NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 31, 2023

Group Chairman's Factual Report

METEOROLOGY

DCA22MA009

Table Of Contents

A. ACCIDENT

Location: Brookshire, Texas
Date: October 19, 2021
Time: about 1000 central daylight time (CDT)
1500 universal coordinated time (UTC)
Airplane: McDonnell Douglas DC-9-87; Registration: N987AK

B. SENIOR METEOROLOGIST

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

C. SUMMARY

On October 19, 2021, at about 10:00 am central daylight time, a McDonnell Douglas DC-9-87, N987AK, operated by 987 Investments LLC, overran the departure end of runway 36 at Houston Executive Airport (TME), Brookshire, Texas, after the crew executed a rejected takeoff. Of the 23 passengers and crew onboard the airplane, two passengers received serious injuries and one received minor injuries. A postcrash fire ensued, and the airplane was destroyed. The airplane was operating as a 14 Code of Federal Regulation Part 91 flight from TME to Laurence G. Hanscom Field Airport (BED), Bedford, Massachusetts.

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 remotely, collecting data from official National Weather Service (NWS) sources including the Weather Prediction Center (WPC) and the National Center for Environmental Information (NCEI). This factual report contains the meteorological factors pertinent to the weather conditions surrounding the time of the accident and during the period when the Houston area was exposed to strong winds. All times are reported as 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 main wreckage site was located at latitude 29.818027° N, longitude 95.898046°.

E. FACTUAL 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 NWS southcentral Surface Analysis Chart for 1000 CDT is included as figure 1 with the approximate accident site marked by a red star. The chart depicted a high-pressure system at 1026-hectopascals[1] over Georgia with a ridge[2] extending west-southwestward into Texas. The station models surrounding the accident site depicted east to east-southeasterly winds of 10 knots or less, with clear skies, temperatures in the 70's °F and with dew point temperatures in the low 60's °F.

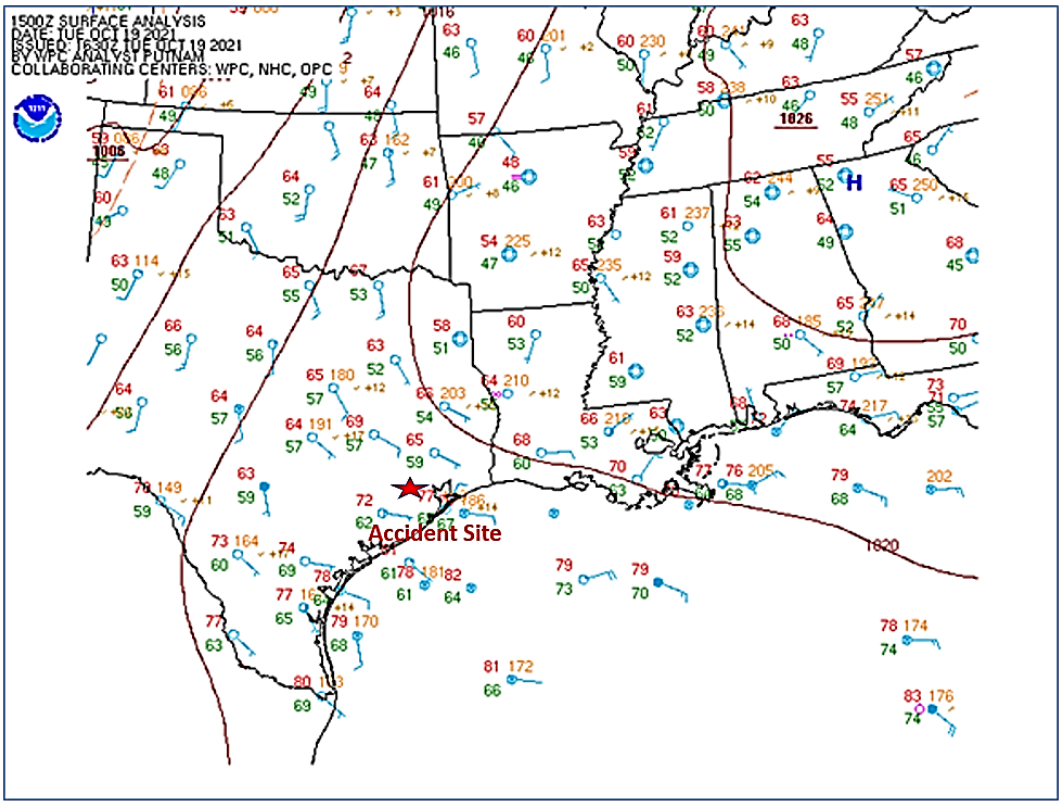

Figure 1 - NWS southcentral Surface Analysis Chart for 1000 CDT.

[1] Hectopascals (hPa) is the standard unit for reporting sea-level pressure and is interchangeable with the former term millibar (mb) with the same units. The international standard atmosphere is based on a standard sea-level pressure of 1013.25-hPa at 59° Fahrenheit (F), or 15° Celsius (C).

[2] A ridge is an elongated area of high-pressure.

A review of the National Composite Radar Mosaic surrounding the time of the accident indicated no significant meteorological echoes in the vicinity of Houston within the hour surrounding the time of the accident.

2.0 Surface Observations

The official observations issued surrounding the accident site were documented using Aviation Routine Weather Reports (METAR[3]) and Aviation Selected Special Weather Reports (SPECI). Cloud heights are reported above ground level (agl) in the following section, and the magnetic variation was estimated at 3º east based on the latest sectional chart for the area.

2.1 Houston Executive Airport

The accident occurred as the aircraft was attempting to depart from runway 36 at Houston Executive Airport (KTME), Houston, Texas. The airport lists an elevation of 166 ft and had an Automated Surface Observation System (AWOS), which was not augmented by any human observer and disseminated observations every 20-minutes via longline[4] or locally every minute via VHF radio broadcast on 119.525 MHZ or by telephone. The airport had a non-federal control tower, who's controllers were not certified to make weather observation under the Supplementary Aviation Weather Reporting Station (SAWRS). The following observations were disseminated surrounding the period. At the time of the accident the following conditions were being reported.

> *KTME weather observation at 0955 CDT, automated, wind variable at 7 knots, visibility 8 miles, sky clear below 12,000 ft agl, temperature 22° Celsius (C), dew point temperature 16° C, altimeter 30.11 inches of mercury. Remarks: automated station with a precipitation discriminator.*

According to the Federal Meteorological Handbook (FMH-1) a variable wind is reported when during the 2-minute evaluation period, the wind speed is 6 knots or less, and the wind varies by 60° or more. However, according to the air traffic control recorded tower conversation immediately prior to takeoff the tower provided N987AK the wind as from 090° magnetic at 6 knots from their AWOS display. No high resolution 1-minute or 5-minute AWOS data was available from the system for documentation.

The raw observations in standard METAR format surrounding the period from 0835 through 1055 CDT were as follows.

METAR KTME 191335Z AUTO VRB06KT 8SM CLR 18/16 A3008 RMK AO2=

METAR KTME 191355Z AUTO VRB05KT 7SM CLR 18/15 A3009 RMK AO2=

METAR KTME 191415Z AUTO VRB06KT 8SM CLR 19/16 A3009 RMK AO2=

METAR KTME 191435Z AUTO VRB07KT 8SM CLR 20/16 A3010 RMK AO2=

[3] Abbreviation for Meteorological Aerodrome Report.
[4] Longline refers to the dissemination of weather observations in near-real time to national databases.

METAR KTME 191455Z AUTO VRB07KT 8SM CLR 22/16 A3011 RMK AO2=

Accident 1500Z

METAR KTME 191515Z AUTO VRB06KT 9SM CLR 23/17 A3011 RMK AO2=

METAR KTME 191535Z AUTO VRB07KT 8SM CLR 25/16 A3011 RMK AO2=

METAR KTME 191555Z AUTO VRB06KT 7SM CLR 26/17 A3011 RMK AO2=

2.2 Aviation Weather Center METAR Display

A display of the METAR observations from the NWS Aviation Weather Center's website[5] is included as figure 2 at 1015 CDT with the accident site within the red circle. The stations are color coded for the general flight categories[6] (LIFR, IFR, MVFR, and VFR), and depicted VFR conditions prevailing across the region.

[5] https://www.aviationweather.gov/metar

[6] 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.

