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.

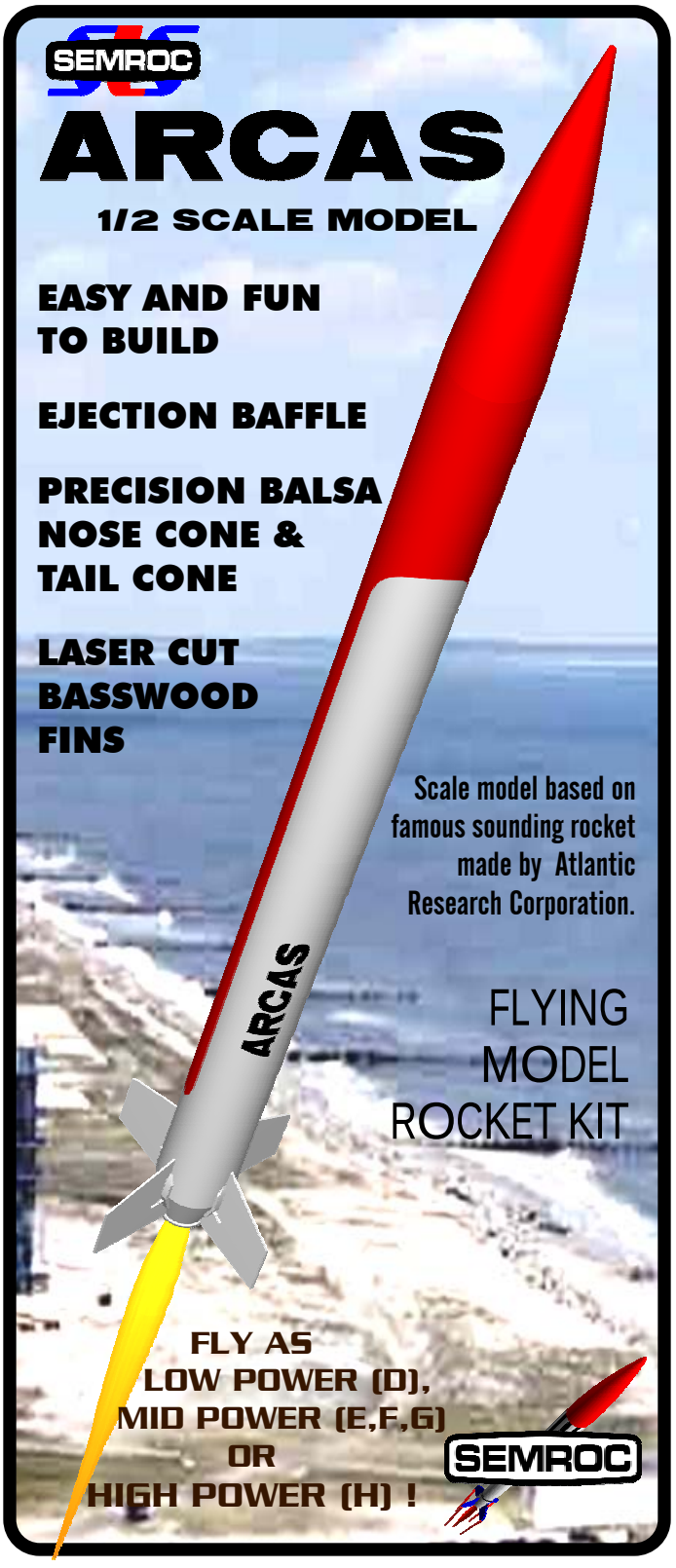
9. Launch Site. I will launch my rocket outdoors, in an open area at least as large as shown in the accompanying table, and in safe weather conditions with wind speeds no greater than 20 miles per hour. I will ensure that there is no dry grass close to the launch pad, and that the launch site does not 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



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

SLS Arcas™
Kit No. KS-5

Specifications	
Body Diameter	2.25" (5.7 cm)
Length	45.5" (115.6 cm)
Fin Span	6.5" (16.5 cm)
Net Weight	8.7 oz. (246.8 g)

Engine	Approx. Altitude
D12-3	225'
E18-4	600'
F21-4	800'
H128-6	1450'

Nylon Parachute Recovery

What is SLS?

SLS is short for Semroc Large-Scale Rocketry. Based on the original Centuri Large Scale Line using larger, thicker-walled body tubes, Semroc is introducing several models in the Mid-Power range. Most of the models will fly on 24mm and 29mm engines in the C through G (and small H) impulse levels. Featured in the family are laser-cut basswood fins, Nylon chutes, and laser-slotted tubes allowing much more robust construction designed to last for years of flying.

About Semroc Astronautics Corporation

Semroc Astronautics Corporation was started by Carl McLawhorn in his college dorm at North Carolina State University in November, 1967. Convincing a small group of investors in his home town of Ayden, North Carolina to invest in a small corporation, the company was re-incorporated as Semroc Astronautics Corporation on December 31, 1969.

Semroc produced a full line of model rocket kits and engines. At its peak, Semroc had twenty-five full time employees working at two facilities. One was for research and development, printing, shipping, and administration. The other was outside town and handled all production and model rocket engine manufacturing. For several years, Semroc was successful selling model rocket kits, supplies, and engines by mail-order and in hobby shops. In early 1971, Semroc became insolvent and had to close its doors.

After 31 years of dreams and preparations, Semroc Astronautics Corporation was reincorporated on April 2, 2002 with a strong commitment to helping put the fun back into model rocketry.

July 7, 2007

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 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 for promotions just for NAR members.

NOTES:

About the SLS Arcas™

The Semroc SLS Arcas™ is a 1/2 scale model of the famous small sounding rocket produced in the 1950's and 1960's by Atlantic Research Corporation. There were over 14,000 Arcas rockets produced and they flew from over 55 launch sites around the world. The primary purpose was to extend the rocketsonde data collection capability to over 200,000 feet, but their payloads were as diverse as cameras, biological, chemical, and inflatable shapes.

This model has a precision shaped scale nose cone of the original No. 5A, heavy-duty thick walled body tube, laser-cut basswood fins, ejection baffle, long tough elastic cord, large Ripstop Nylon chute, and 24mm and 29mm engine mounts. It is capable of flying the full range of D impulse engines through H impulse engines, making it a great choice for Level 1 Certification for High Power.

