



NATIONAL TRANSPORTATION SAFETY BOARD

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

December 8, 2015

Group Chairman's Factual Report

WEATHER STUDY

WPR16FA014

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A. ACCIDENT

Location: Morongo Valley, California
Date: October 17, 2015
Time: 1552 Pacific daylight time (2252 UTC¹)
Airplane: Piper PA-28R-180; registration N4972J

B. METEOROLOGY GROUP

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Washington, D.C. 20594-2000

C. SUMMARY

On October 17, 2015, at 1552 Pacific daylight time, a Piper PA28R-180, N4972J, impacted mountainous terrain near Morongo Valley, California. The airplane was registered to, and operated by, the pilot under the provisions of 14 Code of Federal Regulations Part 91. The private pilot and passenger sustained fatal injuries; the airplane was destroyed. The cross-country flight departed Palm Springs International Airport, Palm Springs, California, at 1513, with a planned destination of Santa Barbara Municipal Airport, Santa Barbara, California. Visual meteorological conditions prevailed at the departure location, and no flight plan had been filed.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) Senior Meteorologist was not on scene for this investigation and conducted the meteorology phase of the investigation from the Washington D.C. office, collecting data from official National Weather Service (NWS) sources including the National Center for Environmental Information (formerly known as the National Climatic Data Center). 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. NWS airport and station identifiers use standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus International Air Transport Association (IATA) 3-letter identifiers which deletes the initial country code designator "K" for U.S. airports. Both codes are both used intermittently in this report.

The accident site was located at latitude 34.1156° N and longitude 116.708° W at an elevation of 7,222 feet.

¹ UTC – is an abbreviation for Coordinated Universal Time.

E. FACTUAL INFORMATION

1.0 Synoptic Situation

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

1.1 Surface Analysis Chart

The National Weather Service (NWS) Surface Analysis Chart for 1400 PDT (2100Z) on October 17, 2015 is included as figure 1, with the approximate accident site marked by a red star. The chart depicted a low pressure system off the Oregon coast at 1013-hectopascals (hPa) with an occluded front curling around the low and extending southeastward into Oregon and northern California before turning into a cold front and extending southeast. Over southern Arizona a thermal low pressure system at 1008-hPa with a trough of low pressure extended southward into Mexico. A general light pressure gradient was depicted by the absence of any isobars and indicated winds generally 10 knots or less across much of the state. The accident site was located well south of the frontal boundary and to the northwest of the thermal low’s position.

The station model for Palm Springs immediately south of the accident site indicated a southeast wind of approximately 5 knots, visibility unrestricted, scattered clouds, temperature 89° Fahrenheit (F), dew point temperature 59° F, and a sea level pressure of 1010.1-hPa.

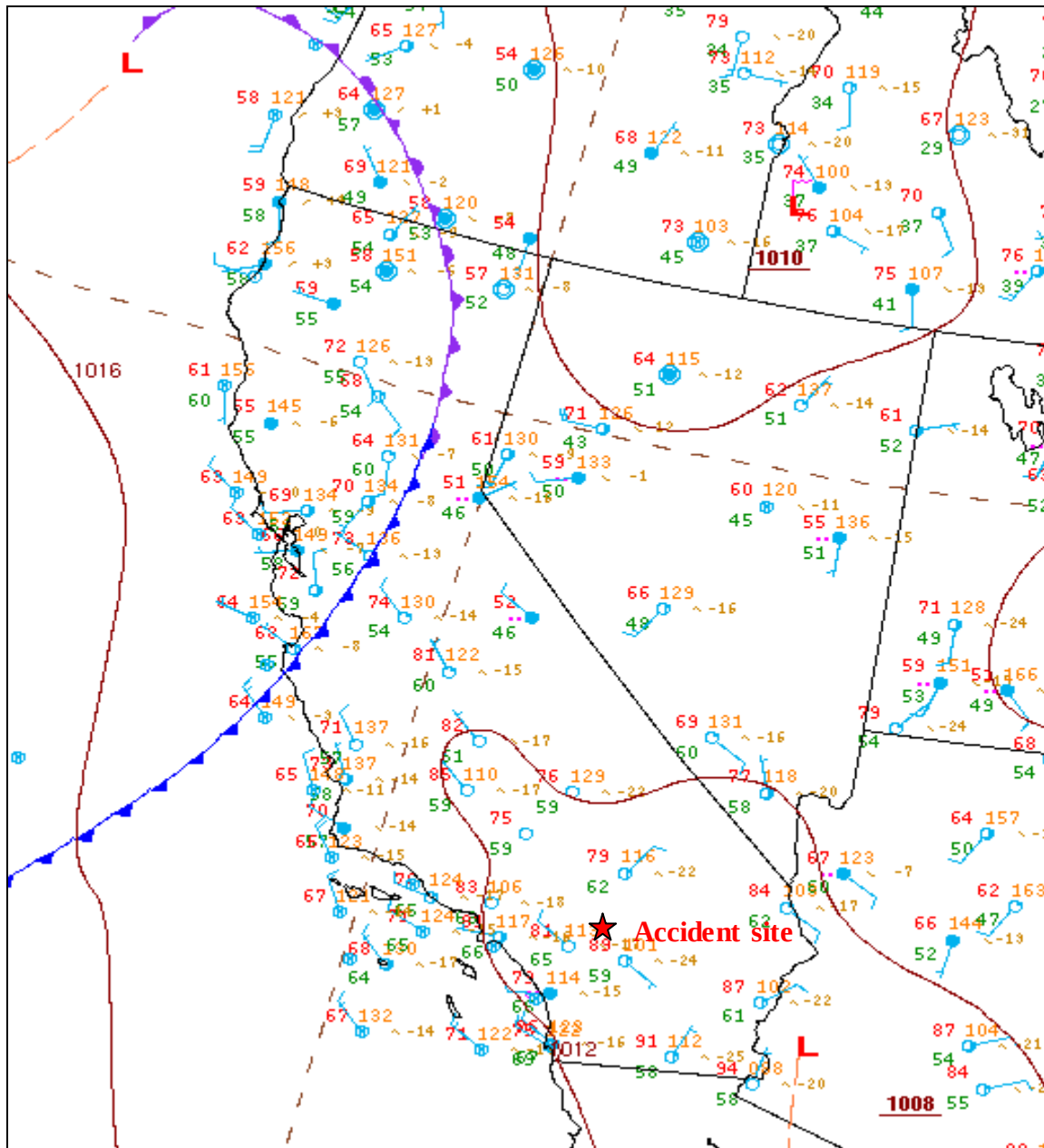


Figure 1 - NWS Surface Analysis Chart for 1400 PDT

1.2 NWS National Radar Mosaic

The NWS National Radar Mosaic for 1550 PDT on October 17, 2015 for the southwest is included as figure 2 with the approximate accident site marked. Several weather echoes were identified southwest, west, and north of Palm Springs and the accident site. The closest weather radar and the accident airplanes flight track will be further documented in section 5.0 of this report.



