National Transportation Safety Board

Office of Aviation Safety

Washington, D.C. 20594-2000

June 13, 2011

METEOROLOGICAL FACTUAL REPORT

WPR11FA173

A. ACCIDENT

Location: Daggett, California
Date: March 20, 2011
Time: About 1237 Pacific daylight time (1937 UTC[1])
Aircraft: Cessna P210; registration N50MC

B. METEOROLOGICAL SPECIALIST

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Senior Meteorologist
National Transportation Safety Board
Operational Factors Division, AS-30
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C. SUMMARY

On March 20, 2011, about 1237 Pacific daylight time, a Cessna P210N Silver Eagle, N50MC, was substantially damaged when it departed from cruise flight and impacted rocky desert terrain about 2 miles south of Barstow-Daggett Airport (KDAG), Daggett, California. The certificated private pilot/co-owner and her two passengers were fatally injured. The personal flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91, and instrument meteorological conditions prevailed for some portion of the climb to cruise altitude. The airplane was operating on an instrument flight rules (IFR) flight plan from John Wayne Airport-Orange County (KSNA), Santa Ana, California, to Henderson Executive Airport (KHND), Las Vegas, Nevada.

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

D. DETAILS OF INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist 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 Pacific daylight time (PDT) based upon the 24 hour clock, local time is +7 hours to UTC, and UTC=Z. Directions are referenced to true north and distances in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles.

The accident site was at latitude 34.8288° N and longitude 116.7909° W, at an elevation of 2,270 feet.

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 1200 PDT (1800Z) on March 20, 2011 is provided as figure 1, with the approximate location of the accident site marked. The chart depicted a low pressure system over southwest Oregon with a central pressure of 992-hectopascals (hPa) with an occluded front extending southeastward from the low across southern Oregon into northern California where the front became a cold front and extended southwestward across California into the Pacific Ocean in the vicinity of Santa Barbara. A separate trough of low pressure was depicted extending across Nevada into Arizona. The accident site was located between the cold front and the trough of low pressure in an area of a weak high pressure ridge.

The station models over southwest California indicated strong southerly winds with light to moderate rain, and overcast clouds, which extended over the departure airport. In the vicinity of the accident site, the Barstow-Daggett Airport station model depicted a calm wind, broken clouds, a temperature of 57° Fahrenheit (F), dew point 29° F, and a sea level pressure of 1008.2-hPA.

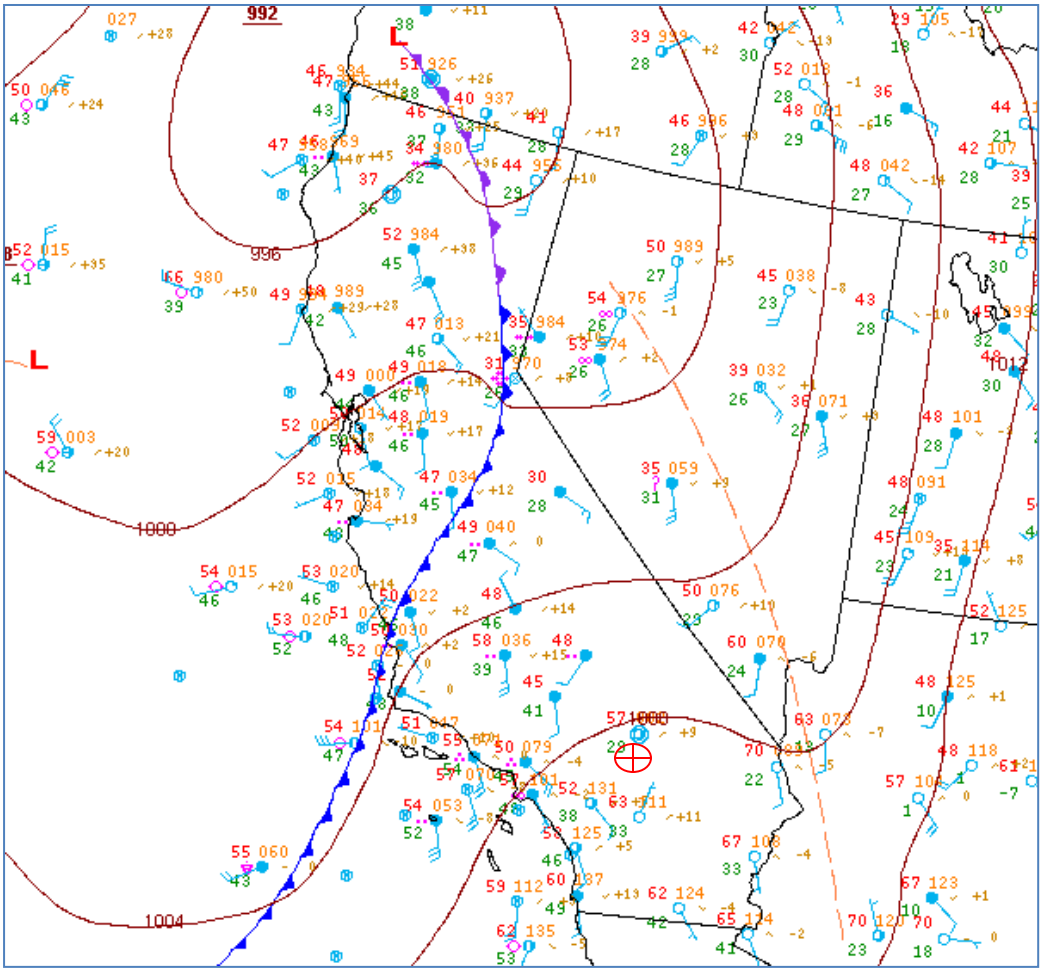


Figure 1 – NWS Surface Analysis Chart for 1100 PDT

1.0.2 Weather Depiction Chart

The NWS Weather Depiction Chart for 1200 PDT is included as figure 2. The chart depicted an area of instrument flight rule (IFR) conditions[2] over southwest California coastal area by a shaded contour line. Surrounding that area was an area of marginal visual flight rules (MVFR) conditions[3] indicated by an unshaded contour over a large portions of western and northern California to the west and north of the accident site. Visual flight rule (VFR) conditions[4] were depicted without a contour line over the accident site and southeastern California.

[2] 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.

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

[4] VFR conditions – are defined as no ceiling or a ceiling greater than 3,000 feet agl and visibility greater than 5 miles.

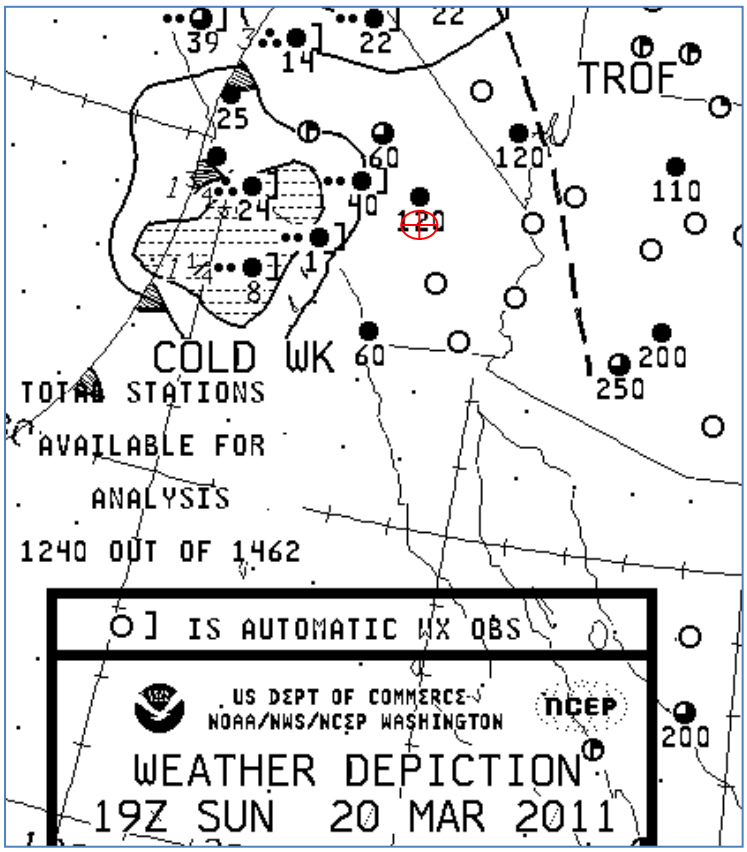
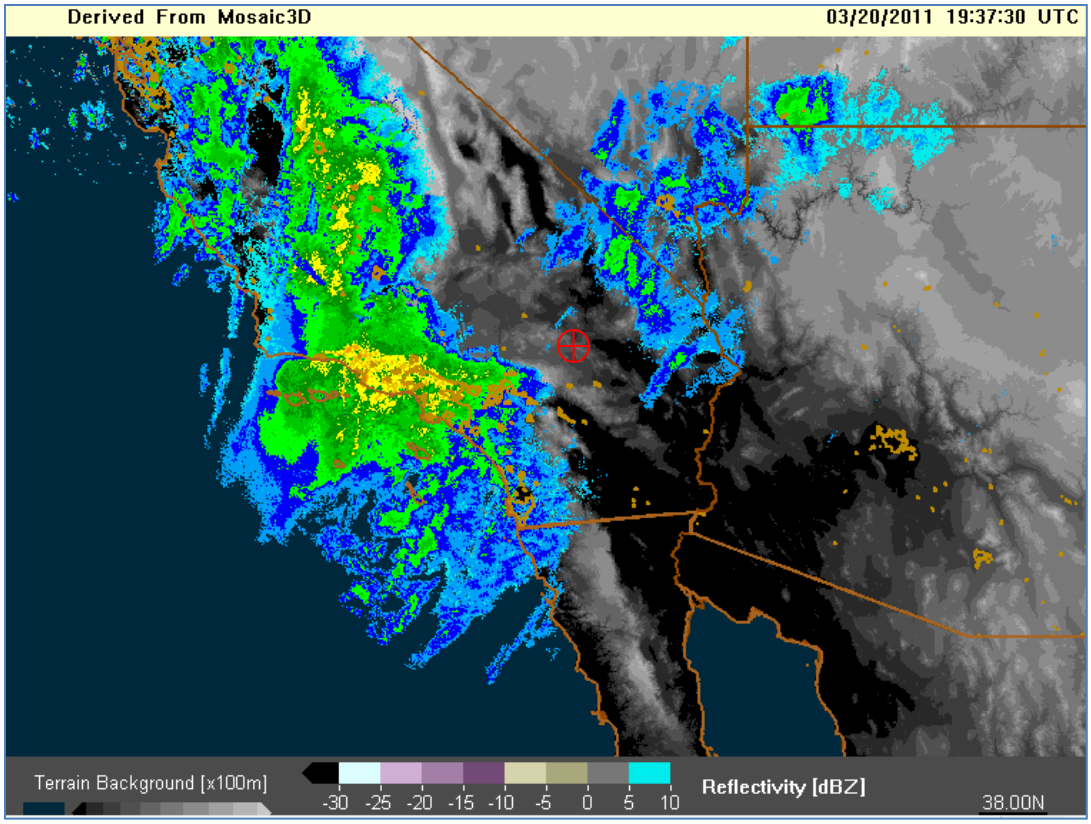


Figure 2 – NWS Weather Depiction Chart for 1200 PDT

1.0.3 Radar Summary Chart

The NWS regional radar mosaic chart completed at 1237 PDT (1937Z) is included as figure 3 with the approximate accident site marked. The chart depicted a large area of echoes associated with thunderstorms and rain showers extending over western and central California immediately west of the accident site. While no large area of echoes were identified in the vicinity of the accident site, section 6.0 of this report will examine the local weather radar and aircraft flight track in more detail.



Figures 3 - NWS Radar Summary Chart for 1237 PDT

2.0 Surface Observations

The surrounding area was documented utilizing standard NWS Meteorological Aerodrome Reports (METARs) and special observations. The following section reports cloud heights above ground level (agl).

