



# Model Rocket Safety Code

- 1. Materials.** I will use only lightweight, non-metal parts for the nose, body, and fins of my rocket.
- 2. Motors.** I will use only certified, commercially-made model rocket motors, and will not tamper with these motors or use them for any purposes except those recommended by the manufacturer.
- 3. Ignition System.** I will launch my rockets with an electrical launch system and electrical motor igniters. My launch system will have a safety interlock in series with the launch switch, and will use a launch switch that returns to the "off" position when released.
- 4. Misfires.** If my rocket does not launch when I press the button of my electrical launch system, I will remove the launcher's safety interlock or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.
- 5. Launch Safety.** I will use a countdown before launch, and will ensure that everyone is paying attention and is a safe distance of at least 15 feet away when I launch rockets with D motors or smaller, and 30 feet when I launch larger rockets. If I am uncertain about the safety or stability of an untested rocket, I will check the stability before flight and will fly it only after warning spectators and clearing them away to a safe distance.
- 6. Launcher.** I will launch my rocket from a launch rod, tower, or rail that is pointed to within 30 degrees of the vertical to ensure that the rocket flies nearly straight up, and I will use a blast deflector to prevent the motor's exhaust from hitting the ground. To prevent accidental eye injury, I will place launchers so that the end of the launch rod is above eye level or will cap the end of the rod when it is not in use.
- 7. Size.** My model rocket will not weigh more than 1,500 grams (53 ounces) at liftoff and will not contain more than 125 grams (4.4 ounces) of propellant or 320 N-sec (71.9 pound-seconds) of total impulse. If my model rocket weighs more than one pound (453 grams) at liftoff or has more than four ounces (113 grams) of propellant, I will check and comply with Federal Aviation Administration regulations before flying.
- 8. Flight Safety.** I will not launch my rocket at targets, into clouds, or near airplanes, and will not put any flammable or explosive payload in my rocket.
- 9. Launch Site.** I will launch my rocket outdoors, in an open area at least as large as shown in the accompanying table, and in safe weather conditions with wind speeds no greater than 20 miles per hour. I will ensure that there is no dry grass close to the launch pad, and that the launch site does not present risk of grass fires.
- 10. Recovery System.** I will use a recovery system such as a streamer or parachute in my rocket so that it returns safely and undamaged and can be flown again, and I will use only flame-resistant or fireproof recovery system wadding in my rocket.
- 11. Recovery Safety.** I will not attempt to recover my rocket from power lines, tall trees, or other dangerous places.

## LAUNCH SITE DIMENSIONS

Installed Total Impulse (N-sec)	Equivalent Motor Type	Minimum Site Dimensions (ft.)
0.00 — 1.25	1/4A	50
1.26 — 2.50	A	100
2.51 — 5.00	B	200
5.01 — 10.00	C	400
10.01 — 20.00	D	500
20.01 — 40.00	E	1000
40.01 — 80.00	F	1000
80.01 — 160.00	G	1000
160.01 — 320.00	2 Gs	1500

**SEMROC**

# Defender™

SPACE PROBE

**THREE ENGINE CLUSTER**

**PAYLOAD SECTION**

**RETRO DESIGN**

**EASY TO BUILD**

1967  
Vintage Retro

FLYING MODEL ROCKET KIT

MADE IN THE USA

**SEMROC**

Made in the U.S.A by Semroc Astronautics Corporation - Knightdale, N.C. 27545

## DEFENDER™ Kit No. KV-60

Specifications	Engines	Approx. Altitude
Body Diameter	Three A8-3	400'
Length	Three B6-4	950'
Fin Span	Three C6-5	1600'
Net Weight		

## Dual Parachute Recovery

## What is a Retro-Repro™?

A Retro-Repro™ is a retro reproduction of an out-of-production model rocket kit. It is a close approximation of a full scale model of an early historically significant model rocket kit from one of the many companies that pioneered the hobby over the past half century. A Retro-Repro™ is not a true clone or identical copy of the original. It incorporates improvements using modern technology, while keeping the flavor and build appeal of the early kits.

### About

## Centuri Engineering Company

Centuri Engineering Company was started in 1961 by Leroy (Lee) Piester in his garage while he was still in college in Phoenix, Arizona. With his wife, Betty, they built Centuri into one of the largest model rocket companies ever.

Centuri was known for its unusual and innovative designs, producing over 140 different kits with something for every model rocketeer. They also produced model rocket engines and pioneered the modern composite high powered engines with their Enerjet line.

