PILOT WORKSHOPS

These pages excerpted from:

Emergency Strategies

A simplified approach to handling emergencies in an airplane.

A Pilot-Friendly® Manual

EVACUATE

Restarting After an Unexpected Engine Stop

A less common startup fire scenario happens often enough to show up several times in the NTSB database. That's fire on a *restart*. A typical scenario would be a pilot practicing touch-and-goes and the engine quits on the rollout. The pilot restarts the engine—only to have it burst into flame. Hopefully, before takeoff.

A warm, running engine stops running for a reason. That reason might be innocuous. A carburetor with a weak accelerator pump may cause the engine to quit when the throttle is advanced too rapidly on the ground. (In the air, the windmilling prop masks the issue.) Maybe fuel vapor in the injection system was an issue at low RPM. However, that last landing turned the tiny crack in the fuel line into a bigger one and fuel pressure dropped and the engine quit. When the pilot cranks the engine to restart and the line repressurizes—fuel sprays everywhere.

If an engine quits for no obvious reason on the ground and you're in a location where it's safe to get out of the airplane and inspect before restarting, do that. If you must restart so you can taxi to safety, do so while remaining vigilant—stay aware of your surroundings, and keep your senses tuned for a possible fire. Shut down when you can step out to inspect.

Engines quitting in flight is a whole 'nuther problem and it's possible there's a fire risk. Your priority is getting on the ground safely whether you're at low altitude (page 16) or at high altitude (page 27). Regardless of altitude, the benefit of restarting while airborne almost always outweighs the relative risk of fire.

SCENARIO 2
Fire Erupting in Cruise Flight

***Halfway into your flight** from Fort Collins, CO (KFNL) to Gillette, WY (KGCC) there's a **vibration and bang** followed by flames and smoke bursting from the cowling of your Bonanza.*

