Zog-43

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Official NARHAMS Newsletter
Editor: Don Carson

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.

If you have any questions about ZOG-43, NARHAMS, subscriptions, or if you have any comment(s), correspondence, or if you'd like to submit an article, send them to:
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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 and at Old National Pike Regional park near Mt. Airy, 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 - HIstory Being Made and History Being Recalled

Don Carson, NAR #11069

In this issue, we pause to bid a fond farewell to longtime NARHAMSter John McCoy. John was a man who truly loved rocketry. He was always building and always flying. Not only that, but in his online presence, he was always willing to help those with a "how to" question. These were, more often than not, people he didn't know and was unlikely to ever meet. He just did it for the hobby.

For years, he created Tech Tips far too detailed to put in a newsletter. We banked that knowledge in our online library, you can find it here. Click the link and browse the variety of topics he documented. It is quite an amazing collection. It did not benefit him, he just did it for the hobby.

Also featured in this issue, we have coverage of this year's NARCON, a history making international competition in Texas, as well as, a piece by Stuart Lodge on one of the most storied rocket clubs in Europe, Raketomodelářský klub Krupka.

As always, my thanks go out to everyone who contributes to make this a such an outstanding newsletter - the credit goes to you.

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 parnoid about that sort of thing.

Front Cover: Artist's illustration of a prototype of SpaceX's Starship vehicle. Actual vehicle being build and planned to begin test launches in June of this year to celebrate ECRM.
Photo: Adrian Mann/Steve Jurvetson

Back cover: Liftoff of the Crew Dragon and Falcon 9 rocket as seen from inside the perimeter fence at Launch Complex 39A, Kennedy Space Center.
Photo: Jared Haworth We Report Space

ZOG ROYAL COURT
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2019 NAR Convention Cape Canaveral, Florida

By Don Carson

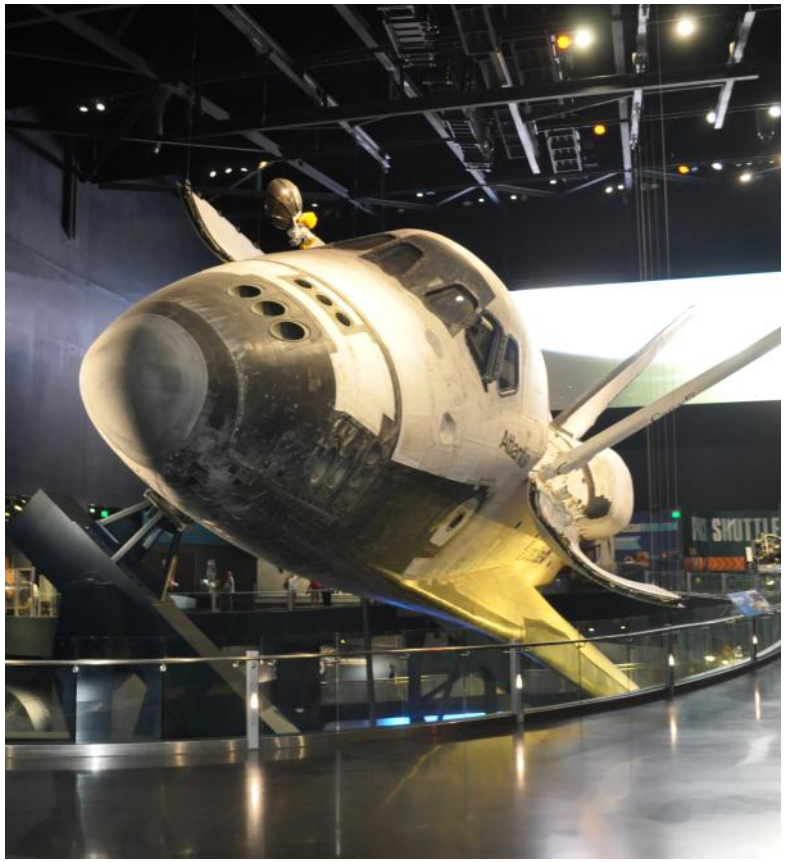
Photos: D. Carson

The NAR's 2019 annual convention (NARCON) had everything a rocket geek could want:

- *Tech sessions on all facets of rocketry*
- *Get to Meet Model Rocketry legends in the flesh*
- *A Live Falcon 9 launch*
- *Tours of historic rockets, missiles, launch pads, and controls centers from the very start of the space program at Cape Canaveral Air Force Station and the Kennedy Space Center through the next generation of crewed space launch capabilities.*
- *Meet old friends and make new ones at the friendliest non-launch gathering of rocketeers there is.*
- *Florida in February!*

Full coverage will be coming in a future Sport Rocketry mag, but I will focus on a few sessions, the tours, and the Board of Trustees meeting. Elsewhere in this issue you'll find great pictures from NARHAMster Jason Haworth of the SpaceX Crew Dragon Demo-1 mission and recovery!

L: John Hochheimer, Jay Marsh, Trip Barber
R: Dr. Kidwell.



Shuttle Orbiter Atlantis spectacular presentation.

Opening Reception

Friday evening featured a social at the Kennedy Space Center's Visitor's Center. If you have never been there, you should go, it is a Mecca for rockteers. It is very well done, One could easily spend two days visiting and taking bus tours of KSC. After some time to visits exhibits, the reception featured an opportunity to meet old friends and make new ones.

