



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

May 16, 2019

Specialist Factual Report

METEOROLOGY

WPR19FA086

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A. ACCIDENT

Location: Stallion Springs, California
Date: February 21, 2019
Time: about 1645 Pacific standard time
0045 Universal Coordinated Time (UTC) on February 22, 2019
Airplane: Beech D55 “Baron”; Registration: N533Q

B. METEOROLOGIST

Don Eick
Meteorology Specialist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On February 21, 2019, about 1645 Pacific standard time, a Beech D55 multi-engine airplane, N533Q, impacted terrain near Stallion Springs, California. The private pilot and both passengers were fatally injured, and the airplane sustained substantial damage. The airplane was registered to a private individual and operated by the pilot as a Title 14 *Code of Federal Regulations* Part 91, cross country flight. Visual meteorological conditions were reported near the accident site about the time of the accident, and no flight plan was filed. The flight originated from San Luis County Regional Airport (KSBP), San Luis Obispo, California, at 1600 and was destined for Whiteman Airport (KWHP), Los Angeles, California.

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.

The accident site was located at latitude 35.0457500° N longitude 118.596944° W at an elevation of approximately 6,700 ft.

E. WEATHER INFORMATION

1.0 Synoptic Conditions

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

1.1 Surface Analysis Chart

The southwest section of the NWS Surface Analysis Chart for 1600 PST (0000Z February 22, 2019) is included as figure 1 over a general topographical chart. The chart depicted a low-pressure system at 997-hectopascals (hPa)¹ associated with an occluded frontal system over Utah which extended southward into Arizona and became a cold front which continued into northern Mexico. Another weakening low-pressure system at 1000-hPa was located over southern California in the vicinity of Los Angeles with a trough of low pressure extending between the two lows and another trough extending northward along the California coast. The accident site was located north of the low and trough on the cold air mass side of the front.

The station models depicted a variable wind flow pattern over the area with a southwest wind of about 10 knots over the accident site with clear to scattered cloud cover over the area. A station south of the accident site and southeast of the destination depicted light rain and overcast clouds. Multiple stations to the east of the accident site over Nevada, Utah, and Arizona reported light rain to moderate and heavy snow associated with the occluded frontal system.

¹ Hectopascals (hPa) is the NWS new standard term for reporting sea-level pressure and is interchangeable with the term millibar (mb) with the same unit. Standard sea-level pressure is 1013.25-hPa at a temperature of 59° Fahrenheit (F) or 15° Celsius (C).

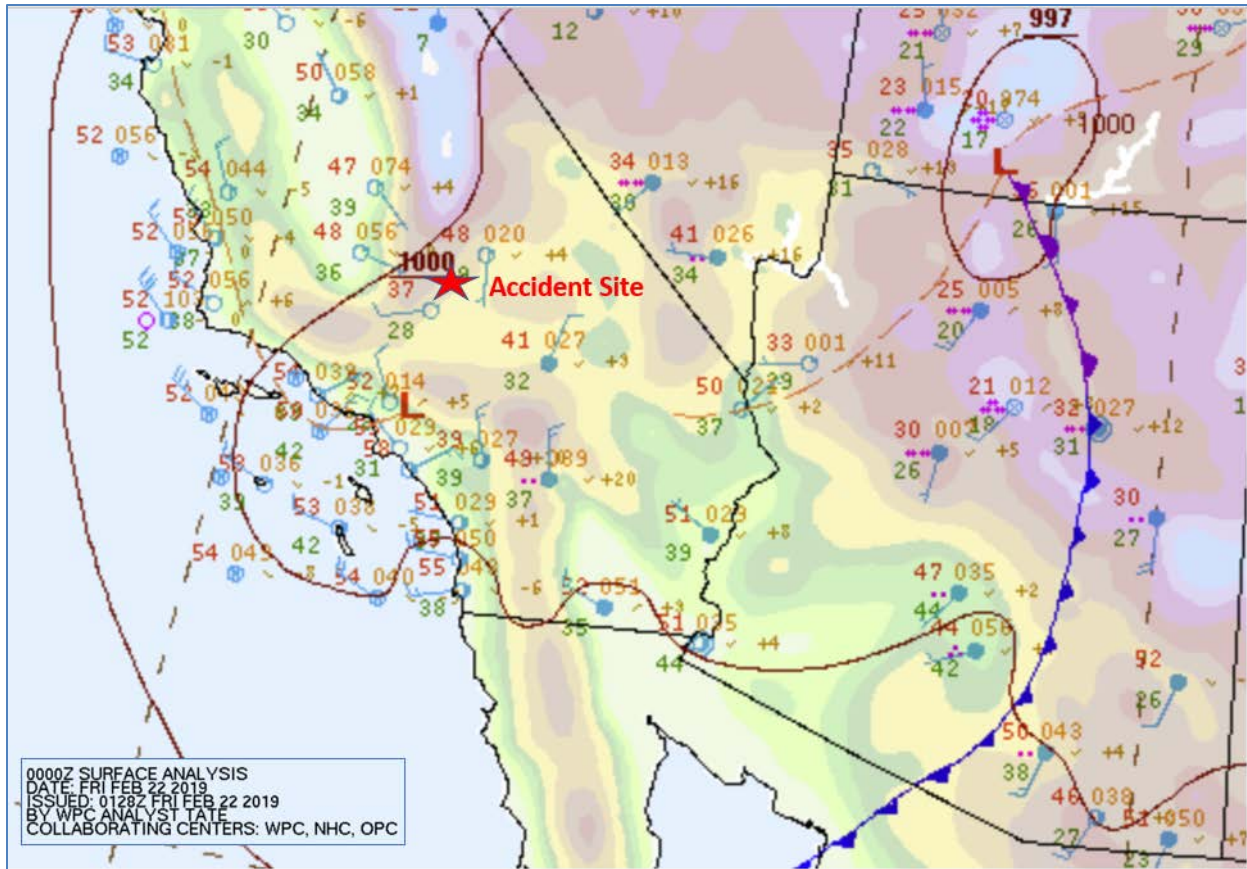


Figure 1 - southwestern section of the NWS Surface Analysis Chart for 1600 PST

1.2 National Composite Radar Mosaic

The NWS National Composite Radar Mosaic for 1645 PST was obtained from archive sources at the NCEI and is included as figure 2, with the accident site marked by a red star and the departure and destination airports by yellow triangles. The chart depicted several areas of echoes over southern California, with a large cluster of heavy to extreme echoes over and south of the departure airport of San Luis Obispo (KSBP) area and several areas of light intensity echoes over the southwestern California coastal area and over Whiteman Airport (KWHP), Los Angeles. Another area was identified east of the Stallion Springs area with echoes of 30 to 50 dBZ, with echoes of 5 to 25 dBZ extending over the accident site.

Section 5.0 of this report will further document the closest NWS Weather Surveillance Radar and document the echoes in the vicinity of the accident site.



Figure 2 - NWS National Composite radar Mosaic for 1645 PST

1.3 Constant Pressure Charts

The NWS Storm Prediction Center’s (SPC) 500-hPa Constant Pressure Chart for 1600 PST is included as figure 3 to depict the upper air conditions with the approximate accident site marked by a red star. The 500-hPa chart depicted the pressure heights, wind and temperature conditions at approximately 18,000 ft or the mean atmosphere by weight. The chart depicted an upper-level low pressure system over central California with a long wave trough extending southwestward. The accident site was located near the base of the upper level low. Troughs are typically areas of favorable upward vertical motion and support the development of clouds and precipitation.

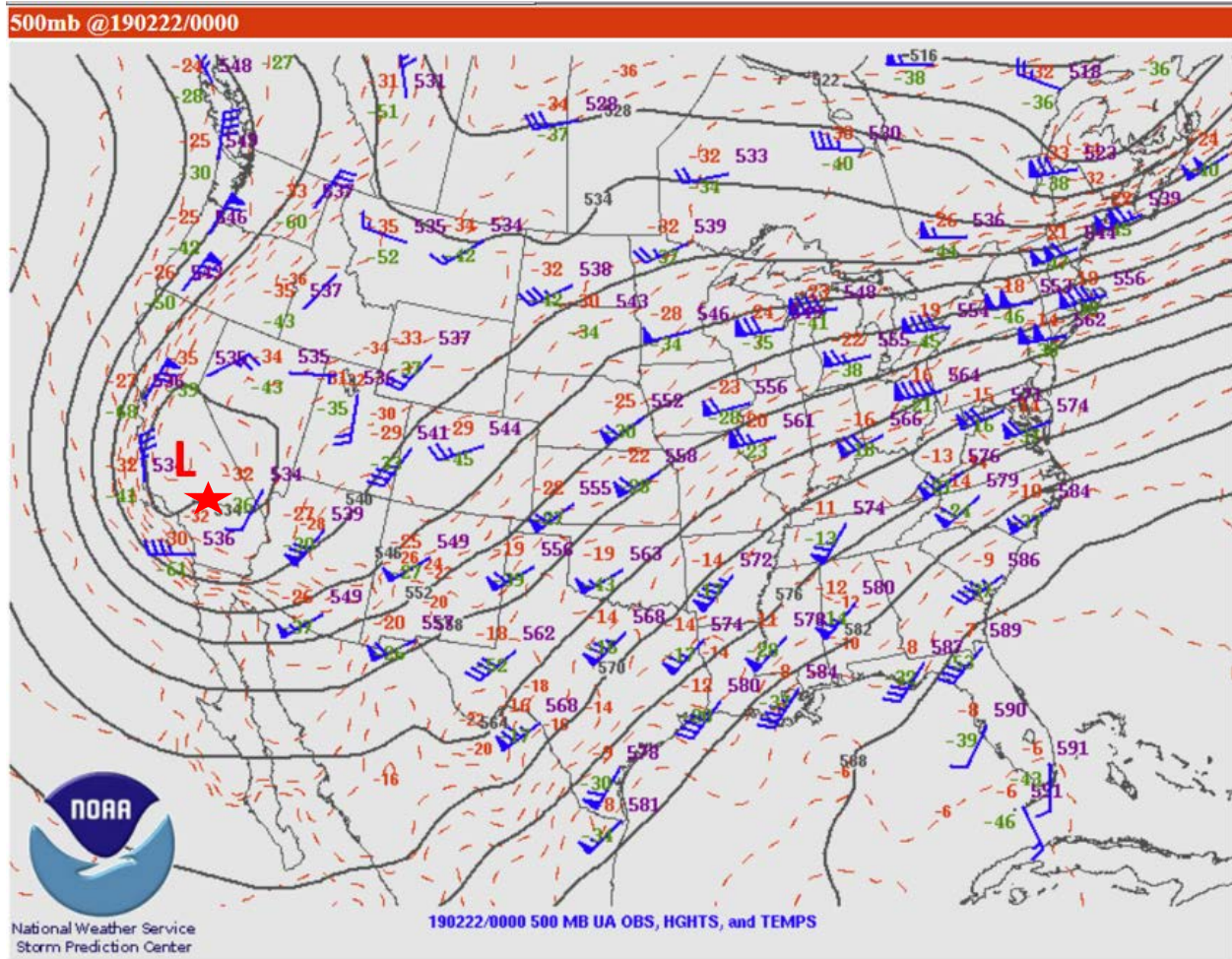


Figure 3 - NWS 500-hPa chart for 1600 PST

1.4 12-hour Surface Prognostic Chart

The NWS NCEP 12-hour Surface Prognostic Chart valid for the period is included as figure 4. The chart was valid for 2200 PST and depicted low pressure systems over southeast Utah and over southern Arizona with an occluded and cold front extending between the lows. The chart also depicted two other low's over southern and central California with a trough extending north-to-south to the west of the accident site. An extensive area of precipitation in the form of snow was expected with the low's and associated front centered over Utah, Colorado, into Arizona and New Mexico. A chance of snow and rain showers extended into eastern and southeastern California to the east of the accident site.

