



# 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 SPACE SHUTTLE

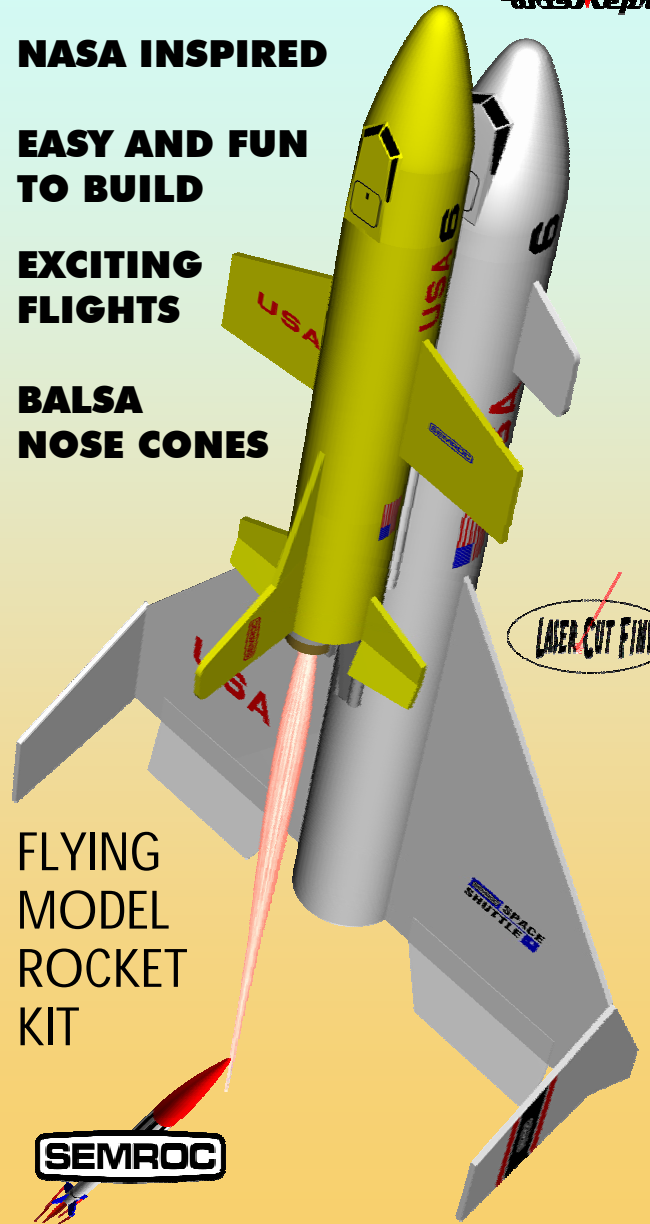


**NASA INSPIRED**

**EASY AND FUN TO BUILD**

**EXCITING FLIGHTS**

**BALSA NOSE CONES**



**FLYING MODEL ROCKET KIT**

**SEMROC**

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

## Space Shuttle Kit No. KV-38

Specifications	Booster	Shuttle	Engines	Alt.
Body Diameter	1.64" (4.2 cm)	1.34" (3.4 cm)	C6-3	150'
Length	15.2" (38.6 cm)	9.5" (24.1 cm)		
Fin Span	9.75" (24.8 cm)	4.7" (11.9 cm)		
Net Weight	1.5 oz. (42.6 g)	0.5 oz. (14.2 g)		

**Dual Glide Recovery**

## What is a Retro-Repro?

A Retro-Repro™ is a 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.

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## About Centuri Engineering

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.

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July 20, 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.



# NOTES

## About the Space Shuttle

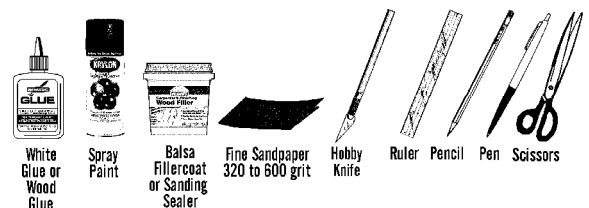
The Centuri Space Shuttle was introduced in Catalog #711 in 1971 as a late addition. It was featured on the back cover and its specifications were on the inside back cover. The Centuri Space Shuttle was based on an early proposal to NASA that did not make the final cut. Featuring two Gliders and a streamer recovered pod, the Space Shuttle was a popular kit for years. Using plastic nose cones, the glide recovery was hard to trim. Launches were exciting and following all three pieces down made recovery a challenge. The Centuri Space Shuttle was introduced as Cat. No. KC-6 and had an initial price of \$3.50.

The Semroc Retro-Repro Space Shuttle is a faithful reproduction of the original. All fins and rings are precision laser-cut balsa and sturdy fiber. The plastic nose cones are replaced with much lighter balsa reproductions for ease of trimming the gliders.

## 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 and wax paper are also required.

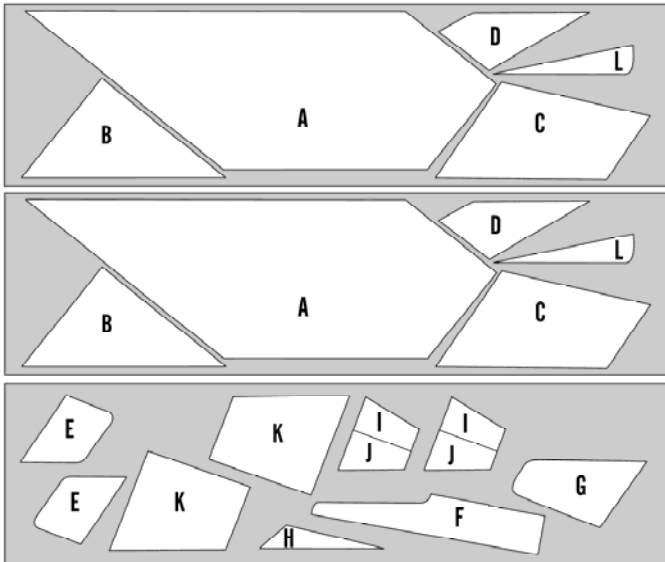


## ASSEMBLY

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

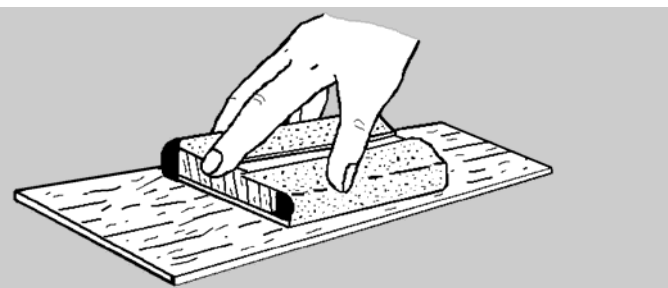
## PARTS IDENTIFICATION

❑ **2.** There are many different balsa parts included in this kit. Use the guide below to identify the parts that are called out in these instructions. Some of the parts are similar, but will not work if exchanged. There are two identical Sheet A's. The balsa parts will be referred as (X) in these instructions.