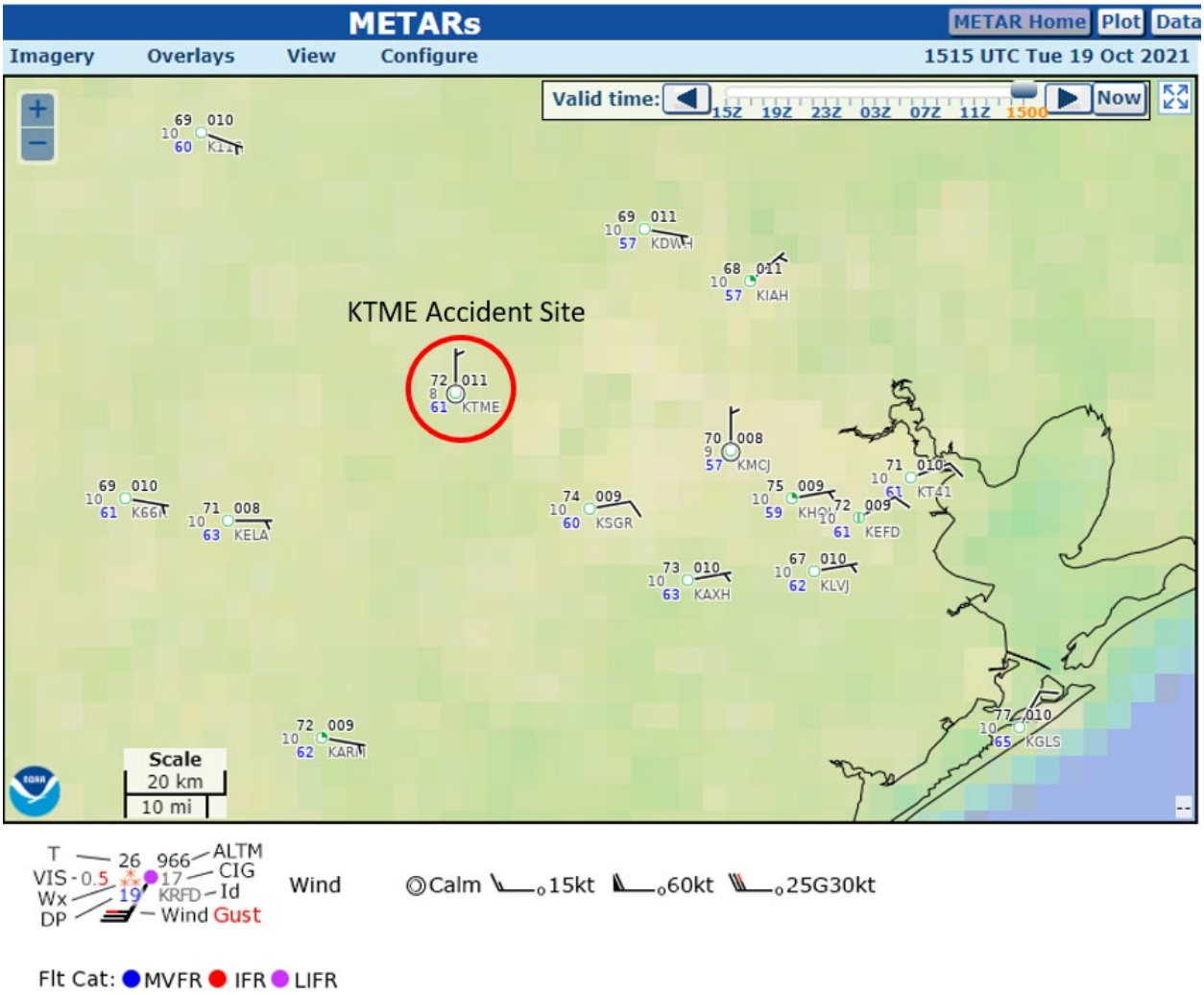

Figure 2 - NWS Aviation Weather Center's METAR display for 1015 CDT.

The KTME observation at 1015 CDT indicated a wind from the north at approximately 5 knots, visibility 8 statute miles, clear skies below 12,000 ft agl, temperature 72° F, dew point temperature 61° F, altimeter setting 30.11 inches of mercury.

3.0 Sounding

To determine the vertical structure and state of the atmosphere over the accident site, a High-Resolution Rapid Refresh (HRRR)[7] numerical model data were retrieved from the NOAA Air Resources Laboratory using the grid point[8] closest to the accident site. The data were then plotted on a standard Skew T log P diagram[9] from the surface to 450-hPa or approximately 20,000 ft for

[7] 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.
[8] Coordinates used were latitude 29.82° N, longitude 92.90° West.
[9] 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

1000 CDT using the RAOB complete Rawinsonde Observation software program[10] and are included as figure 3.

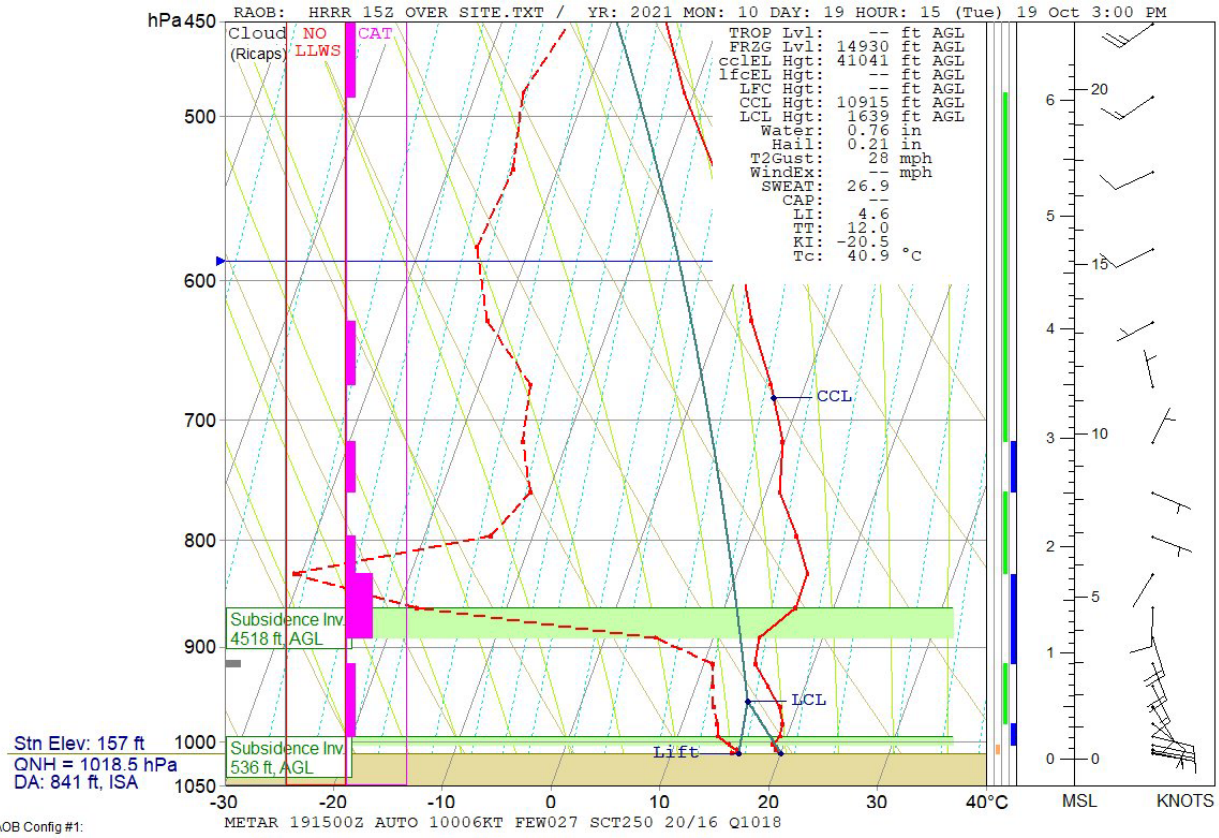

Figure 3 - High-Resolution Rapid Refresh (HRRR) numerical model sounding over accident site for 1000 CDT.

The sounding depicted an elevation of 157 ft over the approximate accident site coordinates with a near surface temperature of 20.1° C (68.2° F), a dew point temperature of 16.2° C (61.2° F), a relative humidity of 78%, with a resultant density altitude of 841 ft. The sounding depicted several low-altitude temperature inversions below 5,000 ft due to subsidence. The lifted condensation level (LCL)[11] was at 1,639 ft agl, and the convective condensation level (CCL)[12] was at 10,915 ft agl. The freezing level was identified near 15,000 ft. The atmosphere was characterized as stable with a Lifted Index (LI)[13] of 4.6, with no convective available potential energy (CAPE)[14] indicated. The precipitable water content was 0.76 inches.

define the vertical structure of the atmosphere.

[10] RAOB – The Universal RAwinsonde OBservation program is an interactive sounding analysis program developed by Eosonde Research Services (ERS) previously known as Environmental Research Services, The Villages, Florida.

