



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

February 12, 2018

Weather Study

METEOROLOGY

CEN18LA047

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A. ACCIDENT

Location: Rockford, Illinois
Date: December 4, 2017
Time: 1802 central standard time
0002 coordinated universal time (UTC) on December 5, 2017
Airplane: Beech C90, Registration: N500KR

B. METEOROLOGIST

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

C. SUMMARY

On December 4, 2017, about 1802 central standard time, a Beech C90 airplane, N500KR, impacted terrain near the Chicago/Rockford International Airport (RFD), near Rockford, Illinois. The private pilot and one passenger sustained serious injuries and two passengers sustained minor injuries. The airplane sustained substantial fuselage damage during the impact. The airplane was registered to and operated by the pilot as a 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed in the area about the time of the accident, and the flight requested a local instrument flight rules clearance (IFR) near RFD. The flight originated from the Kissimmee Gateway Airport, near Orlando, Florida, about 1342 and was destined for RFD.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board's (NTSB) 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 to UTC, and UTC=Z. NWS airport and station identifiers use the standard International Civil Aviation Organization (ICAO) 4-letter station identifiers versus the International Air Transport Association (IATA) 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 42.203056° N and longitude 89.082500° W at an elevation of about 726 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) 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.

1.1 Surface Analysis Chart

The northcentral portion of the NWS Surface Analysis Chart for 1800 CST on December 4, 2017 (0000Z on December 5, 2017) is included as figure 1, with the location of Chicago/Rockford, IL (KRFD) within the red circle. The chart depicted a deep low-pressure system at 987-hectopascals (hPa)¹ associated with a frontal wave over northern Wisconsin with a cold front extending southward over Wisconsin, eastern Iowa, extreme western Illinois, and then southwestward across Missouri, into northwest Arkansas, and into Oklahoma, and a warm front extending to the east of the low over the Great Lakes region. A second Arctic cold front was also depicted across northern Minnesota, and North Dakota. The accident site was located to the east or ahead of the cold front in the warm air sector of the front.

The station model for KRFD indicated southerly winds sustained at 20 knots, overcast clouds, temperature 61° Fahrenheit (F), a dew point of 49° F, with a sea level pressure of 998.6-hPa. Along the cold front to the west, several stations reported rain showers and thunderstorms. Behind the cold front over Iowa, eastern Nebraska, Minnesota, and eastern South Dakota numerous stations reported light to heavy snow, with west to northwesterly winds sustained at 25 to 30 knots with temperatures in the 20's °F.

¹ Hectopascals (hPa) is the new standard term to refer to pressure and is interchangeable with millibar (mb). Standard sea level pressure is 1013.25-hPa at 15° Celsius (C).

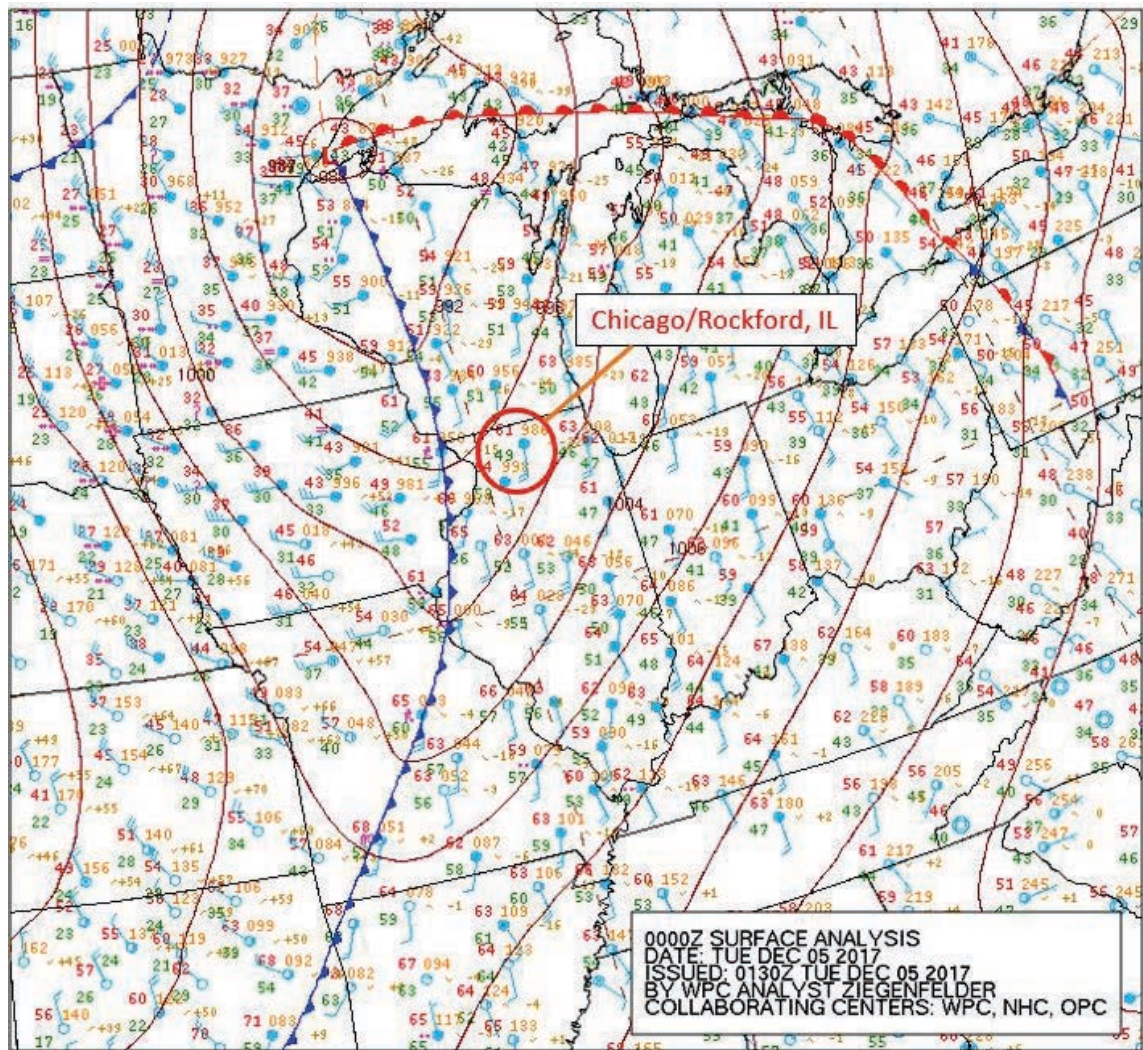


Figure 1 – Northcentral portion of the NWS Surface Analysis Chart for 1800 CST

1.2 National Composite Reflectivity Image

The NWS NCEP National Composite Reflectivity image for 1805 CST with the accident site marked by a red star is included as figure 2. The chart depicted the accident site ahead of a defined north to south band of echoes associated with thunderstorms and rain showers moving across western Illinois and Wisconsin. A review of the radar images surrounding the period indicated the echoes were moving eastward with time. No significant weather echoes were identified in the immediate vicinity of the flight track or accident site.

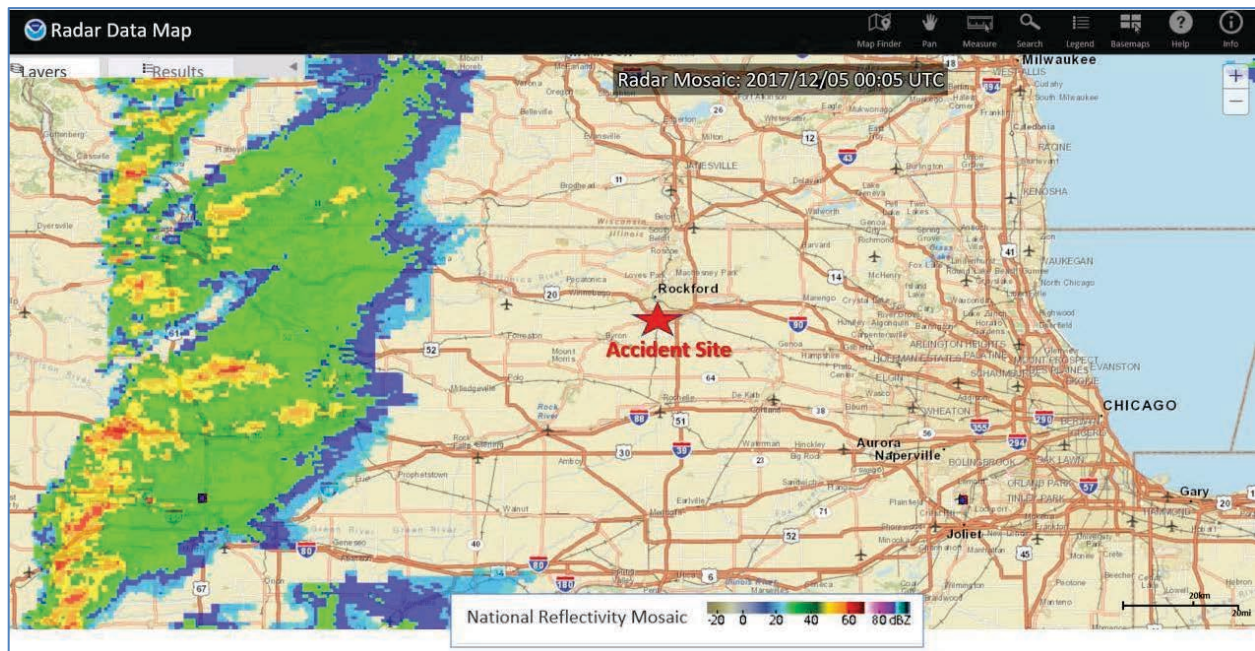


Figure 2 - NWS National Composite Radar Reflectivity image at 1805 CST

1.3 12-Hour Surface Prognostic Chart

The NWS 12-hour Surface Prognostic Chart current at the time of the accident airplanes departure from Florida issued at 1010 CST is included as figure 3, and depicted the expected movement of the pressure and frontal systems, and the forecast precipitation expected during the period at midnight local or 2400 CST. The chart depicted the cold front and expected precipitation having moved through the KRFD area, with a strong pressure gradient across the area implying west to northwesterly winds of 25 knots or more over the area.