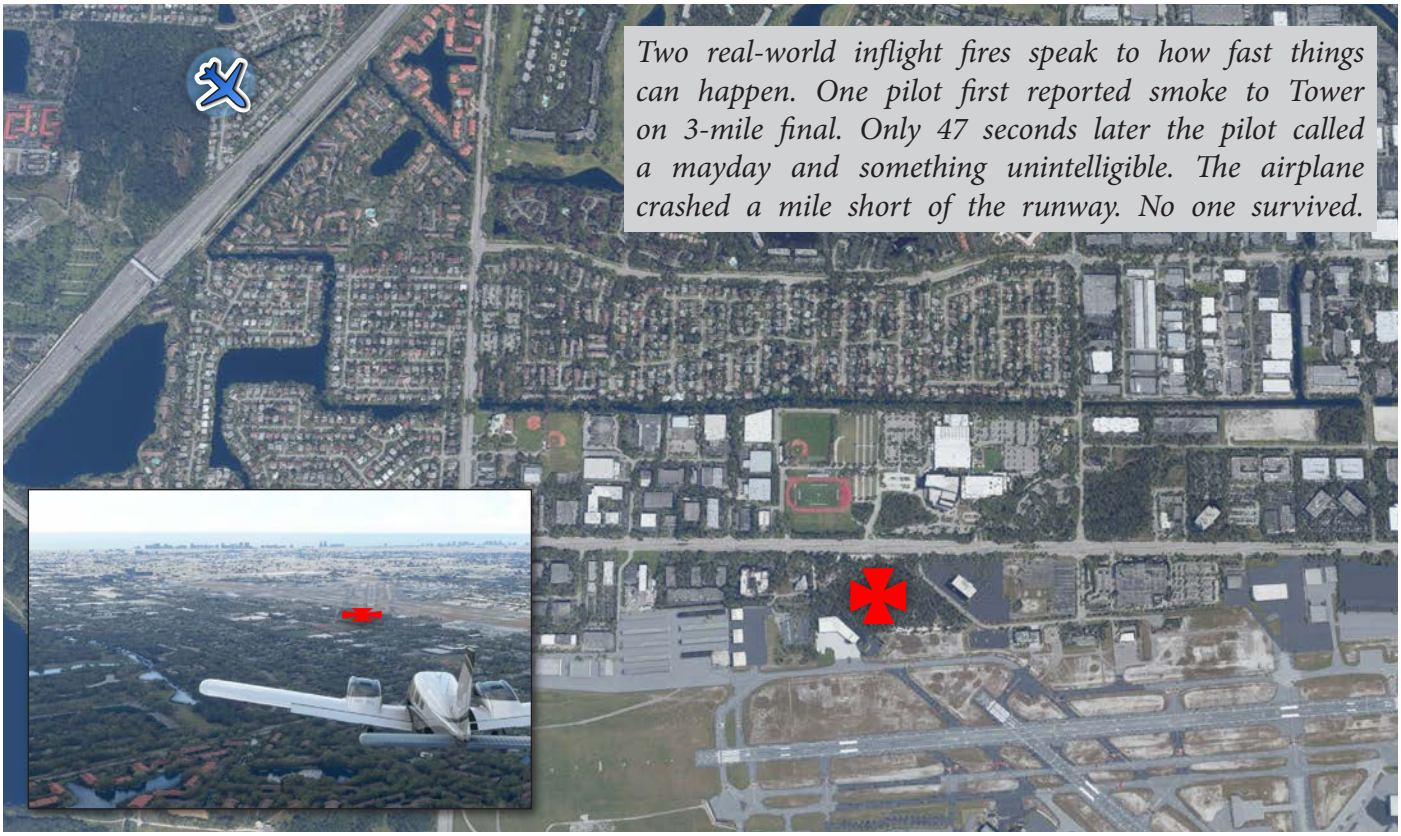
A Find Your Nearest Exit

Most "Inflight Fire" checklists start with actions to put out the fire. You'll get to that, but first take action to get out of the sky and heading for the ground.

You're in visual conditions and basically over Converse County (KDGW), so pull the power to idle, drop the gear for drag, and start a spiraling emergency descent. (See "Using Load Factor to Pump Up Your Go-Down" on page 50.) Even if there wasn't an airport below, this would be your first move over any terrain with a likely survivable off-field landing. If you had been over unlandable terrain just a few miles south of KDGW, a straight-ahead high-speed dive would have been the right choice toward better landing options.

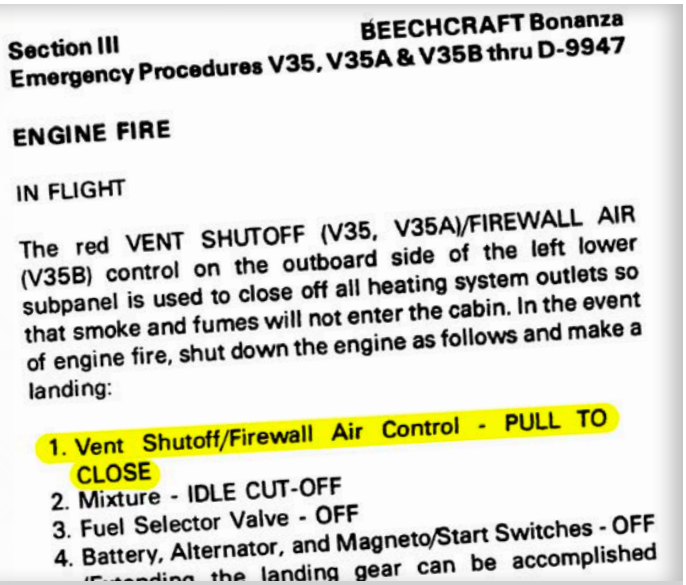
The POH recommends a speed of 154 knots—which is VLE, the maximum speed with gear extended. Don't focus on that number. Getting down as fast as possible while still in control is your goal rather than maintaining any specific airspeed.

Both a turning descent and a straight one can be at speeds that may snuff out a fire under the cowling. The speed required to snuff a fire has too many variables to know if a given speed is fast enough in a specific situation. Airspeed won't quench a fire in the cabin, but you should descend anyway. Assume you won't be able to extinguish any fire. You can be pleasantly surprised if it goes out and then can recover from the descent as needed. If you had been in instrument conditions, or flying in the dark without a moon, you would have been between a rock and a hard place. (See "Cabin Fire in IMC" on page 52.)



Two real-world inflight fires speak to how fast things can happen. One pilot first reported smoke to Tower on 3-mile final. Only 47 seconds later the pilot called a mayday and something unintelligible. The airplane crashed a mile short of the runway. No one survived.

The other pilot experienced a fire on downwind and chose to immediately land off-airport rather than try to complete an abbreviated pattern. That pilot and passenger were uninjured.



Section III
BEECHCRAFT Bonanza
Emergency Procedures V35, V35A & V35B thru D-9947

ENGINE FIRE

IN FLIGHT

The red VENT SHUTOFF (V35, V35A)/FIREWALL AIR (V35B) control on the outboard side of the left lower subpanel is used to close off all heating system outlets so that smoke and fumes will not enter the cabin. In the event of engine fire, shut down the engine as follows and make a landing:

1. Vent Shutoff/Firewall Air Control - PULL TO CLOSE
2. Mixture - IDLE CUT-OFF
3. Fuel Selector Valve - OFF
4. Battery, Alternator, and Magneto/Start Switches - OFF

The V35 has a dedicated cutoff knob to prevent flames from following the heating system into the cabin. You must know the specific procedures and any special fire equipment by heart. The more complex the airplane (pressurization from turbochargers anyone?) the more specific procedures you'll need committed to memory.

