



National Transportation Safety Board

**Office of Aviation Safety
Washington, D.C. 20594-2000**

July 8, 2016

**WEATHER STUDY
WPR16FA097**

A. Accident

Location: Henderson, Nevada
Date: April 30, 2016
Time: about 1630 Pacific daylight time (2330 UTC¹)
Aircraft: N330MT; Extra Flugzeugproduktions-UND EA 300/L

B. Meteorological Specialist

Mike Richards
Senior Meteorologist
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Operational Factors Division, AS-30
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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 Pacific daylight time (PDT) for April 30, 2016 (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).

Coordinates used for the accident location: 35.811094° north latitude, 115.204419° west longitude, elevation of about 3,100 feet.

¹ UTC – abbreviation for Coordinated Universal Time

Synoptic Conditions

The National Weather Service (NWS) Surface Analysis Chart for 1700 PDT is presented in figure 1. A low pressure center was depicted at the California/Arizona border. A WSR-88D regional radar composite reflectivity mosaic obtained from the National Mosaic and Multi-Sensor (NMQ) Project for 1630 PDT (figure 2) identified extensive areas characterized by light to moderate (with some heavy) values of reflectivity across the extreme southern portion of Nevada, southwestern Utah and northwestern Arizona. Some of these reflectivity patterns were consistent with convection.

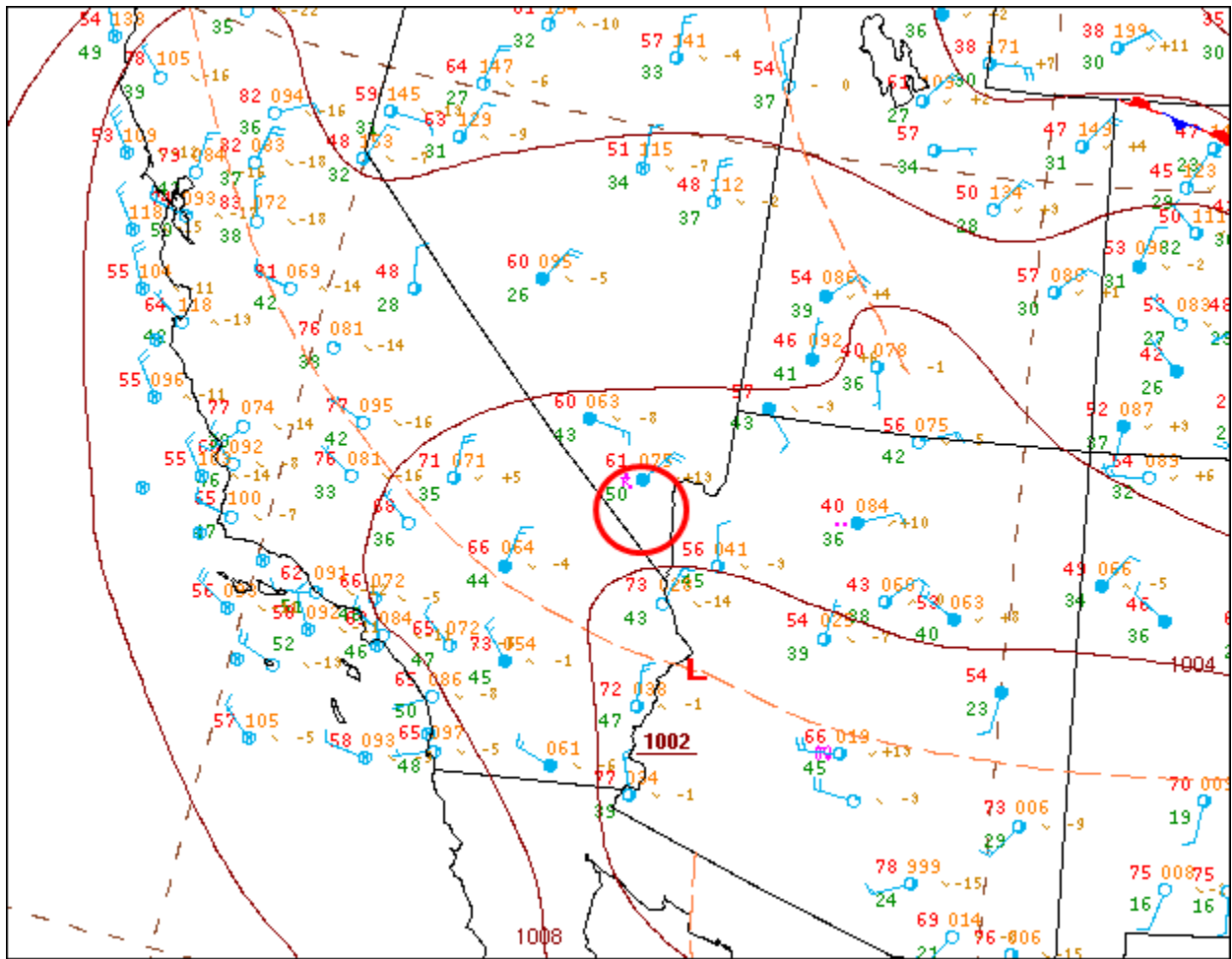


Figure 1 – NWS Surface Analysis Chart for 1700 PDT. The accident location is denoted by the red circle.

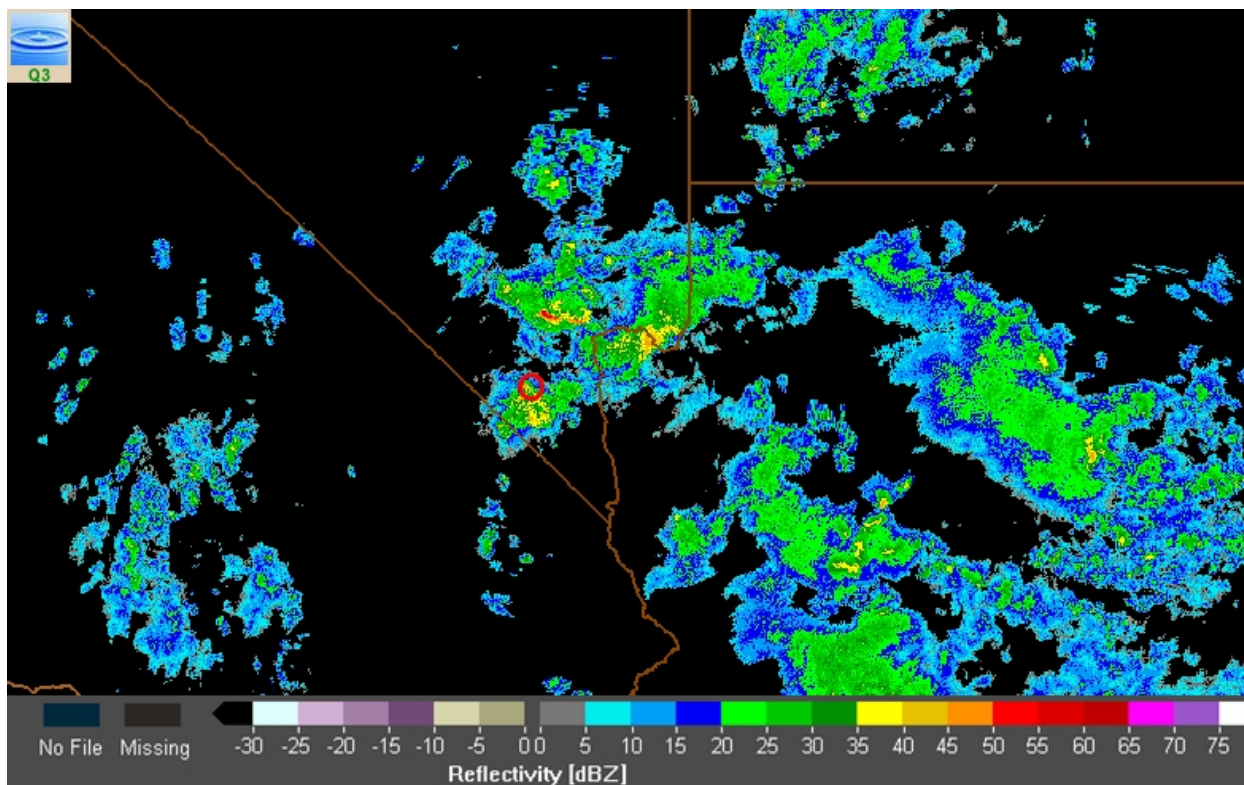


Figure 2 – NMQ NEXRAD mosaic from 1630 PDT. The accident location is denoted by the red circle.

