

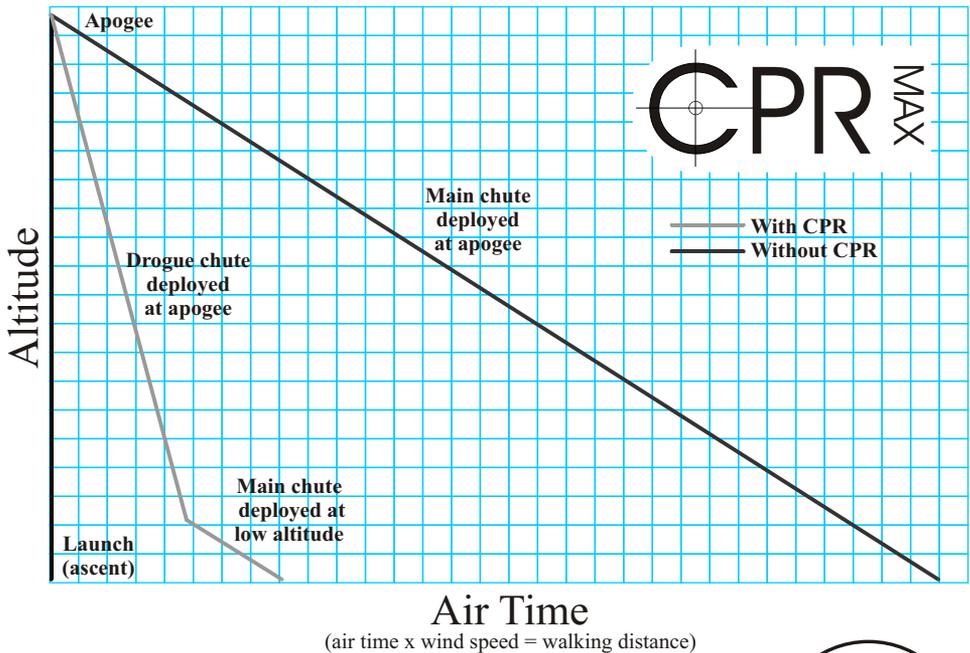
# CPR-MAX

## CLOSE PROXIMITY RECOVERY SYSTEM

Tired of the long walks associated with recovering high altitude rockets? So were we! That's why we developed the Close Proximity Recovery System (CPR). CPR uses the Co-Pilot altimeter that fires two charges (sold separately) to first eject a small drogue chute at the rocket's apogee allowing for a fast yet controlled descent. Seconds before touchdown, the system deploys a second, much larger chute for a soft landing. This technique greatly reduces wind drift during descent allowing the rocket to land much closer to the original launch location. In addition, the altimeter will provide a readout of the peak altitude attained by your rocket.

The CPR-MAX was developed for 6" and 7.5" rockets. This system allows for redundant recovery system deployment for the purpose of safety and to protect your investment. The CPR-MAX System contains nearly everything you need\* to convert your existing rocket or as an enhancement to your own design.

\*Altimeters, epoxy, ejection powder, and additional airframes (if required) not included.



**Please read and understand all instructions before building!**



# 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.

## 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.

A complete flight prep check list is provided on the back of this booklet.

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

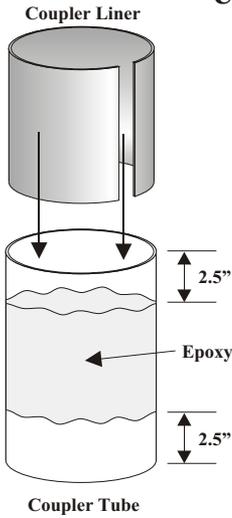
For our complete FAQ, see the FAQ Page on our website at [www.publicmissiles.com](http://www.publicmissiles.com).

## CPR-MAX parts list:

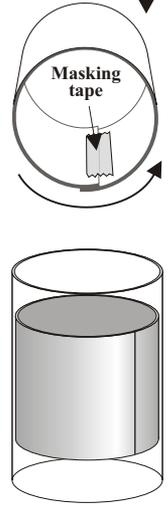
- |   |                                   |
|---|-----------------------------------|
| Coupler Tube 6.0" or 7.5" x 12"                     | (2) Piston Systems including:     |
| Coupler Liner 6.0" or 7.5" x 8" (slit)              | Piston Body (tube)                |
| (2) Coupler Liner 6.0" or 7.5" x 1.5" (slit)        | Piston Plate                      |
| Airframe Spacer 6.0" or 7.5" x 2"                   | Kwik Link                         |
| (2) Threaded Urethane Retainer Cap                  | 2" wide Piston Strap              |
| (2) Threaded Urethane Sleeve                        |                                   |
| (2) Fore Altimeter Mount                            | (8) Small Socket Head Screws      |
| (2) Aft Altimeter Mount                             | Allen Wrench                      |
| (4) Charge Cylinder Holders                         | (2) Safety Switch                 |
| (4) Charge Cylinder Canisters                       | (2) Safety Switch Wire            |
| (8) Vinyl Charge Canister Caps                      | (4) Safety Switch Mounting Screws |
| (2) Slotted Altimeter Mounting Tube 1.5" x 10" long |                                   |
| Temporary Coupler Tube 1.5" x 2" long               | Instruction manual (this one)     |
| (2) Small O-ring 1-1/2" dia.                        | PML Logo Decal                    |
| (2) Small O-ring 1-3/8" dia.                        |                                   |
| (2) Plywood Mounting Plates                         |                                   |

### Step 1

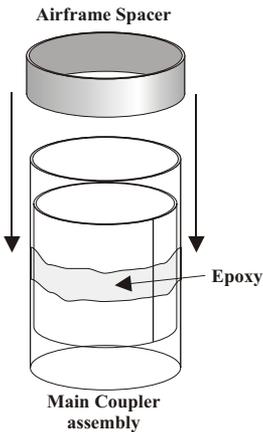
## Use a slow setting epoxy for this step.