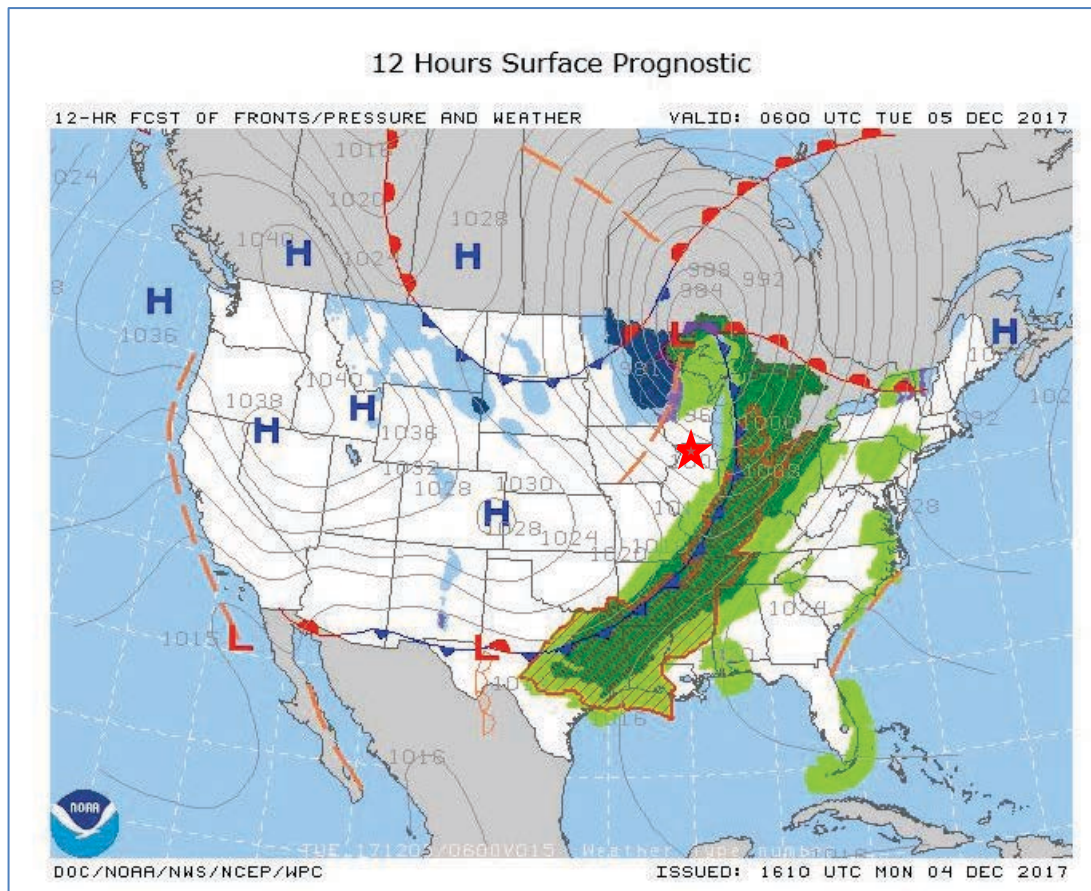


Figure 3 - 12-hour Surface Prognostic Chart valid at midnight

1.4 Convective Outlook

Figure 4 is the NWS Storm Prediction Center (SPC) issued graphic Convective Outlook followed by the text bulletin issued at 1337 CST. The products indicated a slight risk of severe thunderstorms from southwest Wisconsin, eastern Iowa, extreme western Illinois, Missouri, into Arkansas, with a marginal risk extending into central Illinois and extending over the accident site.

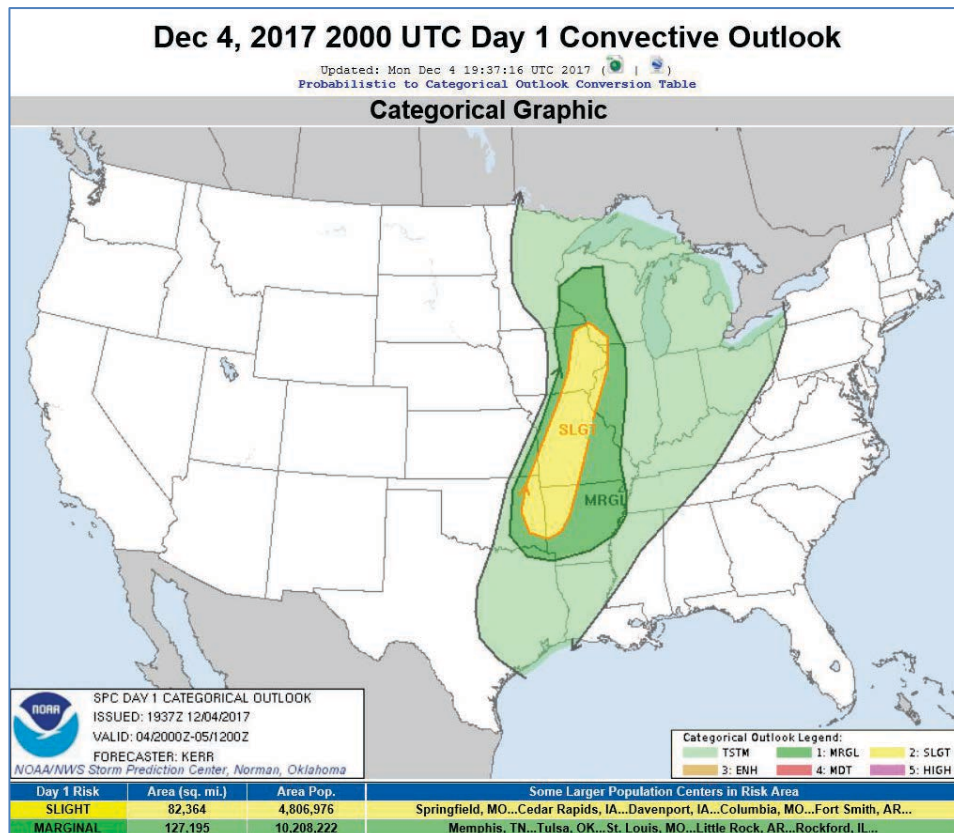


Figure 4 - Convective Outlook issued at 1337 CST

SPC AC 041937

Day 1 Convective Outlook

NWS Storm Prediction Center Norman OK

0137 PM CST Mon Dec 04 2017

Valid 042000Z - 051200Z

...THERE IS A SLIGHT RISK OF SEVERE THUNDERSTORMS LATE THIS AFTERNOON AND EVENING ACROSS PARTS OF EASTERN OKLAHOMA AND NORTHWEST ARKANSAS THROUGH MISSOURI...EASTERN IOWA...NORTHWESTERN ILLINOIS AND SOUTHWESTERN WISCONSIN...

...THERE IS A MARGINAL RISK OF SEVERE THUNDERSTORMS ACROSS SURROUNDING AREAS OF THE PLAINS AND OZARK PLATEAU INTO THE UPPER MIDWEST...

...SUMMARY...

Isolated strong to severe thunderstorms are expected across eastern Oklahoma and the Ark-La-Tex region, northward across Missouri into portions of the Upper Midwest, late this afternoon into tonight.

...20Z Outlook Update...

Severe weather categorical and probabilistic areas have been expanded westward some to account for the current frontal position, and some lingering uncertainty concerning exact timing of storm initiation late this afternoon. The axis of strongest pre-frontal surface heating currently extends northward near/east of Bartlesville, OK through the Chillicothe, MO area, and seems

likely to provide the focus for strongest storm development through early evening. Modest boundary layer destabilization is also ongoing within a narrow pre-frontal corridor as far north as the deepening surface low center, now near Minneapolis, and severe categorical/probabilistic lines have been expanded northward through the Upper Midwest to account for this.

..Kerr.. 12/04/2017

.PREV DISCUSSION... /ISSUED 1027 AM CST Mon Dec 04 2017/

...Synopsis...

A surface cyclone in southwest MN this morning will move toward Lake Superior by tonight, with rapid deepening expected in response to strong deep-layer forcing for ascent within the left exit region of a 130 kt upper jet streak. An associated surface cold front will surge southeastward in the wake of the cyclone and cross the mid MS Valley and southern Plains by the end of this forecast period. In advance of the cold front, a narrow moist sector with boundary-layer dewpoints in the mid 50s into IA and mid-upper 60s in TX, will

continue to spread northeastward through the day. Though surface heating will be tempered by widespread clouds, the low-level moisture and remnant steep midlevel lapse rates will support at least weak surface-based buoyancy as far northeast as parts of IA/IL.