Surface Observations

An Automated Surface Observing System (ASOS) was located at McCarran International Airport (LAS) in Las Vegas, Nevada. LAS was located approximately 16 miles north of the accident location at an elevation of 2,181 feet. Human-augmented reports from LAS during the times surrounding the accident time are presented here:

[1456 PDT] METAR KLAS 302156Z 01012G18KT 10SM FEW045 BKN060 BKN110
18/07 A2973 RMK AO2 SLP055 T01830072 \$=

[1556 PDT] **METAR KLAS 302256Z 04009KT 10SM FEW050 BKN090 OVC110**
18/07 A2972 RMK AO2 SLP054 SH DSNT SE-S T01780067 \$=

[1649 PDT] SPECI KLAS 302349Z 09009KT 10SM TS SCT035 BKN080CB OVC100
17/08 A2975 RMK AO2 OCNL LTGICCG N TS N-NE MOV SW
T01670083 \$=

[1656 PDT] **METAR KLAS 302356Z 04026G31KT 6SM TSRA SCT035**
BKN080CB OVC100 16/10 A2978 RMK AO2 PK WND 04031/2356
PRESRR SLP075 OCNL LTGICCG N TS N-NE MOV SW P0000
60000 T01610100 10189 20106 53013 \$=

[1658 PDT] SPECI KLAS 302358Z AUTO 03028G33KT 2 1/2SM RA FEW021
BKN049 OVC080 14/11 A2978 RMK AO2 PK WND 04033/2357
PRESRR P0000 T01440111 TSNO \$=

[1700 PDT] SPECI KLAS 010000Z 04020G33KT 1 1/4SM RA BR FEW021 BKN049
OVC080 13/11 A2977 RMK AO2 PK WND 04033/2357 P0001 T01330111
\$=

At 1556 PDT, LAS reported a wind from 040° at 9 knots, visibility of 10 statute miles or greater, few clouds at 5,000 feet above ground level (agl), ceiling broken at 9,000 feet agl, overcast cloud base at 11,100 feet agl, temperature of 18° Celsius (C) and a dew point temperature of 7°C, altimeter setting of 29.72 inches of mercury; remarks included: station with a precipitation discriminator, showers more than 10 miles away to the southeast through south.

At 1656 PDT, LAS reported a wind from 040° at 26 knots with gusts to 31 knots, visibility of 6 statute miles, thunderstorm and rain, scattered clouds at 3,500 feet agl, ceiling broken at 8,000 feet agl of cumulonimbus type, overcast cloud base at 10,000 feet agl, temperature of 16°C and a dew point temperature of 10°C, altimeter setting of 29.78 inches of mercury; remarks included: station with a precipitation discriminator, peak wind of 31 knots from 040° at 1656 PDT, pressure rising rapidly, occasional lightning in-cloud and cloud-to-ground to the north, thunderstorm to the north through northeast moving southwest, trace precipitation in last hour.

An ASOS was located at Henderson Executive Airport (HND) in Las Vegas, Nevada. HND was located approximately 10 miles north-northeast of the accident location at an elevation of 2,491 feet. Human-augmented reports from HND during the times surrounding the accident time are presented here:

[1543 PDT] SPECI KHND 302243Z 03010KT 10SM VCTS FEW043 BKN055 17/08
A2978 RMK AO2 LTG DSNT E AND SE TSB37=

[1556 PDT] METAR KHND 302256Z 02014KT 10SM VCTS FEW041 BKN065
OVC110 17/08 A2978 RMK AO2 LTG DSNT NE AND SE TSB37
SLP075 T01720078=

[1615 PDT] SPECI KHND 302315Z 11007KT 10SM VCTS -RA FEW040 BKN080
OVC110 15/10 A2979 RMK AO2 WSHFT 2255 RAB2259 P0000=

**[1636 PDT] SPECI KHND 302336Z 12008KT 10SM FEW041 SCT070 OVC095
16/09 A2979 RMK AO2 WSHFT 2255 LTG DSNT N AND NE
TSE30RAB2259E20 P0000=**

[1656 PDT] METAR KHND 302356Z 09008KT 10SM VCTS FEW065 OVC080 16/09
A2980 RMK AO2 WSHFT 2255 LTG DSNT N TSE30B49RAB2259E20
SLP084 P0000 60004 T01560089 10178 20094 53003=

[1723 PDT] SPECI KHND 010023Z 03006KT 10SM TSRA FEW018 BKN048
OVC075 12/10 A2982 RMK AO2 WSHFT 0003 RAB04 P0006=

At 1636 PDT, HND reported a wind from 120° at 8 knots, visibility of 10 statute miles or greater, few clouds at 4,100 feet agl, scattered clouds at 7,000 feet agl, overcast cloud base at 9,500 feet agl, temperature of 16°C and a dew point temperature of 9°C, altimeter setting of 29.79 inches of mercury; remarks included: station with a precipitation discriminator, wind shift at 1555 PDT, lightning more than ten miles away to the north and northeast, thunderstorm ended at 1630 PDT and rain began at 1559 PDT and rain ended at 1620 PDT, trace precipitation in last hour.

Unofficial meteorological reporting station JEAN2 was located about 6 miles east-southeast of the accident site at an altitude of about 2,835 feet. Calibration, maintenance and siting standards of this instrument are not known. Reports² from JEAN2 during the times surrounding the accident time are presented here (temperatures are in degrees Fahrenheit and wind magnitudes are in miles-per-hour):

<u>Time</u>	<u>Temp</u>	<u>D_Temp</u>	<u>RH</u>	<u>W_Mag</u>	<u>W_Dir</u>
1611	--	--	--	10	011°
1625	--	--	--	11	011°
1636	--	--	--	13	011°
1639	56	48.6	76	--	--
1651	--	--	--	10	063°
1654	--	--	75	--	--

Unofficial meteorological reporting station JSEN2 was located about 5 miles south of the accident site at an altitude of about 3,170 feet. Calibration, maintenance and siting standards of this instrument are not known. Reports³ from JSEN2 during the times surrounding the accident time are presented here (temperatures are in degrees Fahrenheit and wind magnitudes are in miles per hour):

<u>Time</u>	<u>Temp</u>	<u>D_Temp</u>	<u>RH</u>	<u>W_Mag</u>	<u>W_Dir</u>	<u>G_Mag</u>
1607	53.0	--	--	--	--	--
1617	51.0	47.4	87	--	--	19
1627	--	--	--	8	074°	--
1639	--	--	--	9	114°	--
1647	--	--	82	--	--	--
1658	--	--	--	6	120°	--

According to a meteorologist at the NWS Weather Forecast Office (WFO) in Las Vegas, Nevada, “JEAN2 and JSEN2 are both CCRFCD sensors and I believe they are very reliable and representative of general weather conditions, though the way they are designed to report winds leaves a little to be desired. I don't think they pick up gusts very well, especially brief gusts from convection.”

Weather Radar

WSR-88D Level-II reflectivity weather radar imagery from Las Vegas, Nevada (KESX), are presented in figures 3-8. KESX was located approximately 17 miles southeast of the accident site at an elevation of about 4,875 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the KESX 0.468° tilt would have “seen” altitudes between about 5,050 and 6,750 feet msl above the accident location. The KESX weather radar depicted high reflectivity values consistent with heavy rain and reflectivity patterns consistent

² Temp=temperature(°F); D_Temp=dew point temperature (°F); RH=relative humidity(%); W_Mag=average wind magnitude(miles per hour); W_Dir=average wind direction(true)

³ G_Mag=gust wind magnitude(miles per hour)

with convection moving through the accident location immediately prior to the accident time. At the accident location around 1632 PDT, immediately following the passage of the convective feature, a small area of light reflectivity was identified over the accident location.

Radial velocity data for 20 minutes surrounding the accident time was retrieved from the Terminal Doppler Weather Radar (TDWR) from Las Vegas, Nevada (TLAS), which was located approximately 22 miles north-northeast of the accident site at an elevation of about 1,995 feet. Review of the 0.8° tilt velocity data for this timeframe showed particle velocity magnitudes of between 10-24 knots at a direction away from the radar. Assuming standard refraction and considering the 0.55° beam width for the TDWR radar beam, the TLAS 0.8° tilt would have “seen” altitudes between about 3,130 and 4,125 feet msl above the accident location. Figure 9 presents the TLAS velocity data for 1630 PDT.