2.1 Barstow-Daggett Airport (KDAG), Daggett, California

The closest weather reporting facility to the accident site was from Barstow-Daggett Airport (KDAG), Daggett, California, and located 1 1/2 miles north of the accident site at an elevation of 1,930 feet msl. The airport reported a magnetic variation of 15° east, and had an Automated Surface Observation System (ASOS) installed which reported the following conditions surrounding the accident:

KDAG weather observation at 1151 PDT, automated observation[5], wind from 090° at 5 knots, visibility 10 miles, ceiling overcast at 12,000 feet agl, temperature 14° Celsius (C), dew point -2° C, altimeter 29.78 inches of mercury (Hg). Remarks: automated observation system,

[5] Automated indicates that there was no human augmentation of the observation.

sea level pressure 1007.6-hPa, temperature 14.4° C, dew point -1.7° C, thunderstorm sensor inoperative, maintenance indicator on[6].

Accident occurs at 1236 PDT.

KDAG weather observation at 1251 PDT, automated observation, wind from 080° at 5 knots, visibility 10 miles, scattered clouds at 11,000 feet agl, temperature 16° C, dew point -2° C, altimeter 29.76 inches of Hg. Remarks: automated observation system, sea level pressure 1006.7-hPa, temperature 16.1° C, dew point -2.2° C, thunderstorm sensor inoperative, maintenance indicator on.

A ceiling again was reported at 1351 PDT with an overcast layer of clouds at 10,000 feet agl, pressure continued to fall at KDAG surrounding the period with wind gusts to 30 knots and precipitation reported after 1900 PDT. The following are the raw observations from KDAG surrounding the period:

METAR KDAG 201751Z AUTO 00000KT 10SM BKN120 14/M02 A2980 RMK AO2 SLP082 T01391017 10139 20061 51009 TSNO $

METAR KDAG 201851Z AUTO 09005KT 10SM OVC120 14/M02 A2978 RMK AO2 SLP076 T01441017 TSNO $

Accident 1936Z

METAR KDAG 201951Z AUTO 08005KT 10SM SCT110 16/M02 A2976 RMK AO2 SLP067 T01611022 TSNO $

METAR KDAG 202051Z AUTO 00000KT 10SM OVC100 16/M04 A2973 RMK AO2 SLP060 T01561044 58021 TSNO $

METAR KDAG 202151Z AUTO 06008KT 10SM BKN110 16/M04 A2970 RMK AO2 SLP047 T01611039 TSNO $

METAR KDAG 202251Z AUTO 07006KT 10SM OVC110 16/M04 A2967 RMK AO2 SLP036 T01611044 TSNO $

METAR KDAG 202351Z AUTO 02005KT 10SM OVC110 16/M06 A2964 RMK AO2 SLP027 T01611056 10167 20133 56030 TSNO $

METAR KDAG 210051Z AUTO 28005KT 10SM OVC090 16/M04 A2961 RMK AO2 SLP016 T01561044 TSNO $

METAR KDAG 210151Z AUTO 14005KT 10SM FEW075 OVC095 14/M03 A2962 RMK AO2 SLP020 T01441028 TSNO $

METAR KDAG 210251Z AUTO 14020G30KT 10SM BKN075 OVC100 14/M05 A2959 RMK AO2 PK WND 14030/0249 SLP012 T01441050 56014 TSNO $

METAR KDAG 210351Z AUTO 16016G21KT 10SM BKN070 BKN090 OVC100 14/M03 A2959 RMK AO2 SLP009 T01391033 TSNO $

METAR KDAG 210451Z AUTO 17018G24KT 10SM FEW070 12/M01 A2960 RMK AO2 PK WND 17028/0415 SLP012 T01221006 TSNO $

[6] The maintenance indicator indicated by the "$" symbol is reported by the system to alert those monitoring the system that one or more of the sensors are inoperative or the system is in need of calibration and maintenance.

METAR KDAG 210551Z AUTO 18012KT 10SM SCT050 BKN070 11/02 A2961 RMK AO2 PK WND 18026/0508 SLP016 T01110022 10161 20111 53005 TSNO $

METAR KDAG 210651Z AUTO 22015G27KT 10SM -RA SCT060 BKN075 BKN090 09/03 A2963 RMK AO2 PK WND 21027/0643 RAB46 SLP022 P0000 T00940033 TSNO $

METAR KDAG 210751Z AUTO 19017G23KT 10SM -RA SCT055 BKN075 OVC095 08/04 A2961 RMK AO2 SLP017 P0004 T00830044 401670061 TSNO $

2.2 Southern California Logistics Airport (KVCV), Victorville, California

Southern California Logistics Airport (KVCV), located in Victorville, California, was also along the accident airplanes route of flight and approximately 35 miles southwest of the accident site at an elevation of 2,885 feet msl had an Automated Weather Observation System (AWOS-3) and reported the following conditions at the approximate time of the accident:

KVCV weather at 1234 PDT, automated, wind from 190° at 29 knots gusting to 38 knots, visibility 10 miles, scattered clouds at 3,300 feet agl, scattered at 6,000 feet, scattered at 11,000 feet, temperature 12° C, dew point 2° C, altimeter 29.71 inches of Hg. Remarks: automated observation system without a precipitation discriminator.

The next observation at 1256 PDT reported sustained wind from 190° at 39 knots with gusts to 51 knots, and at 1314 PDT continued to report high winds with IFR conditions due to 2 miles in haze, scattered clouds at 100 feet, ceiling broken at 3,500 feet, and broken at 5,000 feet. A review of the raw observation indicated an extended period prior to the accident or wind gusts over 25 knots. The raw observations surrounding the period were as follows:

KVCV 201714Z AUTO 17019G28KT 7SM -RA SCT035 SCT065 BKN075 09/03 A2981 RMK AO1

KVCV 201754Z AUTO 19019G27KT 10SM SCT036 BKN070 BKN110 09/03 A2979 RMK AO1

KVCV 201814Z AUTO 17028G32KT 7SM -RA SCT019 BKN029 BKN040 09/05 A2978 RMK AO1

KVCV 201834Z AUTO 17026G35KT 10SM SCT029 BKN047 BKN100 09/04 A2977 RMK AO1

KVCV 201854Z AUTO 19027G39KT 10SM SCT030 SCT100 11/04 A2975 RMK AO1

*KVCV 201914Z AUTO **18028G45KT** 10SM SCT032 SCT065 BKN070 11/04 A2973 RMK AO1*

KVCV 201934Z AUTO 19029G38KT 10SM SCT033 SCT060 SCT110 12/02 A2971 RMK AO1

Accident at 1936Z

*KVCV 201956Z AUTO **17039G51KT** 7SM SCT033 SCT043 BKN110 11/03 A2971 RMK AO1*

*KVCV 202014Z AUTO **18038G49KT 2SM HZ** SCT001 BKN035 BKN050 11/02 A2970 RMK AO1*

*KVCV 202034Z AUTO **17035G43KT** 10SM SCT030 SCT038 SCT110 12/02 A2969 RMK AO1*

*KVCV 202054Z AUTO **17033G40KT 7SM -RA** SCT031 BKN050 BKN070 09/04 A2970 RMK AO1*

KVCV 202114Z AUTO 18027G36KT 10SM SCT033 SCT070 SCT100 11/03 A2970 RMK AO1

*KVCV 202135Z AUTO **17027G43KT** 10SM SCT034 SCT044 09/03 A2971 RMK AO1*

*KVCV 202154Z AUTO **18032G42KT** 10SM SCT036 SCT050 11/02 A2969 RMK AO1*

KVCV 202214Z AUTO 17024G30KT 10SM SCT027 SCT045 11/03 A2967 RMK AO1

KVCV 202234Z AUTO 18022G39KT 10SM -RA SCT037 BKN045 BKN090 09/03 A2967 RMK AO1

*KVCV 202254Z AUTO **18032G43KT** 10SM SCT033 SCT041 09/02 A2966 RMK AO1*

KVCV 202314Z AUTO 17027G35KT 10SM SCT039 SCT100 09/02 A2966 RMK AO1

KVCV 202334Z AUTO 18031G40KT 10SM SCT030 SCT038 BKN100 09/02 A2965 RMK AO1

3.0 MesoWest Observations

Figure 4 is a plot of the MesoWest plot of the NWS remote observation sites wind data across the region at 1238 PDT on March 20, 2011. The sustained wind speeds are provided in miles per hour (mph) in a box on the left of the station with the maximum wind gust on the right side of the station, also in mph. Barstow-Daggett Airport (KDAG) is located immediately north of the accident site in the top right section of the image and Southern California Logistics Airport (KVCV), Victorville, near the center of the image. Several other selected sites are indicated which also reported strong wind during the period with multiple stations reporting wind gusts in excess of 57 mph (50 knots), such as Burns Canyon, Chilao, Mill Creek, and Henninger Flats. The following table is a listing of several surrounding stations arranged by distance away from the accident site, the wind direction and speed in mph, temperature, dew point, and relative humidity.

Station	***Identifier***	***Elevation (feet)***	***Location (dir/nm)***	***Wind (dir/speed mph)***	***Temp (°F)***	***Dew point (°F)***	***Relative Humidity***
Apple Valley	GNTC1	3162	SW 24	SSW 21 G 40	53	31	43
Big Bear	KL35	6752	S 34	SW 21 G 38	36	12	37
Means Lake	MNLC1	2818	SE 35	SE 24 G 36	57	17	21
Heaps Peak	TS957	6350	SSW 38	SSE 29 G 46	31	31	98
Burns Canyon	BCNC1	6284	SSE 39	SW 65 G 110	42	4	20
El Mirage	EMRC1	2880	WSW 40	SSE 22 G 39	51	39	64
Chilao	CHOC1	5450	SSW 67	SE 40 G 77	32	32	99
Mill Creek	ANF	5021	SSW 69	S 37 G 72	36	35	95
Henninger Flats	HNGC1	2800	SSW 75	E 52 G 116	43	41	91

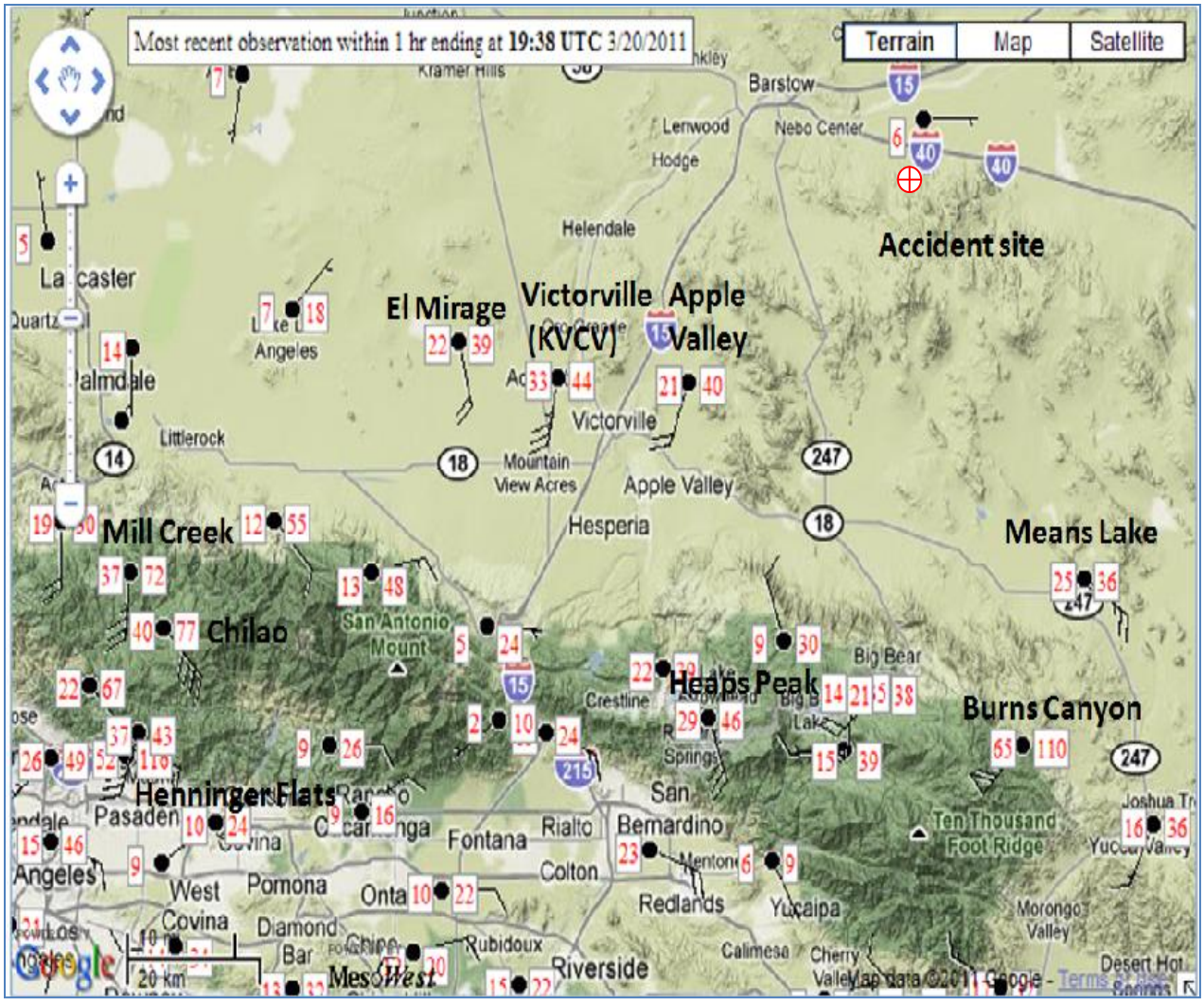


Figure 4 – MesoWest plot of wind speeds and gusts across the region

4.0 Upper Air Data

The NWS San Diego/Miramar (KMYF), site number 72293, upper air sounding or rawinsonde observation (RAOB) was located approximately 125 miles south of the accident site and provided a sampling of the conditions immediately upwind of the site. The 0400 PDT (1200Z) sounding on March 20, 2011, from KMYF plotted on a standard Skew-T log P diagram[7] utilizing RAOB[8] software from the surface to 500-hPa or 18,000 feet is included as figure 5.