Centuri Engineering was sold to Damon in the late 1960's and shared the same parent corporation with Estes Industries, the largest model rocket company in the world. The Centuri product line was kept separate from the Estes line until 1983. A few of the old kits have been reissued by Estes since then, but for the most part, Centuri Engineering Company lives today only in the dreams of the senior members of the model rocket community.

March 4, 2007

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Box 1271 Knightdale, NC 27545 (919) 266-1977

## LIMITATION OF LIABILITY

Model rockets are not toys, but are functional rockets made of lightweight materials and are launched with NAR or Tripoli safety certified model rocket motors, electrically ignited and flown in accordance with the NAR Model Rocket Safety Code. If misused, model rockets can cause serious injury and property damage. Semroc certifies that it has exercised reasonable diligence in the design and manufacture of its products. Semroc cannot assume any liability for the storage, transportation, or usage of its products. Semroc shall not be held responsible for any personal injury or property damage whatsoever arising out of the handling, storage, use, or misuse of our products. The buyer assumes all risks and liabilities therefrom and accepts and uses Semroc products on these conditions.

Your purchase and use of any Semroc products is construed as your agreement to and acceptance of these terms. If you do not agree to these terms and conditions, you must return the product, unused, for refund or credit.

## 100% SATISFACTION GUARANTEE

If you are not 100% satisfied with your Semroc product, we will make it right by providing whatever you consider fair, from refund to replacement.

Contact us at:

**Semroc Astronautics Corporation**

Customer Service Department  
P.O. Box 1271  
Knightdale, North Carolina 27545

## JOIN THE NAR!

Sign up online at [www.nar.org](http://www.nar.org) to join the premier model rocketry organization. Semroc fully supports the National Association of Rocketry and recognizes it as the sport's official voice. The NAR is the oldest and largest sport rocketry organization in the world. Since 1957 over 80,000 serious sport rocket modelers have joined the NAR to take advantage of the fun and excitement of organized rocketry. It is always more fun if you fly with friends. The *Sport Rocketry* magazine is one of the best ways to keep informed of new developments in the hobby. Check online at [www.semroc.com/nar](http://www.semroc.com/nar) for promotions just for NAR members.



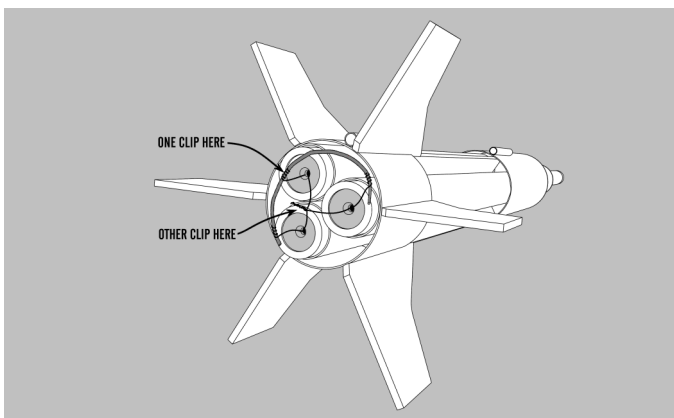
# FLIGHT PREPPING

❑ **30.** Use a small amount of masking tape to hold each engine in place. Use enough to hold it snug, but not so much that it will be difficult to remove the engines later. **Be sure to fill the top of each engine with a ball of recovery wadding!** All engines should be the same type and delay. It is recommended to use A8-3's for the first flight.

❑ **31.** Pack the recovery wadding from the top of the body tube. Use a sufficient quantity to protect the parachutes, but not too much that there is no room left.

❑ **32.** Fold the parachutes and pack them and the shock cord on top of the recovery wadding. Slide the payload section into place, making sure it does not pinch the shock cord or parachute.

❑ **33.** Refer to the model rocket engine manufacturer's instructions to complete the engine prepping. Different engines have different igniters and methods of hooking them up to the launch controllers. A cluster of three engines is a challenging combination. We recommend a short piece of solid copper wire about 12-16 gauge like found in house wiring to be used as a bus bar for one connection to the launch controller wired as shown. The other three igniter wires can be twisted together for the other clip. Use at least a 12 volt system with a fresh battery that can fire three igniters reliably. Always fire a cluster in low wind conditions with a vertical launch rod.



❑ **34.** Carefully check all parts of your rocket before each flight as a part of your pre-flight checklist. Launch the Defender™ from a 1/8" diameter by 36" long launch rod.