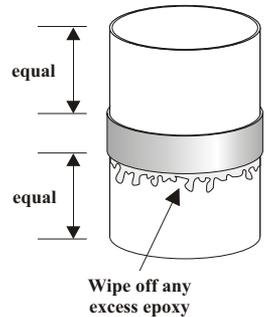
By squeezing the Coupler Liner, over-lap the seam by about 1 inch or so. Use a piece of wide masking tape on the INSIDE to keep the Coupler Liner from expanding. Spread a thin layer of epoxy inside of the Coupler Tube starting about 2.5" from the top and extending down to within 2.5" of the bottom. Position the Coupler Liner inside of the Coupler Tube at about the middle. Quickly remove the tape and allow the Coupler Liner to expand against the inner walls of the Coupler Tube. Before the epoxy begins to set, adjust the position of the Coupler Liner so that it is exactly in the middle of the Coupler Tube and that the seam is not skewed. Wipe up any excess epoxy as it appears using a cloth. **Make sure that there is no epoxy build-up at the ends of the Coupler Liner.**



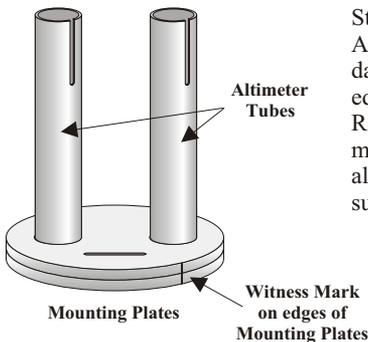
### Step 2



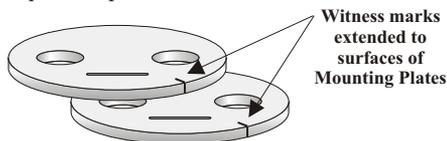
Spread a thin layer of epoxy about 1.5" wide centered on the outside of the Coupler Tube. Position the Airframe Spacer over the Coupler Tube at exactly the middle. Before the epoxy begins to set, adjust the position of the Airframe Spacer so that it is exactly in the middle of the Coupler Tube. Wipe up any excess epoxy as it appears using a cloth. Make sure that there is no epoxy build-up at the ends of the Airframe Spacer.



### Step 3

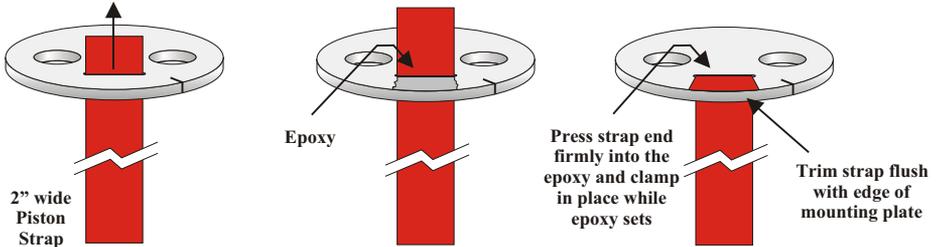


Stack the 2 Mounting Plates one atop the other. Use the 2 Altimeter Tubes to align the holes in the plates. Using a dark pencil or pen, make a witness mark anywhere on the edge of the Mounting Plates. Remove the Altimeter Tubes and extend the witness marks to the surfaces of each plate. These marks will allow for exact alignment of the Mounting Plates in a subsequent step.



### Step 4

Pass one end of one of the 2" wide Piston Strap through the slot in one of the Mounting Plates. Spread a layer of epoxy on the Mounting Plate from the slot out to the edge of the plate. Fold the strap over the epoxy and clamp it firmly in place while the epoxy sets. Once set, trim the strap flush with the edge of the Mounting Plate using a sharp knife or razor blade. Repeat this procedure with the remaining Mounting Plate and Piston Strap.

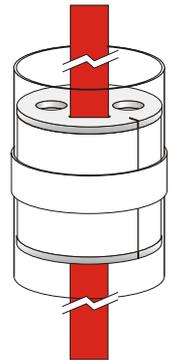
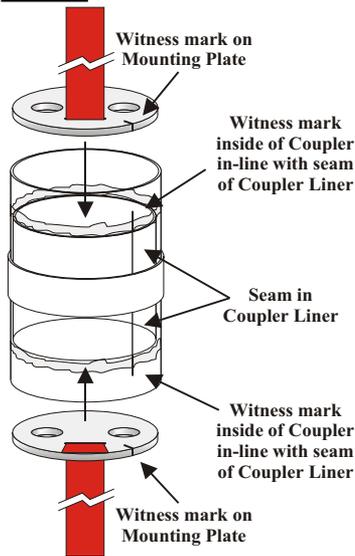


### Step 5

You will be using the seam in the Coupler Liner as a reference point for aligning the Mounting Plates. Using a dark pencil or pen, make a 1" long mark inside of the Coupler extending from the seam in the Coupler Liner. Flip the assembly over and do the same thing on this end.