[11] Lifted Condensation Level (LCL) – is the level at which a lifted parcel becomes saturated. The LCL height corresponds to cloud base height for forced ascent.

[12] Convective Condensation Level (CCL) – is 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.

[13] Lifted Index (LI) - A common measure of atmospheric instability. Its value is obtained by computing the temperature that air near the ground would have if it were lifted to 500-hPa or approximately 18,000 feet and comparing that temperature to the actual temperature at that level. Negative values indicate instability - the more negative, the more unstable the air is, and the stronger the updrafts are likely to be with any developing thunderstorms.

[14] Convective Available Potential Energy (CAPE) – A measure of the amount of energy available for convection.

The HRRR 1000 CDT wind profile indicated a near surface wind from 100° at 6 knots, with wind veering clockwise to the south through 5,000 ft, then to the west-southwest with increasing altitude. A low-level wind maximum was identified at approximately 3,000 ft agl with wind from 160° at 19 knots. The mean 0 to 6 kilometer or 18,000 ft wind was from 200° at 5 knots.

The HRRR parameters of height, pressure, temperature (T), dew point temperature (Td), relative humidity (RH%), wind direction and speed, and derived clear air turbulence (CAT) intensity, low-level wind shear (LLWS), and icing potential below 5,000 ft are provided in the following table (no LLWS or icing were indicated).

Height (ft-msl)	Pres (hPa)	T (°C)	Td (°C)	RH (%)	Wind (deg/kts)	CAT FAA	LLWS FAA	Icing AFGW
157	1013	20.1	16.2	78	101/ 6			
185	1012	19.9	15.5	76	102/ 6			
269	1009	19.5	15.9	80	102/ 7			
438	1003	19.0	15.0	78	103/ 8			
693	994	19.4	13.7	70	105/ 9	LGT		
1094	980	19.2	13.2	68	131/ 8	LGT		
1617	962	18.4	12.3	68	150/ 10	LGT		
2267	940	16.6	11.5	72	156/ 14	LGT		
2958	917	14.7	10.8	77	161/ 19			
3756	891	14.2	4.7	53	165/ 18	MDT		
4675	862	16.5	-18.3	8	182/ 10	MDT		

4.0 Satellite Imagery

The Geostationary Operational Environmental Satellite number 16 (GOES-16) visible and infrared 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 software. Figure 4 is the GOES-16 visible band 2 image at 2X magnification with a resolution of 2 kilometers. The image depicted clear skies over the Houston area and accident site, with the closest low stratiform clouds located about 80 miles northwest of the accident site.

CAPE is directly related to the maximum potential vertical speed within an updraft; thus, higher values indicate greater potential for severe weather. Observed values in thunderstorm environments often may exceed 1000 joules per kilogram (J/kg), and in extreme cases may exceed 5000 J/kg.

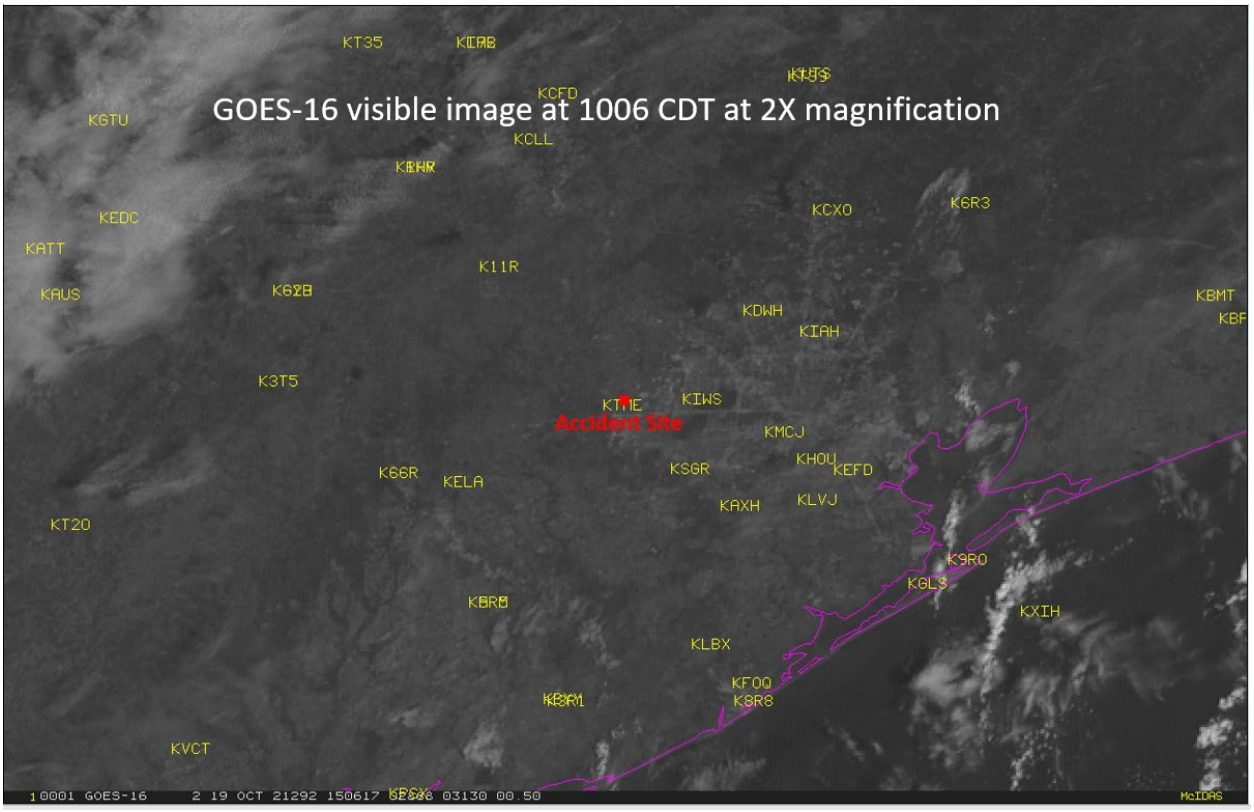

Figure 4 - GOES-16 visible image at 1006 CDT at 2X magnification.

5.0 Inflight Weather Advisories

There were no NWS inflight weather advisories current over southern Texas surrounding the time of the accident, and the Fort Worth Center Weather Service Unit (CWSU) had not issued any Meteorological Impact Statements (MIS) or Center Weather Advisories (CWA) for the airspace on October 19, 2021.

6.0 Astronomical Conditions

The United States Naval Observatory's Multiyear Interactive Computer Almanac (MICA) software program[15] provided the following astronomical conditions for Brookshire on October 19, 2021. The time of the accident has been added in bolt italic type for reference.

Sun	Time (CDT)
Begin Civil Twilight	0703
Sunrise	0727
Accident	***1000***
Culmination	1308
Sunset	1849

[15] https://www.usno.navy.mil/USNO/astronomical-applications/software-products

End Civil Twilight 1913

At the 1000 CDT the Sun was about 30° above the horizon at an azimuth of 124°.

7.0 Previous High Winds Events

A review of high winds events impacting the KTME airport from the time the accident airplane last flew on April 26, 2021, through the time of the accident produced the following days with wind gusts over 25 knots for more than one consecutive hours.

Date	Maximum Wind	Observed Weather	Duration (LCL) ≥25KT
April 2021			
6	180° 21G28KT		1115-1955
9	180° 19G26KT		1035-1555 INTER[16]
10	360° 19G25KT		0735-1155 INTER
17	010° 24G30KT	-DZ	0935-1335
27	120° 20G25KT	CLR	1955-2035
28	180° 20G27KT		1115-2355 INTER
May 2021			
1	140° 10G31KT		1035-1715 INTER
8	180° 19G27KT		0955-1915 INTER
9	190° 20G28KT		1235-1855 INTER
11	190° 15G25KT 360° 18G35KT	 +RA	1335-1535 1755-2015
18	200° 34G46KT	+RA Thunderstorms	1955-2155
19	100° 15G30KT		0655-0835
22	110° 12G25KT	RA	0155-1255 INTER
June 2021			
2	330° 16G34KT	+RA	0055-0135
7	190°15G27KT		1055-1515 INTER
8	190° 20G25KT		1935-1955
15	150° 21G27KT	+RA	1635-1655
20	220° 19G26KT		1415-1655
July 2021			
13	220° 10G29KT	+RA	1515
30	100° 22G28KT	+RA	1755-1815
August 2021			
16	050° 16G25KT	-RA	1715-1755
18	180° 21G28KT	-RA	1135-1515
September 2021			
6	110° 17G28KT	+RA	0715-0755

[16] INTER – intermittent gusts reported during the period.

