



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 30, 2020

Weather Study

METEOROLOGY

CEN20FA075

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A. ACCIDENT

Location: Chatham, Louisiana
Date: February 6, 2020
Time: 1413 central standard time
2013 Universal Coordinated Time (UTC)
Aircraft: Cessna 182; Registration: N60381

B. METEOROLOGIST

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C. SUMMARY

On February 6, 2020, about 1413 central standard time, a Cessna 182 airplane, N60381, registered to an LLC, impacted the ground in Chatham, Louisiana. The commercial pilot and 2 passengers sustained fatal injuries. Marginal visual meteorological conditions prevailed in the area and an instrument flight rules (IFR) flight plan was filed. The personal flight was being conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91. The flight originated at 1307 from the Jackson-Hawkins Field Airport (KHKS), Jackson, Mississippi, and was enroute to its intended destination of Shreveport Regional Airport (KSHV), Shreveport, Louisiana.

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 (CST) based upon the 24-hour clock, local time is -6 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 32.314444° N and longitude 92.440556° W, at an elevation of approximately 170 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 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 1200 CST is included as figure 1 with the approximate accident site marked by the red star. The chart depicted a low-pressure system at 995-hectopascals (hPa)¹ over Alabama with a cold front extending south-southwestward across Alabama, the western Florida Panhandle, and into the Gulf of Mexico. The accident site was located in the cold air sector behind the cold front.

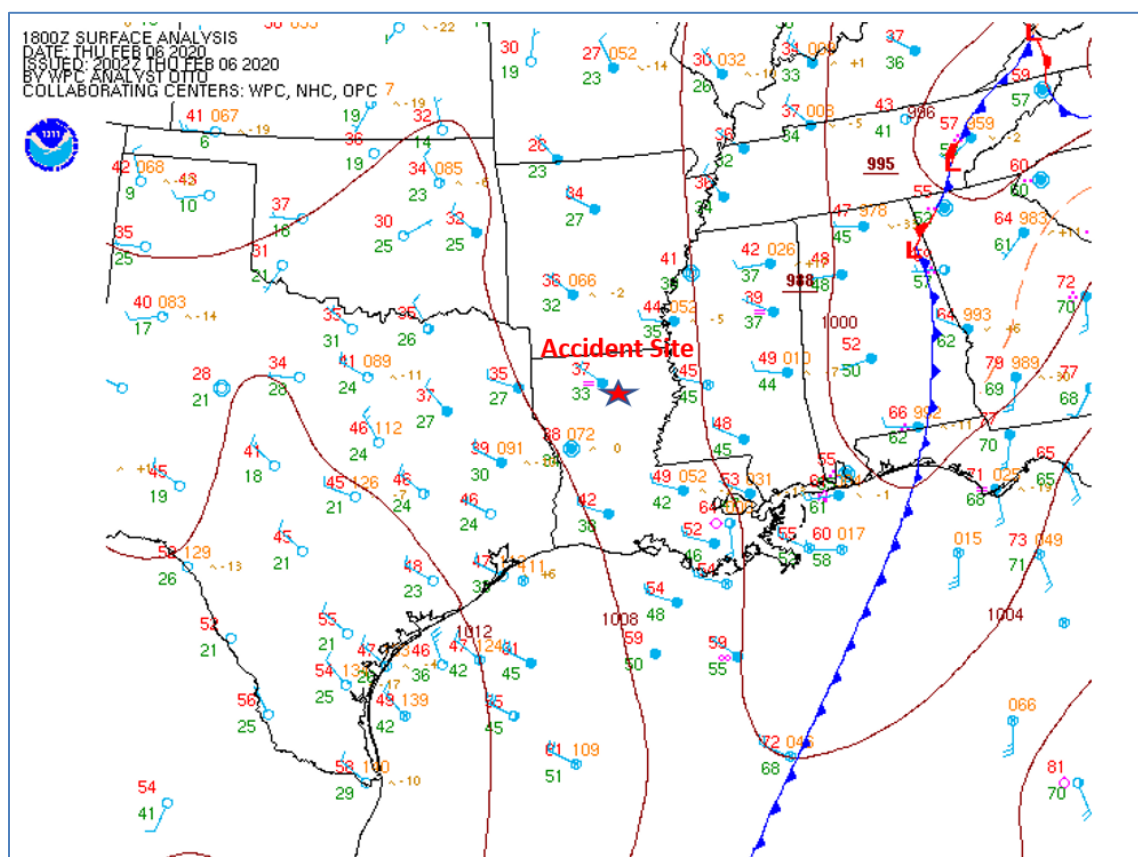


Figure 1 - NWS Surface Analysis Chart for 1200 CST with the approximate accident site marked by the star

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).

The station models in the vicinity of the accident site indicated at approximately 1200 CST wind from the northwest at about 5 knots, visibility restricted in mist, overcast clouds, with a temperature of 37° F and a dew point of 33° F.

1.2 National Composite Radar Mosaic

The National Composite Radar Mosaic for 1415 CST over the region is included as figure 2 with the approximate accident site marked by a red star and the closest airports marked. The mosaic indicated that a small area of light intensity echoes over southern Louisiana with a large area of heavy intensity echoes over the Gulf of Mexico, Alabama and the Florida Panhandle. No echoes were depicted in the vicinity of the accident site.

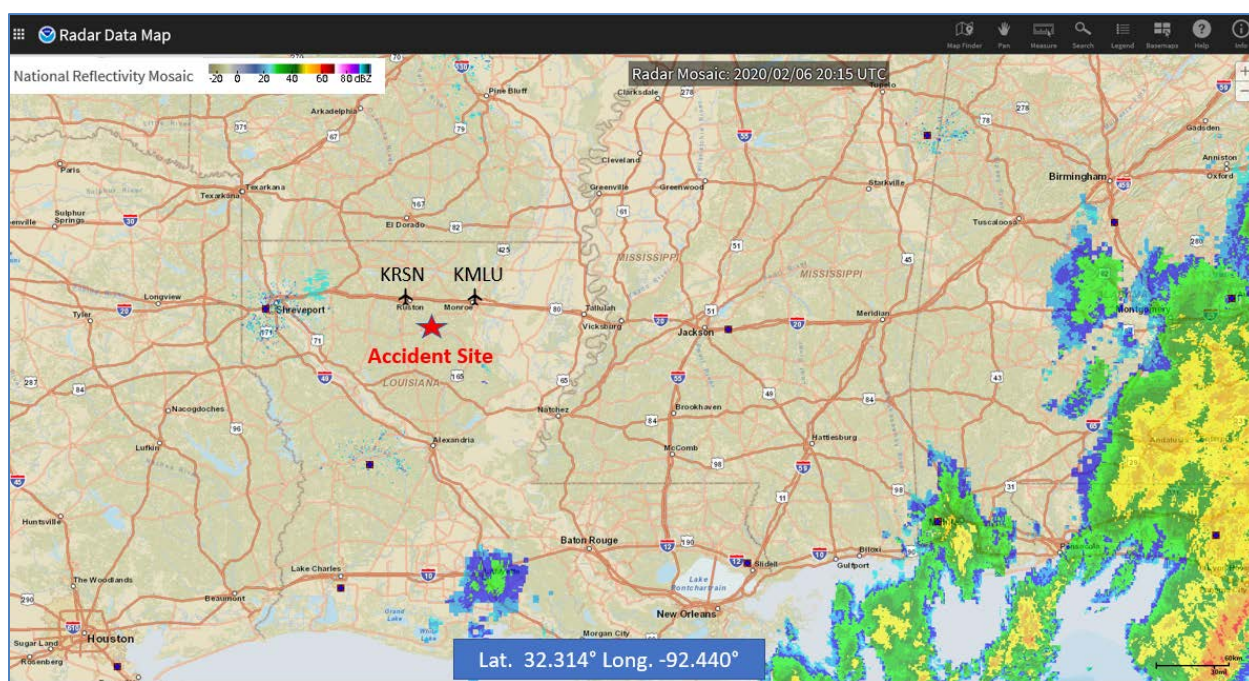


Figure 2 - National Composite Radar Mosaic for 1415 CST with accident site marked

An additional search of the closest NWS Weather Surveillance Radar 1988 Doppler (WSR-88D) located approximately 71 miles west of the accident site in Shreveport (KSHV), Louisiana, confirmed no significant meteorological echoes over the flight path or the accident site.

1.3 Upper Air Charts

The NWS Constant Pressure Charts obtained from the University of Wyoming for 1800 CST for 850-, 700-, and 500-hPa are presented as figures 3-5, respectively. The charts provided the height of the various pressure surfaces by contour lines, lines of equal temperature or isotherms by dash lines green lines, along with the plotted upper air station data of temperature, temperature-dew point spread or depression, wind, and height in meters.

The 850-hPa chart (figure 3) depicted the conditions at approximately 5,000 ft and depicted a slight cyclonic wind shift from Jackson (JAN)² to Shreveport (SHV)³ with winds from the west-southwest at 10 knots shifting to the west-northwest at 30 knots over SHV, with temperature decreasing from -2° to -8° C, and indicated cold air advection over the region. At 700-hPa (figure 4) or approximately 10,000 ft the chart also depicted the trough over central Louisiana with winds shifting from the southwest at 45 knots to the west at 25 knots between JAN and SHV, with temperature from -10° to -14° C. At 500-hPa (figure 5) depicted the base of the long wave trough over Louisiana with the winds shifting from the southwest at 90 knots to the west at 40 knots between the stations with temperatures near -25° C over the region.

