CALLBACK

From NASA's Aviation Safety Reporting System

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IN-FLIGHT ICING: SOME COLD, HARD FACTS

According to the FAA[1] and NTSB[2], icing is a cause or contributing factor in aircraft accidents and incidents every year. In-flight icing can degrade aircraft performance and alter controllability. Ultimately, complete loss of control of the aircraft may result. Other hazards associated with icing include:

- Blockage of pitot tubes and static vents causing errors in pressure instruments such as the altimeter, airspeed indicator, and vertical speed indicator if the associated heating system is not activated or operating properly.
- Airframe or engine damage caused by ice shedding off of aircraft surfaces or propellers.

The following ASRS reports offer lessons on each of the above hazards from pilots who experienced in-flight icing incidents— incidents that came uncomfortably close to being accidents.

Carrying an Extra Load

After an unexpected "hard bank" resulted in a hard landing, an ERJ145 crew discovered that icing may have been the cause.

■ *ATC…descended us to 2,000 feet and vectored us for the approach. We were having a little problem picking up the localizer, however we finally got a strong signal before the FAF and decided to fly the approach…. The Captain called, "Visual" and I said, "Landing." I tried to turn off the autopilot and had a hard time getting the autopilot warning off. The Captain called, "Speed." I had gotten slow by about 3-4 knots and we were about 200 feet off the ground. I said, "Correcting" and added power and had no issue from there. We crossed the threshold and I started my crosswind correction and that is when the airplane took a hard bank to the right. The Captain and I did everything we could to get the airplane on the ground. The landing was hard but we decided that the plane was able to taxi in. We asked to hold short of the center runway to collect ourselves, talk to the Flight Attendant, and resume the taxi. "Rudder INOP" displayed on the EICAS during taxi in.*

We got to the gate and deplaned then started making phone calls to report the rudder and hard landing. After that was done, a ramp agent came up and let us know that there was some limited wing damage. We both went outside to see and it was then that we saw a considerable load of ice built up on all leading edges and engine nacelles.

"The Airplane was Still in a Descent with Full Power"

Faced with little IFR experience, poor CRM, and airframe icing, the pilots of a Rockwell 112 were lucky to break out into conditions that would allow the ice to dissipate. Among the lessons this incident highlights are the need for an adverse weather "escape plan," and the value of building actual instrument time with a qualified instructor until proficiency is attained.

■ *Sunset was imminent, this area of the country was new to me, and the more things changed for the worse, the more interest I had in parking the airplane and just spending the night in a hotel.*

Always leave an out. The area over the airport…was in IMC. Ordinarily this would not have been an issue. The AWOS indicated a 1,500 foot ceiling. Things were going smoothly then at 6,000 feet, with no control input to cause a descent rate of over 500 feet per minute, my VFR rated passenger told me that we were descending (I could see that and was trying to process why we were descending). He further stated that I needed to "fly the airplane." Then he took the controls and pulled back on the yoke. The attitude indicator shifted to a very sharp indication of a left turn. The descent rate increased to about 1,500 feet per minute. I could not over power this person. I told him, "The airplane was flying a minute ago, let the airplane continue to fly." He let go of the controls. I reiterated that announcing, "Your airplane/My airplane" prior to manipulating any controls was a requirement when flying with me.

The airplane was still in a descent with full power after he released the controls. It took a while to discover that we had ice on the wings. We broke out into VMC and ATC asked what my intentions were. I explained that I needed to stay VFR to dissipate the ice and would like the approach into [a nearby airport].

I do not have much experience as an IFR pilot; less than 20 hours in actual IMC. I thought my passenger, with over 50 years of aviation experience, would be an asset in the cockpit. In VMC he is a continuing source of information and a person I respect. But, there is a difference between being IFR rated and VFR rated…. Being diverted 59 miles south due to the iced over runways was already putting me outside of my comfort range. I usually fly in [warmer states].

The majority of my flight instructors had minimal or no experience in actual IMC. I will be signing up for a course on "icing" in the near future.

"The Airspeed Was Decreasing Rapidly and I Began to Worry"

ATC helped to get a trio of pilots in a PA32 out of trouble as they dealt with zero IAS, no GPS, and ice on the leading edge of the wings. FAA and NTSB statistics show that accidents often result from similar scenarios, especially when "get-there-itis" is added to the mix.

