

Quantum Leap 3000



2 STAGE HIGH POWER ROCKET KIT

Parts list:

- Pre-slotted booster airframe 24" long
- Pre-slotted sustainer airframe 16" long
- Aft recovery airframe 17-7/8" long
- Fore recovery airframe 17-7/8" long
- Nose cone
- (4) Booster fins
- (4) Sustainer fins
- (2) Kwik Switch motor mount system:
 - (1) 54mm motor mount tube
 - (1) 38mm motor mount tube
 - (1) 29mm motor mount tube
 - (1) 54mm threaded adapter retainer
 - (2) 29/38 threaded tube adapter
 - (1) 54 to 38 centering ring
 - (1) 54 to 29 centering ring
- (2) Notched centering rings
- (2) Standard centering rings
- CPR-3000 System including:
 - Aluminum Threaded Airframe Coupler
 - Aluminum Threaded Sleeve
 - Fore Altimeter Mount
 - Aft Altimeter Mount
 - (2) Charge Cylinder Holders
 - (2) Charge Cylinder Canisters
 - (4) Vinyl Charge Canister Caps
 - Slotted Altimeter Mounting Tube 1.5" x 7"
 - Mounting Tube 1.5" x 4" long
 - Coupler Tube 1.5" x 2" long
 - Airframe Coupler 1-7/8" long
 - Airframe Coupler Tube
 - O-ring for Airframe Coupler
 - Small O-ring 1-1/2" dia.
 - Small O-ring 1-3/8" dia.
 - (2) Standard Centering Rings
 - (2) Notched Centering Rings
 - (2) Piston Systems including:
 - Piston Body (tube)
 - Piston Plate
 - D-ring
 - Piston Strap 60" long
 - Strap for fin unit (16" long)
 - D-ring (for strap above)
 - Slotted Bulk Plate (for airframe coupler)
 - (4) Small Socket Head Screws
 - Allen Wrench
 - Safety Switch
 - Safety Switch Wire
 - (2) Safety Switch Mounting Screws
- Interstage Coupler Assembly including:
 - Coupler 8.5" long
 - Airframe section 2.5" long
 - Timer tube 1.5" x 5" long
 - Bulkplate
 - Coupler centering ring
 - Notched coupler centering ring
 - Strap 12" long
 - D-ring (for strap above)
 - Fore timer mount
 - Aft timer mount
 - Safety switch
 - Wire 10" long
 - (2) Set screws
 - (4) Socket head screws
 - Kwik-Link
 - (2) Safety switch screws
- Sustainer drogue Parachute
- Sustainer main Parachute
- Booster parachute
- Piston System for booster
- (3) Launch lugs
- (3) Shock Cord (Tubular Nylon)
- (3) Kwik-Links
- Glass cloth set
- Instruction manual (this one)
- CPR-3000 Logo Decal

Please read and understand all instructions before building!

The center of pressure (CP) of this rocket is 65" from nose tip in complete two stage configuration, 50" as single stage. After finishing your rocket, permanently mark the center of pressure on the airframe. After loading the rocket with a motor, make sure that the center of gravity (balancing point) is at least one body diameter forward of the center of pressure mark. The center of gravity can be moved forward by adding weight to the nose cone.



Basic Construction FAQ

The major parts involved in each step are shown shaded at the beginning of that step. Areas where epoxy should be applied are shown as well.

PREP & ASSEMBLY

Read and understand the instruction steps fully before you begin the step.

ALWAYS sand the parts to be bonded with 100-120 grit sandpaper.

We strongly recommend you dry-fit (assemble without gluing) all parts in each step

BEFORE epoxying them together. Sand or adjust fit as needed before gluing.

Most epoxies work fine. Use 5 or 15 minute depending on how quickly you feel you can complete the step. Use longer set-time epoxy if you're unsure.

To make internal fillets to the fins deep up into the airframe, "load up" the end of a dowel with a blob of epoxy, then stick the dowel into the airframe and onto the fin joint you're working on. After depositing enough epoxy in this fashion, you can pull the dowel toward you, making a fillet with the rounded edge of the dowel.

Fins do not need to be "shaped". Lightly sand the edges to remove any manufacturing burrs.

PAINTING/FINISHING

Before you paint the fins, scuff the entire surface with 220 grit sandpaper. This is easiest to do before mounting the fins.

Plastic nosecone imperfections can be filled with plastic model kit putty.

Stay with the same brand of paint throughout the process; primer, base color, accent colors, and clear coat. DO NOT skimp on the "shake the can for at least two minutes after the ball rattles" step! For the best finish, let each coat dry overnight and sand lightly with 320 or 400 grit sandpaper.

Apply the last color coat as heavy as possible without running or sagging. Let the paint cure for at least 48 hours before handling!

We recommend a clear coat of some sort to help protect the decals as well as "seal" their edges to help prevent them peeling off. When using any clear coat, put on only VERY thin, light coats, and wait at least 5 minutes between coats. The clear coat can damage your decals or paint if you put it on too heavily or don't wait long enough between coats!

FINAL FITTING/PREPARATIONS FOR FLIGHT

The piston should be a smooth slip-fit in the airframe; this is critical. Sand the piston as needed so it can be easily inserted, and pulled out with just a gentle tug on the shock cord.

Keep sandpaper in your range box in case you need to adjust the fit the first few times at the field to deal with differing temperature and humidity.

Couplers should also be sanded to allow easy separation of the rocket.

If the coupler or nosecone is too loose, use masking tape to build it up to a good fit. If the nosecone is too tight, sand the ribs on the shoulder until it fits well. The parts fit properly if the rocket can be held upside down and gently shaken with nothing moving or coming apart.

Ejections will leave a black, gritty residue inside the airframe. Occasionally wipe the tube interior with a damp cloth wrapped around a dowel or broomstick; allow to dry.

See our website FAQ for information about thrust rings and motor retention. Motor recommendation information is available on our website on the Specs Page.

For our complete FAQ, see the FAQ Page on our website at www.publicmissiles.com.

www.publicmissiles.com

The PML Web Store and Knowledge Base

Other items you will need:

One set of epoxy
One set of finishing epoxy
Thin CA
One sheet each 120 and 220 sandpaper

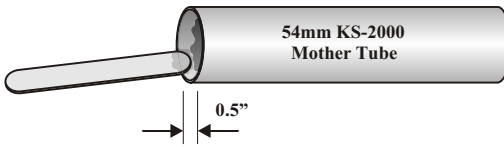
Ruler and pencil
Masking tape
Cellophane tape
1" wide disposable brush

**Please read and understand all instructions before continuing!
All surfaces to be bonded must be scuffed with 120 grit sandpaper.**

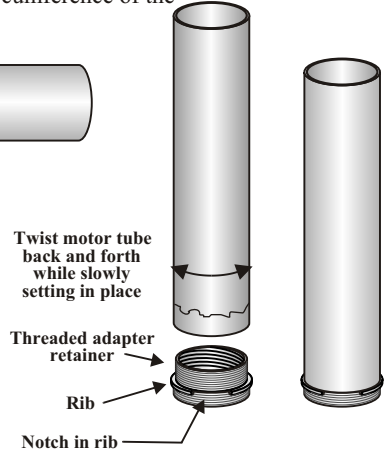
Assembling the Booster Stage

Step 1

Spread a bead of epoxy around the inside circumference of the 54mm mother tube to a depth of about 1/2"

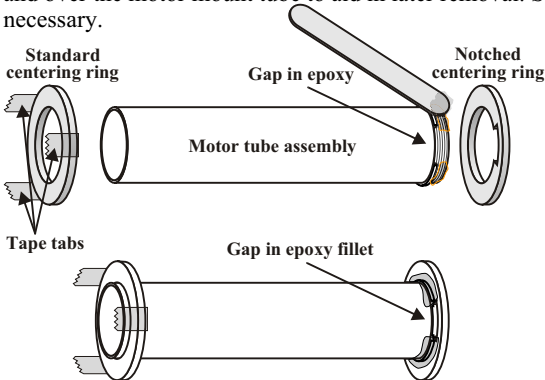


With the threaded adapter retainer laying flat on the table, slowly lower the motor tube in place over the retainer using a back and forth twisting motion to spread the epoxy. Look down into the tube and make sure no epoxy runs onto the threads! If this occurs, remove the retainer immediately, wipe it clean and start again. Press the tube firmly over the retainer until it is in firm contact with the notched rib. Allow the epoxy to set.



Step 2

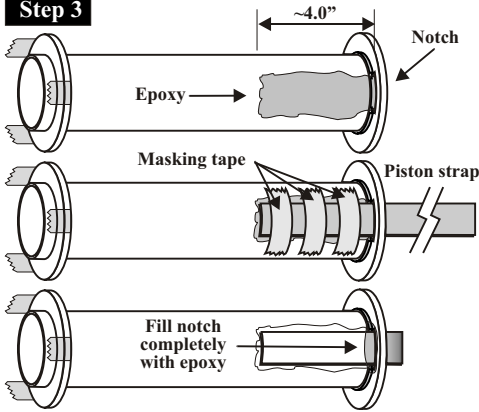
Dry fit both centering rings into the airframe and over the motor tube. The notched ring can be a little snug in the airframe and on the threaded adapter retainer. If it is tight, sand the ID and/or OD for a better fit. The standard centering ring should be a little looser in the airframe and over the motor mount tube to aid in later removal. Sand the ID and/or OD for a looser fit if necessary.



Spread a bead of epoxy around the circumference of the threaded adapter retainer leaving a 1" gap in the bead at the notch in the rib. Slip the notched centering ring over the threaded adapter retainer with the notch aligned with the gap in the epoxy bead. Be sure the notch in the ring remains clear of epoxy. Locate the ring against the rib and with the notches aligned. Allow the epoxy to set.

Slide the standard centering ring over the motor tube until 1/8" of the motor tube is protruding beyond the ring. Make 3 or 4 tabs using cellophane tape as shown above to aid in removing this ring later. Do not use any glue at this time. This centering ring will be removed in a subsequent step.

Step 3



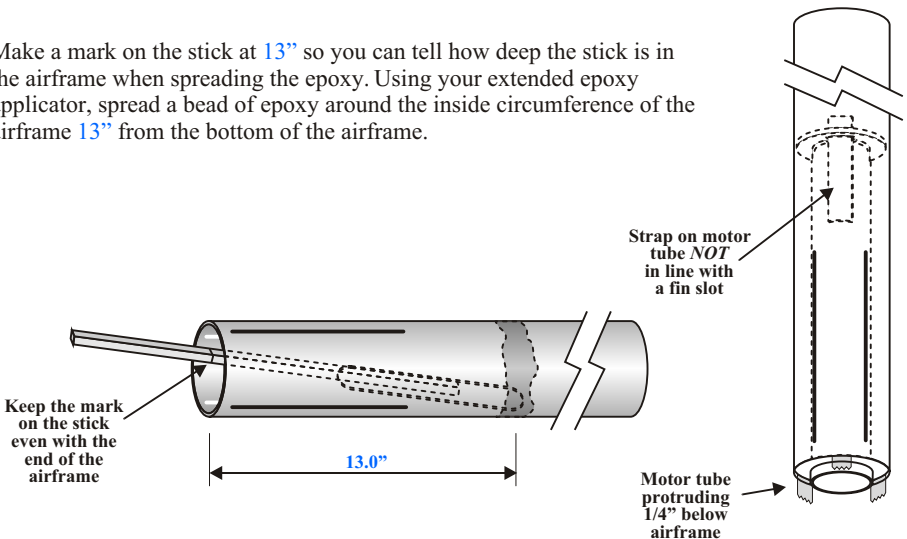
Spread a layer of epoxy about 1" wide and 4" long on the motor tube just below the notch in the upper centering ring. Slip one end of the 60" long nylon strap through the notch in the centering ring. Pull through about 4" of this strap through the notch and press it firmly into the epoxy on the side of the motor tube. Hold the strap in place against the tube with masking tape until the epoxy cures. Remove the masking tape. **Fill the entire centering ring notch with epoxy.** Stuff the free end of the strap into the motor tube to keep it out of the way for the next step.

