



# ***THE LAUNCH RACK***

Published by the Garden State Spacemodeling Society

*National Association of Rocketry Section No. 439*

New Jersey's Oldest Model Rocket Club

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\*\*\* 2014 LAC NEWSLETTER AWARD HONORABLE MENTION \*\*\*

\*\*\* 2015 LAC NEWSLETTER AWARD HONORABLE MENTION \*\*\*

\*\*\* 2016 LAC NEWSLETTER AWARD RECIPIENT \*\*\*

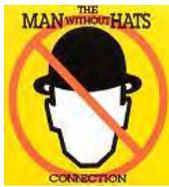
Stop Complaining! The Alaska Northstars Rocket Club Launches like this all year long. Woosies!



Photo by: ANRC - Lake Louise Launch

# President's Message

Arnie Klein



unconventional ideas. So send me your feedback, good or bad (along with your launch photos!) – it's the only way the Launch Rack evolves.

## Countdown!

2018

Please Note: All Launch Dates are SATURDAY *Except* where noted.



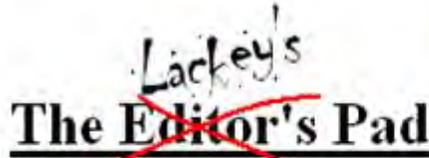
### Presidents Report



The November launch started out with great weather a little cool with no wind. We had a group that showed up for a rocket birthday party of about 16 people they were going to launch rockets and then go to a restaurant and have a big birthday party. We launched a total of more than 42 rockets some were large "G" powered rockets. One person brought a drone and was flying overhead while we

were launching. Jim Zindel launched a rocket with a jolly logic parachute release device that landed high in a tree we hooked together three poles but were not able to get it. In the process two of the recovery poles were broken. All and all it was an excellent launch.

-Arnie



Dr. "It's the Truth" Bob Kreutz

IF it'll FIT – I'll Print IT!

If not, I'll probably print it anyway...



OMG! You won't believe this one! We finally got some sport launch photos! Thanks to Mark Stevens and Emily Laber-Warren subscribers will no longer doubt that GSSS actually flies rockets. This issue there's proof in the pudding – and MANY thanks for sending in those photos folks! You can have your launch shots included as well! Simply send your photos attached to an email (you can send any file extension: jpg jpeg, bmp, png, tiff, ect [no, that's not a file extension] – and any compression, if you wish: zip, or rar) to yours truly – Dr. Bob [orbitboybob@comcast.net](mailto:orbitboybob@comcast.net) - I'll find a page to put it on! ((just remember my motto: "IF it'll FIT, I'll Print IT!!!, If not, I'll probably print it anyway...")) SO send them IN!!!

You may notice a few small Flash Videos (swf's) floating around the pages of the Launch Rack this issue (surrounded by a red dashed box.) Click on them and you will get a banner in yellow above the page asking if you "trust" this document. I would hope you answer "yes." Newer PDF protocols demand I notify you 'you are opening an embedded file.' You will also most likely get a warning that unknown files could be detrimental to the health of your computer. Folks, that's the disclaimer I'm forced to use. If anyone knows how to get around that in a PDF (like the older versions) – PLEASE – let me know. The older PDFs would never ask and just do what they were told, but I'm afraid I'm having a hard time getting around that...

You will be free to left click to activate the media file and right click to bring up a control menu. Another \*First\* for the Launch Rack! (besides, you can always turn them off in the control window.) If you like them – there will be more! Send me you flight videos and I'll see what I can do on our "On The Launch Rack" pages...

So, please enjoy our latest issue. I'm constantly searching for interesting content, you all get to be guinea pigs for my

As you know, at the beginning of each year, Section Advisor Bob Zabriskie submits our requests to North Branch Park Authorities to reserve fields and facilities for our monthly launches. North Branch Officials are usually delayed in granting our reservations until they believe all public requests have been received. Announcements will be made by the club until that confirmation is received. Just take note that launch dates are usually the last Saturday of the month-Stand by for Launch Date announcements!

**Potential** 2018 Launch Dates are Last Saturday of the Month. ALL launches\***Saturdays**\*unless otherwise noted in C O U N T D O W N  
?? Jan 27 – Sport Launch (Eve of the Total Lunar Eclipse Launch)  
?? Feb 24 – Sport Launch (Pre Full Moon Celebration Launch)

Our WebMaster Rob Nee says: Check the GSSS Website! If you go to the launch dates page on the new website there is more info. You can add calendar subscriptions to most phones and Google Calendar. If the launch dates change they show up on your phone or in Outlook automatically!

NEW URL -> <http://www.gsss.club/launches.php>

## It's The monthly morph!



Lokleinus of Borg

### RE:ENLISTMENTS

**>>WELCOME<< ((BACK))  
ONE & ALL FOR 2018!!!**

Everybody: Please WELCOME our  
Earliest renewing member : Ed  
Fritch and our newest member:  
John Hubinski from Lodi NJ!!!



WELCOME BACK! – WELCOME ABOARD!



# THE SOAPBOX

## STAND UP AND SHOUT!

Shout, shout, let it all out

These are the things I can do without  
Come on, I'm talking to you, come on...

Here you can say what you want: So SOUND OFF GSSSS – right here on anything you would like! May similar minds come together - or secret plans be revealed...

### Has ITAR killed Scale Model Rocketry?

Have you ever heard of ITAR? You can bet all the FAI guys have! But you may run into it if you are data mining for your next scale model these days.. So, just what is ITAR and why is it threatening building scale model rockets?

If you want to build a scale model, possibly one that hasn't been seen before – you need DATA. That is dimensions, colors, details and photographs. It once took me over 6 months just to get some photographs copied by the Air & Space Museum. But I got them. It can be worse if making the request of the manufacturer, here's why:

ITAR refers to the International Traffic in Arms Regulations. It is the export control regulations run by different departments of the US Government. ITAR is designed to help ensure that defense related technology does not get into the wrong hands. An export license is a general term for ITAR controlled items in which the US Government has granted permission to transport or sell potentially dangerous items to foreign countries or parties.

ITAR is a quite stringent set of regulations written for articles with direct defense-related applications. Articles specifically designed or otherwise intended for military end-use are enumerated on the United States Munitions List (USML) or the Missile Technology Control Regime (MTCR) Annex and therefore controlled by International Traffic in Arms Regulations (ITAR) which is administered by the Directorate of Defense Trade Controls (DDTC) at the State Department. Items, services, and information are all covered by the ITAR regulations. The most controlled items are Significant Military Equipment (SME) which have "capacity for substantial military utility or capability" such as tanks, high explosives, naval vessels, attack helicopters and rockets & missiles. Some examples include; an export license (DSP-5), exchanging technical emails or teaching how to repair an ITAR-covered item which requires a Technical Assistance Agreement (TAA), and allowing a foreign company to manufacture an item requires a Manufacturing License Agreement (MLA). But you will still have to assure the manufacturers that you won't be supplying their information to foreign nationals. But if what you want is ITAR controlled, you'll just be told "not available" Its killing Scale modeling.