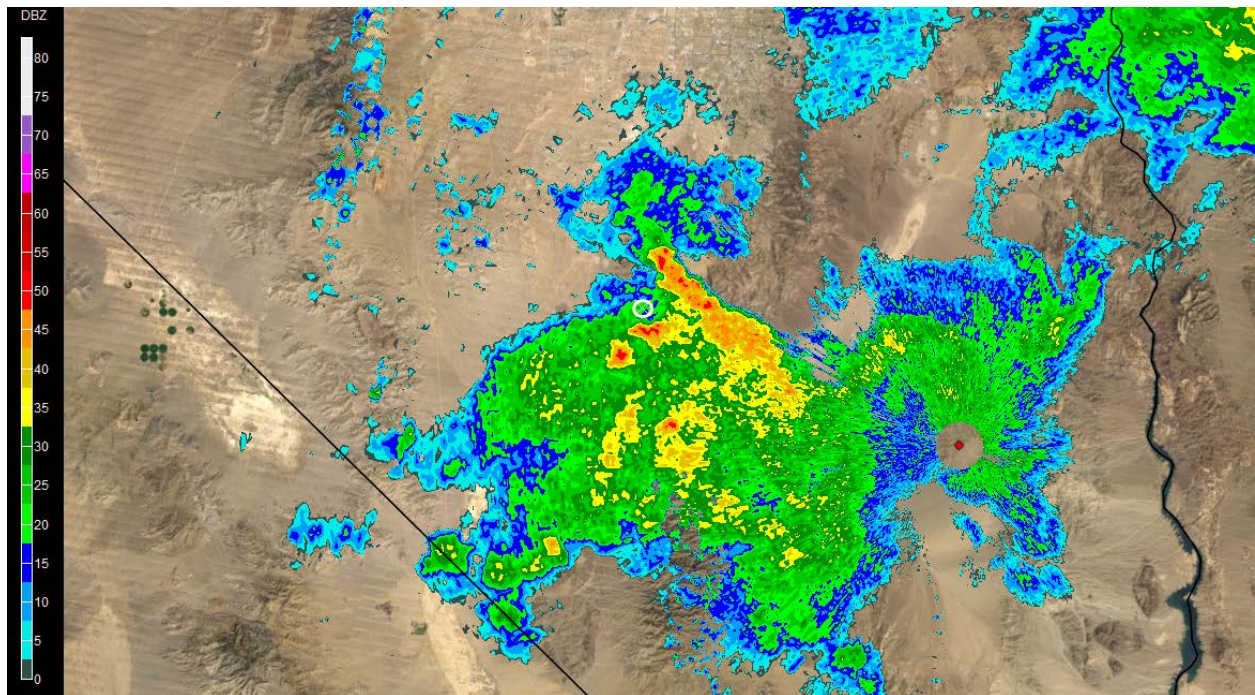


Figure 3 – KESX 0.468° Level-II reflectivity product from 1619:09 PDT. Accident location denoted by white circle.

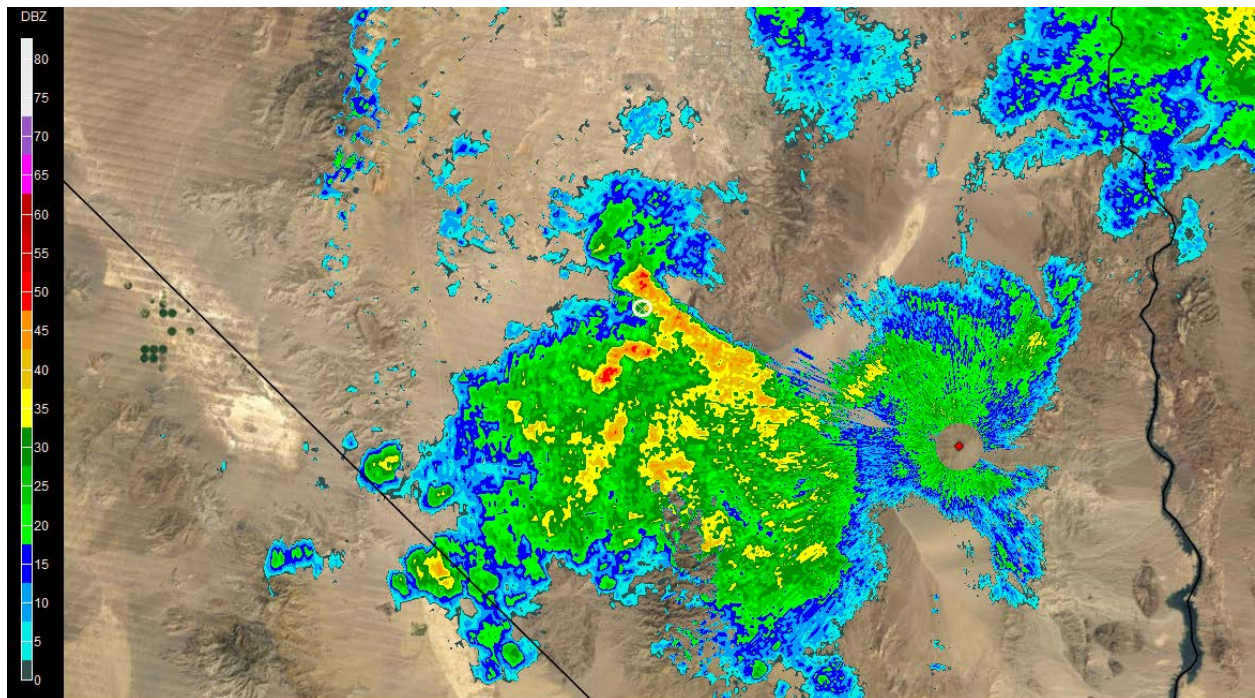


Figure 4 – KESX 0.468° Level-II reflectivity product from 1623:31 PDT. Accident location denoted by white circle.

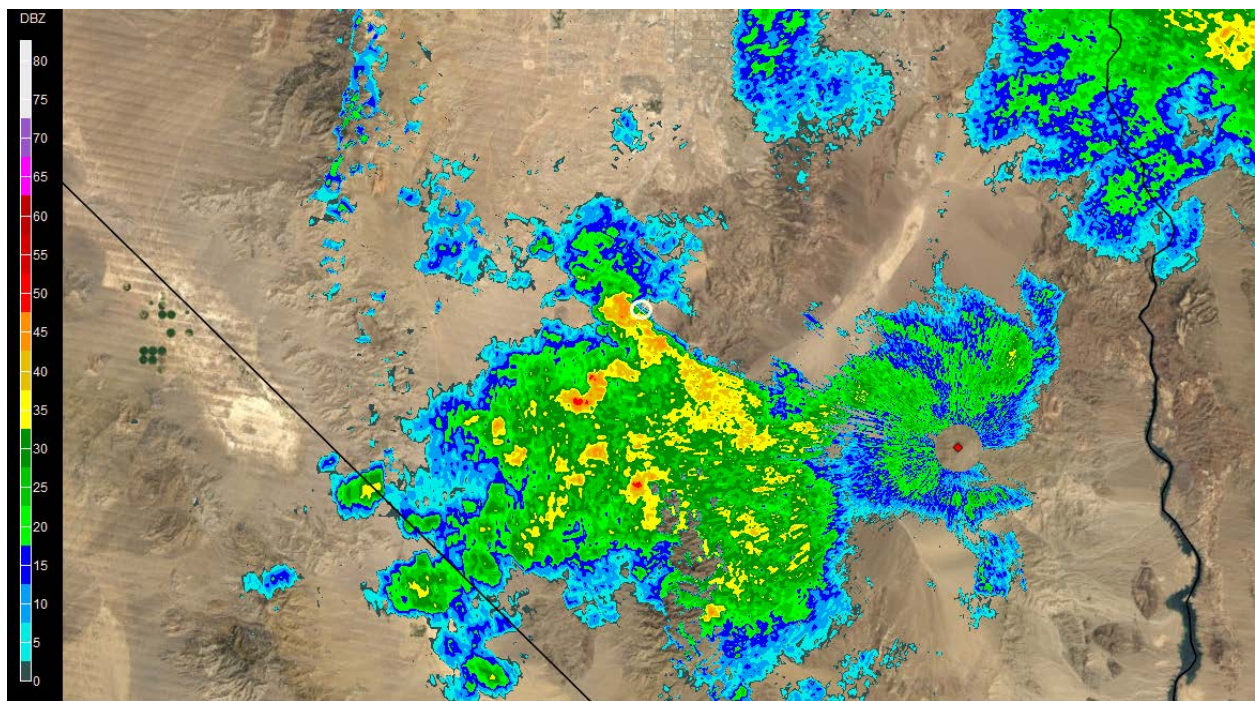


Figure 5 – KESX 0.468° Level-II reflectivity product from 1627:53 PDT. Accident location denoted by white circle.

