

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR24FA073

METEOROLOGY

Specialist's Factual Report

April 19, 2024

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A. ACCIDENT

Location: Half Moon Bay, California
Date: January 14, 2024
Time: 1905 Pacific standard time
0305 coordinated universal time (UTC) on January 15
Airplane: Cozy Mark IV; Registration: N656TE

B. METEOROLOGY SPECIALIST

Paul Suffern
Senior Meteorologist
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

The NTSB's Senior Meteorologist did not travel for this investigation but gathered all data remotely. Data for this investigation were collected from official National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). This Specialist's Factual Report contains the meteorological factors pertinent to the weather surrounding the accident time. All times are Pacific standard time (PST) and are based upon the 24-hour clock, where local time is -8 hours from UTC. Directions are referenced to true north and distances are in nautical miles. Heights are above mean sea level (msl) unless otherwise noted. Visibility is in statute miles and fractions of statute miles. NWS 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.

The accident site was located at approximate latitude 37.501833° N, longitude 122.5105° W, and elevation of sea-level.

D. FACTUAL INFORMATION

1.0 Synoptic Situation

The synoptic or large-scale migratory weather systems influencing the area were documented using standard NWS charts issued by the National Center for Environmental Prediction and the WPC, located in College Park, Maryland. These are the base products used in describing synoptic weather features and in the creation of forecasts and warnings for the NWS. Reference to these charts can be found in the Federal Aviation Administration (FAA) "Aviation Weather Handbook", FAA-H-8083-28.¹

1.1 Surface Analysis Chart

The NWS Surface Analysis Chart centered over the western United States for 1900 PST is provided as figure 1 with the location of the accident site within the black circle. The chart depicted a low-pressure system at 1013-hectopascals (hPa) located along the central California and Nevada border. A trough² was oriented north to south from the 1013-hPa low-pressure system with the trough stretching into northwestern Nevada as well as into southern California. A high-pressure system at 1023-hPa was located in the eastern Pacific Ocean, southwest of the accident site. There were no surface frontal boundaries near the accident site at 1900 PST.

The station model closest to the accident site depicted an air temperature of 55 degrees Fahrenheit (°F), dew point temperature of 48°F, missing cloud cover, and light and variable winds.

¹ [FAA-H-8083-28](#)

² Trough - An elongated area of relatively low atmospheric pressure or heights.

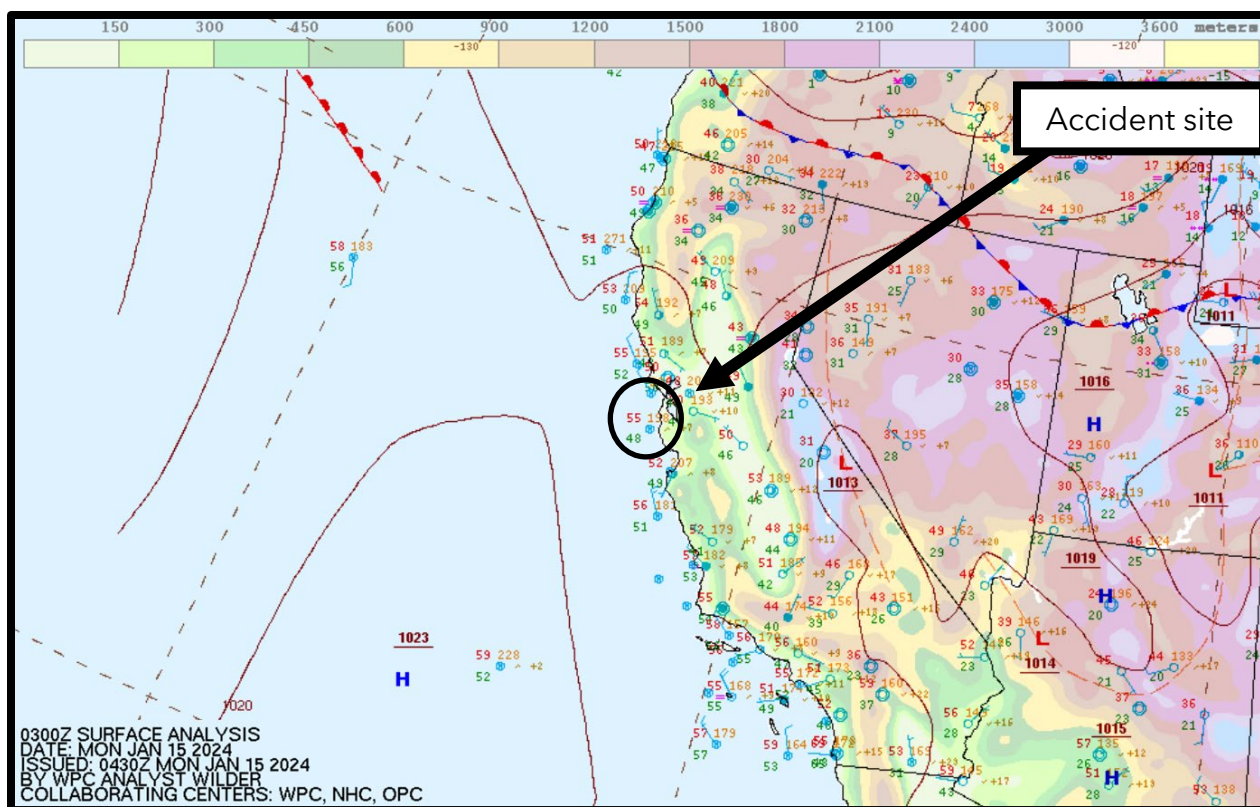


Figure 1. NWS Surface Analysis Chart for 1900 PST.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 1600 PST at 925-, 850-, and 700-hPa are presented in figures 2 through 4. The charts indicated a mid-level trough at 850- and 700-hPa (figures 3 and 4) in central California, just southeast of the accident site. Troughs and fronts can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. The 925-hPa constant pressure chart depicted a northeast wind around 5 knots (figure 2) becoming a north 10-knot wind by 850-hPa (figure 3). By 700-hPa, the wind became northwesterly at 30 knots (figure 4).

