



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

August 13, 2019

Weather Study

METEOROLOGY

CEN19FA095

Table Of Contents

A. ACCIDENT	3
B. METEOROLOGIST	3
C. SUMMARY	3
D. DETAILS OF THE INVESTIGATION	3
E. WEATHER INFORMATION	4
1.0 Synoptic Conditions.....	4
1.1 Surface Analysis Chart	4
2.0 Observations	5
2.1 South Lafourche Leonard Miller Jr. Airport, Galliano, LA.....	5
2.2 Bristow US LLC Heliport, Galliano, LA.....	6
2.3 METAR Display	6
3.0 Sounding	7
4.0 Satellite Imagery	9
5.0 Pilot Reports.....	10
6.0 NWS Forecasts.....	11
6.1 Terminal Aerodrome Forecasts.....	11
6.2 Graphic Forecast for Aviation	12
7.0 NWS Inflight Weather Advisories.....	16
8.0 Astronomical Data	19

A. ACCIDENT

Location: Galliano, Louisiana
Date: March 10, 2019
Time: about 1203 central daylight time
1703 Universal Coordinated Time (UTC)
Airplane: Bell 407; Registration: N577AL

B. METEOROLOGIST

Don Eick
Meteorologist Specialist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On March 10, 2019, about 1203, a Bell 407, N577AL, impacted a marsh after descending from cruise flight from an approximate altitude of 300 feet mean sea level about 5 nautical miles east of South Lafourche Leonard Miller Jr Airport (GAO), Galliano, Louisiana. The helicopter was destroyed by impact forces. The commercial pilot and a passenger received fatal injuries. The helicopter was registered to and operated by Bristow Group Inc. under Title 14 *Code of Federal Regulation* Part 135 as an on-demand passenger flight that was operating on a company visual flight rules flight plan. The flight originated from Bristow US LLC Heliport (2LS0), Galliano, Louisiana, about 1155, and was destined to an offshore platform in Viosca Knoll (VK956), Gulf of Mexico, about 69 nautical miles east/southeast of Venice, 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 daylight 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 estimated at latitude 29.422778° N and longitude 90.178333° W, at sea level.

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) 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 1.

1.1 Surface Analysis Chart

The southcentral section of the NWS Surface Analysis Chart for 1000 CDT (1500Z) is included as figure 1 with the approximate accident site located within the red circle and depicted the condition in the region prior to the accident. The chart depicted a stationary front extending northeast to southwest across Mississippi, northern Louisiana and into Texas. The accident site was located south of the stationary front in the warm airmass sector of the front. The isobars depicted a weak pressure gradient over the region, with light southeasterly wind flow near the coast, calm winds inland near the accident site, and wind flow from the east-northeast and generally parallel to the frontal zone over northern Louisiana. The station model in the immediate vicinity of the accident site depicted calm winds, visibility restricted in mist or fog, overcast clouds with a temperature of 70 °Fahrenheit (F), and a dew point temperature of 66° F.

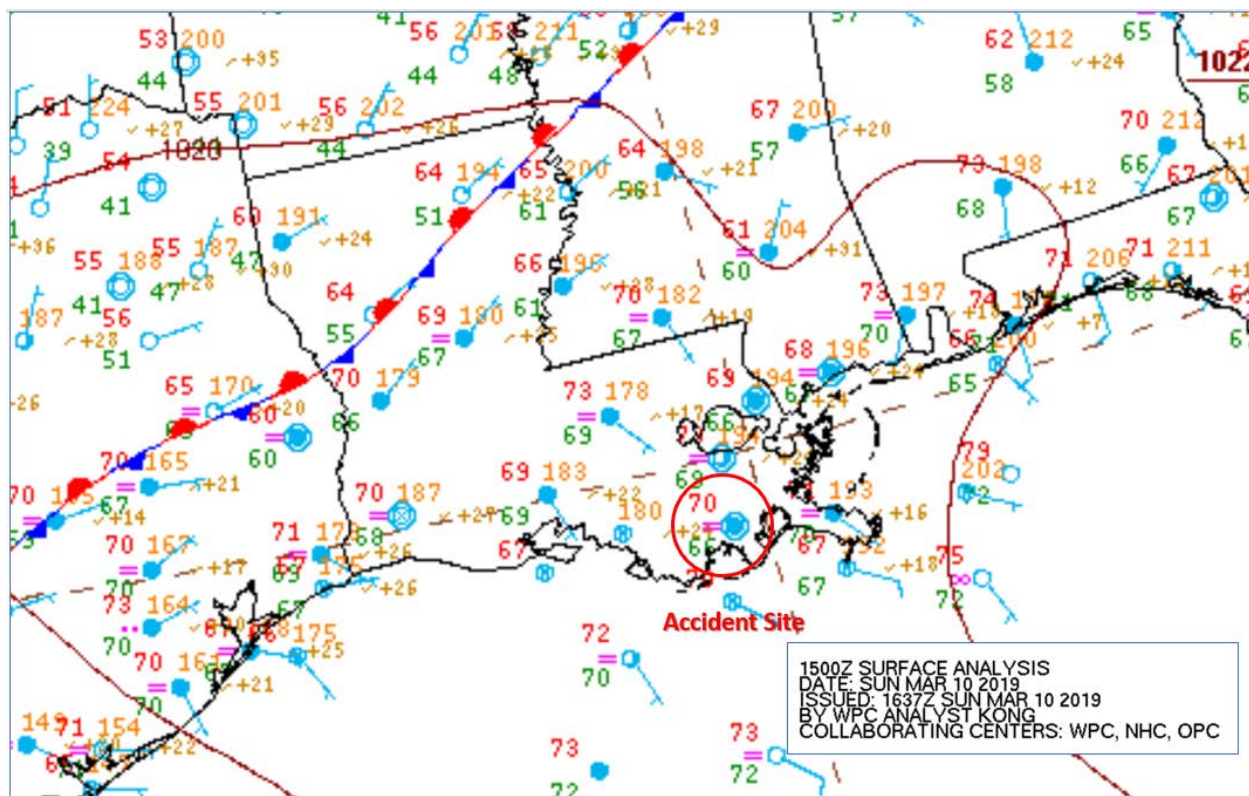


Figure 1 - Southcentral section of the NWS Surface Analysis Chart for 1000 CDT

A review of the NWS National Composite Radar Imagery surrounding the period indicated no significant meteorological echoes over southern Louisiana other than ground clutter.

2.0 Observations

The official surface 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°30' W based on the latest sectional chart for the area.

2.1 South Lafourche Leonard Miller Jr. Airport, Galliano, LA

The closest weather reporting location to the accident site was from South Lafourche Leonard Miller Jr. Airport (KGAO), Galliano, Louisiana, located approximately 5 miles west of the accident site at an elevation of 0 ft. The airport had an Automated Weather Observation System (AWOS) and issued observations every 20-minutes. The following conditions were reported surrounding the time of the accident.

KGAO weather observation at 1155 CDT (1655Z), automated, wind from 170° at 4 knots, visibility 10 miles or more, ceiling overcast at 600 ft agl, temperature 25° Celsius (C), dew point temperature 23° C, altimeter 30.12 inches of mercury (Hg).

KGAO weather observation at 1215 CDT (1715Z), automated, wind from 180° at 5 knots, visibility 10 miles or more, ceiling overcast at 800 ft agl, temperature 25° C, dew point temperature 23° C, altimeter 30.12 inches of Hg.

