

Getting the Most Out of an O.S. 46LA Engine

By Dennis S. Nunes – October 2026

What I Learned Flying “*Big Blue*”



My Gladiator 35 (nicknamed Big Blue) with an O.S. 46LA engine at the 2026 Northwest Regionals (Photo by Flying Lines)

I have been approached by quite a few people at contests who have seen me fly my *Gladiator 35*. The first question is usually, “*What plane are you flying?*” The next question is, “*What engine are you running?*” And eventually, I hear the question I get most often: “*How did you get your engine to run so well?*”

The first two questions are easy to answer.

The airplane is a *Gladiator 35*, designed by Dennis Schauer and affectionately named *Big Blue*. The Gladiator appeared in the February 1968 issue of *American Aircraft Modeler* and was originally offered in both 35- and 45-size versions. Mine is the 35-size version.

The engine is an O.S. 46LA.

The answer to the third question, however, is a little more complicated.

Believe it or not, it took me several years—and a lot of flying—to figure out how to make this particular engine combination run as smoothly and consistently as it does today. There wasn't one magic modification or secret trick. Instead, I made a number of relatively small changes, learned from several experienced control-line fliers, and paid attention to what the airplane and engine were telling me.

This article documents what I changed, what I didn't change, and what I learned along the way.

I'm also writing this for a practical reason. As I get older, I find that I don't remember every detail quite as well as I once did. So, this article is partly my own reference document—and hopefully it will also help someone else who is trying to get the most out of an O.S. 46LA for control-line precision aerobatics.

Some of the trials and tribulations involving *Big Blue* and this engine were previously documented in the *Flying Lines – News of Northwest Control-Line Model Aviation* article, [“An Ongoing Saga of the Love/Hate Relationship between Me and Big Blue.”](#)

The O.S. 46LA

The O.S. 46LA is one of the easiest and most forgiving engines I've used for control-line sport and precision aerobatic flying.

Although the engine is often thought of as a sport or trainer engine, I've found that a completely stock O.S. 46LA can be a very powerful and reliable engine for control-line precision aerobatics.

And it is a perfect fit for *Big Blue*.

For years I ran the engine completely stock, using the factory remote needle valve and E-3030 muffler. It worked well.

However, as I became more serious about competing in control-line precision aerobatics—and as my flying improved—I began noticing a few relatively minor issues with my engine runs. I wanted to make the engine more **consistent and reliable**.

That's when the experimenting started.

Most of the changes described in this article are nothing new or earth-shattering. In fact, most don't require drilling, grinding, or otherwise modifying the engine. *So put away the Dremel tool!*

The results came from a combination of advice from experienced modelers, experimentation, and many flights.

The goal wasn't to turn the O.S. 46LA into a different engine. The goal was to make a good engine run **smoothly, consistently, and reliably** in a precision aerobatic airplane.

What I Didn't Do

Before getting into what I changed, let me explain what I didn't change.

Again, there is no need to bring out a Dremel tool or a saw and start hacking away at the engine or muffler. I don't recommend modifying the engine simply for the sake of modifying it.

I also don't believe there is a need to start adding or removing head gaskets to make this engine work.

Leave the engine alone—at least until you have identified an actual problem that needs to be solved.

That became an important lesson for me. The engine already worked well. My job was to identify the things that were preventing it from working consistently in my particular airplane.

Engine Break-In

Breaking in an engine is one area where everyone seems to have their own procedure.

O.S. provides a relatively short break-in procedure that can be performed with the engine installed in the airplane. The basic idea is to run the engine rich initially and gradually close the needle over the first several flights until the engine reaches its optimum setting.

The “O.S. Owner’s Instruction Manual” states the following:

1. *Start the engine and, with the throttle fully open, open the needle-valve an extra half turn (180°) from the optimum setting. This will produce a rich mixture that will result in cooler running. Allow the engine to run out a full tank on the ground. (Avoid dusty surroundings.)*
2. *Now fly the model with the needle-valve re-set 20-30 degrees open from the optimum setting (i.e. 40-60° from the highest rpm setting).*
3. *Close the needle-valve very slightly on successive flights so that the engine is running on its optimum needle setting at the fifth or sixth flight.*

That's the manufacturer's procedure.

What I Do

Personally, I prefer to break in my engines on a test stand rather than put a brand-new engine on an airplane and immediately go flying.

I use a small 9 × 4 prop and run the engine for approximately five to seven minutes at a time. I keep the needle open and run the engine—**very rich**.

Every minute or so, I'll pinch the fuel line briefly. This allows the engine to transition to a two-cycle for a few seconds before I release the line and allow it to return to a nice, rich four-cycle.

