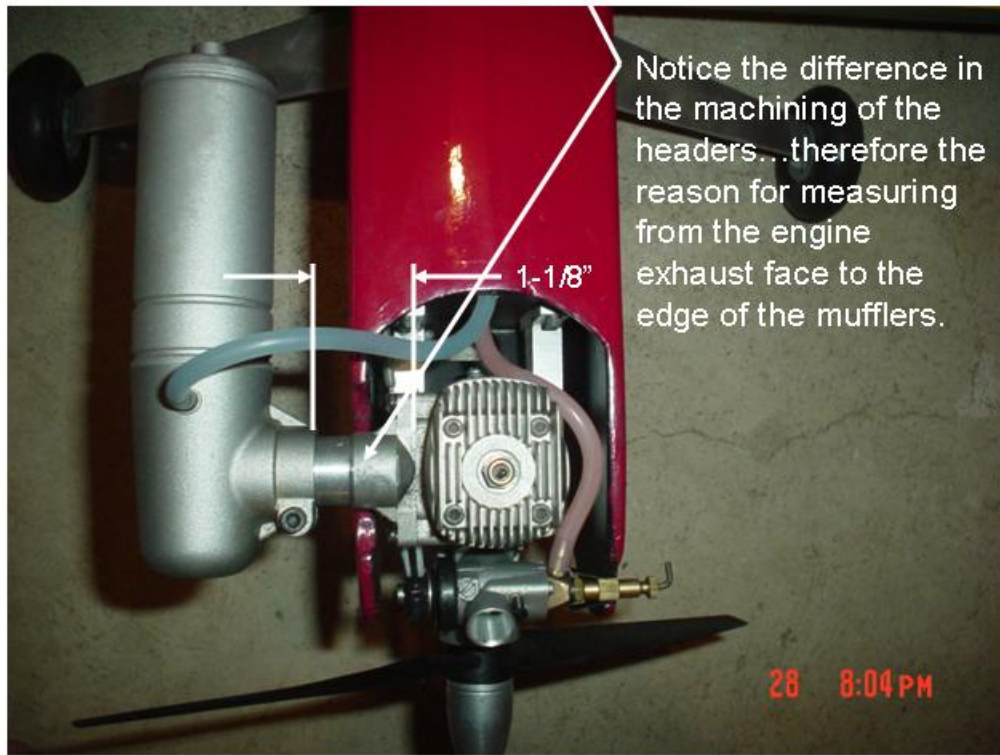
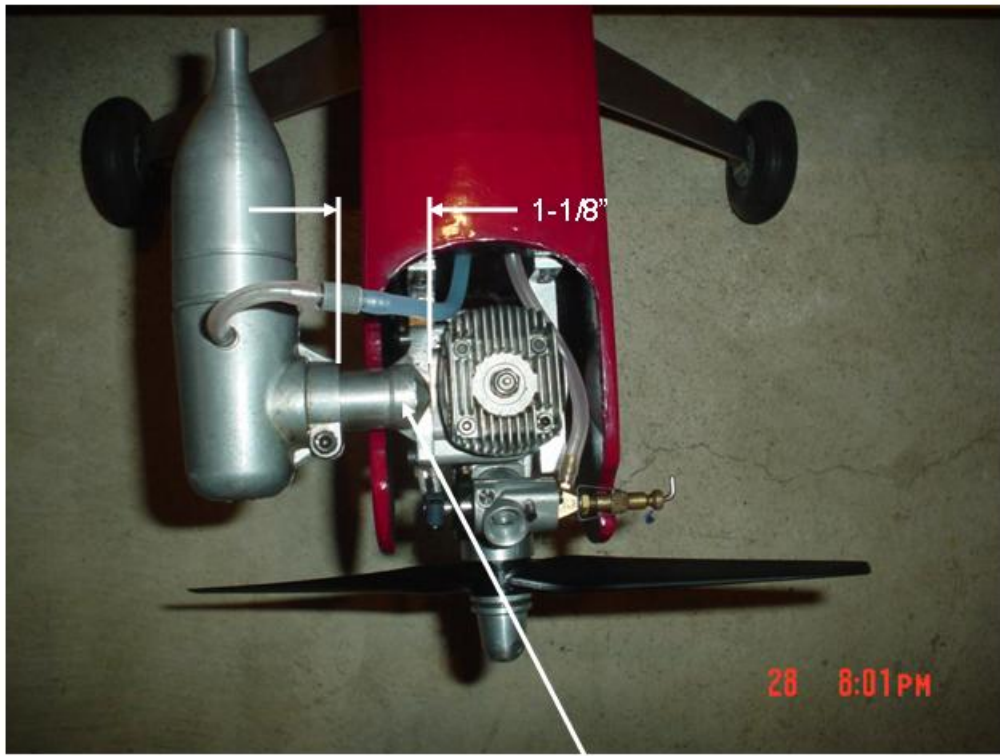


What makes a SIG Four-Star-40 FAST?

