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TARC 2018, FAI Modeling Cheap!, Winter Projects, Antares Launch, New Products from Doug Frost Rocketry, Outreach, Club Launches, and more...

ZOG-43 is dedicated to model rocketeers of all ages, abilities, and interest. We are committed to providing the most current, up-to-date information on model and real world rocketry, and to provide educational material, as well as, entertaining information.

ZOG-43 is published bi-monthly and is available to all paid up members of NARHAMS. Club membership is open to all, dues are 10 cent per week.

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About NARHAMS

The National Association of Rocketry Headquarters Astro Modeling Section, or NARHAMS, serves Baltimore, the state of Maryland., Washington, DC and the surrounding Metropolitan areas. The club is a section (#139) of the National Association of Rocketry (NAR).

We are the oldest continuously active model rocket club in the United States, first established as a high school club in 1963, changing our name to NARHAMS when chartered as a NAR section in 1965. NARHAMS is the only seven time winner of the NAR "Section of the Year" award (1997, 1998, 1999, 2001, 2004, 2006, and 2007).

NARHAMS members regularly fly their model rockets at NASA's Goddard Space Flight Center in Greenbelt Md, at Old National Regional park near Mt. Airy, Md. and at the Carroll County Agriculture Center, near Westminster, Md.

NARHAMS welcomes all to our monthly meetings and launches.

For details, dates and directions to our club, meetings and launches, go to: <http://narhams.org>

From the Editor - 'Tis the Season to Fly Rockets

Don Carson, NAR #11069

Take a look at the calendars in this issue. Locally, in June, there are 4 launches/contests. In July, there are 6 launches/contests/demos plus the World Space Modeling Championships (in Poland)! There is plenty of opportunity to fly rockets.

In this issue, we have a tremendous article by Kevin Johnson. In Getting Into FAI Style Flying Without Breaking the Bank, KJ shows us how to build a competitive FAI rocket with materials you probably have on hand. Now you can see what it's all about. With this model, you can fly Parachute Duration, Streamer Duration and Helicopter Duration. This is his second article showing just how to get started in the FAI world (the other one was a plan for the A Rocket Glider event, called S4A).

NARHAMS has no less than a dozen members with experience in FAI competition, in addition to many past members. To a person, they like nothing more than to help newcomers into that aspect of the hobby. I know, I am an example. Being a glider fan, I had a goal to make the US team flying S4A. Our club mates, and other competitors were very welcoming, showing me their techniques and helped me to improve my models. In doing so, I beat some of them out to make the team! Thanks to all who helped me, I'll pay it forward too.

I hope you enjoy this issue. As always,

Fly 'em high, bring 'em back, and be safe..

For questions, answers, opinions, files, photos, and more NARHAMS, join the [NARHAMS Yahoo group](#). It is free, painless, no ads, and may just be the cure for the common cold. Also: [Facebook](#) if you are not paranoid about that sort of thing.

Front Cover: High Power demonstration launches opening the 13th Team America Rocketry Challenge caught by our own Dr. Chris Kidwell (head of the Florida chapter of NARHAMS).

Photo: C. Kidwell

Back cover: Full size templates for making your own FAI competition models without the expense and hassle of fiberglass construction. See Keven Johnson's article *Getting Into FAI Style Flying Without Breaking the Bank*.
Graphics: K. Johnson

ZOG ROYAL COURT (NARHAMS OFFICERS)

ZOG (President) Alex Mankevich

VICE ZOG (Vice-President) Alan Williams

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(Treasurer) Ed Jackson

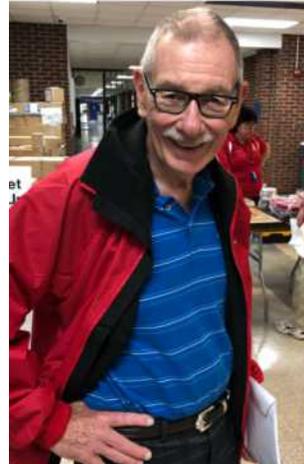
KEEPER OF THE HOLY WORDS (Secretary)
Sarah Jackson

COURT JESTER (Section Advisor) John McCoy

Team America Rocketry Challenge 2018

NARHAMS Past and Present Support the Biggest Rocket Contest

By Ed Pearson



L-R: Top - Maria Ha; Mark Wise; Tom Lyon; Bottom - James Duffy; James Miers; Judy Barrowman.

Photo: E. Pearson

L-R: Top - Jennifer Ash and Kevin Johnson; Tom Ha; Dimitre, Stoil, and Abana Avramov; Bottom - Jim Barrowman; Chris Kidwell; Sally Cook and DJ Emmanuel.

Photo: E. Pearson

TARC, Continued



L-R: Top - Esther Johnson; Jim Filler; Bottom - Alan Williams; Alex Mankevich (Zog).
Photo: E. Pearson

L-R: Top - Tom and Joanna Bagg; Greg Kennedy; Bruce Camino; Bottom - Steve
Humphrey; Doug Pratt; Matt Filler.
Photo: E. Pearson



April 2018 Mt. Airy Sport Launch

By Bill Boublitz, NAR 36860

Load out was scheduled for 9:15. With a beautiful day in the forecast, the entire crew was present at 9:00. Everyone seemed anxious to shrug off the lingering winter chill and feel spring on their faces. Sarah and Ed Jackson, Alex Mankevich, Mike Kelley and yours truly were the load-out/set-up crew. We were ready to fly at 10:00 am with temps in the low 50's, winds from the NW at 6 mph, gusting to 15.

Sarah and Ed delivered lots of new, fashionable NARHAMS wear. Colors, logos, quality and fit are terrific. If you haven't ordered, "buy" all means contact Ed Jackson for info. Once the 'HAMSTERS were decorated in sartorial splendor, we got down to business. Due to activity on the upper and lower soccer fields, we began under a self-imposed D impulse limit. This had no bearing on fun.

Mike Kelley led off with a "Stratocruiser" and "Red Nova" from Estes, both flying on B6-4s. Sarah loaded her semi-steam-punk "Tiberius" for it's first flight on a B6-2. No sooner had she landed, Mike Kelley was back with an Estes "Honest John" and "Magician" on C11 and C6 respectively. Alex was up next with a "Crayon" on a B6, followed by Ed J's "Shooting Star" on a 1/4A. The "Shooting Star" launched from a homemade piston launcher which worked well, though Ed snarled, "I can do better." Go, Ed. Guess you're getting ready for June?

Jim Filler arrived to fly a Semroc "Mars Lander" on a D12. It landed as a proper Mars descent stage should; upright on it's feet. Jim also provided a thermometer for the range head and discussed putting together an NRC package for the storage shed. With new contest rules and upcoming NRC launches; this will come in handy for launch managers.

Mike K., Sarah J., and Alex shared the next round with a "Vagabond", "Plasma Probe" and "Heat Seeker" respectively. Brad Lowekamp joined the fun with a "Flutterby" featherweight. The following round included Mike Kelley flying a "Majestic" and Brad Lowekamp flying his "nine-lives" Estes "Puma".

Continued next page



Lots viewed the launch.

Photo: E. Pearson



Rachel Shafer (R) and sister Natalie at Safety check-in with their Shark Attack model.

Photo: E. Pearson



Sarah Jackson performed check-in. Here Sarah shows off her finished FlisKit's Tiberius and sports a new club shirt.

Photo: E. Pearson

April Mt Airy Launch, Continued

Next were two historic models; Jim Filler flew a "NARHAMS 50th", two stager, followed by Alex Mankevich with a "NARHAMS Blue." These were prototype models for NARHAMS's 50th Anniversary that never went into production. Both were exotic designs which flew well. (I want one of those NARHAMS Blue designs. Super cool!)

Sarah Jackson aced her NARTREK Bronze two-stage requirement, flying a "Mini-Commanche 3" in a two stage configuration. The remainder of the club time proceeded at a relaxed pace. Mark Wise and Dick Stafford joined us. Mark provided conviviality and launched a "Der Yellow Max" built by Jim Filler. Dick launched an original design, named "Stink Bomb" from a tube launcher and a Mini Little Joe I on an A10T.