...Mid MS Valley to the Ozarks through tonight...

Thunderstorm development is expected in a band along the cold front from mid-late afternoon (21-23z). It appears there will be a 2-4 hour window of opportunity for damaging winds (and perhaps an isolated tornado) this evening as far northeast as southeast IA and northwest IL, given buoyancy rooted at the surface and 50-60 kt flow just above the surface. Strong deep-layer shear may support embedded supercells within the line for a few hours this evening. The frontal convection will maintain intensity longer from eastern OK into AR, where mid 60s dewpoints will drive at least weak buoyancy into tonight. However, the convection will become more anafrontal with time and low-level flow will veer/weaken, which will limit the southwestward extent of any severe-storm threat.

2.0 Observations

Chicago/Rockford International Airport (KRFD), Chicago/Rockford, Illinois, had an Automated Surface Observation System (ASOS) and was augmented by FAA contracted certified weather observers. The magnetic variation over the area was estimated as 2° West based on the local sectional chart and the isogonic lines, and the airport reported an elevation of 742 ft msl. The official observations presented in plain language transmitted surrounding the period were as follows:

KRFD weather observation at 1754 CST, wind from 190° at 18 knots gusting to 25 knots, visibility 10 miles or more, ceiling² overcast at 3,800 ft agl, temperature 16° Celsius (C), dew point temperature 9° C, altimeter 29.49 inches of mercury (Hg). Remarks; automated observation system with a precipitation discriminator, peak wind from 190° at 27 knots recorded at 1731 CST, sea level pressure 998.6-hPa, 6-hour precipitation a trace (less than 0.01 inches), temperature 16.1° C, dew point 9.4° C, 6-hour maximum temperature 16.7° C, 6-hour minimum temperature 15.6° C, 3-hour pressure tendency fallen 2.2-hPa.

KRFD weather observation at 1854 CST, wind from 190° at 18 knots gusting to 27 knots, visibility 10 miles or more in light rain, ceiling overcast at 3,600 ft agl, temperature 16° Celsius (C), dew point temperature 10° C, altimeter 29.47 inches of Hg. Remarks; automated observation system with a precipitation discriminator, peak wind from 170° at 27 knots recorded at 1847 CST, lightning distant west

² Ceiling is defined as the lowest layer of clouds reported as broken or overcast, or the vertical visibility into a surface based obscuration.

and northwest, rain began at 1853 CST, sea level pressure 997.9-hPa, hourly precipitation less than 0.01 inches, temperature 16.1° C, dew point 10.0° C.

The general flight categories³ and raw Meteorological Aerodrome Reports (METARs) and special reports (SPECI) in standard format and code were as follows between 1330 through 2100 CST, with the flight categories color coded (blue for MVFR, and black for VFR conditions) surrounding the period were as follows:

MVFR METAR KRFD 041954Z 19015KT 10SM OVC030 16/09 A2957 RMK AO2 SLP015 T01610094=

VFR METAR KRFD 042054Z 19019KT 10SM OVC033 16/10 A2956 RMK AO2 SLP009 T01610100 56030=

VFR METAR KRFD 042154Z 19019G26KT 10SM OVC034 16/10 A2955 RMK AO2 PK WND 20029/2118 SLP006 T01610100=

VFR METAR KRFD 042254Z 19019G27KT 10SM OVC036 16/09 A2953 RMK AO2 PK WND 18027/2254 RAB2155E15 SLP000 P0000 T01610094=

VFR METAR KRFD 042354Z 19018G25KT 10SM OVC038 16/09 A2949 RMK AO2 PK WND 19027/2331 SLP986 60000 T01610094 10167 20156 58022=

Accident 0002Z

VFR METAR KRFD 050054Z 19018G27KT 10SM -RA OVC036 16/10 A2947 RMK AO2 PK WND 17027/0047 LTG DSNT W AND NW RAB53 SLP979 P0000 T01610100=

VFR METAR KRFD 050154Z 19021G29KT 10SM -RA BKN032 OVC150 16/11 A2945 RMK AO2 PK WND 20031/0140 LTG DSNT W RAE09B38 SLP973 P0000 T01610111=

MVFR SPECI KRFD 050242Z 24022G38KT 10SM SCT017 BKN027 OVC065 16/12 A2948 RMK AO2 PK WND 21038/0238 RAE31 PRESRR P0000 T01560122=

MVFR METAR KRFD 050254Z 24017G26KT 10SM BKN017 OVC025 13/09 A2949 RMK AO2 PK WND 21038/0238 RAE31 PRESRR SLP986 P0000 60000 T01330094 53000=

2.1 5-minute Observations

The 5-minute ASOS observations for KRFD were obtained from the NWS from NCEI for the period immediately surrounding the accident, and provided a report of the conditions being reported at the time of the accident.

³ 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 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.

KRFD 5-minute ASOS observation at 1800 CST, wind from 180° at 19 knots gusting to 26 knots, visibility 10 miles or more, ceiling overcast at 3,800 ft agl, temperature 16° C, dew point 10° C, altimeter 29.48 inches of Hg. The supplementary information indicated a pressure altitude of 1,150 ft, a relative humidity of 64%, and a density altitude of 1,600 ft, magnetic wind and a peak wind from 190° at 26 knots at 1800 CST.

The raw 5-minute observations from 1745 through 1815 CST were as follows:

17:45:31 5-MIN KRFD 042345Z 19016KT 10SM OVC038 16/09 A2950 1140 64 1600 190/16 RMK AO2 PK WND 19027/2331 T01610094

17:50:31 5-MIN KRFD 042350Z 19019G25KT 10SM OVC038 16/09 A2949 1140 64 1600 190/19G25 RMK AO2 PK WND 19027/2331 SLP987 60000 T01610094 10167 20156 56030

17:55:31 5-MIN KRFD 042355Z 19020G26KT 10SM OVC038 16/09 A2949 1150 64 1600 190/20G26 RMK AO2 PK WND 19026/2355 T01610094

18:00:31 5-MIN KRFD 050000Z 18019G26KT 10SM OVC038 16/10 A2948 1150 67 1600 190/19G26 RMK AO2 PK WND 19026/0000 T01610100

18:02 CST Accident

18:05:31 5-MIN KRFD 050005Z 19020G26KT 10SM OVC038 16/10 A2949 1140 67 1600 190/20G26 RMK AO2 PK WND 19026/0000 T01610100

18:10:31 5-MIN KRFD 050010Z 19018KT 10SM OVC038 16/10 A2949 1140 67 1600 190/18 RMK AO2 PK WND 19026/0000 T01610100

18:15:31 5-MIN KRFD 050015Z 19017G26KT 10SM OVC036 16/10 A2949 1140 67 1600 190/17G26 RMK AO2 PK WND 19026/0000 T01610100

3.0 Sounding

The closest NWS upper air sounding or rawinsonde site were from Davenport, IA (KDVN) located 94 miles southwest of the accident site and from Lincoln, IL (KILN) 124 miles south. Both stations were ahead of the front in the warm air sector of the front and represented the airmass over the accident site. In addition, the NWS Air Resource Laboratory database of High Resolution Rapid Refresh (HRRR) numerical model was also obtained for conditions directly over the accident site.

3.1 Davenport, IA (KDVN) Sounding

The NWS Davenport (KDVN), IA, observed sounding, number 74450, for 1800 CST (0000Z on December 5, 2017) is included as figure 5 plotted on a standard Skew T log P diagram⁴ from the surface to 500-hPa or about 18,000 ft using the RAOB software package⁵.

⁴ 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.

⁵ RAOB software – The complete Rawinsonde Observation program is an interactive sounding analysis program