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 is also required.

ASSEMBLY

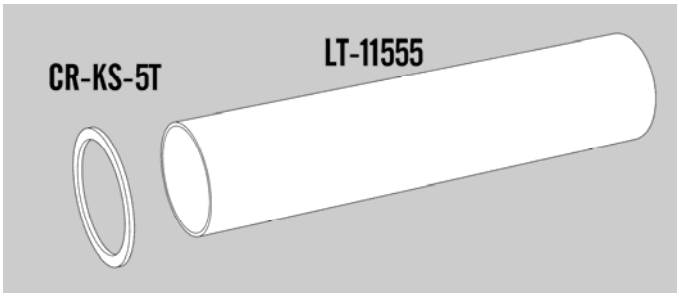
❑ **1.** These instructions are presented in a logical order to help you put your SLS Arcas™ together quickly and efficiently. Check off each step as you complete it and enjoy putting this kit together.

HIGH POWER?

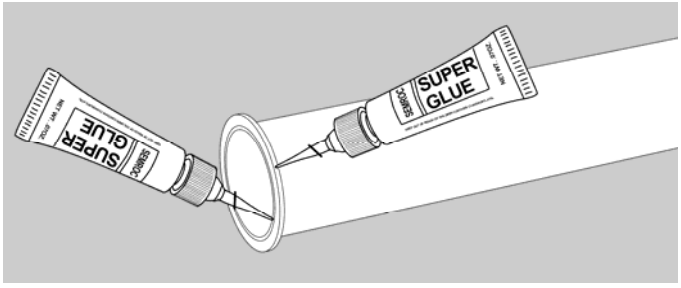
Note: This kit can be built to fly low power, mid-power, or high power. That does not mean it is built the same for all three. If you plan on launching it on engines with less than 50 Newtons of average thrust, it can be built with yellow glue. If it will be flown using higher thrust engines, it should be built with epoxy and all the joints should be well-filleted. Fiberglass should be used on internal rings for maximum strength.

ENGINE MOUNT

❑ **2.** Place the small fiber ring (CR-KS-5T) on one end of the engine tube (LT-11555.) Make sure it is exactly even with the end. Stand the assembly on a table to line them up.



❑ **3.** Use cyanoacrylate glue (CA) to seal the edges of the ring and the bottom of the engine tube. Wipe off any excess from the inside of the tube. You must use CA. Yellow glue will not work well! Allow to dry.



ARCAS DATA SHEET

ROCKET ENGINE	
Average Thrust	312 Lb. (1388 N)
Burn Time	29.2 Sec
Propellant	Solid Composite
NAR Designation	P1400-105
PARACHUTE	
Material	3-Momme Silk
Configuration	15 ft. diameter
Shape	Hemisphere
Ballistic coefficient	.050, with 10 lb payload
PAYLOAD	
Separation	Gas Pressure (pyro)
Length	26" (varies)
Material	.040" Aluminum
Weight	8 to 25 lbs
NOSE CONES	
No. 5A	18.1" long, 170 in cu
No. 8	22 " long, 230 in cu
LAUNCH DATA	
Flight Angle	84 degrees
Burnout Velocity	3600 ft/sec (approx.)
Burnout Altitude	55,000 ft (approx.)
Time to Apogee	135 sec
Nominal Spin Rate	20 r/s (at burnout)
Launch Weight	76.4 lb.
Burnout Weight	33.3 lb.
Launch Method	ARCAS closed breech

DESIGNERS:
Walter C. Roberts, Jr.
Roland C. Webster
Millard Lee Rice

Scale Sources:

"Astroscale Arcas," G. Harry Stine, *Model Rocketry Magazine*, April 1969, pp 19-22.

"Rockets of the World, Third Edition." Peter Alway, Saturn Press, pp 132-135.

"Small Sounding Rockets," Richard B. Morrow with Mitchell S. Pines, Small Rocket Press, pp 387-391, 419-429.

FLIGHT PREPPING

❑ **40.** The SLS Arcas™ will accept 29mm engines as built. Since most 29mm engines have widely varying lengths, they will have to be friction fit using masking tape. Using the EM-9115 adapter, 24mm engines may be used. The adapter will have to be secured with masking tape, then the engine is secured with the engine hook included with the adapter.

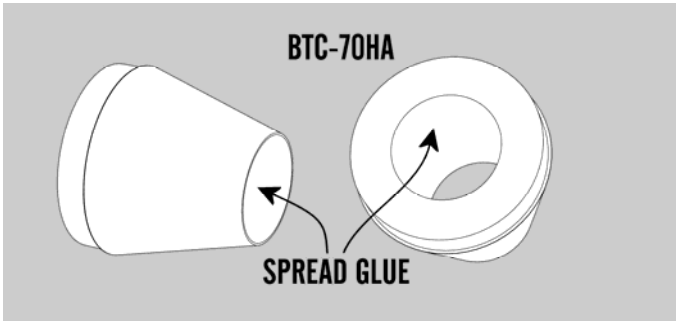
❑ **41.** The SLS Arcas™ has an ejection baffle to reduce the need for recovery wadding. If you do add recovery wadding, pack it from the top of the body tube. Use a sufficient quantity to protect the parachute, but too much will not leave enough room for the chute and shock cord.

❑ **42.** Fold the parachute and pack it and the elastic shock cord on top of the recovery wadding. Slide the nose cone into place, making sure it does not pinch the shock cord or parachute.

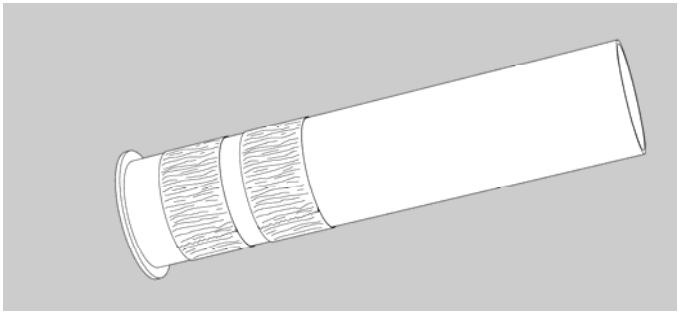
❑ **43.** Refer to the model rocket engine manufacturer's instructions to complete the engine prepping. Different engines have different igniters and methods of hooking them up to the launch controllers. Since the SLS Arcas™ will fly on a wide variety of engines, it is important that you pick the correct delay times. Some G engines will exceed the 500g FAA limit and you will have to notify the FAA before flying. All H impulse engines require user certification and an FAA waiver. Locate members of a local club to help you with the regulations.