13	100° 18G27KT 090° 24G35KT	-RA	1715-1915 2315-2355
14	050° 32G45KT	-RA T.S. Nicholas	0000-0915
October 2021			
10	180° 17G25KT		1315-2015 INTER
16	040°18G26KT	CLR	0955-1315 INTER

A review of the data indicated that the two strongest wind events occurred on May 18-19, 2021, and on September 13-14, 2021. Those two events are documented below.

7.1 Severe Thunderstorm Event May 18-19, 2021

On the afternoon of May 18, 2021, a line of thunderstorms developed across central and southern Texas and merged into a bow echo configuration with embedded supercell thunderstorms. The line was responsible for producing an extensive area of strong winds, large hail, and several tornadoes. Figure 5 is the southcentral section of the NWS Surface Analysis Chart for 2200 CDT on May 18, 2021, with the approximate accident site marked by the red star. The chart depicted a squall line moving across the Brookshire area with a distinct wind shift.

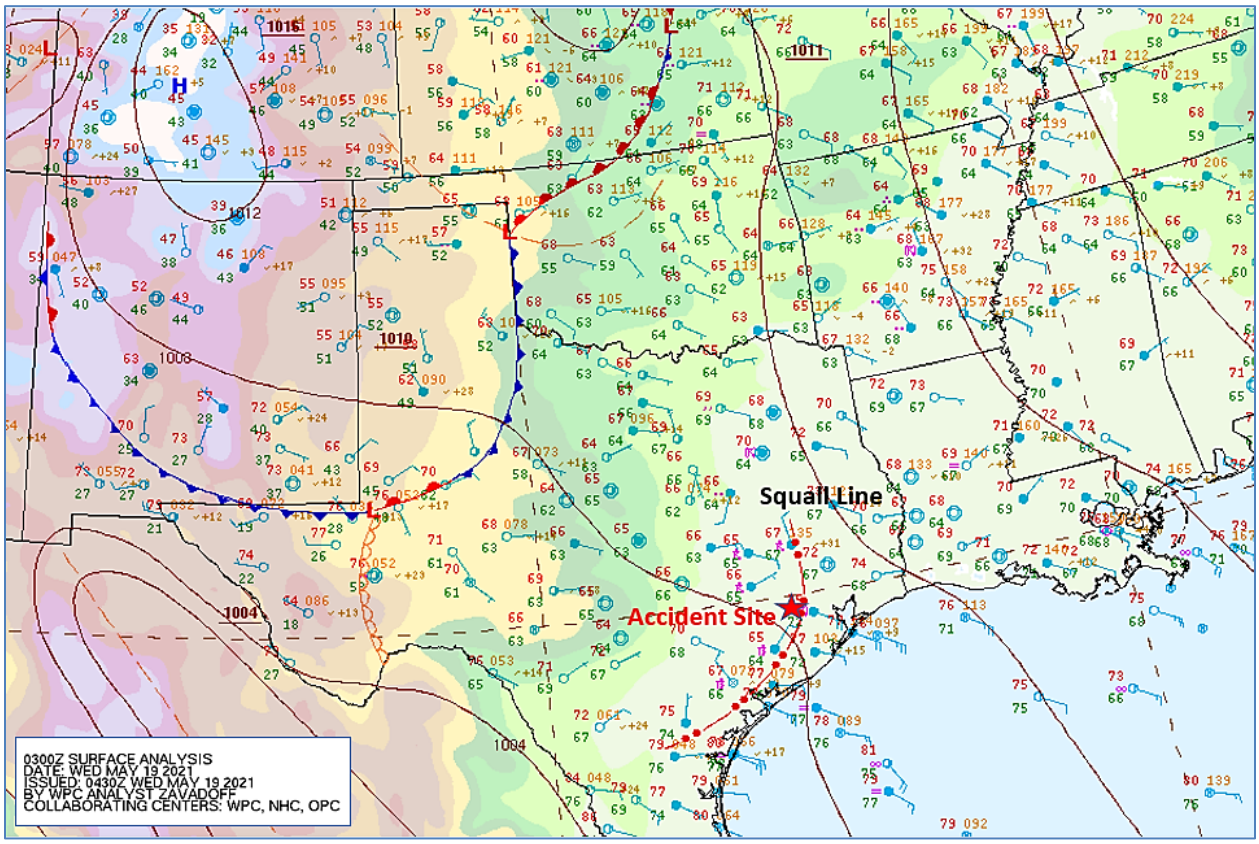

Figure 5 - Southcentral section of the NWS Surface Analysis Chart for 2200 CDT on May 18, 2021.

Figure 6 is the NWS Composite Radar Mosaic for 2115 CDT on May 18, 2021, when the strong winds were reported at KTME. The line of echoes with reflectivity values as high as 65.5 dBZ extreme intensity echoes immediately west of the airport.

Figure 6 - NWS National Composite Radar Mosaic for 2115 CDT on May 18, 2021.

Observations surrounding the period of high winds associated with the passage of the line of thunderstorms are shown below.

KTME weather observation at 2055 CDT, automated, wind from 110° at 18 knots gusting to 27 knots, visibility 9 miles, ceiling broken at 2,800 ft agl, broken at 5,000 ft, overcast at 10,000 ft, temperature 25° C, dew point 19° C, altimeter setting 29.79 inHg.

KTME weather observation at 2115 CDT, automated, ***wind from 200° at 34 knots gusting to 46 knots,*** *visibility 5 miles in haze, ceiling broken at 2,200 ft agl, broken at 3,000 ft, overcast at 5,000 ft, temperature 25° C, dew point 19° C, altimeter setting 29.86 inHg.*

KTME weather observation at 2135 CDT, automated, wind from 340° at 13 knots gusting to 30 knots, visibility less than 1/4 mile in heavy rain, ceiling overcast at 200 ft agl, temperature 19° C, dew point 19° C, altimeter setting 29.92 inHg.

KTME weather observation at 2155 CDT, automated, wind from 040° at 19 knots gusting to 28 knots, visibility 1 3/4 miles in heavy rain, ceiling broken at 200 ft agl, broken at 1,800 ft, overcast at 2,500 ft, temperature 18° C, dew point 18° C, altimeter setting 29.82 inHg.

The raw observations in standard METAR format during the periods from 1855 through 2255 CDT on May 18, 2021, and from 0635 through 0735 CDT on May 19, 2021, were as follows.

METAR KTME 182355Z AUTO 12015KT 7SM BKN022 BKN027 25/22 A2980 RMK AO2=
METAR KTME 190015Z AUTO 11014G20KT 8SM FEW022 FEW029 SCT090 25/21 A2978 RMK AO2=
METAR KTME 190035Z AUTO 11012G18KT 8SM SCT030 SCT090 25/20 A2980 RMK AO2=
METAR KTME 190055Z AUTO 11017G24KT 8SM -DZ FEW032 SCT048 BKN085 25/20 A2979 RMK AO2=
METAR KTME 190115Z AUTO 11014G21KT 10SM SCT028 BKN041 OVC085 25/19 A2979 RMK AO2=
METAR KTME 190135Z AUTO 12018G23KT 10SM SCT028 BKN039 OVC100 25/19 A2980 RMK AO2=
METAR KTME 190155Z AUTO 11018G27KT 9SM BKN028 BKN050 OVC100 25/19 A2979 RMK AO2=
METAR KTME 190215Z AUTO 20034G46KT 5SM HZ BKN022 BKN030 OVC050 25/19 A2986 RMK AO2=
METAR KTME 190235Z AUTO 34013G30KT M1/4SM +RA OVC002 19/19 A2992 RMK AO2=
METAR KTME 190255Z AUTO 04019G28KT 1 3/4SM +RA BKN002 BKN018 OVC025 18/18 A2982 RMK AO2=
METAR KTME 190315Z AUTO 07012G18KT 5SM -RA BKN026 BKN032 OVC050 18/18 A2987 RMK AO2=
METAR KTME 190335Z AUTO 07013KT 4SM -RA SCT024 BKN029 OVC050 18/18 A2986 RMK AO2=
METAR KTME 190355Z AUTO 06010KT 6SM -RA 18/18 A2988 RMK AO2=

METAR KTME 191135Z AUTO 06015KT 7SM -RA 19/19 A2986 RMK AO2
*METAR KTME 191155Z AUTO 13016**G26KT** 8SM -DZ FEW041 SCT065 BKN095 19/19 A2984 RMK AO2*
*METAR KTME 191215Z AUTO 10015**G30KT** 9SM FEW039 SCT090 BKN120 19/19 A2977 RMK AO2*
METAR KTME 191235Z AUTO 13013G20KT 9SM FEW120 19/19 A2979 RMK AO2

Based on the observations, the highest wind gust reported was 46 knots (53 mph), which was reported at 2115 CDT (0215Z on May 19, 2021) prior to the onset of heavy rain and a wind shift to the west. This gust was the highest 5-second wind reported during the 10-minute reporting period prior to the observation. No peak winds were reported by the AWOS during the period.