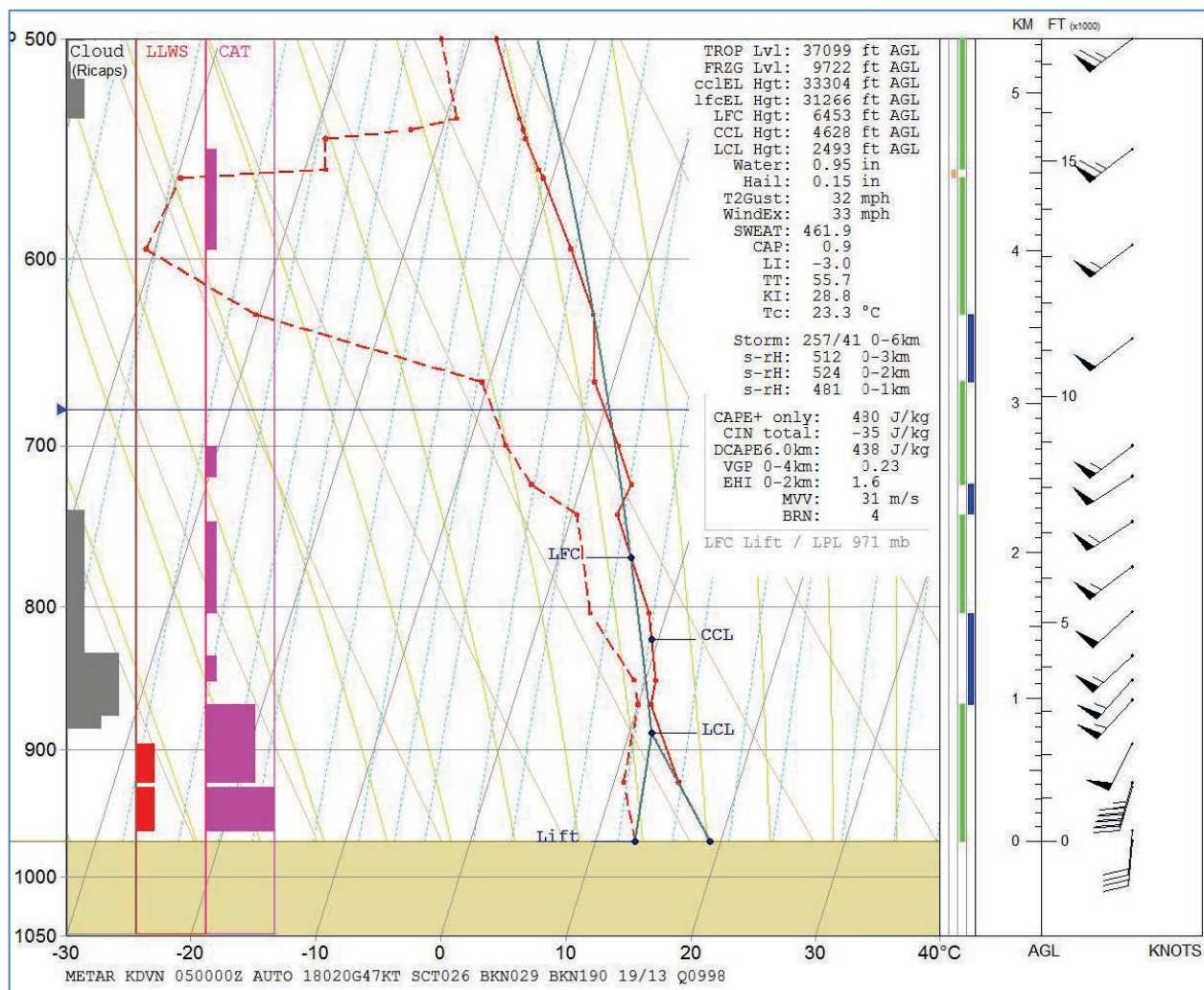


Figure 5 - KDVN sounding at 1800 CST

The KDVN 1800 CST sounding depicted a surface temperature of 66.6° F (19.2° C), a dewpoint of 55.8° F (13.2° C), a relative humidity of 68%, and a precipitable water content of 0.95 inches. The lifted condensation level (LCL)⁶ was at 2,493 ft agl, the convective condensation level (CCL)⁷ at 4,628 ft agl, and a level of free convection (LFC)⁸ at 6,453 ft agl. The sounding supported multiple layers of clouds with a scattered layer at 2,600 ft agl and a broken layer at 2,900 ft agl.

developed by Environmental Research Services, Matamoras, Pennsylvania, for plotting and analyzing upper air data.

⁶ Lifting Condensation Level (LCL) - The height at which a parcel of moist air becomes saturated when it is lifted dry adiabatically.

⁷ Convective Condensation Level (CCL) - The height to which a parcel of air, if heated sufficiently from below, will rise adiabatically until condensation starts. This is typically used to identify the base of cumuliform clouds, which are normally produced from surface heating and thermal convection.

⁸ Level of Free Convection (LFC) - The level at which a parcel of saturated air becomes warmer than the surrounding air and begins to rise freely. This occurs most readily in a conditionally unstable atmosphere.

The freezing level was identified at 10,473 ft. The atmosphere was characterized as unstable with a Lifted Index (LI) of -3.

The KDVN wind profile indicated a surface wind from the south or from 185° at 20 knots, which veered or changed clockwise with height to the southwest immediately above the surface with increasing wind speeds. A low-level wind maximum or low-level jet was identified at 3,900 ft with the wind from 220° at 55 knots. At higher levels, the jet stream or the level of maximum wind was identified at 36,000 ft from 240° at 122 knots, which was located below the tropopause at 37,850 ft. As a result, the mean 0 to 6 kilometer or 18,000 ft wind steering wind was from 230° at 55 knots.

Figure 6 is a table of the KDVN sounding parameters of observed height, pressure, temperature, dew point, relative humidity, and wind, with the derived clear air turbulence (CAT), low-level wind shear (LLWS), and icing potential from the observed data.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
751	971	19.2	13.2	68	185 / 20			
1000	962				185 / 20	XTR	LIGHT	
2000	929				195 / 43			
2113	925	15.2	10.8	75	195 / 44	SVR	LIGHT	
3000	896				205 / 50	SVR		
3904	867	11.0	10.0	94	220 / 55			
4447	850	10.8	9.1	89	220 / 54	LGT		
5000	833				225 / 53			
5966	804	8.6	3.9	72	225 / 52	LGT		
7000	774				230 / 53	LGT		
8000	745				235 / 54			
8163	741	3.6	0.4	80				
8819	723	4.0	-4.0	56				
9000	718				235 / 52	LGT		
9679	700	2.0	-7.0	51	230 / 54			
11069	664	-1.5	-10.5	50				
12000	641				230 / 50			

Figure 6 - KDVN sounding data

Due to the strong wind profile, the KDVN 1800 CST sounding indicated a 100% probability of moderate and greater low-level turbulence below 3,900 ft due to the strong vertical wind shears.

3.2 Numerical Model Sounding

The HRRR numerical model for 1800 CST for the accident coordinates is included as figure 7. The model sounding depicted a surface wind from 170° at 16 knots, a surface temperature of 60° F (15.7° C), a dew point of 52° F (11.1° C), with a relative humidity of 74%. The precipitable water content was 1.06 inches. The model sounding depicted a LCL at 1,900 ft agl, and a CCL at 4,226 ft agl. The sounding had a relative humidity greater than 80% from about 2,500 ft through 8,500 ft and supported nimbostratus type clouds capable of producing drizzle and/or light rain. The freezing level was identified at 10,800 ft.

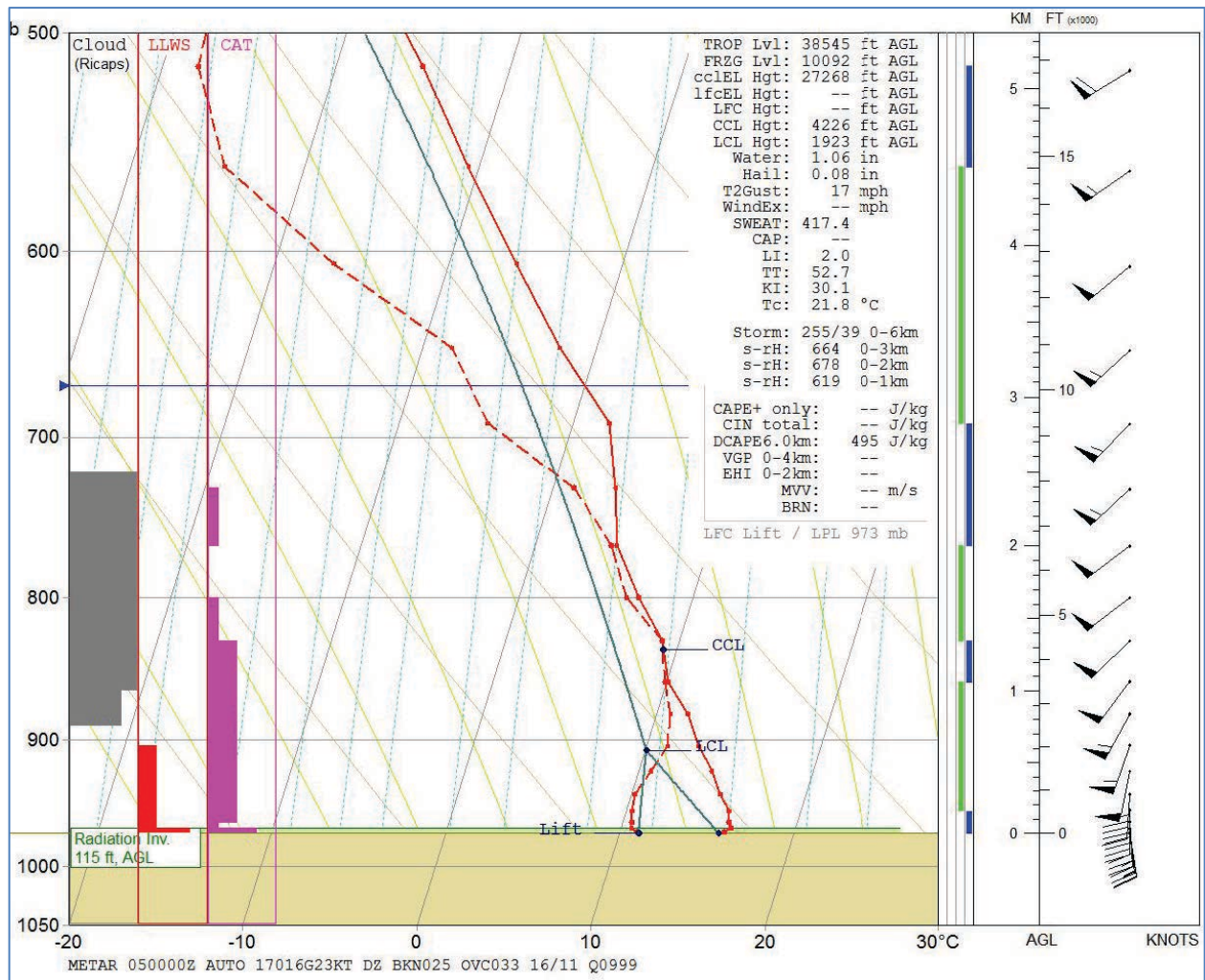


Figure 7 - HRRR numerical model sounding for 1800 CST

The HRRR wind profile also depicted southerly winds veering to the southwest with increasing wind speeds. A low-level jet was also expected at 2,700 ft with winds from 200° at 54 knots. The mean 0 to 6 km wind was from 225° at 52 knots. The model indicated a greater than 90% probability of moderate and greater turbulence below 4,000 ft.

