5 to 1.5 which indicated echoes more horizontal than vertical in shape, characteristics similar to freezing drizzle and supercooled liquid water droplets.²¹ The CC images depicted high values over 0.97 to 1.0 which indicated that the meteorological echoes within the volume were of similar size and shape, and type (liquid versus solid) and orientation.

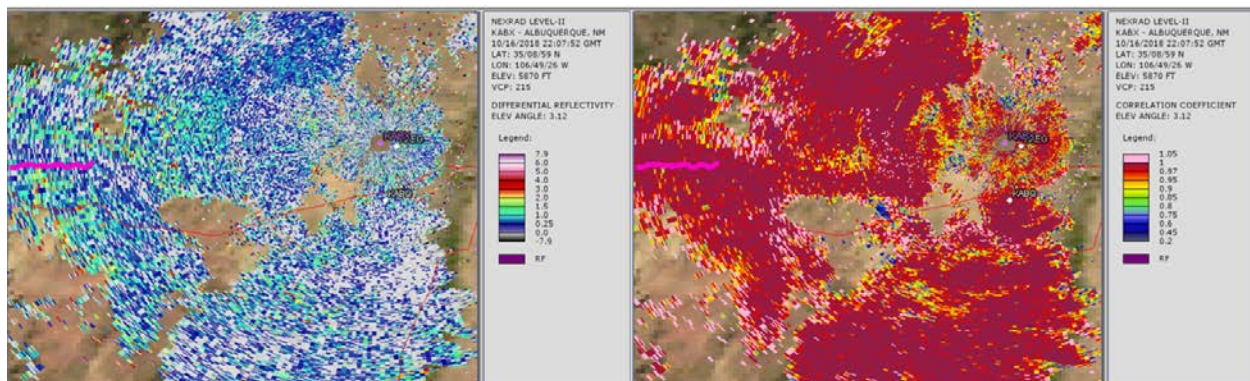


Figure 16 - KABX WSR-88D 3.1° differential reflectivity and correlation coefficient for 1607:52 MDT

¹⁹ Differential Reflectivity (Zdr) – is the logarithmic ratio of the horizontal power return to the vertical power return. Positive values of Zdr indicate that there is more horizontal power return than vertical power return and means that the dominant hydrometeors within the volume are larger in the horizontal than vertical such as rain droplets. Negative values of Zdr indicates that there is more vertical power return than horizontal power return indicating that the dominant hydrometeors are larger in the vertical than in the horizontal such as in crystals or graupel. A near zero values of Zdr indicate horizontal and vertical power return are of similar value, and the hydrometeors are similar in size and shape such as rain droplets.

²⁰ Correlation Coefficient (CC) – is a measure of how similar the horizontal and vertical returned pulse characteristics are among all pulses in the sampled WSR-88D volume scan, and provides information about the diversity of hydrometeors with values between 0 to 1. Meteorological echoes tend to have CC values greater than 0.80.

²¹ Ikeda, Kyoto, Roy M. Roy M. Rasmussen, Edward Brandes, and Frank McDonough, 2009: Freezing Drizzle Detection with WSR-88D Radars. Journal of Applied Meteorology and Climatology, 48, 41-60.

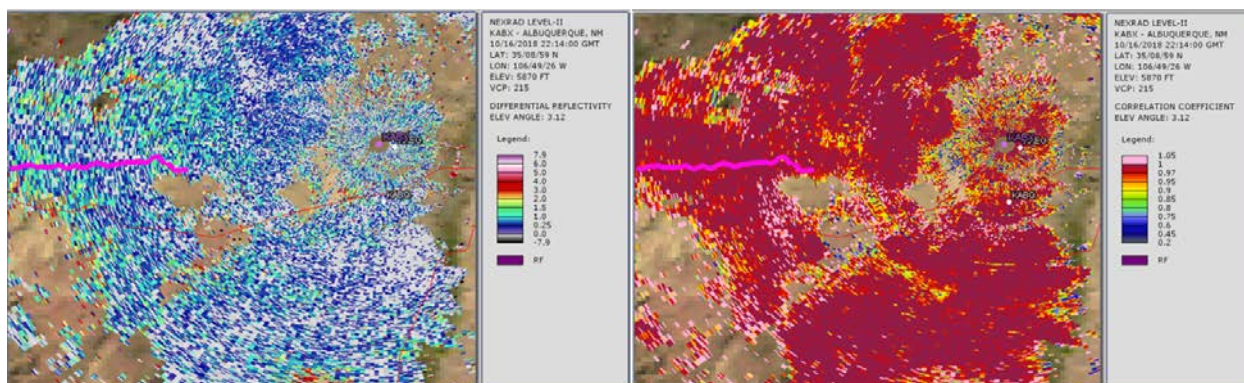


Figure 17 - KABX WSR-88D 3.1° differential reflectivity and correlation coefficient for 1614:00 MDT

6.0 Pilot Reports

The following pilot reports (PIREPs) were recorded within 100 miles of the accident site between 1330 and 2030 MDT. The reports have been decoded from standard code and abbreviations, with time converted to local. The reports were as follows:

ABQ routine pilot report (UA); Over – Albuquerque VORTAC²² 045° azimuth at 12 miles; Time - 1350 MDT; Altitude - 10,000 ft; Type aircraft – Embraer ERJ-175 regional air carrier jet; Turbulence – moderate turbulence between 10,000 and 11,000 ft.

ABQ routine pilot report (UA); Over – ABQ VORTAC 030° azimuth at 17 miles; Time - 1430 MDT; Altitude - 15,000 ft; Type aircraft – Boeing 737 air carrier jet; Turbulence – continuous moderate turbulence; Remarks – on GRZZZ three departure route turbulence from surface through 15,000 ft.

ABQ routine pilot report (UA); Over – ABQ VORTAC 045° azimuth at 30 miles; Time - 1431 MDT; Flight Level²³ - 18,000 ft; Type aircraft – Boeing 737 air carrier jet; Sky cover – tops of clouds at 20,000 ft; Turbulence – moderate from the surface to 18,000 ft; Remarks – during climb.

