Fire

A FIND YOUR NEAREST EXIT. The best thing you can do with a fire is to get as far away from it as you can and as quickly as possible.

B SNUFF THE SOURCE. You're not a firefighter and the insurance company owns the airplane. Putting out the flames matters if it buys you more time for Step A.

C CLEAR THE AIR. Smoke can obscure your vision and toxic fumes can render you incapacitated. Fresh air that doesn't fan the flames can help. So can just proceeding to "Evacuate" if you're on the ground.

D EVACUATE. Remember the part about the best thing you can do? Yeah, do that if you haven't done it already.

KEY SKILLS

- *Fly the airplane*
- *Prioritize, don't multitask*
- *Know when to slow down*

SCENARIO 1
Fire During Startup

*You prime the Cessna 152 for what your southern California skin believes is a cold weather start, and then crank to no avail. You prime again and goose the throttle for good measure—only to get a **BANG**, plus the smell of fuel and something burning. Your passenger looks alarmed.*

A Find Your Nearest Exit

While it's certainly possible you could get this fire to extinguish from inside the airplane, consider three things before you do.

First is that in every other instance of an emergency we talk about not trying to save the airplane. Yet in the situation where you could simply open the door and jump out, the book answer is to try and save the plane. Seems like an odd choice.

Second is that of all the fires on startup found during research for this manual, exactly one went out with repeated cranking, and it's not clear that was from cranking or just that the fuel burned out without setting oil and other flammables on fire. Most fires on startup didn't go out even after multiple fire extinguishers were emptied into the engine compartment. (See "What NTSB Reports Say About Fire" on page 44.)

Finally, many pilots don't even know they have an engine fire until flames are exiting the cowling or Tower calls to ask if they need assistance with their smoking airplane (seriously). If you *know* you have an engine fire, you probably have a fire too big to deal with from inside the airplane.

That means your first move is popping open the door of the 152 and telling your passenger to do the same. If this was in an airplane with the only door on the passenger side, you'd tell the passenger to open it or get ready to reach across to pop it yourself.

Despite what the POH says, your PIC authority entitles you to exit any door now if you think that's best.

B Snuff the Source

Exercising your PIC authority, you decide to keep cranking but also reach down and turn the fuel selector valve to "off." If you were exiting without cranking, you'd turn off the selector as well. This stops any continued feed of fuel past the firewall and might be the difference between a fire that can be extinguished and one that reduces the airplane to an aluminum puddle.

The 152 POH guidance for a fire on start is to continue cranking the engine to suck the flames into the engine and put out the fire. If the engine starts, you're supposed to sit in a running airplane that just had an engine fire for several minutes. If it doesn't start, the POH lists several things to secure before exiting.

FIRES

DURING START ON GROUND

1. **Cranking -- CONTINUE,** to get a start which would suck the flames and accumulated fuel through the carburetor and into the engine.

If engine starts:

2. Power -- 1700 RPM for a few minutes.
3. Engine -- SHUTDOWN and inspect for damage.

If engine fails to start:

4. **Throttle -- FULL OPEN.**
5. **Mixture -- IDLE CUTOFF.**
6. **Cranking -- CONTINUE** in an effort to obtain a start.
7. Fire Extinguisher -- OBTAIN (have ground attendants obtain if not installed).
8. Engine -- SECURE.

This guidance leaves out how long to continue cranking if the engine doesn't start. Don't be a hero. If you keep cranking and the evidence of fire doesn't immediately diminish, consider stopping. Also consider switching the fuel selector to "off" as you crank. A carbureted engine, as in the 152, can start and run for a minute without additional fuel from the tanks. You can switch the fuel back on after a start if you must.

That's fine in theory and it may even work. Just know that other airplane POHs agree with your logical choice of cutting off the fuel flow to the engine while cranking. This may still result in an engine start, but it will quit on its own when it runs out of fuel. If it doesn't start, at least the fuel isn't still flowing to the scene of the fire. Note that other POHs say to cut off the fuel and magnetos before evacuating. No cranking recommended.

Here's an additional data point by anecdote on how hard it can be to know if a fire is actually out. One report tells of a pilot who couldn't get the engine started, stopped trying, and went into the FBO to find a mechanic. When the two of them came back out, flames were pouring out of the cowling. The airplane was a total loss.

TIP If you don't have a fire extinguisher, or the one you have didn't put the fire out, fuel trucks have extinguishers on them. So do fuel pumps.

C Clear the Air

A startup fire is unlikely to fill the cockpit with fumes you need to clear (if it has, you're far beyond the stage where continuing to crank could help). That makes this step essentially the same as "Evacuate" if you're on the ground. Use it to remember that even small amounts of smoke could contain all sorts of toxins. Get out to clear air.