■ *We decided to depart knowing that most of the flight would be VFR, but the last 100 miles would be in marginal conditions. We planned on stopping prior to encountering the marginal conditions….*

Once at [the interim stop], we refueled and obtained a telephone weather briefing. For the briefing, I had [one of the other pilots] call the briefer. We spoke about the information the briefer gave him. We were told that the freezing level was at the surface and above. Our understanding was that other aircraft were not having problems with icing, but were experiencing moderate turbulence.

At this point my mindset was that icing could happen, but would not be an extreme hazard to us. I spoke with the owner of the airplane, (our passenger) and told him that as soon as we got any accumulation of icing, we would divert to an airport that was along our route. We chose our route with that plan in mind.

The preflight was performed by another pilot. Thirty minutes after departure, the weather became marginal and I avoided IMC while we got an IFR clearance from TRACON. We were cleared to climb to 7,000 feet to see if we could find VFR conditions. During the climb, we started to notice icing. We then climbed to 8,000 feet, but we were still IMC so we asked for 6,000 feet.

At 6,000 feet, I noticed that the airspeed was decreasing rapidly and I began to worry. For a while I thought we were losing the capability to generate lift due to the icing and by instinct I reacted by reducing the pitch of the aircraft to avoid a stall. At this point the other pilot suggested it was the pitot tube getting clogged by the ice which was the cause of the IAS decrease. I then noticed that our altitude was now 5,300 feet MSL….

While all of this was happening, the pilot beside me was attempting to coordinate with ATC to help us get back down to an airport…. The Controller gave us an Initial Approach Fix and told us to fly direct to that fix. As we were loading the information into the GPS system, we realized that the GPS had lost its signal. With IAS at zero, no GPS, and ice on the leading edge of the wing, we thought it would be best to get vectors to the nearest airport…. Flying at a lower altitude in VMC helped us regain the airspeed indicator and land in visual conditions.

The one factor that hurt us the most was "get-there-itis." I had been asked to help out the owner with the flight since I had more experience than he did. The owner was spending a lot of money for each night at a hotel and wanted to get back soon.

I should have been more involved with the preflight and weather briefing and not just taken the other pilot's word since I am the PIC. I also just assumed that the pitot heat was working since I assumed it was the responsibility of the owner to ensure that the plane was up to date on maintenance.

Low Level Ingestion

After experiencing a flameout and "vigorous" relight on one of the engines, a BE100 pilot was able to regain control after breaking out of the clouds. There was no mention of how low the airplane descended, but since a "climb to 3000 feet" ensued, this was undoubtedly a chilling lesson on the dangers of engine inlet icing.

■ *Before the final turn for the ILS approach, with all deicing equipment on, the right engine seemed to stutter. I assumed it was [the right engine] from the direction that the plane was suddenly going. I corrected with left aileron and rudder. I did not see a decrease in torque with either engine when I looked at the gauges. The engine restarted vigorously and pushed the plane hard left and into a fast descent. I was able to control this just as I broke out of the clouds. I climbed to 3000 feet, stabilized the plane, and made the approach without further incident.*

After landing, I observed that the inlet to the right engine was clear of ice. The inlet to the left engine was significantly blocked by ice buildup. I suspect that the right engine flamed out, caused by ice breaking loose and entering the engine. The igniters were armed, which restarted the engine.

A possible cause is that I did not have the engine inlet heat system on soon enough to avoid ice buildup. I was watching the wings during flight and turned on the engine inlet heat system only after I observed ice on the wings. The icing was encountered at 5000 feet enroute. There was no icing in the immediate vicinity of [the destination airport].

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[1] https://www.faasafety.gov/gslac/alc/course_content.aspx?cID=33&sID=148&preview=true

[2] http://www.ntsb.gov/news/speeches/EWeener/Documents/weener_020111.pdf

A NASA course on aircraft icing can be found at: http://aircrafticing.grc.nasa.gov/courses.html

ASRS Alerts Issued in October 2014

Subject of Alert	No. of Alerts
Aircraft or Aircraft Equipment	6
Airport Facility or Procedure	4
ATC Equipment or Procedure	6
TOTAL	**16**

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Air Carrier/Air Taxi Pilots	4,757
General Aviation Pilots	1,271
Controllers	635
Flight Attendants	443
Mechanics	218
Military/Other	165
Dispatchers	107
TOTAL	**7,596**