No Time To Spare:

Catastrophic Oil Loss and Dealing with the Aftermath

MATTHEW McDANIEL recounts a harrowing incident where his taildragger suddenly lost engine oil mid-flight in freezing conditions, and how this close call led him to review and change his cold-weather flying procedures.

The forecast was for IFR conditions, so I'd only gone to the hangar to update the GPS databases and do a few other chores. However, when I arrived, the field was VFR, the 20-knot wind was nearly straight down the primary runway, and the temperature was several degrees higher than forecast. What would you have done? My normal default is to choose flight!

Preflight patience

New plan: A few laps in the pattern and a short hop to my favorite cheap-fuel airport. Top the tanks there, fly the short distance back, and have the plane ready for tomorrow's trip. Normally, with temps below 40 F, I like to have the engine preheater on for about 12 hours preceding engine start. Yet, when necessary, I've started and flown piston aircraft in temperatures as low as 0 F without any form of preheating—more times than I can count. In those less-than-ideal situations, patience is required, allowing the engine and avionics to warm slowly at recommended warm-up RPM. As operating temps rise, first taxi power, then runup power, and eventually, takeoff power, become safe.

With the temps right at freezing (32 F), observing the precautions that I'd practiced over my many winters operating in the Great Lakes and upper Midwest regions was in order. The engine started without difficulty and quickly settled into its warm-up idle. Oil pressure came right up and I ground-leaned the mixture. Parking brake set, I built my nest, programmed avionics, listened to the automated weather observation, and ran the checklist, as the engine slowly warmed. When the oil temperature reached 90 F, I advanced just enough throttle to get the plane rolling, then taxied to the runway at idle.

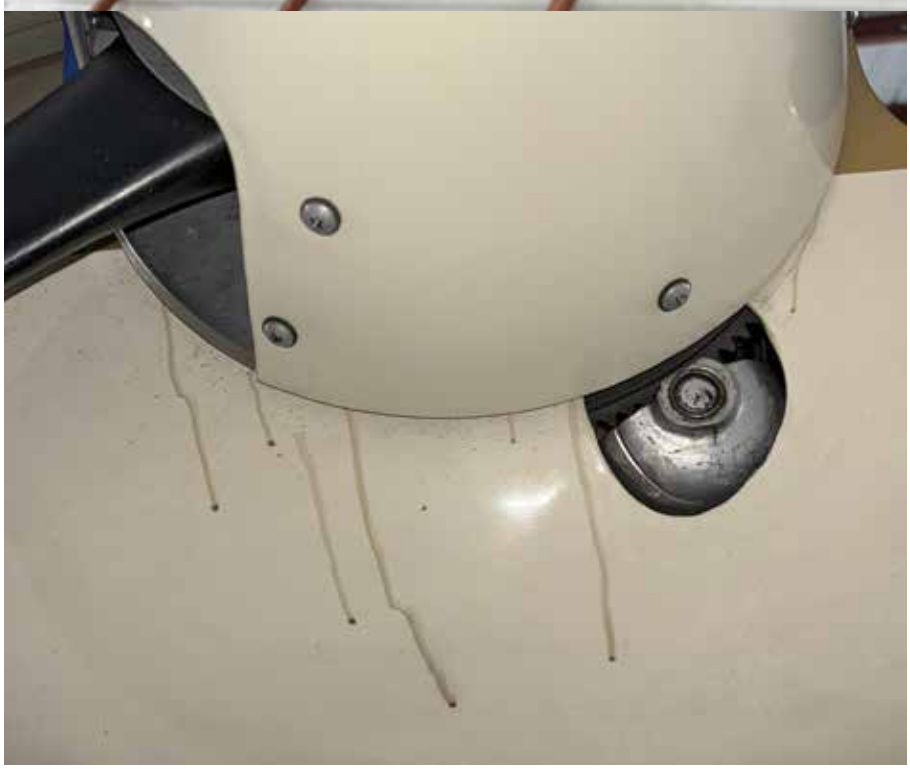
From no cause for alarm...

