





**E**SENCE

**A**EROSPACE

**T**ECHNOLOGIES

**INCLUDES:**

INSTRUCTIONS  
SCALE SHEET  
CUTTING TEMPLATES  
BODYPAPER  
CHUCK WIRE  
PLASTIC MODEL CONE GRIPPER  
MODEL WHEEL SETS  
1/8" LAUNCH LUG  
1/4" CENTERING SHOCK CONE  
1/8" PARACHUTE  
PROTECTOR WHEEL SETS



**IMPERIAL  
LAMBDA-CLASS  
SHUTTLE II**

**SKILL LEVEL = 5  
RECOMMENDED AGES:  
16-2, 16-3**

# Essence Aerospace Technologies - Lambda-Class Shuttle - II

## Overview:

We hope you enjoy this Plan Pak of our version of a Lambda-Class Shuttle. This rocket is unique and as such requires careful considerations during the build and finishing process. The most important thing to remember is that the body of the rocket needs to be as light as possible without negatively impacting the build strength. Special attention to detail is presented throughout these instructions and we caution any deviation. EAT cannot be responsible for any poor performance if build differently than described below.

Using a good wood glue is critical as it will be able to provide excellent bonding strength without having to use a lot of it. In most cases, unless specified, you only need a thin coating to give the needed strength.

Other pre-cautions:

- Do not substitute Epoxy for the Wood Glue
- Do not add an Estes-type Motor Hook
- Do not Fiberglass the Fins
- Do not substitute Basswood or G10 for the Balsa Fins
- Do not use a Nylon Parachute (use a plastic or mylar)

In finishing this rocket, think light. Take your time finishing, especially in the sanding department. Remember it is only balsa and it sands away quickly. If you are using primers, definitely sand between coats instead of simply coating and coating until all balsa grains are hidden. Do not go over-board on the finishing coats either. One solid coat (applied with several light coats) will do.

We're sure you will enjoy flying this rocket and it is indeed special. There will only a small number of them on the field. If you enjoy this kit, please let us know. If you need any assistance, please let us know. If you hated this kit, please let us know.

**Parts Needed:** (Apogee = Apogee Components, ASP = Aerospace Speciality Products)

- 1x 6mm (1/4") Balsa Piece (3" x 6")
- 2x 3mm (1/8") Balsa Pieces (6" x 7" each)
- 1x 2mm (3/32") Balsa Piece (3" x 2 1/2")
- 7.7cm (3") 18mm Motor Mount Tube (Apogee #10085 or ASP #T20/12)
- 18mm Motor Thrust Ring (Apogee #10029 or ASP #CR-520-6)
- 18mm Nose Cone (2 pieces) (Apogee #19207 or ASP #PNC-20C)
- 10.5mm Nose Cone (Apogee #19001)
- BB's
- 1/8" Launch Lug (Apogee #13051 or ASP #LL1/8-6)
- Kevlar Shock Cord (Apogee #29505 or ASP #KEV120-5)
- 15" - 18" Plastic/Mylar Parachute (Apogee #29113 or ASP #SC-15S)
- 6-8x Hole Strengtheners (for Apogee Parachute #29113)

**Tools Needed:**

- Pencil
- Metric Ruler (T-Square is best)
- Hobby Knife (Sharp is very important - change the blade to start this project)
- Estes 18mm Motor (spent or not) or equivalent
- Wood Glue - We *strongly, strongly, strongly* recommend TiteBond Original Wood Glue
- 5-Minute & 15-Minute Epoxy
- CA Glue (Super Glue)
- Wax Paper
- Masking Tape
- Sand Paper (220 grit) on a block and on a dowel
- Sand Paper (400 grit) on and off a block
- Filler (Elmers' Fill-n-Finish, Light Spackle, or Bondo Glazing Putty work)

### Step 1 - Motor Mount:

- Ruler
- Pencil
- Wood Glue
- Estes 18mm Motor (spent or not) or equivalent
- 7.7cm (3") 18mm Tube
- 18mm Motor Thrust Ring

Mark the 18mm motor casing using a pen at 1cm (3/8") from one end. Using a small stick of balsa (or a straw or a chopstick) make a mark 6cm from one end. Using the small stick, apply glue on the inside of the motor tube at the 6cm mark. Not a lot of glue but enough to be all the way around. Slide the thrust ring into the same of the tube you have been work from and then push it up by inserting the marked 18mm motor until the line is aligned with the end of the tube. Slowly remove the motor and allow assembly to dry.



### Step 2 - Base Cutting:

- Sharp Hobby Knife
- Ruler (T-Square preferred)
- 6mm (1/4") - thickest Balsa Sheet
- Template Sheet

Cut out the Lower Base Template. DO NOT cut along the dashed lines for the Upper Base. Position the Lower Base Template on the 1/4" balsa wood so that the grain line matches the grain of the wood. Ensure the one edge is even with the edge of the balsa. The upper and lower edges should be equal with the sides of the balsa piece. Mark the balsa for the cut. Use the T-Square to cut a straight line. Be sure to take multiple passes cutting through just a little at a time.

Mark the center of the Lower Base balsa (4.2cm) perpendicular to the grain and make a solid line. Run the mark line over the front and back edges of the Lower Base.

Now cut along the dashed lines on the Lower Base Template to get the Upper Base Template. You will notice the remaining piece of 1/4" balsa simple needs to be cut in half perpendicular to the grain to make the two Upper Base pieces. The template simply confirms that.