Disclaimer: "The SOAPBOX: Stand Up and Shout," "The Editor's Pad," "Rocket eMail" and "President's Message" are instruments of personal opinion and expression. The Launch Rack and the GSSS Board neither support nor oppose the opinions expressed in these columns and wash their hands of these affairs... [-RTK, AsstEd & Beast of Burden]



**ROCKET EMAIL**

Send your Rocket eMail to me here:  
[orbitbob@comcast.net](mailto:orbitbob@comcast.net) and I'll do the rest!  
 ...and Remember! The Postage(?) is - FREE!

Dear Mr. Rob,  
Yea haw! I really enjoy the newsletter but I have to tell ya the AMA (Academy of Model Aeronautics) is stealing it and posting it on their website at [www.ama-d4.org](http://www.ama-d4.org) .

TJ  
Those Dirty Rotten Scoundrels! GSSS will send them the bill... Please see that they read it and stop using it to clean their carburetors!  
DrB

The judges all accept print or e-versions as the current rules allow for either. I'd take the road that is easiest on the Head Lackey. And thanks for helping to create such a fine newsletter.

Best regards,  
Ed (Chess, LAC Newsletter Committee)

I am humbled by your email Ed. My sincerest Thanks!  
DrB

Doctor Bob,  
Looks like another winner from where I sit.  
Jack

Thanks Jack! So, am I to understand that the Launch Rack has the reaction of literally making you sit down before you can read it? <G>

DrB

Dear Dr Bob,  
THANK YOU for the latest *The Launch Rack*. I've not read it all yet, but I'll be back in touch once I've had the chance...but **I LUV THE WITCH ASTRIDE THE ROCKET!!!**  
sincerely...stuart

Stuart – have you seen the “Gal from Peenemunde” on the V2? I'll bet you a Euro you have....



DrB

Great job!  
Verna & Randy

Thanks Randy! However, I must report that your long time position at the head of the reply line has fallen! Some AMA guy beat you to it this month – but always good to hear back from you!

DrB



**Messages  
Channeled  
through the  
Oui-GSSS  
Board**

The GSSS BOARD will discuss matters that relate to the Club and affect the membership. A synopsis and the results of any votes will be presented here.

...Or "Stuff We've Heard That's Been Floating Around In Empty Space"

### Received info about Jackson Hobby - GSSS Discounts Subject: (Club Member Discounts)

Please let your members know by putting in your newsletter and putting on your web page, to show their club cards so they can get 10 % off non net rocket items. Please ask store personnel for details. If they don't show their club cards we don't know if they're in a club or not.

Jackson Hobby Shop  
2275 W. Countyline Rd.  
Bennetts Mills Plaza  
Jackson, NJ 08527

732-364-3334  
[www.jacksonhobby.com](http://www.jacksonhobby.com)  
Tues. Wed. Thurs. Fri. 11-6  
Sat. 11-5

## > Jackson Hobby Shop Up For Sale <

The business was started in 1969, a lucrative hobby shop and one of the oldest one in NJ. I will be retiring in March of 2018 because of medical reasons. The business is up for sale for \$200,000 firm. Any one that is interested can contact Brad Palmer, at Crown Business Brokers, at (908)364-6920 or email him brad.palmer1@aol.com. Anyone that has ever been to the shop knows we have an extensive amount of inventory for all facets of the hobby industry. For all of my customers and friends, which are more like family, this is a sad time in my life and one that I am sorry to see happen.

Thanks again for all the wonderful years this has given me. It's been my pleasure to serve you.

Frank Gustafson

Jackson Hobby Shop  
2275 West County line Rd  
Jackson NJ 08527

Bennetts Mills Plaza  
732-364-3334  
[jacksonhobby@aol.com](mailto:jacksonhobby@aol.com)



[Downloadable Flight Cards](#)

Flight cards **MUST** be filled out to the best of your ability before each flight. You will not be allowed to fly without providing accurate information about your rocket to the launch controller.

Website: <http://www.sojars.org/>

## SoJARS (NRC) Sojourn



We will also be having our first NRC contest using the new NRC contest format and rules. The events will be:

- C Eggloft Altitude – Altimeter
- A Payload Altitude – Altimeter

- A Helicopter Duration
- A Streamer Duration
- 1/2A Parachute Duration
- 1/2A Boost Glider Duration

We will have entry forms and results cards along with a thermometer and stop watches.

Altitude events fliers -you need to supply your own egg or payload along and an NAR approved Altimeter.

**SoJARS plans on having the same contest events every month at all our upcoming club launches.**

If you have any questions, please contact [info@sojars.org](mailto:info@sojars.org)

## NARAM-60 Competition and Events Announced

Including:

The Old Rocketeer  
Reunion (8/4)

NARAM-60  
August 4-10, 2018

Pueblo, CO  
hosted by SCORE

CD: Scott Alexander

- 1/2A PD \*
- 1/2A B/G \*
- A SD \*
- A HD \*
- A PL Alt \*
- C EL Alt \*
- B Cluster Alt
- C SR Alt
- Classic Model
- Sport Scale
- R&D
- \* - NRC Events

### [Inaugural National Rocketry Competition Events](#)

Sat Jun 24, 2017 9:54 pm (PDT) . Posted by: [elac2az](#)

Beginning August 5th, the day after NARAM 59 ends, the inaugural year of the National Rocketry Competition (NRC) begins! The first slate of six events has been chosen by the Contest Board and the NARAM 60 Contest Director, Scott Alexander. The list is...

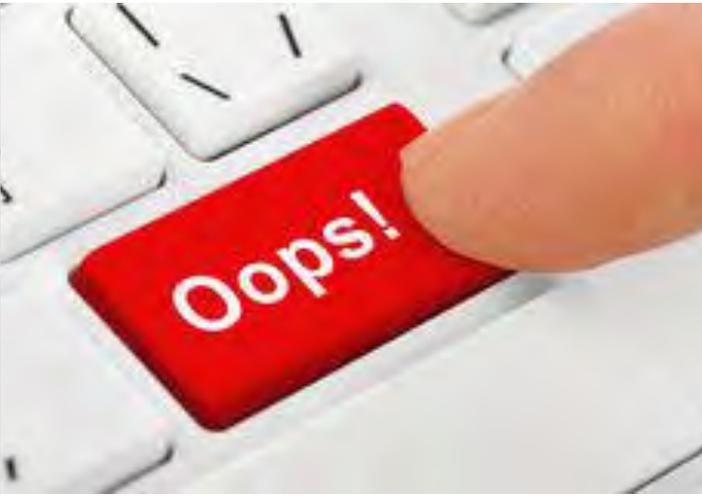
- C Egg Loft Altitude (Altimeter)**
- A Payload Altitude (Altimeter)**
- A Streamer Duration**
- A Helicopter Duration**
- 1/2A Parachute Duration**
- 1/2A Boost Glider Duration**

What's significant about these six events and the format of the NRC is that all these events WILL be flown at NARAM 60 (along with 3-5 events yet to be determined by the CD) and that the NRC will allow members to fly these events as much as they want starting August 5th and ending June 30, 2018, in the lead up to NARAM 60. The details behind the significance of the new NRC contest format can be found by downloading the new U.S. Model Rocket Sporting Code (aka Sporting Code) from the NAR website. Reading Section 13!

