PML GENERAL INFO FAQ

6/26/05

Getting Started In Higher-Power Rocketry

If you're completely new to rocketry as a hobby, the National Association of Rocketry (www.nar.org) "specializes" in the beginning hobby rocketeer and the rockets best for getting started. We'd recommend a visit to the NAR site to start off. One of the other great places to "surf around", whether you're new to rocketry or have flown lots of model rockets and are ready for something bigger is www.rocketryonline.com. This site has all kinds of information and links about hobby rocketry, including higher power. However, you're here to see what PML has to offer, so below are some of the typical questions and answers for people just getting into high-power rocketry:

What Do I Need to Get Started in High-Power Rocketry?

Many people see that PML offers kits and single-use 29mm motors, but also ask about launch pads, launch controllers, bigger motors, flying fields, etc. High-power rocketry is a little different than model (A through D motors) and midpower (E through smaller G) rocketry. The equipment is larger (and more expensive), the flying fields must be bigger (and therefore harder to find), and there are regulations governing where large rockets can be flown and what altitudes are allowed.

We always recommend joining a NAR (National Rocketry Association) or TRA (Tripoli Rocketry Association) club in your area. They'll already have the launch equipment, they'll have suitable launch fields lined up, they'll know local regulations, they'll already be filing the paperwork necessary to fly big rockets ("FAA waivers") and they'll also be more than willing to help you out. Besides, it's always more fun to fly with other people that enjoy the hobby (and can help you out as you move along), so joining a club is the way to go in keeping costs down, finding good flying fields, and complying with regulations.

Be sure to visit the www.nar.org and www.tripoli.org websites. They have detailed information about local clubs, the motor certification process (required for flying H motors and above), and much more. Really, join a club…it'll make your higher-power rocketry experience a LOT easier and more fun!

I've Flown Lots of Model Rockets; What's a Good "Starter" Kit for Higher Power?

As far as getting started into high power, take a look at our 29mm motor AMRAAM-2, Callisto, Io, or Tiny Pterodactyl, which fly on F and G motors (F and G being the next step to the "lower edge" of high power). Or, try the 38mm X-Calibur or Small Endeavour (or the 38mm Callisto or Io) with our ADPTR-38/29 optional motor adapter. That way you can fly it on 29mm F and G motors, then move to 38mm H and I when you're ready. You might also like the Bullpuppy. The military styling is cool, and it too can be flown

on some 29mm motors with a ADPTR-38/29 installed, but is built with a 38mm mount so you can fly H and I on it when you're ready. Or you can fly our Bullpuppy 2.1 on 29's. Callisto, Io, Phobos, Ariel, they're all popular kits and would be good starters. The best bet is to take a look at the Motor Recommendations Chart (click on Specs Page on our website) at the kits that will fly on Gs (and maybe some F's) and small H motors, and then look at which one of those you might like. The KitSpecs Chart (also on the Specs Page of the website) lists all the detailed information about all PML kits.

What PML Kit Should I Get for my Level 1 Flight?

I know it keeps coming up in this section of the FAQ, but the best is to take a look at the Motor Recommendations Chart on the Specs Page section of our website. See the kits there that will perform to a level that'd be good for the flying field you have available (basically look at the predicted altitude on, say, H128 (29mm) or H123 and H242T (38mm) motors, both popular Level One cert motors), then take a look at the webstore for what the kits look like and find one that "strikes your fancy". Some quick ones that come to mind are the Io, Callisto, Phobos, Quasar, Explorer, Black Brant VB, Ariel, Miranda, D-Region Tomahawk, Tethys, Small Endeavour, and X-Calibur. It really depends on the type of performance you want out of the rocket both for your L1 cert flight (under 2000' altitude and simple are our recommendations there) and for "fun flying" after you've achieved your L1. Some people who fly in the Midwest have smaller fields where altitudes and trees surrounding the field are a limiting factor and like to/need to keep the altitudes down, whereas people out West often have miles of uncluttered desert to fly on. So, it all depends!

I Want to Get a PML Kit That'll Be Good for Level 1 AND Level 2

Really there are a number of PML kits that would work well for L1 and L2, but a lot of the decision depends on:

1) What you like as far as looks and features, and
2) The altitude waiver of the club you'll fly with at their field.

Take a look at the Motor Recommendations Chart on our Specs Page. It will tell you how each kit will perform on various motors. Obviously you'll want to pick one that'll stay under the waiver for your field when you fly it on the L2 motor you'd plan on using, yet can achieve an altitude that you like when flown on an L1 motor. Then when you've narrowed down which ones will fit the flying specs you'll need to meet, you can decide which one has the looks or other features you like. Some kits that quickly come to mind are: AMRAAM-4, Tethys, Endeavour, and Miranda. However, there are *many* PML kits that can "fill the bill" for L1 and L2, depending on your situation!