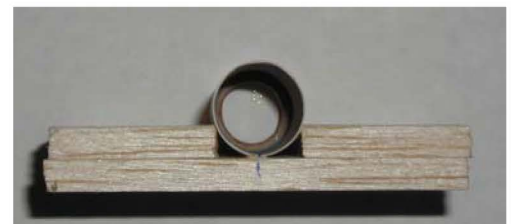
### Step 3 - Base Assembly

- Door Jam
- Pencil
- Wood Glue
- Sandpaper (220 grit) on a block
- Motor Mount (Step #1)
- Lower Base (Step #2)
- 2x Upper Bases (Step #2)

By holding the Motor Mount in a door jam, draw a straight line the entire length. Wrap the line around the tube ends and into the tube just a bit. Place a thin, but continuous, line of wood glue along the line on the Lower Base. Place the Motor Mount with the line you marked on it down into the glue. By checking the front and the back of the Lower Base ensure that the Motor Mount is centered.

Put a thin layer of wood glue on the bottom of one of the Upper Bases. Also put glue on the upper part of the inside edge where it will meet the Motor Mount. Place this Upper Base on the Lower Base and move smoothly and slightly back and forth while pressing it into place. Slide it up next to and touching the Motor Mount without moving the Motor Mount from its centered position. Repeat with the other Upper Base.

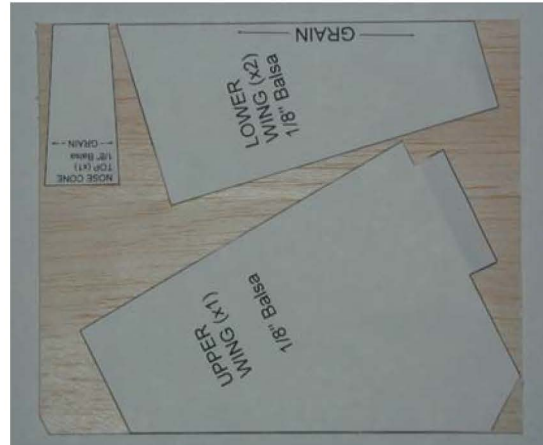
It's okay if the Upper Bases don't align exactly with the Lower. The important thing is that Motor Mount stays in the center. After the assembly dries, then you can square up the outside edges by using a sanding block. Do this before going to Step 4 though.



#### Step 4 - Upper Wing, (1) Lower Wing, Nose Cone Top Cutting

- Sharp Hobby Knife
- Ruler (T-Square preferred)
- 3mm (1/8" - 6"x7") Balsa Sheet #1
- Template Sheet

Cut out the Upper Wing, Lower Wing, and Nose Cone Top templates. Place these three pieces on one of the 1/8" sheets of balsa with the Upper Wing on one edge, the Lower Wing on the opposite and the Nose Cone positioned so that the maximum amount of excess balsa is available. Follow the grain indicators on the templates. Trying to salvage as much of the balsa as possible, cut out the Upper Wing, Lower Wing and Nose Cone Top. Save the left over balsa pieces.



#### Step 5 – Covering the Upper Wing

- Upper Wing (Step #4)
- 20lb Printer Paper Upper Wing Covers
- 15-Minute Epoxy
- Wax Paper
- Heavy Object

The Upper Wing is vulnerable to cracking at the junction of the overhang. The 20lb notebook paper Upper Wing Covers will strengthen the wing.

Cut out the Wing Covers. Test for fit on the Upper Wing.

Have ready two sheets of wax paper on a flat surface and a heavy object. These will be used to sandwich the Upper Wing while drying.

Mix a large portion of 15-minute epoxy. It has to be enough to cover both sides of the Upper Wing with a thin coat. Once mixed, spread it one side using a piece of scrap balsa wood, so that the Upper Wing balsa is wet with epoxy. The objective is not to have a thick layer of epoxy, just a thin coat. Use a piece of flat, scrap balsa to scrap up the excess. Then place the Wing Cover on and press from center out; this may squeeze out some epoxy. (*optional*: use a wall-paper seam roller)

Lay this side down on the wax paper and then spread epoxy on opposite side as before. Place on the second Wing Cover. Press from center out.

Set the Upper Wing between wax paper and place a heavy object on top. Leave this alone for 24 hours!

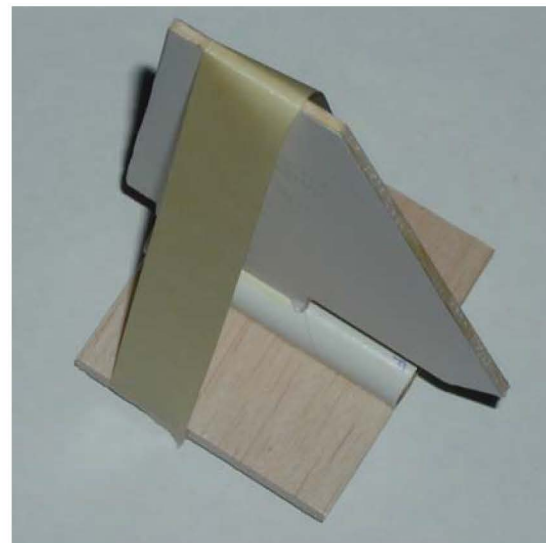
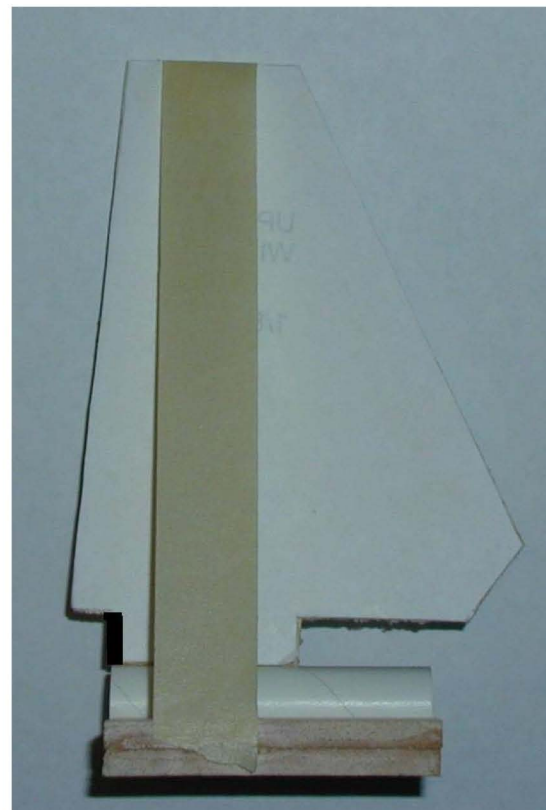
Don't worry about epoxy on the edges, this can be cleaned off later with a hobby knife or sand paper.

