OAS-43A
(12/12)

Interagency Aviation Accident Prevention Bulletin

Subject: Engine Ice Awareness

Area of Concern: Flight Operations in an Icing Environment

Distribution: All Aviation Activities

Discussion: In April of this year, two separate uncommanded engine shutdowns occurred on two different fixed-wing aircraft. The first event occurred at about 100' AGL on short final for landing and the second event occurred after landing, while exiting the active runway. Both aircraft were inspected by maintenance personnel after the incidents occurred, but no mechanical issues were found. After the maintenance inspections, the aircraft were test flown without incident. Both aircraft were then deemed airworthy and returned to service by appropriate maintenance personnel.

Unfortunately, the cause of the uncommanded engine shutdowns is unknown. However, a review of the similarities of the two events revealed the following circumstances:

- Both aircraft were conducting ferry flight operations.
- Both aircraft flew at altitudes between 12,000 ft msl and 14,500 feet msl for a large portion of the flight.
- The temperature at these altitudes were below 0°C.
- Both aircraft encountered visible moisture along their route; one aircraft was in and out of the clouds, while the other could see virga and thunderstorms in the vicinity.
- Both aircraft descended from higher colder altitudes to lower warmer altitudes.
- Both aircraft were at a reduced throttle setting for landing.
- Both aircraft did not utilize engine inlet anti-ice.

The specific cause(s) of the two uncommanded engine shutdown events may not be known. However, since the aircraft were flying in environments conducive to icing, it's possible that it was a contributing factor. In these conditions, icing can develop on the engine inlets when the engine inlet anti-ice system is turned off. When an aircraft descends into lower altitudes to land with reduced/low power settings, ice begins to melt from the engine inlets and sheds into the engine ultimately resulting in Foreign Object Damage (FOD) which could result in an uncommanded engine shutdown.

Flying in visual meteorological conditions (VMC) does not guarantee you will not accumulate ice on the airframe or in the engine. While it is rare to accumulate ice without visible moisture, the same result occurs on vehicles overnight even when it is clear and absent any visible moisture. The same result can occur for aircraft.

Here are some reminders about icing and icing conditions:

- Icing can develop with a presence of visible moisture and an Outside Air Temperature (OAT) reading of less than + 5°C or 41° F.
- Each aircraft flight manual or Pilots Operating Handbook (POH) will address icing for its particular aircraft based off of the manufacturer's data.
- Anti-icing systems (different from de-icing systems) are meant to be turned on **prior** to entering icing conditions.
- Pilots should not wait until the appearance of visible ice before activating the anti-icing system.

Flight in icing conditions brings two risks which are independent of each other.

1) the possibility of ice accreting on the airframe which is very noticeable and
2) the possibility of ice affecting the normal operation of the powerplant(s) attached to the airframe (because of ice formation in or around the air inlet path) which is harder to determine.

Understanding engine inlet icing:

- Air that is drawn into the engines creates an area of reduced pressure at the inlet, which lowers the temperature below that of the surrounding air.
- In conditions where icing is possible this reduction in temperature may be sufficient to cause ice to form on the engine inlet, disrupting the airflow into the engine.
- Another hazard occurs when ice breaks off and is ingested into a running engine, which can cause damage to fan blades, engine compressor stall, or cause combustor flameout.

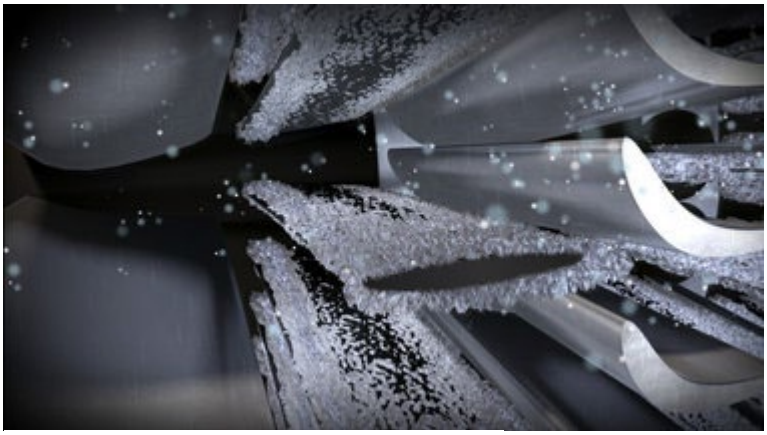

Photo by Erik Mindek/NASA

This computer rendering shows how researchers believe ice builds up on blades in the interior of a jet engine. When ice fragments dislodge, they can cause the engine to lose power or shut down.

These events provide an opportunity to learn and refresh our knowledge regarding icing. As we leave winter behind and move into spring and summer flying, some winter flying techniques might be overlooked in the warmer seasons. Weather absent of any visible moisture can provide a false sense of security as the potential for icing moves to the back of our minds as we don't believe that we will need to consider those hazards until fall. Icing is a year-round issue requiring us to remain vigilant as it can happen…even on a sunny cloudless day.

Summary – Remember:

- Icing conditions can be present at any time of the year.
- Review the aircraft's flight manual/POH for limitations and operating procedures for icing conditions.
- When flying a multiengine aircraft: if the anti-icing system is not turned on prior to developing ice on the aircraft, ensure the engine inlet anti-icing systems are turned on one at a time with a pause in between to ensure any icing debris is successfully removed without incident.

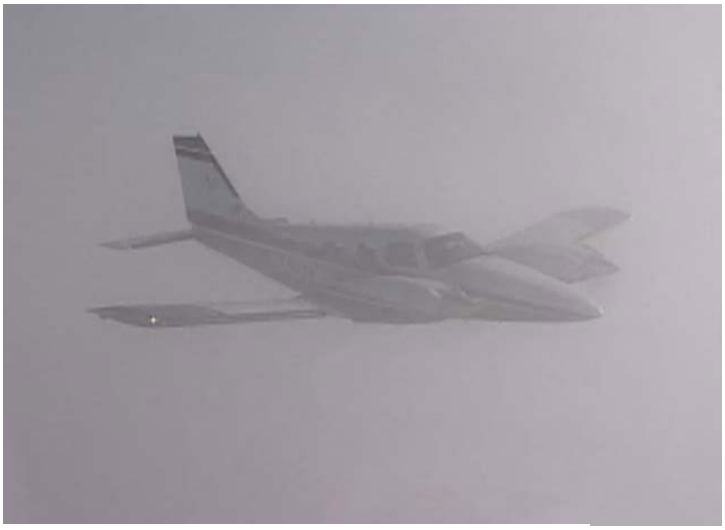

Photo from: NASA Aircraft Icing Training

/s/ Keith C. Raley	***/s/ Lori Clark***
Keith C. Raley Chief, Aviation Safety, Training, Program Evaluation, and Quality Management DOI, Office of Aviation Services	Lori Clark Branch Chief, Aviation Safety Management Systems USDA, Forest Service