## BALSA PREPARATIONS

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



## FLIGHT PREPPING

❑ **48.** The Space Shuttle will only work with a C6-3 engine. Insert it into the power-pod and make sure the engine hook will retain it.

❑ **49.** Wrap the streamer around the engine tube. Slide the power-pod upwards and latch it to the booster ship. Slide the Shuttle Craft over the power-pod and latch it onto the booster ship. Make sure the streamer and shock cord do not get pinched.

❑ **50.** 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. It is important to make sure the igniter leads will not catch the wings and fins on the way up after launch.

❑ **51.** Either of the two launch lugs on the booster ship can be used with your launch rod.

❑ **52.** Even though the two gliders may be trimmed with hand tossing, it is important to make the first few flights on grass or soft dirt to make sure the trim works as well on an actual flight. Since three pieces will be coming down make sure you have some others to help you recover all the pieces. One or both of the gliders could land far away from the launch site.

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

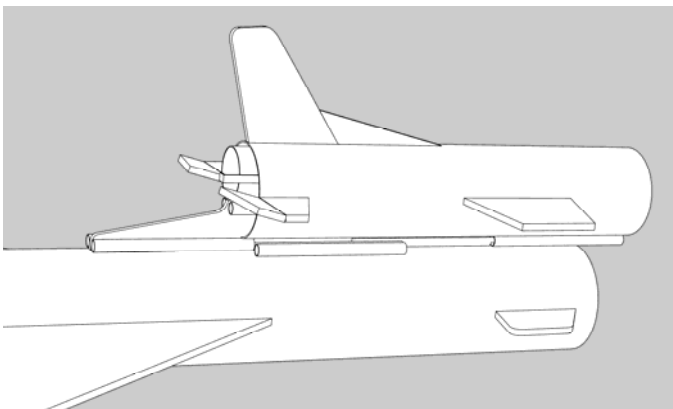
## GLIDE TRIMMING

❑ **45.** Locate a clear grassy area free of objects that will damage your gliders. Start with the larger booster ship since it is usually easier to trim. Make sure the flaps are still at a 45 degree angle. Face the wind and gently toss the booster with a slight angle of attack upward. If the glider stalls, lower both flaps and try again. If it dives, raise the flaps and retry. If it turns in flight, lower the flap on the side that turns until it glides straight. If you have a very small field, you may want the glider to turn to stay in the area.

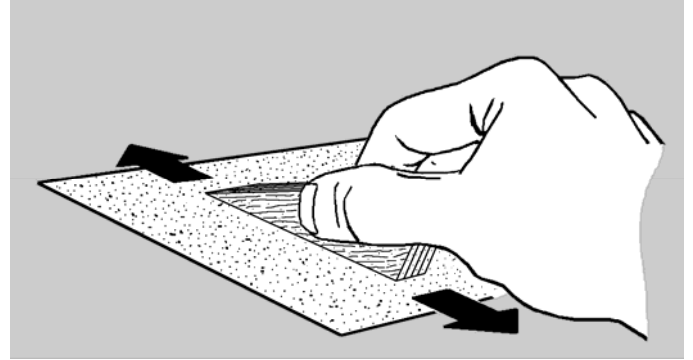
❑ **46.** The shuttle craft is usually a little more difficult to trim. The elevators may be adjusted with a little heat applied to the glue joint using a light bulb or hair dryer on low heat. Using the same technique as the booster ship, adjust the elevons up if it dives and down if it stalls. There should already be some dihedral on the main wings, but if it rolls, more dihedral may be necessary. Like the real space shuttle, this glider is not designed for high performance glides. Patience will get you results and a good glide. For really difficult trims, a small amount of clay or small trim nails may be necessary to trim it properly.

## FINAL FITTING

❑ **47.** Refer to the drawing below. Make sure all the pieces fit together properly. There should be very little wobble. A small amount of masking tape may be required on the ends of the dowels for a snug fit.

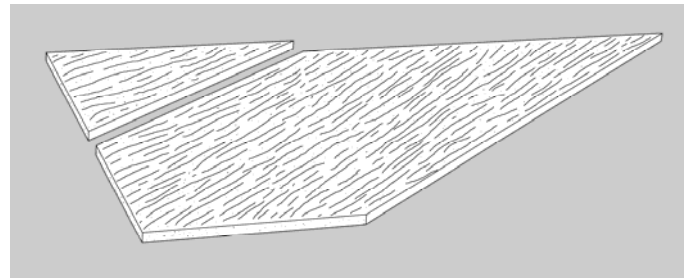


❑ **4.** Stack all the like fins in groups. Line each group up squarely and sand the fins back and forth over some fine sandpaper to get rid of the hold-in tabs as shown below.