It is not needed to round or airfoil the edges as that takes away from the overall look.

#### Step 6 - Upper Wing Installation

- Pencil
- Wood Glue
- Masking Tape
- Upper Wing (Step #5)
- Fin Alignment Guide

Mark the top of the Motor Mount Tube with an "F" on the side that the Thrust Ring is on. Mark the Motor Mount with a line 0.2cm (3/32") from the rear. Then, after your fin is prepared (optional), then apply a light coat of wood glue to the root edge and mount onto the Motor Mount so that the tab is aligned (even) with the mark at 0.2cm from the back of the Motor Mount. Check the alignment against the Fin Alignment Guide. Tape or hold until secure.





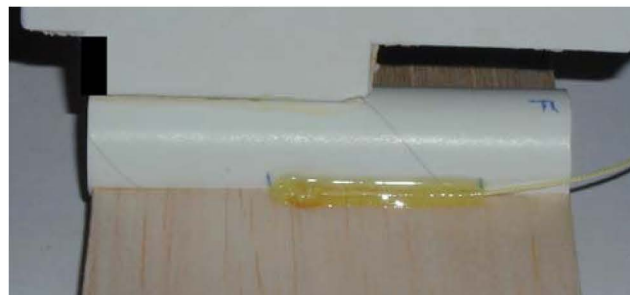
## Step 7 - Attach Shock Cord to Body:

- Pencil
- Ruler
- Kevlar Shock Cord
- 5-Minute Epoxy



Mark the Motor Mount 3cm (1 1/8") from the rear of the Motor Mount where the left (as viewed from the front) Upper Base meets the Motor Mount. Mark the Motor Mount 1.5cm (5/8") from the front of the Motor Mount where the left Upper Base meets the Motor Mount.

Tie a double-knot in one end (very end) of the Kevlar. Mix up a small amount of 5-Minute Epoxy and lay it in the joint between the two marks. Lay the Kevlar into the epoxy with the knot nearest to the mark on the rear of the Motor Mount. Do not use a lot of epoxy. Just enough to cover the Kevlar and to contact both the Motor Mount and the Upper Base. Let dry completely.

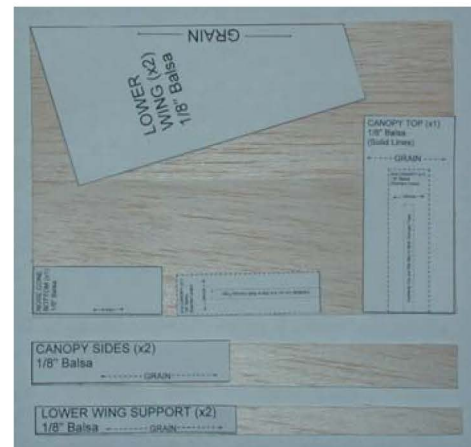


Once dry, stuff the Kevlar into the motor tube to keep it out of the way for future assembly.

## Step 8 - Lower Wing Supports and Canopy Sides Cutting:

- Sharp Hobby Knife
- Ruler (T-Square preferred)
- 3mm (1/8" - 6"x7") Balsa Sheet #2
- Template Sheet

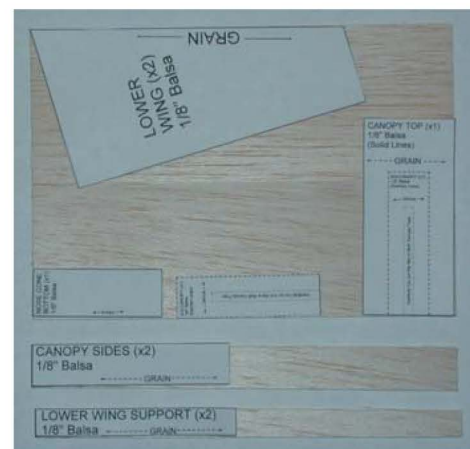
Cut out the Lower Wing Support and Canopy Sides templates. Using the second sheet of 3mm balsa wood, cut a 1.1cm (7/16") strip from the one edge parallel with the grain. Use the Lower Wing Support template and make two Lower Wing Supports. From the same edge on the second sheet of 3mm balsa wood, cut a 1.7cm (11/16") strip also parallel with the grain. Use the Canopy Sides template and make two Canopy Sides.