ABQ routine pilot report (UA); Over – ABQ VORTAC 045° azimuth at 30 miles; time - 1441 MDT; Altitude - 22,000 ft; Type aircraft – Cessna 421 Golden Eagle multiengine aircraft; Sky cover – cloud tops 23,000 ft; Turbulence – light chop.

ABQ routine pilot report (UA); Over – ABQ VORTAC 195° azimuth at 45 miles; Time - 1550 MDT; Altitude - 20,000 ft; Type aircraft – Pilatus PC-12 high performance single engine turboprop; Turbulence – light to moderate turbulence between 17,000 and 21,000 ft.

ABQ routine pilot report (UA); Over – ABQ VORTAC 195° azimuth at 35 miles; Time - 1552 MDT; Altitude - 17,000 ft; Type aircraft – Pilatus PC-12 high performance single engine turboprop; Temperature – minus 10° C; Icing – light rime type icing.

²² VORTAC – is a radio-based navigational aid for pilots which consists of a co-located for Very High Frequency (VHF) Omnidirectional Range (VOR) beacon and a tactical air navigation (TACAN) beacon which provides for distance measuring capability. Unless otherwise noted, the name of the system is collocated with the city or airport name.

²³ Flight Level (FL) – are the altitudes above 18,000 ft reported in hundreds of feet when the aircraft's altimeter is set to 29.92 inches of Hg and the aircraft reports pressure altitude. FL180 is the equal to 18,000 ft msl.

ABQ routine pilot report (UA); Over – ABQ VORTAC 200° azimuth at 25 miles; Time - 1555 MDT; Altitude - 17,000 ft; Type aircraft – Pilatus PC-12 high performance single engine turboprop; Temperature – minus 9° C; Icing – moderate rime type icing between 17,000 and 15,500 ft.

Accident 2222Z

ABQ routine pilot report (UA); Over – ABQ VORTAC 300° azimuth at 50 miles; Time - 1634 MDT; Altitude – 23,500 ft; Type aircraft – Boeing 737 air carrier jet; Temperature – minus 8° C; Icing – light rime type icing.

ABQ routine pilot report (UA); Over – Albuquerque VORTAC 122° azimuth at 26 miles; Time - 1744 MDT; Altitude – during climb; Type aircraft – Embraer ERJ-175 regional air carrier jet; Temperature – 6° C; Icing – trace of icing at 14,000 ft.

ABQ routine pilot report (UA); Over – ABQ VORTAC 285° azimuth at 35 miles; Time - 1811 MDT; Altitude - 15,000 ft; Type aircraft – Pilatus PC-12 high performance single engine turboprop; Temperature – minus 7° C; Icing – light rime type icing.

ABQ routine pilot report (UA); Over – ABQ VORTAC 280° azimuth at 35 miles; Time - 1827 MDT; Altitude - 13,000 ft; Type aircraft – Cessna 404 Titan multiengine airplane; Turbulence – moderate; Icing – light rime type icing.

ABQ routine pilot report (UA); Over – ABQ VORTAC 100° azimuth at 36 miles; Time - 1910 MDT; Altitude - 13,000 ft; Type aircraft – Pilatus PC-12 high performance single engine turboprop; Temperature – minus 3° C; Icing – light to moderate rime type icing between 14,500 and 12,000 ft.

ABQ routine pilot report (UA); Over – ABQ VORTAC 170° azimuth at 35 miles; Time - 1912 MDT; Altitude - 13,000 ft; Type aircraft – Beechcraft King Air multiengine turboprop; Temperature – minus 5° C; Icing – light to moderate rime type icing between 19,000 and 11,000 ft.

ABQ routine pilot report (UA); Over – Albuquerque VORTAC 240° azimuth at 30 miles; Time - 1930 MDT; Flight Level – 19,000 ft; Type aircraft – Embraer ERJ-175 regional air carrier jet; Temperature – minus 10° C; Turbulence – moderate turbulence; Icing – light rime icing from 19,000 and 10,000 ft.

ABQ routine pilot report (UA); Over – ABQ VORTAC 165° azimuth at 20 miles; Time - 2019 MDT; Altitude - 15,000 ft; Type aircraft – Pilatus PC-12 high performance single engine turboprop; Turbulence – moderate turbulence between 14,000 and 16,000 ft; Icing – light rime type ice.

The raw PIREPs in their original format were as follows:

ABQ UA /OV ABQ045012/TM 1950/FL100/TP E75L/TB MOD TURB BTWN 100 AND 110
ABQ UA /OV ABQ030017/TM 2030/FL150/TP B737/TB CONS MOD/RM GRZZZ3 DEPT. SFC-150
ABQ UA /OV ABQ045030/TM 2031/FL180/TP B738/SK TOP200/TB MOD SFC-180/RM ZAB/FDCS - DURC
ABQ UA /OV ABQ045030/TM 2041/FL220/TP C421/SK TOP230/TB LGT CHOP/RM ZAB/FDCS
ABQ UA /OV ABQ195045/TM 2150/FL200/TP PC12/TB LGT-MOD 170-210/RM ZAB/FDCS
ABQ UA /OV ABQ195035/TM 2152/FL170/TP PC12/TA M10/IC LGT RIME/RM ZAB/FDCS
ABQ UA /OV ABQ200025/TM 2155/FL170/TP PC12/TA M09/IC MOD RIME/RM BTW 170-155

Accident 2222Z

ABQ UA /OV ABQ300050/TM 2234/FL235/TP B737/TA M08/IC LGT RIME/RM ZAB/FDCS
ABQ UA /OV ABQ122026/TM 2344/FLDURGC/TP E75L/TA 06/IC TRACE 140/RM ZAB/FDCS
ABQ UA /OV ABQ285035/TM 0011/FL150/TP PC12/TA M7/IC LGT RIME/RM ZAB/FDCS
ABQ UA /OV ABQ280035/TM 0027/FL130/TP C404/TB MOD/IC LGT RIME/RMK ZAB/FDCS
ABQ UA /OV ABQ100036/TM 0110/FL130/TP PC12/TA M3/IC LGT TO MOD RIME ICING 145 TO 120
ABQ UA /OV ABQ170035/TM 0112/FL130/TP BE90/TA M5/IC LGT TO MOD RIME BETWEEN 130 AND 110
ABQ UA /OV ABQ240030/TM 0130/FL190/TP E75L/TA M10/TB MOD TURB/IC LGT RIME BTWN 190-100
ABQ UA /OV ABQ165020/TM 0219/FL150/TP PC12/TB MOD 140-160/IC LGT RIME

7.0 Forecasts & Advisories

The following aviation forecast products were reviewed and documented over the region.