By Paul F. Geders Revised September 13, 2012 *Current changes in red.*
Previous revision was August 3, 2010

Decided to document everything I can think of that will make a SIG Four-Star 40 fly as fast as it can. Let's get started right at the nose.

- I use an OS type spinner nut. Some pilots like to use a 2 or 2 ½" spinners to help with streamlining the front of the airplane. Your choice. I personally think it takes more horsepower to turn the spinner, or translate that to loss of RPM too, especially in the turns when you are fighting the gyroscopic effect of the spinner.
- It has come to our attention that some individuals used Master Airscrew 10 X 7 propellers...and guess what they were faster and didn't have to work very hard at beating the competition. So make sure you have a 10 X 6 propeller installed. Thus, the reason we wanted everyone to change propellers after every heat from the club furnished 10 X 6 propellers. However, that rule was rescinded and is no longer in effect.
- Propellers must be cleaned up and balanced. First remove any white paint/labels, etc. with acetone. Then use a straight edge razor blade, 90 degrees to all surfaces, to remove the sharp leading edge of the prop by smoothing it out from hub to tip. A slightly rounded leading edge is much better than a sharp one. Use the razor blade to sharpen the trailing edge and remove any flashing. Then, use the razor blade to remove material from the "face" of the prop (part that has the white paint label on it, or the curved surface of the prop) to balance it. Never remove material from the aft part of the prop...it's what is doing the work. A balanced prop is probably the most important part since it is doing all the work.
- The muffler that currently comes with the engine has a flat aft face and has been shown to be about 400 RPM's better in the air than the one sometimes referred to as the "Coke bottle" muffler that came with earlier Italian made engines (This is not the economy muffler which is a small cast type muffler and will lose you about 1,000 RPM) You should set the inboard edge of the muffler, where it mounts on the exhaust extension tube, 1 and 1/8" from the engine face. This is the optimum tuned position of the either muffler. See picture below.



- **I used to use Cool Power 15% and K&B-1L plugs in all my engines. Castor based fuel such as Omega 15% has one benefit in an older engine. It has a little better sealing capability between the ring and the cylinder wall over Cool Power...thus slightly increasing the compression and power output. Exclusive use of a castor oil based fuel will slow your engine down over time, and is a little messier to clean off. Morgan Fuel has come out with a “Multi-viscosity” synthetic oil blended fuel. Some individuals have claimed large RPM increases. To verify any advantage of running one fuel over another a Fuel Comparison Analysis was performed. Below are the results.**

Fuel Comparison Analysis					
O.S. FP .40 Plain (Bushing Type) Bearing with 10 X 6 Master Airscrew Prop.					
					Head Temperature at base of glow plug
		Max. RPM	Δ		Δ
15% Omega		12,254			320° F
15% Cool Power		12,305	+ 51 RPM		351° F
15% Cool Power Multiviscosity		12,355	+ 50 RPM		347° F
Super Tiger GS-40 (Ball Bearing Type)with 10 X 6 Master Airscrew Prop.					
					Head Temperature at base of glow plug
		Max. RPM	Δ		Δ
15% Omega		13,837			286° F
15% Cool Power		13,799	- 38 RPM		311° F
15% Cool Power Multiviscosity		13,837			320° F
Analysis performed on September 13, 2012, Temperature 82° F, Relative Humidity 42%, Dew Point 57, Barometric Pressure 30.18 inches					

The results were surprising, but one thing that stands out is the fact the castor oil based fuel will dissipate heat a little better than straight synthetic oils. Omega is 17% lubricant of which 30% is Castor & 70% is Synthetic Blend. Cool Power is 18% lubricant which is 100% Synthetic. Cool Power MV is also 18% lubricant and also 100% Synthetic. Sig makes a “Champion 15” which is 20% lubricant that is ½ Castor and ½ Klotz (synthetic).