Step 4

You will need a long stick or dowel for applying epoxy in this step. Just below is a drawing of one good method for creating an extended epoxy applicator. Simply epoxy a dowel or stick to a tongue depressor or popsicle stick.



Make a mark on the stick at 13" so you can tell how deep the stick is in the airframe when spreading the epoxy. Using your extended epoxy applicator, spread a bead of epoxy around the inside circumference of the airframe 13" from the bottom of the airframe.



Holding the airframe upright (vertical), push the motor tube assembly into the airframe, **making sure the strap is NOT in line with a fin slot**, until the bottom of the motor tube is protruding 1/4" from the bottom of the airframe. Keep the assembly vertical until the epoxy cures.

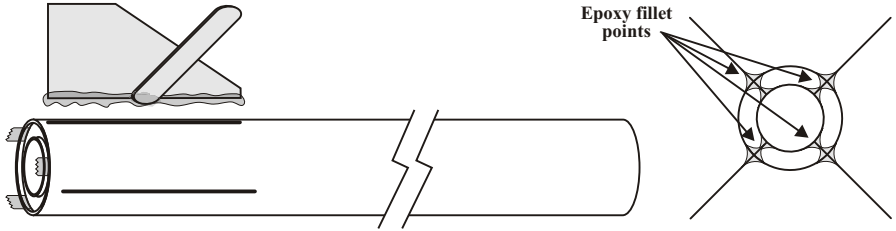
Step 5

A) Apply a bead of epoxy to the root edge of a fin. Push the fin through the slot in the airframe and against the motor mount tube. Make sure that the fin is perpendicular to the airframe. Use tape to hold the fin in position while the epoxy cures. Repeat this process for all fins.

B) Apply an epoxy fillet to both sides of each fin. Carefully smooth the epoxy with your finger before it begins to gel. Allow the epoxy to set up before rotating the rocket to do the next set of fins. Once the epoxy has fully cured, you should sand the fillet smooth with fine sandpaper. Sanding will help the primer hold better to the epoxy.

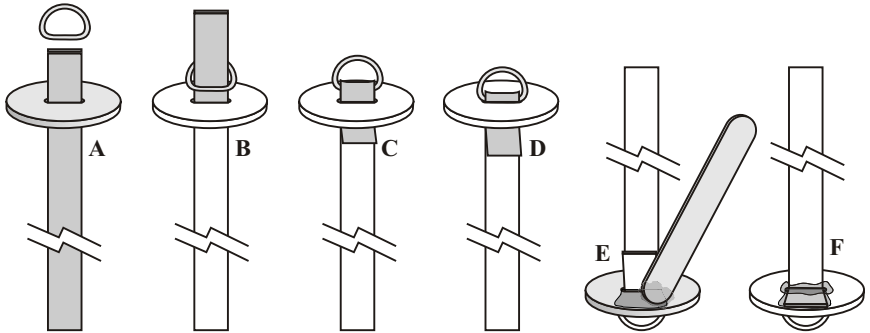
C) Gently pull the centering ring off the end of the rocket by tugging on the tape tabs. Using a stick, apply an epoxy fillet to the fins at the motor mount tube and the inner airframe wall.

D) Remove the tape tabs from the centering ring and permanently epoxy it in the base of the rocket 1/8" in from the bottom of the airframe.



Step 6

NOTE: In this step you will be using the free end of the strap that you mounted to the motor mount tube in a previous step.



A) Pull the free end of the strap through the slot in the piston bulk plate.

B) Slip the metal "D" ring over the strap.

C) Feed the strap back through the slot.

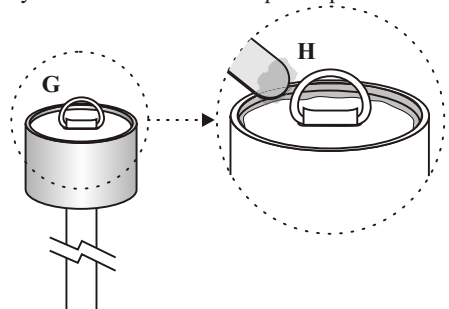
D) Pull on the strap until the "D" ring is wedged at the slot.

E) Flip the assembly over. Spread a layer of epoxy on the underside of the piston plate as shown. Fold the short end of the strap flat against the piston plate and press it into the epoxy. You can use a clamp to hold the strap in the epoxy while it sets.

F) When the epoxy has cured, pull the strap until the "D" ring is wedged tight at the slot. Apply epoxy to the strap at the "D" ring.

G) Epoxy the piston plate inside the piston body 1/8" from the top.

H) Apply an epoxy fillet to both sides of the piston plate.



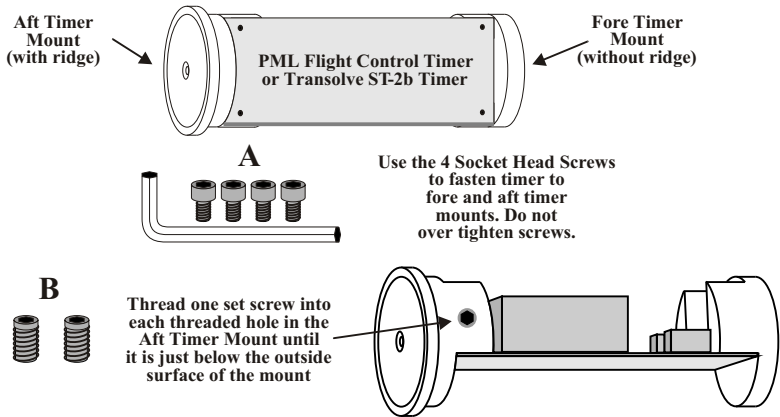
Step 1

Assembling the Inter-Stage Coupler

The Fore and Aft Timer Mounts used in the Inter-Stage-3000 system are designed around the PML Flight Control Timer and the Transolve ST-2b Timer. Other units may work as well with slight modifications to the mounts. Modifications may require relocating the mounting holes and grinding away material for clearances. Be careful not to weaken the mounts. Consult the timer manufacturer for their recommendations.

A) Mount the PML Flight Control Timer or Transolve ST-2b Timer to the fore and aft timer mounts using the 4 Socket Head Screws and wrench supplied with this kit. Do not over-tighten the screws to prevent stripping the mounts.

B) Thread one set screw into each threaded hole in the Aft Timer Mount until it is just below the outside surface of the mount.

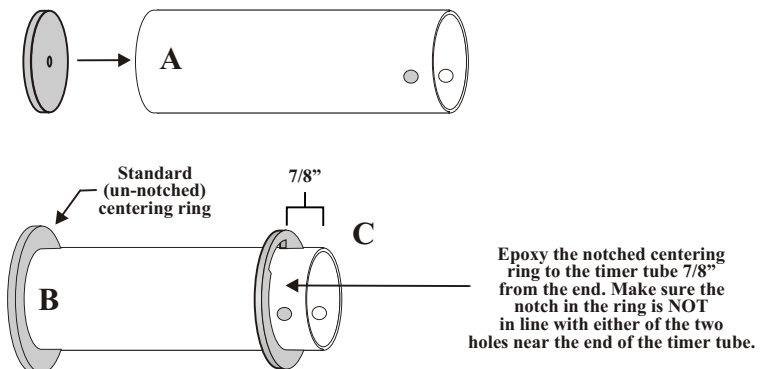
**Step 2**

A) Epoxy the bulk plate flush with the end of the timer tube opposite of the end with the drilled holes.

B) Epoxy the standard (un-notched) centering ring flush with the end of the timer tube on the same end of the tube as the bulk plate.

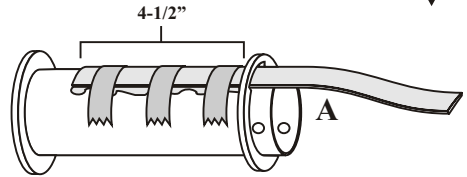
C) Epoxy the notched centering ring to the timer tube 7/8" from the end with the drilled holes. Make sure the notch in the ring is NOT in line with either of the two holes near the end of the timer tube.

Apply an epoxy fillet to both centering rings but keep the notch open.

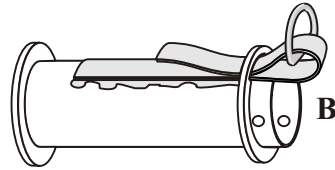


Step 3

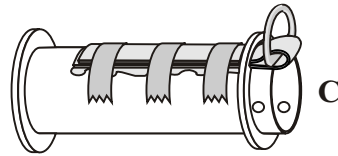
A) Slip one end of the 12" long strap through the notch in the centering ring. Pull the strap through until 4-1/2" of the strap is pulled through the centering ring. Epoxy the strap to the timer tube between the two centering rings. Hold the strap to the tube using masking tape while the epoxy cures.



B) Place the D-Ring over the strap. Push the free end of the strap through the same notch in the centering ring and pull until another 4-1/2" is pulled through the centering ring.



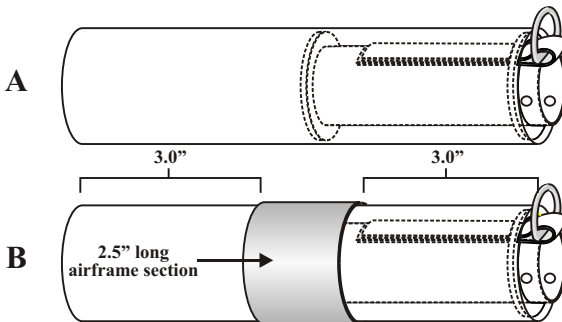
C) Epoxy this section of strap over the strap already bonded to the timer tube. Again, use masking tape to hold the strap in place while the epoxy cures. Once epoxy has cured, remove the masking tape. Fill the remaining gaps in the notch with epoxy.



Step 4

A) Epoxy the timer tube assembly into the 8-1/2" long coupler tube. The notched centering ring should be just 1/8" from the end of the coupler.

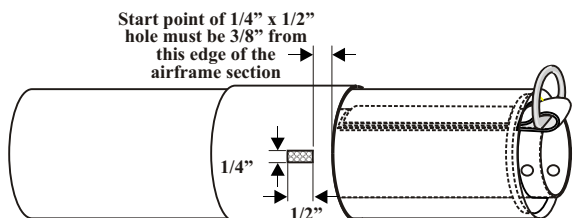
B) Epoxy the 2.5" long airframe section over the exact middle of the coupler tube.



Step 5

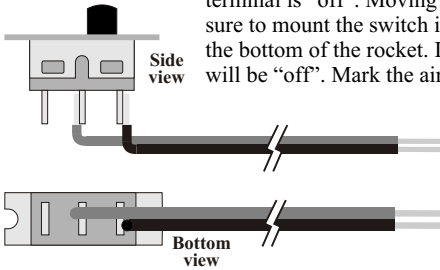
In order to properly install the safety switch, you will need to cut a 1/2" x 1/4" opening into the airframe starting 3/8" from the bottom edge as indicated in the drawing below. First mark out the perimeter of the opening on the airframe, then drill a series of small holes within the marks, starting near the corners, and removing the remaining material with a pointed X-Acto knife. Test fit the switch into the hole to assure a good fit.