The general flight categories¹ and raw observations from approximately 0700 through 1235 CST were as follows:

*LIFR METAR KGAO 101315Z AUTO 00000KT 1/4SM FG OVC002 19/17 A3005 RMK AO2 T01900170=
LIFR METAR KGAO 101335Z AUTO 00000KT 1/4SM FG OVC002 19/18 A3006 RMK AO2 T01930175=
LIFR METAR KGAO 101355Z AUTO 00000KT 1 1/4SM BR OVC002 20/18 A3007 RMK AO2 T01960177=
LIFR METAR KGAO 101415Z AUTO 11003KT 1/2SM FG OVC002 20/18 A3007 RMK AO2 T02000180=
LIFR METAR KGAO 101435Z AUTO 12003KT 1/2SM FG OVC002 21/19 A3008 RMK AO2 T02050186=*

¹ As defined by the NWS and the FAA Aeronautical Information Manual (AIM) section 7-1-7 defines the following general flight categories:

- Low Instrument Flight Rules (LIFR*) – ceiling below 500 ft above ground level (agl) and/or visibility less than 1 statute mile.
- Instrument Flight Rules (IFR) – ceiling between 500 to below 1,000 feet agl and/or visibility 1 to less than 3 miles.
- Marginal Visual Flight Rules (MVFR**) – ceiling from 1,000 to 3,000 ft agl and/or visibility 3 to 5 miles.
- Visual Flight Rules (VFR) – ceiling greater 3,000 ft agl and visibility greater than 5 miles.

* By definition, IFR is a ceiling less than 1,000 ft agl and/or visibility less than 3 miles while LIFR is a sub-category of IFR.

**By definition, VFR is a ceiling greater than or equal to 3,000 ft agl and visibility greater than 5 miles while MVFR is a sub-category of VFR.

LIFR METAR KGAO 101455Z AUTO 00000KT 1/2SM FG OVC002 21/19 A3009 RMK AO2 T02090190=
LIFR METAR KGAO 101515Z AUTO 12003KT 4SM BR OVC002 22/20 A3010 RMK AO2 T02160198=
LIFR METAR KGAO 101535Z AUTO 00000KT 7SM OVC004 23/21 A3010 RMK AO2 T02250207=
LIFR METAR KGAO 101555Z AUTO 13004KT 10SM OVC004 23/22 A3010 RMK AO2 T02340216=
IFR METAR KGAO 101615Z AUTO 15006KT 10SM OVC006 24/22 A3010 RMK AO2 T02390220=
IFR METAR KGAO 101635Z AUTO 16003KT 10SM OVC006 24/22 A3011 RMK AO2 T02410222=
IFR METAR KGAO 101655Z AUTO 17004KT 10SM OVC006 25/23 A3012 RMK AO2 T02490228=
Accident 1703Z
IFR METAR KGAO 101715Z AUTO 18005KT 10SM OVC008 25/23 A3012 RMK AO2 T02540227=
MVFR METAR KGAO 101735Z AUTO 22003KT 10SM BKN010 OVC019 26/21 A3012 RMK AO2 T02580212=
MVFR METAR KGAO 101755Z AUTO 20004KT 10SM OVC012 27/21 A3011 RMK AO2 T02670207 10268
 20190=
MVFR METAR KGAO 101815Z AUTO 20007KT 10SM OVC014 27/21 A3011 RMK AO2 T02650209=
MVFR METAR KGAO 101835Z AUTO 19005KT 10SM BKN014 OVC018 27/20 A3010 RMK AO2 T02670204=

A review of the observations indicated that LIFR to IFR conditions were reported prior to and after the accident with an improvement to MVFR conditions beginning at 1235 CDT.

2.2 Bristow US LLC Heliport, Galliano, LA

The next closest weather reporting location was from the departure airport at Bristow US LLC Heliport (K2LS), Galliano, Louisiana, located 7 miles west of the accident site. The heliport also had an AWOS and reported the following conditions surrounding the period. At the approximate time of departure, the following conditions were being reported.

K2LS weather observation at 1155 CST (1655Z), automated, wind 170° at 6 knots, visibility 10 miles or more, ceiling broken at 700 ft agl, broken clouds at 2,200 ft, temperature 24° C, dew point temperature 22° C, altimeter 30.14 inches of Hg.

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

IFR K2LS 101535Z AUTO VRB04KT 10SM OVC005 22/22 A3012 RMK AO2
IFR K2LS 101555Z AUTO VRB05KT 10SM BKN005 OVC010 22/22 A3011 RMK AO2
IFR K2LS 101615Z AUTO 16006KT 10SM BKN006 BKN010 OVC022 23/22 A3012 RMK AO2
IFR K2LS 101635Z AUTO VRB05KT 10SM BKN007 OVC022 24/22 A3013 RMK AO2
IFR **K2LS 101655Z AUTO 17006KT 10SM BKN007 BKN022 24/22 A3014 RMK AO2**
MVFR K2LS 101715Z AUTO VRB04KT 9SM SCT007 BKN018 BKN075 24/22 A3013 RMK AO2
VFR K2LS 101735Z AUTO VRB04KT 10SM SCT018 BKN080 24/22 A3013 RMK AO2

A review of the observations indicated that IFR conditions were reported at the time of departure with a ceiling broken at 700 ft agl. MVFR to VFR conditions were reported beginning at 1215 and 1235 CST, respectively.

2.3 METAR Display

The NWS Aviation Weather Center's METAR display at 1200 CDT is depicted in figure 2. The image depicted IFR conditions being reported at KGAO and at Houma-Terrebonne Airport (KHUM), Houma, LA, which was located approximately 27 miles to the northwest, at the time.

LIFR conditions were still being reported at Port Fourchon (KXPY), Golden Meadow, LA, which was located approximately 20 miles south of the accident site.

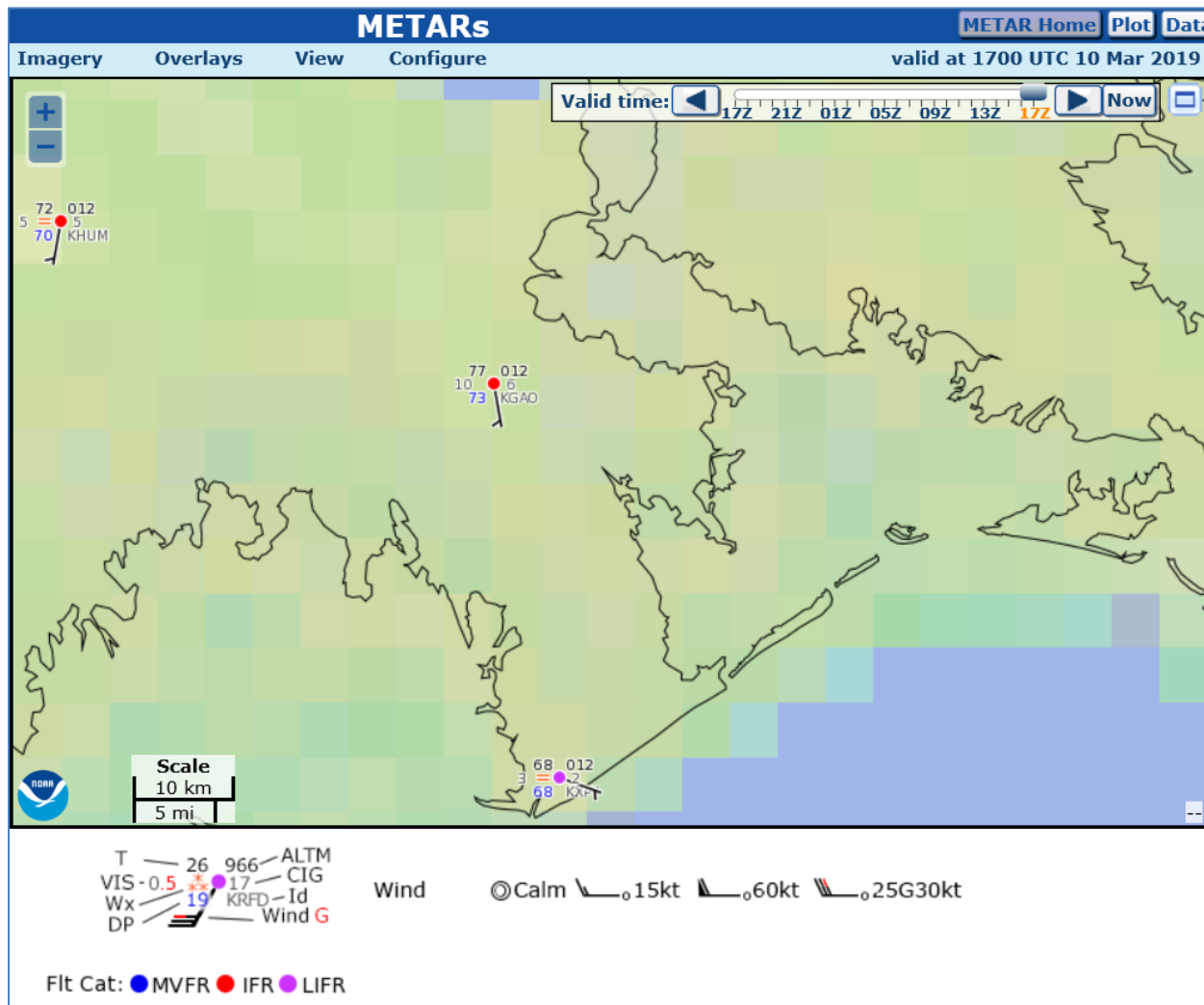


Figure 2 - NWS METAR Display from the Aviation Weather Center for 1200 CDT

3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site a High-Resolution Rapid Refresh (HRRR)² numerical model data was retrieved from the NOAA Air Resources Laboratory for the accident sites coordinates for 1200 CST and plotted on a standard

² 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.