As Sol crossed the Meridian, Cub Pack 278, from Braddock Heights, MD arrived. Approximately fifteen in number, they enthusiastically ramped up the pace. Most flew "Gnomes" and "Alphas" with creative re-names. Some flew larger models. The pace grew frantic. Sarah Jackson shouldered safety check in and we were putting 'em up! Around 1:30, Ed Jackson provided relief at the console. When I returned, circa 2:15, the pace was still brisk. A handful of HAMSTERS; Stafford, Jackson, Kelley and Lowecamp managed to get flights in, launching off 3/16th rods on D impulse power.

The Shafer family made their first appearance of the season. As the Scout pace slowed, Natalie Shafer presented a "V4" original design to fly on a D12. Later, Rachel Shafer flew an original "Shark Attack" on a D12-3.

Conditions continued to improve. The temperature was flirting with 62 degrees and winds were calm. Crowds were thinning on the athletic fields. Alex and Ed J. dispersed to positions on the upper field with safety vests and horns to warn athletes of incoming vehicles. We cautiously lifted the impulse limit and let everybody rip.

Dick Stafford had been itching to fly a "USAF Saucer" model on an F15. It went straight up and brought enthusiastic applause from spectators. Keeping with the saucer theme, Dick next put up a "Ring Of Fire" kit. This bird flies on two canted motors, producing a rapid spin during ascent. Dick flew his bird twice on D12 x 2 and E12 x 2 motors. Spectacular. Next, Rachel Shafer presented another original design, the "Cherry Bomb" to fly on an E12-4. Chute Release at 200' for a beautiful flight.

Natalie (L) and Rachel Shafer prepare their D12-powered Shark Attack rocket. They used a Jolly Logic Chute Release. Check out how close that rocket is to the ground!

Photo: E. Pearson



Bill Boublitz was launch manager. When he wasn't firing models he helped prepared others' rockets--as seen in this montage..

Photo: E. Pearson



Continued next page

April Mt Airy Launch, Continued

Having attended a Goddard launch, Kiki Gazit and his father came out to fly. Kiki was exuberant and enthusiastic, putting up his first build three times. Another guest flyer known to us only as "George" flew his "Red Rocket" four times. Hmm... Espionage?

Ed Jackson brought out some exotic stuff; an Estes Mars Snooper (re-issue version) for an excellent flight, as well as an Apogee Cirrus Breeze Rocket Glider. The Cirrus enjoyed a good boost on a 1/2A and settled into a respectable, spiral glide homeward.

Veteran Mike Kelley flew an "Ascender" on an E12, then put a period on the day with our first G impulse of the year. His "Super Mean Machine" flew on a G53-5. It was a perfect flight and a nice way to conclude.

Eighteen youth, twenty-three youth-at-heart attended. Forty-one rocketeers put up one hundred-thirty eight flights. One hundred forty-three motors burned.

Breakdown; one each 1/4A and MicroMaxx, eighteen 1/2A3T, eleven A10T, twenty-two A8, eight B4, thirty-seven B6, twenty-one C6, seven C11, one D9, ten D12, three E12 and one each; E18, F15, G53.

We closed the range at 3:58 pm. Alex, Sarah, Ed, Mike and I were grateful for extra hands during break down. Special thanks go out to Brad Lowecamp, Rachel and John Shafer for their generous assistance.

I have enjoyed serving our club these past three months. It's work, but it's fun and rewarding. If you are interested in giving it a try, don't hesitate to contact a Launch Manager or Club Officer. You'll have plenty of help. Promise.



Ed Jackson backed Bill up. Here is Ed and a way-back Estes Mars Snooper.

Photo: E. Pearson

Brad Lowekamp launched this fine looking model. It jumped off in a hurry on a C11.

Photo: E. Pearson



Alex Mankevich helped people load the rack. Here he sets up his own model.

Photo: E. Pearson



Antares OA-9 Mission Launch Report

Photos and Article by Alex Mankevich
NARHAMS President

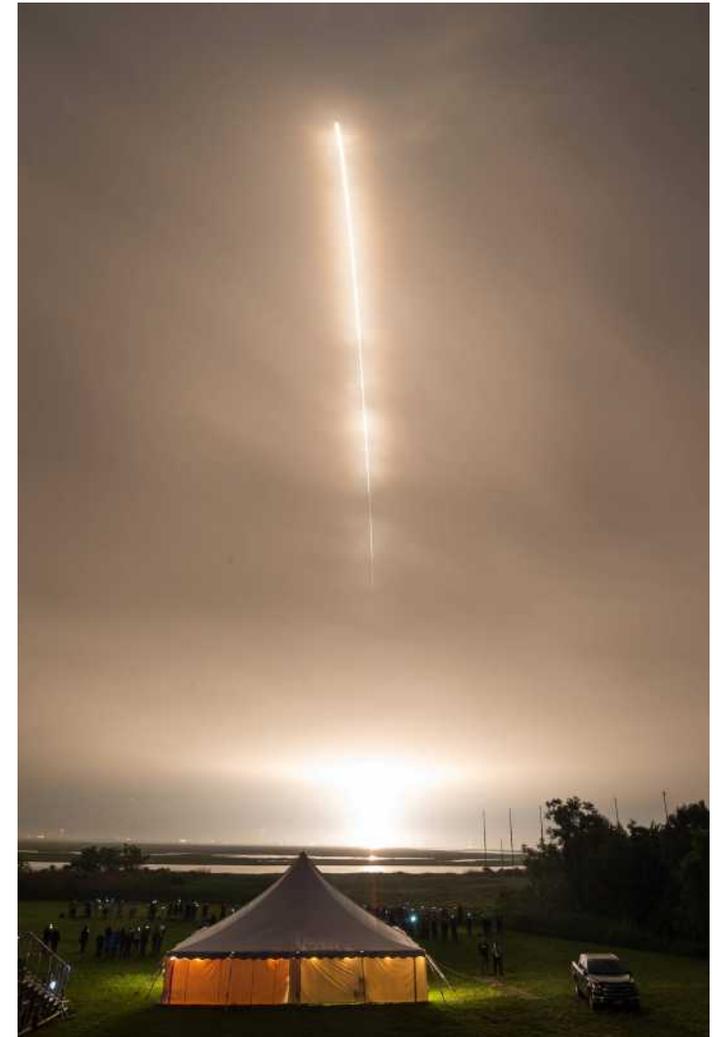
Orbital ATK's Cygnus spacecraft lifted off aboard an Antares 230 rocket from the NASA Wallops Flight Facility in Virginia at 4:44 in the pre-dawn morning of May 21, 2018. The 20 feet tall Cygnus will deliver vital equipment, supplies and scientific equipment to the International Space Station (ISS). Once Cygnus is unberthed from the International Space Station after a 52 day stay, its NanoRacks deployer will release six Cubesats. Several tons of trash will be disposed during Cygnus' fiery reentry into Earth's atmosphere in July.

A new component aboard Cygnus on this ISS re-supply mission is a communications system for all visiting space vehicles – known as the Common Communications for Visiting Vehicles radio, or the C2V2. Added to the list of novel accomplishments is the plan to use Cygnus' thrusters to perform an ISS re-boost. This mission will be the first since the Space Shuttle era for a U.S. spacecraft to perform a re-boost. These orbit-raising maneuvers are required to counteract the slow orbit decline of the ISS due to atmospheric drag which exists even at the ISS's attitude.



The 139 feet tall Antares 230 rocket on the Mid-Atlantic Regional Spaceport's launch pad 0A, which is classified as a medium class launch facility.