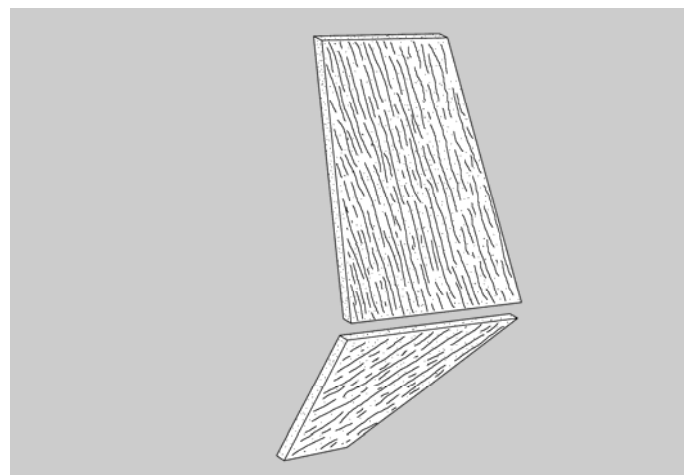


## BOOSTER SHIP ASSEMBLY

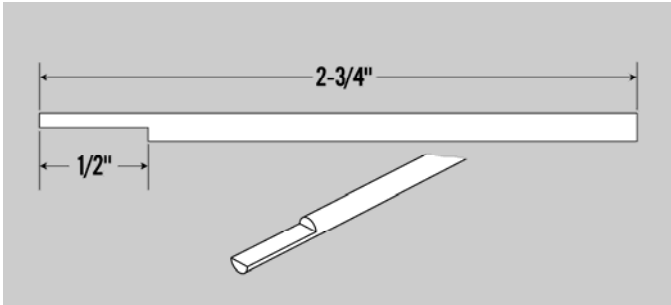
❑ **5.** Glue the main wing sections (A) and (B) together. Align section B so it achieves a square fit with section A. Use wax paper over a flat surface to keep it from sticking. Repeat for the other wing and allow the main wing assemblies to dry completely.



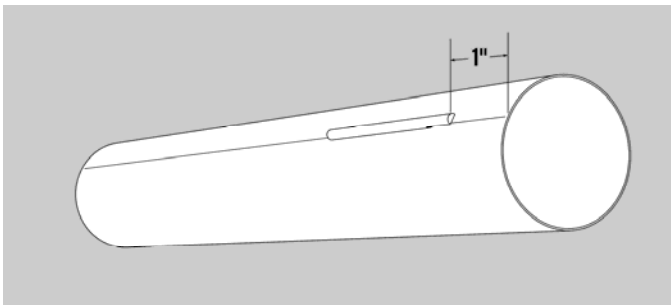
❑ **6.** Glue the upper stabilizer (C) and lower stabilizer (D) sections together on wax paper. Repeat for the other stabilizer and allow both stabilizers to dry completely.



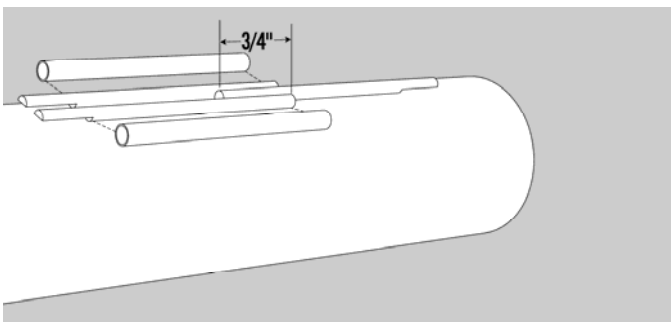
- 7.** Cut the wood dowel (WD-29) into three sections exactly 2-3/4" long. Carve out a notch on one end of each dowel 1/2" long and about half way through the dowel as shown below.



- 8.** Using a door jamb or drawer, mark a line on the largest body tube (ST-16120) for the entire length of the tube. Using this line as a reference, glue one of the dowels with the notched end 1" from the end of the tube and with the notch area toward the body tube.

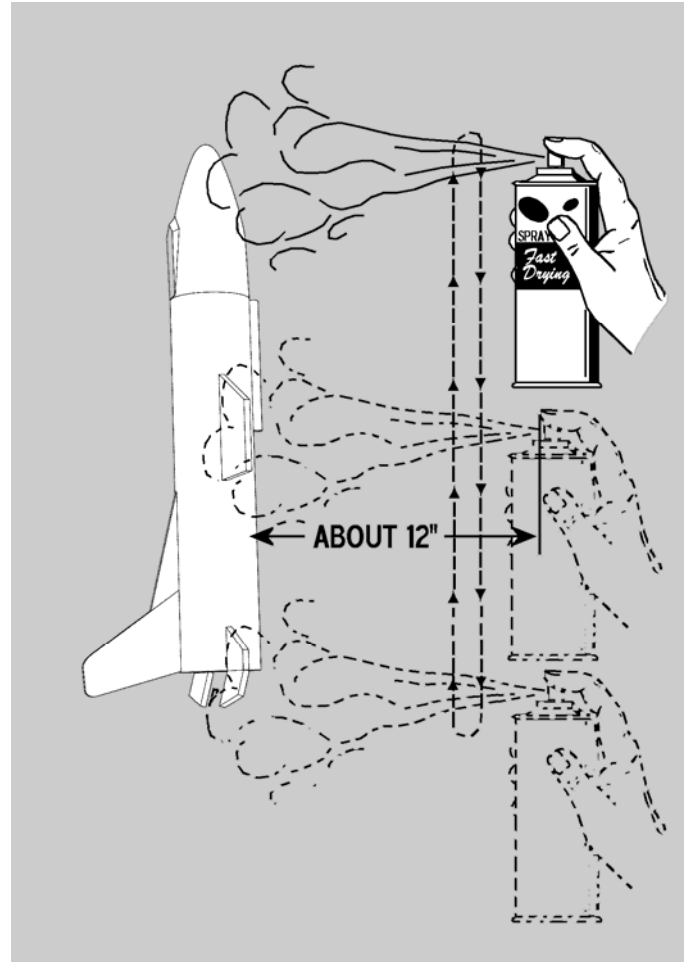


- 9.** Glue the two remaining dowels on either side of the first dowel. They should overlap 3/4" and also have the notched areas facing down (toward the body tube.) Glue a launch lug (LL-122) on either side of the outside dowels and even with their top end, leaving the notched areas free.

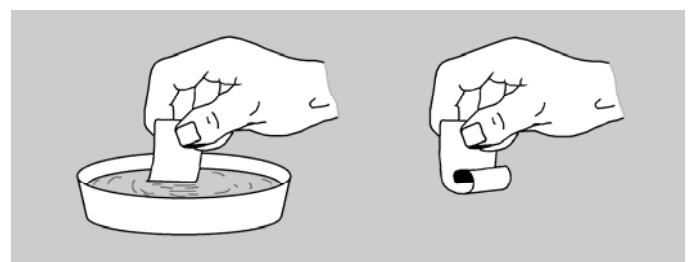


- 10.** Before the glue sets, check for the proper positioning using the guide on the next page. If any of the pieces are more than 1/16" off from any of the measurements, slide them into the correct posi-

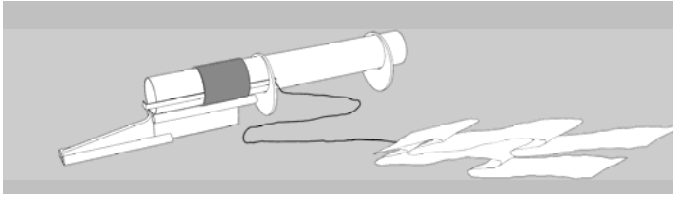
- 43.** Spray painting your model with a fast-drying enamel will produce the best results. PATIENCE...is the most important ingredient. Use several thin coats, allowing each coat to completely dry before the next coat. Start each spray a few inches above the model and end a few inches below the model.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



- 44.** After the paint has dried, decals should be applied. The decals supplied with the Space Shuttle 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. There are two decal sheets. The flag sheet is printed on white waterslide decal paper.