Skew T log P diagram³ using the complete Rawinsonde Observation RAOB program software⁴. Figure 3 is the HRRR plot for 1200 CDT from the surface to approximately 20,000 ft. The HRRR model sounding indicated the accident elevation as 0 ft, a temperature of 22.1° C (71.8° F), dew point temperature of 21.5° C (70.7° F), a relative humidity of 96%, with a resultant density altitude of 928 ft. A low-level temperature inversion was noted between 500 and 1,500 ft. The sounding expected a lifted condensation level at 252 ft agl, a convective condensation level (CCL) at 2,446 ft agl, and a level of free convection (LFC) at 3,175 ft agl. A low-level temperature inversion was noted between from 500 through 1,500 ft due to subsidence and supported the low stratiform clouds which were indicated from approximately 500 ft with tops near 3,500 ft where the sounding had a relative humidity greater than 90%. The freezing level was at approximately 14,230 ft, which was well above the helicopters planned altitude, so no icing issues were identified.

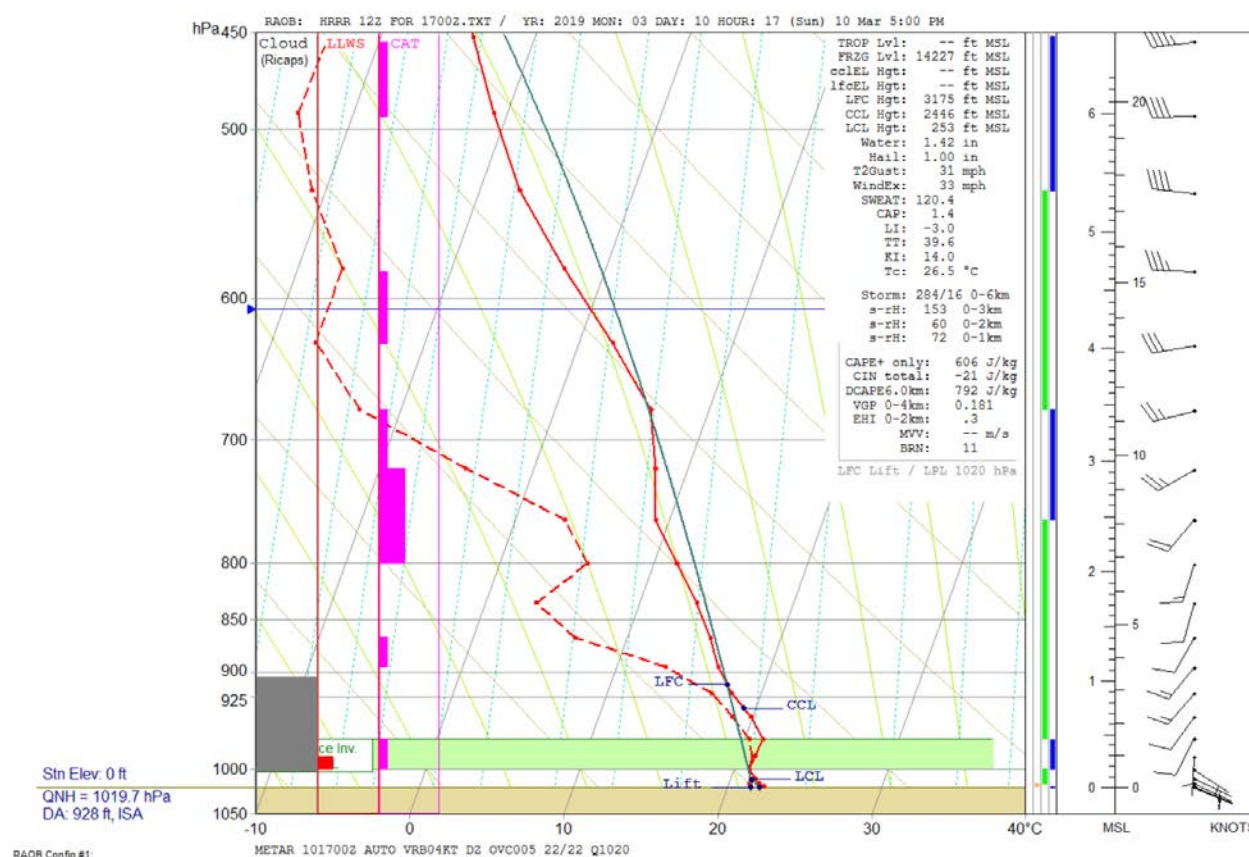


Figure 3 - HRRR numerical model sounding for 1200 CDT through 21,000 ft

The HRRR wind profile indicated a light and variable surface wind at 4 knots, with wind immediately from the southeast above the surface and veering to the southwest above the inversion and then to the south at 5,000 ft and then veered to the west about 10,000 ft with increasing wind

³ 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.

⁴ 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.

speeds. The mean 0 to 6 kilometer or 18,000 ft winds were from 255° at 22 knots. A review of the vertical wind shear in the profile indicated no significant vertical shears to indicate anything other than light turbulence potential below 6,000 ft and near the inversion.

Figure 4 is the HRRR numerical model data parameters of height, pressure (Pres), temperature (T), dew point temperature (Td), relative humidity (RH), wind direction and speed, and RAOB derived clear air turbulence (CAT) and low-level wind shear (LLWS) potential below 6,000 ft.

Height (ft-MSL)	Pres (hPa)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS
0	1020	22.1	21.5	96	116 / 4		
28	1019	22.4	21.5	95	115 / 4		
112	1016	22.0	21.4	96	117 / 4		
281	1010	21.6	21.3	98	117 / 5		
565	1000	21.0	21.0	100	125 / 4	LGT	LIGHT
967	986	21.1	20.9	99	183 / 6	LGT	
1493	968	21.2	20.3	95	206 / 10		
2178	945	19.9	18.7	93	214 / 12		
2906	921	18.1	16.8	92	219 / 14		
3711	895	16.6	13.2	80	218 / 14	LGT	
4599	867	15.4	6.6	56	208 / 11		
5643	835	13.7	3.3	49	195 / 11		

Figure 4 - HRRR numerical model parameters through 6,000 ft

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) data was 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 visible image 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 retrieved at a normal spatial resolution of 0.5 km.

The GOES-16 visible image at 1202 CDT at 2X magnification is included as figure 5 and depicted a layer of low stratiform clouds over the accident site marked by a red square, a slight break in the clouds was immediately south of KGAO and K2GL. Another layer of low clouds extended south over the Louisiana coastal sections.