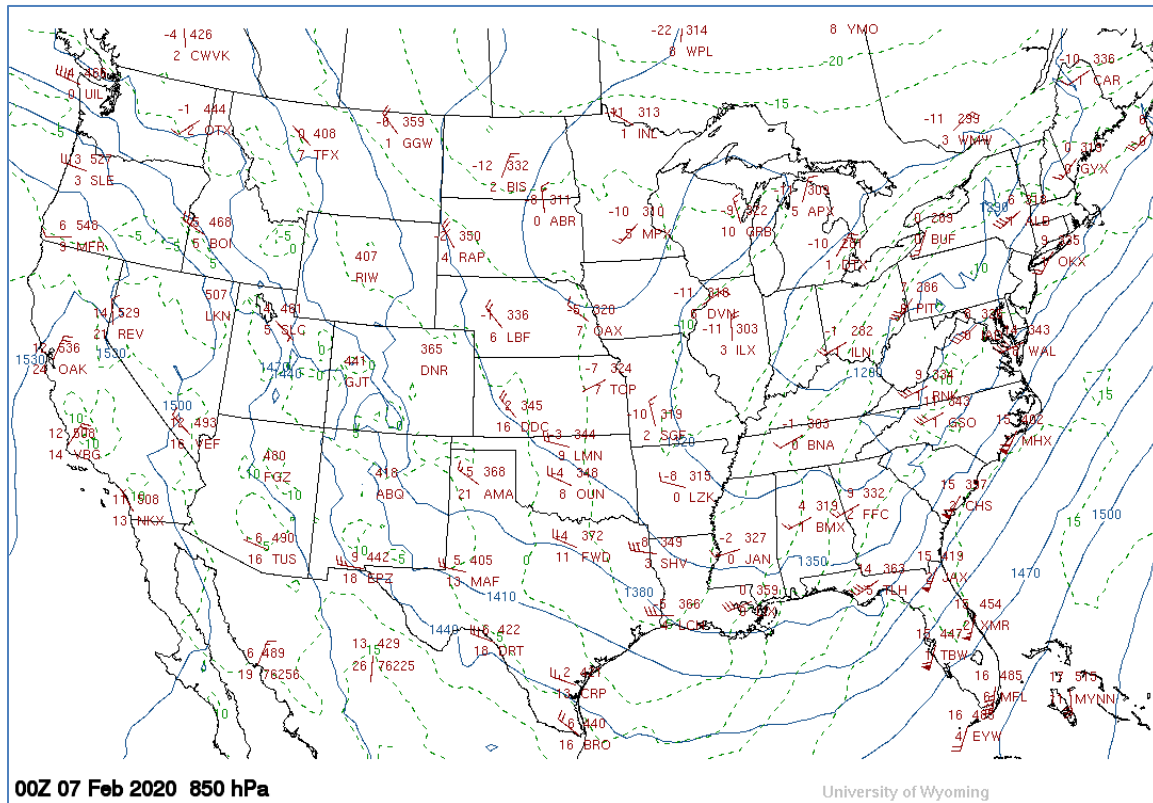


Figure 3 - 850-hPa Constant Pressure Chart for 1800 CST

² JAN – Jackson-Medgar Wiley Evers International Airport, Jackson, Mississippi, upper air site number 72235.

³ SHV – Shreveport Regional Airport, Shreveport, Louisiana, upper air site number 72248.

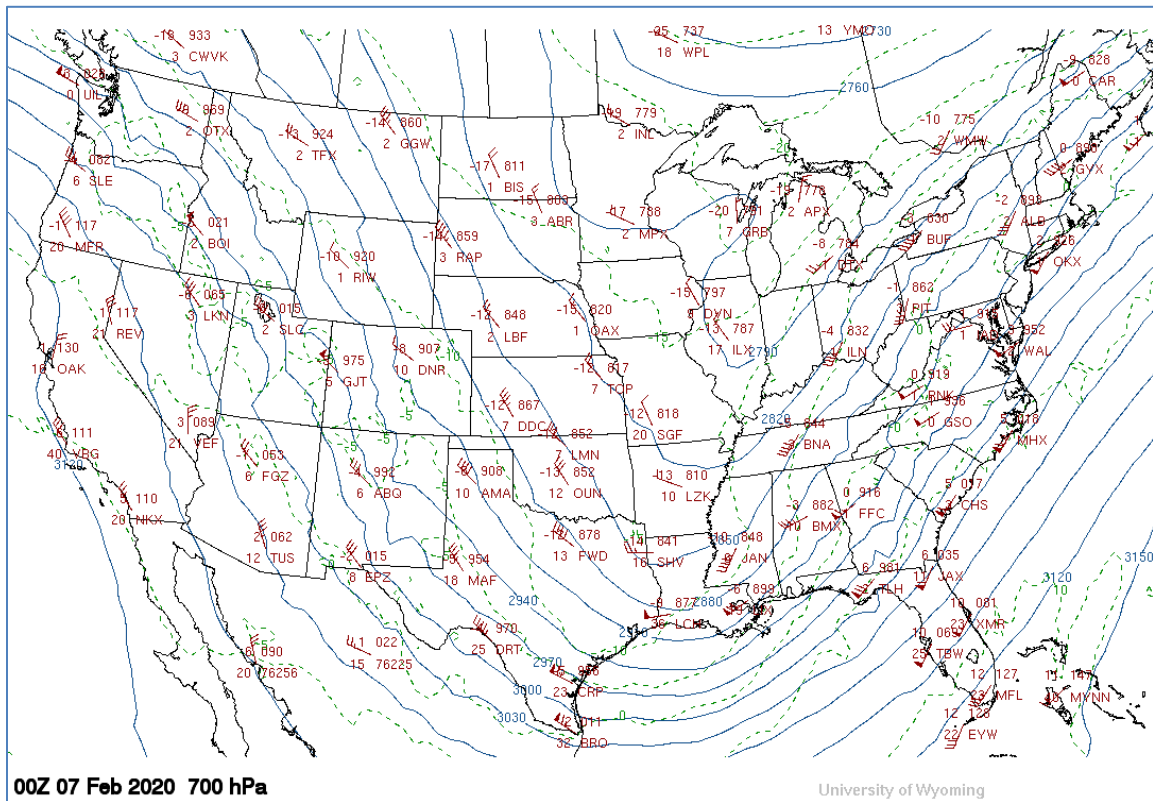


Figure 4 - 700-hPa Constant Pressure Chart for 1800 CST

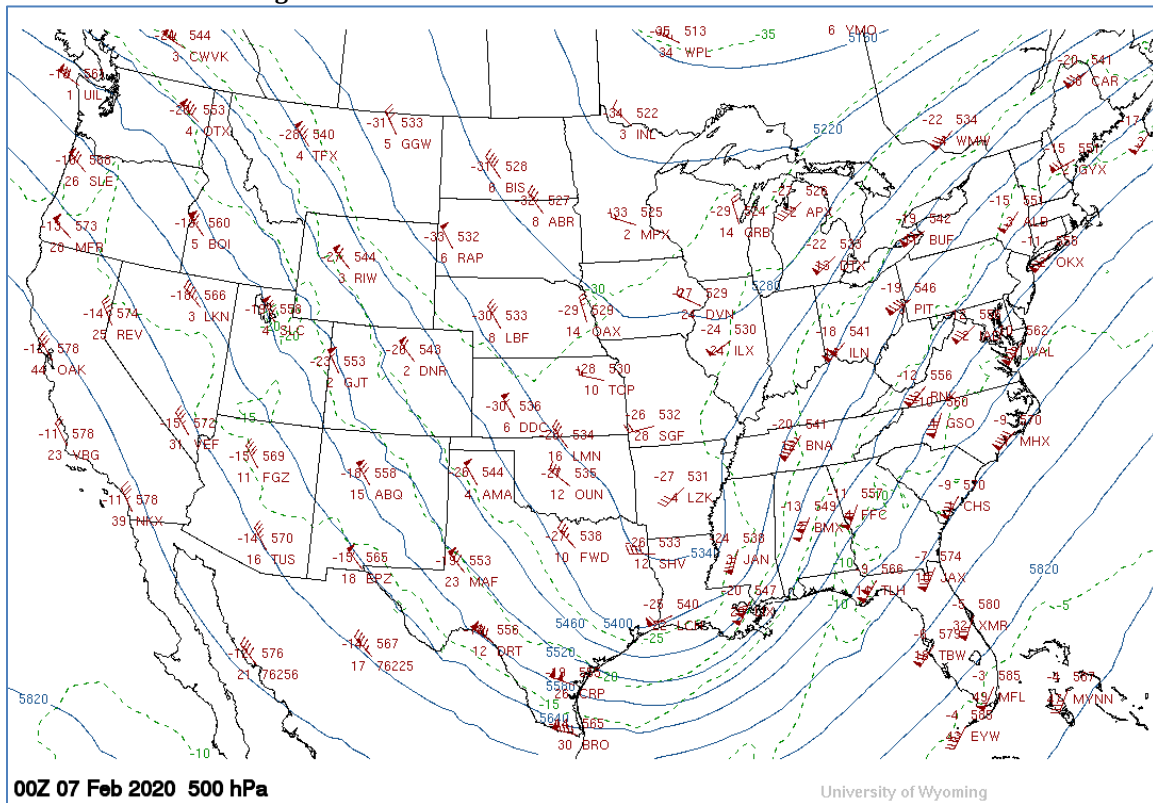


Figure 5 - 500-hPa Constant Pressure Chart for 1800 CST

1.4 12-hour Surface Prognostic Chart

Figure 6 is the 12-hour Surface Prognostic Chart that was current during the period was issued at 1004 CST and depicted the expected conditions at 2400 CST or midnight local. The chart depicted a low pressure system over Virginia associated with a frontal wave, with a cold front extending southward through Florida. A large area of precipitation was expected along and behind the front, with mixed freezing precipitation expected in northern Mississippi, and rain in central Mississippi immediately north and east of the departure location in Jackson, as well as in Alabama, Georgia, and Florida. No significant weather was depicted over the planned route of flight from Jackson, Mississippi to Shreveport, Louisiana.

