AGNI-1

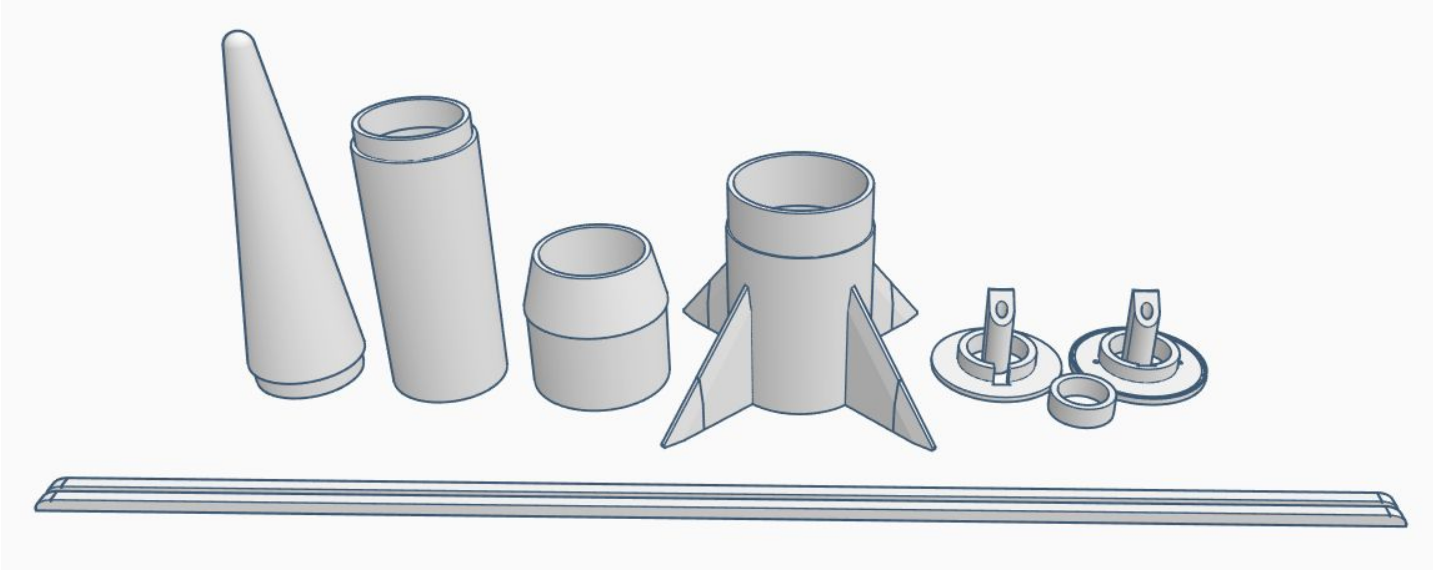
Builder's Kit Parts List

Quantity	Part
2	Centering Rings
2	Launch Lugs
1	Fin Unit
1	Motor Block
1	Nose kit (nose tip, tube section, frustum section)
2	Plastic Conduits
1	Template Sheet

Parts Needed to Complete

~0.5 ounces	Nose Weight
1	Body Tube, BT-60, 14.625" long (371.5mm)
1	18mm Motor Tube, 2.75" long (69.9mm)
1	Shock Cord, ~36" long (~915mm) elastic
1	Shock Cord, ~18" long (~457mm) Kevlar
1	18" Parachute (457mm)
1	Motor clip (if desired)

3D Printed Builders Kit Parts

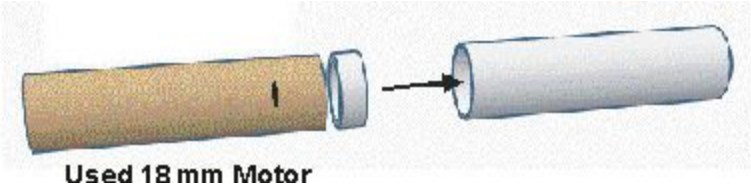


BACKGROUND

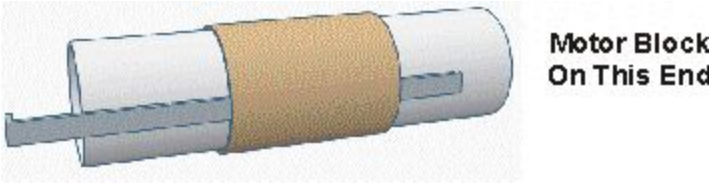
The Agni 1 is a mobile, solid-propellant, short-range ballistic missile. ("Agni" means "Fire" in Hindi). Operated by the Indian Army, this missile is capable of carrying a nuclear warhead. The Agni 1 traces its heritage to India's SLV-3 satellite launch vehicle – a vehicle modeled after the US Scout. India used SLV-3 technology to build the Agni 2 medium range ballistic missile. Later, the Agni 1 was developed around the Agni 2's first-stage motor (the Agni 2 really came first!). The Agni 1 is just one of many missiles India has developed to ensure their national security and demonstrate their place as a world power.