Figure 2 - NWS National radar mosaic for 1550 PDT

1.3 NWS 500-hPa Constant Pressure Chart

The NWS 500-hPa Constant Pressure Chart for 1700 PDT (0000Z on October 18, 2015) is included as figure 3 and depicted the conditions at approximately 18,000 feet and the mean atmosphere immediately after the accident. The chart depicted a cut off upper level low pressure system off the Oregon and northern California coast with a long wave trough extending southward. The upper level low provided favorable upper level divergent conditions over the region for upward vertical motion and supported the development of convective showers over the western United States during the period.

The station models over southern California generally depicted southwesterly winds of 25 knots at 18,000 feet with a temperature of -11° Celsius (C) near the accident site.

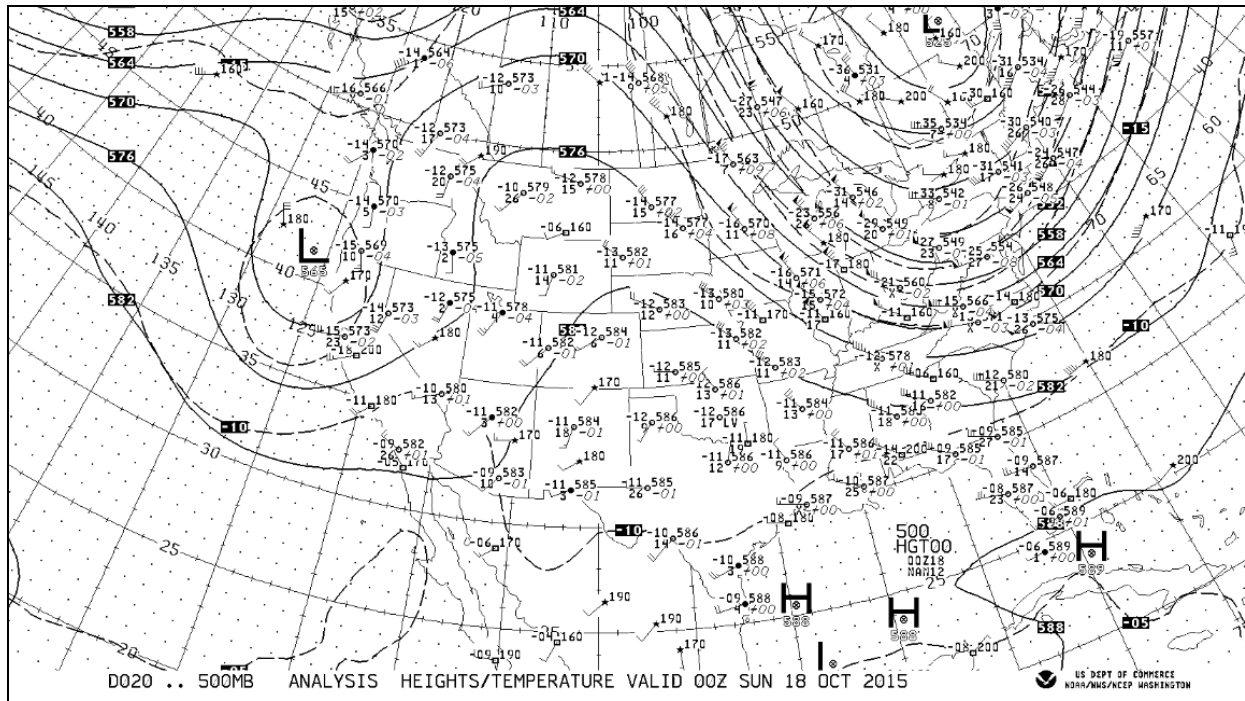
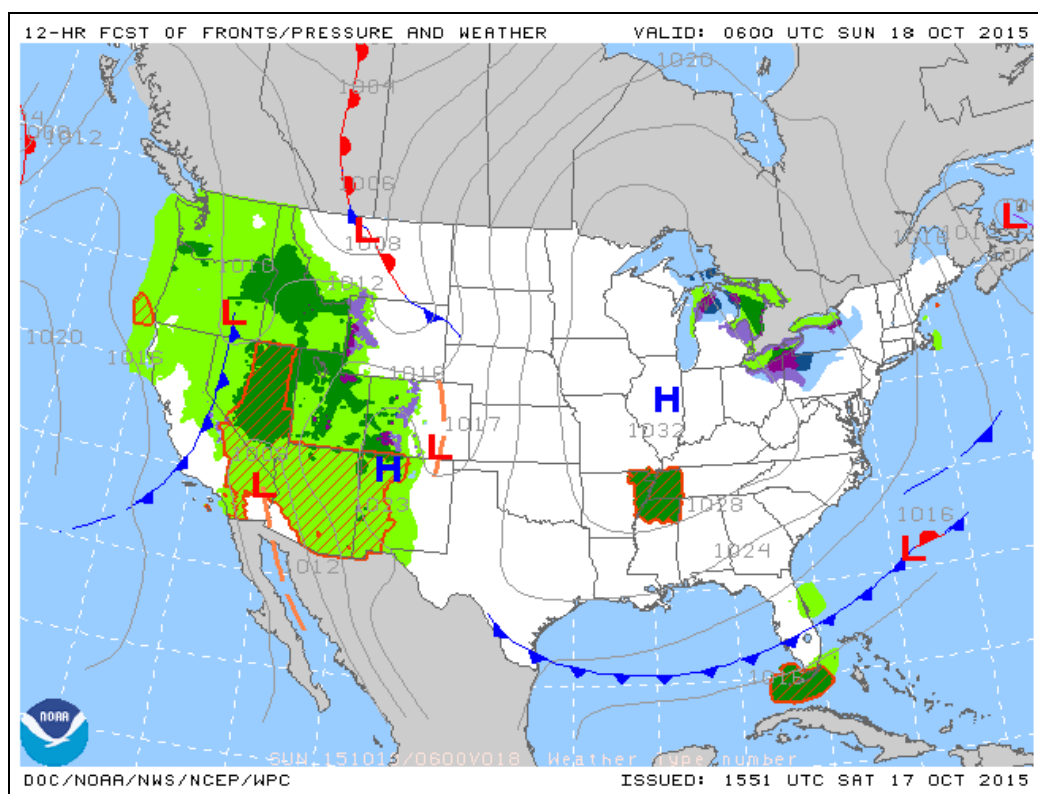