After the first run, I let the engine cool completely and check the head and backplate bolts for tightness. ***Do not overtighten the backplate bolts!***

I'll typically make five or six of these test runs before putting the engine on the airplane.

One Important Tool

Speaking of tightening and loosening bolts:

Don't use a Phillips screwdriver on an O.S. engine.

The metric screws used on these engines have a JIS head. Use a #2 JIS screwdriver.

Give the Front Bushing Time

One thing you may notice during the early runs is that the front portion of the crankcase, just behind the propeller, gets quite hot.

On a new engine, the clearances around the crankcase bushing are tight. It takes a number of runs for this area to loosen up.

One indication that the engine is beginning to break in, as the clearance around the bushing increases, the front of the crankcase begins running cooler.

The First Problem: Fine Needle Adjustment

After years of flying the stock engine, one of the first things I wanted to improve was the needle valve.

The stock remote needle valve works fine, especially during break-in. The problem I encountered was that I sometimes needed to make a very small needle adjustment.

The stock ratchet-type needle valve simply didn't provide enough adjustment between clicks.

I would occasionally find myself thinking, *"I need about half a click."*

Of course, that isn't possible. One click might leave the engine too rich, while the next click might make it too lean.

The advantage of the remote needle valve is obvious: it allows you to make adjustments without putting your fingers near the propeller. But for precision aerobatics, I wanted finer control.

I've always liked the old Supertigre and PA needle valves because of their finely threaded needles. Unfortunately, installing those on the 46LA requires drilling the

engine case and venturi to accommodate their larger spraybar diameter. I didn't want to modify the engine that way, and both types are becoming increasingly difficult to find. Then I discovered an alternative.

Enya 40 Needle Valve Assembly

I eventually came across an [Enya 40 needle valve assembly, Part No. 034020](#), that appeared to be a possible replacement for the O.S. remote needle valve and venturi nozzle.

The best part was that it fit the O.S. 46LA without requiring me to drill out the engine case or venturi.

The finely threaded needle provided the adjustment I was looking for.



Enya 40 - Part No. 03420 Needle Valve Assembly for the O.S. 46LA

A Small Problem with the New NVA

After installing the Enya needle valve, I still experienced inconsistent engine runs for several flights.

We eventually removed the spraybar, thinking it might be partially plugged.

That's when we discovered a small brass burr inside the spraybar.

I initially thought this was simply a defect in that particular spraybar. Then I checked another brand-new unit and found the same thing.

I believe the burr was left from the manufacturing process when the small hole for the fuel outlet was drilled into the spraybar.

Fortunately, the solution was simple.

I used a properly sized AWG drill bit to carefully clean up the hole and remove the burr. The important thing is to make sure that the small fuel outlet is completely clean and unobstructed.

Don't Forget the O-Ring

When installing the venturi, ***do not leave out the small rubber O-ring!***

The O-ring prevents leakage between the venturi and the engine crankcase.

I also use a small amount of [Permatex Ultra Copper Gasket Maker](#) around the flange and nut where the needle valve assembly fits against the crankcase. The objective is to prevent an air leak.

You don't need much. In fact, use as little as necessary and wipe away any excess. This stuff has a tendency to get everywhere.

Spraybar Orientation

Spraybar orientation is also important.

I normally rotate the spraybar so that the small fuel outlet hole is pointed toward the front of the engine and is perpendicular to the venturi.

I then rotate the spraybar downward approximately 5–10 degrees toward the crankshaft, to the point where the hole just disappears from view when looking down through the venturi.

Then I tighten it securely.

The Backplate

The stock nylon backplate works perfectly well—as long as you don't overtighten the screws.

Overtightening can crack the nylon backplate and create a leak.

For my engines, I prefer to use a [machined aluminum backplate](#). If you make this change, be sure to install the thin backplate gasket.

The important point here isn't that everyone needs an aluminum backplate. The important point is simply:

Don't overtighten the screws if using the stock nylon backplate.

The Muffler

The stock O.S. E-3030 muffler works extremely well without modification.

It is, however, somewhat heavy.

If your airplane can accommodate the additional nose weight, there is nothing wrong with using it exactly as O.S. supplied it.

I eventually changed to a tongue-style muffler because I wanted to reduce the nose weight on *Big Blue*.

With either muffler, I use muffler pressure with my uniflow fuel tank.

I do **not** recommend modifying the stock E-3030 muffler simply to make more power. In my experience, the stock muffler works very well.

Managing the Power: The Venturi

This was one of the more important changes I made.