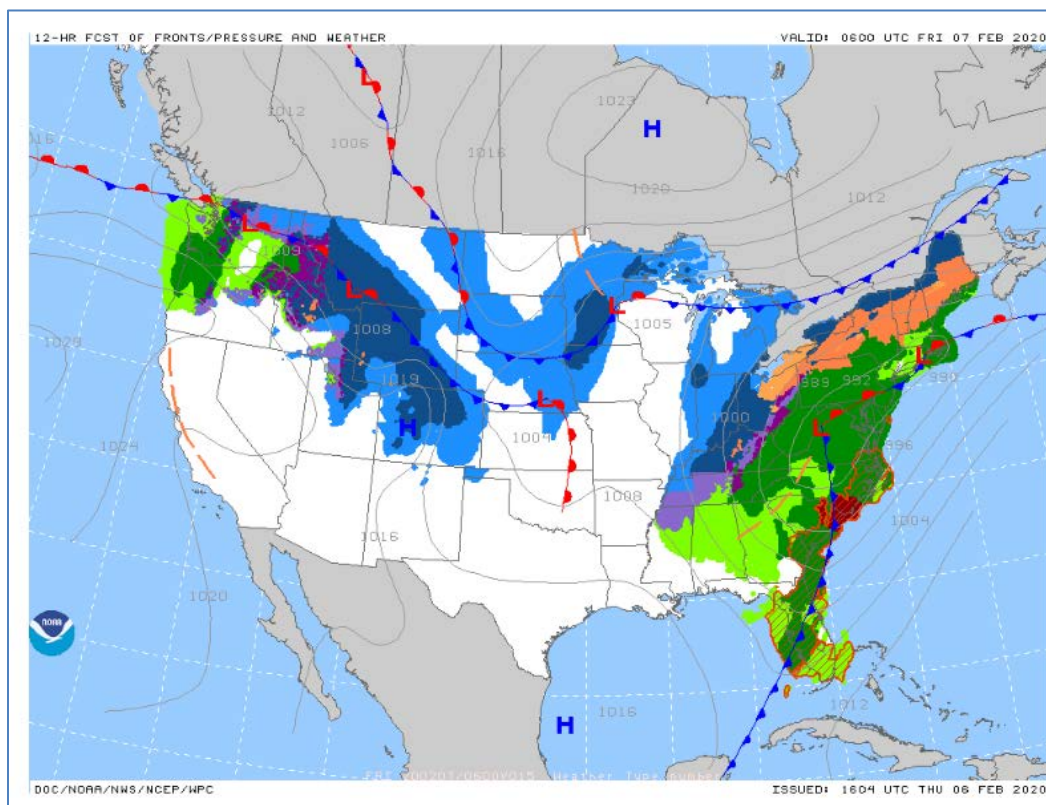


Figure 6 - 12-hour Surface Prognostic Chart valid for 2400 CST

1.5 Low Level Significant Weather Prognostic Chart

The 12- and 24-hour Low level Significant Weather Prognostic Chart current at the time was issued at 1200 CST and were valid for 1800 CST (left) and 0600 CST on February 7, 2020 (right). The low-level graphics product is a forecast of aviation weather hazards, primarily intended to be used as a guidance product for briefing the VFR pilot. The two panels depict freezing levels, turbulence, and low cloud ceilings and/or restrictions to visibility shown as contoured areas of the general flight categories⁴ of MVFR and IFR conditions.

⁴ 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 or the lowest layer of clouds reported as broken or overcast, or the

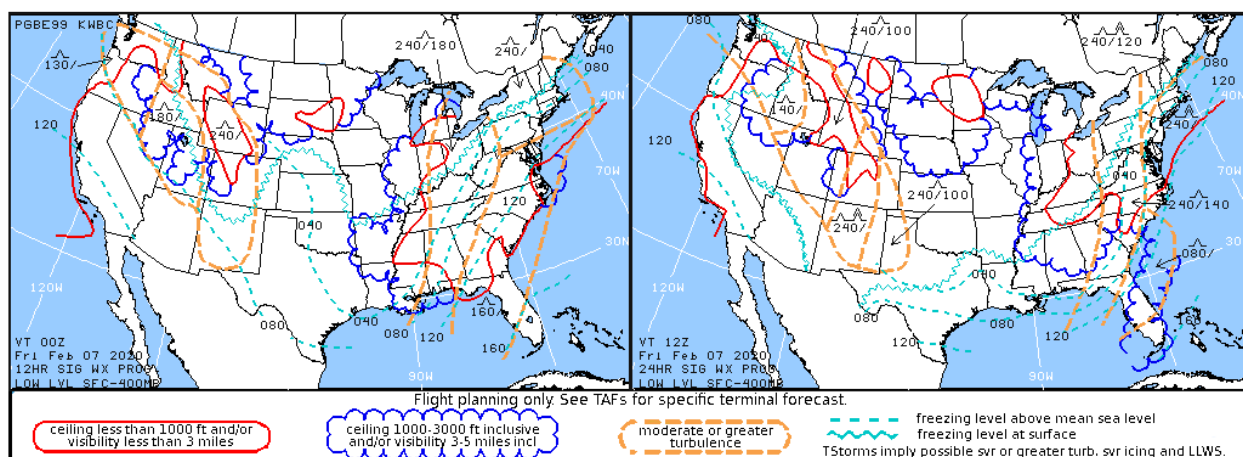


Figure 7 – The 12- and 24-hour Low Level Significant Weather Prognostic Charts depicting the general aviation hazards at 1800 CST (left) and 0600 CST (right)

The 12-hour Low Level Significant Weather Prognostic Chart on the left depicted MVFR conditions over the planned route of flight, with the freezing level less than 4,000 ft over the area. No significant turbulence was indicated over the route below 24,000 ft.

2.0 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 0° West based on the latest sectional chart for the area.

2.1 Jackson, Mississippi

The flight originated at Jackson-Hawkins Field Airport (KHKS), Jackson, Mississippi, at approximately 1307 CST. The airport was at elevation of 341 ft and had an Automated Surface Observation System (ASOS), which was augmented by air traffic control personnel. At the time of the accident airplane's departure the following conditions were being reported.

Weather observation for KHKS at 1253 CST, wind from 290° at 9 knots, visibility 10 miles or more, ceiling overcast at 1,000 ft agl, temperature 7° C, dew point temperature 4° C, altimeter 29.61 inches of mercury (Hg). Remarks: automated station with a precipitation discriminator, rain began at 1214 CST and ended at 1232 CST, ceiling 900

vertical visibility into a surface based obscuration 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.

ft variable 1,300 ft, sea level pressure 1002.4-hPa, hourly precipitation less than 0.01 inch or a trace, temperature 7.2° C, dew point 4.4° C.

The general flight categories and raw observations from approximately 0953 through 1500 CST were as follows:

IFR METAR KHKS 061553Z 29011KT 3SM BR BKN008 OVC012 07/04 A2967 RMK AO2 RAB27E36 SLP041 P0000 T00670044

IFR METAR KHKS 061653Z 29009KT 5SM -RA BR OVC007 07/04 A2968 RMK AO2 RAB1558E04B48 SLP044 P0000 T00670044

IFR METAR KHKS 061753Z 32009KT 9SM OVC009 07/04 A2965 RMK AO2 RAE06 CIG 007V013 SLP036 P0000 60002 T00670044 10072 20050 50005

MVFR METAR KHKS 061853Z 29009KT 10SM OVC010 07/04 A2961 RMK AO2 RAB14E32 CIG 009V013 SLP024 P0000 T00720044

Flight departed at 1907Z

MVFR SPECI KHKS 061938Z 30010KT 10SM OVC016 08/04 A2957 RMK AO2 PRESFR T00780044

MVFR METAR KHKS 061953Z 30009KT 10SM BKN018 OVC022 08/04 A2958 RMK AO2 SLP012 T00830044

Accident 2013Z

MVFR METAR KHKS 062053Z 29008KT 10SM OVC023 09/04 A2955 RMK AO2 SLP001 60000 T00890039 56034=

A review of the observations from KHKS indicated that IFR conditions prevailed at the station up to approximately 20-minutes prior to the accident airplane's departure when ceilings increased to 1,000 ft to 1,600 ft and MVFR conditions prevailed. The surface temperature was reported at 7° C (45° F) at the time of departure.

2.2 Ruston, Louisiana

The closest weather reporting location to the accident site was Ruston Regional Airport (KRSN), Ruston, Louisiana, about 14 miles north-northwest at an elevation of 311 ft. The airport had an Automated Weather Observation System (AWOS), which was not augmented by any human observers and issued observations every 20-minutes. At the approximate time of the accident the following conditions were being reported.

Weather Observation for KRSN at 1415 CST, automated, wind from 290° at 8 knots, visibility 10 miles or more, ceiling overcast at 1,100 ft agl, temperature 2° C, dew point -1° C, altimeter 29.70 inches of Hg. Remarks: automated station with a precipitation discriminator, temperature 2.0° C, dew point -0.6° C.

The general flight categories and raw observations surrounding the period from about 1000 CST through 1500 CST were as follows.

IFR METAR KRSN 061555Z AUTO 30005KT 4SM BR OVC006 03/02 A2976 RMK AO2 T00320022

IFR METAR KRSN 061615Z AUTO 29006KT 260V330 3SM BR BKN006 OVC010 03/02 A2976 RMK AO2 T00320020

IFR METAR KRSN 061635Z AUTO 31004KT 2SM BR OVC008 03/02 A2976 RMK AO2 T00300019

MVFR METAR KRSN 061655Z AUTO 30006KT 270V330 10SM SCT007 OVC012 03/02 A2977 RMK AO2 T00320015

IFR METAR KRSN 061715Z AUTO 29003KT 10SM OVC009 03/01 A2976 RMK AO2 T00300011

IFR METAR KRSN 061735Z AUTO 30007KT 250V350 10SM OVC009 03/01 A2976 RMK AO2 T00290010

IFR METAR KRSN 061755Z AUTO 31004KT 4SM BR BKN009 OVC015 03/01 A2975 RMK AO2 T00270007 10053 20025

IFR METAR KRSN 061815Z AUTO 28005KT 10SM OVC009 03/01 A2975 RMK AO2 T00260005

IFR METAR KRSN 061835Z AUTO 30005KT 10SM OVC009 03/01 A2973 RMK AO2 T00250007

IFR METAR KRSN 061855Z AUTO 29008KT 270V330 10SM OVC009 03/00 A2972 RMK AO2 T00260001=

IFR METAR KRSN 061915Z AUTO 30006KT 280V350 10SM OVC009 02/00 A2971 RMK AO2 T00230002=

IFR METAR KRSN 061935Z AUTO 29007KT 250V310 10SM OVC009 02/00 A2971 RMK AO2 T00200000

MVFR METAR KRSN 061955Z AUTO 31005G14KT 10SM OVC011 02/00 A2970 RMK AO2 T00201005

Accident 2013Z

MVFR METAR KRSN 062015Z AUTO 29008KT 10SM OVC011 02/M01 A2970 RMK AO2 T00201006

MVFR METAR KRSN 062035Z AUTO 27006KT 240V300 10SM OVC011 02/00 A2969 RMK AO2 T00171005=

MVFR METAR KRSN 062055Z AUTO 29007KT 260V350 10SM OVC011 02/M01 A2968 RMK AO2 T00151010=

A review of the observations from KRSN indicated that IFR conditions prevailed due to low ceilings and visibilities in mist until 1355 CDT or shortly prior to the accident when visibility improved, and the ceiling lifted slightly and MVFR conditions prevailed. At the time of the accident the ceiling was overcast at 1,100 ft agl, visibility unrestricted with a temperature of 2° C (36° F).