- ☐ **40.** Attach one end of the Kevlar® Cord to the engine tube and tie the other end to the center of the streamer.



This completes the assembly of your

## SEMROC SPACE SHUTTLE

### FINISHING

- ☐ **41.** When the fillets have dried, prepare balsa 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. Don't overdo it! Layers of unsanded filler can add much weight!



**1st coat of fillercoat**



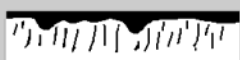
**2nd coat of fillercoat**



**After 1st sanding**



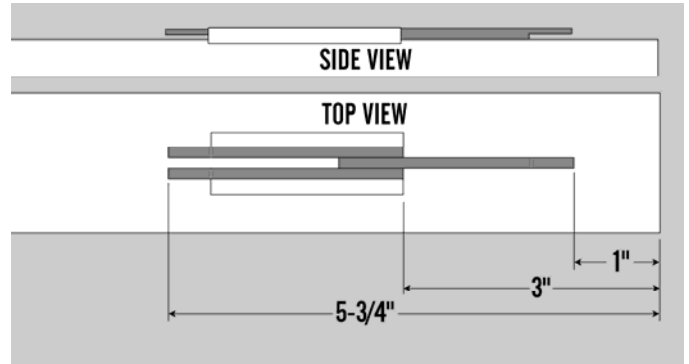
**3rd coat of fillercoat**



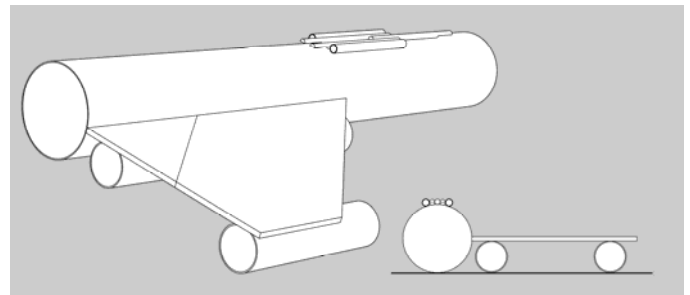
**After 1st sanding**

- ☐ **42.** After all balsa 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. The finish colors can be all white, all silver, or like the cover, a white booster and yellow shuttle craft.

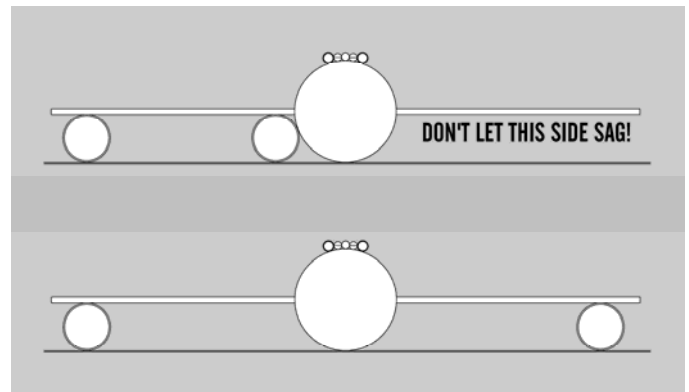
tion. Apply a fillet of glue to all joints, keeping glue away from the three notched ends.



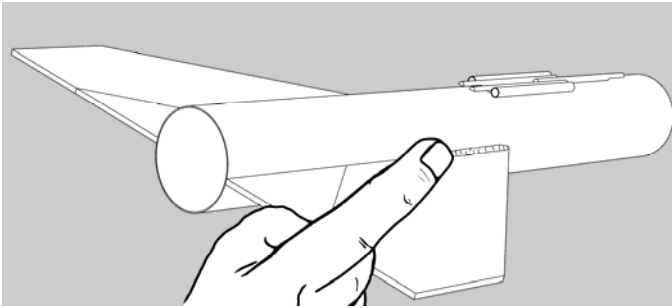
- ☐ **11.** Lay the booster tube on a flat table with the dowels exactly to the top. Align the long engine tube (ST-758) against one side of the large body tube. (This tube will be used in the next few steps as a spacing tube.) Place the smaller spacing tube (ST-730) a few inches away. Place one of the wings on these two spacing tubes and roll it into position. Refer to the end view. Apply a bead of glue along the root edge and touch it into position against the booster tube. Roll it away slightly and allow to dry for a few minutes. Roll it into position with the trailing edge even with the booster tube and let the glue set.



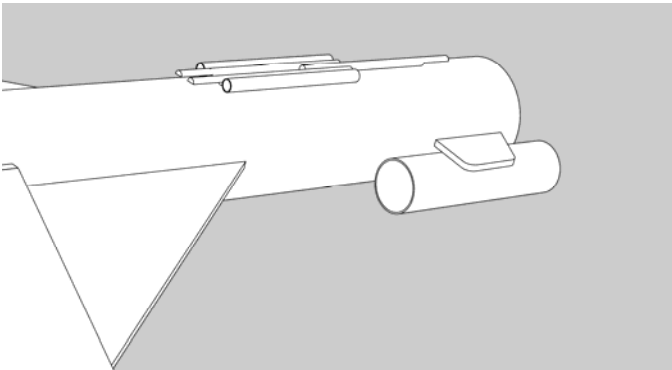
- ☐ **12.** After the first wing is dry, reposition the spacing tubes on the opposite side and repeat with the other main wing. When the glue has set, move one of the spacing tubes to the first side and leave this assembly alone until it is completely dry. After the wings are dry, round the leading and trailing edges. An airfoil shape may be sanded on each for slightly better performance.