## About the Defender™

The Centuri Defender Space Probe was released in the 1967 Catalog as their first three-engine cluster model rocket kit. Adopting elements of many early space program designs like the Saturn 1B and Redstone, the Defender was a look into the future. Lots of transitions and a unique fin set made the Defender look at first glance like its smaller brother, the Recruiter, which was introduced at the same time. The Defender was introduced as Catalog # KC-35 for \$3.50.

The Retro-Repro™ Defender™ is a full-size reproduction of the original using all balsa couplers and nose cone. It uses laser-cut balsa fins for ease of construction. The large paper adapter is replaced with a balsa transition for ease of construction. The original 20" parachute is replaced with two 12" two-color chutes. A Kevlar® shock cord mount is provided. The original decal that was shared with the Snipe Hunter is replaced with one closer to the catalog photos.

### BEFORE YOU START!

Make sure you have all the parts included in this kit that are listed in the Parts List in the center of these instructions. In addition to the parts included in this kit, you will also need the tools and materials listed below. Read the entire instructions before beginning to assemble your rocket. When you are thoroughly familiar with these instructions, begin construction. Read each step and study the accompanying drawings. Check off each step as it is completed. In each step, test-fit the parts together before applying any glue. It is sometimes necessary to sand lightly or build-up some parts to obtain a precision fit. If you are uncertain of the location of some parts, refer to the exploded view in the center of these instructions. It is important that you always ensure that you have adequate glue joints.

**TOOLS:** In addition to the parts supplied, you will need the following tools to assemble and finish this kit. Masking tape will also be useful.

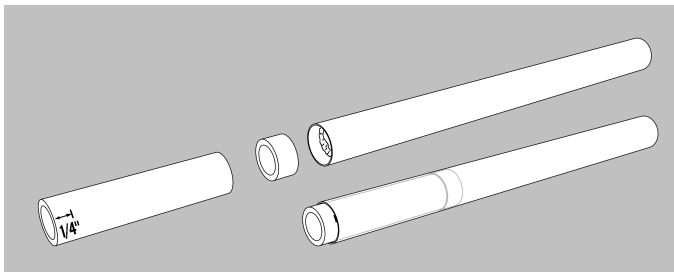


# ASSEMBLY

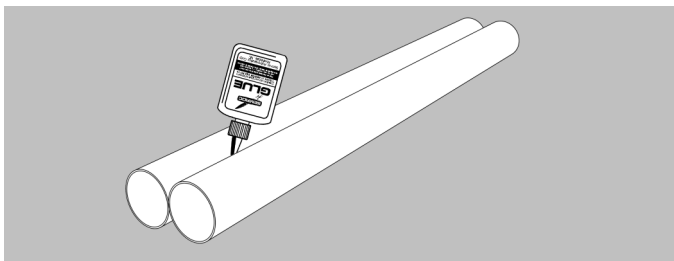
**1.** These instructions are presented in a logical order to help you put your Defender™ together quickly and efficiently. Check off each step as you complete it and enjoy putting this kit together.

## ENGINE TUBES

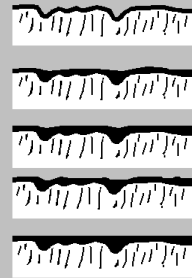
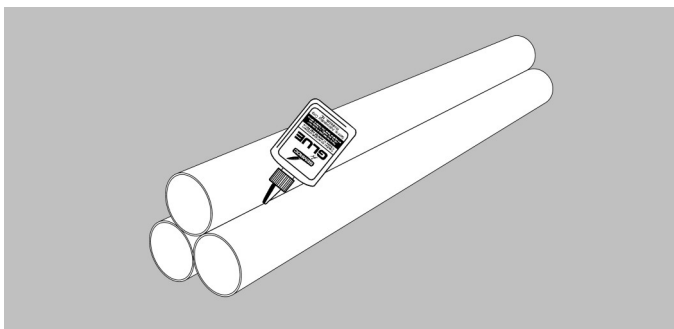
**2.** Mark the engine spacing tube 1/4" from one end. Apply a bead of glue inside one of the long engine tubes (ST-790). Insert one of the thrust rings (TR-7) into the tube and push it into place quickly with the spacing tube until the mark lines up with the end of the engine tube. Repeat for the other two engine tubes. Mark each engine tube on the end that you just inserted the thrust ring.



**3.** On a flat surface, line up two engine tubes with the marked ends facing in the same direction. Apply a bead of glue along the joint and hold the tubes together until the glue sets.