## Step 9 - Nose Cone Bottom, Canopy Top, 2nd Canopy, (1) Lower Wing Cutting:

- Sharp Hobby Knife
- Ruler (T-Square preferred)
- 3mm (1/8" - 6"x7") Balsa Sheet #2
- Template Sheet

Cut out the Nose Cone Bottom, and Canopy Top templates. On the Canopy Top template cut out the thin 1/8" slot in the center but do not cut out the 2nd Canopy Template (dashed lines). Also use the Lower Wing Template from step #4. Place these four pieces on the remainder of the second 1/8" balsa sheet with the Upper Wing on the upper left side, the Canopy Top on the lower right side and the Nose Cone Bottom along the bottom edge (previously cut on edge) on the left side. Follow the grain indicators on the templates. Trying to salvage as much of the balsa as possible, cut out the Lower Wing, Nose Cone Bottom, and Canopy Top. Save the left over balsa piece.



On the Canopy Top, using the template, cut out the 1/8" slot. This is where the Upper Wing will pass through.

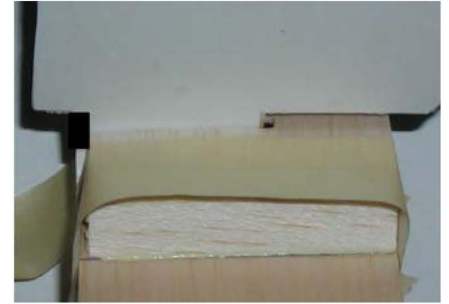
Now cut out the 2nd Canopy template from the Canopy Top template. Follow the grain indicators on the template and place this template next to where the Nose Cone Bottom was cut out, along the bottom edge, center. Trying to salvage as much of the balsa as possible, cut out the 2nd Canopy. Save the left over balsa piece.

### Step 10 - Canopy Installation:

- Pencil
- Wood Glue
- Masking Tape
- 2x Canopy Sides (Step #8)
- Canopy Top (Step #9)
- Ruler
- Sandpaper (220 grit) on a block
- Fin Alignment Guide



Using the Canopy drawing on the Fin Alignment Guide, measure from each outside edge and place a mark at 1.7cm (11/16"). Draw a line from front-to-back on each of the Upper Base pieces. Using sandpaper on a block, take off the inside, bottom, lengthwise corner and the outside, top, lengthwise corner. Don't spend a lot of time on this, but it will help if the corners are taken down.



Test fit the Canopy Top to make sure the slot for the Upper Wing is clear. You may also want to check it for being centered. Slide the Canopy Top slot onto the Upper Wing and move it up until it touches the base of the Wing. This is just to hold it in place for now.

Apply a line of wood glue on the bottom edge of one Canopy Side. Attach it perpendicular so that the outside edge is even with the line (at 1.7cm). Ensure that it is even with the Base of the rocket which will leave a 3/32" gap at the back of the Base. Repeat for the other Canopy Side. While they are still perpendicular, apply a line of wood glue to the top edges of both Canopy Sides. With skillful manipulation of two hands and fingers lean both of the Canopy Sides in until the Canopy Top can be slide down and meet both Canopy Sides.

Apply a small amount of glue on both sides of the slot where the Canopy Top and the Upper Wing meet. The idea is that this will seep into the gap between the two pieces.

Check all the positions. Each Canopy Side should still be even with the 1.7cm line on the Upper Base. The Canopy Top should be centered (forced by the Wing slot) so that the angles on the Canopy Sides match. Again, use the Canopy drawing on the Fin Alignment Guide. *NOTE:* You may want to use some masking tape by placing two strips on the top of each side of the Canopy Top and pulling and wrapping down to the bottom Base. This will eliminate and wood warping from the glue which will pull the Canopy Top away from the Canopy Sides.

### Step 11 - 2nd Canopy Installation:

- Wood Glue
- 2nd Canopy Top (Step #9)

Test fit the 2nd Canopy to make sure the slot for the Upper Wing is clear. Apply a thin, even layer of wood glue on the bottom of the 2nd Canopy. By positioning the 2nd Canopy at an angle (with front part slightly higher) slide it on to the Upper Wing and then down onto the Canopy Top. Doing it this way will avoid getting glue on the Canopy Top front.



### Step 12 - Lower Wing Support Installation:

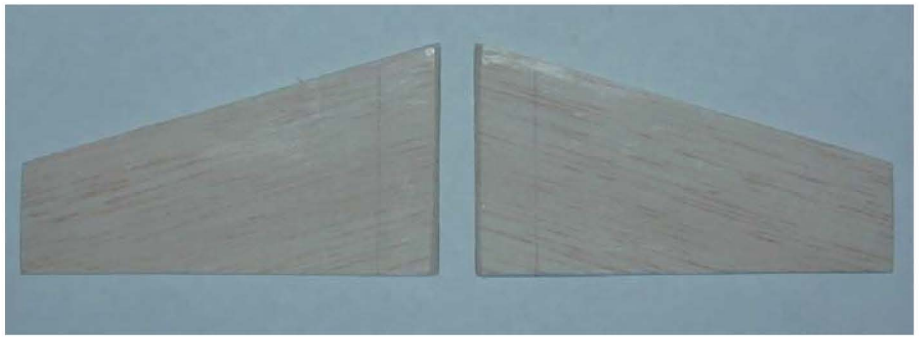
- Wood Glue
- 2x Lower Wing Supports (Step #8)

Apply a thin, even layer of wood glue on one edge of a Lower Wing Support. Attach it to the bottom of the Base, running front to back and even with the edge. Repeat for the other Lower Wing Support on the other side.