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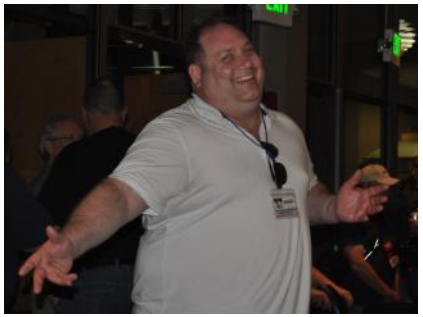
More Opening Reception

Bob Alway, Steve Kristal, and Mike Nowak.



Above and clockwise: the Duffys; the inimitable Chad Ring; Jim Wilkrson and his bride; Wolfram Kiparski and Chris Flanigan .

Technical Sessions

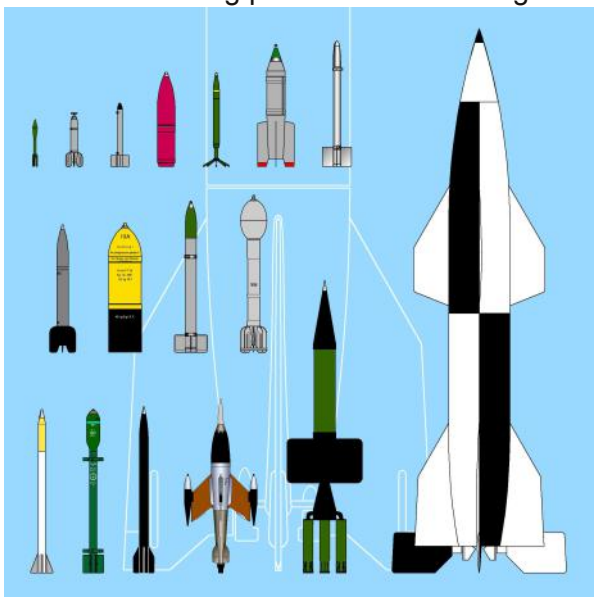
Beyond the V2; Less-known Rockets of WWII

Peter Alway

A new chapter is unfolding in the world of scale modeling. Just in time for NARCON 2019, Peter has put together a new project called Beyond the V-2, Rockets and Missiles of WWII. Peter Alway's books have long been the go-to source when looking for data scale models. In this booklet, he has focused on a selection of unusual and historically significant rockets from the era leading up to and including the second World War. He also traces their influence on latter day rockets. A cool thing about his selection of rockets is that nearly all of them could conceivably be built as scale model rockets.

First, he shared a little history of solid propellants, explosives, black powder, nitrocellulose, nitroglycerin, and the like.

His research leads to a wide variety of information about these rockets and the people that made them. This makes for a fascinating presentation covering a multitude of topics.



For instance, early rocketry development in Stalin's Russia was hampered because a competing innovator could be killed or imprisoned by rivals simply by spreading a rumor about their political leanings. Over the years, this substantially reduced the pool of available rocket scientists.

Peter shared a great tip for online searches: translate your Google search terms into a foreign language (Russian, German, etc)

Continued next page

NARCON, Continued

Cape Canaveral Tour

Hanger C, where all the restored beauties are.

Peter Alway needed just a few more Bomarc measurements.

A Hounddog pretty beaten up by hurricaine winds.

Exploerer 1's Launch Control Center, including old analog computers!

Plenty of opportunities to document the details, harder to get an overall view.

RASCAL cluster - extra points!

NARCON, Beyond the V2, Continued

and then do your search with those terms! This will often yield lots of results that don't show up when using the English terms. In addition, if you use Chrome for your browser, you have the option to translate the results back to English.

Peter discussed a sampling of the rockets included in the new book, including the Russian Katyusha unguided barrage rockets and Great Britain's 3.25" anti-aircraft batteries.

He touched on the US development of the Bazooka which was based, surprisingly, on Robert Goddard's early solid propellant work! Goddard is, of course, more popularly known for his work in developing the first liquid propellant rockets here in the States and his advancement of staging as a means to reach extreme altitudes. Those Bazooka rockets ended up being the upper stage of the Scout launch vehicle!

If you get the chance to see Peter do a presentation on his research, don't miss it. They are lively, unpretentious, and chock full of great tidbits of info. His book is available through NARTS.

Technical Sessions

3D Printing in Scale Model Building

Mike Nowak

Most people who want to get into 3D printing ask what printer should they get. Mike says, “Whoa, back the bus up, that is ***not*** where you start.” First you need to learn to draw what you want to create (unless you just want to print other people’s designs). Mike led us down a very pragmatic approach to getting into 3D printing:

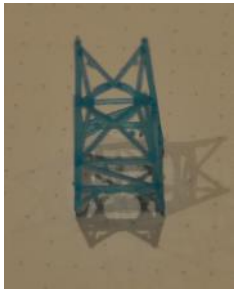
- First learn to create the files that describe the object you want to print.
- Use existing 3D print services to start off.
- Once you have gained experience, you can decide if buying a printer is right for you.

Design

After taking two community college courses in Solidworks Computer Aided Design(CAD), whose license costs ~$4k, Mike suggests a different route. He suggests you try learning a cheaper or free alternate like TinkderCAD. CAD software has a steep learning curve and you need a different mindset when creating objects with it. Essentially, you make complex objects out of multiple smaller simple objects.