[http://www.nar.org/wp-content/uploads/2017/06/USMRSC-July\\_-2017.pdf](http://www.nar.org/wp-content/uploads/2017/06/USMRSC-July_-2017.pdf) [http://www.nar.org/wp-content/uploads/2017/06/USMRSC-July\\_-2017.pdf](http://www.nar.org/wp-content/uploads/2017/06/USMRSC-July_-2017.pdf)

-Ed LaCroix, Chairman

Expanding Competition Subcommittee



***Apologies from the Garden State Spacemodeling Society Board of Directors***

Due to circumstances beyond their control and a general lack of nominations  
(what? no one wants to sit on the throne?)

Club elections will be delayed (slightly)

We have assurances from Jack Sarhage that ballot post cards will be mailed to  
every member in good standing (those with paid up dues!) soon.

Be sure to VOTE!

(or the commies will take over!)



# NRC PARACHUTE and STREAMER DURATION

## Consider FAI Style Models for Low Impulse Competition (1/4A, 1/2A & A)

When we deliberate all the possible designs for the NRC Events like 1/2A Parachute and A Streamer Duration, it seems clear to me that the time proven, most efficient model is an FAI style S3 (parachute) or S6 (streamer) design. They are light in weight and have a large capacity or payload space allowing for very large parachutes and streamers.

Most FAI models are constructed on expensive forms or "mandrels" from fiberglass and epoxy. There is a learning curve to get it right. Other exotic materials are now being used such as Kapton sheet and Carbon Fiber veil. Two materials that lend themselves very well to ease of crafting internats models are vellum and paper. Vellum is classically considered parchment and is made of thin calve skin. Modern "paper vellum" is made of synthetic plant material, and is called such for its parchment usage and quality similarities. Paper Vellum is used for a variety of other purposes including tracing, technical drawings, plans and blueprints. It has the characteristic of being stronger or more tear resistant than every day paper. But "paper" is available in a variety of thicknesses (called weight) and other characteristics. Selecting the right type – just like balsa – makes all the difference. I use various papers for some of my "internats" models.

S3 and S6 models are required to be 40mm in diameter for 50% of their total length, which is minimally 500mm. It is the reason they have their peculiar shape – but it works well. You will probably have all the parts



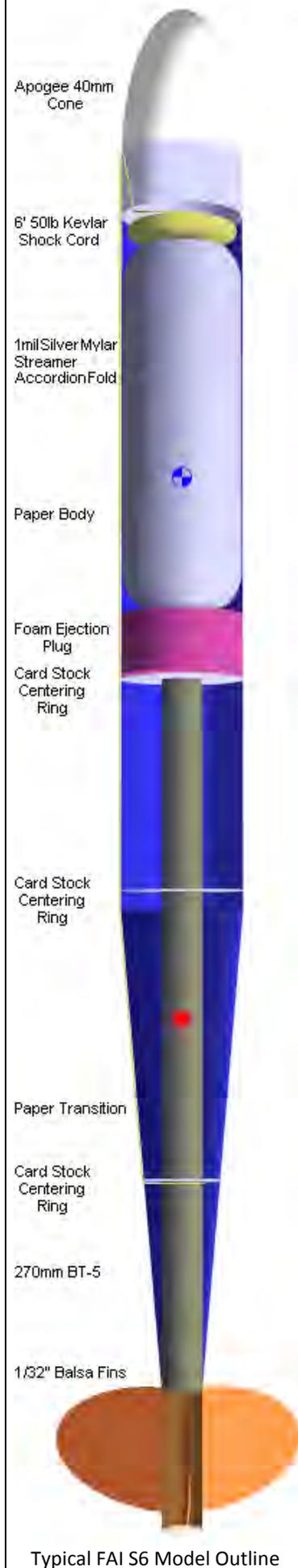
The choice for those people in FAI (international) rocketry competitions. Does not come with a shoulder, which you'll make from a ring of paper to keep the weight of the rocket down. Every tenth of a gram counts.

you need at home, with the exception of the nose cone which can be obtained through Apogee Rockets. The only other items you need are "forms" for the paper tube and tail cone. I find I spend a majority of my time making forms and jigs for many if not most of my models. Jigs render models that are consistent in dimensions and alignment. Many of you may use a "fin jig" to insure your fins are straight. Same concept here, just different parts. So, it is not necessary to purchase an "FAI Mandrel"

now (thru NARTS). You may consider it for your future modeling needs. In addition, please note that we are constructing a model that complies with FAI standards. There is no requirement to produce a 40mm diameter model 500mm long for NRC competition. You can make your bodies and tail cones any size: 30mm, 35mm, or 50mm. But if you use the information presented here, your model will comply with the rules for international FAI competition, as well as NRC. As stated, The FAI design should prove more competitive, if not superior to what you are used to using.

You can make these forms yourself using any tube that approximates 40mm. Rolls of Christmas or Birthday wrap, or a piece of 1/4" PVC pipe from the hardware store, just build it up with spiral wrapped masking tape to 40mm. You know what? That's a lot of tape! An easier, more accurate method is to purchase some 40mm Body Tube from Quest (Q9525.) Support the form with cardboard centering rings with a 1/2" wooden dowel running through them (see diagram below). The ends of the dowel allow you to handle your parts without crushing or denting them. The resulting model will be ultra light and somewhat fragile. But that is the competitive edge you want. The rings can be drawn in a computer program and printed out for consistent size. Glue that sheet onto some cardboard and cut them out. You might also want to design some fancy graphics for the model, your name printed on the side, shooting flames or even your photograph. It can make for some colorful models! You might consider building a cone from some heavy construction card paper and a series of centering rings. As tools go, this is all you should need and they are easy to make. Keep them handy, you can form all the paper bodies you need from just one set.