You crank with no start (because the fuel is off) but think maybe the fire is out. Now is the time to shut off all fuel and ignition systems to make sure there's really no fire from a position outside the airplane. Even though you turned off the magnetos, it's possible the p-leads burned and the mags can't be grounded. Treat the prop as if it could start on some residual fuel until proven otherwise. (Yes, you should do that anyway, but be extra careful in this case.)

D Evacuate

This is simple in the 152 with two doors. You both get out.

If your passenger(s) exit the airplane, stop cranking no matter what. You can't count on them staying clear of the propeller.

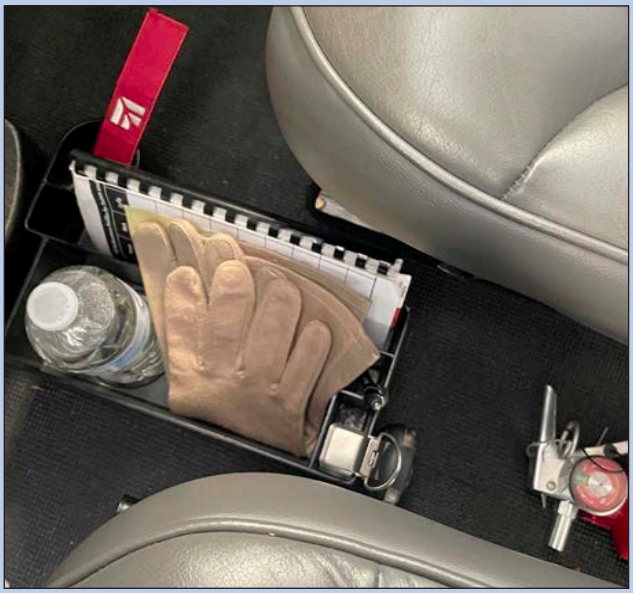
Dressing for Success

One of the grizzly details of airplane fire investigation is how many of the fatalities appear to be from incapacitation preventing people from landing the airplane or escaping it after landing. Even pilots who did escape describe the difficulty of manipulating hot controls or opening a hot door with bare hands.

For this reason, some pilots fly with Nomex gloves on or immediately accessible. Closed-toed shoes and long pants are a good choice for the same reason. A T-shirt offers little protection; however, that might be a tradeoff you chose for a hot cabin. Natural fibers tend to burn, but provide some protection while they do. Synthetics, on the other hand, can melt onto skin and cause more damage. Consider that justification to ditch the polar fleece and buy that leather jacket you always wanted.

Make sure passengers dress appropriately as well. It's like the safety briefing on opening the doors: Give enough information to be productive without terrifying anyone.

Consider fire when upgrading your aircraft interior. Materials not meant for aviation may be less fire retardant and more prone to releasing hazardous fumes. Some interior materials are unavoidably toxic. Consider getting a smoke hood for yourself and practice donning it in flight. (See "Pull Out That Fire Extinguisher" on page 52.)



With more passengers and/or fewer doors, it would be more complicated. You might have to direct people out by name to keep it orderly and quick. In an airplane like a Bonanza, you might be the last one out. Luckily, your right-seater was just as motivated as you today, but it could have easily required you reaching across this 152 and opening the door if that person panicked.

Now look back: Is it still smoking from the outside? Where there's smoke ... well, you know the rest.

It's a mistake to think a quick blast with a fire extinguisher will do the job. It could take several fire extinguishers, especially if oil on the engine has started burning too. Even that might not be enough. You can get creative. One Alaskan pilot of a 180 kept shoving snow into the cowling until the fire went out.

Here at Hemet-Ryan (KHMT), you have another option. It's home to Ryan Cal Fire Air Attack Base just down the ramp. They probably have something you can use.

Presuming you get the fire out, don't be in a hurry to get back in. It's hard to tell if the fire is completely out if it's under the cowling. You'll also want everything inspected by a trained mechanic before you trust your life to this airplane again.

FIND YOUR NEAREST EXIT

Smoke on the Takeoff Roll

The takeoff roll is no place for subjective decisions. That's why a REACT check can be so useful. (See "Preventing the Emergency: REACT" on page 21.)

But what if you smell smoke on the takeoff roll? If it's safe to abort the takeoff, abort and turn onto the taxiway. Get ready to shut down and evacuate if the smell persists. If it's a strong smell of smoke, or if you see flames, abort even if you'll overrun the end of the runway. Don't assume you'll have time to fly a full pattern to a landing. You might not even make it past the upwind leg.

Of course, you might clear the runway just to realize the smell was a whiff of burnt rubber from the jet that just landed on the crossing runway. It's still better to have a good laugh than a really bad day.

