

SEMROC

PRO

ARCAS

**1/2 Scale Sounding
Rocket Model**

**Build light weight to fly on
low power D motors or build
strong to fly on high power
motors**

**Precision Turned
Balsa Nose Cone**

**3D Printed
Tail Cone**

**Laser Cut
Basswood Fins**

Ejection Baffle

**15" Nylon
Parachute**

ARCAS

*Designed by:
Carl McLawhorn*



**FLYING MODEL
ROCKET KIT**

Made in the U.S.A by Semroc - Dayton, Ohio

Pro ARCAS™ Kit No. KS-5

	Specifications	Engine	Approx. Altitude
Body Diameter	2.247" (5.7cm)	D12-3	225'
Length	45.5" (115.6cm)	E18-4	600'
Fin Span	6.5" (16.5cm)	F44-4	800'
Net Weight	8.7oz (246.8g)	H128-6	2450'

Skill Level 3

What is Pro?

Once known as SLS is short for Semroc Large-Scale Rocketry. Based on the original Centuri Large Scale Line. Now better known in the industry as Pro Series. Models will have 29mm motor mounts to take advantage of F through G (and small H) impulse motors. Featured in the family are laser-cut basswood or plywood fins, High quality rip stop nylon chutes, and laser-slotted tubes allowing much more robust construction designed to last for years of flying.

About Semroc

Semroc 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 motors. 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 of town and handled all production and model rocket motor manufacturing. For several years, Semroc successfully sold model rocket kits, supplies, and motors 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. Many years of excellent service to the rocketry community passed by until sadly, on August 11 2013, Carl passed away and left a great void in the hearts of many rocketeers. He is forever in our hearts and minds.

In February of 2015, Semroc was sold to eRockets and moved to Dayton, Ohio where it resides today. It is our goal to continue the level of service and dedication to the hobby that Carl and his family were so well known for. We strive to serve you, our customers, to the best of our abilities as we carry the vision of Carl McLawhorn boldly into the future.

July 7, 2007, May 2, 2016, September 11, 2018, February 2020

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About the Pro Arcas™

The Semroc Pro 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 rockets 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.

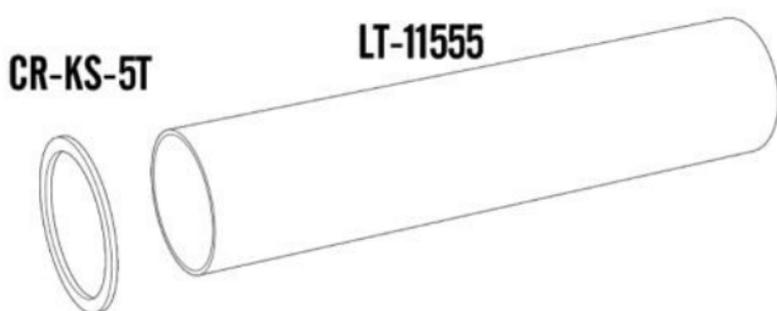


ASSEMBLY

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.

ENGINE MOUNT

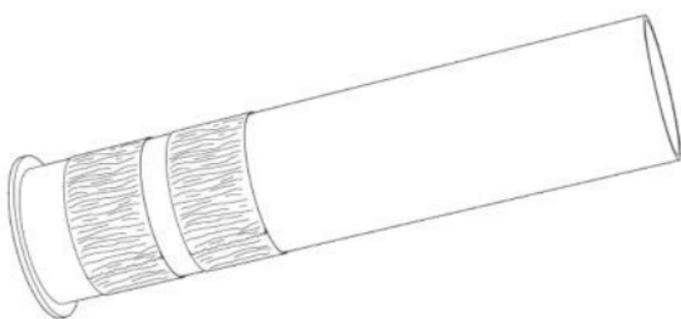
2. Place the small fiber ring (CR-KS-5T) on one end of the engine tube (LT-11555.) Make sure it is exactly even with the end. Stand the assembly on a table to line them up.



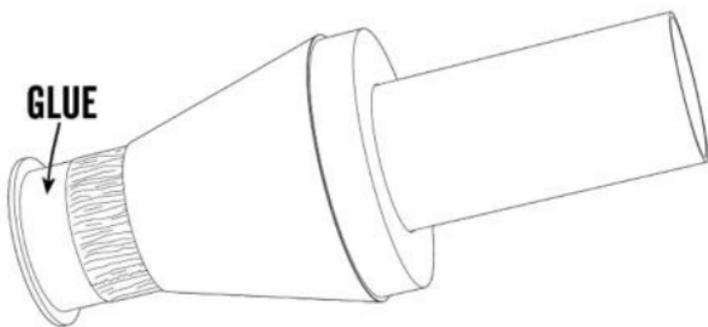
3. Use cyanoacrylate glue (CA) to seal the edges of the ring and the bottom of the engine tube. Wipe off any excess from the inside of the tube. You must use CA. Yellow glue will not work well! Allow to dry.