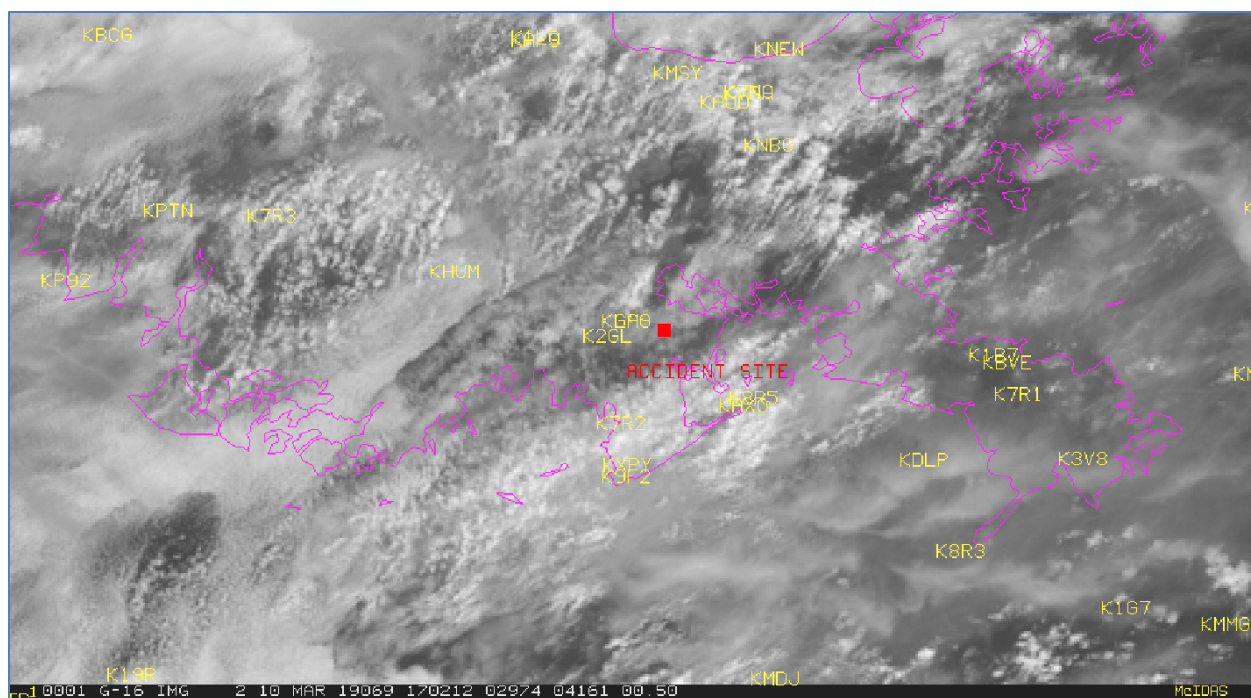


Figure 5 - GOES-16 visible image at 1202 CDT with the accident site marked in red

5.0 Pilot Reports

The following pilot reports or PIREPs were noted over southern Louisiana near the accident site during the period. The raw observation is provided in standard code and abbreviations, with the decoded report with time converted to local. The reports were as follows.

BTR UA /OV BTR/TM 1335/FL006/TP CRJ9/SK OVC

Baton Rouge Metropolitan Airport (BTR) routine pilot report (UA); Over – BTR; Time – 0835 CDT; Altitude – 600 ft; Type aircraft – Bombardier formerly Canadair regional air carrier jet; Sky cover – overcast clouds.

BTR UA /OV LSU090050 /TM 1345 /FL180 /TP A319 /SK TOPS RPRTD /RM FM ZHU AWC-WEB

BTR routine pilot report (UA); Over – 090 azimuth and 50 miles on Fighting Tiger (LSU) VORTAC, Baton Rouge, LA; Time – 0845 CDT; Altitude – 18,000 ft; Type aircraft – Airbus air carrier jet; Sky cover – tops reported; Remarks – entered from Houston ARTCC (ZHU).

BTR UA /OV BTR/TM 1505/FL007/TP PA32/SK OVC/RM BASES 750 FEET

BTR routine pilot report (UA); Over – BTR; Time – 1005 CDT; Altitude – 700 ft; Type aircraft –Piper Cherokee light single engine airplane; Sky cover – overcast clouds; Remarks – bases at 750 ft.

BTR UA /OV BTR/TM 1518/FL008/TP CRJ7/SK OVC/RM BASES 008 OVC

BTR routine pilot report (UA); Over – BTR; Time – 1018 CDT; Altitude – 800 ft; Type aircraft – Bombardier formerly Canadair regional air carrier jet; Sky cover – overcast clouds; Remarks – bases at 800 f overcast.

HUM UA /OV 1/2 MILE NORTH OF RWY 18/TM 1533/FL400/TP A139/RM HELICOPTER ON ILS RWY 18 RPTD TOPS 2000 AGL BASES AT 400 AGL

Houma-Terrebonne Airport (HUM) routine pilot report (UA); Over – 1/2 mile north of runway 18; Time – 1033 CDT; Altitude – 400 ft; Type aircraft – Agusta Westland AW139 turbine helicopter; Remarks – helicopter on ILS runway 18 approach reported cloud tops at 2,000 ft agl with bases at 400 ft agl.

6.0 NWS Forecasts

6.1 Terminal Aerodrome Forecasts

The NWS New Orleans/Baton Rouge Weather Forecast Office (WFO) located in Slidell, Louisiana was responsible for the region of the helicopter's departure and the accident site. The closest TAF was issued for KHUM located approximately 22 miles west from the accident site. A TAF is only valid for a 5-mile radius around the airport center point, but is often reviewed for familiarization purposes, and for a better break down of the expected conditions. The forecasts issued surrounding the period were as follows:

*AMD TAF KHUM 101244Z 1013/1112 VRB03KT 1SM BR OVC005
FM101500 VRB03KT P6SM BKN015
FM101800 17007KT P6SM SCT025 BKN130
FM110500 VRB03KT 2SM BR OVC015
FM110600 VRB03KT 1/2SM FG OVC003=*

The initial forecast issued at 0744 CDT was an amended TAF which expected the LIFR conditions with visibility 1 mile in mist with ceiling overcast at 500 ft agl expected until 1000 CDT, with MVFR conditions expected after 1000 CDT with visibility 6 miles or more and ceiling broken at 1,500 ft through 1300 CDT, and VFR conditions afterwards until 2400 CDT the following day.

The forecast was amended again at 1006 CDT and was as follows.

*AMD TAF KHUM 101506Z 1015/1112 VRB03KT 1 1/2SM BR BKN002
FM101600 VRB05KT 4SM BR BKN005
FM101700 17007KT P6SM SCT025 BKN130
FM110500 VRB03KT 2SM BR OVC015
FM110600 VRB03KT 1/2SM FG OVC003=*

The forecast current at the time of the accident expected LIFR until 1100 CST with visibility 1 ½ miles in mist, with ceiling broken at 200 ft agl. With IFR conditions expected between 1100 and 1200 CDT with visibility 4 miles in mist, ceiling broken at 500 ft agl, with VFR conditions after 1200 CDT through 2400 CDT.

6.2 Graphic Forecast for Aviation

The Graphic Forecast for Aviation (GFA) replaced the Area Forecast for providing enroute weather conditions and cloud cover with bases and tops. The GFA static forecast for “Aviation Surface Forecast” issued by the AWC at 1100 CDT for the period for wind, visibility, and weather phenomena, with the Graphic AIRMET⁵ (G-AIRMET) Sierra for IFR conditions and G-Tango for strong gusty surface winds are included as figures 6 through 8, and provide snap shots of conditions at 1300, 1600, and 1900 CDT respectively. The charts depicted light southerly winds of 5 knots or less over the region with visibilities restricted less than 3 miles offshore, with conditions deteriorating with time. G-AIRMET Sierra for IFR conditions extended over southern Louisiana and the coastal sections during the entire period warning of IFR conditions.

