



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 26, 2021

Specialist's Factual Report

METEOROLOGY

WPR22FA073

Table Of Contents

A.	ACCIDENT	3
B.	METEOROLOGIST	3
C.	DETAILS OF THE INVESTIGATION	3
D.	WEATHER INFORMATION	3
1.0	Weather Radar	3
2.0	Lightning.....	4
3.0	HRRR Model Sounding.....	4
4.0	Satellite Imagery	5
5.0	Surface Observations	7
6.0	Pilot Reports.....	7
7.0	Area Forecast Discussion.....	8
8.0	AIRMETs.....	8
9.0	SIGMETs	9
10.0	CWSU Products	9

A. ACCIDENT

Location: Marana, Arizona
Date: December 31, 2021
Time: 1330 mountain standard time (2030 UTC)¹
Aircraft: Type – Mooney M20C; Registration – N6796N

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board’s meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in mountain standard time (MST) for December 31, 2021 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl). The accident site was located at about: 32.691664° north latitude; 112.12789° west longitude at an elevation of about 2,180 feet.

This report provides information on the weather conditions and forecasts applicable to the accident time and location.

D. WEATHER INFORMATION

1.0 Weather Radar

WSR-88D² Level-II base reflectivity weather radar imagery from the Phoenix, Arizona, site (KIWA) is presented in figure 1. KIWA was located about 43 miles north-northeast of the accident location at an elevation of about 1,425 feet. Assuming standard refraction and considering the 0.95° beam width³ for the WSR-88D radar beam, the KIWA 0.484° tilt would have “seen” altitudes over the accident location of between about 2,700 and 7,000 feet. The imagery revealed light values of reflectivity⁴ in the immediate vicinity of the accident location at the accident time.

¹ UTC – abbreviation for Coordinated Universal Time

² Weather Surveillance Radar 88 Doppler (WSR-88D)

³ Here we define the angular width of the radar beam as the region of transmitted energy that is bounded by one-half the maximum power. The maximum power lies along the beam centerline and decreases outward from the radar antenna.

⁴ According to the Federal Aviation Administration’s Advisory Circular 00-24C, a reflectivity intensity of “light” is

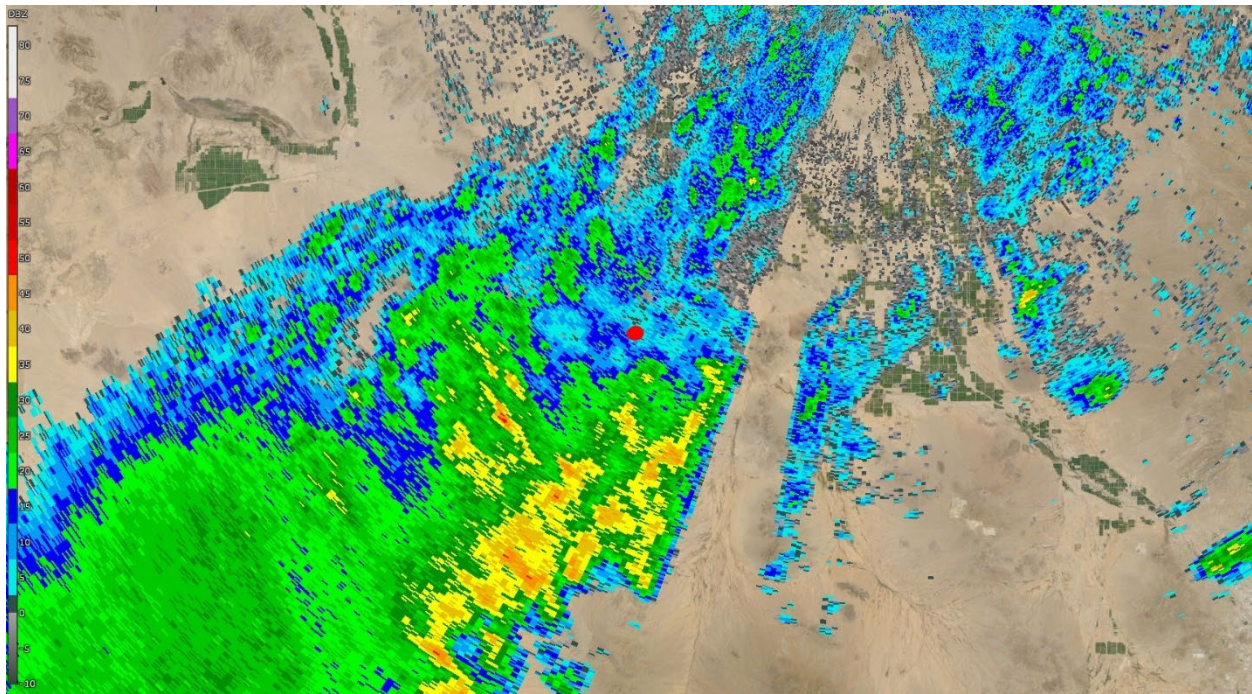


Figure 1 – KIWA 0.484° Level-II base reflectivity product from a sweep initiated at 1329:05 MST. Accident location marked by the red circle.