12 Hours Surface Prognostic

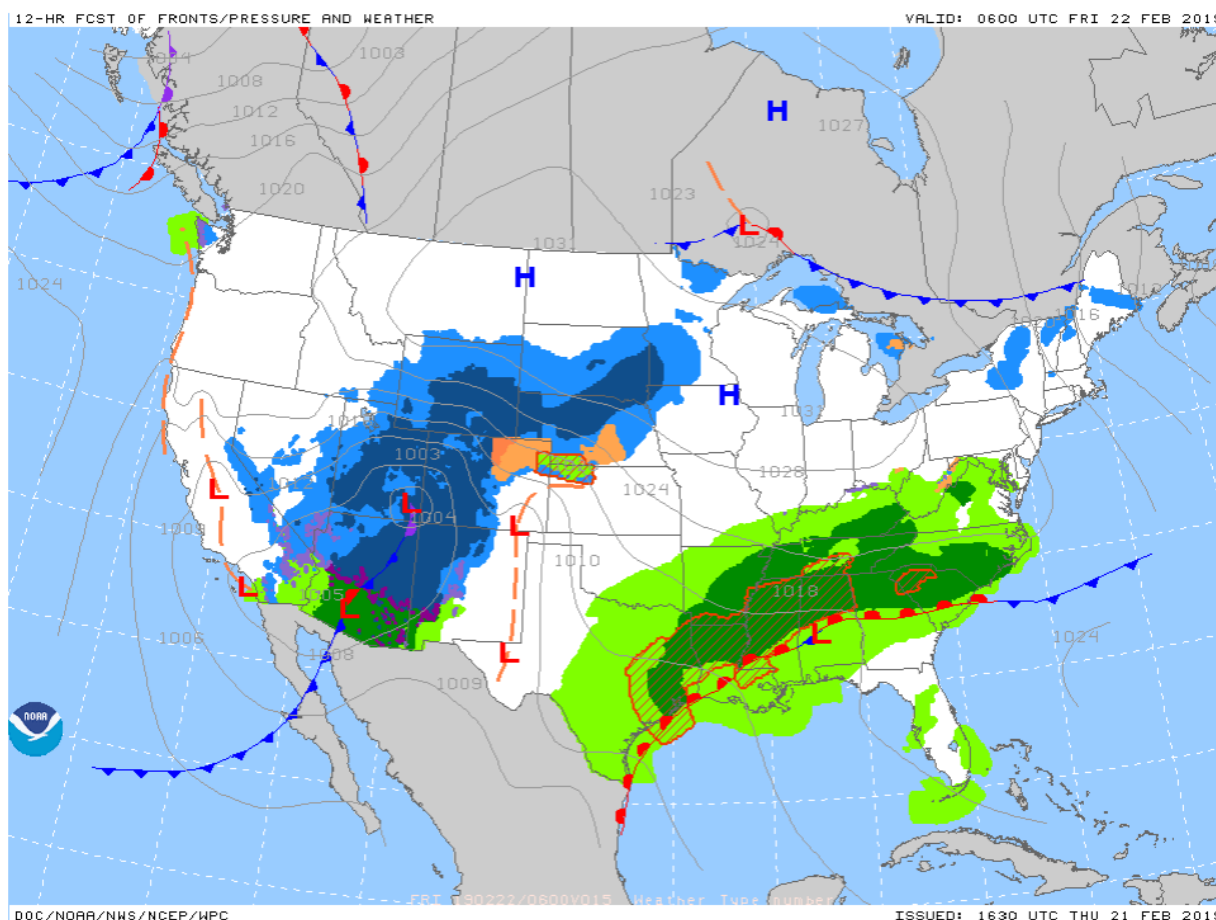


Figure 4 - NWS 12-hour Surface Prognostic Chart valid for 2200 PST

2.0 Surface Observations

The surrounding area was documented using Meteorological Aerodrome Reports (METAR) and Specials observations (SPECI). The area had a magnetic variation of 12.5° East based on the sectional chart for the area. Cloud heights are reported in height above ground level (agl) in the following section.

2.1 San Luis Obispo, California

The accident airplane departed San Luis County Regional Airport (KSBP), San Luis Obispo, California at approximately 1600 PST. The airport listed an elevation of 212 ft and had an Automated Surface Observation System (ASOS) that was augmented by air traffic control personnel by a Limited Aviation Weather Reporting Station (LAWRS). The following conditions were reported surrounding the period:

KSBP weather observation at 1556 PST, wind from 310° at 13 knots gusting to 20 knots, visibility 10 miles or more, ceiling broken at 7,000 ft agl, temperature 12° Celsius (C), dew

point 3° C, altimeter 29.67 inches of mercury (Hg). Remarks: automated observation system with a precipitation discriminator, sea level pressure 1005.0-hPa, 6-hour precipitation less than 0.01 inches, temperature 11.7° C, dew point 2.8° C, 6-hour maximum temperature 12.8° C, 6-hour minimum temperature 8.9° C, 3-hour pressure tendency fallen 0.4-hPa.

KSBP weather observation at 1656 PST, wind from 070° at 12 knots, visibility 9 miles in thunderstorm and light rain, scattered clouds at 4,100 ft agl, ceiling broken at 5,000 ft, temperature 9° C, dew point 0° C, and altimeter 29.70 inches of Hg. Remarks: automated observation system with a precipitation discriminator, lightning distant south, rain began at 1650 PST, thunderstorm began at 1650 PST, sea level pressure 1005.0-hPa, hourly precipitation less than 0.01 inches, temperature 9.0° C, dew point 0.0° C.

The following general flight categories² and raw METAR observations were reported approximately 3 hours either side of the time of the accident:

VFR METAR KSBP 212056Z 02011G22KT 10SM -RA BKN049 BKN070 09/02 A2969 RMK AO2 RAB54 SLP054 P0000 60000 T00940017 57002
VFR METAR KSBP 212156Z COR 02011KT 10SM SCT060 12/00 A2968 RMK AO2 RAE04 SLP051 P0000 T01170000
VFR METAR KSBP 212256Z 35006KT 10SM SCT055 BKN080 11/00 A2967 RMK AO2 SLP049 T01110000
VFR METAR KSBP 212356Z 31013G20KT 10SM BKN070 12/03 A2967 RMK AO2 SLP050 60000 T01170028 10128 20089 55004

Departed 0000Z

Accident 0045Z

VFR METAR KSBP 220056Z 07012KT 9SM -TSRA SCT041 BKN050 09/00 A2970 RMK AO2 LTG DSNT S RAB50 TSB50 SLP059 P0001 T00940000
VFR SPECI KSBP 220111Z 00000KT 10SM FEW039 OVC055 08/01 A2971 RMK AO2 LTG DSNT SE RAE10 TSE05 P0001 T00830006
VFR METAR KSBP 220156Z 00000KT 10SM SCT110 07/02 A2972 RMK AO2 RAE10B24E39 TSE05 SLP064 P0001 T00720022
VFR METAR KSBP 220256Z 00000KT 10SM CLR 05/02 A2976 RMK AO2 SLP079 60002 T00500022 53028

2.2 Tehachapi, California

The closest weather reporting station to the accident site was Tehachapi Municipal Airport (KTSP), Tehachapi, California, located approximately 9 miles northeast at an elevation of 4,001 ft. The airport had an Automated Weather Observation System (AWOS) that was not augmented

² 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.

by human observers and issued observations every 20-minutes. The following weather conditions were reported surrounding the period:

KTSP weather observations at 1635 PST, automated, wind from 310° at 6 knots, visibility 10 miles or more in light rain, ceiling broken at 600 ft agl, broken at 1,200 ft, overcast at 2,900 ft, temperature -2 C, dew point -2 C, altimeter 29.61 inches of Hg.

Prior to this period a band of heavy snow and unknown precipitation impacted the station, with the precipitation turning over to rain with below freezing surface temperatures during the period before changing back to snow. The general flight categories and raw observations in standard code and abbreviations were as follows:

LIFR METAR KTSP 212055Z AUTO 30008KT 1 1/4SM -SN BKN003 BKN041 BKN050 00/M02 A2958 RMK AO2 P0003
LIFR METAR KTSP 212115Z AUTO 31006KT 1/4SM +SN OVC003 M01/M02 A2958 RMK AO2 P0044
IFR METAR KTSP 212135Z AUTO 30009KT 2SM -SN SCT002 SCT020 00/M02 A2957 RMK AO2 P0051
MVFR METAR KTSP 212155Z AUTO 29008KT 9SM -RA FEW009 SCT018 BKN030 M01/M02 A2957 RMK AO2 P0051
MVFR METAR KTSP 212215Z AUTO 31008KT 10SM -RA BKN015 BKN020 OVC028 00/M03 A2958 RMK
MVFR METAR KTSP 212235Z AUTO 29009KT 10SM -RA BKN015 OVC021 00/M03 A2958 RMK AO2
IFR METAR KTSP 212255Z AUTO 26008KT 6SM -RA BKN008 BKN015 OVC021 M01/M03 A2958 RMK
MVFR METAR KTSP 212315Z AUTO 30008KT 5SM UP SCT008 OVC015 M01/M02 A2959 RMK AO2
LIFR METAR KTSP 212355Z AUTO 31006KT 1SM -SN BKN003 BKN008 OVC015 M02/M02 A2960 RMK AO2 P0004
MVFR METAR KTSP 220015Z AUTO 31006KT 5SM -RA SCT006 BKN012 OVC017 M02/M02 A2960 RMK AO2
IFR METAR KTSP 220035Z AUTO 31006KT 10SM -RA BKN006 BKN012 OVC019 M02/M02 A2961
Accident 0045Z
MVFR METAR KTSP 220055Z AUTO 31008KT 10SM -RA FEW006 BKN019 OVC035 M02/M03 A2962
MVFR METAR KTSP 220115Z AUTO 29007KT 10SM BKN014 BKN019 OVC035 M02/M03 A2963 RMK
MVFR METAR KTSP 220135Z AUTO 30008KT 9SM -RA BKN013 OVC018 M02/M03 A2963 RMK
MVFR METAR KTSP 220155Z AUTO 30007KT 9SM BKN010 OVC013 M02/M03 A2964 RMK AO2
LIFR METAR KTSP 220215Z AUTO 30008KT 3/4SM -SN OVC003 M02/M03 A2964 RMK AO2 P0017
LIFR METAR KTSP 220235Z AUTO 30007KT 2SM -SN OVC003 M02/M03 A2966 RMK AO2 P0035
LIFR METAR KTSP 220255Z AUTO 25007KT 1 1/2SM -SN BKN004 OVC008 M03/M03 A2967 RMK AO2 P0041
IFR METAR KTSP 220315Z AUTO 24007KT 1 1/4SM -SN SCT003 OVC011 M03/M03 A2967 RMK AO2 P0006
IFR METAR KTSP 220335Z AUTO 25008KT 2 1/2SM -SN OVC009 M03/M03 A2967 RMK AO2 P0007
IFR METAR KTSP 220355Z AUTO 29009KT 5SM -RA OVC007 M02/M03 A2968 RMK AO2 P0007

2.3 Sandberg, California

The next closest weather reporting location was from the NWS Sandburg (KSDB) ASOS near the crest of Bald Mountain, located approximately 19 miles south of the accident site at an elevation of 4,521 ft. At the approximate time of the accident KSDB reported the following conditions:

KSDB weather observation at 1653 PST, automated, wind from 350° at 13 knots gusting to 24 knots, visibility 10 miles or more, ceiling broken at 500 ft agl, broken at 1,200 ft, temperature -2° C, dew point temperature -3° C, altimeter 29.59 inches of Hg. Remarks: automated observation system, snow began at 1629 and ended at 1630 PST, ceiling 200 ft

variable 800 ft, sea level pressure 1002.6-hPa, hourly precipitation a trace, temperature -2.2° C, dew point -3.3° C.