2.3 Monroe, Louisiana

The next closest weather reporting location was from Monroe Regional Airport (KMLU), Monroe, Louisiana, located approximately 23 miles northeast of the accident site and immediately north of the route of flight at an elevation of 79 ft. The airport had an ASOS with the observations augmented by tower personnel during normal hours. At the approximate time of the accident the following conditions were being reported.

Special weather observation for KMLU at 1400 CST, wind from 270° at 14 knots, visibility 7 miles in mist, ceiling broken at 1,000 ft agl, overcast at 1,600 ft, temperature 4° C, dew point 3° C, altimeter 29.65 inches of Hg. Remarks: automated station with a precipitation discriminator, ceiling 600 ft variable 1,200 ft, temperature 4.4° C, dew point 2.8° C.

The general flight categories and raw observations surrounding the period from about 1000 CST through 1500 CST were as follows.

*IFR METAR KMLU 061553Z 30009KT 4SM BR BKN006 BKN010 OVC020 07/04 A2972 RMK AO2
RAB1455E43 SLP063 P0001 T00670044*

MVFR SPECI KMLU 061600Z 29013KT 8SM BR FEW006 SCT019 OVC026 07/04 A2973 RMK AO2 T00670044

*IFR SPECI KMLU 061616Z 29010KT 3SM -RA BR BKN006 BKN010 OVC026 06/04 A2972 RMK AO2 RAB09
P0000 T00610044*

*IFR METAR KMLU 061653Z 28012KT 10SM BR BKN006 BKN010 OVC026 06/04 A2973 RMK AO2
RAB09E27 SLP066 P0000 T00610044*

MVFR SPECI KMLU 061718Z 29011KT 4SM BR BKN010 OVC019 06/04 A2972 RMK AO2 T00560039

MVFR SPECI KMLU 061731Z 29009KT 4SM BR SCT010 OVC019 06/04 A2973 RMK AO2 T00560039

IFR SPECI KMLU 061751Z 27010KT 4SM BR BKN007 OVC017 06/03 A2972 RMK AO2

*IFR METAR KMLU 061753Z 28011KT 4SM -RA BR BKN007 OVC017 06/03 A2971 RMK AO2 RAB52 SLP061
P0000 60001 T00560033 10067 20056 58002*

MVFR SPECI KMLU 061755Z 27011KT 4SM -RA BR SCT008 OVC015 05/03 A2972 RMK AO2 P0000 T00500033

*MVFR SPECI KMLU 061802Z 27011KT 3SM -RA BR SCT008 OVC013 06/03 A2972 RMK AO2 P0000
T00560033*

*IFR SPECI KMLU 061808Z 27010KT 2 1/2SM -RA BR BKN007 OVC013 05/03 A2971 RMK AO2 P0000
T00500033=*

*IFR SPECI KMLU 061829Z 29009KT 4SM BR BKN007 OVC013 06/04 A2969 RMK AO2 RAE21 P0000
T00560039=*

*IFR METAR KMLU 061853Z 29008KT 8SM BR BKN007 OVC013 06/03 A2968 RMK AO2 RAE21 SLP049
P0000 T00560033=*

*MVFR SPECI KMLU 061900Z 27012KT 4SM -RA BR BKN012 OVC018 05/03 A2968 RMK AO2 RAB1857 P0000
T00500033*

*IFR SPECI KMLU 061907Z 28012KT 3SM -RA BR BKN008 OVC012 05/03 A2967 RMK AO2 RAB1857 P0000
T00500033*

*IFR METAR KMLU 061953Z 27012KT 7SM BR BKN008 OVC012 04/03 A2966 RMK AO2 RAB1857E46 SLP041
P0000 T00440028*

*MVFR SPECI KMLU 062000Z 27014KT 7SM BR BKN010 OVC016 04/03 A2965 RMK AO2 CIG 006V012
T00440028*

Accident 2013Z

MVFR METAR KMLU 062053Z AUTO 28011KT 10SM BR OVC012 04/02 A2962 RMK AO2 SLP031 60000
T00390017 56030=

IFR SPECI KMLU 062108Z 28014G18KT 10SM OVC008 04/02 A2963 RMK AO2 T00390017=

A review of the observations from KMLU indicated that IFR to MVFR prevailed during the period due to low ceilings and visibilities in mist and light rain. At the time of the accident a ceiling ranged from 600 ft to 1,200 ft agl with a temperature of 4° C (40° F).

2.4 Shreveport, Louisiana

The planned destination was Shreveport Regional Airport (KSHV), Shreveport, Louisiana, located approximately 71 miles west of the accident site at an elevation of 258 ft. The airport had an ASOS which was augmented by air traffic control personnel. At the approximate time of the accident the following conditions were being reported.

Weather observation for KSHV at 1356 CST, wind from 300° at 14 knots, visibility 10 miles or more, ceiling overcast at 2,200 ft agl, temperature 2° C, dew point -2° C, altimeter 29.71 inches of Hg. Remarks: automated station with a precipitation discriminator, sea-level pressure 1005.9-hPa, temperature 2.2° C, dew point -2.2° C.

The general flight categories and raw conditions reported from about 1000 CST through 1600 CST were as follows.

MVFR METAR KSHV 061556Z 31009KT 10SM OVC014 02/M01 A2978 RMK AO2 SLP085 T00171006

MVFR METAR KSHV 061656Z 32013KT 10SM OVC012 02/M01 A2977 RMK AO2 SLP081 T00171011

MVFR METAR KSHV 061718Z 31012G18KT 10SM OVC015 02/M02 A2977 RMK AO2 T00171017

MVFR METAR KSHV 061756Z 31011KT 10SM OVC018 02/M02 A2976 RMK AO2 SLP076 T00171022 10022
20017 58009

MVFR METAR KSHV 061856Z 29012KT 10SM OVC022 02/M02 A2973 RMK AO2 SLP066 T00221022

MVFR METAR KSHV 061956Z 30014KT 10SM OVC022 02/M02 A2971 RMK AO2 SLP059 T00221022

Accident 2013Z

VFR METAR KSHV 062056Z 30011KT 10SM SCT027 OVC034 03/M03 A2971 RMK AO2 SLP060 T00281028
55016

A review of the KSHV observations indicated that MVFR conditions prevailed during the period with a ceiling overcast at 2,200 ft agl and a temperature of 2° C (36° F) at the time of the accident. The temperature change over the 182 mile route decreased 5° C (9° F).

2.5 METAR Display

A display of the METAR observations from the NWS Aviation Weather Center's (AWC) website⁵ for 1434 CST is included as figure 8 with the approximate accident site marked by a red star. The image depicted MVFR conditions prevailing along the route of flight through the accident site with overcast clouds prevailing over the region. Several stations immediately north reported IFR conditions due to ceilings between 600 to 700 ft agl.