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

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

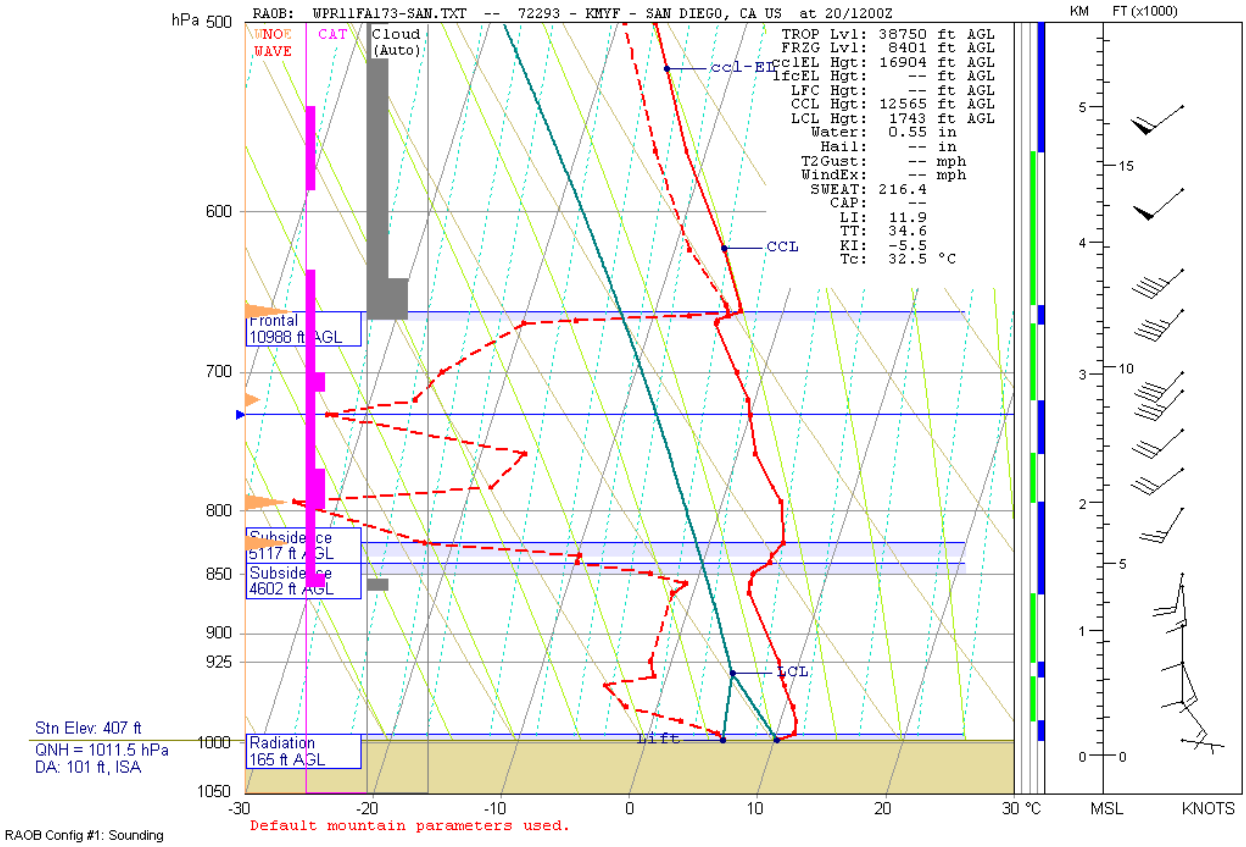


Figure 5 –KMYF 0400 PDT sounding

The sounding depicted the lifted condensation level (LCL)[9] at 935-hPa or at 1,743 feet agl, and a convective condensation level (CCL)[10] at 621-hPa or 12,565 feet agl. The sounding depicted several temperature inversions with the freezing level at 8,800 feet and supported icing in clouds above that level. The sounding had a relative humidity of 75 percent or more from 11,000 to 20,000 feet. The tropopause height was identified at approximately 39,000 feet. The precipitable water value was 0.55 inches.

The sounding indicated a Lifted Index (LI)[11] of 11.9 and indicated a stable atmosphere supporting nimbostratus type clouds.

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

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

[11] 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 some higher level (around 18,000 feet, usually) 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.

The sounding wind profile indicated a surface wind from the east at 5 knots with wind veering to the south and southwest with height. The mean 0 to 6 kilometer "steering level" wind was from 222° at 36 knots, with the level of maximum wind identified immediately below the tropopause at 38,400 feet from 235° at 115 knots. At the accident airplanes cruising level at 15,000 feet, the wind was identified from 225° at 54 knots, with a temperature of -11° C.

The KMYF sounding also depicted favorable conditions for mountain wave activity immediately downwind of high terrain based upon the stability and wind direction and speeds. Based on local terrain feature figure 6 is a plot of the potential mountain wave identified at 11,395 feet. Given the atmospheric conditions, the wave had a wavelength of 4.63 miles, amplitude of 4,692 feet, maximum vertical velocities of 4,088 feet per minute (fpm), and favorable to provide severe turbulence. Another defined wave was located at 18,400 feet with maximum vertical velocities of 5,190 fpm, and also capable of producing severe turbulence.

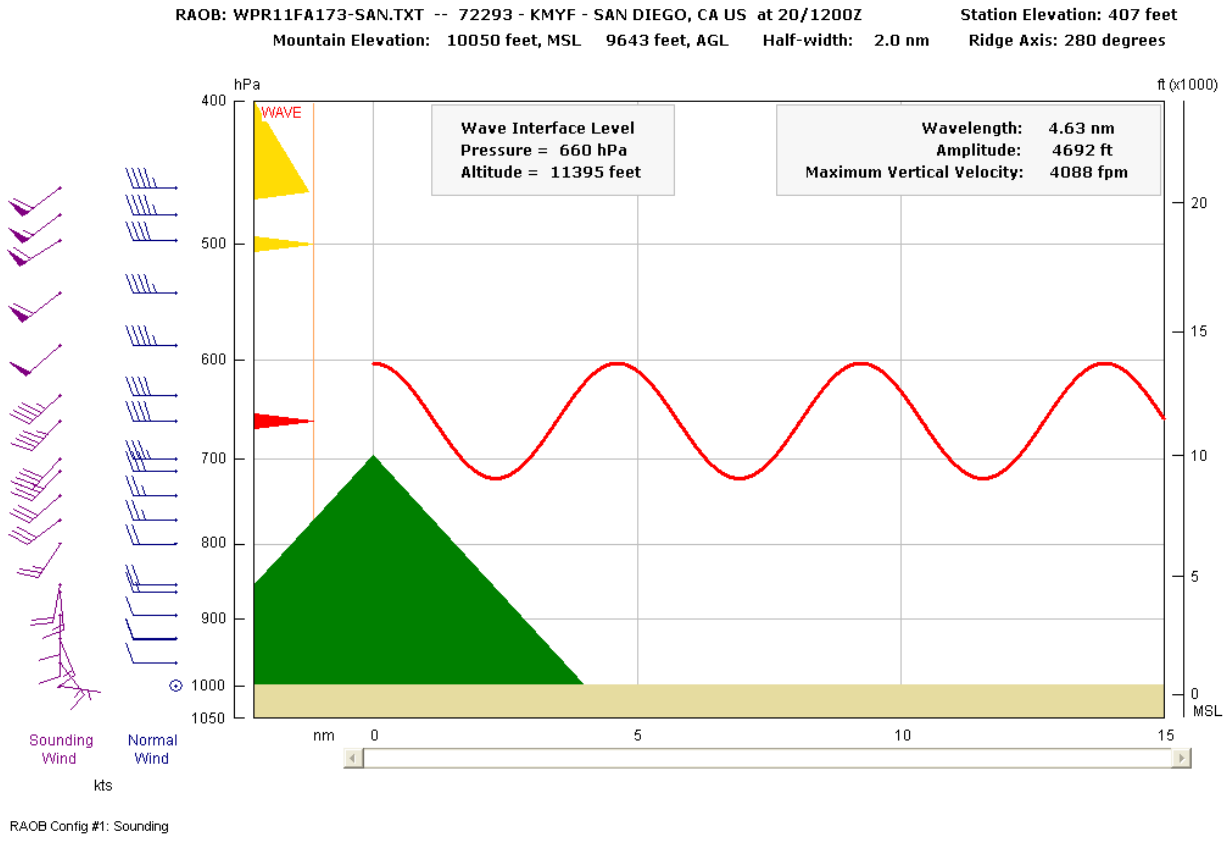


Figure 6 – KMYF mountain wave plot

5.0 Aircraft Observations

A special meteorological equipped aircraft was in the vicinity prior to the accident at 1145 PDT descending into Los Angles (KLAX). The Meteorological Data Collection and Reporting System (MDCRS) plot of the aircraft identified as #144 is included in figure 7 on a skew-T log-P diagram. The plot showed a defined temperature inversion between 12,000 and 14,000 feet. At 15,000 feet the MDCRS data indicated a wind from 222° at 63 knots and a temperature of -11.8° C. The sounding also depicted a similar veering with the winds with height as the KMYF sounding, but showed slightly stronger wind speeds.