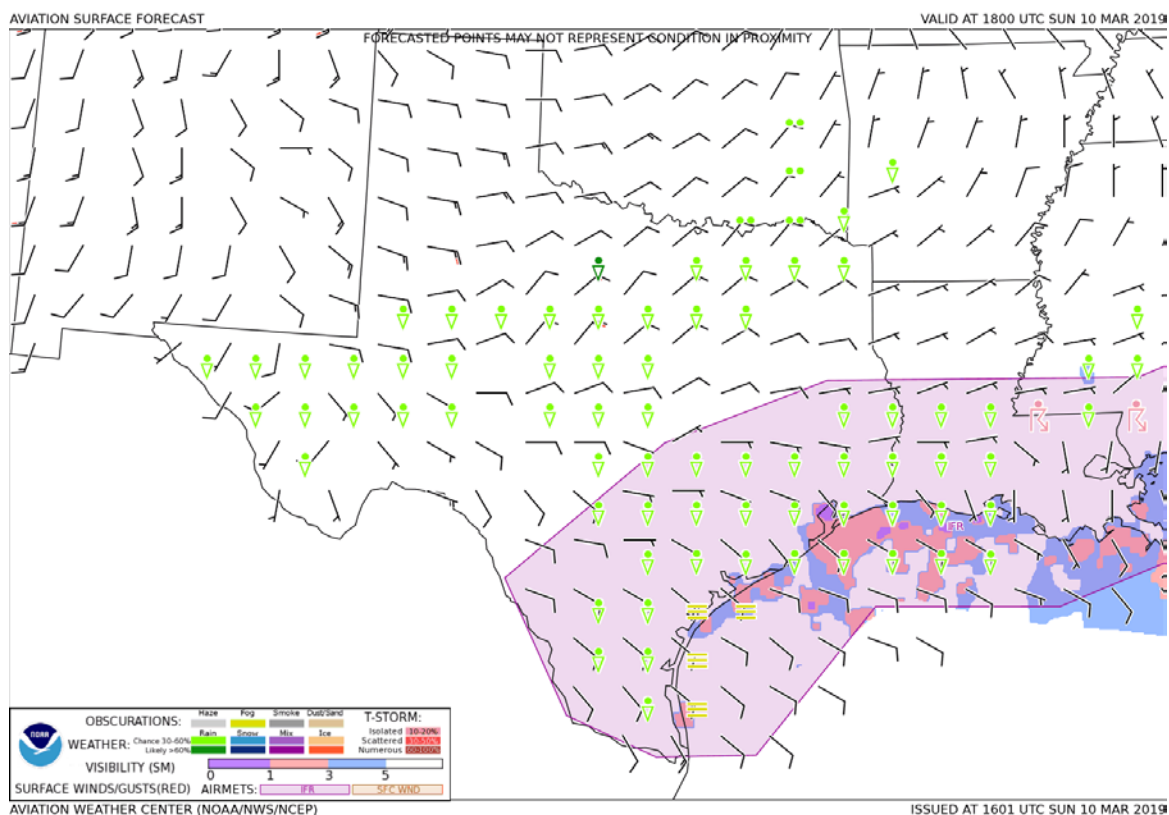
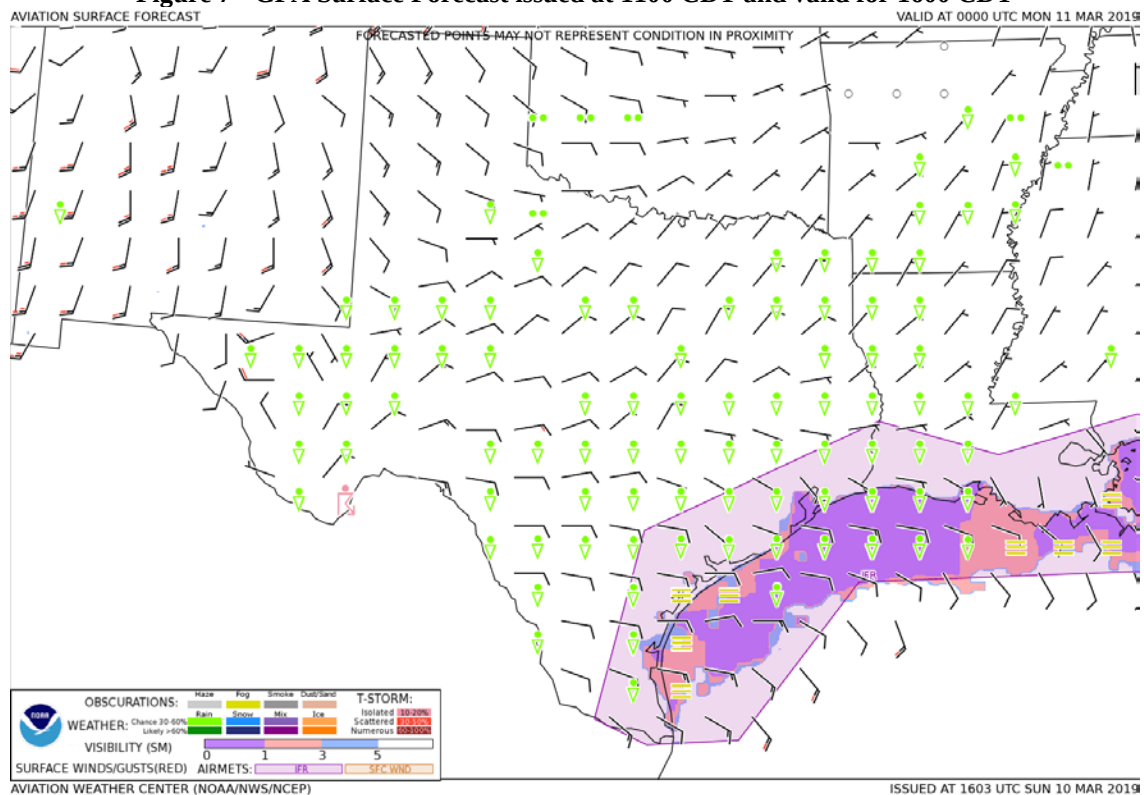
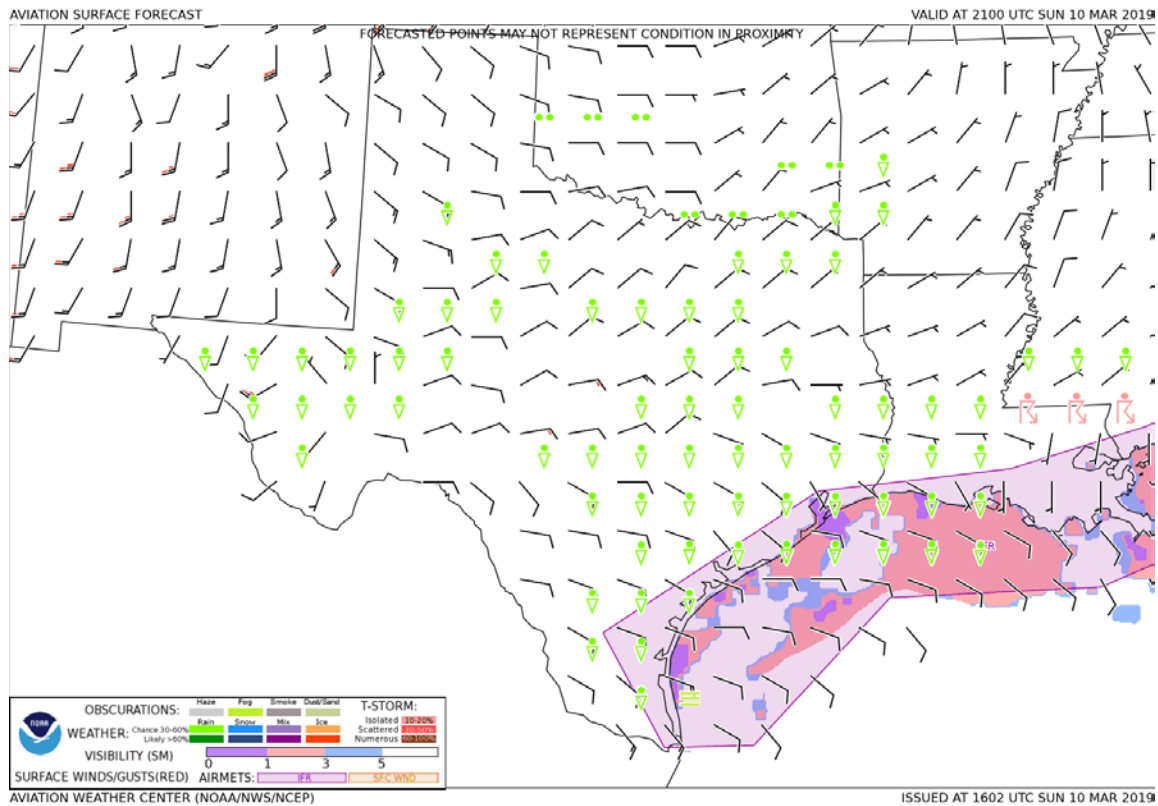


Figure 6 - GFA Surface Forecast issued at 1100 CDT and valid for 1300 CDT

⁵ Airmen’s Meteorological Information (AIRMET) is a concise description of weather phenomena that are occurring or may occur (forecast) over an area of at least 3,000 square miles that may affect aircraft safety. AIRMETs are issued for moderate turbulence or icing, sustained surface winds of 30 knots or more, Low-Level Wind Shear (LLWS), widespread restricted visibility below 3 statute miles and/or ceilings less than 1,000 ft agl or IFR conditions and mountain obscuration conditions.