Spread a bead of epoxy inside one end of the Coupler Tube just above the Coupler Liner. Push the Mounting Plate into the Coupler Tube until it contacts the Coupler Liner. Rotate the Mounting Plate as needed to align the witness mark on the Mounting Plate with the mark you made inside the Coupler Tube. Invert the assembly while the epoxy sets.

Repeat the above procedure for the second Mounting Plate on the opposite end of the Coupler Tube, again being certain to align the marks.

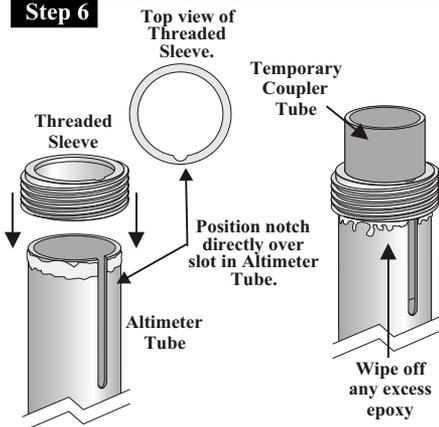


### Step 6

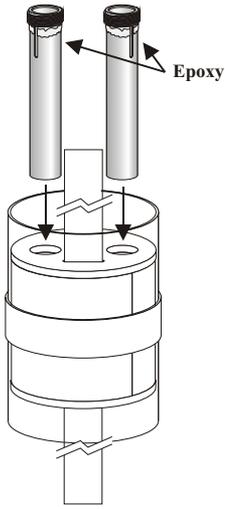
Spread a layer of epoxy around the slotted end of the Altimeter Tube. Keep the epoxy away from the slot. Slip the Threaded Sleeve over the Altimeter Tube making sure the small notch in the top of the Threaded Sleeve is aligned over the slot in the Altimeter Tube.

Push the Temporary Coupler Tube half way into the slotted end of the Altimeter Tube to keep the tube round and firmly against the ID of the Threaded Sleeve. **Do not glue this tube in place!** Wipe off any excess epoxy from the Altimeter Tube.

When the epoxy has set, remove the Temporary Coupler Tube from the Altimeter Tube. Repeat this procedure with the second Altimeter Tube.



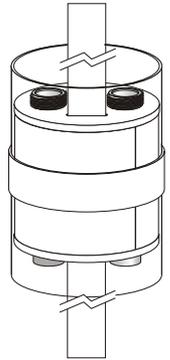
### Step 7



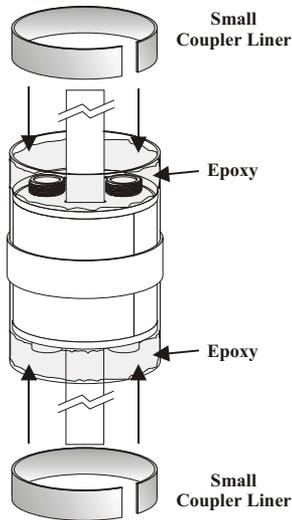
Spread a thin layer of epoxy on the Altimeter Tube just below the Threaded Sleeve. Push the Altimeter Tube through one of the holes in the Mounting Plate until the Threaded Sleeve is in firm contact with the Mounting Plate. Position the slot in the Altimeter tube so that it is closest to the Coupler wall. Exact position is not critical. Wipe off any excess epoxy at the base of the Threaded Sleeve.

Repeat this procedure with the second Altimeter Tube.

When the epoxy has set, flip the entire assembly over and apply an epoxy fillet to the joint between the Altimeter Tubes and the lower Mounting Plate.

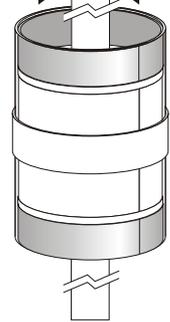


### Step 8

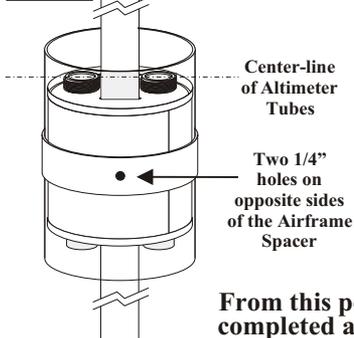


Spread a layer of epoxy around the inside circumference of the Coupler Tube just above the Mounting Plate. Using the same technique described in Step 1, squeeze the Small Coupler Liner and insert it into the Coupler in firm contact with the Mounting Plate. Allow the Small Coupler Liner to expand into position against the inner walls of the Coupler. Wipe off any excess epoxy from the top of the Coupler. When the epoxy has set, repeat this procedure at the opposite end of the Coupler.