2.0 Lightning

A review of the Earth Networks Total Lightning Network (ENTLN) lightning database indicated that there was no flash lightning activity between 1315 and 1345 MST around the accident location.⁵

3.0 HRRR Model Sounding

A High-Resolution Rapid Refresh (HRRR) model⁶ sounding (figure 2) for near the accident site⁷ at 1300 MST using an elevation of 664 feet was retrieved from the National Oceanic and Atmospheric Administration's Air Resources Laboratory and analyzed by the RAwinsonde OBservation (RAOB) program. Cloudy conditions were identified by RAOB from about 3,700 to 11,200 feet. The freezing level was noted at about 8,500 feet. The wind below 5,000 feet was

dBZ values less than 30, "moderate" is dBZ values between 30 and 40, "heavy" is dBZ values greater than 40 and less than or equal to 50, and "extreme" is dBZ values greater than 50.

(https://www.faa.gov/documentlibrary/media/advisory_circular/ac%2000-24c.pdf)

⁵ The ENTLN was queried for a geographic area bounded by latitudes 33.1053°N and 32.3753°N, and longitudes 112.6978°W and 111.5442°W.

⁶ 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.

⁷ Coordinates used for the model were 32.69, -112.13.

southerly at magnitudes between 5 and 15 knots. Above this layer the wind veered⁸ slightly and increased in magnitude to a southwest wind of 25 knots at 10,000 feet. RAOB identified light to moderate icing between about 9,600 and 10,900 feet.

