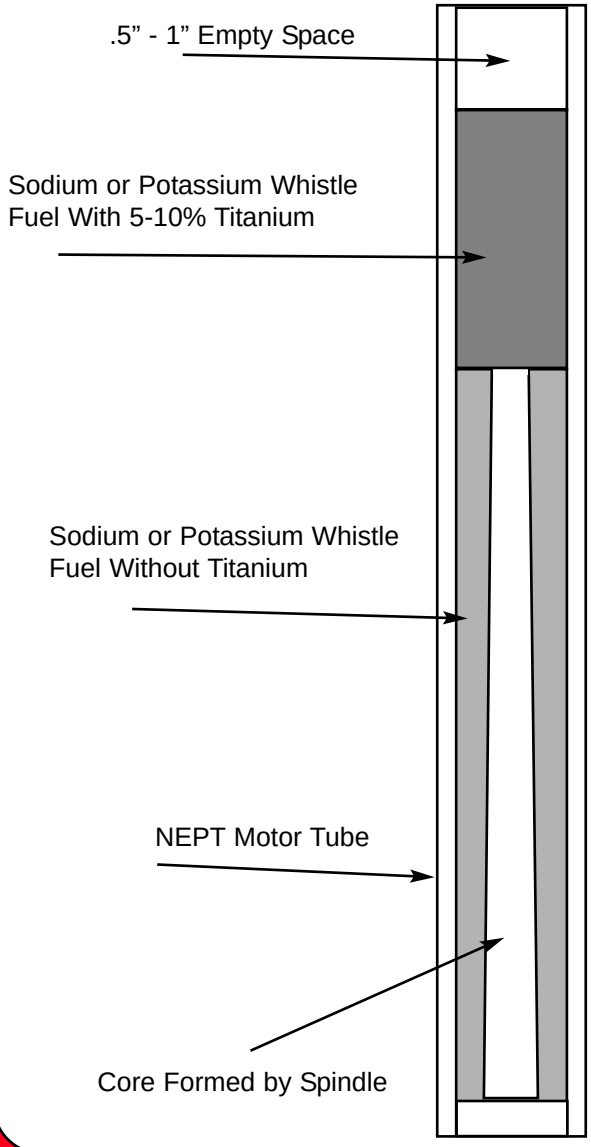
FIRESMITH
pyrotechnic tooling
1154 NW Gary St. • Lincoln, NE 68521 • www.firesmithtools.com • 402.304.3685

How to Build a White Tailed Whistle Rocket

CAUTION!!

Working with pyrotechnic devices is a very rewarding endeavor that can become a lifetime passion. To ensure continued enjoyment of this hobby, please follow appropriate safety guidelines. Work in an open area outdoors, keep all pyrotechnic mixtures in closed containers, limit any compositions to only the amount needed for a particular item, store finished items in an appropriate day box or magazine, be sure to wear appropriate non-synthetic clothing, wear eye protection and keep a source of water nearby. FireSmith cannot be held responsible for any accidents or incidents resulting from the construction and use of any pyrotechnic devices. It is highly recommended to check and adhere to all local, state and federal regulations. Please consider joining the PGI and any pyro clubs in your area so that you may construct pyrotechnic items in a safe and legal environment. Additional information can be found at **www.pgi.org**.



Whistle rockets are one of my absolute favorites. They are relatively simple to manufacture, yet they can display truly awesome performance. In fact, I use the following whistle motors to do the majority of my heavy lifting. The techniques depicted in this tutorial will produce a “deep-throated and raspy” whistle with a beautiful white tail.

The whistle rocket in this tutorial will be produced with FireSmith Super BP Core Burn tooling (for even better performance use FireSmith Nozzleless Core Burn tooling) and will use two slightly different types of Potassium Benzoate whistle fuel (Sodium Benzoate whistle fuel can be used as well). The fuel around the spindle contains no titanium while the fuel above the spindle contains 5-10% 80-150 mesh titanium. Using this “stacked fuel” technique will produce a rocket that has a bright white tail upon ignition while eliminating potential damage and safety hazards present when using titanium bearing fuel around a rocket spindle.

The formula for the fuel in this construction guide is as follows (a tutorial depicting the manufacture of this whistle fuel is located on the FireSmith website). It is very important that this fuel only be compacted by pressing. NEVER ram or pound whistle fuel. Proper compaction of whistle fuel is important. I press my rockets to just about 9,000psi on the fuel grain (though anything in the 8,000-9,000psi range will work fine).