Wipe off any excess epoxy from the top edge of the Coupler



### Step 9



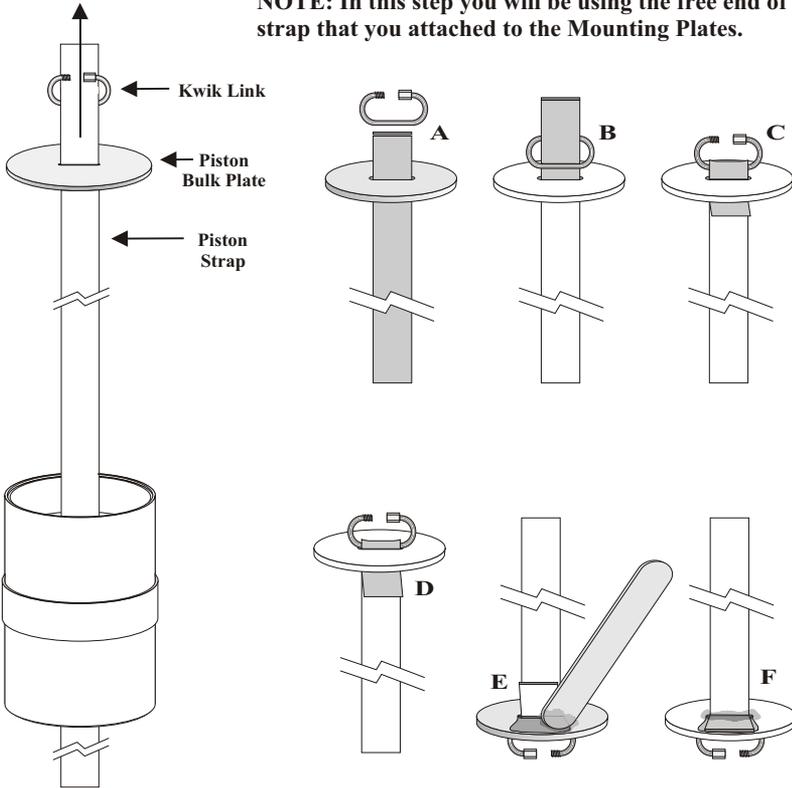
Drill two 1/4" holes on opposite sides of the Airframe Spacer perpendicular to the center-line of the Altimeter Tubes as shown. Both holes should be free of burrs and debris. These holes will act as vent holes for the Barometric Sensor based Altimeter(s) such as the PML Co-Pilot.

**From this point forward, we will refer to this completed assembly as the "Electronics Bay"**



## Step 10

**NOTE: In this step you will be using the free end of the strap that you attached to the Mounting Plates.**



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

**B)** Slip the metal Kwik Link over the strap.

**C)** Feed the strap back through the slot.

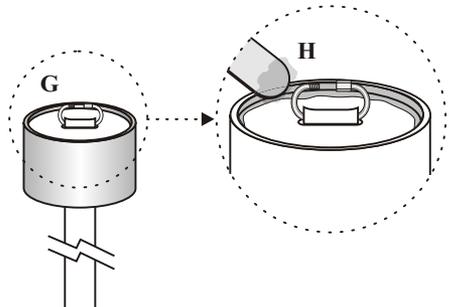
**D)** Pull on the strap until the Kwik Link is wedged at the slot.

**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 Kwik Link is wedged tight at the slot. Apply epoxy to the strap at the slot. Fill the slot with epoxy to prevent gasses from passing through.

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

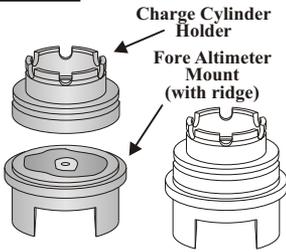
**H)** Apply an epoxy fillet to both sides of the piston plate.



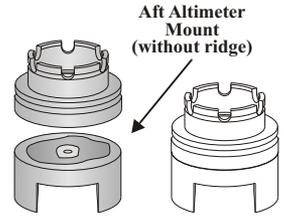
**Repeat this procedure for the second Piston with the Strap at the opposite end of the Electronics Bay assembly.**

# Assembly and installation of the altimeter mounts and ejection system

## Step 11



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.

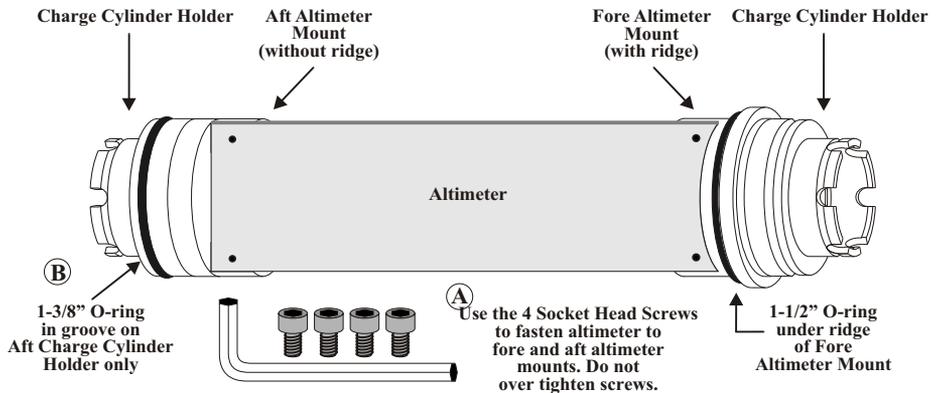


## Step 12

*The Fore and Aft Altimeter Mounts used in the CPR-MAX 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 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 altimeter manufacturer for their recommendations.*