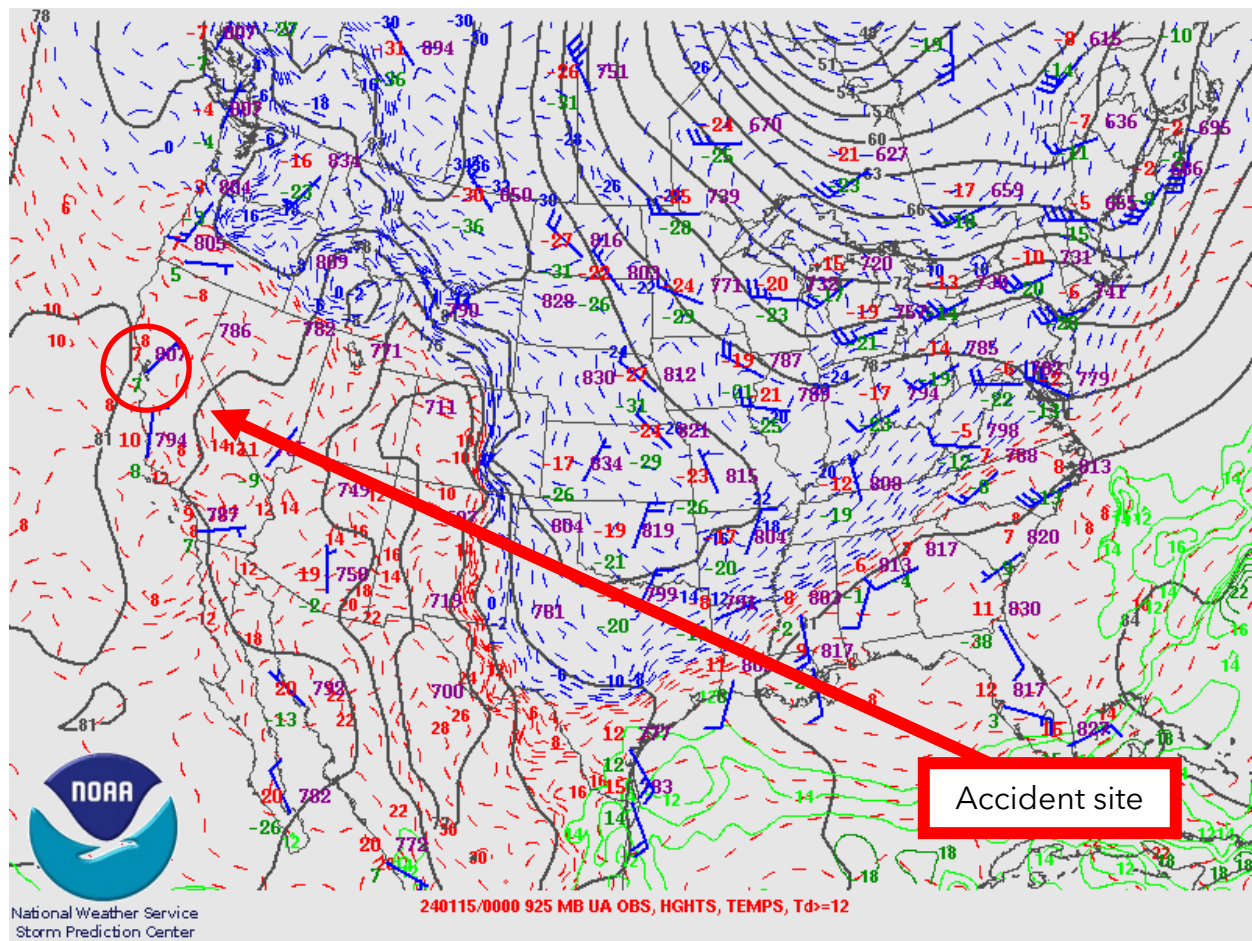


Figure 2. 925-hPa Constant Pressure Chart for 1600 PST.

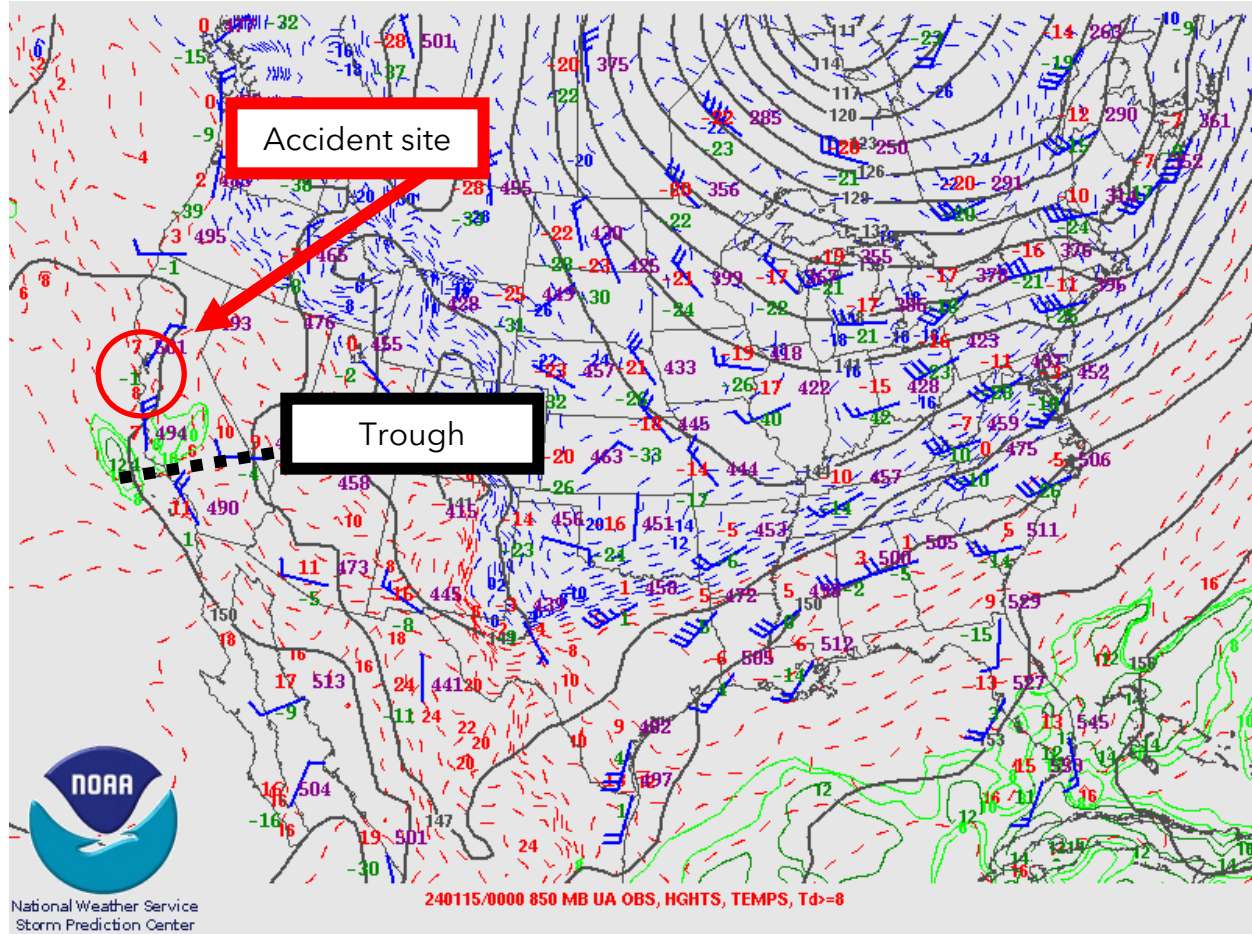


Figure 3. 850-hPa Constant Pressure Chart for 1600 PST.