Once you have your design finalized, the CAD software will export a print file (an STL file).

The printer will take that file and convert it using a slicer program into g-code for the printer to use. Wait, what? Here is where Mike directs you to a 3D printer service, like Shapeways, to print your design.



LES tower printed in metal(l) and plastic(r).

Printing

3D printing is slow. Ordering parts can have a turnaround time of several weeks. You really need to plan months ahead for complex parts like you might use for a scale model.

There are several advantages to going with a print service. Unknown to you, your design may have errors in it that can ruin the print job. Shapeways, for instance, checks printability and checks the feasibility of your design free of charge. This can save you time and money.

A variety of 3D printed parts.

Print services offer access to high end printers and a wider variety of materials that can be printed (including metals) which can result in stronger/lighter parts. They can also make parts with smoother surfaces than consumer-grade printers.

You might also find a Makerspace where you pay only for materials used to print. Local universities and libraries may offer access to 3D printers at reasonable rates.

After a time, you will know what materials you want to print with and what kind of surface quality you require. You will also have a better feel for how much you would actually use a 3D printer of your own.

Buying a printer

If you are ready to shop for a 3D printer, here is what you are looking at:

- <$500 - entry level, not very smooth surfaces, limited print materials
- <$1k - more complex machine, larger, smoother surface finishes, a wider range of print materials available
- <$5K - near professional grade
- $100k and up – professional grade

3D printed corrgated tube.

Mike suggests you ask for help before buying a printer. You should recognize that it will be obsolete in a few years. Even with the best of printers, you are still will have some work to do. The parts will need some filling and sanding to get the surface finish you will need for scale models.

Board of Trustees Meeting

How do you get the scoop on what's going on in the NAR? Attend a Board of Trustees meeting. The Board meets twice a year. This was the second one I've attended in the past two years. What I've discovered is that, you, as a member, can find out what going on and why. You can even have an input to the process.

News from NSL- Joining the current Apollo mania, LOC released a 7.5" diameter Saturn V! They sold out first run of 50, but don't worry they are producing another run.

NARAM – will be held this year in Muncie, Indiana at the Academy of Model Aeronautics (AMA) International Aeromodeling Center. Jay Marsh, AMA VP and NAR member, joined the meeting to discuss the AMA perspective on hosting our annual Rocketry Festival on their turf. According to Jay, the AMA is extremely interested in, and supportive of, this venture. They will be promoting the Festival in their Model Aviation magazine (circulation over 200K). They see a mutual benefit to potentially increase membership for both organizations. The AMA sees the NAR as a model for recruiting youth into the hobby. To that end, registration to NARAM (contest or sport launch) will include a free trial 90-day membership in the AMA for Senior members. Junior members will receive a free membership until age 19! This membership will include the electronic version of the outstanding Model Aviation magazine, which will have an article on the Rocketry Festival. They will also be offering discounts for new AMA members.

There was a discussion of what can NAR and AMA can do to attract AMA member interest. Among the discussion topics was a Combined Duration Event using Estes Alpha III rockets and the Alpha AMA rubber powered starter plane, and also the inclusion in the Entry Packet of a B/G designed for that field.

Section Championship – based on requests to reinstate an annual Section Championship Award, a proposal has been assembled and distributed to Section Advisors for feedback from the Sections. The Board is targeting the new Award for the next Contest Year.

Upcoming events – the discussion of *potential* sites for upcoming national events included: 2020 NSL – Alamosa, CO; 2020 NARCON – Tuscon, AZ; 2020 NARAM – Muncie, IN again, or Geneseo, NY.

TARC – There was a discussion of the plans for this year's TARC which featured a focus on the Apollo anniversary with a demo of an Apollo-like rocket, a high power Saturn V, and the 100th anniversary of the AIA.

Financials -Tom Ha Our bottom line grew last year. NARTS sales are really down. Insurance costs only went up 0.3% even though the number of members went up ~500! This due to our great safety record.

John Hochhiemer's View to the Future! We are due to have audit or an Accounting Review.

- Get best practices recommendations.
- The person resolving the account should not be able to write checks
- Need a voucher/ requisition system for checks and balances on writing checks. Can be an online system to increase accountability.

Lunch Discussion

The Board had a wide ranging discussion of B Division support. Travel grants -do not seem to be giving "much return on investment." They discussed if there is a better way. The idea of a reconstituted LAC was discussed.

Secretary Updates

- Elections: Current terms are up for Carol, Tom, and Vince (who will not running again). Vince will continue as Education committee chair. Identified the need for Election monitors (Judges) at NARAM.
- NARTREK – current requirements reflect the old Pink Book rules for the competition part and need to be updated.

Board of Trustees Meeting

Committee Reports

Education Committee – Supporting the April National Science Teachers Association (NSTA) Conference. The AIA is funding a booth with us. Trip Barber has the lead.

Section Activities - Huntsville Space and Rocket Center hosting a mass launch of 5000 rockets on July 16 (Apollo 11 50th anniversary of the launch). They will use 1/2A6-2 motors with e-matches. It's all done by Huntsville (not the NAR). They will sell tickets, have press/TV. Also, they are sponsoring a global launch over the 24hr period. Any rocket (water, stomp rockets, etc) can be registered to set to set a record.