❑ **44.** Carefully check all parts of your rocket before each flight as a part of your preflight checklist. Launch the SLS Arcas™ from a 3/16" diameter by 48" long launch rod.

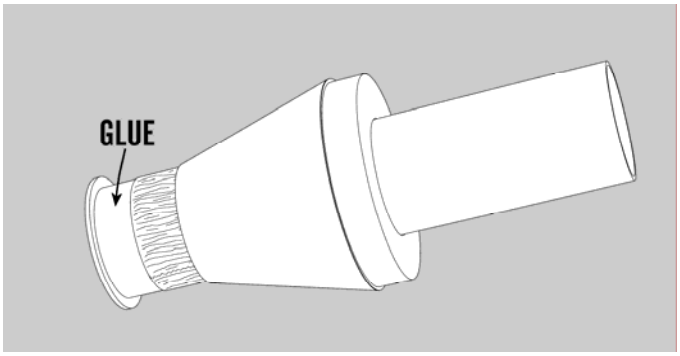
❑ **4.** Apply a generous amount of yellow glue inside the balsa tail cone. This will add much strength to the cone.



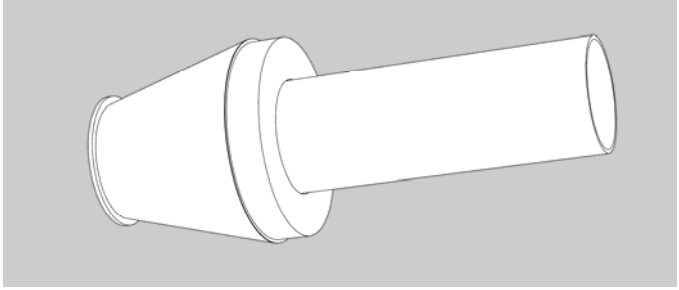
❑ **5.** While the glue is setting inside the tail cone, apply two wraps of masking tape on the bottom end (nearest the ring) of the engine tube.



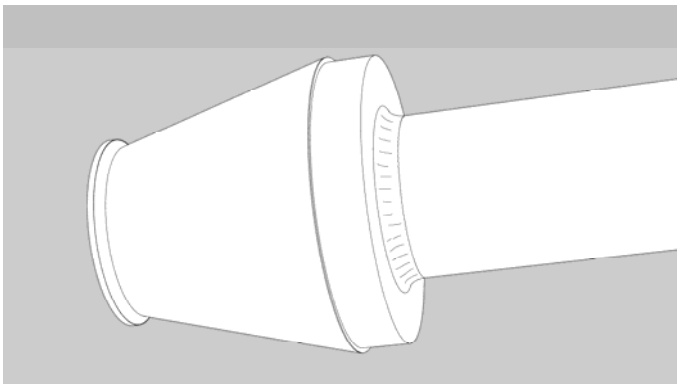
❑ **6.** Slide the tail cone over the top of the engine tube and check it for fit. Apply a bead of glue around the bottom of the engine tube.



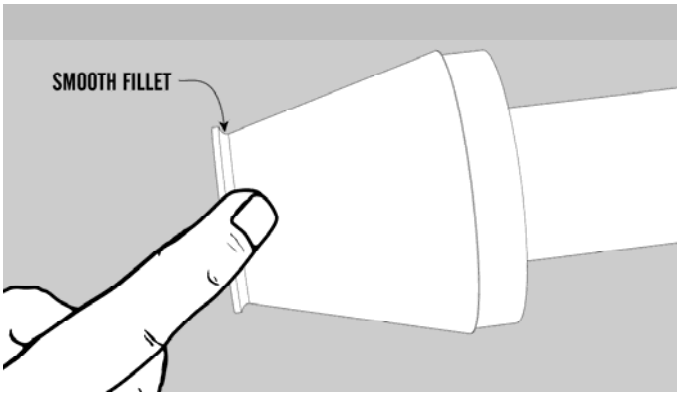
❑ **7.** Push the cone gently until the end is flush with the ring. Cut off any excess masking tape that is exposed.



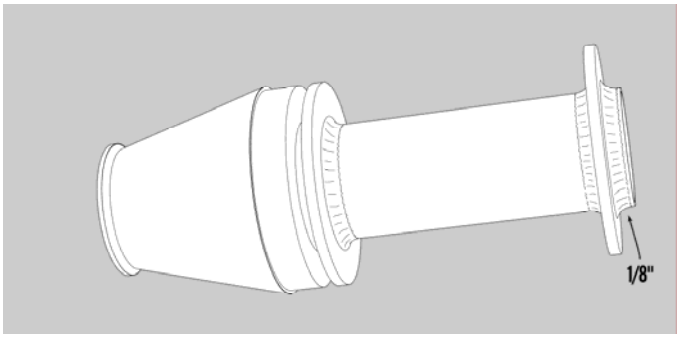
❑ **8.** Apply a fillet of glue around the joint of the cone and engine tube.