Fabricating the bodies is simple. Simply wrap the proper sized paper around your forms (they are actually mandrels!) and seal along the overlap with stick glue. I would suggest using a wrap or 2 of plain old waxed paper first. It will build up the form or Quest tube to 40mm (because the Quest tube is actually 39.8mm in diameter) **and** it will prevent sloppy glue from seeping through and permanently sticking your paper body to the form! So, wait for the seam to dry a few minutes, slide off the paper body and you are ready to make another. You might even be able to reuse the wax paper!



Typical FAI S6 Model Outline

Same goes for making the paper tail cone. Assemble a conical jig from thick computer photo paper or card stock. Again, use cardboard centering rings to keep it in the round. You may also wish to install a smaller diameter dowel down the center for easier handling. Try to make your parts consistent and straight by working the seams together from one end to the other. You want that seam to be flat and straight without warps and creases. Practice makes perfect.

Assemble the Model: Start with the motor tube by gluing on the 3 centering rings first. They can be made with a compass. Then, tie on your Kevlar shock line just below the bottom ring. Slide the tube into the paper cone until the middle ring fits a little snug in the top of the cone. Note the position of the bottom ring and poke a pin hole in the paper tail just below it. Use some thin wire to guide the Kevlar cord through the hole and wind it up. Slide the motor tube all the way (approx 45mm of BT-5 will exit the bottom) and glue it in place with any method you are comfortable with. The excess paper above the middle ring is snipped with a scissors approx every 1/4" around the perimeter. This gives some relief to the cone for when you slide it inside your paper body tube. The 2 large centering rings, once inside the "body" will not only center the tail cone but will support the body walls to keep a cylindrical shape. Once the cone and rings are inside, apply a light wipe of glue inside the aft end of the body and continue to slide the tail through it until the cone top is even with the bottom of the paper body tube. Afterwards, a fillet of glue can be placed along the edge of the upper ring with a stick from above. You may realize now why you poked a hole in the tail cone for the shock line. If the cord was on the inside, it would zipper the paper body. The exit point is critical too. This should be your models CG without the nose but with an expended motor. You may need to play with this position to get it perfect. When the model descends, the body should lie perfectly horizontal – in this position it will present the greatest surface area to



the air and increase your hang time. And that is the name of the game! Good Streamer flights are 3 min. – parachute flights over 5!!!

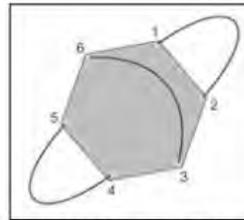
Ok, just about there. FAI models usually do not use tissue wadding (although you can try) but instead utilize a round "plug" or puck as an ejection "piston." It allows for small motors with very small ejection charges to expel the larger parachutes and streamers used in FAI models.

Which brings us to the recovery tools for extended duration models. There are numerous excellent reports and articles on maximizing parachute and streamer duration. You should read them. Here we will cover the basic devices you need.

Streamers are commonly made from 1mil aluminized mylar sheet. You can get a whole role of the stuff cheap enough off Amazon or eBay. It is sold by Garden Shops for green house window covers. Begin by determining your size. I recommend 5"x50" or 5.5"x55". Fai streamers must be at minimum a 10:1 ratio, length to width. I suggest cutting a piece of mylar the length you need first, re-rolling it on an expendable tube and cutting it circumferentially to the width required. Make one cut deep enough to cut all layers of the mylar simultaneously. This will insure straight smooth edges. Nicks in the side of a mylar streamer are where rips begin. Avoid this at all costs. Tape a small piece of music wire top one end. Make accordinated folds 1/2" apart along the entire length of the streamer. These pleats will help catch air and assist the streamer whipping around creating additional resistance.



Parachutes are made from 1/4mil aluminized mylar or polyethylene (dry cleaner bags.) Due to the way 1/4mil mylar is packaged (its folded) you may only be able to get a 30" parachute from a sheet – without welding 2 sheets together. Light weight sewing thread is all that is needed for shroud lines – but you should use at least 12, if not 16 of them. Parachutes are assembled as you normally do. A snap swivel is commonly tied to the shroud gather point for ease of removal and prepping. An excellent article in Apogee's Peak of Flight Newsletter-368 describes a technique for making reliable parachutes. If you are looking for the NRC competitive \*upper edge\* - Try FAI !!!