7.1 Terminal Aerodrome Forecast

The NWS KABQ WFO was responsible for the issuance and amendments of the KAEG Terminal Aerodrome Forecast (TAFs). The TAFs issued during the period were as follows:

*TAF KAEG 161734Z 1618/1718 11013KT P6SM BKN080
FM162200 12014G24KT P6SM VCSH OVC070
TEMPO 1622/1702 6SM -SHRASN OVC040
FM170900 12016G24KT P6SM OVC050=*

The forecast for KAEG expected for the estimated time of arrival after 1600 MDT wind from 120° at 14 knots gusting to 24 knots, visibility better than 6 miles with showers in the vicinity, ceiling overcast at 7,000 ft agl, with a temporary condition between 1600 and 2000 MDT of 6 miles in light rain and snow showers, ceiling overcast at 4,000 ft agl.

7.2 Area Forecast Discussion

The KABQ WFO issued the following public discussion regarding the weather conditions over the region, with the aviation section discussing the details on the TAF issued above. The discussion was as follows:

*FXUS65 KABQ 161740 AAB
AFDABQ*

*Area Forecast Discussion...UPDATED
National Weather Service Albuquerque NM
1140 AM MDT Tue Oct 16 2018*

*.AVIATION...
18Z TAF CYCLE*

Varied conditions and a complex forecast for the next 24hrs as an upper low over Arizona nears the New Mexico border and strong easterly low level flow persists. Short-lived MVFR conditions are likely with showers central and west today, but conditions are forecast to deteriorate significantly overnight across eastern New Mexico. LIFR conditions are forecast to develop at KLVN overnight, with freezing drizzle or light freezing rain. IFR conditions are forecast to develop overnight at KROW with drizzle or light rain, but should remain above freezing. MVFR conditions are possible at KTCC, but lower forecast confidence there. Improvement on Wednesday will be slow at best. A stronger easterly canyon/gap wind will develop overnight at KABQ and another Airport Weather Warning will likely be required.

.PREV DISCUSSION...332 AM MDT Tue Oct 16 2018...SYNOPSIS...

Cool, cloudy, and generally unsettled weather will persist over New Mexico for much of the remainder of the week as a low pressure system remains west of the state and continues drawing in a colder, moist airmass. East winds will commonly be gusty in the central Rio Grande valley near Albuquerque and toward the Continental Divide of west central New Mexico. Areas of precipitation will range from rain to high elevation snow showers in western New Mexico, while areas along and east of the central mountain chain tend to observe drizzle or freezing drizzle and sleet. Today, temperatures will remain 10 to 30 degrees below average for mid October, moderating only by a few degrees through the middle to later part of the week.

.DISCUSSION...

Upper level low is likely bottoming out right now over western AZ with some horizontal stretching about a rotating axis. This will pinwheel a lobe of vorticity into western NM this afternoon. This will spread a swath of

showers and perhaps a few thunderstorms into the western to northwestern zones later today while a widespread synoptic easterly surface wind prevails over the state. Driven primarily by upslope, batches of high elevation snow will be possible on the central mountain chain peaks with lower elevation east faces potentially observing some drizzle and freezing drizzle/sleet where boundary layer temperatures remain near/below freezing. Farther east into the plains, precipitation type will predominantly be drizzle or very light rain. Afternoon temperatures will be far below average, but sufficiently warm enough to preclude the need for a winter weather advisory. This will need to be re-evaluated through the day today and perhaps hoisted for tonight as temperatures cool back toward freezing.

The low will fill in about 4 to 5 decameters (at 500 mb) as it lifts slightly north northeastward into UT on Wednesday. While a large source of lift will be lost with decreasing positive vorticity advection, sufficient diffidence aloft and isentropic lift will linger with light precipitation persisting in western NM (much of this likely driven more by easterly upslope over the Divide). The easterly flow will likely undergo a resurgence Wednesday, and according to MOS guidance could approach wind advisory criteria in the middle Rio Grande valley and west central zones. Moving farther east, the east slopes of the central mountain chain will continue to deal with the light, upslope- driven stratiform precipitation, ranging from snow to light rain/drizzle and freezing drizzle or sleet. All things considered, the accumulations of wintry precipitation, whether high elevation snow or lower elevation ice accumulation, will be on the lower side today and through early Thursday, especially considering the window of opportunity for melting in the afternoon hours. Still, subsequent shifts will need to monitor for potential advisory issuance (more-so in the overnight hours).

Into Thursday, the aforementioned low will draw a bit farther northeast, potentially filling in a bit more while an area of new pressure falls begins over the open Pacific waters just west of Tijuana, Mexico. This will cause surface winds to start veering more southerly with upslope gradually fading over most of the Divide and the central mountain chain. Sufficient dynamics aloft within the base of the remnant trough/low will keep some precipitation going over western zones, and mostly in northwestern while eastern zones begin to observe their last stand for precipitation. Temperatures will still be 15 to 25 degrees below normal on Thursday.

By Friday, the developing low over the eastern Pacific will become the more notable feature while a ridge builds to the north of it near WA/OR. Despite the appearance of a rex block, this setup doesn't hold for long, with the low shifting eastward as a weak, but somewhat negatively-tilted open trough over the American Southwest by late this weekend. Much lower precipitation chances will be in the works for NM Friday and Saturday, gradually trending up from the west/southwest into Sunday and Monday as the trough approaches. This trough would have the benefit of deeper moisture potentially being drawn northward ahead of it. Temperatures will be struggling to climb toward normalcy through this time with most locations in NM still falling short by 5 to 10 degrees.