Sport Rocketry Magazine - One issue expanded 8 pages due to extra content being available. Todd Schweim is providing content help, tips on taking good photos.

Website update – From Todd Schweim, National Event websites are now centralized. This will provide a common look and organization across the events and from year to year.

Top 10 NAR Website Hits:
- NAR Home Page
- Club Locator
- Section Guidebook
- My Membership
- Find a Local Club
- High Power Rocketry
- Join the NAR
- NARCON
- Safety Code
- Launch Sites

I highly recommend going to a Board meeting. It is your NAR, take the time to sit in on a Board meeting once in a while. Both you and the NAR will be the better for it.

SpaceX Crew Dragon Demo-1 Mission Launched During NARCON

The Crew Dragon atop a Falcon 9 Block 5 rocket at LC-39A, Kennedy Space Center. The new crew access arm is nestled against the spacecraft (at left). *Photo: Jared Haworth/ We Report Space*

After spending a week in orbit, the crew dragon splashed down in the Atlantic Ocean northeast of Jacksonville, Florida. It was retrieved by Go Navigator, SpaceX's modified support ship, and transported back to Port Canaveral for post mission evaluation. *Photo: Jared Haworth/ We Report Space*

In Memory and Celebration of John McCoy

By Ed Pearson

John McCoy, NAR 15731, passed away February 2, 2019. The cause of death was kidney failure, and for more than a year he fought aggressive cancer that had spread from his prostate. He was in his sixties and lived in Washington, D.C. To our section he was a patriarch, having been in NARHAMS for thirty years. For the past two years he was section adviser while serving concurrently as ROMAC head. (ROMAC is a constitutional position and stands for Range Operations and Maintenance Committee. John was the chief—like forever).

He could bend metal, meaning he could do anything shop wise and often would prove it by accomplishing unrelated tasks requiring different skill sets, such as modifying the club's away-pads, repairing a fiberglass retrieval pole, insulating pad's igniter wires, fabricating metal FAI-measuring templates, designing range layouts, generating poles for range P.A. speakers, working leather to make straps, hinges and cases; generating signage, and so much more.

That signage example spoke of his career, as a sign professional with Jack Stone Signs of Landover, Maryland, where he worked for decades and retired. One club member remembers seeing John leading a group of designers around a Metro subway stop talking about sign-engineering specs required for the system.

That may have contributed to his knowledge as a paint expert. He knew what was compatible, techniques and products. He was the go-to man for advice and questions.

Another club member, Don Carson, recently wrote that John was “a craftsman beyond compare. He got involved in all aspects of both sport and competitive model rocketry. He was known online as Micromeister.”

The latter referred to his specialty interest in the last two decades with Micro Maxes. Working small and detailing, he deemed a worthy challenge. He made a fleet of historic aircraft or fanciful designs in micro scale, either by making them from photos or modifying static models.

John also went old-school in documentation. He recorded every flight he made and generated a book on his tips and ideas. You can see his technical tips on our Web site (NARHAMS.org—go to Library on the menu bar, then to Tech Tips).

John learned some of his skills from his dad and inherited his tools. He also used his dad's trailer in Chincoteaque, Virginia, for annual summer vacation getaways. When

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McCoy, Continued

he learned of the 1988 US/USSR contest was at nearby Wallops, he got the family to go to see it. Shortly thereafter, John joined NARHAMS. Prior to this, John was a member of the NOVAAR section.

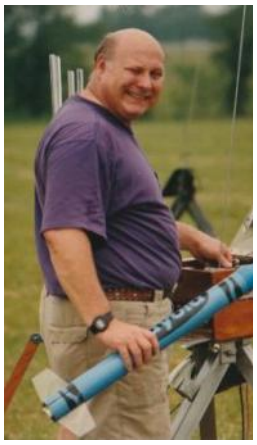
Initially John was into rocketry mainly for his daughter, Kathleen. She was eight when John joined NARHAMS. The club watched as Kathleen grew, finished high school (home schooled by mom Mary), got married, moved to Alaska and now has five children of her own.

Mary constantly supported John, coming to meetings, launches, contests, public events, and offering help/suggestions throughout the years. On the day John died, NARHAMS awarded John and Mary its highest honor—the FROG award (For Rocketeers Of Greatness; it was John's second FROG award).

In addition to Mary and Kathleen, John leaves behind two children from a previous marriage—a son, John, Jr., daughter, Sandy and respective families.

John was an eagle scout and lived his life as one—prepared. From life he formed conclusions and stuck by them. Anyone would tell you John McCoy was an alpha male. And yet he once restated that the club was for diverse individuals united by the common interest of model rocketry. NARHAMS had found a team player and now has lost a club patriarch, multifaceted expert, family man and friend.

I first met John at a NARHAMS meeting in 1989. I've been attending meetings and launches with John for the past 30 years. John and his family have always been family. John was like a brother. John always wanted to talk rockets and I spent time when I could with him comparing notes on anything rocket related. We flew NAR competition over the years including many an ECRM. Before the Micro Max motors came onto the scene, John built many model rockets from sport models to odd rocs to scale. Two of John's favorite events were Plastic Model Conversion and Cluster Altitude. We had fun flying these and other events through the years. John has a collection of "tech tips" on various topics on the NARHAMS website on the library page, lots of great stuff. I am saddened at losing him.