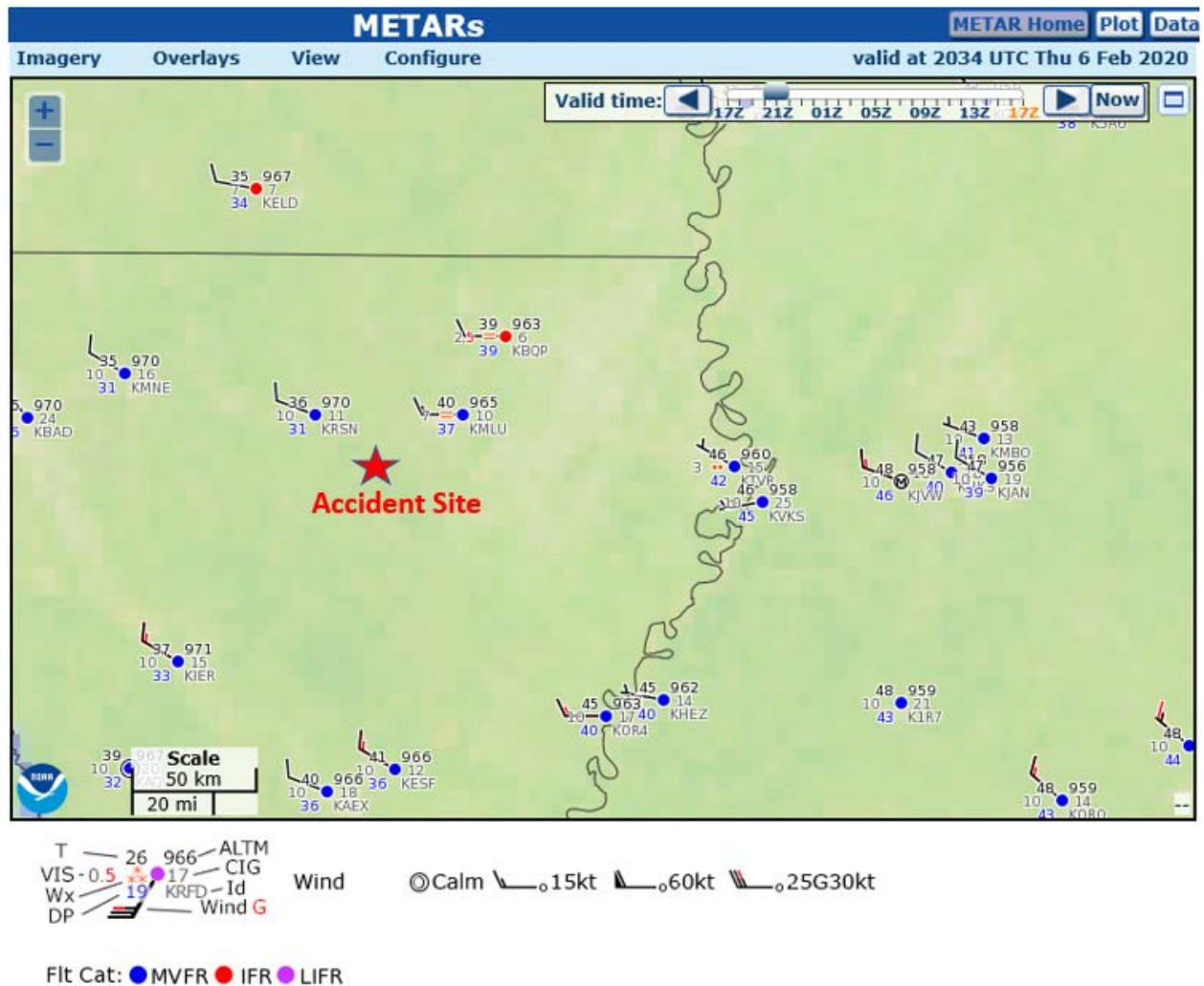


Figure 8 - METAR display for 1435 CST

⁵ <https://aviationweather.gov/metar>

3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site a High-Resolution Rapid Refresh (HRRR)⁶ numerical model data was retrieved from the NOAA Air Resources Laboratory and plotted on a standard Skew T log P diagram⁷ using the complete Rawinsonde Observation RAOB program software⁸. Figure 9 is the HRRR numerical model over the accident site for 1400 CST from the surface through 450-hPa or approximately 20,000 ft.

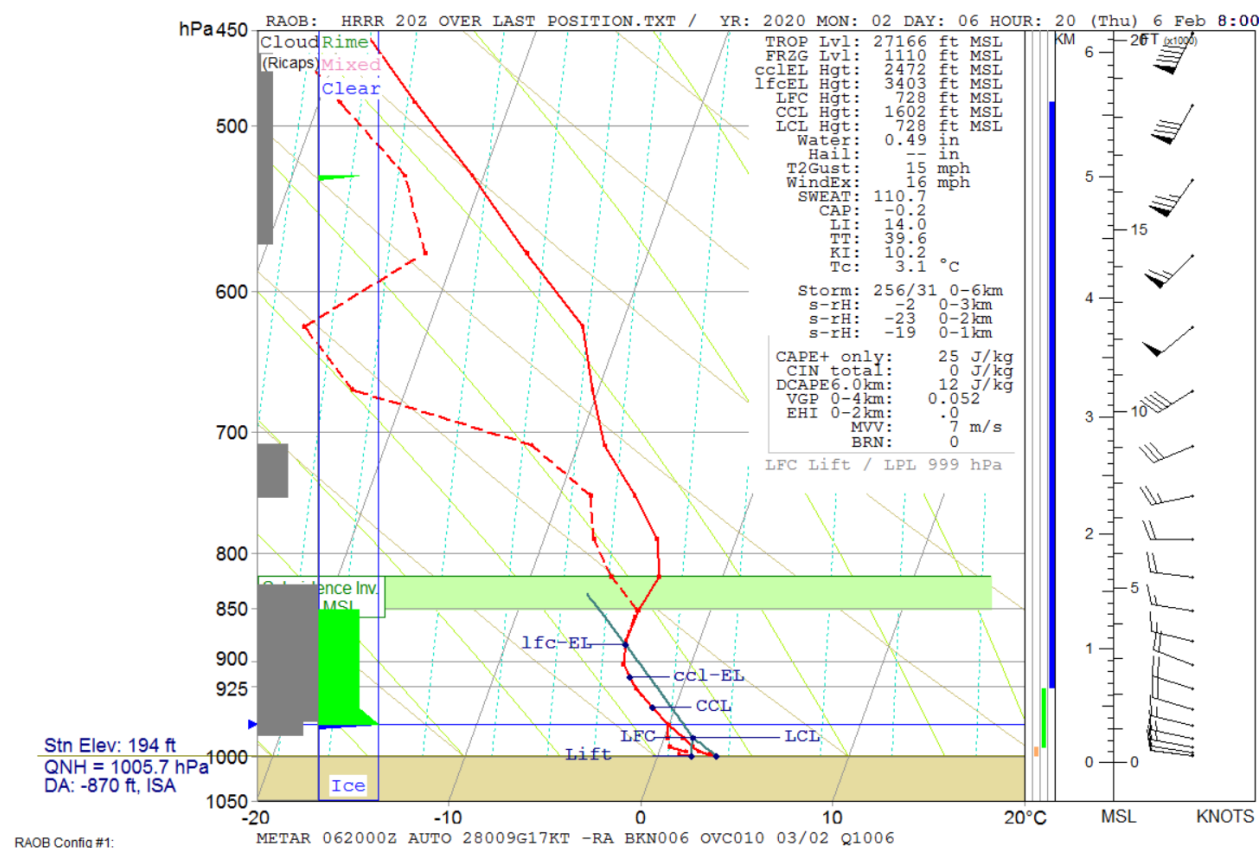


Figure 9 - HRRR numerical model sounding over the accident site for 1400 CST

The HRRR 1400 CST sounding depicted a station elevation of 194 ft, with a near surface temperature of 3.1° C (38° F), a dew point temperature of 1.8° C (35° F), with a relative humidity of 91%. The lifted condensation level (LCL)⁹ and level of free convection (LFC)¹⁰ were identified

⁶ 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.

⁷ 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.

⁸ 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

⁹ Lifted Condensation Level (LCL) - the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

¹⁰ Level of Free Convection (LFC) - the last level where a parcel becomes buoyant, or "warmer" than the

at 534 ft agl, with the convective condensation level (CCL)¹¹ at 1,408 ft agl. The sounding was saturated from the LCL through 5,000 ft where the relative humidity exceeded 95%, with several high layers of scattered clouds also indicated. The freezing level was identified at 1,110 ft with conditions favorable for icing in clouds and precipitation above this level. A temperature inversion was noted between approximately 2,600 ft through 5,345 ft, where temperature increased with altitude or remained nearly constant or isothermal. The precipitable water¹² content was 0.49 inches and supported light rain at the surface. Except for a layer below 2,500 ft which was conditionally unstable, the atmosphere was characterized as stable based on the Lifted Index¹³ of 14.0 and the Convective Available Potential Energy (CAPE) of 25 Joules/kilogram.

Figure 10 is a table of the observed sounding parameters of height, pressure (Pres), temperature (T), dew point (Td), relative humidity (RH), wind direction and speed (DD/FF), and RAOB derived clear air turbulence (CAT), low-level wind shear (LLWS), and potential icing conditions from the surface through 12,000 ft.

Height (ft-AGL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGW/C method)
0	999	3.1	1.8	91	279 / 9		LIGHT	
53	997	2.7	1.1	89	278 / 8	LGT	MODRT	
133	994	2.1	1.4	95	280 / 12		LIGHT	
267	989	1.7	0.5	92	282 / 14			
536	979	1.0	0.2	94	283 / 16			
916	965	0.0	0.0	100	285 / 17			MDT Clear
1383	948	-1.1	-1.1	100	288 / 19			LGT Rime
1968	927	-2.4	-2.4	100	290 / 19			LGT Rime
2650	903	-3.5	-3.5	100	294 / 19	LGT		LGT Rime
3319	880	-3.8	-3.8	100	284 / 14			LGT Rime
4188	851	-3.7	-3.8	99	279 / 15	LGT		LGT Rime
5151	820	-3.3	-5.8	83	278 / 18	LGT		
6216	787	-4.1	-7.4	78	270 / 21	LGT		
7458	750	-6.1	-8.4	84	257 / 25	LGT		
8860	710	-8.6	-12.4	74	246 / 31	MDT		
10407	668	-10.3	-22.8	35	236 / 40	MDT		
12164	623	-12.0	-26.5	29	229 / 50	MDT		

Figure 10 - HRRR model parameters from the surface through 12,000 ft

According to the Air Traffic Control replay the accident airplane was initially operating at 6,000 ft when the pilot requested a lower altitude of 4,000 ft due to encountering icing in the cloud tops. At 1349 CST the accident airplane descended to 4,000 ft and remained at that altitude until approximately 1406 CST when the pilot requested to divert to KRSN due to icing and began a gradual descent.

environmental temperature at the same level. The LFC represents the bottom of the layer containing CAPE.

¹¹ 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.

¹² 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.

¹³ 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 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.

GOES-16 infrared image for 1416 CST at 2X magnification

Figure 12 is the GOES-16 visible image for 1416 CST at normal magnification. The visible image depicted an extensive area of low stratiform type clouds extending over Louisiana and the accident site.