.FIRE WEATHER...

An upper level low pressure system will remain stalled over AZ until Wednesday and Wednesday night, when it will drift northward over UT. The storm system will draw low level moisture over NM from the east and southeast in the process with a chance for rain and snow showers. The best chance for any wetting precipitation will be from the east slopes of the central mountain chain westward, and especially across the high terrain where some spots may accumulate over a half foot of snow. Precipitation chances will linger into Thursday and Thursday night as the upper low opens into a trough and shifts eastward across the central Rockies. The easterly and southeasterly low level flow will produce moderate to strong gap winds below canyons from Santa Fe southward today through Wednesday evening. Gusts may peak near 45 mph in Albuquerque and Grants Wednesday. Pockets of poor ventilation that develop along and east of the central mountain chain Wednesday will spread to much of the forecast area Thursday.

In the wake of the exiting upper level trough a dry back door front will spread quickly southwestward across the entire forecast area on Friday producing a sharp decrease in humidity's, especially across the east. The drying trend will continue at a more modest pace through Saturday most places. Poor ventilation is forecast to persist through Friday, except across the northeast where the front will be gusty enough for some ventilation improvement. Widespread poor ventilation is then expected to return to north central and eastern areas on Saturday, while the west experiences some improvement. Warmer conditions will also accompany the dry air at the end of the week.

On Sunday and Monday a fairly weak upper level low pressure system is forecast to approach NM from the west drawing better moisture and a chance for rain showers and very high terrain snow showers over the state. This will be a warmer system, so temperatures may manage to climb some as it approaches and the showers arrive.

.ABQ WATCHES/WARNINGS/ADVISORIES...
None.

7.3 Graphic Forecast for Aviation

The NWS AWC Graphic Forecast for Aviation (GFA) for the southwest United States forecast for wind, expected weather, and general flight categories issued at approximately 1000 MDT and valid for 1500 MDT is included as figure 18. The graphic provides a quick flight category forecast of surface visibility, expected wind depicted by standard wind barbs, with gusts indicated by red barbs, and expected precipitation type. In addition, AIRMETs for IFR conditions will also be depicted in pink and AIRMETs for high winds in light orange if applicable. The chart depicted westerly winds of 10 knots over the Albuquerque area (within red circle) with an AIRMET for IFR conditions over central and eastern Arizona along the route of flight with generally VFR conditions expected over New Mexico, with a chance of rain showers expected over the area.

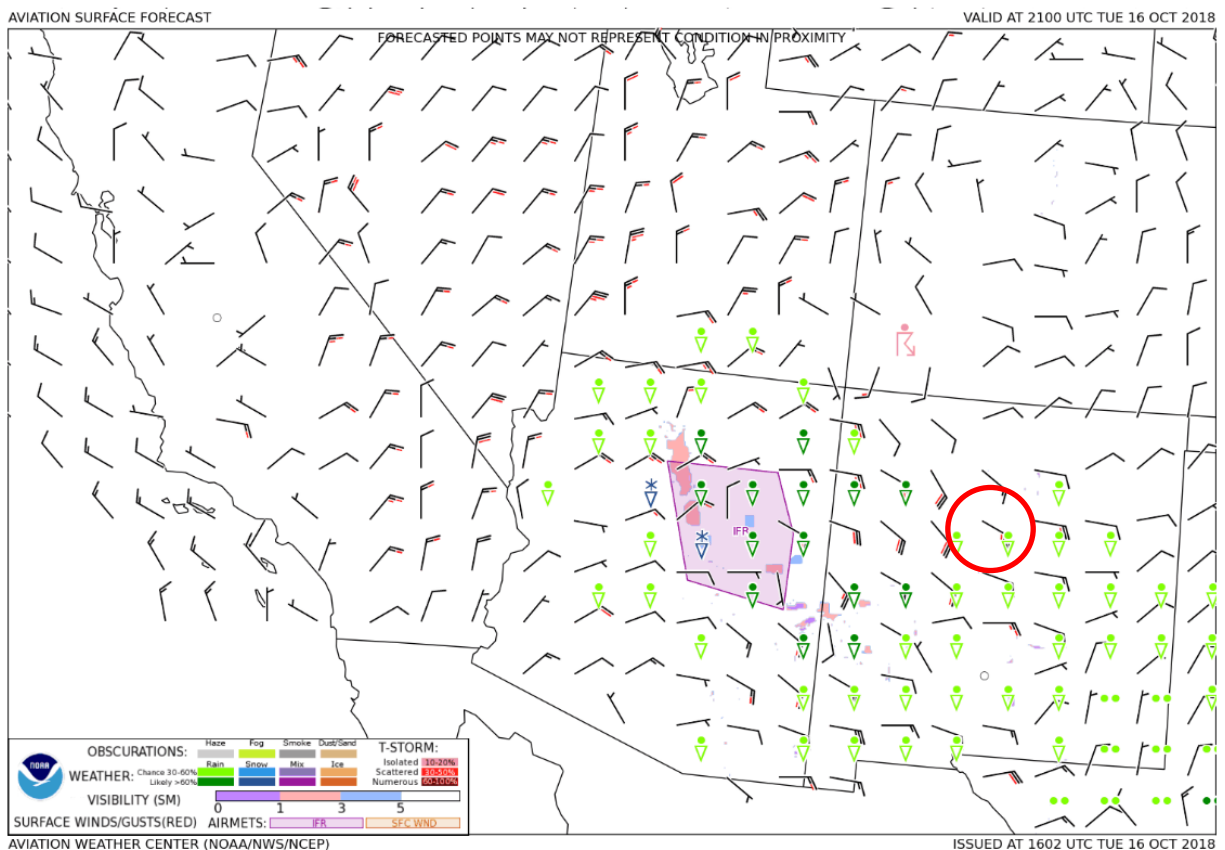


Figure 18 - GFA southwest surface forecast issued at 1000 MDT and valid for 1500 MDT

The GFA southwest graphic of cloud coverage with bases and expected tops, with AIRMETs for mountain obscuration in pink and icing conditions in light blue for 1500 MDT is included as figure 19. The chart depicted varying cloud cover over the route with areas of broken to overcast cloud coverage and with AIRMETs for icing and mountain obscuration over the region, which

included the accident site. The cloud coverage varies with a sky clear to overcast at 10,000 ft with tops to 18,000 ft.