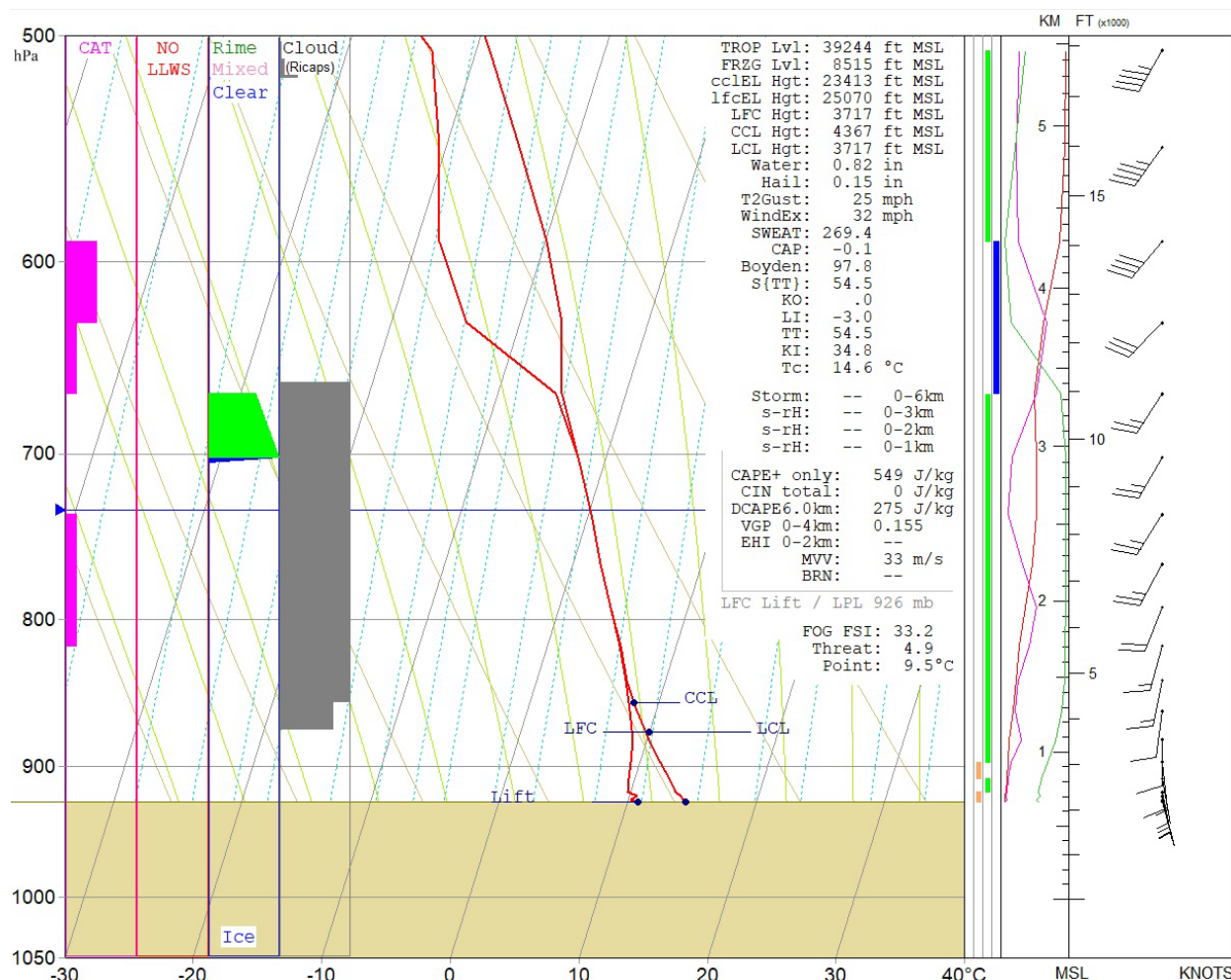


Figure 2 – HRRR model sounding data in SkewT/LogP format for 1300 MST near the accident site, surface to 500 hectopascals.

4.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-17 visible (0.64 μ m) and infrared (10.3 μ m) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Images from 1331 MST are presented in figures 3 and 4. The GOES-17 visible imagery depicted cloudy conditions over the accident region. Infrared cloud-top temperatures over the accident site were about -39°C, which, when considering the 1300 MST HRRR sounding, corresponded to cloud top heights greater than 25,000 feet (not depicted in figure 2).

⁸ A veering wind's wind barbs turn clockwise with increasing height.

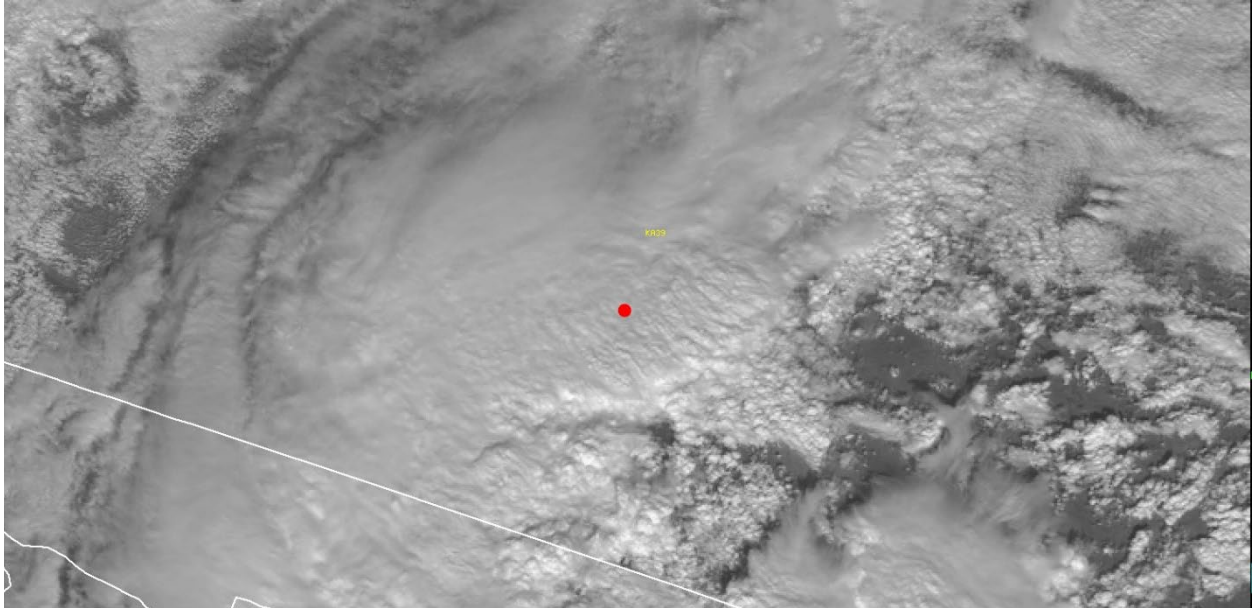


Figure 3 – GOES-17 visible imagery from 1331 MST. Accident location denoted by the red dot. Image is not corrected for parallax error.

