



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 13, 2019

Weather Study

METEOROLOGY

DCA19IA036

Table Of Contents

A. INCIDENT.....	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 National Composite Radar Mosaic	5
1.3 Convective Outlook	5
1.4 Constant Pressure Charts	7
1.5 12-hour Surface Prognostic Chart.....	10
2.0 Observations	10
2.1 METAR Display	12
2.2 5-minute Observations	12
2.3 1-minute Wind and Weather Observations.....	13
3.0 Sounding Data.....	14
3.1 Numerical Model Sounding.....	14
3.2 Aircraft Meteorological Report.....	16
4.0 Satellite Imagery	17
5.0 Weather Radar	19
5.1 Reflectivity Scales	19
5.2 Base Reflectivity Imagery.....	20
6.0 Pilot Reports.....	21
7.0 NWS Forecasts and Advisories	22
7.1 Terminal Aerodrome Forecast	22
7.2 Area Forecast Discussion.....	22
7.3 Winds and Temperatures Aloft Forecast	24
7.4 Inflight Weather Advisories.....	25
8.0 Dispatchers Statement.....	29
9.0 Dispatch Release	29
10.0 Weather Document	30
F. LIST OF ATTACHMENTS	30

A. INCIDENT

Location: Burbank, California
Date: December 6, 2018
Time: about 0905 Pacific standard time
1705 Universal Coordinated Time (UTC)
Airplane: Southwest Airlines flight 278, Boeing 737-7H4; Registration: N752SW

B. METEOROLOGIST

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National Transportation Safety Board

C. SUMMARY

On December 6, 2018, about 0905 Pacific standard time, Southwest Airlines flight 278, a Boeing 737-7H4, N752SW, overran runway 08 during the landing roll at Bob Hope Airport (KBUR), Burbank, California, and came to rest in the engineered materials arresting system (EMAS) at the departure end of the runway. The 2 certificated airline transport pilots, 3 cabin crewmembers, and 112 passengers were not injured and evacuated the airplane via airstairs. The airplane sustained minor damage. The regularly scheduled domestic passenger flight was operating under the provisions of 14 *Code of Federal Regulations* Part 121. Instrument flight rules conditions prevailed at the airport at the time of the incident, and an instrument flight rules flight plan was filed for the flight, which originated at Metropolitan Oakland International Airport (KOAK), Oakland, California, about 0810 Pacific standard time.

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 Pacific standard time (PST) based upon the 24-hour clock, local time is -8 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.

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 0700 PST (1500Z) on December 6, 2018 on a general topographical map is included as figure 1 with the approximate accident site marked by a red star. The chart depicted a low pressure system at 1008-hectopascals (hPa)¹ off the southwest California coast with an associated occluded front wrapping around the low and turning into a cold front across the Mexican Baja of California. The Burbank area was located north of the occluded front. A second low pressure system at 1015-hPa was located over western Arizona to the east of the area with troughs of low pressure extending northeast and south of the low.

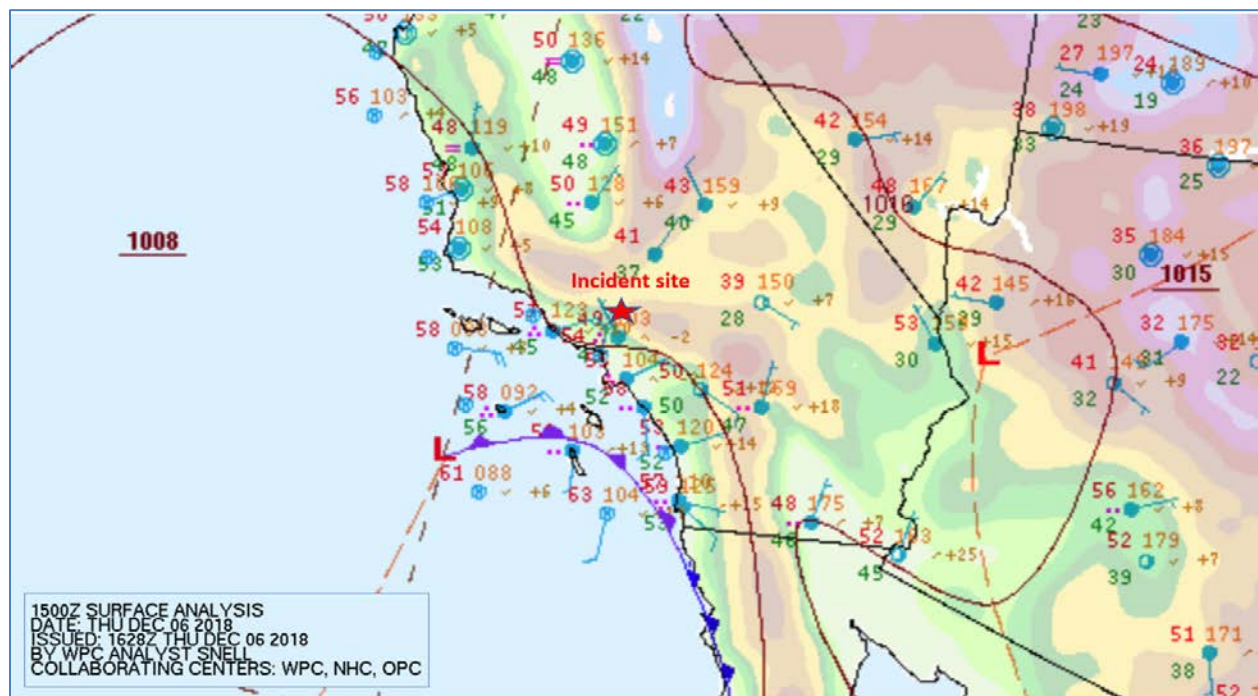


Figure 1 - southwest section of the NWS Surface Analysis Chart for 0700 PST

The surface analysis station models in the vicinity of the accident site depicted the cyclonic or counterclockwise wind flow into the low with winds generally from the northeast to east at 5 knots

¹ Hectopascals (hPa) is the new standard term for reporting sea level pressure and is interchangeable with the former term millibar (mb) with the same units. Standard sea-level pressure is 1013.25-hPa at 15° Celsius (C).

with stronger winds off the coast near the low, and with some exceptions were noted due to the terrain in the immediate vicinity of the incident where wind from the northwest at 5 knots. An extensive area of light to moderate rain was also indicated over southern California with overcast clouds, and temperatures in the 50's degrees Fahrenheit (F), with dew point temperatures generally within 2° F of the temperature.

1.2 National Composite Radar Mosaic

The NWS National Composite Radar Mosaic for 0900 PST centered over the region is included as figure 2 with the approximate incident site marked by a red star. The composite radar mosaic image depicted a large area of echoes over the Burbank area associated with moderate to heavy rain.

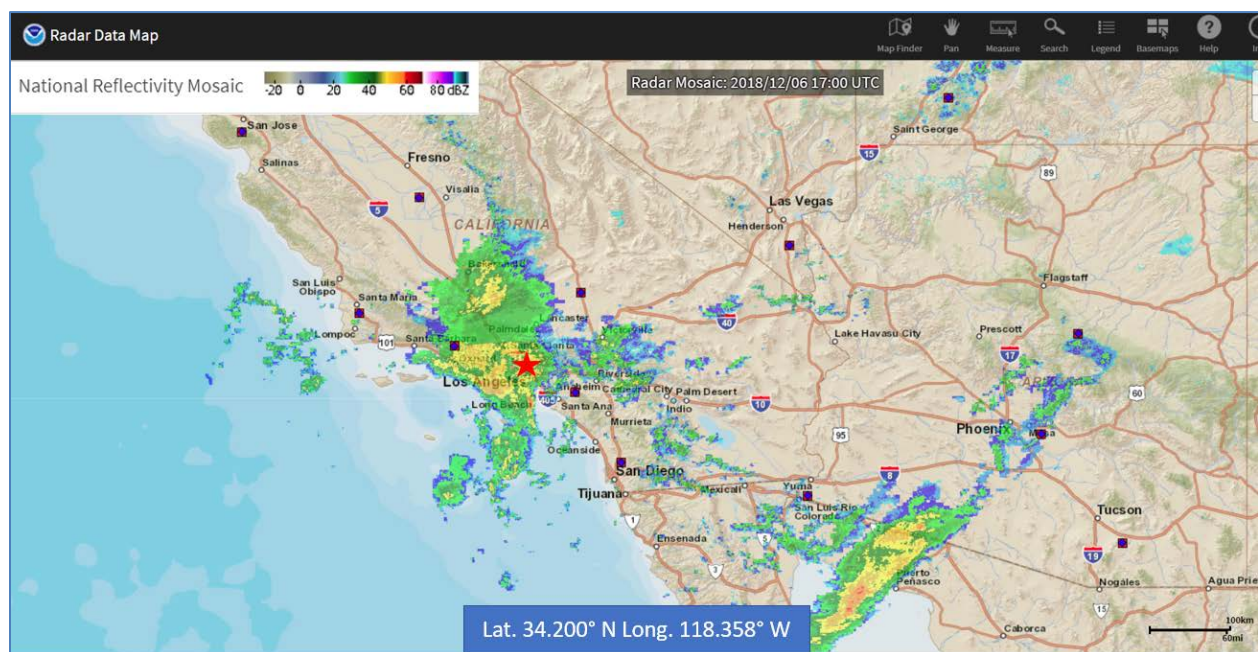


Figure 2 - National Composite Radar Mosaic over the region at 0900 PST

The closest NWS weather surveillance radar and the echoes in the vicinity of the airport at the time of the incident are documented in section 5.0 of this report.

1.3 Convective Outlook

The NWS Storm Prediction Centers (SPC) Convective Outlook graphic and text bulletin (AC) current for the period are included below. The Convective Outlook is designed to provide users a quick reference to where strong to severe organized convection or thunderstorms are expected within the next 24-hours, with the text bulletin providing a description of the meteorological conditions, the threat potential, and general timing in the forecast.

Figure 3 is the graphical outlook issued at 0818 PST which expected a general risk of thunderstorms over the southwestern California and Arizona, which included the accident site. No

organized severe thunderstorms² were expected during the period. The AC bulletin issued with the graphic indicated that the water vapor satellite imagery showed a well-organized upper level low pressure system off the California coast, with a shortwave trough rotating inland over southern California that was expected to support the development of scattered rain showers and thunderstorms over the Los Angeles Basin down to San Diego. The overall severe threat was minimal, but a few of the stronger convective storms were expected to produce small hail during the afternoon and evening hours.

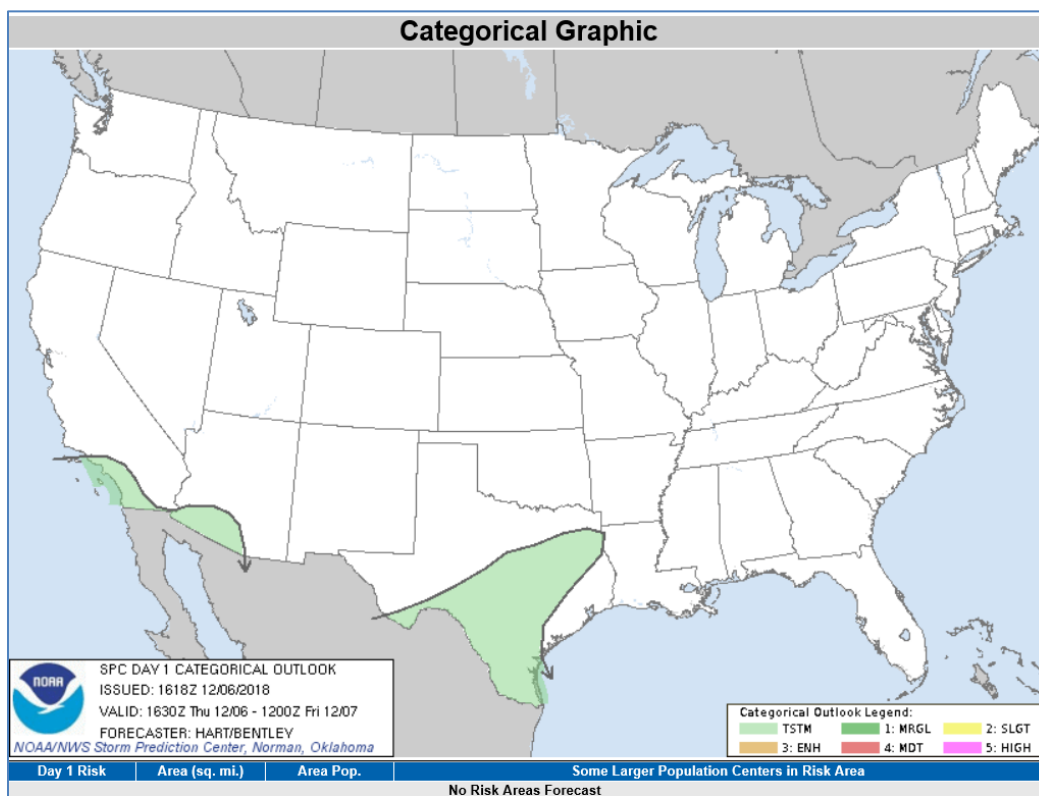


Figure 3 - Convective Outlook issued at 0830 PST for organized and severe thunderstorms

ACUS01 KWNS 061618
 SPC AC 061618

Day 1 Convective Outlook
 NWS Storm Prediction Center Norman OK
 1018 AM CST Thu Dec 06 2018

Valid 061630Z - 071200Z

...NO SEVERE THUNDERSTORM AREAS FORECAST...