Figure 8 is a table of the HRRR sounding parameters of height, pressure, temperature, dew point, relative humidity, and wind, with the CAT, LLWS, and icing potential from the model.

Height (ft-MSL)	Pres (mb)	T (C)	Td (C)	RH (%)	DD / FF (deg / kts)	CAT (FAA)	LLWS	Icing - Type (AFGWC method)
725	973	15.7	11.1	74	172 / 16			
754	972	16.0	11.0	72	172 / 16	SVR	STRNG	
840	969	16.3	10.6	69	174 / 27	LGT	LIGHT	
985	964	16.1	10.5	69	176 / 30	MDT	LIGHT	
1247	955	15.9	10.3	69	180 / 38	MDT	LIGHT	
1629	942	15.1	10.2	73	183 / 44	MDT	LIGHT	
2165	924	14.2	10.7	79	191 / 50	MDT	LIGHT	
2741	905	13.0	11.2	89	198 / 54	MDT		
3483	881	11.8	10.8	94	207 / 53	MDT		
4209	858	10.1	9.9	99	215 / 52	MDT		
5148	829	9.0	9.0	100	224 / 50	LGT		
6115	800	6.9	6.2	95	230 / 49			
7284	766	4.7	4.4	98	231 / 50	LGT		
8572	730	3.6	1.2	84	225 / 54			
9994	692	2.1	-4.9	60	222 / 55			
11641	650	-2.1	-8.3	62	225 / 53			
13456	606	-6.1	-16.6	43	228 / 52			

Figure 8 - HHHR model sounding over KRFD at 1800 CST

4.0 Satellite imagery

The Geostationary Operational Environmental Satellite number 13 (GOES-13) data was obtained from an archive at the Space Science Engineering Center (SSEC) 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 imagery was obtained surrounding the time of the accident and reviewed. The infrared long wave imagery (band 13) at a wavelength of 10.3 microns (μm) provided standard satellite image with radiative cloud top temperatures with a resolution of 2.0 km.

Figure 9 is the GOES-13 infrared image at 1815 CST at 4X magnification and with a standard MB temperature enhancement curve applied to highlight the higher and colder cloud tops typically associated with deep convection. The image depicted an enhanced area of clouds over Illinois extending southwestward into Missouri. The radiative cloud top temperature over the accident site (KRFD) was 224° Kelvin or -49.16° C, which corresponded to cloud tops near 31,700 ft.

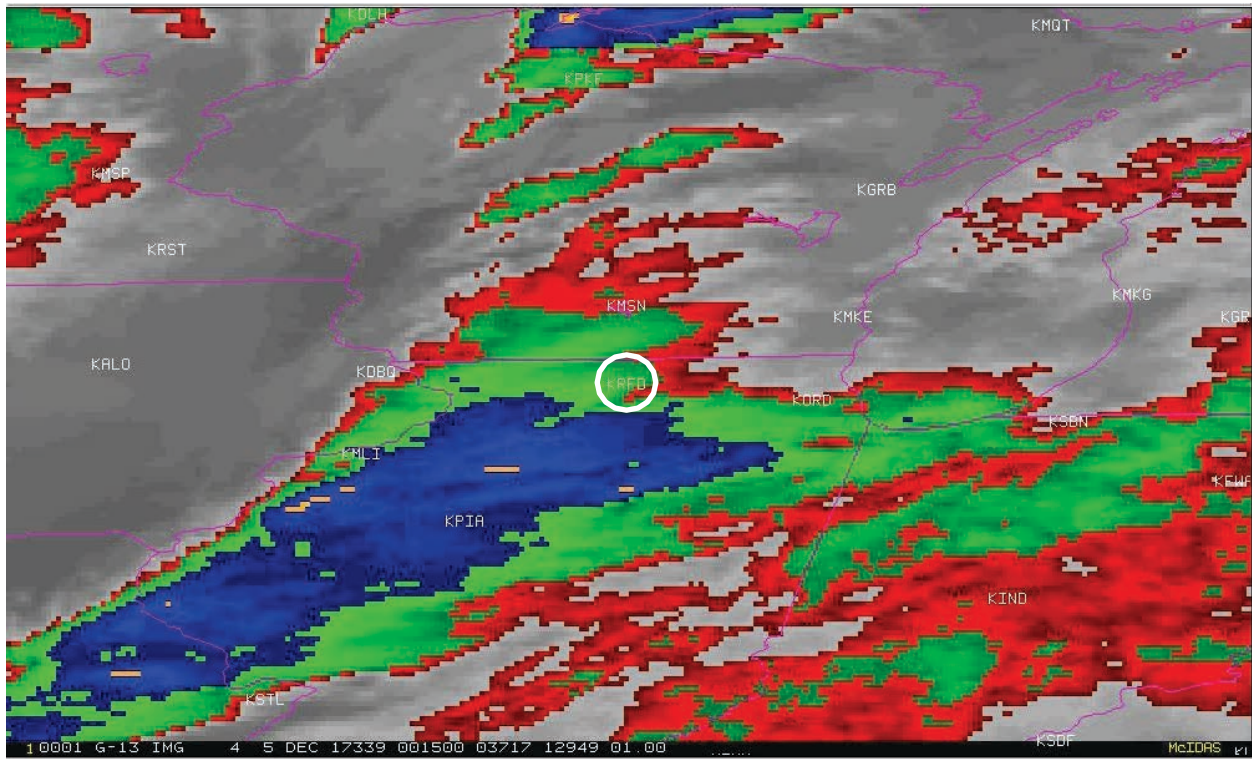


Figure 9 - GOES-13 infrared image at 1815 CST at 4X magnification

5.0 Pilot Reports

The following pilot reports (PIREPs) were recorded over Illinois between 1400 to 2300 CST, the reports have been decoded from standard code and abbreviations, with time converted from UTC to CST. The reports were as follows:

General Downing - Peoria International Airport (PIA), Peoria, IL urgent pilot report (UUA); Over – KPIA; Time – 1418 CST; Altitude – 800 ft; Type aircraft – Canadair Regional Jet (CRJ9) air carrier jet; Remarks – LLWS +10 knots of airspeed from surface through 900 ft.

Veterans Airport of Southern Illinois (MWA), Marion, IL routine pilot report (UA); Over – MWA; Time – 1418 CST; Altitude 400 ft; Type aircraft – Cessna Businessliner (C402) multiengine airplane; Turbulence – moderate; Remarks – MWA arrival from 4,000 ft and below moderate turbulence, entered by Kansas City ARTCC (KZC).

Abraham Lincoln Capital Airport (SPI), Springfield, IL routine pilot report (UA); Over – KSPI; Time – 1438 CST; Altitude – during descent; Type aircraft – Embraer (E170) regional air carrier jet; Sky cover – overcast clouds with bases at 4,800 ft with tops at 7,400 ft; Turbulence – moderate turbulence below 1,000 ft.

PIA routine pilot report (UA); Over – KPIA; Time – 1443 CST; Altitude – 900 ft; Type aircraft – Canadair Regional air carrier jet (CRJ2); Remarks – LLWS +10 knots of airspeed during descent to runway 22.

PIA routine pilot report (UA); Over – 200° radial and 8 miles of PIA VORTAC; Time – 1522 CST; Altitude – 4,400 ft; Type aircraft – Canadair Regional air carrier jet (CRJ9); Sky cover – broken clouds with bases at 4,400 ft.

SPI routine pilot report (UA); Over – SPI; Time - 1545 CST; Altitude – during climb; Type aircraft – Embraer regional air carrier jet (E170); Sky cover – cloud tops at 6,000 ft; Turbulence – light chop; Remarks – plus or minus 5 knots of airspeed during climb.

Quad City International Airport (MLI), Moline, IL routine pilot report (UA); Over – 5 miles north of MLI; Time – 1546 CST; Altitude – 6,000 ft; Type aircraft – Canadair Regional Jet (CRJ2); Sky cover – base of overcast clouds at 6,000 ft; Remarks – during descent.

SPI routine pilot report(UA); Over – SPI; Time – 1602 CST; Altitude – during climb; Type aircraft – McDonald Douglas (MD83) air carrier jet; Sky cover – overcast clouds with bases at 4,000 ft; Remarks – LLWS plus 15 knots and loss of 10 knots of airspeed from surface to 200 ft agl.