Potassium Perchlorate 64
Potassium Benzoate 32
Copper Oxychloride 2
Petroleum Jelly 5
(5-10% 80-150 Mesh Ti Sponge or Flake for fuel above the spindle)

Quality paper tubes must be used to produce whistle rockets. The single best source is the NEPT line of tubes available from www.hobbyhorse.com. You will need to cut these tubes to the following length(s):

1lb = 7.5”
2lb = 8.75”
3lb = 10”
4lb = 12”
6lb = 16”

Required Materials:
FireSmith Super BP or Nozzleless Core Burn Tooling
Tube Support
Tube Extender
Spindle Remover
Press
Potassium or Sodium Benzoate Whistle Fuel (both with and without titanium)
Small Funnel
Teaspoon
NEPT Paper Tube
3/16” dia x 14” Brass or Wood Rod
3/16” Hex Key

Step 1
Flip the tube support upside down, lower the taper rings and insert the empty tube into the tube support.

Step 2
Flip the tube support right side up and drop the taper rings over the support and lightly snug them up with hand pressure.

Step 3
Slide the tube & tube support assembly onto the motor spindle

Step 4
Gather the #1 rammer (the longest rammer with the conical tip).

Step 5
Using a teaspoon and a funnel, dump one increment of non-titanium bearing fuel into the tube.

*An appropriate increment size is about 1/2 the ID (inside diameter) of the motor tube. If you experience CATO's, try cutting increment sizes in half. A good starting point is as follows:

1lb = 1-2 teaspoons
2lb = 2-3 teaspoons
3lb = 3-4 teaspoons
4lb = 4-5 teaspoons
6lb = 5-6 teaspoons

Step 6
Insert the #1 rammer into the motor tube and press the fuel down by hand. A light amount of force is all that is needed to initially compact the fuel.

Step 7
Place the motor into the press and compact this increment of fuel to 8,000-9,000psi. The actual force being applied to the fuel isn't as important and being able to consistently reach that force with the press. Anywhere from 8,000-9,000psi will work fine.

*Do note the location of the line machined into the top of the rammer. If that dips below the top of the tube, tooling damage may result.

Step 8
Remove the entire assembly from the press, insert the T-puller into the rammer and with a light twisting motion, remove the #1 rammer from the motor.

*A wise safety precaution is to avoid placing any part of one's body over the top of the rammer when performing this task. If for some reason the rammer becomes stuck (typically due to wet fuel, too large an increment or driving the rammer past the "no-pass" line onto the spindle), remove the spindle from the motor (if possible) and soak the entire assembly in water overnight. The rammer should then be easily removed.

Step 9
Using the brass or wooden rod, gently clean out any fuel that may have gotten inside the rammer. It is highly important to clean rammers in between pressing each increment of fuel. Failure to do so can result in a serious accident.

Step 10
Repeat steps 5-9 until the second line machined into the rammer is visible above the tube after pressing an increment.

Step 11
Switch to the #2 rammer (the second longest with a flush tip).

Step 12
Add another increment of non-titanium bearing fuel

Step 13
Lightly seat the rammer with hand pressure

Step 14
Insert the assembly into the press and compact the fuel to 8,000-9,000psi.

Step 15
Remove the assembly from the press, insert the “T-puller” and with a light twisting motion, remove the rammer from the motor.

Step 16
Using the wooden or brass rod, gently clean the bore of the #2 rammer.

Step 17
Repeat steps 12-16 until the swap-out line is visible above the top of the motor tube after pressing an increment of fuel.

Step 18
Switch to the #3 rammer (the third longest with a flush tip)

Step 19
Add another increment of non-titanium bearing fuel.

Step 20
Insert the #3 rammer into the motor tube and seat the fuel with light hand pressure.

Step 21
Insert the entire assembly into the press and compact the fuel to 8,000-9,000psi.

Step 22
Using the puller, apply a slight twisting motion and remove the rammer from the motor tube.

Step 23
Use the brass or wooden rod to gently clean any fuel residue trapped inside the bore of the rammer.

Step 24
Repeat steps 19-23 until the swap-out line is visible above the motor tube after pressing an increment of fuel.