B Snuff the Source

Your descent should punch down the flames to some degree. Unfortunately, the success rate for putting out the flames with airspeed is mixed at best.

As you descend, you instinctively do what the checklist says—including the first step that is specific to the V35. That's to pull the Vent Shutoff. This cuts all air heating connections that could be conduits for flames to enter the cabin. Items like this are why it's essential to know any specific procedures for *your* airplane from memory. The rest of the checklist items are what you'd expect: "mixture cutoff; fuel off; battery; alternator switches off." "Magnetos off" is not a bad idea as they're generating sparks up there.

The V35 has no separate checklist for an electrical or cabin fire versus engine fire. In practice, it can be hard to tell the difference. Several pilots who survived fires thought they had an electrical fire because the heat and melting smell was coming from under the panel. But it turned out that it was from much more heat on the *other* side of the firewall right by their knees.

If the cabin had started filling with smoke you thought was electrical, you could have still idled the engine and turned off the master switches as you spiraled down. But in the face of any uncertainty, it's better to shut down every potential source of fire. Restarting the engine at the bottom of descent is an option if it's still functional.

These flames are coming from the cowling. Flames in the cabin are even more terrifying, but you have a shot at putting them out with an extinguisher. If you can't see flames but can see reflected light, that

TIP Don't stow electronics with lithium batteries in a compartment you can't reach. They burn incredibly hot if they fail and can set almost any combustible item on fire.

The best way to deal with fire is not having one in the first place. Chafed wires or fuel lines should be replaced immediately if discovered. Blue staining, as seen on this carburetor, indicates a fuel leak of 100LL and should be investigated. A dirty engine bay might not seem like a hazard, but excessive oil can accelerate deterioration of wiring and is a combustible material that's hard to extinguish.

Many engine fire causes can't be determined because too much damage occurs, but it appears the leading cause is oil starvation (including exhaustion). This leads to excessive temperatures and mechanical failure, which sets things ablaze. Exhaust systems are second. That's separate from turbocharger failures, which are third.

can help locate the source. Better yet is to get your front-seat passenger handling the extinguisher while you focus on the emergency descent and landing. Tell that person to get the extinguisher as close to the fire location as they can and sweep or make little circles as they discharge. There are probably only two good shots before a small extinguisher empties.

If you discharge a fire extinguisher, you'll get a whole new take on "flying IMC." And if it's a halon extinguisher, the gas can settle in the lungs. You should clear the air immediately afterward.

TIP One thing you may notice in this discussion is little mention of referencing a checklist. Fire procedures need to be memorized and practiced to keep that memory sharp. The only time you'll have the luxury of consulting a checklist is after the fire is out.

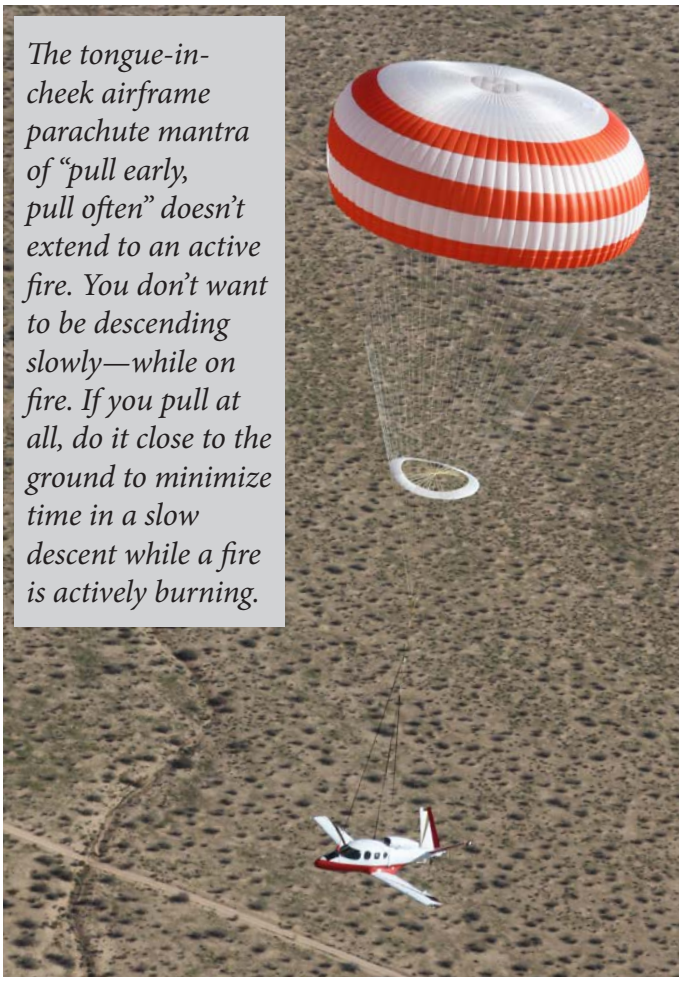
Decompression is an additional tool in a pressurized cabin for clearing the air.