Jim Filler

F.I.R.E.2019 – Historic Contest

Article and Photos by Ed Pearson

Firefly Aerospace held F.I.R.E.2019, a remarkable spacemodeling event, March 7-9, 2019, at their Briggs, Texas test facility, and Cedar Park, Texas headquarters. (Disclosure—I was a guest of Firefly during F.I.R.E.2019). The event was remarkable as it (was):

- The first bilateral U.S. and Ukrainian spacemodeling competition—a milestone;
- The first U.S.-held bilateral spacemodeling contest in 30 years (see Zog-43, September/October 2018, for coverage of the 1988 U.S./U.S.S.R. contest);
- Corporate initiated, sponsored, hosted and with technical, social and public-outreach activities;
- Used leveraged resources of an organization other than NAR with NAR volunteer expertise;
- Flew new events (maybe for the first time internationally) and was an FAI-type contest which was not a world cup, continental/world championship or world air game;
- Perhaps forecasts future cooperation and events —such as annual F.I.R.E.s or a U.S.-held world spacemodeling championship.

Above: Cultural aspects included visiting Austin nightlife and a concluding excursion to the Alamo. (L-R: Uliana Biryukova, Serhii Serdiukov, Oleksandr Radchenko, Ohla Khmil, David O'Bryan, Valeryi Bidovskyi, Denys Khmil).

The flying field.

In summary, this event involved Firefly holding an FAI-type spacemodeling competition between U.S. and Ukrainian teams, which NAR volunteers ran, and had notable technical and public components. F.I.R.E. was an acronym for Firefly International Rocketry Event.

Specifically, six guests from Ukraine flew into Austin, got oriented and toured the city, traveled to Cedar Park (about 20 miles from Austin), toured Firefly's headquarters, and had three days of flying in Briggs with a team of (11) U.S. flyers. Everyone met visiting school children, who flew their own models, were treated to

Test Firing of Firefly Alpha's engine.

Oleksandr Radchenko launches his S2/P; team manager Denis Khmil watches.

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F.I.R.E.2019, Continued

remarks from Firefly's founder Tom Markusic and members of the Texas House of Representatives. They witnessed a static test firing of Firefly's Alpha rocket engine (narrated by Tom). Competitors attended a BBQ award-banquet presided over by NAR's James Duffy, Tom, and Michael Ryabokon, CIO and owner of Noosphere—Firefly's Ukrainian-based parent company. Following the contest, group members made an excursion to San Antonio and saw the Alamo before returning home with contest swag of shirts, hats, and coffee cups.

Firefly was established in 2014 with the objective of providing customers access to low Earth orbit. Its Firefly Alpha rocket is intended to fly as early as December 2019, with a 1,000 kg payload to a 200 km altitude. In 2017, Firefly was bought by Noosphere, a 5,000 member Ukrainian aerospace company. Noosphere ran the 2016 World Spacemodeling Championships in Lviv, Ukraine, and developed Cup Navigator, a Web-based spacemodeling-reporting software application. Noosphere is an FAI global partner.

The contest got its start after James Duffy and Matt Steele attended the 2016 world championships. Matt subsequently toured the Dnipro City, Ukraine, rocket facility, met with Max Polyakov, co-founder of Noosphere, and told Max about Firefly's purchase availability. Duffy met with visiting Ukrainian rocketeers at TARC in 2017, and further cemented friendships. Dialogues developed and in late December 2018, James let Matt know a meet was set and asked Matt to organize the U.S. contingency. For the next two months they worked on the meet—James with Texas' rocketeers and Uliana Biryukova, a Firefly business development associate who coordinated Firefly's resources. Matt worked with NAR members on the U.S. spacemodeling team who expressed interest and set about getting the contest together.

Five events were decided for the contest—egg lofting (FAI class S2/P), scale (S7), RC rocket glider (S8E/P), a variant on streamer duration (S6A/P), and an event that required multiple flights with different recovery devices (S12A/P). The last two events were unfamiliar to U.S. or Ukrainian modelers as the events exist in the FAI sporting code but are not recognized as world cup or championship events —where spacemodelers put their focus and hold their contests.

Marc McReynolds and his Atlas Agena model.

Valeryi Bidovskyi observes Denis Khmil's MAR-6 sounding rocket model.

F.I.R.E.2019 Event Director James Duffy.

CD Mike Nowak and his Little Joe II. That is RSO Nick Nowak watching the lift-off.

Continued next page

F.I.R.E.2019, Continued

The American rocketeers consisted of James Duffy (event organizer & contestant), Matt Steele (U.S. manager, co-CD & contestant), Dr. Mike Nowak (CD & contestant), Nick Nowak (RSO), Chas Russell (scale judge), David Bellhorn (student range RSO/firing officer) and contestants Chris Flanigan, O. James Lee, Dr. Steve Kristal, Marc McReynolds, Dave O'Bryan, Tony Reynolds, Herb Vinyard, and Wolfram von Kiparski.

Dave O'Bryan got his start in spacemodeling at the first US bilateral meet in 1988.

Herb Vinyard (foreground) and Dave O'Bryan measure their gliders landings in the S8E/P event.