### Step 13 - Lower Wing Installation:

- Pencil
- Wood Glue
- Tracing Paper -or- Japanese Tissue (Optional)
- CA -or- Water Thinned White Glue -or- SIG Nitrate -or- SIG Lite-Coat -or- Brodak (Optional)
- 2x Lower Wings (Step #4 and Step #9)
- Sandpaper (220 grit) on a block
- Fin Alignment Guide



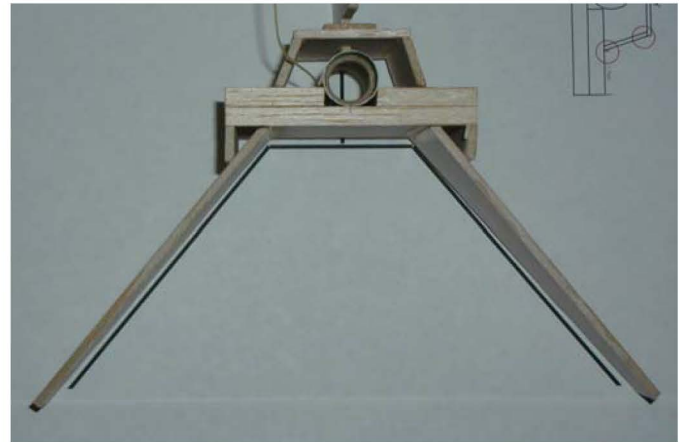
*Optional:* You may want to strengthen the Lower Wings by covering both sides Tracing Paper. Or you may choose just to soak the Lower Wing in CA. There are many tips on EMRR about strengthening fins, BUT, two important points. Do it in the **LIGHTEST** way possible (don't glass it) and also using Wax Paper and weight to keep this fin from warping. **NOTE:** The picture shows the use Tracing Paper.

Place the two Lower Wings together and sand them so that they are equal on all edges. It is not needed to round or airfoil the edges as that takes away from the overall look.

Place the Lower Wings on a flat surface as they will be installed on the rocket. From the widest part edge of each Lower Wing make a line 1.9cm (3/4") in from the edge which runs from front to back.

Using sandpaper on a block, take off the inside, lengthwise corner of the Lower Wing Supports using the Fin Alignment Guide to give you an idea on the angle. Using sandpaper on a block, take off the upper, lengthwise corner of the Lower Wings (where they will attach to the Base) using the Fin Alignment Guide to give you an idea on the angle. Don't spend a lot of time on this, but it will help if the corners are taken down.

Apply an even layer of wood glue on the upper, lengthwise edge of the left Lower Wing and on the left Support. Press the Lower Wing in place so that its back edge is even with the back of the rocket's Base. Use the line (should be to the outside of the Lower Wing Support) and the Fin Alignment Guide to set the angle. Repeat for the Right Wing.



### Step 14 - Fillets:

- Wood Glue

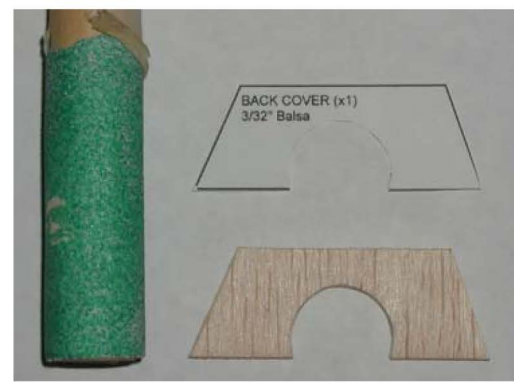
The rocket does not really need Fillets as you may be familiar with, but there are a few gaps that should be filled in. Using Wood Glue, apply a bead of glue on the two joints where the Canopy meets the Upper Base. Run your finger on this to eliminate the excess. Do the same where the Lower Wings attach to the Lower Wing Supports and also where they meet the bottom of the Base. Remember, do not use a lot of glue here. Any remaining gaps will be filled during the finishing stage.



### Step 15 - Back Cover Cutting and Installation:

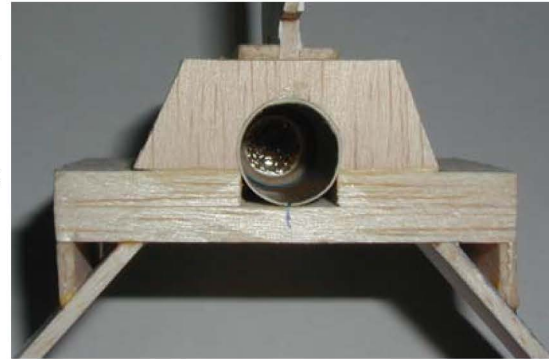
- Sharp Hobby Knife
- 2mm (3/32") Balsa Sheet
- Sandpaper (220 grit) on a dowel
- Wood Glue
- Masking Tape
- Template Sheet

Cut out the Back Cover template. Be sure to cut out the round motor tube on the outside of the lines (so that you don't have the circle lines left on the template). **NOTE:** This picture shows the grain on the Back Cover going the wrong direction. The intent is to be able to get the Back Cover and two Upper Wing Support cut from the 3/32" balsa sheet. The grain will be horizontal.



Test fit the template to the back of the rocket. Using the template cut out the Back Cover from the 2mm (3/32") balsa wood. **CAREFULLY** - use sandpaper on a dowel to get the proper fit around the 18mm hole.

