



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

July 9, 2020

Factual Report

METEOROLOGY

CEN20LA186

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A. ACCIDENT

Location: Center, Texas
Date: May 20, 2020
Time: 1640 central daylight time
2140 Universal Coordinated Time (UTC)
Aircraft: Cessna T206H; Registration: N51610

B. METEOROLOGIST

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C. SUMMARY

On May 20, 2020, about 1640 central daylight time (CDT), a Cessna T206H airplane, N51610, was substantially damaged when it was involved in an accident near Center, Texas. The pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal cross-country flight.

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 central standard time (CDT) based upon the 24-hour clock, local time is -5 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 31.823056° N and longitude 94.154722° W, at an elevation of approximately 300 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) and the Weather Prediction Center (WPC) 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 change 2.

1.1 Surface Analysis Chart

The southcentral section of the NWS Surface Analysis Chart for 1600 CDT is included in figure 1 with the approximate accident site marked by a red star. The chart depicted a low pressure system at 1002-hectopascals (hPa)¹ to the west-northwest of the accident site over northern Texas along a stationary front which extended east-southeast across central and southern Texas into southern Louisiana and into the Gulf of Mexico off the Mississippi, Alabama, and the Florida Panhandle coasts. A col² or neutral point was indicated in the pressure field over lower Louisiana. The accident site was located north of the stationary front on the cold air side of the front in an area with a relatively weak pressure gradient and on the western edge of the col.

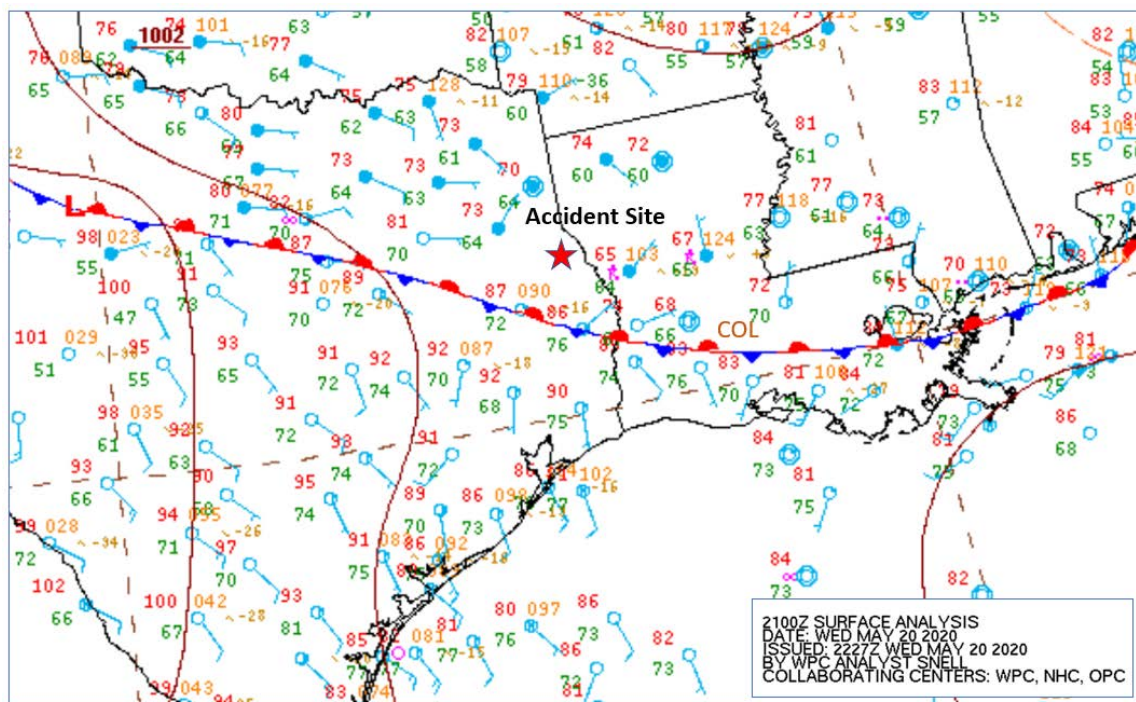


Figure 1 - Southcentral section of the NWS Surface Analysis Chart for 1600 CDT

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

² Col also called a saddle point or neutral point, is a point between two high and low pressure systems. A col is also a location of deformation in the wind field and will often strengthen the thermal pattern strengthening frontal development.

The station models south of the stationary front depicted southerly winds of 5 knots, with clear skies, with temperatures in the 90's degrees Fahrenheit (F), with dew point temperatures in the high 60's to mid 70's. North of the front over Texas and northern Louisiana the station models depicted northeast to easterly winds of 5 knots, broken to overcast cloud cover, with temperatures generally in the 70's. Immediately east of the accident site over Louisiana several stations reported thunderstorm and rain showers.

1.2 National Composite Radar Mosaic

The National Composite Radar Mosaic for 1640 CDT is included as figure 2 with the approximate accident site marked by a red star. The radar mosaic depicted several well defined intense to extreme intensity echoes associated with thunderstorms east of the accident site over Louisiana. The closest echo was more than 20 miles east-southeast of the accident site.

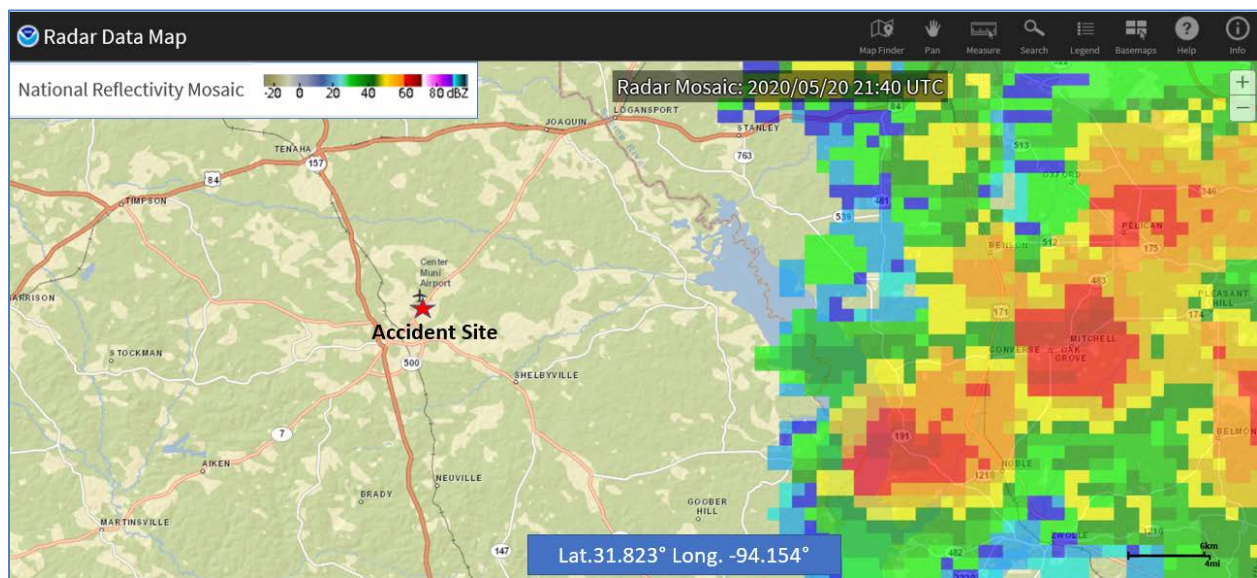


Figure 2 - National Composite Radar Mosaic over the area at 1640 CDT

1.3 Convective Outlook

The NWS Storm Prediction Center (SPC) is tasked with providing timely and accurate forecasts and watches for severe thunderstorms and tornadoes over the contiguous United States. One of their primary products highlighting the expected areas of organized thunderstorms is the Convective Outlook (AC). The intent of the chart is to identify to users like NWS forecasters, emergency managers, media, and pilots where the NWS SPC expects organized thunderstorms and severe thunderstorms³ to form. The SPC Day 1 Convective Outlook issued prior to the

³ A severe thunderstorm is one that produces a tornado, large hail over 1.0 inch in diameter, or outflow winds greater than 50 knots. While all thunderstorms imply the likelihood of severe turbulence, a severe thunderstorm implies a high likelihood of severe to extreme turbulence, wind shear, and a high probability of encountering hail.

accident at about 1130 CDT is included as figure 3 with the approximate accident site marked by a red star and is followed by the text bulletin issued with the graphic. The accident site was in an area where general air mass type convective were possible with a marginal risk of severe thunderstorms immediately east-southeast over Louisiana where thunderstorms had developed north of the frontal boundary defined as “elevated thunderstorms⁴”. A slight risk of severe thunderstorms was also expected over western and northwest Texas, generally south of the flight route from Colorado.

May 20, 2020 1630 UTC Day 1 Convective Outlook

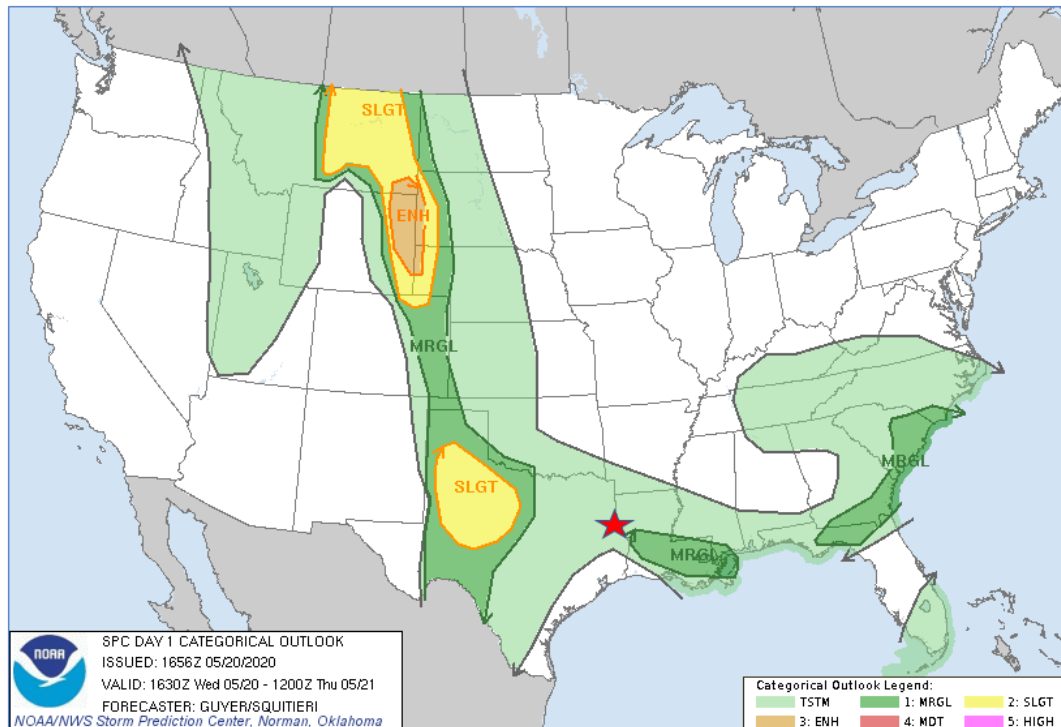


Figure 3 – Day 1 Convective Outlook issued at about 1130 CDT

The text version of the Convective Outlook for the period was as follows:

SPC AC 201656

Day 1 Convective Outlook

NWS Storm Prediction Center Norman OK

1156 AM CDT Wed May 20 2020

Valid 201630Z - 211200Z

⁴ Elevated thunderstorms – are formed by lifting of air that is warm, moist, and unstable at some level well above the surface. These storms are common north of stationary and warm fronts in the cool air sector, where the warm moist air overruns the frontal surface aloft. These storms often produce heavy rainfall, lightning, and hail, but seldom produce tornadoes or organized damaging winds such as gust fronts, as the layer of cool, stable air near the surface tends to “insulate” the surface from stronger winds and rotation in the storm aloft.

...THERE IS AN ENHANCED RISK OF SEVERE THUNDERSTORMS ACROSS THE NORTH-CENTRAL HIGH PLAINS...

...THERE IS A SLIGHT RISK OF SEVERE THUNDERSTORMS ACROSS WEST/NORTHWEST TEXAS...

...SUMMARY...

Severe thunderstorms are expected this afternoon and evening across a broad portion of the High Plains.

...Eastern Wyoming/southeast Montana and Black Hills...

Influenced by increasing forcing for ascent/strengthening southerly mid/high-level winds ahead of the ejecting Great Basin/northern Rockies upper-level trough, widely scattered thunderstorms are still expected to initially develop near the Laramie range as well as the mountains of southern Montana by around mid-afternoon. Semi-discrete supercells are initially expected as storms mature, with large hail the primary risk along with some tornado potential. Upscale aggregation and outflow mergers will occur by early evening coincident with a general increase in convective coverage with time across portions of east-central/northeastern Wyoming to near the Black Hills and eastern MT.

...West/northwest Texas...

Development/intensification of thunderstorms is still expected by mid/late afternoon along the north/south-extending dryline and especially across the Llano Estacado vicinity near/just north of a surface triple point and nearby front where low-level/deep-layer shear and buoyancy will maximize. Large hail will likely be the primary risk with initial intense supercell development. Storm mergers will occur over time and downdraft/outflow prevalence will support aggregating/upscale-growing clusters during the evening, with a severe hail/wind threat spreading southeastward toward the Rolling Plains/Big Country/west-central Texas.

...North Florida to coastal Carolinas...

A moist warm-sector air mass persists across the region on the eastern/southern periphery of a Tennessee Valley/southern Appalachians-centered vertically stacked cyclone. One focus for short-term severe potential will remain along the immediate South Carolina coast where the environment is conducive for an isolated damaging wind/brief tornado risk. A couple of severe thunderstorms could also occur near the effective boundary that extends southwestward across far southern Georgia and northern Florida.

...Louisiana...

Elevated thunderstorms are occurring at midday across west-central Louisiana. These storms may continue to regenerate and gradually build southeastward in vicinity of a front that extends roughly WNW/ESE across the region. Hail locally to marginally severe levels may continue to occur, and while not certain, a damaging wind threat may exist if storms development occurs into the warmer air along/just south of the boundary across southern Louisiana.

..Guyer/Squitieri.. 05/20/2020

NOTE: THE NEXT DAY 1 OUTLOOK IS SCHEDULED BY 2000Z

2.0 Surface Observations

The official observations issued surrounding the accident site were documented using standard meteorological aerodrome reports (METARs) and specials (SPECI). Cloud heights are reported

above ground level (agl) in the following section, and the magnetic variation was estimated at 2° east based on the latest sectional chart for the area.