Contacting PML and Information Resources

- All telephone contacts (except fax: 24hrs./7days) are 9am-5pm EST Monday through Friday.
  Telephone 810-327-1710 or fax at 810-327-1712
  For ***orders only*** (no technical or order status questions, please): 1-888-PUBLICM
- Online at our web site: www.publicmissiles.com.

- All pricing information quoted in FAQs is subject to change. Always see the website for the latest prices. Our entire retail price list is available on the entry page to the Webstore section of the site, and the prices for individual items are listed next to the item in the webstore.
- Our catalog is FREE, and can be ordered at the above phone numbers or on the Hardware page of our website. (However, the website is always the "freshest" source of information, as the paper catalog can't be updated after it's printed, whereas the website is updated regularly).
- See the Contacting PML page of the website for how to direct your question to PML via email.

Services, Returns, Timing

- We nearly always ship within 24-48 hours after receipt of your order.
- Custom work is usually shipped within 48-72 hours of your order.
- Fiberglass nosecone and tube-wrapping orders usually ship within a week.
- Parts damaged in shipping will be replaced quickly.
- Return Policy: "If you don't like it, send it back!" Remember, mistakes may happen, but we will do whatever it takes to make the situation right with you. We are absolutely committed to your satisfaction. Always have been, always will.
- There are no returns on custom items (unless we made a mistake). Custom items are by definition unique, specialized parts, and they cannot necessarily be resold to another customer.
- The PML website always has the latest Warranty information (on the Warranty Policy page) and Shipping information (on the first page after clicking the Webstore button). Check there for questions on these items or for the latest information.

PML Email Newsletter

Public Missiles, Ltd. has an email distribution list for distributing information about new kits, new products, and new information direct to the rocketry community. People on this list will be the first to know about new products, sales, and other information of interest. There's no cost to you, and the list will only be used by PML to notify you of developments at PML. Your email address or other information will not be distributed by PML to other companies or organizations.

How do you sign up? Go to http://mx.blastzone.com/mailman/listinfo/pmlnewsletter to manage your PML News subscription. The above URL is also on our Newsletters page of our website at www.publicmissiles.com, so if you forget it some day in the future when you need to do something with your subscription just visit the Newsletters page.

Glossary/Abbreviations/Terminology/Misc.

BP – Black Powder; used for ejection charges.
CG – Center of Gravity; the point on an object where it balances, where all the weight seems to be centered. (See additional information under the section "Stability".)

CP – Center of Pressure; the point on a rocket where all the corrective action of the fins seems to be centered. (See additional information under the section "Stability".)
Dado – A groove or "channel" that does not go all the way through a tube. Used in minimum-diameter kits for fin mounting; also used for some canard-type fins.
G-10 – A type of fiberglass used in all PML kits for fins. Similar to circuit boards.
ID – Inside Diameter
KS – KwikSwitch; motor mounting system
LES – Loadable Ejection System; system used with altimeter for deployment charges
MMT – Motor Mount
OD – Outside Diameter
VHA – Very High Altitude; a line of PML kits. This abbreviation used on our website and our catalog.

Inches x 25.4 = Millimeters
Millimeters ÷ 25.4 = Inches
1 Pound = 4.45 Newtons
1 Pound = 16 ounces = 454 grams
1 Ounce = 28.3 grams
1 Kilogram = 2.2 Pounds = 35.2 ounces

Stability

Center of Pressure

CP stands for Center of Pressure. You're probably aware of the center of gravity; this is the point on a rocket (or any object) where all the weight seems to be "centered". The center of pressure is similar; it is the point on the rocket where the corrective force of the fins is "centered". The center of pressure must be a minimum of one body diameter **behind** the center of gravity on a rocket fully prepped for launch to ensure stability. CP doesn't vary; it's controlled by the design of the kit. CP specifications given in the PML catalog and on the website spec sheet are measured from the nose tip. However, you CAN vary CG, by adding more nose weight. That's why we specify CP in the charts, so the owner of the rocket can find their CG and compare it against the CP to see if they need to add some nose weight for stability.

A very generalized rule of thumb: CP moves about 75-80% of the length of airframe added to a rocket. Example: A rocket is "stretched" by adding 10" of airframe. The CP will move rearward about 7.5, around 75% of the 10" that was added.

A quick description of CG vs. CP and how to properly adjust the relationship can be found at www.rocketryonline.com. Go to the InfoCentral section, then to Rocketry Design, then to CG/CP Relation. The information is repeated below for your convenience. It is somewhat simplistic, but was intended to introduce the "newbie" to the concept of CG/CP:

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The CG (Center of Gravity) and CP (Center of Pressure) are very important fundamental design and flight parameters of any rocket, and have an important relationship to each other. The general relationship between the CG and CP is as follows: the center of pressure must be a minimum of 1 body diameter BEHIND the center of gravity on a rocket fully prepped for launch to ensure stability. Now we'll explain why it must be this way, and what you can do to make sure your rocket meets this requirement, whether it's a kit or a scratchbuilt design.