The GFA “Aviation Cloud Forecast” provided cloud coverage, bases, layers, and tops with the G-AIRMET Zulu for icing conditions also included on the images. The GFA cloud forecasts issued about 1100 CDT and valid for 1300, 1600, and 1900 CDT are included as figures 9 through 11. Low overcast clouds were expected offshore with bases near 300 ft and tops to 6,000 ft,

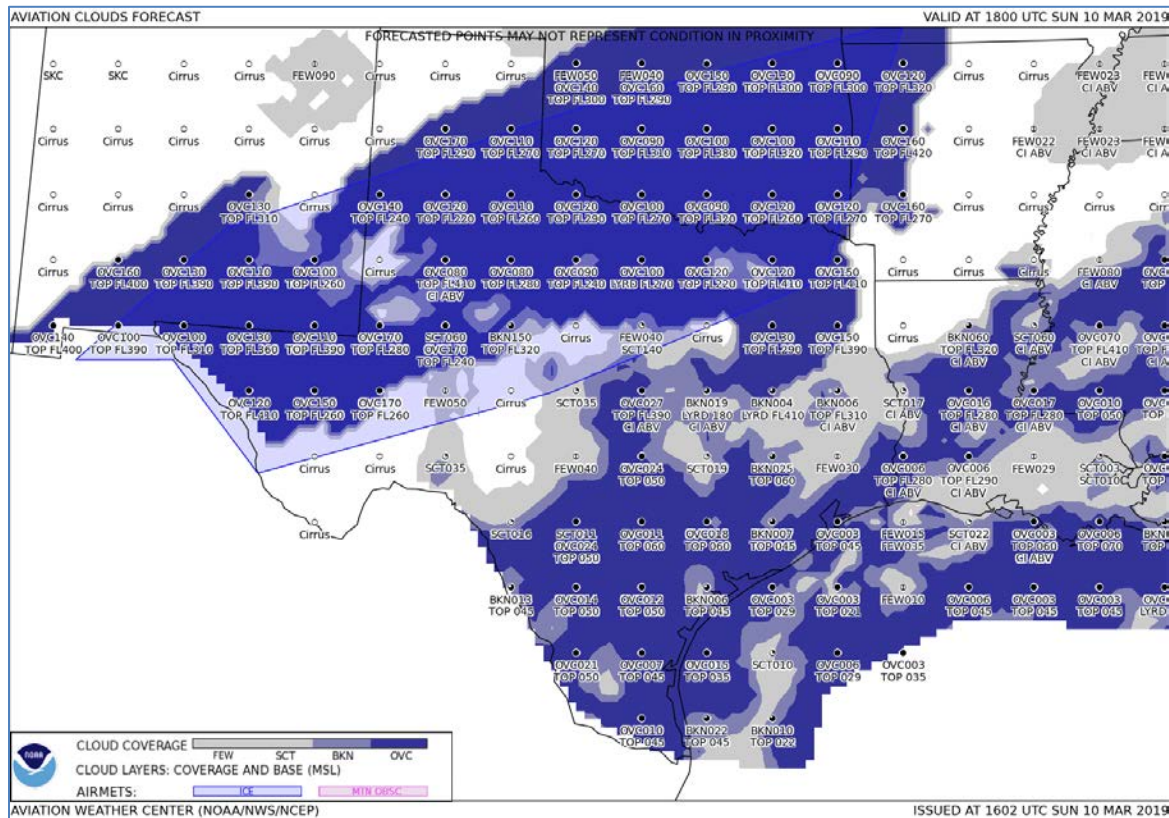


Figure 9 - GFA Cloud Forecast issued at 1100 CDT and valid for 1300 CDT

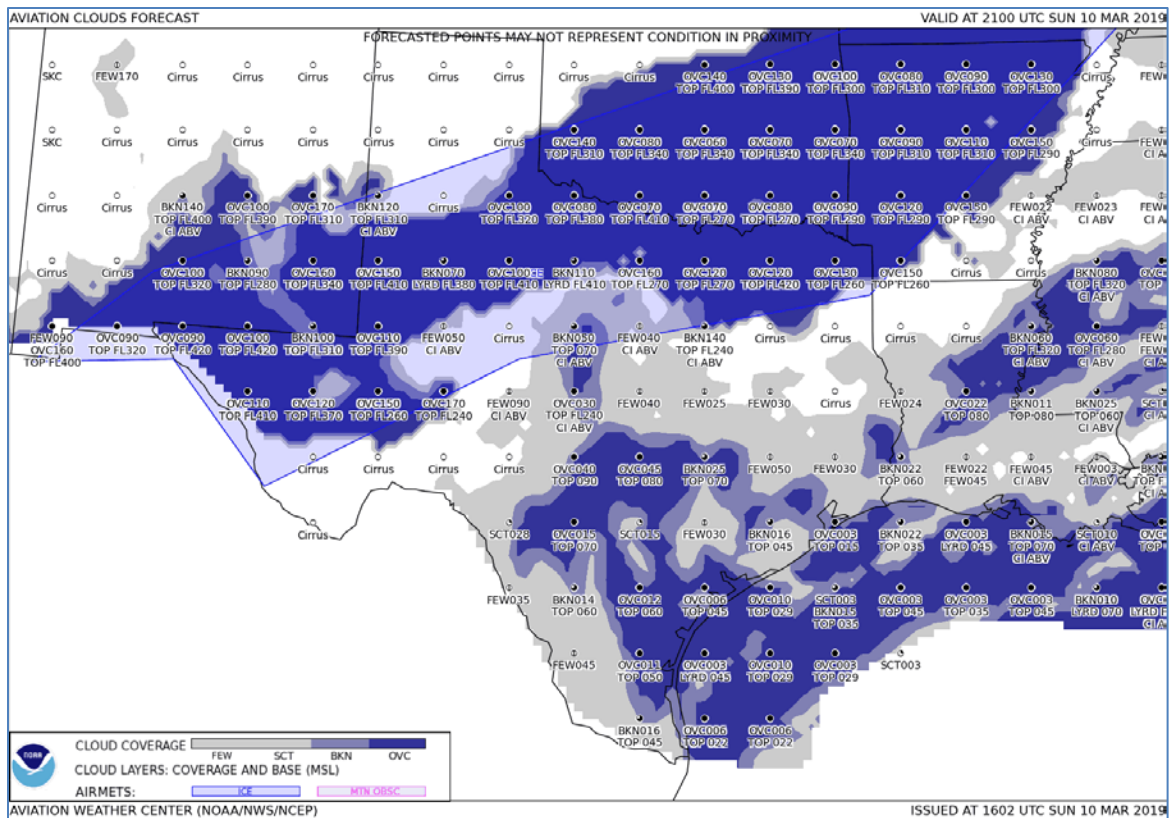


Figure 10 - GFA Cloud Forecast issued at 1100 CDT and valid for 1600 CDT

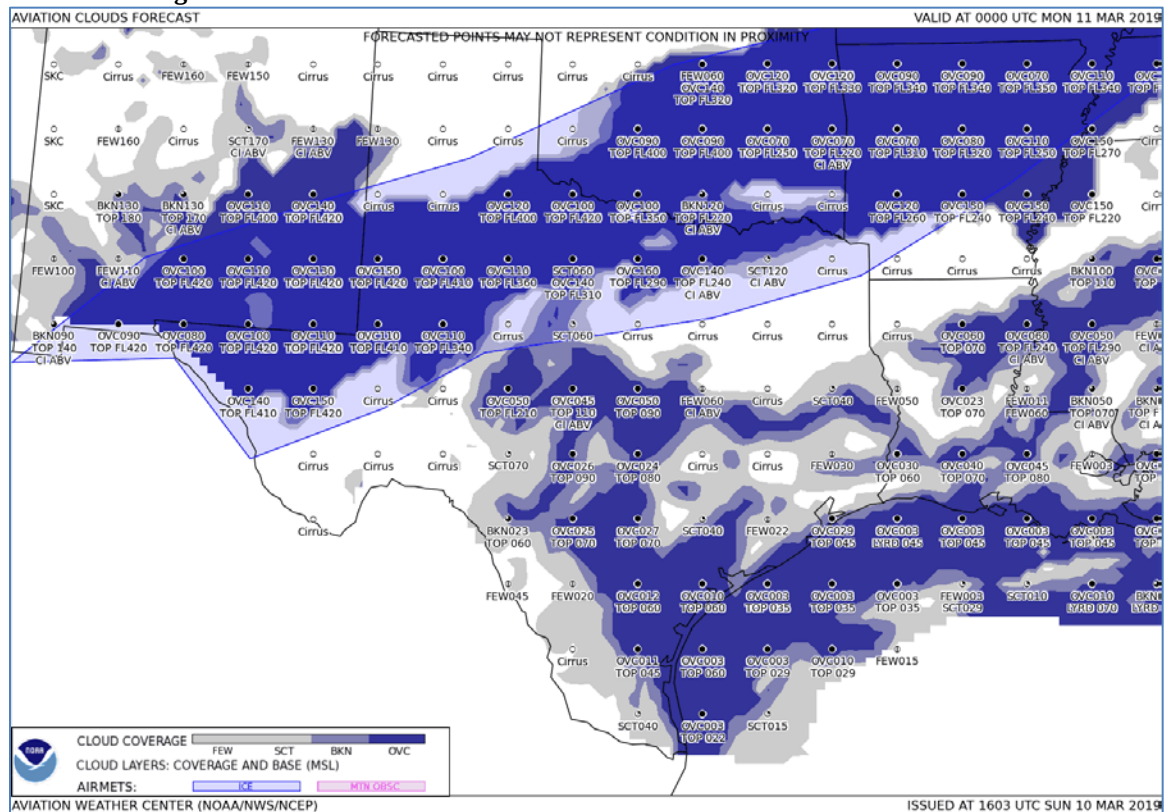


Figure 11 - GFA Cloud Forecast issued at 1100 CDT and valid for 1900 CDT

7.0 NWS Inflight Weather Advisories

Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of the 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.