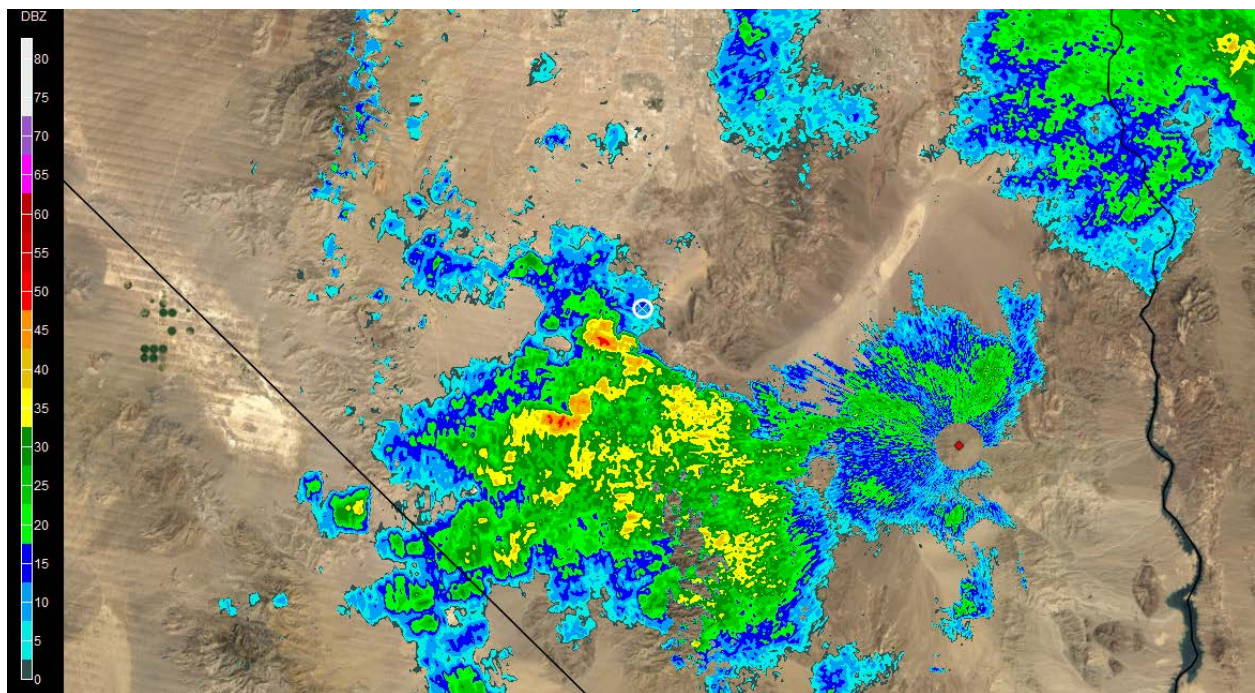


Figure 6 – KESX 0.468° Level-II reflectivity product from 1632:15 PDT. Accident location denoted by white circle.

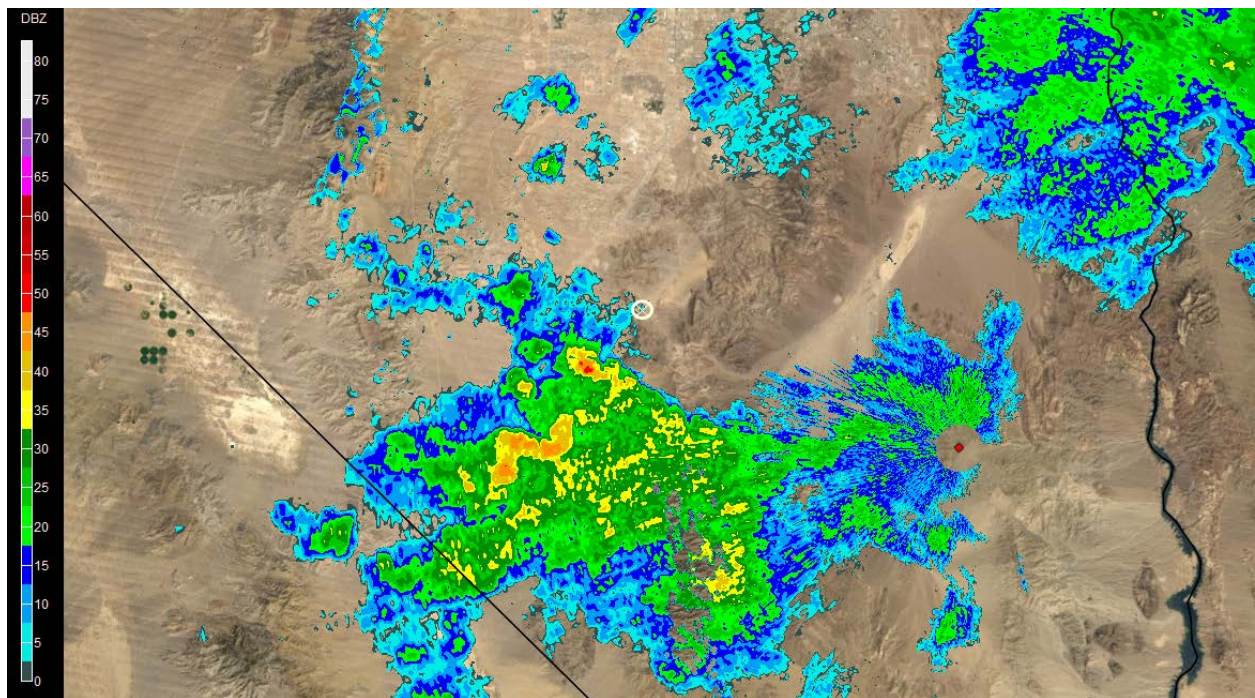


Figure 7 – KESX 0.468° Level-II reflectivity product from 1636:37 PDT. Accident location denoted by white circle.

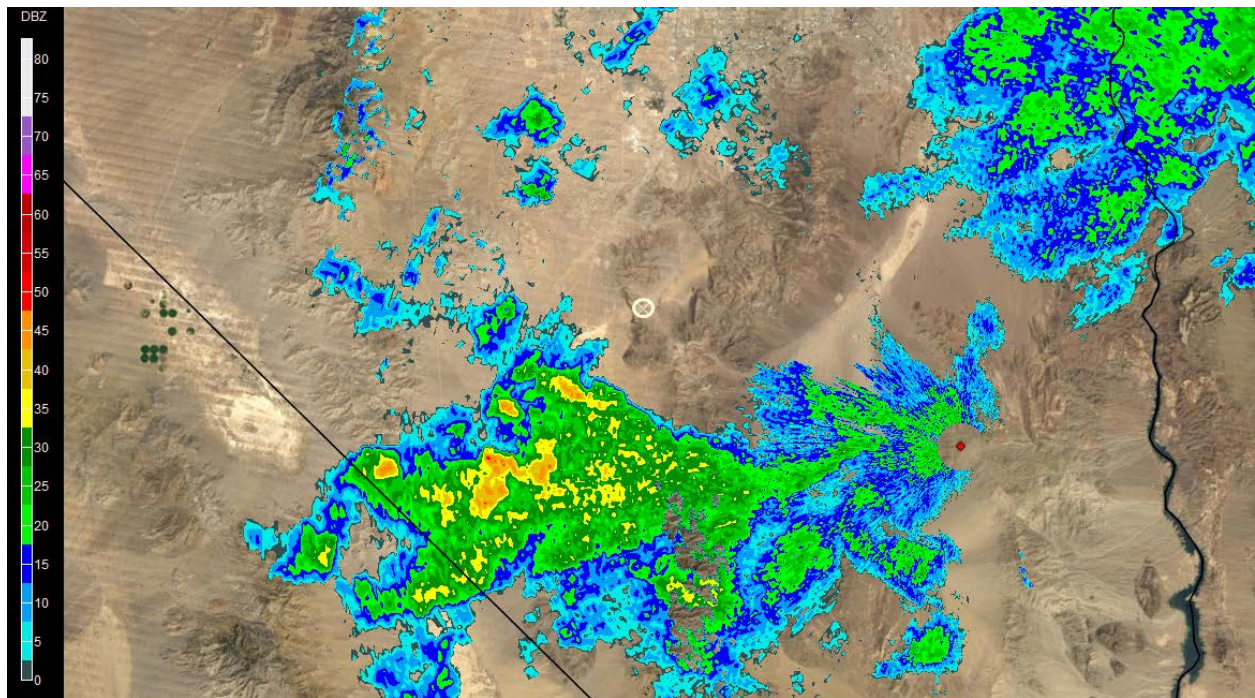


Figure 8 – KESX 0.468° Level-II reflectivity product from 1640:59 PDT. Accident location denoted by white circle.