**4.** Stack the final engine tube on the other two and apply a bead of glue to each joint. Make sure the three marked ends are all in the same direction. This marked end is the bottom of the rocket. Allow this assembly to completely dry.



1st coat of fillercoat

2nd coat of fillercoat

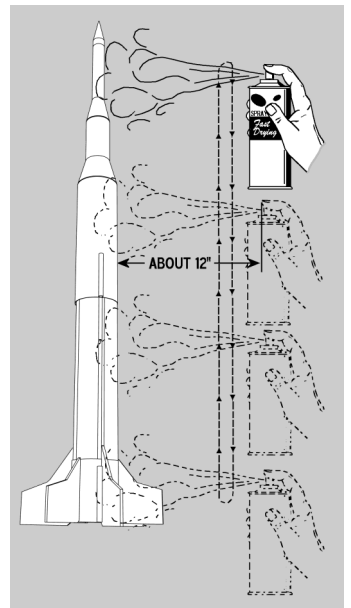
After 1st sanding

3rd coat of fillercoat

After 1st sanding

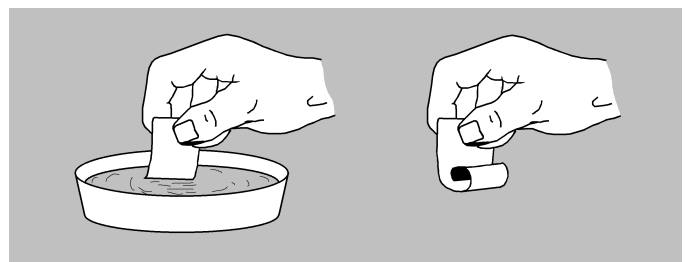
**26.** After all balsa surfaces have been prepared, wipe off all balsa dust with a dry cloth. First spray the model with an enamel primer, then spray a base color of gloss white.

**27.** Spray painting your model with a fast-drying enamel will produce the best results. PATIENCE...is the most important ingredient. Use several thin coats, allowing each coat to completely dry before the next coat. Start each spray a few inches above the model and end a few inches below the model. Keep the can about 12" away and use quick light coats. The final coat can be a little heavier to give the model a glossy wet-looking finish.



**28.** The Defender™ can now be painted with its final colors. The payload section is silver. The engine tubes, small fins, nose cone and top half of the small body tube are painted black.

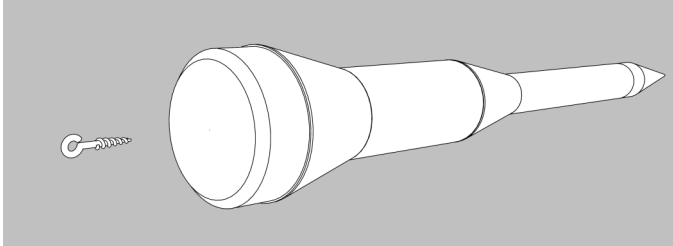
**29.** After the paint has dried, decals should be applied. The decals supplied with the Defender™ are waterslide decals. Keep the roll patterns as one piece and wrap around the body tubes. Apply each decal before starting the next. Check for fit before wetting the decal.





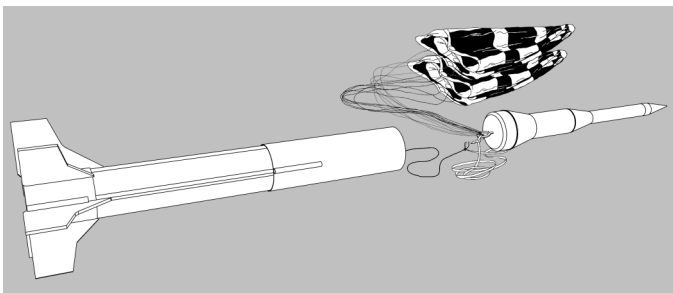
## FINAL ASSEMBLY

- ❑ **22.** Twist the screw eye into the center of the base of the large tube adapter and squirt glue into the hole. Reinstall the screw eye and wipe off any excess glue.



- ❑ **23.** Assemble both chutes using instructions printed on the canopy. Tie the chutes to the screw eye on the payload section. Put a drop of glue on the joint to keep the lines from moving.

- ❑ **24.** Shake the Kevlar® cord free so it extends out of the top of the rocket. Line up one end of the elastic shock cord with the free end of the Kevlar cord. Tie an overhand knot at the end of the two cords. Pull the knot tight and place a small drop of white glue on the knot to prevent it from loosening. Tie the loose end of the elastic to the screw eye on the payload section.