7.2 Hurricane/Tropical Storm Nicholas on September 13-14, 2021

Tropical Storm Nicholas formed on Sunday, September 12, 2021, in the southwestern Gulf of Mexico. It strengthened slowly as it moved northward along the western edge of the Gulf of Mexico off the Texas coast and on Monday night, September 13th the storm was upgraded to Hurricane Nicholas. It made landfall shortly thereafter west of Sargent Beach, Texas, at 0030 CDT on September 14, 2021, with maximum sustained winds of 65 knots (75 mph) and a minimum central pressure of 988-hPa, making it a category 1 hurricane on the Saffir-Simpson scale. Figure 7 is the NWS southcentral section of the Surface Analysis Chart for 0100 CDT on September 14, 2021, depicting Hurricane Nicholas near the time of landfall. The storm quickly weakened to tropical storm strength after landfall and moved east-northeast over Galveston Bay and the Houston area, and then into Louisiana where it weakened to a remnant low-pressure system on September 16th and dissipated on September 18th.

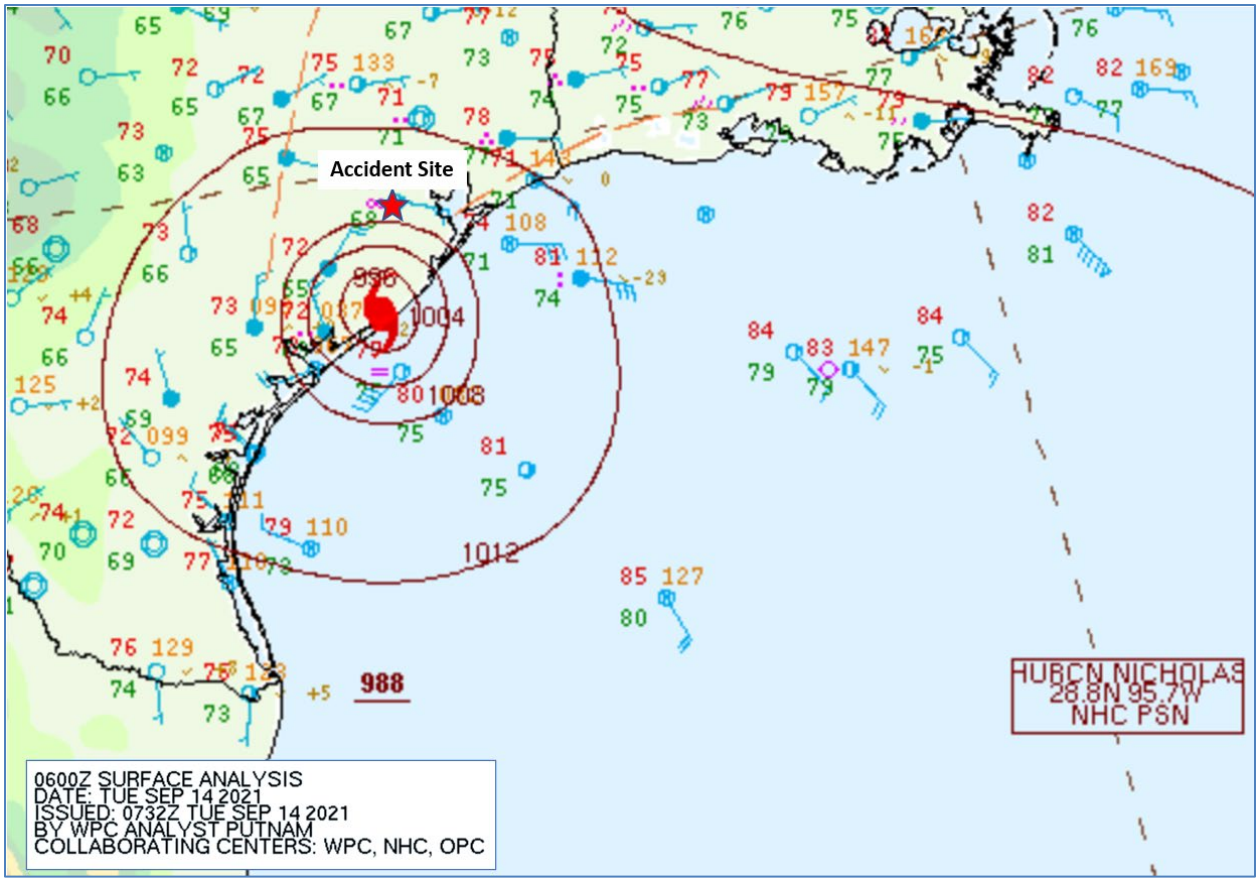

Figure 7 - NWS southcentral Surface Analysis for 0100 CDT September 14, 2021, with accident site.

The NWS National Hurricane Center (NHC) Surface Wind Field and Forecast Track issued at 0100 CDT on September 14, 2021, near the time of landfall is included as figure 8 followed by the NWS NHC Hurricane Nicholas Intermediate Public Advisory Number 8A for the period.

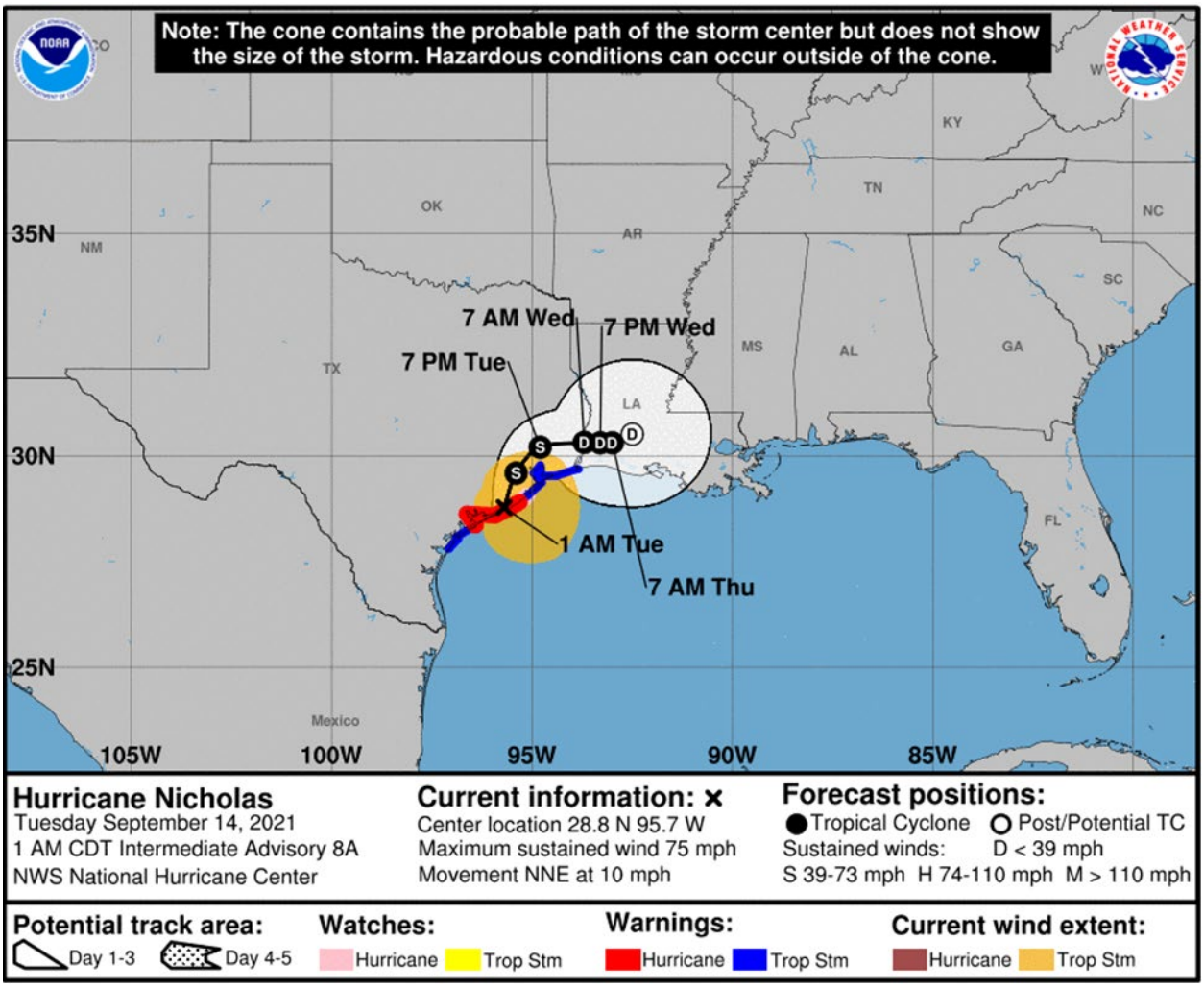

Figure 8 - NHC Hurricane Nicholas Advisory 8A issued at 0100 CDT September 14, 2021.