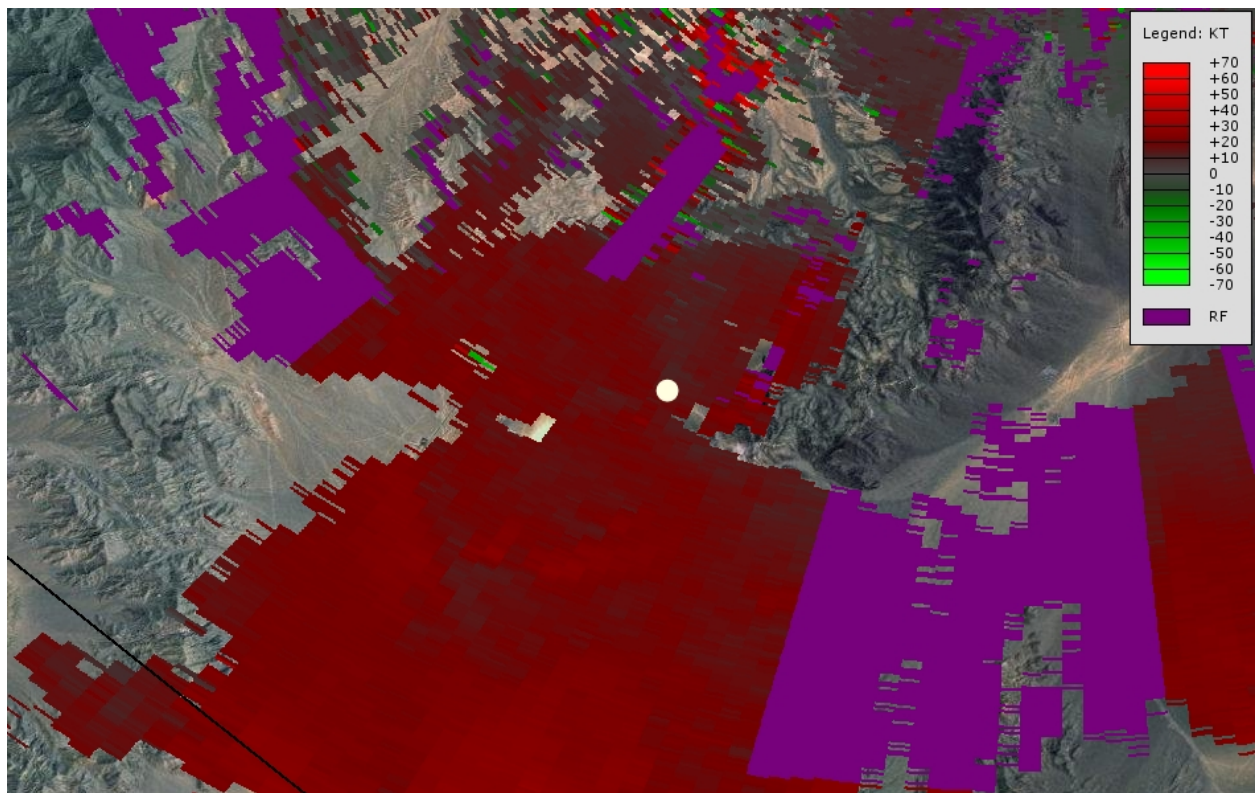


Figure 9 – TLAS 0.80° radial velocity product from 1630 PDT. Accident location denoted by white circle.

Upper Air Data

Atmospheric data were retrieved from an NWS 1700 PDT rawinsonde launch from Las Vegas, Nevada (rawinsonde station: 72388), where low-level meteorological data was likely retrieved beginning between 1600 and 1630 PDT. These data are presented in figure 10.

Near-surface wind was from about 015° at 9 knots. Above this level, the wind was generally from the northeast at magnitudes below about 25 knots. The most-unstable Convective Available Potential Energy (CAPE)⁴ parameter was 319 Joules/kilogram (from 927 hectopascals [hPa]). Maximum vertical velocity (MVV) for this atmosphere was calculated as 25 meters/second (about 49 knots). Downdraft CAPE (DCAPE)⁵ was measured at 221 Joules/kilogram. The T2Gust (“Severe Weather Gust Potential”) and WindEx (“Microburst Gust Potential”) parameters were 34 knots and 35 knots, respectively.

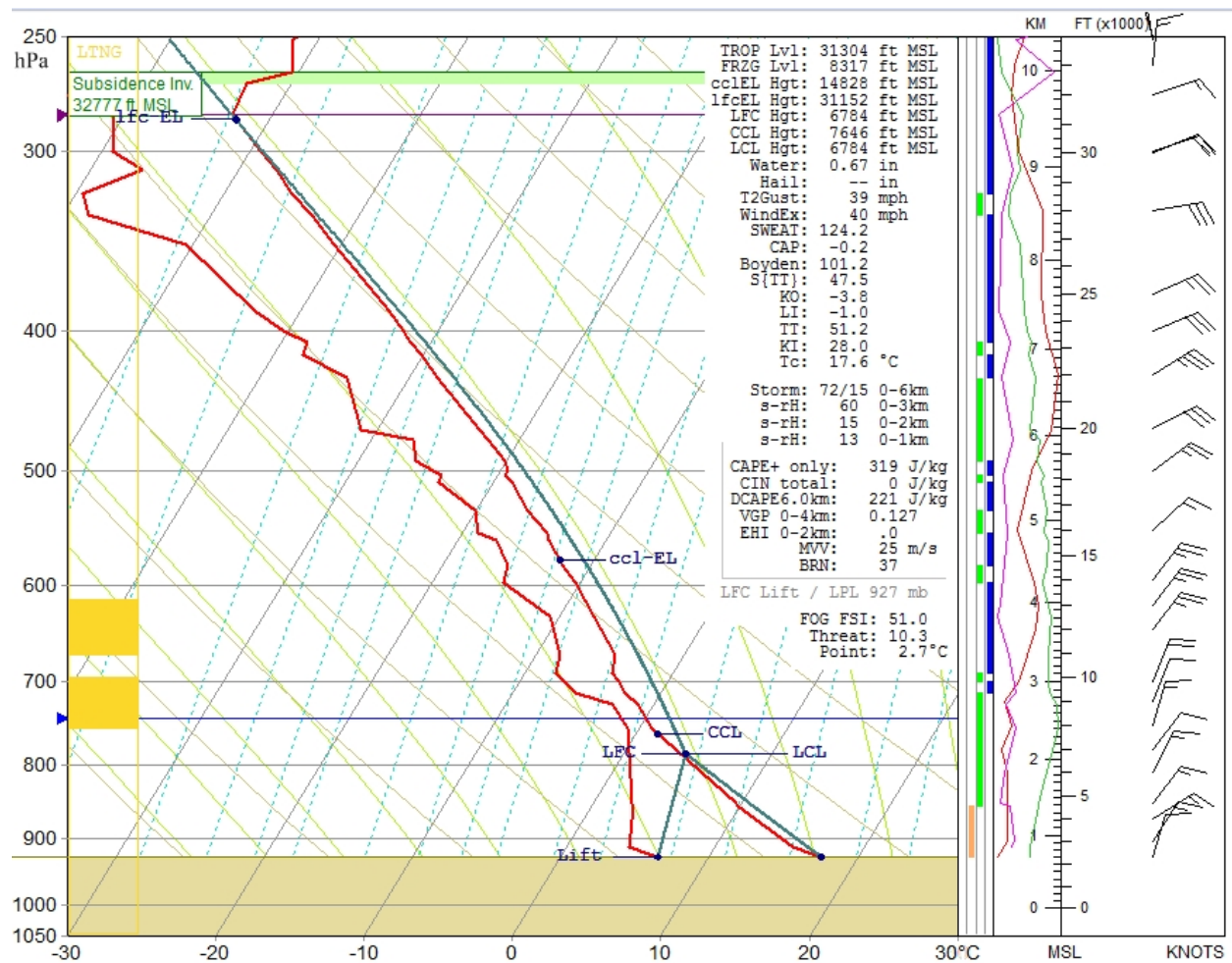


Figure 10 – Rawinsonde data from Las Vegas, Nevada, in SkewT/LogP format for 1700 PDT at the accident site, surface to 250 hPa.