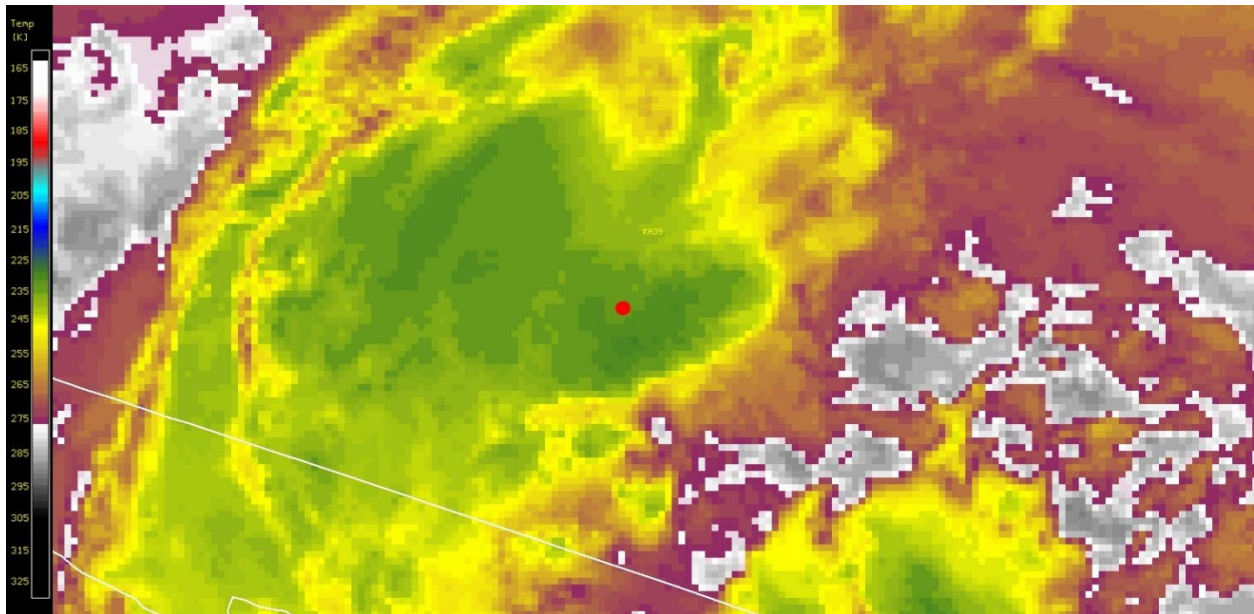


Figure 4 – GOES-17 infrared imagery from 1331 MST. Accident location denoted by the red dot. Image is not corrected for parallax error.

5.0 Surface Observations

An Automated Weather Observing System (AWOS) was located at Ak-Chin Regional Airport (A39⁹) which was in Maricopa, Arizona, about 19 miles north-northeast of the accident location at an elevation of about 1,305 feet and had a magnetic variation of about 10° east. Automated longline¹⁰ reports from the A39 AWOS during the times surrounding the accident time are presented here. The observation closest in time to the accident time is highlighted by bold text.

[1255 MST] METAR KA39 311955Z AUTO 34008KT 5SM -DZ BR OVC022 12/12
A2967 RMK AO2=

[1315 MST] METAR KA39 312015Z AUTO 35009KT 10SM SCT010 OVC024 12/12
A2965 RMK AO2=

**[1335 MST] METAR KA39 312035Z AUTO 35011KT 2SM RA BR SCT006 BKN023
OVC029 12/12 A2963 RMK AO2=**

[1355 MST] METAR KA39 312055Z AUTO 36007KT 2 1/2SM -RA BR BKN004
BKN029 OVC034 12/ A2964 RMK AO2 P0001=

At 1355 MST, the A39 AWOS reported a wind from 350° at 11 knots, visibility of 2 statute miles, moderate rain, mist, scattered clouds at 600 feet above ground level (agl), ceiling broken at 2,300 feet agl, overcast clouds at 2,900 feet agl, temperature of 12° Celsius (C) and dew point temperature of 12°C, altimeter setting of 29.63 inches of mercury; Remarks: automated station with a precipitation discriminator.

6.0 Pilot Reports

The following longline-disseminated pilot reports¹¹ (PIREPs) were applicable within 50 miles of the accident location below 20,000 feet and within 2 hours of the accident time.