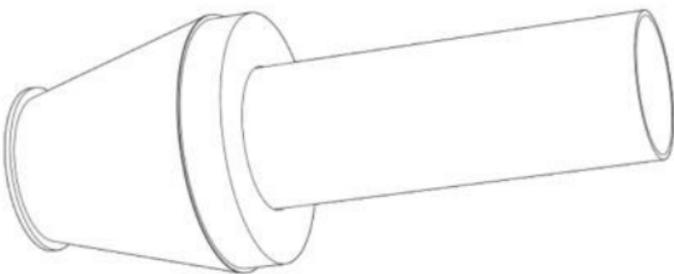
4. Apply two wraps of masking tape on the bottom end (nearest the ring) of the engine tube.



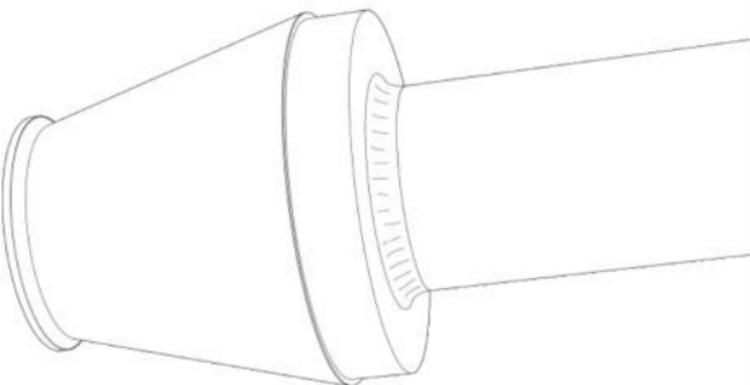
5. Slide the tail cone over the top of the engine tube and check it for fit. Apply a bead of glue around the bottom of the engine tube.



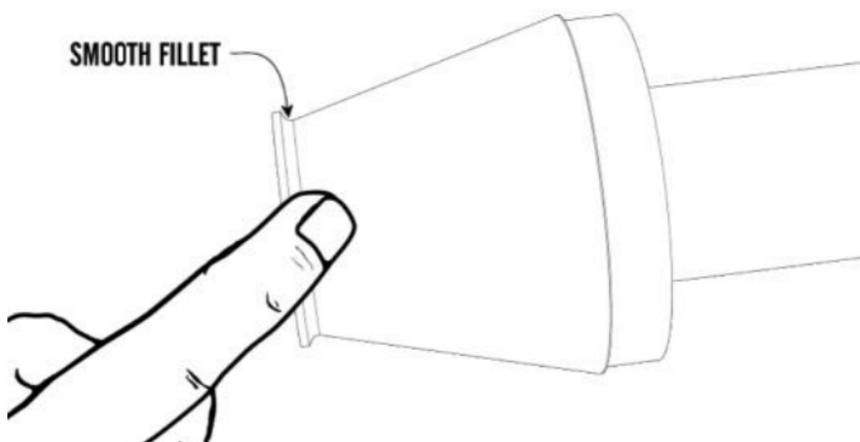
- ❑ **6.** Push the cone gently until the end is flush with the ring. Cut off any excess masking tape that is exposed.



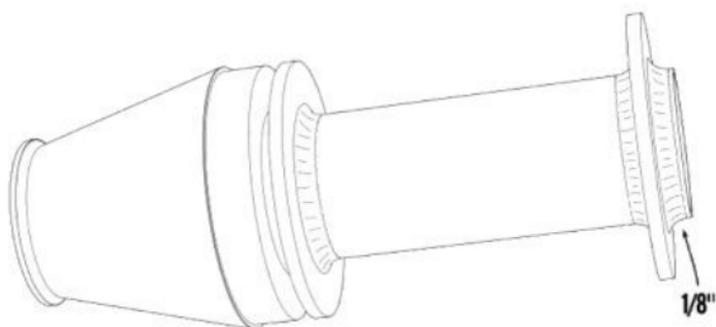
- ❑ **7.** Apply a fillet of glue around the joint of the cone and engine tube.



- ❑ **8.** 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.

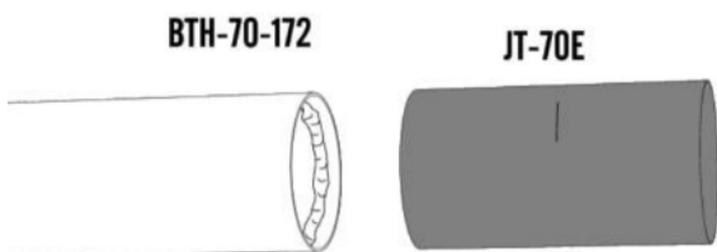


- ❑ **9.** Slide the two centering rings (RA-115-70P) over the top of the engine tube. Align one against the tail cone and the other about 1/8" from the top of the engine tube. Apply a fillet of glue around all the joints.

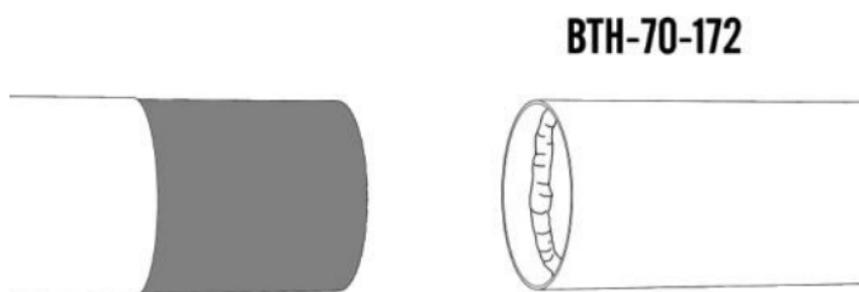


MAIN TUBE

- ❑ **10.** 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.