⁴ Convective Available Potential Energy - A measure of the amount of energy available for convection. CAPE is directly related to the maximum potential vertical speed within an updraft; thus, higher values indicate greater potential for severe weather. 210 Joules/kilogram would be considered a weak value.

⁵ The DCAPE can be used to estimate the potential strength of rain-cooled downdrafts within thunderstorm convection, and is similar to CAPE. Larger DCAPE values are associated with stronger downdrafts. 736 Joules/kilogram would be considered a moderate value.

Pilot Reports

Publicly disseminated pilot reports⁶ made within about 30 minutes of the accident time near LAS for altitudes below 10,000 feet are presented here:

LAS UA /OV 5 NE/TM 2341/FL50/TP B747/TB MODERATE TURBULENCE/RM
HEAVY RAIN=

Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-15 visible (0.62 μ m) and infrared (10.7 μ m) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 1630 PDT are presented in figures 11 and 12. The GOES-15 imagery identified cloudy conditions over the accident location consistent with convection. The coolest infrared cloud-top temperatures were -48°C which, when considering the Las Vegas, Nevada, rawinsonde sounding, corresponded to cloud top heights of near 30,000 feet. It should be noted these figures have not been corrected for any parallax error.

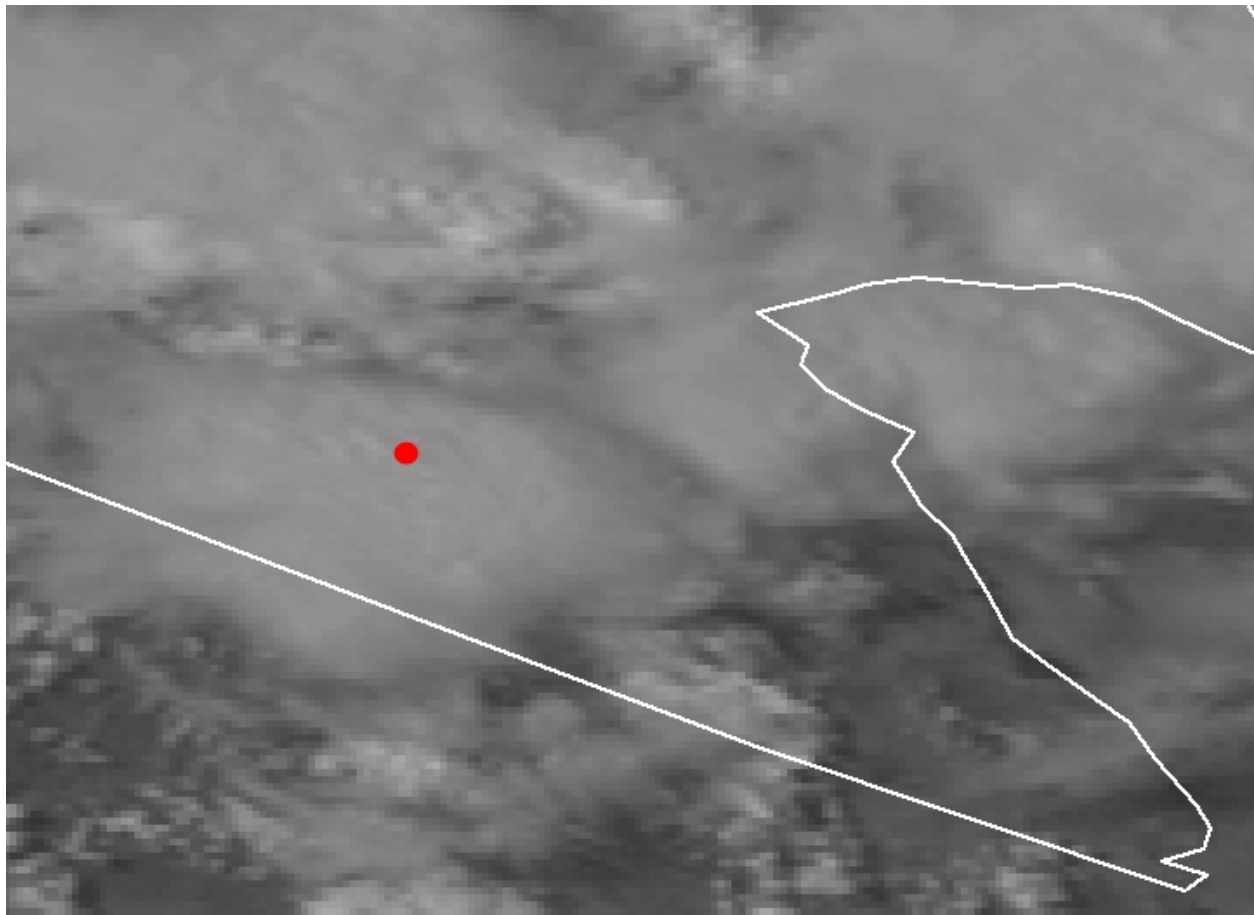


Figure 11 – GOES-15 0.62 μ m (visible) imagery from 1630 PDT. The accident location is denoted by the red circle.

⁶ Only pilot reports with the WMO header UBNV** were considered.

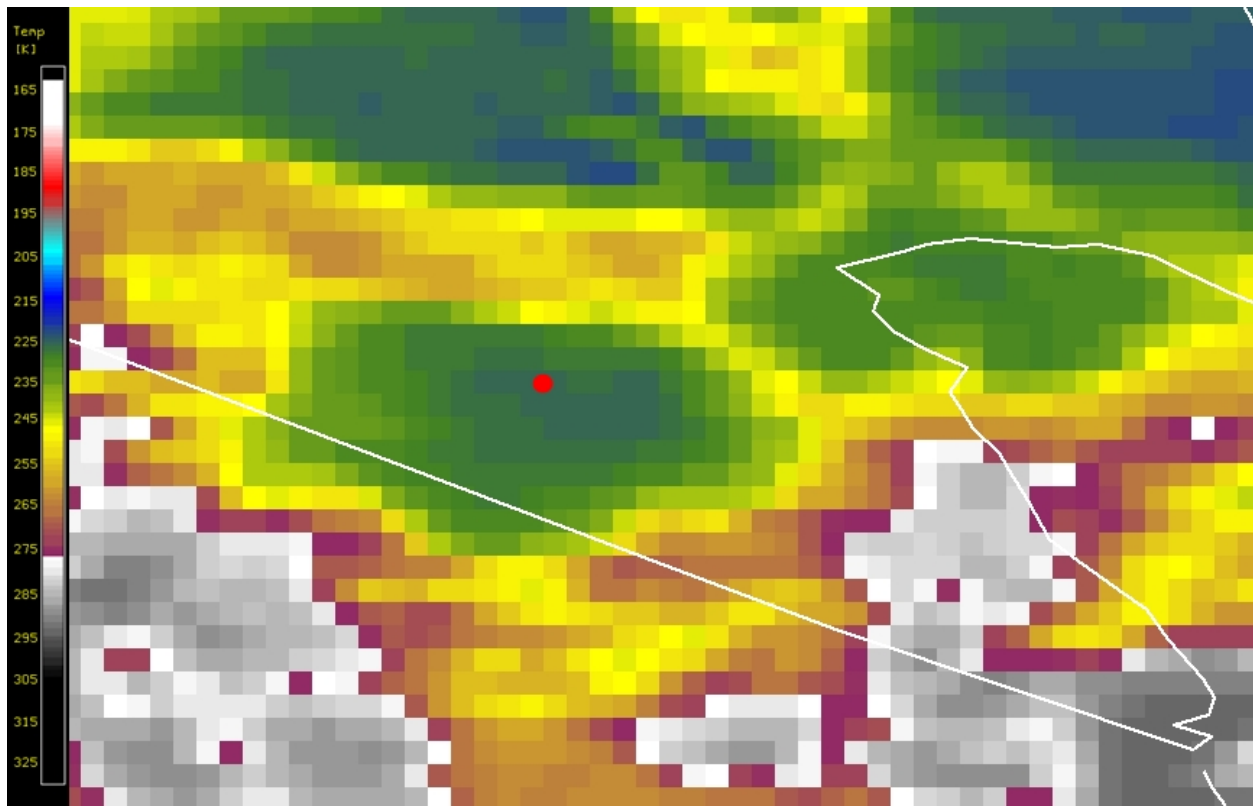


Figure 12 – GOES-15 10.7 μ m (infrared) color-enhanced imagery from 1630 PDT. The accident location is denoted by the red circle.

