



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 1, 2020

Specialist's Factual Report

METEOROLOGY

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A. ACCIDENT

Location: Beverly, Massachusetts
Date: March 12, 2020
Time: about 1622 eastern daylight time
2022 coordinated universal time (UTC)
Airplane: Piper PA28-181; Registration: N656ST

B. METEOROLOGIST

Don Eick
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C. SUMMARY

On March 12, 2020, about 1622 eastern daylight time, a Piper PA28-181, N656ST, was substantially damaged when it was involved in an accident near Beverly Regional Airport (KBVY), Beverly, Massachusetts. The student pilot sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

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. All times are eastern daylight time (EDT) based upon the 24 hour clock, local time is +4 hours to UTC, and UTC=Z. 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.

This report provides information on conditions conducive to carburetor icing at the accident site, which was based on the coordinates of latitude 42.5841° N and longitude 70.9161° W, and an elevation of 107 ft.

E. WEATHER INFORMATION

1.0 Observations

Beverly Regional Airport (KBVY), Beverly, Massachusetts, had an Automated surface Observation System (ASOS) and was augmented by air traffic control personnel during normal operating hours. The airport listed an elevation of 107 ft and a magnetic variation of 14.5° W

based on the sectional chart for the area. The following conditions were reported at the approximate time of the accident.

Weather observation for KBVY at 1553 EDT, wind from 100° at 6 knots, visibility 10 miles or more, ceiling overcast at 6,000 ft agl, temperature 7° Celsius (C), dew point temperature 1° C, altimeter 30.23 inches of mercury. Remarks: automated station with a precipitation discriminator, sea level pressure 1023.5-hectopascals (hPa), temperature 6.7° C, dew point 0.6° C.

Based on the 1553 EDT observation and a temperature of 6.7° C or 44° Fahrenheit (F), and a dew point temperature of 0.6° C or 34° F, the relative humidity was 65%, and the density altitude was calculated at -1,140 ft.

2.0 Model Sounding

To determine the vertical structure of the atmosphere over the region High-Resolution Rapid Refresh (HRRR)¹ numerical model data were retrieved from the NOAA Air Resource Laboratory and plotted on a standard Skew T log P diagram² using the RAOB software³ program. Figure 1 is a plot of the HRRR numerical model sounding for 1600 EDT from the surface to 400-hPa (approximately 24,000 ft) over the airport's coordinates. The HRRR model sounding depicted a near surface temperature of 7° C, and a dew point temperature of 2° C, with a surface wind from 120° at 6 knots. Except for the lowest several hundred feet of the surface, the atmosphere was characterized as stable with a Lifted Index of 15.7. The freezing level was identified at approximately 3,160 ft. The sounding supported carburetor icing from the surface through 6,000 ft and is indicated by the dark green bar on the left side of the diagram.

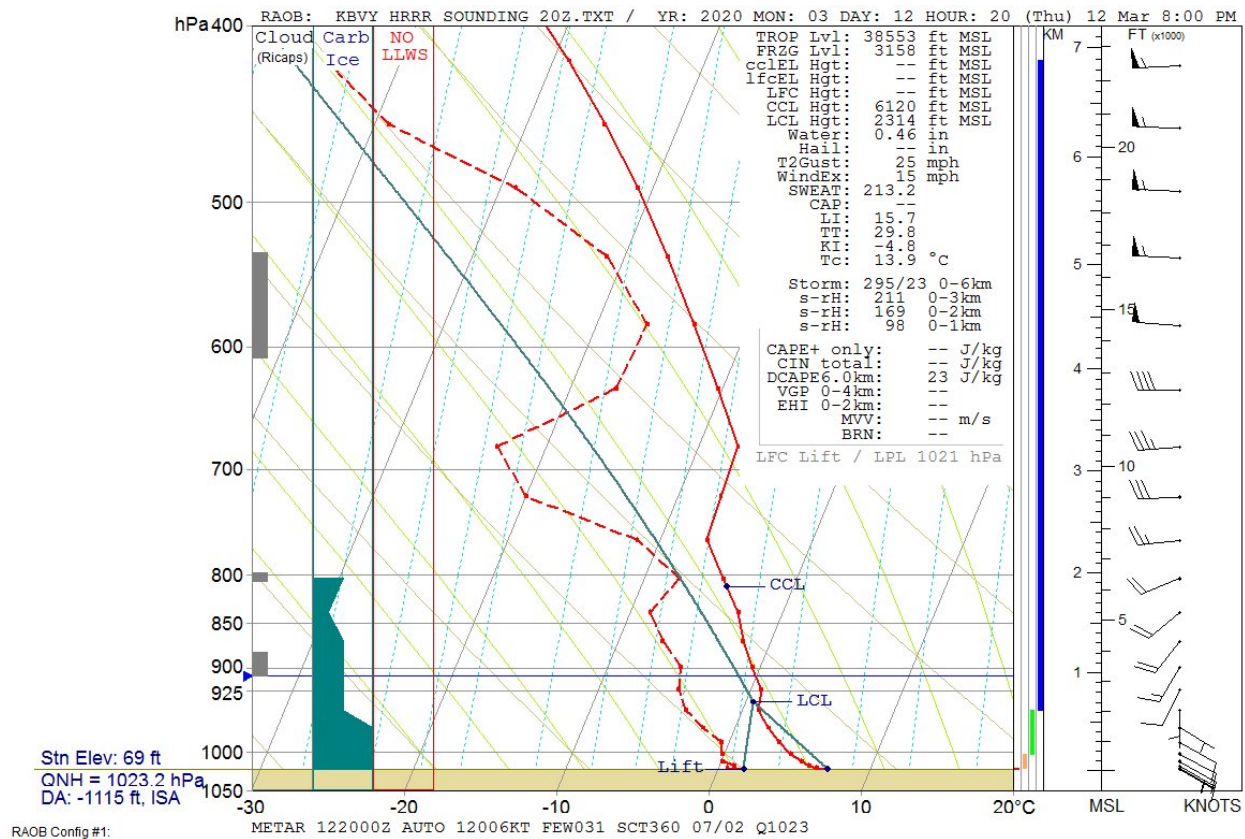
The HRRR wind profile indicated near surface winds from the southeast with the wind veering⁴ to the south and southwest through 2,000 ft, and to the west above 7,000 ft. The mean 0 to 6 kilometer or 18,000 ft wind was from 295° at 23 knots.