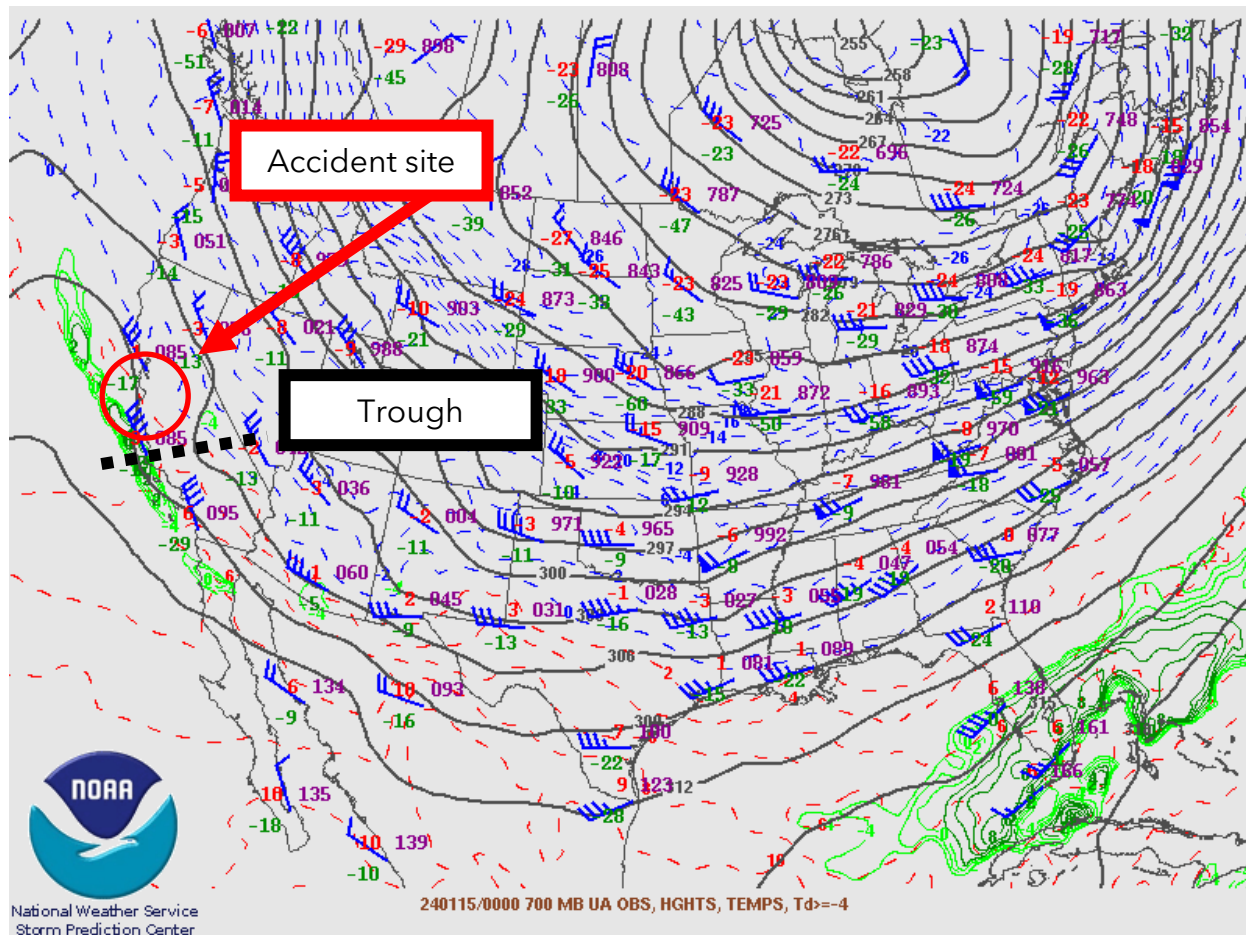


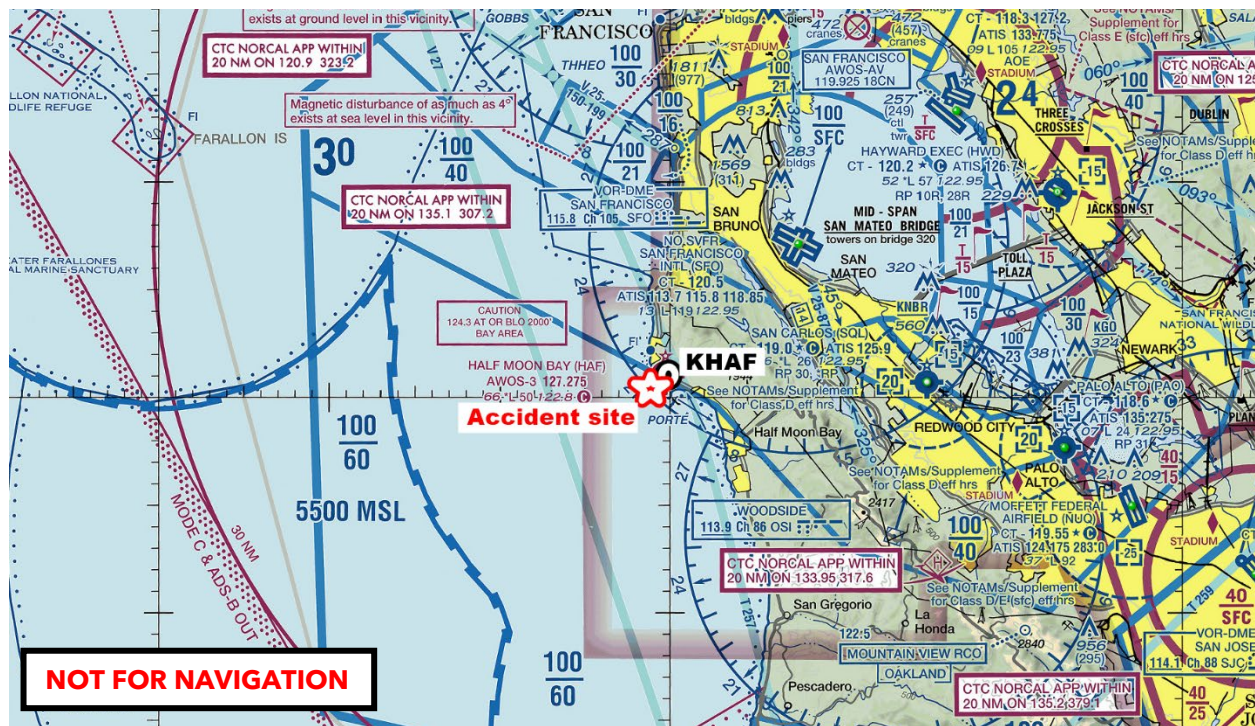
Figure 4. 700-hPa Constant Pressure Chart for 1600 PST.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Special Reports (SPECIs)³. The following observations were taken from standard code and are provided in plain language. Figure 5 is a local sectional chart with the accident site and the closest weather reporting location marked. A magnetic variation⁴ of 13.5° east was identified near the area.

³ Latest criteria for SPECIs can be found in the Federal Meteorological Handbook: [Federal Meteorological Handbook Number 1, Surface Weather Observations and Reports \(icams-portal.gov\)](https://www.federalregister.gov/documents/2018/01/16/2018-01-16-federal-meteorological-handbook-number-1-surface-weather-observations-and-reports)

⁴ Magnetic variation - The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>



Half Moon Bay Airport (KHAF) had the closest official weather station to the accident site and was the departure airport. KHAF had an Automated Weather Observing System (AWOS⁵) and its longline⁶ reports were not augmented. The KHAF AWOS was located 5,000 feet (ft) northeast of the accident site (figure 5) at an elevation of 66 ft, and issued the following observations surrounding the accident time:⁷

[1735 PST] METAR KHAF 150135Z AUTO 34007KT 2 1/2SM BR CLR
11/10 A3010 RMK AO2

⁵ AWOS – Automated Weather Observing System is equipped with meteorological instruments to typically observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to 12,000 feet, and altimeter setting. AWOS are maintained by the FAA. Certain AWOS may have different reporting or observational equipment.

⁶ “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases and accessible to the general global public from a large number of vendors. This does not include public accessibility to observations from a reporting station’s Very High Frequency (VHF; line-of-site) or telephone broadcast, where applicable. Longline dissemination of weather observations is the primary vehicle through which the weather observations are distributed.

⁷ The bold sections of products in this report are intended to highlight the text that directly reference the weather conditions that affected the accident region around the accident time. The local times in this section next to the METARs are provided for quick reference between UTC and local times.