Drill a 1/8" hole in the timer tube through the rectangular switch opening so that the safety switch leads can pass through into the timer tube.



Step 6

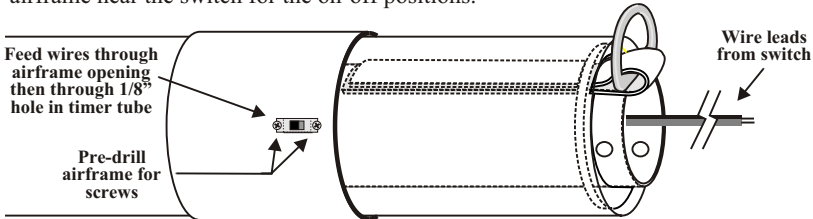
Solder one safety switch wire to the center terminal of the switch and the other wire to one of the outside terminals of the switch. Polarity does not matter in this application. This switch has two positions; ON-ON, meaning the switch is able to make connections in both positions. Since you are using only two wires (center terminal and one end terminal), the switch position toward the unwired terminal is “off”. Moving the switch toward the wired terminal is “on”. Be sure to mount the switch into the rocket with the two wired terminals towards the bottom of the rocket. In this configuration, “down” will be “on” and “up” will be “off”. Mark the airframe for the on-off positions.



Strip about 1/4” of the insulation from the two wires and “tin” the exposed wires with a bit of solder to stiffen them. These wires will be attached to the safety switch terminals of the timer.

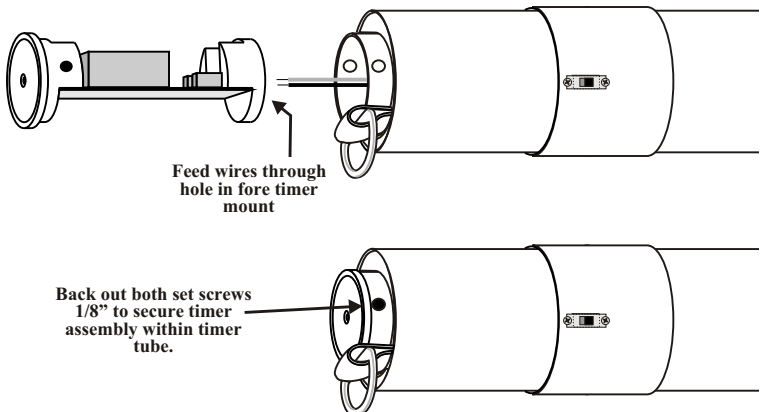
Step 7

Feed the wire ends into the airframe opening, then through the 1/8” hole in the timer tube and finally out through the end of the timer tube. Set the switch into the rectangular airframe opening, pre-drill the airframe for the mounting screws, and install the screws. Mark the airframe near the switch for the on-off positions.



Step 8

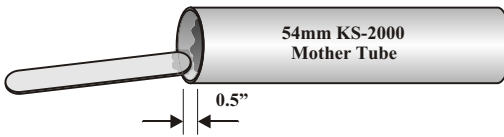
Align the timer assembly with the timer tube. Pass the safety switch wires through the hole in the fore timer mount (in flight prep, you will also pass the igniter leads through this hole). Begin sliding the timer assembly into the timer tube while gently pulling the wires through the hole. As soon as the fore timer mount is in the tube, attach the safety switch wires to the appropriate terminals on the timer. Once the wires are attached, continue to push the timer assembly into the timer tube until the ridge on the aft timer mount contacts the timer tube. Turn the timer assembly until the set screws in the aft timer mount align with the holes in the timer tube. Using the supplied Allen wrench, back the set screws out about 1/32” beyond the OD of the timer tube through the holes to lock the timer assembly in place.



Assembling the Sustainer Stage

Step 1

Spread a bead of epoxy around the inside circumference of the 54mm mother tube to a depth of about 1/2"



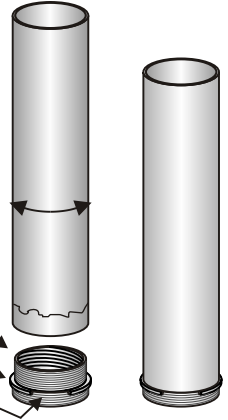
With the threaded adapter retainer laying flat on the table, slowly lower the motor tube in place over the retainer using a back and forth twisting motion to spread the epoxy. Look down into the tube and make sure no epoxy runs onto the threads! If this occurs, remove the retainer immediately, wipe it clean and start again. Press the tube firmly over the retainer until it is in firm contact with the notched rib. Allow the epoxy to set.

Twist motor tube back and forth while slowly setting in place

Threaded adapter retainer

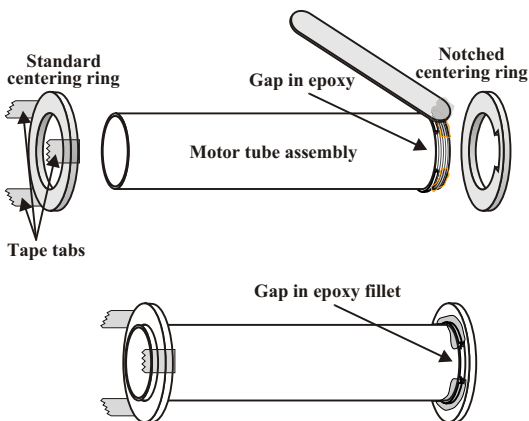
Rib

Notch in rib



Step 2

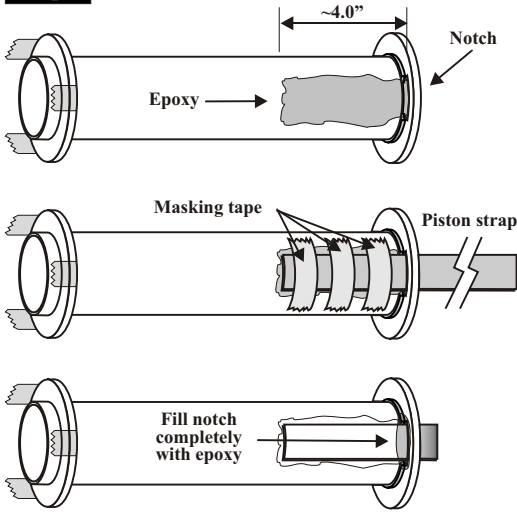
Dry fit both centering rings into the airframe and over the motor tube. The notched ring can be a little snug in the airframe and on the threaded adapter retainer. If it is tight, sand the ID and/or OD for a better fit. The standard centering ring should be a little looser in the airframe and over the motor mount tube to aid in later removal. Sand the ID and/or OD for a looser fit if necessary.



Spread a bead of epoxy around the circumference of the threaded adapter retainer leaving a 1" gap in the bead at the notch in the rib. Slip the notched centering ring over the threaded adapter retainer with the notch aligned with the gap in the epoxy bead. Be sure the notch in the ring remains clear of epoxy. Locate the ring against the rib and with the notches aligned. Allow the epoxy to set.

Slide the standard centering ring over the motor tube until 1/8" of the motor tube is protruding beyond the ring. Make 3 or 4 tabs using cellophane tape as shown above to aid in removing this ring later. Do not use any glue at this time. This centering ring will be removed in a subsequent step.

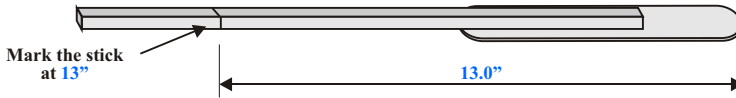
Step 3



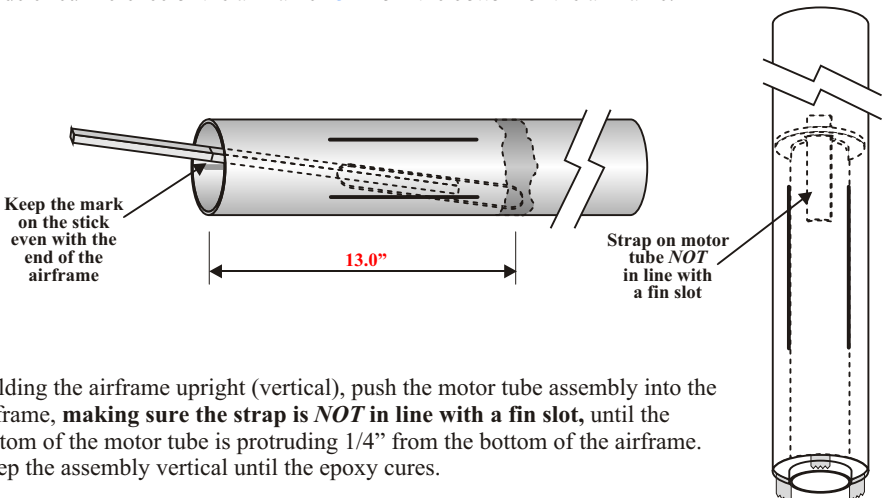
Spread a layer of epoxy about 1" wide and 4" long on the motor tube just below the notch in the upper centering ring. Slip one end of the 16" long nylon strap through the notch in the centering ring. Pull through about 4" of this strap through the notch and press it firmly into the epoxy on the side of the motor tube. Hold the strap in place against the tube with masking tape until the epoxy cures. Remove the masking tape. **Fill the entire centering ring notch with epoxy.** Stuff the free end of the strap into the motor tube to keep it out of the way for the next step.

Step 4

You will need a long stick or dowel for applying epoxy in this step. Just below is a drawing of one good method for creating an extended epoxy applicator. Simply epoxy a dowel or stick to a tongue depressor or popsicle stick.



Make a mark on the stick at 13" so you can tell how deep the stick is in the airframe when spreading the epoxy. Using your extended epoxy applicator, spread a bead of epoxy around the inside circumference of the airframe 13" from the bottom of the airframe.



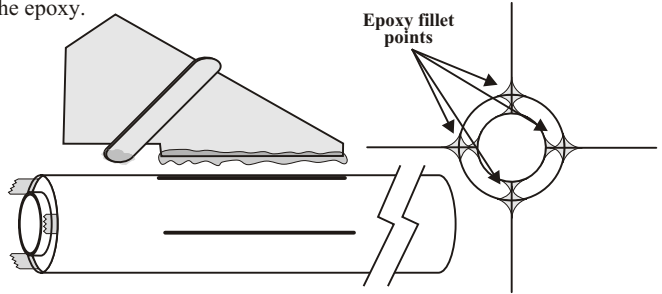
Holding the airframe upright (vertical), push the motor tube assembly into the airframe, **making sure the strap is NOT in line with a fin slot**, until the bottom of the motor tube is protruding 1/4" from the bottom of the airframe. Keep the assembly vertical until the epoxy cures.

Step 5

A) Apply a bead of epoxy to the root edge of a fin. Push the fin through the slot in the airframe and against the motor mount tube. Make sure that the fin is perpendicular to the airframe. Use tape to hold the fin in position while the epoxy cures. Repeat this process for all fins.

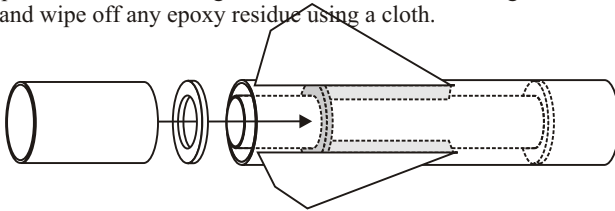
B) Apply an epoxy fillet to both sides of each fin. Carefully smooth the epoxy with your finger before it begins to gel. Allow the epoxy to set up before rotating the rocket to do the next set of fins. Once the epoxy has fully cured, you should sand the fillet smooth with fine sandpaper. Sanding will help the primer hold better to the epoxy.