- ❑ **11.** 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.



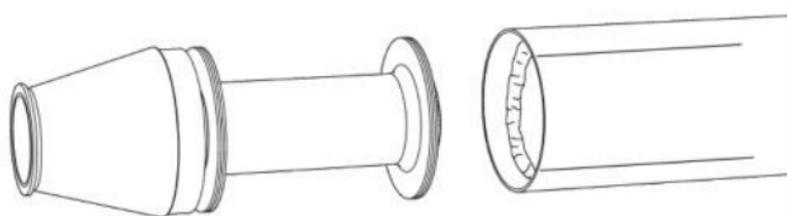
MARK THE TUBE

12. Stand the body tube assembly on the fin guide below. 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.

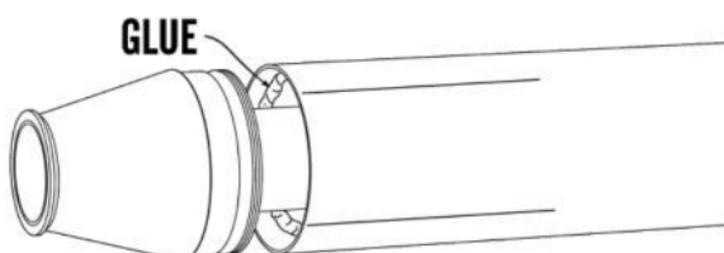


GLUE ENGINE

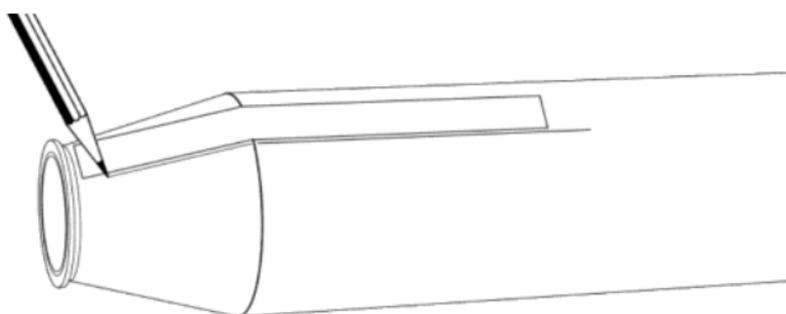
13. Apply a heavy bead of glue inside the end of the main body tube that has the four pencil marks. Partially insert the mount.



14. 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.



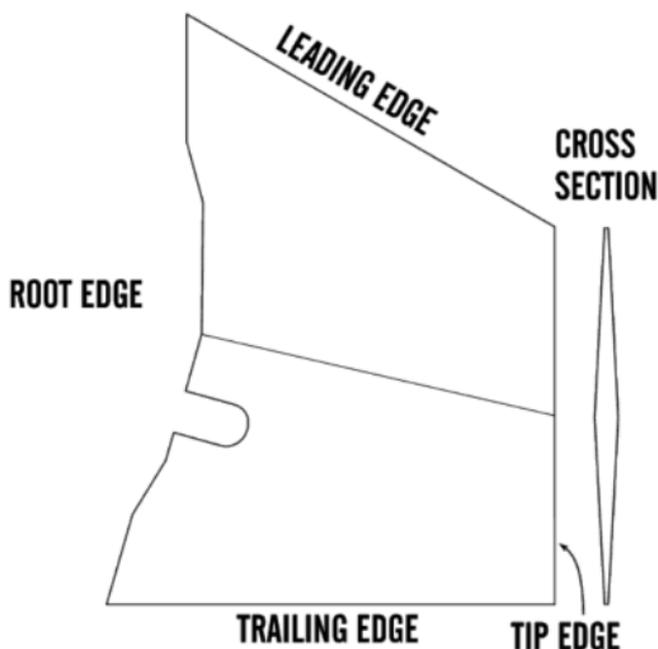
- ❑ **15.** Using a piece of card stock as a straightedge, extend the lines marked on the tube along the boat tail as shown..



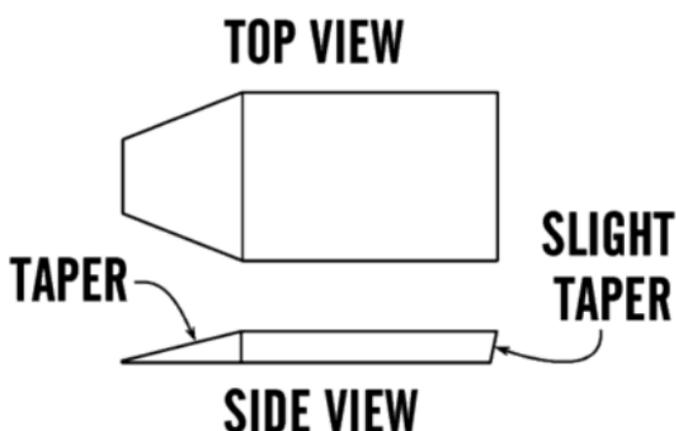
PREPARING THE FINS

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.