The general flight conditions and raw observations reported surrounding the period were as follows:

LIFR METAR KSDB 212053Z AUTO VRB04KT 1/2SM SN FZFG OVC002 M02/M03 A2956 RMK AO2 SLP016 P0001 60001 T10221028 50002

LIFR SPECI KSDB 212111Z AUTO 03006KT 1 1/4SM -SN BR OVC003 M02/M03 A2956 RMK AO2

LIFR SPECI KSDB 212115Z AUTO VRB05KT 2SM -SN BR OVC003 M02/M03 A2956 RMK AO2

LIFR SPECI KSDB 212122Z AUTO VRB06KT 4SM -SN BR OVC003 M02/M03 A2956 RMK AO2 P0000

IFR METAR KSDB 212153Z AUTO 36009G16KT 10SM BKN005 OVC014 M01/M03 A2956 RMK AO2 SNE30 SLP012 P0000 T10061028

IFR SPECI KSDB 212214Z AUTO 36011G16KT 2SM -SN BR BKN005 OVC009 M01/M03 A2956 RMK AO2 SNB06 P0000 T10111028

IFR SPECI KSDB 212220Z AUTO 36009G19KT 340V060 1 1/4SM BR OVC005 M02/M03 A2956 RMK AO2 SNB06E15 P0000 T10171028

LIFR SPECI KSDB 212224Z AUTO VRB04G19KT 3/4SM BR OVC004 M01/M02 A2956 RMK AO2 SNB06E15 P0000 T10111022

LIFR SPECI KSDB 212234Z AUTO 01005KT 1 1/2SM BR OVC002 M01/M02 A2956 RMK AO2 VIS 3/4V3 SNB06E15 P0000 T10111022

LIFR SPECI KSDB 212238Z AUTO 02005KT 1SM -SN BR OVC002 M01/M02 A2956 RMK AO2 VIS 1/2V3 SNB06E15B37 P0000 T10111017

LIFR SPECI KSDB 212246Z AUTO VRB05KT 3/4SM -SN BR VV002 M01/M02 A2956 RMK AO2 SNB06E15B37 P0000 T10111022

LIFR METAR KSDB 212253Z AUTO 1/2SM FZFG VV002 M01/M02 A2956 RMK AO2 SNB06E15B37E48 SLP013 P0000 T10111022

LIFR SPECI KSDB 212315Z AUTO 01009G19KT 2 1/2SM BR OVC003 M02/M03 A2957 RMK AO2 SNB2254E10 P0000 T10171028

LIFR SPECI KSDB 212319Z AUTO 02007G19KT 10SM OVC003 M02/M03 A2957 RMK AO2 SNB2254E10

IFR SPECI KSDB 212339Z AUTO 10SM BKN005 OVC011 M02/M03 A2957 RMK AO2 SNB2254E10 CIG 002V007 P0000 T10171033

IFR METAR KSDB 212353Z AUTO VRB04G16KT 9SM BKN005 OVC011 M01/M02 A2958 RMK AO2 SNB2254E10 SLP020 P0000 60001 T10111022 10006 21022 53003

LIFR SPECI KSDB 212358Z AUTO 03006KT 2 1/2SM BR BKN003 OVC007 M01/M02 A2957 RMK AO2 T10061017

IFR METAR KSDB 212353Z AUTO VRB04G16KT 9SM BKN005 OVC011 M01/M02 A2958 RMK AO2 SNB2254E10 SLP020 P0000 60001 T10111022 10006 21022 53003

LIFR SPECI KSDB 212358Z AUTO 03006KT 2 1/2SM BR BKN003 OVC007 M01/M02 A2957 RMK AO2 T10061017

LIFR SPECI KSDB 220009Z AUTO 36009G15KT 9SM BKN003 BKN007 OVC012 M01/M03 A2958 RMK AO2 T10111033

IFR SPECI KSDB 220017Z AUTO VRB04G15KT 10SM FEW003 OVC009 M01/M03 A2958 RMK AO2 T10061033

Accident 0045Z

IFR METAR KSDB 220053Z AUTO 35013G24KT 10SM BKN005 BKN012 M02/M03 A2959 RMK AO2 SNB29E39 CIG 002V008 SLP026 P0000 T10221033

LIFR SPECI KSDB 220130Z AUTO 35016G26KT 8SM BKN003 BKN009 BKN017 M02/M04 A2960 RMK AO2 PK WND 35026/0127 SNB00E09 P0000 T10221044

IFR SPECI KSDB 220134Z AUTO 36012G26KT 10SM SCT003 BKN009 M02/M04 A2960 RMK AO2 PK WND 35026/0127 SNB00E09 P0000 T10221044

MVFR SPECI KSDB 220151Z AUTO VRB06G22KT 10SM BKN010 BKN015 BKN020 M02/M04 A2960 RMK AO2 PK WND 34027/0139 SNB00E09 P0000

MVFR METAR KSDB 220153Z AUTO 01007G22KT 10SM BKN010 BKN015 BKN020 M02/M04 A2960 RMK AO2 PK WND 34027/0139 SNB00E09 CIG 006V014 SLP031 P0000 T10221044

IFR SPECI KSDB 220202Z AUTO 35015G21KT 10SM BKN008 BKN012 M03/M04 A2960 RMK AO2 CIG 005V010 T10281039

LIFR SPECI KSDB 220223Z AUTO 35016G22KT 10SM OVC004 M03/M04 A2962 RMK AO2 CIG 002V008 T10281039

LIFR METAR KSDB 220253Z AUTO 35009G19KT 10SM OVC002 M03/M04 A2964 RMK AO2 SLP046 60000 T10281039 53015

IFR SPECI KSDB 220323Z AUTO 35015G22KT 10SM BKN005 BKN070 M03/M04 A2964 RMK AO2 CIG 002V010 T10281044

VFR SPECI KSDB 220335Z AUTO 35014G21KT 10SM SCT006 M03/M04 A2965 RMK AO2 T10281044

2.4 Lancaster, California

The next closest station was from General William J. Fox Airfield (KWJF), Lancaster, California, located approximately 26 miles southeast of the accident site an elevation of 2,351 ft. The airport had an ASOS which was augmented by ATC personnel. The following conditions were reported at the approximate time of the accident:

KWJF weather observation at 1656 PST, wind from 260° at 3 knots, visibility 10 miles or more, ceiling broken at 7,000 ft agl, temperature 4° C, dew point 0° C, altimeter 29.63 inches of Hg. Remarks: automated observation system with a precipitation discriminator, sea level pressure 1004.4-hPa, temperature 4.4° C, dew point 0.0° C.

The general flight categories and weather observations reported surrounding the period were as follows:

VFR METAR KWJF 212056Z 26016KT 10SM CLR 06/M01 A2959 RMK AO2 SLP029 T00611011 58008

VFR METAR KWJF 212156Z 34009KT 10SM -RA SCT028 BKN034 OVC046 04/00 A2960 RMK AO2 RAB47 SLP033 P0000 T00440000

IFR SPECI KWJF 212206Z 36003KT 1 3/4SM -SN SCT013 BKN027 OVC033 02/M01 A2961 RMK AO2 VIS 1V5 RAE01SNB01 P0000 T00221006

MVFR SPECI KWJF 212213Z 5SM -SN BKN015 OVC029 02/M01 A2961 RMK AO2 RAE01B07E10SNB01 P0000 T00221011

MVFR SPECI KWJF 212243Z 25012KT 5SM -SN FEW024 BKN035 OVC075 02/M01 A2960 RMK AO2 RAE01B07E10SNB01 P0003 T00221006

MVFR METAR KWJF 212256Z 23009KT 5SM -SN FEW047 BKN060 04/M01 A2961 RMK AO2 RAE01B07E10SNB01 SLP037 P0005 T00391006

VFR METAR KWJF 212356Z 26010KT 10SM BKN085 02/01 A2962 RMK AO2 SNE2257 SLP043 P0003 60008 T00220006 10078 20017 53009

Accident 0045Z

VFR METAR KWJF 220056Z 26003KT 10SM BKN070 04/00 A2963 RMK AO2 SLP044 T00440000

VFR METAR KWJF 220156Z 27007KT 10SM FEW036 SCT055 OVC075 03/M01 A2965 RMK AO2 SLP054 T00331011

VFR METAR KWJF 220256Z 29009KT 10SM OVC070 01/M02 A2968 RMK AO2 SLP064 T00111022 53018 53018

VFR METAR KWJF 220356Z 29005KT 10SM CLR 01/M03 A2970 RMK AO2 SLP072 T00061028

2.5 Los Angeles, California

The planned destination was Whiteman Airport (KWHP), Los Angeles, California, located approximately 43 miles south of the accident site at an elevation of 1,003 ft. The airport had an AWOS and reported the following conditions surrounding the period.

KWHP weather observation at 1650 PST, wind from 350° at 10 knots, visibility 10 miles or more, sky clear below 12,000 ft agl, temperature 8° C, dew point -2° C, altimeter 29.65 inches of Hg.

The raw observations were as follows:

VFR METAR KWHP 212055Z 35009KT 10SM BKN060 11/M03 A2961=
VFR METAR KWHP 212150Z 30015G30KT 10SM FEW050 07/M01 A2963=
VFR METAR KWHP 212250Z 30010KT 10SM SKC 08/M02 A2962=
VFR METAR KWHP 212350Z 30015G20KT 10SM SKC 09/M02 A2963=
Accident 0045Z
VFR METAR KWHP 220050Z 35010KT 10SM SKC 08/M02 A2965=
VFR METAR KWHP 220155Z 32008KT 10SM BKN085 08/M02 A2967=
VFR METAR KWHP 220255Z 30006KT 10SM SKC 07/M01 A2970=
VFR METAR KWHP 220355Z 28010KT 10SM SKC 07/M02 A2972=

3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site a High-Resolution Rapid Refresh (HRRR)³ numerical model data was retrieved from the NOAA Air Resources Laboratory and plotted on a standard Skew T log P diagram⁴ using the complete Rawinsonde Observation RAOB program software⁵. Figure 5 is the HRRR plot from the surface through 450-hPa (or approximately 21,000 ft) from the HRRR 1600 PST model run for the approximate accident site with an elevation of 5,702 ft.

The HRRR numerical model for 1600 PST depicted a surface temperature of -5.6° C (21.9° F), a dew point temperature of -6.4° C (20.5° F), a relative humidity of 94%, with a density altitude of about 5,000 ft. The entire sounding was below freezing, and no defined temperature inversion were identified below 21,000 ft. The lifted condensation level (LCL)⁶ was identified at 326 ft agl

³ The HRRR is a National Oceanic and Atmospheric Administration (NOAA) real-time three-kilometer resolution, hourly-updated, cloud-resolving, convection-allowing atmospheric model, initialized by three-kilometer grids with three-kilometer radar assimilation. Radar data is assimilated in the HRRR every 15 minutes over a one-hour period.

⁴ 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.

⁵ 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.

⁶ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically. The LCL is typically used to identify the base of clouds from lifting due to terrain and frontal systems.

(6,028 ft msl), the level of free convection (LFC)⁷ at 361 ft agl (6,063 ft msl), and the convective condensation level (CCL)⁸ at 2,821 ft agl (8,523 ft msl). The sounding had a relative humidity greater than 80% from the surface through approximately 8,000 ft msl and supported clouds and potential structural icing conditions from the LCL through 8,000 ft. The HRRR wind profile indicated northwest winds which veered to the north through 10,000 ft. The mean 0 to 6 kilometer or 18,000 ft wind was from 350° at 13 knots. The HRRR thermal and wind profile did not support any organized mountain wave conditions over the area.