By the time I reached the hold short line, the oil temperature was in its normal range (which starts at 115 F in my aircraft). I completed my Before Takeoff checklist and runup. Without the benefit of preheating, I checked the mags and carb heat slowly, allowing the engine to re-stabilize at the new RPM between each selection. Thereafter, oil temp was well into the green range, and oil pressure and CHTs were all normal. I re-leaned the mixture for the last bit of taxi that would take me to the runway centerline.

The hold short line of my runway is a fair bit down the taxiway. I made my radio call, taxied the 100 yards or so to the centerline, and stopped to complete/confirm the takeoff final items:

- Carb heat: OFF
- Mixture: RICH
- Elevator trim: TAKEOFF
- Landing lights: ON
- Engine parameters: NORMAL

Advancing the throttle slowly and smoothly, the tail was up before reaching full throttle. With nearly 20 knots of wind on my nose, lightly loaded, with cool temps, I was airborne in less than 500 feet, even though I was making no effort whatsoever toward achieving a short-field or STOL-style takeoff. Climbing at my usual 80 mph ias, I reached up to crank in some nose-down trim at approximately 200 feet agl. Perhaps craning my head upward toward the overhead trim handle briefly heightened my olfactory sense. Regardless, that's when I noticed the smell. At first, I thought it was just the heater putting off a mild odor with the engine now running at full power. Then,



In what must have been mere seconds, I realized it was neither heater odor I smelled, nor freezing breath I saw. It was very faint white smoke and the smell of burning oil.

I thought I saw my breath freezing in front of my face. However, in what must have been mere seconds, I realized it was neither heater odor I smelled, nor freezing breath I saw. It was very faint white smoke and the smell of burning oil.

...to emergency return!

At this point of realization, I looked at the altimeter: I was at 1,000 feet msl; exactly 320 feet agl. My eyes darted right, directly to my aircraft's digital engine analyzer, and zeroed in on the oil values. The oil temperature was typical for that early in a flight (about 140 F), but the pressure was in the caution range, at 45 psi. I decided that 500 feet between myself and Mother Earth would have to be sufficient today.

Reaching 1,200 feet msl (520 feet agl), I pulled the power back as far as I dared to maintain safe flying speed while not delaying my return to terra firma. Passing the intersection of my airport's two runways, I made an immediate left-hand turn. This put me on a perfect downwind (low altitude notwithstanding) for the crosswind runway, and I briefly considered just pulling the power to idle, making a tight pattern, and landing there. However, I quickly dismissed that idea, knowing that would give me a 20-knot direct crosswind (beyond my taildragger's crosswind limits).

So, I kept the left turn coming around and entered a low downwind for my departure runway. Rolling out on that heading, I looked at the oil pressure again... it was down to 40 psi. Keeping the power as low as feasible, I made a quick traffic call and turned my base slightly inside the threshold abeam point. With

6,000-plus feet of runway available, I didn't care that I was wasting some of it. My airplane doesn't need much space anyway, and I'm well-practiced at taking it into runways as short as 1,000 feet (without headwind advantage, of which I had nearly 20 knots today). My goal was to keep the pattern tight, keep the airspeed normal, and land ASAP.

My turning point from that tight base to final approach allowed my eyes to fall upon the area of the taxiway where I'd been sitting during my runup only moments prior. A large dark spot on the asphalt caught my eye. Yet, I had no time to process that fact just then. I was busy processing more critical thoughts and decisions.

The item my eyes darted to and from was oil pressure, which I could see (and comprehend) was now down to 35 psi (deep into the caution range). It was also time to make a decision about flaps. I elected not to use any. I'm equally comfortable landing my plane with full, partial, or no flaps, and I practice all these configurations regularly. Flaps would only delay my arrival, and time was the currency I was rapidly exhausting. I retarded the throttle to idle.

Rolling out on final, I was approximately 200 feet agl and probably 1,000 feet down the runway. A quick glance to the right; oil pressure, 30 psi. No more time for processing information. The time was upon me to focus on landing. As I rounded out the descent, a red light to the left of my flight instruments illuminated. It's a remote warning light. It lights up, in the pilot's field of view, when any parameter on the engine analyzer falls into a warning (red) zone. I didn't look right to see what had triggered it, because I knew.