2.1 Center, Texas

The Center Municipal Airport (KF17), Center, Texas, had an Automated Weather Observation System (AWOS) which normally broadcasts conditions locally on 128.775 MHz, had a published phone number for users to access the latest observation, and disseminated observations every 20-minutes. However, according to the Airport Manager due to the airport being closed for construction and a lightning strike which damaged a circuit board in the AWOS, the system was turned off on April 7, 2020 and therefore no observations were issued from the airport surrounding the period. The KF17 airport notice to airmen (NOTAM) was as follows.

Location	Number	Class	Start Date UTC	End Date UTC	Conditions
F17	04/005	Aerodrome	04/06/2020 1100	06/30/2020 2300	AD AP CLSD 2004061100-2006302300

2.2 Carthage, Texas

The next closest weather reporting facility that disseminated observations was from Panola County Airport-Sharpe Field (K4F2), Carthage, Texas, located approximately 22 miles north of the accident site at an elevation of 248 ft. The airport had an AWOS and issued observations every 20-minutes. The following conditions were reported at the time of the accident.

K4F2 weather observation at 1635 CDT, automated, wind from 060° at 3 knots, visibility 10 miles or more, ceiling overcast at 1,700 ft agl, temperature 20° Celsius (C), dew point 18° C, altimeter 29.87 inches of mercury (“Hg). Remarks: automated station with a precipitation discriminator, lightning distant⁵ northeast through southeast, temperature 19.9° C, dew point 17.5° C.

The general flight categories⁶ and raw observation with time referenced to UTC reported during the period from 1255 through 1755 CDT were as follows.

MVFR METAR K4F2 201755Z AUTO 11009KT 10SM OVC025 22/17 A2991 RMK AO2 T02200169 10222 20199=

MVFR METAR K4F2 201815Z AUTO 11010G15KT 10SM OVC025 22/17 A2990 RMK AO2 LTG DSNT SE T02180171=

⁵ Distant – refers to more than 10 statute miles from the point of observations.

⁶ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories based on weather conditions reported:

- 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.

MVFR METAR K4F2 201835Z AUTO 09007KT 10SM OVC023 22/17 A2990 RMK AO2 LTG DSNT SE
T02190171=

MVFR METAR K4F2 201855Z AUTO 09007KT 060V160 10SM OVC023 21/17 A2991 RMK AO2 LTG DSNT SE
T02130168=

MVFR METAR K4F2 201915Z AUTO 09006KT 10SM OVC023 21/17 A2991 RMK AO2 LTG DSNT SE
T02150173=

MVFR METAR K4F2 201935Z AUTO 09006KT 10SM OVC023 21/17 A2990 RMK AO2 LTG DSNT N AND SE
T02130172=

MVFR METAR K4F2 201955Z AUTO 09007KT 10SM OVC021 21/17 A2989 RMK AO2 LTG DSNT E AND SE
T02130174=

MVFR METAR K4F2 202015Z AUTO 10007KT 040V120 10SM OVC021 21/17 A2989 RMK AO2 LTG DSNT E
AND SE T02100175=

MVFR METAR K4F2 202035Z AUTO 05004KT 10SM OVC021 21/18 A2989 RMK AO2 LTG DSNT NE THRU SE
T02090176=

MVFR METAR K4F2 202055Z AUTO 05004KT 10SM VCTS OVC021 21/18 A2988 RMK AO2 LTG DSNT NE
THRU SE T02070175=

MVFR METAR K4F2 202115Z AUTO 08005KT 10SM OVC019 20/17 A2989 RMK AO2 LTG DSNT NE THRU SE
T01990172=

MVFR METAR K4F2 202135Z AUTO 06003KT 10SM OVC017 20/18 A2987 RMK AO2 LTG DSNT NE THRU
SE T01990175=

Accident 2140Z

MVFR METAR K4F2 202155Z AUTO 07004KT 10SM BKN013 OVC021 20/18 A2987 RMK AO2 LTG DSNT E
AND SE T01980177=

MVFR METAR K4F2 202215Z AUTO 04004KT 10SM BKN011 OVC021 20/18 A2987 RMK AO2 LTG DSNT E
AND SE T01950178=

MVFR METAR K4F2 202235Z AUTO 06003KT 10SM SCT011 SCT017 OVC021 20/18 A2986 RMK AO2 LTG
DSNT E AND SE T01980181=

MVFR METAR K4F2 202255Z AUTO 10004KT 10SM OVC023 20/18 A2986 RMK AO2 LTG DSNT E AND SE
T01990182=

MVFR METAR K4F2 202315Z AUTO 09003KT 10SM SCT010 OVC025 20/18 A2986 RMK AO2 LTG DSNT E AND
SE T02010184=

MVFR METAR K4F2 202335Z AUTO 10006KT 10SM BKN010 OVC025 20/18 A2986 RMK AO2 LTG DSNT SE
T02020184=

MVFR METAR K4F2 202355Z AUTO 09005KT 10SM OVC010 20/19 A2986 RMK AO2 LTG DSNT SE T02020187
10223 20195 402840195=

A review of the observations from 1255 through 1755 CDT indicated that MVFR conditions prevailed through the period with overcast clouds from 2,500 ft lowering immediately after the accident to 1,300 ft agl. A thunderstorm was reported in the vicinity or within 10 miles but not at

the station at 1555 CDT with lightning in the distance from the northeast, east and southeast during the period. No precipitation was recorded at the station during the period.

2.3 Mansfield, Louisiana

The next closest weather reporting facility was from C.E. 'Rusty' Williams Airport (K3F3) located 28 miles east of the accident site in Mansfield, Louisiana, at an elevation of 324 ft. The airport also had an AWOS system and issued observations every 20-minutes. The following conditions were reported at the approximate time of the accident.

K3F3 weather observation at 1635 CDT, automated, wind from 040° at 4 knots, visibility 3 miles in thunderstorm and light rain, ceiling overcast at 400 ft agl, temperature 18° C, dew point temperature 18° C, altimeter 29.91 "Hg. Remarks: automated station with a precipitation discriminator, lightning distant all quadrants, hourly precipitation 0.04 inches since 1555 CDT, temperature 18.3° C, dew point 18.0° C.

The general flight categories and raw observation reported during the period from 1255 through 1755 CDT were as follows.

MVFR METAR K3F3 201755Z AUTO 07006KT 10SM OVC027 21/17 A2995 RMK AO2 LTG DSNT E AND SE 60009 T02080170 10212 20192=

MVFR METAR K3F3 201815Z AUTO 09004KT 10SM -RA OVC025 21/17 A2995 RMK AO2 LTG DSNT E AND SE T02050167=

MVFR METAR K3F3 201835Z AUTO 12004KT 10SM OVC023 20/17 A2995 RMK AO2 LTG DSNT E AND SE T02010169=

MVFR METAR K3F3 201855Z AUTO 10005KT 10SM OVC023 20/17 A2995 RMK AO2 LTG DSNT SE 01950171=

MVFR METAR K3F3 201915Z AUTO 10003KT 3SM BR SCT010 BKN021 OVC026 19/18 A2995 RMK AO2 LTG DSNT NE THRU SE T01900176=

IFR METAR K3F3 201935Z AUTO 08004KT 2SM VCTSDZ BKN006 OVC013 19/18 A2994 RMK AO2 LTG DSNT NE THRU S T01860177=

IFR METAR K3F3 201955Z AUTO 04005KT 2 1/2SM TSDZ BKN006 OVC011 19/18 A2993 RMK AO2 LTG DSNT N THRU SE P0001 T01870182=

IFR METAR K3F3 202015Z AUTO 04005KT 4SM VCTS BR BKN006 OVC013 19/18 A2993 RMK AO2 LTG DSNT N THRU SE T01880184=

IFR METAR K3F3 202035Z AUTO 04005KT 2SM RA OVC004 19/18 A2992 RMK AO2 LTG DSNT ALQS T01870183=

LIFR METAR K3F3 202055Z AUTO 04005KT 2 1/2SM +VCTSDZ OVC004 19/18 A2992 RMK AO2 LTG DSNT ALQS P0001 60002 T01850181=

LIFR METAR K3F3 202115Z AUTO 03005KT 2SM +TSDZ OVC004 19/18 A2992 RMK AO2 LTG DSNT ALQS P0001 T01850182=

LIFR METAR K3F3 202135Z AUTO 04004KT 3SM -TSRA OVC004 18/18 A2991 RMK AO2 LTG DSNT ALQS P0004 T01830180=

Accident 2140Z

LIFR METAR K3F3 202155Z AUTO 06003KT 7SM -VCTSRA OVC004 19/18 A2990 RMK AO2 LTG DSNT ALQS P0004 T01850182=

LIFR METAR K3F3 202215Z AUTO 00000KT 7SM TS BKN004 BKN020 OVC029 19/18 A2990 RMK AO2 LTG DSNT ALQS T01860183=

LIFR METAR K3F3 202235Z AUTO 03005KT 7SM -VCTSRA BKN004 BKN020 OVC029 19/18 A2992 RMK AO2 LTG DSNT N THRU SE P0001 T01860183=

LIFR METAR K3F3 202255Z AUTO 00000KT 7SM VCTS OVC004 19/18 A2991 RMK AO2 LTG DSNT NE THRU SE P0001 T01860183=

The observations for K3F3 indicated MVFR conditions lowering to LIFR conditions as thunderstorms and light to heavy rain with ceiling overcast at 400 ft agl moved in the area between 1435 through 1755 CDT.

2.4 Nacogdoches, Texas

Nacogdoches A.L. Mangham Jr. Regional Airport (KOCH), Nacogdoches, Texas, was located 32 miles southwest of the accident site at an elevation of 354 ft. The airport had an AWOS and issued observations hourly with specials as required. The following conditions were reported at the time of the accident.

KOCH weather observation at 1556 CDT, automated, wind from 050° at 4 knots, visibility 10 miles or more, sky clear below 12,000 ft, temperature 28° C, dew point 22° C, altimeter 29.84 "Hg. Remarks: automated station with a precipitation discriminator, sea level pressure 1010.5-hPa, temperature 28.3° C, dew point 21.7° C, 3-hour pressure tendency fallen 1.6-hPa.

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

MVFR METAR KOCH 201756Z AUTO VRB04KT 10SM BKN016 OVC026 24/19 A2989 RMK AO2 SLP121 T02440194 10250 20211 58001=

MVFR METAR KOCH 201856Z AUTO 08006KT 10SM OVC025 26/21 A2988 RMK AO2 SLP117 T02610206=

VFR SPECI KOCH 201932Z AUTO 08005KT 10SM SCT029 27/21 A2987 RMK AO2=

VFR METAR KOCH 201956Z AUTO 08005KT 10SM BKN031 26/21 A2987 RMK AO2 SLP114 T02610211=

VFR METAR KOCH 202056Z AUTO 05004KT 10SM CLR 28/22 A2984 RMK AO2 SLP105 T02830217 58016

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VFR METAR KOCH 202156Z AUTO 07003KT 10SM CLR 28/22 A2983 RMK AO2 SLP101 T02780217=

VFR METAR KOCH 202256Z AUTO 06009KT 10SM FEW023 26/21 A2982 RMK AO2 SLP099 T02610211=

VFR METAR KOCH 202356Z AUTO 08008KT 10SM CLR 23/19 A2983 RMK AO2 SLP103 T02280194 10289
20228 55003=

A review of the KOCH observations indicated that MVFR conditions prevailed during the morning through 1430 CDT due to broken to overcast low cloud cover, which began to break up and dissipated by the time of the accident.

2.5 Shreveport, Louisiana

The next closest weather reporting location to the accident site was from Shreveport Regional Airport (KSHV), Shreveport, Louisiana, located approximately 41 miles northeast of the accident site at an elevation of 258 ft. The airport had an Automated Surface Observation System (ASOS) and was augmented by air traffic control personnel. The following conditions were reported at the approximate time of the accident.

KSHV weather observation at 1652 CDT, wind calm, visibility 1 3/4 miles in thunderstorm and heavy rain, a few clouds at 500 ft agl, few clouds at 2,500 ft, and overcast at 5,000 ft with cumulonimbus clouds, temperature 18° C, dew point temperature 18° C, altimeter 29.87 "Hg. Remarks: automated station with a precipitation discriminator, visibility 1 variable 5 statute miles, lightning distant southeast occasional lightning in-cloud, cloud-to-cloud, and cloud-to-ground southeast through south, thunderstorm southeast through south moving southeast, hourly precipitation since 1556 CDT 0.31 inches.

A review of the observations indicated that thunderstorms were reported in the vicinity of the airport between 1441 and 1756 CDT, with no strong wind gusts reported during the period. The general flight categories and reported during the period were as follows.