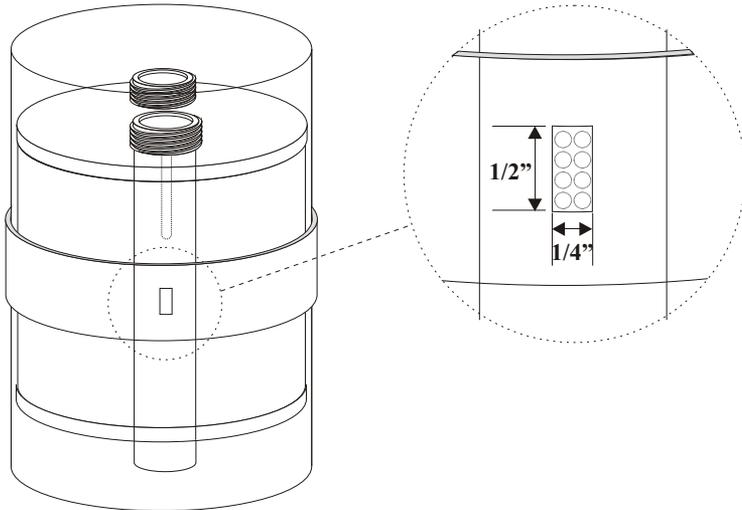
**A)** Mount the altimeter to the Fore and Aft Altimeter Mounts using the 4 Socket Head Screws and wrench supplied with this kit. Do not over-tighten the screws to prevent stripping the mounts.

**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 13

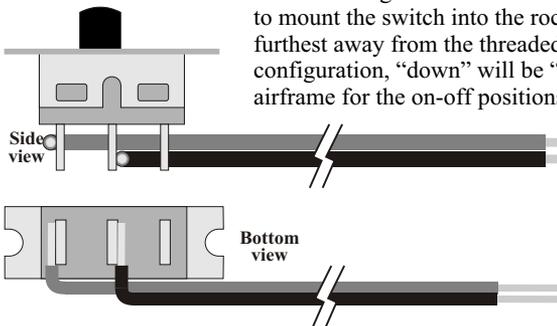
In order to properly install the safety switches, you will need to cut a 1/2" x 1/4" opening into the Airframe Spacer for each switch as indicated in the drawing below. **These switch openings must be aligned with the slot in the internal altimeter mounting tube.** First mark out the perimeter of the opening on the Airframe Spacer, 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 and a small file. Test fit the switch into the hole to assure a good fit. Repeat this procedure on the opposite side of the Airframe Spacer for the second switch.



**Pistons and straps  
not shown for clarity**

### Step 14

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.

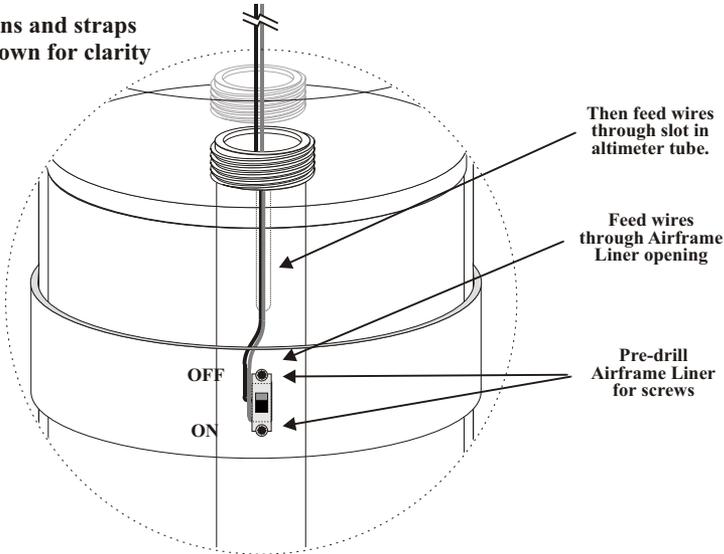


Strip about 1/4" of the insulation from the two wires and "tin" the exposed wires with a bit of solder to stiffen them. These wires will be attached to the power terminals of the altimeter.

## Step 15

Feed the wire ends into the Switch opening, then through the slot in the Altimeter Tube and finally out through the end of the Altimeter Tube. Set the switch into the Switch opening, pre-drill the Airframe Spacer for the mounting screws, and install the screws. Mark the Airframe Spacer near the switch for the on-off positions.

**Pistons and straps  
not shown for clarity**



## Step A

### Determining airframe lengths for Fore and Aft recovery sections

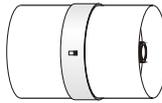
**Aft (drogue) Recovery Airframe**



16" for internal structural elements (see below)  
plus 4" for drogue chute and shockcord

**Total for Aft Recovery Airframe=**  
20" (minimum)

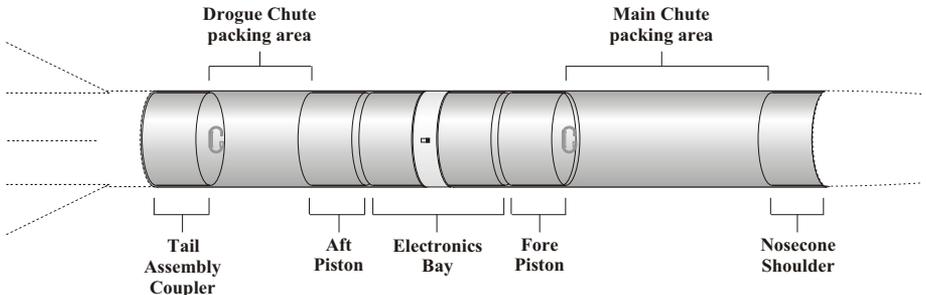
**Fore (Main) Recovery Airframe**



16" for internal structural elements (see below)  
plus 6" for 72" to 84" main chute and shockcord  
---or---  
16" plus 10" for 96" to 120" main chute and shockcord