C) Peel off the tape and gently pull the centering ring off the end of the rocket. Using a stick, apply an epoxy fillet to the fins at the motor mount tube and the inner airframe wall.



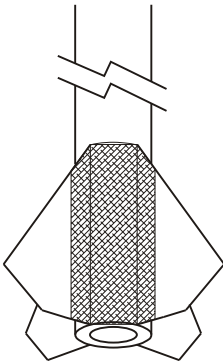
Step 6

Remove the tape tabs from the centering ring. Using a stick, apply a layer of epoxy in the base of the airframe just below the fin tangs. Press the centering ring into the base of the rocket using the coupler tube. Push the ring in until it contacts the fin tangs. Immediately remove the coupler tube and wipe off any epoxy residue using a cloth.



Step 7

Because of the partial fin tabs necessary on the sustainer stage, fiberglass cloth is provided to strengthen this area. Remove the fiberglass cloth from the plastic wrapper. Be very careful not to distort or fray the edges of the fabric. Mix up a batch of 20 minute finishing epoxy in a small cup. Using a 1" wide disposable brush, Coat the facing sides of two adjacent fins and the airframe between and 1/4" above the fins with the epoxy as shown. Apply just enough epoxy to completely wet the surfaces, but not enough to run or sag.



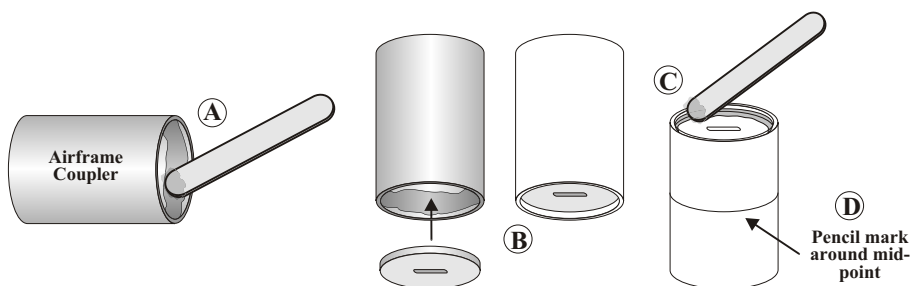
Apply a piece of glass cloth to the coated surfaces. The cloth should over hang the fins at the top and bottom. Press the cloth into the epoxy by dabbing it with the brush. Be sure there is no air trapped under the cloth. The cloth becomes transparent when it is properly wetted with epoxy. If some areas do not appear wet, dip the brush in the epoxy and dab the dry area.

When the epoxy has set firm, but not completely cured, trim the overhanging cloth with an X-Acto knife. Don't worry about making it perfect at this point.

Repeat this process on all four sides. When the epoxy has completely cured, sand off any bumps that may have occurred using 120 grit sandpaper. Wipe clean and apply another coat of finishing epoxy to the entire fiberglass surface. When cured, sand with 220 grit sandpaper. Repeat if necessary until smooth. Sand the edges of the fins smooth and round. Apply thin CA to all the edges of the fins and cloth. Fill any imperfections with spot putty or other filler. Allow to cure, then sand again lightly using 220 grit sandpaper.

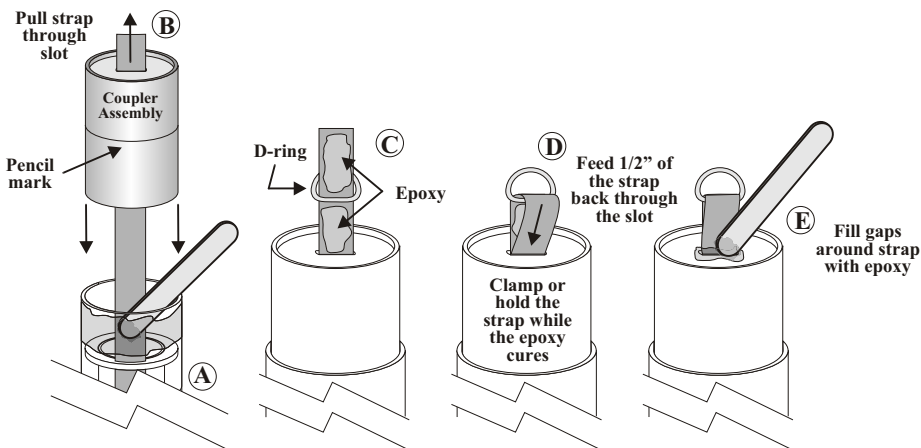
Step 8

- A) Spread a bead of epoxy around the inside circumference of one end of the 5" long coupler tube.
- B) Press the slotted bulk plate into the coupler about 1/8" past the end. Allow the epoxy to cure.
- C) Flip the assembly over and add an epoxy fillet to the other side of the bulk plate.
- D) Draw a pencil mark around the mid-point of the coupler tube.



Step 9

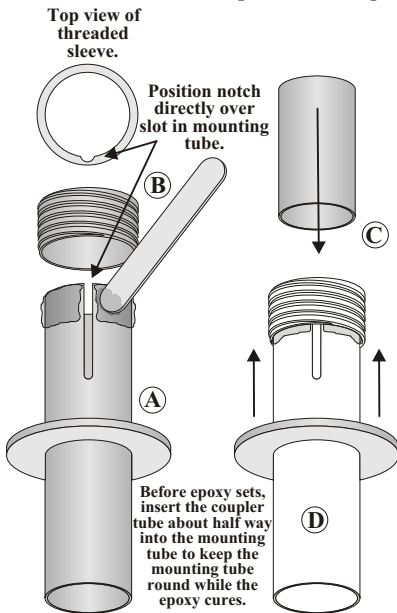
- A) Pull the free end of the strap out of the motor mount tube. Spread a layer of epoxy around the inside circumference of the airframe above the uppermost centering ring.
- B) Slip the end of the strap through the slot in the bulk plate of the coupler assembly. Slowly and with a twisting motion, push the coupler into the airframe up to the pencil mark. Pull up on the strap to make sure it is not bunched up inside the coupler.
- C) Cut the strap 4-1/2" above the bulk plate and seal the end by heating it with a lighter or match. Spread a layer of epoxy onto the strap as shown. Place the D-ring over the strap.
- D) Fold the strap over the D-ring and feed about 1/2" of the strap back into the slot. Clamp or hold the straps tightly while the epoxy cures.
- E) Apply an epoxy fillet where the strap meets the slot in the bulk plate.



Step 10

Important note:

This step must be completed without interruption before the epoxy sets.

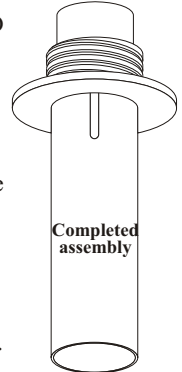


A) Slide the standard centering ring over the slotted mounting tube to the area below the slot.

B) Spread a layer of epoxy around the slotted end of the tube. Keep the epoxy away from the slot. Slip the threaded sleeve over the tube making sure the small notch in the top of the threaded sleeve is aligned over the slot in the tube.

C) Push the coupler tube half way into the slotted end of the mounting tube to keep the tube round and firmly against the ID of the threaded sleeve. **Do not glue this tube in place!**

D) Slide the centering ring up the tube and against the base of the threaded sleeve. Wipe away any excess epoxy from the bottom of the threaded sleeve and centering ring joint. Excess epoxy here can interfere with the proper fit of the upper threaded coupler when the CPR system is complete and assembled. Allow the epoxy to cure.

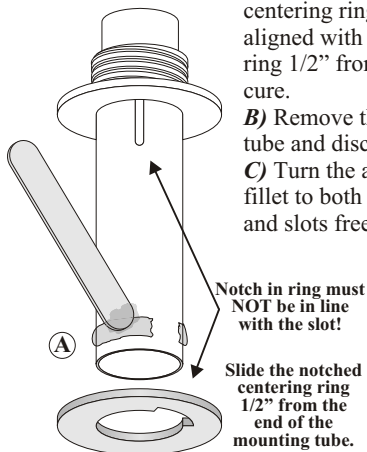


Step 11

A) Spread a layer of epoxy around the circumference of the opposite end of the tube about 1/4" from the end. Leave a 1" gap in the epoxy **not in line with the slot**. Push the notched centering ring onto the tube with the notch aligned with the gap in the epoxy. Position the ring 1/2" from the bottom. Allow the epoxy to cure.

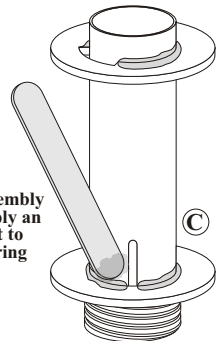
B) Remove the coupler tube from the mounting tube and discard it.

C) Turn the assembly over and apply an epoxy fillet to both centering rings. Keep the notches and slots free of epoxy

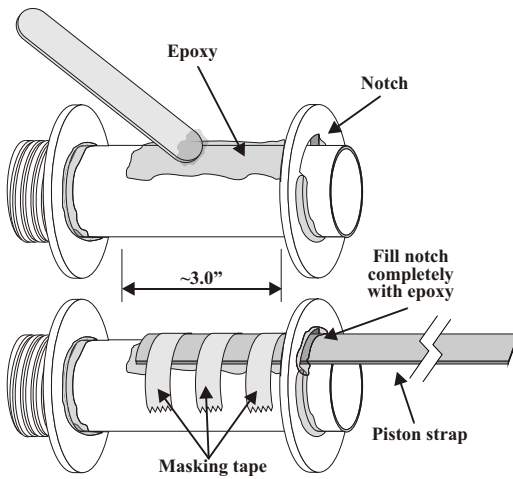


B) Remove the coupler tube.

Turn the assembly over and apply an epoxy fillet to both centering rings.



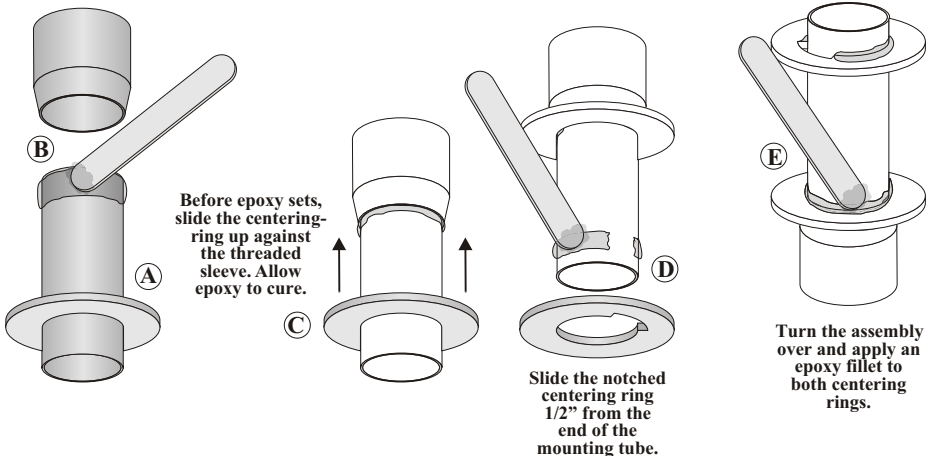
Step 12



Spread a layer of epoxy about 1" wide and 3" long on the mounting tube just below the notch in the centering ring. Slip one end of the piston strap (one of the wide, 60" long straps) through the notch in the centering ring. Pull through about 3" of this strap through the notch and press it firmly into the epoxy on the side of the mounting tube. Hold the strap in place against the tube with masking tape until the epoxy cures. Remove the masking tape. **Fill the entire centering ring notch with epoxy.** Stuff the free end of the strap into the tube to keep it out of the way for the next step.