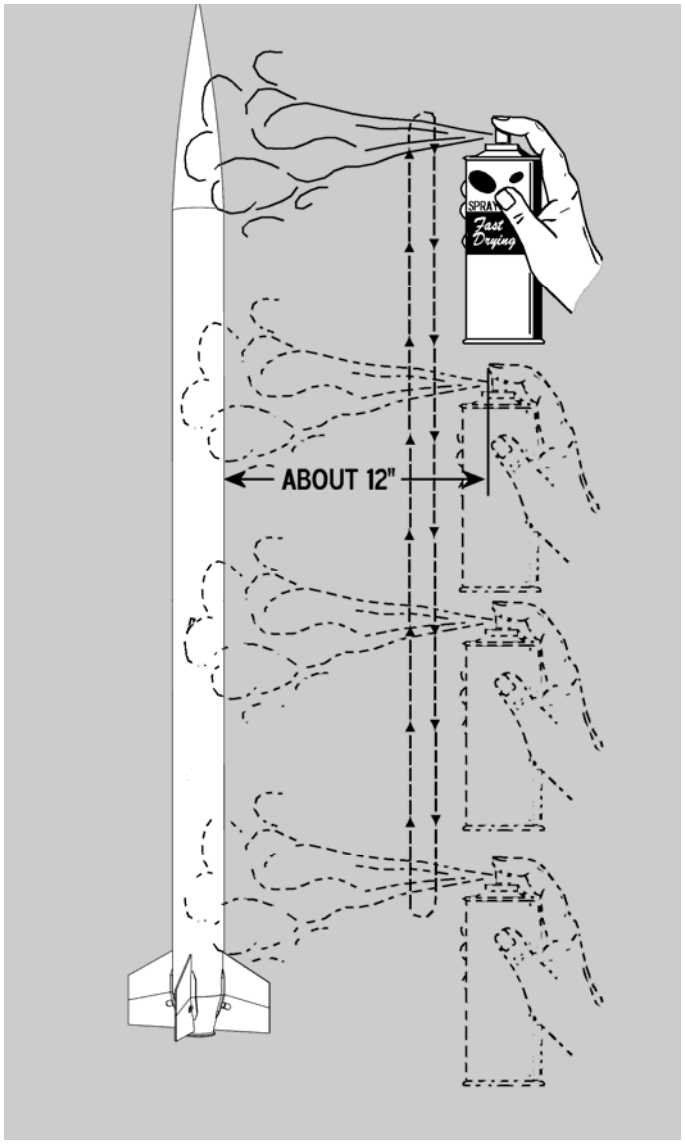


❑ **9.** Apply a fillet of glue around the joint of the tail cone and fiber tail ring. Yellow glue can be used since this joint is cosmetic. This should form approximately a 90 degree angle as shown. Turn the tube to keep both fillet from running while the glue is drying.

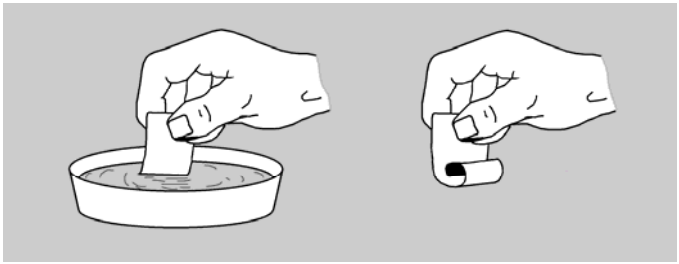


❑ **10.** Slide the two centering rings (RA-115-70P) over the top of the engine tube. Align one against the tail cone and the other about 1/8" from the top of the engine tube. Apply a fillet of glue around all the joints. If you are planning on using high thrust engines, a layer of lightweight fiberglass cloth on the plywood rings will greatly improve their strength.



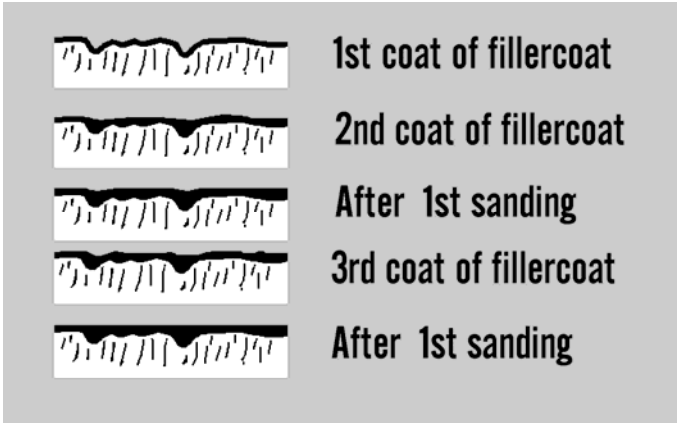


❑ **39.** After the paint has dried, decals should be applied. The decals supplied with the SLS Arcas™ are waterslide decals. Refer to the photo for decal placement. Check for fit before wetting the decal. A drop of detergent in the water will allow for more movement before the decal sets.



FINISHING

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



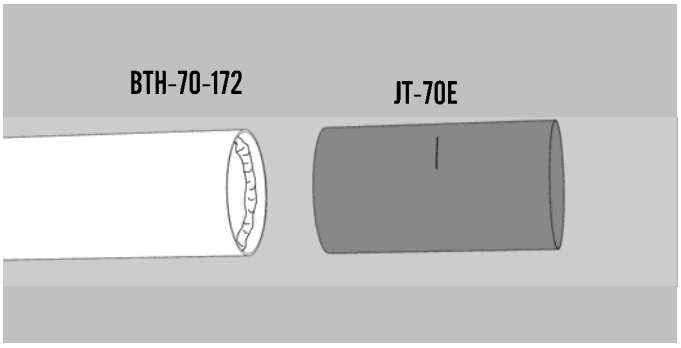
❑ **36.** After all balsa and basswood surfaces have been prepared, wipe off all wood dust with a dry cloth. First spray the model with an enamel primer, then spray a base color of gloss white.

❑ **37.** The SLS Arcas™ can now be painted with its final colors. There were over 14,000 Arcas flights with a wide range of color patterns. The color scheme on the front of the instructions depicts the round pictured in NASA photo 63-Arcas-1. It was painted in their advertising paint scheme without the Arcas bear. The nose cone and payload section are red and the two stripes down the side. The payload section separation point is 5.78" from the top of the main tube. The striping line is 1.125" wide and extends almost to the top edge of the fins.

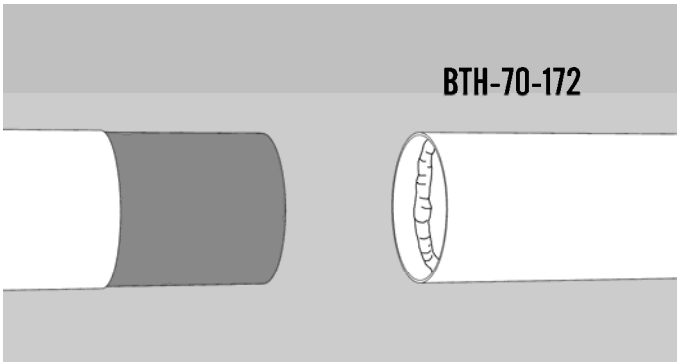
❑ **38.** Spray painting your model with a fast-drying enamel will produce the best results. PATIENCE…is the most important ingredient. Use several thin coats, allowing each coat to completely dry before the next coat. Start each spray a few inches above the model and end a few inches below the model. 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.