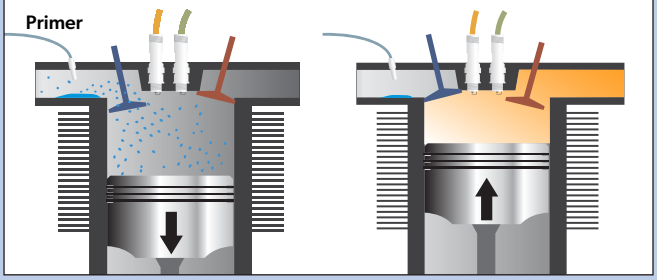
Of Primers, Pumps, and Two Kinds of Backfire

Given that internal combustion engines are designed to burn fuel in a contained space all day long without catching fire, something must go wrong for a fire to erupt during normal starting. (Put aside gross mechanical failure like a fuel line breaking for a moment.) There are two possibilities: Either fuel ended up where it shouldn't be and touched something hot, or the fuel ignited before it was safely contained inside the cylinder.

Virtually all airplane engines achieve the super-rich fuel-to-air ratio needed to start by spraying a bunch of extra fuel into the engine right before cranking. If you have fuel injection, that's done by running the fuel pump to spray fuel out the injectors before starting. If you have a carburetor, the priming plunger and line acts like a simple fuel injector where your hand powers the pump. In both cases, the fuel ends up in a puddle close to the intake valve. Injectors spray into all cylinders, where the primer might spray into all, some, just one, or a space between cylinder intakes.

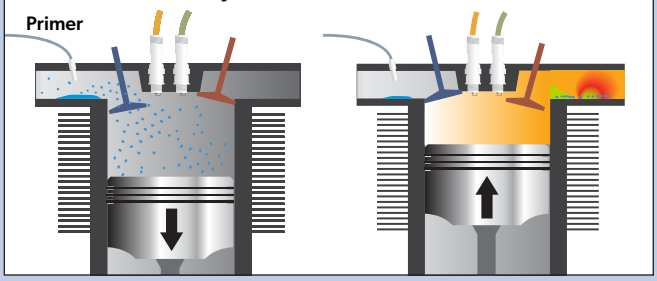
When you crank the engine to start, vapor from that puddle of fuel gets sucked into the engine, along with even more fuel from the injectors or carb. When the engine starts it sucks in any remaining fuel in that puddle and burns it. If the engine doesn't start before the entire fuel puddle is sucked in, you stop cranking and prime again.

Normal Ops: Pooled fuel richens mixture for startup and fully burns. After a compression and power stroke, exhaust gases exit on the exhaust stroke.



That's how it should work. However, until the engine starts, unburnt fuel passes through the cylinders and can accumulate in the exhaust system. More fuel when you prime means more fuel available to move through, allowing more fuel to accumulate in the exhaust. When the engine starts, hot exhaust gasses hit that fuel in the exhaust system and—BANG—you get an exhaust backfire. That's why you usually hear an exhaust backfire right after the engine starts.

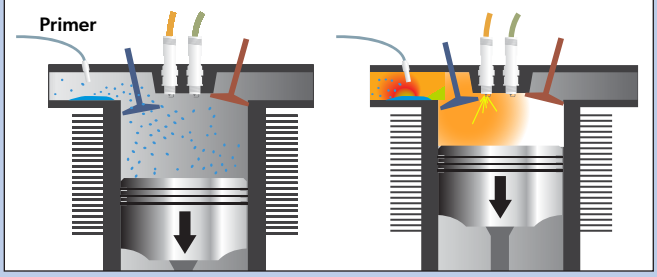
Exhaust Backfire: Pooled fuel passes through engine and collects in the exhaust. Hot exhaust gases exit and ignite fuel in the exhaust system.



Exhaust backfires rarely cause engine fires unless they damage the exhaust system. If you get a loud backfire on engine start but then the engine sounds normal, it's usually fine to let it warm up before shutting down to check that the exhaust is still attached and has no bulges or holes. If the engine sounds extra loud after a startup backfire, you probably made a hole. That's a fire risk. Shut it down.

The backfire that's much more likely to start an engine fire is when poor spark timing for any reason ignites the fuel in the cylinder while an intake valve is still partway open. That flame can travel back into the intake and set the whole pool of priming fuel ablaze. This can cause a bang or "whump" sound and usually isn't linked to the engine starting.

Intake Backfire: Early ignition, a leaking intake valve, or other issues allows combustion to ignite pooled fuel in the intake manifold.