Surrounding the period there were no SIGMETs or Convective SIGMETs issued for any hazardous weather conditions. The Houston (KZHU) CWSU issued several CWAs during the period warning of LIFR conditions over the region. Figures 12 and 13 are the GOES-16 visible satellite image with the CWA advisory for LIFR conditions plotted with reference to the accident site, followed by the text advisory.

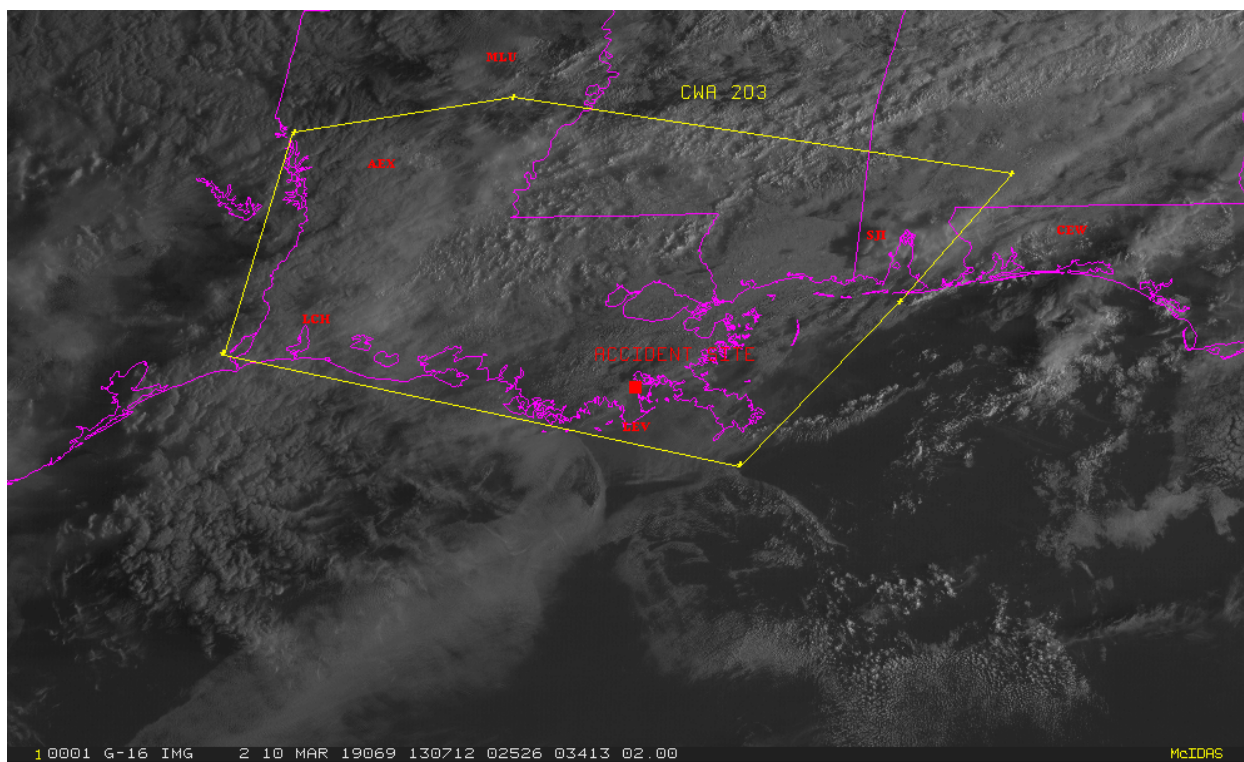


Figure 12 - GOES-16 visible satellite image at about 0800 CDT with CWA 203 for LIFR conditions

FAUS22 KZHU 101404
ZHU2 CWA 101404
ZHU CWA 203 VALID UNTIL 101600
FROM 50WNW AEX-25SSE MLU-45NW CEW-40SSE SJI-55ESE LEV-45WSW
LCH-50WNW AEX
AREA OF SCT/WDPSRD LIFR CONDS CONT. CIGS AOB 005/VIS AOB 1SM BR/FG.
CONDS TO SLWY IMPR AFT 15Z.

