

National Transportation Safety Board

Office of Aviation Safety

Washington, DC 20594



WPR23FA185

METEOROLOGY

Specialist's Factual Report

August 31, 2023

TABLE OF CONTENTS

A. ACCIDENT	3
B. METEOROLOGY SPECIALIST	3
C. DETAILS OF THE INVESTIGATION	3
D. FACTUAL INFORMATION	4
1.0 SYNOPTIC SITUATION	4
1.1 Surface Analysis Chart.....	4
1.2 Upper Air Charts	5
2.0 SURFACE OBSERVATIONS	7
3.0 UPPER AIR SOUNDING	10
4.0 SATELLITE DATA.....	12
5.0 NATIONAL RADAR IMAGERY	13
6.0 PILOT WEATHER INFORMATION	14
7.0 ASTRONOMICAL DATA	15
E. LIST OF ATTACHMENTS	15

A. ACCIDENT

Location: San Clemente Island, California
Date: May 10, 2023
Time: 0749 Pacific daylight time
1449 coordinated universal time (UTC)
Airplane: Gates Lear Jet 36A; Registration: N56PA

B. METEOROLOGY SPECIALIST

Paul Suffern
National Transportation Safety Board
Washington, DC

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board'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 daylight time (PDT) and are based upon the 24-hour clock, where local time is -7 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 32.839382° N, longitude 118.51568° W, at 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 southwestern United States for 0800 PDT is provided as figure 1 with the location of the accident site within the black circle. The chart depicted the closest low-pressure system at 1004-hectopascals (hPa) located in northern Arizona. A trough² stretched from the mountainous region of eastern California southwestward into the Pacific Ocean west of the Los Angeles Basin. Troughs and fronts can act as lifting mechanisms to help produce clouds and precipitation if sufficient moisture is present. A ridge³ was located from the accident site northeastward into southern California marked on figure 1.

The station model closest to the accident site depicted an air temperature of 58 degrees Fahrenheit (°F), dew point temperature of 52°F, and a northwest wind at 15 knots. Overcast skies were noted on several station models surrounding the accident site.

¹ [FAA-H-8083-28](#)

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

³ Ridge - An elongated area of relatively high atmospheric pressure or heights.