Step 13

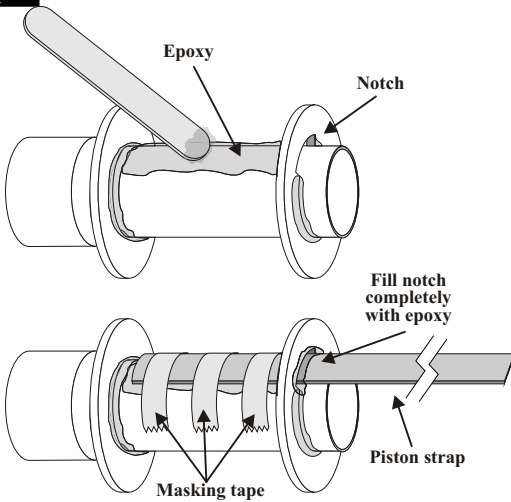
- A) Slide the standard centering ring over the 4" long mounting tube.
- B) Spread a layer of epoxy around one end of the tube. Slip the threaded airframe coupler over the tube. Make sure the threaded coupler is fully seated on the tube.
- C) Slide the centering ring up the tube and against the base of the threaded airframe coupler. Allow the epoxy to cure.



D) Spread a layer of epoxy around the circumference of the opposite end of the tube about 1/4" from the end. Leave a 1" gap in the epoxy. Push the notched centering ring onto the tube with the notch aligned with the gap in the epoxy. Position the ring 1/2" from the bottom. Allow the epoxy to cure.

E) Turn the assembly over and apply an epoxy fillet to both centering rings. Keep the notch free of epoxy.

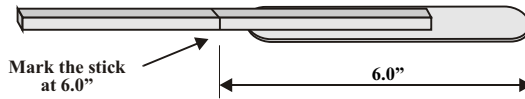
Step 14



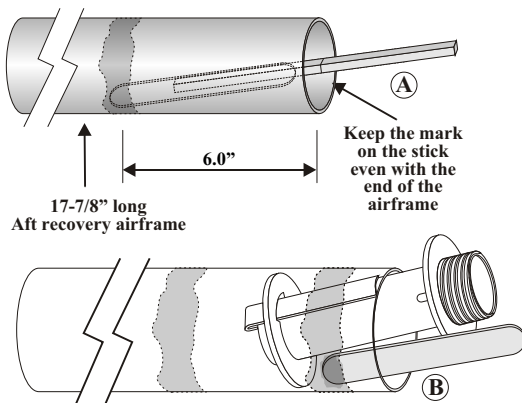
Spread a layer of epoxy about 1" wide on the mounting tube just below the notch in the centering ring. Slip one end of the piston strap (the second of two 60" long straps) through the notch in the centering ring. Pull through about 3" of this strap through the notch and press it firmly into the epoxy on the side of the mounting tube. Hold the strap in place against the tube with masking tape until the epoxy cures. Remove the masking tape. **Fill the entire centering ring notch with epoxy.** Stuff the free end of the strap into the tube to keep it out of the way for the next step.

Step 15

You will need a long stick or dowel for applying epoxy in this step. Just below is a drawing of one good method for creating an extended epoxy applicator. Simply epoxy a dowel or stick to a tongue depressor or popsicle stick.

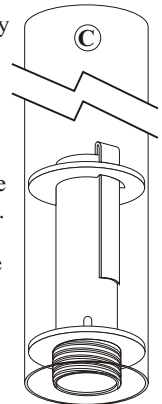


A) Make a mark on the stick at 6.0" so you can tell how deep the stick is in the airframe when spreading the epoxy. Using your extended epoxy applicator, spread a bead of epoxy around the inside circumference of the aft recovery airframe 6.0" from the bottom of the airframe.



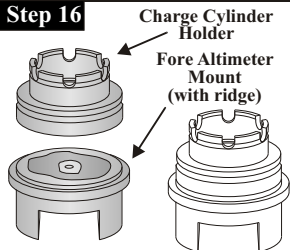
B) Push the altimeter mounting tube assembly about 2" into the aft recovery airframe. Spread another bead around the inside circumference about 1/2" from the end of the Aft Recovery Airframe. You can rock the assembly from one side to the other to make it easier to reach with the epoxy applicator.

C) Holding the aft recovery airframe upright (vertical), push the motor tube assembly the rest of the way into the airframe until the bottom of the threaded sleeve is flush with the bottom of the airframe. Keep the assembly vertical until the epoxy cures.

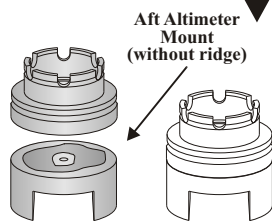


↑
Threaded sleeve flush with airframe

Step 16

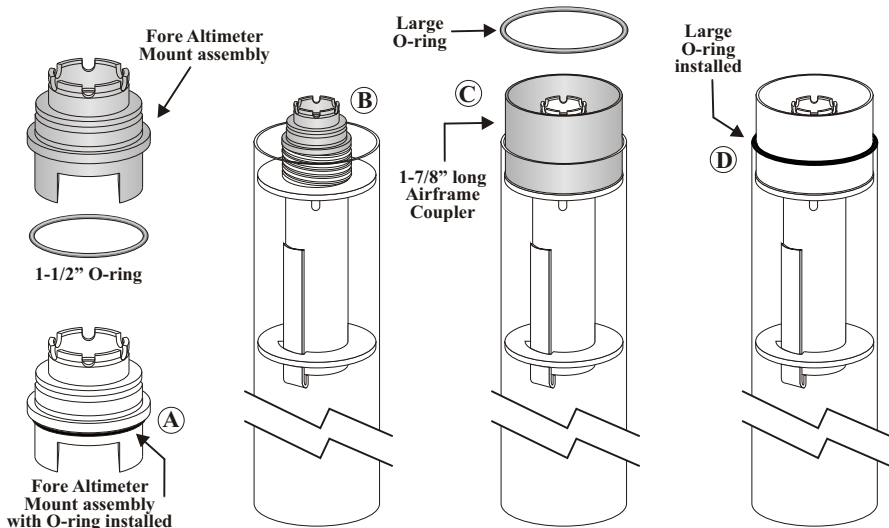


Epoxy one of the Charge Cylinder Holders to the fore altimeter mount and the other to the aft altimeter mount. Make sure the mounts and Holders are centered with one another as closely as possible. Prevent epoxy from filling the holes in the center of each piece.



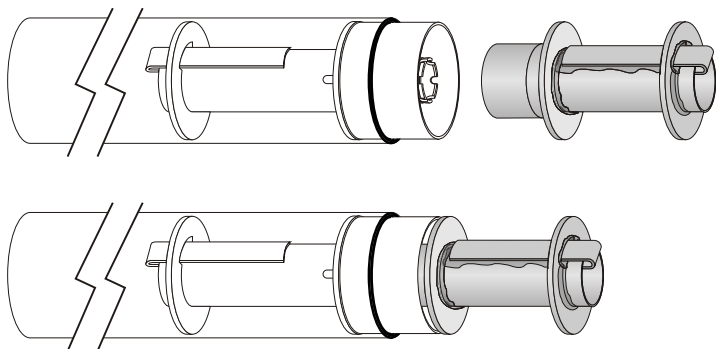
Step 17

- A) Roll the 1-1/2" O-ring onto the fore altimeter mount as shown.
- B) Place the fore altimeter mount assembly into the altimeter mounting tube.
- C) Slip the 1-7/8" long airframe coupler into position.
- D) Roll the largest of the O-rings over the coupler down to the airframe.



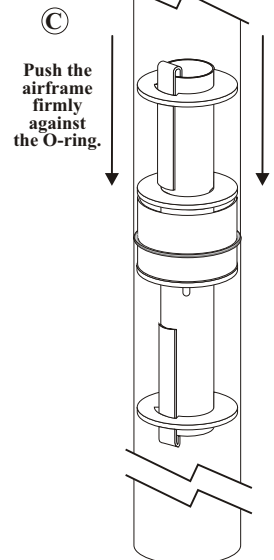
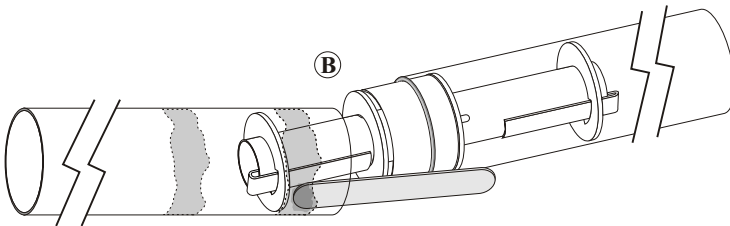
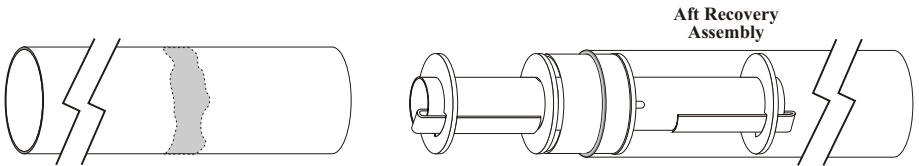
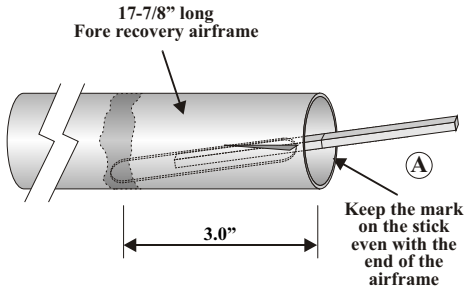
Step 18

Thread the threaded airframe coupler assembly onto the altimeter mounting tube assembly just until you feel the resistance of the threaded airframe coupler contacting the fore altimeter mount. Do not tighten at this time.



Step 19

A) Make a mark on the stick at 3.0" so you can tell how deep the stick is in the airframe when spreading the epoxy. Using your extended epoxy applicator, spread a bead of epoxy around the inside circumference of the airframe 3.0" from the bottom of the Fore Recovery Airframe.

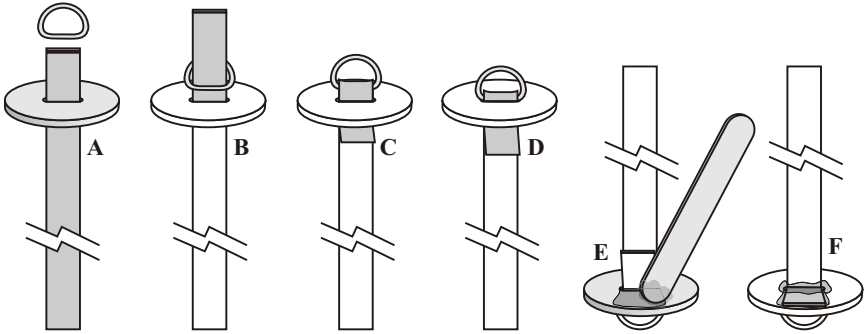


B) Push the altimeter mounting tube assembly about 2" into the fore recovery airframe. Spread another bead around the inside circumference about 1" from the end of the airframe. You can rock the assembly from one side to the other to make it easier to reach with the epoxy applicator.