MAIN TUBE

❑ **11.** Place a mark 2" from either end of the tube coupler (JT-70E). Apply a bead of glue inside one end of one of the large body tubes (BTH-70-172). Insert the tube coupler until it is halfway inside the main tube and even with the mark.

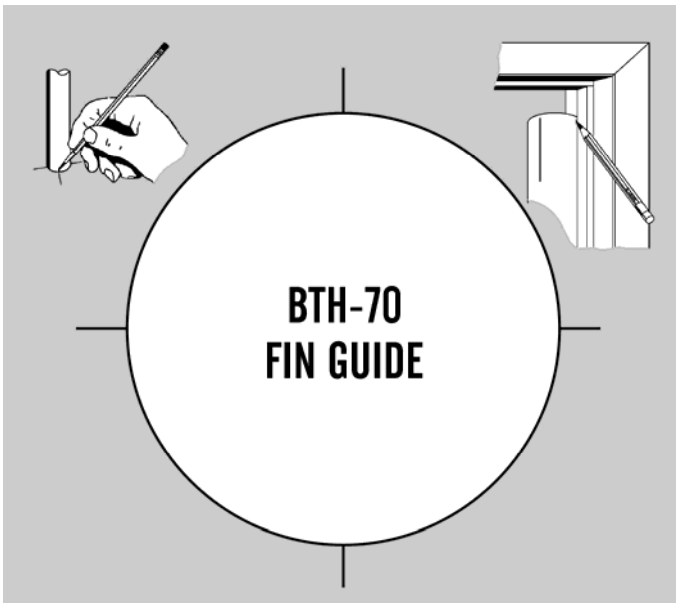


❑ **12.** Before the glue sets, apply a bead of glue inside the end of the other large body tube and insert the exposed end of the coupler. Twist slightly to make the joint between the tubes as tight as possible. Roll the assembly on a long flat surface to make sure the two tubes are aligned properly. Turn while drying to keep excess glue from pooling inside the tubes.



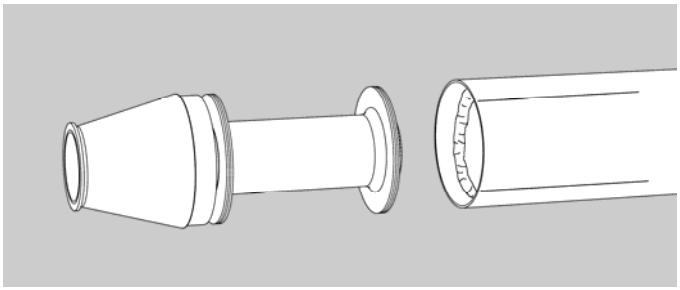
MARK THE TUBE

❑ **13.** Stand the body tube assembly on the fin guide on the next page. Mark the four fin positions. Find a convenient channel or groove such as a door jamb (as shown) or a piece of molding. Using the channel, extend the marks at least 4" from the end to provide lines for aligning the fins.

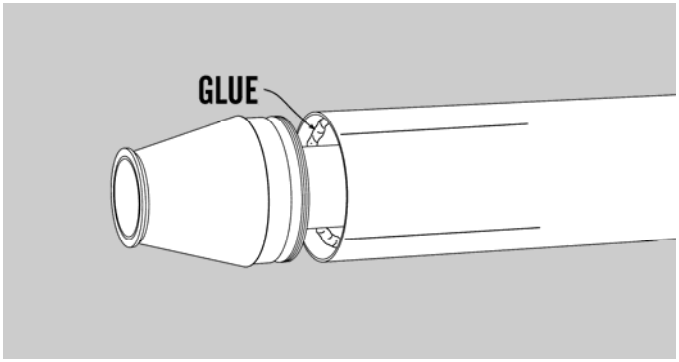


GLUE ENGINE MOUNT

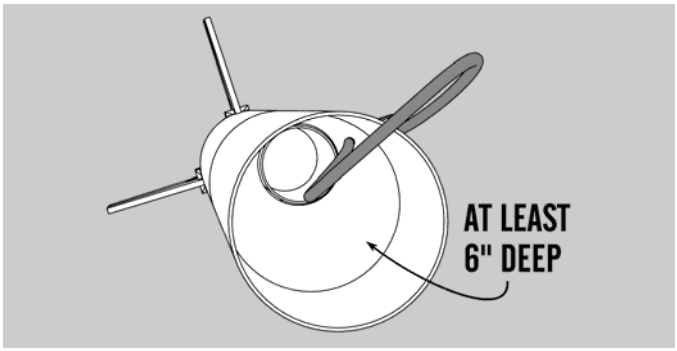
❑ **14.** Apply a heavy bead of glue inside the end of the main body tube that has the four pencil marks. Partially insert the mount. If you are building this for high thrust engines, this should be epoxy.



❑ **15.** Quickly apply another bead of glue just inside the body tube and finish inserting the engine mount until the shoulder is flush with the end of the tube. Turn the assembly in a vertical position with the boat tail down and allow the glue to dry completely.



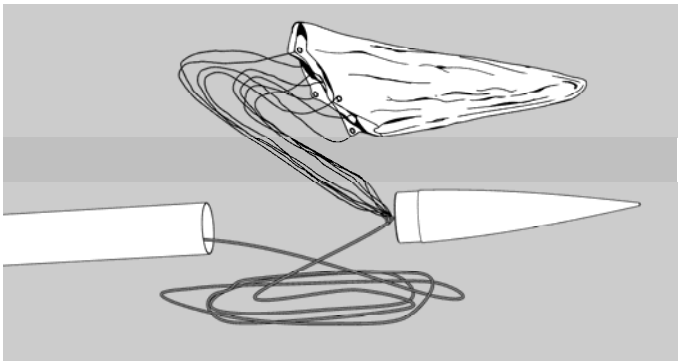
❑ **32.** Apply a generous bead of glue around the top ring of the ejection baffle using the glue applicator. Keep glue away from the elastic cord. Allow to dry.



FINAL ASSEMBLY

❑ **33.** Assemble the 24mm engine mount (EM-9115) using the instructions supplied.