This model was created using photos and drawings of the Agni 1 available on the internet. Based on reported dimensions, this model is approximately 1:40 scale.
KIT ASSEMBLY

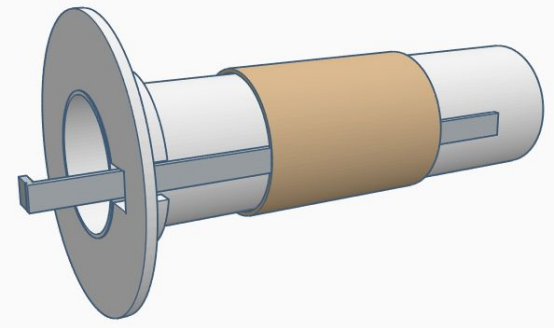
1. Assemble the motor mount/fin can. You'll need an 18mm (BT-20) motor tube 2.75" (69.9mm) long. Note, this motor mount is intended for a "friction fit" of the rocket motor. Mark an expended 18mm motor ½" (12.7mm) from one end. Make sure the motor block fits into the tube. Sand as needed to fit. Put a bead of cyanoacrylate (CA) glue ("super glue") roughly 5/8" (15.9mm) inside one end of the motor tube. Insert the motor block in the other end, then use the expended motor to push the block into the tube, stopping at the ½"/12.7mm mark on the motor. Remove the motor quickly.



If you want a motor clip (not included), mark the tube 2.25" (57.2mm) from one end. Cut a narrow slot at this point, and put the forward end of the motor clip in the slot. Secure the clip to the tube in the center of the motor tube with a wrap of 1" (25.4mm) masking tape. Put a bead of glue in the forward end of the tube, just in front of the motor clip. Use an expended motor to push the motor block in until it hits the motor clip. Do NOT install the motor block in the aft end, or no motor will fit!

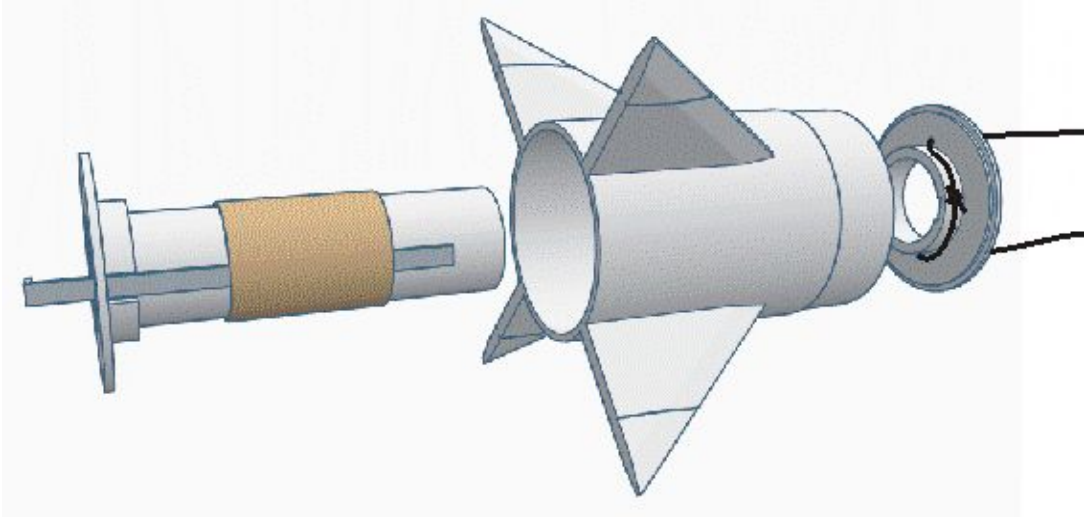


The forward centering ring has a built-in motor block and attach points for a shock cord. The aft ring has a cutout for a motor clip, if used. Glue the aft ring to the motor tube, even with the aft end. Allow to dry.