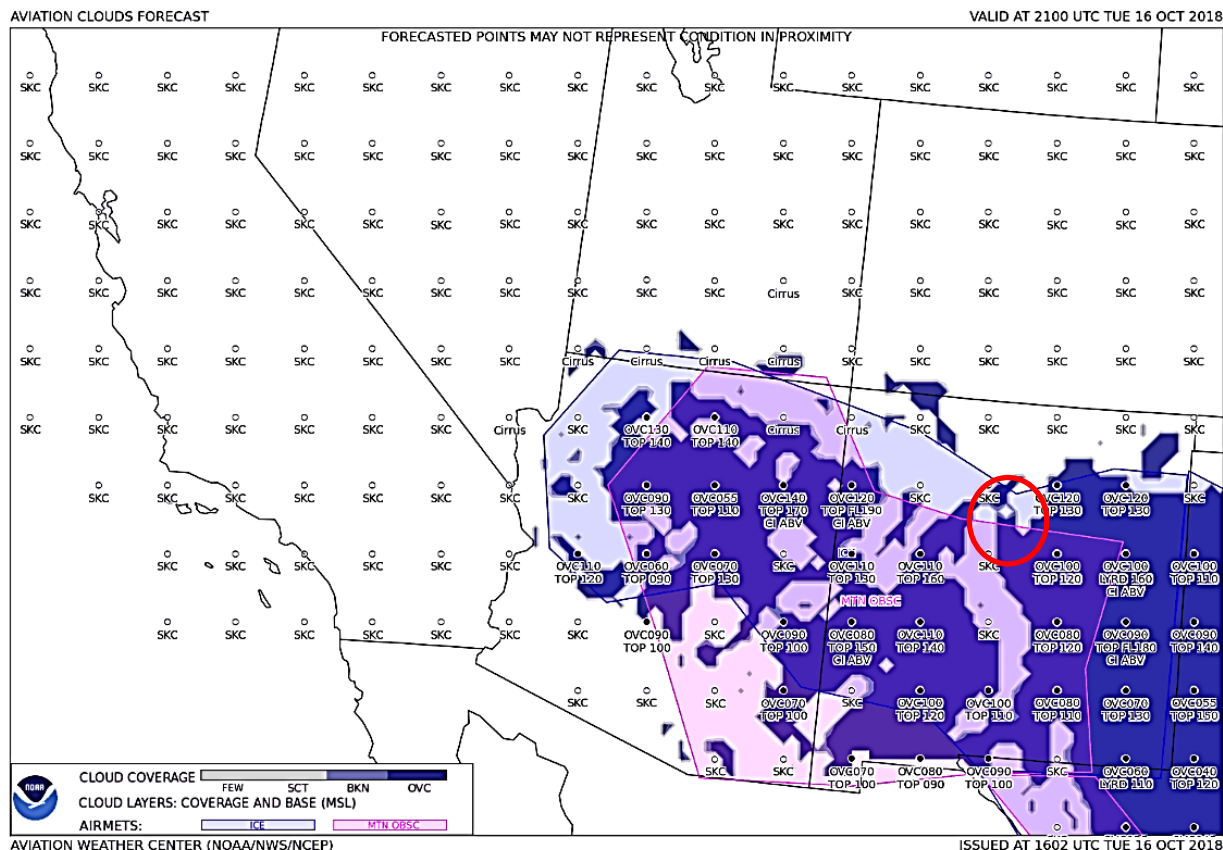
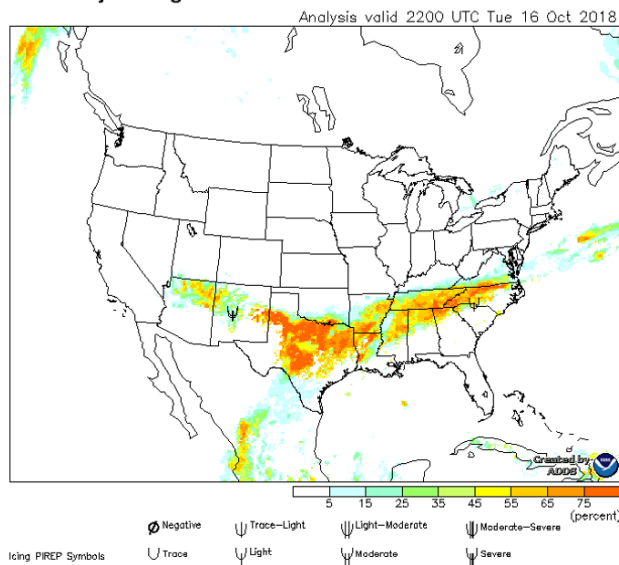


Figure 19 - GFA southwest cloud coverage forecast issued at 1002 MDT and valid for 1500 MDT

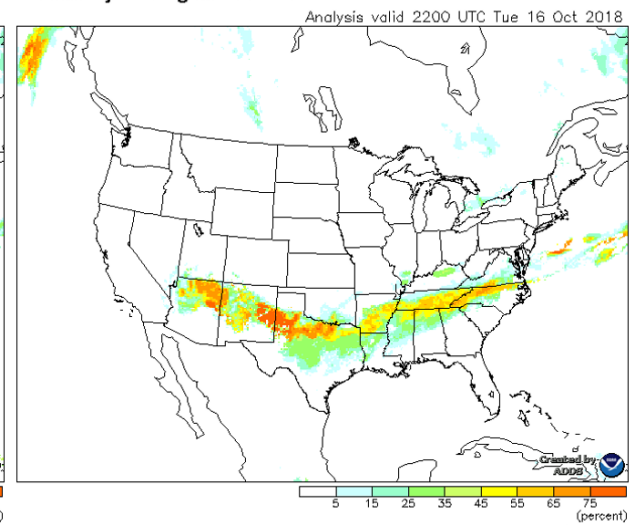
7.4 Current Icing Product

The NWS AWC Current Icing Products (CIP) analysis for 1600 MDT is included as figure 20 and provided the icing probability at 2,000 ft increments from 17000 ft, 15000ft, 13000 ft, and 11000 ft. The CIP analysis indicated a greater than 65% probability of icing conditions across Arizona into western New Mexico, with a probability of 35% of icing in the KABQ area at the accident airplanes cruising level at 16,500 ft and increased to over 75% at 13,000 and 11,000 ft.