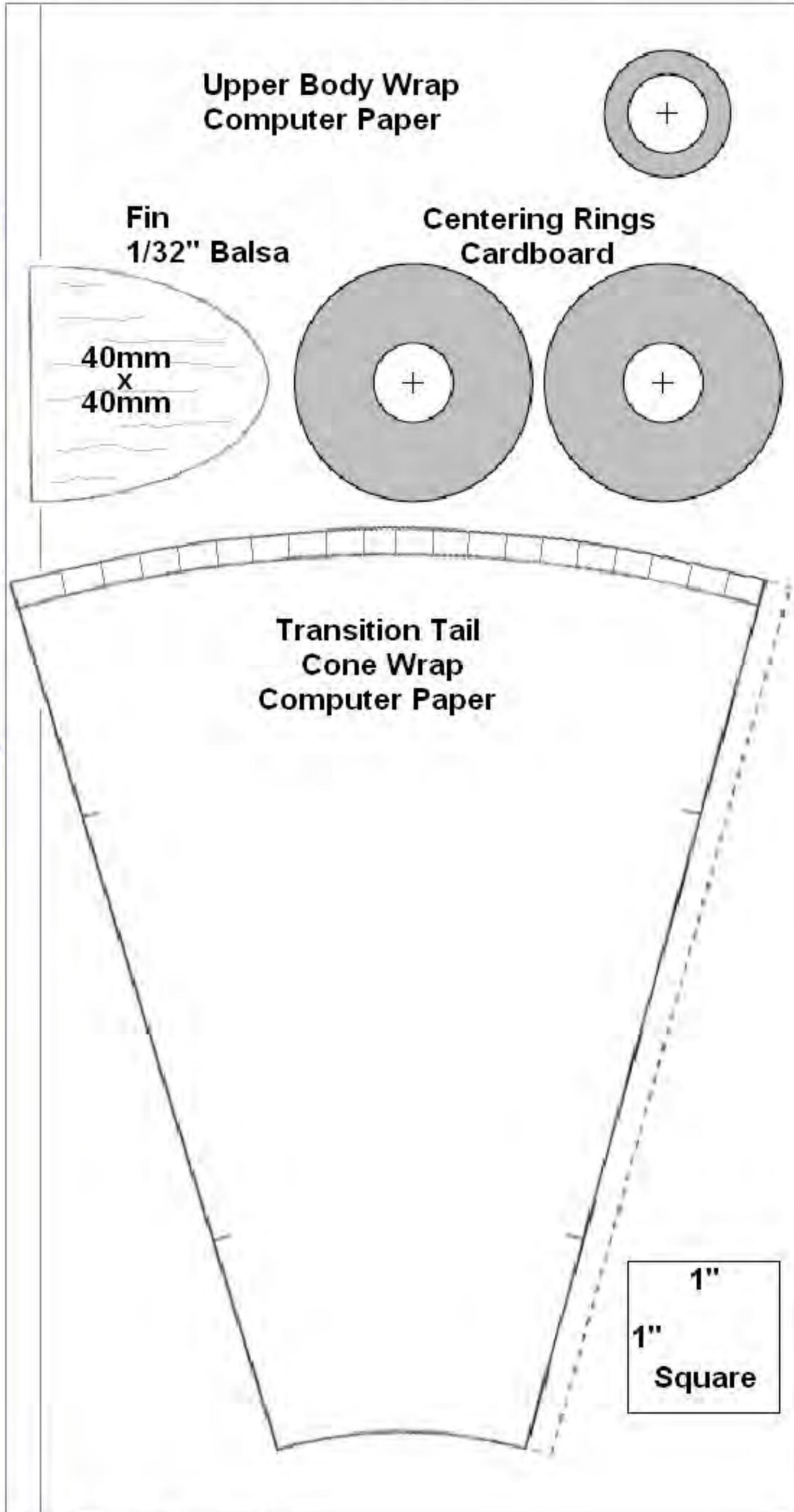
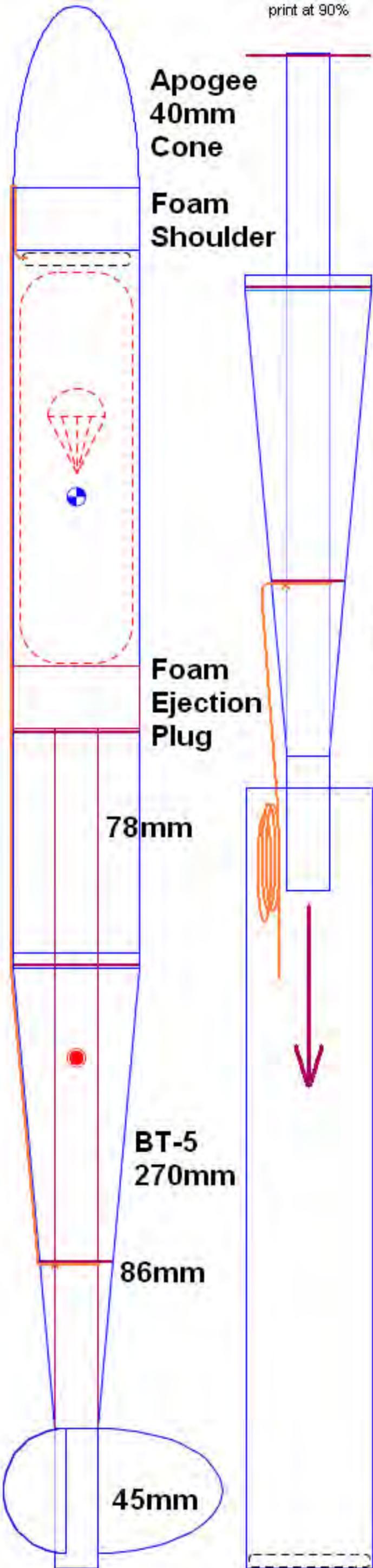