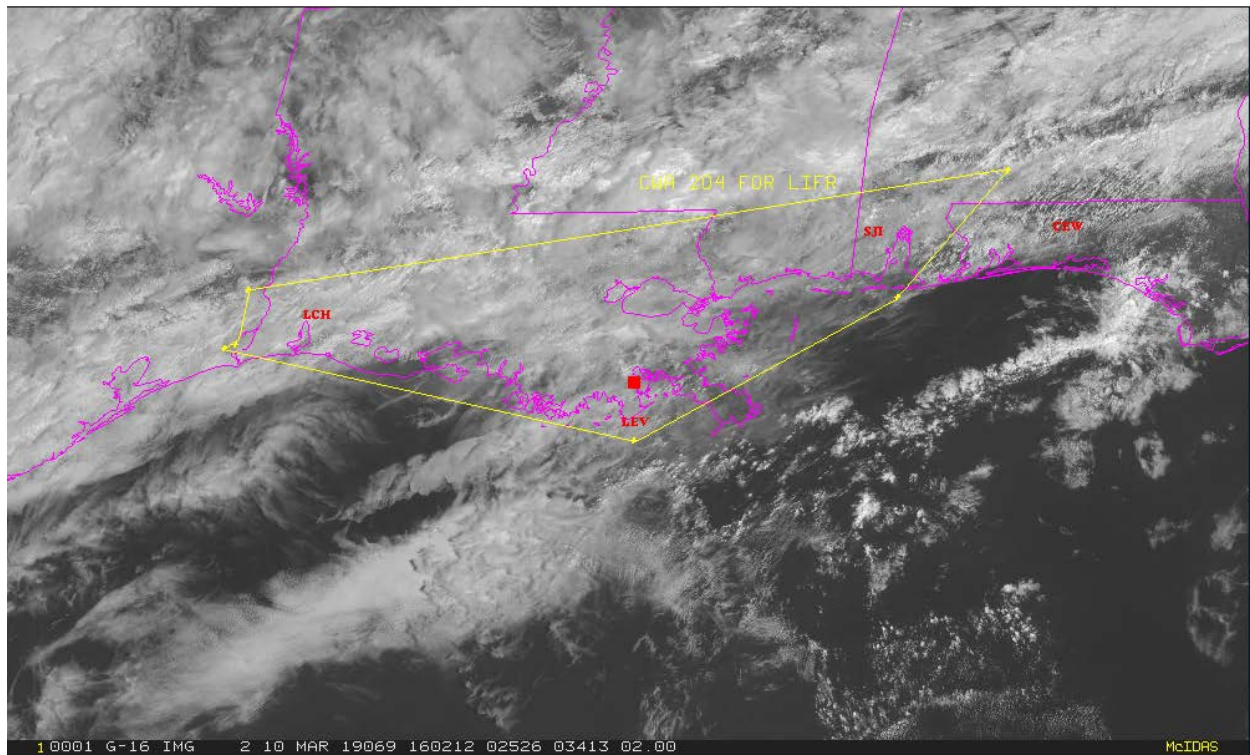


Figure 13 - GOES-16 visible satellite image at about 1100 CDT with CWA 204 for LIFR conditions

FAUS22 KZHU 101603

ZHU2 CWA 101603

ZHU CWA 204 VALID UNTIL 101800

FROM 40WNW LCH-45NW CEW-40SSE SJI-10S LEV-45WSW LCH-40WSW LCH

AREA OF SCT/WDPSRD LIFR CONDS CONT. CIGS AOB 005/VIS AOB 1SM BR/FG.

CONDS TO SLWY IMPR THRU PD.

In addition, the NWS AWC issued AIRMETs Sierra for IFR conditions with ceilings below 1,000 ft and/or visibility below 3 miles in mist/fog. The conditions were expected to continue beyond 1600 CDT through 2200 CDT. Figures 14 and 15 are the G-AIRMET Sierra for IFR conditions valid for 1000 and 1300 CDT. The figures indicated that AIRMET Sierra was current for the planned route and over the accident site for IFR conditions during the period. The text of the AIRMET Sierra follows the graphic images and differs slightly from the graphic image.

SIERRA 2019-03-10 15:00:00

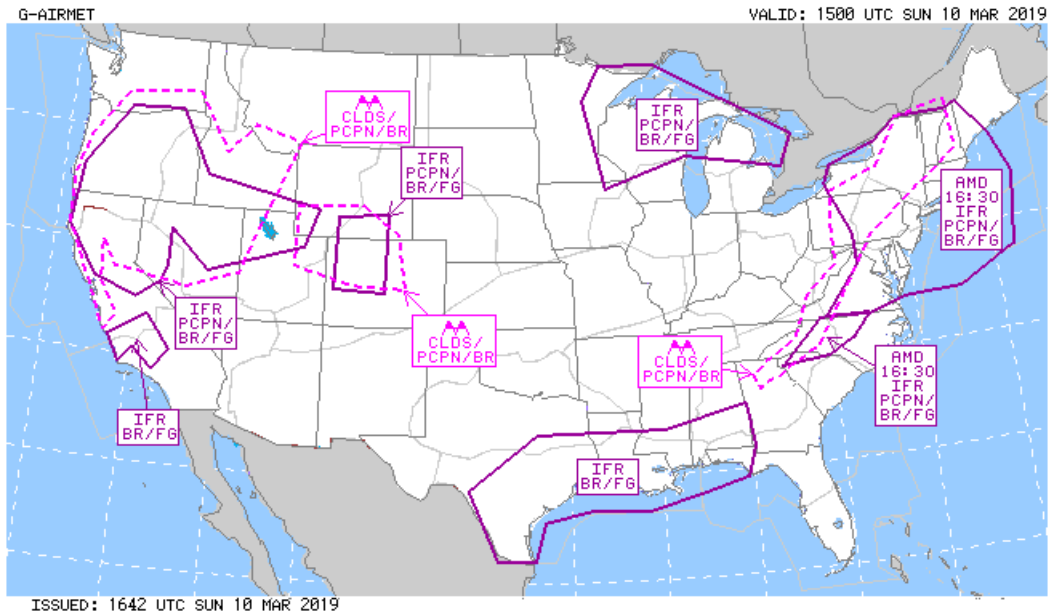


Figure 14 - G-AIRMET Sierra for IFR conditions valid at 1000 CDT

SIERRA 2019-03-10 18:00:00

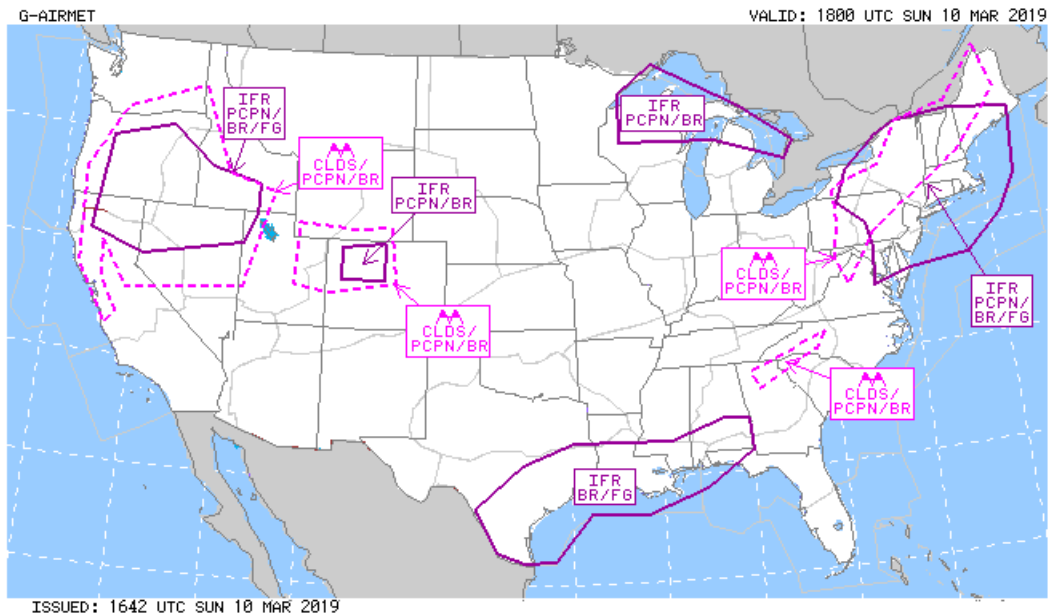


Figure 15 - G-AIRMET Sierra for IFR conditions valid for 1300 CDT

WAUS44 KKKI 101445
 WA4S
 -DFWS WA 101445
 AIRMET SIERRA UPDT 3 FOR IFR VALID UNTIL 102100

.
AIRMET IFR...TX LA MS AL AND CSTL WTRS
FROM LGC TO 50SW PZD TO 40W CEW TO 120SSE SJI TO 70SE LEV TO
120SSW LCH TO 80E BRO TO 90W BRO TO DLF TO 30NE ACT TO 30SE MHZ TO LGC
CIG BLW 010/VIS BLW 3SM BR/FG. CONDS CONTG BYD 21Z THRU 03Z.
....

8.0 Astronomical Data

The United States Naval Observatory provided the following astronomical conditions for March 10, 2019. The local time of the accident is included in bold italic print for reference.

<u>SUN</u>	
Begin of civil twilight	0653 CDT
Sunset	0716 CDT
<i>Accident</i>	<i>1203 CDT</i>
Sun transition	1311 CDT
Sunset	1906 CDT
End of civil twilight	1930 CDT

Submitted by:

Don Eick
Senior Meteorologist