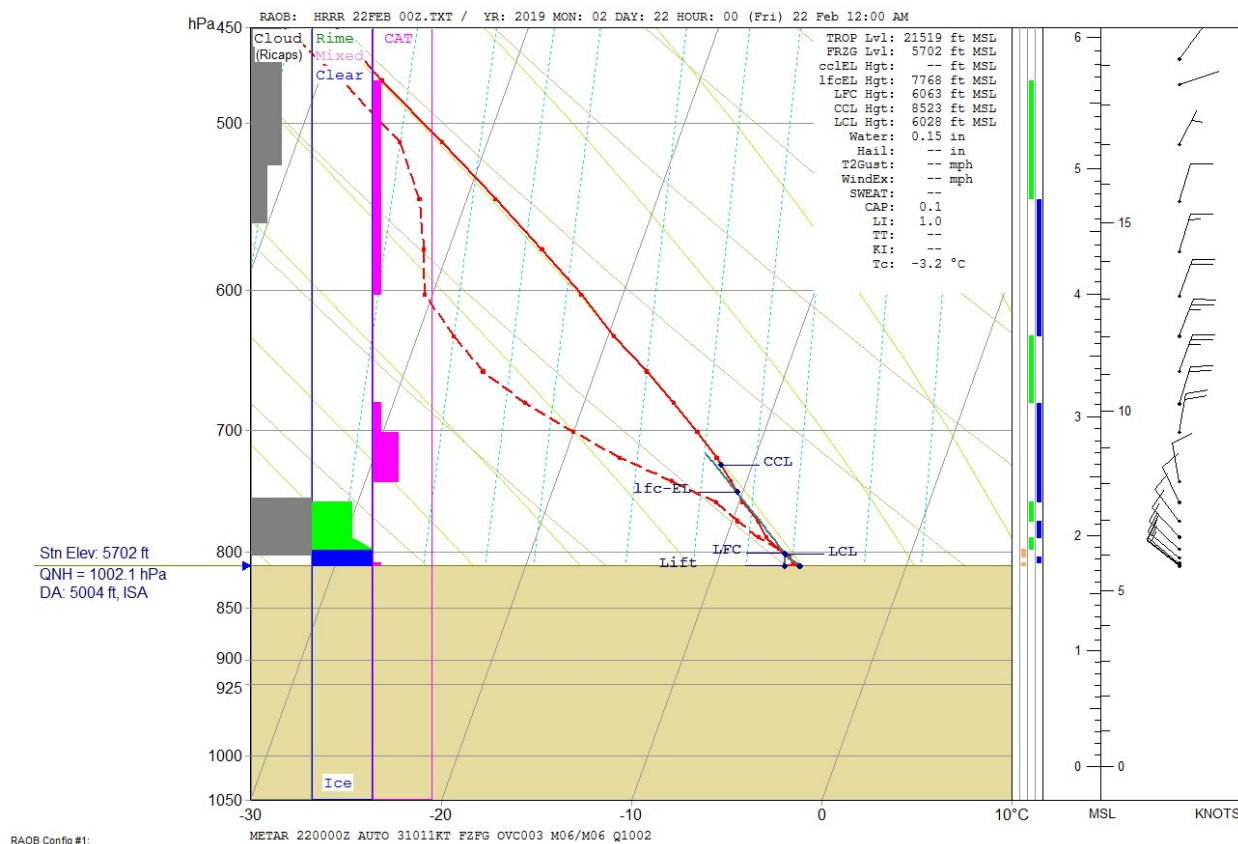


Figure 5 - HRRR numerical model over the accident site for 1600 PST

Figure 6 is a table of the HRRR model heights, pressure, temperature (T), dew point (Td), relative humidity (RH%), and wind direction and speed, and the RAOB derived potential for clear air turbulence (CAT), low-level wind shear (LLWS), icing, and mountain wave potential from the surface to approximately 19,000 ft. The table indicated a high probability of moderate clear type icing conditions below 6,000 ft, and light rime type icing to 8,000 ft.

⁷ Level of Free Convection (LFC) – the height at which a parcel of air lifted dry adiabatically until saturated at the LCL, then lifted moist-adiabatically thereafter would become warmer or more buoyant than the surrounding air and continue rising.

⁸ Convective Condensation Level (CCL) – is the height to which a parcel of air, if heated sufficiently from below, will rise adiabatically until condensation occurs. This is used typically to identify the base of convective clouds, which are normally produced from surface heating and thermal convection.

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
5702	812	-5.6	-6.4	94	311 / 11			MDT Clear	
5734	811	-5.7	-5.7	100	311 / 10	LGT	LIGHT	MDT Clear	
5798	809	-6.0	-6.0	100	312 / 13			MDT Clear	
5957	804	-6.3	-6.3	100	312 / 14			MDT Clear	
6181	797	-7.0	-7.0	100	315 / 13			MDT Clear	
6504	787	-7.9	-8.3	97	320 / 12			LGT Rime	
6962	773	-8.6	-9.7	92	324 / 11			LGT Rime	
7493	757	-9.8	-11.2	89	336 / 10			LGT Rime	
8067	740	-10.8	-13.9	78	350 / 11				
8722	721	-12.0	-17.1	66		MDT			
9426	701	-13.5	-20.0	58	8 / 18	LGT			3.03 399 LIGHT
10219	679	-15.3	-23.1	51	15 / 21				
11070	656	-17.3	-25.9	47	18 / 23				
12021	631	-19.7	-28.1	47	19 / 23				
13121	603	-22.2	-30.4	47	18 / 21	LGT			
14303	574	-25.1	-31.3	56	16 / 17	LGT			
15618	543	-28.5	-32.5	68	16 / 11	LGT			
17081	510	-32.4	-34.6	81	25 / 6	LGT			
18615	477	-36.7	-38.8	81	70 / 2				

Figure 6 - HRRR sounding parameters and RAOB derived turbulence, wind shear, icing, and wave potential

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 17 (GOES-17) 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 accident, with the images closest to the time of the accident documented below. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns (μm) provided radiative cloud top temperatures with a nominal spatial resolution of 2 km. The visible (band 2) at a wavelength of 0.64 μm images at a resolution of 1 km.

Figure 7 is the GOES-17 infrared image at 1646 PST at 4X magnification with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops associated with deep convection and cold cirriform type clouds. The accident site is marked by the white square and is under an area of low stratiform-type clouds with a radiative cloud top temperature of 264° Kelvin or -9.6° C, which corresponding to cloud tops near 7,500 ft based on the HRRR sounding. Higher cloud tops (red shades) associated with more vertically defined clouds were identified approximately 20 miles northeast and 50 miles west and south of the accident site.

Figure 8 is the GOES-17 visible image at 1646 PST at 2X magnification. Low stratiform clouds obscure the accident site marked by the white square, and the cloud cover extend from near the California coast eastward into the central portion of the state.

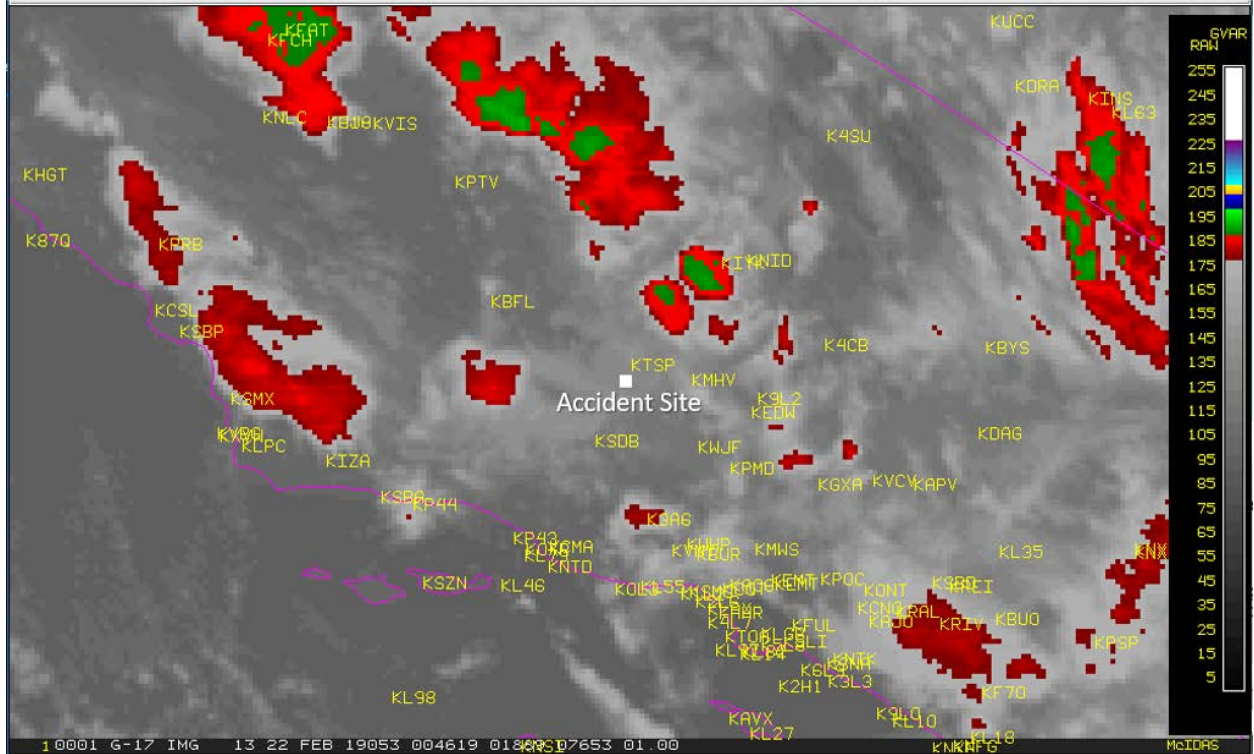


Figure 7 - GOES-17 infrared satellite image at 1646 PST at 4X magnification

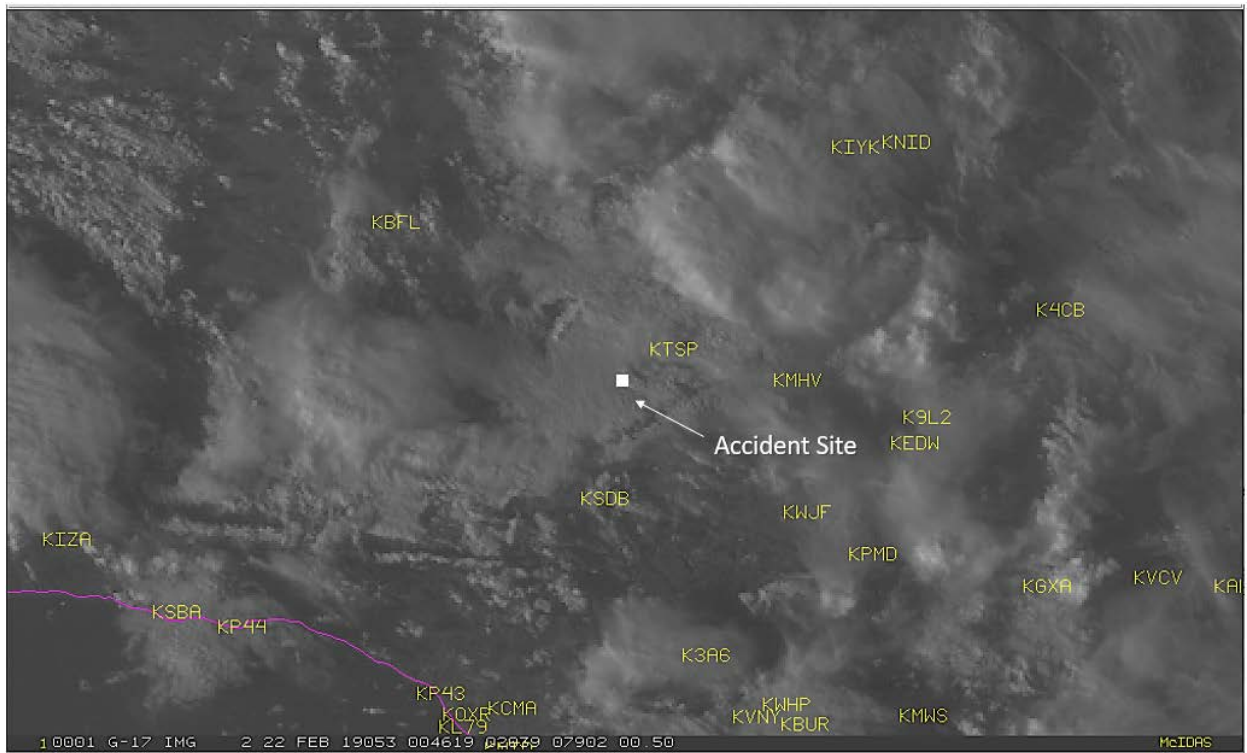


Figure 8 - GOES-17 visible image at 1646 PST at 2X magnification

5.0 Weather Radar

The closest Weather Surveillance Radar 1988 Doppler (WSR-88D)⁹ was from the Department of Defense Edwards Air Force Base (KEYX) site located 51 miles east of the accident site in Boron, California. 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)¹⁰ and is a general measure of echo intensity. Figure 9 below is a chart that 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	

Figure 9 – WSR-88D intensity scales and reflectivity values

⁹ 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.

¹⁰ dBZ – 10 log Ze, a non-dimensional “unit” of radar reflectivity which represents a logarithmic power ratio (in decibels, or dB) with respect to radar reflectivity factor, Ze.

FAA Advisory Circular AC 00-24C - “Thunderstorms” also defines the echo intensity levels and weather radar echo intensity terminology associated with those levels. The following table provides the reflectivity value and echo intensity terminology that is also used by air traffic controllers (ATC) weather display systems.

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

5.2 Elevation Scan

Based on the radar antenna’s location 51 miles east of the accident site with a height of 2,873 ft, the 0.5° elevation scan would be centered at about 7,300 ft over the accident site and sampling the altitudes from 4,730 ft to 9,870 ft.

5.3 Base Reflectivity Imagery

Figure 10 is the KEYX WSR-88D 0.5° base reflectivity image for 1646 PST with a resolution of 0.5° X 250 meters. Echoes of -5 dBZ were identified in the immediate vicinity of the accident site with scattered echoes of 10 to 35 dBZ or light to moderate intensity echoes extending north through south immediately east of the accident site, with another area approximately 50 miles west of the accident site. Echoes were identified in the vicinity of KPMD and the destination airport KWHP. The echoes were noted moving southward at approximately 10 knots. The stronger echoes (>45 dBZ orange and red) identified on the image immediately east and northeast of the accident site were not moving with time and were associated with false echoes and not meteorological in nature.

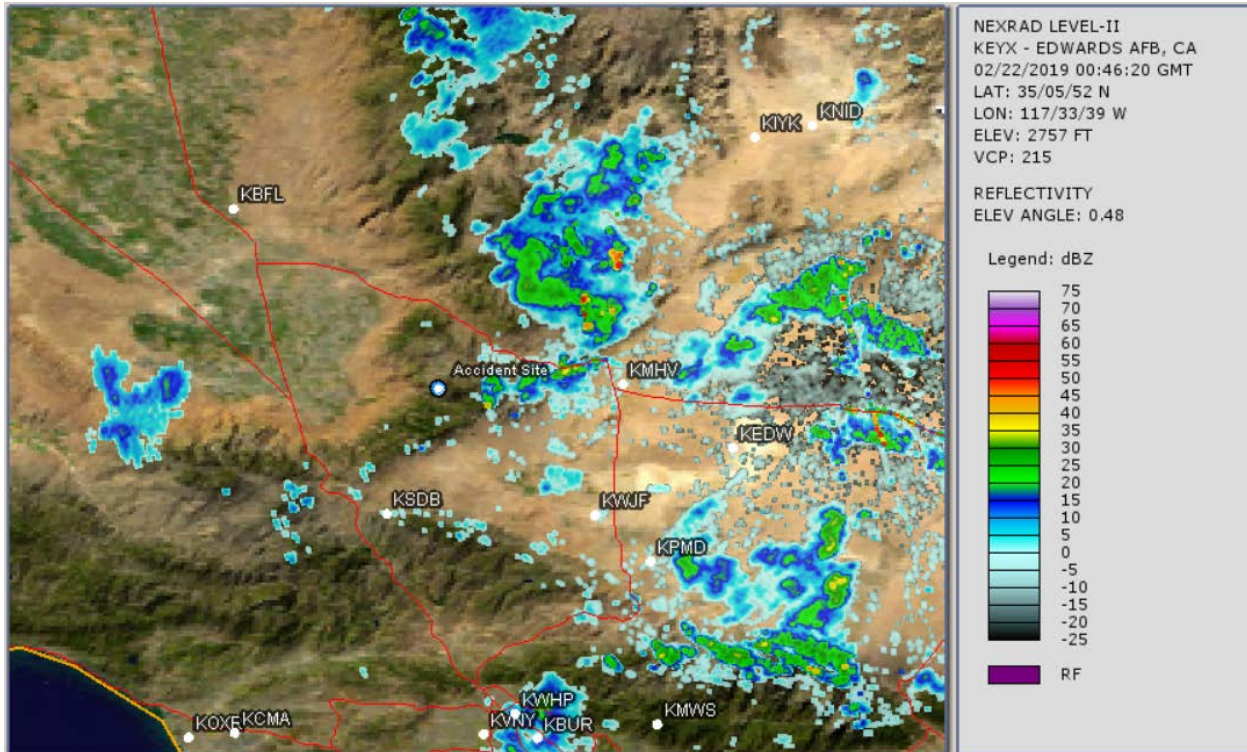


Figure 10 - KEYX 0.5° base reflectivity image for 1646 PST

A separate review of archive data from Earth Networks indicated no lightning activity within 20 miles of the time of the accident.

6.0 Pilot Reports

The following pilot reports or PIREPs below 18,000 ft for the route of flight in the NWS database for the period from 1200 to 1900 PST or approximately 4 hours prior to and after the time of the accident. Cloud bases and tops are reported in msl heights. The following are the decoded reports with time converted to local:

Santa Barbara Municipal Airport (SBA) routine pilot report (UA); Over – Santa Maria Public Airport (KSMX); Time -1201 PST; Altitude – 9,000 ft; Type aircraft – Beechcraft (BE20); Turbulence – light-to-moderate clear air turbulence; Remarks – entered through the AWC website.

San Luis County Regional Airport (SBP), San Luis Obispo, routine pilot report (UA); Over – SBP; Time -1247 PST; Altitude – 6,000 ft; Type aircraft – Cessna Stationair (C206) single engine airplane; Icing – light rime icing; Remarks – from 10 miles east of SBP.

Palmdale USAF Plant 42 Airport (PMD) routine pilot report (UA); Over – PMD; Time – 1312 PST; Altitude – 9,000 ft; Type aircraft – Cessna Citation (C560) corporate jet; Temperature – minus 4° C, Icing – moderate time type icing.

Los Angeles International Airport (LAX) routine pilot report (UA); Over – 080° radial and 15 miles from Ventura (VTU) VORTAC; Time – 1316 PST; Altitude – 9,000 ft; Type aircraft – Cessna Conquest (C425) multiengine airplane; Weather – thunderstorms; Remarks – entered from Los Angeles Center (KZLA).

Santa Monica Municipal Airport (SMO) routine pilot report (UA); Over – 270° radial and 11 miles from Santa Monica VORTAC; Time – 1325 PST; Altitude – unknown; Type aircraft – Cessna (C172) single engine airplane; Sky cover – overcast clouds at 2,000 ft msl; Weather – freezing rain.

SBA routine pilot report (UA); Over – 105° and 17 miles from SBA; Time – 1335 PST; Altitude – 6,000 ft; Type aircraft – Cessna Citation Mustang (C521) corporate jet; Temperature – minus 1° C; Icing – light mixed icing conditions.

LAX routine pilot report (UA); Over – Van Nuys Airport (VNY); Time – 1349 PST; Flight Level - 20,000 ft; Type aircraft – Cessna Centurion (C210) high performance single engine airplane; Sky cover – broken clouds with tops 19,000 ft msl; Remarks – entered by KZLA center.

Santa Monica Municipal Airport (SMO) routine pilot report (UA); Over – 030° radial and 5 miles from SMO VORTAC; Time – 1402 PST; Altitude – 2,700 ft; Type aircraft – Pilatus (PC12) high performance single engine turboprop; Sky cover – broken clouds with bases at 2,700 ft.

Paso Robles Municipal Airport (PRB) routine pilot report (UA); Over – 180° radial and 20 miles from Avenal (AVE) VORTAC; Time – 1417 PST; Altitude – 11,000 ft; Type aircraft – SOCATA TBM 700 (TBM7) high performance single engine turboprop; Temperature – minus 15° C; Icing – moderate rime type icing; Remarks – entered by KZLA.

Fullerton Municipal Airport (FUL) urgent pilot report (UUA); Over – 1 mile east of FUL; Time – 1435 PST; Altitude – 1,000 ft; Type aircraft – Cessna 152 light airplane; Remarks – low-level wind shear (LLWS) plus or minus 10 knot loss of airspeed on final.

PMD routine pilot report (UA); Over – 295° radial and 15 miles from PMD VORTAC; Time – 1446 PST; Altitude – 6,500 ft; Type aircraft – Beechcraft Baron (BE55) light multiengine piston airplane; Temperature – minus 10° C; Icing – light rime type icing.

PMD routine pilot report (UA); Over – 240° radial and 9 miles from PMD VORTAC; Time – 1449 PST; Altitude – 8,500 ft; Type aircraft – Bombardier Challenger (CL60) corporate jet; Temperature – minus 12° C; Turbulence – light chop; Icing – trace of rime type icing.

Bob Hope Airport, Burbank (BUR) routine pilot report (UA); Over – BUR; Time – 1520 PST; Altitude – 800 ft; Type aircraft – Boeing 737 air carrier jet; Remarks – plus and minus 10 knots of airspeed during descent for runway 33.

Oxnard Airport (OXR) routine pilot report (UA); Over – 20 miles east of SBA; Time – 1618 PST; Altitude – 3,300 ft; Type aircraft – Cessna 172 Skyhawk single engine airplane; Sky cover – scattered clouds with bases at 3,700 ft msl; Remarks – clearer over the coast.

SBP urgent pilot report (UUA); Over – 1 mile west of SBP; Time - 1643 PST; Altitude – 800 ft; Type aircraft – Cessna Citation Sovereign (C680) corporate business jet; Remarks – LLWS loss of 20 knots between the surface and 800 ft during climb out from runway 29 at SBP.

The reports in raw format with time in UTC were as follows:

*SBA UA /OV KSMX/TM 2001/FL090/TP BE20/TB LGT-MOD CAT/RM AWC-WEB/
SBP UA /OV SBP/TM 2047/FL060/TP C206/IC LIGHT RHIME/RM 10 MI EAST OF SBP C206 REPORTED
LIGHT RHIME ICING.
PMD UA /OV PMD/TM 2112/FL90/TP C560/TA M04/IC MOD RIME
LAX UA /OV VTU008015 /TM 2116 /FL090 /TP C425 /WX TS /RM ZLAWC AWC-WEB
SBA UA /OV GVO /TM 2127 /FL110 /TP C525 /TA M11 /IC LGT RIME /RM ZLAWC AWC-WEB
SMO UA /OV SMO270011/TM 2135/FLUNKN/TP C712/SK OVC020/WX FZRA
SBA UA /OV SBA105017/TM 2135/FL060/TP C510/TA M01/IC LGT MX
LAX UA /OV VNY/TM 2149/FL200/TP C210/SK BKN-TOP190/RM ZLAWC AWC-WEB/*

*SMO UA /OV SMO030005/TM 2202/FL027/TP PC12/SK BKN027
PRB UA /OV AVE180020/TM 2217/FL110/TP TBM7/TA M15/IC MOD RIME/RM ZLAWC AWC-WEB/
FUL UUA /OV FUL090001/TM 2235/FL010/TP C152/RM LLWS 10 KNOTS PLUS OR MINUS ON FINAL.
PMD UA /OV PMD295015/TM 2246/FL065/TP BE55/TA M10/IC LGT RIME
PMD UA /OV PMD240009/TM 2249/FL085/TP CL60/TA M12/TB LIGHT CHOP/IC TRACE RIME
BUR UA /OV BUR/TM 2320/FL008/TP B737/RM +/- 10 KTS DURD RWY33
OXR UA /OV SBA090020/TM 0018/FL033/TP C172/SK SCT037/RM CLEARER OVER COAST
SBP UUA /OV KSBP290001/TM 0043/FL008/TP C680/RM LLWS -20 KT SFC-008 DURC RY29 SBP*

7.0 NWS Forecasts and Advisories

The following forecast products were issued surrounding the period and available for preflight briefing.

7.1 Terminal Aerodrome Forecast

A Terminal Aerodrome Forecast (TAF) is a concise statement of the expected meteorological conditions at an airport during a specified period (usually 24 hours). TAFs are valid for a 5 mile radius around an airport's center point. When planning a flight to an airport that does not have a TAF, pilots typically refer to the closest available TAFs to supplement the information in weather forecast products that cover large areas, such as the Graphic Aviation Forecast (GFA), Airmen's Meteorological Information (AIRMET) bulletins, and other graphical products.

The NWS Los Angeles/Oxnard (KLOX) Weather Forecast Office (WFO) was responsible for issuing the TAFs for the area and issuing any special weather advisories. The TAF issued for the departure KSBP and for Bob Hope Airport (KBUR), Burbank, California, located about 4 ½ miles southeast of planned destination airport of KWHP current during the period were as follows.

Departure Area

*TAF AMD KSBP 212038Z 2121/2218 01010KT P6SM -SHRA VCTS SCT050CB BKN120
FM212200 32014KT P6SM VCSH SCT035 BKN060
FM220200 32008KT P6SM SKC
FM220500 33005KT P6SM SKC
FM221400 VRB03KT P6SM SKC=*

*TAF KSBP 212340Z 2200/2224 35006KT P6SM VCSH SCT035 BKN060
FM220300 VRB04KT P6SM SKC
FM222100 30008KT P6SM SKC
FM222300 31011KT P6SM SKC*

The forecast current and available for any preflight briefing prior to the flight's departure was an amended forecast issued at 1238 PST and expected light rain showers and thunderstorms in the vicinity of the airport until 1400 PST then general VFR conditions to prevail with a wind from 320° at 14 knots, visibility better than 6 miles with showers in the vicinity of the airport, scattered clouds at 3,500 ft agl, ceiling broken at 6,000 ft.

The next schedule TAF was issued about 20-minutes prior to the flight's departure 1540 PST. The forecast continued to expect VFR conditions and a surface wind from 350° at 6 knots, with no other significant changes to the forecast.

Destination Area

*TAF AMD KBUR 212026Z 2120/2218 33005KT P6SM -SHRA VCTS SCT040CB BKN120
FM212100 30006KT P6SM VCSH SCT035 BKN060
FM220200 35008KT P6SM SKC
FM220600 VRB03KT P6SM SKC
FM221500 00000KT P6SM SKC=*

*TAF KBUR 212340Z 2200/2224 30009G15KT P6SM VCSH SCT035 BKN100
FM220200 32005KT P6SM BKN150
FM220900 VRB03KT P6SM SKC
FM221700 35005KT P6SM SKC
FM222100 19007KT P6SM SKC*

The forecasts issued for KBUR at 1226 PST also expected VFR conditions to prevail with wind from 300° at 6 knots, visibility better than 6 miles with showers in the vicinity, scattered clouds at 3,500 ft agl, ceiling broken at 6,000 ft. The next scheduled forecast issued at 1540 PST continued to expected VFR conditions to prevail with showers in the vicinity of the airport.

7.2 Area Forecast Discussion

The NWS KLOX Area Forecast Discussion current for the period is included below and provided the general public forecast and additional background and reasoning on the TAFs issued during the period.

*FXUS66 KLOX 212203
AFDLOX*

*Area Forecast Discussion
National Weather Service Los Angeles/Oxnard CA
203 PM PST Thu Feb 21 2019*

.SYNOPSIS...21/1233 PM.

A very cold storm system continues to move across the area this afternoon bringing light to moderate rain, low elevation snow, and a chance of thunderstorms through early evening. Dry conditions will return on Friday through early next week, but below normal temperatures are expected for most areas.

.SHORT TERM (TDY-SUN)...21/149 PM.

Showers and thunderstorms developing this afternoon under a very cold pool of air aloft. Amounts have been pretty light but there have been multiple reports of small hail, graupel, and even a few snowflakes down to around 1500'. Expect this to continue through the afternoon then start winding down in the evening as the air mass stabilizes. Upslope showers near the Grapevine will likely continue off and on through the overnight hours but with minimal additional accumulation.

After the clouds and showers dissipate we'll see temperatures falling to near or below freezing across many of our valleys and some areas closer to the coast as well. The earlier Freeze Watch has been converted to a Freeze Warning.

Pretty quiet weather Friday and through the weekend. Temps remaining well below normal but warming a degree or two each day.

.LONG TERM (MON-THU)...21/202 PM.

Quiet weather through the period as a ridge of high pressure develops along the west coast. Temps will warm a degree or two each day reaching close to normal by Tue/Wed and possibly even slightly above normal Thu.

.AVIATION...21/1826Z.

At 1800Z, there was no marine inversion at KLAX.

Overall, moderate confidence in 18Z TAF package. Cold and unstable air mass will bring VFR CIGs and a chance of showers to all sites through this evening. There is a 30% chance of MVFR CIGs in association with any shower activity. There is a 10-15% chance of TSTMs through early this evening for all sites. Any TSTMs would be capable of producing gusty/erratic winds and small hail.

KLAX...Moderate confidence in 18Z TAF. There is a 20-30% chance of MVFR CIGs and light showers through 02Z. Additionally, there is a 10% chance of TSTM through 02Z.

KBUR...Moderate confidence in 18Z TAF. There is a 20-30% chance of MVFR CIGs and light showers through 02Z. Additionally, there is a 10% chance of TSTM through 02Z.

.MARINE...21/1023 AM.

For the Outer Waters, moderate to high confidence in current forecast. High confidence in strong Small Craft Advisory (SCA) level northwest winds through tonight for all Outer Waters with local gusts reaching GALE force this morning. On Friday, there is a 70% chance of SCA level northwest winds continuing into the evening. For Saturday through Monday, there is a 50% chance of SCA level winds on Saturday afternoon/evening for PZZ673/676. Otherwise, winds and seas are expected to remain below SCA levels.

For the Inner Waters north of Point Sal, high confidence in current forecast. There is a 70% chance of SCA level northwest winds this afternoon and evening. For Friday through Monday, winds and seas are expected to remain below SCA levels.

For the Inner Waters south of Point Conception, high confidence in current forecast. SCA level west to northwest winds will continue through mid-afternoon today, before diminishing with the strongest winds across western sections. For tonight through Monday, winds and seas are expected to remain below SCA levels.

For all waters, there is a slight chance of thunderstorms through this evening. Gusty/erratic winds, small hail, waterspouts and steep seas will be possible with any thunderstorms.

.LOX WATCHES/WARNINGS/ADVISORIES...

CA...Freeze Warning in effect from midnight tonight to 8 AM PST Friday for zones 34>36-44>46-88-547. (See LAXNPWLOX). Winter Weather Advisory in effect until 10 PM PST this evening for zones 37-38-51>54-59. (See LAXWSWLOX).

PZ...Small Craft Advisory in effect until 9 PM PST this evening for zones 645-650-655. (See LAXMWWLOX). Small Craft Advisory in effect until 3 AM PST Friday for zones 670-673-676. (See LAXMWWLOX).

.HAZARD POTENTIAL OUTLOOK (SUN-THU).

No significant hazards expected.

PUBLIC...MW
 AVIATION...RAT/Sweet
 MARINE...RAT/Sweet
 SYNOPSIS...Stewart

7.3 Graphic Forecast for Aviation

The Graphic Forecast for Aviation (GFA) replaced the Area Forecast for providing enroute weather conditions and cloud cover and tops. Figures 11 and 12 are the graphic forecast for wind, visibility, weather, and cloud cover that was issued at 1400 PST and valid for the period of the accident at 1600 PST. The graphics also include the Graphic AIRMET advisories for IFR, icing, and mountain obscuration conditions overlaid for the period for reference.

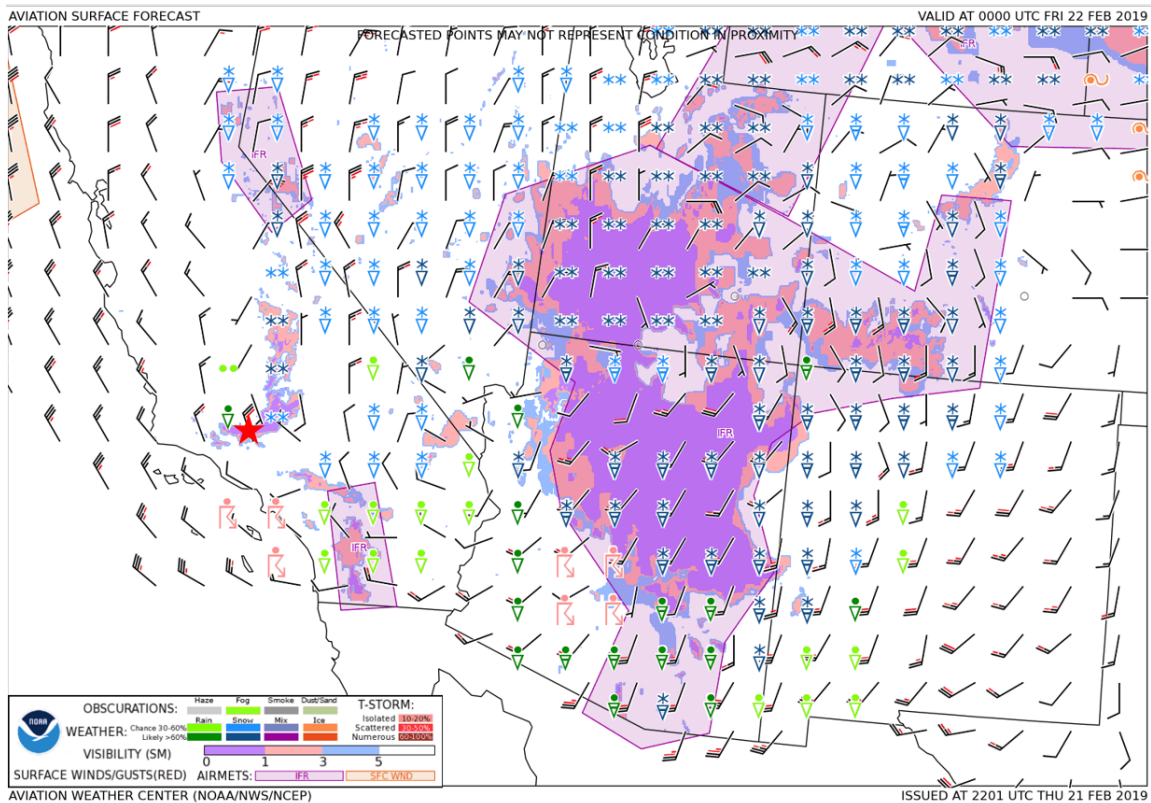


Figure 11 - GFA wind, visibility, weather and G-AIRMET for IFR conditions valid for 1600 PST

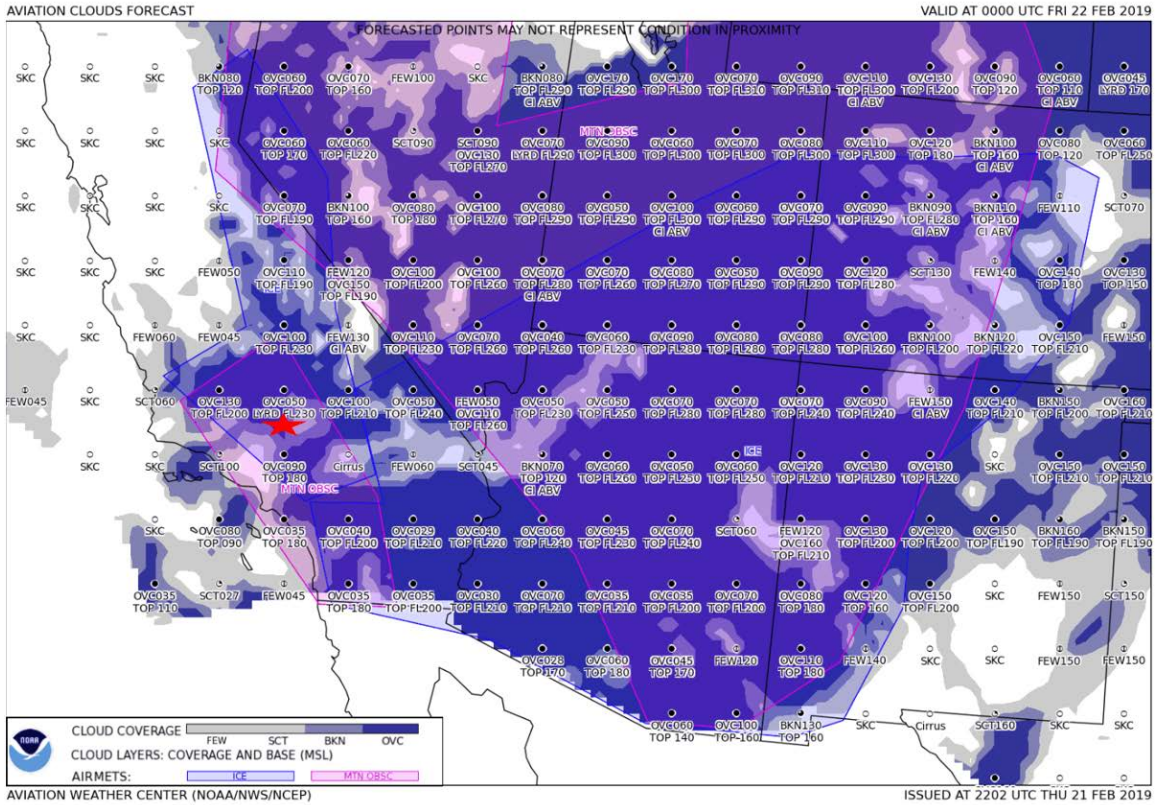


Figure 12 - GFA cloud cover and top forecast valid for 1600 PST with G-AIRMET for mountain obscuration and icing conditions

The GFA forecast expected areas of restricted visibility in rain and snow shower in the vicinity of the accident site, with overcast clouds with bases near 5,000 ft msl with tops layered to 23,000 ft. Recall the accident site elevation was at approximately 6,700 ft. The GFA also depicted the G-AIRMETs for mountain obscuration and moderate icing conditions current over the accident site.

7.4 Winds and Temperatures Aloft Forecast

The NWS Winds and Temperature Aloft Forecast current during the period is included below for the region.

*WINDS ALOFT FORECASTS
 DATA BASED ON 220000Z
 VALID 220600Z FOR USE 0200-0900Z. TEMPS NEG ABV 24000*

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
SBA	0116	3625-04	3621-12	3516-20	3323-32	3572-37	358443	348246	335748
WJF		0220-05	0213-13	3515-19	3512-34	3417-42	344343	334844	324046
ONT	3612	0221-05	0321-12	3614-19	3213-33	3115-42	323542	323844	304346

The closest forecast station to the accident site was for General William J. Fox Airport (WJF/KWJF) located approximately 28 miles southeast of the accident site at an elevation of 2,351

ft. No winds are forecast within 1,500 ft of station elevation, and no temperatures are forecast for the 3,000 ft level or within 2,500 ft of the surface elevation. The WJF forecast for 6,000 ft expected a wind from 020° at 20 knots with a temperature of -5° C.

7.5 Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA 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 to evaluate on the basis of experience and the operational limits of the aircraft.

The NWS had a Convective SIGMET and a full series of AIRMETs current at the time of the accident for southern California. The Los Angeles CWSU issued no CWA's surrounding the period of the accident. The advisories are detailed below.

7.5.1 Convective SIGMET

The NWS AWC issued Convective SIGMET 4W at 1555 PST for a diminishing line of thunderstorms to the east of Los Angeles (LAX) and west of Palm Springs (TRM), California, to the south of the accident site and the destination. The plot of the Convective SIGMET over the GOES-17 visible image at 1601 PST is included as figure 13 followed by the text of the advisory. The boundary of the Convective SIGMET was located approximately 20 miles east of KWHP.

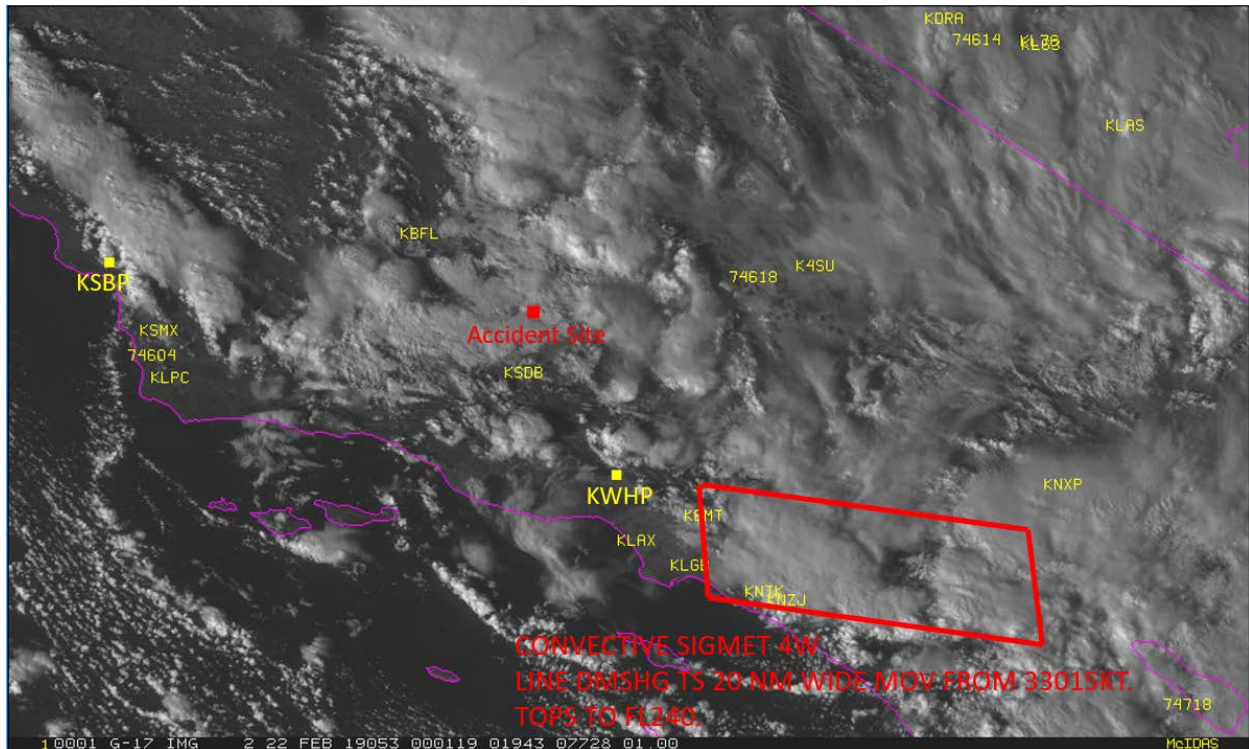


Figure 13 - Convective SIGMET 4W over the GOES-17 visible satellite image at 1601 PST

WSUS33 KKCI 212355
 SIGW
 CONVECTIVE SIGMET 4W
 VALID UNTIL 0155Z
 CA AND CSTL WTRS
 FROM 20E LAX-40W TRM
 LINE DMSHG TS 20 NM WIDE MOV FROM 33015KT. TOPS TO FL240.

7.5.2 AIRMETs

The NWS AWC had a full series of AIRMETs current for the area; AIRMET Sierra for mountain obscuration conditions, AIRMET Tango for moderate turbulence below 10,000 ft, and AIRMET Zulu for moderate icing conditions. Figures 14 through 16 are the Graphic-AIRMETs followed by the text bulletins issued during the period.

SIERRA 2019-02-22 00:00:00

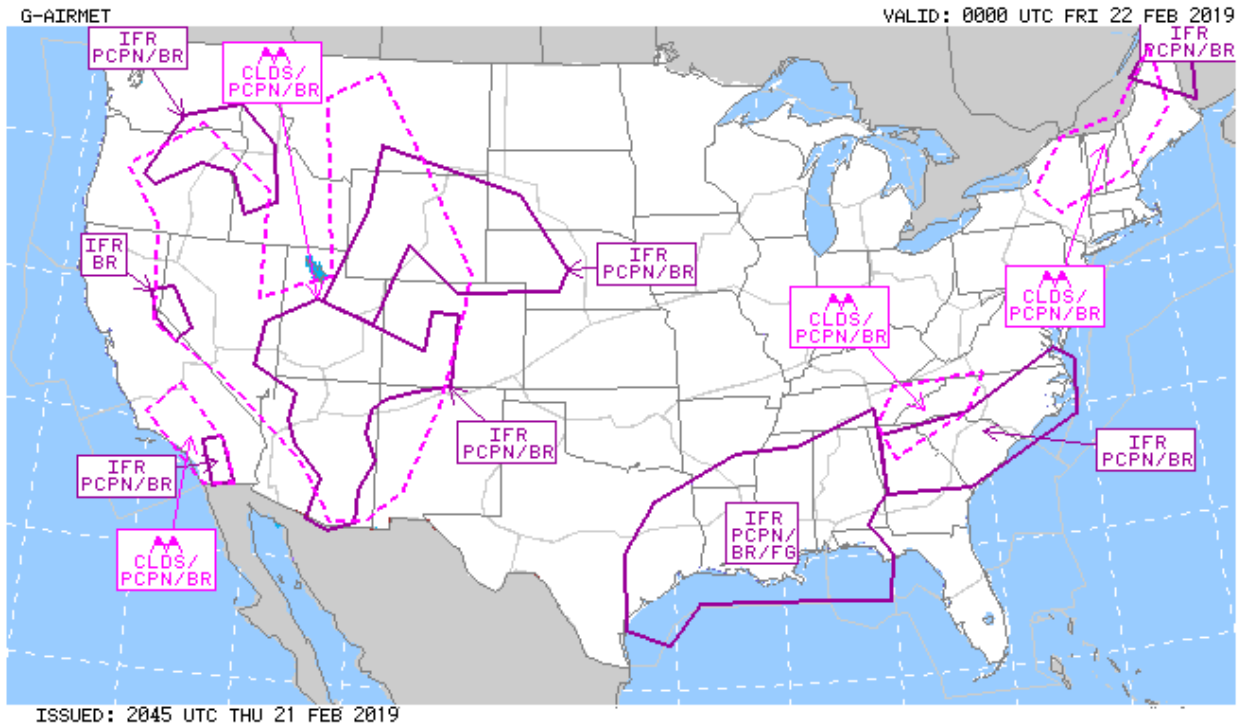


Figure 14 - G-AIRMET Sierra for IFR and mountain obscuration conditions valid for 1600 PST

WAUS46 KKCI 212045

WA6S

SFOS WA 212045

AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 220300

AIRMET IFR...CA NV

FROM 30NNE FMG TO 30ESE OAL TO 40E CZQ TO 40ENE SAC TO 50WNW FMG TO 30NNE FMG
CIG BLW 010/VIS BLW 3SM BR. CONDS DVLPG 21-00Z. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET IFR...CA AND CSTL WTRS

FROM 50E EHF TO 20SW HEC TO 60SSE TRM TO 30SE MZB TO 60SW HEC TO 40SSE EHF TO 50E EHF
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 03Z ENDG 06-09Z.

AIRMET MTN OBSCN...CA

FROM 60ESE CZQ TO 30NNW TRM TO 60SSE TRM TO 30S MZB TO 20W LAX TO 40W RZS
TO 60ESE CZQ

MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z ENDG 06-09Z.