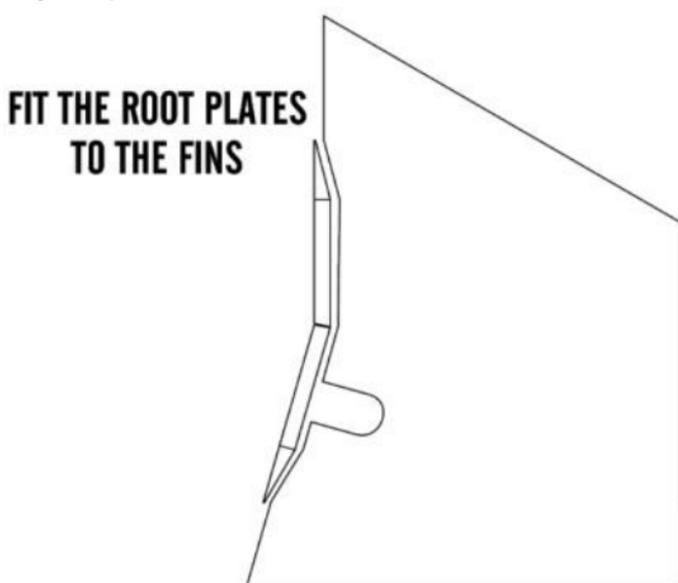
- ❑ **16.** Sand the fins with a slight taper from the root edge to the tip edge. The root edge should be 0.125" and the tip edge should be 0.1" when you are finished. Mark a mid-line on the front and back of each fin from the center of the root edge to the center of the tip edge. Taper each edge as shown in the cross section. The leading edge and trailing edge should be about 0.017". Much patience is required since basswood is much harder than balsa.



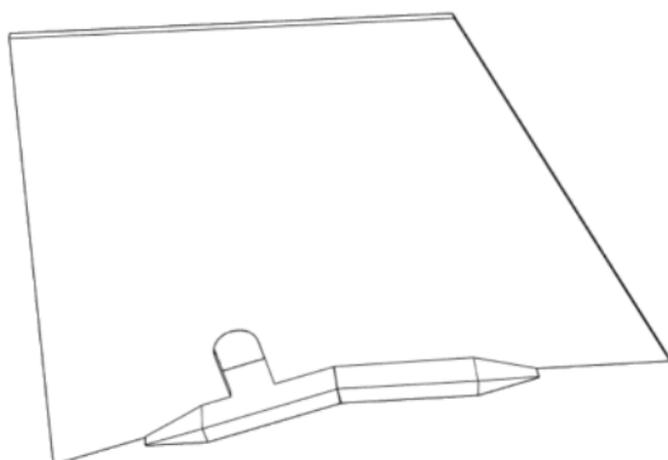
- ❑ **17.** Sand all eight of the root edge plates as shown below. Slightly round all the top edges just enough to remove the sharp corners.



- ❑ **18.** 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.

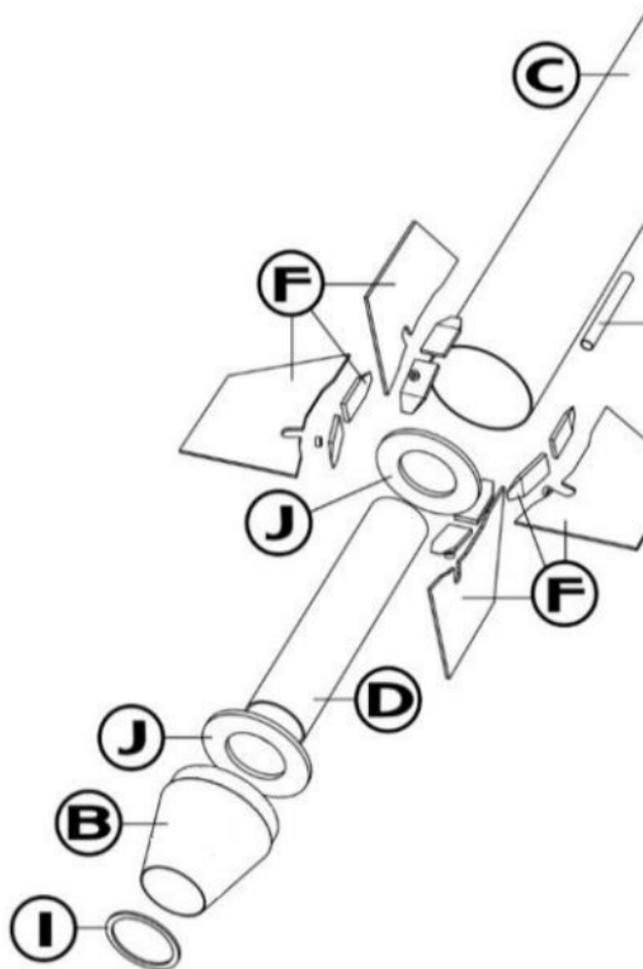


- ❑ **19.** When a proper fit is achieved, apply glue along the center of the two plates and glue one of the fins to the plates. make sure they are centered and a tight fit is formed.