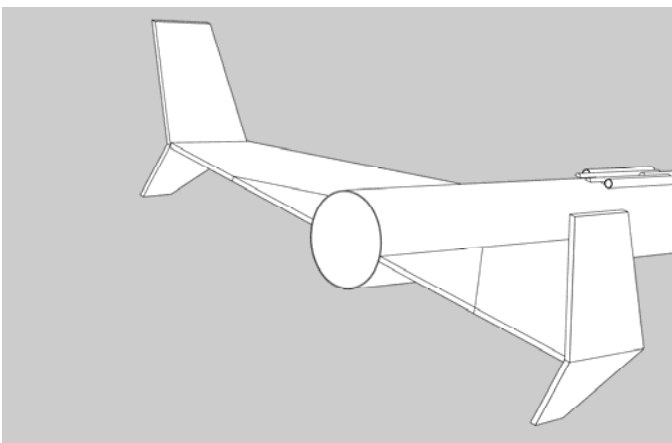
- ❑ **13.** Apply a bead of glue on the top and bottom of each wing along the body tube joint. Use your finger to smooth the joint into a concave fillet.



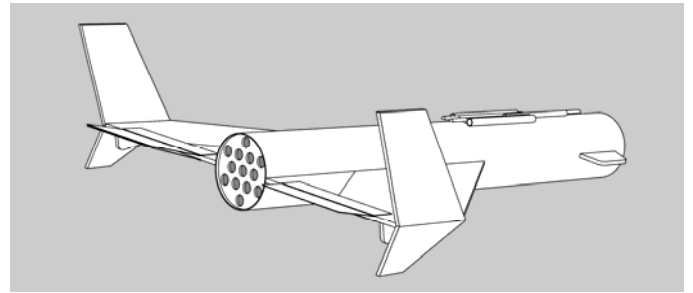
- ❑ **14.** Round the leading and trailing edges of the canards (**E**). Using one of the spacing tubes, balance one of the canards on it and glue it 3/8" from the front of the booster tube and inline with the main fin. Repeat for the other canard on the opposite side. Leave the spacing tubes in place until the canards are dry. The short spacing tube is not used any more.



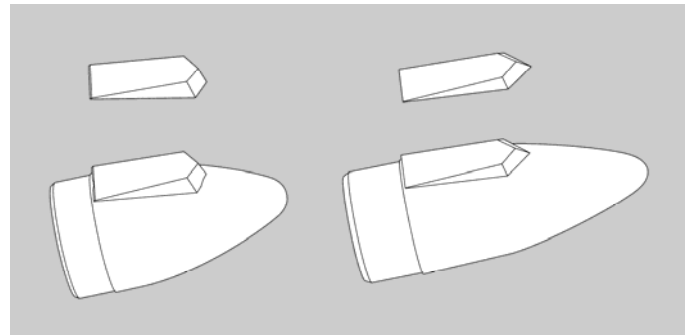
- ❑ **15.** Apply a bead of glue along each tip edge of the main wings. Attach a stabilizer to each with the long fin toward the top of the body tube as shown. Allow them to dry with the tube in a vertical position. When the glue is dry, apply a fillet of glue at each joint to strengthen the fins. Allow the assembly to dry in a horizontal position.



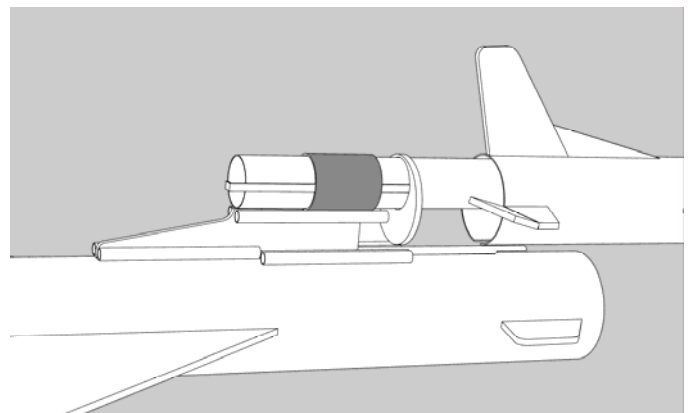
- ❑ **37.** Paint the laser-cut nozzle plate bright red. When it is dry, glue it just inside the booster body tube. Cover with masking tape for later.



- ❑ **38.** Carefully cut out both cockpits from the pattern sheet on the solid lines. Use a straightedge and ball point pen to score the dotted (fold) lines. Fold on the lines and form the shape, using the small tabs to help glue them together. Patience is required to get a good result. Since the cockpits add weight to the front of the gliders, too much glue will affect the glide. Apply the small cockpit to the small nose cone and the large cockpit to the large nose cone. Align the rear edge of each cockpit with the shoulder of the nose cone. Glue each nose cone into its respective body tube with the cockpit upward.

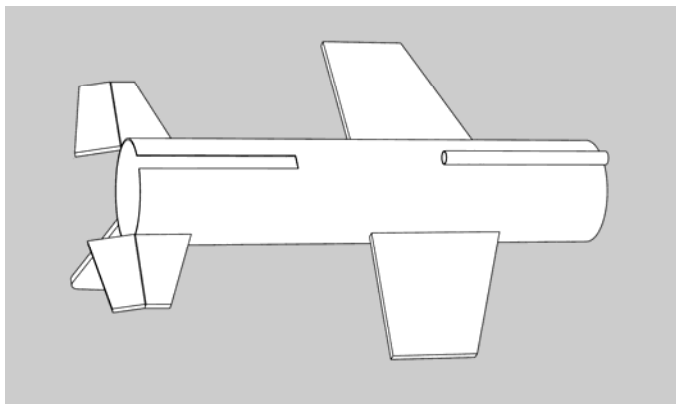


- ❑ **39.** Check the three assemblies for fit. Slide the power-pod so the notched dowels fit into the launch lugs on the engine mount. Slide the shuttlecraft over the rings on the engine holder and fit the launch lug on the shuttlecraft over the top notched dowel.