Step 25
Switch to the #4 rammer (the shortest with a solid tip).

Step 26
Using the fuel that contains titanium, dump an increment into the motor tube.

Step 27
Insert the #4 rammer and seat the fuel with light hand pressure.

Step 28
Insert the entire assembly into the press and compact the fuel to 8,000-9,000psi.

Step 29
Use the puller and a slight twisting motion to remove the rammer from the motor tube.

Step 30
It will be necessary to use a tube extender while loading the last few increments of fuel. Simply slide the tube extender over the top of the tube and dump in an increment of fuel that contains titanium.

Step 31
Place the #4 rammer into the tube extender and use hand pressure to compact the fuel into the motor tube.

Step 32
Slide the tube extender over the rammer and set aside.

Step 33
Insert the entire assembly into the press and compact the fuel to 8,000-9,000psi. Remove the rammer and repeat steps 30-33 until the motor is filled to within 1/2”-1” from the top of the tube.

*The height of the gap at the top of the tube that contains no fuel is dependent upon the speed of your fuel and the weight the motor will be carrying. Lighter payloads may use more fuel and a smaller gap (since they will reach higher altitudes) and heavier payloads may need less fuel a larger gap to prevent the motor from coming back to earth before the heading is deployed. A bit of experimentation will be necessary.

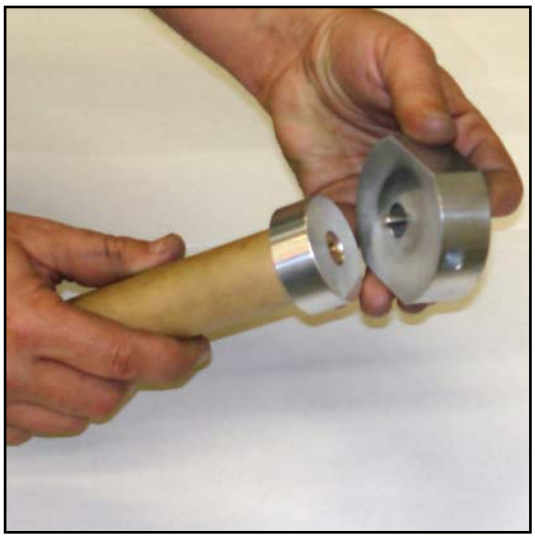
Step 34
Remove the entire assembly from the press. Using a 3/16” hex key, remove the base from the spindle.

Step 35
Insert the tube support back into the press keeping it upside down. Set the motor removal tool on top of the tube support

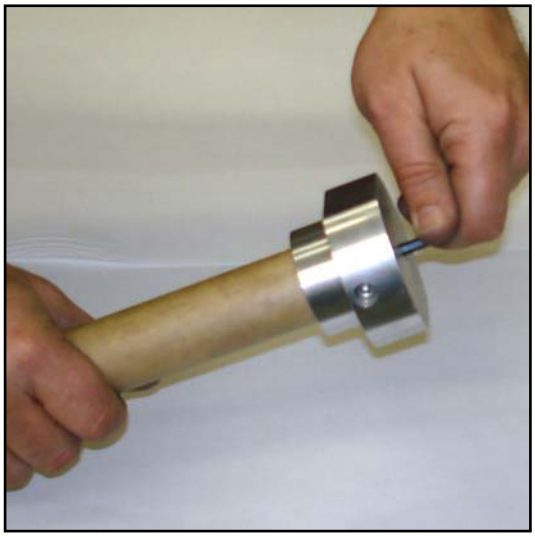
Step 36
Bring the ram of the press down on to the motor removal tool. Apply a small amount of pressure until the top ring drops. Lower the ram and apply a bit more pressure until the bottom ring drops. Remove the entire assembly from the press.

Step 37
Remove the completed motor.

Step 38
Slip the removal tool over the bottom of the spindle/pressed motor.



Step 39
Set the base on the spindle/pressed motor and insert the 1” long cap screw through the base and into the bottom of the spindle.



Step 40
Using a 3/16” Allen key or T-wrench, tighten the screw until the spindle is pulled out of the pressed motor. Once the screw is “snugged up” it should only take one or two revolutions of the screw to pull the spindle out of the motor.

Step 41
Set your completed in the nearest daybox. Please reference the tutorials on the FireSmith website for information detailing attaching a heading, sticking and fusing rocket motors.