TIP Black smoke is likely engine oil, hydraulic fluid, or plastics. Orange flame with white or gray smoke is probably fed by fuel. Fuel fires are generally easier to blow out with airspeed and (obviously) more likely to go out once fuel is cut off with the selector or shutoff.

C Clear the Air

Fresh air with a cabin fire is both a curse and a blessing: it can fan the flames but it can also clear the smoke and fumes. Your POH is the authority and some airplanes have specific procedures. This V35 has a Vent Shutoff to prevent smoke and flames from entering the cabin from an engine fire. However, turning off all cabin heat and vents until you get the flames under control—unless you must get fresh air to breathe—is generally good advice in any airplane..

Because you're pretty sure there's no fire in the cabin but the air is smoky, you decide to unlatch the door. The open door is terrifically effective in venting the cabin and the airflow will keep it from opening too far. However, it adds a lot of noise and some wind



The tongue-in-cheek airframe parachute mantra of "pull early, pull often" doesn't extend to an active fire. You don't want to be descending slowly—while on fire. If you pull at all, do it close to the ground to minimize time in a slow descent while a fire is actively burning.

into an already chaotic environment. There is arguably some advantage in having that door unlatched prior to landing for a speedy exit.

This would be a good time to squawk 7700 and make a mayday call—which could be hard with the master off. The mayday gets people's attention and starts help heading your way. Leaving it on makes flaps and gear control available for the last step. You might do that even with an electrical issue, although you'd do it at the last practical moment.

With smoke and flames right outside the windscreen, a left-turning descent is a good choice for helping you see. A slight slip with right rudder would help you see even more (and increase your descent rate).

When you roll wings level before landing, keeping this left forward slip will direct smoke over the right side of the windscreen and help keep you descending quickly but without building airspeed for the last several hundred feet to the ground.

D Evacuate

You made it down to high key 1000-1500 feet above KDGW. If you had managed to extinguish the fire, this could be a more sedate power-off 180 to land. But there's still smoke so you reestablish some left bank and make a slipping 180° turn. You're cross-controlled, but you keep a low enough angle of attack to stay stall-safe until touchdown.

You put this Bonanza on a runway today, but if you were landing off-airport (or even if you were concerned about running off the end of the runway) you might consider putting the gear back up before landing. The last thing you want is to flip over on landing and have trouble exiting an airplane on fire.

The door was unlatched before landing. Remind the passengers to exit as soon as the airplane has stopped moving. Also tell them to head for the tail of the airplane after exiting if they can. This does two things: It sends them away from fire and it generally gets everyone in the same area when you evacuate.

You apply the brakes with rapidly increasing pressure to get stopped halfway down the runway and get everyone out. When you meet up behind the plane, immediately count heads to ensure no one is still inside.

Now watch from a safe distance as the airplane burns. At least it'll act as a beacon for rescue.

SNUFF THE SOURCE

Fire on the Wings

This discussion is focused on single-engine planes because it's a bit different with a twin. An engine fire in a twin is also a wing fire, so it must be extinguished before it causes structural failure. At least flames in the cabin are not an issue (at first). The twin can also keep flying on the second engine once the fire is out, presuming the damage isn't too extensive.

Singles can have wing fires, too. POHs that address it usually say to turn off any electronics and slip to keep the flames off the cabin (and away from the fuel-bearing parts of the wing) as you dive to snuff it out. There's clearly no point in doing anything to the engine other than reducing power for the dive.

A cabin fire in a twin is just as urgent as in a single and just as potentially deadly. But at least you'd get down with idling engines to use for landing.

IS HALON NECESSARY?

Halon is no longer produced due to its destructive effect on ozone. Halon fire extinguishers are still available from existing stock. (Most of that stock is from systems installed in buildings that had to be replaced but the halon was reclaimed.)

Halon is the most effective fire suppression you can get for an airplane cabin for a given weight. Given this is life and death, get halon if you can.

Don't confuse it with a product called Halotron. This is less expensive, less hazardous to health, and more forgiving to ozone, but it's less effective. You'd need a bigger, heavier extinguisher to have the same level of fire suppression.