**Picture 6: Loop one set of lines across the canopy to keep from twisting the set.**

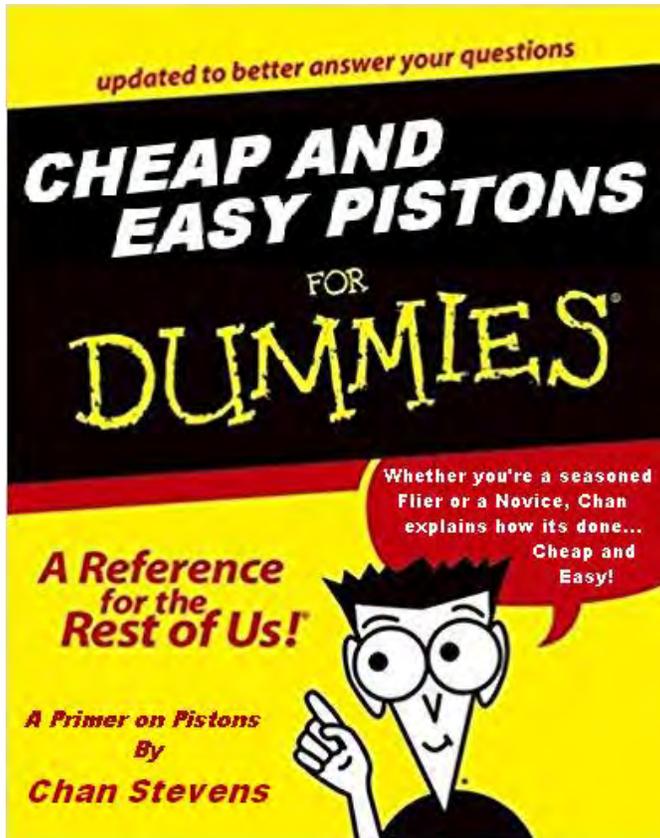


# FULL SIZE PATTERNS

print at 90%



Light Glue Ring Here



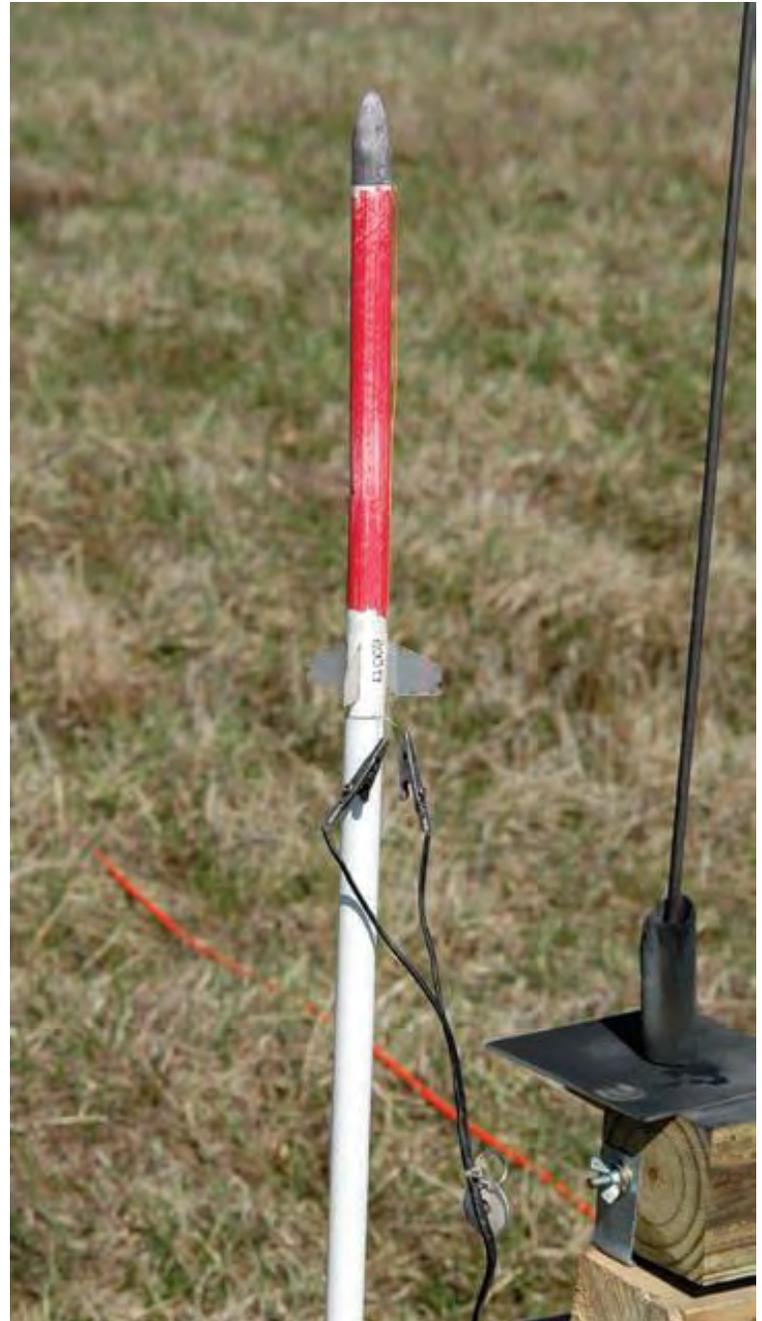
As a newbie to competition, I noticed as I started venturing out beyond the more casual local/open meet circuit into regionals and (gasp) NARAM that the more serious competitors were typically using pistons. From a performance perspective, suffice it to say that there was a significant gap, and that my fanny was getting whupped. After my first NARAM, I spent the next couple of years figuring out how to close that gap.

Pistons, though, proved to be something I simply could not figure out. After a couple of years of poking through various R&D reports, as well as lots of dialog with fellow competitors at meets, I think I have finally managed to make a piston that is reliable, simple, and offers consistently superior performance. I'm not claiming anything here that is innovative or pioneering. In fact, the opposite is true— I am stealing shamelessly from much savvier rocketeers such as Peter and Bob Alway and members of Launch Crüe (especially Chad Ring, Don Fent, Jim Stum, John Buckley, et al.). The concept of paying forward still dominates our hobby, and these folks have been kind enough to help me improve, even when it was clear that I might be in direct competition with them often in the same meet.

The type of piston described in this article is known as a zero volume piston launcher. It is available in kit form from Quality Competition Rocketry at <http://www.cybertravelog.com/qcr/index.html>. The kit consists of a piston rod, a piston head, some sort of centering ring "stop" or block, and an outer piston tube. Typically the piston rod is anchored to a launch rod or fixed stand. The piston tube is sized for the motor, meaning an 18mm motor would use a BT-20 piston tube. The rocket motor slips into the end of the piston tube. The igniter leads slip out over the top of the piston tube. When the motor lights, the gasses try to build pressure, but the sliding piston allows for a volume expansion instead. As the tube slides all the way up, the

centering ring/stop catches on the bottom of the piston head, and the tube stops traveling. Since the volume can no longer expand, pressure builds up. In the next split second, the continued increase in pressure, plus the momentum of the rocket-plus-motor climbing vs. the now-stopped piston tube will cause the rocket to break free from the piston tube. See figure 1.

This approach offers a few advantages over regular flight. First, you can usually avoid launch lugs, as there are generally either fingers along the piston tube acting like a mini tower, or you get enough velocity while on the piston that the rocket is stable at separation. Second, by containing the gasses in the piston tube, you're wasting less of the motor's energy compared with flying off a blast deflector. Of course, this approach also has disadvantages. The separation from



**A Cheap and Easy Piston ready for launch. The igniter leads are bent out of the top of the piston tube for simple hookup**

the piston tube can be clumsy, costing momentum and in some cases resulting in non-vertical trajectory (called tipoff). Also, especially if using guide fingers, the motor is initially lifting more weight than just

the rocket - you're pulling along the piston tube as well as launch wires. In my experience, this method boils down to an art form, trying to get the friction fit in the piston tube "just right." Too tight and you get little or no extra boost. Too loose results in non-vertical tip-off and you get little or no piston benefit. It can be a frustrating and steep learning curve, and performance is far from consistent.

In 1986, Jeff Vincent and Chuck Weiss introduced a method referred to as a "floating head piston." It works essentially the same as the zero volume piston method, but in this case the piston head is not attached to the piston rod. When the stop inside the bottom end of the piston tube hits the piston head, the piston tube continues to travel upward from the momentum, and ends up rising up and off the rod. The pressure continues to build inside the piston tube, though, and the rocket separates. See figure 2.

The floating head piston specifically addresses the issue of momentum loss in the regular zero volume piston, and it is less prone to tip-off. There is still the issue of having to get the right friction fit, but this is much less critical now as there is no deceleration from stopping the piston tube, so separation occurs at a higher velocity. I have experienced approximately 25% failure rate using the zero volume method, compared to less than 5% failure rate using the floating head method. In fact, the floating head failures tend to be almost exclusively on boost gliders where the piston separation tends to fake the glider into thinking it's time to depart from the pod, so I avoid piston launching gliders (until I can debug this problem, which will probably require a better pod hook design). Additionally, I am finding that boosts are at least 15 to 20% higher using floating heads (the Vincent/Weiss study reported a 34% increase).

So, how do you go about making and using floating head pistons? Most of the designs I ran across had complex machined pistons, internal wiring involving soldered connectors, etc. Well, it can actually be pretty simple once you get your head around how they work, if you're willing to use cheap materials that might only last a few flights. Table 1 lists part dimensions and cross references for everything from Micro Maxx to 24mm. Yes, I admit it—I've actually used a piston to get an extra kick out of a 0.3 N-sec motor. Total cost is about \$2 for materials.