This completes the assembly of your

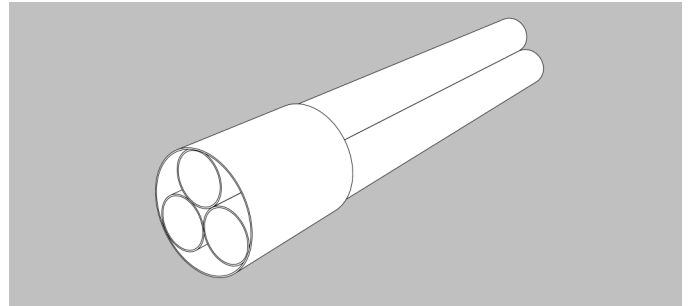
# Defender™

SPACE PROBE

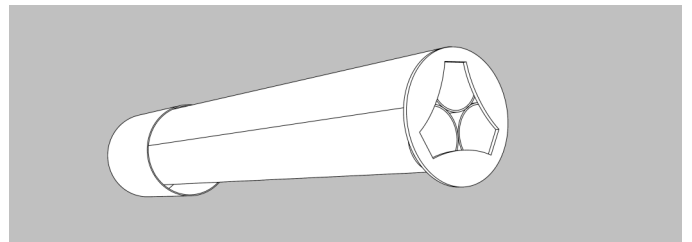
## FINISHING

- ❑ **25.** When the fillets have dried, prepare balsa surfaces for a smooth professional looking finish. Fill the wood grain with balsa fillercoat or sanding sealer. When dry, sand with fine sandpaper. Repeat until smooth.

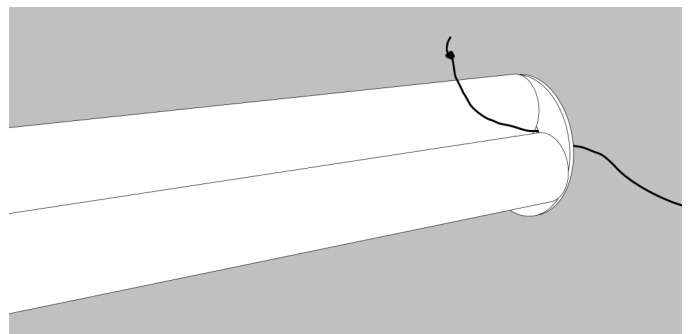
- ❑ **5.** Slide the short rear body tube (ST-1620) over the engine mount assembly on the marked end. It will have to be deformed slightly to fit. Apply a bead of glue along each joint.



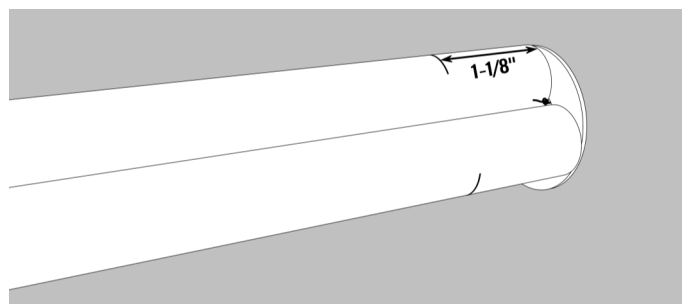
- ❑ **6.** Check the centering ring (CT-KV-60) for fit. Deform the tops of the engine tubes slightly so they do **not** overhang the edges of the ring. Apply a bead of glue around the tops of the tubes and apply the ring as shown. Allow to dry.



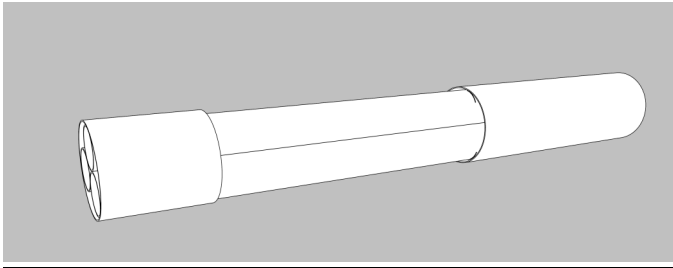
- ❑ **7.** Tie a large knot in one end of the yellow Kevlar® cord. Push it through one of the holes in the centering ring. If glue covers the hole, use a knife or pencil to open it enough for the cord. Pull it until the knot is seated against the ring and apply a heavy bead of glue. Stuff the loose end of the cord in one of the tubes.