Figure 3 - NWS 500-hPa Constant Pressure chart for 1700 PDT

1.4 NWS 12-Hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart valid for 2300 PDT on October 17, 2015 depicted a low pressure system over Oregon with the cold front extending south-southwest across California with the thermal low over the California and Arizona border with a trough extending southward. A large area of precipitation was expected along and ahead of the front over the western United States during the period, with a chance of thunderstorms expected over southern California, Nevada, and Arizona, which included the accident site.



Palm Springs weather at 1553 PDT (2253Z), wind from 140° at 4 knots, visibility unrestricted at 10 statute miles, scattered clouds at 7,000 feet agl, temperature 32° C, dew point temperature 15° C, altimeter 29.82 inches of mercury (Hg). Remarks: automated observation system, sea level pressure 1009.3-hPa, temperature 31.7° C, dew point 15.0° C.

The raw observations surrounding the period were as follows:

METAR KPSP 171753Z VRB04KT 10SM SCT080 29/16 A2992 RMK AO2 SLP126 T02940156 10300 20244 50002=

METAR KPSP 171853Z VRB03KT 10SM SCT080 31/16 A2990 RMK AO2 SLP120 T03060156=

METAR KPSP 171953Z VRB06KT 10SM SCT080 32/15 A2987 RMK AO2 SLP111 T03170150=

METAR KPSP 172053Z 12004KT 10SM SCT080 32/15 A2984 RMK AO2 SLP101 T03170150 58024=

METAR KPSP 172153Z 12007KT 10SM SCT070 32/15 A2983 RMK AO2 SLP096 T03170150=

Accident 2252Z

METAR KPSP 172253Z 14004KT 10SM SCT070 32/15 A2982 RMK AO2 SLP093 T03170150=

METAR KPSP 172353Z 03003KT 10SM SCT070 BKN100 31/15 A2981 RMK AO2 SLP092 T03110150 10322 20294 56009=

2.2 Big Bear City Airport (KL35), Big Bear City, CA

The next closest weather reporting facility was located at Big Bear City Airport (KL35), Big Bear City, CA approximately 11 ½ miles north-northwest of the accident site at an elevation of 6,752 feet had an AWOS and reported the following:

Big Bear City Airport weather at 1535 PDT (2235Z), automated, wind from 080° at 3 knots, visibility 10 miles, ceiling broken at 2,100 feet, broken at 2,600 feet, and overcast at 3,500 feet, temperature 13° C, dew point 9° C, altimeter 30.15 inches of Hg.

The raw observations were as follows:

KL35 172155Z AUTO 34004KT 10SM BKN015 OVC026 13/10 A3015 RMK AO2

KL35 172215Z AUTO 03003KT 10SM SCT015 OVC021 13/09 A3015 RMK AO2

KL35 172235Z AUTO 08003KT 10SM BKN021 BKN026 OVC035 13/09 A3015 RMK AO2

Accident 2252Z

KL35 172255Z AUTO 10003KT 10SM -RA SCT021 BKN038 OVC044 13/10 A3015 RMK AO2

KL35 172315Z AUTO 08003KT 10SM SCT029 SCT036 SCT045 13/09 A3014 RMK AO2

KL35 172335Z AUTO 09004KT 10SM SCT027 BKN075 13/08 A3014 RMK AO2

2.3 San Bernardino International Airport (KSBD), San Bernardino, CA

The next closest weather reporting location was from San Bernardino International Airport (KSBD), San Bernardino, CA approximately 26 miles west of the accident site at an elevation of 1159 feet had an AWOS and reported the following conditions:

San Bernardino International Airport weather at 1447 PDT, wind from 240° at 10 knots, visibility 7 miles, scattered clouds at 6,000 feet, temperature 29° C, dew point 14° C, altimeter 29.87 inches of Hg.

The raw observations were as follows:

METAR KSBD 171747Z 29006KT 3SM HZ SCT011 24/17 A2994=

METAR KSBD 171949Z 24008KT 4SM HZ SCT100 27/15 A2991=

METAR KSBD 172050Z 24009KT 6SM HZ SCT060 28/14 A2989=

METAR KSBD 172147Z 24010KT 7SM SCT060 29/14 A2987=

Accident 2252Z

METAR KSBD 172347Z 23008KT 7SM SCT060 28/14 A2985=

2.4 March Air Force Base (KRIV), Riverside, CA

March Air Force Base (KRIV), Riverside, CA, was located immediately south of San Bernardino and was located 31 miles southwest and west of Banning Pass at an elevation of 1,536 feet reported the following conditions:

March Air Force weather at 1558 PDT (2258Z), wind from 340° at 9 knots, visibility 10 miles, a few clouds at 4,000 feet, scattered clouds at 8,000 feet, and scattered at 25,000 feet, temperature 26° C, dew point 18° C, altimeter 29.88 inches of Hg. Remarks: automated observation system, lighting over mountain distant east, sea level pressure 1010.7-hPa, temperature 26.4° C, dew point 18.2° C.