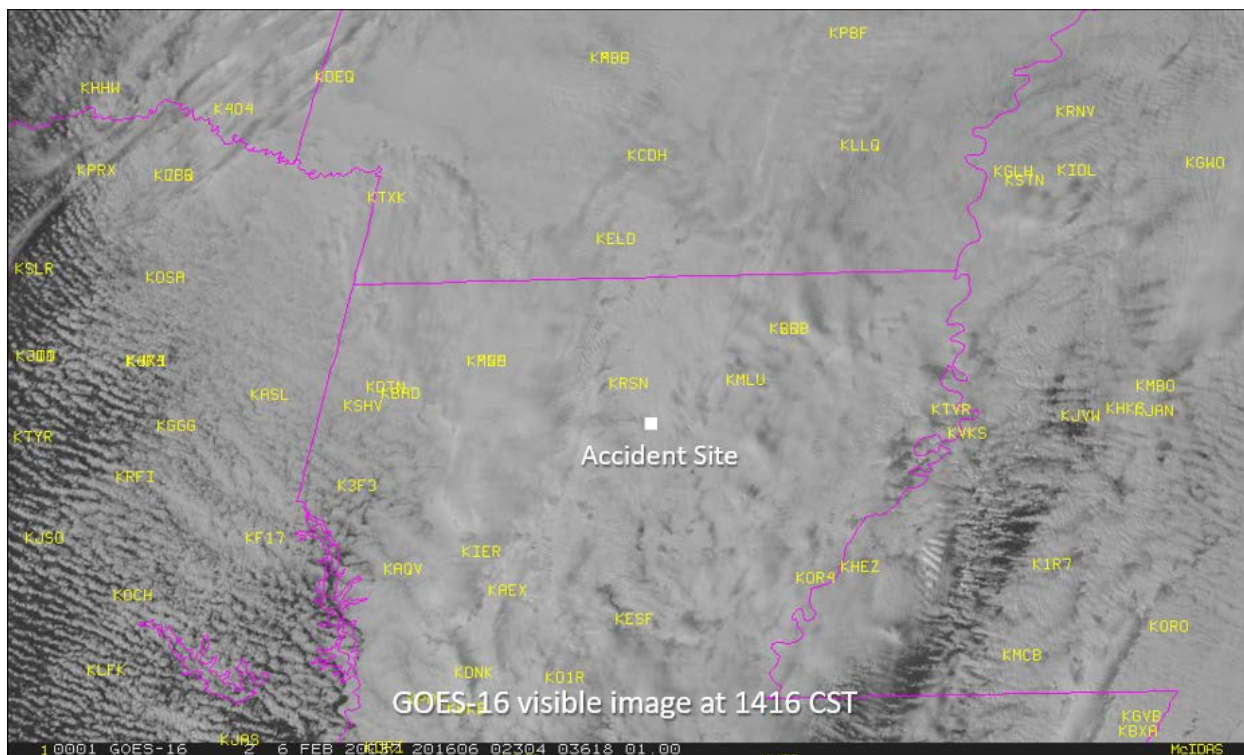


Figure 12 - GOES-16 visible image at 1416 CST at normal magnification

5.0 Pilot Reports

The pilot reports or PIREPs reported within 100 miles and below 12,000 ft from 0930 through 1900 CST were documented below. The reports are provided in raw code with time reference to UTC.

SHV UA /OV SHV/TM 1552/FL030/TP E170/TA -4/IC LGT MX/RM DURD RY32

SHV UA /OV BAD/TM 1555/FL016/TP B52/SK OVC016-TOP036/RM DURC RY33

SHV UA /OV SHV/TM 1730/FLB017/TP SW3/RM A/C RPTD LIGHT/ CLEAR AND RIME ICING DURD RY 32

MLU UA /OV MLU040005/TM 1742/FL070/TP CRJ2/SK OVC007-TOP070/TA M03

MLU UA /OV MLU/TM 1802/FLDURGC/TP B350/SK BKN007-TOP071

MLU UA /OV MLU/TM 1839/FLDURGC/TP C25B/SK TOPS067 CLR ABV

MLU UA /OV MLU180005/TM 1850/FLDURGC/TP C680/IC NEG

Departed KHKS 1907Z

HKS UA /OV KHKS/TM 1908/FL020/TP C182/SK BASES 014

SHV UA /OV 3F3/TM 1934/FL043/TP EPIC/SK OVC030-TOP043/RM 10SW OF 3F3 DURD

SHV UA /OV SHV/TM 1943/FL033/TP SW3/SK OVC023-TOP033/RM DURD RY32

MLU UA /OV MLU222002/TM 1910/FLDURC/TP CRJ2/SK OVC010

MLU UA /OV MLU100015/TM 1950/FL060/TP C182/TA M02/IC LGT RIME

Accident 2013Z

MLU UA /OV MLU340020/TM 2052/FL030/TP B350/IC TRACE RIME 050-030

MLU UA /OV MLU340020/TM 2052/FL050/TP B350/TA UNK/IC TRACE RIME 030-050

SHV UA /OV SHV225010/TM 2100/FL050/TP SW3/SK OVC027/WX FV10SM/TA 00/IC LGT MX

MLU UA /OV MLU042002/TM 2102/FLDURGD/TP BE20/SK OVC008

MLU UA /OV RSN320004/TM 2110/FL038/TP BE55/TA UNK/IC LGT RIME

MLU UA /OV MLU042004/TM 2137/FL030/TP BE40/TA 01/IC LGT RIME

MLU UA /OV MLU042003/TM 2138/FLDURGD/TP C25B/SK OVC012

MLU UA /OV MLU140010/TM 2155/FL050/TP C25B/SK TOP050

ELD UA /OV ELD080015/TM 2155/FL035/TP C208/TA M02/IC LGT RIME/RM ZFW AWC-WEB/

MLU UA /OV MLU042003/TM 2156/FL011/TP CRJ2/SK OVC011-TOP050

MLU UA /OV MLU300015/TM 2200/FL030/TP SR22/TA M07/IC LGT RIME

MLU UA /OV MLU222002/TM 2208/FL013/TP E45X/SK OVC013-TOP050/TA 05/IC LGT RIME 023-050

MLU UA /OV MLU260010/TM 2232/FL030/TP C208/SK OVC014/WX 10/TA M05/IC LGT RIME 030-040

MLU UA /OV MLU060018/TM 0018/FL048/TP BE20/SK BKN030-TOP060/WX 10/TA M04/IC LGT RIME

*MLU UA /OV MLU045010/TM 0056/FL030/TP CRJ2/SK OVC027/TA 00/IC LGT RIME 048/RM TOPS
RPTD 047*

A review of the PIREPs indicated that there were 2 reports of light mixed icing in the vicinity of the destination below 3,000 ft between 0952 and 1130 CST, with no other reports of icing up until 1350 CST. That report of icing likely came from the accident pilot approximately 15 miles east of KMLU, who reported light rime icing at 6,000 ft with a temperature of -2° C. Sky cover in the KMLU area during the period was reported as overcast clouds with bases near 700 ft with tops to 7,100 ft. After the accident there were 11 PIREPs of a trace to light rime and mixed icing from 3,000 to 6,000 ft over the area, with all but 3 of the reports coming from turboprop and regional jet aircraft with known deicing/anti-icing capability. There were no urgent PIREPs issued over the region during the period, and no reports greater than light icing.

For reference the following icing intensity is taken from the Aeronautical Information Manual (AIM), Safety of Flight, Section 7-1-21 PIREPs Relating to Airframe Icing.

1. Trace. Ice becomes noticeable. The rate of accumulation is slightly greater than the rate of sublimation. A representative accretion rate for reference purposes is less than ¼ inch

(6 mm) per hour on the outer wing. The pilot should consider exiting the icing conditions before they become worse.

2. **Light.** The rate of ice accumulation requires occasional cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is ¼ inch to 1 inch (0.6 to 2.5 cm) per hour on the unprotected part of the outer wing. The pilot should consider exiting the icing condition.

3. **Moderate.** The rate of ice accumulation requires frequent cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is 1 to 3 inches (2.5 to 7.5 cm) per hour on the unprotected part of the outer wing. The pilot should consider exiting the icing condition as soon as possible.

4. **Severe.** The rate of ice accumulation is such that ice protection systems fail to remove the accumulation of ice and ice accumulates in locations not normally prone to icing, such as areas aft of protected surfaces and any other areas identified by the manufacturer. A representative accretion rate for reference purposes is more than 3 inches (7.5 cm) per hour on the unprotected part of the outer wing. By regulation, immediate exit is required.

NOTE- Severe icing is aircraft dependent, as are the other categories of icing intensity. Severe icing may occur at any ice accumulation rate when the icing rate or ice accumulations exceed the tolerance of the aircraft.

6.0 NWS Forecasts

The standard NWS aviation products over the area were documented over the route of flight.

6.1 Terminal Aerodrome Forecasts

The closest Terminal Aerodrome Forecast (TAF) was issued by the NWS Shreveport (KSHV) Weather Forecast Office (WFO) for KMLU. A 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 forecasts issued surrounding the period relevant to the preflight planning and the time of the accident was as follows.

TAF KMLU 061741Z 0618/0718 28012KT 4SM BR SCT010 OVC019
FM070000 28010KT P6SM BKN025 OVC035
FM070600 27008KT P6SM SKC
FM071500 20006KT P6SM FEW100 SCT250

The forecast for KMLU expected winds from 280° at 12 knots, visibility 4 miles in mist, with scattered clouds at 1,000 ft agl, and a ceiling overcast at 1,900 ft. After 2200 CST, the wind was from 280° at 10 knots, visibility 10 miles or more, with a ceiling broken at 2,500 ft, and overcast at 3,500 ft.

6.2 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 and marine sections have been excluded. The forecast discussion issued at 1242 CST was as follows.

*FXUS64 KSHV 061842
AFDSHV*

*Area Forecast Discussion
National Weather Service Shreveport LA
1242 PM CST Thu Feb 6 2020*

.AVIATION...

For the 06/18Z TAF period, MVFR cigs continue to affect all sites early this afternoon with gradual improvement expected over the next several hours. Cigs will continue to lift and scatter out across our East Texas terminals this afternoon and eventually at SHV/TXK closer to 07/00Z with full clearing expected through the evening and overnight hours farther east at ELD/MLU. Beyond that, VFR conditions will prevail through the remainder of the period with only some mid and high level cloud cover returning on Friday. Breezy W/NW winds will prevail this afternoon from near 10-15 kts with higher gusts up around 20 mph. Winds will decouple overnight to around 5 kts or less before increasing again from the S/SW by 07/15Z.

6.3 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.

Figures 13 and 14 are the southeast sections of the GFA Surface Forecast issued at 1001 CST and valid for 1200 and 1500 CST, which depicted the expected surface wind, visibility, flight category, precipitation and weather from data output from the NWS Localized Aviation MOS¹⁴ Product (LAMP), with G-AIRMETs for IFR conditions and strong surface winds overlaid. The charts depicted a large area of IFR and MVFR conditions across Georgia, southeastern Alabama and southern Mississippi with rain showers and thunderstorms. Over the accident airplane's route of flight across western Mississippi and northern Louisiana, the GFA Surface Chart depicted expected surface winds from the west-northwest at approximately 10 knots with a chance of light rain and rain showers. While the general flight category indicated VFR conditions prevailing, the

¹⁴ Model Output Statistics (MOS)

chart depicted G-AIRMET for IFR conditions over the route at 1200 CST (figure 13) and slowly shrinking and moving eastward by 1500 CST (figure 14).

