

Building a Smoke System for your airplane. A few tips.

This kind of smoking is actually GOOD for you. That is because of the new name some people are calling it. No longer is it just a SMOKE SYSTEM, now it is a VISUAL POSITION SAFETY ENHANCING SYSTEM. If you really want people to know you are on downwind at some uncontrolled field, just turn on your Visual Position Safety Enhancing System for a few seconds and everyone for miles can see you. If you are putting it on a certified airplane how could the FAA turn down a safety enhancing device like this.

There is no need to tell anyone how much fun it is to turn it on during takeoff and smoke out the whole runway. If you are aerobically inclined it has obvious advantages.

Let me say right up front that nothing is really critical. If you dump oil into a hot exhaust pipe you will get smoke. We just want to do it efficiently and keep the airplane belly as clean as possible. I have sold hundreds of complete systems in the past before I got too lazy to build them anymore.

The pump I am using is only putting out about 12-15 psi and that is really a little bit on the low side, 30 to 60psi works better. However this pump works for a long time, is lightweight and cheap. If you are willing to spend the money there are more powerful ones on the market. This small one is called a Shurflo Nautilus single-fixture water pump model 100-009-21. You can go to shurflo.com and pick out a larger, more expensive one if you like. The pumps can be found at recreational vehicle dealers, they go on motor homes. One dealer in Houston, Texas that stocks them can be reached at 877 325-7449. They sell for about \$60.00. Of course some “expert” will tell you that a water pump will not work. I only know that I have had these on airplanes for several years and they still work just fine.

There is only one thing about this smoke system that makes it different and better than any other on the market. That is what I call a smoke oil injector. This is the actual part that goes into your exhaust pipe. I invented a injector that sprays the oil into the pipe in a wide, flat, spray. This makes it burn all the oil instead of half of it trailing down your belly. Also this injector is installed with a clamp, no welding required. Where do you get this wonderful device you ask. **Our own local EAA member Ron (the machinist) Sturgill makes them and his work is excellent.** They are very

labor intensive to make. The injectors cost \$50.00 each, without the hose clamp. I do not supply the hose clamp because there are so many sizes and I will not know which size to send you. **One size injector does not fit everybody.** You will need to know what pressure your pump is rated at so I can send you the correct one.

It has been a few years since I actively sold complete smoke systems and I have lost some to the part numbers to a couple of things. The smoke oil injector is held into the exhaust pipe with a stainless steel radiator hose clamp. The only difference is that I use a slightly wider than normal clamp. They came from a NAPA auto store and were a special order part. I recommend a wider than usual clamp just for more strength. After you put a quarter inch hole in a normal hose clamp there is not much metal left so use the wider clamp. If you go to <https://www.napaonline.com> and use the “search” function in the upper right corner you will find some good clamps. My first choice to search is “clamp hi torque”. Other good choices to search would be “clamp constant torque” and “clamp channel bridge” and “clamp T-boltband”. All these are wide clamps that will work fine. Don’t even bother with just a standard width radiator hose clamp, it will break. Be very careful drilling the hole in these clamps, they can get away from you and chop off a finger. I always use a hand punch called a Model 8500 power puncher I got from U.S. Industrial tool. It is fairly cheap and makes a clean hole.

The list of things you need is short.

1. You need a tank to hold the oil. An old, empty Freon tank can be made into a first class oil tank, the 30 lb. size holds 3 gallons of smoke oil. For skywriting you need to use the 50 lb. size, it holds about 6 gallons. Heating and air conditioning places throw these tanks away. I get my filler neck and cap from auto junk yards, every car has a gas tank with a filler.
2. A electric pump to pump the oil. Roughly 15/60 psi output pressure, a water or fuel pump will work.
3. A switch to turn the pump on and off.
4. **You need 2** smoke oil injectors on most airplanes, more for skywriting.
5. All the rest is just wires and hoses to connect it all together. Use high temp hose and/or firesleves in the firewall forward area. I have had good luck with Aeroquip braided stainless steel hose with a Teflon liner. It is difficult but not impossible to get the ends on it without special equipment. Some local hydraulic hose companies stock it and can put the ends on it for you.

Where you locate the smoke oil injector in your exhaust pipe is not critical. Common sense tells us that the longer the oil is inside a hot pipe the more time it has to burn. But do not interpret that as having to place it very, very near your cylinder head. Just put it in a easy to reach spot. Try to keep the oil inside the pipe for at least one foot, more would be better. Anywhere in front of a muffler works good.

Now you have made or purchased a tank, connected the pump to the tank, run a hose to your firewall and thru it with a "T" firewall fitting. **Do not use ¼ inch line from the output side of your pump to the firewall.** Use the next size larger because the smaller line causes too much restriction to the oil flow. Run 2 lines from your firewall "T" fitting to 2 different exhaust pipes and install the injectors. Install a switch for the electric pump and you are done. Most of you built your airplanes so I am sure you have plenty of common sense about doing this job properly to **aircraft quality standards.**

If you want it to work inverted, for you aerobatic types you will need a flop tube inside your tank. The flop tube is actually your oil pickup line inside the tank. One can be made by using some flexible clear plastic tubing available from most auto supply stores, and sliding 3 or 4 auto lug nuts over the end of it and secure them there. Secure the lug nuts by piercing the clear tube with some safety wire. The lug nuts are plenty of weight to make the end of the tube go wherever gravity takes it. Make your flop tube just long enough to reach any part of the tank. If you get carried away and make it way too long it can and will eventually tie itself into a knot. Don't forget to vent your tank. If you do not plan to go inverted a simple small hole in the cap works fine. For aerobatics it gets more complicated.

What kind of oil do you use for smoke. Use a very light weight oil such as the oil that builders use to spray on their concrete forms works well and you can get it in 5 gallon buckets. It is known as a **concrete form release agent.** Aeroshell makes a very good oil simply called aircraft smoke oil but I think it is only available in 55 gallon drums.

FOR ALMOST FREE SMOKE OIL :

A good alternate is new or used automatic transmission fluid.

For used automatic transmission fluid be sure to filter it or it will damage your pump or wear it out quickly but it is by far the least expensive oil, sometimes even free. I have been using it for years with good results. I

simply hooked an automotive oil filter to the hand pump on my 55 gallon drum and it works good.

Never, Never, try diluting thicker oil with kerosene or diesel fuel to make it work. At some point you will add too much diesel fuel, now instead of a smoke system, you have just created a flamethrower. **It will set your airplane on fire** and there is a good chance of you getting killed.

Different systems:

1 injector and 1 pump will make smoke but not very impressive.

Use this option only for low horsepower and very slow airplanes.

2 injectors and 1 pump works for everyone for fun flying, good smoke.

1 injector per cylinder and a powerful pump and a large oil tank are needed for good skywriting or for truly impressive smoke. This system requires more parts and labor to install but it can make an airport IFR. Also you may need a solenoid or check valve if your tank is mounted higher than your injector nozzles. Sometimes after engine shutdown the oil can leak down thru your pump and you can end up with all your smoke oil on the hangar floor. I would try it without the solenoid or check valve and see what happens, you may not need it.

Use plastic or nylon hose fittings in the input and output sides of the pump. The Surflo pump head is plastic and if you use a normal metal fitting it may crack the pump head before you get it tight enough not to leak.

The pump and the smoke oil injectors are the heart of the system. Everything else is just plumbing.

I love pictures of airplanes, with or without smoke. email me a picture of your pride and joy to add to my collection. Call anytime if I can be of any help to you.

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