The raw observations were as follows:

METAR KRIV 171958Z AUTO VRB06KT 10SM CLR 26/19 A2992 AO2 SLP120 T02640185

METAR KRIV 172058Z AUTO 30008KT 260V330 10SM CLR 27/18 A2990 AO2 SLP113 T02720183 57017

METAR KRIV 172158Z AUTO 31010KT 10SM CLR 27/18 A2988 AO2 SLP106 T02700182

Accident 2252Z

METAR KRIV 172258Z COR34009KT 10SM FEW040 SCT080 SCT250 26/18 A2988 AO2A LTG OMTNS DSNT E SLP107 T02640182 COR 0049

METAR KRIV 172358Z AUTO 29006KT 10SM CLR 26/18 A2987 AO2 SLP103 T02570182 10274 20238 56008

2.5 AWC Display of Observation

The NWS Aviation Weather Center's observation display of METARs and the regional radar mosaic overlaid for 1550 PDT (2250Z) is included as figure 5. overlay

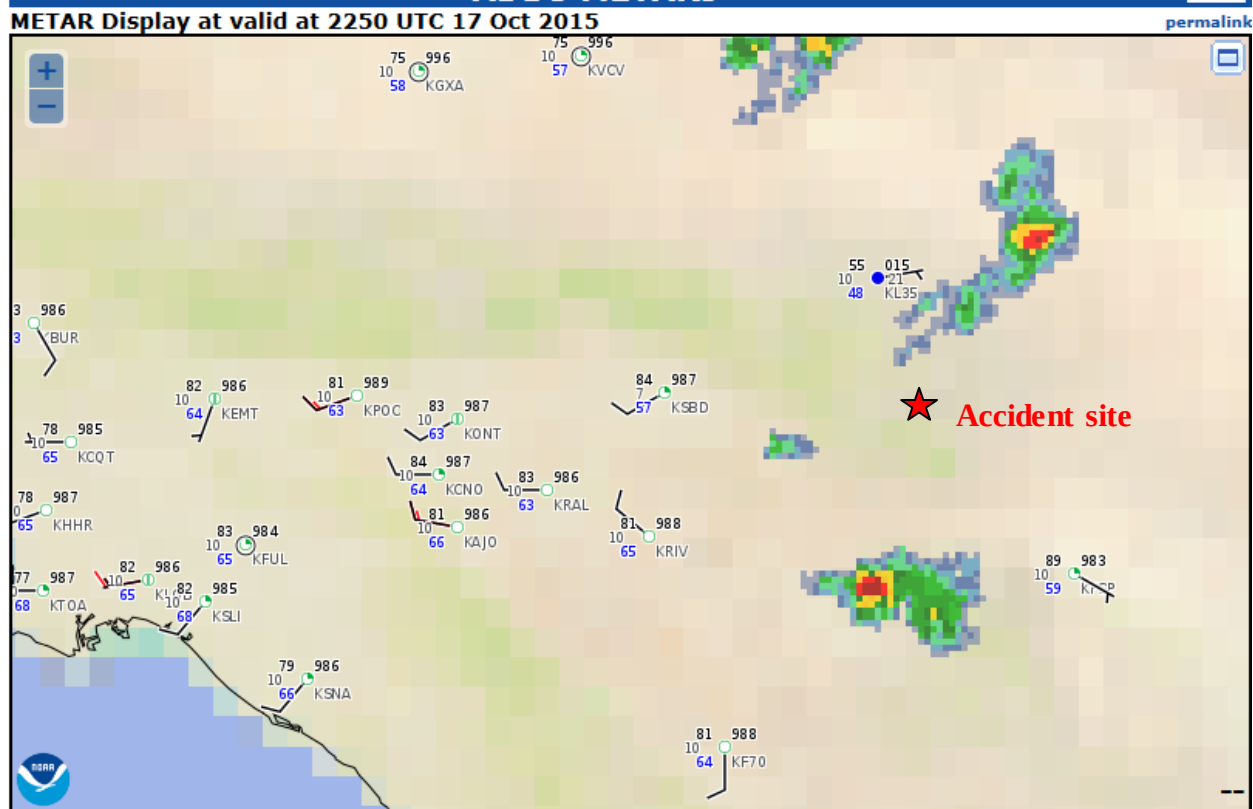


Figure 5 - NWS observation display at 1550 PDT

3.0 Upper Air Data

The NOAA Air Resource Laboratory (ARL) North American Mesoscale numerical model for 1400 PDT (2100Z) on October 17, 2015 was run over the accident site location and the data plotted on a standard Skew T – log P diagram² over the accident location. The chart depicted a conditional unstable atmosphere with a Lifted Index of -3.0 and with the expected cloud base at 2,196 feet agl, with cloud tops near 11,000 feet based on the relative humidity greater than 80% through the layer and potential convective cloud tops near 40,000 feet. The freezing level was identified at 14,776 feet well above the aircraft's altitude. The wind profile indicated southerly winds veering to the west with height, the mean 0 to 18,000 feet wind was from 250° at 9 knots. No significant turbulence or mountain wave activity was noted in the model sounding through 18,000 feet.

² 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.