VFR METAR KSHV 201856Z 09008KT 10SM OVC037 22/16 A2991 RMK AO2 SLP123 T02220156 \$=

VFR SPECI KSHV 201941Z 12007KT 10SM VCTS OVC037 22/15 A2990 RMK AO2 LTG DSNT E RAB25E37
TSE35 P0000 T02170150=

VFR METAR KSHV 201956Z 08009KT 10SM VCTS OVC037 22/16 A2989 RMK AO2 LTG DSNT E-S RAB25E37
TSE35 SLP119 P0000 T02170161=

VFR SPECI KSHV 202015Z 09008KT 10SM -RA OVC037 21/17 A2989 RMK AO2 LTG DSNT E AND SE RAB12
P0000 T02060167=

VFR SPECI KSHV 202021Z 08008KT 10SM -TSRA OVC037 21/16 A2989 RMK AO2 LTG DSNT E AND SE AND
W RAB12 TSB21 P0000 T02060161=

MVFR SPECI KSHV 202049Z 05006KT 3SM +TSRA BR BKN036 OVC045 19/17 A2990 RMK AO2 LTG DSNT E-
S RAB12 TSB21 FRQ LTGICCG ALQDS TS ALQDS MOV SE P0015 T01890172=

MVFR METAR KSHV 202056Z 06009KT 3SM +TSRA BR BKN036CB OVC045 19/18 A2989 RMK AO2 LTG DSNT
SE RAB12 TSB21 SLP118 FRQ LTGICCG ALQDS TS ALQDS MOV SE P0017 60017 T01890178
56009=

IFR SPECI KSHV 202103Z 09007KT 1 1/2SM +TSRA BR BKN033CB OVC047 18/17 A2988 RMK AO2 LTG
DSNT SE OCNL LTGICCCCG ALQDS TS ALQDS MOV SE P0014 T01830172=

IFR SPECI KSHV 202118Z 11007KT 2SM TSRA BR FEW008 SCT025 OVC050CB 18/17 A2988 RMK AO2 LTG

DSNT E-S OCNL LTGICCCCG ALQDS TS ALQDS MOV SE P0024 T01830172=

MVFR SPECI KSHV 202128Z 11006KT 3SM -TSRA BR FEW008 SCT025 OVC050CB 18/18 A2988 RMK AO2
LTG DSNT E-S OCNL LTGICCCCG OHD-SE TS OHD-SE MOV SE P0026 T01830178=

Accident 2140Z

IFR SPECI KSHV 202152Z 00000KT 1 3/4SM +TSRA FEW005 FEW025 OVC050CB 18/18 A2987 RMK AO2
VIS 1V5 LTG DSNT SE OCNL LTGICCCCG SE-S TS SE-S MOV SE P0031=

IFR METAR KSHV 202156Z 00000KT 1 1/4SM +TSRA FEW005 FEW025 OVC050CB 18/17 A2987 RMK AO2
LTG DSNT SE AND S SLP113 FRQ LTGICCG OHD-SE-S TS OHD-SE-S MOV SE P0033
T01830172=

MVFR SPECI KSHV 202209Z 00000KT 5SM -TSRA FEW007 BKN041CB OVC060 19/18 A2986 RMK AO2 LTG
DSNT SE AND S OCNL LTGICCG SE-S TS SE-S MOV SE P0009 T01890178=

VFR SPECI KSHV 202231Z 11003KT 10SM -RA FEW007 OVC050 19/18 A2986 RMK AO2 LTG DSNT SE AND
S TSE31 OCNL LTGICCG SE-S TS SE-S MOV SE P0009 T01940178=

VFR METAR KSHV 202256Z 10003KT 10SM FEW007 OVC044 19/18 A2986 RMK AO2 LTG DSNT SE AND S
RAE36 TSE31 SLP108 OCNL LTGICCG DSNT SE TS MOV SE CB DSNT SE MOV SE P0009
T01940178=

The observations from KSHV reported VFR conditions deteriorating to IFR conditions due to heavy rain in thunderstorms during the hour at the time of the accident, with occasional in-cloud, cloud-to-cloud, and cloud-to-ground lightning. No strong outflow winds were noted during the period.

2.6 Gainesville, Texas

The accident flight made a refueling stop at Gainesville Municipal Airport (KGLE), Gainesville, Texas located approximately 188 miles northwest of the accident site at an elevation of 846 ft. The airport had an AWOS and reported the following conditions surrounding the period. The accident airplane departed KGLE at approximately 1440 CDT with the following condition being reported at that time.

KGLE weather observation at 1435 CDT, automated, wind from 100° at 9 knots, visibility 10 miles or more, ceiling overcast at 2,500 ft, temperature 24° C, dew point 16° C, altimeter 29.90 "Hg. Remarks: automated observation system with a precipitation discriminator, temperature 23.8° C, dew point 16.4° C, precipitation identifier information not available.

The raw observations and general flight categories between 1235 and 1615 CDT prior to the accident airplane landing and departure were as follows.

MVFR METAR KGLE 201735Z AUTO 11008KT 10SM OVC023 22/16 A2992 RMK AO2 T02210156 PWINO

MVFR METAR KGLE 201755Z AUTO 11007KT 10SM OVC023 22/16 A2991 RMK AO2 T02200155 10221 20188
PWINO

MVFR METAR KGLE 201815Z AUTO 13011KT 10SM OVC023 22/16 A2992 RMK AO2 T02200156 PWINO

MVFR METAR KGLE 201835Z AUTO 09008KT 10SM OVC023 23/16 A2991 RMK AO2 T02250159 PWINO

MVFR METAR KGLE 201855Z AUTO 12009KT 10SM OVC023 23/16 A2991 RMK AO2 T02280161 PWINO

MVFR METAR KGLE 201915Z AUTO 12008KT 10SM OVC023 23/16 A2990 RMK AO2 T02340163 PWINO

MVFR METAR KGLE 201935Z AUTO 10009KT 10SM OVC025 24/16 A2990 RMK AO2 T02380164 PWINO

Departure 1940Z

*MVFR METAR KGLE 201955Z AUTO 11010KT 10SM BKN025 OVC038 24/17 A2989 RMK AO2 T02410166
PWINO*

*VFR METAR KGLE 202015Z AUTO 10011KT 10SM SCT025 OVC038 24/17 A2988 RMK AO2 T02440171
PWINO*

*VFR METAR KGLE 202035Z AUTO 11010KT 080V140 10SM SCT025 OVC038 24/17 A2988 RMK AO2
T02430172 PWINO*

*VFR METAR KGLE 202055Z AUTO 10010KT 10SM SCT026 OVC038 24/17 A2987 RMK AO2 T02410169
PWINO*

*VFR METAR KGLE 202115Z AUTO 12009G14KT 10SM SCT026 OVC036 24/17 A2987 RMK AO2 T02410173
PWINO*

The observations from KGLE indicated that MVFR conditions prevailed at the time the accident airplane arrived and departed due to an overcast cloud layer between 2,300 and 2,500 ft agl. The overcast ceiling raised to 3,600 to 3,800 ft approximately 35 minutes after the aircraft departed.

2.7 METAR Display

A display of the METARs from the NWS Aviation Weather Center's website for 1645 CDT is included as figure 4 with the weather radar overlaid and the approximate accident site marked by a red star. The image depicted the general flight categories by color coded station models and indicated generally MVFR conditions northwest through north of the accident site in Texas and Louisiana, with IFR to LIFR conditions to the northeast, east, and southeast of the accident site in Louisiana. VFR conditions were noted to the southwest through south of the accident site.

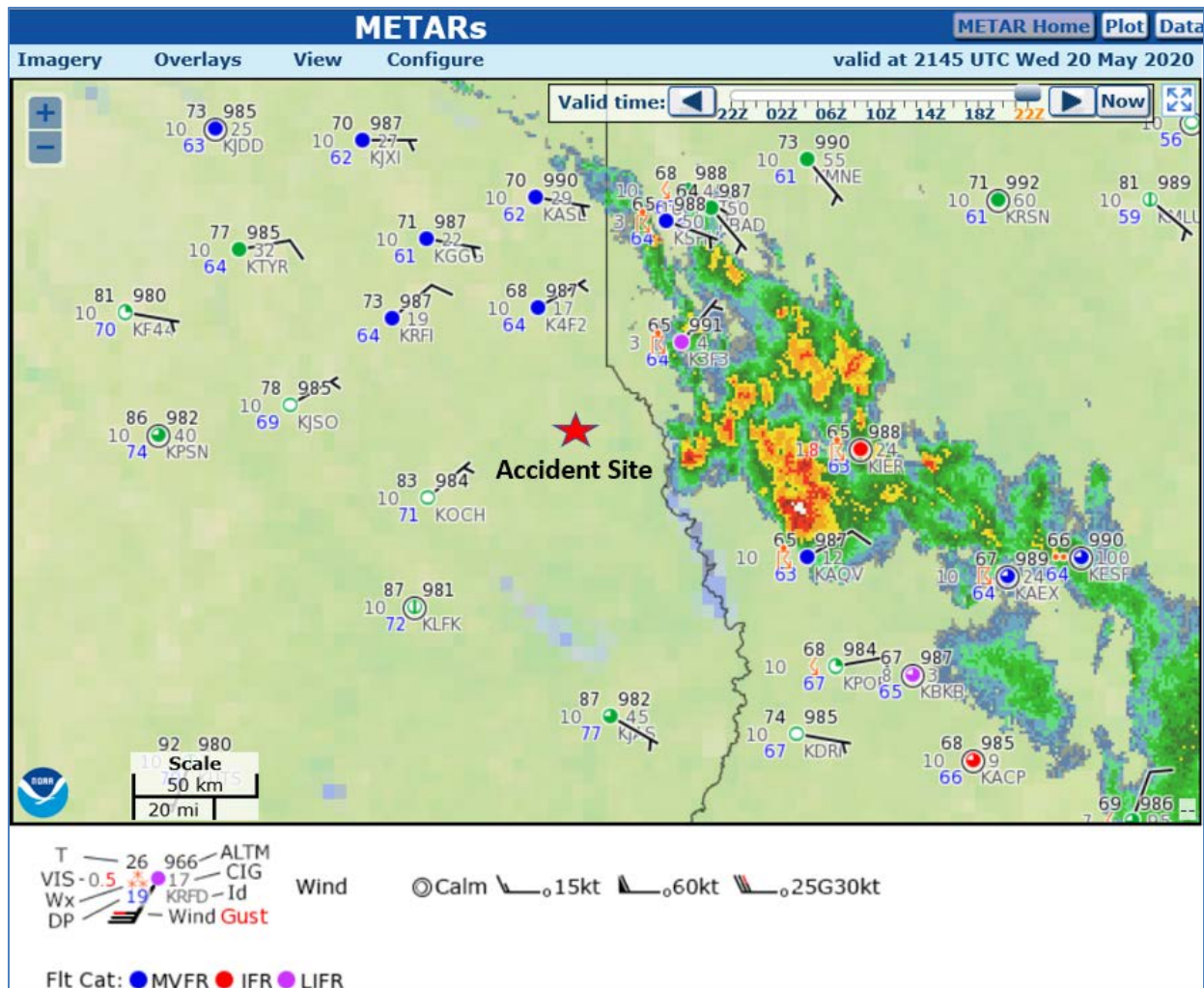


Figure 4 - METAR display at 1645 CDT with the weather radar overlaid and accident site marked

2.8 MesoWest Display

A search of additional weather reporting systems across the region through the MesoWest website⁷ operated by the University of Utah was also documented. Figure 5 is a plot of all the official NWS METAR observations, Remote Automated Weather Stations (RAWS), and other observational networks reporting across eastern Texas and western Louisiana at 1645 CDT on May 20, 2020, with the accident site marked by a red star. The display depicts the temperature in a white box in °F, and wind direction and speed in miles per hour (mph).

⁷ <https://mesowest.utah.edu/>

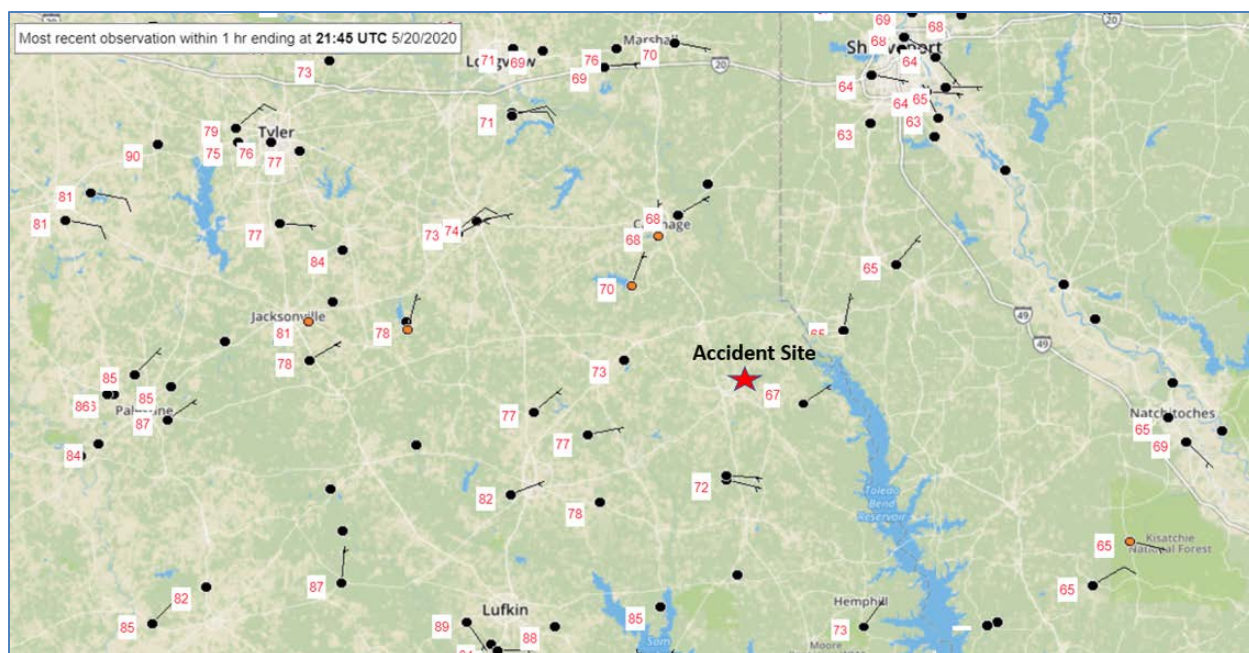


Figure 5 - MesoWest display of observations at 1645 CDT over eastern Texas and western Louisiana

The chart depicted general light east to northeast winds of 5 mph or less in the area immediately surrounding the accident site. The station closest immediately east-southeast of the accident site was identified as Sabine North 2 (DRKT2)⁸ at an elevation of 229 ft, which indicated a wind from the northeast at 1 mph with a peak gust of 5 mph, temperature of 67° F, dew point of 65° F, with a relative humidity of 93%. The DRKT2 station did not report visibility, precipitation, or sky cover.

3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site a High-Resolution Rapid Refresh (HRRR)⁹ numerical model data was retrieved from the NOAA Air Resources Laboratory and plotted on a standard Skew T log P diagram¹⁰ using the complete Rawinsonde Observation RAOB program software¹¹. Figure 6 is the HRRR numerical model for 1600 CDT over the accident site from the surface through 450-hPa or approximately 21,000 ft.

⁸ Sabine North 2 (DRKT2) location Latitude 31.8024° N, Longitude -94.0002° W.

⁹ 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.

¹⁰ 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.

¹¹ 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.