Quincy Regional Airport-Baldwin Field (UIN), Quincy, IL, routine pilot report (UA); Over – SPI; Time – 1705 CST; Altitude – 6,000 ft; Type aircraft - Cessna Conquest II (C441) multiengine turboprop; Sky cover – overcast clouds with bases at 4,000 ft with tops at 5,500 ft; Icing – negative; Remarks – entered by KZC.

MLI routine pilot report (UA); Over– MLI; Time – 2015 CST; Altitude – 2,000 ft; Type aircraft – Canadair regional jet; Wind – from 180° at 46 knots; Remarks – on final for runway 9 over threshold wind from 160° at 33 knots, with comments “HAD TO WORK FOR THAT ONE”.

DuPage Airport (DPA), Chicago/West Chicago, IL, urgent pilot report (UUA); Over – 020° radial and 1 miles from DPA VORTAC; Time – 2250 CST; Altitude 1,000 ft; Type aircraft – Piper Aztec (PA 27) multiengine airplane; Turbulence – light to moderate chop; Remarks – LLWS plus to minus 10 knots of airspeed on approach.

6.0 Terminal Aerodrome Forecast

The Terminal Aerodrome Forecast (TAF) for KRFD was issued by the NWS Chicago (KLOT) Weather Forecast Office (WFO) at 1137 CST and was valid for a 24-hour period, and was as follows:

*TAF KRFD 041737Z 0418/0518 19020G32KT P6SM SCT025 OVC035
FM042000 19024G38KT P6SM VCSH OVC025
TEMPO 0500/0502 26030G40KT 3SM +SHRA OVC025
FM050300 26022G34KT P6SM SCT035*

The forecast relevant to the accident flight from 1400 through 2100 CST expected winds from 190° at 24 knots gusting to 38 knots, visibility better than 6 miles with rain showers in the vicinity, ceiling overcast at 2,500 ft agl, with temporary conditions between 1800 and 2000 CST of winds from 260° at 30 knots gusting to 40 knots, visibility 3 miles in heavy rain showers, ceiling overcast at 2,500 ft agl. There was no forecast of low-level wind shear included.

The forecast was amended at 1511 CST with no changes for the estimated time of arrival.

*TAF AMD KRFD 042111Z 0421/0518 19020G32KT P6SM SCT025 OVC035
FM042200 19024G38KT P6SM VCSH OVC025
TEMPO 0500/0502 26030G40KT 3SM +SHRA OVC025
FM050300 26022G34KT P6SM SCT035=*

The forecast was corrected at 1607 CST to the following:

TAF COR KRFD 042207Z 0422/0518 19020G32KT P6SM VCSH OVC035

TEMPO 0501/0503 26030G40KT 3SM +SHRA OVC025
FM050300 26022G34KT P6SM SCT035=

The forecast for the estimated time of arrival expected from 1800 through 2100 CST wind from 190° at 20 knots gusting to 32 knots, visibility better than 6 miles with rain showers in the vicinity or within 10 miles of the station, ceiling overcast at 3,500 ft agl, with temporary conditions between 1900 through 2100 CST of wind from 260° at 30 knots gusting to 40 knots with visibility 3 miles in heavy rain showers, ceiling overcast at 2,500 ft agl.

The new scheduled forecast was issued at 1734 CST immediately prior to the accident at 1734 CST with no significant changes in the forecast for the expected time of arrival, and was as follows:

TAFKRFD 042334Z 0500/0524 19020G32KT P6SM VCSH OVC035
TEMPO 0501/0503 26030G40KT 3SM +SHRA OVC025
FM050300 27020G33KT P6SM SCT030=

7.0 Area Forecast Discussion

The NWS KLOT Area Forecast Discussion (AFD) issued at 1454 CST discussing the short term forecast and aviation forecast was as follows:

*FXUS63 KLOT 042055
AFDLOT
Area Forecast Discussion
National Weather Service Chicago/Romeoville, IL
255 PM CST Mon Dec 4 2017*

*.SHORT TERM...
254 PM CST*

Through Tuesday...

Main forecast concerns/challenges are with the thunderstorm potential late this afternoon through mid/late evening, which now includes an increased threat for isolated strong to severe thunderstorms mainly across north central Illinois. Also, strong/gusty winds will continue into tonight with current wind headline still on track.

In the near term, dry conditions in place as lacking focus in the area continues. However, this will likely change by mid to late afternoon as system to the west draws near. Have been monitoring convective trends over the last couple hours, with concerns growing for an increased threat of strong to severe storms across the region. Some limiting factors such as thick cloud cover and weaker instability are still noted and valid items to consider, but these trends have been showing that these could become offset later today into this evening at least across a portion of the CWA. Surface low continues to deepen across the midwest ahead of large upper level trough and strong vort max swinging across the region. Expect this low to further deepen through the night as it lifts across the western Great Lakes, with associated surface front pushing east the region. As large scale forcing quickly increases over the next couple of hours, will see convection develop over eastern Iowa into west central Illinois along and ahead of this front.

While instability is in place across the region, observational trends and rap analysis indicating a narrow ribbon of MLCAPE situated right along this front. What's also in place is weakening CIN, with short term guidance indicating this trend of weakening CIN may continue into this afternoon and evening into northern Illinois. Cloud cover in place may limit this trend, but strong forcing

ahead of this system could offset this and allow further erosion. This is concerning, as this front/environment along with precip development push east towards the CWA later this afternoon. Now, while the highest instability and higher threat for more robust development is situated just to the west of the CWA at this time, areas along and west of I-39 in northern Illinois still have a threat for this stronger development before MLCAPE weakens and CIN increases. Guidance has struggle to catch up on trends, and think its also still struggling to the most eastward extent. This will occur, while bulk shear will be more than sufficient for organized development and while low level flow continues to increase.

Showers/thunderstorms will likely reach the I-39 corridor in the 5-7 PM CST time frame, with the highest threat of strong to severe thunderstorms along this corridor and with the main hazards damaging winds. This is especially as the low level flow increases, strong flow that is just right above the surface. Although the main hazards would be strong damaging winds, could not rule out an isolated tornado threat. This threat should be higher to the west, but cannot rule out this threat reaching the CWA. As these showers/storms push further to the east in the evening, intensity of any storms should diminish. However, will need to monitor for a continued threat further to the east as this convection moves into northeast Illinois and northwest Indiana.

Southerly winds/gusts have continued to increase this afternoon, and will likely continue this trend this afternoon into the evening. Gusts of 45-50 MPH will remain a possibility but with FROPA later this evening, could see a slight quick increase. Also, outside of the thunderstorm threat, high wind gusts will be possible with any shower.

Rodriguez

...

.AVIATION...

For the 18Z TAFs...

In the near term, southerly winds/gusts continue to steadily increase with gusts right around 30 kt. Expect this trend to continue this afternoon, with increasing speeds reaching the upper 30 kt range. As winds increase this afternoon, expect VFR ceilings to lower with MVFR ceilings eventually moving overhead. This will be ahead of the approaching system to the west. Overall dry conditions still expected over the next several hours, outside of a few passing light showers. A line of stronger showers still expected to develop later this afternoon and move across the terminals this evening. Confidence on thunder continues to be low, but the possibility for isolated/embedded thunder remains. The period of rain is still appearing to be small, with dry conditions returning late this evening and overnight. Ceilings should quickly rise later tonight with the fropa⁹, however, some scattered lower clouds could linger. Winds turn more westerly tonight, but with speeds staying elevated into Tuesday.

Rodriguez

.LOT WATCHES/WARNINGS/ADVISORIES...

IL...Wind.A dvisory...ILZ003-ILZ004-ILZ005-ILZ006-ILZ008-ILZ010-ILZ011-ILZ012-ILZ013-ILZ014-ILZ019-ILZ020-ILZ021-ILZ022-ILZ023-ILZ032-ILZ033-ILZ039 until 6 AM Tuesday.

8.0 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.

⁹ fropa – abbreviation for frontal passage

are issued by the NWS AWC, as well as from the Center Weather Service Units (CWSU) associated with FAA Air Route Traffic Control Center's (ARTCCs).

There are four basic types of inflight aviation weather advisories: the Significant Meteorological Advisory (SIGMET), the Convective SIGMET, the Airmen's Meteorological Information (AIRMET), and the Center Weather Advisory (CWA). These advisories use the same location identifiers (either VORs, airports, or well-known geographic areas) to describe the hazardous weather areas. The Severe Weather Watch Bulletins (WWs), with the associated Alert Messages (AWW) supplements these advisories.

On December 4, 2017 the following advisories were issued for the region; Convective SIGMET, AIRMETs, CWA, and AWWs. No SIGMETs were issued during the period for severe turbulence, or severe icing, and no weather watches extended over Illinois during the period and therefore were not included.

8.1 Convective SIGMETs

The following Convective SIGMETs (WST) were current at the time of the accident for a line of severe to embedded thunderstorms extending from Wisconsin, western Illinois, eastern Iowa, into Missouri to the west of the Rockford area. The line was moving north-northeastward at 35 knots, and with cumulonimbus cloud tops more than 38,000 ft. Figure 10 is the graphic depiction of the advisories in red and the outlook region in yellow, which included the accident site followed by the text of the advisories.