ZCZC MIATCPAT4 ALL
TTAA00 KNHC DDHHMM

BULLETIN
Hurricane Nicholas Intermediate Advisory Number 8A
NWS National Hurricane Center Miami FL AL142021
100 AM CDT Tue Sep 14 2021

...NICHOLAS MAKES LANDFALL ALONG THE TEXAS COAST...
...HEAVY RAIN, HIGH WINDS AND DANGEROUS SURGE ONGOING...

SUMMARY OF 100 AM CDT...0600 UTC...INFORMATION

LOCATION...28.8N 95.7W
ABOUT 20 MI...30 KM NE OF MATAGORDA TEXAS
ABOUT 25 MI...40 KM WSW OF FREEPORT TEXAS
MAXIMUM SUSTAINED WINDS...75 MPH...120 KM/H
PRESENT MOVEMENT...NNE OR 25 DEGREES AT 10 MPH...17 KM/H

MINIMUM CENTRAL PRESSURE...991 MB...29.26 INCHES

WATCHES AND WARNINGS

CHANGES WITH THIS ADVISORY:

The Storm Surge Warning from Port Aransas, Texas to Port O'Connor, Texas including Aransas Bay and San Antonio Bay has been discontinued.

SUMMARY OF WATCHES AND WARNINGS IN EFFECT:

A Storm Surge Warning is in effect for...
** Port O'Connor Texas to Sabine Pass*
** Galveston Bay and Matagorda Bay*

A Hurricane Warning is in effect for...
** Port O'Connor to Freeport Texas*

A Hurricane Watch is in effect for...
** Freeport to San Luis Pass Texas*

A Tropical Storm Warning is in effect for...
** North of Port Aransas to Port O'Connor*
** North of Freeport to Sabine Pass*

A Storm Surge Watch is in effect for...
** Sabine Pass to Rutherford Beach Louisiana*

A Storm Surge Warning means there is a danger of life-threatening inundation, from rising water moving inland from the coastline, during the next 36 hours in the indicated locations. For a depiction of areas at risk, please see the National Weather Service Storm Surge Watch/Warning Graphic, available at hurricanes.gov. This is a life-threatening situation. Persons located within these areas should take all necessary actions to protect life and property from rising water and the potential for other dangerous conditions. Promptly follow evacuation and other instructions from local officials.

A Tropical Storm Warning means that tropical storm conditions are expected somewhere within the warning area.

A Storm Surge Watch means there is a possibility of life-threatening inundation, from rising water moving inland from the coastline, in the indicated locations during the next 48 hours. For a depiction of areas at risk, please see the National Weather Service Storm Surge Watch/Warning Graphic, available at hurricanes.gov.

A Hurricane Warning means that hurricane conditions are expected somewhere within the warning area.

A Hurricane Watch means that hurricane conditions are possible within the watch area.

Interests elsewhere in southwestern Louisiana should monitor the progress of Nicholas.

For storm information specific to your area, including possible inland watches and warnings, please monitor products issued by your local National Weather Service forecast office.

DISCUSSION AND OUTLOOK

Hurricane Nicholas made landfall near 1230 AM CDT (0530 UTC) on eastern part of the Matagorda Peninsula, about 10 miles (15 km) west-southwest of Sargent Beach, Texas.

At 100 AM CDT (0600 UTC), the center of Hurricane Nicholas was located near latitude 28.8 North, longitude 95.7 West. Nicholas is moving toward the north-northeast near 10 mph (17 km/h) and this general motion is expected to continue through tonight, followed by a turn toward the northeast and a slower motion by late today and an even slower eastward motion on Wednesday. On the forecast track, the center of Nicholas is expected to move slowly over southeastern Texas today and tonight, and over southwestern Louisiana on Wednesday.

Maximum sustained winds remain near 75 mph (120 km/h) with higher gusts. Weakening is expected during the next couple of days as Nicholas moves over land.

Hurricane-force winds extend outward up to 25 miles (35 km) from the center and tropical-storm-force winds extend outward up to 115miles (185 km). A station at San Luis Pass, Texas recently reported a 1-minute sustained wind of 56 mph (91 km/h) gusting to 67 mph (107 km/h).

The latest minimum central pressure is 991 mb (29.26 inches) based on reconnaissance dropsonde data.

HAZARDS AFFECTING LAND

Key messages for Nicholas can be found in the Tropical Cyclone Discussion under AWIPS header MIATCDAT4, WMO header WTNT44 KNHC and on the web at hurricanes.gov/graphics_at4.shtml?key_messages

RAINFALL: Nicholas is expected to produce storm total rainfall of 6 to 12 inches, with isolated maximum amounts of 18 inches, across the upper Texas coastal areas into Wednesday. Life-threatening flash flooding impacts, especially in urbanized metropolitan areas, are possible across portions of the upper Texas Gulf Coast into far southwestern Louisiana.

Across interior southeast Texas into southern-central Louisiana and southern Mississippi, rainfall totals of 4 to 8 inches with locally higher amounts near 10 inches are expected into Thursday. This rainfall may produce areas of considerable flash and urban flooding.

The potential for minor to isolated major river flooding exists across the entire region especially in smaller river basins and urban areas.

STORM SURGE: The combination of a dangerous storm surge and the tide will cause normally dry areas near the coast to be flooded by rising waters moving inland from the shoreline. The water could reach the following heights above ground somewhere in the indicated areas if the peak surge occurs at the time of high tide...

Port O'Connor, TX to High Island, TX...3-5 ft
Matagorda Bay and Galveston Bay...3-5 ft
High Island, TX to Rutherford Beach, LA...2-4 ft
Baffin Bay, TX to Port O'Connor, TX...1-3 ft
Aransas Bay and San Antonio Bay...1-3 ft
Rutherford Beach, LA to Intracoastal City, LA...1-3 ft
Sabine Lake and Calcasieu Lake...1-3 ft
Corpus Christi Bay...1-3 ft

The deepest water will occur along the immediate coast in areas of onshore winds, where the surge will be accompanied by large and dangerous waves. Surge-related flooding depends on the relative timing of the

surge and the tidal cycle, and can vary greatly over short distances. For information specific to your area, please see products issued by your local National Weather Service forecast office.

WIND: Tropical storm conditions are expected within the warning area across the central and upper Texas coasts through this morning. Hurricane conditions are possible in the Hurricane Watch area for the next few hours. Hurricane conditions are expected in the warning area for the next few hours.

TORNADOES: A tornado or two will be possible today along the upper Texas and southwest Louisiana coast.

SURF: Swells generated by Nicholas will continue affecting portions of the northwest Gulf coast today. These swells are likely to cause life-threatening surf and rip current conditions. Please consult products from your local weather office.

NEXT ADVISORY

Next complete advisory at 400 AM CDT.

Forecaster Blake

Figure 9 is the NWS NHC 50 knot wind probability issued at the time of advisory and indicated a greater than 50% probability of 50 knots over the KTME area, with the area immediately south at greater than 90%.

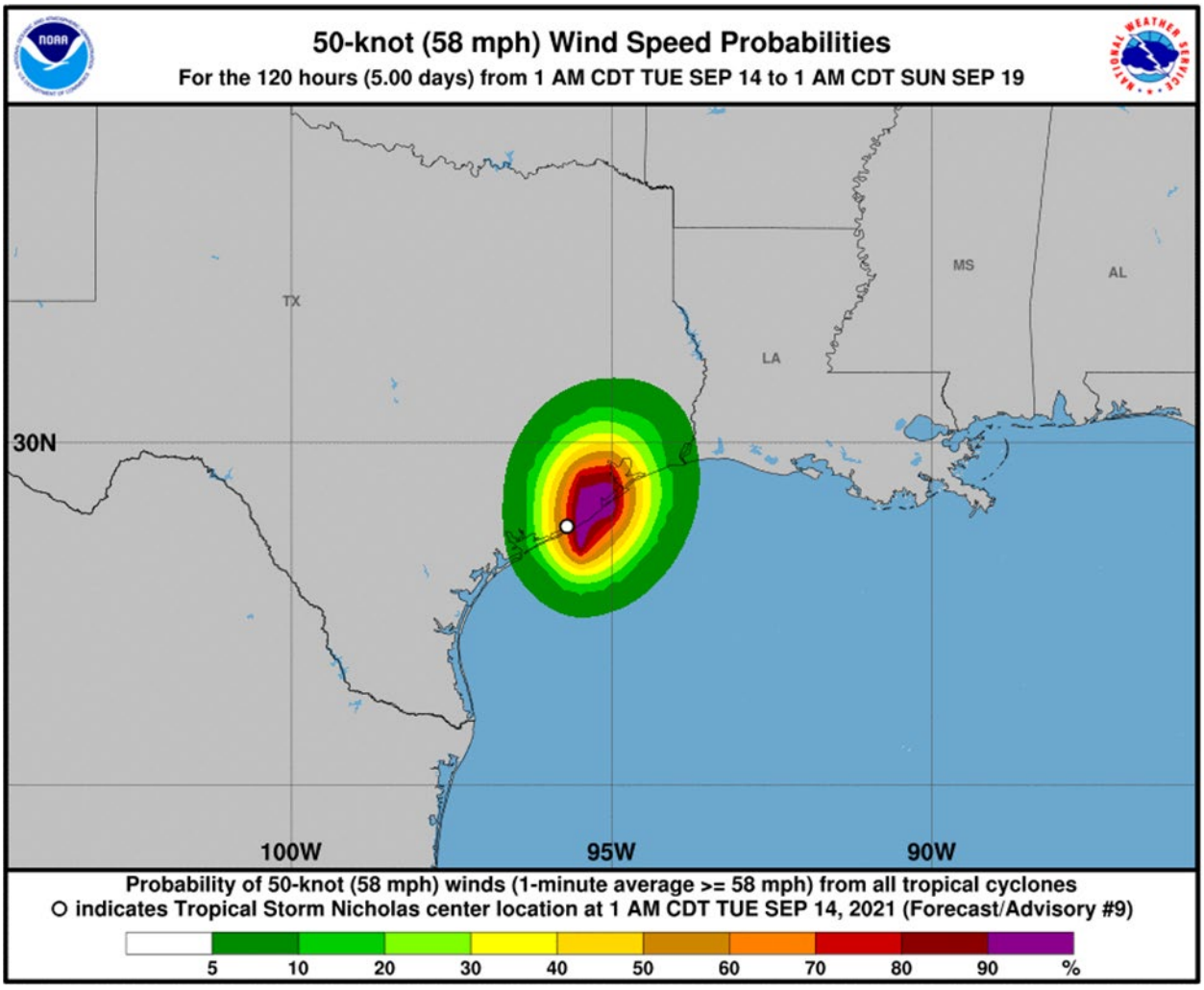

Figure 9 - NHC 50-knot Wind Speed Probabilities issued at 0100 CDT on September 14, 2021.

The last NWS National Hurricane Center (NHC) advisory 11 was issued at 1600 CDT on September 14, 2021, with no reports of winds over tropical storm strength of 34 knots (39 mph) after 1900 CDT.

The observations from KTME during the period were as follows.

METAR KTME 132035Z AUTO 8SM SCT048 BKN055 28/22 A2997 RMK AO2=
METAR KTME 132055Z AUTO 07010G16KT 8SM FEW026 BKN035 OVC048 27/21 A2996 RMK AO2=
METAR KTME 132115Z AUTO 08012G18KT 4SM -DZ FEW026 SCT034 BKN046 25/23 A2997 RMK AO2=
METAR KTME 132135Z AUTO 08012G18KT 9SM FEW042 SCT060 OVC070 26/24 A2996 RMK AO2=
METAR KTME 132155Z AUTO 09011KT 8SM FEW042 BKN070 OVC080 27/24 A2995 RMK AO2=
*METAR KTME 132215Z AUTO 10018**G26KT** 8SM FEW022 SCT047 BKN080 27/22 A2995 RMK AO2=*
*METAR KTME 132235Z AUTO 10018**G27KT** 8SM FEW023 FEW031 SCT041 26/19 A2996 RMK AO2=*
*METAR KTME 132255Z AUTO 10018**G26KT** 6SM HZ CLR 25/19 A2995 RMK AO2=*
METAR KTME 132315Z AUTO 10015G21KT 6SM HZ 25/19 A2994 RMK AO2=
METAR KTME 132335Z AUTO 08014G20KT 7SM 24/20 A2993 RMK AO2=
METAR KTME 132355Z AUTO 09016G21KT 7SM CLR 24/20 A2992 RMK AO2=
METAR KTME 140015Z AUTO 09013G22KT 6SM HZ CLR 24/19 A2991 RMK AO2=
METAR KTME 140035Z AUTO 08012G18KT 7SM CLR 24/19 A2990 RMK AO2=

METAR KTME 140055Z AUTO 07010G20KT 7SM 23/20 A2989 RMK AO2=
METAR KTME 140115Z AUTO 07012KT 7SM 23/20 A2990 RMK AO2=
METAR KTME 140135Z AUTO 8SM 23/20 A2990 RMK AO2=
METAR KTME 140155Z AUTO 05011KT 8SM 23/20 A2990 RMK AO2=
METAR KTME 140215Z AUTO 7SM A2991 RMK AO2=
METAR KTME 140235Z AUTO 07017KT 7SM 23/21 A2989 RMK AO2=
METAR KTME 140255Z AUTO RMK AO2 PWINO=
*METAR KTME 140315Z AUTO 0**80KT** 24/21 A2989 RMK AO2 PWINO=*
*METAR KTME 140335Z AUTO 10022**G40KT** 9SM 24/19 A2989 RMK AO2=*
METAR KTME 140355Z AUTO 7SM 24/18 A2990 RMK AO2=
*METAR KTME 140415Z AUTO 09018**G31KT** 6SM HZ 23/18 A2989 RMK AO2=*
*METAR KTME 140435Z AUTO 09024**G35KT** 6SM -DZ 22/19 A2988 RMK AO2=*
*METAR KTME 140455Z AUTO 090**27G34KT** 3SM -RA 21/20 A2987 RMK AO2=*
*METAR KTME 140515Z AUTO 09016**G26KT** 8SM FEW026 SCT033 OVC065 21/20 A2985 RMK AO2=*
METAR KTME 140535Z AUTO 08021KT 8SM 22/21 A2984 RMK AO2=
*METAR KTME 140555Z AUTO 07022**G27KT** 2 1/2SM -RA FEW003 SCT030 BKN043 22/21 A2984 RMK AO2=*
*METAR KTME 140615Z AUTO 07017**G30KT** 8SM FEW031 SCT060 OVC075 22/20 A2983 RMK AO2=*
*METAR KTME 140655Z AUTO 08022**G31KT** A2982 RMK AO2 PWINO=*
*METAR KTME 140715Z AUTO 080**27G34KT** 2SM BR 21/21 A2981 RMK AO2=*
*METAR KTME 140735Z AUTO 08023**G33KT** 2 1/2SM BR 21/21 A2979 RMK AO2=*
*METAR KTME 140755Z AUTO 07022**G30KT** 1 3/4SM BR 20/20 A2979 RMK AO2=*
*METAR KTME 140815Z AUTO 060**26G35KT** 1SM BR 21/21 A2978 RMK AO2=*
*METAR KTME 140835Z AUTO 07024**G33KT** 1 3/4SM -RA 21/21 A2977 RMK AO2=*
*METAR KTME 140855Z AUTO 060**27G39KT** 2SM RA 21/21 A2974 RMK AO2=*
*METAR KTME 140915Z AUTO 060**29G39KT** 3SM -RA 21/21 A2973 RMK AO2=*
*METAR KTME 140935Z AUTO **05032G45KT** 2SM -RA 21/21 A2973 RMK AO2=*
*METAR KTME 140955Z AUTO 040**27G35KT** 3SM BR 21/21 A2971 RMK AO2=*
*METAR KTME 141015Z AUTO 040**26G38KT** 2SM -RA 21/21 A2970 RMK AO2=*
METAR KTME 141035Z AUTO 04027KT 2SM -RA 21/21 A2968 RMK AO2=
*METAR KTME 141055Z AUTO 04025**G37KT** 2SM -RA 21/21 A2968 RMK AO2=*
*METAR KTME 141115Z AUTO 060**30G38KT** 2 1/2SM -RA 21/21 A2968 RMK AO2=*
*METAR KTME 141135Z AUTO 050**28G36KT** 2SM -RA 21/21 A2969 RMK AO2=*
*METAR KTME 141155Z AUTO 050**27G34KT** 2SM BR 21/21 A2969 RMK AO2=*
*METAR KTME 141215Z AUTO 05021**G34KT** 2 1/2SM BR 22/22 A2970 RMK AO2=*
*METAR KTME 141235Z AUTO 06023**G37KT** 3SM BR 22/22 A2971 RMK AO2=*
*METAR KTME 141255Z AUTO 06021**G37KT** 9SM 22/22 A2972 RMK AO2=*
METAR KTME 141315Z AUTO 05023KT 9SM 22/22 A2973 RMK AO2=
*METAR KTME 141335Z AUTO 05022**G27KT** 9SM 22/22 A2974 RMK AO2=*
*METAR KTME 141355Z AUTO 05017**G26KT** 9SM 22/21 A2974 RMK AO2=*
METAR KTME 141415Z AUTO 04013G24KT 6SM -DZ 23/22 A2976 RMK AO2=
METAR KTME 141435Z AUTO 03012G19KT 7SM 22/22 A2977 RMK AO2=
METAR KTME 141455Z AUTO 02015KT 7SM -DZ 23/22 A2978 RMK AO2=
METAR KTME 141515Z AUTO 03017G22KT 9SM 23/22 A2977 RMK AO2=
METAR KTME 141535Z AUTO 03011G19KT 9SM 23/22 A2979 RMK AO2=