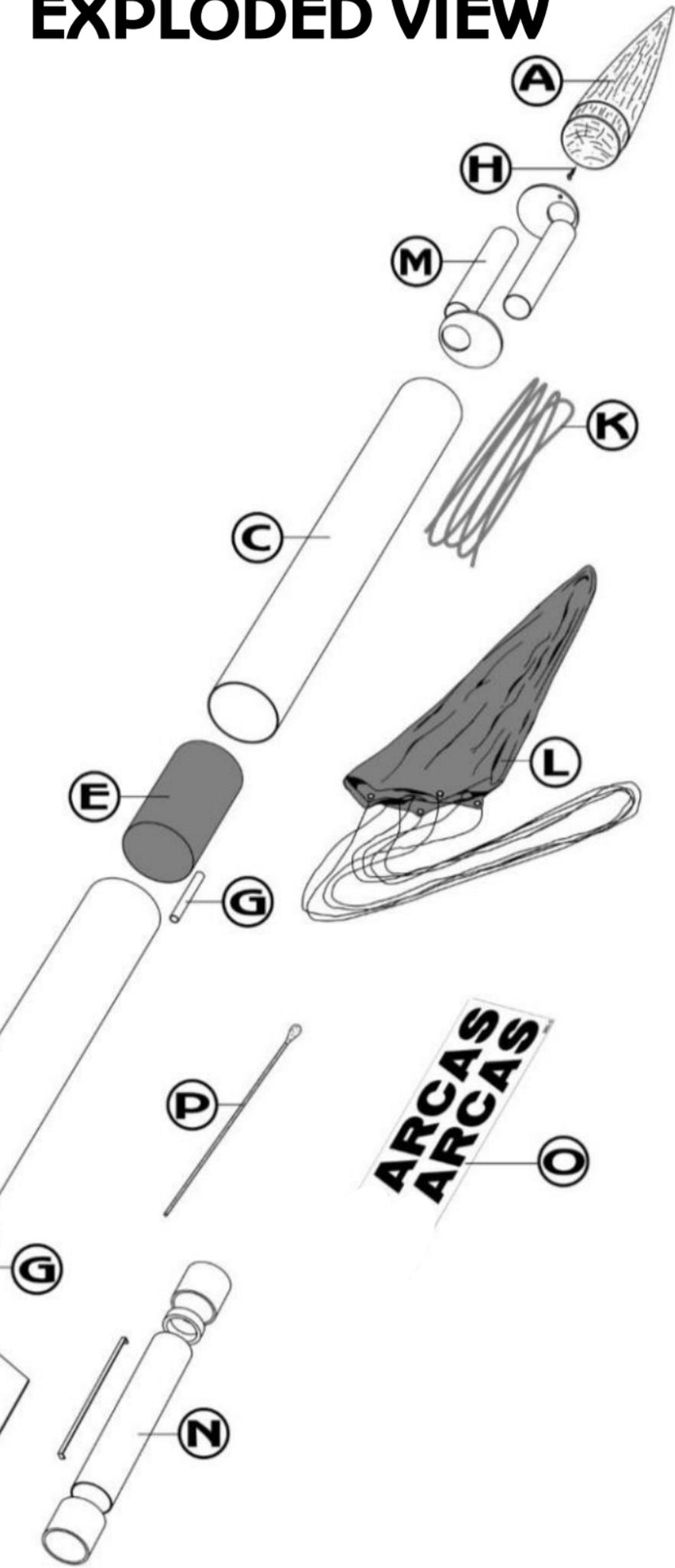


Parts List

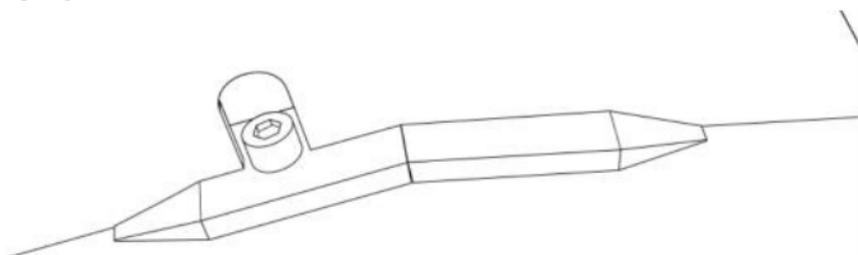
A	1	Nose Cone	BNC-70HAC
B	1	Tail Cone	TC3D-70HA
C	2	Body Tubes	BTH-70-172
D	1	Body Tube	LT-11555
E	1	Tube Coupler	JT-70E
F	1	Laser Cut Fins	FS-5
G	2	Launch Lugs	LL-320
H	1	Screw Eye	SE-14
I	1	Arcas Tail Ring	CR-KS-5T
J	2	Centering Rings	RA-115-70P
K	1	Elastic Cord	EC-236
K	1	Kevlar Cord	SCK-436
L	1	Nylon Parachute	PAR-15Red
M	1	Ejection Baffle	EB-70T
N	1	Engine Mount	EM-9115
O	1	Decal	DKS-5
P	1	Glue Applicator	GA-2