...SUMMARY...

² The NWS defines a severe thunderstorm as one that produces a tornado, hail of 1-inch in diameter or greater, or wind gusts of 50 knots or more. Severe thunderstorms also imply severe to extreme turbulence, severe icing, localized instrument flight rule (IFR) conditions, and an increase risk of low-level wind shear and microbursts.

A few thunderstorms remain possible today along the southern California coastal area, and from southwest through central Texas tonight.

...Southern CA...

Water vapor loop shows a strong upper low off the CA coast, with a significant lead shortwave trough rotating inland over southern CA. Scattered showers and thunderstorms will accompany this system, affecting the LA Basin down to San Diego. A few of the stronger convective elements may produce small hail this afternoon and evening, but the overall severe threat appears minimal.

...TX...

Deep lift is slowly increasing across TX ahead of the large upper system moving into CA. Scattered showers and even isolated thunderstorms have developed across this region this morning. Coverage of precipitation will expand through the day and especially tonight. Present indications are that the risk of scattered thunderstorms will increase tonight, and especially after midnight. Weak thermodynamics will preclude a severe threat.

..Hart/Bentley.. 12/06/2018

1.4 Constant Pressure Charts

The NWS SPC upper air charts for 850-, 700-, 500-, and 250-hPa for 0400 PST (1200Z) are included as figures 4 through 7 with the approximate incident site located by a red star and the location of the major pressure systems and troughs added to the charts. The charts represent the conditions at approximately 5000 ft, 10000 ft, 18000 ft, and 34000 ft, and depict the temperature, moisture, and winds at those levels. The 250-hPa chart includes isotachs for lines of equal wind speed and are shaded above 70 knots to show the location of jet stream strength winds.

The charts depict a closed low pressure system off the southwest California coast at 850- and 700-hPa, with a defined long wave trough at 500- and 250-hPa. The 850- and 700-hPa charts both depicted winds from the south, which veered to the southwest at 500- and 250-hPa with winds speeds increasing with altitude. The accident site was in an area ahead of the low and in an area favorable for upward vertical motion supporting clouds and precipitation formation.

