TAKE A SHOTGUN TO YOUR NOSEPLUG

by George White

When we build an "Old Time" performance model, most of us follow the "old time" tradition of building a nice square nose block, or at least one that fits the shape of the front end of our model, then add a box like structure to fit snugly inside the nose of the model. We hold the nose block onto the model with a rubber band rig of some sort. Then, if we need to make adjustments, out come the good old shims. Works like a charm, so why screw around with something that works?

Occasionally, there comes a time when the old time methods just aren't good enough, especially when you're dealing with either a scale ship or a nice endurance model you want to enter into a SAM beauty contest. There are such alternatives as using magnets or spring catches to hold the nose block on, both of which I've used, and they work. Perhaps your models fly right off the board and the thrust you built in is just right. Mine seldom do. I start gluing in shims and by the time I get the thing trimmed I've got a nose on the model which resembles a frog's ass stitched up with a logging chain. Then the magnets don't connect or the spring catches don't catch.

In a recent issue of this rag, Mike Isermann wrote an article on the merits of using a round nose plug. After talking to and stealing ideas from Gene Smith, I've devised an accurate method of making a nose plug which is much simpler than Mike's and is repeatable with little effort. I'll also describe how to change the thrust settings without using shims.

All you need are some "high brass" shotgun shells and some brass tubing. A 10 gauge shell will make a nose plug which will easily allow you to use a 3/4" OD blast tube, or a 13/16" blast tube with a tight fit. A 12 gauge shell will allow you to use a 3/4" tube — the fit will be a bit tighter, but very usable. A 20 gauge shell will allow you to use a 5/8" blast tube. For very small models such as dime or peanut scale, you'll need to revert to nested brass tubing, which I'll describe later

Here's a step-by-step procedure to do this. It's a bit of a pain to make the tools, but once you've made them, life gets pleasant and flexible. You can't ever have too many tools!!

1. You need to acquire an empty 10,12 or 20 gauge **high brass** shotgun shell, depending upon how large a blast tube you need. The 10 gauge is better than a 12 gauge, but finding someone who is brave enough to shoot a 10 gauge won't be easy. You may need to buy a small box and have them emptied and the primers removed by a gunsmith or someone who knows how to handle ammunition. You'll then have some to give away. If you aren't competent with ammunition, **do not** try to empty a live shotgun shell yourself, and **do not** try to remove the primer of a shell which hasn't been fired unless you know what you're doing.

2. Once the shell is emptied of powder and shot and the primer has been removed you can start to work. If the shell has been fired, you can can simply tap the primer out with a hammer and punch — just be sure it's been fired. Cut the plastic shell casing off leaving about 1/8" extending beyond the brass. This extra 1/8" will help you remove the remaining plastic later. You'll then notice that in the bottom of the shell is a grayish cup-shaped area, the purpose of which was to focus the blast of the powder. It's made of tightly coiled paper, and can be difficult to deal with. After much experimentation, I finally learned to drill a series of 1/16" holes, close together in that cupped area all around the circumference of the primer. Don't drill all the way through the back of the shell. Then put the shell in a pan of water and boil it for about 15 minutes. While it is still wet, stick the tines of a needle nose pliers into the holes you drilled and literally rip the paper out of the shell with the pliers. Trying to grind that mess out with a dremel tool is an exercise in frustration. When you're finished you'll see the brass back of the shell and the plastic shell casing still inside the brass. Take a dremel tool with a burr and grind out the plastic.

3. Then, using a reamer, gently ream out the primer hole until a 2" long piece of 1/4" brass tubing will fit snugly into the primer hole. Use a reamer, **not** a drill bit; take your time to do this carefully to ensure that the 1/4" brass tubing fits snugly. With the brass tubing inserted into the primer hole, chuck the tubing into a drill press. Tap the shell onto the drill press plate to ensure it is not crooked and turn on the drill press at a low speed to check that the shell is running true. Being careful not disturb the alignment, remove the tubing/shell from the drill press, sit it onto a concrete floor and solder the tubing into the shell. I used silver solder and a cheap Radio Shack soldering torch powered by lighter fluid. You'll need a torch to get everything hot enough to get the solder to flow (lots of flux is necessary). I imagine JB Weld epoxy would do the trick just about as well because there's not a great deal of torque stress involved in cutting balsa.

4. After you've got everything soldered together, take a sanding block with 80 grit sandpaper or a course file and stroke the edges of the shell inward at 90º to the radius to create a rough cutting edge. Check to ensure that the edge roughness extends toward the inside of the shell to allow a kerf gap on the plug, otherwise getting the plug out of the shell after you drill it will be difficult. Ask how I know this.

For very small plugs, you can use nested brass tubing from your friendly hobby shop, reducing the sizes only to make it fit into your drill press. The nested tubing **MUST** be secured with CA. Soldering will warp the tubing. You're now in possession of a plug cutting tool, either from a shotgun shell or nested brass tubing as shown in the photos.

Here's how to put the plug cutter to use.

1. Glue enough layers of 1/8" balsa together to create a solid nose of the model, such as the finished one on the right above. Make the height and width slightly larger than the front of the fuselage to which the nose will be glued. This will allow small adjustments when you get ready to finish the nose block. The nose block needs to be at least 1/2" deep to ensure a securely fitting nose plug.

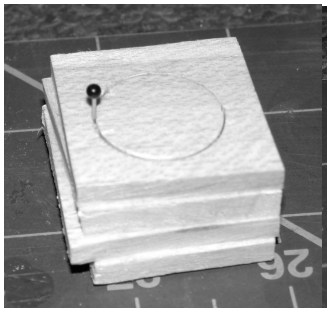
2. Hold the rough nose block against the front of the fuselage and mark the point on the front where the prop shaft will exit the nose.

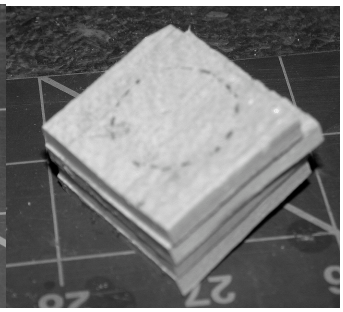
3. If there is to be a spinner faired into the nose block as is often found on WWII inline engined aircraft and some round nose SAM models, you must determine the diameter of the spinner at this point and using a draftsman's compass draw a circle around the prop shaft mark equal to the size of the spinner. **DO NOT** shape the nose block or glue it to to the fuselage at this point.

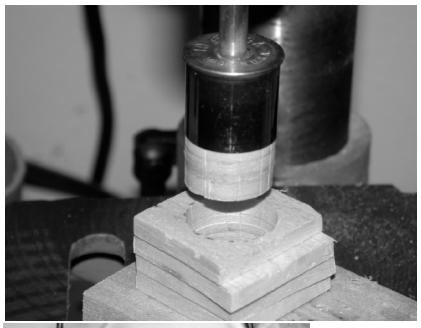
3. Determine the size of the shotgun shell plug cutter you want to use. It will need to be at least 1/8" smaller in diameter than the spinner. If there's no spinner, use as large a cutter as you wish.

4. Chuck the shotgun shell plug cutter into the drill press. Center it on the point at which the prop shaft will exit the front of the nose block. Using the draftsman's compass centered on the prop shaft exit mark to draw a circle the size of the plug cutter will help. If the nose block is very deep, the plug cutter may not go all the way through.

No sweat. Just drill as deeply as you can, remove the plug cutter and push straight pins into the kerf left by the plug cutter, ensuring that they go all the way through the back of the nose block. Then, take a pencil and mark the points where the pin protruded on the back as seen in the photo on the right below. Center the plug cutter on the marks you've just made and drill the plug out from the rear, giving you a clean, accurate plug to fit into the nose of the model.

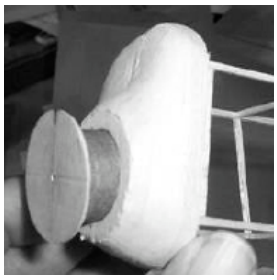






You can see in the next photo where the pins left their marks on the plug as it is removed from the nose block.

Once you have the plug cut, go ahead



and finish the nose of the model as shown in the photos below of Gene Smith's Smoothie racer and glue it to the nose of the fuselage

Once you have the nose of the model shaped the way you want, it's time to finish the plug.

1. Cut a circle the same size as your spinner out of 1/64 ply (1/32 ply if you're going to use the equivalent of an 18 wheeler inner tube for a motor). If there's no spinner, the size of the circle isn't critical, but in either case the circle must be about 1/8" larger in diameter than the plug you just cut, as seen above. Glue that ply circle onto the face of the plug.

2. Determine the combination of right and down thrust you intend to use. Most of us start with 3º right and 3º down, so for illustration purposes I'm going to assume you do that as well. Make yourself a drilling jig which will allow the nose plug to rest on it at a 4º angle. Now as you can see from the table of thrust angle settings further below, that will actually only get you 2.8º right and 2.8º down. If you are skilled enough to drill at angles in fractions of degrees, you can get an actual 3ºR3ºD if you drill the hole at 4.2426º!! To save yourself the trouble of borrowing your kid's Trigonometry book, just make a 3" square piece of wood and prop one edge of it up as shown in the following table and you'll have the correct angle. Drill the hole in the plug through the center of the plywood disc for the prop shaft. I've shown the tangents in this table just so the engineer readers can waste time checking my numbers!!

Thrust Angle	Tangent	Block Height at 3"
0º	0	0"
1º	.01745	3/64"
2º	.03492	3/32"
3º	.05241	5/32"
4º	.06993	7/32"
5º	.08749	17/64"
6º	.10510	5/16"
7º	.12278	3/8"
8º	.14054	14/32"

3. Go ahead and install whatever thrust bearing/prop shaft

bearing you care to use, and place a mark on the ply disk at the point where the prop shaft is pointing down the most.

4. You'll notice that the plug fits too loosely in the nose block at this point. Simply wrap bond paper around the plug, gluing it with white glue until there is enough to compensate for the kerf remaining from the plug cut. Make sure it fits snugly in the nose.

5. After winding and preparing to fly, since in our illustration we want to have 3º right and 3º down, all we need to do is insert and rotate the plug so that the mark you made in 3 above is at the 7:30 o'clock position. When you're trimming, you can rotate the plug one way or the other as needed to give more or less right thrust/down thrust combination as seen in the table below. You may need to pin the ply circle in place so it doesn't rotate while trimming

6. Here's where the flexibility of this system comes into play. Suppose you find that you need more right thrust but the down thrust is OK. You'll have to make a new plug, but that is a simple process. Just stack up and glue some scrap 1/8 balsa such as you see in one of the photos above and cut another plug adding whatever angle you you need based on the table below. The plug will match the original one perfectly.

7. When you've gotten the model "dialed-in" insofar as thrust is concerned, cut a key slot in the nose block hole and glue a 1/16" square key to the nose plug. Now you've got a nose plug which will stay in place with a consistent thrust pattern.

Table of Approximate Thrust Angle Settings Using a Round Nose Plug

Nose Plug Shaft Angle	Rotation Angle From 180º	Side Thrust	Down Thrust
3º	30º	1.5º	2.6º
3º	45º	2º	2º
3º	60º	2.6º	1.5º
4º	30º	2º	3.5º
4º	45º	2.8º	2.8º
4º	60º	3.5º	2º
5º	30	2.5º	4.3º
5º	45º	3.5º	3.5º
5º	60º	4.3º	2.5º
6º	30º	3º	5.2º
6º	45º	4.2º	4.2º
6º	60	5.2º	3º
7º	30º	3.5º	6º
7º	45º	5º	5º
7º	60º	6º	3.5º
8º	30º	4º	7º
8º	45º	5.6º	5.6º
8º	60	7º	4º

Example: If you need 3º right thrust and 5º down thrust, drill a 6º angle prop shaft hole in the plug and rotate it 30º to the right of 180º on the nose block.