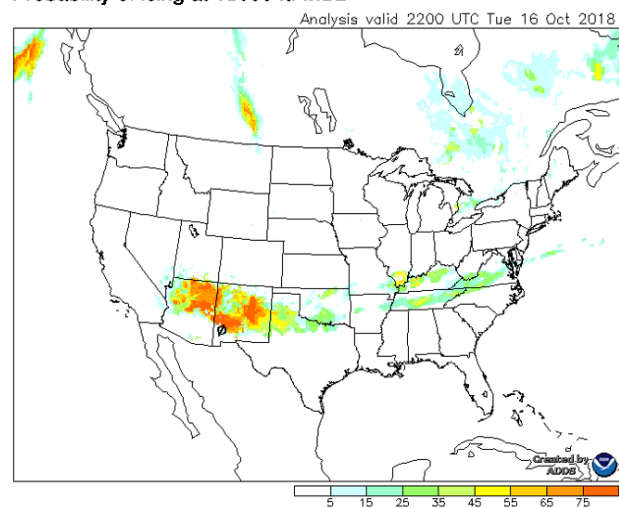
Probability of icing at 17000 ft. MSL



Probability of icing at 15000 ft. MSL



Probability of icing at 13000 ft. MSL



Probability of icing at 11000 ft. MSL

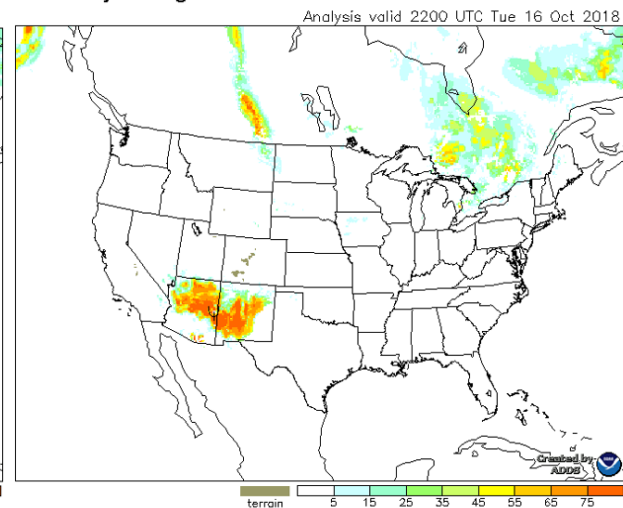
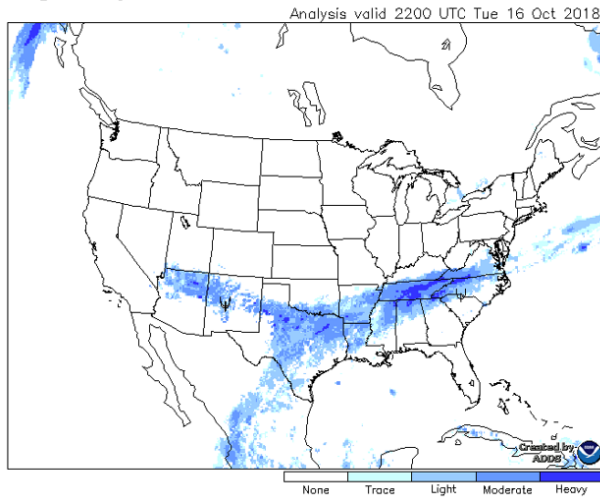


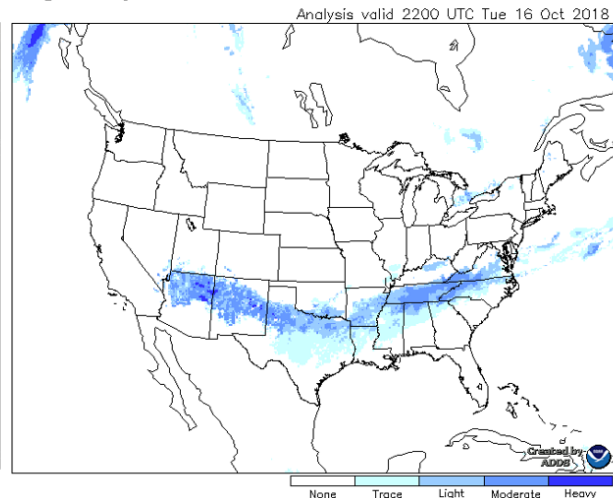
Figure 20 - CIP Probability of Icing at 17000 ft (top left), 15000 ft (top right), 13000 ft (bottom left), and 11000 ft (bottom right) for 1600 MDT

The NWS AWC CIP icing severity for 17,000 through 9,000 ft are included in figure 21 and indicated a threat for light to moderate intensity icing at cruise and on descent into the KABQ area at 1600 MDT.