Apply thin line of glue on the back edges of the Canopy and on the top of the motor mount. Install the Back Cover and wipe off any excess. Use masking tape to ensure it stays tight and in place. **NOTE:** This picture shows the grain on the Back Cover going the wrong direction.

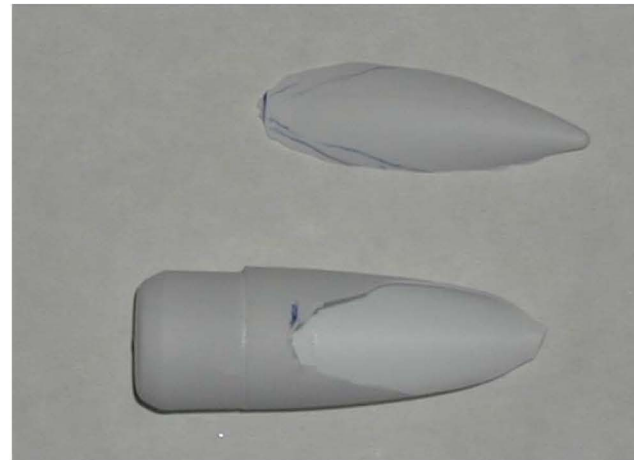


### Step 16 - Cutting the Nose Cone:

- Pencil
- Sharp Hobby Knife
- CA (Super Glue)

**WARNING:** This is the MOST DIFFICULT part of building this rocket. Let us say, we're sorry, right now to get it over with. In addition, it is highly recommended that you use a new blade in your Hobby Knife.

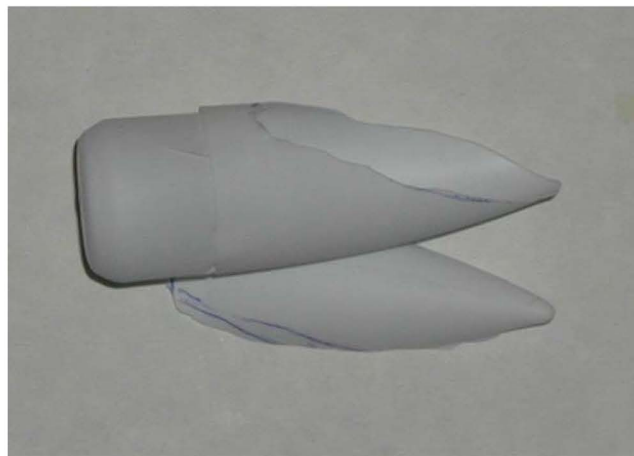
Assemble the Nose Cone by running a ring of CA around the inside of the Nose Cone and then sliding the shoulder into it to the edge (slight crease on shoulder). Make sure this is centered. Hold it until it dries.



Marking the Nose Cone: First draw a line from one spot on the shoulder to the Nose Cone dip. Then match that 180 degrees around. This essentially marks the Nose Cone in half. On the bottom side, place a mark 0.8cm (5/16") from the tip on the lengthwise line you just drew. On the top side, place a mark 4.2cm (1 1/2") from the tip on the lengthwise line. Lastly, draw a line (free-hand) from the mark on top to the mark on the bottom on both sides.

NOTE: A Hobby Razor Saw could be used instead of the Hobby Knife.

Okay, here we go: holding your Hobby Knife at about the same angle as the line from the top to the bottom, start a slit at the top mark and slowly push the Hobby Knife down, following the lines to the bottom. You can do some clean-up afterward. Do the best you can. As you can see from ours, it does not have to be perfect.

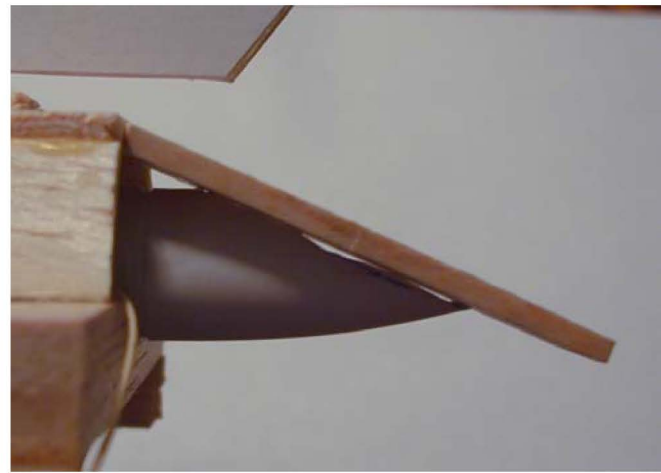


### Step 17 - Nose Cone Top Installation:

- Nose Cone Top (Step #4)
- CA (Super Glue)

Place the plastic Nose Cone into the rocket front until it hits the Thrust Ring with the hole that you cut out in Step #14 upward. Place the Nose Cone Top (balsa) on the plastic Nose Cone to test the fit. The balsa Top should be just about even with the top of the Canopy (slightly less or slightly higher is okay). Cut the plastic nose cone if needed to address any fit issues. Also ensure the plastic Nose Cone is turned to make the balsa even with the Canopy.

Once the fit is checked, run a ring of CA around the top, cut-edge of the plastic Nose Cone. Place the balsa Nose Cone Top onto the plastic Nose Cone and position to be up against the Canopy and even (parallel) with the Canopy. Let this dry.