My O.S. 46LA came with an aluminum venturi with an opening of approximately 0.284 inches.

That allows the engine to produce a lot of power. In my case, it produced too much power.

The additional power made *Big Blue* fly faster than I wanted. My first solution was to run the engine richer in an attempt to slow the airplane down.

That wasn't a good solution.

Running the engine rich enough to reduce the airplane's speed made the engine less consistent. Worse, the airplane suffered from a lack of power when it needed it most—particularly during square and vertical maneuvers.

I eventually learned that there are several ways to manage the overall combination:

1. Propeller
2. Venturi
3. Fuel

The important thing I learned is that these three things can't necessarily be treated independently. Change one and you may change the way the other two behave.

I purchased several different-size Delrin venturis from [Lee Machine Shop](#) and eventually settled on a 0.240-inch venturi.

That turned out to be a very good match for *Big Blue*.

The airplane weighs approximately 61 ounces and uses about 3.5 ounces of fuel to fly an entire pattern, with approximately 10–15 laps remaining.

My typical lap times are 5.15 to 5.30 seconds using 63-foot stainless-steel lines, measured eye-to-eye.

One benefit I found with the smaller venturi is improved fuel draw, which contributed to a more consistent engine run and reduced fuel consumption.

Finding the Right Propeller

When I first started using the O.S. 46LA on *Big Blue*, the propeller everyone seemed to be using was the APC 12.25 × 3.75 composite prop.

I used it for quite a while.

In May 2022, however, I was still experiencing inconsistent and erratic engine runs. At the Northwest Regional contest, someone suggested that I try an APC 11.5 × 4 composite prop and handed me one to try.

That propeller turned out to be a significant improvement.

I eventually concluded that the 12.25 × 3.75 was simply too much propeller for my particular airplane and engine combination.

With the 11.5 × 4, I got better acceleration coming out of the corners and a more consistent engine run.

And here's the part that still amazes me:

More than 300 flights later, I'm still using that same propeller on *Big Blue*.

My suspicion is that the larger and heavier propeller was loading the engine more heavily and contributing to higher operating temperatures. The smaller propeller reduced that load and gave me the combination of power and consistency I was looking for.

Again, this isn't necessarily a statement that an 11.5 × 4 is the correct propeller for every O.S. 46LA. It is this propeller that worked for *my engine, my airplane, and the way I wanted the airplane to fly*.

Fuel: The Biggest Surprise

For years I used VP Racing/Powermaster **GMA** 10/22, with 10% nitro.

It seemed to work fine.

But when I was dealing with unpredictable engine runs, Brett Buck suggested that I try VP Racing/Powermaster 10% **AIR**.

The result was almost like turning on a light switch. The engine became smoother, steadier, and more consistent.

Brett's explanation was that the O.S. 46LA—and the O.S. 25LA—don't require the higher castor-oil content of the GMA fuel.

Over time, castor residue can build up inside an engine. In my case, after switching fuels, the engine seemed to get better and better with each flight as the old residue was gradually cleaned out.

It took approximately a dozen flights before I felt that the engine had really settled down.

What a difference the fuel made!

For reference, the GMA 10/22 fuel I was using contains approximately 22% oil: 11% castor and 11% synthetic.

The 10% AIR fuel contains approximately 18% oil: 3% castor and 15% synthetic.

Altitude Makes a Difference

My normal practice fields are less than 40 feet above sea level, and Powermaster 10% AIR works extremely well for me at those locations.

When I compete in Tucson, Arizona, or Las Vegas, Nevada, where the elevation is above approximately 2,200 feet, I switch to Powermaster **15% AIR**.

Again, that's what has worked for my particular setup.

The Combination

With the APC 11.5 × 4 propeller, 0.240-inch venturi, and Powermaster 10% AIR fuel, I set the engine between approximately 9,800 and 10,000 RPM.

For *Big Blue*, that seems to be the sweet spot.

Glow Plug

Glow plugs are becoming increasingly difficult to find, and prices have gone up considerably.

O.S. recommends a hot-range glow plug for the 46LA. I use the O.S. No. 6, formerly known as the A3, hot-range glow plug.



O.S. No 6 (formerly A3) hot-range glow plug

An alternative I've used is the **SH R3** available at [Mike Goes Flying](#).

Once I had the engine completely dialed in and running smoothly, I discovered that an aging glow plug could reveal itself in a very recognizable way.

The engine would suddenly begin behaving erratically for no obvious reason.