[1755 PST] METAR KHAF 150155Z AUTO 35005KT 4SM BR FEW003
11/10 A3011 RMK AO2

[1815 PST] METAR KHAF 150215Z AUTO 35005KT 6SM BR CLR 11/10
A3011 RMK AO2

[1835 PST] METAR KHAF 150235Z AUTO 36003KT 4SM BR FEW003
11/10 A3012 RMK AO2

**[1855 PST] METAR KHAF 150255Z AUTO 01005KT 6SM BR BKN003
10/09 A3012 RMK AO2**

ACCIDENT TIME 1905 PST

**[1915 PST] METAR KHAF 150315Z AUTO 02005KT 5SM BR BKN003
09/09 A3011 RMK AO2**

[1935 PST] METAR KHAF 150335Z AUTO 01005KT 6SM BR SCT003
09/09 A3011 RMK AO2

The bold type observations decoded in plain language were as follows:

KHAF weather at 1855 PST, automated, wind from 010° at 5 knots, visibility 6 miles, mist, broken ceiling at 300 ft above ground level (agl), temperature of 10° Celsius (C), dew point temperature of 9°C, and an altimeter setting of 30.12 inches of mercury (inHg). Remarks, automated station with a precipitation discriminator.

KHAF weather at 1915 PST, automated, wind from 020° at 5 knots, visibility 5 miles, mist, broken ceiling at 300 ft agl, temperature of 9°C, dew point temperature of 9°C, and an altimeter setting of 30.11 inHg. Remarks, automated station with a precipitation discriminator.

The observations from the KHAF reported LIFR⁸ conditions at the time of the accident due to cloud ceilings with a north wind around 5 knots.

⁸ 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.

3.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)⁹ model sounding was created¹⁰ for the approximate accident site coordinates for 1900 PST. The HRRR sounding was plotted on a standard Skew-T Log P diagram¹¹ from the surface to 600-hPa (or approximately 14,000 ft) using the RAOB¹² software package and is included as figure 6. The sounding depicted an elevation of 23 ft over the grid point with a near surface temperature of 12.1°C, a dew point temperature of 9.8°C, and a relative humidity of 86%. The sounding depicted the lifted condensation level (LCL)¹³ at 980 ft and the convective condensation level (CCL)¹⁴ at 10,849 ft. The freezing level was at 11,402 ft. The precipitable water value was 0.57 inches.

**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.

⁹ The HRRR is a 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.

¹⁰ HRRR sounding was created using NOAA Air Resource Laboratory: [READY Archived Meteorology \(noaa.gov\)](https://ready.noaa.gov/).

¹¹ Skew T log P diagram - is a standard meteorological plot using temperature and the logarithmic of pressure as coordinates, used to display winds, temperature, dew point, and various indices used to define the vertical structure of the atmosphere.

¹² RAOB - (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Esonde Research Services, The Villages, Florida.

¹³ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁴ 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.

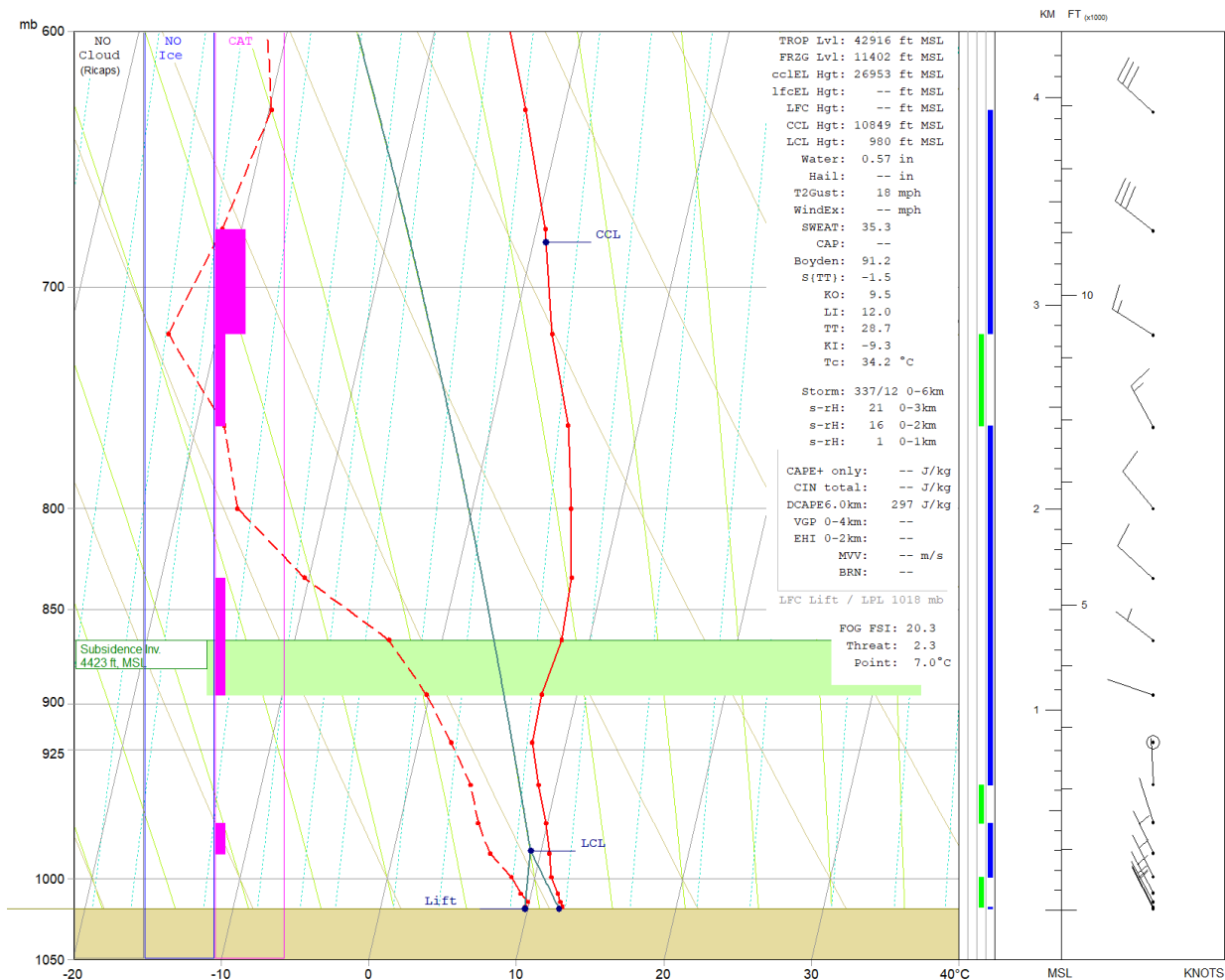


Figure 6. 1900 PST HRRR sounding.

The 1900 PST HRRR sounding indicated a conditionally unstable to stable environment from the surface through 2,000 ft, then a stable layer between 2,000 and 8,000 ft. RAOB did not indicate any cloud layers. No icing was indicated by RAOB below 10,000 ft. The top of a subsidence inversion¹⁵ was indicated at 4,423 ft.

¹⁵ Inversion - A departure from the usual decrease of the value of an atmospheric property with increasing altitude; also, the layer through which this departure occurs (the "inversion layer"), or the lowest altitude at which the departure is found (the "base of the inversion").

The 1900 PST HRRR sounding wind profile indicated a near-surface wind from 335° at 5 knots with the wind remaining northwesterly through 5,000 ft. The wind speed remained at or below 5 knots through 5,000 ft. RAOB indicated light clear air turbulence (CAT) in several layers above 1,000 ft.

4.0 Satellite Data

Geostationary Operational Environmental Satellite number 18 (GOES-18) visible and infrared data were 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 software. Visible and infrared imagery (GOES-18 bands 2 and 13) at wavelengths of 0.64 microns (μm) and 10.3 μm , respectively, were retrieved for the period from 1600 PST through 2300 PST and reviewed, and the closest images to the time of the accident were documented. Due to the sun angle the visible imagery was not useful data around the accident time.