❑ **34.** Prepare the shock cord as follows. Shake the elastic shock cord free and pull it out from the top of the main body tube. Tie the loose end of the elastic cord to the screw eye on the payload section. Attach the parachute to the screw eye.



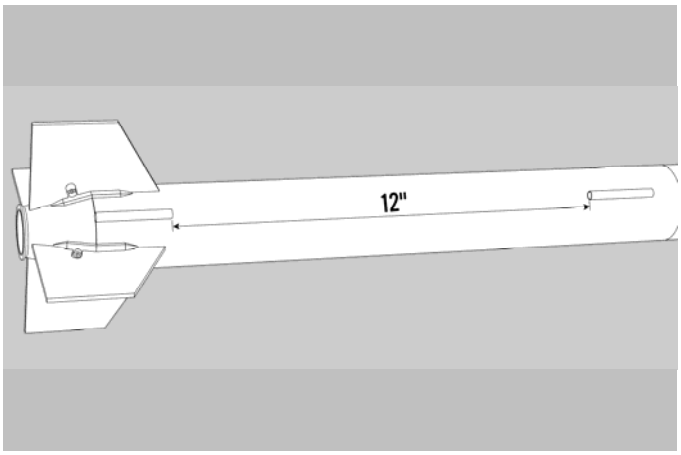
This completes the assembly of your

SEMROC

ARCAS

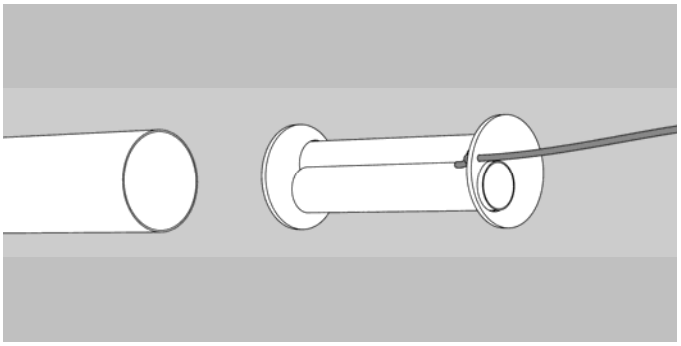
ADD LAUNCH LUGS

❑ **30.** Glue one of the launch lugs into position between two fins even with the bottom of the main body tube. Glue the second launch lug 12" above the lower launch lug and in line with it. Sight from the top to ensure that they are properly aligned. If you are flying with high thrust engines, a layer of lightweight fiberglass cloth should be applied with epoxy over the lugs.

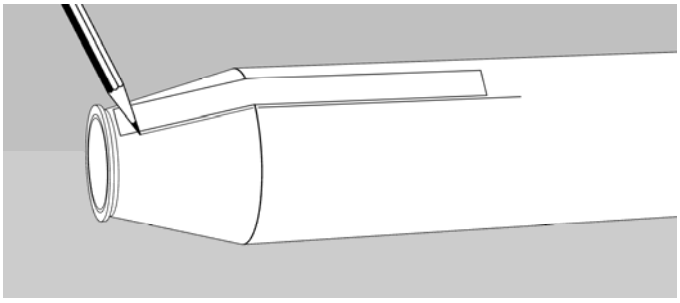


ADD EJECTION BAFFLE

❑ **31.** Test fit the ejection baffle in the main tube. Sand the edges so it will slide freely in the main body tube. Apply a bead of glue about 6" inside the top of the main tube. Orient the baffle assembly so the elastic cord is at the top end. Slide the ejection baffle in the tube past the bead of glue until the top of the baffle is about 6" from the top of the tube. Rotate the main tube as the glue is drying so it does not pool in one place. Allow to dry completely.



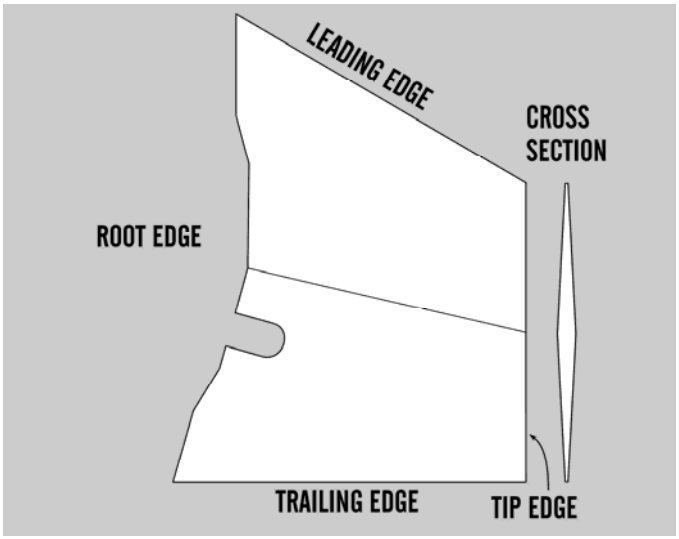
❑ **16.** Using a piece of card stock as a straightedge, extend the lines marked on the tube along the boat tail as shown..



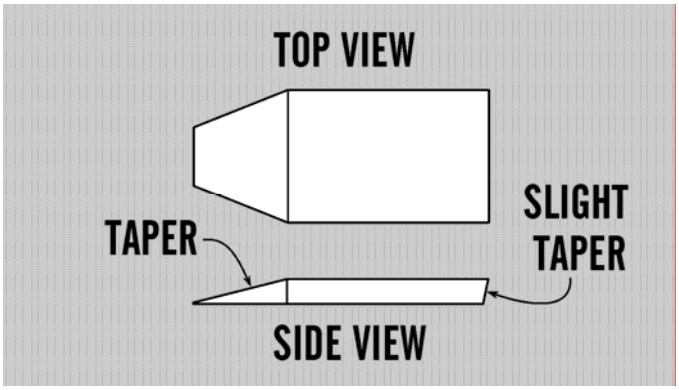
PREPARING THE FINS

NOTE: This is probably the most difficult step if you decide to do this model to full scale. Sanding basswood to the proper shape is difficult and time consuming. Using a file to rough out the shape may be helpful. If you are building this model for sport, you can round all the edges, except the root edges, and skip the difficult sanding steps.