If an engine that has been running smoothly suddenly starts acting differently, don't automatically assume you need to change the needle setting, fuel system, propeller, or venturi. ***Try a new glow plug.***

“Burp” the Engine — Not Me!

Another thing I like to do before an official flight is what is called “*burping*” the engine.

I normally do this two or three flights before my official flight.

One-flip starts are much easier to achieve when the engine is warm.

To burp the engine, I use a small syringe to put a small amount of fuel directly into the venturi to prime the engine.

Without the glow igniter installed, I'll pull the propeller through compression several times and flip the propeller two or three times.

WARNING: Any time you put fuel down the venturi, be prepared for the engine to start—even without the glow igniter installed.

Under the right conditions, these engines can start without the glow igniter. Be careful.

I then hold onto the propeller, install the glow igniter, and pull the propeller through compression again. I should feel a distinct “bump” as the piston comes up on compression.

Then I start the engine. It will normally run for a few seconds and stop. I repeat this process four or five times to bring the engine up to temperature.

On the final burp, I continue flipping the propeller until there is no more pop.

On extremely cold mornings, I'll actually let the engine run for a minute or two to warm it up.

Don't Rush the Start

Another lesson I've learned is not to start the engine and immediately run out to the handle.

Once the engine starts, let it warm up.

I will pinch and hold the muffler-pressure line briefly, allowing the engine to speed up, then release the line.

I'll do that once; sometimes twice and then make whatever final needle adjustment is necessary.

Only then do I head out to fly.

Miscellaneous Problems That Can Cause Big Headaches

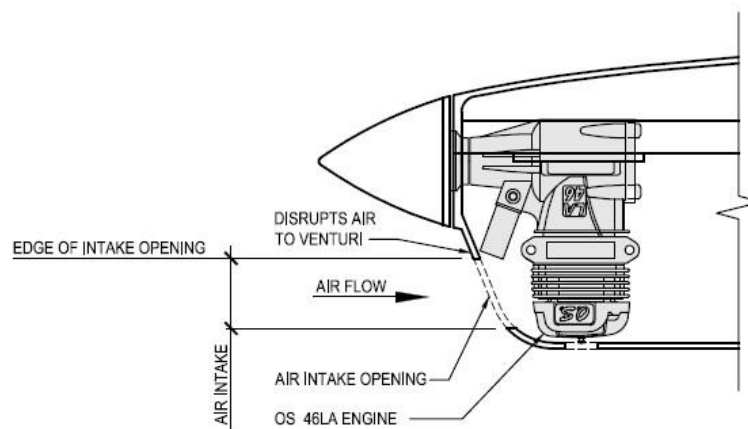
Sometimes an engine problem isn't actually an engine problem.

I learned that lesson with *Big Blue*.

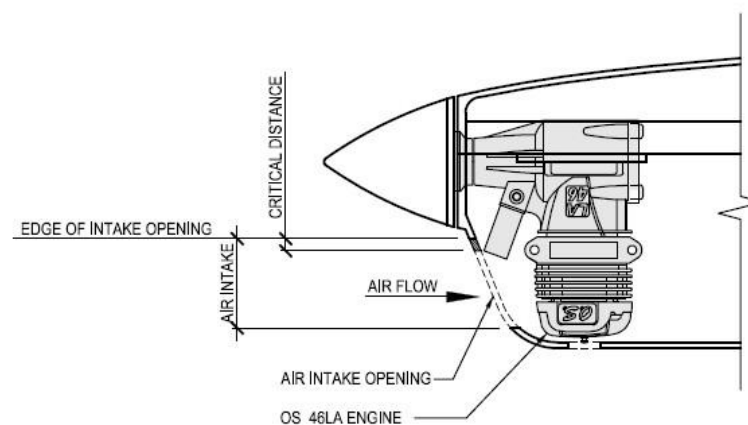
At one contest, Dave Fitzgerald discovered that the air inlet in the cowl was interfering with the airflow entering the venturi.

That disruption contributed to the erratic and inconsistent engine runs I had been experiencing.

