



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 9, 2018

Weather Study

METEOROLOGY

ERA18FA022

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A. ACCIDENT

Location: Fountain Run, Kentucky
Date: November 12, 2017
Time: about 1410 central standard time (2010 UTC)¹
Airplane: Type: Piper PA 32-260; Registration: N3371W

B. METEOROLOGIST

Mike Richards
Senior Meteorologist
Operational Factors Division (AS-30)
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's meteorological specialist did not travel in support of this accident investigation and gathered all weather data remotely. Unless otherwise noted, all times are in central standard time (CST) for November 12, 2017 (based upon the 24-hour clock), directions are referenced to true north, distances are in nautical miles and heights are above mean sea level (msl).

Coordinates used for the accident location: 36.773333° north latitude, 85.992222° west longitude, at an elevation of about 725 feet.

D. WEATHER INFORMATION

1.0 Synoptic Conditions

The National Weather Service (NWS) Surface Analysis Chart for 1500 CST is presented in figure 1. The surface analysis chart identified a low pressure center of 1024 hectopascals (hPa) in southeastern Indiana, with a cold front extending southwest through central Kentucky and western Tennessee and approaching the accident location. Station models ahead of the cold front in the vicinity of the accident site generally depicted southwesterly winds of less than 10 knots, overcast sky conditions, temperatures in the mid to high 50's degrees Fahrenheit (°F), with dew point depressions greater than 5°F. Aside from light rain in northern Kentucky, no precipitation was noted in the accident region. Several stations close to the cold front reported mist and lower dew point depressions.

¹ UTC – abbreviation for Coordinated Universal Time

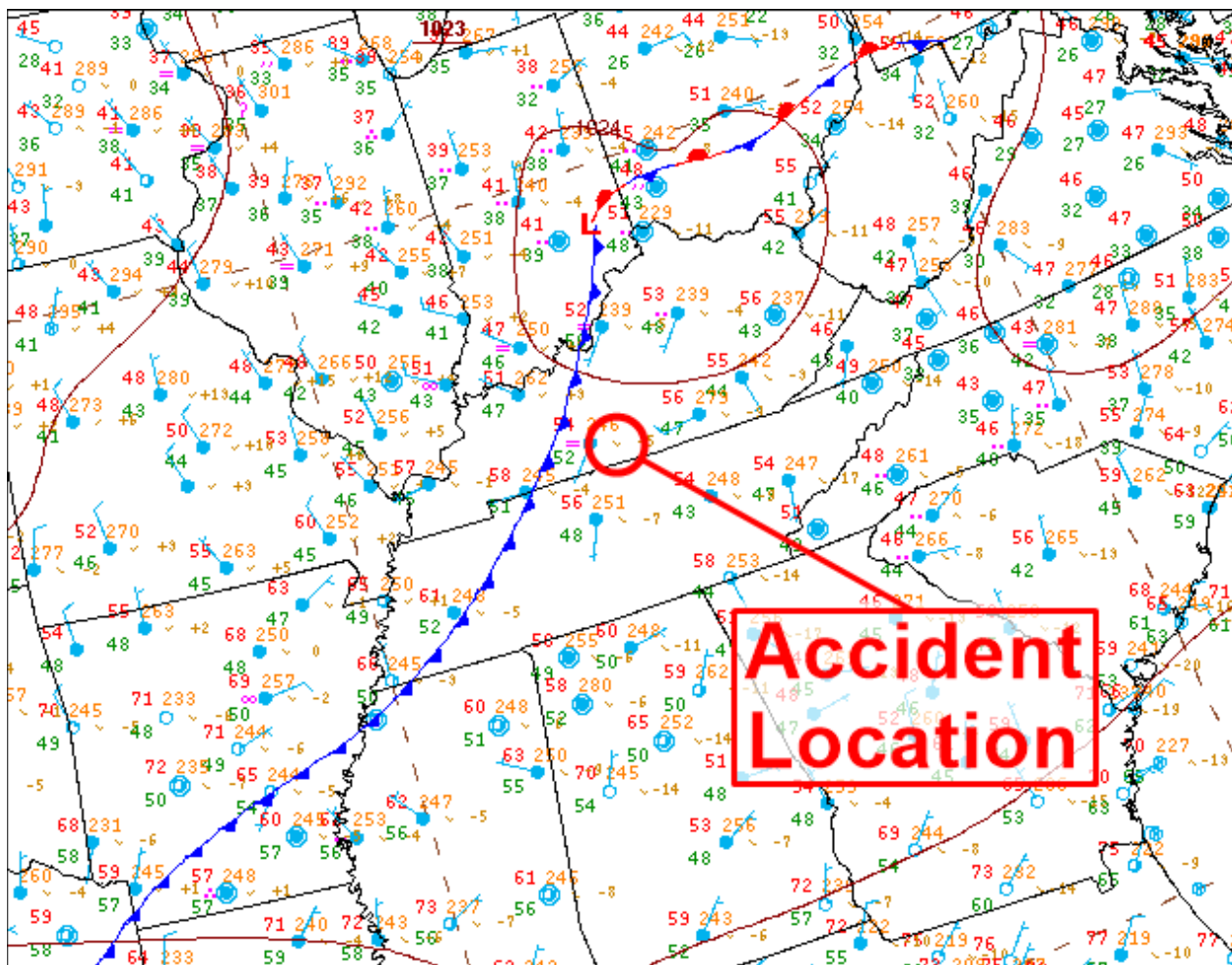


Figure 1 – East-central portion of the NWS Surface Analysis Chart for 1500 CST.