**Total for Fore Recovery Airframe=**

22" (minimum) for 72" to 84" main chute  
24" (minimum) for 96" to 120" main chute



### Structural elements within Recovery Airframes

## Step B

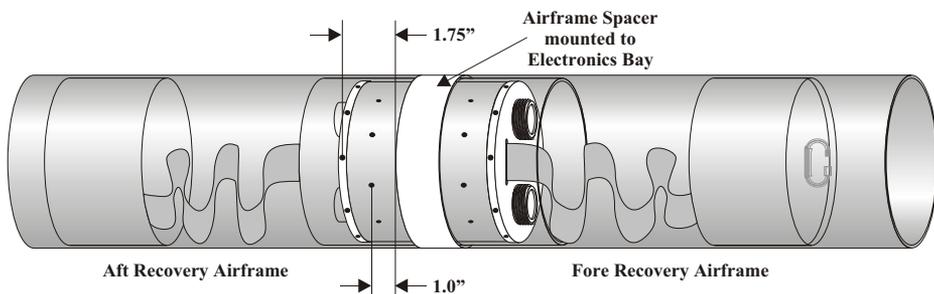
**NOTE:** The drilling dimensions for the first set of holes below are intended to locate the holes in the exact middle of the plywood Mounting Plates within the Electronics Bay and will only be correct if the Coupler Liner was installed in the exact middle of the Coupler in Step 1 AND if the Airframe Spacer was also installed in the exact middle of the Coupler in Step 2. Verify these dimensions and make any adjustments to the hole placement that may be necessary before drilling.

Push the Fore Piston into the Fore Recovery Airframe followed by the strap and the fore end of the completed Electronics Bay (the end with the Threaded Sleeves). Now push the Aft Piston into the Aft Recovery Airframe followed by the strap and the aft end of the completed Electronics Bay.

Drill a series of (8) 0.070" dia. holes (when using #6 x 3/4 sheet metal screws) around each Recovery Airframe exactly 1.75" from the Airframe Spacer. These holes should end up in the center of the plywood Mounting Plates within the Electronics Bay. Drill these holes 0.75" deep and be sure you are not drilling into an Altimeter Tube or the Piston Strap.

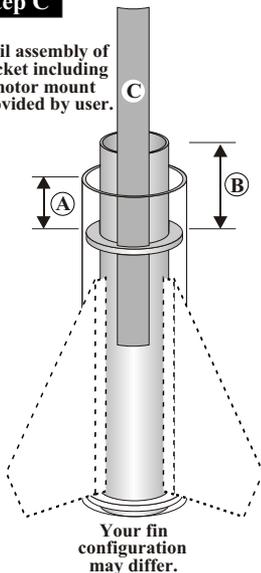
Now drill another series of (8) holes around each Recovery Airframe exactly 1.0" from the Airframe Spacer and offset from the previously drilled holes. These holes will penetrate the Recovery Airframe, Coupler and the Coupler Liner only. **Be careful not to inadvertently puncture the Altimeter Tubes while drilling.**

Use 3/4" long, #6 sheet metal screws to secure the Recovery Airframes to the Electronics Bay. When servicing the altimeters during prep, only the Fore Recovery Airframe needs to be removed.



## Step C

Tail assembly of rocket including motor mount provided by user.



### Important notes on preparing the fin unit:

When building or modifying your tail assembly for the CPR-MAX system, keep the following three points in mind.

Whether you are cutting the airframe of an existing PML rocket or are scratch-building, the distance (A), from the top of the uppermost centering ring to the top of the airframe should be **at least one half the length** of the coupler.

The distance (B), from the top of the uppermost centering ring to the top of the motor tube must be **at least 3/4" less** than the overall length of the same coupler. In most rockets, the motor tube barely extends beyond the uppermost centering ring and will end up below the top of the airframe. This is fine.

If you are retro-fitting an existing PML rocket kit, the piston strap (C) should already be mounted to the motor tube. Cut the strap so that it extends about 16" beyond the airframe for easy installation of the coupler that follows. If you are scratch-building your tail assembly, you can either use this method (described in detail in the next step) or simply mount a U-bolt to the bulkplate.

## Step D

If you are scratch-building your tail assembly, you can either use this method (described in detail in this step) or simply mount a U-bolt to the bulkplate.