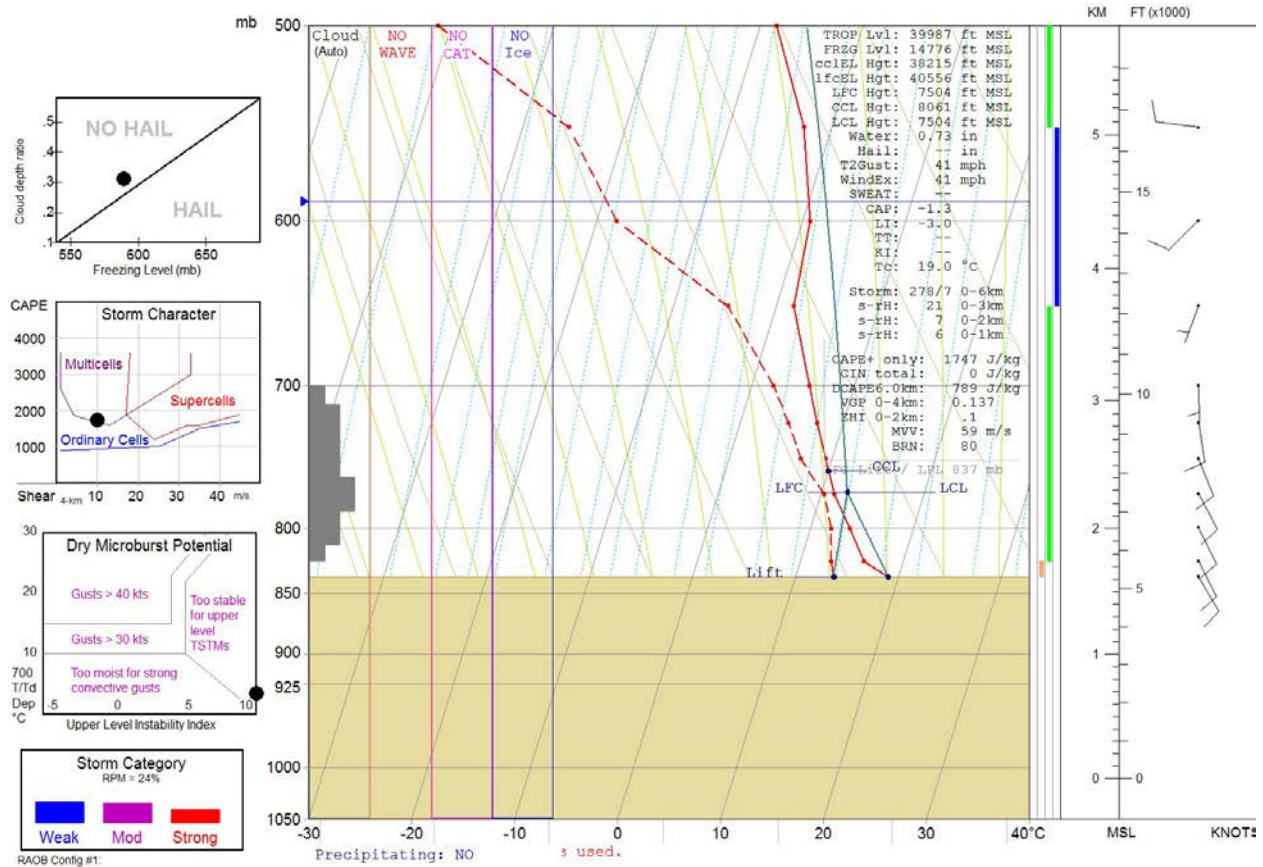


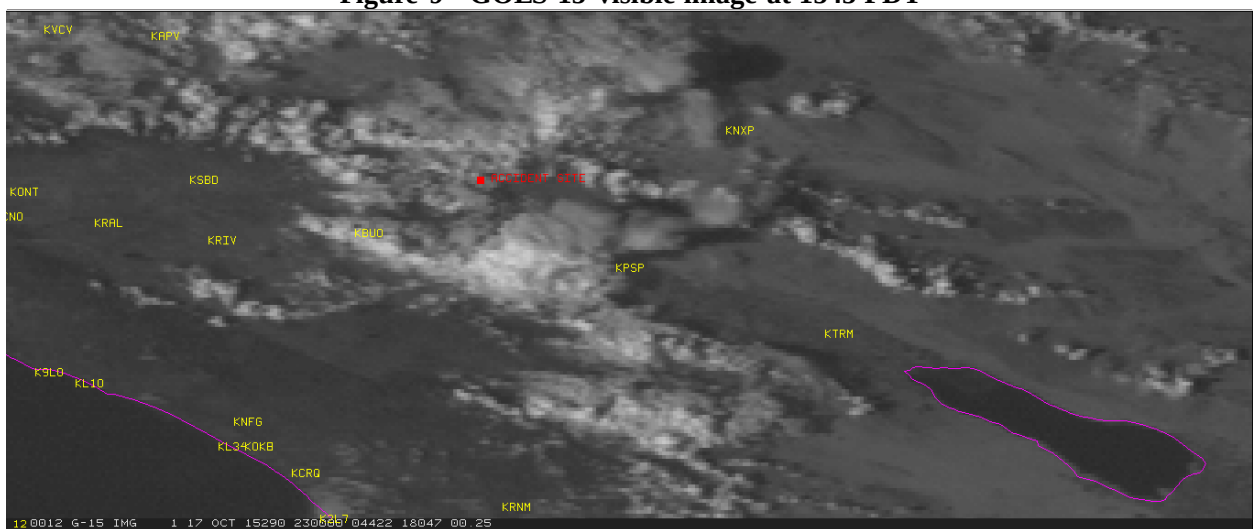
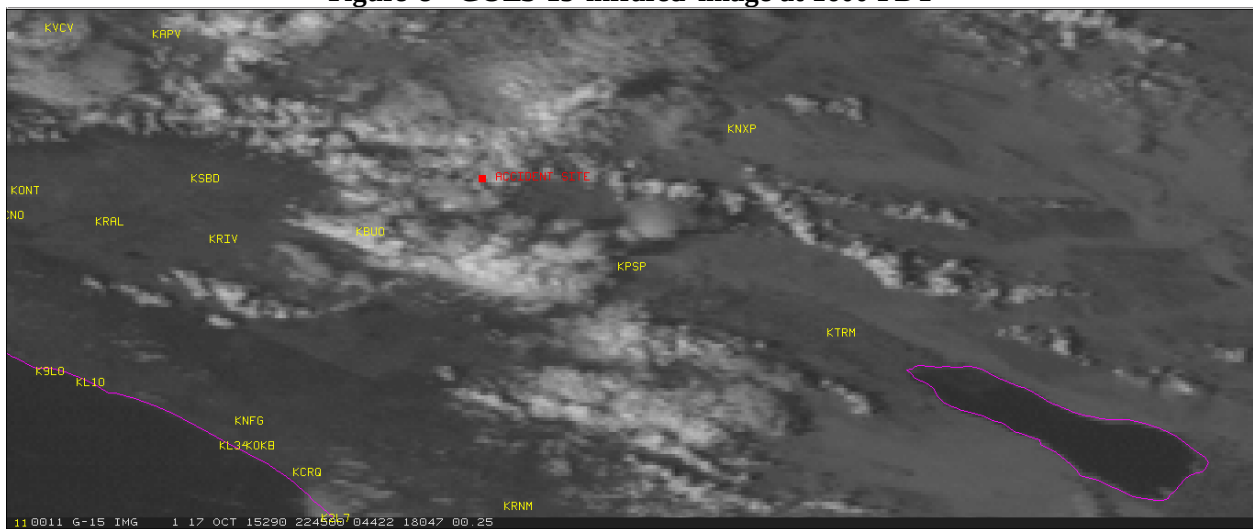
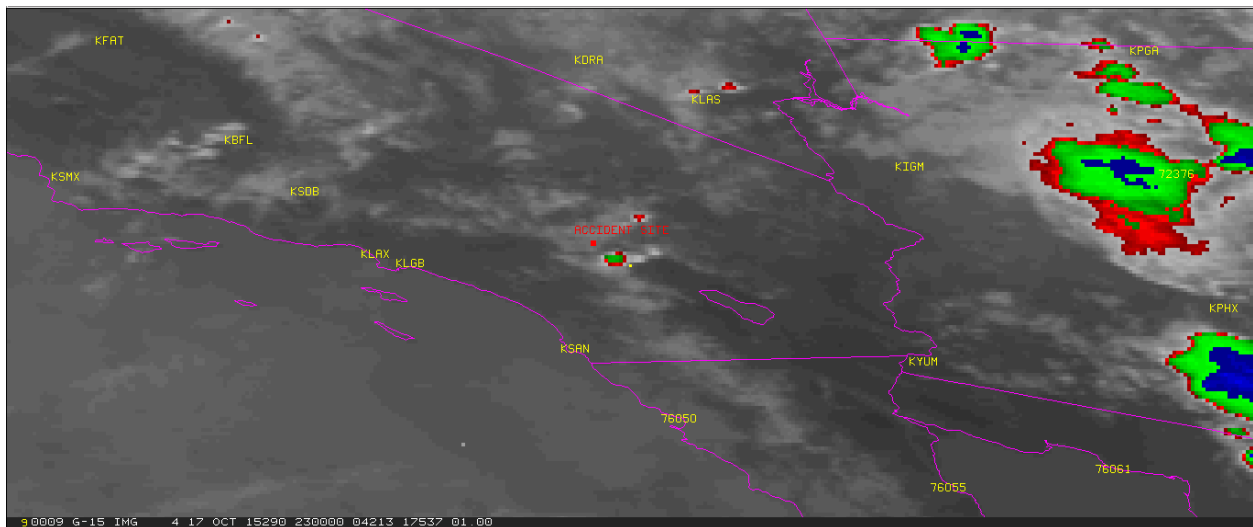
Figure 6- NAM model sounding for 1400 PDT over the accident site