### Step 18 - Nose Cone Bottom Installation:

- Nose Cone Bottom (Step #9)
- Wood Glue
- CA (Super Glue)

Ensure the Nose Cone Assembly is still in the rocket against the Thrust Ring. Check the fit of the Nose Cone Bottom (balsa) by holding it in place on the bottom. It should touch the Base and be about even with the front of the Nose Cone Top (balsa) and touch the bottom of the plastic Nose Cone. Cut the length a bit shorter if needed (probably if the Nose Cone Top is higher than the Canopy it will need to be cut).

Once the fit is checked, then apply a line of glue across the front edge of the Nose Cone Bottom (balsa) where it will meet the Nose Cone Top (balsa). Then run a line of CA in the center of the Nose Cone Bottom (balsa) where it will touch the plastic Nose Cone. Then place in position and hold until tacked.



### Step 19 - Nose Cone Sides Cutting:

- Sharp Hobby Knife
- Ruler (T-Square preferred)
- 3mm (1/8" - 6"x7") Balsa Sheet Scraps
- Template Sheet

Cut out the Upper Nose Cone Side and the Lower Nose Cone Side templates. Cut out 2 each of the Nose Cone Sides from the remainder of the 1/8" balsa sheets.

## Step 20 - Nose Cone Sides Installation:

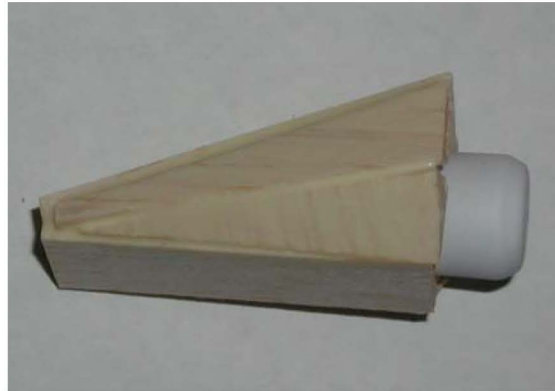
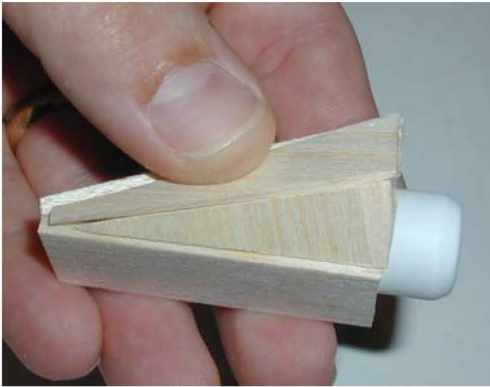
- Nose Cone Sides (Step #19)
- Sandpaper (220 grit) on a block
- Wood Glue

Take one of the Upper Sides and one of the Lower Sides. By using the templates identify the Top of the Upper Side and the Bottom of the Lower Side. The unmarked edges are the center joint. Sand the inside edges at 45 degree angles.

Apply glue to the Upper Side, Top edge and place onto the edge (point) of the Nose Cone Top (balsa). Align the back edge so that it is even with the back edge of the Nose Cone Top (balsa). While this is still wet, apply glue to both inside edges of the Lower Side. While holding the nose cone assembly in one hand and hold the Upper Side in position with your thumb, place the Lower Side in position to fill the gap. Again, align this piece with the back edge of the nose cone. Align every thing up. Don't worry about the gaps in the joints. Let this dry completely.

After the first side is dry, repeat the process for the opposite side. When aligning the pieces do your best to match the first sides angles and positions. Let this dry completely.

Using wood glue fill in all the joints. Once complete, if you were to fill the inside of the nose cone with water (DON'T) it shouldn't leak out . . . that's the objective.



## Step 21 - Nose Weight - Preparation:

- Sharp Hobby Knife

Using a hobby knife cut the end off of the end cap of the shoulder. **NOTE:** This picture shows the end cap off. You may also see the plastic Nose Cone shoulder cut in half. This was a test build and we have since determined it is better to simply cut the end cap off.

Mark the inside of the nose cone assembly with a "S" on the left (as viewed from the front) side. This should line up with the same side that the shock cord was mounted on the main rocket assembly.

Tie a double-knot in the end (very end) of the Kevlar shock cord coming from the main rocket assembly.





## Step 22 - Nose Weight - Filling:

- BB's (there should be **MORE** than enough)
- 5-Minute Epoxy

READ THIS ENTIRE SECTION FIRST. **NOTE:** A couple of these pictures show the plastic Nose Cone shoulder cut in half, since this test build we have determined it is better to simply cut the end cap off (see step #21).

Have something ready to lean the nose cone assembly up against so that the can be filled and so that the shoulder open is level.

Place some of the BB's into the nose cone assembly both inside and outside the interior plastic nose cone. Use enough BB's to fill about the bottom 1/3rd. Use a tooth pick or a small dowel to move the BB's around and "pack" them in. Don't press too hard so the bals nose cone assembly doesn't break. Mix up some epoxy and "drip" it into the nose cone from the end of a tooth pick over the BB's. The objective is to get enough epoxy in to fill the spaces between the BB's. Don't wait until the epoxy is dry, continue on.

Insert the end of the shock cord into the side marked with an "S". Add additional BB's around the shock cord to about 2/3rds of the way full. Add BB's on the opposite side and in the plastic nose cone to about 2/3rd's of the way full. (using where the balsa ends are you full mark, not the where the shoulder sticks out). Mix up some epoxy and "drip" it into the nose cone from the end of a tooth pick over the BB's. The objective is to get enough epoxy in to fill the spaces between the BB's. Use a toothpick or a small dowel to "pack" the BB's. Keep the shock cord in the center of the space on the "S" side. Don't wait until the epoxy is dry, continue on.