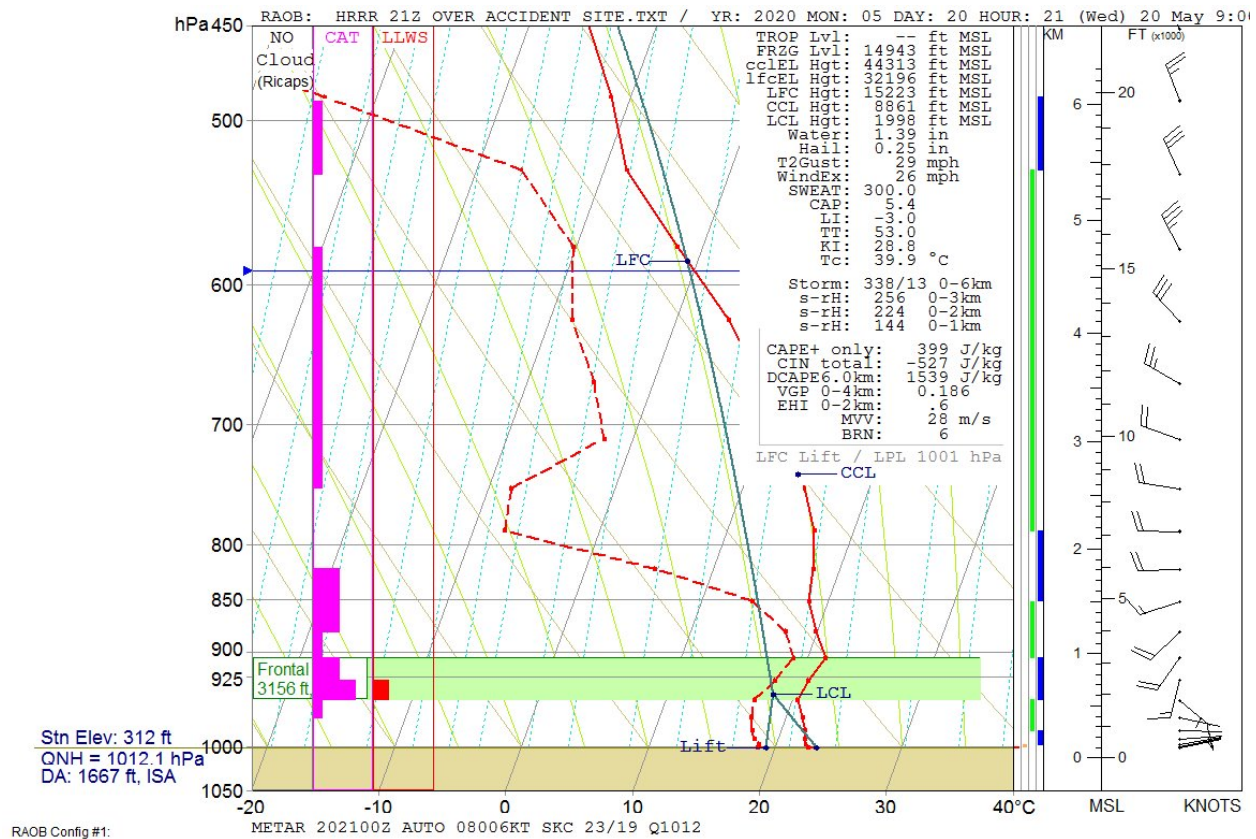


Figure 6 - HRRR numerical model for 1600 CDT over the accident site

The 1600 CDT HRRR sounding indicated a surface temperature of 23° C (73° F), a dew point of 19° C (66° F), with a relative humidity of 78%, with an estimated elevation of 310 ft and a density altitude of 1,667 ft. The sounding depicted a lifted condensation level (LCL)¹² at 1,686 ft agl (1,998 ft msl), a convective condensation level (CCL)¹³ at 8,861 ft msl, and a level of free convection (LFC)¹⁴ at 15,223 ft msl. A frontal inversion (green shaded area) was noted between the LCL and 3,156 ft, where temperature increased with altitude. The sounding had a marginal precipitable water¹⁵ content of 1.39 inches. The freezing level was at approximately 15,000 ft. The atmosphere was characterized as conditional unstable with a Lifted Index¹⁶ of -3.0, and a K-index¹⁷ of 28.8, which indicated an approximately 60% of air mass type thunderstorms across the

¹² Lifted Condensation Level (LCL) - the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

¹³ Convective Condensation Level (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.

¹⁴ Level of Free Convection (LFC) - the last level where a parcel becomes buoyant, or "warmer" than the environmental temperature at the same level. The LFC represents the bottom of the layer containing CAPE.

¹⁵ Precipitable Water (PW) is a measure of the depth of liquid water at the surface that would result after precipitating all of the water vapor in a vertical column over a given location, usually extending from the surface to 300 mb.

¹⁶ Lifted Index (LI) - the difference between the lifted parcel temperature at 500 hPa and the 500 hPa temperature in the sounding. Negative values denote parcels that are warmer than the background 500 hPa temperatures and are thus buoyant or "unstable". The LI Index was originally intended to utilize average moisture and temperature properties within the planetary boundary layer.

¹⁷ K-Index is a measure of thunderstorm potential based on the vertical temperature lapse rate, and the amount and vertical extent of low-level moisture in the atmosphere.

region. The Convective Available Potential Energy (CAPE) value was weak at 399 Joules per kilogram. The T² Gust factor which estimates the maximum probable wind gust in air-mass thunderstorms and/or squall line wind gust potential was 25 knots (29 mph), with the microburst (WindEx) estimate for outflow winds of 23 knots (26 mph).

The HRRR model wind profile indicated light surface winds from the east at 5 knots, with winds abruptly veering to the southwest above the frontal inversion from 240° at 20 knots, and then veering to the west between 5,000 and 10,000 ft, and to the northwest above 10,000 ft at 20 to 35 knots. The mean 0 to 6 kilometer storm motion was from 338° at 13 knots. The sounding supported moderate turbulence between 1,600 ft and 3,000 ft msl where there was a strong vertical wind shear and direction shear in the wind field and in the stable layer of the frontal inversion.

A similar HRRR model sounding immediately after the accident at 1700 CDT is included as figure 7. The sounding depicted a CCL at 787 ft agl (1,099 ft msl), with the LCL at approximately 1,800 ft agl (2,113 ft msl). The frontal inversion continued to be depicted from the CCL through 3,000 ft. The RAOB algorithm indicated a broken layer of clouds at 1,500 ft agl with tops near 3,000 ft msl. The sounding indicated a more stable atmosphere than the 1600 CDT HRRR sounding with the LI of +1, with no CAPE values indicated.

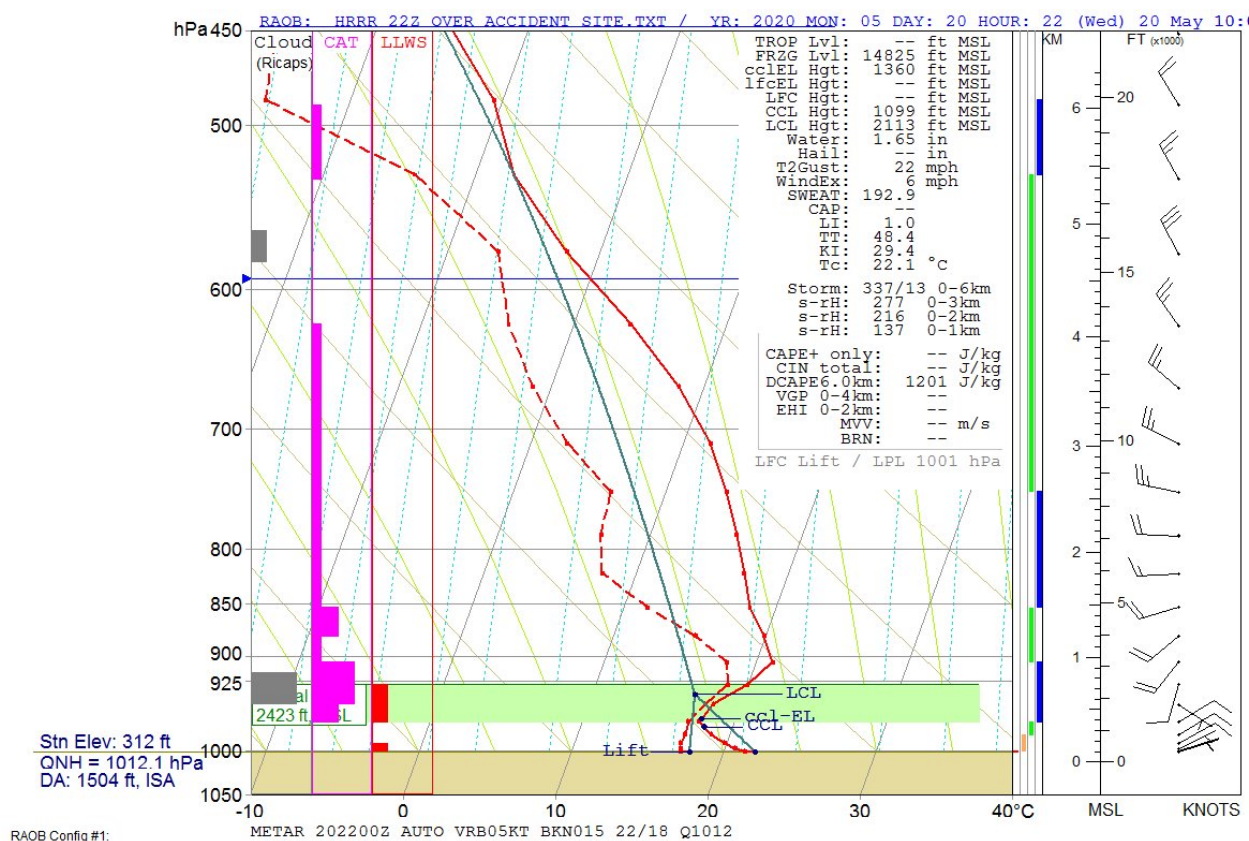


Figure 7 - HRRR model sounding for 1700 CDT over the accident site

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) imagery 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 (McIDAS) software. The infrared long wave and visible imagery were obtained for times 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 provided images at a resolution of 0.5 km.

Figure 8 is the GOES-16 infrared image for 1641 CDT at 2X magnification with a standard MB temperature enhancement curve applied to high light the higher and colder clouds typically associated with deep convection. The approximate accident site is marked by the white square to the west of an enhanced area of clouds associated with cumulonimbus clouds, with a lower layer of stratiform clouds extending over northeastern Texas. The radiative cloud top temperature over the accident site was 287 Kelvin or 13.8° C, which corresponded to cloud tops near 3,500 ft based on the HRRR sounding.

Figure 9 is the GOES-16 visible image for 1641 CDT at 2X magnification. An overcast layer of clouds obscures the accident site.

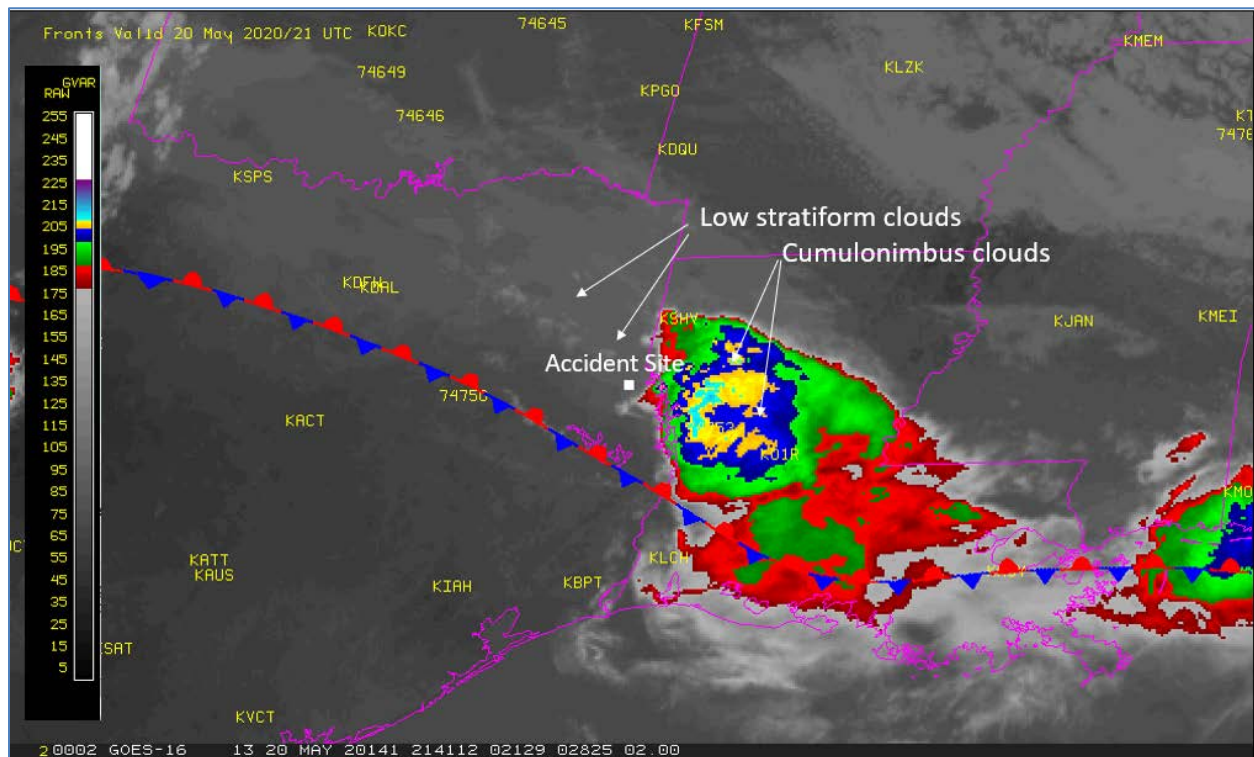


Figure 8 - GOES-16 infrared image at 1641 CDT at 2X magnification with a MB temperature enhance curve and fronts overlaid