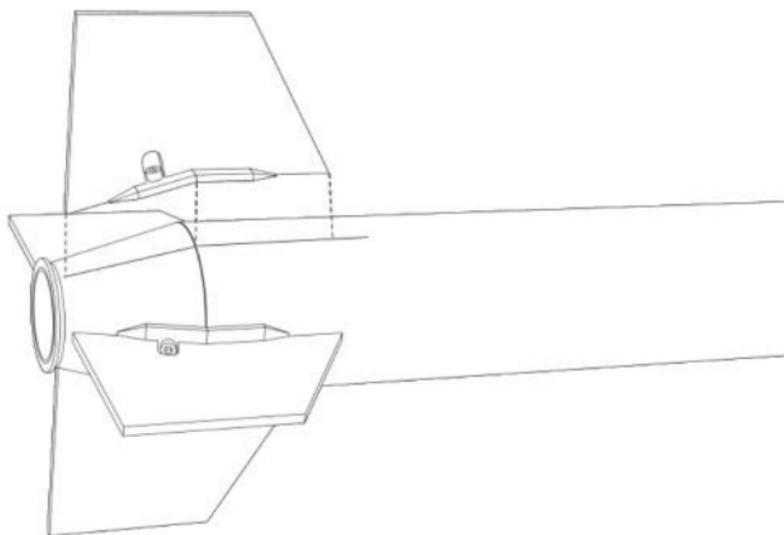
EXPLODED VIEW



- ❑ **20.** 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.



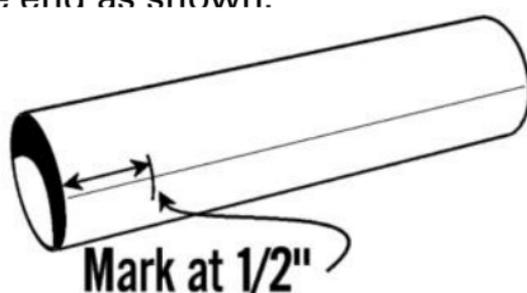
- ❑ **21.** Some of the Arcas flights had canted fins to cause spin. The amount was slight, less than 2 degrees, and rotated around the attachment bolt. You can apply the fins along the marked lines for a spin-less flight or slightly canted for spin. Apply glue generously and allow to dry. Additional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



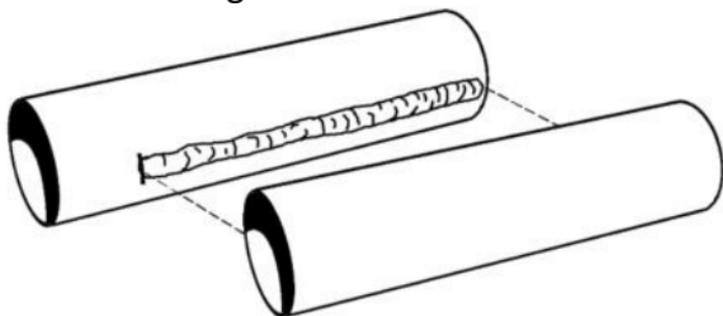
- ❑ **22.** While the glue is drying, sight down the end of the tube to make sure the fins stay aligned. Clean all runs and drips. When the glue is completely dry, apply one final fillet to all joints. These do not have to be thick, but should leave no gaps between the surfaces.

EJECTION BAFFLE

- ❑ **23.** 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.



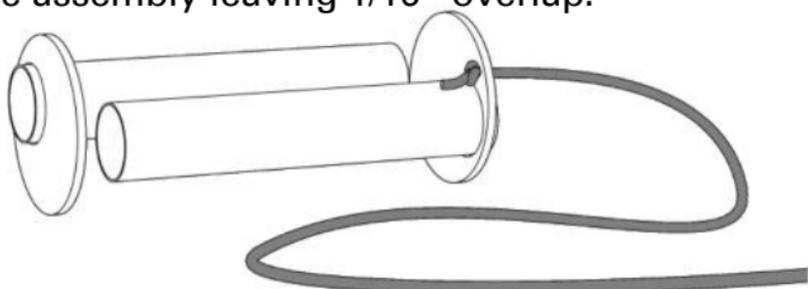
- ❑ **24.** Apply a bead of glue along the marked line from the 1/2" mark to the far end. With both tubes on a flat surface, slide the second tube against the bead of glue and hold in place until the glue sets.



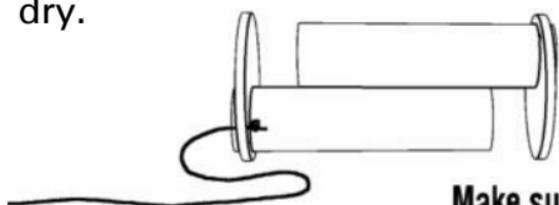
- ❑ **25.** After the glue is dry, apply additional fillets along both sides of the tube joints for strength. Since these tubes will absorb much of the heat of the ejection gases, apply a generous coating to the inside and outside of both tubes. Allow this assembly to dry.