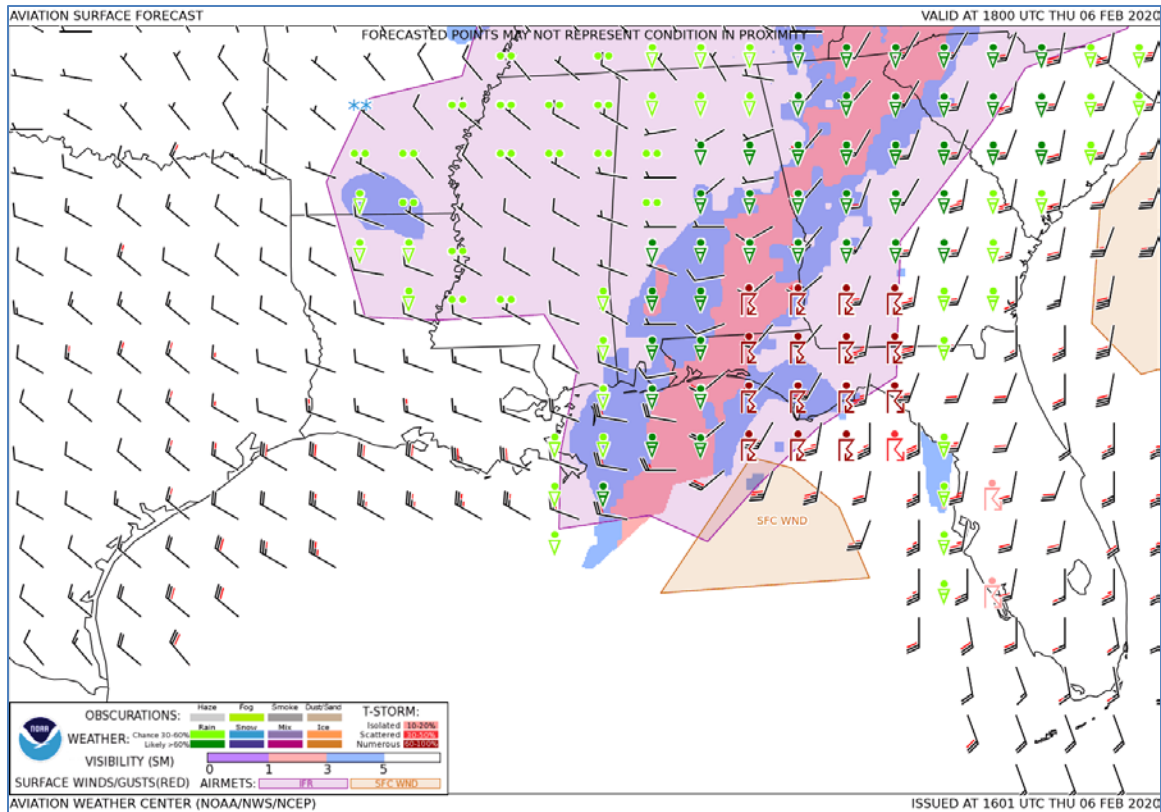


Figure 13 - Southeast GFA Surface Forecast issued at 1001 CST and valid for 1200 CST

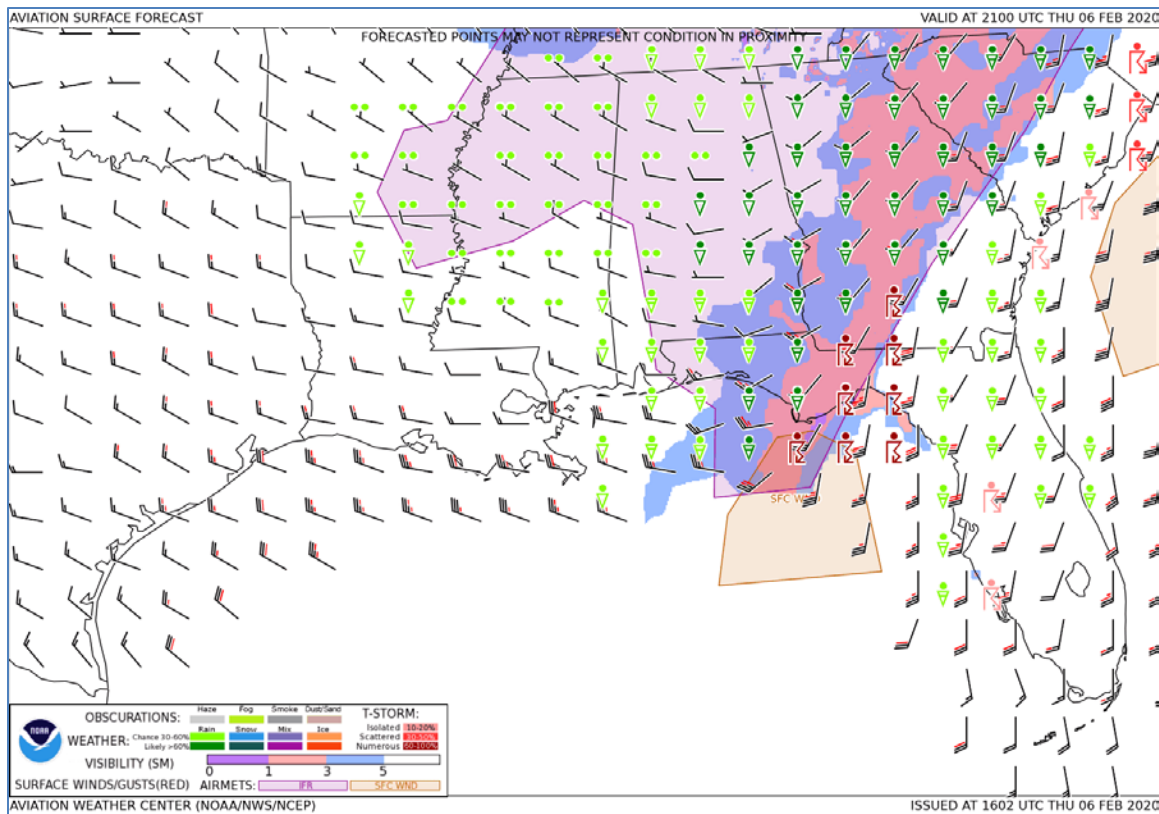


Figure 14 - Southeast GFA Surface Forecast issued at 1001 CST and valid for 1500 CST

Figures 15 and 16 are the southeast sections of the GFA Cloud Forecast issued at 1002 CST and valid for 1200 and 1500 CST, respectively. The primary data are derived from the NWS Rapid Refresh (RAP) continental-scale NOAA hourly-updated assimilation modeling system run operational at NCEP to produce cloud layers, bases and tops. The GFA Cloud Forecasts indicated overcast clouds over the route of flight with bases between 600 and 1,000 ft msl with tops to 6,000 and 8,000 ft for 1200 CST (figure 15), and at 1500 CST overcast cloud bases between 600 and 1,600 ft msl with tops layered to 11,000 ft. A G-AIRMET for moderate icing conditions extended over the route over Louisiana and Mississippi.

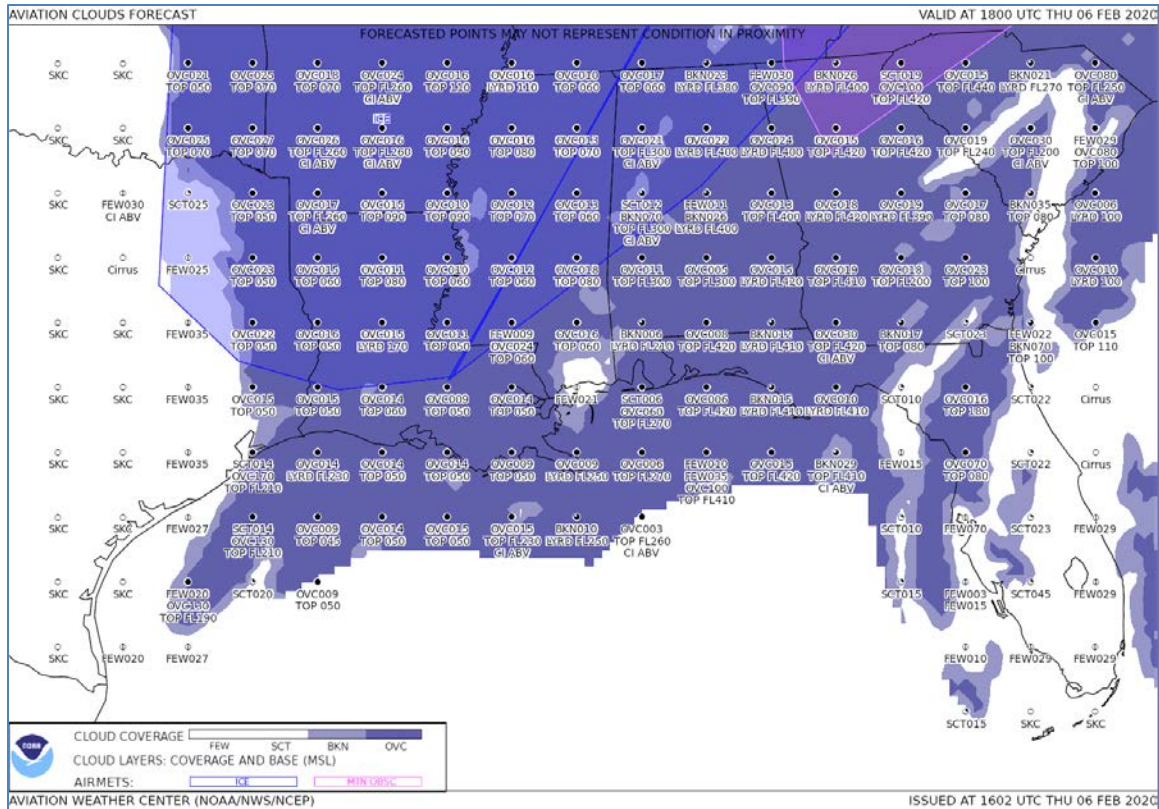


Figure 15 – Southeast GFA Cloud Forecast issued at 1002 CST and valid for 1200 CST

