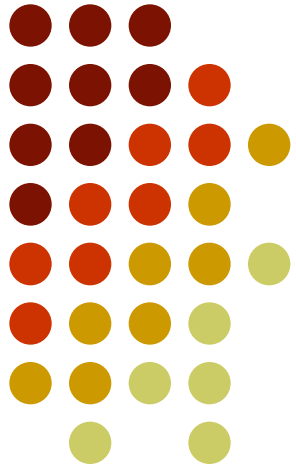
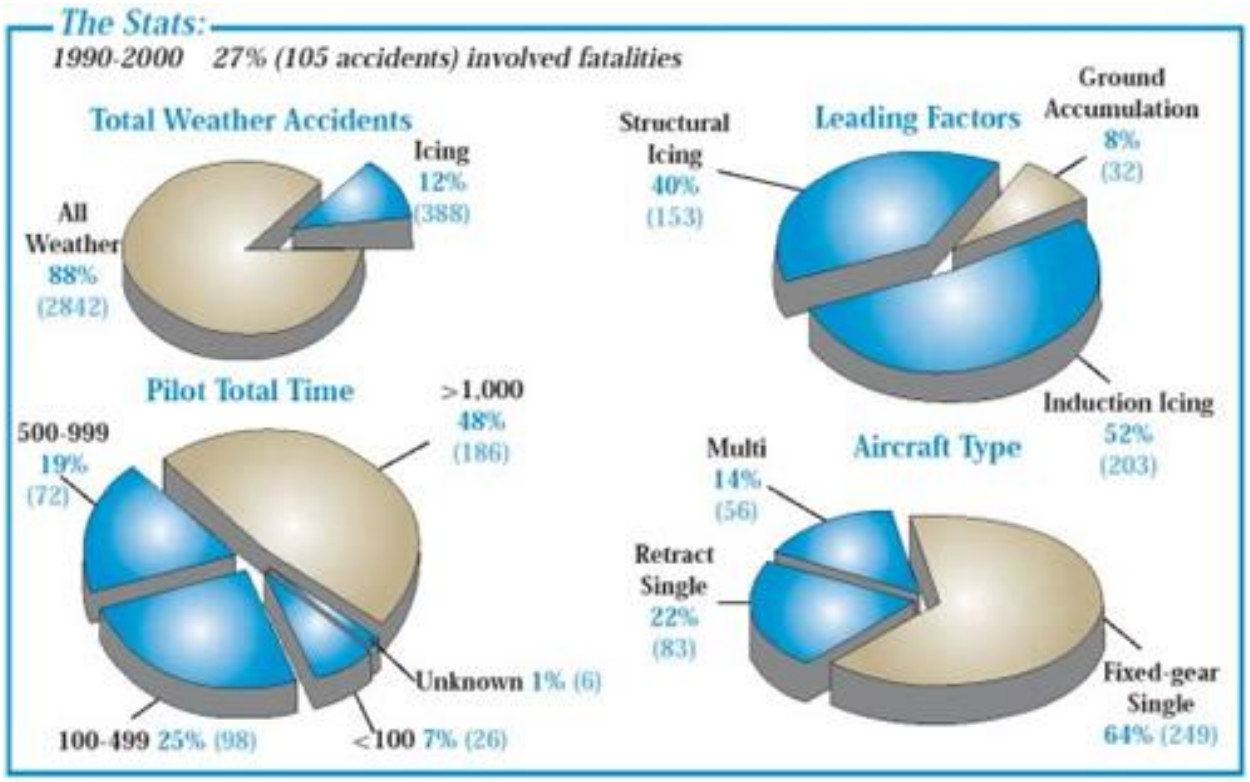
Snow & Ice

Effects on an aerofoil



Why worry about ice?