- ❑ **26.** Tie a large knot in one end of the Kevlar 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.



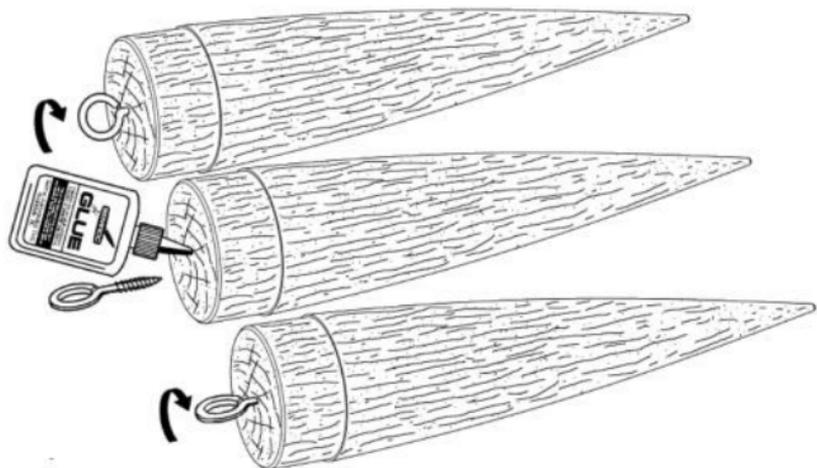
- ❑ **27.** Align the two rings so the assembly is symmetrical and rolls smoothly over a flat surface. When the assembly is aligned, apply fillets of glue over both sides of each ring along the tube joints. Keep glue off the outside surface of each ring. Set this assembly aside to dry.



Make sure it rolls smoothly

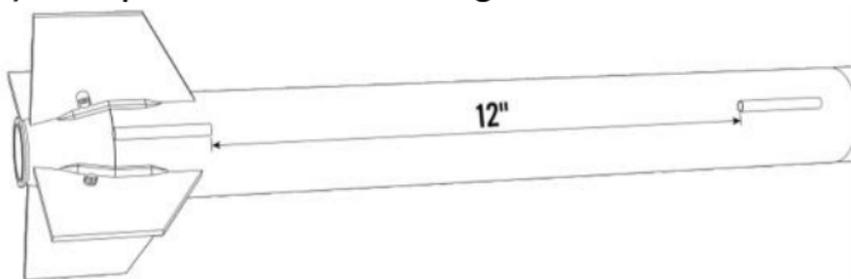
NOSE CONE

❑ **28.** 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.



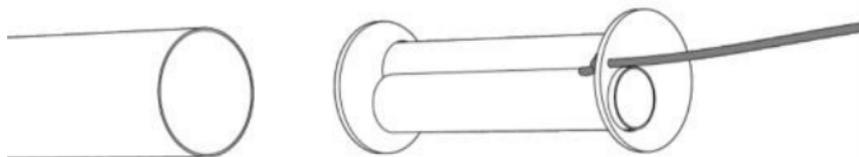
ADD LAUNCH LUGS

❑ **29.** 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 planning on flying High Power Motors, we recommend that you replace the Launch Lugs with Rail Buttons.

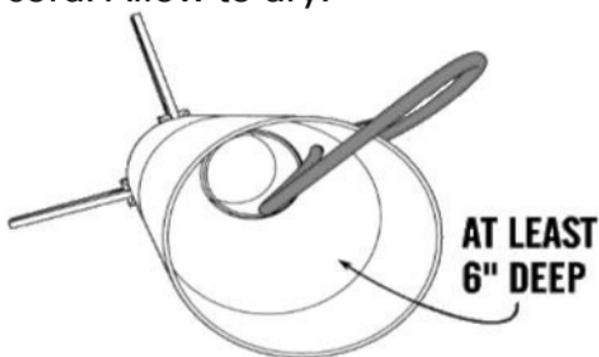


ADD EJECTION BAFFLE

❑ **30.** 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 Kevlar 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. Allow to dry completely.



- ❑ **31.** 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

- ❑ **32.** Assemble the 24mm engine mount (EM-9115)

Quantity	Part	Description
2	CR-9115	Centering Rings
1	TR-9	Thrust Ring
1	EH-38	Engine Hook
1	ST-950E	Engine Tube
1	MC-909	Spacer Tube

- ❑ **1.** Cut a groove on the inside of one of the centering rings the width of the engine hook about one-half the thickness of the centering ring.



- ❑ **2.** Place a mark 3/4" from the aft (rear) end of the engine tube. Insert engine hook into the pre-punched hole in the engine tube.



- ❑ **3.** Glue the thrust ring in place on top of the engine hook as shown.