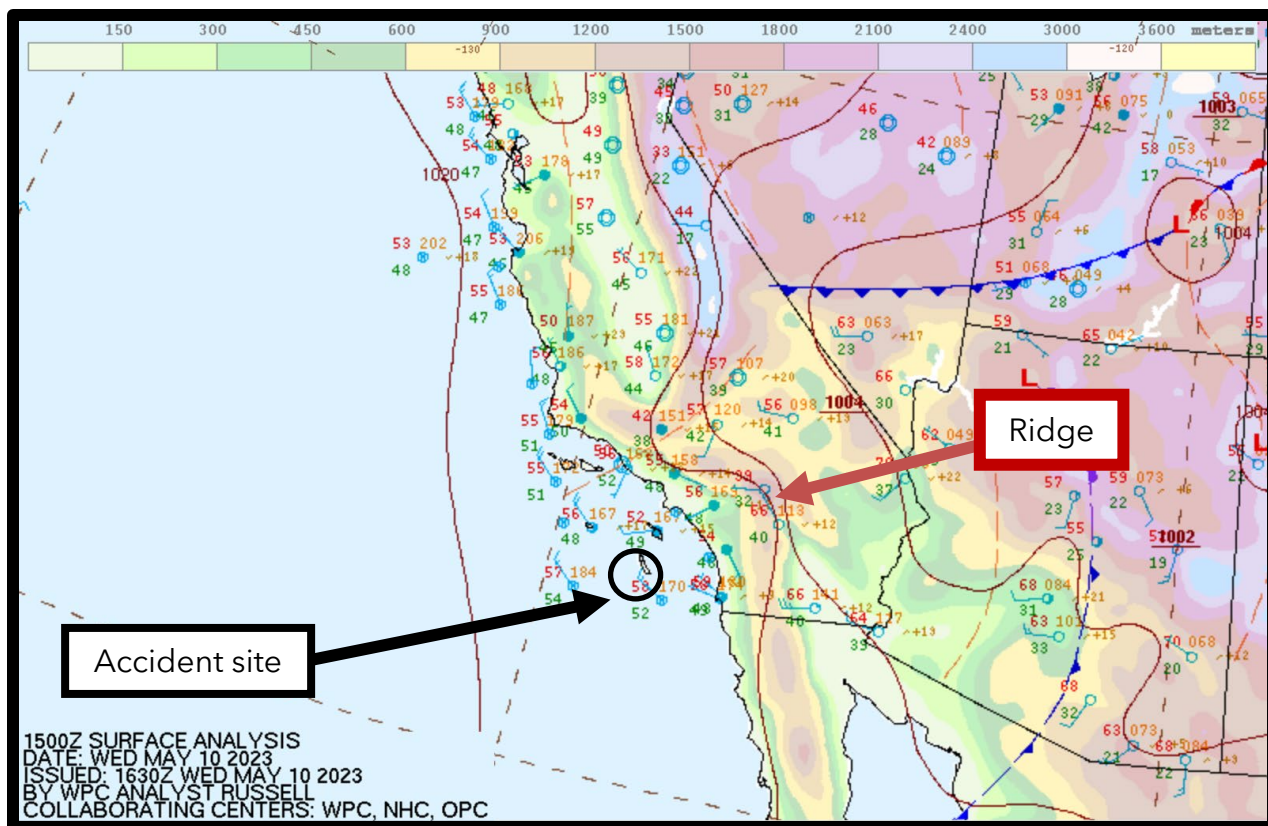


Figure 1. NWS Surface Analysis Chart for 0800 PDT.

1.2 Upper Air Charts

The NWS Storm Prediction Center (SPC) Constant Pressure Charts for 0500 PDT at 850- and 700-hPa are presented in figures 2 and 3. The charts depicted a trough to the east of the accident site over the southwestern United States. The 850-hPa constant pressure chart depicted a west wind around 15 knots above the accident site (figure 2) with the wind becoming northwesterly to 30 knots by 700-hPa (figure 3).

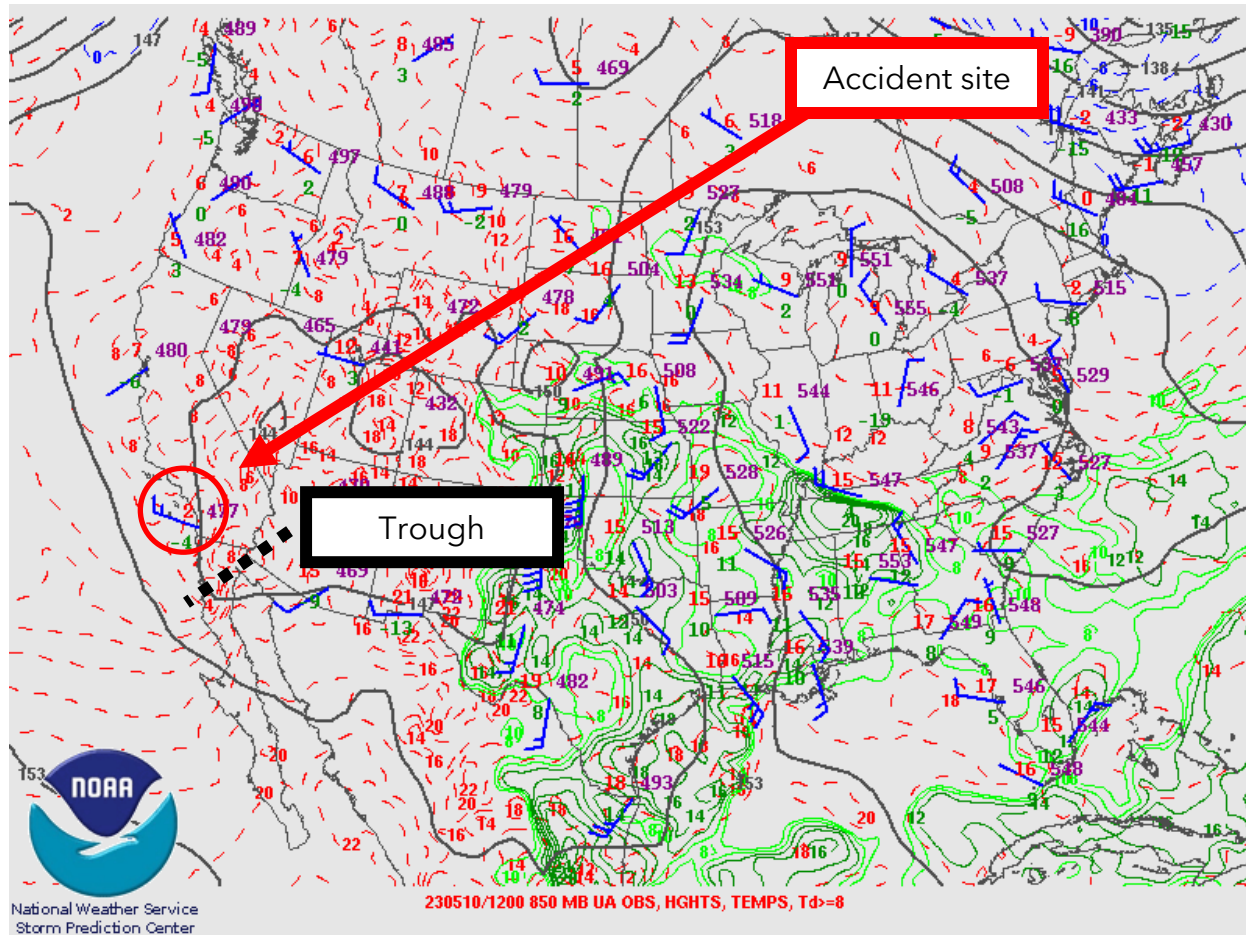


Figure 2. 850-hPa Constant Pressure Chart for 0500 PDT.