Add additional BB's until they are "packed" to be even with the balsa ends. The BB's in the plastic nose cone should also only be level with the balsa. Do not fill up in the plastic shoulder. They should not be sticking up over the edges. Mix up some epoxy and "drip" it into the nose cone from the end of a tooth pick over the BB's. The objective is to get enough epoxy in to fill the spaces between the BB's.

Use a toothpick or a small dowel to "pack the BB's. Keep the shock cord in the center of the space on the "S" side. Let the epoxy dry.

The epoxy will most likely "drain" into the nose cone assembly and leaving room for more. Do that by mixing up some epoxy and leveling it off with the balsa edges outside of the plastic Nose Cone. In addition, now fill up the inside of the plastic nose cone's shoulder all the way to the top.



### Step 23 - Launch Lug Installation:

- Ruler
- Sandpaper (220 grit) on a block
- Wood Glue
- 5-Minute Epoxy
- Launch Lug

Using the front and back edges of the Base, measure the center (the lines drawn from Step #3 may be used). Draw a line 3cm long from the front of the Base on the bottom.

Using sandpaper, slightly rough up one side of the Launch Lug. Apply a layer of wood glue to the roughed up edge of the launch lug and glue it onto the center line, even with the front of the Base. Let dry.

Using epoxy, fillet both sides of the Launch Lug.



### Step 24 - Lambda-II Details

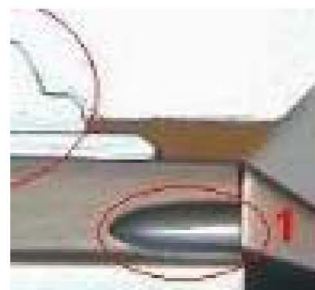
- Wood Glue
- 10.5mm Balsa Nose Cone
- 2mm (3/32") Balsa Sheet
- Template Sheet

Cut out the Upper Wing Support template. Using the 3/32" Balsa Sheet, cut out two Upper Wing Supports.

Using wood glue, attach each Upper Wing Support to the Upper Wing by aligning them to the tab that extends to the motor tube (as pictured).

Next cut the shoulder off of the 10.5mm Balsa Nose Cone. Then cut it in half lengthwise.

Using wood glue, attach each Upper Wing Support to the Upper Wing by aligning them to the tab that extends to the motor tube (as pictured).



### Step 25 - Nose Cone Test Fit:

- Masking Tape (if needed)

Yippee! You're done building. Congratulations are in order.

Fold up the shock cord and put it into the left compartment. Slide the nose cone in place to check its fit. Using masking tape, if needed, to ensure a nice snug fit. Nose cone should not fall out when the rocket is help pointing down, even with some level of shaking (as opposed to a hard snap).

### Step 26 - Finishing:

- Masking Tape (if needed)
- Sand Paper (220 grit) on a block
- Sand Paper (220 grit) on a dowel
- Sand Paper (400 grit) on and off a block
- Filler (Elmers' Fill-n-Finish, Light Spackle, or Bondo Glazing Putty work)

Finishing the rocket is really up to you but we do have the following recommendations and you should look at the front cover picture for some guidance.

- Keep it as light as possible
- Remember the balsa is soft so careful about where you are sanding.
- Use filler in the exposed joints in the nose cone assembly
- Use filler in the exposed outside joints where the Lower Wings attach to the Lower Wing Supports
- Round the balsa on the upper corners of the Canopy (both sides)
- Round the balsa on the Upper Base (both sides)



### Step 27 – Lambda-II Decals:

- Decals

The Decals are water-transfer type and have been coated with “Future” or Microscale coating to protect them. They are thin, so be careful. The picture is our finished 29mm version for your reference.

Place your decals where you will enjoy them.



### Step 28 - Parachute Assembly and Attachment:

- 15” or 18” Plastic/Mylar Parachute Kit

Assemble the Parachute according to the provided instructions.

When complete, pull the parachute from its center in one hand and all the shroud lines in the other so that the lines are all even. Tie the group of shroud lines in a knot. Locate the shock cord and tie the parachute shroud lines to the shock cord 6" from the nose cone.

*Optional:* Cut out a 3" or 6" diameter spill hole in the 15" or 18", respectively, parachute.

### Step 29 - Preparing for Flight:

- Masking Tape
- Flame-proof Wadding

Apply masking tape to the 18mm motor so that the fit is tight. Push the motor up to the thrust ring. The only recommended motors are a B6-2 and C6-3. B4's seem to be too low of average thrust. Apogee C10-4 (with small adaptor) and D10-5 should be okay based on thrust curve and initial mass.

Use wadding in the top of the actual motor casing and up to the thrust ring. Cellulose type would be best.

Fold the parachute with the shroud lines inside it and the opening pointing toward the front. Use the last 1-3" of shroud line to wrap around the front of the parachute (where the shrouds attach). The idea is that when the nose cone ejects, it will pull out the parachute from that front section, but there will not be too much of the parachute wrapped to prevent it from open.

Gather the shock cord from the rocket body to the parachute attachment and push into the canopy compartment.

Slide the parachute into the same compartment (if possible). If not possible, then be sure to have the excess lines go across the top of the motor mount and not in front of it!

Gather the remainder of the shock cord and push into the same canopy compartment, then push the nose cone into place.

Follow NAR Safety Rules! Avoid windy days! Place on an 1/8" launch rod and let it fly!



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