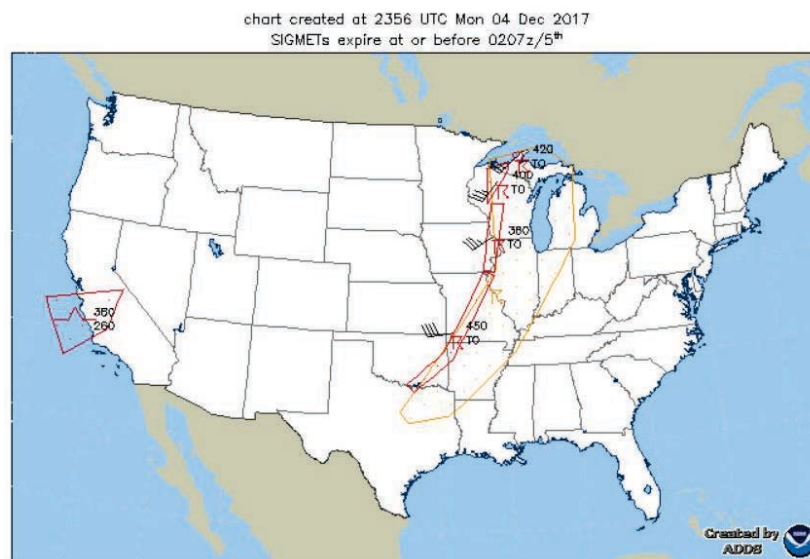


Figure 10 - Convective SIGMETs issued at 1755 CST for thunderstorms

WSUS32 KKCI 042355
SIGC
-MKCC WST 042355
CONVECTIVE SIGMET 38C
VALID UNTIL 0155Z
IL MO AR IA TX OK

**FROM 40N UIN-20NNW FSM-30S ADM
LINE SEV TS 40 NM WIDE MOV FROM 26040KT. TOPS TO FL450.
HAIL TO 1 IN...WIND GUSTS TO 60KT POSS.**

CONVECTIVE SIGMET 39C
VALID UNTIL 0155Z
MI W I L S
FROM 80N RHI-50N RHI-20SSE EAU-40ESE DLH-80N RHI
AREA EMBD TS MOV FROM 22035KT. TOPS TO FL400.

**CONVECTIVE SIGMET 40C
VALID UNTIL 0155Z
W I L I A
FROM 50ESE EAU-50N UIN
LINE EMBD TS 40 NM WIDE MOV FROM 24035KT. TOPS TO FL380.**

**OUTLOOK VALID 050155-050555
FROM 90NNE SAW-SSM-50W DXO-DYR-ELD-30SE GGG-ACT-50NW ACT-60NNE
UIN-50ENE DLH-90NNE SAW
REF WW 518 519¹⁰.
WST ISSUANCES EXPD. REFER TO MOST RECENT ACUS01 KWNS FROM STORM
PREDICTION CENTER FOR SYNOPSIS AND METEOROLOGICAL DETAILS.**

8.2 Center Weather Advisories (CWA)

The Chicago (KZAU) CWSU issued the following advisories during the period prior to the accident, with no advisory current at the time of the accident. The advisories were as follows:

FAUS21 KZAU 041810
ZAU1 CWA 041810
ZAU CWA 101 VALID UNTIL 041900
FROM 45WNW MKG-50NNE GRR-50NNW GIJ-45WNW MKG
AREA TS WITH MOD RAIN MOV FROM 24055KT. TOPS TO FL350. LM/MI

FAUS22 KZAU 042140
ZAU2 CWA 042135
ZAU CWA 201 VALID UNTIL 042200
FROM 60W DBQ-30NNW IRK
RAPIDLY DVLPG LINE TSRA 15NM WIDE
MOV FROM 24040KT TOPS TO FL370
LTL CHG EXPECTED. IA

8.3 AIRMETs (WA)

Figures 11-13 are the graphic AIRMETs Sierra for IFR conditions, AIRMET Tango for moderate turbulence and LLWS, and AIRMET Zulu for moderate icing conditions current for the

¹⁰ Severe Weather Forecast Alerts (AWW) were issued for severe thunderstorms over Missouri, extreme western Illinois, western Arkansas, into eastern Oklahoma. The watches did not extend over the route of flight or were applicable to the accident flight.

period, followed by the text of the advisories. AIRMET Tango was the most relevant advisory for the area and expected moderate turbulence from the surface through 15,000 ft and for LLWS.

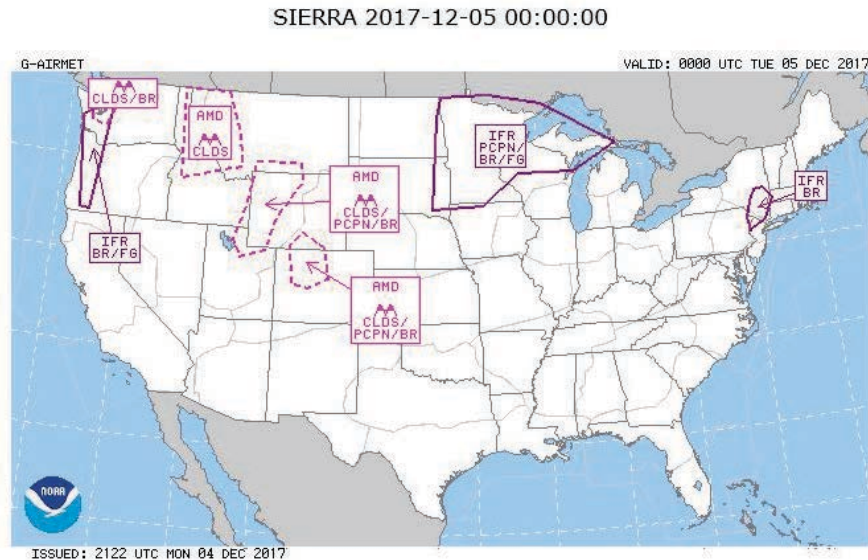


Figure 11 - AIRMET Sierra for IFR and mountain obscuration conditions

WAUS43 KPCI 042045

WA 3S

-CHIS WA 042045

AIRMET SIERRA UPDT 3 FOR IFR VALID UNTIL 050300

AIRMET IFR...ND SD NE MN IA WI LM LS MI LH

FROM 30N INL TO YQT TO SSM TO 60SE SSM TO 30E TVC TO 50ENE GRB
TO EAU TO 30N MCW TO 30W FOD TO 40SW LBF TO 60WSW ANW TO 50S BIS
TO 90SW YWG TO 30N INL

CIG BLW 010/VIS BLW 3SM PCPN/BR/FG. CONDS CONTG BYD 03Z THRU 09Z.

OTLK VALID 0300-0900Z...IFR MO IL KY TX AR TN LA MS AL AND CSTL WTRS
BOUNDED BY 40ENE FAM-40SW PXV-40WSW VUZ-50SW PZD-40W CEW-50SE
SJI-50WNW LEV-PSX-20W BRO-SAT-EIC-30WNW LIT-40ENE FAM
CIG BLW 010/VIS BLW 3SM PCPN/BR. CONDS DVLPG 03-06Z. CONDS CONTG
THRU 09Z.

....

TANGO 2017-12-05 00:00:00



Figure 12 - AIRMET Tango current for moderate turbulence and low-level wind shear conditions

WAUS43 KPCI 042045

WA3T

-CHIT WA 042045

AIRMET TANGO UPDT 4 FOR TURB STG WNDZ AND LLWS VALID UNTIL 050300

**AIRMET TURB...ND SD NE KS MN IA MO WI LM LS MI LH IL IN KY
FROM 30N INL TO YQT TO SSM TO YVV TO ECK TO FWA TO PXV TO 50SW PXV TO
20NNE ARG TO RZC TO OSW TO 50W LBL TO GLD TO BFF TO 70SW RAP TO
50NNW ISN TO 30N INL
MOD TURB BTN FL180 AND FL390. CONDS CONTG BYD 03Z THRU 09Z.**

**AIRMET TURB...ND SD NE KS MN IA MO WI LS OK TX
FROM 30N INL TO 40E EAU TO IOW TO MLC TO 60N INK TO 30ESE TCC TO 30ESE TBE
TO 50W LBL TO GLD TO BFF TO 70SW RAP TO 70SW DIK TO 50NNE ISN TO 30N INL
MOD TURB BLW 120. CONDS CONTG BYD 03Z THRU 09Z.**

**AIRMET TURB...KS IA MO WI LM LS MI LH IL IN KY OK TX AR TN MS AL
FROM 70NNE SAW TO SSM TO YVV TO 30SE ECK TO FWA TO CVG TO 30W HNN TO
40NE MSL TO ELD TO TXK TO MLC TO 20SW SAW TO 70NNE SAW
MOD TURB BLW 150. CONDS CONTG BYD 03Z THRU 09Z.**

**AIRMET STG SFC WNDZ...SD NE KS IA MO
FROM RAP TO 60NNW OVR TO 40NNE DSM TO 40ESE DSM TO 30SW OVR TO 20NNW ICT
TO GLD TO BFF TO RAP
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 03Z
ENDG 03-06Z.**

**AIRMET STG SFC WNDZ...ND SD MN WI
FROM 50NW GFK TO 20WNW BRD TO 40WNW EAU TO RWF TO 60E ABR TO DPR TO 60E
BIS TO 60E MOT TO 50NW GFK
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 03Z
ENDG 06-09Z.**

AIRMET STG SFC WNDZ...MI LH

FROM 20S SSM TO 30NW YVV TO 50SSW YVV TO 50SE ASP TO 30NNE ASP TO 20S SSM
SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS CONTG BYD 03Z THRU 09Z.