Aviation Section of the Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 1520 PDT by the NWS WFO in Las Vegas, Nevada, with geographic applicability to the accident location. The aviation portion of the AFD is presented here. It states that “erratic winds will be possible under any shower or thunderstorm activity.”

FXUS65 KVEF 302220

AFDVEF

AREA FORECAST DISCUSSION

NATIONAL WEATHER SERVICE LAS VEGAS NV

320 PM PDT SAT APR 30 2016

.AVIATION...FOR MCCARRAN...A SECOND ROUND OF SHOWERS AND ISOLATED THUNDERSTORMS ARE CURRENTLY MOVING WESTWARD TOWARD THE LAS VEGAS VALLEY. THIS ACTIVITY WILL SPREAD ACROSS THE VALLEY BETWEEN 2200 AND 2300 THIS AFTERNOON...YIELDING ANOTHER ROUND OF RAIN...LOW CIGS...MOUNTAIN OBSCURATIONS...AND ICING AS LOW AS 10K FEET THROUGH THIS EVENING. LIGHTNING ASSOCIATED WITH THIS ACTIVITY CONTINUES TO DIMINISH EAST OF THE VALLEY. THOUGH THUNDERSTORM CHANCES ARE GENERALLY LOW...ISOLATED THUNDER CANNOT BE COMPLETELY RULED OUT. ERRATIC WINDS WILL BE POSSIBLE UNDER ANY SHOWER OR THUNDERSTORM

ACTIVITY. OTHERWISE...NORTH NORTHWEST TO NORTHEASTERLY WINDS ARE EXPECTED TO PREVAIL THROUGH THE OVERNIGHT HOURS. FOR THE REST OF SOUTHERN NEVADA...NORTHWEST ARIZONA...AND SOUTHEAST CALIFORNIA...A SECOND ROUND OF SHOWERS AND ISOLATED THUNDERSTORMS ARE CURRENTLY MOVING WESTWARD TOWARD THE LAS VEGAS VALLEY. THIS ACTIVITY WILL SPREAD ACROSS THE VALLEY BETWEEN 2200 AND 2300 THIS AFTERNOON...YIELDING ANOTHER ROUND OF RAIN...LOW CIGS...MOUNTAIN OBSCURATIONS...AND ICING AS LOW AS 10K FEET THROUGH THIS EVENING. A SECOND ROUND OF THUNDERSTORMS IS CURRENTLY DEVELOPING TO THE SOUTHEAST OF KEED AND KIFP AND GENERALLY MOVING NORTHWEST...WITH ISOLATED TO SCATTERED SHOWER DEVELOPMENT OVER INYO AND WESTERN SAN BERNARDINO COUNTIES AT THIS HOUR. EXPECT ACTIVITY TO TAPER OFF FROM NORTHWEST TO SOUTHEAST TONIGHT. ERRATIC WINDS WILL BE POSSIBLE UNDER ANY SHOWER OR THUNDERSTORM ACTIVITY. OTHERWISE...WINDS WILL GENERALLY PREVAIL FROM THE NORTH OVERNIGHT.

Area Forecast

An Area Forecast that included Nevada was issued by the Aviation Weather Center in Kansas City, Missouri, at 1245 PDT. The portion of the Area Forecast directed toward southern Nevada forecasted for the accident time: ceiling broken at 10,000 feet msl with cloud tops to FL250⁷, widely scattered light rain showers and thunderstorms with rain, cumulonimbus type clouds with tops to FL380.

FAUS45 KPCI 301945

FA5W

-SLCC FA 301945

SYNOPSIS AND VFR CLDS/WX

SYNOPSIS VALID UNTIL 011400

CLDS/WX VALID UNTIL 010800...OTLK VALID 010800-011400

ID MT WY NV UT CO AZ NM

.

SEE AIRMET SIERRA FOR IFR CONDS AND MTN OBSCN.

TS IMPLY SEV OR GTR TURB SEV ICE LLWS AND IFR CONDS.

NON MSL HGTS DENOTED BY AGL OR CIG.

.

SYNOPSIS...ALF..UPR LOW OVR S CNTRL NE MOVG EWD. UPR LOW OVR SERN CA/SWRN AZ BY 14Z OVR NERN AZ. BROAD TROF THRU CNTR OF FA WL MOV LTL THRU 14Z. SFC..LOW PRES OVR SWRN AZ WITH CDFNT THRU NWRN OLD MEX. LOW WL MOV LTL AND CDFNT WL WKN BY 03Z. WK STNR FNT OVR SWRN CO-N CNTRL NM-TX S PLAINS DRFTG SWD

⁷ Flight Level - 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 in Hg), the average sea-level pressure, and therefore is not necessarily the same as the aircraft's true altitude either above msl or agl.

AND WKNG BY 12Z. TROF OVR WRN MT-SERN ID-NWRN UT MOVG EWD
AND BY 14Z OVR ERN WA-ERN OR-NRN NV.

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NV

NWRN...SCT-BKN100 TOP 160. ISOL -SHRA. WND NE 20G30KT.

00Z SCT100 SCT CI. OTLK...VFR.

NERN-CNTRL...BKN100-120 TOP FL250. WDLY SCT -SHRA/TSRA. CB TOP
FL380. WND NE G25KT. 04Z SCT100 SCT-BKN150 TOP FL220. OTLK...VFR.

SRN...BKN100 TOP FL250. WDLY SCT -SHRA/TSRA. CB TOP FL380.
BECMG 0305 SCT120 BKN CI. OTLK...VFR.

AIRMETs

There was one Airmen's Meteorological Information (AIRMET) advisory active for the accident location for altitudes below 8,000 feet (which was about the freezing level according to the Las Vegas, Nevada, rawinsonde data). The following AIRMET for mountain obscuration was issued at 1345 PDT:

WAUS45 KPCI 302045

WA5S

-SLCS WA 302045

AIRMET SIERRA UPDT 3 FOR IFR AND MTN OBSCN VALID UNTIL 010300

.

AIRMET MTN OBSCN...NV UT CO AZ NM CA

FROM 40WSW HVE TO 40SE RSK TO 20WSW ABQ TO 30S SJN TO 20SSE DRK
TO 60S EED TO 60W HEC TO 20SSW BTY TO 40WSW HVE

MTNS OBSC BY CLDS/PCPN/BR. CONDS CONTG BYD 03Z THRU 09Z.

SIGMETs

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

There were several Convective SIGMETs active for the accident location at the accident time, though the one issued at 1555 PDT could be considered to have replaced the one issued at 1455 PDT.

At 1455 PDT the following Convective SIGMET was issued:

WSUS33 KPCI 302155

SIGW

-MKCW WST 302155

CONVECTIVE SIGMET 10W

VALID UNTIL 2355Z

AZ UT NV CA

FROM 30SSE ILC-30NNE INW-20SSE DRK-20SSE EED-30E BTY-30SSE ILC

AREA TS MOV FROM 16010KT. TOPS TO FL350.

At 1555 PDT the following Convective SIGMET was issued:

WSUS33 KPCI 302255

SIGW

-MKCW WST 302255

CONVECTIVE SIGMET 13W

VALID UNTIL 0055Z

AZ UT NV CA

FROM 50W HVE-30SE INW-20SSE EED-30ESE BTY-20S ILC-50W HVE

AREA TS MOV FROM 16010KT. TOPS TO FL350.