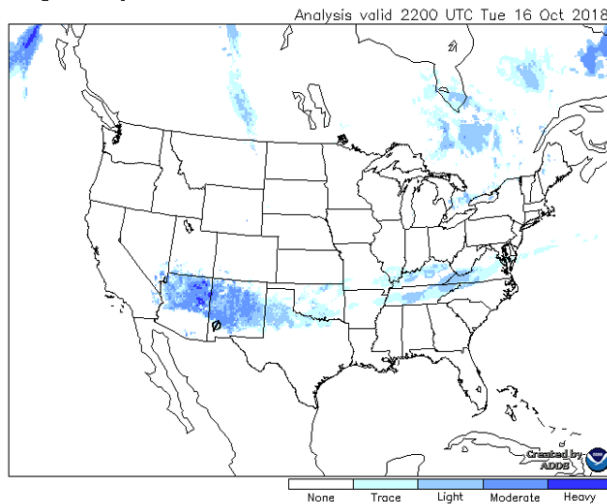
Icing severity at 17000 ft. MSL



Icing severity at 15000 ft. MSL



Icing severity at 13000 ft. MSL



Icing severity at 11000 ft. MSL

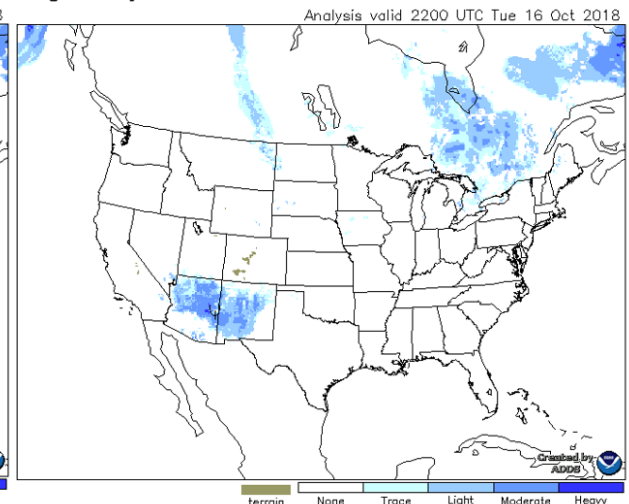


Figure 21 - CIP Icing Severity at 17000 ft (top left), 15000 ft (top right), 13000 ft (bottom left), and 11000 ft (bottom right) for 1600 MDT

7.5 Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA Air Route Traffic Control Center's (ARTCCs).

There are four basic types of inflight aviation weather advisories: the Significant Meteorological Advisory (SIGMET), the Convective SIGMET, AIRMET, and the Center Weather Advisory (CWA). During the period only a set of AIRMETs were issued for the area that impacted the flight, which are included below with the bold advisories current over the route of flight. Figure 22 is a plot of G-AIRMET Sierra for IFR and mountain obscuration conditions and AIRMET Zulu for icing conditions over the southwest.

WAUS45 KPCI 162045

WA5S

SLCS WA 162045

AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 170300

.

AIRMET IFR...AZ NM

**FROM 60NE PGS TO 30NE INW TO 20SSE DMN TO 30NE PHX TO 60NE PGS
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS ENDG 00-03Z.**

.

AIRMET MTN OBSCN...UT CO AZ NM

**FROM 40WSW HBU TO 20NW TCC TO CME TO 60W INK TO ELP TO 60S TUS
TO 20WNW PHX TO 70SW DRK TO 30S PGS TO 50S BCE TO 40WSW HBU
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.**

.

OTLK VALID 0300-0900Z...MTN OBSCN UT CO AZ NM

**BOUNDED BY 40NW DEN-30SSE PUB-20S TBE-CME-40W INK-ELP-60S TUS-
20W PHX-70SW DRK-20WSW PGS-20SW BCE-40W JNC-40ESE JNC-40NW DEN
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG THRU 09Z.**

....

WAUS45 KPCI 162045

WA5T

SLCT WA 162045

AIRMET TANGO UPDT 5 FOR TURB VALID UNTIL 170300

.

AIRMET TURB...CO AZ NM

**FROM 30NW RSK TO 30ESE TBE TO 70WSW LBB TO 50S TUS TO BZA TO 30NW RSK
MOD TURB BTN FL180 AND FL300. CONDS CONTG BYD 03Z ENDG 03-06Z.**

.

AIRMET TURB...NV UT CO AZ NM

**FROM 20S BCE TO 30ESE TBE TO 20W TXO TO 20ENE ELP TO 50S SSO TO
30SSE PHX TO 40ENE LAS TO 20S BCE
MOD TURB BLW FL180. CONDS CONTG BYD 03Z THRU 09Z.**

WAUS45 KPCI 162045

WA5Z

SLCZ WA 162045

AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 170300

.

AIRMET ICE...NV UT CO AZ NM

**FROM 20S JNC TO LAA TO 50W LBL TO 30ESE TBE TO INK TO ELP TO 40SSW DMN TO SSO TO
TUS TO 40SSE EED TO 30S LAS TO 60SSW ILC TO 50W BCE TO 40NNE BCE TO 20S JNC
MOD ICE BTN FRZLVL AND FL210. FRZLVL 070-110. CONDS CONTG BYD 03Z THRU 09Z.**

.

FRZLVL...RANGING FROM SFC-125 ACRS AREA

**MULT FRZLVL 050-090 BOUNDED BY 50ESE TBE-INK-ELP-60SE SSO-
60NNE SSO-40NW TCS-50NNW ABQ-20WNW FTI-50ESE TBE
SFC BOUNDED BY 20ESE CHE-30W DEN-40ENE HBU-20ESE CHE
080 ALG 70S YYN-70NW RAP
080 ALG 70SSW TXO-30NE ABQ-60WNW ABQ-40ENE SJN-70E ELP**

....