C) Holding the aft recovery airframe upright (vertical), push the fore recovery airframe the rest of the way over the assembly until the airframe is in full contact with the exterior O-ring. Give it a little extra push to assure full contact. Do not turn either airframe to tighten or loosen the threads. Keep the assembly vertical until the epoxy cures. Unscrew the two airframes. The airframe coupler may have bonded to the fore airframe. If it has, that's not a problem. If it hasn't, it can remain loose and does not need to be bonded.

Step 20

NOTE: In this step you will be using the free end of the straps that you mounted to the fore and aft recovery assemblies.



A) Pull the free end of the strap through the slot in the piston bulk plate.

B) Slip the metal "D" ring over the strap.

C) Feed the strap back through the slot.

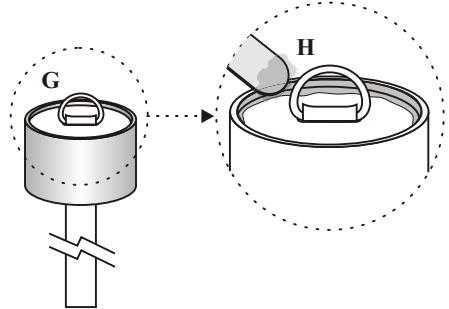
D) Pull on the strap until the "D" ring is wedged at the slot.

E) Flip the assembly over. Spread a layer of epoxy on the underside of the piston plate as shown. Fold the short end of the strap flat against the piston plate and press it into the epoxy. You can use a clamp to hold the strap in the epoxy while it sets.

F) When the epoxy has cured, pull the strap until the "D" ring is wedged tight at the slot. Apply epoxy to the strap at the "D" ring.

G) Epoxy the piston plate inside the piston body 1/8" from the top.

H) Apply an epoxy fillet to both sides of the piston plate.



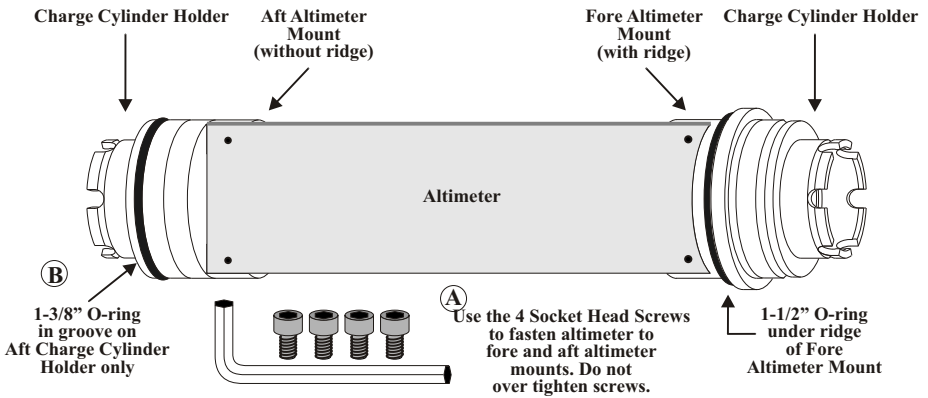
Repeat this entire step to assemble the other piston

Step 21

The Fore and Aft Altimeter Mounts used in the CPR-3000 system are designed around the PML Co-Pilot Altimeter and the Transolve P6 Altimeter. Mounts for the Transolve P5 and ALTS-25 are available as optional items through PML. Other altimeters may work as well with slight modifications to the mounts. Modifications may require relocating the mounting holes and grinding away material for clearances. Be careful not to weaken the mounts. Consult the altimeter manufacturer for their recommendations.

A) Mount the altimeter to the fore and aft altimeter mounts using the 4 Socket Head Screws and wrench supplied with this kit. Do not over-tighten the screws to prevent stripping the mounts.

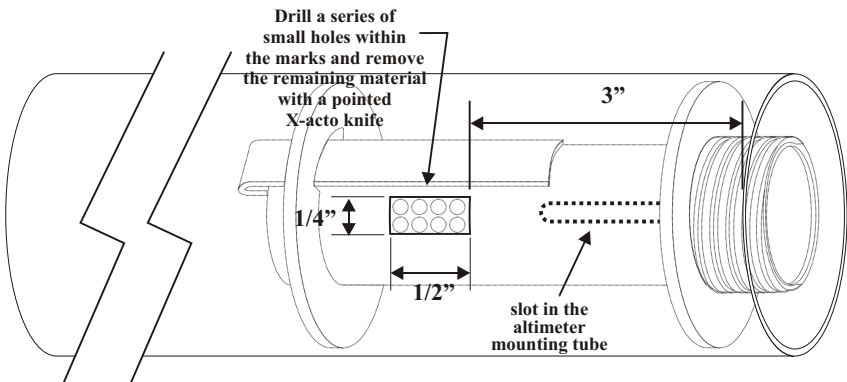
B) Install the smallest (1-3/8") O-ring in the groove of the Aft Charge Cylinder Holder. The second smallest (1-1/2") O-ring should already be installed against the ridge of the Fore Altimeter Mount from a previous step.



Step 22

In order to properly install the safety switch, you will need to cut a 1/2" x 1/4" opening into the airframe as indicated in the drawing below. **This switch opening must be aligned with the slot in the internal altimeter mounting tube.** First mark out the perimeter of the opening on the airframe, then drill a series of small holes within the marks, starting near the corners, and removing the remaining material with a pointed X-Acto knife. Test fit the switch into the hole to assure a good fit.

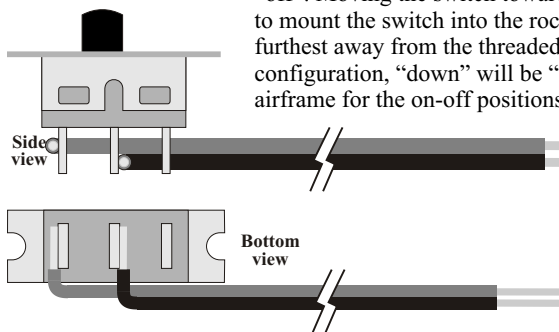
Drill a 1/8" hole in the airframe opposite of the safety switch and 5" from the top of the airframe. This hole is for venting the altimeter to the atmosphere.



Step 23

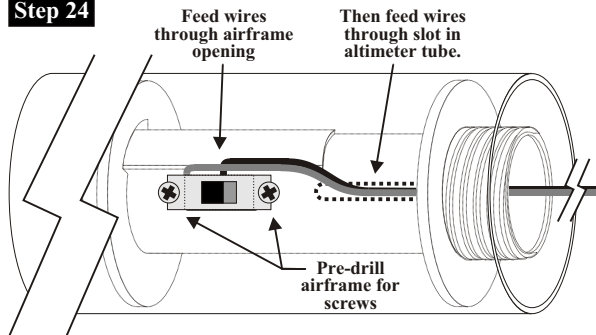
Solder one safety switch wire to the center terminal of the switch and the other wire to one of the outside terminals of the switch. Since space between the altimeter tube and the airframe is limited, solder the wires to the terminals from the side as shown in the bottom view below. Polarity does not matter in this application. This switch has two positions; ON-ON, meaning the switch is able to make connections in both positions. Since you are using only two wires (center terminal and one end terminal), the switch position toward the unwired terminal is

“off”. Moving the switch toward the wired terminal is “on”. Be sure to mount the switch into the rocket with the two wired terminals furthest away from the threaded sleeve end of the airframe. In this configuration, “down” will be “on” and “up” will be “off”. Mark the airframe for the on-off positions.



Strip about 1/4" of the insulation from the two wires and "tin" the exposed wires with a bit of solder to stiffen them. These wires will be attached to the power terminals of the altimeter.

Step 24



Feed the wire ends into the airframe opening, then through the slot in the altimeter tube and finally out through the end of the altimeter tube. Set the switch into the airframe hole (or stand-off), pre-drill the airframe for the mounting screws, and install the screws. Mark the airframe near the switch for the on-off positions.

Step 25

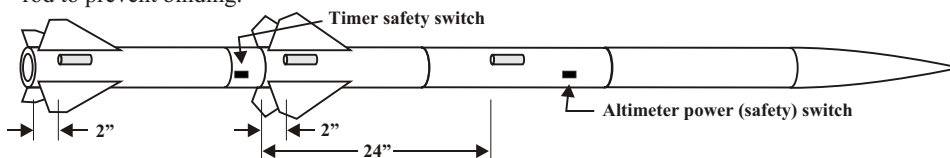
Sand the entire surface of each launch lug with 120 grit sandpaper.

The launch lugs must not obstruct or even be near the altimeter vent hole. In fact, the lugs should be mounted on the opposite side of the airframe near but not in direct line with the altimeter power switch.

Assemble all the components of the rocket in the flight ready configuration. Be sure the booster fins are aligned with the sustainer fins.

Epoxy one launch lug in place 1 to 2 inches from the bottom of the booster. Epoxy another launch lug in place 1 to 2 inches from the bottom of the sustainer and the third launch lug about 24" from the bottom of the sustainer.. Placement of the lugs is not critical and can be adjusted an inch or so up or down the airframe if necessary. Just be sure the lugs are perfectly in line with each other, parallel to the airframe and not in line with a fin or the altimeter power switch. Apply an epoxy fillet to both sides of each lug.

Since with all PML CPR based rocket kits the tail section can be rotated in relation to the aft recovery airframe, be sure all lugs are perfectly aligned when placing the rocket on the launch rod to prevent binding.



Flight Prep

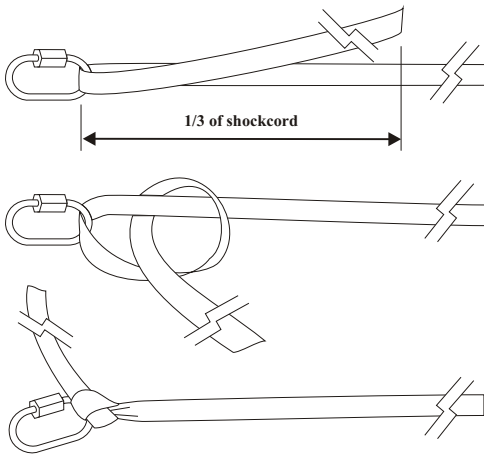
Congratulations! You have completed the assembly process of the CPR-3000 based Quantum Leap 3000 rocket kit.

The remainder of this booklet is designed to show you how to prep your Quantum Leap 3000 rocket for flight. Please follow the instructions in the order they are written.

When prepping and packing the parachutes, refer to the chute instructions that are packed with each chute.

Instructions for using your particular altimeter and timer, as well as connecting charges, safety switches, and igniters should have been included with your altimeter and timer. If these instructions are missing or vague, consult your electronics manufacturer before proceeding.

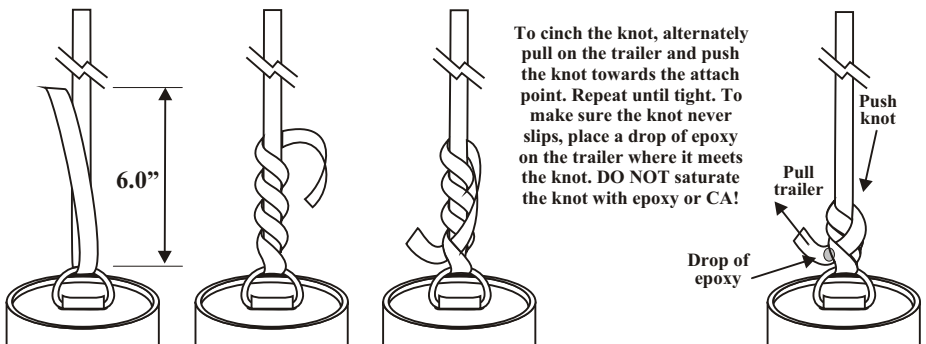
Step A



Thread the shock cord through the Kwik-Link and tie it using the knot illustrated on the left. Note that the Kwik-Link should be attached to the shock cords at about the 1/3 point of the shock cord. Repeat this step for all three shockcords.