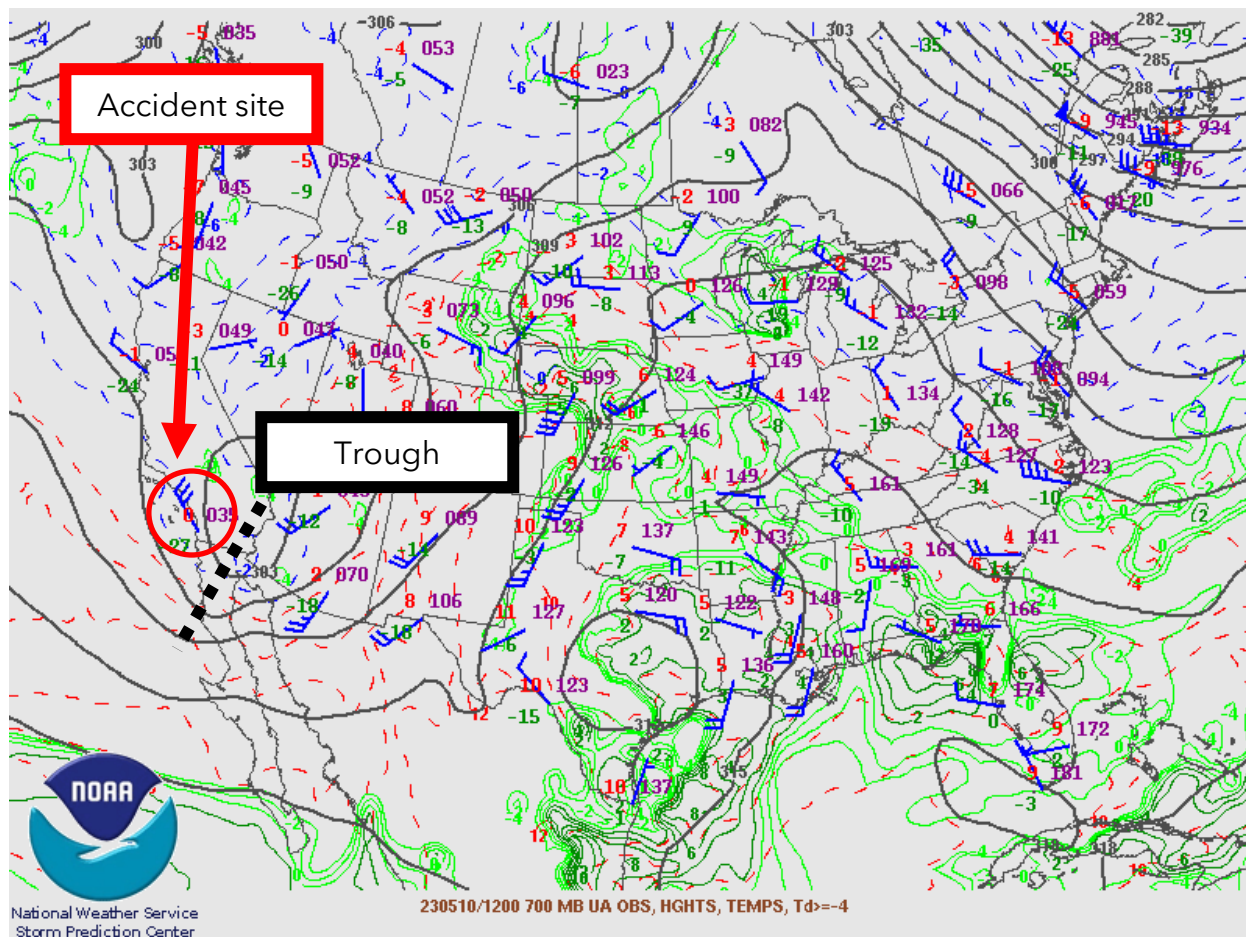


Figure 3. 700-hPa Constant Pressure Chart for 0500 PDT.