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD/FF (deg/kts)	CAT (AF)	LLWS	Icing - Type (S-F clouds)
5308	837	19.0	13.7	71	151/8			
5714	825	16.2	13.0	81	154/8			
6572	800	13.8	12.0	89	154/8			
7449	775	11.3	10.3	94	153/9			
8347	750	9.4	7.0	85	159/9			
9269	725	7.5	4.7	82	171/8			
10216	700	5.6	2.1	78	178/6			
12193	650	1.7	-4.7	62	199/7			
14307	600	0.7	-18.1	23	223/9			
16584	550	-2.7	-25.5	15	278/11			
19036	500	-8.4	-41.3	5	282/14			

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

Figures 9 and 10 are the GOES-15 visible imagery at 2X magnification which shows multiple layers of clouds extending from west of Palm Springs through the accident site, and obscuring Banning Pass.





5.0 Weather Radar Information

The closest Weather Surveillance Radar-1988, Doppler (WSR-88D) to the accident site was from the Edwards Air Force Base (KEYX) located approximately 72 miles northwest of the accident site. The level II and III archive data was obtained from the National Climatic Data Center (NCDC) utilizing the Hierarchical Data Storage System (HDSS) and displayed using the NWS NEXRAD Interactive Viewer and Data Exporter software.

5.1 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors³ 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 (dBZ⁴), and is a general measure of echo intensity. The chart below relates the NWS video integrator and processor (VIP) intensity levels versus the WSR-88D's display levels, precipitation mode reflectivity in decibels, and rainfall rates.

NWS VIP/DBZ CONVERSION TABLE

NWS VIP	WSR-88D LEVEL	PREC MODE DBZ	RAINFALL
0	0 1 2	< 5 5 to 9 10 to 14	
1 Very Light	3 4 5	15 to 19 20 to 24 25 to 29	.01 in/hr .02 in/hr .04 in/hr
2 Light to Moderate	6 7	30 to 34 35 to 39	.09 in/hr .21 in/hr
3 Strong	8	40 to 44	.48 in/hr
4 Very Strong	9	45 to 49	1.10 in/hr
5 Intense	10	50 to 54	2.49 in/hr

³ 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.

⁴ dBZ - $10 \log Z_e$

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, NWS VIP level 1)
- (b) "Moderate" (30 to 40 dBZ, NWS VIP level 2)
- (c) "Heavy" (> 40 to 50 dBZ, NWS VIP level 3 and 4)
- (d) "Extreme" (> 50 dBZ, NWS VIP level 5 and 6)

5.2 Base Reflectivity

Figure 12 is the Edwards AFB (KEYX) WSR-88D 0.5 base reflectivity image at approximately 1552 PDT with the flight track of N4972J overlaid. The image shows several developing echoes north and south of the track, with the flight clear of any significant echoes. Some very light intensity echoes are identified immediately ahead of the aircraft likely indicating echoes in cloud buildups immediately ahead over the higher terrain. At no time did N4972J encounter any of the intense echoes.