Step B

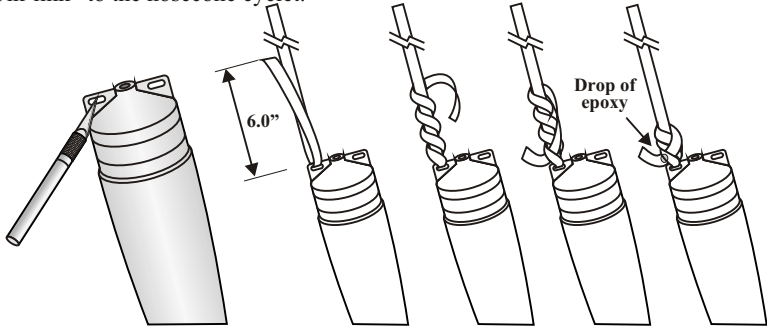
Thread the long end (the 2/3 section) of the shock cord through the "D" ring and tie it using the knot illustrated below. Alternatively, you can tie the shock cord to a "kwik-link" and then attach the "kwik-link" to the "D" ring. Use the same knot to attach the other end of the shock cord to the other components as shown in Step D.



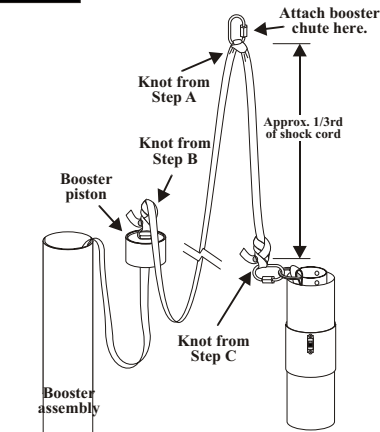
To cinch the knot, alternately pull on the trailer and push the knot towards the attach point. Repeat until tight. To make sure the knot never slips, place a drop of epoxy on the trailer where it meets the knot. DO NOT saturate the knot with epoxy or CA!

Step C

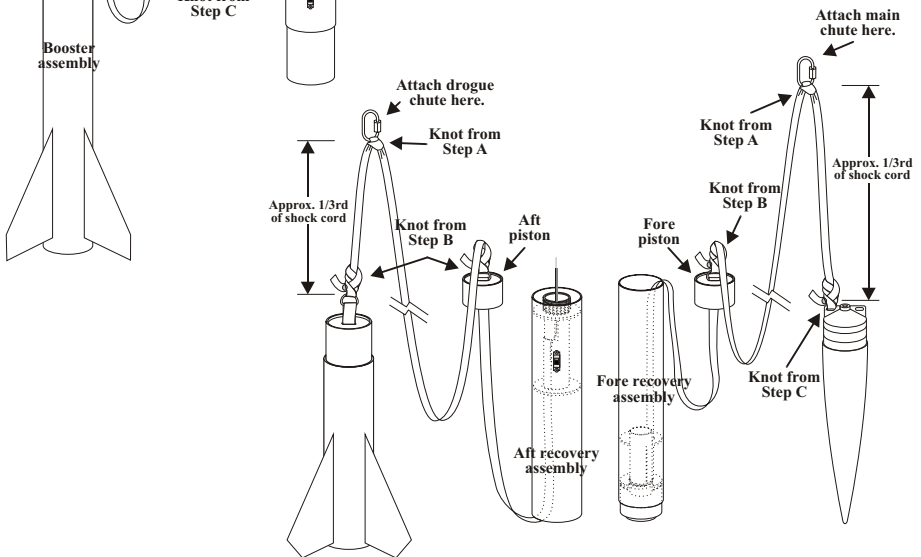
Using a sharp pointed knife, remove the flash from the eyelet at the base of the nosecone. If necessary, you can enlarge the eyelet by using the knife to extend the opening toward the nosecone body (not toward the edges as this will weaken the eyelet). Thread the shock cord through the eyelet and tie it to the nosecone using the knot illustrated below. Add a drop of epoxy to the trailer at the knot to make sure the knot never slips. **DO NOT** saturate the knot with epoxy or CA. Alternatively, you can tie the shock cord to a “kwik-link” and then attach the “kwik-link” to the nosecone eyelet.



Step D



These diagrams illustrate the various shock cord and parachute attachment points.

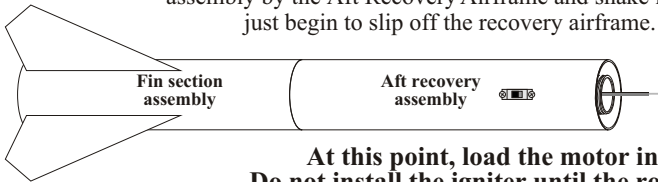


Step E

Push the Fore Piston into the Fore Recovery Airframe as far as it will go without forcing it. Pack the main chute as directed in the parachute packing instructions. Fit the nosecone to the Fore Recovery airframe. The nosecone should fit **tight** (you should be able to lift the entire assembled rocket by the nosecone without it slipping off). Apply masking tape to the nosecone shoulder to make the fit tighter if necessary. Double-check this fit once the rocket is fully assembled.



Push the Aft Piston into the Aft Recovery Airframe as far as it will go without forcing it. Fold the drogue chute as shown in the parachute packing instructions. Do not wrap the drogue with the shock cord. pack the shock cord and drogue into the Aft Recovery Airframe. Fit the fin unit to the Aft Recovery Airframe. The fin unit should fit **snug**, but not tight. Lift this assembly by the Aft Recovery Airframe and shake lightly. The fin unit should just begin to slip off the recovery airframe.



**At this point, load the motor into the rocket.
Do not install the igniter until the rocket is on the pad.**

Step F

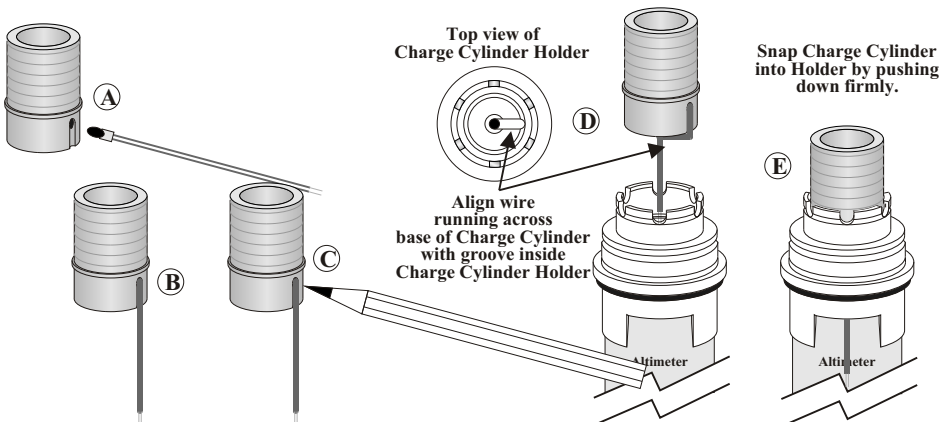
Be safe...

From this point on, wear safety glasses while prepping your altimeter for flight!

NOTE: Charge Cylinders for use with flash bulbs are available as an option through PML.

- A)** The electric match is inserted into this hole and is held horizontal and centered by the internal geometry of the Charge Cylinder.
- B)** The lead is then bent over toward the bottom of the cylinder following the groove.
- C)** Push a small wad of tissue into the hole using a pointed object. This will seal the hole and keep the black powder from leaking out.
- D)** The lead is then threaded into the hole in the bottom center of the Holder and finally through the altimeter mount.
- E)** Push down to snap the Charge Cylinder into the Holder.

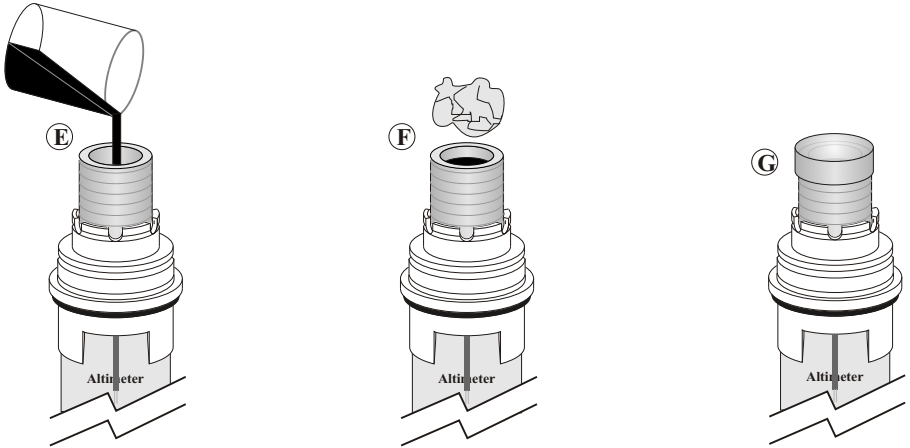
This routing method creates a labyrinth that the gasses cannot follow to the altimeter bay. Follow the instructions supplied with your altimeter for connecting the electric match to the altimeter.



E) Determine the correct amount of FFFFg Black Powder to use for proper ejection using the chart below. Measure-out the Black Powder and pour it into the Charge Cylinder.

F) Fill the remainder of the Charge Cylinder with a crumpled piece of flame-proof wadding to keep the Black Powder from moving about.

G) Place the orange vinyl cap over the Charge Cylinder.



Repeat this step for prepping the Aft Charge Cylinder.

The chart below is intended as a guide for determining the proper amount of ejection powder used with various diameter CPR-3000 rockets using a piston ejection system and an 18" fore or aft recovery airframe.

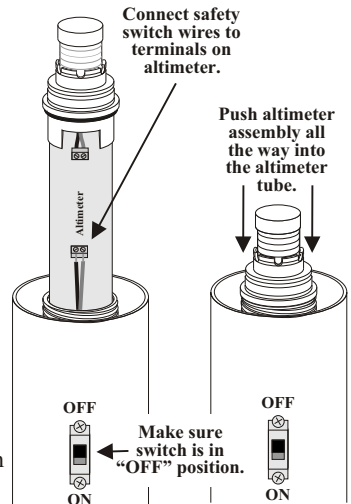
2.1" dia.	0.2 to 0.3 grams
2.5" dia.	0.3 to 0.4 grams
3.0" dia.	0.4 to 0.5 grams
3.9" dia.	0.5 to 0.6 grams

Step G

"Lubricate" the inside of the altimeter tube using Talcum Powder. This will allow the O-ring on the aft Charge Cylinder Holder to travel smoothly within the tube. Move the Safety Switch wires into the groove at the top of the Threaded Sleeve. This will allow the Aft Charge Cylinder Holder and Aft Altimeter Mount to slip into the Altimeter Tube. Double check that the electric matches are connected to the proper terminals.

Make absolutely sure the Safety Switch is in the OFF position! Place masking tape over the switch so that the system is not accidentally armed during handling. Mark the tape with "Remove before flight" as a reminder.