Photo: A. Mankevich



Right: Liftoff of the
OA-9 Mission.
*Photo: NASA Wallops
Flight Facility/Allison
Stancil*

Firsts for Antares/Cygnus on the OA-9 Mission

- 1st. Antares/Cygnus pre-dawn launch (4:44 a.m.)
- 1st. ISS orbital re-boost using a US spacecraft since the Space Shuttle
- 1st. Naming of Cygnus for a non-astronaut (J.R. Thompson)
- 1st. Use of the C2V2 communications system for ISS proximity ops
- 1st. Antares/Cygnus launch in the month of May

Continued next page

Antares Launch, Continued

The OA-9 mission was the third of the two-stage Antares rocket in its latest 230 configuration, which includes the third flight of the upgraded second stage Castor 30XL motor. The Cygnus spacecraft for this mission is named in honor of J.R. Thompson, a late aerospace executive and former NASA Deputy Administrator who worked on the Cygnus spacecraft and helped Orbital ATK to develop its signature highly-reliable and innovative products. Orbital ATK's Frank DeMauro and Kurt Eberly paid homage to Mr. Thompson during the pre-launch press conference, describing him as a mentor to many and having left an indelible mark on those who worked with him.



A setting springtime sun shines spectacularly across the salt marsh upon the Antares rocket.

Photo: A. Mankevich

This reporter felt a personal connection to the OA-9 flight since he was able to view the spacecraft hardware inside the Horizontal Integration Facility last fall. NASA made viewing of this hardware possible as part of the media activity prior to the Orbital ATK OA-8 mission which launched on November 12, 2017. Inside the cavernous hanger the Antares first stage and the second stage Castor 30XL motor were displayed horizontally.

The OA-9 mission was initially set to launch early Sunday, May 20th. Orbital ATK and NASA opted on Friday May 18th to reschedule the launch one day later. This decision allowed time for extra rocket inspections and for improving weather conditions. The cloud cover for the original launch day was predicted to be around 95%. The persisting low level cloudiness on the new launch day was still a concern, but it represented only a 30% probability of violation for launch.

It rained on your intrepid reporter on launch day as he loaded his photography equipment into his car at 2:00 in the morning. It rained as he drove to the media bus staging area. Dramatic displays of lightning east of the Antares rocket were witnessed by the media as they departed the busses at the radar site, however the P.A. system assured everyone that the lightning was several miles offshore and moving away from our direction. Launch control later announced their decision to set



Media members receive a briefing from a Orbital inside the Horizontal Integration Facility as part of the media schedule on T-1 day.

Photo: A. Mankevich

the liftoff at the end of the five minutes launch window due to a violation of the cumulus cloud rule. This delay to allow for improving weather pushed back the liftoff to 4:44 a.m. A few stars were seen peeking through the clouds at around T -15 minutes, however it was difficult to gauge the extent of cloud cover due to the bright flood lamps illuminating the media area.



Ken Kremer (in space-themed shirt at left) of Space UpClose, Jared Haworth (center) of We Report Space and Mark Usciak (standing) of Spaceflight Insider review their launch images.

Photo: A. Mankevich

The monitor on your reporter's camera flooded out with a blast of incandescent white light the moment the engines ignited. He

The monitor on your reporter's camera flooded out with a blast of incandescent white light the moment the engines ignited. He

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Antares Launch, Continued

blindly jammed down on his camera's continuous-mode shutter release and prayed that the pre-programmed manual settings would return some usable launch images. The Antares rocket rose on its flickering orange flame for about 15 seconds then disappeared into a mid-level cloud layer. The engines' flames then dramatically reappeared a few seconds later. The light from the flames allowed the launch spectators to realize that the cloud cover was patchy, thus permitting the flames to remain visible up to Main Engine Cut Off (MECO) at 3:55 into the flight. Several seconds later the second stage motor ignited off in the distance.

The Visitor Center reported that about 720 visitors were on hand to witness the early morning launch. This count was far less than the expected crowd that was originally anticipated to number in the thousands. Understandably, the delay of the launch to a work day, combined with the continued uncertainty with the weather played into the diminished count of launch spectators. Neon-blue noctilucent clouds produced by the Antares' flight were reported as far south as Murrells Inlet, South Carolina. A glimpse of the Antares rocket's flight was reported as far north as Torrington, Connecticut.

The media returned to the NASA Wallops Island Visitor Center around 5:45 a.m. The media personnel had about 18 laptops in action in the media center to upgrade their websites with news of the successful launch. Other media worked their laptops to review, process and share their launch images.

The successful completion of the OA-9 mission leaves only two more missions remaining for Orbital ATK under the original Commercial Resupply Services (CRS-1) contract with NASA, which is paying Orbital ATK a total payment of \$2.89 billion, or an average cost of \$262.6 million per mission. NASA has awarded Orbital ATK the first of the CRS-2 missions, which is tentatively scheduled for October 2019.



The Antares rocket is secured by the Transporter/Erector/Launcher (TEL) system whose umbilical support structure is seen to the rocket's right.

Photo: A. Mankevich

Below: A chaos of cascading condensate falling off the Antares rocket moments after the engines' ignition.

Photo: A. Mankevich



Pad technicians making final preparations at the base of the Antares rocket.

Photo: A. Mankevich



May 2018 Mt. Airy Sport Launch *Rocketeers Emerging from the Deluge*

Photos By Alex Mankevich



Gently coming home under a colorful chute.

Continued next page



Jim Baird's Spaceship One ignition!



Jim Filler and Mike Kelley load'em up.



Above, below and below left: Bruce Mitchell's Saturn V posing with the craftsman, launching and safely returning.



May Mt Airy Launch, Continued



Lift Off!

Left: The grass is taller than the Crayon.



A Medevac helo using the adjacent field, not for us thankfully!



Another Saturn V, great launch, and return under fully deployed chutes.



Tom Jackson's NARHAMS Gold, what a beauty!



Winter Projects - Show and Tell

Here's What's Been Going on During the "Build Season"



Above: Jim Baird worked on his FlisKit NARHAMS Gold model (that Dave Fuller designed). Jim's advice: Read the instructions before assembly to avoid mistakes.

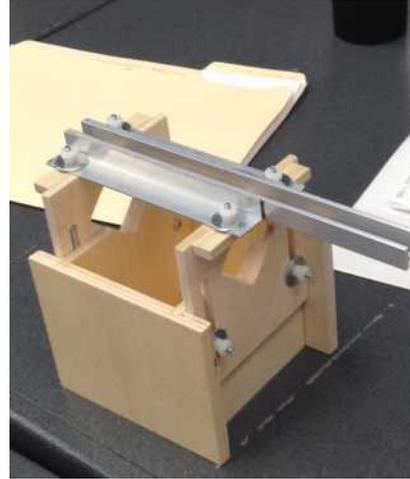
Photo: E. Pearson

Right: While Ed Jackson has been working on his Dark Silver Estes model (almost 30" in length - skill level 4), Sarah Jackson is finishing a retro-looking steam-punk-type Tiberius.



Right: John McCoy has been puttering around on Bomarc and Sea Dart models, but he really piqued everyone's interest with saying he's thinking of buying a Squadron's Jonny Quest Dragonfly plastic model and then converting it for flight. John also showed a fin jig he got from Ted Macklin. Macklin Missile Works Mini-Fin Jig for \$80. Aligns fins from T-2 to BT-55..

Photo: E. Pearson



Jef Fineran said his projects included a 4" dia. LOC Precision Expediter that he plans to finish with a Blue Angles motif. He's also working on a 4" Hornet. Jen Ash said the ASP Black Brant IV model featured in the January/February 2018 Zog-43 issue was her winter project. She also gave the club a mini-report on NARCON 2018, held February 23-25 in Clear Lake, Texas, minutes away from NASA JSC. Austin area NARHAMster James Duffy did a super job organizing NARCON.



Above: Dave Fuller has been active with plastic model building. Here Dave displays his Hobby Boss 1/72 scale US P61-B "Black Widow" plastic aircraft. Note the Top Gun tee.

Photo: E. Pearson

Right: Brad Lowekamp showed off his LOC Precision Minie-Magg model (5.5" dia.) and his Eggtimer Rocketry's Eggfinder GPS Tracker. His daughter inspired the paint scheme.

Photo: E. Pearson



Above: Chris Greco came late, but brought a 4' Standard ARM model, told of converting his C-cluster Estes Saturn V to G power, and did a little knitting--for his 'pumpkin chucker'. He plans to build a few chuckers, starting small but make each successive one larger until he gets kinks out and range achieved!