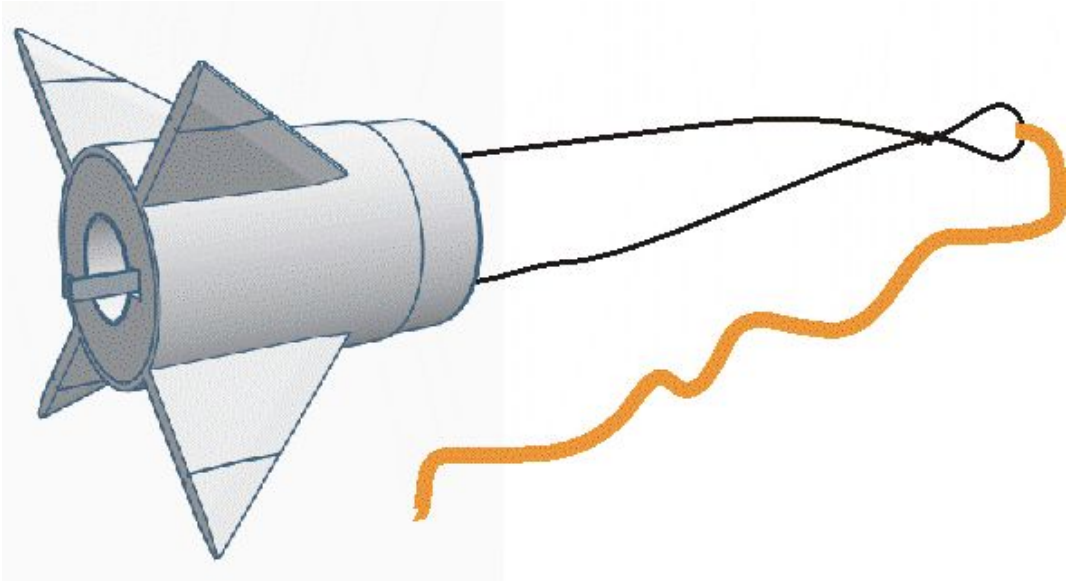


The motor mount is designed to use a Kevlar anchor. 100-pound Kevlar works well. The length should be approximately 36" (915mm). Thread both ends of the Kevlar through the holes in the forward centering ring. Tie a double knot or even a triple knot in the Kevlar so it can't be pulled back through the holes, and use CA to glue it in place. Seal the holss in the ring with CA as well. At the other end of the Kevlar, make a loop about 1" in diameter.

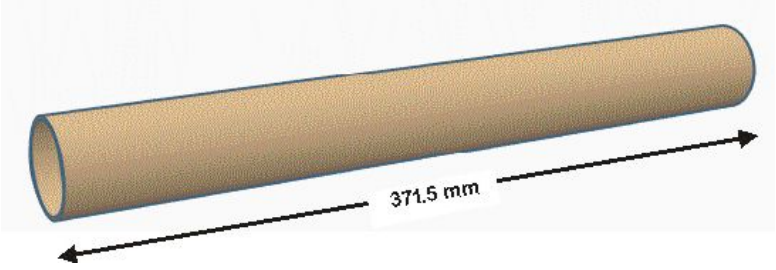
For the next steps, use a SLOW CURE CA glue, to allow time to work with the parts before the glue sets. Put a bead around the aft end of the fin can, then press the motor tube with aft centering ring into the can, stopping when the ring is even with the end of the can. Put a bead of glue into the forward end of the can. Slide the forward centering ring down over the motor tube, and seat the ring into the forward end of the fin can. Allow everything to dry.



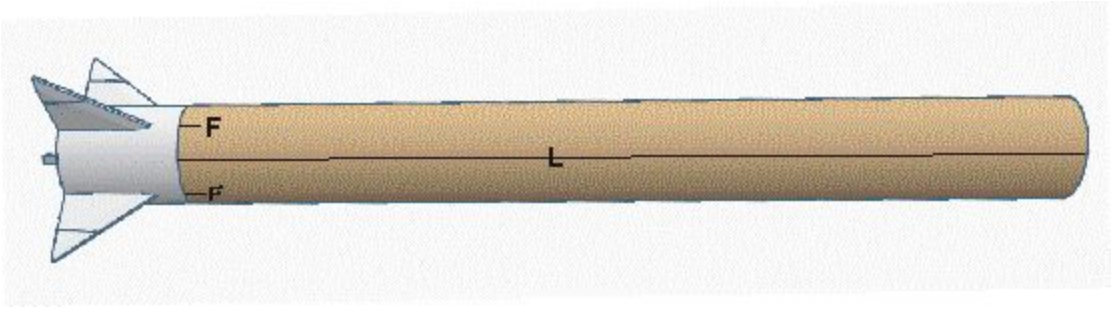
Attach an elastic shock cord roughly 36” long (915mm) to the forward loop in the Kevlar shock cord anchor. We prefer ¼” (6.35mm) braided elastic.