There was maybe 10 degrees of crosswind component, so I touched down on the left main wheel first and bounced slightly (I had kept energy in reserve, and at that point I still had plenty). The second contact was on both mains equally, and I pushed the yoke forward to pin the mains to the runway. As speed slowed, I lowered the tail to the runway and let the plane roll. Passing the intersection of the runways, I made the turn onto the parallel taxiway of the crossing runway (at a taxi speed for which I would have admonished any student). From there, I added a tiny amount of throttle, just enough to keep me rolling to exit the taxiway onto an apron.

At the edge of the apron, I looked at the oil pressure one last time; the numbers were red now and reading 23 psi. I pulled the mixture to idle cutoff. Total flight time was approximately two and a half minutes, liftoff to touchdown.

Initial assessment

Without conscious thought, I shut off the electrical system and mags, set the parking brake, rotated the fuel selector to OFF, and just sat still for a moment. I exchanged my headset for a stocking cap, donned my gloves, and climbed out, wondering what I would see. My plane is far from new (67 years old), but it is clean and well-maintained. Thus, at that point, all manner of thoughts were going through my mind, but chief among them was the hope that I'd not just destroyed my engine.

The puddle of oil was already substantial and growing, fed by a steady stream from the lower cowl. The right side and nosebowl were clean. But the left side had oil seeping through the joint where the upper cowl overlaps the lower. The left gear leg was coated with oil and the belly was a slimy mess. My first thought was that I must have blown an oil line. Then, I considered a possible problem with cylinder No. 1 (adjacent to the oil oozing from the cowl side). So, I opened the left side of my clamshell cowl, finding oil splattered everywhere. Yet, try as I might, I could not find a disconnected or compromised oil hose. Nor could I see cracks or anything obvious on or near cylinder No. 1.

A plugged breather line was my next thought, but no. Not only do I have the suggested whistle hole in my breather line (adjacent to a warm exhaust pipe), but the end of the line was also clear of obstruction. I verified the oil cap was on tight. Deciding there was little more I could do then/there, I walked to the FBO. The line guys were blissfully unaware of my emergency return or my stricken airplane sitting on their apron's edge. Nonetheless, they willingly helped me retrieve the tow bar and push the airplane to my hangar. It dripped an inconsistent trail of oil along the way.

Inside, I immediately got to work cleaning up the mess. For the next few hours, I busied myself with that task while thinking through what had happened. I was careful, however, to not remove any evidence that I thought might help diagnose the root cause. So, I left the inside of the cowl alone, and the exterior nosebowl, where some little streaks of oil were now appearing below the spinner. Before leaving, I pulled the dipstick. Though I'd started with 6 quarts of oil, the dipstick now only had evidence of oil on its lowest tip, well below where any quantity readings begin. However, it wasn't bone dry; I took that as a good sign.

Diagnosis and repair plan

Before we even met at the hangar, my mechanic said he had a pretty good idea what the problem was. First, he diligently checked the oil hoses/fittings and looked for leakage in other areas. But, the oil streaking under the spinner (that I'd decided not to clean) was the big clue. He'd suspected the crankcase nose seal had failed, which would account for the oil oozing from behind the spinner and the copious amounts of oil inside the nosebowl and on the adjacent exhaust pipes. After a bit of a struggle to get visual access, he was able to confirm the seal was, indeed, the culprit. But, all that could be seen was that it was out of its seat, protruding outside the crankcase.

Knowing that, the root cause was still mysterious. Had the seal ruptured, split, or simply been pushed outward? Had the crankcase over-pressurized, forcing an intact seal from its seat? The former option seemed the most likely, given the engine's advanced age and the fact the breather line wasn't blocked.

At that point, all manner of thoughts were going through my mind, but chief among them was the hope that I'd not just destroyed my engine.

A new seal was ordered, and I thanked my lucky stars again for being over the airport when this had happened. I removed the upper and lower cowls and spinner, but I left the removal of the prop and nosebowl to the professionals. Instead, I just cleaned more oil from the interior of the removed cowl sections. On the way out the door, I covered the engine with a thermal blanket and plugged in the engine's oil pan heater. At least the metal wouldn't be quite so frigid when the mechanics returned to my unheated hangar, with temps forecast to fall into the single digits (F) in the coming days.

A perfect storm?