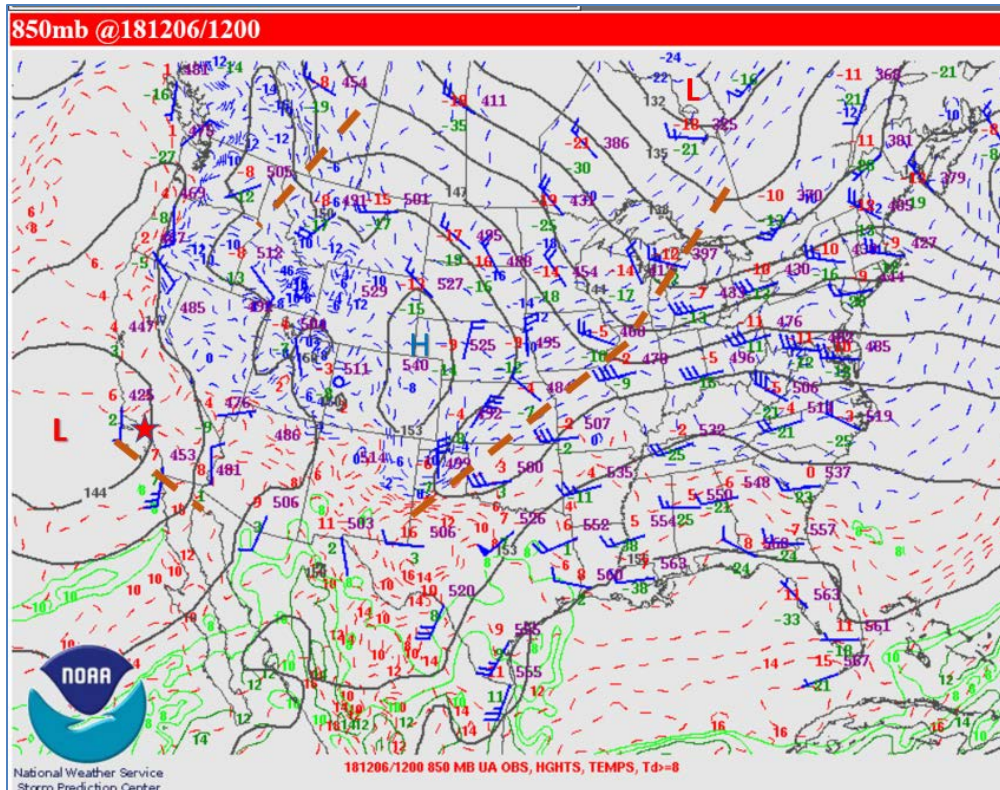


Figure 4 - NWS 850-hPa constant pressure chart for 0400 PST

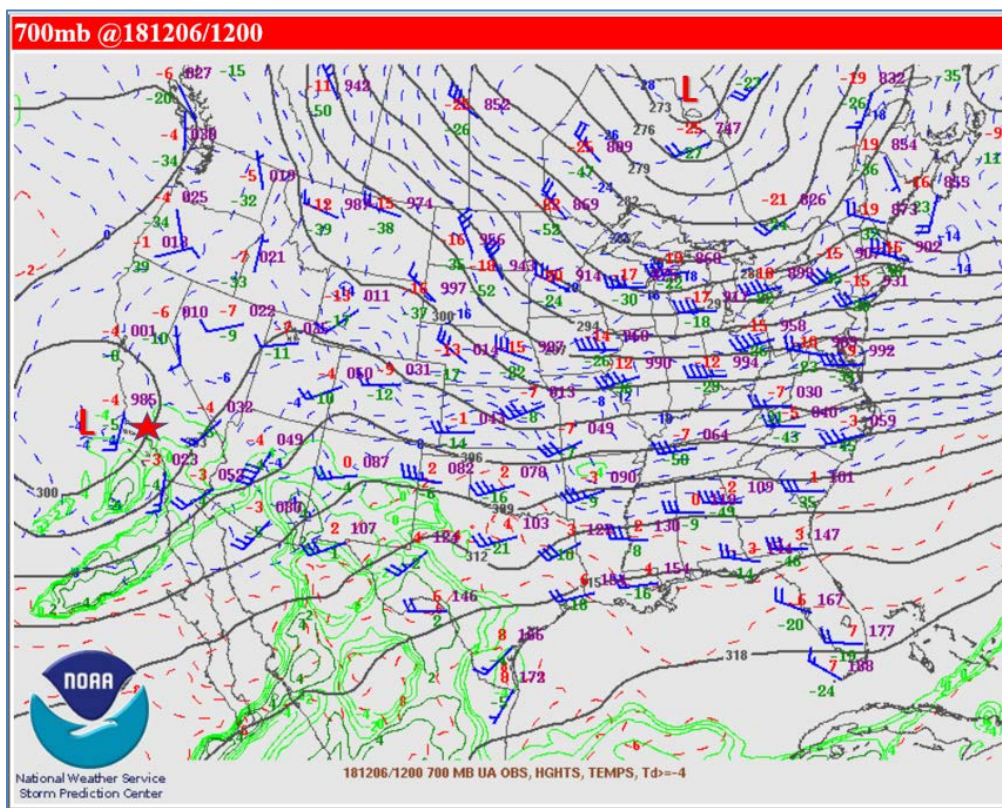


Figure 5 - NWS 700-hPa constant pressure chart for 0400 PST

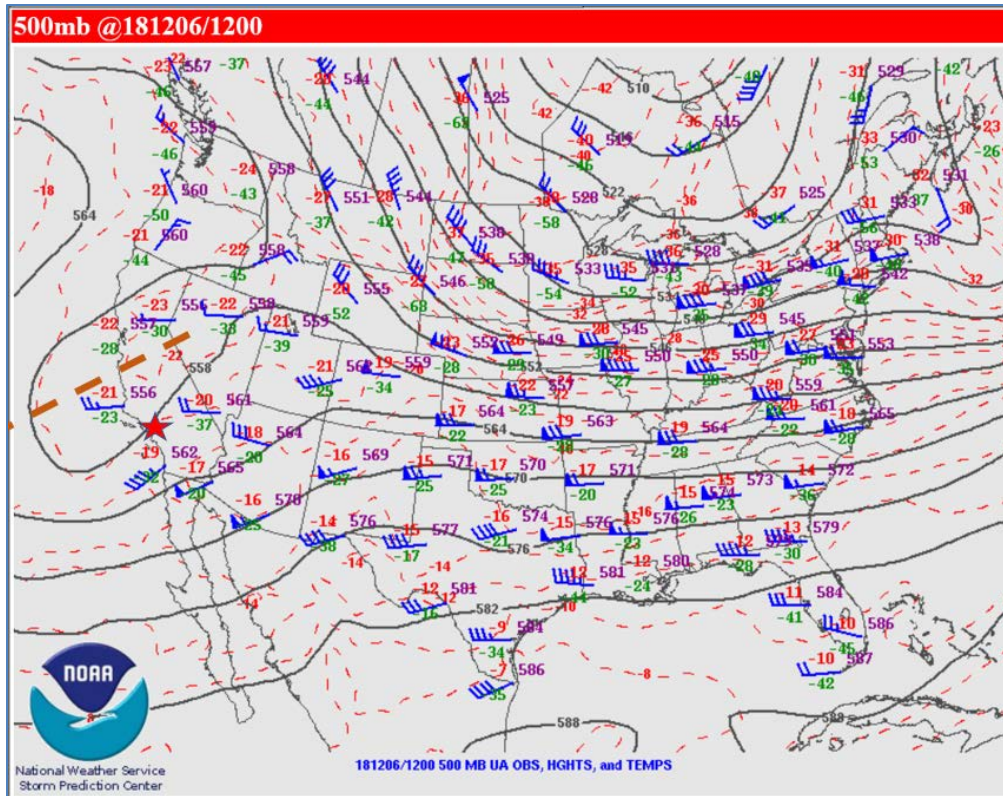


Figure 6 - 500-hPa constant pressure chart for 0400 PST

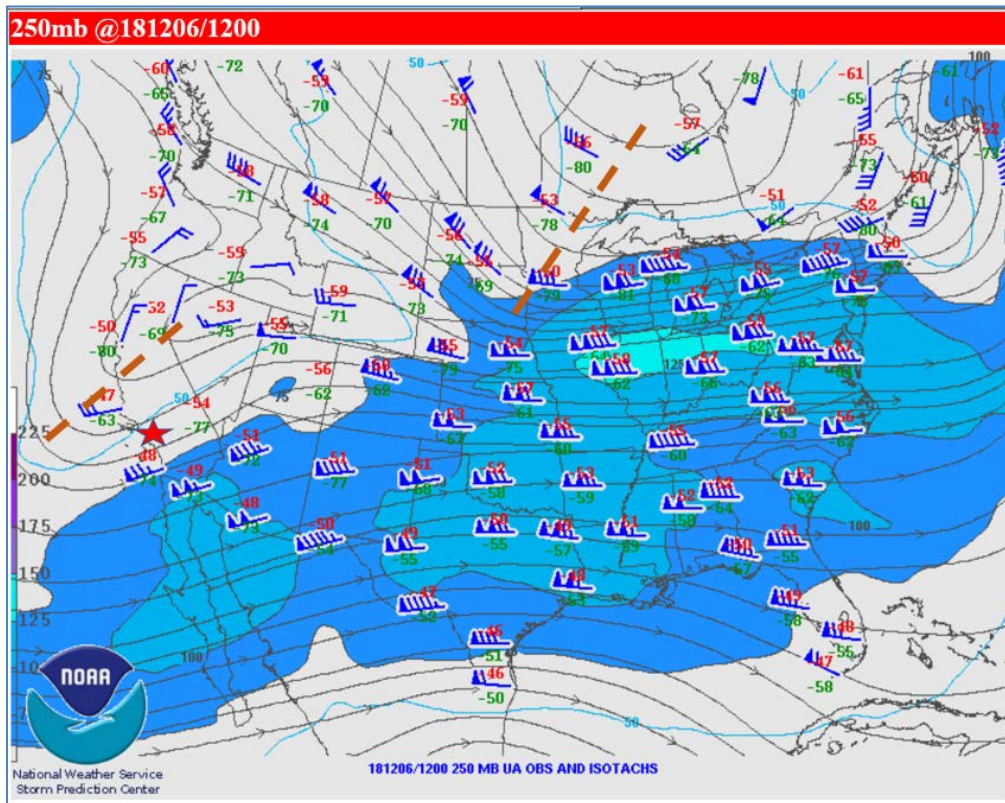


Figure 7 - 250-hPa constant pressure chart for 0400 PST

1.5 12-hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart issued by NCEP current during the period is included as figure 8. The chart depicted the expected pressure system location and strength, frontal boundaries, and forecast precipitation expected at 1600 PST. The chart depicted the low pressure system off the southwest California coast with an associated occluded low pressure system and another low over southern Arizona to the east. A large area of precipitation was depicted over southern California and Arizona, which continued to be depicted over the accident site.

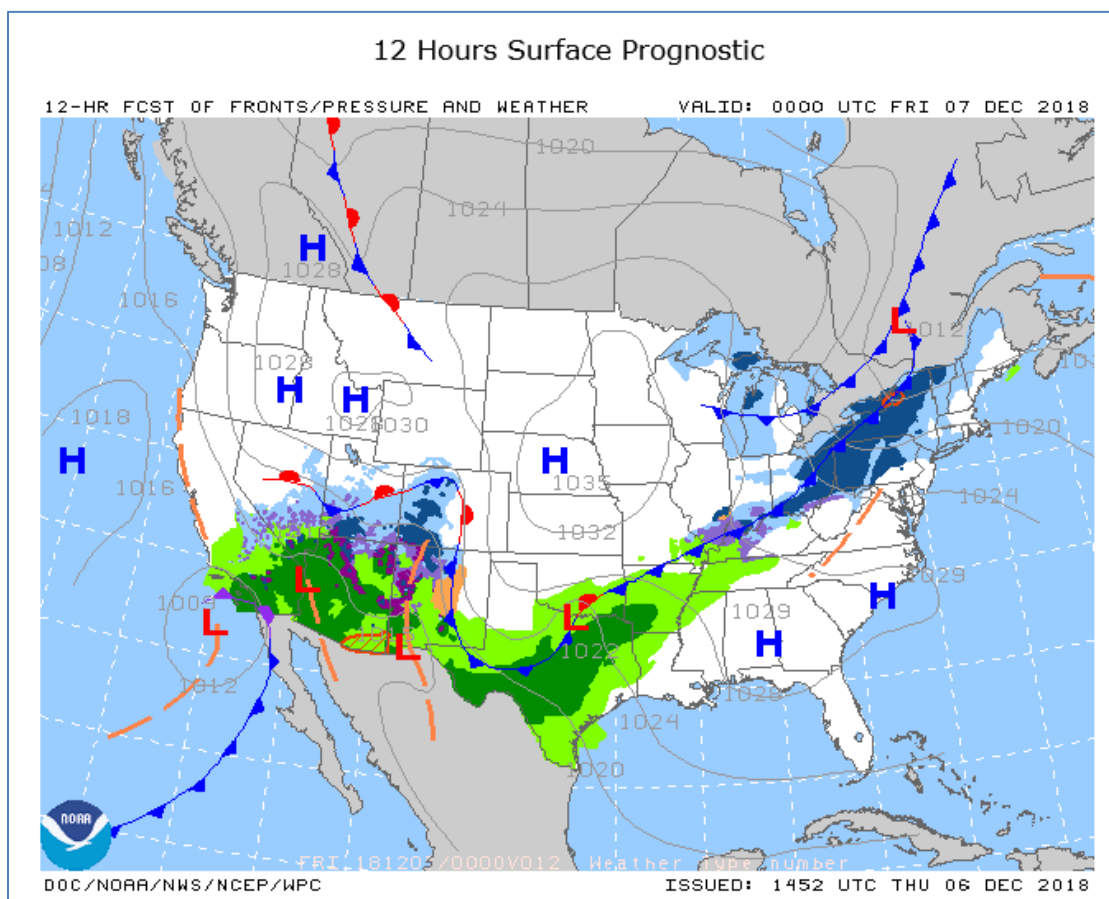


Figure 8 - 12-hour Surface Prognostic Chart

2.0 Observations

Bob Hope Airport (KBUR), Burbank, California, had a federally installed and maintained Automated Surface Observation System (ASOS) and was augmented by air traffic control tower personnel in a Limited Aviation Weather Reporting Station (LAWRS). The airport listed an elevation of 778 ft and a magnetic variation of 12° E. The Meteorological Aerodrome Reports (METAR) and Special (SPECI) reports issued surrounding the period were documented, with cloud heights reported above ground level (agl). The following conditions were reported surrounding the time of the incident:

KBUR weather observation at 0853 PST (1653Z), wind from 280° at 11 knots, visibility 1 ½ miles in heavy rain and mist, a few clouds at 400 ft, ceiling overcast at 1,300 ft,

temperature and dew point temperature 8° C (47° F), altimeter 29.91 inches of mercury (Hg). Remarks: automated observation system with a precipitation discriminator, sea level pressure of 1012.2-hPa, hourly precipitation 0.33 inches, temperature 8.3° C, dew point temperature 8.3° C.

KBUR special weather observation at 0915 PST (1715Z), wind from 290° at 8 knots, visibility 1 mile in heavy rain and mist, a few clouds at 500 ft, ceiling broken at 1,300 ft, overcast at 3,100 ft, temperature and dew point temperature 8° C (47° F), altimeter 29.93 inches of Hg. Remarks: automated observation system with a precipitation discriminator, aircraft mishap, precipitation since 0853 PST 0.26 inches, temperature 8.3° C, dew point temperature 7.8° C.

The general flight categories³ and raw observations in standard code and abbreviations from 0853 through 1153 PST were as follows:

MVFR METAR KBUR 061453Z 32003KT 4SM RA BR FEW003 SCT026 OVC049 09/09 A2985 RMK AO2 SLP103 P0020 60063 T00940094 58002=

IFR SPECI KBUR 061547Z 29005KT 1 3/4SM +RA BR SCT011 BKN047 OVC060 09/09 A2986 RMK AO2 P0017=

IFR METAR KBUR 061553Z 29005KT 1 1/4SM +RA BR BKN011 BKN017 OVC047 09/09 A2986 RMK AO2 SLP106 P0021 T00940089=

IFR SPECI KBUR 061641Z 26011KT 2 1/2SM RA BR FEW004 BKN013 OVC019 09/09 A2989 RMK AO2 P0023 T00890089=

IFR METAR KBUR 061653Z 28011KT 1 1/2SM +RA BR FEW004 OVC013 08/08 A2991 RMK AO2 SLP122 P0033 T00830083=

Incident 1705Z

IFR SPECI KBUR 061715Z 29008KT 1SM +RA BR FEW005 BKN013 OVC031 08/08 A2993 RMK AO2 AIRCRAFT MISHAP P0026 T00830078=

IFR SPECI KBUR 061723Z 28012KT 1 1/4SM +RA BR FEW008 BKN016 OVC024 08/08 A2994 RMK AO2 AIRCRAFT MISHAP P0032 T00830078=

IFR METAR KBUR 061753Z 29005KT 2 1/2SM +RA BR FEW020 BKN026 OVC048 08/07 A2996 RMK AO2 SLP139 AIRCRAFT MISHAP P0049 60166 T00830072 10100 20083 53035=

³ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

2.1 METAR Display

A display of the METARs from the NWS Aviation Weather Center (AWC) website⁴ for 0900 PST (1700Z) with the radar overlaid is included as figure 9. The station model for KBUR indicated IFR conditions with a westerly wind of approximately 10 knots, visibility of 1 ½ miles in heavy rain, overcast clouds at 1,300 ft agl, temperature 47 F, dew point 47 F, and an altimeter setting of 29.91 inches of Hg. The surrounding stations continued to depict a more easterly wind direction into the low pressure system off the California coast.

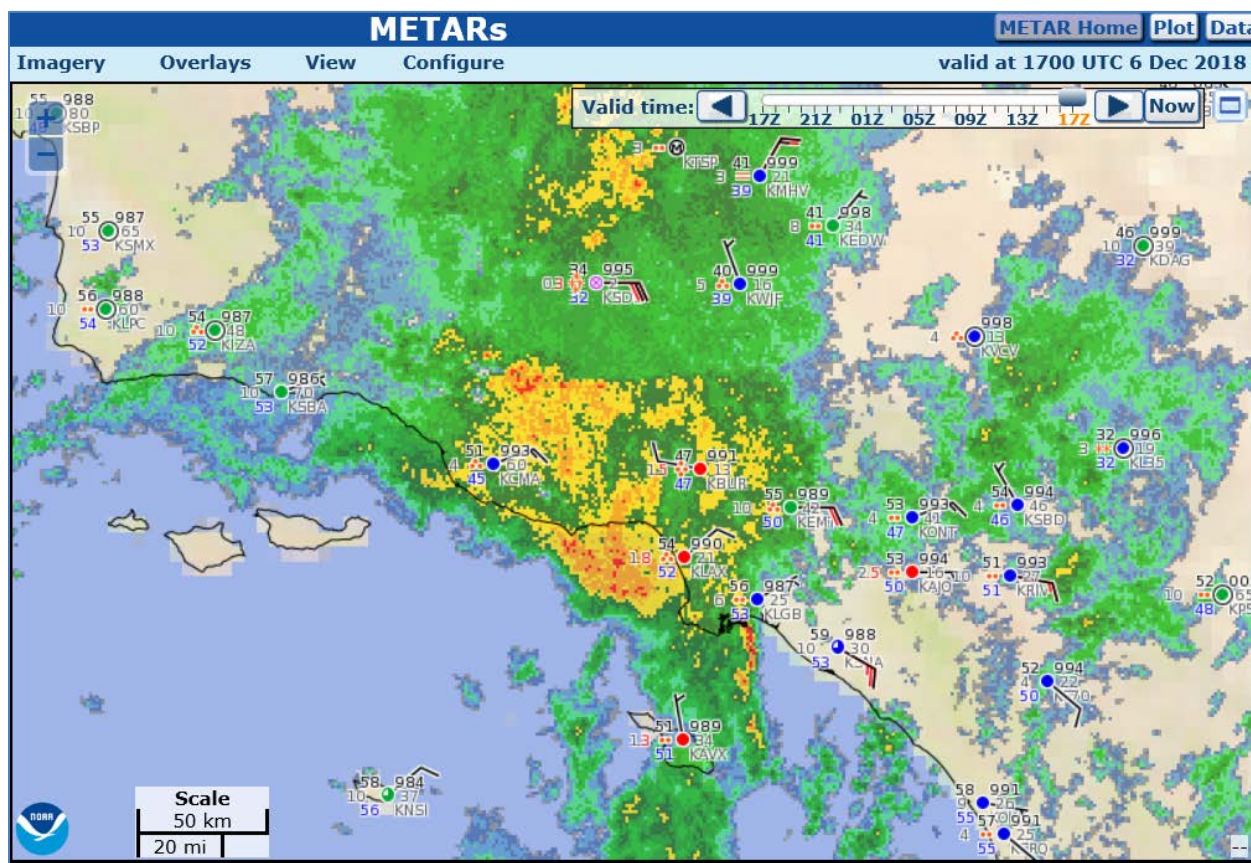


Figure 9 - AWC METAR display for 0900 PST with weather radar overlaid

2.2 5-minute Observations

A review of the 5-minute ASOS observation which were recorded by the system and displayed in the air traffic control tower and the ASOS computer workstation were as follows with the local time and the observation:

08:45:31 PST 5-MIN KBUR 061645Z 27014KT 2 1/2SM +RA BR FEW004 BKN013 OVC019 09/09 A2989 810 100
300 250/14 RMK AO2 P0024 T00890089

08:50:31 PST 5-MIN KBUR 061650Z 27015KT 1 3/4SM +RA BR SCT004 BKN013 OVC019 09/08 A2991 790 96
300 250/15 RMK AO2 PRESRR P0028

⁴ <https://aviationweather.gov/metar>

08:55:31 PST 5-MIN KBUR 061655Z 28011KT 1 1/4SM +RA BR FEW004 BKN013 OVC017 08/08 A2991 790 100 200 260/11 RMK AO2 P0002 T00830083

09:00:31 PST 5-MIN KBUR 061700Z 27016KT 1SM +RA BR SCT004 OVC013 08/08 A2991 790 100 200 260/16 RMK AO2 P0009 T00830083

Incident 1705Z

09:05:31 PST 5-MIN KBUR 061705Z 28013KT 1 1/4SM +RA BR SCT004 BKN013 OVC020 08/08 A2991 790 96 200 270/13 RMK AO2 P0013 T00830078

09:10:31 PST 5-MIN KBUR 061710Z 28014KT 1 1/2SM +RA BR FEW005 BKN013 OVC031 08/08 A2993 770 96 200 270/14 RMK AO2 PRESRR P0018 T00830078

09:15:31 PST 5-MIN KBUR 061715Z 29008KT 1SM +RA BR FEW005 BKN013 OVC031 08/08 A2993 770 96 200 280/08 RMK AO2 AIRCRAFT MISHAP P0026 T00830078

At the time of the incident the 5-minute observation at 0905 PST for KBUR reported the wind from 280° at 13 knots, visibility 1 1/4 mile in heavy rain and mist, scattered clouds at 400 ft agl, ceiling broken at 1,300 ft, overcast at 2,000 ft, temperature and dew point 8° C, altimeter 29.91 inches of Hg. The pressure altitude was 790 ft, the relative humidity 96%, the density altitude was 200 ft, and the magnetic wind from 270° at 13 knots. The remarks included the hourly precipitation since 0853 PST at 0.13 inches, temperature 8.3° C, dew point 7.8° C.

Based on the 2-minute average wind reported at 0905 PST resulted in a 2 knot crosswind and 13 knot tailwind component for runway 8, with the runway contaminated by heavy rain.

2.3 1-minute Wind and Weather Observations

The 1-minute ASOS wind, weather, and precipitation data was obtained from the NWS surrounding the period and is included below in table format. The 1-minute wind data is also displayed in the tower for issuance as required. The 1-minute observations include the average 2-minute wind, which is updated every 5-seconds and reported every minute. The second value is maximum 5-second wind reported during the minute, which is used to report gust values and peak wind. The current weather column (WX) abbreviation R is for rain, with the intensity provided as light (-), moderate (), and heavy (+), and with precipitation amount in hundreds of an inch.

Time (PST)	2-min Avg. Wind	Max 5-sec Wind	WX	PRECIP
0845	265° 14	259° 17	R+	0.00
0846	264° 15	261° 16	R	0.00
0847	261° 14	260° 16	R	0.01
0848	259° 14	256° 17	R+	0.01
0849	259° 14	260° 17	R+	0.01
0850	266° 15	268° 16	R+	0.01
0851	270° 14	266° 16	R+	0.01
0852	273° 13	276° 14	R+	0.02
0853	278° 11	275° 13	R+	0.02
0854	278° 10	282° 13	R+	0.01
0855	276° 11	269° 16	R+	0.01
0856	274° 13	281° 19	R+	0.01
0857	269° 14	268° 16	R+	0.02

0858	267° 14	267° 17	R+	0.01
0859	268° 16	267° 19	R+	0.01
0900	269° 16	268° 18	R+	0.02
0901	273° 15	275° 18	R+	0.01
0902	279° 14	284° 18	R+	0.00
0903	282° 14	276° 19	R+	0.01
0904	281° 13	273° 16	R+	0.01
0905	279° 13	274° 18	R+	0.01
0906	275° 15	269° 19	R+	0.00
0907	273° 17	271° 21	R+	0.01
0908	273° 19	271° 21	R+	0.01
0909	274° 17	276° 20	R+	0.01
0910	279° 14	279° 16	R+	0.02
0911	282° 12	280° 15	R+	0.01
0912	284° 11	281° 14	R+	0.02
0913	284° 12	278° 15	R+	0.02
0914	284° 11	273° 13	R+	0.02
0915	290° 8	267° 10	R+	0.01
0916	299° 7	303° 9	R+	0.02

3.0 Sounding Data

Due to the time of the incident between the two upper air observation times of 0400 PST (1200Z) and 1600 PST (0000Z), a combination of numerical model sounding and aircraft-based observed data was used to document the vertical structure of the atmosphere at the approximate time of the incident.

3.1 Numerical Model Sounding

A High-Resolution Rapid Refresh (HRRR) numerical model data was obtained from archive data from the NOAA Air Resource Laboratory (ARL) over KBUR for 0900 PST. The HRRR data was plotted on a standard Skew T log P diagram⁵ using the complete Rawinsonde Observation RAOB program software⁶. Figure 10 is the sounding plot from the surface through 450-hPa (or approximately 21,000 ft) with the derived sounding parameters. The HRRR sounding for 0900 PST over KBUR forecasted a surface temperature of 10.5° C (50.9° F), a dew point temperature of 9.6° C (49.3° F), and a relative humidity of 94% which resulted in a density altitude of 515 ft. The lifted condensation level (LCL)⁷ was identified at 374 ft agl (1,106 ft msl), with the convective condensation level (CCL)⁸ at 3,070 ft agl (3,802 ft msl). The sounding had a relative humidity greater than 90% from the surface through 26,000 ft, with a precipitable water content of 0.96 inches. The sounding's lapse rates and stability indices indicated a stable atmosphere, and

⁵ 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.

⁶ RAOB software – The complete RAWinsonde OBservation program is an interactive sounding analysis program developed by Environmental Research Services, Matamoras, Pennsylvania, for plotting and analyzing upper air data.

⁷ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

⁸ 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.

supported nimbostratus-type clouds and heavy rain. The freezing level was identified at approximately 8,100 ft, and supported icing-in-clouds above that level.

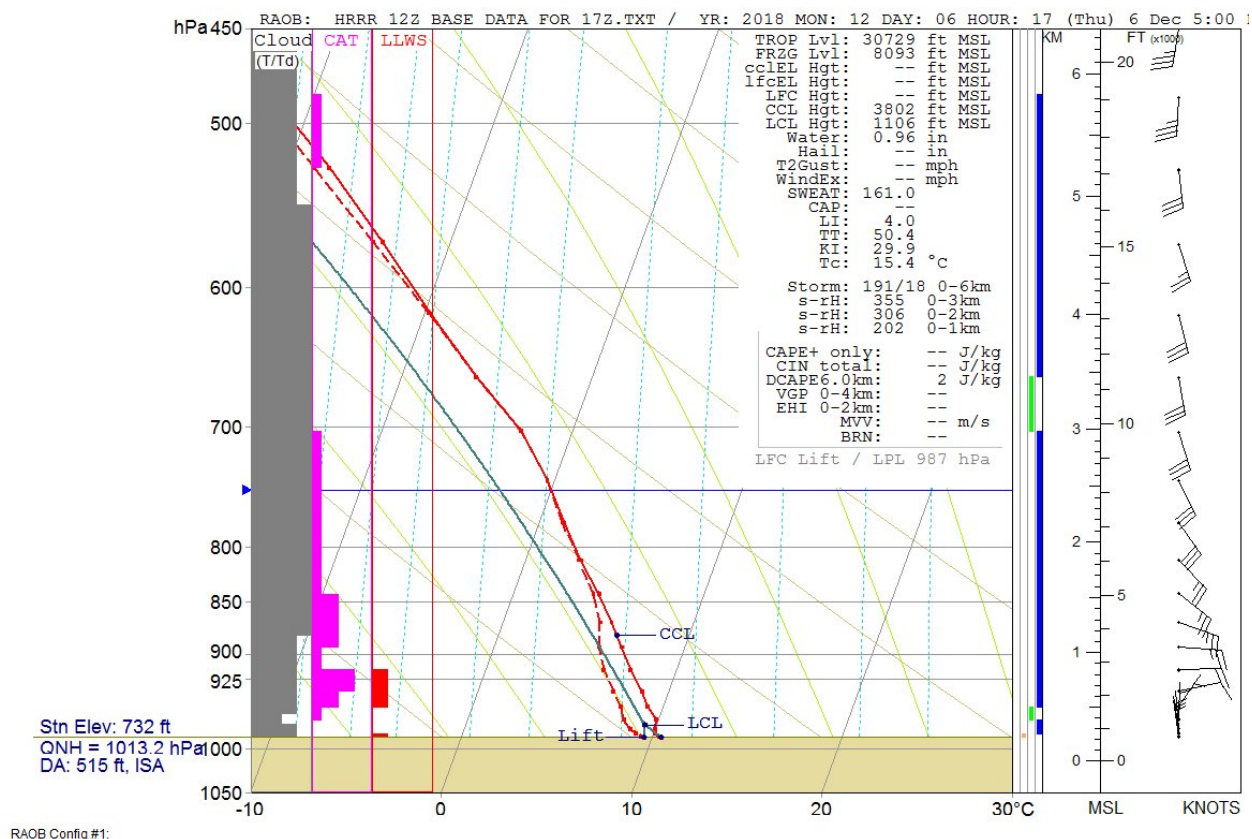


Figure 10 - HRRR numerical model sounding for 0900 PST

The HRRR sounding wind profile expected a surface wind from 350° at 5 knots, with winds veering to the east at 2,000 ft with a low-level wind maximum at 3,450 ft from 095° at 25 knots. Winds then veered clockwise to the south above 4,000 ft through 21,000 ft. The mean 0 to 6 kilometer or approximately 18,000 ft wind was from 160° at 24 knots. The level of maximum wind was identified at approximately 33,270 ft from 210° at 45 knots, which was above the tropopause identified at 30,730 ft.

Figure 11 is a table of the observed height, pressure (Pres), temperature (T), dew point (Td), relative humidity (RH), wind direction and speed, the RAOB algorithm derived clear air turbulence (CAT), low-level wind shear (LLWS), and icing intensity and type, and mountain wave potential from the surface through 21,000 ft based on RAOB algorithms.