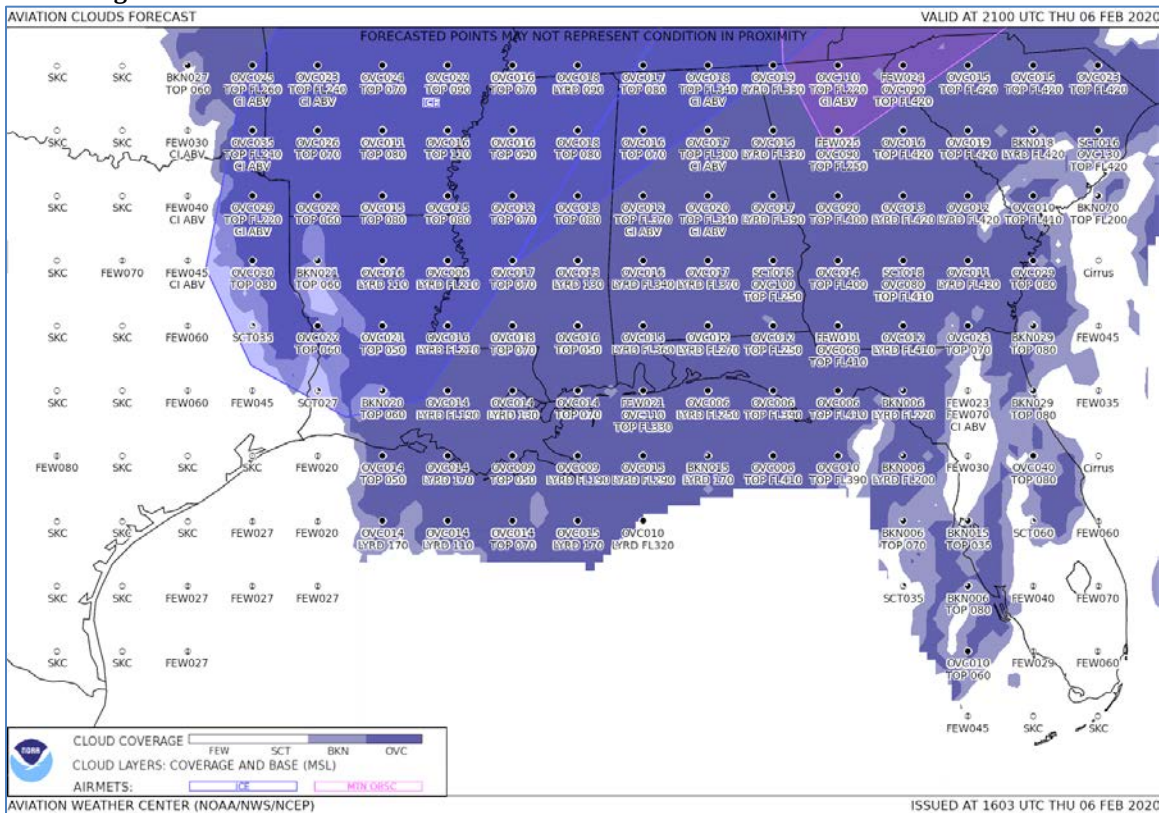


Figure 16 - Southeast GFA Cloud Forecast issued at 1002 CST and valid for 1500 CST

6.4 Winds and Temperature Aloft Forecast

The NWS Winds and Temperature Aloft Forecast current for the route of flight was valid for 1200 CST and for use between 0800 and 1500 CST.

WINDS ALOFT FORECASTS

DATA BASED ON 061200Z

VALID 061800Z FOR USE 1400-2100Z. TEMPS NEG ABV 24000

FT	3000	6000	9000	12000	18000	24000	30000	34000	39000	45000	53000
JAN	3115	2428+03	2447-02	2372-06	7101-18	7114-30	714940	714246	723050	730254	227155
SHV	3215	2821-05	2621-10	2238-12	2261-24	2180-36	228141	227642	227345	236149	225553

The forecast for JAN for 3,000 ft was 310° at 15 knots, at 6,000 ft from 240° at 28 knots, with a temperature of +3° C, and for 9,000 ft from 240° at 47 knots with a temperature of -2° C. The forecast for SHV approximately 190 miles west of JAN for 3,000 ft expected a wind from 320° at 15 knots, at 6,000 ft a wind from 280° at 21 knots with a temperature of -5° C, and at 9,000 ft from 260° at 21 knots with a temperature of -10° C.

7.0 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 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 NWS AWC issued no SIGMETs or Convective SIGMETs over Louisiana during the period, and the Center Weather Service Units (CWSU) at Dallas Fort Worth (KZDV) and Memphis (KZME) Air Route Traffic Control Center (ARTCC) issued no CWA prior to the accident. Immediately after the accident at 1543 CST the CWSU at KZFW issued a CWA advisory for occasional IFR conditions below 1,000 ft agl, which extended over the accident site.

FAUS21 KZFW 062143

ZFW1 CWA 062145

ZFW CWA 101 VALID UNTIL 062330

FROM 15SW MLU-20NE MLU

AREA OCNL IFR CIGS...20NM WIDE.

CIGS BLW 010. CONDS ENDG BY 2330Z.

The NWS also had AIRMETs current for IFR conditions and for moderate icing conditions valid for the periods of 1200 and 1500 CST and are depicted as G-AIRMETs in figures 17-20.

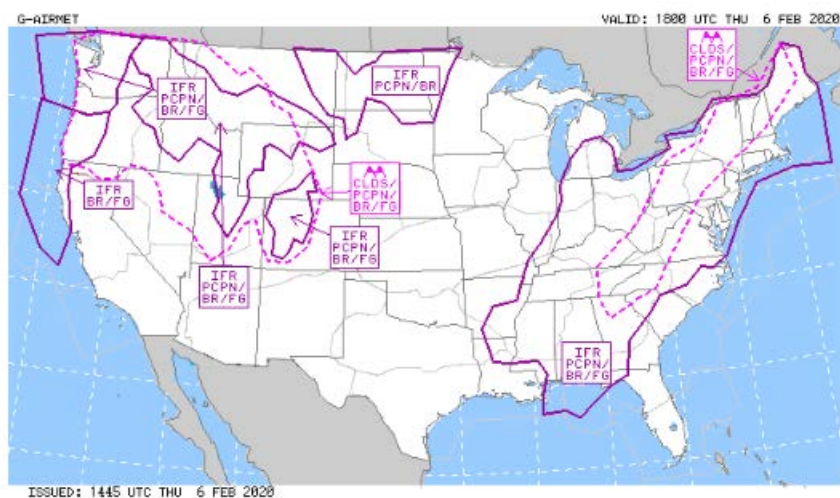


Figure 17 - G-AIRMET Sierra for IFR conditions valid for 1200 CST

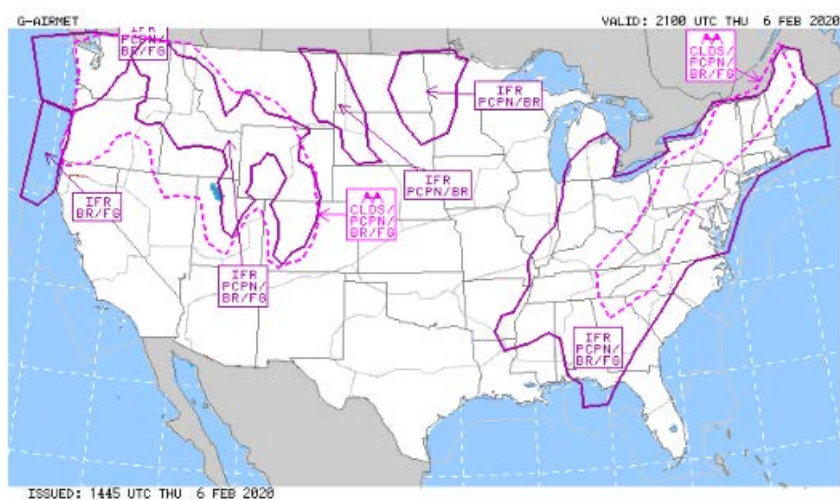


Figure 18 - G-AIRMET Sierra for IFR conditions valid for 1500 CST



Figure 19 - G-AIRMET Zulu for icing conditions valid for 1200 CST



Figure 20 - G-AIRMET Zulu for icing conditions valid for 1500 CST

The accident airplane was operating under instrument flight rules so the AIRMET Sierra was not necessarily considered a hazard and provided the extent of the IFR conditions and locations for alternate airport planning. The AIRMET Sierra for IFR conditions suggested conditions over southern Louisiana south of the route of flight provided a higher likelihood of VFR conditions. The G-AIRMET Zulu series for icing implied a threat of moderate icing. The freezing level was depicted between the surface and 4,000 ft over northern Louisiana.

8.0 Preflight Weather Briefing

A search of the FAA Automated Flight Service Station (AFSS) contract provider Leidos indicated that they had no contact with the pilot of N60381 for any weather briefing on February 6, 2020, and no third-party vendors utilized their system for weather data or to file an instrument flight plan. An additional search of ForeFlight also indicated that they had no contact with the pilot for any weather briefing services. It is therefore unknown what the pilot may have used for his weather familiarization and planning for the flight.

9.0 Astronomical Conditions

The astronomical conditions for Chatham, Louisiana on February 6, 2020, indicated the following conditions. The time of the accident has been added in bold italic print for reference.

<u>Sun</u>	
Begin civil twilight	0635 CST
Sunrise	0700 CST
Sun transition	1223 CST
<i>Accident</i>	<i>1413 CST</i>
Sunset	1747 CST
End civil twilight	1812 CST

At the time of the accident the Sun was 35° above the horizon at an azimuth of 212° but was obscured by the low overcast cloud layer.

Submitted by:

Donald Eick
Senior Meteorologist