Winter Icing

After the long, hot summer, many people look forward to cooling off during the fall and winter months. Watching the leaves change, taking a hike, watching football, celebrating the holidays with family and friends…perhaps these are a few of your favorite things. The fall and winter months also bring many aviation weather hazards. Chief among them is icing.

Icing

In the mid-latitudes, icing is most frequent during the winter months. This is because frontal systems are more numerous during this time of year, and frontal systems are the No.1 culprit.

Icing increases the weight of the aircraft. But more importantly, it disrupts the smooth flow of air, increasing drag while decreasing lift. This is a bad combination. Some tests indicate that icing can reduce wing lift by up to 30% and can increase drag by up to 40%.

Aircraft Impacts

The accumulation of ice on aircraft surfaces can affect the control of the aircraft. If ice forms on a propeller's blades, the propeller's efficiency decreases, and additional power is required to maintain flight. Ice accumulation on rotors and propellers can cause dangerous vibrations. Ice can also form in an engine's intake, disrupting the combustion process. Ice may even break off and be sucked into the engine creating ice FOD. Icing can also cause improper operation of control surfaces, brakes or landing gear; reduction of the aircrew's outside vision; and incorrect flight instrument readings. If ice collects on the radio antenna, comms will likely be affected.

There are two main categories of icing, structural and induction. In simplest terms, structural icing requires two conditions temperatures at or below freezing and visible moisture (i.e. clouds). Induction icing can occur with temperatures well above freezing and/or in the absence of clouds.

Structural Icing

Structural icing is described in terms of type and intensity or amount. The three main types of structural icing are clear, rime and mixed. Frost is another form of icing that mainly affects the aircraft during takeoff and landing.

We classify structural icing by amount or intensity. The four icing intensities are trace, light, moderate and severe. Trace icing is when icing first becomes noticeable. It generally does not pose an operational hazard unless it lasts for longer than an hour. Light icing occurs when icing conditions persist for more than an hour. Accumulation continues and can become problematic for the aircraft. Occasional use of deicing equipment helps keep accumulation under control. With moderate icing, the rate of accumulation is greater and even brief encounters can be hazardous. Use of deicing equipment is necessary. When the rate of accumulation is so great that deicing equipment does not reduce or control the icing, you have severe icing. Severe icing is an extremely hazardous situation and if you ever encounter it, you should immediately divert.

The rate of icing accumulation depends on three variables airspeed, droplet size, and aircraft size/shape. As the airspeed of the aircraft increases, so does the rate of ice formation---to a point. At very high airspeeds (575 knots or greater), heat generated

by friction on the skin of the aircraft actually serves to melt the ice. The rate of ice formation increases as the droplet size increases. When an aircraft flies through clouds or precipitation, the smaller droplets move with the deflected air stream and therefore do not collect on the aircraft. Although larger drops are not so easily deflected and can form ice deposits. Finally, the rate of ice accumulation depends on the size, shape and smoothness of the aircraft surfaces. A large, non-streamlined aircraft will see ice accumulations more quickly than a thin, smooth, streamlined aircraft. It should be noted that once ice accumulation begins, the rate of accumulation increases because the ice increases the aircraft's surface area.

Induction Icing

Induction icing, sometimes referred to as engine icing, occurs when ice forms around the air intake and blocks the air filter before air enters the engine resulting in a loss of power. It most commonly occurs in the air induction system but may also occur in the fuel system. Which leads us to carburetor icing.

Carburetor icing is extremely dangerous and can cause complete engine failure. Carburetor ice forms during the fuel vaporization process. With the right combination of moisture and temperature inside the carburetor, ice can form at the discharge nozzle, in the venturi, on the butterfly valve or in the carburetor passages. Carburetor icing is considered one of the most dangerous of all icing threats because it can occur in the absence of clouds and temperatures well above freezing.

Forecasting Icing

Your friendly Air Force Weather forecaster will provide you a run-down of expected icing conditions for your mission on a DD 175-1 block 24. We'll brief you on what type of icing to expect (rime, mixed, clear) and in what amount (trace, light, moderate, severe). We'll tell you the flight levels of the icing as well as the location. Remember, when we brief hazards, we are considering the corridor encompassing +/- 25NM of your route of flight and +/- 5,000 feet of your planned flight level. If your route of flight is not a relatively straight line, let us know so we can paint the best picture possible of en route hazards.

Please note that block 24 is ONLY for structural icing and is ONLY for icing outside of thunderstorms. If you are piloting an aircraft with other icing sensitivities, please alert the forecaster to ensure you receive a proper and thorough weather briefing.

For icing conditions during takeoff and climb, a remark will be entered in block 13. Icing conditions at the terminal during landing will be noted in block 30.

Where is that information in block 24 coming from? We look at many products, including the Operational Weather Squadron's upper and lower level icing charts. We also look at satellite, radar, surface observations, upper-air observations and pilot reports (PIREPs). We especially like to look at a forecast Skew-T diagram, a vertical profile of the atmosphere. That gives us a snapshot of the temperature and dew point from surface to the troposphere for any particular location. A quick look can tell us the height of the clouds, the amount of cloud coverage, and the temperature dew point spread. This is all very helpful in pinpointing areas of icing.

Conclusion

As the fall-winter months approach, we will see an increasing number of frontal systems. It is around these frontal zones that we have to be vigilant for hazards such as icing, turbulence, low-level wind shear and fog. Our focus today was icing. Icing is extremely dangerous to both fixed-wing and rotary-wing pilots and can affect both internal and external components of your aircraft. Knowledge is power and I hope you are empowered today! ■

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