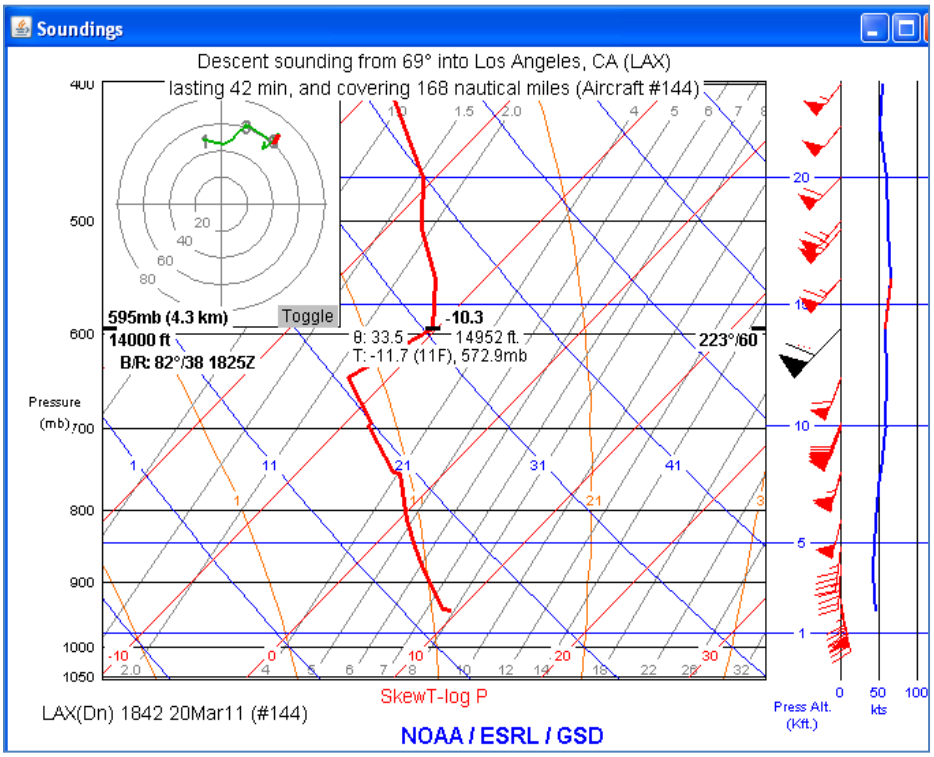


Figure 7 – MDCRS descent sounding into KLAX at 1142 PDT

JFK-LAX 1842Z 20Mar2011
Descent sounding from 69° into Los Angeles, CA (LAX)
lasting 42 min, and covering 168 nautical miles (Aircraft #144)

P_alt (ft)	mb	T (°C)	wind dir/spd (kts)	Time (UTC)	Bng/Rng (nm)
1,990	942	9.5	164° 048	1842	267°/006
2,100	939	8.8	167° 047	1841	266°/009
2,498	925	7.9	170° 046		
4,000	875	4.5	183° 043	1837	238°/011
4,778	850	2.9	187° 045		
5,990	812	0.5	192° 048	1836	228°/009
7,990	753	-3.0	193° 052	1835	206°/005
8,030	752	-3.5	195° 054	1835	205°/005
9,882	700	-8.0	200° 061		
10,000	697	-8.3	200° 061	1831	81°/013

10,120	694	-8.3	200° 059	1830	81°/016
12,000	644	-12.8	198° 061	1826	82°/033
14,000	595	-10.3	223° 060	1825	82°/038
15,990	549	-13.3	221° 067	1821	83°/056
17,970	507	-17.5	220° 064	1820	81°/061

6.0 Satellite Data

The Geostationary Operational Environmental Satellite number 11 (GOES-11) data was obtained from the Space Science and Engineering Center (SSEC) archive from the University of Wisconsin 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 imagery (band 4) at a wavelength of 10.7 microns (μm) provided a 4-kilometer (km) resolution with radiative cloud top temperatures. The visible imagery (band 1) at a wavelength of 0.65 μm provided a resolution of 1 km. The satellite imagery closest to the time of the accident are documented below.

Figure 8 is the GOES-11 infrared band 4 image at 1230 PDT (1930Z) at 2X magnification with the accident site marked. The image depicts an extensive area of clouds over the region with several bands of clouds in the vicinity of the accident site, with a narrow but distinct clear zone immediately south of the accident site. The cloud band over the accident site had a radiative cloud top temperature of 240.0° Kelvin (K) or -33.16° C, which according to the KMYF sounding corresponded to cloud tops near 22,500 feet.

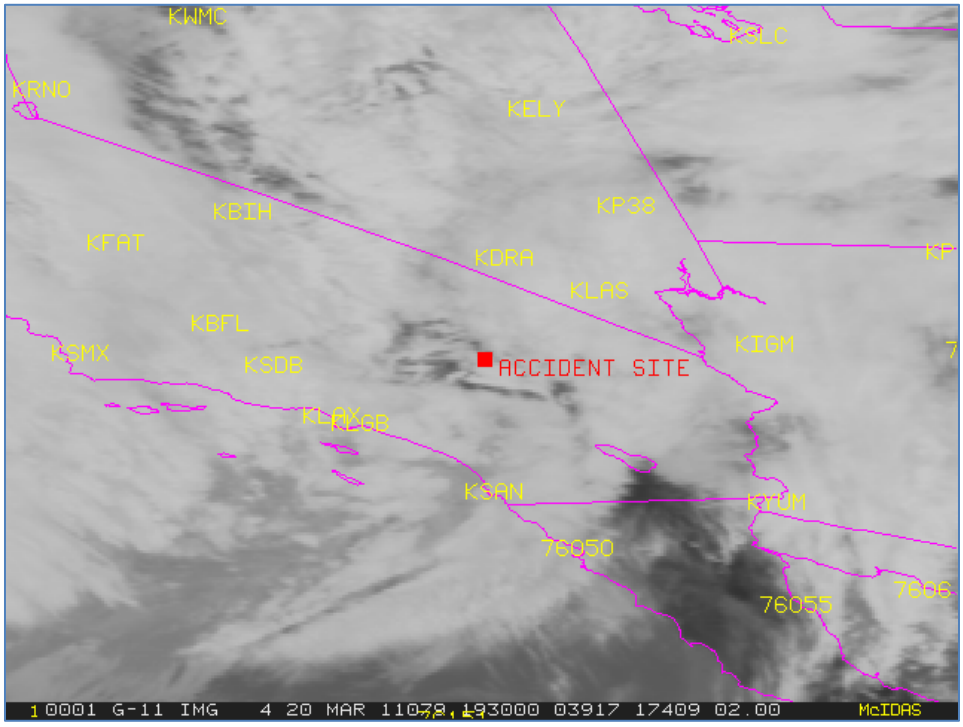


Figure 8 – GOES-11 infrared image for 1230 PDT

Figure 9 is the GOES-11 visible satellite imagery at 1223 PDT at 2X magnification and with a resolution of 1 kilometer and with the flight track for N50MC overlaid. The image depicts the aircraft climbing through 13,500 feet to 15,000 feet and was approximately over the San Gabriel Mountains and approaching the clear zone in the clouds that was associated with a hydraulic jump associated with the mountain wave activity. Several bands of stratocumulus standing lenticular clouds (SCSL) extend west-to-east over the Barstow-Daggett area. An animation of the visible satellite imagery during the period showed no significant movement of the lenticular clouds that remained stationary over the area despite the strong mid-level winds over the area.

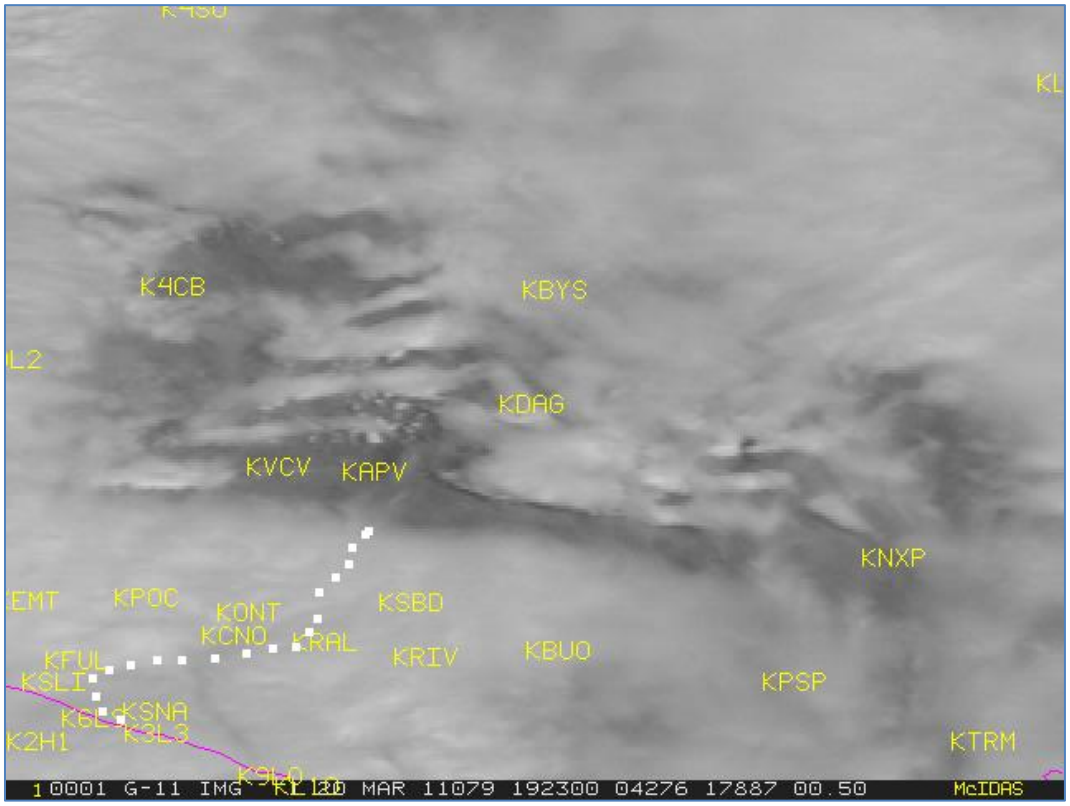


Figure 9 – GOES-11 visible image at 1223 PDT with flight track

Figure 10 is the next available image at 1230 PDT with the flight track and accident site marked. The accident site is depicted in one of the cloud bands. The image corresponds to the time when the pilot of N50MC reports to air traffic control encountering moderate turbulence at 15,000 feet, and then within minutes communications is lost with N50MC with the flight track indicating a rapid descent.

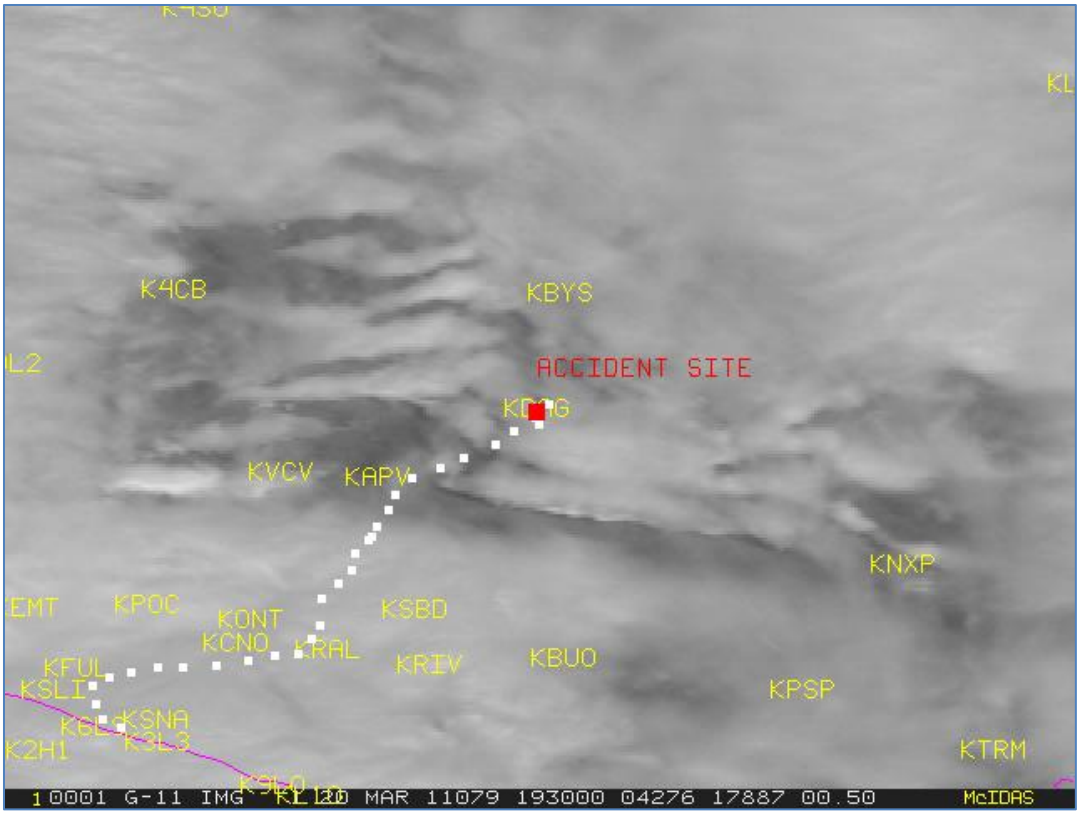


Figure 10 – GOES-11 visible image at 1230 PDT

7.0 Weather Radar Information

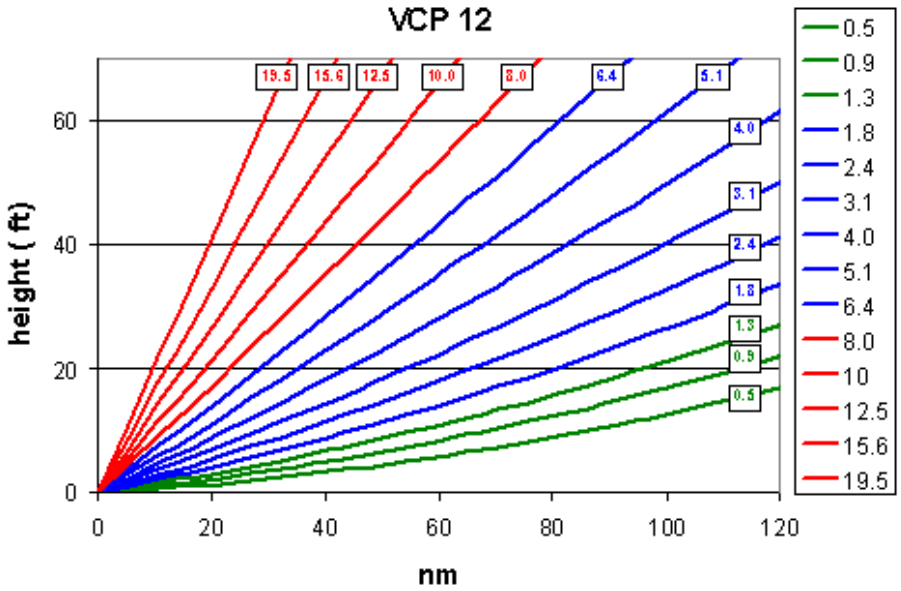
The closest Weather Surveillance Radar-1988, Doppler (WSR-88D) was the NWS Santa Ana Mountain (KSOX) located approximately 70 miles southwest of the accident site. The level II archive data was obtained from the National Climatic Data Center (NCDC) utilizing the Hierarchical Data Storage System (HDSS) 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.