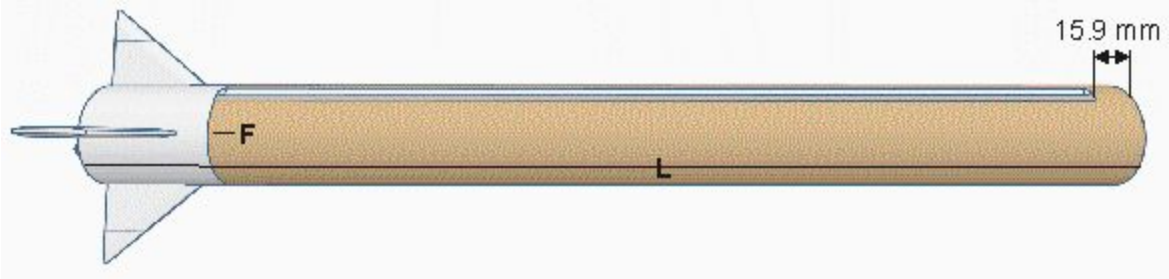
2. Mark the body tube. The body tube for the Agni 1 is BT-60. The length should be 14.625” (14 5/8”), or 371.5mm. Place one end of the body tube on the fin location guide. Mark the fin locations, the launch lug location, and the conduit locations. We recommend marking the fin locations with an “F,” the launch lug location with an “L,” and the conduit locations with a “C.” Using a straight edge, extend the “L” and “C” lines the entire length of the body tube. The fin lines do not need to be extended.



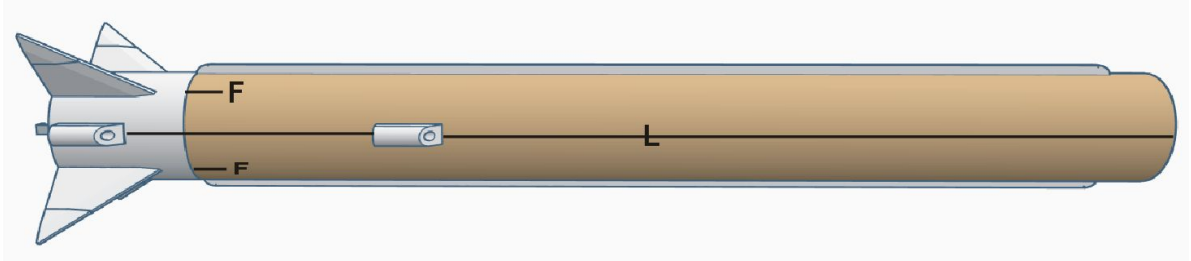
3. Install the fin can. Test fit the fin can in the body tube. If the fit is too tight, lightly sand until you get the right fit. Apply a generous ring of CA glue inside the body tube (be sure to use the end with the fin or "F" marks!), drop the shock cord through the tube, and insert the fin can into the tube, taking care to align the fins with the "F" marks. Allow to dry. You might want to use putty to hide the can/tube seam. This seam should not be visible. Do this before proceeding to the next step.



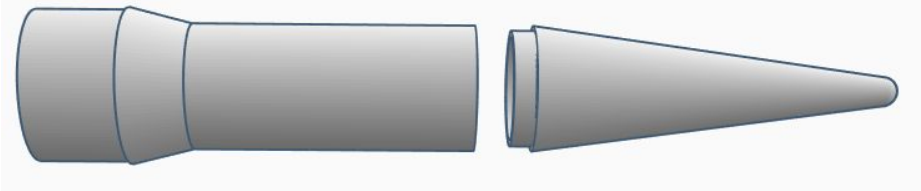
4. Attach the cable conduits. Mark the "C" lines 5/8" (15.9mm) from the front end of the tube. Glue one conduit on each conduit line, with the front end of the conduit at the 5/8"/15.9mm mark. Make sure the conduit is straight along the tube. It should be parallel with the sides of the body tube.