These flames can spread back down the intake and set other items in the engine compartment on fire. The more fuel you pumped into the intake, the more likely the "pool" overflowed and

Of Primers, Pumps, and Two Kinds of Backfire (continued)

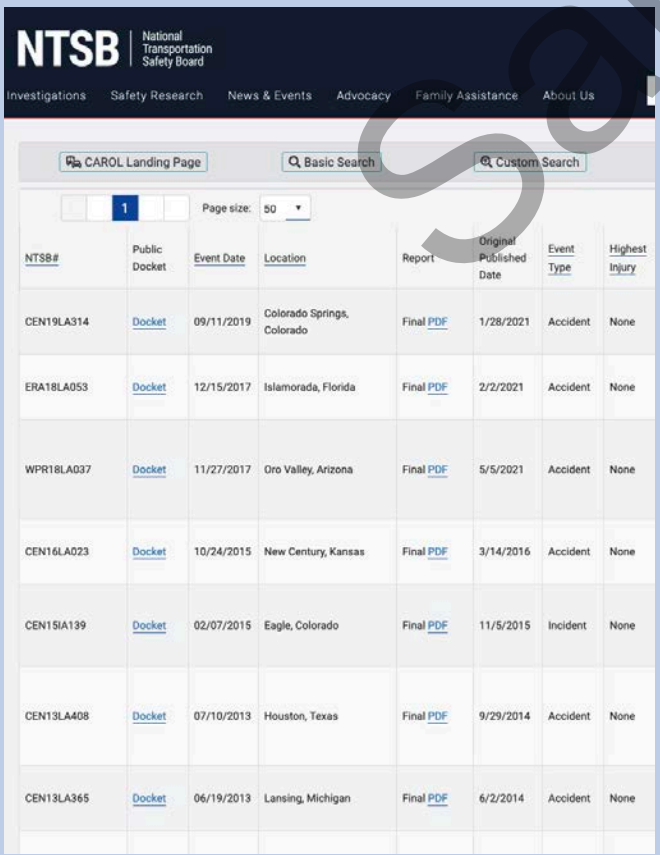
ran down, providing a path for flames. This is the fire that POHs mean when they suggest continuing to crank will help. But it's a fine line between the flames getting far enough down the intake to be detectable as a fire and getting so far that they can't be sucked in anymore. If you suspect you have a fire and you can smell gas, chances are continued cranking will be in vain.

This also explains why pumping the throttle with a carburetor can be a problem. The carb has an accelerator pump that sprays fuel like a primer/injector, but it sprays at the beginning of the intake where the carb is. This fuel pools under the carb, far from the cylinders. It's quite effective in helping start the engine, but if flames make it that far back due to a backfire in the intake, an engine compartment fire is almost assured.

Final thought: An intake backfire shouldn't happen without something mechanically (or electrically) wrong with the engine. Even if cranking puts the fire out and you don't see damage, you should get the engine examined by an A & P mechanic. Intake backfires can also damage air filters and ducting such that pieces get ingested by the engine on subsequent flights and cause engine failure. (It's happened.)

What NTSB Reports Say About Fire

Aircraft fires significant enough to generate an NTSB report are relatively rare. Research showed only 122 in the past 10 years. It was roughly a 2-to-1 split on events in flight (80) versus on the ground (42). Of the ground events, 18 were while starting the engine and 11 were brake fires. One imagines there were more on the ground where the fire went out relatively quickly and were not ever reported.



NTSB#	Public Docket	Event Date	Location	Report	Original Published Date	Event Type	Highest Injury
CEN19LA314	Docket	09/11/2019	Colorado Springs, Colorado	Final PDF	1/28/2021	Accident	None
ERA18LA053	Docket	12/15/2017	Islamorada, Florida	Final PDF	2/2/2021	Accident	None
WPR18LA037	Docket	11/27/2017	Oro Valley, Arizona	Final PDF	5/5/2021	Accident	None
CEN16LA023	Docket	10/24/2015	New Century, Kansas	Final PDF	3/14/2016	Accident	None
CEN15IA139	Docket	02/07/2015	Eagle, Colorado	Final PDF	11/5/2015	Incident	None
CEN13LA408	Docket	07/10/2013	Houston, Texas	Final PDF	9/29/2014	Accident	None
CEN13LA365	Docket	06/19/2013	Lansing, Michigan	Final PDF	6/2/2014	Accident	None

It's no surprise that fire in flight was far more deadly—but not as much as you might expect. In 25 of the 80 inflight events, there was at least one fatality. In 11 more, there was at least one serious injury. But that leaves 44 inflight fire events—more that half—where there were only minor or no injuries.

You'd think that fires breaking out on the ground would cause minor injuries at most, but there were two fatal accidents. One was a warbird when leaking fuel on landing initiated a fire under the wing and engulfed the plane before the pilot could escape. The other was a pilot who crashed shortly after takeoff. Post-crash examination revealed evidence the fire started *before* takeoff, presumably unbeknownst to the pilot.

This underscores how difficult it can be to detect a fire until it's big enough to be catastrophic. Of course, it's impossible to say how many small fires started and went out without anyone even knowing, or at least without any significant damage. Of the airplanes that did get into the reports, almost all noted that the airplane was seriously damaged or destroyed before the fire could be extinguished.

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.*

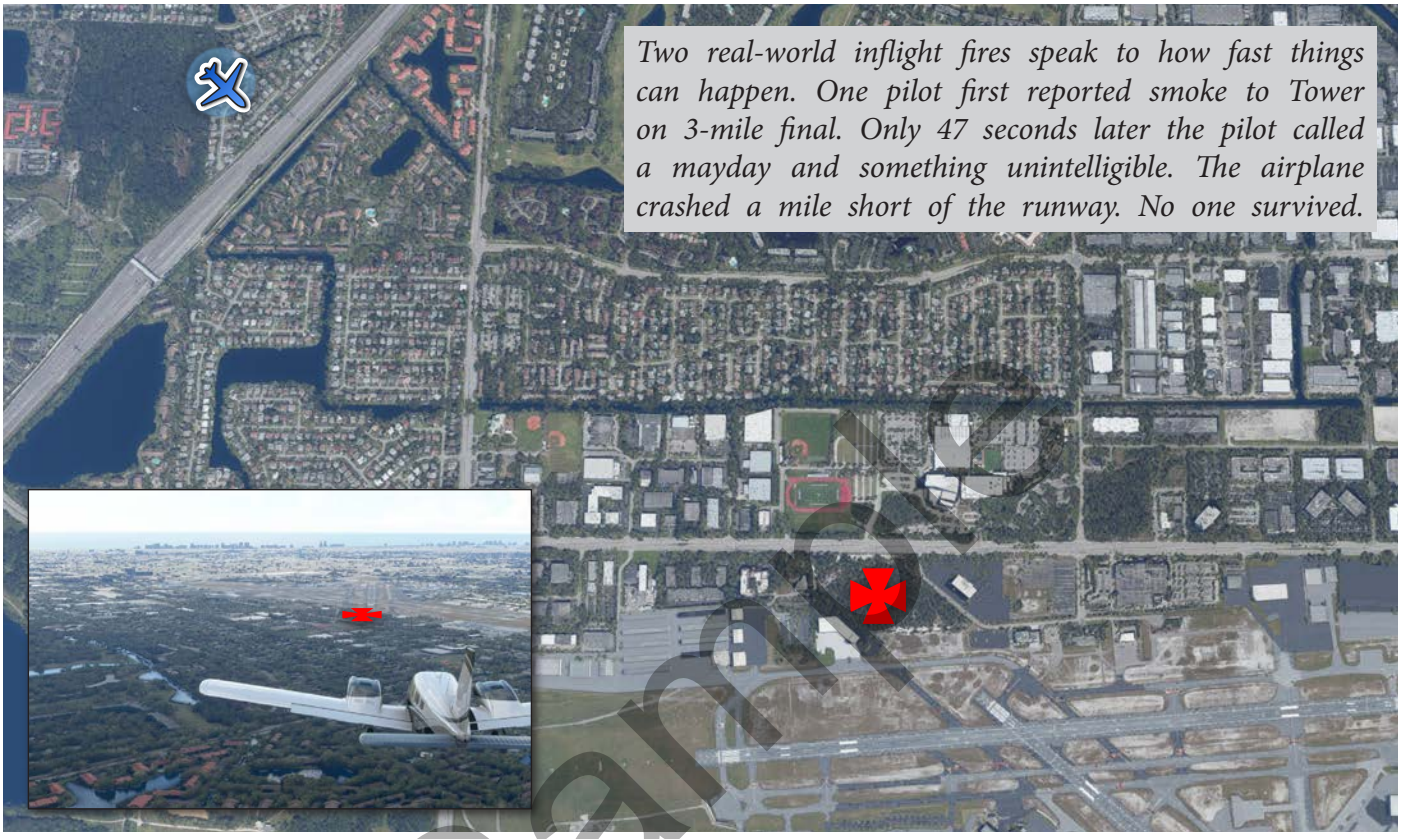
A Find Your Nearest Exit

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.