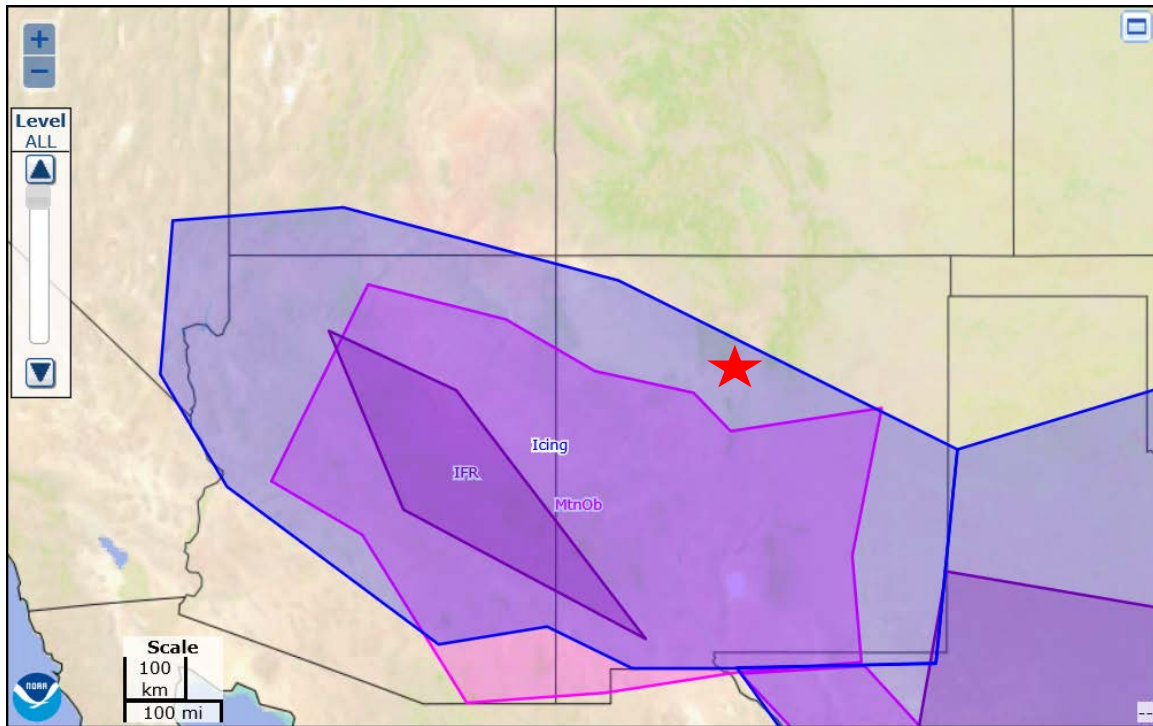


Figure 22 - Graphic-AIRMETs for icing, IFR and mountain obscuration conditions valid at 1600 MDT

7.6 Winds and Temperatures Aloft Forecast

The NWS Winds and Temperatures Aloft Forecast current for the period for the route of flight is included below, the forecast was based on observations and model run data from 0600 MDT and valid for 1800 MDT, and for use between 1500 and 2400 MDT.

FBUS33 KWNO 161357

FD3US3

-DATA BASED ON 161200Z

VALID 170000Z FOR USE 2100-0600Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
----	------	------	------	-------	-------	-------	-------	-------	-------

LAS	0317+09	0521+02	0424-04	0526-16	0414-30	081345	021548	301650	
-----	---------	---------	---------	---------	---------	--------	--------	--------	--

PRC		0611-01	1107-05	0817-18	0833-29	201239	233342	234244	
-----	--	---------	---------	---------	---------	--------	--------	--------	--

PHX	0616	1108+06	9900+01	2012-06	2115-18	2350-25	245837	236042	234647
-----	------	---------	---------	---------	---------	---------	--------	--------	--------

ZUN		1527+01	1617-04	1020-17	1811-28	226238	226842	225747	
-----	--	---------	---------	---------	---------	--------	--------	--------	--

ABQ		1032+00	1428-02	1528-18	2151-24	238237	228444	228849	
-----	--	---------	---------	---------	---------	--------	--------	--------	--

The forecast for ABQ at 9,000 ft expected a wind from 100° at 32 knots with a temperature of 0° C. At 12,000 ft a wind from 140° at 28 knots with a temperature -2° C.

8.0 Preflight Weather Briefing

There was no record of any preflight weather briefing, inflight updates, or flight plan being filed for N9326G during the period from the FAA contract Automated Flight Service Station (AFSS) provider Leidos, and from any other third party online weather vendors such as ForeFlight that use the Leidos system. It is therefore unknown what the pilot used to become familiar with the weather conditions prior to departure.

9.0 Witness Statements

The first responders reaching the accident site was a Helicopter Emergency Medical Service (HEMS) pilot and his crew of two medical personnel who had been advised by ABQ air traffic control of the emergency situation taking place with N9326G and responded to the accident site. The pilot's statement is included as attachment 2. Regarding the weather conditions, the HEMS pilot indicated that he spotted the wreckage about a mile out and arrived overhead at 1629 MDT. He estimated the ceiling to be around 1,800 ft agl, and the prevailing visibility to be 8 miles in light rain. Conditions to the southwest were worsening and he indicated that snow showers obscured the higher terrain beyond. He landed the helicopter at 1630 MDT upwind of the accident site and noted the outside air temperature (OAT) on the ground indicated 5° C. The medical team proceeded to the accident site to provide any assistance but found no survivors. The pilot then radioed back their position to ATC and shut down the helicopter, and then walked to the accident site. He observed several pieces of mixed ice shed from the leading edge of the left wing, which were rectangle in shape 12 to 18 inches in length, 4 to 5 inches in height, and ¼ to 3/8 inch thick, He did a cursory walk around the wreckage but did not notice ice on any other visible surfaces, but the weather conditions were beginning to rapidly deteriorating, and he did not do an in-depth analysis. He then noticed multiple emergency vehicles ½ mile and directed them to the site by the use of a strobe flashlight. They turned the scene over to the Bernalillo County Sheriff's Deputies and departed the landing zone at 1705 MDT.

10.0 Astronomical Conditions

The United States Naval Observatory website²⁴ provided the following astronomical conditions for Albuquerque, Bernalillo County, New Mexico. The time of the accident has been added in bold print for reference.

<u>Sun</u>	
Beginning of civil twilight	0648 MDT
Sunrise	0713 MDT
Sun transit	1252 MDT
Accident	1622 MDT
Sunset	1630 MDT
End of civil twilight	1655 MDT

²⁴ http://aa.usno.navy.mil/data/docs/RS_OneDay.php

At the time of the accident the Sun was approximately 24° above the horizon and at an azimuth of 238°, but was not visible at low altitude due to the overcast cloud cover over the region.

F. LIST OF ATTACHMENTS

Attachment 1 – Flight track of N9326G

Attachment 2 – Helicopter pilot witness statement

Submitted by:

Don Eick
Senior Meteorologist