2.0 Surface Observations

An Automated Weather Observing System (AWOS) was located at Glasgow Municipal Airport (GLW)² in Glasgow, Kentucky, and was located about 15 miles north of the accident location at an elevation of 716 feet. Automated reports from GLW during the times surrounding the accident time are presented here:

[1215 CST] METAR KGLW 121815Z AUTO 21006KT 10SM OVC019 12/08 A3026
RMK AO2 T01220078=

² The National Weather Service uses the 4-digit International Civil Aviation Organization (ICAO) format for station identifiers (as seen in the body of some formatted weather observations). This report uses the 3-digit International Air Transport Association format for station identification, which does not use the geographic designating digit (“K” for stations in the continental U.S. and “P” for U.S. stations in Alaska and the Pacific region) as found in the ICAO format.

[1235 CST] METAR KGLW 121835Z AUTO 22005KT 10SM OVC017 12/08 A3026
RMK AO2 T01210079=

[1255 CST] METAR KGLW 121855Z AUTO 21006KT 10SM OVC017 12/08 A3026
RMK AO2 T01210080=

[1315 CST] METAR KGLW 121915Z AUTO 21008KT 7SM OVC017 12/08 A3026
RMK AO2 T01200083=

[1335 CST] METAR KGLW 121935Z AUTO 22005KT 3SM BR OVC015 11/09 A3026
RMK AO2 T01100092=

**[1355 CST] METAR KGLW 121955Z AUTO 22004KT 2 1/2SM BR BKN005
OVC013 11/11 A3025 RMK AO2 T01050105=**

**[1415 CST] METAR KGLW 122015Z AUTO 21004KT 10SM BKN005 OVC013
11/11 A3025 RMK AO2 T01050105=**

[1435 CST] METAR KGLW 122035Z AUTO 22004KT 10SM OVC011 11/11 A3026
RMK AO2 T01050105=

At 1355 CST, GLW reported a wind from 220° at 4 knots, visibility of two and one-half statute miles, mist, ceiling broken at 500 feet above ground level (agl), overcast clouds at 1,300 feet agl, temperature of 11° Celsius (C) and a dew point temperature of 11°C, altimeter setting of 30.25 inches of mercury; Remarks: station with a precipitation discriminator, temperature of 10.5°C and dew point temperature of 10.5°C.

At 1415 CST, GLW reported a wind from 210° at 4 knots, visibility of 10 statute miles or greater, ceiling broken at 500 feet agl, overcast clouds at 1,300 feet agl, temperature of 11°C and a dew point temperature of 11°C, altimeter setting of 30.25 inches of mercury; Remarks: station with a precipitation discriminator, temperature of 10.5°C and dew point temperature of 10.5°C.

An Automated Surface Observing System was located at Bowling Green-Warren County Regional Airport (BWG) in Bowling Green, Kentucky, and was located about 24 miles northwest of the accident location at an elevation of 547 feet. Automated reports from BWG during the times surrounding the accident time are presented here:

[1230 CST] SPECI KBWG 121830Z AUTO 22008KT 2SM BR BKN011 OVC017 11/11
A3027 RMK AO2 P0001 T01110106=

[1253 CST] METAR KBWG 121853Z AUTO 20005KT 4SM BR OVC010 12/11 A3026
RMK AO2 CIG 005V014 SLP249 P0001 T01170111=

[1301 CST] SPECI KBWG 121901Z AUTO 21005KT 5SM BR BKN006 OVC010 12/11
A3026 RMK AO2 T01170111=

[1337 CST] SPECI KBWG 121937Z AUTO 22006KT 8SM OVC012 12/11 A3026 RMK
AO2 T01220111=

[1353 CST] METAR KBWG 121953Z AUTO 23007KT 9SM BKN012 OVC018 12/11
A3026 RMK AO2 SLP246 T01220111=

**[1412 CST] SPECI KBWG 122012Z AUTO 23006KT 10SM BKN015 OVC020 12/11
A3026 RMK AO2 T01220111=**

At 1412 CST, BWG reported a wind from 230° at 6 knots, visibility of 10 statute miles or greater, ceiling broken at 1,500 feet agl, overcast clouds at 2,000 feet agl, temperature of 12°C and a dew point temperature of 11°C, altimeter setting of 30.26 inches of mercury; Remarks: station with a precipitation discriminator, temperature of 12.2°C and dew point temperature of 11.1°C.

An AWOS was located at Portland Municipal Airport (1M5) in Portland, Tennessee, and was located about 26 miles west-southwest of the accident location at an elevation of 817 feet. Automated reports from 1M5 during the times surrounding the accident time are presented here:

[1235 CST] METAR K1M5 121835Z AUTO 19009KT 9SM FEW015 BKN021 BKN031
11/10 A3026 RMK A01=

[1255 CST] METAR K1M5 121855Z AUTO 21009KT 10SM FEW009 SCT020
BKN032 11/10 A3025 RMK A01=

[1315 CST] METAR K1M5 121915Z AUTO 21008KT 10SM SCT009 BKN028
OVC037 11/10 A3026 RMK A01=

[1335 CST] METAR K1M5 121935Z AUTO 20006KT 10SM FEW008 OVC028 12/10
A3026 RMK A01=

[1355 CST] METAR K1M5 121955Z AUTO 20005KT 10SM OVC029 12/10 A3025
RMK A01=

**[1415 CST] METAR K1M5 122015Z AUTO 20006KT 10SM OVC031 12/10 A3025
RMK A01=**

[1435 CST] METAR K1M5 122035Z AUTO 20006KT 10SM BKN021 OVC031 12/10
A3025 RMK A01=

At 1415 CST, 1M5 reported a wind from 200° at 6 knots, visibility of 10 statute miles or greater, ceiling overcast at 3,100 feet agl, temperature of 12°C and a dew point temperature of 10°C, altimeter setting of 30.25 inches of mercury; Remarks: station without a precipitation discriminator.

An AWOS was located at Sumner County Regional Airport (M33) in Gallatin, Tennessee, and was located about 45 miles south-southwest of the accident location at an elevation of 583 feet. Automated reports from M33 during the times surrounding the accident time are presented here:

[1235 CST] METAR KM33 121835Z AUTO VRB04KT 10SM SCT015 BKN026
OVC032 12/09 A3030 RMK A01=

[1255 CST] METAR KM33 121855Z AUTO VRB04KT 10SM BKN030 OVC034 12/09 A3030 RMK A01=
 [1315 CST] METAR KM33 121915Z AUTO 22004KT 10SM FEW020 OVC031 13/09 A3029 RMK A01=
 [1335 CST] METAR KM33 121935Z AUTO VRB04KT 10SM FEW020 OVC031 13/09 A3029 RMK A01=
 [1355 CST] METAR KM33 121955Z AUTO 00000KT 10SM OVC032 13/09 A3029 RMK A01=
[1415 CST] METAR KM33 122015Z AUTO VRB05KT 10SM OVC033 13/09 A3029 RMK A01=
 [1435 CST] METAR KM33 122035Z AUTO 00000KT 10SM FEW018 OVC032 13/09 A3029 RMK A01=

At 1415 CST, M33 reported a variable wind at 5 knots, visibility of 10 statute miles or greater, ceiling overcast at 3,300 feet agl, temperature of 13°C and a dew point temperature of 9°C, altimeter setting of 30.29 inches of mercury; Remarks: station without a precipitation discriminator.

An AWOS was located at Springfield Robertson County Airport (M91) in Springfield, Tennessee, and was located about 55 miles southwest of the accident location at an elevation of 706 feet. Automated reports from M91 during the times surrounding the accident time are presented here:

[1220 CST] METAR KM91 121820Z AUTO 18005KT 5SM BR OVC008 11/11 A3025 RMK A01=
 [1255 CST] METAR KM91 121855Z AUTO 18006KT 9SM BKN010 OVC013 12/11 A3024 RMK A01=
 [1315 CST] METAR KM91 121915Z AUTO 20006KT 9SM OVC012 13/11 A3024 RMK A01=
 [1335 CST] METAR KM91 121935Z AUTO 22005KT 10SM BKN014 OVC019 13/11 A3024 RMK A01=
 [1355 CST] METAR KM91 121955Z AUTO 22006KT 10SM OVC015 13/11 A3024 RMK A01=
[1415 CST] METAR KM91 122015Z AUTO 22004KT 10SM SCT015 SCT023 OVC031 13/11 A3024 RMK A01=
 [1435 CST] METAR KM91 122035Z AUTO 21007KT 10SM FEW021 OVC030 13/11 A3024 RMK A01=

At 1415 CST, M91 reported a wind from 220° at 4 knots, visibility of 10 statute miles or greater, scattered clouds at 1,500 feet agl, scattered clouds at 2,300 feet agl, ceiling overcast at 3,100 feet agl, temperature of 13°C and a dew point temperature of 11°C, altimeter setting of 30.24 inches of mercury; Remarks: station without a precipitation discriminator.



Figure 2 – Map depicting locations of surface observing stations presented in this report, as well as the final portion of the accident aircraft’s flight path (pink line).

3.0 Weather Radar

WSR-88D Level-II base reflectivity weather radar imagery from Nashville, Tennessee (KOHX), is presented in figure 3. KOHX was located approximately 42 miles southwest of the accident site at an elevation of about 595 feet. Assuming standard refraction and considering the 0.95° beam width for the WSR-88D radar beam, the KOHX 0.582° tilt would have “seen” altitudes above the accident location of between about 2,200 and 6,400 feet above msl. The KOHX imagery did not identify any pertinent echoes near the accident location.

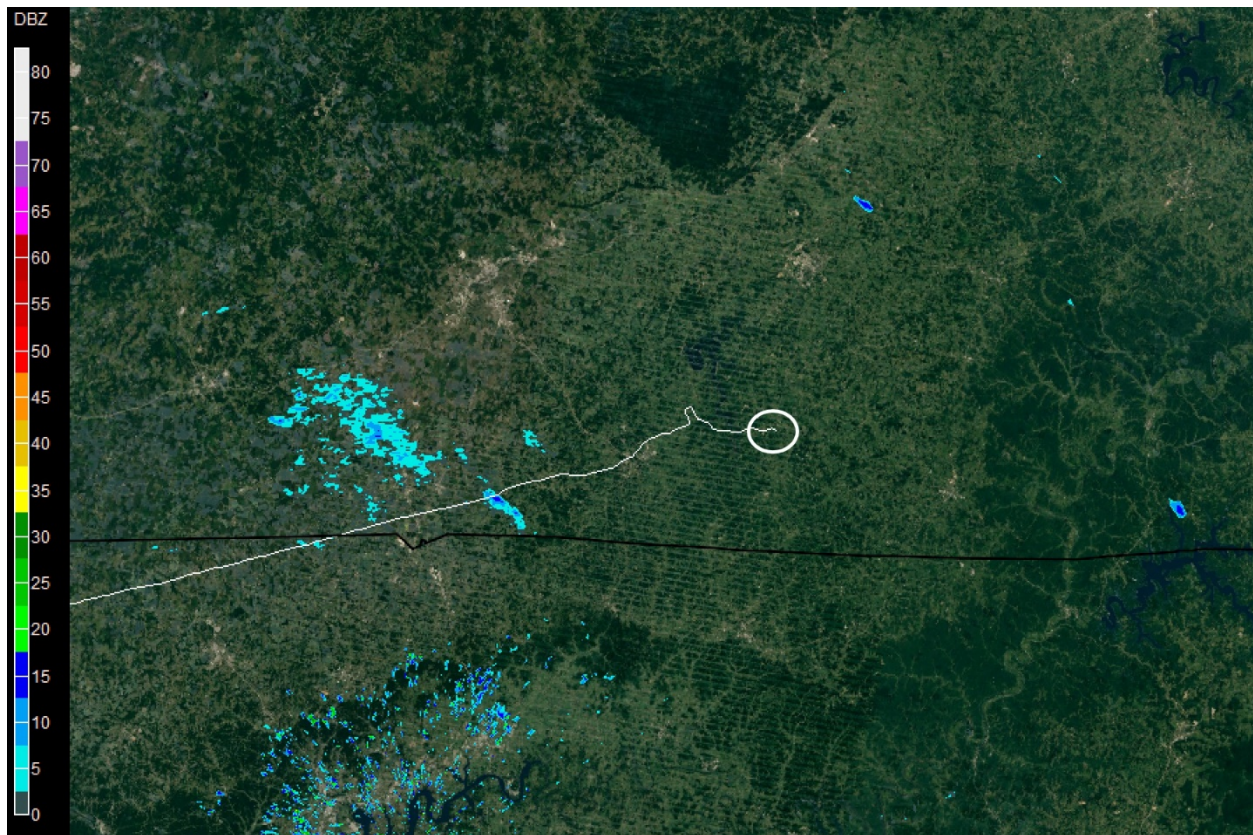


Figure 3 – KOHX 0.582° Level-II base reflectivity product from a sweep initiated at 1407:10 CST. The final portion of the accident aircraft's flight path denoted by the white line. Accident location denoted by the white circle.

4.0 Pilot Reports

The following pilot reports were made below 15,000 feet within about 50 miles of the accident location and within about 2 hours of the accident time:

BNA UA /OV BNA005010/TM 1802/FL110/TP SR22/TA M02/IC LGT RIME=

At 1202 CST, a Cirrus SR-22 aircraft located 10 miles on the 005° radial from the Nashville VORTAC in Nashville, Tennessee, at 11,000 feet reported an air temperature of -2°C and light rime icing.

SDF UA /OV EWO193007/TM 2101/FL100/TP BE35/RM NEGATIVE ICE IN AND OUT OF TOPS=

At 1501 CST, Beechcraft Bonanza aircraft located 7 miles on the 193° radial from the New Hope VOR in New Hope, Kentucky, at 10,000 feet reported negative icing and that the aircraft was in and out of the cloud tops.

5.0 Upper Air Data

A High-Resolution Rapid Refresh (HRRR) model³ sounding (figure 4) valid for the accident location at 1400 CST was retrieved from the NOAA Air Resources Laboratory. The wind near the surface was from the southwest at 6 knots. Above this level, the wind veered and increased in magnitude to a west wind of 36 knots at about 10,000 feet. The relative humidity was ninety-nine percent or greater between about 2,000 and 8,500 feet. The freezing level was at about 8,400 feet. Calculations made by the Rawinsonde Observation Program indicated an area of significant clear air turbulence between about 6,000 and 7,000 feet.

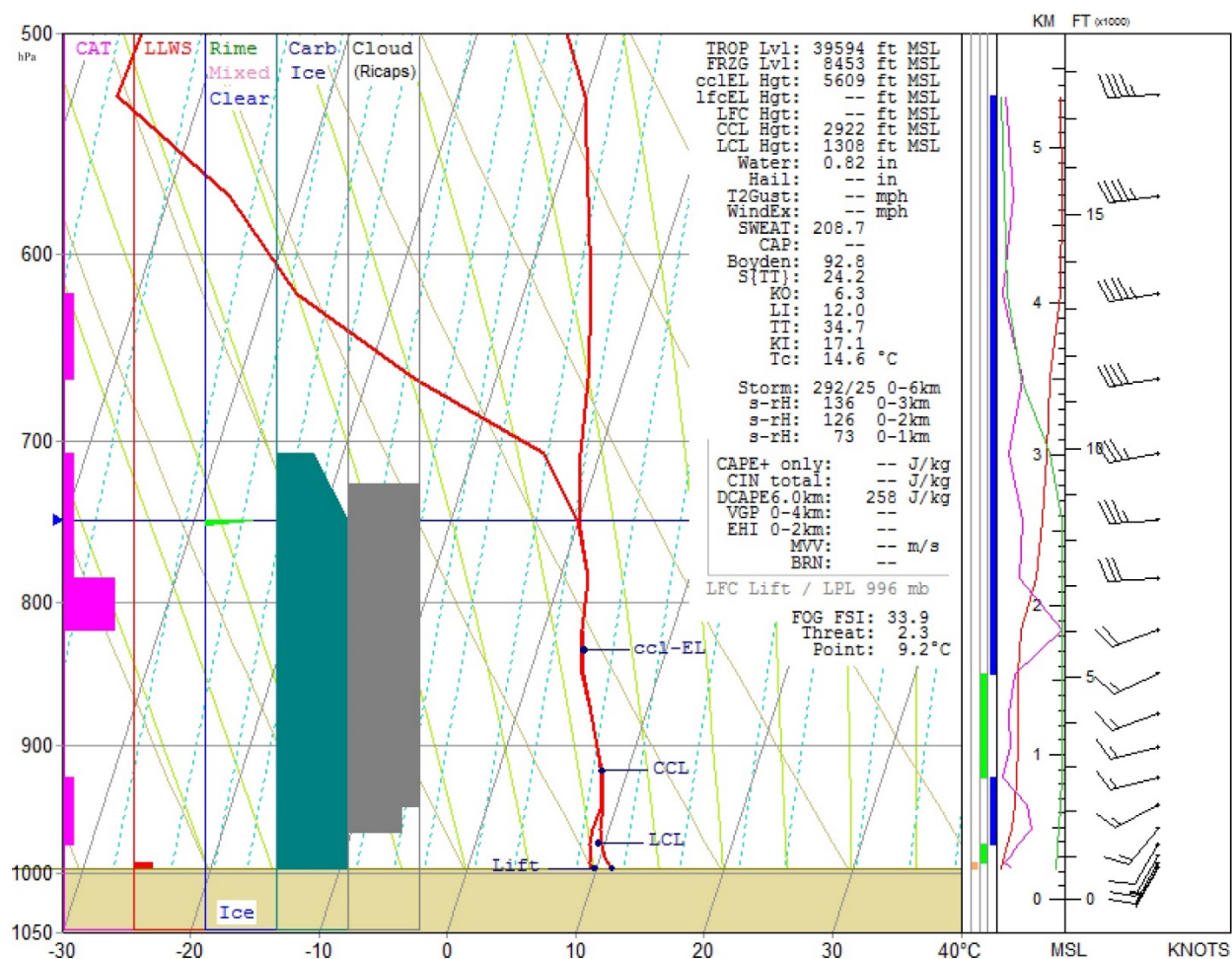


Figure 4 – HRRR model sounding data in SkewT/LogP format for 1400 CST at the accident site, surface to 500 hPa.

³ 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.

6.0 Satellite Imagery

Geostationary Operational Environmental Satellite (GOES)-16 “visible” ($0.64\mu\text{m}$) and infrared ($10.3\mu\text{m}$) data were obtained from an archive at the Space Science Engineering Center at the University of Wisconsin-Madison. Imagery from 1407 CST are presented in figures 5 and 6. The GOES-16 visible data revealed cloudy conditions over the accident region. Infrared cloud-top temperatures in the area immediately surrounding the accident location varied between about 0°C and -7°C , which, according to the HRRR model sounding, corresponded to cloud top heights of about 8,500 feet and 15,000 feet, respectively. It should be noted figures 5 and 6 have not been corrected for any parallax error.

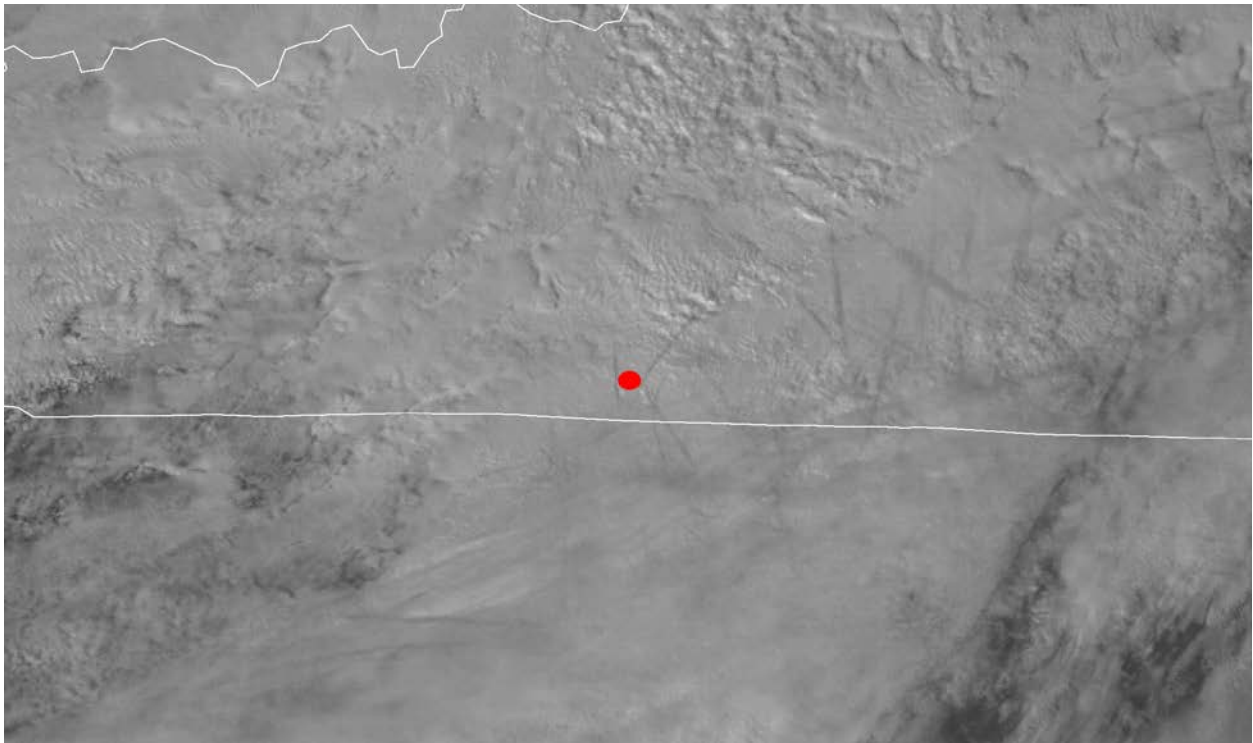


Figure 5 – GOES-16 visible imagery from 1407 CST. Accident location denoted by red circle.

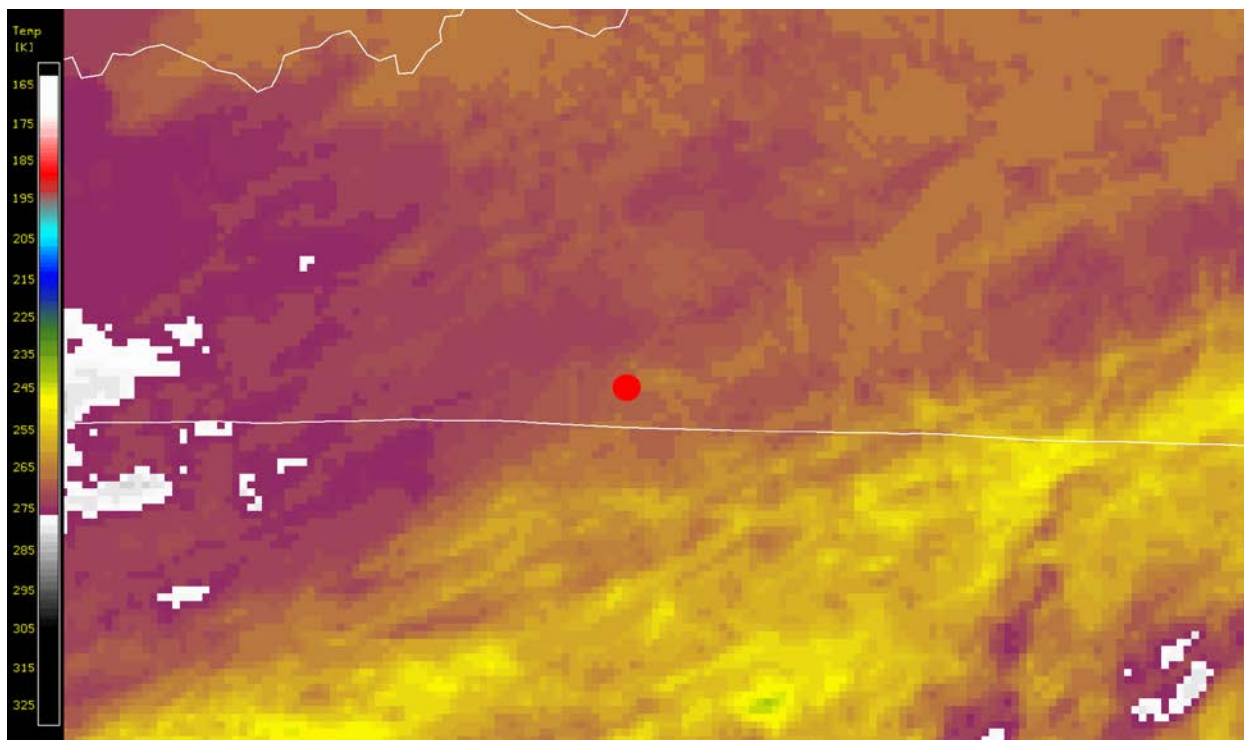


Figure 6 – GOES-16 infrared imagery from 1407 CST. Accident location denoted by red circle.

7.0 Terminal Aerodrome Forecasts

The NWS issued Terminal Aerodrome Forecasts (TAFs)⁴ for the accident aircraft’s destination airport Lake Cumberland Regional Airport (SME)⁵ in Somerset, Kentucky. The most recent SME TAF issued prior to the accident aircraft’s departure and prior to the accident time is presented here. This TAF forecasted for the accident time: wind from 200° at 6 knots, visibility greater than 6 statute miles, rain showers 5-10 miles⁶ away from SME, ceiling broken at 2,500 feet agl, overcast clouds at 6,000 feet agl.

[1301 CST] KSME 121901Z 1219/1318 **20006KT P6SM VCSH BKN025 OVC060**
 FM122100 21005KT 5SM -RA BR OVC010
 FM130400 28003KT P6SM OVC007
 FM131100 33003KT P6SM OVC020=

⁴ Conditions forecasted in the TAF are only official for 5 statute miles from the forecast site.

⁵ SME was located about 68 miles east-northeast of the accident location at an elevation of 927 feet.

⁶ The METAR acronym “VC” (in the vicinity) means between 5 and 10 nautical miles from the reporting station.

8.0 Area Forecast Discussion

An Area Forecast Discussion (AFD) was issued at 1403 CST by the NWS Weather Forecast Office in Louisville, Kentucky. The Aviation section of that AFD (originally issued at 1138 CST in a previous AFD) is presented here.

FXUS63 KLMK 122003

AFDLMK

Area Forecast Discussion

National Weather Service Louisville KY

303 PM EST Sun Nov 12 2017

.Aviation...(18Z TAF Issuance)

Issued at 1238 PM EST Sun Nov 12 2017

Low pressure near IND has a cold front dropping back to LIT, accompanied by low ceilings and scattered light rain showers. Once the system pushes through this evening, winds will switch to the northwest and the showers will end. Ceilings will hang around though, with the lowest bases at SDF and LEX. HNB poses the greatest challenge with ceilings, as low level moisture remains in the region but models differ on just how much actual cloud cover will develop.

9.0 NWS Low-level Significant Weather forecast charts

Low-level Significant Weather forecast charts valid for the times surrounding the accident time are presented in figures 7 and 8. This product is a forecast of aviation weather hazards and is primarily intended to be used as a guidance product for briefing the VFR pilot. 12-hour forecasts valid for 1200 CST and 1800 CST forecasted ceilings less than 1,000 feet and/or visibility less than 3 statute miles for the accident site.

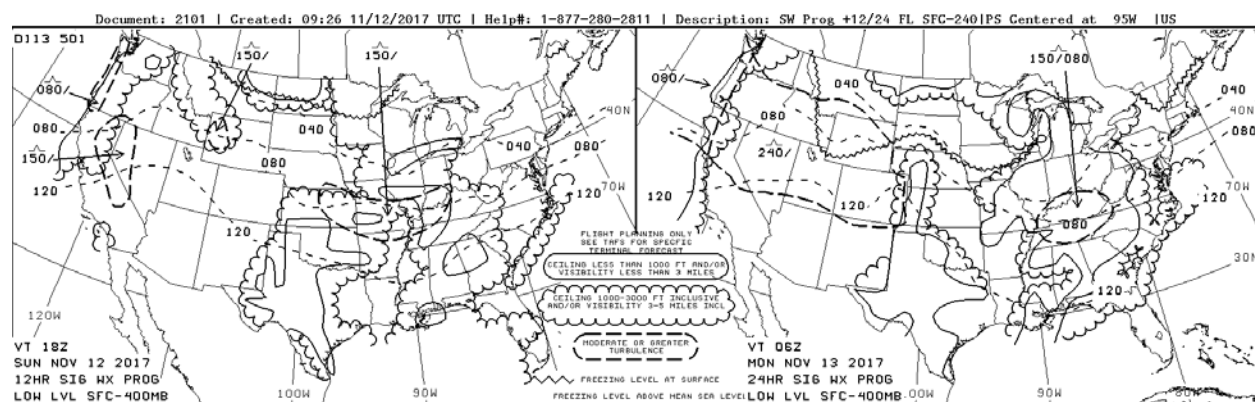


Figure 7 – NWS Low-level Significant Weather 12-hour forecast chart valid for 1200 CST (left panel).

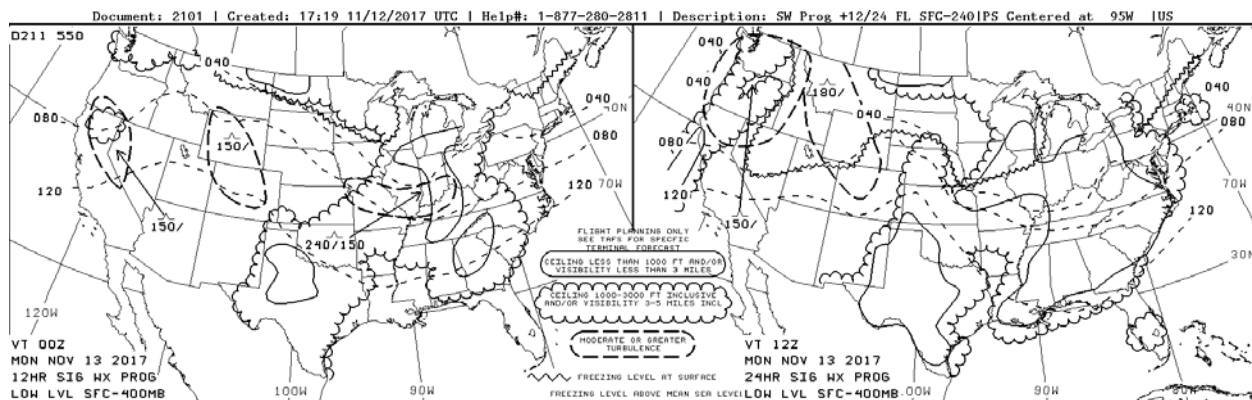


Figure 8 – NWS Low-level Significant Weather 12-hour forecast chart valid for 1800 CST (left panel).

10.0 AIRMETs

There were no Airmen's Meteorological Information (AIRMET) advisories for turbulence below 10,000 feet or icing conditions (below the freezing level) active for the accident location at the accident time.

At 1238 CST, an AIRMET SIERRA for instrument flight rules conditions was issued by the AWC for a region that bordered the accident location and advised of ceilings below 1,000 feet, visibility below 3 statute miles, precipitation and mist.

WAUS43 KPCI 121838 AAA

WA3S

-CHIS WA 121838 AMD

AIRMET SIERRA UPDT 5 FOR IFR AND MTN OBSCN VALID UNTIL 122100

.

AIRMET IFR...IL IN KY TN...UPDT

FROM FWA TO CVG TO 40SE IJU TO 20SW BNA TO 20N MSL TO 30E MEM TO
20N DYR TO PXV TO 50NNW PXV TO FWA

CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS CONTG BYD 21Z THRU 03Z.

11.0 SIGMETs

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

12.0 CWSU Products

There were no Center Weather Advisories issued by the Center Weather Service Unit (CWSU) at the Memphis Air Route Traffic Control Center that were active for the accident site at the accident time.

13.0 Astronomical

The astronomical data obtained from the United States Naval Observatory for 36° 46' north latitude and 86° 0' west longitude, for the accident location, indicated the following:

SUN	
Sunrise	0619 CST
Sunset	1637 CST

14.0 Preflight Weather Briefing

There was no record of a preflight weather briefing via Leidos Flight Service, CSC DUATS or ForeFlight.

Submitted by:

Mike Richards
Senior Meteorologist

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