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
732	987	10.5	9.6	94	352 / 5				
760	986	10.4	9.4	94	353 / 5		LIGHT		
843	983	10.1	9.1	93	352 / 6				
982	978	10.0	8.7	92	355 / 7				
1263	968	9.9	8.2	89	1 / 7	LGT			
1660	954	9.2	7.8	91	31 / 5	MDT	LIGHT		
2120	938	8.6	7.1	90	78 / 10	SVR	LIGHT		
2764	916	7.6	6.2	91	88 / 20	LGT			
3452	893	6.7	5.5	92	94 / 25	MDT			
4186	869	5.7	5.1	96	112 / 24	MDT			
5033	842	4.5	4.2	98	131 / 24	LGT			
6035	811	2.9	2.8	99	139 / 27	LGT			
7137	778	1.3	1.2	99	148 / 30	LGT			
8387	742	-0.4	-0.4	100	156 / 32	LGT			
9800	703	-2.7	-2.7	100	165 / 32			LGT Rime	
11356	662	-6.1	-6.1	100	171 / 31			MDT Clear	
13154	617	-9.7	-9.8	99	168 / 28			MDT Clear	
15148	570	-13.6	-14.1	96	164 / 25			MDT Rime	
17185	525	-17.8	-18.6	93	174 / 28	LGT		MDT Mixed	
19164	484	-22.3	-23.1	93	183 / 33			LGT Rime	5.13 415 LIGHT
20938	449				189 / 37				6.89 367 LIGHT
21065	447	-26.9	-27.6	94					

Figure 11 - HRRR sounding parameters and RAOB algorithm derived clear air turbulence, low-level wind shear, icing, and mountain wave potential from the surface through 21,000 ft

3.2 Aircraft Meteorological Report

The Aircraft Meteorological Data and Relay (AMDAR) observations were also obtained from the NOAA Earth System Research Laboratory (ESRL) archive site to help identify the vertical structure of the atmosphere near the time of the accident. Figure 12 presents observation from an aircraft that departed KBUR at 0910 PST and was identified as AMDAR aircraft #10733.

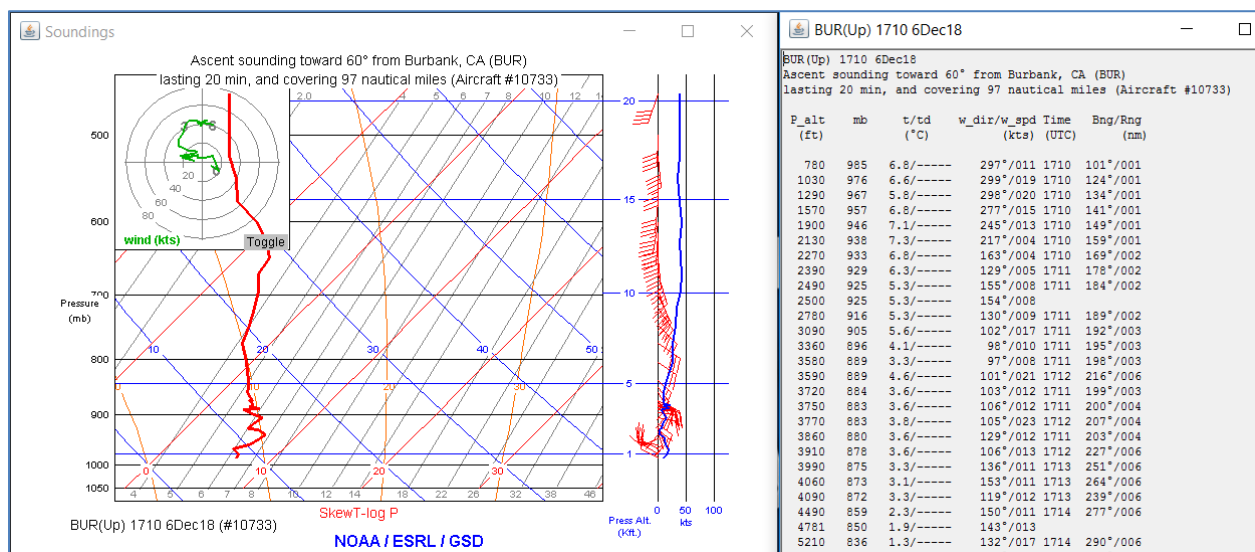


Figure 12 - AMDAR ascent sounding at 0910 PST

The ascent sounding from aircraft #10733 at 0910 PST indicated a low-level temperature inversion from 1,290 ft through approximately 880-hPa or 3,800 ft, where temperature increased

or stayed constant with height. The freezing level was identified at approximately 6,000 ft. The wind profile indicated westerly low-level winds through 1,900 ft that backed to the south and then east above the inversion. Above 7,000 ft the winds then veered to the south with height with wind speeds over 30 knots. A low-level wind maximum was noted at 3,770 ft with wind from 105° at 23 knots. Several rapid changes in wind speed were noted below 3,800 ft consistent with the aircraft encountering turbulence.

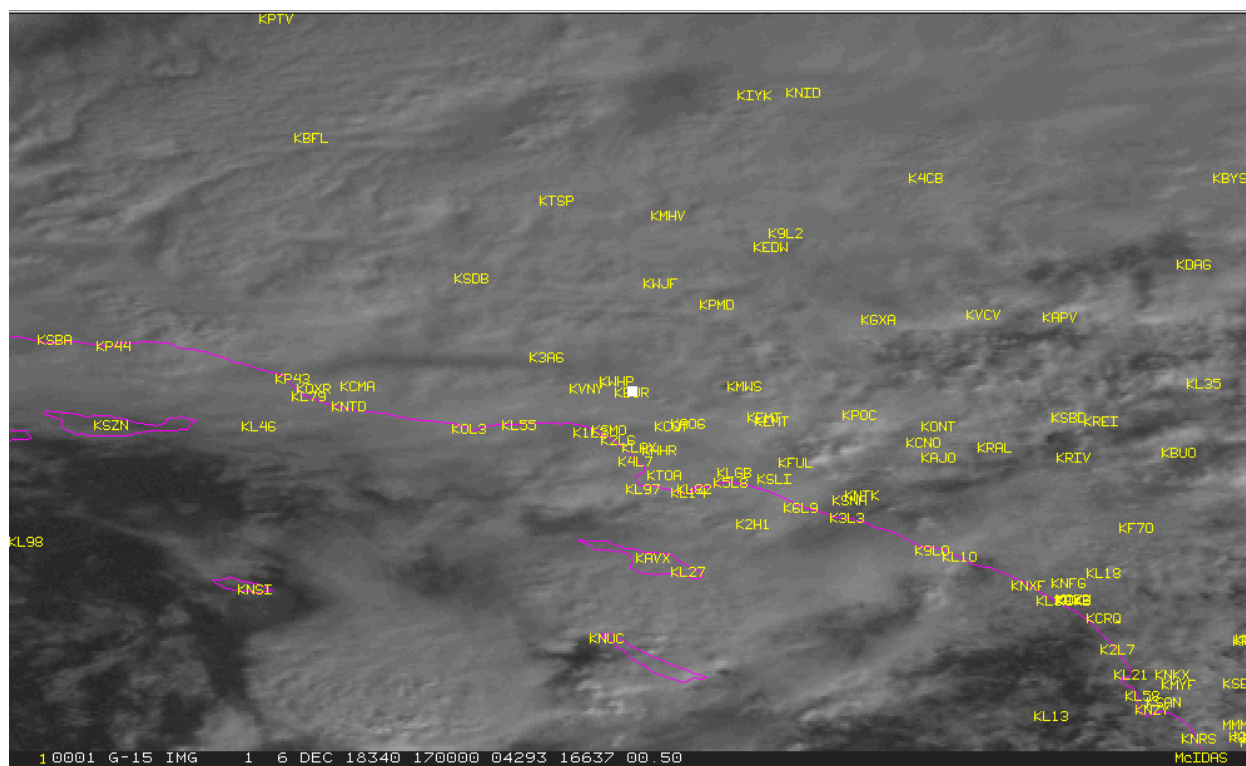
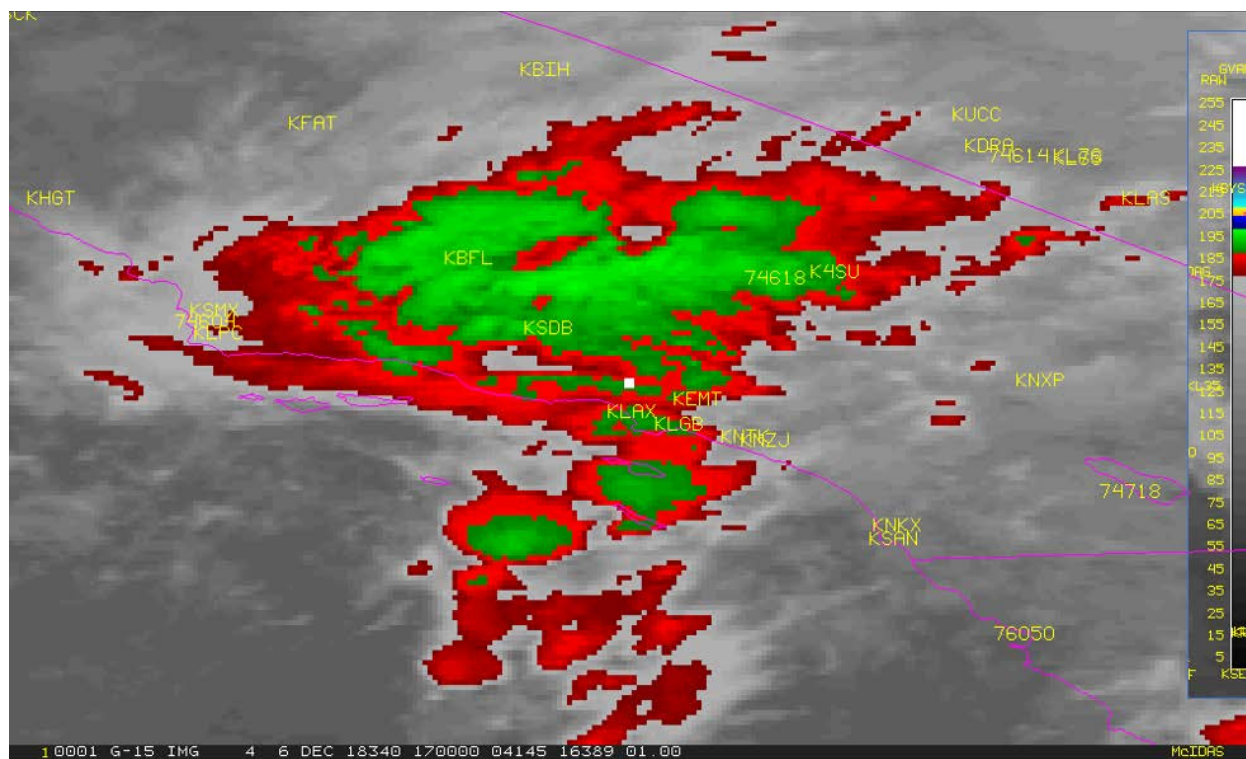
4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 15 (GOES-15⁹) 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. The infrared long wave and visible imagery were obtained surrounding the time of the incident, with the images closest to the time of the accident documented below. The infrared long wave imagery (band 4) at a wavelength of 10.7 microns (μm) provided radiative cloud top temperatures with a nominal spatial resolution of 4 km. The visible (band 1) at a wavelength of 0.65 μm images at a resolution of 1 km.

The GOES-15 infrared image for 0900 PST at 4X magnification with a standard MB temperature enhancement curve applied is included below as figure 13. The radiative cloud top temperature over KBUR at that time was 232° Kelvin or -41.16° C, which corresponded to cloud tops near 26,500 ft based on the HRRR sounding.

Figure 14 is the GOES-15 visible image at 2X magnification further defining the extensive area of clouds over the region, which were consistent with nimbostratus-type clouds over KBUR. Two defined cumulonimbus cloud systems were identified approximately 65 miles south and 90 miles south-southwest of the incident site off the California coast.

⁹ The higher resolution GOES-17 satellite imagery data was not available during the period.



5.0 Weather Radar

The closest Weather Surveillance Radar 1988 Doppler (WSR-88D)¹⁰ was from the NWS Los Angeles (KVTX), California, Weather Forecast Office (WFO) located 43 miles west of the incident site. 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.

5.1 Reflectivity Scales

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors, 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) 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	

Air traffic control (ATC) Air Route Traffic Control Center (ARTCC) 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

¹⁰ 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.

is that the center's weather and radar processor system does not display light intensity echoes below 30 dBZ. This table is also referenced for pilots in Advisory Circular AC 00-24C - "Thunderstorm".