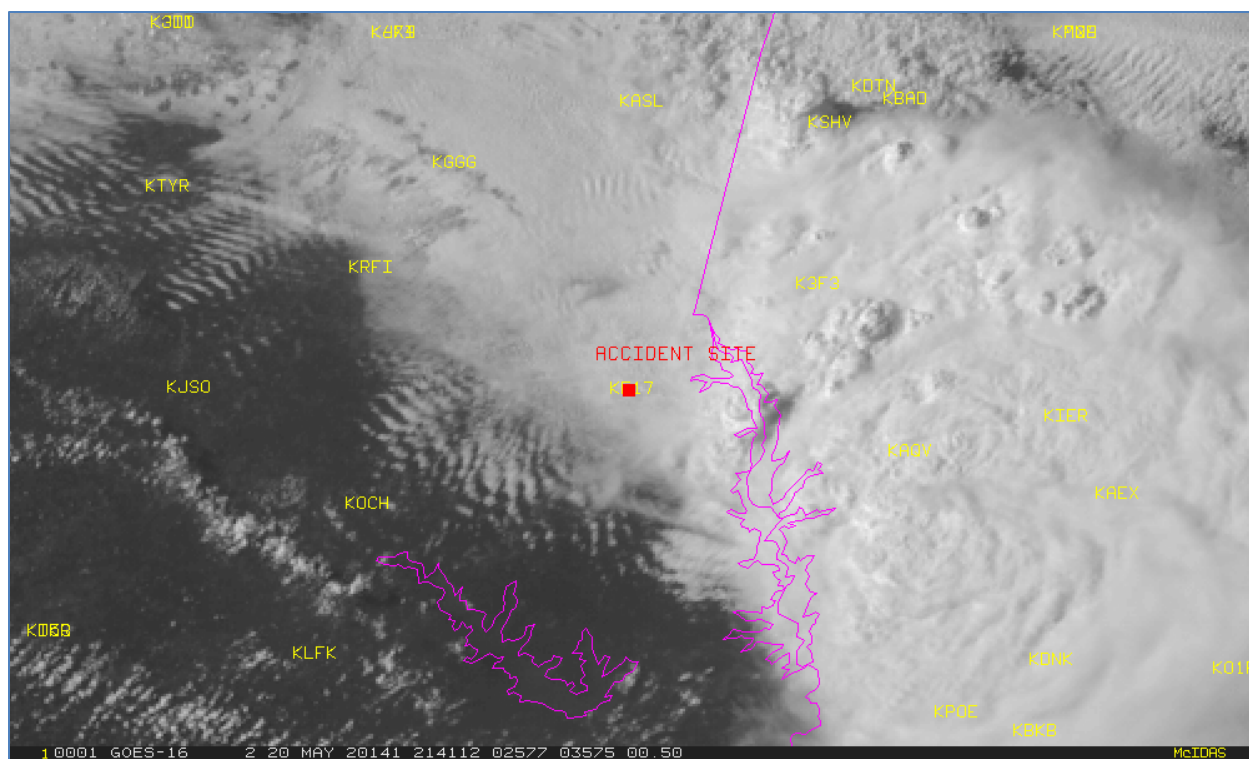


Figure 9 - GOES-16 visible image at 1641 CDT at 2X magnification

5.0 Weather Surveillance Radar Imagery

The closest NWS Weather Surveillance Radar 1988 Doppler (WSR-88D)¹⁸ was located approximately 41 miles northeast of the accident site in Shreveport (KSHV), Louisiana. 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.

During the period the KSHV WSR-88D was operating in the precipitation mode volume scan pattern 215 (VCP-215), where the radar makes 15 different elevation scans in 6 minutes. Assuming standard refraction¹⁹ of the WSR-88D's lowest 0.32° elevation beam at an antenna height of 387 ft, the center of the beam was at about 2,890 ft with the base at 830 ft and the top at 4,960 ft.

5.1 Reflectivity

Reflectivity is the measure of the efficiency of a target in intercepting and returning radio energy. With hydrometeors²⁰, it is a function of the drop size distribution, number of particles per

¹⁸ 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.

¹⁹ Standard Refraction in the atmosphere is when the temperature and humidity distributions are approximately average, and values set at the standard atmosphere.

²⁰ Hydrometeors are any product of condensation or sublimation of atmospheric water vapor, whether formed in the free atmosphere or at the earth's surface. Hydrometeors are classified as; (a) Liquid or solid water particles suspended

unit volume, physical state (ice or water), shape, and aspect. Reflectivity is normally displayed in decibels (dBZ²¹) and is a general measure of echo intensity. Figure 10 relates the NWS former video integrator and processor (VIP) intensity levels (1-6) versus the WSR-88D's display levels (0-15), precipitation mode reflectivity in decibels (DBZ), 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 10 - NWS VIP Levels 1-6, WSR-88D intensity, reflectivity, and rainfall rates

The FAA has taken the NWS previous VIP levels 1 to 6 intensity levels and has redefined the intensity levels for pilots in Advisory Circular AC 00-24C - "Thunderstorm". That AC further defines echoes less than 30 dBZ as "light" in intensity, "moderate" echoes 30-40 dBZ, "heavy" with echoes of >40-50 dBZ, and "extreme" intensity with echoes above >50 dBZ. These are the new standard radio phraseology terms used by air traffic controllers to describe weather conditions to pilots as shown in figure 11.

in the air: cloud, water droplets, mist or fog. (b) Liquid precipitation: drizzle and rain. (c) Freezing precipitation: freezing drizzle and freezing rain. (d) Solid (frozen) precipitation: ice pellets, hail, snow, snow pellets, and ice crystals. (e) Falling particles that evaporate before reaching the ground: virga. (f) Liquid or solid water particles lifted by the wind from the earth's surface: drifting snow, blowing snow, blowing spray. (g) Liquid or solid deposits on exposed objects: dew, frost, rime, and glaze ice.

²¹ dBZ - 10 log Ze

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

Figure 11 - FAA precipitation intensity terminology

5.2 Base Reflectivity Images

The NWS WSR-88D base reflectivity images are the individual elevation scan images for the VCP being operated. The lowest 0.5° base reflectivity elevation scan is often the one radar product distributed by vendors and also available on NWS sites, unless the user has the analysis software to open and view all the VCP scanning strategy for storm structure and to identify other features.

Figures 12 through 20 are the KSHV WSR-88D 0.32° base reflectivity images from 1545 through 1642 CDT with the flight track overlaid (purple) to fit the time of the image. The images depicted a small area of echoes develop upstream of the airport near 50 dBZ or extreme intensity and move over and east of the airport between 1517 and 1524 CDT with several other extreme echoes 20 miles northeast through east-southeast of the accident site over Louisiana. The echoes were observed to move towards the southeast as indicated on the HRRR sounding storm motion. The intense echoes also had a high probability of producing hail based on the WSR-88D hail algorithms²². At the time of the accident at 1640 CDT the echo had moved to approximately 20 miles east-southeast of the station with only very light intensity echoes of 5 dBZ along the flight path, which were associated with scattering within the low stratiform clouds.

A review of the KSHV WSR-88D radial velocity winds did not indicate any strong outflow winds over the area.

A depiction of the flight track of N51610 with spot altitudes is provided as figure 21 broken down by time segments used in the KSHV WSR-88D base reflectivity images.

²² WSR-88D Hail Index (HI) algorithm provides a probability the storm will produce severe-sized hail of ¾ inch or large hail, (Probability of Severe Hail (POSH)) and utilized in the GR2 Analysis software program, which was also cross referenced in this case.

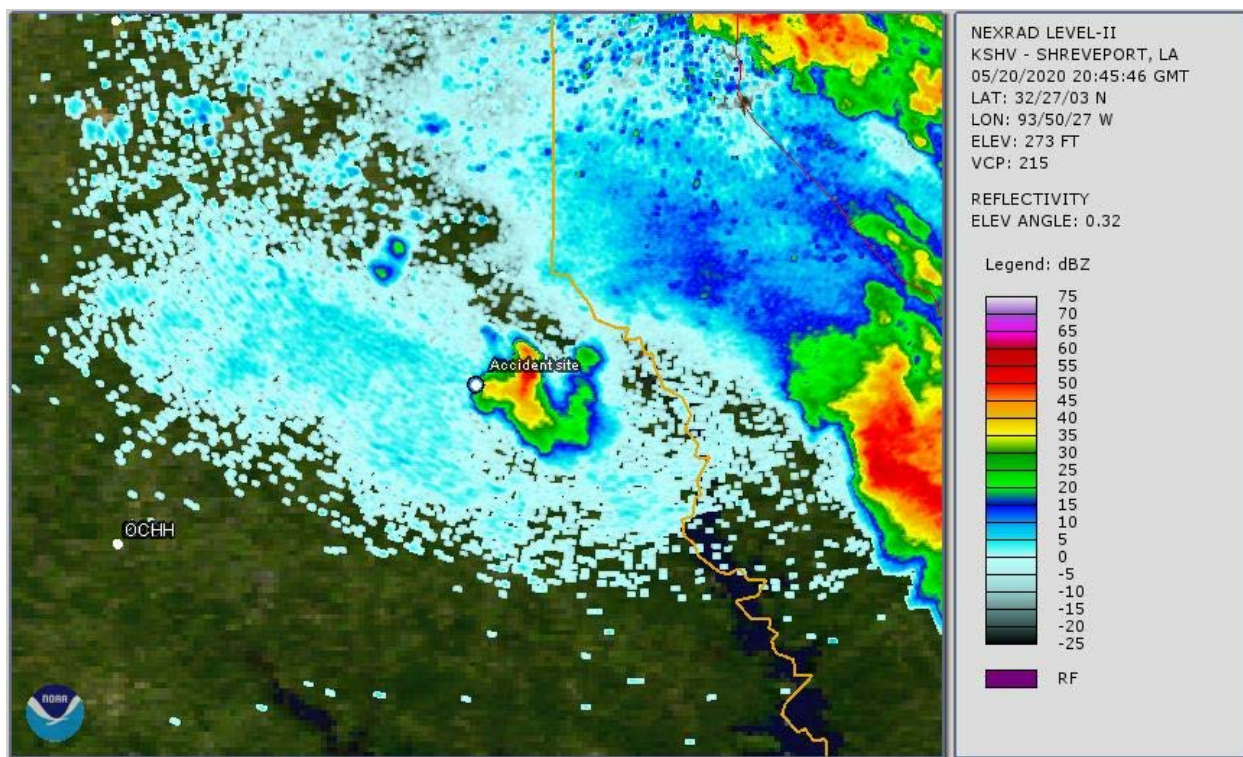


Figure 12 - KSHV WSR-88D 0.32° base reflectivity image at 1545 CDT

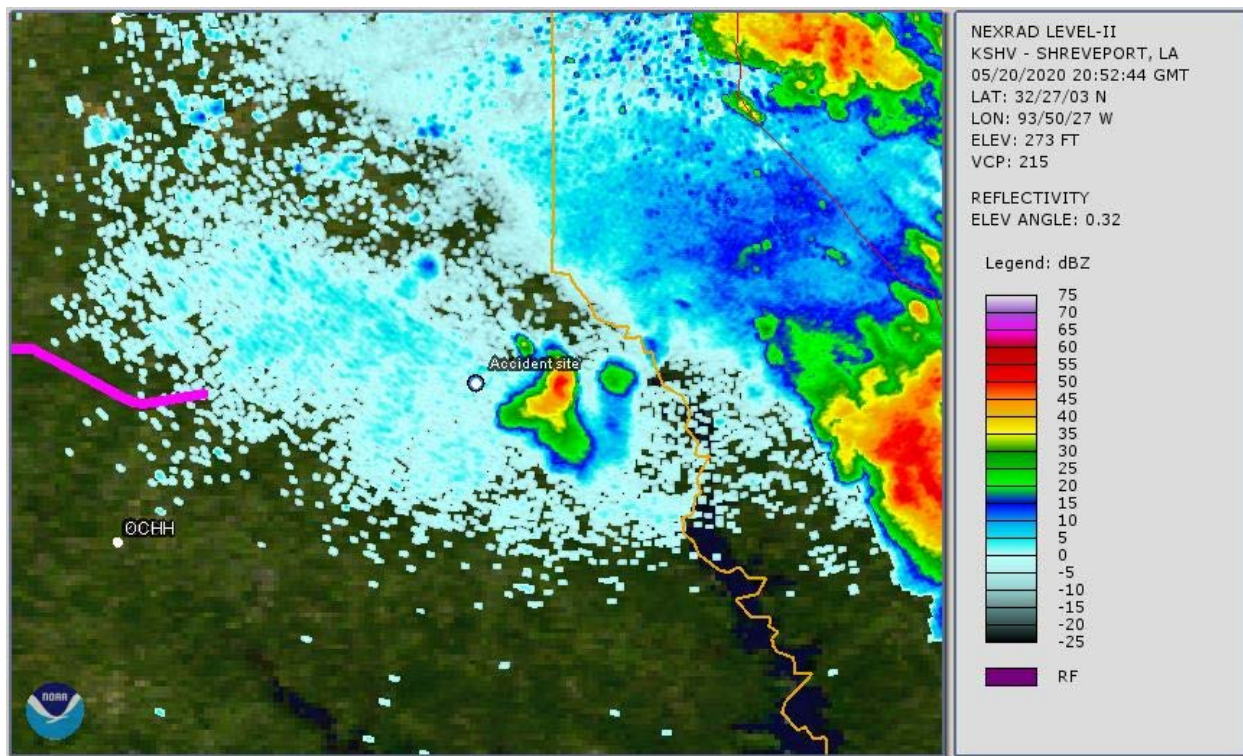
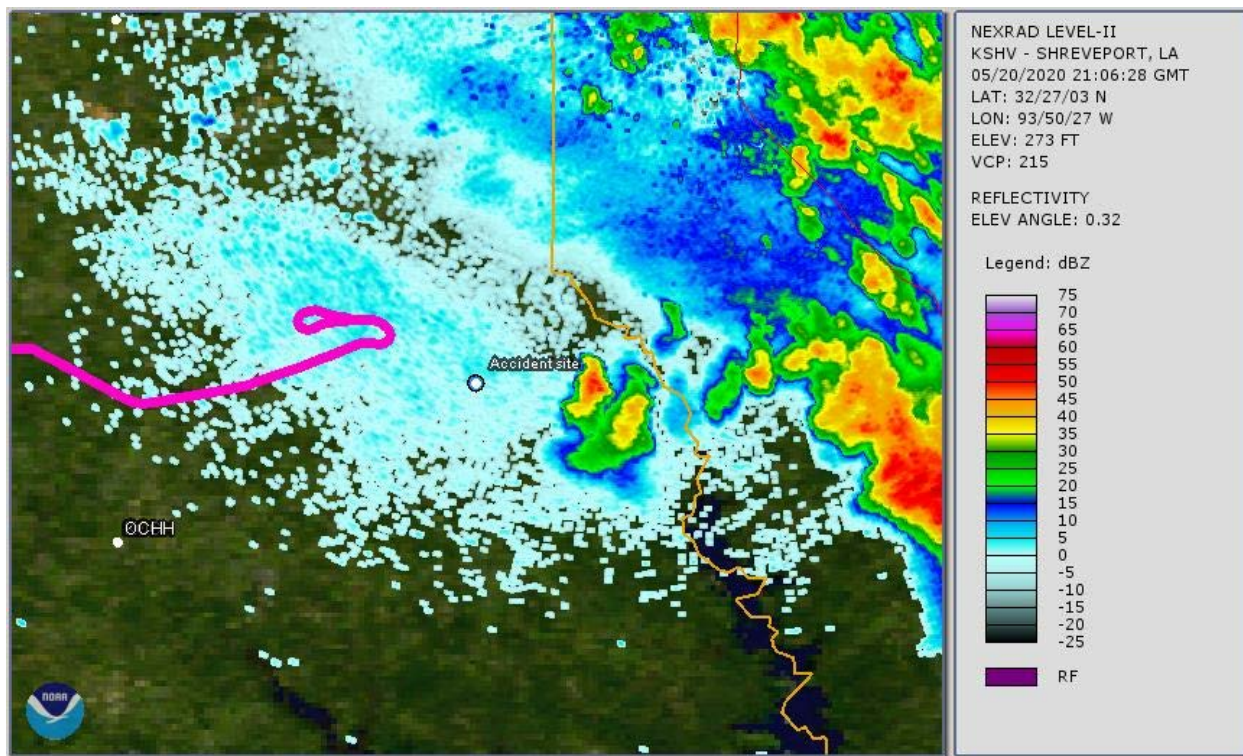
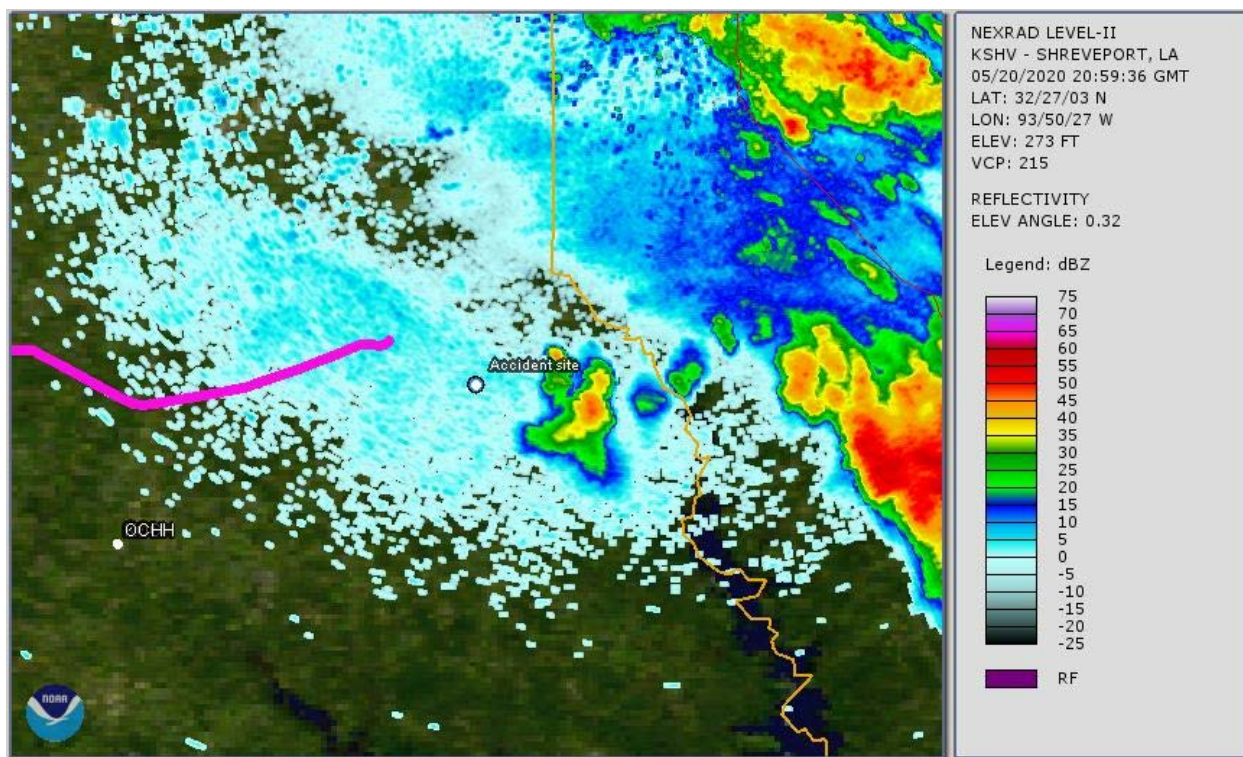