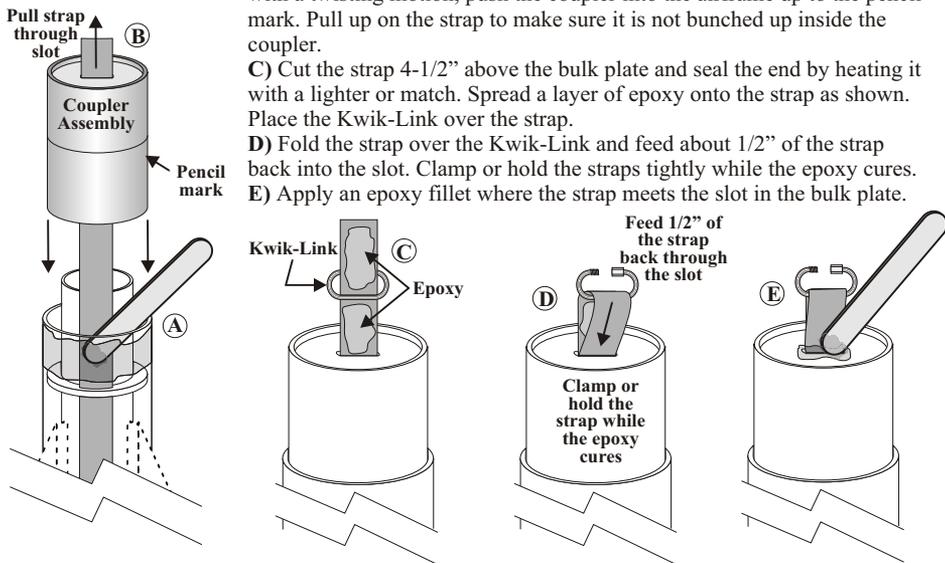
A) Spread a layer of epoxy around the inside circumference of the airframe above the uppermost centering ring.

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 Kwik-Link over the strap.

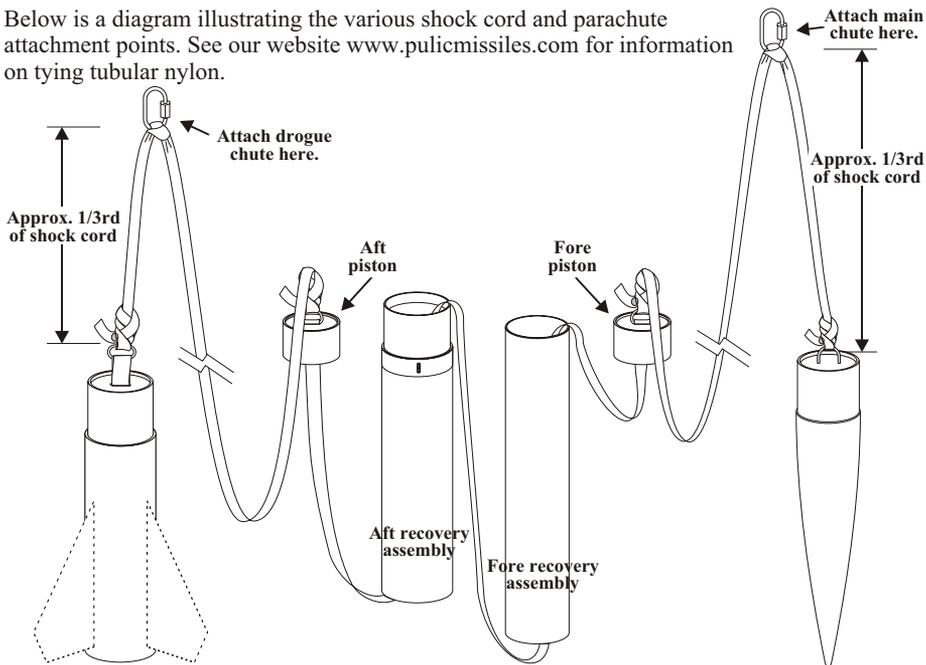
D) Fold the strap over the Kwik-Link and feed about 1/2" of the strap back into the slot. Clamp or hold the straps tightly while the epoxy cures.

E) Apply an epoxy fillet where the strap meets the slot in the bulk plate.



## Step E

Below is a diagram illustrating the various shock cord and parachute attachment points. See our website [www.pulicmissiles.com](http://www.pulicmissiles.com) for information on tying tubular nylon.



## Step F

Push the Aft Piston into the Aft Recovery Airframe as far as it will go without forcing it. Pack the drogue chute as directed in the parachute packing instructions. 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.

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 snug but not tight. You should just be able to lift the entire Fore Recovery Section by the nosecone without it slipping off. Apply masking tape to the nosecone shoulder to make the fit tighter if necessary.

## Step G

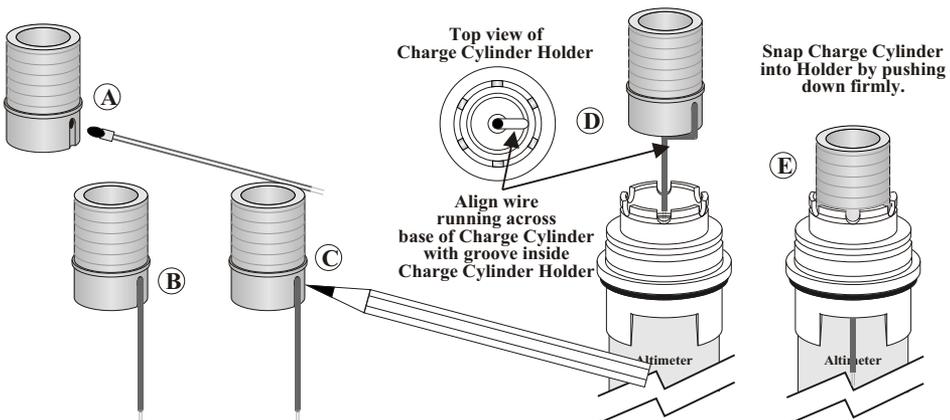
# Be safe...