**Table 1. Floating Head Piston Dimensions**

Piston size:	6 mm	13 mm	18 mm	24 mm
Piston tube	BT-2+/2.5x8.5"	BT-5x17"	BT-20x17"	BT-50x17-34"
Head dia.	0.246	0.516	0.708	0.948
Coupler dia.	0.246	0.516	0.708	0.948
Stop ring O.D.	0.246	0.516	0.710	0.950
Stop ring I.D.	0.220	0.376	0.542	0.736
Dowel dia.	3/16"	3/8"	1/2"	11/16" or 3/4"

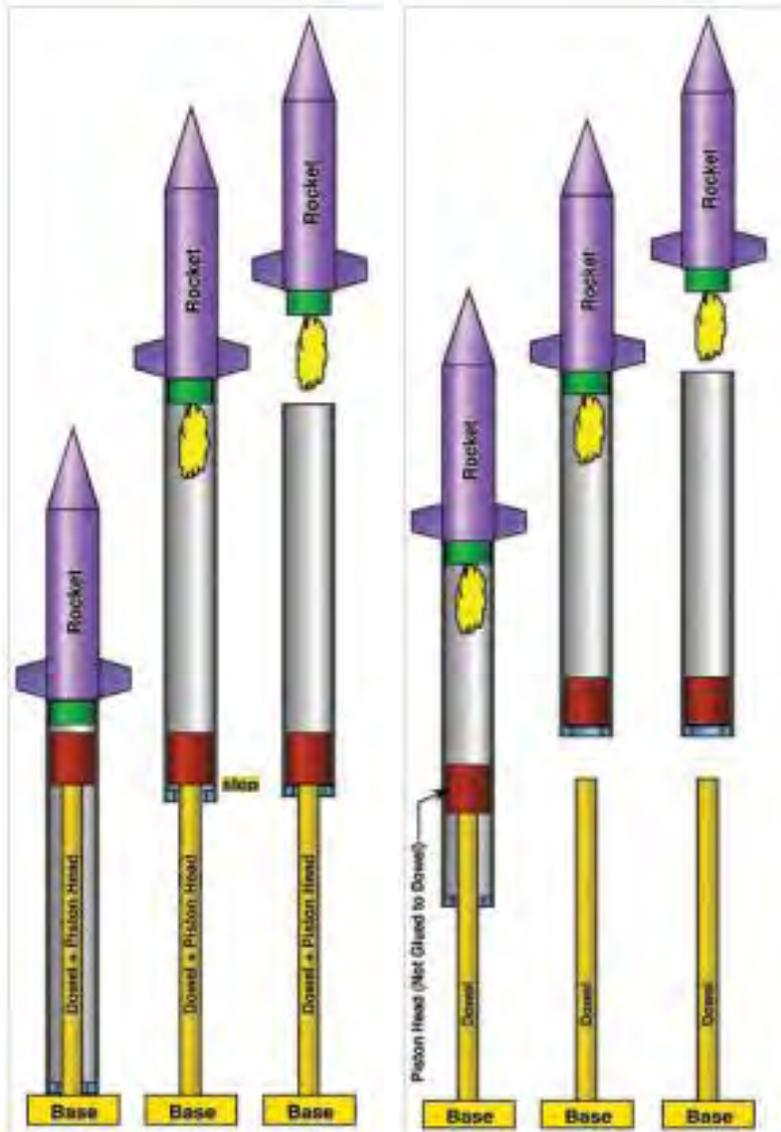
Start by making the piston tube. The piston tube is simply a regular body tube with a centering ring glued flush with one end, which we'll call the bottom. A good wood glue joint is in order here. The length of the tube should be at least 12" for smaller models, though I generally go with 17", since buying bulk tubes in 34" lengths yields 2 pieces per tube. Note that the Alway brothers did an excellent (first place) R&D report in 2005 establishing that for heavier models, such as egg lofters, longer pistons perform better than shorter ones, and they used 30" piston tubes. I typically also color the outside of my tube with red marker, which helps spotting it lying around the pad post-flight.

The piston consists of coupler stock, usually about 3/4" to 1" long, and a bulkhead disk. I typically make my disks out of basswood, and coat with a thin layer of epoxy so they don't get burned up. Glue the bulkhead to the top of the coupler (CA is probably your best bet). Once the glue has dried, sand down the outside surface of the piston



**Two piston heads made from coupler stock and bulkhead disks.**

cylinder nice and smooth with a good 300-400 grit paper. You might want to coat the outside of the coupler with CA first so that it doesn't swell or shrink in varying weather. Finally, I also like to put a



**Left: Figure 1. Operation of a Zero Volume Piston Launcher. Right: Figure 2. Operation of a Floating Head Piston Launcher.**

centering ring inside the coupler flush with the bottom (peel off a layer or two of paper). This helps keep the piston aligned with the piston rod while in the tube.



**Install the igniter and bend its leads back up along the rocket. Slide the floating piston head into the piston tube.**

## Flight Prep

Slide the piston inside the piston tube, with the bulkhead up. Prepare your rocket and motor for flight, but make sure at least  $\frac{1}{4}$ " of the aft end of the motor is exposed. You won't be able to use a metal engine hook, so you'll need to friction fit the motor for retention. Insert the igniter and plug, then bend the igniter leads up the outer edge of the motor. Next, slip the motor into the piston tube, making sure the igniter leads remain exposed. It will probably be too loose and need a layer of Mylar tape. Judging the fit here is still a bit of an art form. I gently turn the piston-plus rocket assembly upside-down. If the rocket comes off, it's too loose. If it's a major struggle getting the motor into the piston tube, that's an indication it's too tight.



**Slide the motor end of the rocket into the piston tube. Getting the proper fit here is critical.**

Anchor the dowel either by attaching to a firm base or by tapping into the ground. Slide the rocket-plus-piston tube assembly onto the top of the dowel gently, until you feel the piston slide up and bump against the aft end of the motor.

Hook up the leads to the igniter, making sure there's plenty of slack. The leads will need to travel at least as far as the piston tube length. If you don't have enough slack, you might wind up tugging on the rocket, causing tip-off.



**Bend the igniter leads back along the piston tube.**

Whether or not you fly with a tower is a matter of choice. If you have one, by all means use it, as that will improve the safety and reliability. If you don't have one and can't borrow one, you will likely be OK if you have used a long enough piston tube. I usually fly without a tower, but I have a high level of confidence that I have the right friction fit between the piston and motor. Starting out, if you don't have a tower your first few flights should be considered "heads up" flights and well away from crowds while you get a feel for the friction fit.

Count down and fire off as usual. Be careful of neck injuries from snapping your head back trying to track the flight! You will notice a much higher-velocity boost and incredible altitudes compared to regular rod/blast deflector launching. Be sure to pick up the piston/tube assembly, which has probably floated a few feet away from the dowel. If you want absolutely peak performance on each flight, then discard the piston tube and possibly also the piston head after each flight. If you can settle for slightly lower performance, then push the piston all the way out of the tube, and clean off the outside edges. Clean out the residue inside the piston tube as well, then repeat the fit test for the piston into the tube. I rarely have to replace a piston, and have gotten as many as ten flights from a piston tube, though I have to occasionally trim off the top inch or so of the tube if it doesn't sufficiently clean up.