Photo: E. Pearson



From the ZOG: *Members Helping Members and Everybody Wins*

By: Alex Mankevich, NARHAMS President

Arguably, three of the top benefits of NARHAMS membership are as follows:

- a. You get the widely-acclaimed ZOG-43 newsletter (for free).
 - b. Plenty of knowledgeable club members to advise you so that you don't have to re-invent the wheel on anything related to sport rocketry.
 - c. You get to benefit from the privileges and gratuities that flow our way.
- So, this is a story about benefitting from the good things that happen just because you are a member of this Section.

Some months back, NARHAMster Ole Ed Pearson became aware that a parachute was currently residing in storage at the Goddard Visitor Center. Its previous owner, Marty Brown, who used to volunteer at the Visitor Center had donated the parachute with the intention that it would be forwarded to NARHAMS for use. This was a parachute that Marty would use when jumping out of perfectly functioning aircraft.

Ole Ed followed through and asked the Visitor Center's Operations Manager DJ Emmanuel about the status of the parachute. DJ shortly thereafter handed over the parachute to Ole Ed, who brought it to hand over to King ZOG Alex at the November 2017 planning meeting. Alex modeled the parachute at that time, feeling much like a superhero with the parachute draped around his shoulders like a superpower-transferring cape. The size of the parachute was then appreciated – there was a lot of nylon canvas. The orange and white parachute was in literally in a tangled condition – its shroud lines were thoroughly intertwined.

The next step in the parachute's journey was to be handed over to the Shafer family at the 2017 Holiday Party. Rachel and Natalie Shaffer and dad John were approached by King ZOG and the Vice ZOG who proffered an offer which the Shafers could not refuse. The Shafers have their own parachute enterprise, you see. They produce stock parachutes which they sell at \$15 or \$20 depending upon the number of Kevlar shroud lines that need to be attached. Rocketeers interested in their parachute line of products can contact them by email at tamyra4h@gmail.com

The Shafers were to use the parachute to their hearts' content, provided they returned some cuttings of the parachute material to be distributed free to the membership. Heads were nodded in agreement, hands were shaken, and the deal was sealed. President Trump isn't the only president who knows the art of the deal!

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Above: A sampling of the cut pieces of nylon parachute material that will be available for the pickings at future club business meetings.

Photo: E. Pearson

Right: Rachel (l) and Natalie (r) Shafer at Old National Pike Park.

Photo: E. Pearson



From the Zog, Continued

Fast forward to the April 2018 sport launch at Old National Pike Park. The Shafers called Alex over and provided an update on their progress with the parachute, and they had not been idle. A set-back had been encountered in that the nylon material had a natural tendency to distort after being cut. The Shafers would trace out a polygonal outline on the nylon, cut the material, only to discover that the angles and lengths of the polygonal segments would warp. Fortunately, the Shafers had a solution in mind. Their plan was to set up a swimming pool filled with hot water and soak the parachute. The parachute was to be hung up and let to air dry. Hopefully, this treatment would retard the nylon's tendency to wrinkle and warp.



King ZOG models the parachute Marty Brown graciously donated to the club at the November 2017 planning meeting.

Photo: E. Pearson

The Shafers returned to the May 2018 Sport Launch at which they triumphantly and proudly handed over their accomplishment to King ZOG. The pesky problems of nylon wrinkling and warping had been solved. The Shafers went (in true NARHAMS fashion) above and beyond and created numerous parachute cut outs of 12", 15", 18" and even few 24" sizes. All the cut outs are wrinkle-reduced, and all the angles and lengths are symmetrical.

The parachute cut outs will be brought to future business meetings. The membership will be able to avail themselves to these cut outs. The Shafers left sufficient material surrounding the polygonal tracings so that you can re-enforce the parachute perimeter with additional stitching if you so choose. The original 1/8-inch diameter shroud lines have been gathered into separate bundles so that members can take those as well.

The next time you see Natalie, Rachel and John at a future Sport Launch, say thank you for their creative problem-solving and efforts on behalf of the club.

Note: Ole Ed Pearson contributed to this article.



April Meeting Highlights



New display signs backdrop John McCoy (L) and acting-Zog Alan Williams at the April meeting. Ed Jackson designed the signs for exhibits and prelaunch help for novices.

Photo: E. Pearson



NAR trustee Mark Wise (center) opens his card while partygoers gustily sing Happy Birthday in an astounding number of keys and tempos. Jen Ash made cupcakes and members feasted on sloppy joes.

Photo: E. Pearson



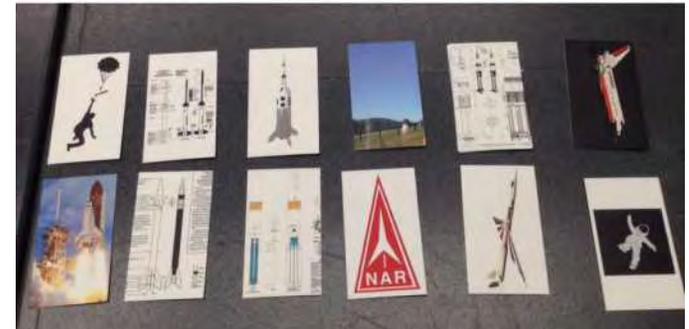
May Meeting Highlights

With Ed Pearson



Above: Ed Jackson demonstrated his laser cutter. Fin stock outlines and resulting balsa fins shown at right.

Photo: E. Pearson



Above: Kevin Johnson (with wife Esther) displays his NAR trustee business card (from Moo.com). Cards may have custom-photo backs as seen at bottom.

Photo: E. Pearson

Right: NARHAMS-wear seen at meeting.

Photo: E. Pearson



May 2018 Goddard Launch Report: By Ed Pearson



It wasn't football, but we had 94 touchdowns. Here are some. Shirley Ramos of the VC presented 36 certificates to brand new flyers.



Ed Jackson (L) ran the launch. Here he fires off a FlisKit UFFO.



The Visitor Center counted approximately 200 spectators/rocketeers.

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May Goddard Launch, Continued



Sarah Jackson and Bill Boublitz did safety checks, repairs and rail assignments.



Hats off to John Bonk: three flights of an Estes Mosquito (painted to resemble a lady bug); all were recovered.



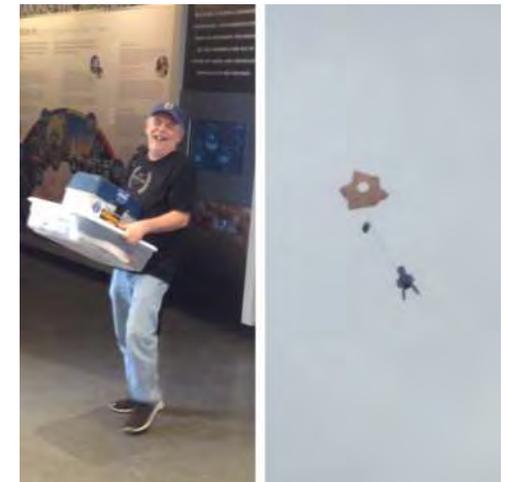
Distinguished guests: Heather Borowski and daughter Annica. Heather (now at APL and working on the Europa mission) grew up with NARHAMS with her dad, Jim, and mom, Judy Barrowman.



Mike and Ian Cochran helped load the racks.



The auditorium was used as a prep and building area. When tables filled, people used the floor to get rockets ready.



NARHAMS Mike Ratel and the flight of one of his Baby Bertha's.



Outreach: Westchester Elementary School Launch

By Alex Mankevich

Tom and Johanna Bagg have regularly done rocketry talks and launches at the Westchester Elementary School yearly from 2004 to the present. The school is located on Old Frederick Road in Catonsville. Two adjoining baseball fields located far from the road provide a flat, near-perfect and spacious launch range.

Just about the entire 4th grade of students participated in this launch activity. Tom and Johanna preceded the launch with a rocketry discussion and a build session. Tom took home the assembled Alpha III rockets to perform checks and repairs as to assure safe flights and to try to keep the launch cadence free of mis-fires and unstable flights. The students were called up by class, and Johanna distributed the rockets, now completely prepared with recovery wadding, motor and igniter wire, to the eager students.