Figure 7 presents the GOES-18 infrared image at 1906 PST at 6X magnification with the accident site highlighted with a red square. Cloud cover was indicated above the accident site with lower brightness temperatures (green and yellow colors; higher cloud tops) located northwest through east of the accident site at the accident time. The brightness temperature of 279 Kelvin¹⁶ above the accident site would have been near 8,000 ft based on the vertical temperature profile provided by the 1900 PST HRRR sounding (not shown in figure 6). It should be noted these figures have not been corrected for any parallax error. The Nighttime Microphysics Red, Green, Blue (RGB) imagery¹⁷ indicated the cloud cover above the accident site was a combination of low-level water clouds and high ice clouds with the cloud cover moving from northwest to southeast (attachment 1).

¹⁶ Around 6°C.

¹⁷

https://weather.msfc.nasa.gov/sport/training/quickGuides/rgb/QuickGuide_NtMicro_GOESR_NASA_SPoRT_20191206.pdf

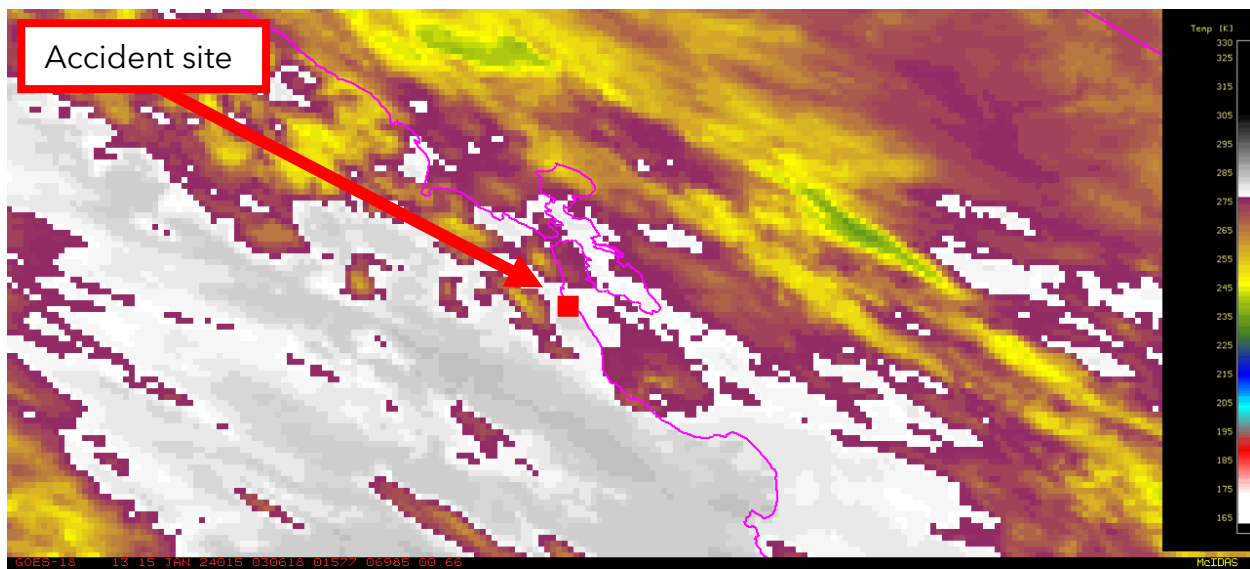


Figure 7. GOES-18 infrared image at 1906 PST.

5.0 National Radar Imagery

A regional view of the NWS National Reflectivity Mosaic is included as figure 8 for 1905 PST with the approximate location of the accident site marked by a red circle. The image depicted no echoes above the accident site.

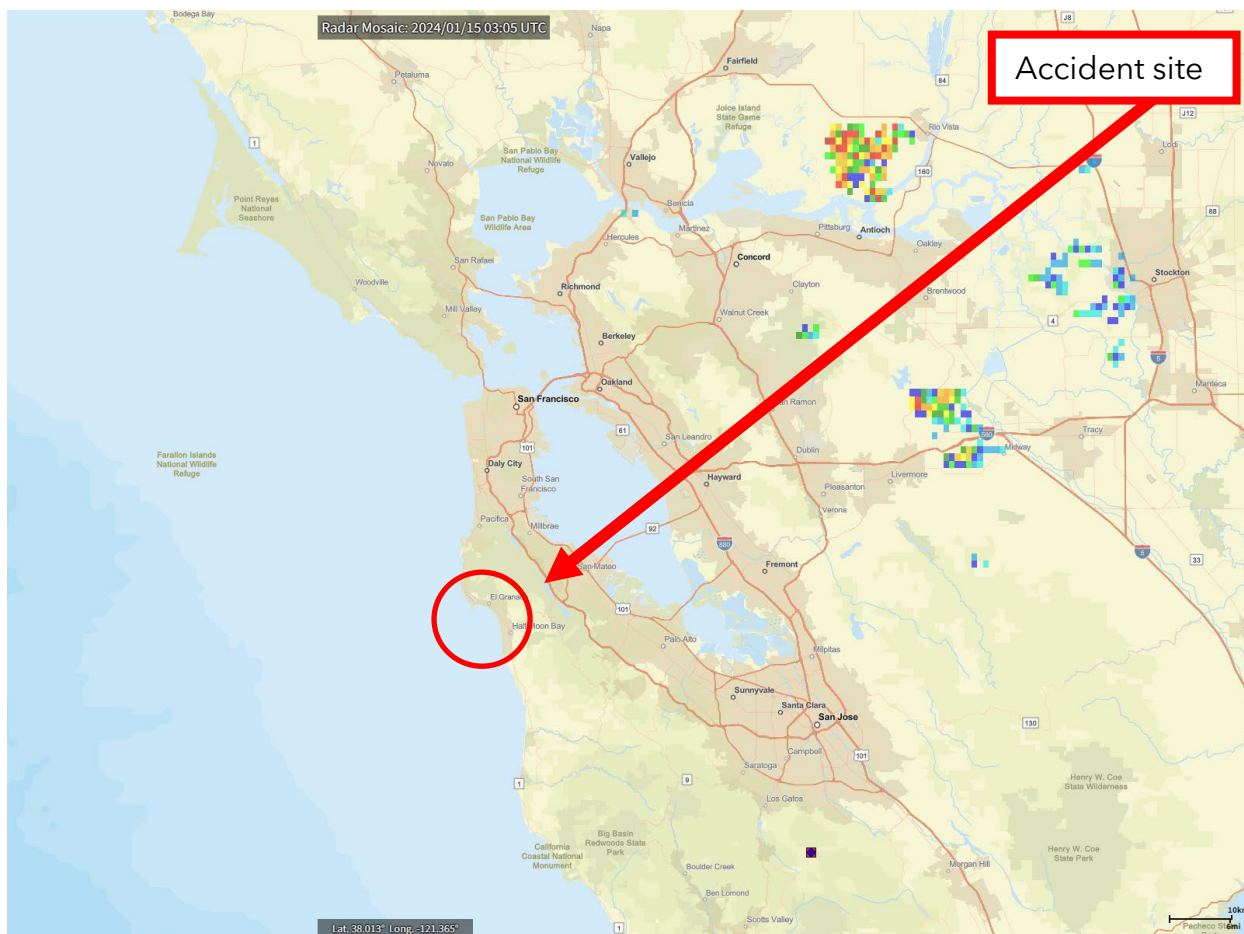


Figure 8. National Reflectivity Mosaic for 1905 PST.

6.0 Pilot Reports

There were no longline-disseminated pilot reports¹⁸ (PIREPs) distributed into the national airspace system (NAS) within 2 hours of the accident time and within 50 miles of the accident site for altitudes below 18,000.

7.0 Significant Meteorological Information

There were no convective or non-convective Significant Meteorological Information (SIGMET) advisories valid for the accident site at the accident time.

¹⁸ Only PIREPs with the World Meteorological Organization headers UBCA** were considered. These do not include pilot reports only broadcast via radio.