¹ 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.

² 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.

³ 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.

⁴ Veering wind is one that changes clockwise or anticyclonically with height and is often indicative of warm air advection and dynamic lifting. Winds often veer ahead of cold fronts or in the warm-air sector of a mid-latitude cyclone.



3.0 Carburetor Icing Probability

FAA Advisory Circular 20-113- "Pilot Precautions and Procedures to be taken in Preventing Aircraft Reciprocating Engine Induction System and Fuel System Icing Problems" explains, "To prevent accidents due to induction system icing, the pilot should regularly use of carburetor heat under conditions known to be conducive to atmospheric icing and be alert at all times for indications of icing in the fuel system." The advisory circular warns pilots that carburetor ice is most likely to occur when temperatures are below 70° F (or 21° C) and when the relative humidity is above 50%.

The FAA Special Airworthiness Information Bulletin (SAIB) CE-09-35 issued in June 2009 warns pilots of the potential hazards associated with carburetor icing. The following graph from that bulletin depicts the probability of carburetor icing for various temperatures and relative humidity conditions from that bulletin.

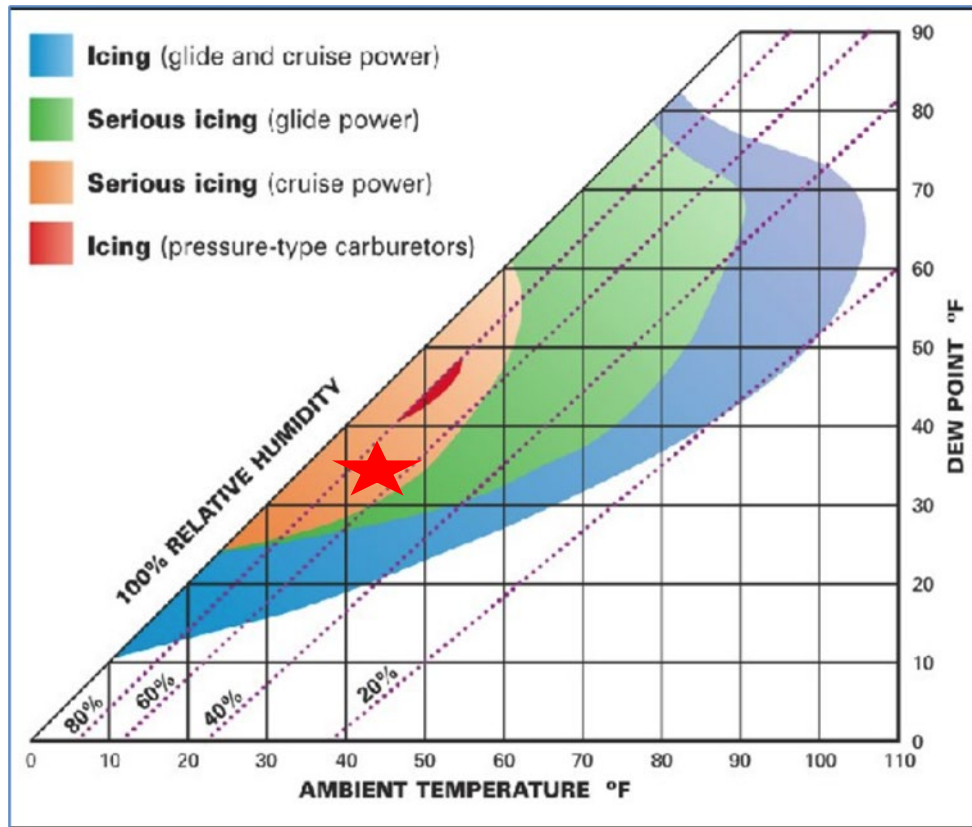


Figure 2 - Probability of carburetor icing at KBVY at the time of the accident are plotted as a red star.

A red star has been added to figure 2 to depict the conditions at KBVY at the time of the accident, which was in the “Serious Icing” category at cruise power.

The FAA SAIB CE-09-35 recommends the following regarding carburetor icing.

There are some steps a pilot can take to prevent, recognize, and respond to carburetor icing.

To prevent carburetor icing, the pilot should:

- *Assure the proper functionality of the carburetor heat during the ground (Before Takeoff) check.*
- *Use carburetor heat on approach and descent when operating at low power settings, or in conditions where carburetor icing is probable.*

To recognize carburetor icing, the warning signs are:

- *A drop in rpm in fixed pitch propeller airplanes.*
- *A drop in manifold pressure in constant speed propeller airplanes.*
- *In both types, usually there will be a roughness in engine operation.*

The pilot should respond to carburetor icing by applying full carburetor heat immediately. The engine may run rough initially for short time while ice melts.

The above recommendations are general suggestions. The pilot should consult the AFM or the pilot's operating handbook for the proper use of carburetor heat.

Submitted by:

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