Tom and Johanna didn't perform some robotic march through the launch of over 100 flights. The teachers got into the act by launching rockets from Tom's personal collection. Tom also threw in a few demonstration flights that included a saucer, a tube finned rocket and a glider to illustrate the variety of model rocketry. Bonus activity had been added to the launch. The Baggs awarded a prize for the Alpha III rocket that achieved the highest altitude. They also judged the best finished rocket and awarded an honorable mention for rocket finishing. Packages of freeze-dried space food were awarded to the winners in these categories.

Pomp and circumstance are sometimes called for, and for this year's May 25th launch Tom invited Phillip Byers, the principal of the Westchester Elementary School, to launch the first flight of the day.

Completing the launch team were NARHAMS President Alex Mankevich and the Baggs' friend Stephen Parkhurst. Alex provided pad assistance, equipment transport and range set-up. Stephen also provided equipment transport and recorded the flight altitude measurements.

This year's launch activity got underway at 10:30 a.m. under partially cloudy skies with temperatures in the high 80's accompanied by a modest breeze. Thankfully, only a few rockets needed to be recovered from the trees. The team took break for lunch, then completed the launches for the final class of the day. A total of about 117 model rockets were launched. The Alpha III rocket which flew the highest on an A8-3 motor achieved a height of 327 feet.

To learn more about the rocketry adventures of Tom and Johanna Bagg, visit the [Sept/Oct 2016 ZOG-43](#).



Johanna Bagg (center) coordinated the distribution of the prepped rockets to the awaiting students.

Photo: A. Mankevich



The Bagg's friend Stephen Parkhurst tracked the altitude of over 100 Alpha III flights.

Photo: A. Mankevich

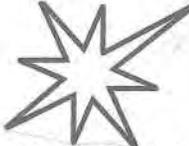


Westchester Elementary School Principal Phillip Byers did the honors of launching the first model rocket flight of the day.

Photo: A. Mankevich



Doug Frost Rocketry Announces

FROST

ROCKETRY
By Doug Frost, NAR #3446,
TRA #1007

THE JAYHAWK NAVY TARGET DRONE
1/8th SCALE KIT WILL BE READY
To Order On July 15, 2018



This Exact Scale (.1254) Jayhawk Kit Is The First Ever JAYHAWK KIT That Has All The Decals, Antennas, Rivets, Launch Pins, and Details Of The Real JAYHAWK Target Drone ! This Kit Has SIX Blueprints So You Can Build It Right ! The Decal Sheets Were Professionally Drafted & Cost \$1500 ! This Model is 1.635 Inch Wide By 18.86 Inch Long. Order@FrostRocketry.Com For \$125 plus \$15 Ship. Advanced Order E-Mail: doug.frost@rocketmail.com

SKY-PUP - 1, A FLEX-WING BOOST GLIDER

This Glider Kit has a 16 Inch Wingspan.
The Wings are 2 mil. Black Plastic Sheet.
The Advantage with a Flex-Wing is a Straight Up Boost. This Glider can Fly: A, B, C, D or E engines. Near peak altitude the eject charge pushes the Glider out. The Glider is protected from the eject blast by a fiber rings & wood piston. The rubber elastic Snaps the Wings Open. This rubber tubing is Very Strong. This is a well built Glider with a Plywood Center Spar & Plywood Wing Spars too. The Nylon Bolts & Nuts are strong pivot points. This Glider is based on a David Shaw design. He flew with the BAYNAR Club, near San Jose, Calif. David won many Glider Contests from 1977 - 80. This Glider will turn many heads at Launch Day. This Kit includes the Booster, engine adapters & A Complete Directions Booklet. Eyes & a Smile are included. You could set U.S. Glider Records. Website: Frost Rocketry .Com, \$24 + 20% ship.



**Doug Frost Rocketry expects to have their Jayhawk Kit ready July 15th. Doug passes on this offer:
Half Off the Shipping Costs to fellow NARHAMS Members! Call Doug with those orders at:
530-320-1863, Noon to Six P.M. Mon. thru Sat. (EST).**

Outreach: 29th Annual Rockville Science Day - 2018

By Alex Mankevich

The 29th annual Rockville Science Day was held at Montgomery College on Sunday April 22, 2018. This annual event always emphasizes a variety of science and technology-related exhibits, displays and hands-on activities. The Science Day slogans express “Inspiring a passion for lifelong exploration of science” and “science that underlies everyday life”.

About 109 exhibitors were on hand to amaze the visitors with activities such as telescope viewing, a travelling planetarium, all kinds of robots, backyard wildlife, ship models, microscopes, electric vehicle demos, quadcopters, 3D printing, and brain games. The event’s host, the Rockville Science Center, Inc., assembled a program to include the varied disciplines of science to include agriculture, biology, botany and the like.

NARHAMS hosted our hands-on model rocket build sessions of Alpha IIIs which were followed later that afternoon by the model rocket launch on the campus’ athletic field. We had set up an information table outside the faculty dining room complete with brochures for our Section, TARC and the Apollo Contest. We also distributed from this station the admission tickets to our two build sessions. Inside the build room we set up a table with a variety of model rockets on display. This display included a night launch model, an egg-lifter and an Orbital Transport model.

NARHAMSters devoting their time and effort included Alex Mankevich, Alan Williams, Ed Pearson, Raul Pena and Sarah and Ed Jackson. This is a veteran crew that works together very well. We also keep tuned into what we can do to make this event go even smoother. Raul excels in his role as the lead instructor for the build sessions. Ed and Sarah Jackson astutely strategize how to channel the youngsters to participate in the build sessions. We always do some pre-building preparatory tasks such as cutting the slot in the engine mount tube for the engine hook and pre-inserting the screw eye into the nose cone. We’ve found that by performing these pre-build tasks that we can avoid the agony of lost pieces and eliminate the need for the youngster to handle any sharp instruments. Mayilan Thanigai from Explorer Post 1010 also helped us for both the build sessions and the launch.

Our recently-purchased portable display banners and table runner made their second appearance in ten days. NARHAMS is now capable of presenting a display booth which is complete with the professional, eye-catching swag of well-funded exhibitors.

Continued next page



A mind expanding array of exhibitors.

Photo: E. Pearson



Raul uses his super-sized Alpha III model to demonstrate the intricate steps of the model rocket build.

Photo: A. Mankevich



NARHAMS new swag.

Photo: A. Mankevich

Rockville, Continued

We didn't have to bend too many arms to recruit the youngsters to participate in the build sessions. We informed the parents that the build sessions each take about 45 to 55 minutes. We also asked the parents to appreciate that we expected the youngsters to stick around for the afternoon's launch, which usually takes place around 3:45 pm. Alex peeled off around 3:00 pm to begin setting up the launch range on the athletic field. A few of the earlier build session participants were eager to help Alex assemble the range. Alex doled out to the youngsters such tasks as carrying what lightweight equipment we had and attaching the clothes pins to the launch rods.

The launch weather thankfully was cooperative. The temperature was comfortable with a slight breeze blowing across the launch range. Alan Williams provided the 'voice' for our launch activities and served as firing officer, provided color commentary and performed the RSO duties. Alan welcomed Bob Ekman to the mic to say a few words about his two Explorer Post 1010 teams that qualified for this year's TARC finals. Their teams qualified with unprecedentedly low and practically perfect scores. Sarah Jackson helped to distribute the model rockets to the launch participants. Explorer Post 1010 members Jose Collantes, Maria Collantes, Aman Sharma, and Mayilan Thanigai served as pad assistants. Ed Jackson tracked the inbound flights to make sure that the modelers all had their rightful models returned to them, since we've had instances in the past where spectators had run off with landed models that belonged to someone else.

While we were busy with our activities, NARHAMsters Scott Branche and Kevin Johnson manned the Hobby Works booth the main gym. Kevin later came out to the athletic field to video our launch activity with his remote-controlled drone. Raul made it a family affair by bringing along his daughter Fiorella and her friend, both of whom participated in the build session and launch.