- ❑ **8.** Mark each tube 1-1/8" from the top.

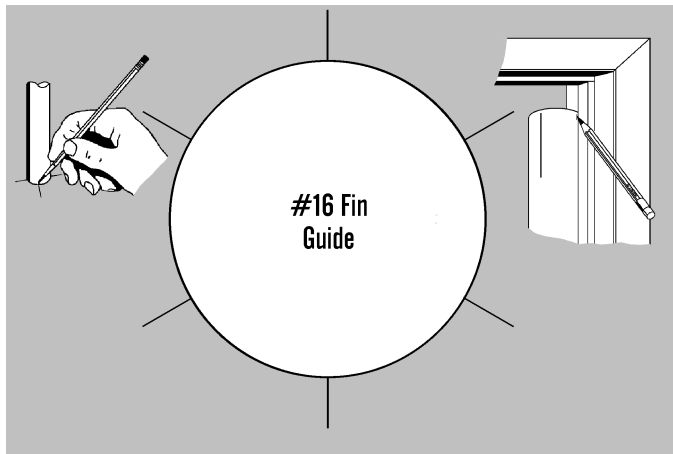


- ❑ **9.** Apply a bead of glue inside the bottom of the large tube (ST-1652). Insert the lower engine mount assembly into the tube until the marks are all even with the bottom of the tube. Roll the assembly on a flat surface to ensure it is aligned.



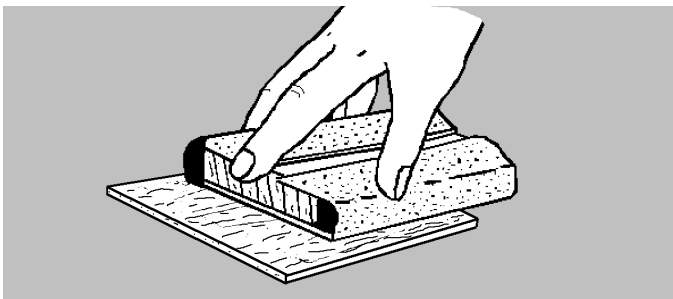
## MARK THE TUBE

- ❑ **10.** Stand the assembly on the fin guide below with the three engine tubes aligned with three of the marks. Mark the six fin positions on the side of the tube. Find a convenient channel or groove such as a partially open drawer, a door jamb (as shown,) or a piece of molding. Using the channel, extend the marks the length of the bottom tube to provide lines for aligning the fins.



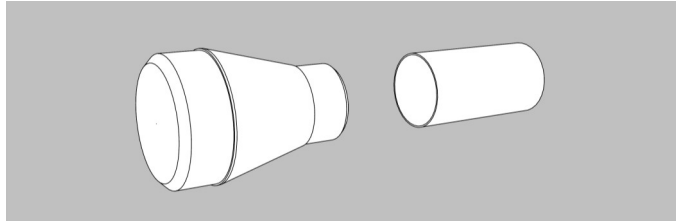
## PREPARE THE FINS

- ❑ **11.** Lightly sand each side of the laser-cut fins. Carefully push the laser-cut fins from their sheet. Start at one point on each fin and slowly and gently work around the fin.

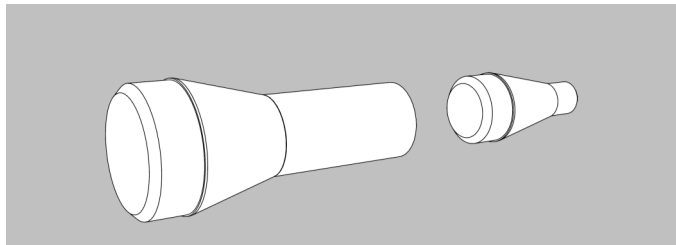


# PAYLOAD SECTION

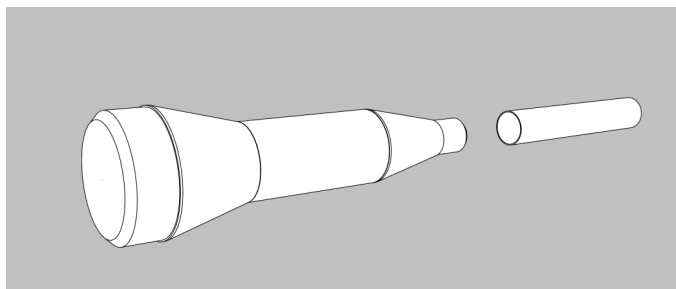
- ❑ **18.** Locate the largest adapter (BR-1016S) and the middle sized body tube (ST-1020). Place a bead of glue around the inside of one end of the body tube and insert the tube adapter.