2.0 Surface Observations

The area surrounding the accident site was documented using official Aviation Routine Weather Reports (METARs) and Special Reports (SPECIs)⁴. The following observations were taken from standard code and are provided in plain language. Figure 4 is a local sectional chart with the accident site and the closest weather reporting location marked. A magnetic variation⁵ of 11.5° east was indicated over the area.

⁴ 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.federalmeteorologicalhandbook.com/)

⁵ Magnetic variation - The angle (at a particular location) between magnetic north and true north. Latest measurement taken from <https://skyvector.com/>

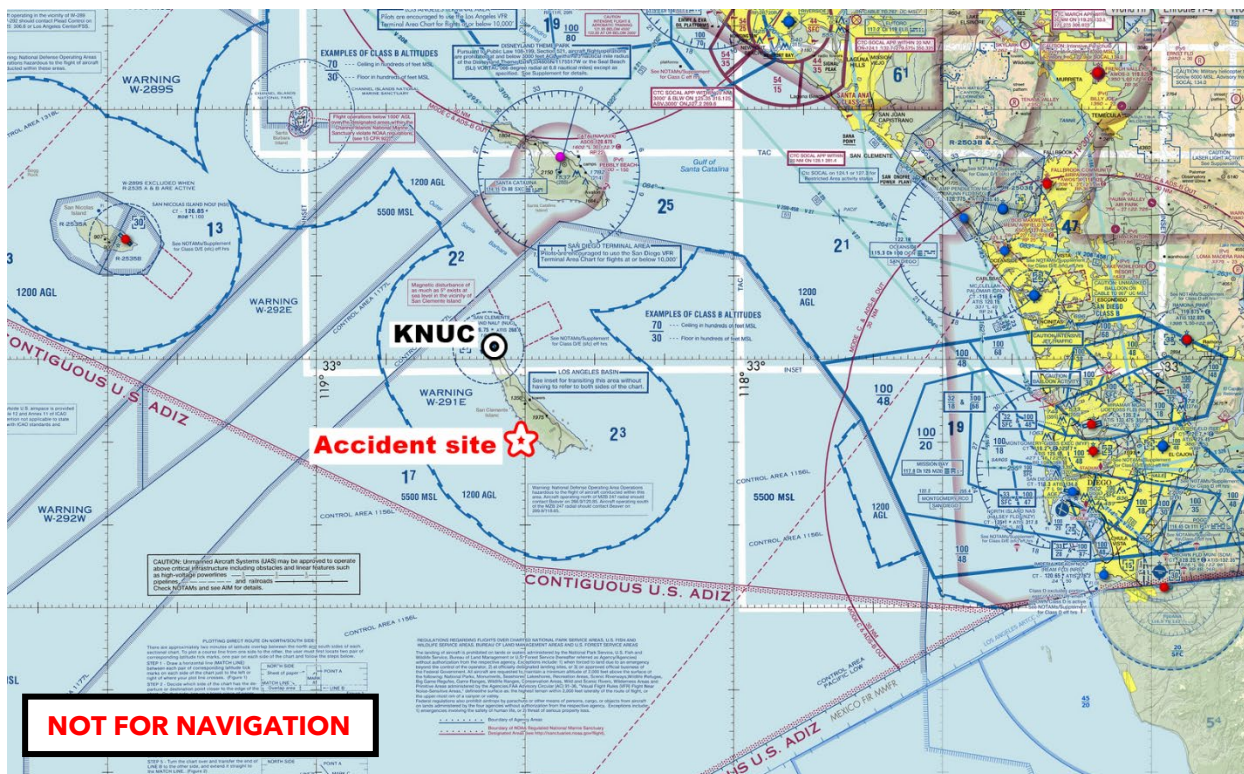


Figure 4. FAA sectional aeronautical chart of the accident area with the location of the accident site and surface observation site.

San Clemente Island NALF⁶ (KNUC) had the closest official weather station to the accident site. KNUC had official weather reporting system similar to an Automated Surface Observing System (ASOS⁷) and its longline⁸ reports were augmented⁹ by an observer. KNUC was located 12 miles north of the accident site (figure 4), at an elevation of 184 feet (ft), and issued the following observations surrounding the period of the accident:¹⁰

⁶ Naval Auxiliary Landing Field (NALF)

⁷ ASOS - Automated Surface Observing System is equipped with meteorological instruments to observe and report wind, visibility, weather phenomena, ceiling, temperature, dewpoint, altimeter, and barometric pressure. ASOS are maintained by the NWS.

⁸ "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.

⁹ Augmented between 0700 and 2200 local.

¹⁰ 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.

[0356 PDT] METAR KNUC 101056Z AUTO 30015G25KT BKN022
BKN030 12/ A3002 RMK AO2 PK WND 29026/1031 SLP164 T0122 \$=

[0456 PDT] METAR KNUC 101156Z AUTO 30016G22KT SCT021
BKN030 OVC034 13/ A3002 RMK AO2 SLP164 T0128 10128 20122
56001 \$=

[0556 PDT] METAR KNUC 101256Z AUTO 31014KT FEW020 OVC030
13/ A3004 RMK AO2 SLP169 T0128 \$=

[0656 PDT] METAR KNUC 101356Z AUTO 30013KT SCT018 OVC024
13/ A3005 RMK AO2 SLP172 T0128 \$=

**[0716 PDT] SPECI KNUC 101416Z 30011KT 10SM SCT016 OVC024
13/10 A3005 RMK T01330100=**

ACCIDENT TIME 0749 PDT

**[0756 PDT] METAR KNUC 101456Z 30013KT 10SM SCT016
OVC024 13/10 A3007 RMK AO2 SLP179 T01330100 53015 \$=**

[0856 PDT] METAR KNUC 101556Z 30012KT 10SM BKN016 OVC024
14/10 A3007 RMK AO2 SLP179 T01390100 \$=

[0907 PDT] SPECI KNUC 101607Z 30012KT 10SM BKN016 OVC024
14/10 A3007 RMK /ACFT MSHP/ T01390100=

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

KNUC weather at 0716 PDT, wind from 300° at 11 knots, visibility 10 miles or greater, scattered clouds at 1,600 ft above ground level (agl), overcast ceiling at 2,400 ft agl, temperature of 13° Celsius (C), dew point temperature 10°C, and an altimeter setting of 30.05 inches of mercury (inHg). Remarks, temperature 13.3°C, dew point temperature 10.0°C.

KNUC weather at 0756 PDT, wind from 300° at 13 knots, visibility 10 miles or greater, scattered clouds at 1,600 ft agl, overcast ceiling at 2,400 ft agl, temperature of 13°C, dew point temperature 10°C, and an altimeter setting of 30.07 inHg. Remarks, station with a precipitation discriminator, sea level pressure 1017.9 hPa, temperature 13.3°C, dew point temperature 10.0°C, 3-hourly pressure increase of 1.5 hPa, maintenance is needed on the system.

The observations from the KNUC around the accident time identified MVFR¹¹ conditions with overcast clouds around 2,600 ft.

3.0 Upper Air Sounding

A High-Resolution Rapid Refresh (HRRR)¹² model sounding was created¹³ for the approximate accident site coordinates for 0800 PDT. The HRRR sounding was plotted on a standard Skew-T Log P diagram¹⁴ from the surface to 600-hPa (or approximately 14,000 ft) using the RAOB¹⁵ software package and is included as figure 5. The sounding depicted an elevation of 16 ft over the grid point with a near surface temperature of 14.3°C, a dew point temperature of 10.4°C, and a relative humidity of 77%. The sounding depicted the lifted condensation level (LCL)¹⁶ and the level of free convection (LFC)¹⁷ at 1,634 ft, and the convective condensation level (CCL)¹⁸ at 2,151 ft. The freezing level was located at 10,772 ft. The precipitable water value at 0.64 inches.

¹¹ 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.

¹² 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.

¹³ HRRR sounding was created using NOAA Air Resource Laboratory: [READY Archived Meteorology \(noaa.gov\)](https://ready.noaa.gov/).

¹⁴ 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.

¹⁵ RAOB - (The complete Rawinsonde Observation program) is an interactive sounding analysis program developed by Esonde Research Services, The Villages, Florida.

¹⁶ LCL - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

¹⁷ LFC - The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

¹⁸ 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.

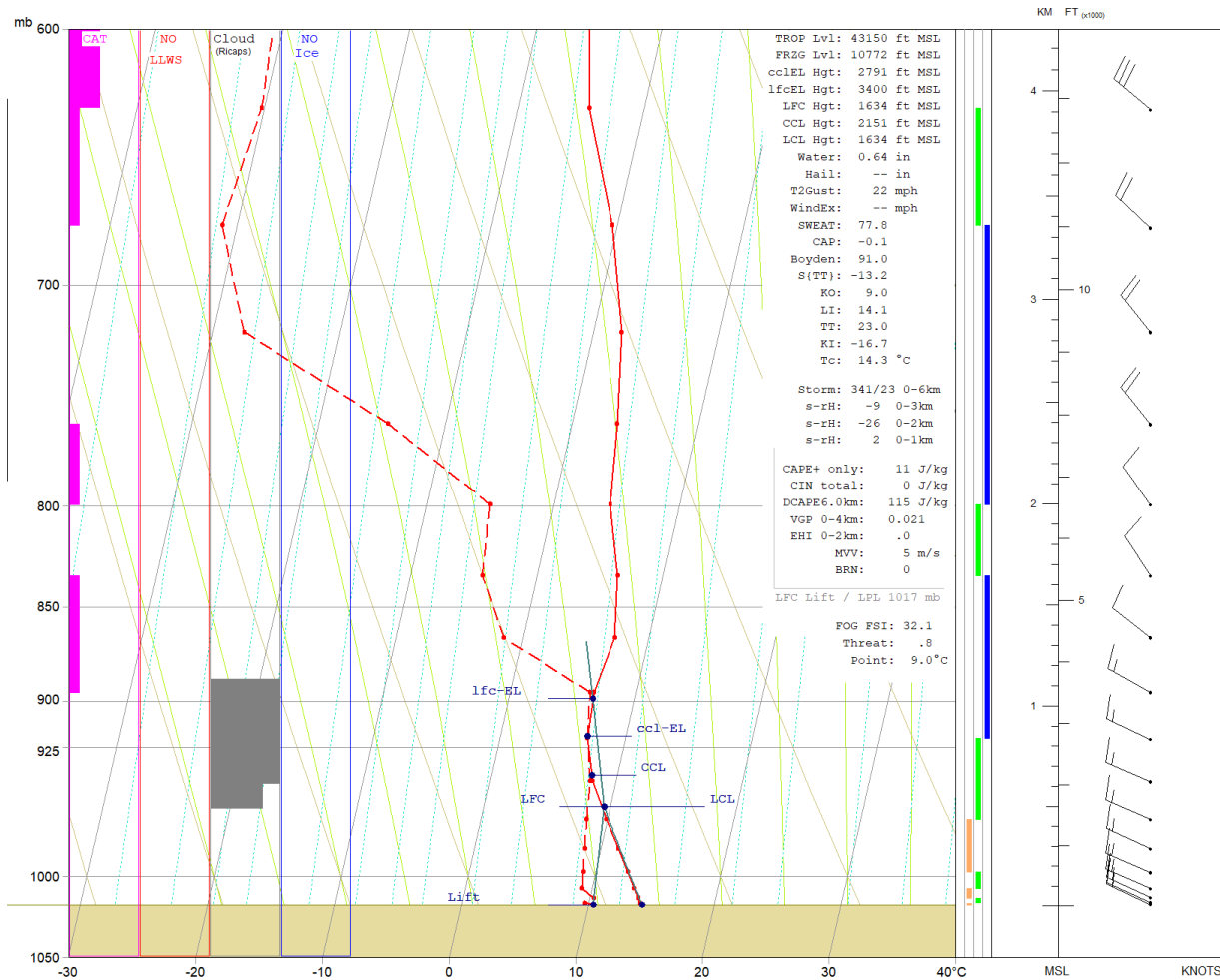


Figure 5. 0800 PDT HRRR sounding.

The 0800 PDT HRRR sounding indicated a generally stable environment from the surface through 11,000 ft. RAOB indicated a cloud layer from 1,500 ft through 4,000 ft. No icing was indicated by RAOB below 14,000 ft.

The 0800 PDT HRRR sounding wind profile indicated a near surface wind from 296 at 15 knots with the wind remaining northwesterly through 14,000 ft. The wind speed increased to 20 knots by 9,500 ft and to 30 knots by 13,000 ft. RAOB did not indicate the possibility of low-level wind shear (LLWS), but RAOB did indicate the possibility of very light clear air turbulence (CAT) in several layers between the 4,000 ft and 14,000 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 0700 PDT through 1200 PDT and reviewed, and the closest images to the time of the accident were documented.

Figure 6 presents the GOES-18 visible image at 0751 PDT at 2X magnification with the accident site highlighted with a red square. The visible imagery indicated cloud cover above the accident site at the accident time with the cloud cover moving from northwest to southeast (attachment 1). Figure 7 presents the GOES-18 infrared image at 0751 PDT at 6X magnification with the accident site highlighted with a red square. The lower brightness temperatures (red colors; higher cloud tops) were located in areas along the southern California coastal region at the accident time. The brightness temperature of 278 Kelvin above the accident site would have been near 6,000 ft based on the vertical temperature profile provided by the 0800 PDT HRRR sounding. It should be noted these figures have not been corrected for any parallax error.