Rockville Science Day is usually a hectic day for its NARHAMS volunteers due to its two back-to-back build sessions followed by the rocket launch and the range clean up, all of which need to be completed between the hours of 1:00 pm to 5:00 pm. Our veteran and capable crew keeps this tight schedule from becoming too chaotic or unmanageable. We are ever appreciative of the fact that of all the science activity offered at each Rockville Science Day, the model rocketry activity has remained for the 29th consecutive year one of the prime attractions of this annual celebration of science.



It Was Nice While It Lasted: NARHAMS Loses the Ag Center Field By Mark Wise

We didn't know it at the time, but 2017 would be the last year for NARHAMS launches at the Carroll County Agriculture Center. New management and a disgruntled farmer led to the loss of an alternate launch site that, though not without problems, allowed our members to fly mid-power rockets without worrying about sharing the field.

I remember the search for a field. Jim Filler, King Zog at the time, tasked me with finding another launch site for NARHAMS. It took three years, but we finally made contact with the manager at the Ag Center and scheduled a demonstration for her. We obtained a NAR insurance certificate for the Ag Center on short notice, and on August 30, 2011, Jennifer Ash, Alex Mankevich, and I set up a rack in the Gesell Lot behind the main buildings. We flew a power series of 1/2A through D along with a boost glider, a two-stage rocket, and a helicopter for good measure. Nichole, the manager, approved of what she saw and agreed to let NARHAMS use the lot and back field as a launch site. She even waived the standard Ag Center fee, agreeing to accept whatever donations we could collect from the flyers.

The Ag Center was a bit hilly, and it was too close to occupied buildings for HPR, but the lack of athletic fields made it a good field for everything up to G total impulse. Every so often a rocket would land in the trees to the northeast or the tall corn to the southwest of the rangehead, but we were generally pretty successful with recovery.

We continued to fly three or four times a year at the Ag Center through 2017. The first signs of trouble appeared when the new manager insisted on a fixed fee for each launch. I talked her down to \$75 per launch (from \$150!), but it wasn't a good omen. Then, when I called to set up the schedule for 2018, she let me know that the back lot wouldn't be available. She offered us an alternative site in front of the buildings. It was about the size of the Goddard launch area, with rocket-eating trees and a pond bordering the area. It wasn't going to be worth driving up to Westminster for that, so after a discussion at the January NARHAMS meeting, I declined her offer on behalf of the club.

It was nice while it lasted. It wasn't perfect by any means, but it was a decent field. Does anybody have a suggestion for another field?



Bits and Pieces

Upcoming Meeting
Presentation Topics:

June 2	Night Launch Lights
July 7	Pot Luck Picnic
August 4	Open Build

Upcoming Launches/Themes:

Jun 3	NASA Goddard public launch
Jun 16-17	Mt Airy, ECRM-45, NRC & Sport launch
July 1	NASA Goddard public launch
July 2-3	Camp Snyder Scout launches
July 11	SISTER launch at Goddard
July 15	Apollo Contest at Goddard
July 21	Mt Airy, Gliders!!!!
July 29-Aug 4	World Space Modelling Championships, Poland
Aug 4-10	NARAM
Aug 5	NASA Goddard public launch

Welcome New/Renewing Members

New Members

Roy Houchin, Arpit Misra

Renewals

Tom Bagg, Joanna Bagg, Dick Stafford, Chuck Schofer, Isaac Schofer, Alan Williams, John Petrie

Announcements

New Online Store for NARHAMS Merchandise:

<https://www.cafepress.com/narhams>

NARHAMS now has an online store for club merchandise. No more waiting for a group buy. Lots more choices of colors and styles. Plus, a huge variety of items, much more than we have ever had in the past.



Shirts, Hoodies, Hats, Mugs and more!

End your loved ones' gift shopping dilemma - leave this page open and circle this announcement.

Not Reading Your Own Copy of the Zog-43?

Join NARHAMS and have your own copy emailed to you hot off the press. Only \$5/year! [Click here.](#)





Competition Corner: A Summer Full of Contests and Building Inexpensive FAI Style Models

East Coast Regional Meet (ECRM) - 45 June 16-17, 2018

1/2A Parachute Duration
1/2A Boost Glider
A Payload Altitude
A Helicopter Duration
Open Spot Landing
Sport Scale

This will be both a contest and an NRC sanctioned launch (as well as a Sport Launch). It provides all participants the ability to fly any of the six NRC events. This event will award trophies for first place in all divisions for the specified ECRM events only.

NOTE: if you choose to fly eggloft for NRC, you must provide your own egg(s) as eggloft is not an ECRM event. Payloads will be available to borrow. Firefly altimeters will also be available to borrow.

All contest forms, launch equipment and stopwatches will be provided. If you choose to fly in the "ECRM" contest, there is a \$10 fee for A& B division entries, and a \$20 fee for C&D division entries.

There will also be a BBQ picnic to follow on Sunday afternoon. \$7 per person or \$25 per family of four or more.

Steel City Smoke Trail 18 – June 2nd & 3rd, 2018 Cedar Grove, PA

All 6 NRC events
1/2A Boost Glide
A Helicopter Duration
A Payload Alt. (18mm)
C Super- Roc Altitude w/altimeter – NARAM event

Meet champions will be determined from the last four events listed above

Contact: [Pittsburgh Space Command](http://www.psc473.org/)
(<http://www.psc473.org/>)

CanAm Cup 2018 Muskegon, MI June 8-10, 2018

World Cup events: S4A, S6A, S8E/P, S9A
Open International Events: S3A, S2/P

Contestants must have an FAI license to fly in the WorldCup.

Contact: Mike Nowak, 2349 Coventry Road,
Cleveland Heights, Ohio, (216) 337- 9537

NARAM-60 Competition and Rocketry Festival

Events:

1/2A Parachute Duration*
1/2A Boost Glide Duration*
A Streamer Duration*
A Helicopter Duration*
A Payload Altitude*
C Eggloft Altitude*
B Cluster Altitude
C SuperRoc Altitude
Classic Model
Sport Scale
Research & Development

August 4-10, 2018
Hudson Ranch
Pueblo, CO

Rocketeer Reunion on August 4
Keep tabs, new activities to be announced

For current info, go to
www.nar.org

NARHAMS NRC Launches

Held in conjunction with the following
Mt Airy Sport Launches:
June 16-17
September 15
November 17

NASA Goddard Visitor Center Model Rocket Contest



WHEN: **Sunday July 15, 2018 12 noon – 4pm**
(no rain date)

FOR: All Area Model Rocketeers

WHERE: NASA/Goddard Visitor Center, Greenbelt, Maryland
(I-95 Exit 22A, Baltimore-Washington Parkway Exit for
Route 193 East, then follow signs to Visitor Center on ICE Sat Road)

EVENTS: "Lunar" Spot Landing

COST: Free

REGISTRATION: Register at the launch site on the day of the launch

SPONSORS: This contest hosted by the NASA Goddard Visitor Center and conducted by the National Association of Rocketry Headquarters Astro Modeling Section (NARHAMS). Assistance has been received from the Maryland Space Business Roundtable and model rocket companies.

AWARDS: First through fifth place trophies and model rocket kits for each event have been donated.

WHY: This event is to commemorate the 49th Anniversary of the Apollo 11 Moon Landing, and promote interest in Space Sciences among area students.

Contest Rules

1. The contest is open to all model rocketeers.
2. Contestants must follow the National Association of Rocketry (NAR) Safety Code
3. Modelers must provide their own model rockets, wadding, engines, igniters, and prepping tools. The Space Center will provide the launch equipment suitable for 1/8" and 3/16" diameter straws (launch lugs).
4. In each event, contestants may fly either as an individual or as part of one team. Entry into both team and individual competition is not permitted.
5. Model rockets must use a single (NAR classification and safety certified) engine for each flight. "D" class engines or greater are prohibited.
6. Total weight of the model rocket with engine must be less than four ounces.
7. Model rockets must pass a preflight safety, engine and weight inspection at the launch site prior to launch.
8. Model rockets must land safely and must use either streamers or parachutes or gyrocopter-type devices for their recovery.
9. Model rockets must not separate into two or more unattached parts during flight.