Figure 13 - KSHV WSR-88D 0.32° base reflectivity image at 1552 CDT with flight track



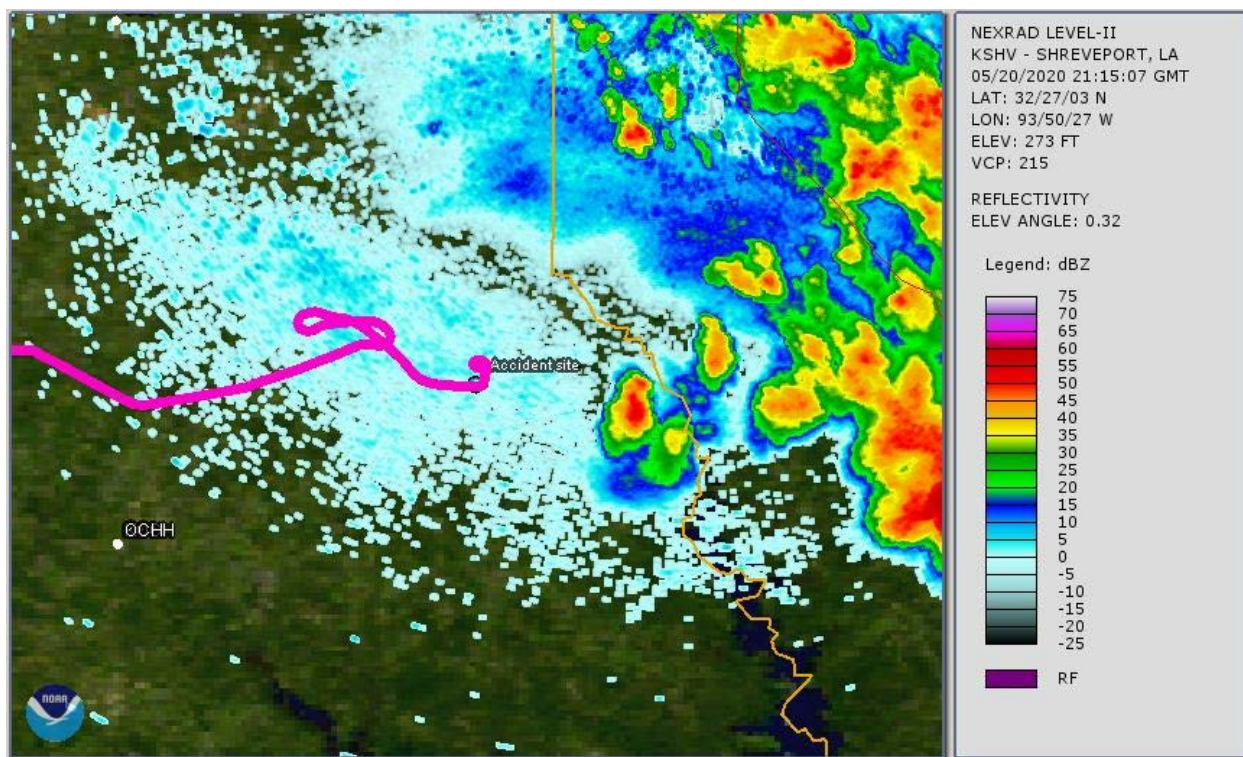


Figure 16 - KSHV WSR-88D 0.32° base reflectivity image at 1615 CDT with flight track overlaid

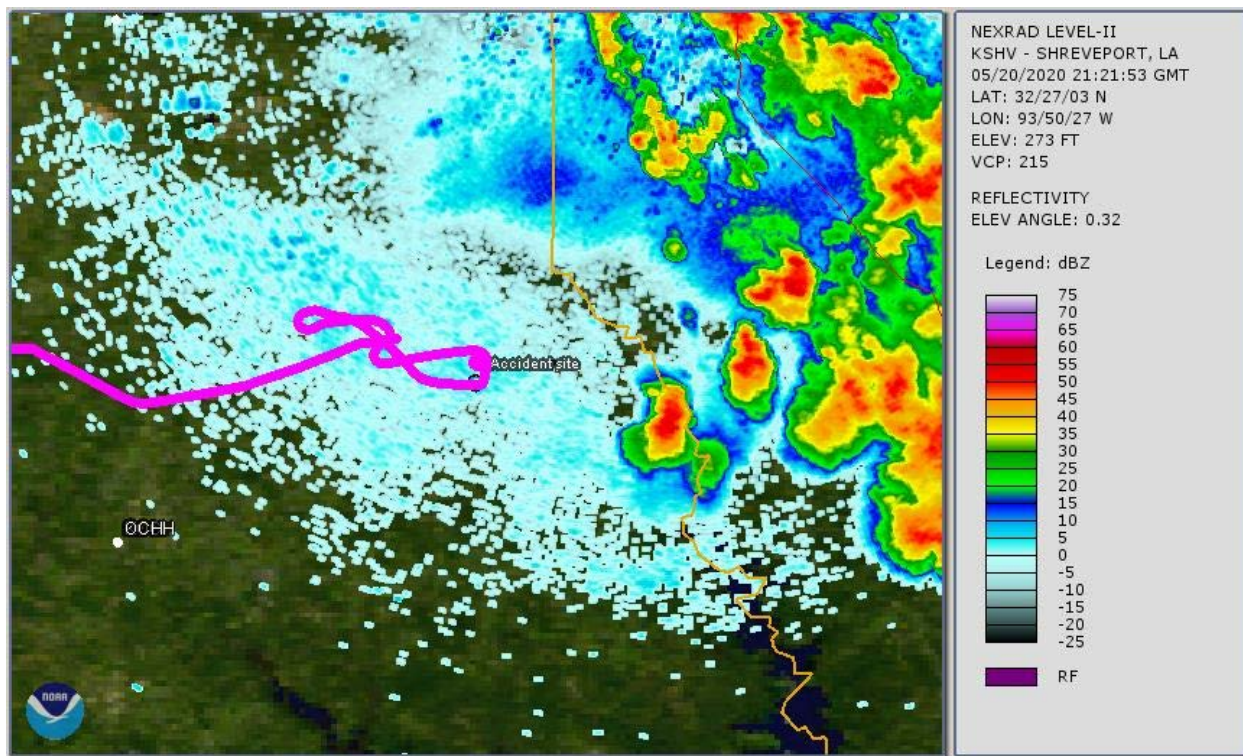


Figure 17 - KSHV WSR-88D 0.32° base reflectivity image at 1621 CDT with flight track overlaid

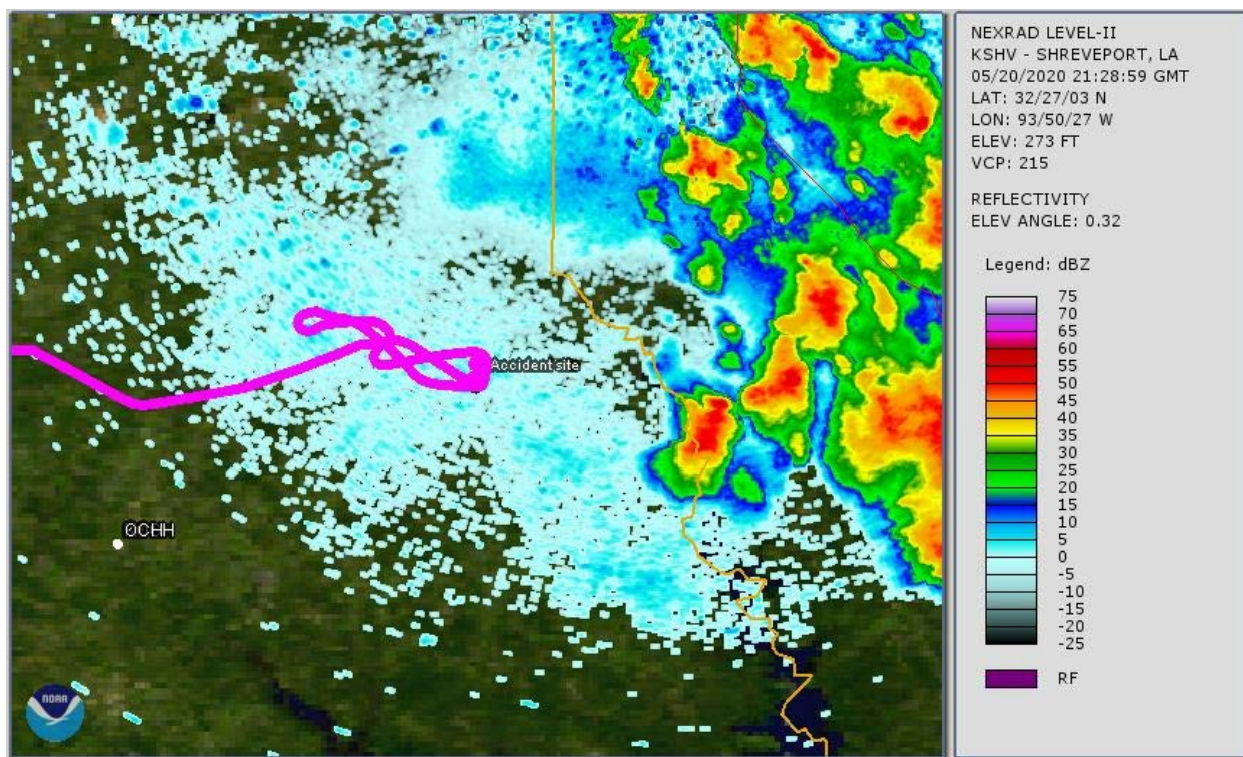


Figure 18 - KSHV WSR-88D 0.32° base reflectivity image at 1628 CDT with flight track overlaid