Begin slipping the altimeter assembly into the Altimeter Tube (aft end first), but stop while the safety switch terminals on the altimeter are still exposed. Attach the Safety Switch wires to the terminals on the altimeter. Continue to push the altimeter assembly into the Altimeter Tube (make sure the safety switch wires are not binding on anything) until the O-ring on the Fore Altimeter Mount is in contact with the Threaded Sleeve.



Screw the Fore section of the rocket to the Aft section. Once contact is made between the Fore and Aft sections, give the airframes a little extra turn to snug everything up.

Step H

WARNING: Not all igniter types will fire using the timer you have selected. In most cases you will need a low current igniter. Be sure to test fire an igniter with the timer of the exact type you will be using in the rocket. Refer to the instructions provided by the timer manufacturer. In addition, E-Matches alone may not produce enough heat or for too short a duration to properly ignite the motor.

Once you have selected the proper igniter, use one of the two methods described below for prepping the igniter before insertion into the upper stage motor.

Method A:

If the nozzle throat and propellant core are large enough, this is the preferred method of igniter preparation. Very carefully bend the lead wires just below the pyrogen as shown. If the pyrogen cracks or flakes during bending, discard the igniter and try again with a different one. If done properly, the igniter should have a slight friction fit within the propellant core and the pyrogen will be in firm contact with the core. Be sure the igniter is inserted to the very top of the propellant core.



Method B:

If the nozzle throat and propellant core are too small for Method A, then this is the preferred method of igniter preparation. Very carefully bend the lead wires just below the pyrogen as shown. If the pyrogen cracks or flakes during bending, discard the igniter and try again with a different one. If done properly, the igniter should have a slight friction fit within the propellant core and the pyrogen will be in firm contact with the core. Be sure the igniter is inserted to the very top of the propellant core.



SUSTAINER MOTOR IGNITER SELECTION

Make sure to use a motor igniter (as opposed to an electric match) for motor ignition. Igniters are specifically designed for motor ignition, whereas electric matches usually do not have the heat energy level or "length of burn" necessary to reliably ignite a rocket motor. Also, the resistance reading of what you intend to use is important. Here's why:

$E = I \times R$, where E is Voltage, I is Amperage, and R is resistance. We know the Voltage involved depending on the battery used in your staging timer. We also know from the specifications of the staging timer that the ignition device must fire with a certain amperage. (See the specifications section of your timer's instructions for the voltage and amperage the unit delivers to the firing circuit). So, you need to find R, the Resistance, to determine which ignition device can work successfully with the staging timer you intend to use.

Let's use an example of the Transolve ST-2B Staging Timer (again, be SURE to use the specifications from your timer!)

ST-2B Staging Timer

Battery = 9 volts

Current = 1 amp (Alkaline Battery) or 5 amps (NiCad battery)

(Alkaline Battery)

$E = I \times R$, $9 = 1 \times R$; rearranging, we get $R = 9/1$ or 9 ohms

Your sustainer motor igniter must be 9 ohms or less to work properly with the ST-2B using an Alkaline battery.

(NiCad Battery)

$E = I \times R$, $9 = 5 \times R$; rearranging, we get $R = 9/5$ or 1.8 ohms

Your sustainer motor igniter must be 1.8 ohms or less to work properly with the ST-2B using an Alkaline battery.

Igniter manufacturers will specify the proper electrical ignition requirements (ohms and volts) for their devices; contact the igniter manufacturer for their specifications. We strongly recommend that you check each igniter you intend to use before flight to determine that it is good and within the ohm range needed. We also strongly recommend that you ground-test the electronic device you intend to use with the ignition device you intend to use before committing that combination for use in an actual flight. Remember, the proper operation of the staging timer AND igniter combination is the ONLY thing that will ignite your sustainer stage! You do NOT have a second chance like you do when launching from the pad!

Step 1

WARNING: REMOVE ALL OF THE EJECTION POWDER FROM THE SUSTAINER STAGE MOTOR, FILL THE WELL WITH WADDING AND REPLACE THE CAP BEFORE INSTALLING THE MOTOR.

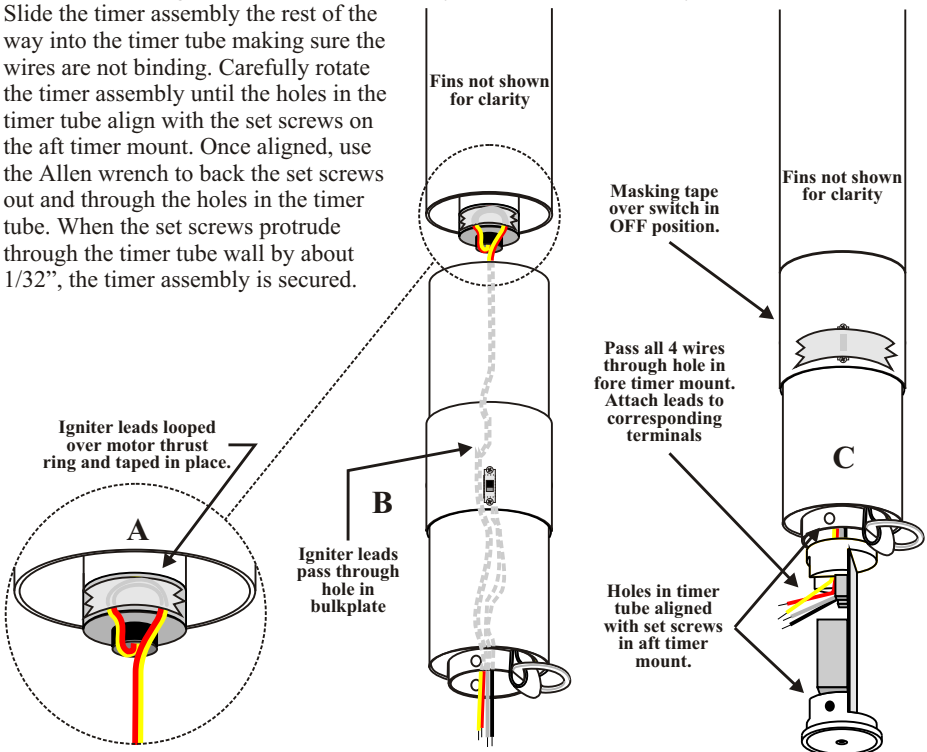
Friction fit the motor into the upper stage. Install the igniter as described in the previous step.

A) Once you are sure the pyrogen end of the igniter is at the top of the propellant core, carefully bend the leads up and into a loop against the thrust ring of the motor. Use masking tape to secure the leads to the thrust ring.

B) Feed the igniter leads through the small hole in the bulkplate within the interstage coupler. Continue pushing the leads through until they exit the timer tube at the bottom of the interstage. Begin joining the interstage to the base of the upper stage. Take up any slack in the igniter leads by pulling them through as you join the sections. Once you can no longer see the motor with the igniter leads taped to the thrust ring, discontinue pulling on the leads. There is plenty of room for the leads to bunch up inside of the interstage. Do not risk pulling the igniter loose or out of the motor. Once the two sections are fully joined, cut the igniter leads so they only extend about 3" from the bottom of the timer tube. Strip about 1/4" of the insulation from each lead. Now make sure the leads from the safety switch are also protruding from the bottom of the timer tube.

Make sure the safety switch on the interstage is in the OFF position. Place masking tape over the switch so that the system is not accidentally armed during handling. Mark the tape with "Remove before flight" as a reminder.

C) Bring the timer assembly into position near the timer tube and feed all four wires through the hole in the fore timer mount. Slide the timer assembly into the timer tube just enough to start it in yet leaving the terminal strips exposed. Secure the igniter wires to the proper terminals for the igniter. Now secure the safety switch wire to the safety switch terminals. Slide the timer assembly the rest of the way into the timer tube making sure the wires are not binding. Carefully rotate the timer assembly until the holes in the timer tube align with the set screws on the aft timer mount. Once aligned, use the Allen wrench to back the set screws out and through the holes in the timer tube. When the set screws protrude through the timer tube wall by about 1/32", the timer assembly is secured.



Step J

Secure the motor into the booster.

Slide the piston down into the airframe. Pack the parachute as described in the Parachute packing instructions supplied with the chute. Attach the Kwik-Link from the booster shock cord to the D-Ring on the interstage coupler. Make sure the interstage fits snugly into the booster. Use strips of masking tape placed on the shoulder of the interstage to tighten the fit if necessary. Sand the shoulder if the fit is too tight. The fit is proper if you can lift the rocket by the interstage and shaking it vertically, the interstage does not begin to slip out.

Rotate the booster so that the fins and launch lugs on the upper and lower stage are aligned.

Check list

At the flight prep table...

UPPER STAGE

Make sure all shock cords and parachutes are attached correctly.

Check fit of both drogue and main chute pistons; sand if necessary for smooth slip-fit.

Pack the upper stage aft recovery system.

Slip the fin section into the aft recovery section.

Pack the fore recovery system.

Fit the nosecone onto the fore recovery section.

Inspect the 1/8" vent hole opposite the safety switch. Make sure it has no burrs and is free of obstructions.

Insert a fresh battery into the altimeter.

Make sure both O-rings are in place.

Put on safety glasses and gloves.

Load and connect both ejection charges.

Set the external safety switch to the "OFF" position.

Partially insert altimeter assembly into the altimeter tube.

Connect the safety switch wires to the altimeter.

Finish installing the altimeter assembly into the altimeter tube.

Make sure the large O-ring is in place around the airframe coupler

Screw the fore recovery section to the aft recovery section.

Check nosecone for tight fit (you should be able to lift the entire rocket by the nosecone without it slipping off).

Remove all ejection powder from the upper stage motor, pack charge well with wadding, and replace the charge cap.

Install the motor in the upper stage.

Install and secure the igniter into the upper stage motor.

Continued on next page

BOOSTER STAGE PREP/FINAL ASSEMBLY

Test the upper stage ignition timer per timer instructions and adjust the time so that upper stage ignition takes place 0.5 to 2.0 seconds after booster burnout. (Depending on velocity at booster burnout) If simulations predict relatively low velocity of the rocket at booster burnout, do not have a long delay before sustainer ignition! Remember, you **MUST** keep good forward airspeed to keep stability with the fins, and the sustainer motor also may take a bit of time to come up to pressure and thrust. When in doubt, **SHORTEN** any delay time used for starting sustainer motor.

Set timer safety switch to OFF position and place masking tape over switch.

Join the inter-stage to upper stage adjusting the fit if necessary.

Secure all leads from timer and safety switch to proper terminals on timer.

Secure timer assembly within timer tube using the setscrews.

Check fit of booster stage piston; sand if necessary for smooth slip-fit.

Make sure to pack the booster stage chute properly and that all shock cords are attached.

Install and secure motor in booster.

Fit the booster to inter-stage bottom adjusting the fit if necessary.

At the launch pad...

Slide the complete rocket onto the launch rod. Make sure the stages and other components are aligned so that the lugs do not bind on the launch rod,

Use a stand-off to keep the base of the rocket a few inches from the blast deflector.

Install the igniter into the booster motor and make sure it is secure.

Remove the tape from the CPR/altimeter safety switch and move the switch to the "ON" position..

Allow the altimeter time to arm and calibrate itself.

Listen for the proper tones emanating from the altimeter to assure deployment charge continuity and flight readiness.

Attach launch control wire leads to the igniter of the booster and check continuity.

When continuity is verified, remove the tape from the timer safety switch and move the switch to the "ON" position.

The rocket is now fully armed and ready for flight.

Get your camera and/or binoculars ready!

As with any complex flight profile, call for a "heads-up launch" and begin your countdown.



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