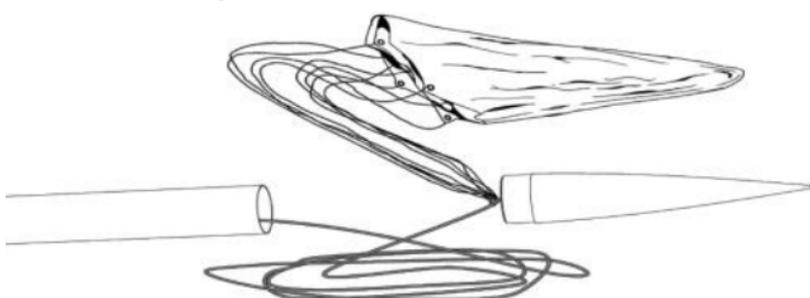
- ❑ **4.** Apply a thin bead of glue around the engine tube just above the mark. Slide the centering ring that was slotted over the engine tube and engine hook with the slot aligned over the engine hook. Slide the ring over the glue until the back edge of the ring is even with the mark. Don't stop until the ring is in place or the glue may "set". Repeat with the other ring, Stopping when the ring is even with the end of the engine tube.



- ❑ **5.** Install the 24 mm engine in the aft end of the engine mount tube. When using the shorter 70 mm engine, use the spacer tube (MC-909) in front of the engine. Install the entire assembly in your 29 mm engine mount as you would install a normal 29 mm engine.



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



This completes the assembly of your

ARCAS

FINISHING

34. 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.



1st coat of fillercoat



2nd coat of fillercoat



After 1st sanding



3rd coat of fillercoat

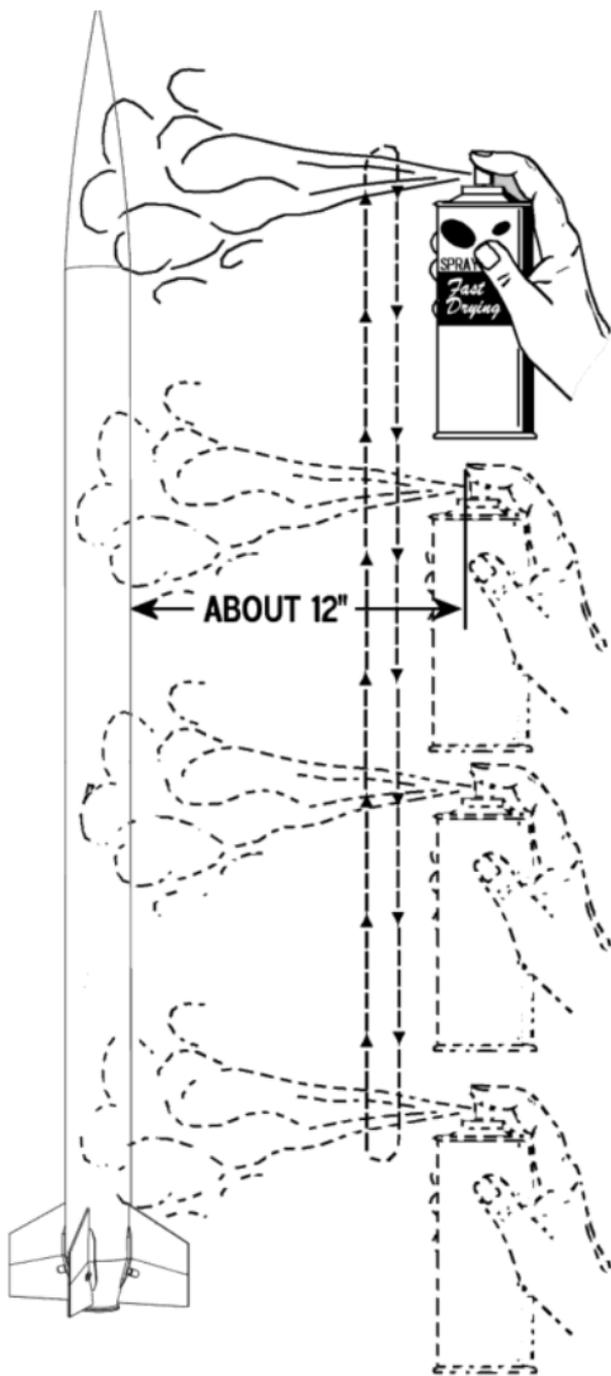


After 1st sanding

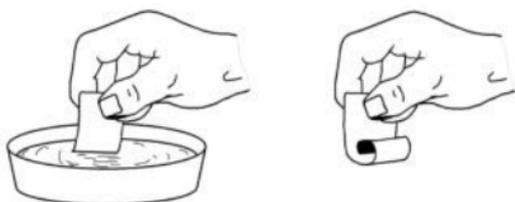
35. After all balsa and basswood surfaces have been prepared, wipe off all wood dust with a dry cloth. First spray the model with an enamel primer, then spray a base color of gloss white.

36. 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.

❑ **37.** 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.



❑ **38.** 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.



FLIGHT PREPPING

❑ **39.** The Pro 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.

❑ **40.** The Pro 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.

❑ **41.** Fold the parachute and pack it and the 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.

❑ **42.** 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 Pro Arcas™ will fly on a wide variety of engines, it is important that you pick the correct delay times.

Some engines may exceed the propellant limits requiring user certification and an FAA waiver.

❑ **43.** Carefully check all parts of your rocket before each flight as a part of your pre-flight checklist. Launch the Pro Arcas™ from an appropriate launch pad with adequate guidance to insure a stable flight.

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 0.050, with 10 lb payload

PAYLOAD

Separation Gas Pressure (pyro)
Length 26" (varies)
Material 0.040" 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.

NOTES: