# The One-Flip Engine Start

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A recent apres flying session at the gourmet hamburger stand included a discussion on engine starting. It's probably time for a refresher course. We'll limit the discussion to a solid engine that runs OK once started. That is, not one with a sick ignition system, low batteries, low compression, leaky gaskets or fuel line, shot plug, bum fuel, broken parts, internal friction, bad tank location, etc. In other words, to simplify the discussion, we'll rule out most of our engines.

A sound engine with good fuel and ignition source will start with one flip of the prop. What we are concerned with is why it's not often the first flip of the prop. You need three basic conditions for that one flip start. 1. The fuel line needs to be full right up to the needle valve with no bubbles inside. 2. The spark or glow must be strong enough and timed correctly. 3. The prime must be a combustible mixture in the combustion chamber with no excess in the crankcase to flood it. Flip briskly and she'll go.

Well, maybe that's too brief. Let's cover the three points:

1. Most of us fill the fuel line by choking and flipping. This usually works, but not always. A long fuel line with an up-and-over loop in it will sometimes let the fuel run back faster than we can flip. The most effective way is to choke only on the piston upstroke, then pop the finger off choke as the piston goes over top center. That way the back pressure of the descending piston doesn't push most of the prime right back to the tank. Check this out sometime when you're priming with a clear fuel line. It's very noticeable on four stroke engines.

You can't see that backflow when priming an engine whose fuel line is hidden or opaque, but understand what's happening and choke accordingly. You only need to bring the fuel to the needle valve, where surface tension at the orifice should hold it there. Stop short of flooding the case. There doesn't need to be fuel in the crankcase, just the top end. That initial serious flip will bring the charge through the case upon firing.

Sometimes the charge won't stay put in the fuel line, often because the tank is too low. But the old needle valve style peculiar to the Fox 35 can also present a problem. In the days before fuel filters, Foxes got a reputation for running steadier than other engines. The Fox needle didn't have the usual conical point, but had a flat taper ground into one side. That left a bigger open hole at the point of fuel metering. That opening would pass larger chunks of the fine debris that usually finds it's way into most fuel cans. By contrast, the  shaped opening created by the conventional needle valve will capture a smaller speck that would flow right through a fox needle.

But the Fox opening had the drawback of having less surface tension to hold the fuel at the orifice, and fuel would flow back into the tank. That made the Fox harder starting. When fuel filters became available, we solved the problem by using a filter and substituting a needle valve

assembly from one of the cheap Testors McCoys. No more dirt in the NV and the fuel would stay in the line, ready for a start.

Resist the urge to fiddle with the needle valve if you don't get an immediate start. The NV adjustment doesn't really begin to work in earnest until the engine is turning. But if you're using castor oil based fuel, and the engine hasn't run in a while, you might open the NV a half turn (only) to start. Castor congeals in the system, especially at the NV and needs to be dissolved during the first run of the day. Another exception to the "don't tweedle the needle" rule is l/2 A engines, whose pore-size openings congeal almost immediately.

2. We won't dwell long on spark or glow ignition problems. That's a complete subject for another seminar. You can pull a glow plug and look for that bright orange glow that's necessary for a decent start. If that strong glow isn't there, fix it. You can attach a known good portable clip-on ignition system to see if a weak spark is the problem. Swap plugs. Again, fix it.

3. Many folks prime by squirting a shot of fuel down the intake. Sometimes works, sometimes doesn't. It's an easy way to get a flooded condition. Surest is to prime into the exhaust with a measured amount of fuel. An old control line flying buddy always used a small hypodermic to precisely inject a couple of cc onto the piston top for a consistent one flip start.

If you get a puddle inside the crankcase, you have a problem. One fix that normally works is to rotate the entire airplane 360° to drain the case. With the piston in the down position, rotate the engine so the fuel runs into the bypass, then to the combustion chamber then out the exhaust. Then start the routine over once more to draw the fuel up to the needle valve. Prime the exhausts, flip the prop once and fly.