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

5.2 Base Reflectivity Imagery

During the period the KVTX WSR-88D was operating in the precipitation mode, volume scanning strategy VCP-12, where the radar makes 14 different elevation scans within 4 minutes. Figure 15 is the KVTX WSR-88D 0.5° base reflectivity image at 0904 PST which depicted heavy intensity echoes of 42.5 dBZ over KBUR at the time of the incident. The echo tops product depicted echoes of 18.5 dBZ up to approximately 11,000 ft over KBUR at that time, with actual cloud tops extending higher.

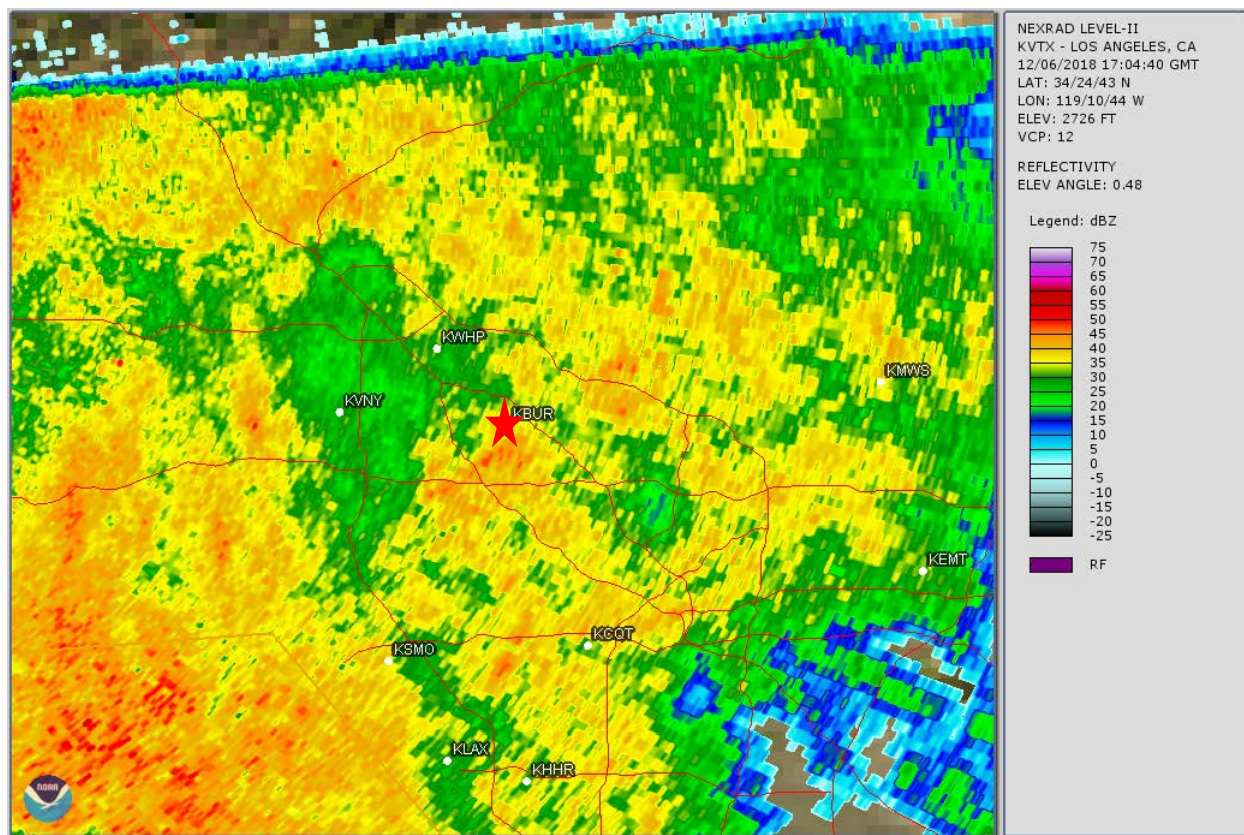


Figure 15 - KVTX WSR-88D 0.5 base reflectivity image at 0904 PST

The KVTX WSR-88D 0.5° base velocity for the period depicted no significant divergence patterns with wind at approximately 3,600 ft from the east at 46 knots over KBUR.

6.0 Pilot Reports

The following pilot reports or PIREPs were issued within 100 miles of KBUR between 0600 and approximately 1100 PST. The reports are in standard code and abbreviations:

LAX UA /OV LAX070050/TM 1414/FL130/TP B757/TA 02/IC LGT RIME/RM ZLAWC AWC-WEB/
LAX UA /OV POM/TM 1417/FL110/TP A321/TB MOD CHOP/RM ZLAWC AWC-WEB/
LAX UA /OV POM/TM 1430/FL290/TP A320/TB MOD/RM AWC-WEB/
SDB UA /OV PMD /TM 1433 /FL280 /TP CRJ7 /TB MOD/RM AWC-WEB
LAX UA /OV LAX070045/TM 1435/FL170/TP B738/TB MOD 170 - 080 DURD /IC TRACE RIME
LAX UA /OV VTU260015/TM 1437/FL080/TP TBM/IC IC LGT RIME/RM AWC-WEB/
SDB UA /OV GMN150020/TM 1449/FL120/TP B350/IC IC LGT RIME M02/RM AWC-WEB/
SDB UA /OV PMD/TM 1453/FL310/TP CRJ9/TB MOD/RM AWC-WEB/
EDW UA /OV 10 E PMD/TM 1501/FL1400/TP B737/WX RA/TB LGT/IC NEG
LAX UA /OV LAX180010 /TM 1518 /FL220 /TP A320 /TB MOD /RM MOD TURB FL 200-260 AWC-WEB
SDB UA /OV LHS250005 /TM 1521 /FL180 /TP B737 /IC IC LGT RIME M8 /RM LGT RIME FL 180-215
LAX UA /OV LAX280005 /TM 1526 /FL260 /TP B737 /TB MOD /RM MOD TURB 260-300 AWC-WEB
LAX UA /OV LAX /TM 1529 /FL260 /TP B737 /TB MOD /RM MOD TURB 260-300 AWC-WEB
VNY UA /OV RUNWAY 34L/TM 1540/FL0/TP BE20/RM BRAKING ACTION REPORTED FAIR TO POOR
LAX UA /OV VNY /TM 1541 /FL110 /TP B737 /TB MOD/RM AWC-WEB
LAX UA /OV POM030010 /TM 1546 /FL170 /TP SW4 /IC IC LGT RIME 170 M3/RM AWC-WEB
SDB UA /OV LHS /TM 1546 /FL090 /TP BE20 /IC LGT CLR M2/RM AWC-WEB
SDB UA /OV FIM /TM 1547 /FL220 /TP BE20 /IC IC LGT TRACE LGT M21/RM AWC-WEB
SDB UA /OV GMN340010 /TM 1548 /FL280 /TP B737 /TB MOD/RM AWC-WEB
LAX UA /OV POM /TM 1555 /FL270 /TP E75S /SK SK TOP 270/RM AWC-WEB
MHV UA /OV MHV/TM 1608/FL110/TP E120/WX 1SM IMC/TA 00/TB LGT CHOP/IC LGT RIME
SBA UA /OV RZS090022/TM 1608/FL080/TP C208/TA M03/IC LGT RIME
EDW UA /OV KOPLE/TM 1652/FL140/TP B737/SK IMC/TA +7/TB LGT CHOP/IC LGT RIME

Incident 1705Z

SDB UA /OV PMD /TM 1712 /FL410 /TP B737 /IC MOD/RM AWC-WEB
EDW UA /OV PMD241009/TM 1712/FL100/TP E75L/WX HVY PRCIP/TB LGT OCCL MOD
EDW UA /OV VCV118008/TM 1713/FL100/TP C208/TA M04/IC LGT TRC
KLAX UA /OV LAX070002/TM 1715/FL013/TP B737/SK OVC015
LGB UUA /OV KLGB120003/TM 1727/FL010/TP GALX/SK BKN007/WX RA/RM LLWS +15KTS ON 3 MI FINAL
LAX UA /OV SLI090020 /TM 1728 /FL180 /TP E75 /TB MOD/RM AWC-WEB
VCV UA /OV VCV148013/TM 1730/FL130/TP M20P/TA M10/IC LGT CLR
SDB UA /OV GMN /TM 1738 /FL140 /TP BE20 /IC IC LGT RIME M5/RM AWC-WEB
LGB UA /OV KLGB120003/TM 1753/FL013/TP B738/RM +20 KT GAIN ON 3 MI FINAL
LAX UA /OV LAX070025/TM 1755/FL140/TP MD11/TA M10/IC LIT - MOD RIME 140 - 130 DURD
LAX UA /OV VTU170030 /TM 1757 /FL160 /TP A320 /IC IC LGT RIME M12/RM AWC-WEB
CMA UA /OV 3/4 SM FINAL/TM 1800/FL002/TP SR22/WV 050 19 G25KT/RM WIND SHEAR LOSS OF 20KT
PMD UA /OV PMD240005/TM 1825/FL095/TP B350/WX IMC SN/TA M04/TB OCNL MOD CHOP/IC TRACE
RIME
SDB UA /OV PMD064020 /TM 1829 /FL140 /TP GLF5 /TB MOD/RM AWC-WEB
VCV UA /OV VCV351012/TM 1904/FL063/TP PC12/TA M02/IC LGT RIME
LAX UA /OV ONT/TM 1905/FL150/TP B757/TB LIT - MOD/IC NEG

The PIREPs included 16 reports of turbulence, with the majority in the moderate category. There were also 13 PIREPs for icing conditions, with the majority reporting light rime type icing, one moderate rime, and one light clear type icing. There were also 3 PIREPs of encounters with LLWS, with all 3 meeting the criteria for severe shear with a 15 knot and greater shear. There were also several reports of encountering heavy precipitation and rain

7.0 NWS Forecasts and Advisories

The following standard NWS forecasts and advisories were issued during the period relevant to the incident.

7.1 Terminal Aerodrome Forecast

The NWS Los Angeles/Oxnard (KLOX) Weather Forecast Office (WFO) was responsible for the issuance of the KBUR Terminal Aerodrome Forecast (TAF). The initial forecast was issued at 0338 PST and was amended twice at 0620 and 0806 PST. According to the Flight Dispatcher the flight was released based on the amended forecast issued at 0620 PST (1420Z). The forecasts issued surrounding the period were as follows:

TAF KBUR 061138Z 0612/0712 28006KT 4SM -SHRA BKN010 OVC020

FM061900 12008KT 6SM -SHRA BKN025 OVC035

FM070300 VRB03KT P6SM -SHRA BKN025 OVC040

FM070800 VRB03KT P6SM BKN050=

TAF AMD KBUR 061420Z 0614/0712 VRB03KT 5SM -SHRA SCT015 OVC040

FM061600 VRB03KT 4SM -SHRA BKN015 OVC025

FM061900 12008KT 6SM -SHRA BKN025 OVC035

FM070300 VRB03KT P6SM -SHRA BKN025 OVC040

FM070800 VRB03KT P6SM BKN050=

TAF AMD KBUR 061606Z 0616/0712 VRB03KT 2SM -RA BR SCT008 OVC015

FM061900 12008KT 6SM -SHRA BKN025 OVC035

FM070300 VRB03KT P6SM -SHRA BKN025 OVC040

FM070800 VRB03KT P6SM BKN050=

The NWS amended TAF issued at 0620 PST in which the flight was released on expected MVFR conditions to prevail from 0800 through 1100 PST with wind variable at 3 knots, visibility 4 miles in light rain showers, ceiling broken at 1,500 ft agl, overcast at 2,500 ft.

The forecast was amended at 0806 PST to expect IFR conditions to prevail with an expected wind variable at 3 knots, visibility 2 miles in light rain and mist, with scattered clouds at 800 ft agl, with a ceiling overcast at 1,500 ft.

7.2 Area Forecast Discussion

The KLOX Area Forecast Discussion (AFD) issued at 0404 PST providing the reasoning behind the synoptic conditions, the general public short term forecast, and the aviation forecasts were as follows (the long term forecast discussion was not reproduced):

FXUS66 KLOX 061203

AFDLOX

Area Forecast Discussion

National Weather Service Los Angeles/Oxnard CA

403 AM PST Thu Dec 6 2018

.SYNOPSIS...05/756 PM.