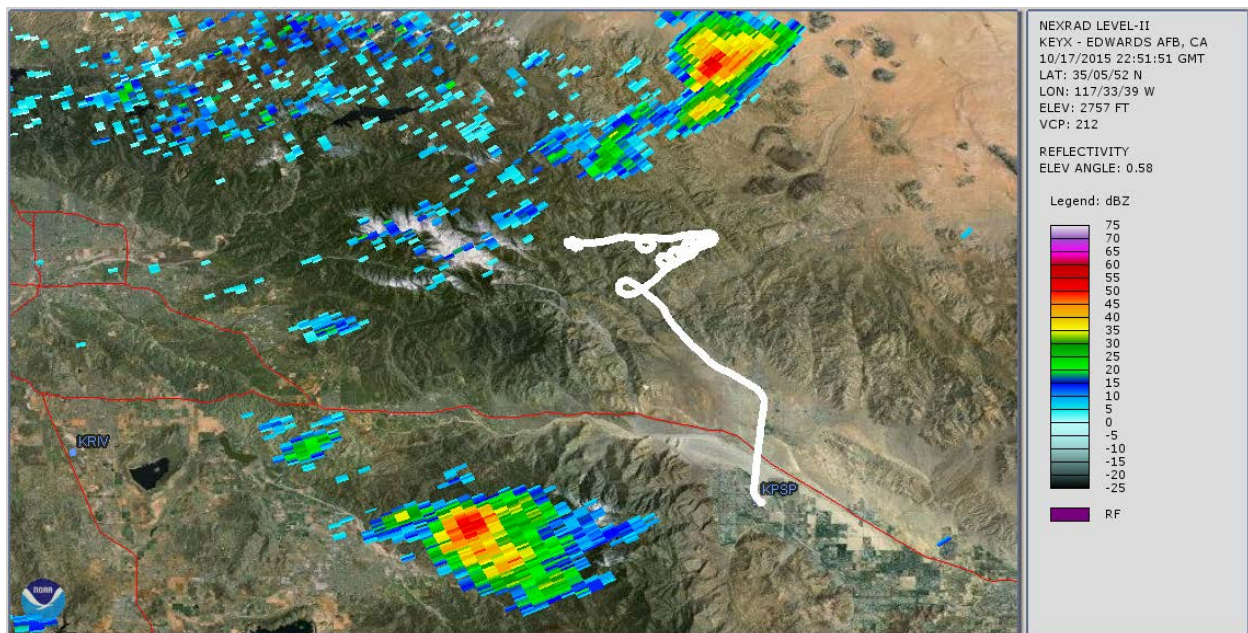


Figure 11 - Edwards AFB WSR-88D 0.5° base reflectivity image at 1552 PDT

6.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over southern California during the period:

SAN UA /OV SAN /TM 1814 /FL045 /TP UNKN /SK BKN018-TOP045=

TOA UA /OV TOA/TM 1906/FL033/TP UNKN/SK SCT020-TOPUNKN/BKN033

*EED UA /OV PAN-EED /TM 1919 /FL085 /TP PC12 /SK BKN-OVC095 /WX FV99SM RA /TA 19 /WV 16509KT
/TB OCNL LGT CHOP 085 /RM OCNL LGTCG=*

ONT UA /OV PDZ355015/TM 1934/FL065/TP P28A/SK OVC070/WX FV99SM/RM VIA CAJON PASS

SDB UA /OV TOA-GMN326005/TM 1940/FL105/TP PA24/SK BKN-TOP105/TB NEG

SDB UA /OV GMN/TM 1944/FL105/TP PA24/SK BKN065-TOP102/TB NEG

*BUO UA /OV PSP330026/TM 2255/FL320/TP B738/TB NEG/RM SK TOP FL320 W/ BUILDING TS...ZLAWC
AWC-WEB:FAAZLA=*

PSP UA /OV HEC177029/TM 2301/FL260/TP A343/TB NEG/RM SK TOP FL250...ZLAWC AWC-WEB:FAAZLA=

SBA UA /OV RZS030025/TM 2319/FL130/TP BE36/TB MOD 130/RM ZLAWC AWC-WEB:FAAZLA=

DAG UA /OV PDZ055060/TM 2324/FL270/TP BE30/RM SK TOP FL270-290...ZLAWC AWC-WEB:FAAZLA=

7.0 Terminal Aerodrome Forecast

The NWS Terminal Aerodrome Forecast (TAF) for Palm Springs International Airport during the period was as follows:

*TAF KPSP 171733Z 1718/1818 VRB06KT P6SM SCT070
FM172300 32009KT P6SM SCT090 SCT120
FM180600 VRB06KT P6SM FEW090 BKN150=*

8.0 Area Forecast

The Area Forecast (FA) is a forecast of visual Flight Rules (VFR) clouds and weather conditions over an area as large as the size of several states. It must be used in conjunction with the AIRMET Sierra (IFR) bulletin for the same area in order to get a complete picture of the weather. The area forecast together with the AIRMET Sierra bulletin are used to determine forecast enroute weather and to interpolate conditions at airports which do not have a terminal forecast (TAF) issued. The NWS Aviation Weather Center (AWC) located in Kansas City, Missouri, issues the FA at regular intervals and issues specials reports as necessary usually in the form of an AIRMET. The San Francisco (KSFO) regional forecast that was current at the time of the accident was issued at 1245 PDT and valid through 0100 PDT on October 18, 2015. The forecast was as follows:

FAUS46 KPCI 171945

FA6W

SFOC FA 171945

SYNOPSIS AND VFR CLDS/WX

SYNOPSIS VALID UNTIL 181400

CLDS/WX VALID UNTIL 180800...OTLK VALID 180800-181400

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...UPR LOW OVR THE NRN CA/SRN OR CSTL WTRS WITH
TROF TO CNTRL CA CST WL MOV SLOLY EWD. WDSRPD MID AND LOW LVL
MSTR ACRS NRN CA-NW NV INTO WRN WA WL SPRD SLOLY EWD. MARINE LVR
ALG THE CNTRL-SRN CA CST WL CONT.

SFC...WK CDFNT EXTDS FM WA CSTL WTRS TO NW CA-CNTRL CA CSTL WTRS.

FNT WL MOV SLOLY EWD TO EXTD FM ERN WA-NWN NV-CNTRL CA BY 12Z.

NRN CA...STS-SAC-TVL LN NWD

CSTL SXNS...BKN-OVC020-030 TOPS 080. ISOL -SHRA. OTLK...MVFR CIG.

SAC VLY...SCT040 BKN100 TOPS 150. WDLY SCT -SHRA. 02Z SCT040 SCT100. OTLK...VFR.

SHASTA-SISKIYOU-SERN CA...BKN080-090 BKN130 TOPS 160. WDLY SCT -SHRA. OTLK...MVFR CIG.

NRN SIERNEV...BKN080-090 BKN130 TOPS FL180. OCNL VIS 3-5SM -SHRA/ISOL -TSRA. CB TOPS FL350.

BECMG 0003 BKN080-090 TOPS 140.