You're probably aware of the center of gravity (CG); this is the point on a rocket (or any object) where all the weight seems to be "centered". The center of pressure (CP) is similar; it is the point on the rocket where the corrective force of the fins is "centered". OK, now imagine just a simple stick, a piece of dowel 12" long. This is your "rocket", with one end the nose end and the other the motor end. It weighs the same on the first 6" as it does on the rear 6"; that's why the CG is exactly in the middle at 6". That's what the CG means, where the weight (or, more correctly, mass) of the item is centered. Now, drive an imaginary nail into your stick "rocket" into the table it's sitting on right at that CG point of 6". OK, now push on the front of the rocket, and it spins right at the nail, the CG. Push on the rear of the rocket, and it spins right at the nail, the CG. That's a good way to think of the CG…it's the "nail" that your real rocket will turn around in flight.

Now, think about if you put fins on the back end of your stick (rocket). Though it's not completely true, say that the CP is exactly where you stuck the fins on your rocket (it's true enough for this example). If that stick was flying through the air front end first, and wind pushes on the rocket, the fins will push on the stick. The stick will rotate around the "nail"/CG. Since the fins are on the back, the rocket straightens back out and continues nose forward. Now remove your imaginary fins from the back of the rocket and put them only on the front near the "nose cone" end of your rocket. OK, now it's flying again, and wind pushes on the fins; push on the fins of your imaginary rocket. What happens? The nose of the rocket turns around the "nail"/CG, and the front end flips over and turns into the rear end. This is bad! Of course, you want the front end of the rocket to stay the front! That's the general reason why the CG must be ahead of the CP… keeping the CP behind the CG makes sure the front of the rocket stays the front!

Many manufacturers specify the CP location on their kits. CP doesn't vary in kit rockets, it's controlled by the design of the kit. CP is affected by such things as the rocket's body diameter, length of body, fin size, number of fins, and fin placement on the body tube. CP can't be changed in kits. However, you CAN vary CG, by adding more nose weight. That's why the kit manufacturers specify CP, so the owner of the rocket can find their CG and compare it against the CP to see if they need to add some nose weight (to move the CG ahead of the CP) for stability.

The CG will be dependent upon how you build and use the rocket, which is why manufacturers usually don't specify CG. Some people really use a bunch of epoxy, others don't. It's variable enough on how the person builds the rocket, but even more so as what type of payload you have (if any). You can imagine that given the same kit design, if someone were carrying some complex and heavy video electronics that the CG would be dramatically different from someone who flies no payload at all.

Once a kit is built and ready to fly (with payload), CG location is most dependent on the motors used. Of course a G motor is much lighter than an I motor, but a certain kit may be able to use G's, H's, and I's. The motor is obviously in the back of the rocket, and weight in the back of the rocket shifts the CG rearward, so the bigger (heavier) the motor, the worse the CG/CP relationship will be. Remember, CP doesn't change…any weight added to the rear of the rocket will move the CG back (bad), and weight added to the front of the rocket will move the CG forward (good).

Mark the CP on the rocket, then mark a point at least one body diameter ahead of the CP. Make sure you prep the rocket as it'll be in flight (with the motor you intend to use installed, chute(s) installed, payload installed, etc.) before you do the CG/CP check. No need to add black powder to an altimeter or the delay area of a reload casing, or to put in igniters; they're not heavy enough to matter. Now balance the rocket "teeter-totter style" on a piece of dowel, back of a chair, something like that. If the rocket balances level with the pivot point of the teeter-totter arrangement at or forward of the CG point you marked, you're good to go! If not, you'll have to add nose weight until it does.

Up to two body diameters is usually even better, but don't go much over two diameters or the rocket will be overstable. By the way, this is what's meant by "one-caliber" or "two-caliber" stability. It comes from wartime artillery terminology, where the diameter of a gun is called the "caliber", so "one-caliber" = one diameter, and so on. Don't forget that if you use, say, a small H motor and set the CG, that if you then decide to use a big J motor, the J weighs more and you may have to add nose weight again to compensate. That's why it's usually recommended to set the CG/CP relationship with the largest motor you intend to use in the rocket.

If you don't have the biggest motor you intend to fly on hand, or if you haven't reached a certification level where you can buy one, check out the weight of the propellant you intend to use and the reload casing from the manufacturer. Many times that information is available on the manufacturer's web site. Simulate the weight of the casing and propellant in the motor mount tube. Use one or more rolls of coins, a baggie with dirt in it, whatever you can come up with that's similar to the weight of the motor and casing.

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