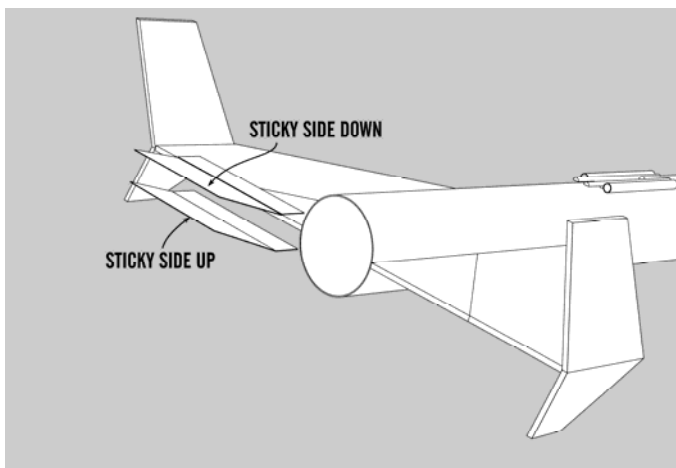




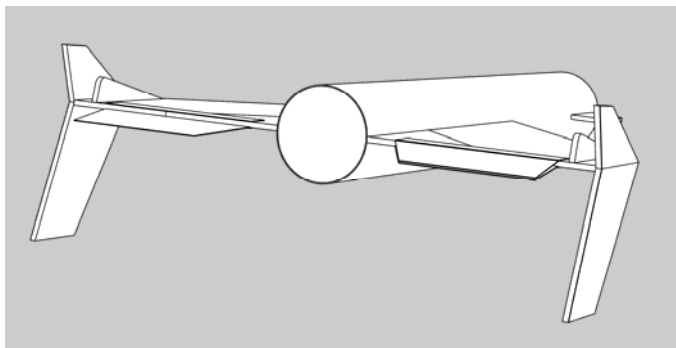
- ❑ **34.** Turn the shuttle craft upside down. Glue the remaining launch lug in line with the center of the slot and even with the front of the body tube. Sight down the tube to make sure it is aligned.



- ❑ **35.** Cut each of the four hinges out from the hinge sheet. Center one on each side of each of the main wings. Align the dotted line with the trailing edge of the main wing. Fold them up slightly before attaching them together so they will hold the shape better. Press them together, sticky side to sticky side. Initially set them to about 45 degrees up.

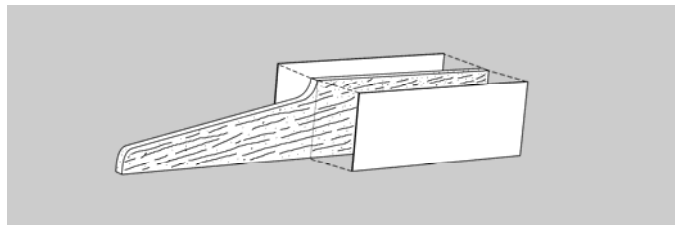


- ❑ **36.** Attach the bottom structural ribs (L) about 5/8" from each stabilizer. Apply a generous bead of glue along each edge. These ribs are important to keep the stabilizer from shearing the wing. Allow to dry.

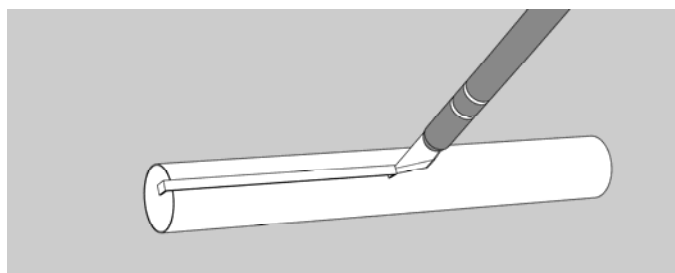


## POWER POD ASSEMBLY

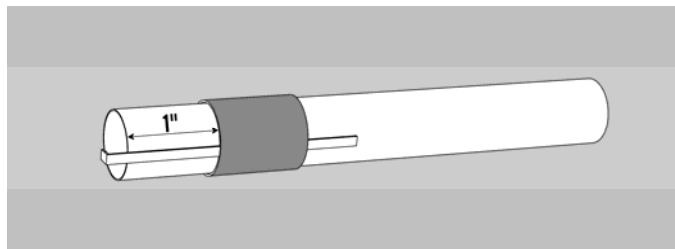
- ❑ **16.** Cut out the two paper mount supports from the pattern sheet. Apply a film of glue to the dull side of one and glue it to the balsa engine mount (F) as shown. Repeat for the other side, and allow to dry. Apply a film of glue along the sloped edge to help protect it from engine exhaust.



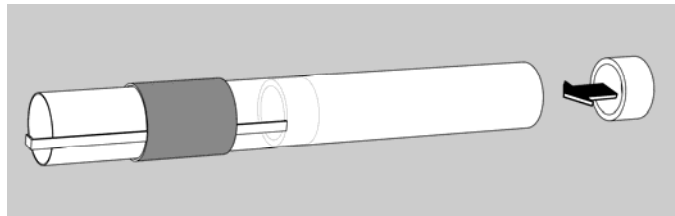
- ❑ **17.** Using the engine hook (EH-28) as a guide, overhang it slightly against the long engine tube (ST-758) and use a hobby knife to punch a small slot in the tube at the opposite end of the hook where it touches the tube. Insert the end of the engine hook into the slot.



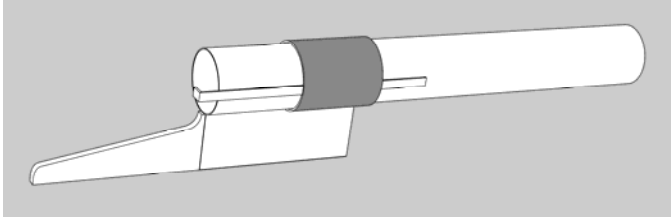
- ❑ **18.** Slide the retaining ring (RR-7) over the hook, leaving 1" from the bottom of the engine tube. Apply a bead of glue around each end of the ring, keeping glue off the outside of the ring as much as possible.



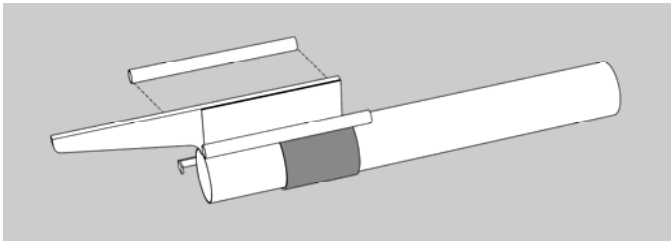
- ❑ **19.** Apply a bead of glue inside the top end of the engine tube. Using a pencil, push the thrust ring (TR-7) into place until it is against the engine hook.