8.0 Center Weather Service Advisories

The Oakland (ZOA) Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU) was responsible for the accident region. There was no Center Weather Advisory (CWA) valid for the accident site at the accident time.

9.0 Graphical Forecasts for Aviation

The Graphical Forecasts for Aviation (GFA) products issued by the AWC before the accident flight that were valid at 1900 PST and issued around 0500 PST are shown in figures 9 and 10 (additional GFA forecast products produced after 0500 PST are not available due to AWC archiving constraints). The GFA surface forecasts applicable at 1900 PST for the accident site indicated VFR conditions and a northwest wind of 5 knots. The GFA cloud forecast applicable to the accident site for 1900 PST indicated few to scattered cloud cover at the accident site with cloud bases around 3,000 ft and cirrus clouds above. No Graphical AIRMETs¹⁹ (G-AIRMET)s were overlaid on the GFA products due to the forecast graphic being beyond the G-AIRMET forecast timeframe (figures 9 and 10). G-AIRMET²⁰ Sierra valid for 1900 PST and issued at 1845 PST is located in figure 11 with the accident site southwest of the G-AIRMET forecast areas. G-AIRMET Sierra valid for 2200 PST and issued at 1845 PST covered the same areal regions northeast of the accident site (not shown).

¹⁹ Graphical AIRMETs (G-AIRMETs), found on the Aviation Weather Center webpage at <http://aviationweather.gov>, are graphical forecasts of en-route weather hazards valid at discrete times no more than 3 hours apart for a period of up to 12 hours into the future (for example, 00, 03, 06, 09, and 12 hours). G-AIRMETs are snap shots at discrete time intervals as defined above. The text AIRMET is the result of the production of the G-AIRMET but provided in a time smear for a 6hr valid period.

²⁰ The only human-generated information reflected in the GFA products are the G-AIRMETs when available.

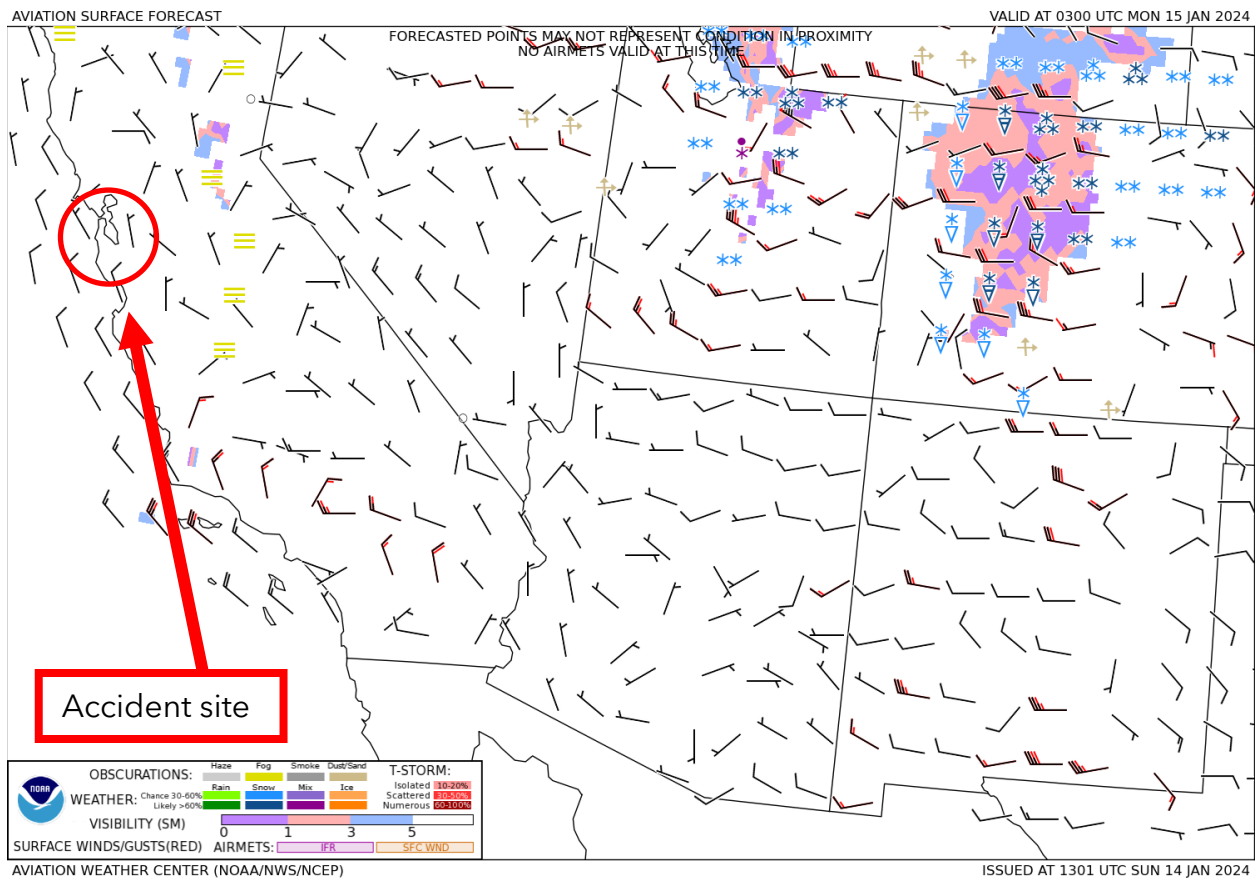


Figure 9. GFA Surface Forecast valid at 1900 PST with forecast issued at 0501 PST.