Contest Judging and Other Important Information

1. Modelers may launch their models one time.
2. A launch is a successful ignition of the engine. A flight is when the model rocket starts to move upward on the launch pad and until the model rocket finally stops its descent.
3. The object of the event is to determine whose flight comes closest to reaching the center of a circular 125'-diameter "Moon" marked on the ground.
4. If a model rocket lands on the "Moon," contestants must leave the model rocket undisturbed until the model rocket is measured.
5. Officials will measure all model rockets that land within the "Moon's" boundaries.
6. Measurement will be from the "Moon's" center to the tip of the model rocket's nosecone. The measurement becomes the contestant's score.
7. The person with the smallest measurement (i.e., closest to the "Moon" center) will be declared the winner. The next smallest score will be second place and so on.
8. The contest will be flown in two age divisions: one is for those 15 years and younger; the other is for those 16 years and older. Teams will be classified by the age of the oldest team members.
9. Decisions of the judges are final.
10. These contest Sundays have traditionally been some of the hottest days of the year, so be prepared. Also, please be prepared to have FUN!

Time Schedule

Visitor Center Hours for This Event	12 Noon to 4:00 p.m.
Contest Registration	12:00 p.m. to 2:30 p.m.
Opening Ceremonies	12:30 p.m. to 12:45 p.m.
Contest (Flying Period)	12:45 p.m. to 2:45 p.m.
Awards Ceremonies	3:30 p.m. to 4:00 p.m.

For further information, call the Goddard Visitor Center at (301) 286-8981, Tuesday through Friday, 10:00 a.m. to 4:00 p.m.



Getting Into FAI Style Flying Without Breaking The Bank

By: Kevin Johnson

Photos and graphics: K. Johnson

I have been lucky enough to have been involved in FAI international rocketry competition since 2005, and over that time I've seen what fun can be had when flying against some of the best competitors in the US and the world. We have a small but slowly growing pool of "internats" competitors in the US, and even though FAI style flying is in the pink book, we don't see too many of the events being flown.

Two of the most common reasons I hear are that the rules are hard to understand, and the models are very difficult to build requiring a large cost outlay to even begin to build models for the events. I don't feel the rules are any more complicated than the typical multi-round events we have, so I'm going to focus on the second topic- cost of entry.

The models used in FAI style events look different than your typical NAR model. Take S3A and A parachute duration for instance. A typical NAR PD model is minimum diameter, and uses relatively small chutes in relation to the size of the model. Per the rules a FAI style model must be a minimum of 40mm in diameter for at least half of the 500mm length, and typically use a chute sized around 30-40 inches. These models can weigh as little as 5 grams!

To make ultra-light and strong models, many competitors use a fiberglass, epoxy and tissue composite construction that is built around a custom aluminum mandrel. This particular construction technique **does** require a not insignificant investment in materials and tools to achieve, but there are other techniques that can be used to create lightweight models for FAI competition. These techniques utilize material you probably already have in your workshop, or are easily available. With these techniques the barriers to participating in FAI style flying can be broken, and more competitors can enjoy new challenges and possibly try out for a spot on a future US Spacemodeling Team.

The parts-

To make a legal model you need a tube of at least 40mm diameter, at least 250mm in length. You can make a transition from 40mm to a BT-5 motor tube to make up the remaining 250mm, or you can fly a straight cylinder of at least 500mm in length. The trade off in drag make having a transition more advantageous, so that's what I'm going to present. To keep things light, paper is going to be our choice of material.



You will need some fins, and 1/32" balsa with no surface prep is perfectly fine. You can go to town and cover them with tissue and epoxy on your later builds, but for now, we will leave them bare, with just a light sanding.

For the nose cone and shoulder you need to keep things light. As a percentage of the overall model mass, the cone and shoulder can be pretty high. You can buy lightweight vacuum formed nose cones, or make your own lightweight cones from paper. I'll show you two paper versions, including a paper shoulder.

For a mandrel to form the tube, you don't have to look further than that Big Bertha kit in your kit collection. BT-60 tube has an outer diameter of 42mm which is perfect for making FAI tubes. Its diameter is big enough to meet the minimum requirements, but small enough that you won't be giving away too much performance to the folks with custom turned 40mm mandrels.

Centering rings and bulkheads for the ejection plug can be cut from recycled meat tray foam to reduce the mass of the model even more.

Continued next page

FAI Style, Continued

Construction- Part 1 Making the Body

To build the cylindrical part of the rocket tube you will need a sheet of 80g/m² paper or artist's vellum large enough to cut out a rectangle that is 132mm x 250mm. You will also need a cone template that will transition from 42mm to 13mm that is 250mm long. You can use one of the many online calculators or template makers, or the old fashioned formula to create the template. Each of these should fit on a standard sheet of letter sized copy paper. You can add an overlap tab to help in forming the parts if you like.

Cut out your tube pattern, and wrap it around your BT-60 mandrel. You can get fancy and glue the parts together, or use double-sided tape, but just running a strip of clear tape down the joint is sufficient. Try to keep things as straight as possible, and avoid wrinkles in the taped seam.

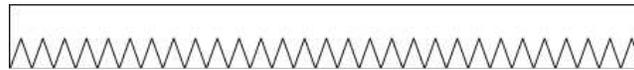
To make the transition section, pre-curl your pattern by gently rolling it over the edge of your table. Work slowly and try to avoid making any creases in the paper. Use your favorite glue or tape technique to join the seam, keeping wrinkles to a minimum.

You will need to join the main body tube to the transition, making a good connection and keeping things straight. You can make an easy alignment jig using a couple of centering rings and BT-5 tubing. The BT-5 to BT-60 rings can be found from Estes in the Laser Cut Centering Rings and Paper Adaptors set, or from Semroc for under

\$3.00 for a 6-pack. Glue two of the centering rings about 50mm apart onto one end of a 45cm BT-5. This will fit inside our BT-60 mandrel, and align the transition to the main tube.



To join the two parts of the airframe, make a coupler from a strip of paper like this, or use a pair of pinking shears to cut off the bottom of a 127mm by 12.5mm" strip of paper.



Slide the paper tube off the mandrel about half an inch, glue the flat part of the coupler strip into the tube with the points sticking out.



Once that has had a chance to dry, insert your assembly jig into the mandrel from the other end, with the BT-5 extending out the end of the tube with the points.



Next, slide the transition over the alignment jig with the large end facing the tube.



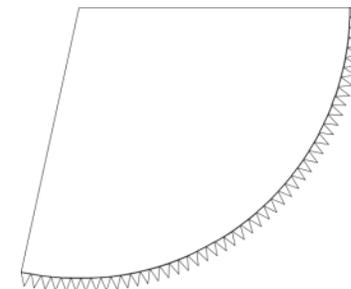
Bend the points on the coupler strip down slightly so they will fit in the transition, apply glue, and mate the parts together. Once the

glue dries, you should be able to slide the airframe off of the mandrel.

Construction- Part 2 Making the Nose

One of the biggest issues with trying to build lightweight models is finding a suitable nose cone. As I said above, most plastic or even balsa cones are a huge portion of the mass of the model we are building, and lightweight options like vacuum formed plastic are expensive (relatively) and won't fit our custom tube very well. Here are two options using paper to make a custom, lightweight nose cone for our model.

The simplest version is a simple cone glued to a paper shoulder. Start with a pattern to make a cone that will fit to the outside diameter of our BT-60 mandrel. When you cut it out, cut outside the bottom line a smidge to account for the thickness of our paper tube.



Add a glue tab and form the cone. Make a couple of copies so you have some to practice with. After making a few, it

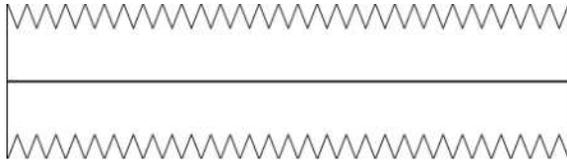
should be easy to get the cone formed and glued without any wrinkles or bumps.