7.1 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 includes multiple scanning strategies. During the period of the accident, the KSOX WSR-88D was operating in the Mode A precipitation mode volume coverage pattern VCP-21, where the radar makes 14 elevation scans from 0.50° to 19.5° every 4 1/2 minutes. The following chart provides an indication of the different elevation angles in this VCP, and the approximate height and width of the radar beam with distance from the radar site.



VCP-12 Precipitation Mode Scan Strategy

7.2 Beam Height Calculation

Assuming standard refraction[12] of the 0.95° radar beam of the KSOX WSR-88D at a distance of 70 miles and an antenna height of 3,105 feet, 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°	10,060 feet	6,540 feet	13,590 feet	7,050 feet
0.94°	13,330 feet	9,800 feet	16,890 feet	7,050 feet
1.36°	16,450 feet	12,920 feet	19,970 feet	7,050 feet

Based on the radar height calculations, the 0.94° elevation scan depicts the conditions encompassing the altitude from 9,800 to 16,890 feet over the accident site.

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

7.3 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors[13] 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[14]), 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	3	15 to 19	.01 in/hr
Very Light	4	20 to 24	.02 in/hr
	5	25 to 29	.04 in/hr
2	6	30 to 34	.09 in/hr
Light to	7	35 to 39	.21 in/hr
Moderate			
3	8	40 to 44	.48 in/hr
Strong			
4	9	45 to 49	1.10 in/hr
Very Strong			
5	10	50 to 54	2.49 in/hr
Intense			
6	11	55 to 59	>5.67 in/hr
Extreme	12	60 to 64	
	13	65 to 69	
	14	70 to 74	
	15	> 75	

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)

[13] 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.

[14] dBZ - 10 log Ze

(c) "Heavy" (> 40 to 50 dBZ)
(d) "Extreme" (> 50 dBZ)

7.4 Base Reflectivity

Figure 11 is the KSOX WSR-88D base reflectivity image for the 0.94° elevation scan completed at 1233 PDT (1933Z) with a resolution of 1° X 1 kilometers, with the flight track overlaid from the National Track Analysis Program (NTAP). The image depicts light intensity echoes over the flight track passing over the higher elevations and in an area clear of any echoes at the time of the accident. The echoes depicted over the high terrain did not move with time and also showed signs of being orographic in nature as a cap cloud.

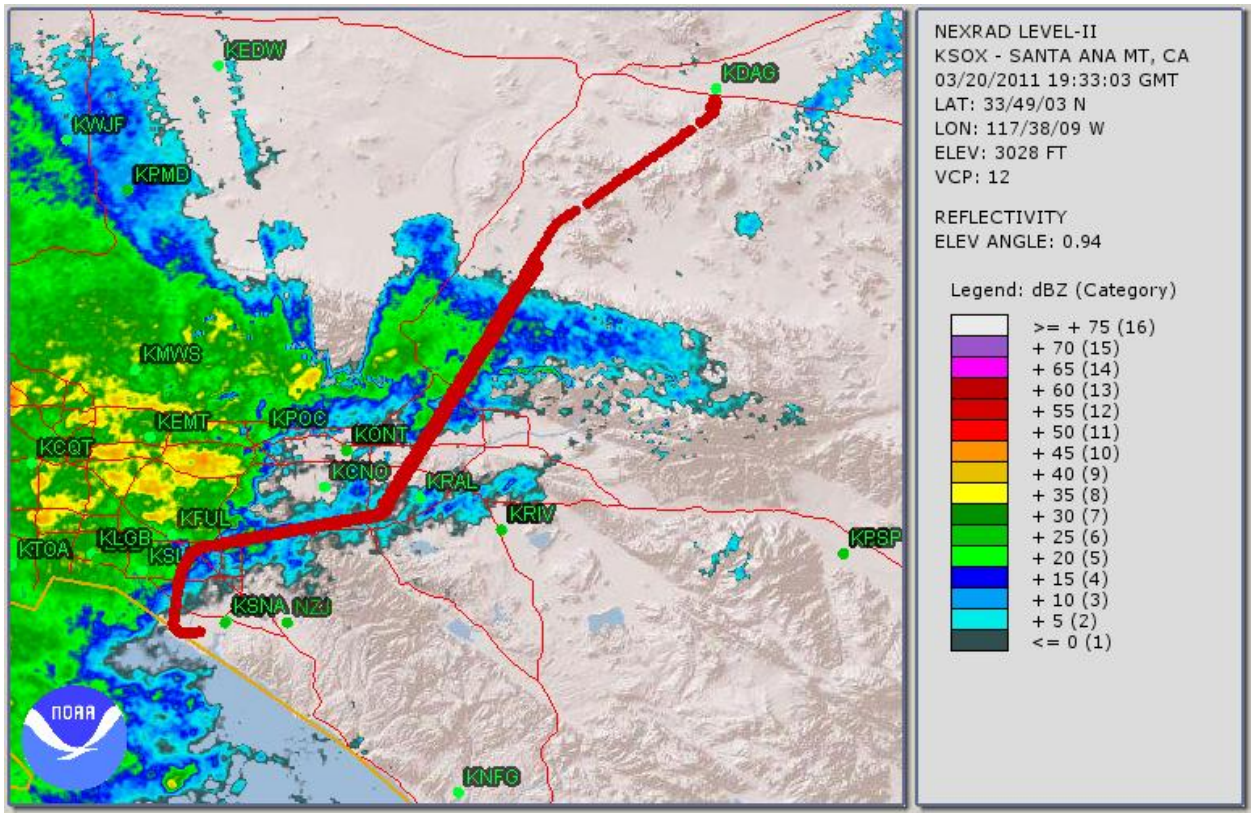


Figure 11 – KSOX WSR-88D 0.94° elevation scan for 1233 PDT

8.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over southern California surrounding the time of the accident. The reports are in standard format and code as received, and are summarized at the end of this section. The reports are as follows:

PSP UA /OV PSP /TM 1323 /FLUNKN /TP UNKN /TB CONT LGT/ OCNL MOD 060-110 /RM REPORTED BY NUMEROUS ACFT SCT=
EDW UA /OV EDW /TM 1404 /FL130 /TP SH33 /TA M10 /IC MOD RIME=

FUL UA /OV LAX090015 /TM 1428 /FL100 /TP B753 /TB MOD 100=
ONT UA /OV PDZ010020 /TM 1458 /FLUNKN /TP B190 /TB MOD 100-060 /RM DURD=
ONT UA /OV PDZ020014 /TM 1458 /FL100 /TP B190 /TA M01 /IC LGT RIME=
LAX UUA /OV LAX /TM 1505 /FL010 /TP CRJ9 /RM LLWS +20KT 010 FAP RY7R=
VCV UA /OV POC045040 /TM 1539 /FL130 /TP GALX /WV 22654KT=
SBA UA /OV GITLE/TM 1557/FL360/TP B738/TA M52/WV 321134KT/TB NEG/RM AWC-WEB:ASA=
MWS UA /OV PMD210015/TM 1602/FL210/TP B737/IC LGT RIME/RM AWC-WEB:KZLA=
SBA UUA /OV SBA /TM 1606 /FLUNKN /TP CRJ9 /RM LLWS -10KTS FAP=
VCV UA /OV PMD090040/TM 1610/FL140/TP B737/IC MOD RIME/RM AWC-WEB:KZLA=
EED UA /OV GFS195024/TM 1611/FL150/TP PC12/IC LGT RIME/RM AWC-WEB:KZLA=
VCV UA /OV VCV360005 /TM 1613 /FL140 /TP B737 /TA 00 /TB OCNL LGT-MOD /IC MOD RIME=
SBA UA /OV GVO200005/TM 1619/FL100/TP E120/TB MOD/IC LGT RIME 100-10/RM TURB BLW 100. AWC-WEB:KZLA=
BUR UA /OV KBUR/TM 1630/FL090/TP B737/TB MOD 090/RM MOD TURB BELOW 090 AWC-WEB:SWA=
PMD UA /OV VCV315010-PMD /TM 1630 /FL110 /TP C25B /TA M08 /TB LGT-MOD /IC LGT-MOD MX /RM DURD 110-090=
IPL UA /OV IPL-IPL258050/TM 1640/FL090/TP B737/TB MOD 090-140/RM AWC-WEB:KZLA=
IPL UA /OV IPL072011/TM 1640/FL045/TP P28R/TB LGT/RM AWC-WEB:KZLA=
VNY UA /OV FIM150010/TM 1650/FL160/TP B737/IC LGT-MOD RIME 160-210/RM AWC-WEB:KZLA=
SMO UA /OV LAX090080-LAX225010 /TM 1653 /FL240 /TP B737 /TA M10/IC LGT RIME /RM DURD FL240-050=
LAX UA /OV LAX/TM 1659/FL140/TP B733/TB MODERATE/RM LT.TURB WITH SOME OCNL MOD TURB UP TO FL140. AWC-WEB:SWA=
PMD UA /OV PMD240010 /TM 1658 /FLUNKN /TP H25B /TA 07 /IC LGT-MOD RIME 090-080 /RM DURD=
WJF UUA /OV VNY360020 /TM 1659 /FL080 /TP LJ45 /TA M11 /TB SEV /IC MOD=
CZZ UA /OV IPL270033 /TM 1709 /FL055 /TP C170 /TA 05 /TB LGT /RM WBND FIRST MTN RANGE NOT OBSCD=
CZZ UA /OV IPL270040 /TM 1719 /FL055 /TP C170 /RM 30KT HDWND WBND=
BUR UUA /OV BUR /TM 1724 /FLUNKN /TP B737 /RM LLWS +/-15KT FAP RWY 8=
SNA UA /OV ELB125009 /TM 1725 /FL025 /TP BE9L /SK OVC025 /WX FV04SM RA /TB CONT LGT OCNL MOD /RM OCNL LGT-MOD RA FV 4-10 UNDER CLDS=
BUR UA /OV KWHP090003/TM 1730/FL130/TP B737/TB MOD 130-140/RM AWC-WEB:KZLA=
PMD UUA /OV PMD218010 /TM 1730 /FL080 /TP LJ45 /TB SEV /IC LGT RIME /RM /TA UNKN=
BUR UUA /OV BUR /TM 1746 /FL028 /TP B737 /RM LLWS +/-15KTS ON FNL RY 8 DURD028-002=
TRM UA /OV TRM /TM 1756 /FL050 /TP GLF4 /TB MOD=
BUO UUA /OV HEC210040/TM 1737/FL110/TP C310/TB MOD-SEV/RM AWC-WEB:KZLA=
NTD UA /OV RZS-LAX/TM 1807/FL110/TP C750/IC LGT RIME 110-210/RM AWC-WEB:KZLA=
BUO UA /OV HEC210030/TM 1816/FL120/TP P180/TB MOD/RM AWC-WEB:KZLA=
VCV UA /OV VCV220010 /TM 1818 /FL120 /TP P180 /TB MOD=
VCV UA /OV L26230006 /TM 1825 /FL110 /TP B190 /TA M06 /IC LGT RIME=
BFL UA /OV EHF135020 /TM 1830 /FL120 /TP PAY3 /TA UNKN /IC MOD RIME=
OXR UA /OV RZS085020/TM 1830/FL170/TP MD83/IC LGT RIME 170-230/RM AWC-WEB:KZLA=
RAL UA /OV PDZ170014/TM 1833/FL160/TP B794/IC MOD RIME/RM AWC-WEB:KZLA=
VNY UUA /OV VNY /TM 1840 /FL050 /TP PC12 /TB SEV=
BUO UA /OV HEC210040/TM 1850/FL180/TP CRJ2/TB MOD 180-170/IC MOD MXD 180-170/RM AWC-WEB:KZLA=
VNY UUA /OV VNY /TM 1856 /FL005 /TP BE35 /RM LLWS -15 KT DURD RY 16R=
POC UA /OV POM/TM 1900/FL225/TP B737/IC MOD RIME/RM AWC-WEB:KZLA=
MWS UA /OV PMD180025 /TM 1904 /FL110 /TP E120 /TB MOD=
TSP UA /OV EHF135030 /TM 1919 /FL140 /TP CRJ9 /TB MOD 140-090=
VCV UA /OV POM030020/TM 1921/FL180/TP A320/IC MOD RIME/RM AWC-WEB:KZLA=
Accident 1936Z
EED UA /OV GFS2800025/TM 1952/FL160/TP BE20/TA M06/IC LGT RIME/RM ZLA=
DAG UA /OV HEC210025/TM 1955/FL160/TP BE9/TA M10/IC MOD RIME/RM ZLA=
PMD UA /OV PMD060030/TM 1955/FL160/TP B737/TA M13/IC MOD RIME/RM ZLA=
LAX UA /OV LAX130020/TM 1958/FL235/TP B737/TA M28/IC LGT RIME/RM ZLA=