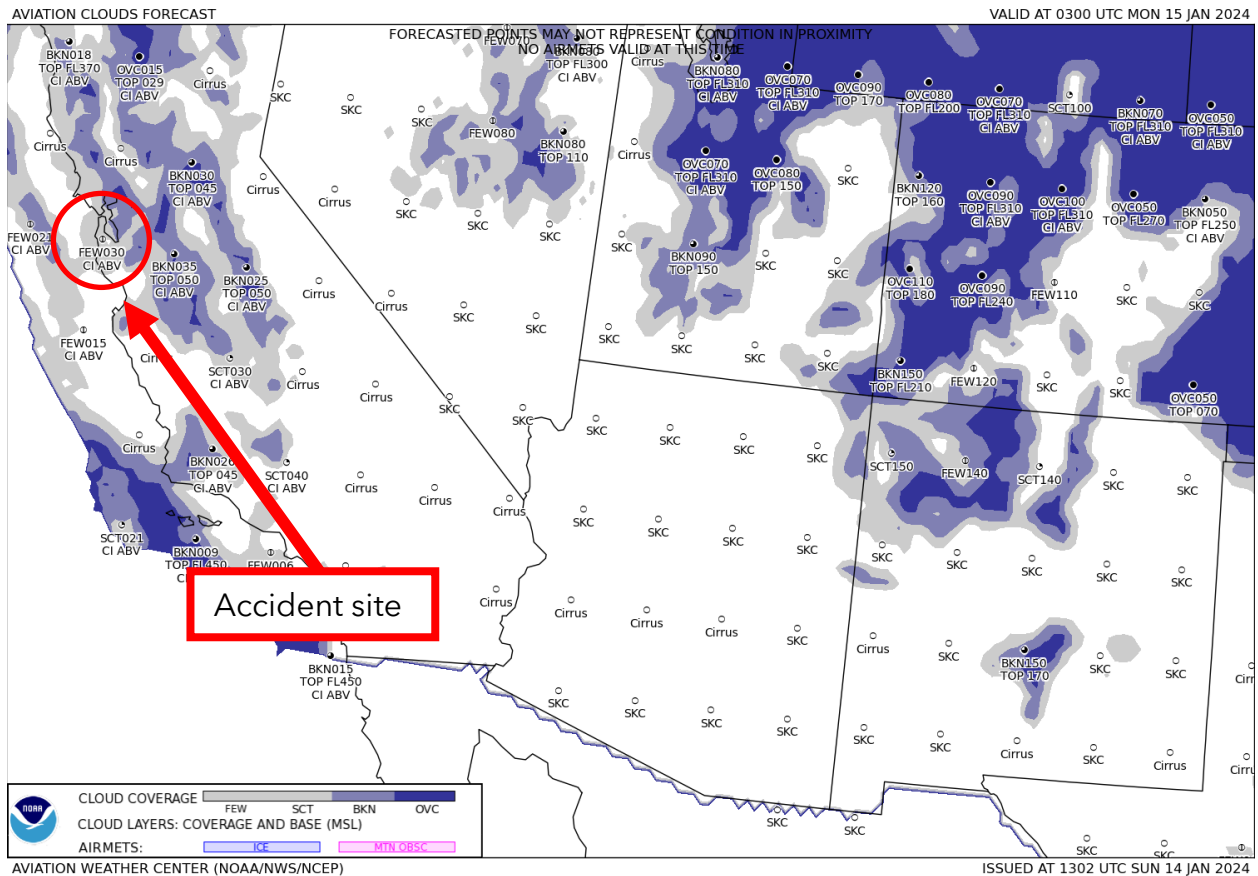


Figure 10. GFA Aviation Clouds Forecast valid at 1900 PST with forecast issued at 0502 PST.

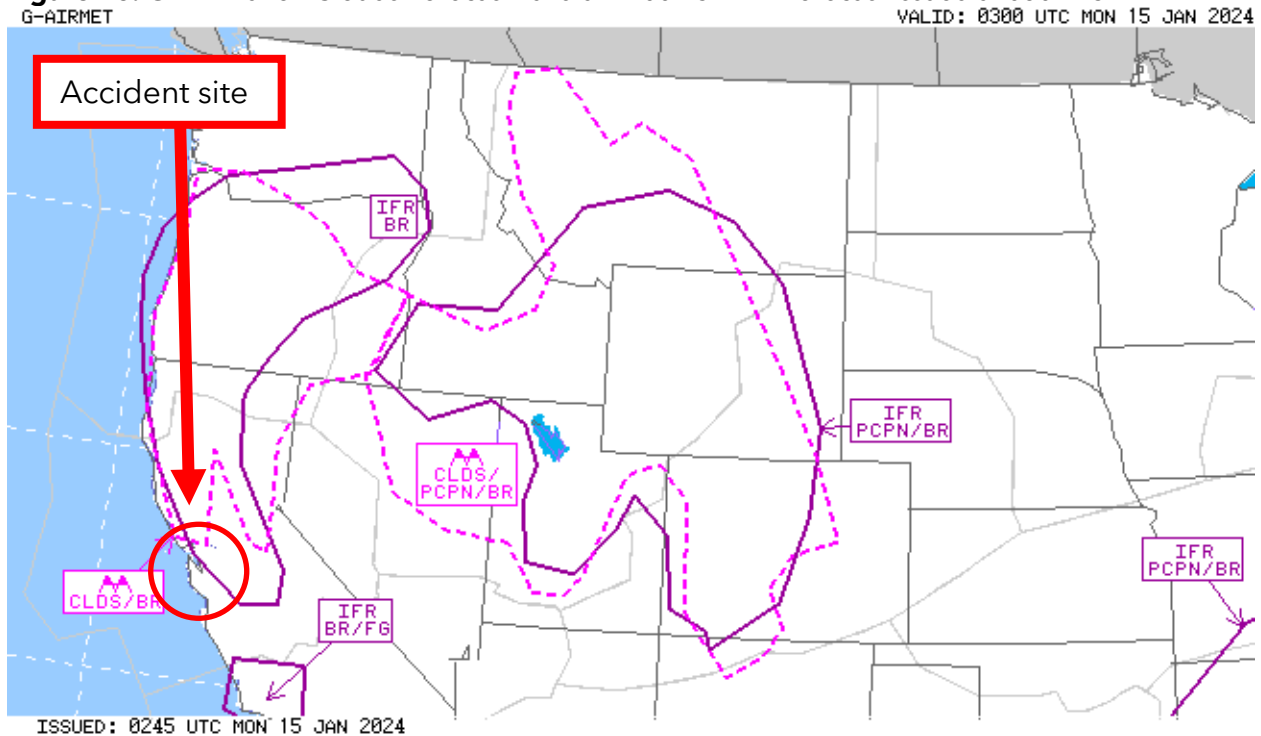


Figure 11. G-AIRMET Sierra valid at 1900 PST with forecast issued at 1845 PST.

10.0 Text Airmen's Meteorological Information

The NWS Aviation Weather Center (AWC) had text Airmen's Meteorological Information (AIRMET) advisory Sierra valid for the accident site at the accident time. The text Sierra was issued at 1845 PST and forecast mountain obscuration conditions due to clouds and mist:

WAUS46 KPCI 150245
WA6S
-SFOS WA 150245
AIRMET SIERRA FOR IFR AND MTN OBSCN VALID UNTIL 150900
.
AIRMET IFR...CA AND CSTL WTRS
FROM 60SSE SNS TO 20NE EHF TO 30SSW LAX TO 80W RZS TO 60SSE SNS
CIG BLW 010/VIS BLW 3SM BR/FG. CONDS ENDG 06-09Z.
.
AIRMET IFR...WA OR CA AND CSTL WTRS
FROM 40SSW GEG TO 80SSE GEG TO 40NNW DNJ TO 30ESE BKE TO 50ESE
CZQ TO 20N EHF TO 30SE SNS TO 20SSE PYE TO 40NW ENI TO 20NNW FOT
TO 90SW ONP TO 50W ONP TO 40N BTG TO 40SSW GEG
CIG BLW 010/VIS BLW 3SM BR. CONDS CONTG BYD 09Z THRU 15Z.
.
AIRMET MTN OBSCN...WA OR CA
FROM 40SSE HQM TO 30NNE BTG TO 50SSW YKM TO 40WSW PDT TO 30W BKE
TO 40S BKE TO 30NW BOI TO 20ENE REO TO 50SW CZQ TO 30SW SNS TO
20W PYE TO 20S FOT TO 80WNW OED TO 40SSE HQM
MTNS OBSC BY CLDS/BR. CONDS CONTG BYD 09Z THRU 15Z.
.
OTLK VALID 0900-1500Z...IFR OR ID MT WY NV UT CO NM
BOUNDED BY 30SSE DLN-90SSW BIL-70SW RAP-BFF-GLD-50W LBL-30ESE
TBE-30NNE ALS-50SW ALS-30SE DVC-40W JNC-40N HVE-50WSW HVE-50SSW
REO-50WNW REO-30SW DNJ-30ENE BOI-80S LKT-30SSE DLN
CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS CONTG THRU 15Z.
....

11.0 Terminal Aerodrome Forecast

San Francisco International Airport (KSFO) was the closest site with an NWS Terminal Aerodrome Forecast²¹ (TAF) current at the time of the accident and was located 10 miles northeast of the accident site. The amended KSFO TAF valid at the accident time was issued at 1900 PST and was valid for a 27-hour period beginning at 1900 PST. The 1900 PST TAF for KSFO was as follows:

²¹ According to NWS Instruction 10-813: "An NWS TAF consists of the expected meteorological conditions significant to aviation at an airport for a specified time period. For the U.S., this is the area within five (5) statute miles (SM) of the center of an airport's runway complex."
www.nws.noaa.gov/directives/sym/pd01008013curr.pdf

FTUS46 KMTR 150300 AAA
TAFSFO
TAF AMD
KSFO 150300Z 1503/1606 **28009KT P6SM BKN250**
FM150600 VRB05KT P6SM BKN250=

Between 1900 and 2200 PST the KSFO forecast expected a wind from 280° at 9 knots, greater than 6 miles visibility, and a broken ceiling at 25,000 ft agl. The same forecast conditions were issued in the 1520 KSFO TAF as well.