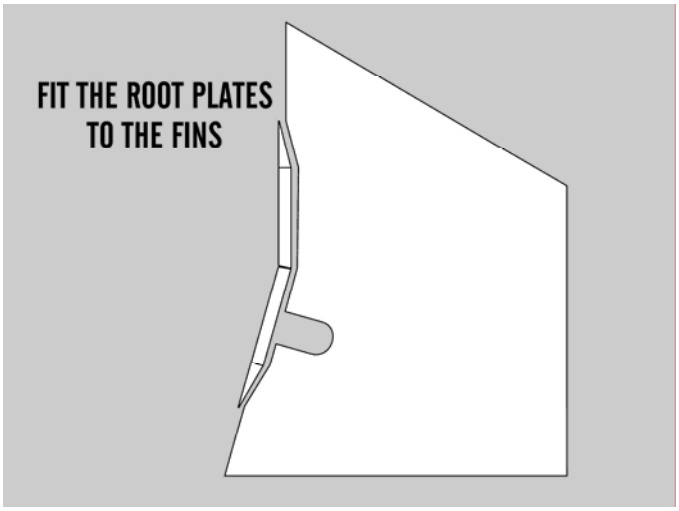
❑ **17.** Sand the fins with a slight taper from the root edge to the tip edge. The root edge should be .125" and the tip edge should be .10" when you are finished. Mark a mid-line on the front and back of each fin from the center of the root edge to the center of the tip edge. Taper each edge as shown in the cross section. The leading edge and trailing edge should be about .017". Much patience is required since basswood is much harder than balsa.



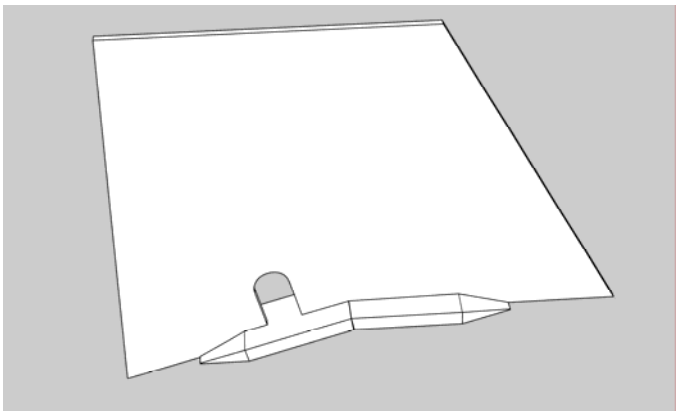
❑ **18.** Sand all eight of the root edge plates as shown below. Slightly round all the top edges just enough to remove the sharp corners.



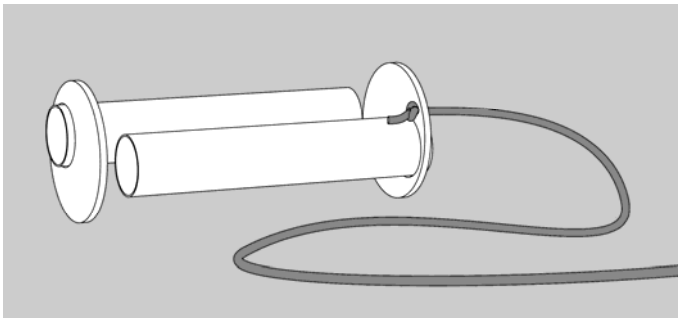
❑ **19.** Fit pairs of root plates inside the root edge cavity on the main fins. The small bevel may be sanded to allow the two pieces to fit properly.



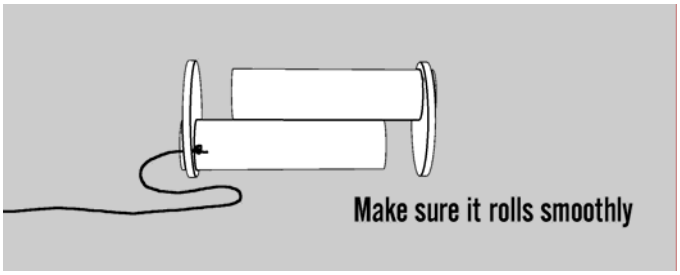
❑ **20.** When a proper fit is achieved, apply glue (or epoxy) along the center of the two plates and glue one of the fins to the plates. make sure they are centered and a tight fit is formed.



❑ **27.** Tie a large knot in one end of the elastic cord. Thread it in the small hole in one of the baffle rings as shown. Slide the ring with the elastic cord over one end of the baffle tube leaving about 1/16″ showing. **Do not glue yet!** Slide the second ring over the opposite end of the assembly leaving 1/16″ overlap.

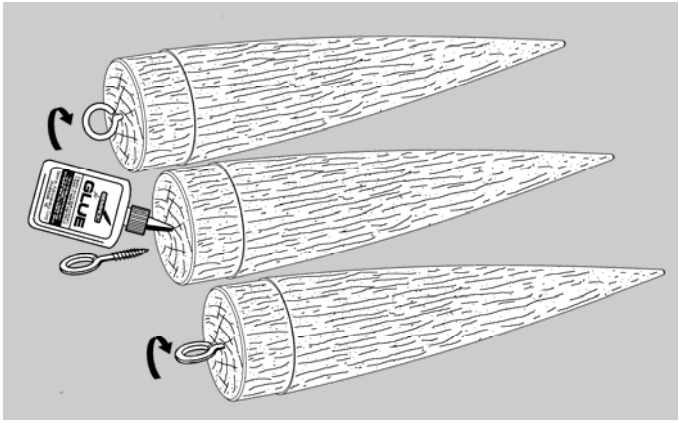


❑ **28.** Align the two rings so the assembly is symmetrical and rolls smoothly over a flat surface. When the assembly is aligned, apply fillets of glue over both sides of each ring along the tube joints. Keep glue off the outside surface of each ring. Set this assembly aside to dry.



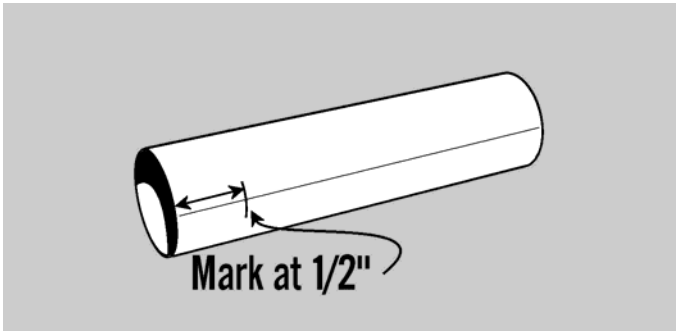
NOSE CONE

❑ **29.** Twist the screw eye into the center of the balsa nose cone. Unscrew it and squirt glue into the hole. Reinstall the screw eye and wipe off any excess glue.