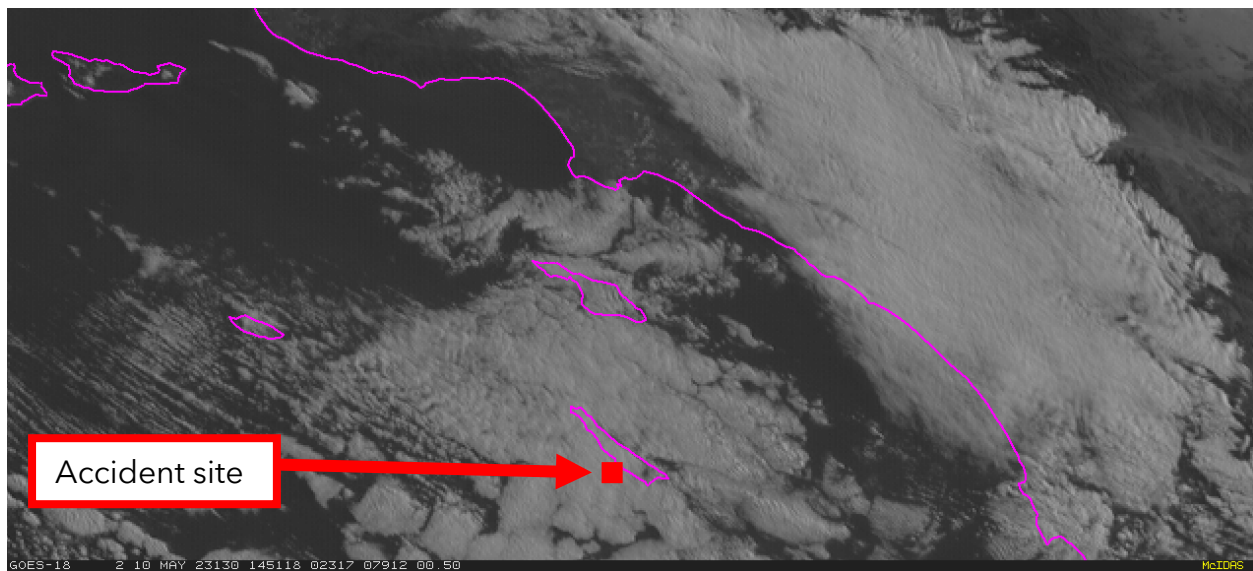


Figure 6. GOES-18 visible image at 0751 PDT.

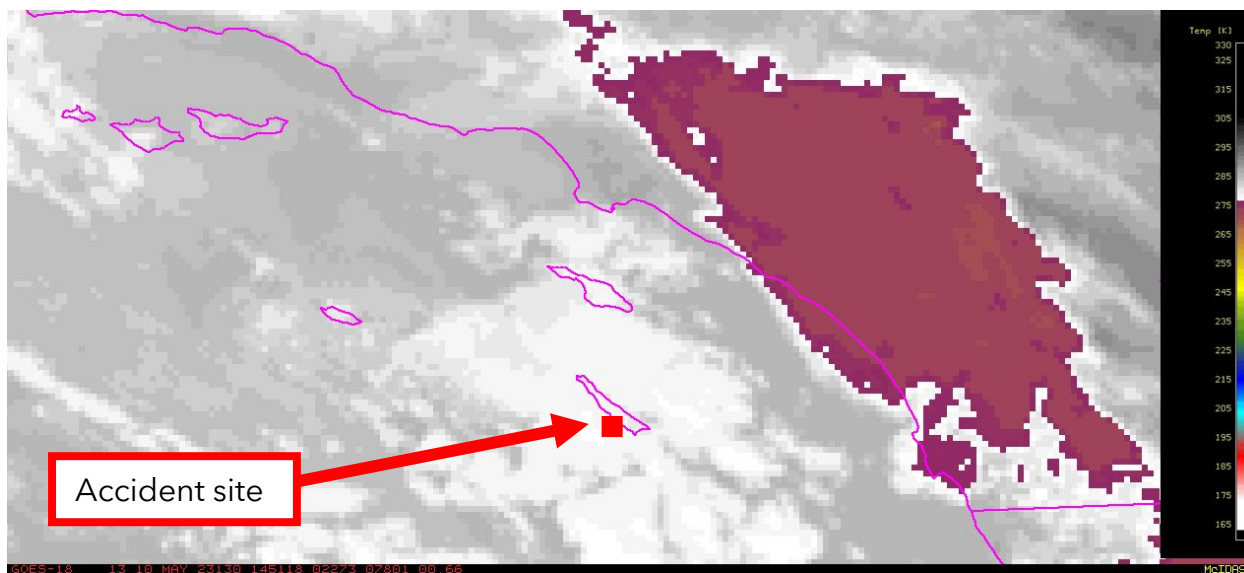


Figure 7. GOES-18 infrared image at 0751 PDT.

5.0 National Radar Imagery

A regional view of the NWS National Reflectivity Mosaic is included as figure 8 for 0750 PDT with the approximate location of the accident site marked by a red circle. No precipitation was depicted above the accident site.