When the mechanics returned, they barely applied any pressure to the crankcase seal with their hands, and it slipped aft and popped back into its seat on its own. Thus, it didn't appear to have any significant rupture. It was cut and removed anyway and the new one was installed, as it was obviously not sealing in place properly anymore. Once that was done (via the engine manufacturer's guidelines), the new seal and the RTV applied around it were allowed to cure for several days (with the engine heater still on to keep the metal well above ambient temperature).

With one mystery solved, another remained. Why did the seal pop out? Obviously, pressure pushed it out, but what allowed the crankcase to over-pressurize? The engine is equipped with an air-oil separator (AOS). If a restriction (ice or debris) formed in the breather line between the crankcase and the AOS, it is possible it could have created an overpressure situation that couldn't be relieved fast enough.

Whistle slot on the oil breather tube, near an exhaust pipe to keep it warm and free of ice.

Upon removal of the upper breather line, no blockage was found within it. However, if that blockage had been ice, the evidence would have melted away long before. So, the AOS was removed and disassembled. While air would pass through it and no debris was visible when peering inside, it was decided to soak it in fuel to clean it thoroughly. In short order, the fuel discolored and significant debris appeared. The AOS might not have been fully clogged, but it also was not "breathing" at its designed capacity.

The conclusion

In the end, the cause was likely a perfect storm of events, none of which would likely have led to the event singularly. However, the cumulative effects of two or more events perfectly aligning could very well have been sufficient to cause the over-pressure of the crankcase, thus blowing out the nose seal. Here are the events that may have contributed:

• A morning at freezing temps, after a night several degrees below freezing, allowing possible condensation in the upper breather line to freeze and create a partial or full blockage of the line (upstream of the AOS).

• No engine preheating was used, which would have likely melted that ice (if it ever existed), given sufficient time.

• A partially clogged AOS likely allowed air to pass through at something less than full capacity, even without an icing component. Combined with icing, significant blockage may have resulted.

• A crankcase seal that could very well have been original to this engine (manufactured in the 1970s) and compromised by age alone. While the seal had not ruptured, it could very well have aged to the point of being less capable of resisting slight over-pressures without becoming unseated.

Hindsight

After reviewing the events, it was evident that the seal became unseated during the runup. I saw the oil slick when I overflew the taxiway during my emergency return. Driving to get a closer look at it later, that truth was undeniable. Unfortunately, I didn't have an opportunity to see the oil slick before takeoff,

as it was under and behind the fuselage. I pivoted the aircraft around directly above the slick and taxied away from it to access the runway. From the takeoff position on the runway, that area of the taxiway isn't visible (as they are neither level with, nor parallel to, one another). Had I seen the oil, I would never have taken off to begin with (even with the normal oil pressure still indicated).

Even though it wasn't a deep freeze kind of morning, the temp was freezing. A good preheat may have prevented this event. However, preheating would not have allowed the discovery of the partially clogged AOS, nor the likely age-compromised crankcase seal.

As they say, all's well that ends well.

After the new seal had cured, the engine was leak-checked via extensive ground runs, up to and including full static RPM. Thereafter, it was flight-tested above the airport in various attitudes, speeds, and power settings, and all was normal. The aircraft is now back to fully operational status, has flown in temps ranging from 45 F down to 0 F, and no lasting ill effects have been noted.

Nonetheless, in such events, if lessons are not learned and future procedures amended as a result, then not enough thought has been given to the causes and outcome. Live and learn.

MATTHEW MCDANIEL is a Master & Gold Seal CFII, ATP, MEI, AGI, IGI, and Platinum CSIP. In 36 years of flying, he has logged nearly 23,000 hours total and 6,000 hours of instruction given. As owner of Progressive Aviation Services LLC (progaviation.com), he has specialized in Technically Advanced Aircraft and Glass Cockpit instruction since 2001, yet retains a passion for teaching in and learning about antique taildraggers. He's also a Boeing 737-series captain for an international airline, holds eight turbine aircraft type ratings, and has flown nearly 150 aircraft types. Matt is one of less than 15 instructors worldwide to have earned the Master CFI designation for 11 consecutive two-year terms. He owns an antique taildragger which he enjoys flying with his wife, two children, and friends. Send questions or comments to editor@cessnaflyer.org.