Tuning Tips, Maintenance and Troubleshooting

by Mike Cathey

The challenge of the past few years in 1/8th scale racing in the Pacific Northwest has been to get the boats to slow to a crawl at the start in lane 1 and then accelerate hard to the first turn. Very few have been able to accomplish this with a single needle carb. One way some of us got around this (somewhat) was to train ourselves to roll into the throttle rather than snapping it wide open. The other way is to use a 3rd channel with an onboard adjustable high-speed needle valve. Starting off rich so the boat will take a start, then leaning it out once the boat is at full speed. The 3rd channel needle valves also work with 2-needle carbs. I can't remember how many times I've seen guys struggling to find a tune and no adjustment to the needle helped, they just stayed lean. Most of time it is because a piece of crud is in the needle valve seat. Sometimes it is a piece of plastic flashing from the inside of the tank, a piece of carbon or pipe coupler material from that has made it through the pressure tap from the tuned pipe. A lot of people run fuel filters. Most fuel filters are directional and have to be installed correctly to be of any use. Always back flush you needle valve with some brake clean before you even start the tuning process. I blow mine out several times during the day, especially in hot weather when the nitro can gum them up.

When you initially do the radio install and throttle set up try to have about a 1 mm opening of the carb barrel at idle. Remember you can always adjust this with the radio throttle trim later without affecting the top end throttle barrel opening. Many radios have an "Idle Up' feature that allows a higher idle until you turn it off at the transmitter after the boat is launched.

An important safety tip is to always make sure you can shut the motor down by having enough servo travel to completely close the throttle barrel. Setting up your failsafe is also a critical safety feature protecting your boat and your fellow competitor's equipment. In my opinion a boat that cannot be shut off, should never be launched.

Tuning Single Needle Carbs

The best way to adjust a single-needle carb for all around performance is start off rich and tune to lean. You can use a lot of your senses to determine if the motor is too lean right on the bunk. If the motor idles too fast, the exhaust sounds too hollow or raspy, the exhaust from the motor smells burned and it makes your eyes water, it is too lean. A flow meter can be indispensable in helping to establish a baseline.

Once you have established that the motor is on the rich side, test run the boat and assess the performance. If it launches and accelerates easily but has no top end, you are probably too rich. Lean it up in small increments until you get a good all around

performance. You want it to take a reasonably slow start, have decent acceleration and good top end performance. Once you get what you want, let the motor cool off and flow it.

A motor that it running lean will generally speed up in the turns (as the prop unloads) and sag coming off of the turns and will take a long time to come up on the pipe from a slow speed, if at all. A lot of times the boat won't come up on the pipe until you get to the turn. Sometimes you just might be trying to use too big a propeller and once the boat slows down you might never get it back up on a plane. There is just not enough grunt in the motor, no matter what the tune is.

2-Needle Carbs

There are a lot of performance advantages to be had by using a 2-needle carb. The engine will have much better performance at all levels of the RPM spectrum. A properly tuned 2-needle carb will give you a solid idle, snappy acceleration and outstanding top end. The low-speed needle will handle the fuel flow from idle to about ¼ throttle and the high-speed needle from there on up to full throttle.

The most common 2-needle carb that has been adapted to our 1/8th scale unlimiteds boats is the O.S. Max 9B. I have seen these mounted on Picco's, CMB's. Kalastrotov's and even Mac's. The newest version of the CMB Hydro Greenhead motor comes with a 2-needle carb that performs and tunes very much like an OS 9B carb. One advantage the CMB carb is that the low-speed needle has a 5/16th hex head that is more easily adjusted than trying to get a screwdriver in from the side as you do with the OS 9B.

Tuning 2-Needle Carbs

Start by over richening the low-speed needle. You basically want to take it out of the picture while you work on getting the high-speed needle right. Again, start by over richening the high-speed needle. Run the boat and keep leaning it out until you get the top end performance you want and the glow plug has a good read. This is the critical adjustment. The reason you must tune the high-speed needle first is because the high-speed needle controls the amount of fuel that the low-speed needle receives because the fuel flows from the fuel line to the high-speed-needle and then on through to the low-speed needle.

Once you have the high-speed needle set you can start adjusting the low-speed needle. Fire up the motor and let it warm up on the bunk. Give the throttle a good solid blip. If the low-speed needle is right, the motor should snap right up to with no bogging or coughing.

Symptoms of a low-speed needle that is too lean.

a. Upon starting the idle rpm increases and then the motor dies. Richen it up until you have good steady idle and the motor snaps up to full speed without any hesitation.
b. If upon starting, the motor misses from idle right up high speed when you crack the throttle wide open, then both the low *and high-speed* needles are too lean. Richen the needles and retune the high-speed needle again. Back on the bunk lean out the low-speed needle until the idle starts to drop and a reliable idle is attained and the motor snaps right up to full throttle with no hesitation.

Symptoms of a low-speed needle that is too rich.

Upon starting a warm motor the idle starts off high and then gradually decreases and the motor dies. Lean it out in small increments until a reliable idle is attained and it snaps up to full throttle without any hesitation or bogging.

More Tuning Techniques

Tuned Pipe Adjustments

Another tuning method is to move the tuned pipe in and out. This affects the mixture as well. Lengthening the pipe tends to richen the mixture and conversely shortening it will cause a leaner mixture. Moving the pipe in less than ¼" increments probably won't bring any discernable differences in performance unless you are really, really close on your optimum set up. Some people measure pipe length from the back of the water jacket to the weld on the pipe, others from the glow plug to the weld. I like measuring from the glow plug as a standard because that won't change from engine to engine. Lengthening the pipe can compensate for hot weather or sites that are high above sea level. The boat may look slow to you, but if you look around so does everyone else's. The motor just isn't going to make the power it will at sea level on a cool day.

Engine Temperature

Monitoring engine temperature can be critical to good overall performance. A motor that is running cold will never work well at slower speeds. The digital, instantaneous spot engine temperature gauges are a great tool to find out where you are at. One long time boater tells me if he can hold the water jacket for a couple of seconds before he gets burned it is just right. Getting a temperature gauge sounds like a less painful way to determine if the motor is running at the right temperature. OK, call me a sissy but jeez!

If the motor is running cold one of the easiest ways to adjust the flow is fit a piece of the next size smaller water cooling tubing in an easily assessable place. Many guys make water line restrictors out of wheel collars or a 3/8" Nylon nut that has an 8/32" hole drilled and tapped through one of the flats toward the center. Use an 8/32" Nylon screw with an 8/32" Nylon lock nut to pinch the water line. Sneak up on it so you don't fry a motor.

If the motor is running hot, check for holes in the tubing or restrictions. Be aware that sometimes the restriction will only happen with the cowling or fake motor is installed. When you push the fake motor or cowling down it pinches the water line. **You should always have a good overboard water flow.** Checking the overboard is something you should always look for on the mill. Sometimes if the ambient water is really warm you might have to water cool the exhaust. In warm ambient water cool the water jacket on the motor and then plumb it to the exhaust header and over the side. If the water is really cold (like we experience here at some of our sites in the Pacific Northwest in the spring) it is better to run the water through the exhaust header first and then through the water jacket on the motor and then overboard.

Reading the Glow Plug

Another method of determining how your motor is tuned is to examine the glow plug. Look at the second or third coil of the platinum element. If it is shiny and oily you are too rich. If it is really pulled out and white it is too lean. The perfect tune will show a coil that is slightly pulled and a little frosted looking. If the outside of the plug is starting to turn dark there are several possibilities such as too lean a mixture, inadequate cooling water flow or perhaps a bind in the cable/stuffing box due to a broken motor mount, rubber isolator (the rubber isolators should be changed every couple years as the fuel destroys them) or the prop shaft bushings/bearings are coming apart.

No matter what adjustment you make, such as adjusting the needle, lengthening the pipe or changing propellers-*make one adjustment at a time*. Otherwise you don't know what the heck you did that changed what. Been there, done that, sold the tee shirt.

My experience is that if you go out for a heat and you find you are too lean don't back out the throttle much (even in the mill-this is where your coach earns his pay) because if you slow down the motor will probably die. Better to just keep the speed up quite a bit and take a start in lane 99 and you just might finish the heat and grab some points.
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Annual Maintenance

Radio Gear, I have found that one good way to avoid radio problems is to send all my gear (Tx, Rx's, and servos) back to a service company to have it all checked right after the regular season is over. The total is usually less than a $100 and the piece of mind is well worth it. Most of the people who have been doing this for awhile also replace the receiver switch every year. You cannot see any corrosion in the switch and if it fails, your failsafe functions will not work at all. This has disaster written all over it. I buy a new receiver battery for each boat every year and relegate last years battery to a back up. I have seen some beautiful boats lost because of bad batteries. Usually the wire gets brittle or corroded and breaks or a solder connection fails. Invest in a battery cycler/charger. This is the only way to make sure your batteries are working in top capacity. Some people prefer using alkaline batteries for their transmitters because alkaline cells are 1.5 volts each. Nicads or Nickle metal Hydride cells are 1.2 volts. Remember that when your transmitter is down to 9.5 volts, the transmitter range is cut in half. Using alkaline cells allow you to start off the day with higher voltage and makes changing them out a simple process if they get low on voltage.

Fuel System, Without a doubt I have seen more boat problems be traced back to a problem in the fuel system. Every year the tank stoppers should be replaced with new ones and new tubing formed and installed (the exception on the tubing would be if you are using stainless steel). Brass tubing will corrode, crack and weaken in the course of a single season. The minimum tubing size for a .67 engine is 5/32". Dubro makes a tubing bender (p/n 786). K & S also makes a tubing cut-off tool (p/n 296) that makes this job much easier. Sullivan manufactures a spun aluminum stopper set (p/n 478) with a 4/40 stainless steel clinching screw that really allows you to crank down on it without stripping as the plastic stoppers (p/n 296) can do.

Leaks in the fuel system can usually be detected by examining the tubing to the carb. If you see air bubbles in the line you have a leak somewhere. This almost always manifests itself in a lean running condition.

If the boat runs good for a couple of laps then the motor leans out and dies, the fuel pick up line in the main tank is either cracked or broken.

Engine Bearings, Almost everyone replaces the engine bearings at the beginning of the season. I also change mine about half way through. Typically, bearing problems become apparent when you can't get a tune no matter what you do or the motor runs OK for a couple of laps, gets up to operating temperature and then lays down on you. I have had good luck really pickling the motor good with after run oil (like JB 80) and then tearing the motor down when I get home, cleaning it with brake clean, blowing it out with air and lubing (Risoline works good, it has lots of additives for anti-rust and anti-corrosion) and reassembling. This gives me an opportunity to examine the motor and bearings and most importantly, eliminates one more race day headache.

Checking your boat out after a race, Look for loose nuts, bolts servos, radio boxes and motor mounts. Hull cracks. Dinged propellers, rudders and turn fins. Blown exhaust couplers. Chafed, cut or worn fuel and water tubing. Radio box pushrod seals. All this stuff is way easier (and a lot less stressful) to fix on the bench at home than it is on race day morning. Race days should be fun, instead of a thrash. In any form of racing preparation is always one of the keys to success.

Drying out wood boats, A wood boat can pick up as much as a pound of weight during a race season if they are not dried out. This also leads to wood rot. You can buy an aquarium pump and all the fittings and tubing for less that $20 at a pet supply store. Feed the lines up into all your drain holes and let it run for a couple of days and it will carry any residual moisture out. I know this works as I have popped the decks off a couple of my 5 year old boats and they looked as if they were built last week.

Race Day Rituals

Many new boaters need to develop habits that will make them successful. Here are a few things that have been helpful to me. ***Above all else, approach the day resolved to have fun.*** This can be a frustrating hobby when things aren't going your way. Try to learn from days like this. It is usually is indicative of some aspect of boat preparation you haven't been paying enough attention to. If the boat won't run, your wings just got run over and maybe the calls aren't going your way-just relax and enjoy some of the really great people that are in our hobby. Remember, it's only a model boat race; not life and death.

1. Make sure you have the frequency pin.

2. Range check your radio- ***before*** you go out on the water for the first time.

3. After every run.
   a. Remove the glow plug, read it and check that it still ignites.
   b. Remove the fuel line, place a rag over the glow plug hole and blow the motor out to remove any water that might have gotten gotten in it when the boat came off plane.
   c. Blow the needle valve out with brake clean.
   d. Refuel the boat.
   e. Check for loose parts and re-tighten as necessary
   f. Check the prop, rudder and turn fin to make sure were not dinged by running over something in the water.

4. Every other run.
   a. Grease the cable if you can do it without removing it.
   b. Grease the strut.

5. If you use a flow meter, wait until the heat before you are up to flow. Weather conditions can change the tune in a hurry, so you want to be current.

I hope this helps some of you enjoy our hobby more. I want to thank all the people who took the time to help me over the years. Remember once you learn what you are doing; pass it on to the new guys. If your day is going good take some time to help someone who is struggling. After all, they might be kicking your butt one day and they might be more willing to share some their speed secrets with you!