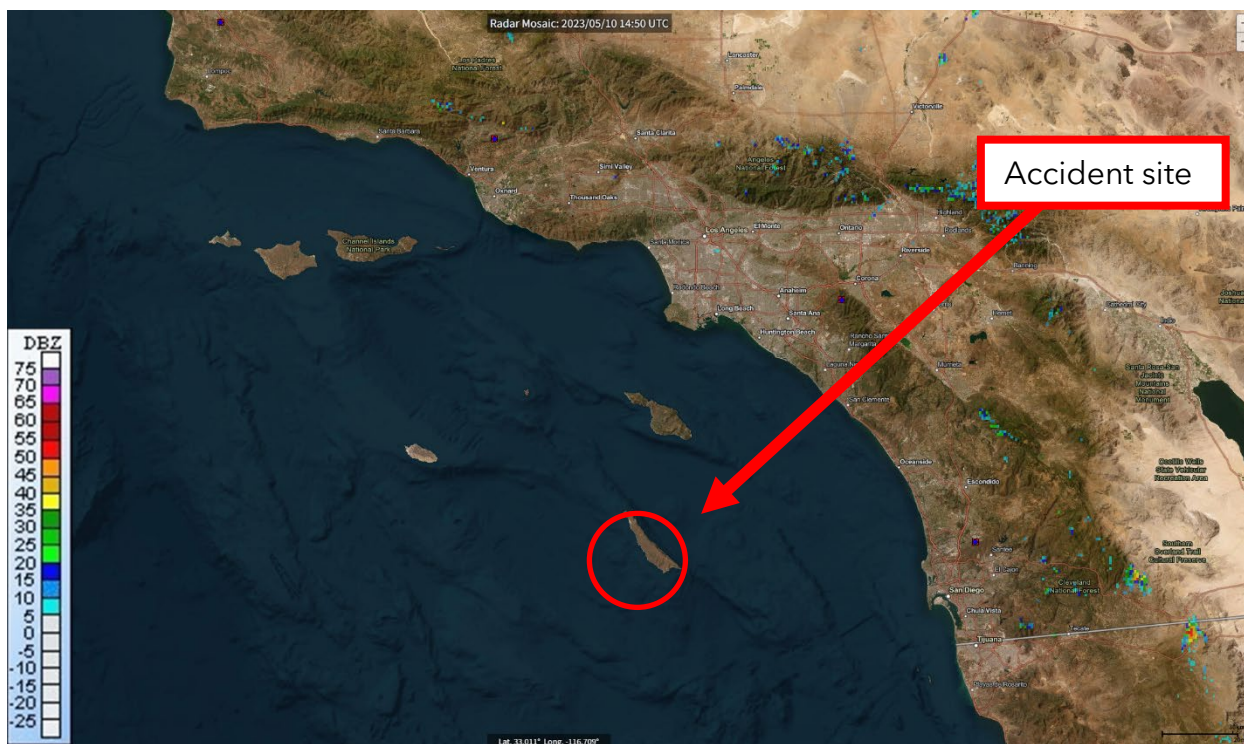


Figure 8. National Reflectivity Mosaic for 0750 PDT.

6.0 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.¹⁹

A search of archived information indicated that the accident pilot did not request weather information from Leidos Flight Service. The accident pilot did have an account through ForeFlight and filed a flight plan at 1612:41 PDT on May 9 for the accident flight with a proposed departure time of 0715 PDT on May 10 (attachment 2). A briefing was generated at the time the flight plan was filed and that can be found in attachment 3. The briefing contained winds aloft, turbulence, icing, the significant weather chart with data valid between FL250²⁰ to FL630, along with other weather forecast datasets, and these weather graphics were generated from weather information valid around 1612 PDT on May 9. For more information please see attachments 2 and 3. It is unknown what additional weather information, if any, the accident pilot checked or received before or during the accident flight.

¹⁹ 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.

²⁰ Flight Level - A Flight Level (FL) is a standard nominal altitude of an aircraft, in hundreds of ft. This altitude is calculated from the International standard pressure datum of 1013.25 hPa (29.92 inHg), the standard sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above mean sea level or above ground level.

7.0 Astronomical Data

The astronomical data obtained for the accident site on May 10, 2023, indicated the following:

SUN

Begin civil twilight 0532 PDT

Sunrise 0559 PDT

Accident time 0749 PDT²¹

Sun transit 1250 PDT

Sunset 1943 PDT

End civil twilight 2009 PDT

At the time of the accident the Sun was had an altitude of 21.55° and azimuth of 82.32°.

E. LIST OF ATTACHMENTS

Attachment 1 - GOES-18 Visible imagery animation from 0701 to 0831 PDT

Attachment 2 - ForeFlight information

Attachment 3 - ForeFlight flight and weather information

Submitted by:

Paul Suffern
Senior Meteorologist

²¹ Inserted accident time for reference and context.