For the shoulder, we will combine a paper coupler and a bulkhead made of meat tray foam. Start by making a strip of paper

Continued next page

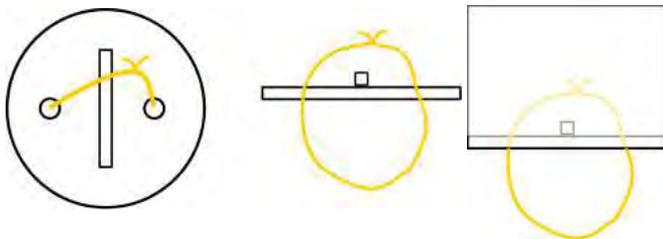
FAI Style, Continued

127mm by 35mm with darts along both the top and bottom edges. Again, pinking shears can be a big help, but you can use this pattern and an X-acto knife to cut out this part. You should end up with a ring that has an inner diameter around 42.1mm.



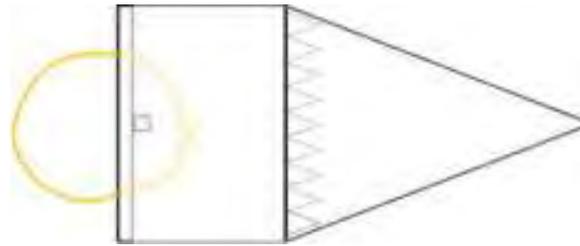
By coincidence, that is the diameter of the bulkhead we need to cut out of our foam tray. Once you have both of these parts made, you need to join them together. Fold the points on the bottom of the coupler strip inward and apply glue to them, then place the foam disk inside the coupler onto the points, and allow that to dry.

To make an attachment point for the shock cord, make two holes in the bulkhead, and glue a small section of 1/16" square balsa between the holes. Take a short length of Kevlar thread and pass it through the holes, tying a knot to form a loop.



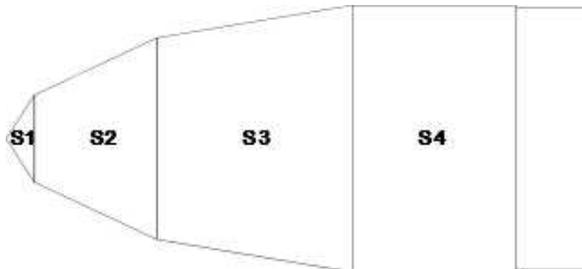
To join the shoulder to the cone, bend the points on the top of the shoulder inward

slightly to match the angle of the inside of the cone. Then put a line of glue inside the base of the cone, and mate them together, being careful to keep things even around the base.

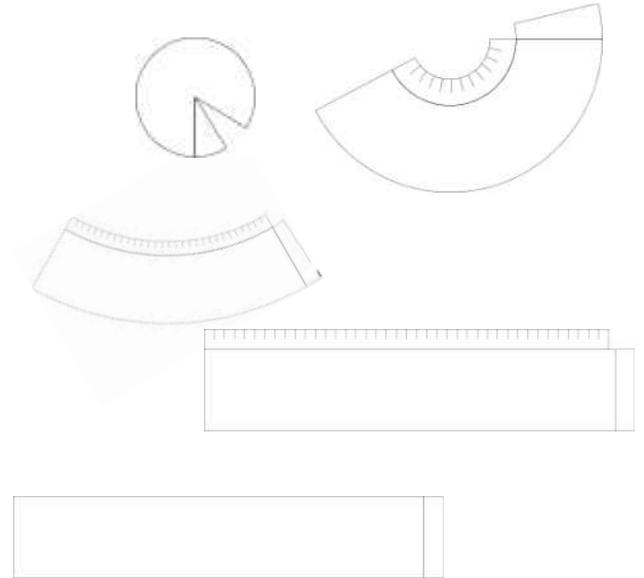


A more complicated way of making a paper nose cone that provides an approximation of an elliptical cone involves stacking different transition shapes, and topping them off with a flat cone. This is based off of work by Greg Poehlein posted to The Rocketry Forum.

Here is the overall view of the completed cone:



Sections 1, 2, and 3 are conical transitions glued together with a cylinder section 4. Inside section 4 is glued a shoulder. Here are the parts for the different sections.



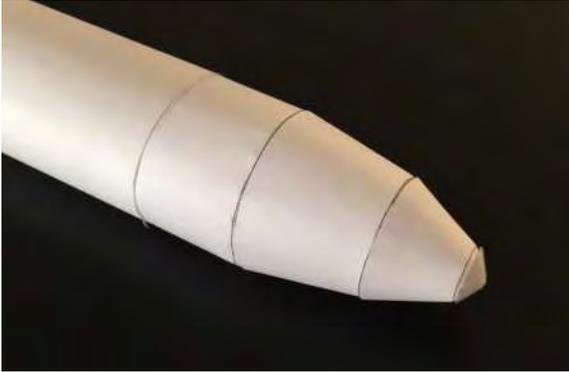
See last page for full size templates

Cut out the sections and pre-curl them by dragging them across the edge of your table. Apply glue to the tabs and form individual sections. Once dry, test fit the sections together, bending in the slotted tabs to make the lower sections nest into the upper sections. Once you are happy with the fit, apply glue to the inside of section 1 and attach it to the top of section 2. Do the same with the inside of section 2 and the top of section 3, and again with the inside of section 3 and the top of section 4.

Before gluing the shoulder part on, add a foam bulkhead as described in the simple cone section above. Apply glue to the inside of section 4, and slide the shoulder in place.

Continued next page

FAI Style, Continued



Construction- Part 3 Motor mount and Fins

To make a motor mount, you need to glue a piece of BT-5 tubing to the model. A simple way to do this and keep things straight is to reuse the assembly jig. Insert a spent 13mm motor into the end of the jig so that about 1/2" overhangs the end of the tube and use a wrap of tape to secure it. Cut a piece of BT-5 2" long and using your favorite method to mark 3 lines equidistant around the tube to use as fin alignment references later. Put the small section of tube over the exposed part of the motor case. Insert the jig from the open end of the tube until the 2" section of tube is almost all of the way out of the small end of the transition. Use a drop of thin CA to glue the motor mount tube to the transition. Be careful not to glue the assembly jig to the model! Slide the assembly jig out of the large end of the model and you should have a straight section of tubing glued to the transition.

You can make your fins from 1/32" balsa,

and just slightly round over the leading and trailing edges. You might need to reinforce these fins with paper or a coat of this CA, then sanding smooth. An alternate is to use 1/16" balsa and sand a symmetrical airfoil in each fin. This is a lot of effort though, and I don't think you gain that much over the 1/32" balsa fins.

Using the lines you marked on the motor mount, glue the fins to the tube, making sure the trailing edge is at least 1/4" from the end of the tube. This will give you a place to wrap tape around the motor to keep it in the model later. Try and get the fins on as straight as possible. Any misalignment here will cause your model to spin or corkscrew, and not go as high. Several members of the US team use precision fin alignment tools, but as long as you are patient, and take our time, you can get good results with a nicely marked tube and your Mk I eyeball.

Construction- Part 4 Shock cord and finishing touches

To attach the nose cone to the body and provide a place to connect your recovery device, I like to use a shock cord made from button thread. You can get this at any craft store with a fabric section, one spool will last you for lots of models. Cut a



section of thread about 3 times the length of the rocket. Take one end and glue it to the joint between one fin and the motor tube. Form a loop at the other end of the shock cord. This will be your attachment point for the recovery device. Thread the loop through the Kevlar on the nose cone shoulder, and then attach your parachute or streamer to the loop. When your model ejects the recovery device, this allows the nose cone to slide down the shock cord and rest against the body, away from the chute or streamer to avoid tangles.

If you don't have a launch tower, you can glue two 1/8" diameter launch lugs to the bottom and top of the cylindrical section of the body tube, centered between the two fins that don't have the shock cord attached.

Flight prep is straight forward.

Insert a motor into the mount so that about 1/4" sticks out the end. Wrap a strip of tape that overlaps the end of the tube and the motor to secure it to the model. Insert wadding or an ejection plug into the model. A plug can be made from foam insulation, or by making an extra nose cone shoulder as described above, but without the holes. Next, fold and prep your recovery device and insert it into the tube, pushing the plug/wadding down into the tube. Pull the shock cord tight along the body, and then roll the excess slack around your fingers. Insert the wrapped up shock cord into the body and then install the nose cone.



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