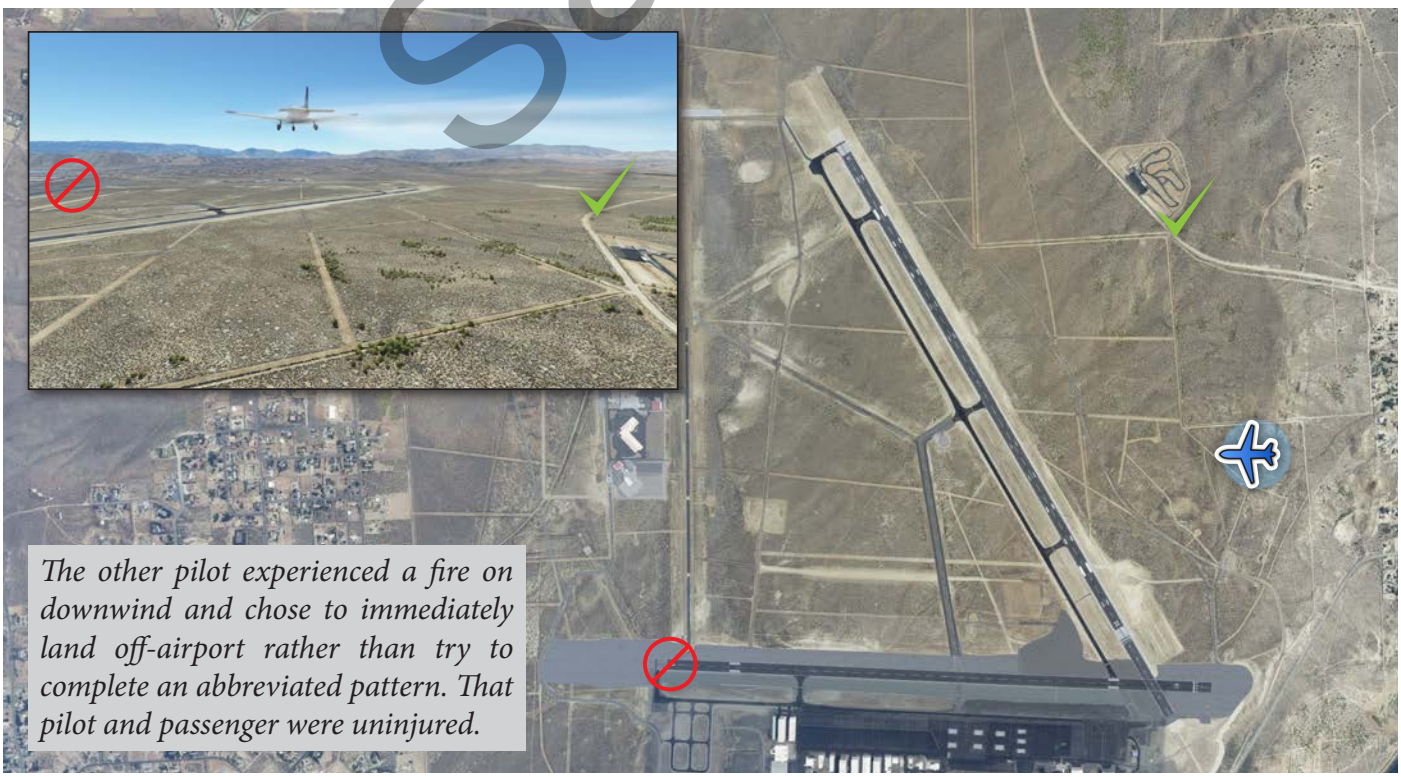
You're in visual conditions and basically over Converse County (KDGW), so pull the power to idle, drop the gear for drag, and start a spiraling emergency descent. (See "Using Load Factor to Pump Up Your Go-Down" on page 50.) Even if there wasn't an airport below, this would be your first move over any 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.

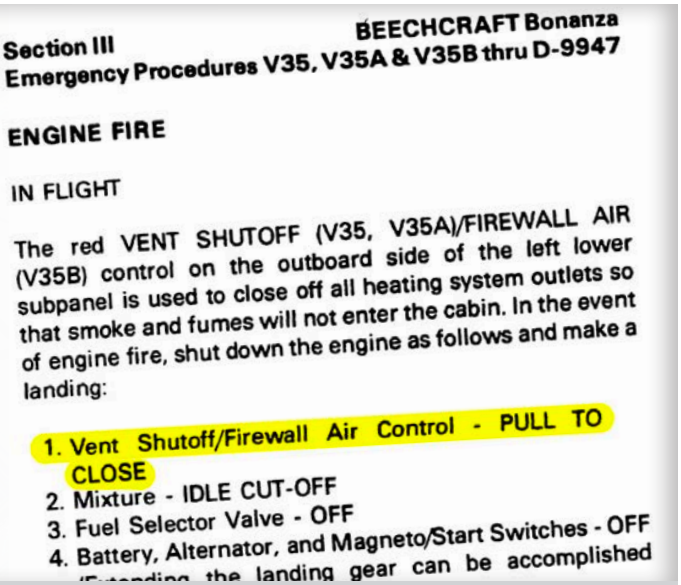
Both a turning descent and a straight one can be at speeds that may snuff out a fire under the cowling. The speed required to snuff a fire has too many variables to know if a given speed is fast enough in a specific situation. Airspeed won't quench a fire in the cabin, but you should descend anyway. 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 is toxic. This means you'll need to 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.