Many on the designated Ukrainian team were unable to obtain visas to come to the U.S. Those who came had to do fill-in contest flying. Four of these had been here before at the 2017 TARC finals. Representing Ukraine were Denis Khmil, General Secretary of the Spacemodelling Sport Federation of Ukraine (Ukraine's NAR); Olya Khmil, Valeryi Bidovskyi, Oleksandr Radchenko, Michael Ryabokon, and Serhii Serdiukov.

Michael Ryabokon, as others there, had to wear many hats (perform double, triple, or even quadruple duty). In his case, he represented Noosphere, was president of the contest jury, chief scale judge, contestant, and on the night of the banquet while others prepped to get ready, he labored to letter certificates of participation. He also designed the awards and give-away shirts.

Other double-duty dippers on the FAI jury were Matt, Denis, and, as a nod, Ole Ed. Ed Tovar, a retired DARPA employee, was the volunteer student activity coordinator.

At least two schools sent model rocketeers to watch the contest, fly their own models and listen to talks of encouragement by three members of the Texas state legislature. One of the NAR-types said he was stunned by the student (6th grader's) questions (e.g., "What is the U.S. going to do when they no longer have to rely on Russia to get to the space station?;" or when a student explained to a parent the parts of James Duffy's Bumper-WAC table-centerpiece).

The field was at Firefly's engine test facility; with a test/office building, and vertical and horizontal test stands. The field was flat, vast, and bordered by cattle ranges. There were power poles too, and sure enough those electric lines caught a model or two. Because of a scheduled test engine firing, segments of the recovery field were cut-off from modelers. F.I.R.E. participants witnessed several firings of the Firefly Alpha engine—the first counted down and narrated by Tom before the students, spacemodelers, legislators, guests and press (local, Ukrainian and Firefly-arranged).

Student rocketeers visited F.I.R.E., flew their own models and met with members of the Texas House of Representatives.

Continued next page

F.I.R.E.2019, Continued

Firefly had erected flag poles at our launch site and rented two corporate party tents to accommodate the contestants, offer shelter, and house refreshments/ lunch. There were plenty of tables and chairs. The portable commode was first class. (This writer did not find the fluorescent lighting garish at all, the vanity sink was a nice touch, but people commented that the piped-in country music was a wee loud).

Since F.I.R.E. was a rare bilateral meet and not a world cup, the contest was not sanctioned by the FAI. James and the NAR volunteers followed the FAI framework however, with concessions (rule shortcuts), to expedite operations.

To comply with U.S. laws, only U.S. safety-certified engines were used—mostly manufactured by Estes. The following summarizes some of the salient features observed and noted by participants.

Contestants Tony Reynolds and O. James Lee.

S2/P—As one might note in an FAI report: “held correctly.” (This is egglofting—three flights of the same egg trying to achieve 100 meters altitude each time with one minute durations). Ukraine took places two and three; Chris Flanigan scored first, however.

S6A/P—This event gives modelers three successive 5-minute windows to launch their streamer duration models on an up-to A-impulse motor. The objective is a 4-minute time (maximum) per flight. Wind carried models too far or towards the test stand, so contestants used 1/2As to facilitate recovery. Contestants felt rushed to meet subsequent rounds and concluded it is best to have breaks between rounds. Some ambiguity in the rules was noted, and F.I.R.E. participants felt this contest “Beta-Tested” this and S12A/P events. Ukraine again took two places—the first two. The winner was Valeryi Bidovskyi—age 17. We only flew one (adult) contest division.

S7—Scale. Michael noted there were no Russian rockets on display. Entries were an Atlas Agena, Black Brant II, Bumper WAC, Little Joe II, MAR-6 Ukrainian sounding probe, Mercury Redstone, and Saturn IB. To speed up judging, static (hotel room) evaluations were limited to 5-minutes per model. Chris Flanigan's Saturn IB won the day after flying.

S8E/P—The Ukrainian flyers didn't get visas to come, and a U.S. contestant dropped out. So the RC E-powered rocket glider event became a shootout between Herb Vinyard and Dave O'Bryan. They found use of smaller Es (30 Nsec) satisfactory. Landing-target measuring tapes (made years ago by Alan Williams) were used instead of measuring to the nearest centimeter. (Dave won the shootouts).

S12A/P—This is the event flown once as a round of helicopter duration, once as streamer duration, and once as parachute duration, all using the same rocket on A-motor flights. Flyers said the event disproportionately favors parachutes (gets the biggest scores and makes streamer and helicopter results second tier). The flyers think the rules should be changed to 'normalize' results between rounds—just as groups are normalized within a round of S8. Matt suggests the flying order should be helicopter, streamer and parachute. Herb got last laugh as winner of this triathlon event.

David Bellhorn—Student range RSO/LCO.

The Trophies.

The overall winner for each event was listed above. For individual results see Cup Navigator —Noosphere's online result application. (Dont know how? Google Cup Navigator and follow the links). Mike was able to enter results on his electronic tablet in the field, and viewers in Ukraine or here states-side saw them contemporaneously.

An award-banquet was held Saturday evening at an Austin BBQ (County Line) with guests and family from Firefly, Michael from Noosphere, the NAR contestants/ volunteers and our Ukrainian guests. Tom gave remarks and awarded an overall prize to the U.S. team. There was much talk about future FIRES and how the U.S. could possibly hold the World Championships in Texas in 2022—the 50th anniversary of the first world spacemodeling championships.