Light to moderate rain and mountain snow is expected through Thursday evening, as low pressure system moves across the region. Additional showers are possible through early Friday. Temperatures will remain cool through the end of the week, then high pressure will bring dry and warm conditions over the weekend. A weak weather system is expected to move in early next week with a chance of rain for northern areas along with cooler temperatures.

.SHORT TERM (TDY-SAT)...06/304 AM.

Main weather concern over the next 24 hours will be shower activity associated with upper low located off the coast of Southwest California. Rainfall rates have increased across portions of LA/Ventura counties as the upper low approaches and turns the low level flow more southerly.

The is upper low is currently just to the west of Pt Conception and is moving eastward. The current track is further north than previously forecasted and this will bring better upper level diffuence and colder temperatures aloft. This will result in more destabilized atmosphere, especially near the core or the upper low that has 500 mb temperatures near -22 Celsius. Perhaps more significantly the low levels of the atmosphere have become more more saturated which is allowing much better rainfall rates and amounts despite the low lever offshore flow. LI values of -2 to -4 will move into the southern waters and southern LA county today as the cold core moves overhead. There is also enough veering in the lower atmosphere to increase the risk of waterspouts.

Rainfall will be fairly light north of Pt Conception with amounts mostly under a quarter inch. Rainfall amounts will ramp up from west to east south of Pt Conception with about a quarter inch of rain forecast for southern SBA county and western VTA county...a quarter to a half inch over eastern VTA county. LA county (xcp for the interior) will be the big winner today with a half inch to three quarters of an inch falling. Rainfall rates will be near .5 inches per hour and could be higher this afternoon as the atmosphere becomes more unstable.

There will be a decent amount of snow above 6500 feet with some snow falling as low as 6000 feet. A winter weather advisory is in effect now through midnight for 3 to 6 inches of snow with isolated higher amounts above 7500 feet.

After 3 days of clouds and rain the upper low responsible for it all will quickly shift to the east and ridge will build in in the predawn hours of Friday. The rain will end and skies will clear. Friday should dawn mostly sunny. Hgts will rise and will kick off a warming trend but not enough to bring max temps back to normal.

Weak offshore flow and continued ridging will make Saturday quite the nice day. Max temps will warm to near normal under sunny skies.

.AVIATION...06/0644Z.

At 0512Z, there was no marine layer nor a sfc based inversion.

Moderate confidence in all TAFs. Cigs will frequently vary between 025 and 035. There is a 30 percent chc of BKN015 and a 10 percent chance of bkn008. Scattered rain showers will persist through the night and into the day. Rain showers will increase later Thursday afternoon and increase in intensity over LA county.

KLAX...Moderate confidence in TAF. Cigs will frequently vary between 025 and 035. There is a 30 percent chc of BKN015 and a 10 percent chance of bkn008. Moderate to high confidence of east winds around 10 knots or greater through this evening, and again on Thursday morning, with occasional gusts over 15 knots. East winds will diminish towards sunset. Heavier showers are possible after 00Z with vsby 2-3SM.

KBUR...Moderate confidence TAF. Cigs will mostly be between 022-028. There is a 30 percent chc of BKN015 and a 10 percent chance of bkn008. Heavier showers are possible after 00Z with vsby 2-3SM.

.MARINE...06/401 AM.

For the Outer Waters, high confidence in current forecast. There will be local gusts to 25 knots at times across PZZ670 through this afternoon. Friday through Sunday, winds and seas will remain below SCA levels. On Monday, there is a 60% chance of SCA level winds developing again. For the Inner Waters north of Point Sal, high confidence in current forecast. Winds and seas will remain below SCA levels through Sunday. On Monday, there is a 30% chance of SCA level winds in the afternoon/evening hours.

For the Inner Waters south of Point Conception, moderate confidence in current forecast. SCA level east to southeast winds will continue across PZZ650 from the Ventura Coast through the channel islands. There will be local gusts across the northern portion of PZ655 through this afternoon. Otherwise, winds and seas are expected to remain below SCA levels.

An upper level low pressure system will bring a slight chance of thunderstorms to the coastal waters mainly west and south of Point Conception today. Any thunderstorms that develop could produce brief heavy downpours with reduced visibility, gusty winds, small hail, and dangerous cloud to ground lightning. In addition, conditions will be favorable for isolated waterspouts across the coastal waters including areas near Huntington Beach to the Palos Verdes peninsula.

.LOX WATCHES/WARNINGS/ADVISORIES...

CA...Winter Weather Advisory in effect until midnight PST tonight for zones 53-54. (See LAXWSWLOX).

PZ...Small Craft Advisory in effect until 3 PM PST this afternoon for zone 650. (See LAXMWWLOX).

.HAZARD POTENTIAL OUTLOOK (SAT-WED).

No significant hazards expected.

PUBLIC...Rorke

AVIATION...Rorke

MARINE...Kaplan

SYNOPSIS...Delerme/Sirard

7.3 Winds and Temperatures Aloft Forecast

The NWS Winds and Temperature Aloft bulletin (FD) current for the period for southern California surrounding the incident site during the period are included below. The wind forecast was valid for 1000 PST and for use between 0600 and 1300 PST.

FBUS31 KWN0 061358

FD1US1

-DATA BASED ON 061200Z

VALID 061800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
ONT	1317	2025+03	1920-02	1920-07	1824-19	1926-32	203849	225348	244546
WJF		1312+02	1921-02	1920-07	1921-20	1924-34	193149	224148	243847
SAN	1929	1921+05	1922-01	1926-06	2133-20	2151-33	226145	236846	246146
SBA	1009	1310+03	1611-02	1912-07	1916-21	1611-34	191748	242346	272945

The closest winds aloft station was General William J. Fox Airfield (WJF), Lancaster, California, located approximately 33 miles north of KBUR. The first level wind forecast was for 6,000 ft and expected a wind from 130° at 12 knots with a temperature of 2° C, and at 9,000 ft from 190° at 21 knots with a temperature of -2° C.

The next closest station was Ontario International Airport (ONT), Ontario, California, located approximately 39 miles east of KBUR. The forecast for 3,000 ft was for wind from 130° at 17 knots, at 6,000 ft from 200° at 25 knots with a temperature of 3° C, and at 9,000 ft from 190° at 20 knots with a temperature of -2° C.

The next closest station was Santa Barbara (SBA) located 75 miles west of KBUR and expected at 3,000 ft wind from 100° at 9 knots, at 6,000 ft from 130° at 10 knots with a temperature of 5° C, and at 9,000 ft from 160° at 11 knots with a temperature of -2° C.

7.4 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 ARTCCs. There are four basic types of inflight aviation weather advisories: the Significant Meteorological Information (SIGMET), the Convective SIGMET, the Airmen's Meteorological Information (AIRMET), and the Center Weather Advisory (CWA). Inflight 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 and/or flight dispatcher in a Part 121 operation to evaluate on the basis of experience and the operational limits of the aircraft.

During the period no Convective SIGMETs were current. The NWS Los Angeles (KZLA) CWSU issued a CWA at 0815 PST for an area of embedded thunderstorms with heavy rain and potential moderate to severe turbulence for an area immediately south of the area over the coastal waters with tops to 31,000 ft and moving north at 15 knots. The advisory plotted over the GOES-15 satellite image is included as figure 16. The NWS AWC also had a series of AIRMETs current over the region for IFR and mountain obscuration conditions (figure 17), moderate turbulence (figure 18), and for moderate icing conditions (figure 19). The text and displayed advisories were as follows:

Convective SIGMET

WSUS33 KPCI 061555

SIGW

-MKCW WST 061555

CONVECTIVE SIGMET...NONE

OUTLOOK VALID 061755-062155

FROM 30NNW LAX-50SSW HEC-60WSW BZA-230SW MZB-160WSW RZS-30SW RZS-30NNW LAX

WST ISSUANCES POSS. REFER TO MOST RECENT ACUS01 KWNS FROM STORM PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

WSUS33 KPCI 061655
SIGW
-MKCW WST 061655
CONVECTIVE SIGMET...NONE

OUTLOOK VALID 061855-062255
FROM 30E CZQ-40NNE TRM-BZA-130SW MZB-150SSW SNS-60SE SNS-30E CZQ
WST ISSUANCES POSS. REFER TO MOST RECENT ACUS01 KWNS FROM STORM PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.

CWA

FAUS21 KZLA 061616
ZLA1 CWA 061615
ZLA CWA 101 VALID UNTIL 061815
FROM 15SE RZS-25SE LAX-110S LAX-140S RZS-15SE RZS
AREA EMBD TS WITH MOD/HVY RAIN AND MOD/SEV TURB MOV FROM 20015KT.
TOPS TO FL310.

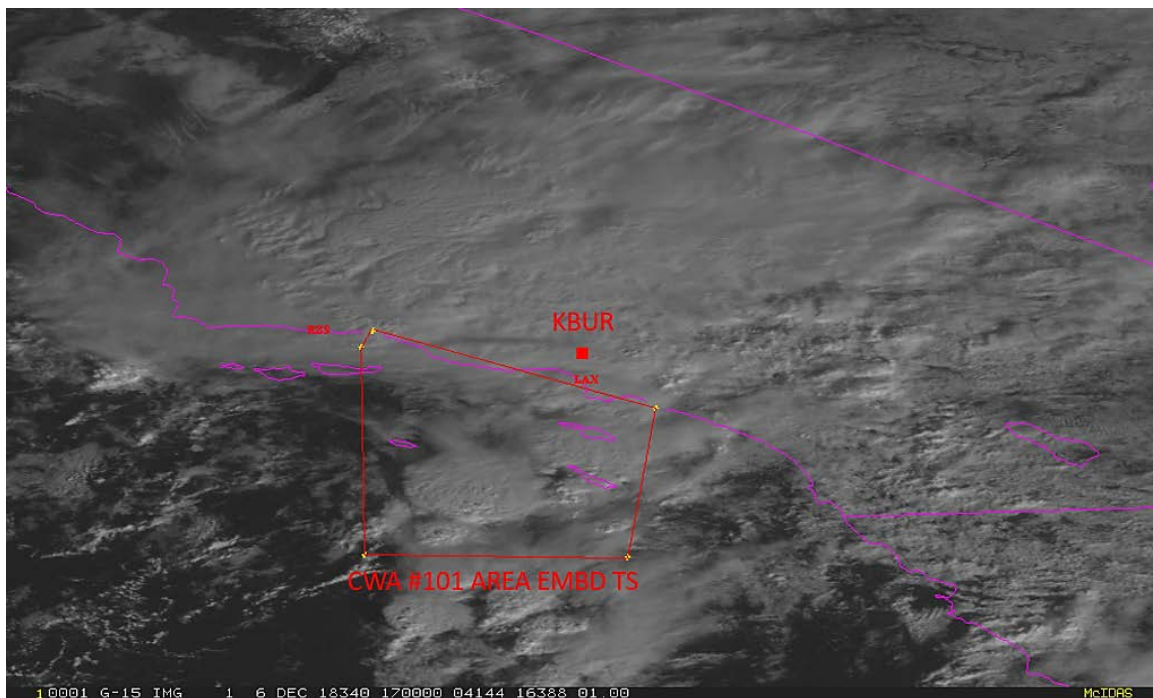


Figure 16 - CWA #101 for area of embedded thunderstorms issued at 0815 PST

AIRMETs

WAUS46 KPCI 061445
WA6S
-SFOS WA 061445
AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 062100
,
AIRMET IFR...CA AND CSTL WTRS

FROM 40ESE MOD TO 40ESE CZQ TO 30SE EHF TO 40SW HEC TO 40E MZB
TO 100SW MZB TO 130WSW MZB TO 210SW MZB TO 120SW RZS TO 40SSW
RZS TO 40ESE MOD

CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z ENDG 00-03Z.

AIRMET IFR...OR CA

FROM 20E EUG TO 70SSW DSD TO 70SE OED TO 20S ENI TO 20SSE FOT TO
40SW EUG TO 20E EUG

CIG BLW 010/VIS BLW 3SM BR/FG. CONDS ENDG 18-21Z.