The observations from KTME indicated wind gusts over 25 knots between 1715 CDT on September 13, 2021, through 0900 CDT on September 14, 2021, with a peak of 45 knots (52 mph)[17] at 0435 CDT on September 14, 2021. The KTME AWOS observations between 2115 through 2255 CDT on September 13, 2021, had missing wind data for unknown reasons, and at 2215 CDT the KTME AWOS reported an incomplete wind report with either a direction or wind

[17] Boeing's recommendation from the MD-80 Maintenance Manual for High wind/gust damage inspection for freedom of elevator control surface movement is required if high winds or gusts over 63 mph (55 knots) are encountered, inspection is then required.

speed of “080” knots and with missing visibility, weather, and sky cover information. No other surrounding stations reported a wind gust of this magnitude during this period and was not listed by the NWS in their documentation of high winds and damage surrounding the period. While similar high wind reports of 39 to 50 knots (45 to 58 mph) were reported over the Houston area, with Houston Hobby Airport reporting the highest gust of 50 knots (58 mph). In addition to the high gusty winds approximately 4 to 7 inches of rainfall was recorded over the Houston area during the period.

According to the KTME airport manager during the impact from Tropical Storm Nicholas the fixed based operator (FBO) next to where the accident airplane was parked had a large 8 ft sliding door blown-in from the high winds and required replacement.

Sugar Land Regional Airport (KSGR), Houston, Texas, was the next closest weather reporting facility located about 17 miles southeast of KTME with a federally-installed and maintained Automated Surface Observation System (ASOS). The winds were also documented for KSGR to backup and verify the KTME reports. The reports from about 2000 through 1100 CDT on September 13-14, 2021, were as follows.

METAR KSGR 140053Z 10018G22KT 10SM SCT090 BKN110 24/21 A2987 RMK AO2 RAE39 SLP114 P0000 T02390206=
METAR KSGR 140153Z 10016G23KT 10SM -RA FEW028 24/19 A2985 RMK AO2 PK WND 10030/0133 RAB0057E17B40 SLP108 P0000 T02440189=
METAR KSGR 140253Z AUTO 09014G24KT 10SM -RA FEW025 BKN055 OVC070 23/20 A2984 RMK AO2 PK WND 07034/0238 SLP107 P0000 60000 T02330200 56013=
METAR KSGR 140353Z AUTO 08019G32KT 10SM FEW023 BKN080 OVC110 23/18 A2984 RMK AO2 PK WND 08036/0343 RAE28 SLP106 P0001 T02330183=
METAR KSGR 140453Z AUTO 08022G30KT 10SM -RA SCT075 BKN090 BKN120 23/19 A2982 RMK AO2 PK WND 08038/0419 RAB10 SLP098 P0000 T02330189=
METAR KSGR 140553Z AUTO 08020G28KT 8SM -RA SCT020 BKN036 OVC110 24/21 A2979 RMK AO2 PK WND 06031/0523 SLP090 P0001 60002 T02390206 10244 20228 402670228 58018=
SPECI KSGR 140643Z AUTO 07029G43KT 2 1/2SM +RA BR SCT014 BKN021 OVC041 23/21 A2976 RMK AO2 PK WND 06043/0642 P0013 T02280206=
SPECI KSGR 140651Z AUTO 08024G43KT 3SM +RA SCT014 BKN032 OVC042 23/20 A2976 RMK AO2 PK WND 06043/0642 P0017=
METAR KSGR 140653Z AUTO 07025G37KT 3SM +RA SCT014 SCT022 OVC042 23/20 A2975 RMK AO2 PK WND 06043/0642 SLP075 P0018 T02280200=
SPECI KSGR 140734Z AUTO 06024G37KT 4SM RA BR BKN015 BKN021 OVC036 22/19 A2970 RMK AO2 PK WND 06042/0711 P0011 T02170194=
METAR KSGR 140753Z AUTO 06026G36KT 4SM RA BKN014 OVC022 22/19 A2969 RMK AO2 PK WND 06042/0711 SLP054 P0015 T02220194=
SPECI KSGR 140802Z AUTO 06025G36KT 3SM +RA BR BKN009 OVC014 22/20 A2969 RMK AO2 PK WND 07034/0801 CIG 006V012 P0003 T02220200 TSNO=
SPECI KSGR 140812Z AUTO 06026G38KT 4SM RA BR BKN011 OVC018 22/20 A2968 RMK AO2 PK WND 07038/0809 P0005 T02220200=
SPECI KSGR 140828Z AUTO 06029G37KT 4SM +RA BR FEW009 BKN014 OVC035 22/20 A2966 RMK AO2 PK WND 07038/0809 P0009 T02220200=
SPECI KSGR 140842Z AUTO 05023G33KT 2 1/2SM +RA BR BKN012 BKN020 OVC032 22/20 A2965 RMK AO2 PK WND 07038/0809 P0015 T02220200=
METAR KSGR 140853Z AUTO 06030G44KT 2 1/2SM +RA BR BKN012 BKN019 OVC027 22/20 A2965 RMK AO2 PK WND 06044/0853 SLP040 P0020 60053 T02220200 56050=
SPECI KSGR 140923Z AUTO 05027G37KT 3SM +RA BR SCT009 BKN013 OVC021 22/20 A2962 RMK AO2 PK

WND 05043/0855 P0013 T02220200=
METAR KSGR 140953Z AUTO 05025G38KT 3SM +RA BR BKN011 OVC018 22/20 A2959 RMK AO2 PK WND 05043/0855 SLP023 P0024 T02220200=
SPECI KSGR 140956Z AUTO 05028G38KT 2 1/2SM -RA BR BKN009 OVC014 22/20 A2959 RMK AO2 PK WND 04037/0954 P0001 T02220200=
SPECI KSGR 141003Z AUTO 06023G40KT 3SM +RA BR BKN009 OVC013 22/20 A2959 RMK AO2 PK WND 05040/0958 P0003 T02220200=
METAR KSGR 141053Z 06016G25KT 2 1/2SM -RA BR BKN005 OVC010 22/21 A2960 RMK AO2 PK WND 05040/0958 SLP024 P0012 T02220206=
METAR KSGR 141153Z 06016KT 3SM -RA BR BKN005 OVC015 23/21 A2962 RMK AO2 SLP032 P0004 60093 7//// T02280211 10239 20217 50009=
SPECI KSGR 141235Z 05017G21KT 2 1/2SM -RA BR BKN007 OVC013 23/21 A2965 RMK AO2 RAE08B25 P0000 T02280211=
METAR KSGR 141253Z 04013KT 2SM -RA BR BKN007 OVC012 23/21 A2966 RMK AO2 RAE08B25 SLP045 P0000 T02280211=
SPECI KSGR 141335Z 03016KT 4SM -RA BR OVC007 23/21 A2967 RMK AO2 P0001 T02280206=
METAR KSGR 141353Z 02017G22KT 5SM -RA BR OVC007 23/21 A2968 RMK AO2 SLP051 P0001 T02280211=
METAR KSGR 141453Z 04019G24KT 10SM BKN008 BKN022 OVC065 25/22 A2970 RMK AO2 RAE28 CIG 006V012 SLP059 P0000 60001 T02500217 51027=
SPECI KSGR 141513Z 04013G20KT 10SM SCT008 SCT050 OVC070 24/22 A2971 RMK AO2 T02440217=
SPECI KSGR 141530Z 01011G20KT 10SM -RA BKN010 BKN047 OVC070 24/22 A2972 RMK AO2 RAB21 P0000 T02440217=
METAR KSGR 141553Z 35009KT 9SM -RA OVC010 24/22 A2973 RMK AO2 RAB21 SLP068 P0000 T02390217=

The highest report wind gust at KSGR from Tropical Storm Nicholas was 44 knots reported at 0353 CDT on September 14, 2021. This peak wind was within an hour of the peak wind reported at KTME.

Submitted by:

_____

Don Eick
Senior Meteorologist