AIRMET STG SFC WINDS...WI LM MI IN

FROM 50SW SSM TO 60SW TVC TO 30SW MKG TO 20ESE ORD TO 40NE BAE TO 60SE SAW
TO 50SW SSM

SUSTAINED SURFACE WINDS GTR THAN 30KT EXP. CONDS DVLPG AFT 21Z.

CONDS CONTG BYD 03Z THRU 09Z.

LLWS POTENTIAL...MN IA MO WI LM LS MI LH IL IN KY AR TN MS

**BOUNDED BY 50ESE YQT-SSM-YVV-30SE ECK-FWA-CVG-50W HNN-BWG-50W SQS-
20NE ELD-50S FSM-RZC-20N STL-30SSW JOT-40W BDF-30WNW DBQ-40E DLH-
50ESE YQT**

LLWS EXP. CONDS CONTG BYD 03Z THRU 09Z.

OTLK VALID 0300-0900Z

AREA 1...TURB ND SD NE KS MN IA MO WI LM LS MI LH IL IN KY OK AR TN MS AL
BOUNDED BY 40S YWG-30N INL-YQT-SSM-YVV-30SE ECK-FWA-CVG-HNN-HMV-GQO-
LGC-50ESE LIT-50WNW ARG-RZC-OSW-50W LBL-GLD-50WSW GFK-40S YWG
MOD TURB BTN FL180 AND FL390. CONDS CONTG THRU 09Z.

AREA 2...TURB ND SD NE KS MN IA MO WI LS MI IL OK TX

BOUNDED BY 30N INL-YQT-70WNW SAW-50ESE RHI-20NE DLL-DBQ-MLC-TTT-INK-30ESE
TBE-50W LBL-GLD-BFF-70SW RAP-50NNW ISN-30N INL
MOD TURB BLW 120. CONDS CONTG THRU 09Z.

AREA 3...TURB MN IA MO WI LM LS MI LH IL IN KY AR TN

BOUNDED BY YQT-SSM-YVV-30SE ECK-40SW DXO-FWA-CVG-HNN-40NE MSL-ARG-50W
COU-20E IOW-50ESE RHI-YQT
MOD TURB BLW 150. CONDS CONTG THRU 09Z.



Figure 13 - AIRMET Zulu for moderate icing conditions

WAUS43 KPCI 042045

WA3Z

-CHIZ WA 042045

AIRMET ZULU UPDT 3 FOR ICE AND FRZLVL VALID UNTIL 050300

.
AIRMET ICE...MO IL IN KY AR TN LA MS AL
FROM 50SW DXO TO 40SW TTH TO MEM TO 50WNW MCB TO 50ESE MCB TO BNA
TO 20NNW LOZ TO 60W HNN TO CVG TO FWA TO 50SW DXO
MOD ICE BTN 110 AND FL210. CONDS CONTG BYD 03Z ENDG 03-06Z.

.
AIRMET ICE...MN WI LM LS MI LH IL IN
FROM YQT TO SSM TO YVV TO 30SE ECK TO FWA TO 20SSW ORD TO 30NNE
GRB TO 50N RHI TO YQT
MOD ICE BTN FRZLVL AND FL240. FRZLVL 080-120. CONDS CONTG BYD 03Z
THRU 09Z.

.
AIRMET ICE...ND SD NE MN IA WI LS
FROM 70SW YWG TO 30N INL TO YQT TO 40WNW EAU TO 40NNE MCW TO FOD
TO 50W OVR TO LBF TO 40WSW PIR TO 70SW YWG
MOD ICE BTN FRZLVL AND FL180. FRZLVL SFC-050. CONDS CONTG BYD 03Z
THRU 09Z.

.
OTLK VALID 0300-0900Z
AREA 1...ICE ND SD MN WI LM LS MI
BOUNDED BY 60SE YWG-30N INL-YQT-70NE SAW-GRB-20SSW ODI-30NNE
MCW-FSD-FAR-60SE YWG
MOD ICE BLW FL180. CONDS CONTG THRU 09Z.

.
AREA 2...ICE KS OK TX
BOUNDED BY 40ESE LAA-60W ICT-30ESE MMB-AMA-20ESE TCC-30ESE
TBE-50W LBL-40ESE LAA
MOD ICE BTN 090 AND FL180. CONDS DVLPG 06-09Z. CONDS CONTG THRU 09Z.

.
AREA 3...ICE MO WI LM LS MI LH IL IN KY OK TX AR TN LA MS AL
BOUNDED BY SSM-YVV-30SE ECK-FWA-CVG-40W HNN-MEI-60E TTT-70S
MLC-40E FSM-AXC-20S ORD-50NW MKG-SSM
MOD ICE BTN FRZLVL AND FL240. FRZLVL 100-120. CONDS CONTG THRU 09Z.

.
FRZLVL...RANGING FROM SFC-115 ACRS AREA
MULT FRZLVL 020-100 BOUNDED BY 30N INL-80E INL-70SE INL-40N
DLL-30SW BDF-40SE END-40WNW END-40ESE SLN-70SSE OBH-50WSW
OVR-50SSE FAR-30NNW BJI-30N INL
SFC ALG 40SE LAA-70SSE OBH-OVR-FOD-50N DLH-70WNW YQT
040 ALG 50SE LAA-30W ICT-20W IRK-30WSW DBQ-20E DLH-70W YQT-
50WNW YQT
080 ALG OSW-BDF-30W BAE-20S RHI-60N RHI-50SE YQT-70N SAW

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9.0 Winds and Temperature Aloft Forecast

The following Winds and Temperature Aloft Forecast were current at the time of the accident, the forecast was based on data at 1200 CST and was valid for 1800 CST, and for use between 1400 through 2100 CST.

WINDS ALOFT FORECASTS
DATA BASED ON 041800Z
VALID 050000Z FOR USE 2000-0300Z. TEMPS NEG ABV 24000

<i>FT</i>	3000	6000	9000	12000	18000	24000	30000	34000	39000
<i>MLB</i>	0816	1315+11	1507+06	9900+03	2611-12	2817-24	312241	333249	313455
<i>PIE</i>	0710	1212+11	9900+08	3107+02	2615-11	3017-23	324038	324548	324557
<i>JAX</i>	1213	1909+10	1907+06	2108+02	2318-13	2818-24	333139	323450	324258
<i>TLH</i>	1411	1811+09	2212+07	2314+01	2421-12	2821-22	313838	314449	324360
<i>SAV</i>	1415	1814+07	2411+06	2311+01	2420-14	2721-25	313139	313450	314459
<i>CSG</i>	1617	2017+10	2215+06	2216+00	2423-13	2726-22	304138	304249	314861
<i>ATL</i>	1518	2020+10	2219+06	2418+00	2427-13	2629-23	294239	294349	315461
<i>TYS</i>	1821	2222+11	2326+05	2429-01	2434-14	2634-24	284840	285550	296062
<i>HSV</i>	1731	2227+11	2330+06	2428-01	2430-12	2634-22	285438	285349	296461
<i>BNA</i>	1840	2334+11	2339+04	2335-02	2438-14	2540-23	276239	276450	287962
<i>LOU</i>	1945	2241+10	2245+04	2341-03	2443-15	2549-24	266341	266551	288262
<i>EVV</i>	2044	2450+09	2452+04	2450-02	2340-14	2454-25	267641	268051	279762
<i>IND</i>	2052	2357+09	2353+03	2452-03	2352-15	2462-26	257342	257952	269363
<i>SPI</i>	2151	2452+09	2452+05	2353-03	2366-16	2369-28	259643	750652	751160
<i>JOT</i>	2057	2457+08	2355+03	2355-03	2466-17	2370-29	248644	740053	259860
<i>DBQ</i>	2152	2353+07	2355+02	2355-04	2367-18	2376-31	248746	249753	248657

The forecast winds for Joliet, IL (KJOT) for 3,000 ft was from 200° at 57 knots, and at 6,000 ft from 240° at 57 knots with a temperature of 8° C. Similar strong winds were also expected at Dubuque, IA (DBQ) at 3,000 ft from 210° at 52 knots, and at 6,000 ft from 230° at 53 knots with a temperature of 7° C.

10.0 Astronomical Conditions

The United States Naval Observatory website provided the following astronomical conditions for Rockford, Winnebago County, IL on December 4, 2017.

Beginning civil twilight	0637 CST
Sunrise	0709 CST
Sun transit	1147 CST
Sunset	1624 CST
End civil twilight	1645 CST
Accident	1802 CST
 Moonset	 0758 CST
Moonrise	1754 CST

A full Moon occurred at 0947 CST on December 3, 2017, and at the time of the accident was a waning gibbous with 97% of the Moon's disk illuminated and was about 1° above the horizon at an azimuth of 64°.

Submitted by:

Don Eick
NTSB Senior Meteorologist