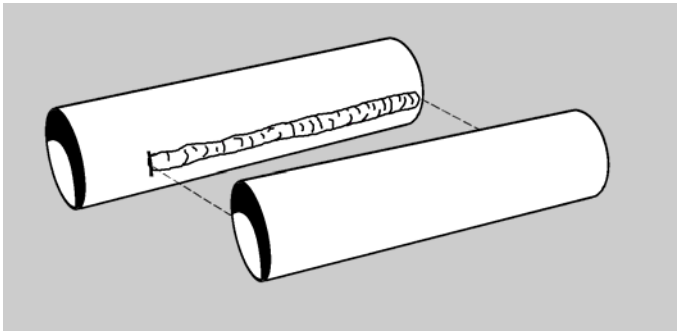


EJECTION BAFFLE

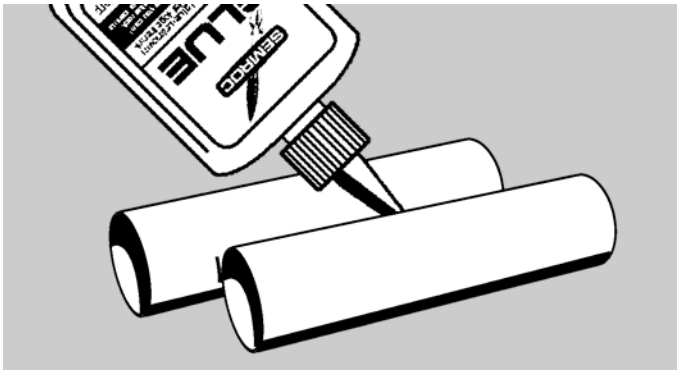
❑ **24.** Using a ruler, straight edge, or door jam, place a straight line on one of the two baffle tubes (ST-950). Place a mark on the line 1/2" from the end as shown.



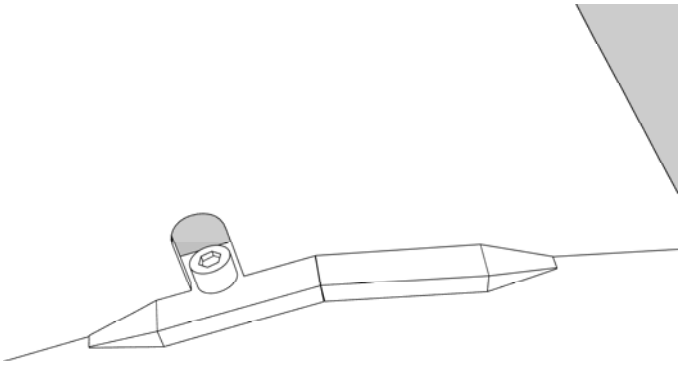
❑ **25.** Apply a bead of glue along the marked line from the 1/2" mark to the far end. With both tubes on a flat surface, slide the second tube against the bead of glue and hold in place until the glue sets.



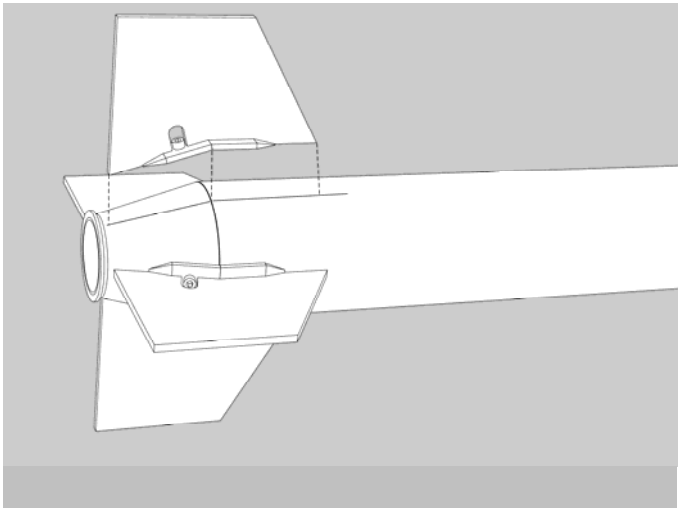
❑ **26.** After the glue is dry, apply additional fillets along both sides of the tube joints for strength. Since these tubes will absorb much of the heat of the ejection gases, apply a generous coating to the inside and outside of both tubes. Allow this assembly to dry.



❑ **21.** Punch out and sand all four of the simulated bolt heads. Center one on each root plate and centered inside the slot in the fin. Make sure the hex cavity is to the outside as shown.



❑ **22.** Some of the Arcas flights had canted fins to cause spin. The amount was slight, less than 2 degrees, and rotated around the attachment bolt. You can apply the fins along the marked lines for a spin-less flight or slightly canted for spin. Apply glue (or epoxy if high power) generously and allow to dry. Additional glue should be added at all the joints along the root plates for additional strength.



❑ **23.** While the glue is drying, sight down the end of the tube to make sure the fins stay aligned. Clean all runs and drips. When the glue is completely dry, apply one final fillet to all joints. These do not have to be thick, but should leave no gaps between the surfaces.

EXPLODED VIEW

Parts List

A	1	Nose Cone	BNC-70HAC
B	1	Tail Cone	BTC-70HA
C	2	Body Tubes	BTH-70-172
D	1	Body Tube	LT-11555
E	1	Tube Coupler	JT-70E
F	1	Laser Cut Fins	FS-5
G	2	Launch Lugs	LL-320
H	1	Screw Eye	SE-12
I	1	Arcas Tail Ring	CR-KS-5T
J	2	Centering Rings	RA-115-70P
K	1	Elastic Cord	ECR-272
L	1	Nylon Parachute	PN-24
M	1	Ejection Baffle	EB-70T
N	1	Engine Mount	EM-9115
O	1	Decal	DKS-5
P	1	Glue Applicator	GA-2