PHX UA /OV 40SE PHX/TM 2115/FL150/TP GLST/TB OCNL MOD SEV/RM
ZAB/FDCS

TUS UA /OV TUS320040/TM 2117/FL170/TP CRJ7/TB CONS MOD/RM ZAB/FDCS

⁹ This report uses the 3-digit International Air Transport Association format for airport identification, which does not use the geographic designating digit (e.g., “K” for stations in the continental U.S. and “P” for U.S. stations in Alaska and the Pacific region) as found in the 4-digit International Civil Aviation Organization (ICAO) identifier format. Weather observations from airports in this report are referenced by their reporting station’s identifier (using ICAO format that includes the geographic designating digit), not by the airport at which the reporting station is located.

¹⁰ “Longline” refers to the dissemination of weather observations with the intent that they are available in near-real time to national databases (effectively, the whole world) 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 general global public has access to surface weather observations, particularly outside of the aviation community.

¹¹ These do not include pilot reports only broadcast via radio.

PHX UA /OV PXR245025/TM 2142/FL140/TP B737/TA 7/TB MOD/IC MOD
RIME/RM FL140-70

PHX UA /OV PXR150020/TM 2145/FL140/TP B737/TA M07/TB MOD/IC MOD
RIME/RM FL140-090

PHX UA /OV PXR270015/TM 2215/FL160/TP A319/TB CONS LGT/RM DURC
ZAB/FDCS

PHX UA /OV PHX120040/TM 2221/FL190/TP B737/TB LGT CONS CHOP/RM
DURC ZAB/FDCS

7.0 Area Forecast Discussion

The National Weather Service (NWS) Tucson, Arizona, Weather Forecast Office issued the following Aviation section of an Area Forecast Discussion at 0355 MST.

*FXUS65 KTWC 311055 CCA
AFDTWC
Area Forecast Discussion...correction
National Weather Service Tucson AZ
355 AM MST Fri Dec 31 2021*

*.AVIATION...Valid through 01/12Z.
Scattered to numerous showers with MTNS mostly obscured in clouds and
precipitation. Areas of MVFR and localized IFR conds thru valid pd. Slight CHC of
TSRA. SFC winds SLY 5-10 kts increasing to SW 11-17 kts with gusts 25-30 kts this
afternoon. Aviation discussion not updated for TAF amendments.*

8.0 AIRMETs

Airmen's Meteorological Information (AIRMET) advisories for mountain obscuration, moderate turbulence between FL180¹² and FL390 and moderate icing between the freezing level and FL200 were active for the accident location at the accident time.

*WAUS45 KKCI 311752 AAA
WA5S
-SLCS WA 311752 AMD
AIRMET SIERRA UPDT 4 FOR IFR AND MTN OBSCN VALID UNTIL 312100
.
AIRMET MTN OBSCN...ID MT WY NV UT CO AZ NM*

¹² Flight Level (FL) - a standard nominal altitude of an aircraft, in hundreds of feet. This altitude is calculated from the international standard pressure datum of 1013.25 hPa (29.92 inches of mercury), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

FROM HVR TO 30NNW CYS TO 60SSW DEN TO 20N FTI TO CME TO ELP TO 50S TUS TO PHX TO EED TO 50S OAL TO 50SE REO TO 40NE GEG TO 70S YQL TO GTF TO HVR

MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

WAUS45 KKCI 311445

WA5T

-SLCT WA 311445

AIRMET TANGO UPDT 4 FOR TURB AND LLWS VALID UNTIL 312100

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

*FROM 20ENE OCS TO 40NNE CHE TO ELP TO 50S TUS TO BZA TO 20S MZB TO 30SSE EED TO 40NE PGS TO 80SSE ILC TO 20SE ELY TO 20NE SLC TO 20ENE OCS
MOD TURB BTN FL180 AND FL390. CONDS CONTG BYD 21Z THRU 03Z.*

WAUS45 KKCI 311845 AAA

WA5Z

-SLCZ WA 311845 AMD

AIRMET ZULU UPDT 4 FOR ICE AND FRZLVL VALID UNTIL 312100

*.
AIRMET ICE...UT CO AZ NM...UPDT*

*FROM 20SSE DVC TO ALS TO 30ENE CIM TO TCC TO INK TO 30S ELP TO 50S TUS TO BZA TO 40ESE MZB TO 60S EED TO 30WNW DRK TO 20SSE DVC
MOD ICE BTN FRZLVL AND FL200. FRZLVL 070-110. CONDS CONTG BYD 21Z THRU 03Z.*

9.0 SIGMETs

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

10.0 CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the NWS Center Weather Service Unit (CWSU) at the Albuquerque Air Route Traffic Control Center that were active for the accident location at the accident time.

Submitted by:

Mike Richards
Senior Meteorologist