Types of Snow & Ice

- There are four types of ice formation which can occur on the surface of an aircraft either on the ground or in the air.
  - Hoar Frost
  - Packed Snow
  - Rime Ice
  - Glaze Ice

Hoar Frost

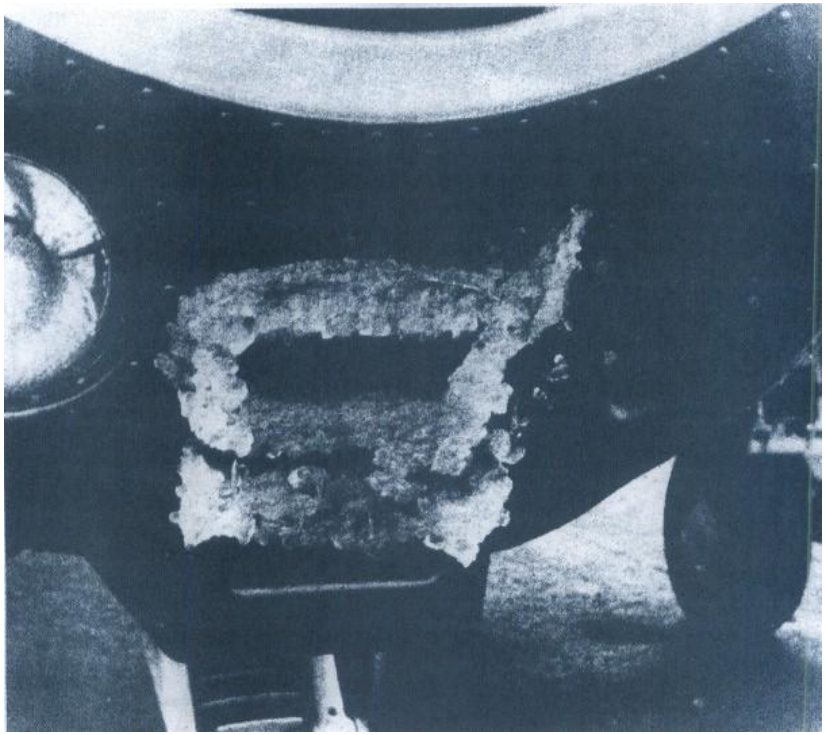
- Occurs principally on the ground
- This builds up into a white crystalline layer due to the pressure of water vapour in the atmosphere under temperature conditions that are below frost point.

Packed Snow

- Occurs on the ground
- This can occur on the upper surface of the aircraft while parked in the open during snowfall. If it is allowed to harden with time, it will be difficult to remove.

Rime Ice

- Occurs both on the ground & in flight
- This is an opaque formation that occurs due to freezing of fine water droplets on a surface whose temperature is below frost point. It is brittle
- Freezing fog brings about this type of formation.
- The irregular shape and rough surface of rime ice make it very effective in decreasing aerodynamic efficiency of airfoils, thus reducing lift and increasing drag.



Glaze (Clear) Ice

- Occurs principally in flight
- This is a firm build-up of solid ice that occurs when flying in a moist or raining situation at sub-zero temperatures. It forms mainly on the wing, tail-plane and fin leading edges, propellers and engine intakes
- It is hard, heavy, and tenacious. Its removal by de-icing equipment is especially difficult

Glaze ice

Effects of Snow & Ice on aerofoils

- Ice destroys the smooth flow of air, increasing drag while decreasing the ability of the airfoil to create lift.
- As power is added to compensate for the additional drag and the nose is lifted to maintain altitude, the angle of attack is increased, allowing the underside of the wings and fuselage to accumulate additional ice.
- Ice accumulates on every exposed frontal surface of the airplane—not just on the wings, propeller, and windshield, but also on the antennas, vents, intakes, and cowlings.
- In moderate to severe conditions, a light aircraft can become so iced up that continued flight is impossible.
- The airplane may stall at much higher speeds and lower angles of attack than normal. It can roll or pitch uncontrollably, and recovery may be impossible.

De-icing

- There are several de-icing systems that can be used to de-ice an aircraft. The most common are:
  - Heat – hot air from the engines is passed through the leading edge of the wing
  - Electrical – wires transfer heat to the wing
  - Vibration – rubber tubes are alternatively inflated and deflated
  - Chemical – glycol antifreeze mixture is sprayed on the aircraft
  - Infrared