The lesson is simple: ***Make sure nothing is interfering with the airflow into the venturi.***

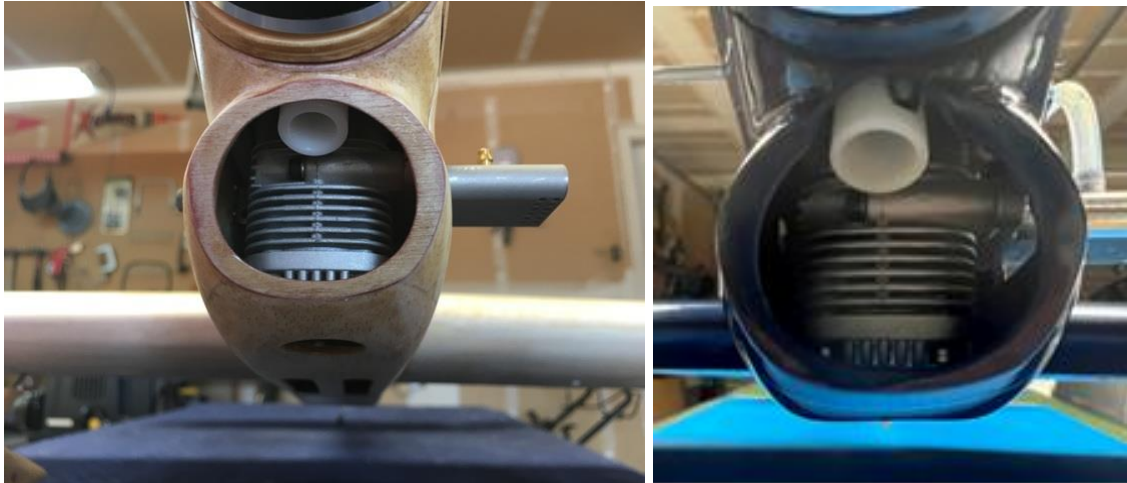


INCORRECT



CORRECT

Cowl Interfering with Air Flow to the Venturi



Modification of Cowl Interfering with Air Flow to the Venturi

Check the Entire Fuel System

When an engine is running erratically, don't automatically start changing the needle, propeller, venturi, or fuel.

Check the fuel system.

Check the tank.

Check every fuel line.

And check the connections.

I once discovered a pinhole leak in the fuel line supplying the engine. The leak was right where the fuel line connected to the spraybar.

When I initially tested the line, I attached my syringe to one end, plugged the opposite end with my finger, and submerged the line in water.

No leak.

However, the pinhole was very close to the end of the line.

For whatever reason, I disconnected the line and connected the syringe to the **opposite end**.

Voila!

There was the leak.

The lesson was that a fuel line can pass a pressure test in one direction and still reveal a problem when tested from the other direction.

Because of that experience, I now replace all of my fuel lines after each season of flying.

My Final Big Blue O.S. 46LA Setup

After years of experimenting, this is the combination that I currently use on *Big Blue*:

Component	My Setup
Engine	O.S. 46LA
Needle valve	Enya 40, Part No. 034020
Venturi	0.240-inch
Propeller	APC 11.5 × 4 composite
Fuel	Powermaster 10% AIR
Higher-altitude fuel	Powermaster 15% AIR
Glow plug	O.S. No. 6 / A3
Muffler	Tongue muffler
Fuel system	Uniflow tank with muffler pressure
Model weight	Approximately 61 oz.
Fuel used	Just over 3.5 oz. per pattern
Lines	63 ft., eye-to-eye
Lap time	Approximately 5.15–5.30 seconds
Operating RPM	Approximately 9,800–10,000 RPM

This isn't intended to be a universal recipe for every O.S. 46LA.

It's simply the combination that has proven itself on ***my airplane, with my engine, and with the way I fly.***

What I Learned

Looking back, there wasn't one modification that suddenly made the O.S. 46LA a great engine.

It was the combination of many relatively small improvements.

The biggest lesson I learned is that *consistency is more important than maximum power* for precision aerobatics.

I don't need the engine to make every ounce of power it possibly can. I need it to produce the right amount of power, at the right RPM, and do it the same way every time I fly.

The propeller, venturi, fuel, needle valve, muffler, glow plug, fuel system, and airflow all interact with one another. Changing one component can affect the way another component behaves.

I also learned not to overlook the simple things.

- A burr inside a spraybar.

- A cracked backplate.

- A glow plug that is beginning to fail.

- A fuel-line pinhole.

- A cowl interfering with the venturi.

Any one of these seemingly minor problems can turn a good engine into an unreliable one.

After years of experimenting, I finally have an O.S. 46LA that starts easily, runs smoothly, pulls consistently, and gives me confidence when I walk out to the handle at a contest.

And that, more than anything else, is what I was trying to accomplish.

I hope this information helps someone else avoid some of the trial and error I went through.

Just remember that what works on *Big Blue* may not be exactly what another airplane needs. The fun—and sometimes the frustration—is figuring out what combination works for ***your airplane, your engine, and the way you fly.***

And, by the way, I use essentially these same modifications on my O.S. 25LA engines as well.

May your lines be tight and the wind always at your back!

Dennis S. Nunes