12.0 National Weather Service Area Forecast Discussion

The NWS weather forecast office in Monterey, California, (WFO MTR) was responsible for the public forecast in the region of the accident site. WFO MTR issued the following Area Forecast Discussion (AFD) at 1608 PST, the AFD issued closest to the accident time with an aviation section:

FXUS66 KMTR 150008
AFDMTR

Area Forecast Discussion
National Weather Service San Francisco CA
408 PM PST Sun Jan 14 2024

...New AVIATION...

.SYNOPSIS...
Issued at 246 PM PST Sun Jan 14 2024

Quiet weather to finish the weekend and begin the work week as high pressure builds overhead. A weak weather system brings some light rain towards mid week with rain chances returning for the weekend. Temperatures will remain seasonally mild.

&&

.SHORT TERM...
(This evening through Monday)
Issued at 159 PM PST Sun Jan 14 2024

Rain/showers have ended, afternoon sun is making an appearance, and radar has been switched back to "clear air" mode. The system that brought precip to the region the last 36-48 hours has weakened and exited to the S. In its wake, drier northwest flow has developed. In fact, satellite imagery show much less cloud cover today compared to yesterday. The increase insolation has led to a marked warm up today with 24 hour trends showing 3 to 10 degrees warmer this afternoon. Temperatures this afternoon will top out in the upper 50s to mid 60s most areas.

After an active weather period the rest of the short term will be rather quiet weather wise with dry and seasonal conditions as high pressure moves overhead. Only real weather impact will be lingering boundary layer moisture tonight leading to patchy fog with some of it being dense.

&&

.LONG TERM...

(Monday night through next Saturday)

Issued at 235 PM PST Sun Jan 14 2024

The quiet weather will come to end as upper level ridging gets flattened by a developing upper level low pressure late Monday night into Tuesday. This low pressure will move through the PacNW, but the attached front will sweep through CA. Precip initially returns to the N Bay early Tuesday before spreading S and E through the rest of the forecast. Pretty standard froppa with another round of beneficial rain. Rain will be highest over the North Bay with little to no rain interior Central Coast. A brief break Wednesday into Thursday. Longer rain forecast gets more interesting as a deep low develops over the EPac Friday into next weekend. This feature will access the sub-tropical tap and usher in a plume of moisture to the W Coast (PWATs greater than 1.25"). Precip arrives on Friday and lingers through the following weekend. It's still several days out and total rain amounts will change, but confidence is increasing for a wetter pattern. Experimental Hazard Outlook from WPC highlights a good portion of CA for heavy precip Jan 20-22. This also fits the cluster QPF analysis, which also favors a wetter solution. Stay tuned as the forecast gets fine tuned this week.

&&

.AVIATION...

(00Z TAFS)

Issued at 408 PM PST Sun Jan 14 2024

Predominantly VFR conditions expected throughout the TAF period, though scattered clouds may develop over terminals. MVFR CIGs likely to develop for North Bay terminals into the early morning of Monday. Models hint at fog development for North Bay terminals in the early morning, reducing visibilities to IFR conditions. However, confidence on this is low as cloud cover may prohibit fog development. Highest confidence is in MVFR cig formation for the North Bay. Otherwise, expect most terminals to remain VFR, with only slight visibility reductions in the night as mist and fog develop. Winds throughout the night tonight remain light and variable for most terminals, with a more onshore component developing into the afternoon of Monday.

Vicinity of SFO...FEW low clouds around the terminal will linger

through the TAF period. At this time, confidence is low in any CIGs developing. Highest confidence in conditions remaining VFR through the TAF period. Winds light and variable.

SFO Bridge Approach...Similar to SFO.

Monterey Bay Terminals...SCT to FEW low clouds may linger over the terminals through the night tonight. Confidence in maintaining VFR conditions is moderate, so this will be something to keep an eye on through the night. Winds otherwise generally light, becoming offshore into the late night. KSNS develops SE drainage winds.

&&

.MARINE...

(Tonight through next Friday)

Issued at 316 PM PST Sun Jan 14 2024

Winds are decreasing and seas abating as high pressure builds across the area in the post-frontal environment. Light to gentle NW winds and moderate sea heights will prevail Monday. By Tuesday a gale force low pressure system in the Pacific Northwest will extend a cold front into the Eastern Pacific, causing prefrontal southerly winds to strengthen to a fresh breeze in the NW waters. These winds will generate rough seas, causing hazardous conditions for small craft. The remainder of the week will be dominated by high pressure and relatively favorable conditions. By Saturday, an approaching system will cause conditions to deteriorate.

&&

.MTR WATCHES/WARNINGS/ADVISORIES...

CA...None.

PZ...None.

&&

\$\$

13.0 Winds and Temperature Aloft Forecast

The NWS 1757 PST, Winds and Temperature Aloft forecast, which was intended for use between 1800 PST on January 14 and 0100 PST on January 15, and was valid for the closest point to the accident site is included below:

FBUS31 KWNO 150157

FD1US1

DATA BASED ON 150000Z

VALID 150600Z FOR USE 0200-0900Z. TEMPS NEG ABV 24000

FT 3000 6000 9000 12000 18000 24000 30000 34000 39000

SFO 0110 3211+08 3121+04 3028-01 2925-14 2829-28 294343 294652 295463

14.0 Pilot Weather Information

Title 14 CFR 91.103 states that “Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight.” FAA AC 91-92 “Pilot’s Guide to a Preflight Planning” (dated March 15, 2021) provided pilot guidance on preflight self-briefings, including planning, weather interpretation, and risk identification/mitigation skills. The AC further stated in part:

Pilots adopting these guidelines will be better prepared to interpret and utilize real-time weather information before departure and en route, in the cockpit, via technology like Automatic Dependent Surveillance-Broadcast (ADS-B) and via third-party providers.²²

A search of archived information indicated that the accident pilot did not request weather information from Leidos Flight Service or through ForeFlight. The accident pilot did have an account through ForeFlight, but only updated route strings on the accident day (attachment 2). It is unknown what weather information, if any, the accident pilot checked or received before or during the accident flight.

15.0 Astronomical Data

The astronomical data obtained²³ for the accident site on January 14, 2024, indicated the following:

SUN

Begin civil twilight	0655 PST
Sunrise	0724 PST
Sun transit	1219 PST
Sunset	1715 PST
End civil twilight	1743 PST
Accident time	1905 PST²⁴

At the time of the accident the Sun was below the horizon.

²² https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_91-92.pdf. The AC also listed multiple online FAA resources for aviation flight planning services for adverse weather.

²³ <https://www.suncalc.org/> and <https://www.mooncalc.org/>

²⁴ Inserted accident time for reference and context.

MOON

Moonrise	0958 PST
Moon transit	1534 PST
Accident time	1905 PST²⁵
Moonset	2120 PST

At the time of the accident the Moon was 22.74° above the horizon at an azimuth of 236.93° and a waxing crescent with 18% of the Moon's illumination.

E. LIST OF ATTACHMENTS

Attachment 1 - GOES-18 Nighttime Microphysics RGB imagery animation from 1701 to 2001 CDT

Attachment 2 - ForeFlight Information

Submitted by:

Paul Suffern
Senior Meteorologist

²⁵ Inserted accident time for reference and context.