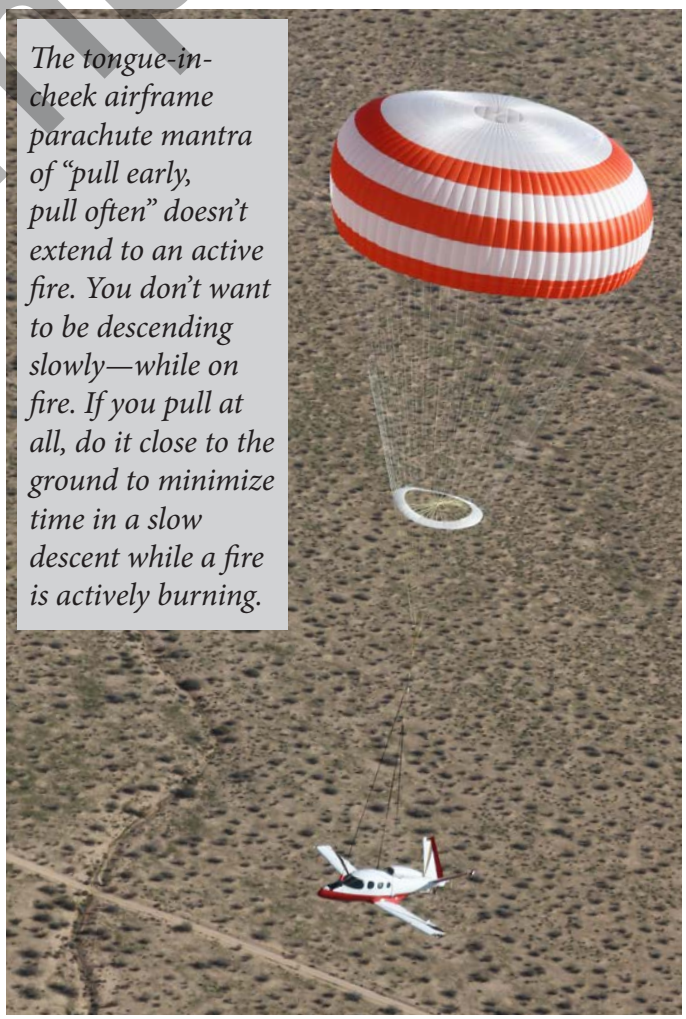
TIP Black smoke is likely engine oil, hydraulic fluid, or plastics. Orange flame with white or gray smoke is probably fed by fuel. Fuel fires are generally easier to blow out with airspeed and (obviously) more likely to go out once fuel is cut off with the selector or shutoff.

C Clear the Air

This V35 has a Vent Shutoff to prevent smoke and flames from entering the cabin from an engine fire. For any airplane, turn off all cabin heat and vents. This also helps with cabin fires as the fresh air can feed the fire you're trying to put out.

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

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



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.

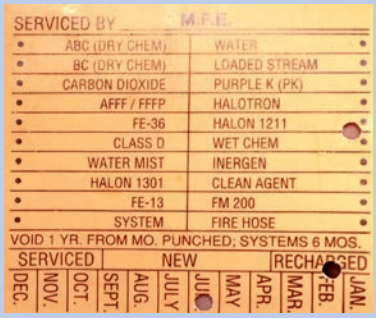
A cabin fire in a twin is just as urgent as in a single and just as potentially deadly. But at least you'd get down with idling engines to use for landing.

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 toxic, 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.



Using Load Factor to Pump Up Your Go-Down

The goal of a truly rapid emergency descent is achieving as high of a decent rate as possible while maintaining aircraft control and remaining within the load limits. How fast? Controlled steady descents of close to 3000 FPM can be accomplished by a 172 in skilled hands. High-performance singles might exceed 4000 FPM. That's why you should only practice this with a competent instructor experienced in flying this kind of emergency descent profile.

This can't be accomplished diving straight ahead without exceeding VNE. And it's not helpful to reach 1000 AGL in two minutes only to spend several more minutes slowing down so you can land.

Your POH guidance is the final word on this, but few POHs address an emergency decent at all. No matter what, you'll want idle power and a steep bank at an airspeed you're comfortable maintaining. Something below VLO is good if you have retractable gear so you can use the gear for additional drag. You might experiment with something comfortably under VFE and using partial flaps.

The turn increases load factor once you have stabilized at a specific airspeed in the descent. The more bank, the more load and the more induced drag you have to help shed altitude. More load factor also increases stall speed, so there is a tradeoff with safety. ***Only practice this with a skilled instructor on board.***

Because your forward view may be compromised by smoke, practice these turning left, looking out the left forward corner of the windscreen and your pilot-side window.

The altimeter unwinds rapidly, so set a recovery point at least 2000 AGL for practice. In the real situation, you might recover under 1000 AGL, roll wings level to slow, and land at the first survivable location.

Factors to discuss before this flight include what you'll do with any autopilot envelope protection that may work against you. You could also discuss the use of some "top rudder" to help control airspeed (see below upper image airspeed is increasing but the lower one is stable). This will also increase descent rate as it's essentially a slight slip during the turn (see coordination at top of PFD below.) You should also talk about engine management if you climb and descend several times during practice if you have concerns about the heating and cooling cycles the engine will experience.

SCENARIO 3
Brake Fire During Taxi

The good news with a brake fire is that you're probably on the ground. The bad news is that if you're in a low-wing airplane ***you may have no idea you're on fire****.*

A Find Your Nearest Exit

It's hard to believe you wouldn't notice a fire, but there are multiple reports of Tower telling a pilot they were trailing smoke on taxi that turned out to be fire started by the brakes. There's even one report of a landing airplane telling one holding short they appeared to be on fire. The story might have ended quite differently if that pilot had taken off.

So that's what happens to you. Tower says you appear to be trailing smoke and asks if you need assistance. You're still on Runway 34, so you turn off at A2 and try to stop—turning around as you do to end up in the grass because one of the brakes was no longer working.

Brake fires are usually a combination of overheated brake rotors and oil or brake fluid hitting those rotors. One clue that brake fluid is leaking is a brake pedal that goes soft or continues to sink as you use the brakes. Another is red fluid or oily streaks on the tires seen during preflight inspection.

Had you been going slower on a taxiway, you would have just stopped right there. Maybe with only one working brake, but you would have stopped.

B Snuff the Source

There's nothing you can do to put this fire out from inside the airplane. You pull the mixture to cutoff and grab that extinguisher.

C Clear the Air

You don't need to clear the air, but you want to exit into clear air. If you had passengers, you would have gotten them out too. There is no "small" fire, even if you can see it's only happening around one wheel, because fires can spread rapidly.

You can see the smoke boiling up from the left wing, so you decide to pop the passenger door and climb over that empty seat as it won't delay you too much.

TIP Airplanes with nosewheel steering aren't immune to brake fires. Riding the brakes during taxi elevates risk of fire.

Source: NTSB

Once brake fluid starts burning, it can spread rapidly and be tough to put out. Did we mention that the fire is probably burning right below a fuel tank?

D Evacuate

Once out the door and down the wing, you can run around to the other side and see what's going on. The wheel has a lot of black smoke and a little flame boiling out around a rapidly melting wheel cover.

You get the extinguisher as close to the base of the fire as possible without endangering yourself and pull the lever. One upside of a brake fire is you stand a good chance of putting it out with a fire extinguisher, even the small kind usually on light airplanes.

You also might even get to fly again that day if the damage is minor and can be repaired easily.

PREP AND PRACTICE

Pull Out That Fire Extinguisher

It's shocking how many pilots know where their fire extinguisher is but have never tried removing it in flight. Some are surprised that when the pilot seat is in position for flight, the extinguisher is impossible to reach.

Find out if your system works by starting with a ground test. Put your seat in the right position for flight. Now start counting and get your extinguisher out. Do this a few times to see how fast you can do it. Relocate the extinguisher and try again if you don't like the results. If you have a smoke hood or personal breathing equipment (PBE), try retrieving and donning that too while sitting on the ramp with your seat in the flight position.

Now take it up a notch. Literally. Get established in cruise flight and start a normal level turn while hand flying. Remove the extinguisher while maintaining the turn. There's nothing special about turning, but it's a small dose of the split attention you would have trying to reach the extinguisher while flying. Take a pilot friend with you to fly while you replace the extinguisher to practice again.

If you have PBE, try donning the hood and getting the extinguisher out as a one-two punch. This is a good flight to try turning the master off to see what it's really like (be sure you're in appropriate airspace first). Also, try using your handheld radio with the master off. You might find it's harder than you expected.

FIND YOUR NEAREST EXIT

Cabin Fire in IMC

This might be the exception to initially treating an engine fire and cabin fire the same way. Fire in IMC presents contradictory needs. Fire means you want to land as fast as possible. IMC means you want a safe procedure to reach the ground, which takes time.

If you suspect a cabin fire, killing the master switches and trying to extinguish while maintaining altitude is worth it. Hopefully, the fire will go out on its own or with the extinguisher. Get trimmed for level flight because you'll be unable to read the instruments for up to a minute after discharging the extinguisher. And the autopilot is of no help with the master off.

If it's the smell of smoke without obvious fire, a checklist will likely suggest turning off the master and then every switch you can, including interior lights and every piece of avionics individually. Then turn the master on and wait. Then turn on the essential items one by one. Exterior lights and strobes are nonessential. Interior lights should be left off if you can. Powering up one radio and navigator is ideal, but a tablet computer might get you enough navigation.

If a cabin fire doesn't go out, or if it's an engine fire, you'll need to get down ASAP and possibly power-off. Whether you spiral down on instruments or dive toward the nearest airport, you may get sight of the ground moments before you reach it. Only you can decide between fighting the fire in the air or making a near-blind landing ASAP.