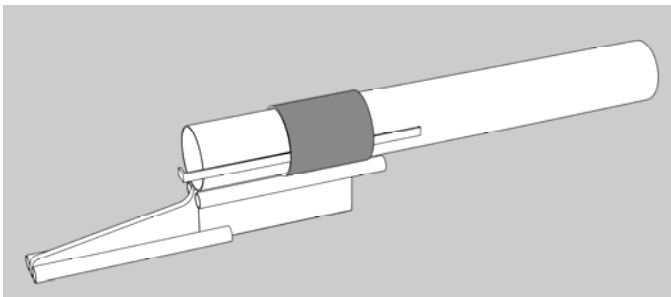
- 20.** Apply a bead of glue to the top edge of the balsa engine mount (F). Align the engine tube assembly with the engine hook to one side as shown. The hook should be half-way between the top and the bottom of the engine tube at a 90 degree angle with the balsa engine mount..



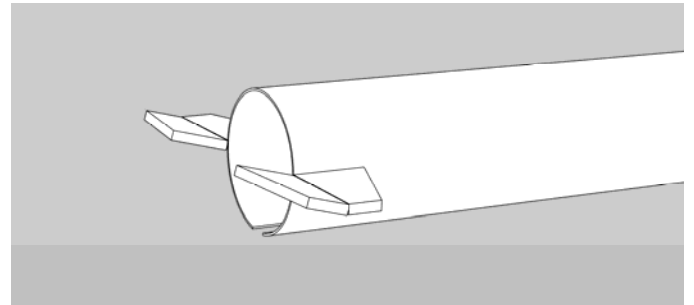
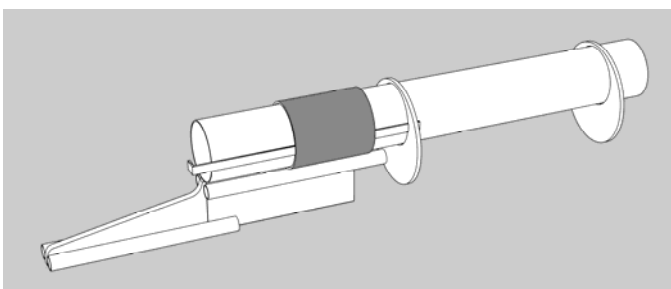
- 21.** Apply a bead of glue along each side of the balsa engine mount and apply a launch lug (LL-122) along each joint.



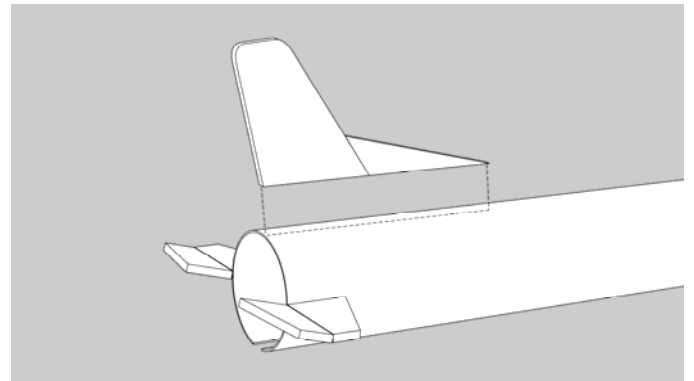
- 22.** Glue two more launch lugs to the bottom edge of the balsa engine mount and even with the back edge. Use a table top to make sure they are flat against the surface and the engine mount is vertical.



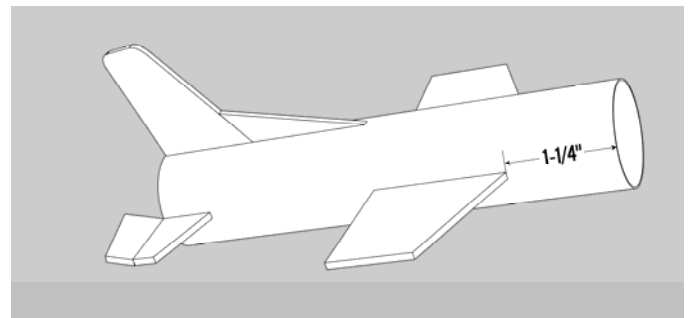
- 23.** Slide the centering ring with the slot over the engine tube and over the engine hook. Slide the remaining ring over the engine tube, leaving about 1/2" at the top. Sight down the tube and make sure the rings are aligned. Apply a fillet of glue around all the joints and allow to dry.



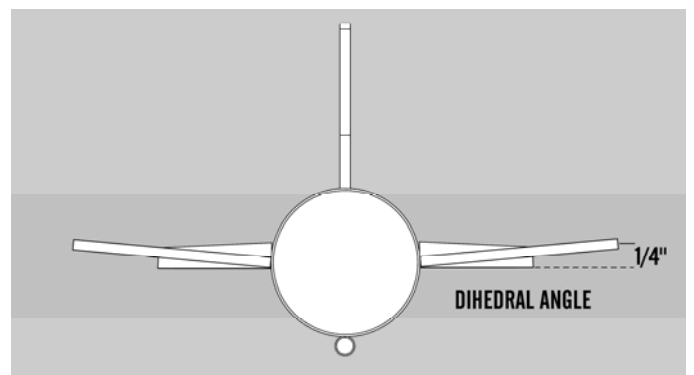
- 31.** Apply glue to the root edge of the rudder assembly and attach it to the shuttle craft body on the top line opposite the slot.



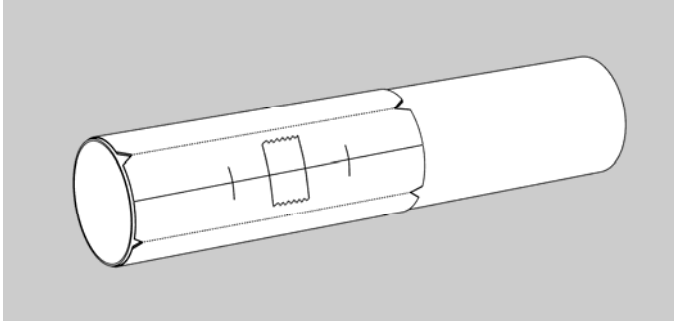
- 32.** Sand the edges of the shuttle craft wings (K) to an air foil shape and glue them 1-1/4" from the front of the body tube.