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

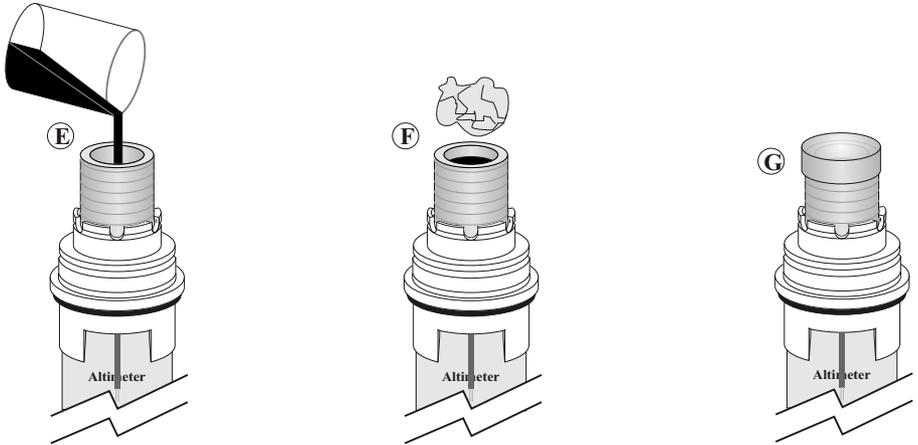
**NOTE: Charge Cylinders for use with flash bulbs are available as an option through PML.**

- 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-MAX rockets using a piston ejection system and an 24" fore or aft recovery airframe.

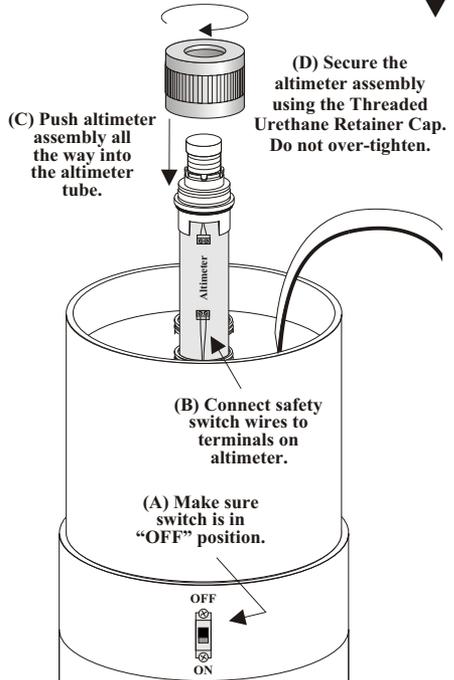
6.0" dia.	1.0 to 1.3 grams
7.5" dia.	1.2 to 1.5 grams

### Step H

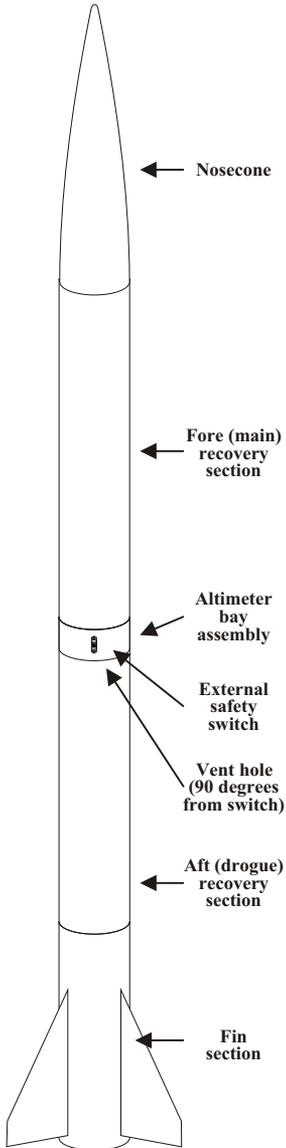
“Lubricate” the inside of the altimeter tube using Talcum Powder. This will allow the O-ring on the aft Charge Cylinder Holder to travel smoothly within the tube. Move the Safety Switch wires into the groove at the top of the Threaded Urethane Sleeve. This will allow the Aft Charge Cylinder Holder and 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!** 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.

Secure the altimeter assembly using the Threaded Urethane Retainer Cap. Do not over-tighten. Repeat for second altimeter assembly.



## CPR-MAX system check list:



### At the flight prep area...

Make sure all shock cords and parachutes are attached correctly.

Pack the 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 1/4" vent holes. Make sure they have no burrs and are free of obstructions.

Install the motor into the rocket.

Insert a fresh battery into each altimeter.

Make sure all O-rings are in place.

Load and connect all ejection charges.

Set the external safety switches 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.

Secure the altimeter assembly using the Threaded Urethane Retaining Cap.

Repeat the 4 steps above for the second altimeter.

Secure the Fore Recovery Airframe to the Electronics Bay.

Check nosecone for proper fit.

### At the launch pad...

Place the rocket on the launch rod.

Install the ignitor into the motor.

Connect ignitor to the launch controller.

Check for continuity.

Set the altimeter safety switches to the "ON" position.

Listen for the altimeter tones to assure the unit is armed and functioning properly.

*The rocket is now ready for launch.*

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