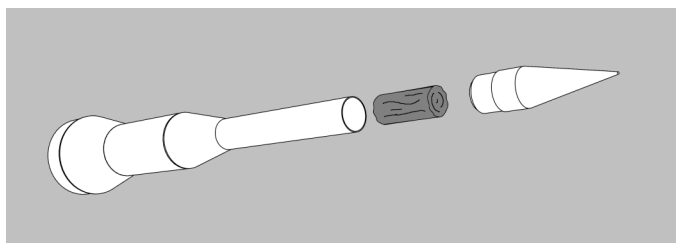
- ❑ **19.** If you will use the payload section, do not glue the pieces together in this step. Locate the small adapter (BR-510) and either glue it into the payload tube or use masking tape to get a good friction fit.



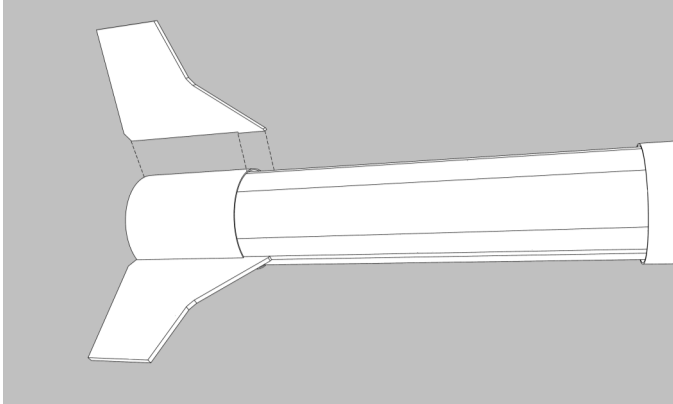
- ❑ **20.** Apply a small bead of glue inside one end of the remaining body tube (BT-530). Insert the small end of the adapter into the body tube.



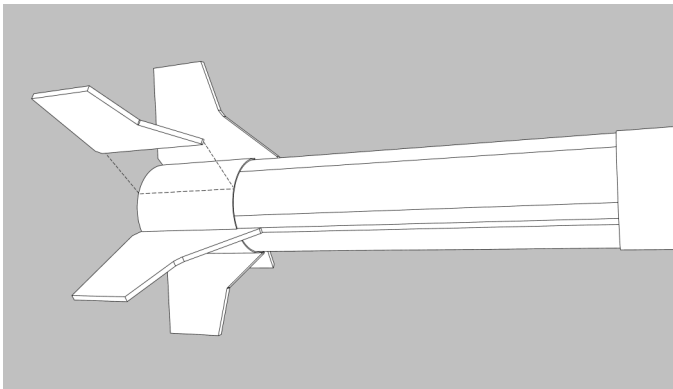
- ❑ **21.** Roll about half of the clay into a cylinder that will fit the upper body tube. Insert the clay and press against the walls. Use masking tape to attach the nose cone. For most engine combinations that is enough clay. If the bottom is heavy due to excessive glue or paint, more clay can be used to shift the Center of Gravity (CG) forward.



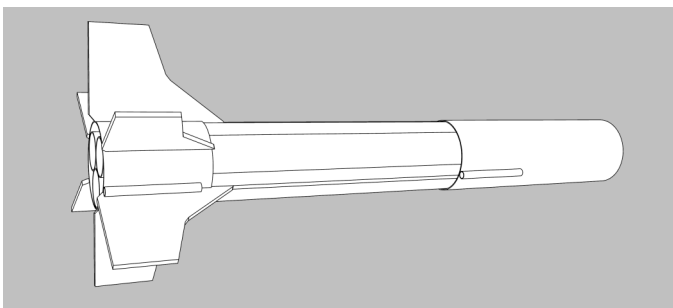
- ❑ **15.** Apply glue to the root edge of a large fin and position it along one of the lines drawn on the side of the bottom tube and aligned with one of the strips. Remove, allow to dry, apply additional glue, and reposition. Repeat for the other two large fins alternating lines to leave space for the small fins.