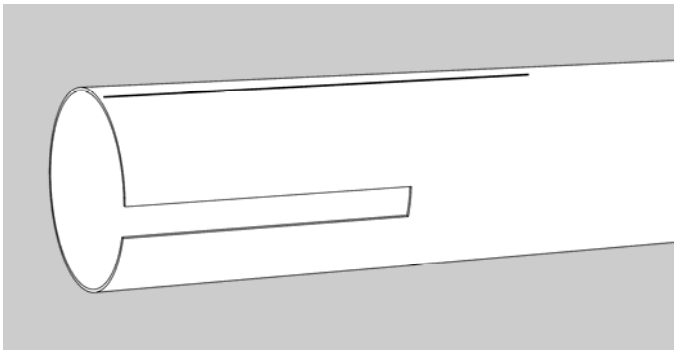
- 33.** Before the wings are dry, add a small amount of dihedral angle as shown below. the tips should be about 1/4" off the center line.



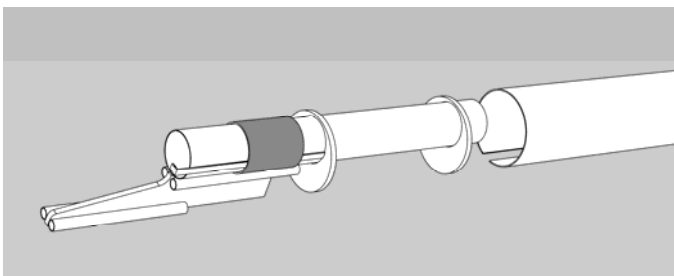
- ❑ **27.** Cut out the fin marking guide from the pattern sheet. Wrap it around the shuttle craft body tube (ST-1363) and tape the two ends together with the marks aligned. Align it even with the bottom of the tube with the slot also towards the bottom. Place a mark at each "V" and mark the cutout slot. Remove the marking guide and connect each line. Use a door jamb or drawer to extend the lines for the length of the tube.



- ❑ **28.** Using a sharp knife or scissors, cut out the slot from the body tube. To make it easier to fit, the bottom edges can be beveled slightly.



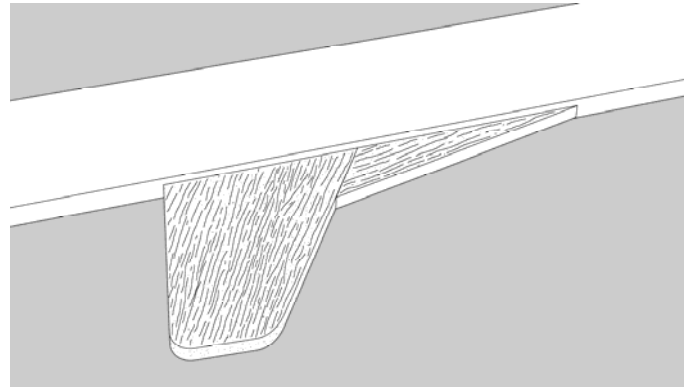
- ❑ **29.** Test fit the power pod in the shuttle craft body tube. Sand the rings if necessary to get a good fit.



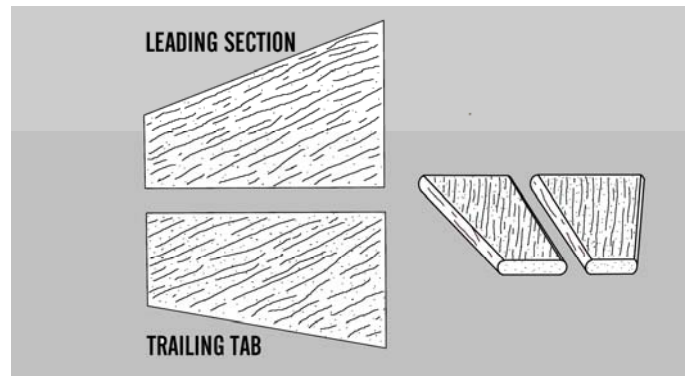
- ❑ **30.** Apply glue on the two elevator lines marked on the tube. Attach the elevators and allow to dry. Sight from the end and make sure they are parallel.

## SHUTTLE CRAFT ASSEMBLY

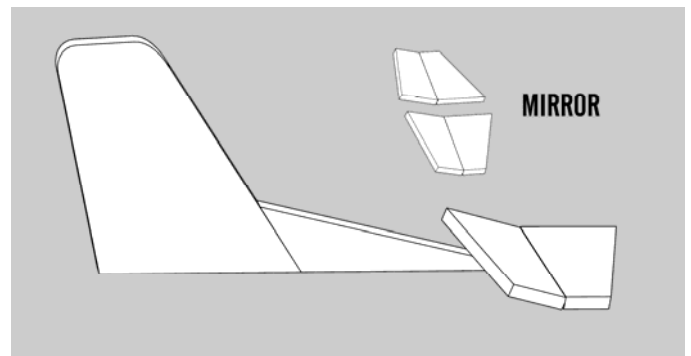
- ❑ **24.** Glue the leading edge strip (H) to the rudder (G) as shown. Use a ruler or straightedge on wax paper to align the pieces. When the assembly is dry, round all the edges except the root edge that will glue to the body tube.



- ❑ **25.** Align the elevator pieces as shown. Slightly round the leading and trailing edges of each piece.



- ❑ **26.** Lay the two pieces of the elevator on a flat surface and use the rudder leading edge to raise the trailing tab to the same angle (about 15%.) Apply a bead of glue to the joint. Allow to dry, then remove the rudder. Repeat for the opposite side. Align the pieces so it is a mirror image of the first elevator. See the illustration.



## Parts List

A	1	Nose Cone.....	BC-1625P
B	1	Nose Cone.....	BC-13275
C	1	Body Tube .....	ST-16120
D	1	Body Tube .....	ST-1363
E	1	Body Tube .....	ST-758
F	1	Body Tube .....	ST-730
G	1	Laser Cut Fins.....	FV-38
H	1	Thrust Ring .....	TR-7
I	1	Engine Hook .....	EH-28
J	1	Retaining Ring .....	RR-7
K	7	Launch Lugs .....	LL-122
L	1	Streamer .....	RS-18
M	1	Kevlar Cord.....	SCK-12
N	1	Wood Dowel .....	WD-29
O	1	Ring Set .....	CR-KV-38
P	1	Hinge .....	IKV-38H
Q	1	Pattern Sheet .....	IKV-38P
R	1	Decal.....	DKV-38

## EXPLODED VIEW