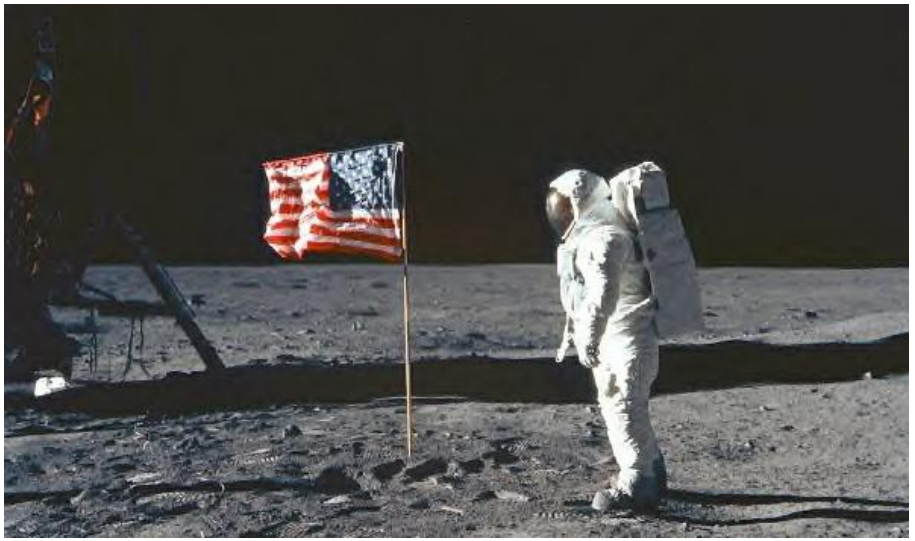
It was not lost on this observer that we were then a week away from observing the (93rd) anniversary of Dr. Goddard's first successful liquid fueled rocket—less than 100 years ago, and here we were finishing up at a rocket facility operated by a youthful-inspired cadre (“We are not your father's rocket company,” Firefly recruitment ads proclaimed) intent on putting “fireflies” (glistening orbiting spacecraft as viewed from Earth) up there.

F.I.R.E. was remarkable, really a milestone, historic spacemodeling event, conceptualized by Max Polyakov and executed by joint U.S. and Ukrainian efforts.

Apollo 11 50th Anniversary Moon Landing Contest – NASA Goddard Visitor Center Greenbelt, MD. Saturday July 20, 2019 12:00 p.m. to 4:00 p.m.

Celebrate the 50th anniversary of the historic Apollo 11 moon landing. Attempt to land your model rocket nearest the center of a "moon" drawn on the ground. We will distribute free commemorative "moon landing" items to the first 200 contest registrants. Trophies and model rocket kit prizes will be awarded to the top youth and adult finishers. A narrated demonstration launch of models of historic NASA space vehicles will take place before the contest.

The contest is free. On-site registration is required on contest day. You must bring your own rocket and motors, or purchase them at the nearby Goddard Gift Shop. An awards ceremony follows the contest. For more contest details see the contest flyer.



NASA Goddard Visitor Center - Model Rocket Contest
50th Anniversary of the Apollo 11 Moon Landing

WHEN: Saturday July 20, 2019 12 noon – 4 p.m. (no rain date)

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

EVENT: "Lunar Spot Landing" land your model rocket nearest the center of a "moon" on the ground.

COST: FREE

AWARDS: First through fifth place trophies and model rocket kits will be awarded.

REGISTRATION: Register at the launch site on the day of the launch. The first 200 registrants will receive free "moon landing" commemorative items.

SPONSORS: This contest is 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.

WHY: This event is to commemorate the 50th Anniversary of the Apollo 11 Moon Landing, which happened on this date (July 20th). This STEM event also promotes 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 only 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"s" 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 days 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.
Demo Launch of Historic NASA Rockets	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.

James Miers Elected as NARHAMS Section Adviser

By Alex Mankevich - NARHAMS President

It is with pride that I announce that Mr. James Miers has been elected as Section Adviser for NARHAMS. Mr. Miers was nominated and elected at the March 2019 business meeting, filling the office that was vacated upon the passing of John McCoy. Jim's prompt election has assured continuity in that office.

Jim has raised his profile with NARHAMS as of late. He currently mentoring the Eagle X TARC team for this year's contest. He is also regularly serving as range crew member for the first Sunday launches at the Goddard Visitor Center. Jim has taken on a few roles at these launches to include pad assistant duties and assisting the flyers to assemble and prep their model rockets before flight. The Team America Rocketry Challenge Finals in May usually recruits Jim as Timer at the launch ranges.

Several of us know that Jim has been our coordinator with the Greenbelt Community Church as they have been the site of our Holiday Parties for the past several years. Jim has been dependable and efficient in terms of setting up the hall to host our celebration needs.

Jim also has been a familiar face at the grill, along with Mark Wise, during our summer Fourth of July picnics. Jim's skill at the grill is not far behind his prowess at consistently having his tickets drawn at our Holiday Party raffles.