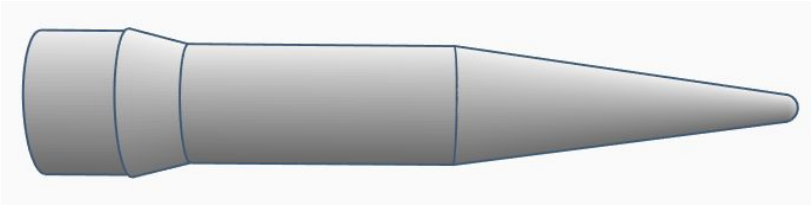
5. Attach the launch lugs. Using a straight edge, extend the "L" line to the bottom of the fin can. Mark this line 1/4" (3.2mm) and 9" (228.6mm) from that AFT end of the fin can. Attach the launch lugs with their aft ends at these marks using CA glue, making sure the launch lugs are aligned. The aft lug is attached to the fin can. Apply CA or epoxy fillets to the launch lug/body joints. Allow to dry.



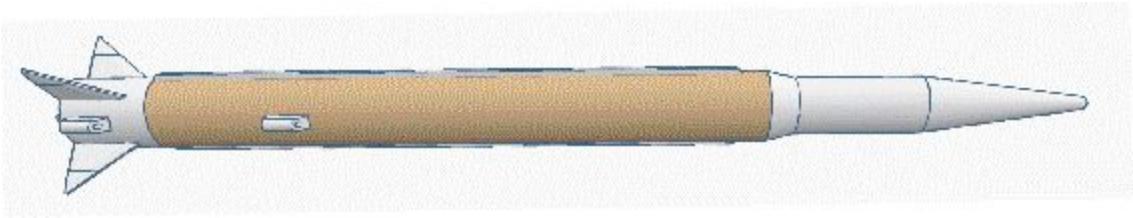
6. Assemble the nose cone. Use CA glue when attaching nose cone sections. Glue the 3D-printed tube section to the frustum section, but do not glue the nose section yet.



Epoxy weight into the nose section. (NEED HELP HERE ON AMOUNTS. I THINK IT'S ABOUT 0.5OZ FOR A C6 MOTOR). Remember epoxy gets hot as it hardens. To protect the plastic, you can place the cone tip-down in cool water while the epoxy dries. Once you have added sufficient nose weight, glue the nose section to the tube section.



7. Finish the 3D-printed pieces. To finish the 3D-printed pieces, sand all pieces thoroughly, then spray with a sandable, filling primer. Sand the primer, then repeat the process at least once more. After two rounds of primer and sanding, the grooves from the 3D printing should all but disappear.



8. Final assembly. Use a 18" (457mm) parachute for your model. Attach the parachute to one of the attach points on the nose cone. Attach the free end of the elastic shock cord to the other attach point on the nose cone. As an alternative, tie a loop in the free end of the elastic shock cord and attach the parachute to the loop. Run a roughly 6" (152mm) length of Kevlar through one of the attach points on the nose cone and attach it to the elastic loop.

9. Finishing. We recommend painting your model with at least one coat of regular primer and sanding until you achieve a smooth finish. There are many interesting paint schemes for the Agni 1. We recommend searching the internet for the paint scheme you like most. Flight-test missiles are painted gloss white with orange stripes and black lettering. Operational missiles sport a number of camouflage paint schemes, including ones like the prototype model on the package. On all versions, the fin tips (which move on the actual missile to provide attitude control) are generally painted a different color from the rest of the fin. Our prototype has a base color of Testor's® Dark Brown, with camouflage stripes of Testor's® Dark Green and Gloss Brown. Once all paint was dry, we painted with Testor's® Dull Cote to flatten the glossy colors. In all cases (flight test vehicles and operational vehicles), the nose cone (reentry vehicle) is flat black. Some have a red nose tip as well, like our prototype.

10. Flying. Unless you added a motor clip, the motor must be "friction-fitted" in the model. Wrap tape around the motor and insert into the motor mount. The motor should be snug (so it won't be ejected) but not so tight you won't be able to remove it later. A C6-5 is the recommended motor. We haven't tested larger (18mm "D") motors, so try larger motors at your own risk!

Aggressor Aerospace Rocketry