DAG UA /OV HEC/TM 1958/FL240/TP MD80/TA M10/IC MOD RIME/RM ZLA=
SBA UA /OV GVO330025/TM 2013/FL130/TP C414/TB MOD/RM ZLA=
VCV UA /OV EDW090020 /TM 2032 /FL200 /TP LJ45 /TA 00 /IC MOD RIME /RM 160-200=
SNA UUA /OV SNA /TM 2050 /FL020 /TP CL30 /RM LLWS +/-20KT 5 MILE FA RY19R SNA=
SBD UUA /OV VCV170020 /TM 2055 /FL120 /TP C500 /TB SEV /RM HITOP INTXN=
RAL UUA /OV RAL360005 /TM 2057 /FL090 /TP GLF5 /TA M07 /TB MOD-SEV 090-110 /IC LGT RIME=
VCV UUA /OV VCV045007 /TM 2102 /FL080 /TP PA31 /RM DDFS 010-015FPM 080-100=
AVX UUA /OV SXC360008 /TM 2102 /FL070 /TP C414 /TB SEV=
SNS UUA /OV SNS130025 /TM 2103 /FLUNKN /TP B737 /TB SEV 230-200=
ONT UA /OV PDZ103026/TM 2104/FL150/TP E120/SK IMC/WX IMC/TA 0/TB LGT /IC LGT RIME/RM ZLA=
WJF UUA /OV LHS325015/TM 2106/FL090/TP M20/WX IMC/RM STG UDDFS. ZLA=
LAX UUA /OV LAX /TM 2112 /FLUNKN /TP B737 /RM LLWS +/-15KT DURC AC RPTD MICROBURST=
BFL UA /OV LHS/TM 2114/FL090/TP `M20/TA M02/IC LGT RIME/RM ZLA=
LAX UA /OV KLAX/TM 2117/FLUNKN/TP B738/TB CONT LGT UNKN/RM DURGD/SADDE6 ARVL / CLOUDS FRM FL300 TO SHORT FINAL. MOD RAIN. NO ICE. LT TURB ONLY AWC-WEB:ASA=
LAX UUA /OV LAX /TM 2120 /FLUNKN /TP B753 /RM LLWS +/- 30KT FA RWY 6 MICROBURST ON FA=
ONT UA /OV PDZ045030/TM 2120/FL160/TP A319/TA M06/TB MOD/IC MOD RIME/RM ZLA=
EED UA /OV GFS/TM 2126/FL160/TP SW4/TA M06/IC LGT RIME/RM ZLA=
PSP UUA /OV PSP330010/TM 2128/FL110/TP C560/TB MOD-SEV/RM ZLA*=*
EED UA /OV GFS180020/TM 2144/FL220/TP C25/TA M06/IC LGT RIME/RM ZLA=
LAX UA /OV KLAX/TM 2151/FLUNKN/TP B738/TB OCNL MOD UNKN/RM CASTA2.GMN SID /LT TO MOD TURB TO 7000 ON DEP. LT RIME ICE 4000 TO 1100 FT AWC-WEB:ASA=
LAX UA /OV LAX /TM 2154 /FL010 /TP B753 /RM LLWS +/- 10KT FA RWY 7R=
LAX UA /OV LAX055055/TM 2155/FL190/TP B738/TA M09/TB LGT /IC LGT RIME/RM ZLA=
BUR UA /OV BUR /TM 2158 /FL030 /TP GLEX /TB MOD BLO 030 /RM LLWS +/- 10KT FA RWY 8 BLW 1400FT AND BLW=
PSP UA /OV PSP315010 /TM 2211 /FL080 /TP C550 /TB MOD 080-110=
LAX UUA /OV LAX /TM 2217 /FL000 /TP B772 /RM LLWS -20KT RY7R LAX=
PSP UA /OV PSP315010 /TM 2220 /FL130 /TP C560 /TA M01 /IC LGT RIME 130-140=
EDW UUA /OV PMD030010 /TM 2229 /FL100 /TP BE35 /TB SEV=
PSP UUA /OV PSP300010 /TM 2229 /FL100 /TP FA50 /TB MOD-SEV=
PSP UA /OV PSP315010 /TM 2236 /FL140 /TP C525 /TA M11 /IC MOD RIME 110-140=
DAG UUA /OV HEC203030/TM 2240/FL130/TP A319/TB SEV/RM ZLA=
CRQ UA /OV CRQ /TM 2242 /FL001 /TP BE20 /RM LLWS +/- 20KT FA RWY 6=
LAX UUA /OV LAX /TM 2247 /FLUNKN /TP CRJ7 /RM LLWS -25KT DURC RY7L=
LAX UUA /OV LAX /TM 2248 /FL005 /TP E135 /RM LLWS -25KT DEP RWY 7R=
DAG UUA /OV HEC/TM 2249/FL170/TP BE40/TB EXTREME/IC SEV RIME/RM ZLA=
BUR UUA /OV BUR /TM 2254 /FLUNKN /TP H25B /RM LLWS +20KT 1 MI FAP RY08 +10KT SHORT FINAL=
DAG UA /OV HEC/TM 2300/FL210/TP FA50/TA M01/IC LGT-MOD RIME/RM ZLA=
PSP UA /OV PSP275012 /TM 2302 /FL100 /TP COL4 /RM UDDFS 1000 FPM=
BUR UUA /OV BUR /TM 2322 /FL010 /TP CRJ2 /WX +RA /TB MOD /RM LLWS +/-20 KT 5 MILE FA RWY 8=
LGB UUA /OV LGB315001 /TM 2327 /FL003 /TP CRJ2 /RM LLWS -10 KT FA RWY 12=
DAG UUA /OV HEC225020 /TM 2346 /FL120 /TP BE55 /TB SEV=
BFL UA /OV LHS140015/TM 2348/FL120/TP B190/TA M07/IC MXD/RM ZLA=

From approximately 6 hours prior to 4 hours after the accident there were 92 pilot reports including 30 urgent pilot reports of icing, turbulence, mountain wave activity, and low-level wind shear (LLWS) encounters over southern California below 22,000 feet. Figure 12 is a plot of the locations of the reports with respect to the accident site, color coded by event type with turbulence reports in red, icing reports in yellow, and wind shear or specific mountain wave reports in green. The size of the plot is proportional to the intensity of the element report.

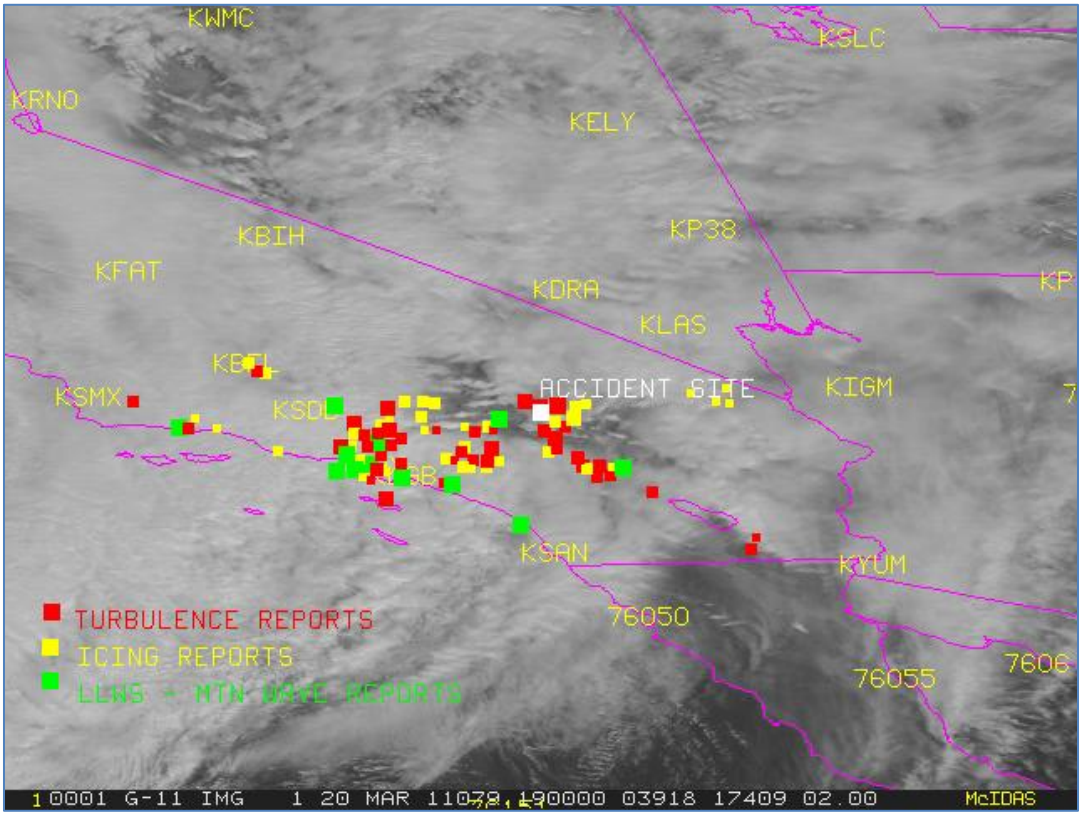


Figure 12 – Pilot reports over southern California

The icing reports were equally split between reports of light to moderate rime type icing, with 1 report of severe icing from a corporate jet after and in the vicinity of the accident site. Of the 39 reports of turbulence, the majority of the reports originated from air carrier aircraft and business jets and while several light turbulence[15] reports were received, the majority of the reports were of moderate[16] and greater turbulence. The main concentration of turbulence reports was in an area between Los Angles, along the San Gabriel Mountains, and the accident site. There were 4 pilot reports of severe turbulence[17] prior to the accident and 10 reports afterwards, with 1 report of extreme turbulence[18] in the vicinity of the accident site from a corporate business jet that also reported encountering severe icing at 17,000 feet. There were also multiple reports

[15] Light turbulence is defined as turbulence that momentarily causes slight, erratic changes in altitude and/or attitude. Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly.

[16] Moderate turbulence is similar to light turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged.

[17] Severe turbulence causes large abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about.

[18] Extreme turbulence in defined as turbulence that causes the aircraft to be violently tossed about and is practically impossible to control. It may cause structural damage. Reaction inside aircraft is best described as chaos.

of strong updrafts and downdrafts from 1,000 to 1,500 feet per minute (fpm) across the region and in the vicinity of the accident site. One business jet in the vicinity of the accident site reported a wind at 13,000 feet from 226° at 54 knots which was consistent with the MDCRS report (section 4.0), and an air carrier aircraft at 36,000 feet reported a maximum wind of 134 knots.

9.0 Area Forecast

The Area Forecast (FA) is a forecast of VFR clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra (IFR) bulletin for the same area in order to get a complete picture of the weather. The area forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports which do not have a terminal forecast (TAF) issued. The NWS Aviation Weather Center (AWC) located in Kansas City, Missouri, issues the FA at regular intervals and issues specials reports as necessary usually in the form of an AIRMET. The region that covers California is under the San Francisco (KSFO) regional forecast. The forecast valid for this accident was issued at 0345 PDT (1045Z) on March 20, 2011, and was valid until 1600 PDT. The forecast was as follows:

FAUS46 KKCI 201045 2011079 1049
FA6W
-SFOC FA 201045
SYNOPSIS AND VFR CLDS/WX
SYNOPSIS VALID UNTIL 210500
CLDS/WX VALID UNTIL 202300...OTLK VALID 202300-210500
WA OR CA AND CSTL WTRS
.
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...LOW W OF N CA CSTL WTRS MOVG S. 11Z TROF FM LOW
S ALG W130 MOVG TO S CA CSTL WTRS BY 05Z. STG MOIST SW FLOW OVR
CA. SFC...11Z LOW ALG N CA CSTLN WITH CDFNT S ALG CNTRL CA CSTLN.
STG LOW LVL WNDS AND MOIST UNSTBL AMS WITH THIS SYS. 05Z LOW ALG
S OR CSTLN WITH CDFNT ACRS NERN CA TO S CA CSTL WTRS.
.
NRN CA...STS-SAC-TVL LN NWD
CSTL SXNS...
N HLF...OVC040 TOP FL280. VIS 3SM -RA BR. 16Z SCT020 OVC050 TOP
160. SCT -SHRA. ISOL -TSRA. CB TOP FL280. OTLK...VFR SHRA.
S HLF...OVC030 TOP 120. VIS 3-5SM -RA. 18Z BKN030 TOP 160. SCT -
SHRA. ISOL -TSRA. CB TOP FL300. OTLK...MVFR CIG SHRA.
SAC VLY...BKN020 OVC050 TOP FL280. VIS 3-5SM -RA BR. WND SE G30KT.
20Z OVC030 TOP 160. SCT -SHRA. OTLK...MVFR CIG SHRA.
SHASTA-SISKIYOUS-NERN CA-NRN SIERNEV...OVC060-080 TOP FL280. VIS 3-5SM -SN.
OTLK...IFR CIG SN.
.
CNTRL CA
CSTL SXNS...
SNS NWD...BKN020 OVC040 TOP FL280. VIS 3-5SM -RA. WND SW G25KT.
18Z BKN030 TOP 160. SCT -SHRA. ISOL -TSRA. CB TOP FL300. WND W G30KT.

OTLK...MVFR CIG SHRA WND.
S OF SNS...BKN015 OVC030 TOP FL280. VIS 3-5SM -RA BR. WND SW G25KT.
OTLK...MVFR CIG RA BR.
SAN JOAQUIN VLY...BKN030 OVC060 TOP FL280. OCNL VIS 3-5SM -RA.WND SE G25KT.
OTLK...MVFR CIG RA.
SRN SIERNEV...OVC080 TOP FL280. VIS 3SM -SN. OTLK...IFR CIG SN.
.
SRN CA..VBG-NID-60NNW BIH LN SWD
CSTL SXNS...
N OF LAX...BKN010 OVC030 TOP FL280. VIS 3-5SM -RA BR. OTLK...IFR CIG RA BR.
LAX-40NNW MZB...SCT020 OVC060 TOP FL250. OCNL -RA. BECMG 1518 BKN010 OVC030. VIS 3SM -RA BR. WND SE G30KT. OTLK...IFR CIG RA BR WND.
RMNDR CSTL SXNS...BKN120 TOP FL250. 18Z SCT020 OVC050. OTLK...VFR. 01Z MVFR CIG RA.
INTR MTNS-DESERTS-VLYS...
N HLF...BKN100 TOP FL250. 20Z SCT050 OVC080. ISOL -SHRA.
OTLK...VFR. BECMG 0003 MVFR CIG SHRA.
S HLF...BKN150 TOP FL250. OTLK...VFR.

Over the departure area broken clouds at 2,000 feet, overcast at 4,000 feet with cloud tops to 28,000 feet were expected with visibility 3 to 5 miles in light rain, winds southwesterly gusting to 25 knots. After 1100 PDT the forecast included scattered rain showers and isolated thunderstorms with tops to 30,000 feet, winds westerly gusting to 30 knots. The forecast for the interior mountains and desert valleys expected broken clouds at 10,000 feet with tops to 25,000 feet. From 1300 PDT (2000Z) scattered clouds at 5,000 feet, overcast at 8,000 feet with isolated light rain showers. The outlook from 1600 to 1900 PDT expected continued VFR conditions to prevail becoming from 1700 to 2000 PDT, MVFR conditions due to ceilings and visibility in rain showers.

10.0 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[19] (WS's), Center Weather Advisories (CWA's), and AIRMET's[20] (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.

[19] SIGMET or Significant Meteorological Information is a weather advisory that contains meteorological information concerning safety of all aircraft. There are two types of SIGMETS, convective and non-convective. The hazard must cover an area greater than 3,000 square mile of impact before issuance of a SIGMET.

[20] AIRMET or Airmen's Meteorological Information is a concise description of weather phenomena that is occurring or may occur that may affect aircraft safety. AIRMETs are issued routinely every 6 hours and are amended as necessary. For an AIRMET to be issued it must be widespread which is defined as covering an area of at least 3,000 square miles.

10.1 AIRMETs

The NWS had 3 AIRMETs that were issued at 0745 PDT concerning IFR conditions and mountain obscurations conditions, moderate turbulence below 18,000 feet, and moderate icing conditions[21] from the freezing level to 20,000 feet over the region. Figure 13 is a plot of the applicable AIRMETs to the accident site. The advisories were as follows:

WAUS46 KKCI 201445
WA6S
-SFOS WA 201445
AIRMET SIERRA UPDT 2 FOR IFR AND MTN OBSCN VALID UNTIL 202100
.
AIRMET IFR...CA AND CSTL WTRS
FROM 40SW EHF TO LAX TO 100SW MZB TO 220SW MZB TO 160WSW RZS TO 80WNW RZS TO 40SW EHF
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET IFR...OR CA NV
FROM 70ESE DSD TO 80SW REO TO 60NNW FMG TO 20ESE FMG TO 50NE OAL TO 40S ELY TO 50S ILC TO 60NW HEC TO 40NE EHF TO 40NE FOT TO 40SW OED TO 60SE OED TO 70ESE DSD
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET MTN OBSCN...WA OR CA NV
FROM 40N PDX TO 50S YKM TO 30NNW LAS TO 40SSE MZB TO 30SSE LAX TO 30SW RZS TO 30SW SNS TO 30SW OAK TO 40SSW ENI TO 30SW FOT TO 80WSW OED TO 70SSW ONP TO 60S HQM TO 40N PDX
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.
.
OTLK VALID 2100-0300Z...MTN OBSCN WA OR CA NV AZ
BOUNDED BY 40S TOU-20WSW SEA-70S GEG-60SSW BKE-20NW BAM-60WSW BAM-60ENE OAL-60NNE BTY-30ESE EED-40SE MZB-30SW RZS-30W SNS-40SSW ENI-30SW FOT-80W OED-40S TOU
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG THRU 03Z.

WAUS46 KKCI 201445
WA6T
-SFOT WA 201445
AIRMET TANGO UPDT 2 FOR TURB STG WNDS AND LLWS VALID UNTIL 202100
.
AIRMET TURB...WA OR CA ID MT WY NV UT CO AZ NM AND CSTL WTRS
FROM 30SSW YDC TO 30SSW ISN TO 70SW RAP TO BFF TO GLD TO 50W LBL TO 30ESE TBE TO TUS TO 20SE BZA TO 20S MZB TO 220SW MZB TO 140WSW PYE TO ONP TO 30SSW YDC
MOD TURB BTN FL180 AND FL410. CONDS CONTG BYD 21Z THRU 03Z.
.
AIRMET TURB...OR CA ID WY NV UT AZ AND CSTL WTRS
FROM PDT TO 20E LKT TO BPI TO 50S SSO TO 50S TUS TO BZA TO 20S MZB TO 220SW MZB TO 140SW SNS TO 80WSW OED TO PDT
MOD TURB BLW FL180. CONDS CONTG BYD 21Z THRU 03Z.
.

[21] The accident airplane was not certified for flight into known icing conditions.

AIRMET STG SFC WNDS...CA AND CSTL WTRS
FROM 40W RZS TO 30WNW LAX TO 20SE MZB TO 220SW MZB TO 180SW RZS
TO 80WSW RZS TO 40W RZS
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 21Z ENDG 21-00Z.
.
LLWS POTENTIAL...OR CA AND CSTL WTRS
BOUNDED BY 40NNE LKV-70NNW FMG-30SSW ENI-70W OED-40NNE LKV
LLWS EXP. CONDS ENDG 15-18Z.

WAUS46 KKCI 201445
WA6Z
-SFOZ WA 201445
AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 202100
.
AIRMET ICE...CA NV UT AZ AND CSTL WTRS
FROM 30SE REO TO 50W BVL TO 60ENE OAL TO 40ENE ELY TO 20ESE HVE
TO 40SSE PGS TO BZA TO 20S MZB TO 220SW MZB TO 120WSW PYE TO
20SSW ENI TO 20N RBL TO 40SE LKV TO 30SE REO
MOD ICE BTN FRZLVL AND FL200. FRZLVL 050-080. CONDS CONTG BYD 21Z
THRU 03Z.
.
AIRMET ICE...WA OR CA ID AND CSTL WTRS
FROM 20NE HUH TO 20ESE MLP TO 30NNW TWF TO REO TO 50ESE OED TO
20WSW ENI TO 120WSW PYE TO 140SW FOT TO 140WSW FOT TO 130WNW FOT
TO 120WNW ONP TO TOU TO 20NE HUH
MOD ICE BTN FRZLVL AND 160. FRZLVL 030-050. CONDS CONTG BYD 21Z
THRU 03Z.
.
OTLK VALID 2100-0300Z...ICE WA OR CA ID MT NV UT AND CSTL WTRS
BOUNDED BY 50WSW YXC-50WSW BPI-20SSE LKV-100WSW PYE-140WSW
FOT-120WNW ONP-20NNE TOU-50WSW YXC
MOD ICE BTN FRZLVL AND 160. FRZLVL 030-050. CONDS CONTG THRU 03Z.
.
FRZLVL...RANGING FROM SFC-090 ACRS AREA
SFC ALG 50W HUH-50ESE YKM-20WSW PDT-40NNW LKV-50SSW LKV-90S
LKV-80N FMG
040 ALG 140WSW SNS-20NNE PYE-30N OED-40ESE EUG-80SSW PDT-50S
BKE
080 ALG 220SSW RZS-180SW MZB-50SSW MZB-50SSE TRM-40S EED
....

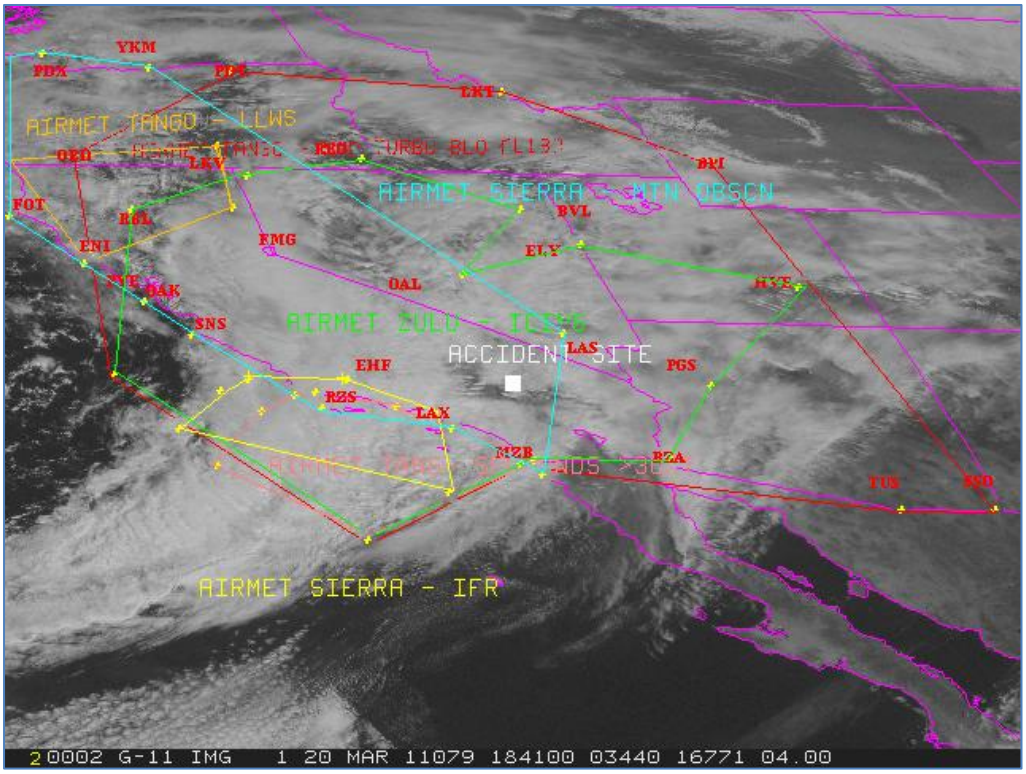


Figure 13 – AIRMETs current at the time of the accident

10.2 Center Weather Advisories

The Los Angles (KZLA) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) issued the following Center Weather Advisories (CWA) surrounding the period:

FAUS21 KZLA 201816
ZLA1 CWA 201815
ZLA CWA 101 VALID UNTIL 202015
FROM 70NE RZS TO 25W HEC TO 40NE TRM TO 37ESE TRM TO 28WSW TRM TO
55SW HEC TO 30NNW LAX TO 70NE RZS
MOD-SEV TURB BLW FL120. CONDS CONTG THRU 23Z.

FAUS22 KZLA 201906
ZLA2 CWA 201905
ZLA CWA 201 VALID UNTIL 202105
FROM 38WNW LAS TO 15E LAS TO 22SSE LAS TO 23WSW LAS TO 38WNW LAS
OCNL SEV TURB BLW FL080. REPORTED BY MULTIPLE AIRCRAFTS. CONDS CONTG
THRU 23Z.

FAUS21 KZLA 201931
ZLA1 CWA 201930
ZLA CWA 102 VALID UNTIL 202130
FROM 70NE RZS TO 25W HEC TO 40NE TRM TO 37ESE TRM TO 28WSW TRM TO
55SW HEC TO 20NNW LAX TO 70NE RZS
MOD-SEV TURB BLW FL120. CONDS CONTG THRU 23Z.

FAUS22 KZLA 202115
ZLA2 CWA 202110
ZLA CWA 202 VALID UNTIL 202130
CNL ZLA CWA 201.

FAUS21 KZLA 202133
ZLA1 CWA 202130
ZLA CWA 103 VALID UNTIL 202200
CNL ZLA CWA 102. SEE SIGMET WHISKEY 1 FOR SEV TURB.

Figure 14 is a plot of CWA advisories 101 and 201 issued at 1116 and 1206 PDT respectively. CWA advisory 101 bordered immediately south of the accident site and was reissued at 1230 PDT (1920Z) and cancelled at 1430 PDT when SIGMET Whiskey was issued. CWA advisory 201 was issued at 1230 PDT and was reissued for the same coordinates of CWA 101, and continued to expect moderate to severe turbulence below 12,000 feet.

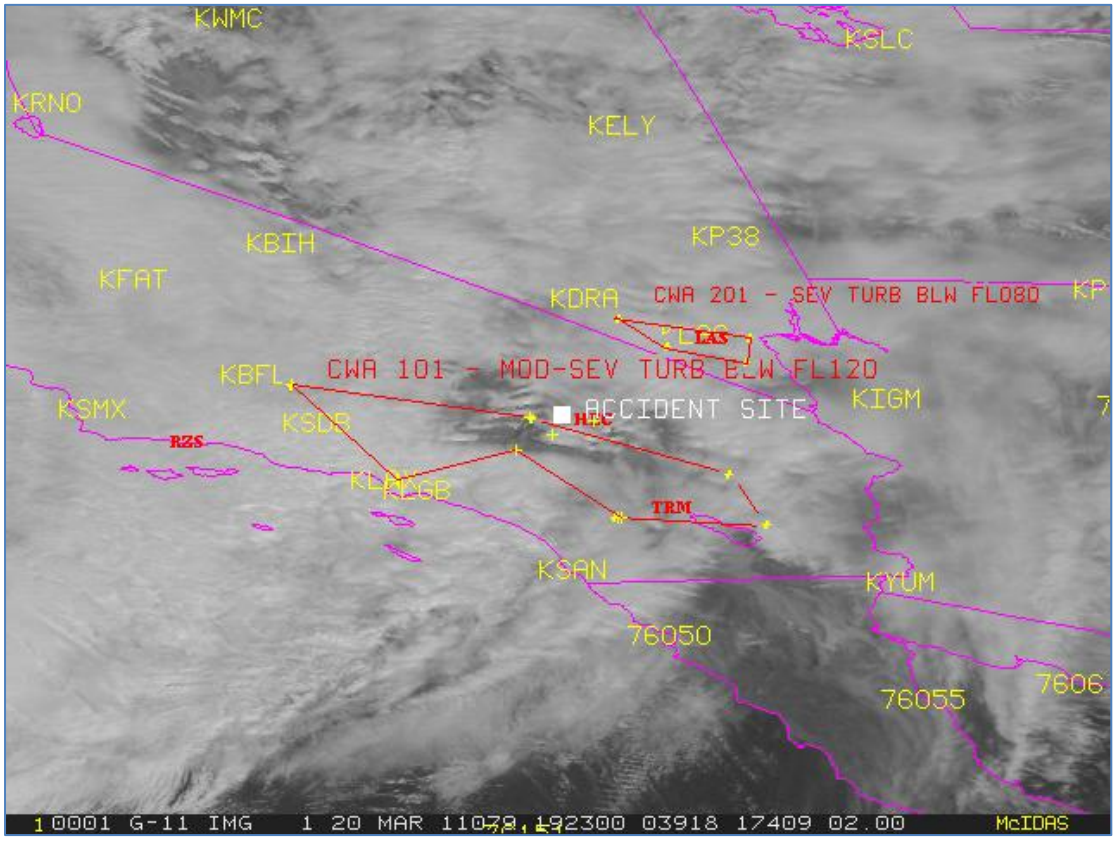


Figure 14 – CWA advisories current at the time of the accident

10.3 SIGMETs

Figure 15 is a plot of SIGMET Whiskey 1 which was issued at 1429 PDT (2129Z) approximately 2 hours after the accident and replaced KZLA CWA 101. The advisory warned of occasional severe turbulence below 12,000 feet due to strong low-level winds, strong updrafts, and low-level wind shear reported by aircraft. The conditions were expected to continue beyond 1829 PDT. A second SIGMET Xray 1 was issued for severe turbulence between 18,000 and 26,000 feet due to wind shear associated with the jet stream, which was reported by a Boeing 737, 25 miles southeast of Salinas (KSNS). The advisories were as follows:

WSUS06 KKCI 202129
WS6W
-SFOW WS 202129
SIGMET WHISKEY 1 VALID UNTIL 210129
CA AND CSTL WTRS
FROM 50ESE EHF TO HEC TO TRM TO 50S LAX TO RZS TO 50ESE EHF
OCNL SEV TURB BLW 120. DUE TO STG LOW LVL WNDS AND STG UDDFS AND
LLWS. RPTD BY ACFT. CONDS CONTG BYD 0129Z.

WSUS06 KKCI 202133
WS6X
-SFOX WS 202133
SIGMET XRAY 1 VALID UNTIL 210133
CA AND CSTL WTRS
FROM 40N SAC TO 40SSW FMG TO 180SSW RZS TO 150WSW RZS TO 40N SAC
OCNL SEV TURB BTN FL180 AND FL260. DUE TO WNDSHR ASSOCD WITH
JTST. RPTD BY B737 25SE SNS. CONDS CONTG BYD 0133Z.

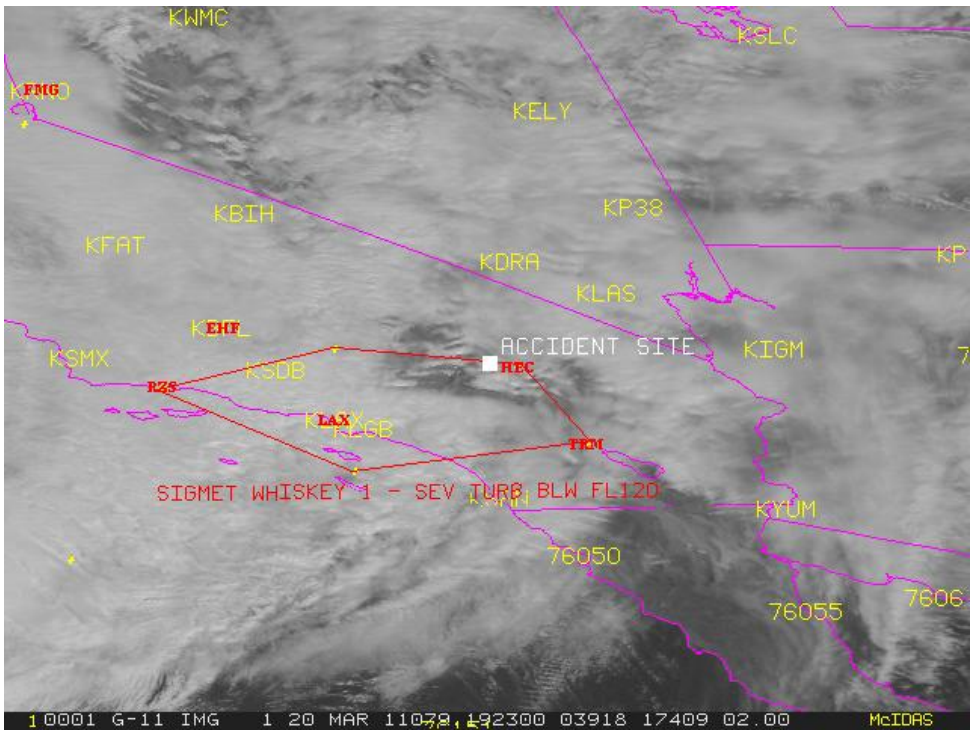


Figure 15 – SIGMET Whiskey 1 issued at 1429 PDT

11.0 Terminal Aerodrome Forecast (TAF)

The closest Terminal Aerodrome Forecast (TAF) to the accident site was from KGA and was issued at 1045 PDT. The forecast was valid for a 5 statute mile radius of the airport and was as follows:

KDAG 201745Z 2018/2118 12008KT P6SM BKN100 BKN150
FM202100 15014G22KT P6SM VCSH SCT050 BKN100
FM210200 19012KT P6SM VCSH SCT030 BKN050
FM210700 25012KT P6SM VCSH SCT030 BKN050=

The forecast expected VFR conditions to prevail during the period with a wind from the 120° at 8 knots, visibility better than 6 miles, ceiling broken at 10,000 feet agl, and broken at 15,000 feet.

12.0 Weather Briefing

There was no record of the pilot of N50MC having obtained a formal weather briefing from the Automated Flight Service Station (AFSS) or Direct Users Access Terminal System (DUATS). There was a record of the pilot utilizing DUATS to file the IFR flight plan with the FAA at 1003 PDT. The flight plan indicated the proposed cruising level of 15,000 feet, with no alternate airport listed.

13.0 Astronomical Data

Data from the United States Naval Observatory indicated that Sunset was at 1918 PDT, with the end of civil twilight was at 1945 PDT. The accident occurred during daylight hours.

Donald E. Eick
NTSB Senior Meteorologist