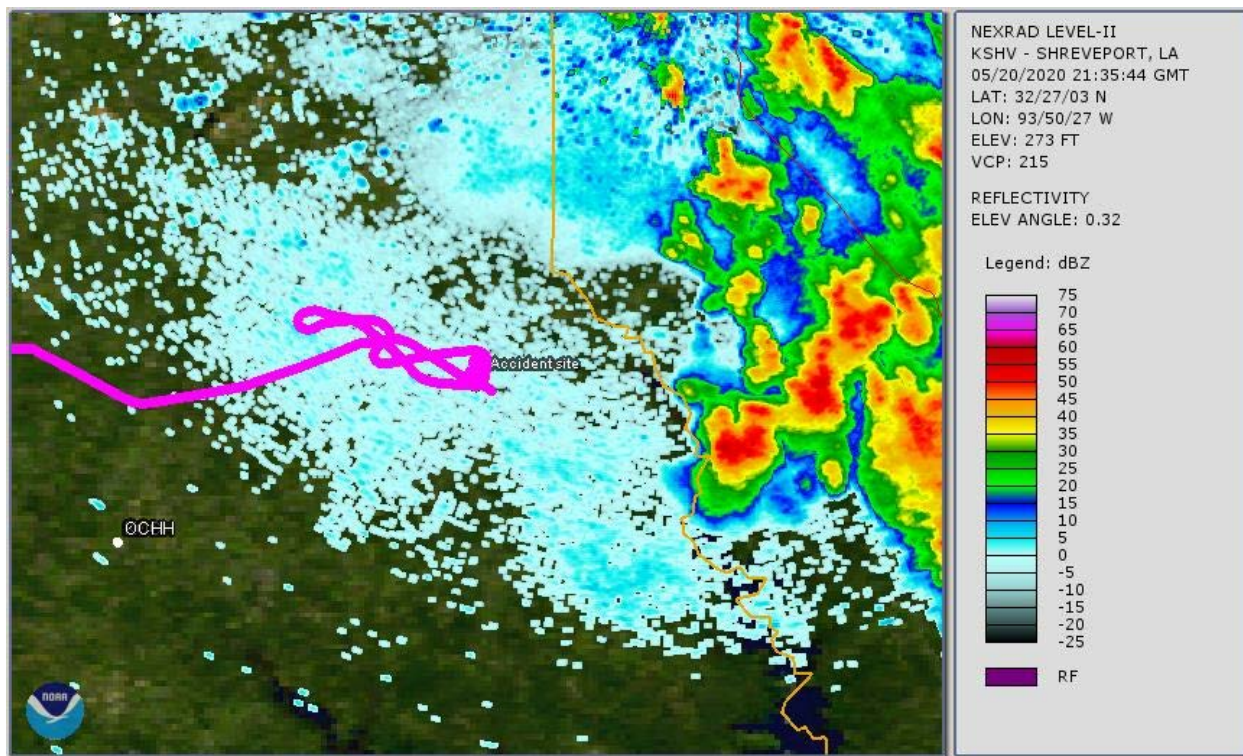


Figure 19 - KSHV WSR-88D 0.32° base reflectivity image at 1635 CDT with flight track overlaid

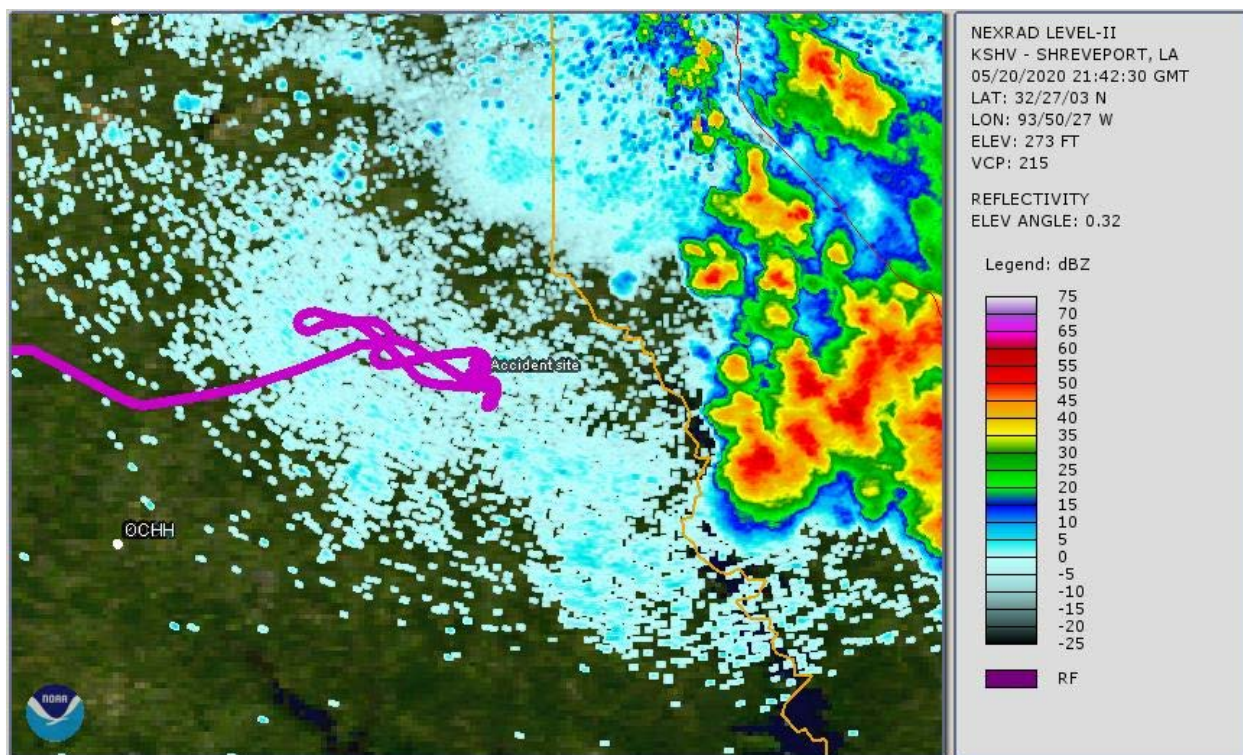


Figure 20 - KSHV WSR-88D 0.32° base reflectivity image at 1642 CDT with flight track overlaid

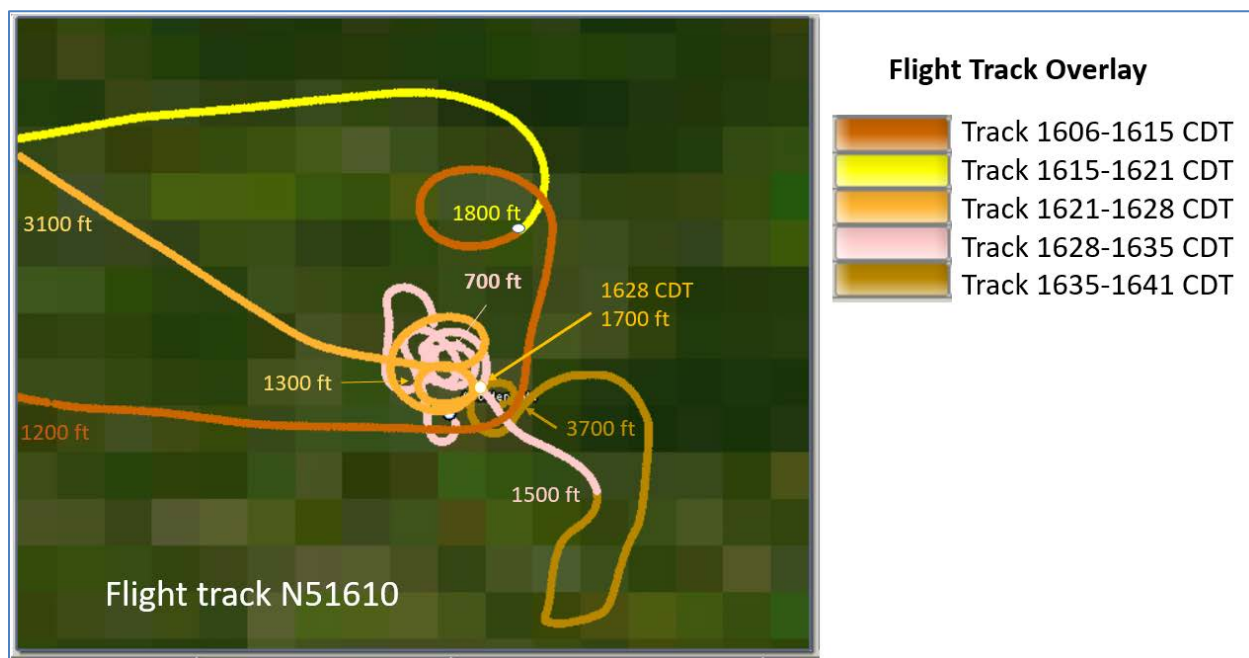


Figure 21 - Close-up view of flight track and altitudes of N51610 between 1606 and 1641 CDT

6.0 Pilot Reports

The following pilot reports or PIREPs were recorded within 100 miles of the accident site from 1300 through 1900 CDT. The reports are in standard code and abbreviations with time in UTC. The reports were as follows.

SHV UA /OV SHV330030/TM 1813/FLDURGC/TP COL3/SK OVC-TOP093

SHV UA /OV SHV/TM 1820/FL033/TP EA50/SK OVC-TOP033

SHV UA /OV SHV/TM 1904/FL040/TP CRJ2/SK B037

SHV UA /OV SHV/TM 1948/FL100/TP C25A/TB MOD TUB 100 OVER EIC

SHV UA /OV SHV/TM 2020/FL035/TP E145/SK B035

SHV UA /OV EIC180010 /TM 2023 /FL370 /TP E55 /SK TOP 370/RM AWC-WEB

GGG UA /OV GGG/TM 2101/FLDURGD/TP EA50/SK OVC025

SHV UA /OV SHV/TM 2105/FL025/TP BE9T/SK B025

SHV UA /OV SHV360015/TM 2138/FL040/TP BE36/SK OVC040

Accident 2140Z

SHV UA /OV SHV/TM 2214/FL040/TP CRJ7/SK B030

SHV UA /OV BAD/TM 2227/FL050/TP B52/H/SK B026 T 030

SHV UA /OV DTN/TM 2255/FL050/TP SF50/SK B040

All the reports except one reported a layer of clouds with bases near 2,600 to 3,700 ft msl with tops from 3,000 to 4,000 ft, with one report over KSHV reporting cloud tops to 37,000 ft associated with convection. There was one report of moderate turbulence at 10,000 ft. There were no reports of any significant low-level turbulence, wind shear, or hazardous conditions encountered or reported during the period.

7.0 NWS Forecasts

7.1 Terminal Aerodrome Forecasts

The NWS Shreveport, Louisiana Weather Forecast Office (WFO) was responsible for the region where the accident occurred. 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. The NWS does not issue any TAFs for KF17. The closest forecasts issued surrounding the period relevant to the preflight planning and the time of the accident were issued for KSHV located 41 miles northeast and East Texas Regional Airport (KGGG), Longview, Texas located 44 miles northwest of the accident site. The forecast current during the period were as follows.

Shreveport, Louisiana

TAF KSHV 201720Z 2018/2118 09007KT P6SM OVC030

FM210800 10004KT P6SM OVC025

FM211500 13009KT P6SM OVC025=

AMD TAF KSHV 202002Z 2020/2118 08009KT P6SM VCTS OVC035CB

TEMPO 2020/2024 VRB15G25KT 2SM -TSRA OVC020CB

FM210800 10004KT P6SM OVC025

FM211500 13009KT P6SM OVC025=

Longview, Texas

TAF KGGG 201720Z 2018/2118 12007KT P6SM OVC025

FM202000 10005KT P6SM BKN035

FM210600 11005KT P6SM OVC015

FM211400 15012KT P6SM OVC025=

The initial forecast issued for KSHV expected winds from 090° at 7 knots, visibility better than 6 miles, with a ceiling overcast at 3,000 ft agl. The forecast was amended at 1502 CDT or after the accident airplane departed KGLE to include thunderstorms in the vicinity of the airport between 1500 and 0300 CDT. The forecast for the time of the accident expected a temporary period between 1500 and 1900 CDT of wind variable at 15 knots gusting to 25 knots, with visibility 2 miles in thunderstorms and light rain, with a ceiling overcast at 2,000 ft agl in cumulonimbus clouds.

The forecast for KGGG expected winds from 100° at 5 knots, visibility better than 6 miles, with a ceiling broken at 3,500 ft agl.

7.2 Area Forecast Discussion

The NWS Area Forecast Discussions (AFD) are issued by each WFO to describe the short term weather conditions within their region with an aviation section that includes the general conditions as it relates to the creation of the TAF. These are useful for additional aviation-related issues that cannot be encoded into the TAF. The discussion also gives some reasoning behind the forecast. These are generated roughly every 6 hours and corresponds to the release of the latest TAFs for that office. The long term sections of the bulletin have been excluded. The forecast discussion issued by KSHV at 1357 CDT was as follows.

FXUS64 KSHV 201857

AFDSHV

Area Forecast Discussion

National Weather Service Shreveport LA

157 PM CDT Wed May 20 2020

.SHORT TERM.../Tonight through Thursday Night/

Latest HiRes models are in agreement that convection across west-central Louisiana will have dissipated by the start of the tonight period as mid to upper-level ridge begins to build across the region from northeast Texas. Weak surface boundary contributing to these storms is forecast to meander across the northern gulf

coast overnight. **Low-level flow to develop a southerly component overnight with increased moisture trapped beneath the diurnal inversion to lead to low ceilings across much of the region.** Overnight low temperatures forecast to fall into the 60s tonight.

Ceilings to remain across much of the region through Thursday with some improvement from the south as the day progresses. An upper-level disturbance translating east across the I-30 corridor to generate scattered convection across these areas. Afternoon high temperatures forecast to range from the mid 70s across southeast Oklahoma to near 90 across deep east Texas.

Otherwise southwest flow aloft to maintain enhanced moisture through the mid-levels maintaining mostly cloudy skies through Thursday night. Low temperatures on Thursday night to fall into the mid to upper 60s areawide.

.PREV DISCUSSION... /issued 1224 PM CDT Wed May 20 2020/

AVIATION...

East winds around 5 to 10 knots today to become 5 knots or less overnight. Winds to become east to southeast on Thursday, increasing to 10 to 15 knots. Otherwise, **MVFR to low VFR ceilings this afternoon to briefly become all VFR by 21/00Z.** However, ceilings forecast to again become MVFR by daybreak Thursday with gradual improvement through the end of the forecast period at 21/18Z.

.SHV WATCHES/WARNINGS/ADVISORIES...

AR...None.

LA...None.

OK...None.

TX...None.

An amendment was issued at 1531 CDT and was as follows.

FXUS64 KSHV 202051

AFDSHV

Area Forecast Discussion

National Weather Service Shreveport LA

351 PM CDT Wed May 20 2020

.UPDATE...

Updated forecast to account for the training storms over Central Louisiana. There are some impressive 10 plus inch rainfall amounts off of the KSHV and KPOE radars in this general area. Have increased rain chances, heavy rainfall wording, and rainfall amounts in this confined region. Storms are firing along the surface front with some strong divergent flow aloft. The real question moving forward will be for how long into the evening will this last.