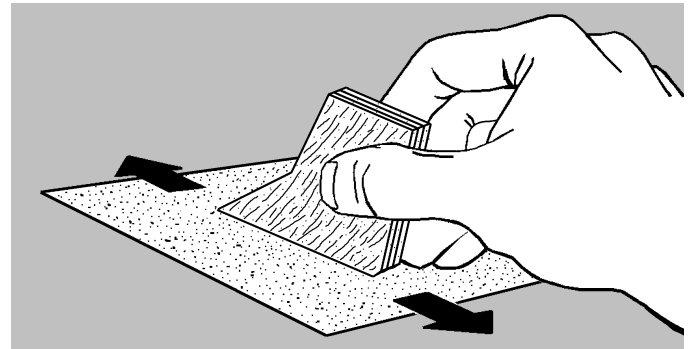
- ❑ **16.** Apply all three small fins between the three main fins as shown using the same technique. They should be directly over each of the three engine tubes. Stand on top end and allow to dry completely.



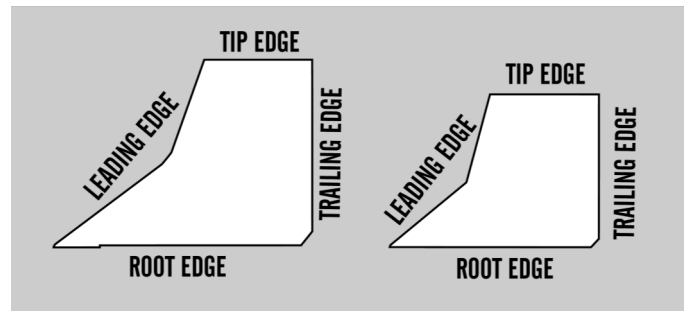
- ❑ **17.** Apply a fillet of glue along each fin and body tube joint. Use your finger to smooth the glue to the shape as shown. This adds much strength to the joint. Apply the lower launch lug against one of the large fins and even with the bottom of the tube. Apply the upper launch lug on the bottom edge of the upper tube and in line with the bottom launch lug.



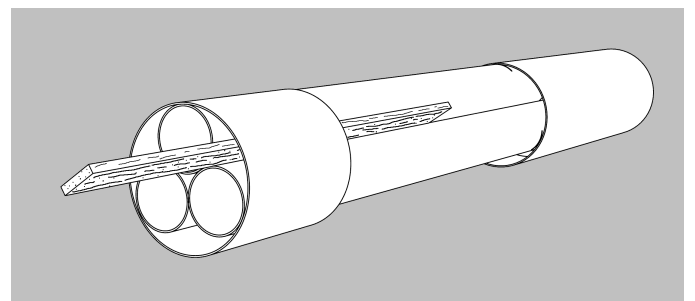
- ❑ **12.** Stack the three smaller fins together. Line them up squarely and sand the fins back and forth over some fine sandpaper to get rid of the hold-in tabs as shown below. Repeat for the three large fins and the three fin strips. **Keep the slight tab on the front of the root edge on the large fins.** It might be preferable to fill all the fins now since the strips will be harder to fill once glued in place. Refer to Step 25 if you want to fill the fins now.



- ❑ **13.** Round all edges except the root edges (which will be glued to the body tube). Again, avoid sanding off the slight tab on the large fins.



- ❑ **14.** Check the three fin strips for fit. They may need to be sanded slightly to fit along the joint between two engine tubes and under the large tubes. Align them with about 1/8" extended under the forward tube and the bottom even with one of the lines on the bottom tube. Apply a bead of glue along each joint. Repeat for the other two strips. It is important that the strips are aligned with the lines that were drawn earlier. If they do not line up, correct the lines before mounting the fins.



# EXPLODED VIEW

## Parts List

- A 1 Balsa Nose Cone..... BC-516
- B 1 Body Tube..... ST-530
- C 1 Balsa Reducer ..... BR-510
- D 1 Body Tube..... ST-1020
- E 1 Balsa Reducer ..... BR-1016S
- F 1 Body Tube..... ST-1652
- G 3 Body Tube..... ST-790
- H 1 Body Tube..... ST-1620
- I 1 Laser Cut Fin Strips..... FV-60S
- J 1 Laser Cut Fins ..... FV-60
- K 3 Thrust Rings ..... TR-7
- L 2 Launch Lugs..... LL-117
- M 1 Centering Ring..... CR-KV-60
- N 1 Screw Eye ..... SE-10
- O 1 Elastic Cord ..... EC-124
- P 1 Kevlar Thread ..... SCK-12
- Q 1 Clay Weight..... WC-5
- R 2 Plastic Parachute..... RC-12
- S 2 Tape Discs..... TD-6
- T 2 Shroud Line ..... SLT-6
- U 1 Empty Casing..... MC-727
- V 1 Decal ..... DKV-60