While pistons are clearly a competition oriented tool, I might also point out as a bit of a scale fan that they offer a benefit to sport models as well. By achieving sufficient velocity off the piston to be stable, you can avoid an unsightly launch lug or rail button that might detract from the appearance of that scale model. I also make sure I've packed a few pistons in the range box for those occasional "D'oh!" moments when I head out to the pad and realize, too late, that I forgot to glue on a launch lug.

Sport Rocketry MARCH/APRIL 2009 25

*Lackey's Note: Chan Stevens is part of the Neutron Fusion competition team. Over the past few years, they've been breaking altitude records at NARAM using a modified floating head piston launcher. We thank him for sharing his knowledge, experience and piston designs.*

# ON THE LAUNCH RACK - NOVEMBER



A family with twin boys from Hudson County celebrated the boys' 11th birthday by attending the launch on Nov. 25 and then heading to a restaurant for lunch and cake. A total of nine adults and 13 boys arrived at the launch site at 10 am. The birthday boys, Nate and Jeremy, who fell in love with rocketry last summer at Camp Shankitunk in the Catskills, had pre-assembled and spray-painted a dozen Viking rockets, which they handed out to their friends, along with B engines. This was the first exposure to rocketry for all the assembled friends and parents, and everyone had a blast! Thanks a million to Mr. Arnold Klein for welcoming us all and sharing his love of rocketry! The drone in the group picture was brought by one of the friends' parents. It was taking a photo!  
All the Best, Emily Laber-Warren



# ON THE LAUNCH RACK - OCTOBER



Mark Stevens from Elizabeth sent us a few of his photos from this recent sport launch. Many flights were of G Impulse.

Clockwise: Andrew (Drew) Gualtieri (NY) preping his Aerotech Sumo, Unknown 3-finned Launch Rack launch, A break in the action: Arnie & Jim Z schmoozin', Looks like a Mean Machine Superroc under the watchful eye of Drew's Dad, Joe Gualtieri, Drew loads his Sumo on an HPR launcher, Drew and what we believe is the MadCow Patriot ¼ scale model.



Above: Drew prepares an NRC Laser Hawk  
Below: Crayon Launch off the HPR pad



Jim Z with an Estes Goblin – Loadin' UP!  
Bull Pup 12D Estes – made/flown by Mark Stevens, Elizabeth





# NATIONAL ASSOCIATION OF ROCKETRY FUNDRAISER

Gain access to special collections of moments and memorabilia preserved on canvas by donating. The National Association of Rocketry needs your help this holiday season to preserve and share their archives with **you!** Show that you're "Pay Forward Proud" **by supporting** the, "NAR History Preservation Fund" and gain access to beautiful artwork preserved on archival quality canvas for your home or office. With each donation you will be granted exclusive access to an increasing level of content based on your donation level.



- MOF have given verbal commitment to raise 50K from their donor base which NAR must match
- NAR Board have transferred 25K to the Historical Fund for the project
- NAR members and supporters must raise at least a total of 25K to initiate project by July 2018
- Our vendor partner is Stretch and Staple

## PAY FORWARD PROUD PREVIEW GALLERY IT'S AS EASY AS "3, 2, 1, 0"!



### Donation Levels \*

- Base \$ 25.00
- Atlas \$ 100.00
- Titan \$ 250.00
- Saturn \$ 500.00
- Nova \$ 1,000.00

### WHY THE NAR IS DOING THIS CAMPAIGN

- Keystone portion of the National Collection is the Stine Collection at MOF with the committed collections of Vern Estes and Lee Piester forming the remaining primary components
- Progress has been made to process the massive Stine Collection however a recent work analysis done by MOF Assistant Director for Collections Amy Heidrick has revealed at current MOF staffing it will take 10 years to complete Stine Collection processing
- Existing MOF archival staff do not have the task time available to accelerate this timeline
- The NAR and MOF do not feel it is appropriate to accept this decade long time delay and wish to make this incredible asset available to rocketry and space enthusiasts in a timely manner
- Processing of the Estes and Piester collections could also be delayed by MOF staff levels
- MOF work assessment states a full time museum professional will require 2 years to complete Stine work
- At the end of 2 years Stine Collection will be processed in compliance with Smithsonian Institution standards with an online finding aid to allow an overview of collection content and ability to respond to reproduction requests
- Completion of processing is the necessary first step toward full digitization and online accessibility (a separate project)
- Stine Collection processing is needed to be able to support exhibit projects and creation of an online museum
- Per MOF estimates the project budget is 100K and 2 years for Stine Processing

3..... Make a "Pay Forward Proud" Donation to the NAR History Fund (100% to NAR, less Paypal fees\*) All donors will receive a NAR "Pay Forward" souvenir pin.

2..... If you desire, select a print for purchase from Stretch and Staple. Bigger donations get bigger selection of classic prints for purchase.

1..... Purchase from Stretch and Staple (separate retail transaction)

0.....Launch your rocket room!

Check out some of the beautiful classic rocketry prints you will be able to purchase after your "Pay Forward Proud" donation to the NAR History Fund!

Every donation gets a "Pay Forward" NAR souvenir pin-

New print selection options appear with **ATLAS, TITAN, SATURN, and NOVA** level donations. Higher donations will give you more purchase options. A **BASE** level donation of \$25 to the NAR will permit an **optional purchase** of these images from vendor [Stretch and Staple](#).

The Project Apollo inspired "Pay Forward" logo with hidden NAR anniversary symbology! Every donor gets a souvenir pin! Now you can own the image!

\*PayPal offers discounted transaction rates for 501(c)(3) charities for most products, and consistently low rates for all other nonprofits. No extra fees for setup, statements, withdrawals or cancellation. 2.2% +\$0.30 per transaction and no monthly fee for charities.



Parting Shots - (or) - "Whasuuup" in Space?  
**SpaceX reveals new sleek white Spacesuit for Astronaut Travel**



CAPE CANAVERAL, Fla. (AP) — SpaceX has unveiled a sleek white spacesuit for astronauts on its crewed flights coming up next year. Chief executive Elon Musk made the big reveal via Instagram in September. He says it's not him in the new suit, rather a SpaceX engineer. SpaceX is developing a crew version of its Dragon cargo capsule for NASA astronauts. Boeing is also working to get U.S. astronauts flying again from home soil. Boeing is going blue for spacesuits for its Starliner capsules. U.S. astronauts last rocketed away from Cape Canaveral, Florida, in 2011. They've since been riding Russian rockets to get to the International Space Station. Musk says the new SpaceX suit has been tested on Earth — and works. He says it was incredibly hard to balance aesthetics and function (shades of 2001 A Space Odyssey...?)

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