ISOL -SHRA. OTLK...MVFR CIG.

CNTRL CA

CSTL SXNS SNS NWD...BKN015-020 TOPS 040. OTLK...MVFR CIG.

CSTL SXNS S OF SNS...SCT015-020. 04Z BKN010-020 TOPS 030. OTLK...IFR CIG.

SAN JOAQUIN VLY...SCT060 SCT-BKN120 TOPS 150. ISOL -SHRA. OTLK...VFR.

SRN SIERNEV...BKN080-100 TOPS 150. WDLY SCT -SHRA/ISOL -TSRA. CB TOPS FL350. 04Z SCT-

BKN080-100. OTLK...VFR.

SRN CA..VBG-NID-60NNW BIH LN SWD CSTL SXNS...

CSTLN LAX SWD...SCT025. 03Z BKN-OVC015 TOPS 040. OTLK...MVFR CIG.

CSTL N OF LAX...SCT025. 06Z BKN015 TOPS 030. OTLK...MVFR CIG.

INLAND...SCT030-040. 06Z BKN015-020 TOPS 035. OTLK...MVFR CIG.

INTR MTNS-MOJAVE-SRN DESERTS...SCT090-100. 05Z FEW100. OTLK...VFR.

9.0 In-Flight Weather Advisories

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

There were no NWS weather advisories current during the period for any hazards. Figure 12 is the graphic plot issued by the NWS Aviation Weather Center for thunderstorms during the period.

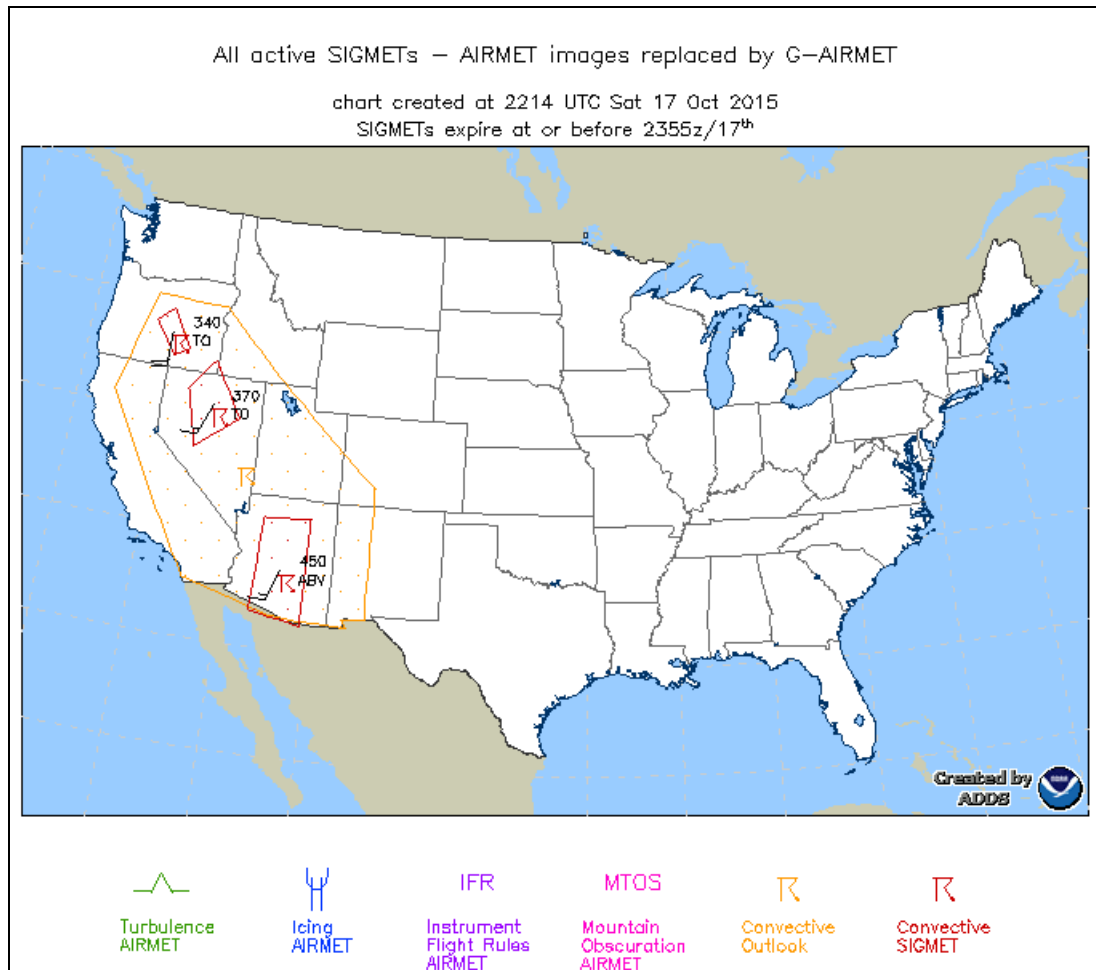


Figure 12 - NWS Convective SIGMETs current during the period

10.0 Winds and Temperature Aloft Forecast

The NWS Winds and Temperature Aloft Forecast current during the period was as follows:

WINDS ALOFT FORECASTS

DATA BASED ON 171800Z

VALID 180000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
ONT	2507	9900+14	1707+08	1906+03	2419-09	2434-22	243739	243650	233859
SAN	9900	1805+14	1510+10	1906+05	2614-08	2623-22	252839	253350	243958
BLH	9900	1509+16	1619+09	1818+04	2711-07	2816-21	271939	251949	253358
WJF		2707+14	2205+08	2010+02	2323-10	2436-23	234340	234350	224059
SBA	3206	3605+13	9900+08	2206+02	2229-10	2435-24	235041	235250	233857

11.0 Astronomical Data

The United States Naval Observatory website provided the following astronomical data for Palm Springs, Riverside County, California on October 17, 2015:

SUN

Beginning of civil twilight	0627 PDT
Sunrise	0653 PDT
Sun transit	1231 PDT
Accident	1552 PDT
Sunset	1810 PDT
End of civil twilight	1835 PDT

At the time of the accident the sun was 26° above the horizon at an azimuth of 236°.

Submitted by:

Donald Eick
NTSB Senior Meteorologist