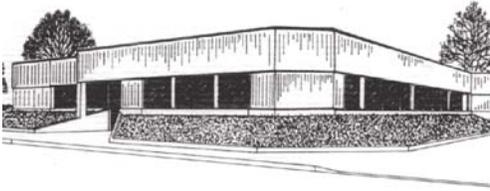


## FROM THE DESK OF



## FORT DODGE AFSS

Courtesy of Steve Hyde

## STRUCTURAL ICING

*Now that we are well into the winter months*, this would be a good time to review one of the major hazards to aviation: **STRUCTURAL ICING**.

Structural icing is extremely dangerous because it has a cumulative effect on an aircraft. It reduces aircraft efficiency by increasing weight, reducing lift, decreasing thrust and increasing drag, all of which result in control problems. Visibility may be reduced as ice builds up on the windscreen and radio. Navigation systems could be affected as ice covers antennas.

It is important to remember that structural icing can occur either in flight or on the ground. Icing experienced on the ground can cause problems with propeller and landing gear operation. Wind tunnel and flight tests have shown that frost, snow and ice accumulations no thicker or rougher than a piece of coarse sandpaper can reduce lift by 30 percent and increase drag up to 40 percent.

There are two ingredients necessary for structural icing to occur: (1) visible water or cloud droplets, and (2) the temperature must be 0 degrees Celsius or colder. Aerodynamic cooling can lower the temperature of an airfoil to 0 degrees C even though the outside air temperature is a few degrees warmer.

There are three types of ice that can form on your aircraft during flight: rime ice, clear ice and mixed ice. All of these types of ice should be taken seriously and be avoided. Remember, visible moisture must be present for structural ice to form.

✈ **Clear ice** forms when raindrops flow out over the aircraft surface, gradually freezing as a smooth sheet of solid ice. This type of ice forms when encountering large drops of rain or when flying through cumuliform clouds. Clear ice is hard, heavy and tenacious. Clear ice is considered the most serious form of ice because it tends to accumulate quickly and adheres itself strongly to the surfaces of the aircraft, making removal by deicing equipment especially difficult.

✈ **Rime ice** forms when tiny water droplets freeze immediately on impact with the surface of the aircraft. As the droplets freeze, they trap air bubbles in the ice giving the ice a milky appearance. Since the droplets freeze immediately, rime ice tends to build up on the leading edges of the airfoils. This changes the shape of the airfoil and destroys lift. Rime ice is the most common type of icing and is generally considered to be the least serious type.

✈ **Mixed ice** forms when drops vary in size or when liquid drops are intermingled with snow or ice particles. Ice particles that are imbedded in clear ice build a very rough accumulation, sometimes in a mushroom shape on leading edges.

✈ **Ground Icing** is icing which occurs while you are on the ground prior to takeoff. Frost, ice pellets, frozen rain, or snow should be removed prior to takeoff. Water blown by propellers or splashed during taxiing can form in wheel wells, brake mechanisms, flap hinges, etc. and prevent proper operation of these parts.

✈ **Frost** is a hazard to flying long recognized in the aviation community. While frost may not look like a threat, it does interfere with the airflow over the wing causing loss of lift. This loss of lift means that the aircraft will stall at a lower-than-normal angle of attack. While your aircraft may be able to reach takeoff speed, it may stall shortly after takeoff. Always remove all frost from the surface of the aircraft prior to departure. A heavy coat of hard frost will cause a 5 to 10 percent increase in stall speed.

In closing, icing is extremely dangerous. It destroys the smooth flow of air. It accumulates on every exposed frontal surface of the airplane, not just on the wing, propeller and windshield, but also on the antennas, vents and cowlings.

As power is added to compensate for additional drag and the nose is lifted to maintain altitude, the angle of attack is increased, allowing the underside of the wing and fuselage to accumulate additional ice. Now you have ice building where no heat or boots can reach it. At the first sign of icing, decide what needs to be done to get out of the icing condition and advise ATC.