.SHV WATCHES/WARNINGS/ADVISORIES...

AR...None.

LA...None.

OK...None.

TX...None.

7.3 Graphic Forecast for Aviation

The NWS Graphic Forecast for Aviation (GFA) product replaced the Area Forecast and provides a graphical depiction of surface wind, weather, color coded general flight categories, and cloud cover bases and tops, with the Graphic-Airmen's Meteorological Information (G-AIRMET)

for IFR conditions, mountain obscuration, icing conditions, and strong surface wind overlaid. The GFA is available at the NWS AWC website and through other weather briefing services. The GFA charts available prior to departure and valid during the period of the accident are included below.

Figure 22 is the southcentral section of the GFA Aviation Surface Forecast issued at 1400 CDT and valid for 1600 CDT, with the approximate accident site marked by a red star. The charts depicted the expected surface wind, visibility, flight category, precipitation and weather from data output from the NWS Localized Aviation MOS²³ Product (LAMP), with would include an overlay of any G-AIRMETs for IFR conditions issued during the period. The chart depicted general east winds of 5 knots over the area with a chance of isolated thunderstorms across the area in the vicinity of the accident site with an approximately 10 to 20% chance indicated by the light red shade, and scattered thunderstorms with chances of 30 to 50% over Louisiana immediately northeast through east of the accident site. Visibility was expected to be greater than 5 miles or unrestricted outside of any thunderstorm activity.

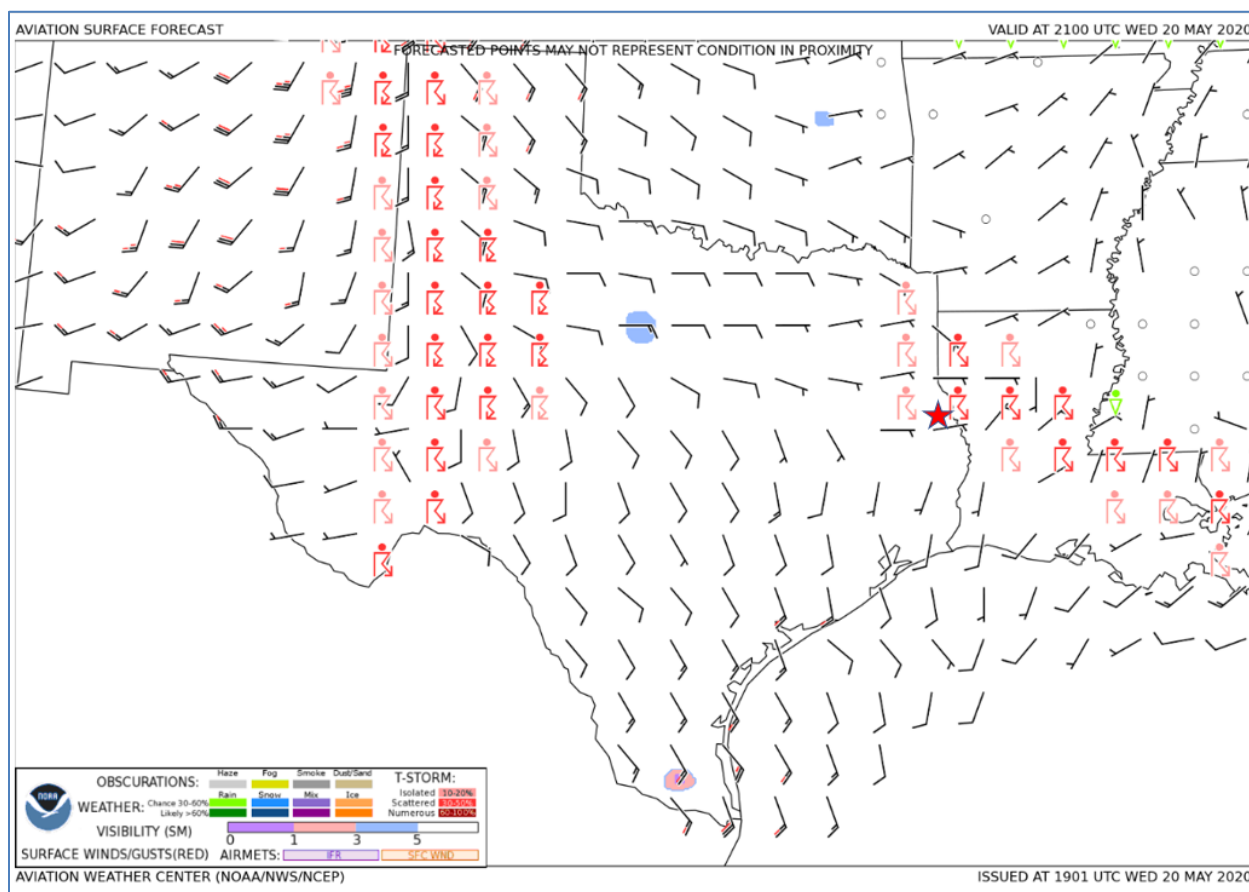


Figure 22 - Graphic Forecast for Aviation (GFA) Surface Forecast valid for 1600 CDT

Figure 23 is the GFA Aviation Clouds Forecast issued at about 1400 CDT and valid for 1600 CDT, with the approximate accident site marked by the red star. The primary data are derived from the NWS Rapid Refresh (RAP) continental-scale NOAA hourly-updated assimilation

²³ Model Output Statistics (MOS) guidance.

modeling system run operational at NCEP to produce cloud layers, bases, and tops. The GFA current at the time expected broken clouds at 2,400 ft msl (2,100 ft agl) with tops to 7,000 ft in the area of the accident with overcast clouds immediately north, northeast, through east of the accident site. No AIRMETs for any icing conditions outside of convection or mountain obscuration conditions were forecast at the time of issuance.

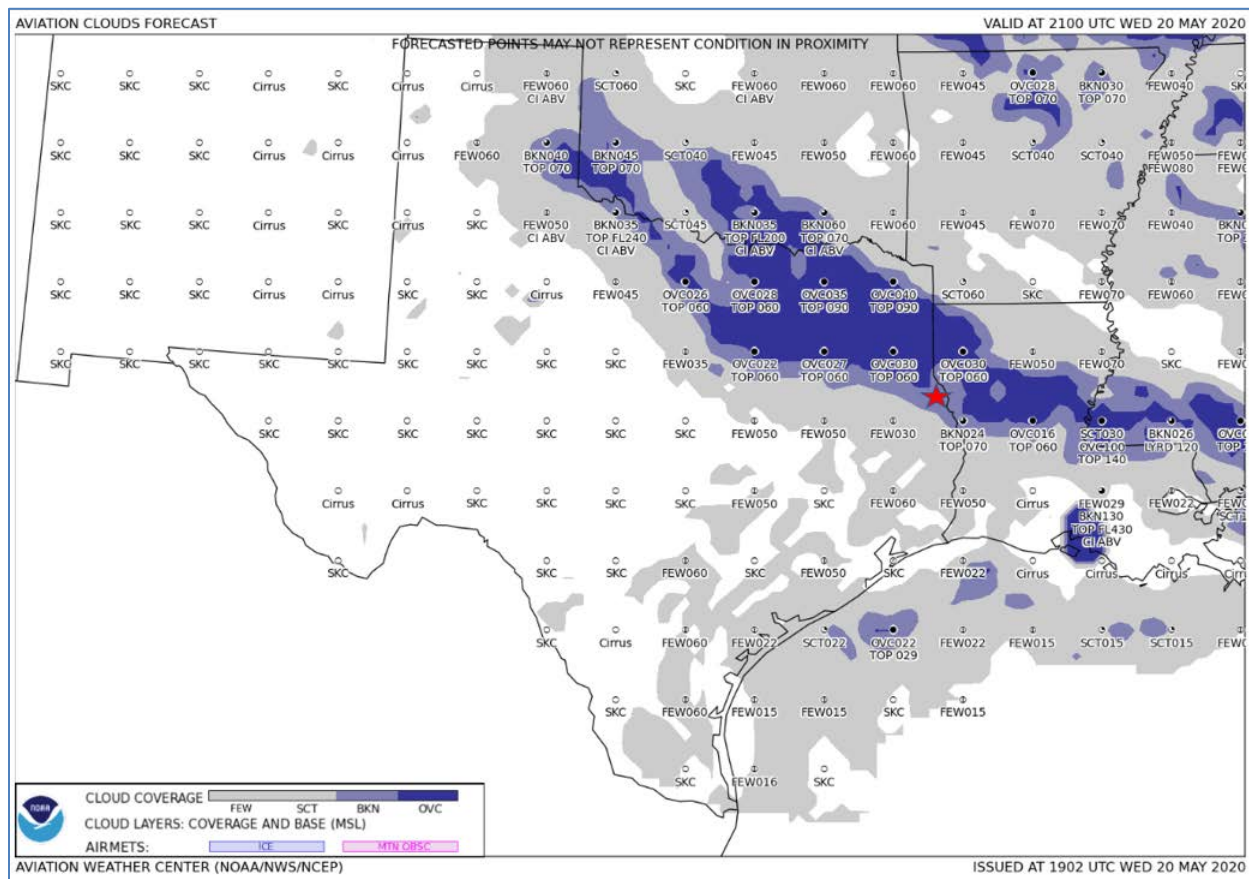


Figure 23 - Graphic Forecast for Aviation (GFA) Cloud Forecast valid for 1600 CDT

7.4 Winds and Temperature Aloft Forecast

The Winds and Temperature Aloft Forecast²⁴ (FD) current for the route of flight was valid for 1900 CDT and for use between 1500 and 2200 CDT. The forecast above 39,000 ft has been excluded.

WINDS ALOFT FORECASTS

DATA BASED ON 201800Z

VALID 210000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000
DAL	1509	2511+21	2812+15	2813+08	2607-11	2810-21	280836	251145	271955
SPS	1217	2107+22	2214+15	2321+08	2717-10	2312-21	232036	222346	242455

²⁴ Derived from FBUS31 KWNO winds aloft bulletin.

SHV 1007 2613+16 2818+13 3229+08 3234-11 3330-21 332636 332645 303555

The forecast for SHV for 3,000 ft expected wind from 100° at 7 knots, and at 6,000 ft from 260° at 13 knots with a temperature of 16° C.

8.0 NWS 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 following advisories were current during the period.

The only weather advisory that was current over the area was Convective SIGMET 40C issued at 1555 CDT for the thunderstorm activity with the advisory extending to the north, east through southeast of the accident site. The Convective SIGMET as depicted by the NWS AWC is included as figure 24 with the accident location noted by the red star, followed by the text of the bulletin below. There were no other SIGMETs, AIRMETs, or CWAs issued surrounding the period of the accident.

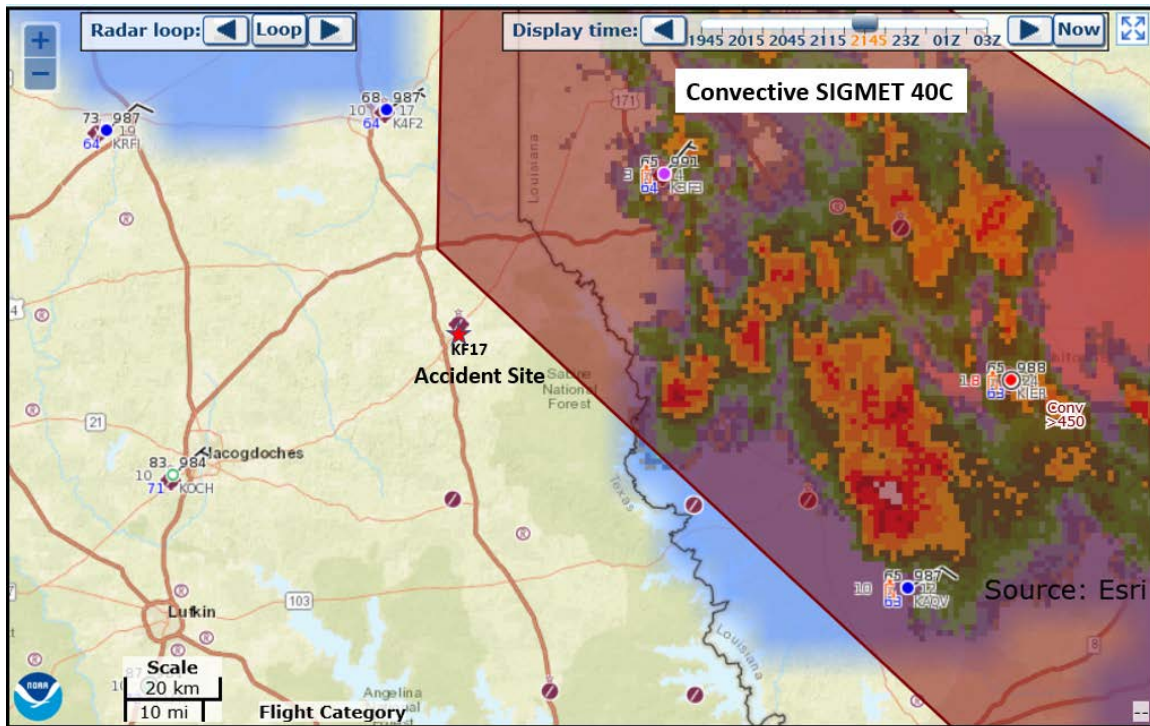


Figure 24 - Convective SIGMET 40C current at the time of the accident

WSUS32 KKCI 202055
 SIGC
 -MKCC WST 202055
 CONVECTIVE SIGMET 40C
 VALID UNTIL 2255Z
 MS LA TX
 FROM 20WNW EIC-60W MCB-40S AEX-40SE GGG-20WNW EIC
 AREA SEV TS MOV FROM 32025KT. TOPS ABV FL450.
 HAIL TO 1 IN...WIND GUSTS TO 50KT POSS.

Convective SIGMET 47C warned of an area of severe thunderstorms moving from 320° at 25 knots with cloud tops above 45,000 ft. Hail to 1 inch and wind gusts to 50 knots were possible with the storms.

9.0 Preflight Weather Briefing

A search of the FAA contract Automated Flight Service Station (AFSS) provider Leidos indicated that they had no contact from the pilot regarding any weather briefings or other contacts inflight, or flight plans. A separate search of ForeFlight and FltPlan.com also found no record of any weather briefings or requests for data. It is therefore unknown what weather information the pilot reviewed for familiarization and planning the flight.

F. LIST OF ATTACHMENTS

Attachment 1 – KSHV WSR-88D radar animation from 1503 through 1642 CDT

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