TANGO 2019-02-22 00:00:00

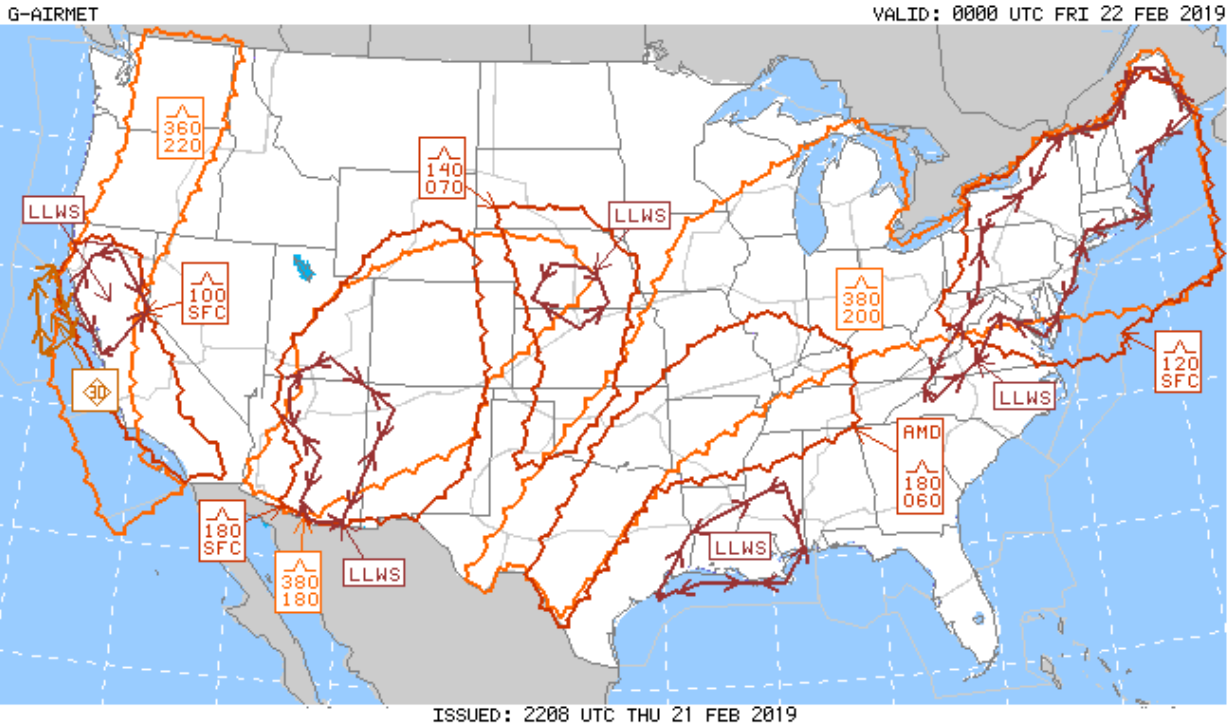


Figure 15 - G-AIRMET Tango for moderate turbulence valid for 1600 PST

WAUS46 KPCI 212045

WA6T

-SFOT WA 212045

AIRMET TANGO UPDT 4 FOR TURB STG WINDS AND LLWS VALID UNTIL 220300

AIRMET TURB...WA OR CA ID MT NV AND CSTL WTRS

FROM 50WSW YXC TO 30NNW MLP TO 50NE DNJ TO 20ESE REO TO 60N FMG
TO 30ESE MOD TO 20NNE RZS TO 20S MZB TO 220SW MZB TO 220SSW RZS
TO 150SW FOT TO 60SW EUG TO 30S BTG TO 30WNW HUH TO 50WSW YXC
MOD TURB BTN FL220 AND FL360. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET TURB...OR CA AND CSTL WTRS

FROM 20S OED TO 40SSW LKV TO 40SSW FMG TO 50SSW BTY TO 20SSW HEC
TO 20ENE TRM TO 40W BZA TO 20S MZB TO 50WSW RZS TO 70SW FOT TO 20S OED
MOD TURB BLW 100. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET STG SFC WINDS...CA CSTL WTRS

FROM 30WSW FOT TO 70SW SNS TO 130SW SNS TO 150SW FOT TO 30WSW FOT
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 03Z
ENDG 03-06Z.

LLWS POTENTIAL...CA AND CSTL WTRS

BOUNDED BY 60S OED-80S LKV-30SSW FMG-40WSW OAL-40WNW RZS-40SW
ENI-20SSW FOT-60S OED
LLWS EXP. CONDS DVLPG 21-00Z. CONDS CONTG BYD 03Z THRU 09Z.

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ZULU 2019-02-22 00:00:00

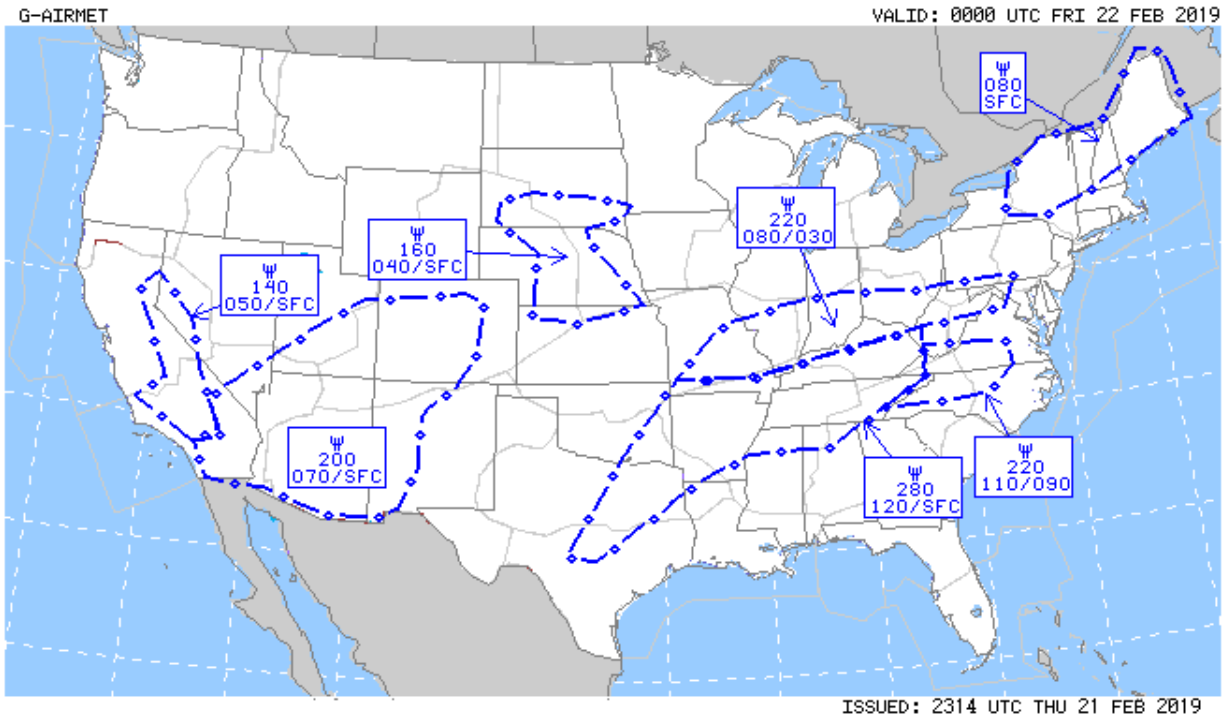


Figure 16 - G-AIRMET Zulu for icing conditions valid for 1600 PST

WAUS46 KKCI 212045

WA6Z

-SFOZ WA 212045

AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 220300

AIRMET ICE...CA WY NV UT CO AZ NM AND CSTL WTRS

FROM 50ESE OCS TO AKO TO 30SSE PUB TO 30NNE CIM TO 20ESE FTI TO 70WNW CME TO ELP
TO 50S TUS TO BZA TO 50SSW MZB TO LAX TO HEC TO 50S BTY TO 40S DTA TO 20E DTA TO
40N MTU TO 50ESE OCS

MOD ICE BTN FRZLVL AND FL180. FRZLVL SFC-070. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET ICE...CA NV AND CSTL WTRS

FROM 70N FMG TO 70ESE FMG TO 50S BTY TO HEC TO LAX TO 80SSE SNS TO 40SE CZQ TO
50ESE RBL TO 70N FMG

MOD ICE BTN FRZLVL AND 140. FRZLVL SFC-050. CONDS ENDG 00-03Z.

OTLK VALID 0300-0900Z...ICE WA AND CSTL WTRS

BOUNDED BY 50W HUH-20SE TOU-130WSW HQM-150W TOU-50W HUH

MOD ICE BTN 060 AND 160. CONDS DVLPG 06-09Z. CONDS CONTG THRU 09Z.

FRZLVL...RANGING FROM SFC-045 ACRS AREA

SFC ALG 50W HUH-40SSW HUH-20SSW SEA-20SSW OED-60NNW RBL-40NE EHF-40SSE BTY

040 ALG 200SSW RZS-150SW MZB-110SW MZB

040 ALG 40ESE MZB-30S EED

040 BOUNDED BY ENI-20WNW SAC-20NNW PYE-ENI

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WAUS46 KKCI 212314 AAA
WA6Z
-SFOZ WA 212314 AMD
AIRMET ZULU UPDT 4 FOR ICE AND FRZLVL VALID UNTIL 220300

.
AIRMET ICE...CA NV AND CSTL WTRS
FROM 70N FMG TO 70ESE FMG TO 50S BTY TO HEC TO LAX TO 80SSE SNS
TO 40SE CZQ TO 50ESE RBL TO 70N FMG
MOD ICE BTN FRZLVL AND 140. FRZLVL SFC-050. CONDS ENDG 00-03Z.

.
AIRMET ICE...CA WY NV UT CO AZ NM AND CSTL WTRS...UPDT
FROM 40NNW CHE TO AKO TO ELP TO 50S TUS TO BZA TO 50SSW MZB TO
20SSW LAX TO HEC TO 60S BTY TO 50SW OCS TO 40NNW CHE
MOD ICE BTN FRZLVL AND FL200. FRZLVL SFC-070. CONDS CONTG BYD 03Z
THRU 09Z.

.
OTLK VALID 0300-0900Z...ICE WA AND CSTL WTRS
BOUNDED BY 50W HUH-20SE TOU-130WSW HQM-150W TOU-50W HUH
MOD ICE BTN 060 AND 160. CONDS DVLPG 06-09Z. CONDS CONTG THRU
09Z.

.
FRZLVL...RANGING FROM SFC-045 ACRS AREA
SFC ALG 50W HUH-40SSW HUH-20SSW SEA-20SSW OED-60NNW RBL-40NE
EHF-40SSE BTY
040 ALG 200SSW RZS-150SW MZB-110SW MZB
040 ALG 40ESE MZB-30S EED
040 BOUNDED BY ENI-20WNW SAC-20NNW PYE-ENI

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8.0 Weather Briefing Information

A search of the FAA Automated Flight Service Station (AFSS) provider Leidos indicated that they had no requests from the pilot for a weather briefing, or to file a flight plan, and no other contact with him on February 21, 2019. A similar search with ForeFlight also came up with no contact for any weather briefing information. It is therefore unknown what the pilot reviewed to familiarize himself with regards to the reported and forecast weather conditions prior to flight.

9.0 Astronomical Conditions

The United States Naval Observatory's website¹¹ provided the following astronomical conditions for Tehachapi, Kern County, California, the closest reporting site for the area. The time of the accident has been added in italic bold type for reference.

<u>Sun</u>	
Begin of civil twilight	0608 PST
Sunrise	0633 PST

¹¹ https://aa.usno.navy.mil/data/docs/RS_OneDay.php

Sun transit	1207 PST
<i>Accident</i>	<i>1645 PST</i>
Sunset	1742 PST
End of civil twilight	1808 PST

At the time of the accident the Sun was 10° above the horizon at an azimuth of 249°.

Submitted by:

Don Eick
Senior Meteorologist

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