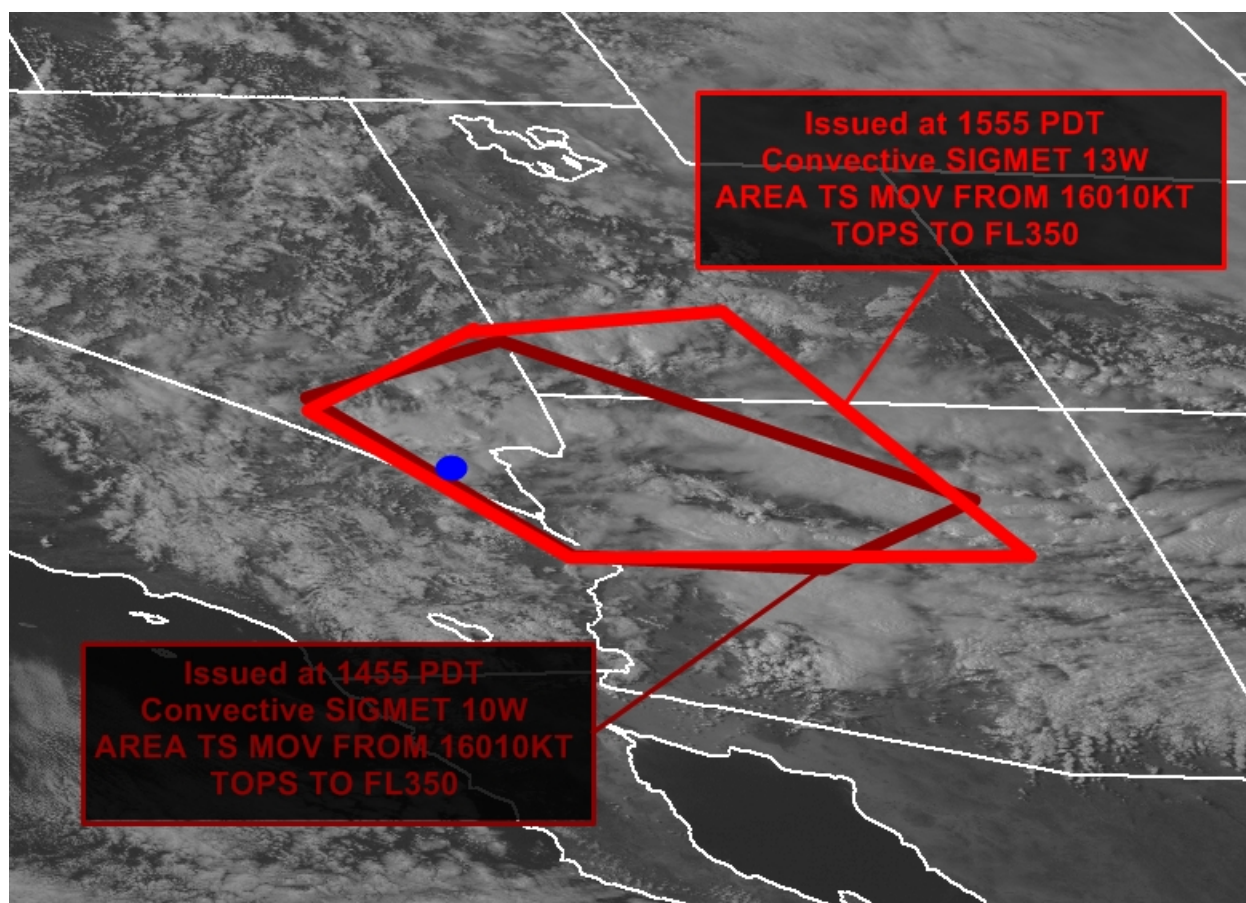


Figure 13 – Convective SIGMETs overlaid onto GOES-15 imagery from 1630 PDT. Accident location denoted by the blue dot.

CWSU Products

There were no Center Weather Advisories or Meteorological Impact Statements issued by the Center Weather Service Unit (CWSU) at the Los Angeles Air Route Traffic Control Center that were active within the accident region at the accident time.

Lightning

Figure 14 presents the total lightning activity detected by the Earth Networks Total Lightning Network (ENTLN) between 1600 and 1700 PDT. There was no activity between 1618 and 1641 PDT (inclusive).

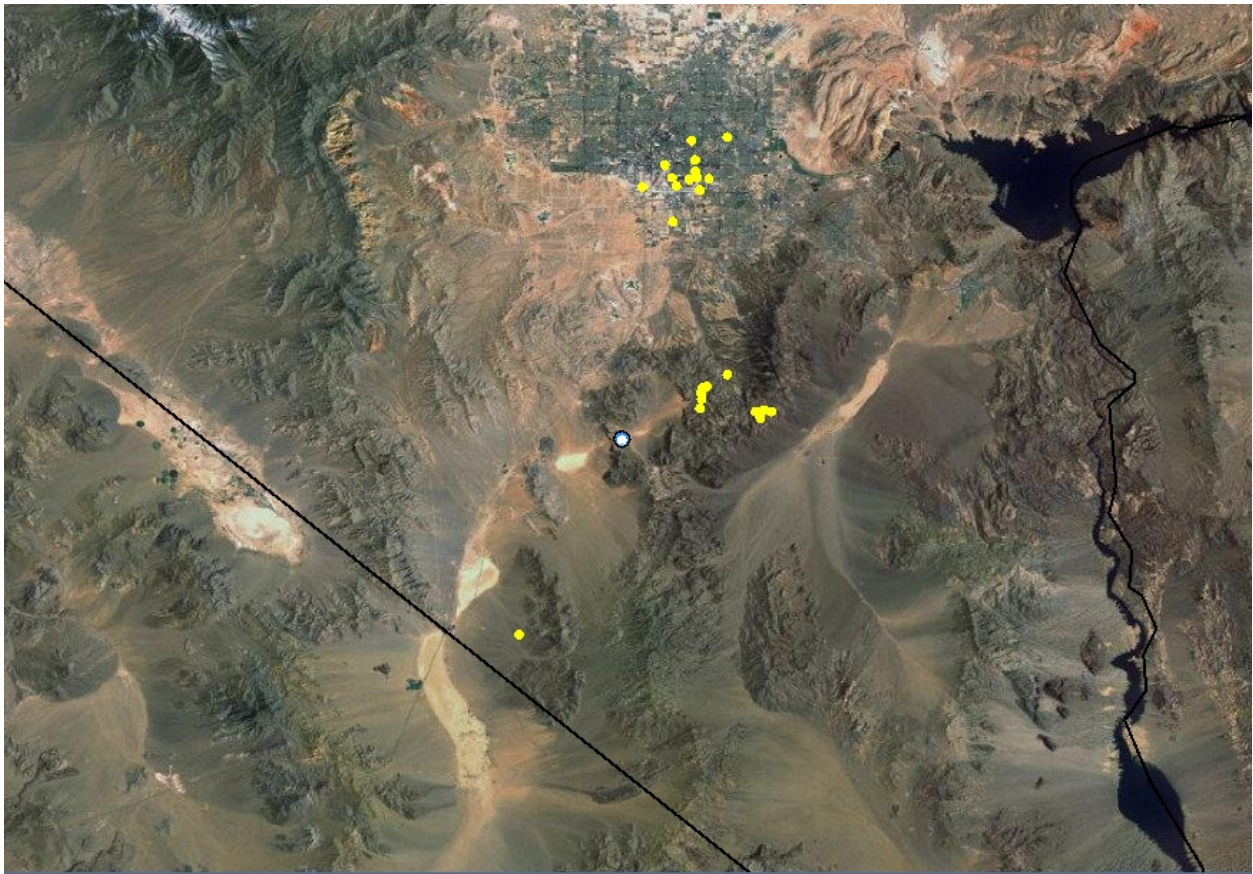


Figure 14 – ENTLN total lightning activity (yellow dots) between 1600 and 1700 PDT.

Astronomical Data

The astronomical data obtained from the United States Naval Observatory for 35° 49' north latitude and 115° 12' west longitude, indicated the following:

SUN

Sunset	1927 PDT
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MOON

Moonset	1250 PST
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*Submitted by: Mike Richards
NTSB, AS-30*