AIRMET MTN OBSCN...WA OR CA ID MT WY NV UT CO AZ NM

FROM 70WSW BIL TO 40SSW BOY TO 20ESE DDY TO CYS TO 30E PUB TO
PHX TO EED TO 30S HEC TO 60SW BTY TO 20NNE EHF TO 20SSE RBL TO
60SW LKV TO 20ESE TWF TO 30N PIH TO 50ESE DLN TO 70WSW BIL
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

AIRMET MTN OBSCN...CA

FROM 20SW SAC TO 50W EHF TO 50SSE EHF TO 20NNE EHF TO 60SW BTY
TO 50SSE TRM TO 20SW MZB TO LAX TO 40W RZS TO PYE TO 20SW SAC
MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

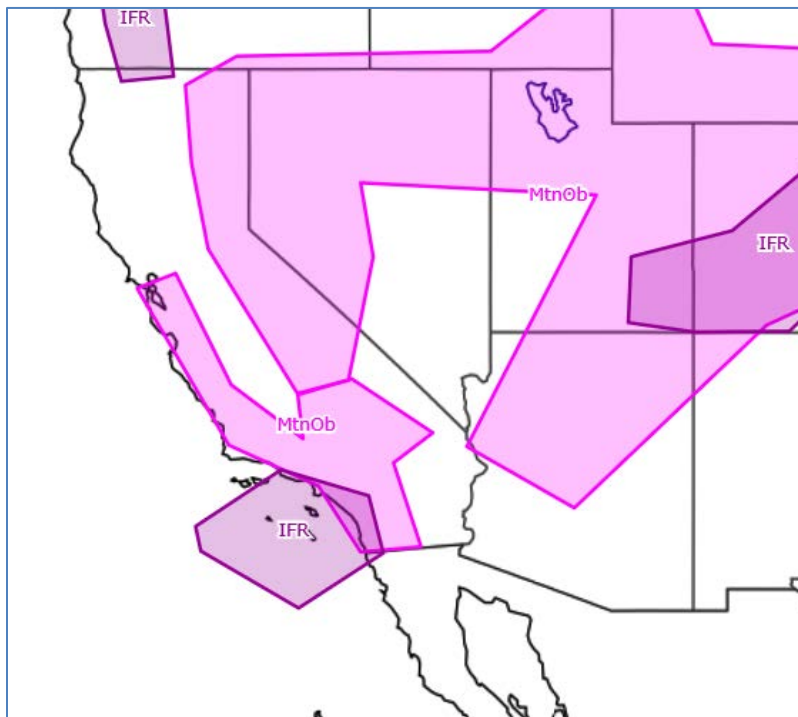


Figure 17 - G-AIRMET Sierra for IFR and mountain obscuration conditions at 0900 PST

WAUS46 KPCI 061555 AAA

WA6T

-SFOT WA 061555 AMD

AIRMET TANGO UPDT 3 FOR TURB VALID UNTIL 062100

AIRMET TURB...CA WY NV UT CO AZ NM

FROM BFF TO GLD TO 50SE LAA TO 50S TUS TO BZA TO 50ESE MZB TO
50WNW HEC TO 30WSW ILC TO 50WSW DTA TO BFF

MOD TURB BTN FL240 AND FL360. CONDS CONTG BYD 21Z THRU 03Z.

.
 AIRMET TURB...CA ID NV UT AND CSTL WTRS
 FROM 70WSW TWF TO 40SE TWF TO 20NE BVL TO 60ENE EHF TO 120WSW
 MZB TO 200SSW RZS TO 150WSW SNS TO 60ESE RBL TO 70WSW TWF
 MOD TURB BTN FL230 AND FL330. CONDS CONTG BYD 21Z ENDG 00-03Z.

.
 AIRMET TURB...CA AND CSTL WTRS...UPDT
 FROM 40NE LAX TO 40SSW HEC TO 40WSW BZA TO 30S MZB TO 40SE LAX TO 40NE LAX
 MOD TURB BLW 120. CONDS CONTG BYD 21Z ENDG 00-03Z.

.
 OTLK VALID 2100-0300Z...TURB WA OR CA AND CSTL WTRS
 BOUNDED BY 30WNW TOU-20WSW EUG-20SSW ENI-50W RZS-190SSW RZS-
 140WSW FOT-140W TOU-30WNW TOU
 MOD TURB BTN FL240 AND FL370. CONDS DVLPG 21-00Z. CONDS CONTG THRU 03Z.

....

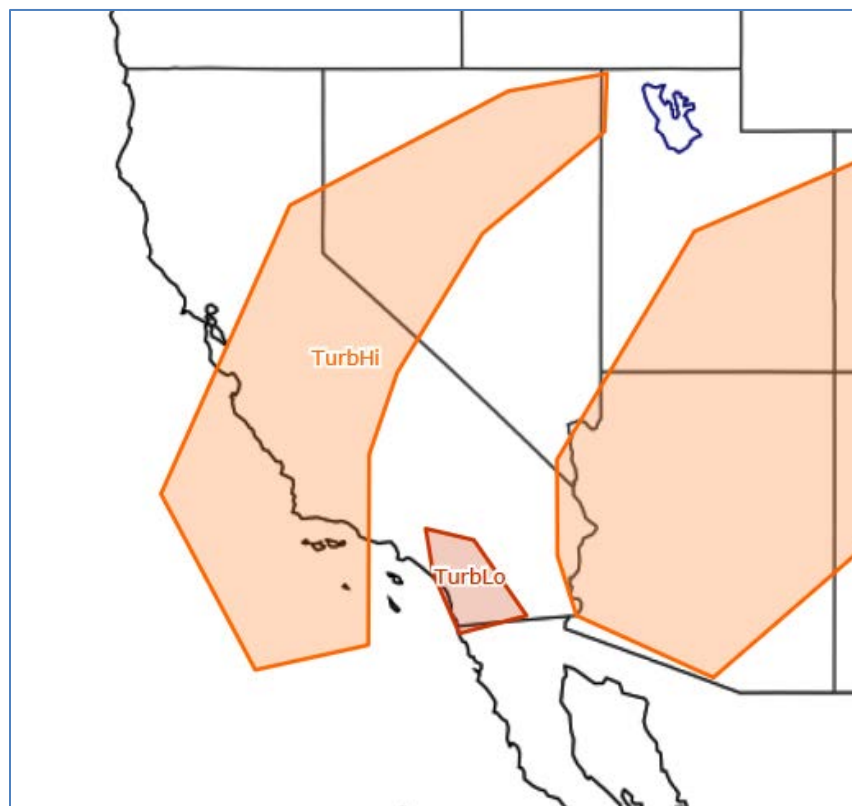


Figure 18 - G-AIRMET Tango for turbulence for 0900 PST

WAUS46 KPCI 061445
 WA6Z
 -SFOZ WA 061445
 AIRMET ZULU UPDT 2 FOR ICE AND FRZLVL VALID UNTIL 062100

.
 AIRMET ICE...CA UT CO AZ NM
 FROM 20SE DBL TO 40SE HBU TO 40SW PUB TO 50SW TUS TO BZA TO 60SSE
 TRM TO 30W EED TO 30SSE BCE TO 30SW JNC TO 20SE DBL
 MOD ICE BTN FRZLVL AND FL200. FRZLVL 060-120. CONDS CONTG BYD 21Z THRU 03Z.

.
 AIRMET ICE...CA NV UT CO AZ AND CSTL WTRS
 FROM 40NNE BVL TO 60W LAR TO 20SE DBL TO 20SSW JNC TO 30SE BCE TO

30W EED TO 30SE MZB TO 80SW MZB TO 220SW MZB TO 150SW SNS TO
 30ESE OAK TO 40W FMG TO 50W BAM TO 40NNE BVL
 MOD ICE BTN FRZLVL AND FL180. FRZLVL SFC-120. CONDS CONTG BYD 21Z THRU 03Z.

.
 FRZLVL...RANGING FROM SFC-095 ACRS AREA
 MULT FRZLVL BLW 080 BOUNDED BY 20SSW YDC-40WNW EPH-50WNW LKV-
 70NNW FMG-RBL-80WSW OED-20S ONP-20NNW HQM-40WNW TOU-20SSW YDC
 SFC ALG 50SW HUH-50ENE FOT-60S OAL
 040 ALG TOU-30WNW OED
 080 ALG 110WNW ONP-120W OED-150SW FOT
 080 ALG 210SSW RZS-MZB-40S EED

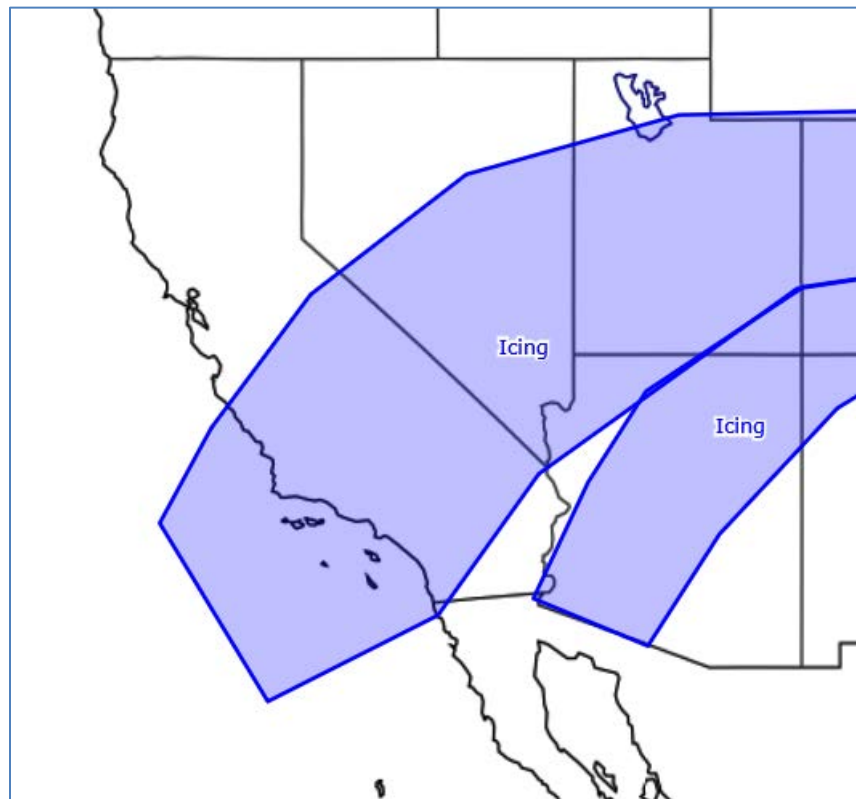


Figure 19 - G-AIRMET Zulu for icing conditions

8.0 Dispatchers Statement

The dispatcher was asked about his planning and concerns regarding the issuance of the dispatch release for the flight and provided a written statement, which is included as attachment 1.

9.0 Dispatch Release

The dispatch release for flight 278 is included as attachment 2 and included two alternate airports; McCarran International Airport (KLAS), Las Vegas, Nevada, and Ontario International Airport (KONT), Ontario, California. The release was planned on landing at KBUR runway 8 with a wet contaminated runway with a “5-good” braking action.

10.0 Weather Document

The flight was issued a weather document at 1515Z that included the METAR, TAF, NOTAMs and field conditions for the departure, destination, designated alternate airports (KLAS and KONT). At the time of issuance KBUR runway 8, taxiways, and ramp reported a braking action 5-Good with the surface condition wet. The D NOTAM for KBUR runway 8 reported a FICON of 5/5/5 with 100% wet. Enroute weather hazards included an advisory for light to occasional moderate turbulence from FL250 to FL320 over southern California and Nevada. The document also included a radar summary chart for 1500Z, which depicted an area of echoes with tops to 25,000 ft over southern California. No Convective SIGMETs were current during the period. A WSI Flight Plan Guide graphic was also included and documented the FL340 wind and provided analysis of the jet stream, areas of expected turbulence. The full weather document is included as Attachment 3.

F. LIST OF ATTACHMENTS

Attachment 1 – Dispatcher Statement

Attachment 2 – Dispatch Release

Attachment 3 - Weather Document issued to flight

Submitted by:

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