You can only get so many BTU’s out of a fuel and there are no magic oils that will increase RPM’s in large amounts. We have tried them all from Jet Engine turbine oil to Slick 50 Teflon filled type oils and it is very hard to beat a Castor and Synthetic blend. Reduced friction and heat dissipation are the keys to consistently good running engines. One last note, a lean run on Synthetic based fuel is not as forgiving as a lean run on Castor oil based fuel.

- **The needle valve assembly must be properly aligned in the carburetor. To set/align it correctly, remove the high speed needle valve and then the 2 small screws that retain the brass needle valve body into the carburetor body. You will notice a slit in the brass needle valve body that is also shape like a football. This is the area that you want pointing directly down the center of the throat of the carburetor barrel to get the maximum mixture dispersal. When you reassemble the brass needle valve body back into the carburetor body ensure that the slit is centered and facing downstream of the incoming air. The fuel nipple (where the fuel line from the tank attaches) will point slightly down and point to the center of the cast-in-machined-off “G40” on the side of the crankcase. This will ensure that you are getting the most efficient fuel flow and dispersion of atomized fuel into the engine. Every little bit helps! Some will see a little RPM increase...some will not!**
- **Ensure that the carburetor barrel opens completely and is in-line with the carburetor body as if a hole was drilled the there wasn't a rotating barrel there. You don't want it to be ever so slightly closed or going the other way too far open. RPM's can also be gained right here. Anything that makes it easier for an engine to breath results in more power, hence speed. Remember, pylon racing is a “drag” race. It is the airplane that can come out of a turn (where the plane actually slows down) and accelerate the fastest to its top speed!**
- **The Super Tiger engine should be broken in with a 9 X 6 Master Airscrew propeller and taken to maximum RPM and then backed off 300 to 400 RPM and let it run the tank dry. You may see an increase in RPM while it is running. Then, VERY IMPORTANT, let the engine cool completely. Restart, and go to maximum RPM again and then back off 200 to 300 and let it run, with a few excursions from factory set idle to full RPM for another full tank. Let it cool completely. Now, refuel, restart and set the engine to maximum RPM and back off the needle 3 clicks...it should hold the same RPM within those 3 clicks. Set the idle mixture by bringing the throttle to the idle position and then start leaning out (turning the idle mixture screw clockwise) until the engine quits. Back out the idle mixture screw ½ turn, restart, and try some rapid transitions from idle to full power. If the engine hesitates briefly and quits it is too lean...back out the screw about a ¼ turn. Check it again for rapid transition from idle to full power. If the engine hesitates for a longer period, and then goes to full power it is a little rich and you need to lean it out a ¼ turn, or less. Once you have a rapid throttle response, without any hesitation, you are now ready to put on a 10 X 6 Master Airscrew propeller. Remember, the above will give you a consistent idle so you can land with the engine running, every time.**

- **Setting the engine for racing...** Here's how you do it! First, which muffler are you using? If you are using the flat aft face muffler, the do the following. Turn your needle valve in to maximum RPM, say it's 14,500. Now slowly back out a click at a time until you see 14,200. Now, slowly continue to turn the needle richer and watch the RPM. If **EVERYTHING IS SET UP RIGHT**, you should be able to turn out the needle, 2, 3, up to maybe even 5 clicks and not see a loss of RPM (14,200). Set it here and fly it. This is the rich side of the tuned muffler and when you get in the air it will really start to pick up. If it doesn't really get going on about the third lap then go only one, and no more than two clicks leaner on the next flight. You should be listening to the engine accelerate out of a turn if you are set right. If you are using the "Coke" bottle type muffler, turn your needle in to the maximum RPM and back off a couple of clicks, or until the RPM drops just 100 or 200 RPM. This should be the way you set the engine on race day...and leave it alone all day, unless a storm front is moving through, or you nick or break a propeller.
- The propeller can be "twisted" to increase or decrease pitch to achieve either higher or lower RPMs when you start it. However, as soon as you launch it and make that first turn the prop will return to its original "un-twisted" pitch. If we were all taking off of the ground simultaneously this may be a slight advantage to get you into the lead...but it doesn't last...but if you can stay in the lead...! Since we do a "flying start there is no advantage. If you don't like the RPM your propeller is turning, try another one!
- Propeller selection can make a big difference. For instance if you use a Master Airscrew 10 X 6 Scimitar and it turns 15,000 RPM on the ground but, when you fly it doesn't seem to go as fast as the other airplanes. Here's why. The engine is not continuing to accelerate down the straight- a-way; it is at full RPM right out of the turn. What you want is to have the engine come out of the turn and hear a change in the engine sound going from deceleration (which happens in a turn) to a slight acceleration. If you listen even more carefully you will hear the engine get to maximum RPM at about 5/8 to 3/4 the way down the straight-a-way. And the prop may only be turning 14,100 to 14, 400 on the ground but it is "working" in the air, not just turning a lot of RPM on the ground and going no where in the air.
- The engine mounts, by our rules, are allowed to be lowered 1/4" to reduce the chance of the engine cutting out in the turns...I think it is a good thing to do!
- Another idea is to put a check valve in the muffler pressure line to keep the "head pressure" in the tank more consistent. Be sure to disconnect it when refueling and slowly go to idle from full power. This in no way increases the RPM...since you have muffler pressure

there anyway...it is just more stable in the turns.

- The landing gear can only be chamfered and not have a full radius to be in accordance with the plans. No real advantage anyway.
- I like to seal the canopy by gluing (RC 56)/epoxy (5 minute) it all the way around, especially on the forward facing part of the windshield versus screwing on the canopy. I feel it is a cleaner, less drag installation.
- The fuel tank should be mounted in foam and have the clunk free to fall easily from one corner of the tank to the other without hitting the back of the tank...but as close to hitting as possible. Use a single vent tank and muffler pressure. Make sure the fuel lines are not pinched nor have pin holes in them. This will definitely affect the adjustment of the carburetor relative to number of clicks on the rich side of the muffler.
- Some pilots don't fill their tanks all the way...to save weight. Lighter is faster when all else is equal. You can experiment with how much to put in if you want. All you have to do is figure out how long you will be in the air during mill time before the start of the race...go ten laps, and then land with the engine still running. Is it worth it...to me no, I just fill up and go for it.
- Since the aircraft are all built to the kit or the ARF version the next thing to check is to make sure you balance the aircraft correctly. I like mine to hang about an inch low in the tail. Yes, just a hair tail heavy...why? The airplane will turn faster, and tighter.
- Check to see if you have a heavy wing by setting the airplane on bench with the lower part of the rudder (in neutral) setting on a surface that allows you to pick up the airplane in a level pitch attitude by the propeller which is held off of compression and allowed to freely pivot. If a wing drops, add appropriate amount of weight to opposite wing so that the wing remains level while doing this. Now you are balanced in both pitch and roll and the airplane will be that much easier to fly.
- The rules state use the size wheels shown on the plans in both diameter and width. I use the lightest weight properly sized wheel and tire available.
- The wing has ailerons that are shown flush with the lower surface of the wing when they are in neutral. If you raise the ailerons on both sides and equal amount (about 1/8") you will go a little faster. It's a sailplane trick! You know...like re-flexed airfoils

- You should set up your controls/transmitter such that a full up elevator position gives you the tightest turn without slowing down, or buffeting.
- Last, but not least, find a way to get your airplane to weigh exactly on 4 and $\frac{3}{4}$ lbs, that's 76 oz., without fuel. If you weigh more than this and everything else being equal the lighter airplane will accelerate to its top speed faster...Every little bit counts!
- **Flying the course:** Obviously after setting up the airplane correctly this is probably the most important part of racing. If you are flying in a crosswind, say in your face, you probably want to "snap turn" on both ends of the course. If the wind is coming up/down the course you may consider a "snap turn" on the downwind turn and a more sweeping turn on the upwind side...every little bit helps. Also, you gain the most distance in the turns with all else being equal...work on flying as close to the pylons as necessary to either stay ahead, or gain ground. When you come out of a turn you want to fly slightly downhill to unload the wing which reduces drag. Try to avoid climbing, and climbing turns. Avoid traffic jams...fly above or below if at all possible. Don't get into a one-on-one race unless absolutely necessary. If you hear someone ahead gets a cut...make sure you don't cut too. Stay relaxed, look ahead, and let the race come to you. This is based on years of close Q-500 racing.

I believe that covers everything that I can think of! Give it a try, and remember you still have to fly the course...but, with a properly set-up airplane it is so much easier to do.

If you can think of any other "speed tricks" let me know...I will add them to the above list and keep this posted on our web-site.

Lastly, see [2 Pylon Race Course Calculator](#) to see how flying close to the pylons makes a lot of difference in feet behind the winner if you all fly the same speed.