If you are looking for Jim at our monthly sport launches, don't bother looking for the guy chasing after an Alpha III or the Wizard models. Jim usually is seen transporting a three-foot-long something as he proceeds to the away pads to fly on an F motor. It is awe inspiring to watch him as he meticulously prepares his models for flight. Jim is unafraid to read and follow written instructions. He takes pride in reducing all elements of chance as he deftly secures his motors and cautiously packs his recovery devices. Jim is a dedicated user of the Jolly Logic chute release device. Jim has the dubious honor of being the NARHAMS member with the highest number of Jolly Logics lost to trees, etc.

Jim is distinguished as a consistent voice of prudence and reason and he is a strong advocate for the safe operation of the launch range.

Please take a chance to congratulate Jim and to wish him many years as our Section Adviser.

RMK Krupka, the History… no, Bohemian Rhapsody!!

By Stuart Lodge

EARLY 1970s…Model Rocketry-Space Modelling was up and running in Europe, with the first FAI international event taking place in the then Czechoslovakia (ČSSR), at a place called Dubnica nad Vahom, in 1966. ČSSR quickly became a 'Big Player' in this activity, with schools' rocketry events and Model Clubs springing up all over. One of these was Raketomodelářský klub Krupka (RMK Krupka), based near Teplice, in northwest Bohemia.

1991 ~ your scribe was invited to attend the inaugural Krupka Cup, over the weekend of 1-2nd June '91 in the company of friend, Pavel Miladinović. A pleasant, if small, event that complemented my tour of Prague. My accommodation was in an apartment block, just out of town, near Bohosudov railway station. Incredible really, high end scale models were built and displayed there, workshops, machine shops, display areas, kitchens and large dining room, plus sleeping accommodation for guests, was provided. I'd never stayed in a model club before! The flying site was close by adjacent to farmland and an Electrical supply unit, supplying the town and other locations. Entries from ČSSR, NED, GER and GBR and over almost before it began and back to UK!

Genesis ~ The club was founded in November 1972, by Rudolf Zych, who served as a youth leader in the club for many years and later its chairman. From the start, it occupied the building of former Svazarm (paramilitary) at Bohosudov, in Lindnerova ulica 306…where I'd stayed in 1991, until December 2000, when RMK Krupka was relocated to new premises in 2001, by the Municipal Council Offices. These days it's based in Krupka-Maršov, in Karla Čapka ulica 272, incorporating workshops for adults and youngsters. In 2012, the ground floor was also layered in, which is representative of the club's growth. There is a permanent exhibition of models – truly spectacular! There's also a meeting room for the events of RMK Krupka, Czechia, World Cup and the Modelling School, including screening facilities. The current premises just amazing and fully meets the needs of both youth and adults modellers. RMK Krupka is chaired by Mrs Věra Pavková,

Continued next page

The 'Scale models' Ariane line at RMK Krupka HQ…super.

Yet more Scale models! Nike Apache S5C-Scale Altitude birds.

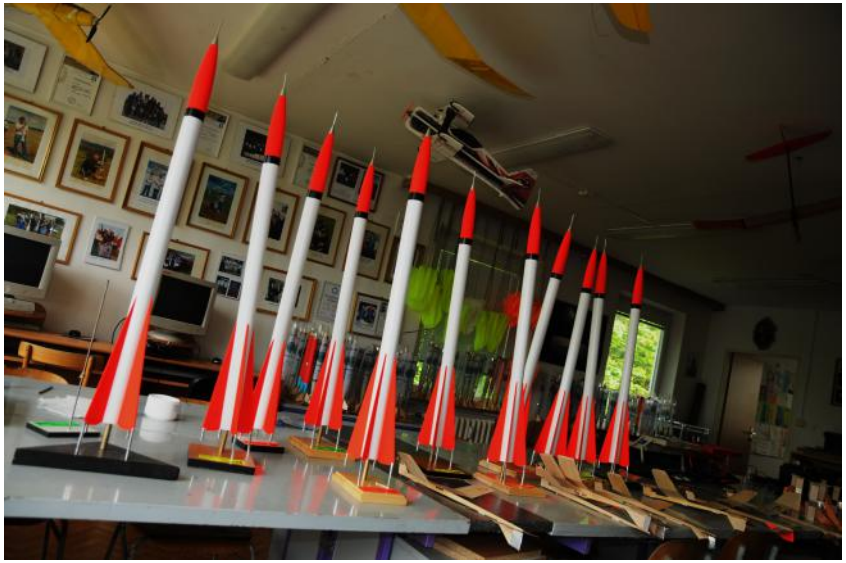
RMK Krupka's charismatic logo, here on the wall of the club.

This is the KnaufInsulation production facility, adjacent to the flying site. Sponsored RMK Krupka for years, especially for the

Vice-chairman Pavel Broný; chief executive and coach of the club and Czechia, is Bedřich Pavka.

RMK Krupka has focused on youth development since its inception. Among the first students under the leadership of Rudolf Zych and Josef Jireš are today's Space Modelling representatives of Czechia; Zdeněk Kolář, Bedřich Pavka and Pavel Broný, long time Big Players too. During more than four decades, pupils and adults have gained countless titles of district and regional champions, become Champions of ČSSR, through to the contemporary Czechia. Their greatest achievements since the establishment of the independent Czech Republic, include the titles; Master of the Czech Republic, absolute champion of the Czech Republic, in addition, European and World Champ in Space Modelling, in both Seniors and Juniors.

Line up of Major Champs' medals, the Czech international team focuses on RMK Krupka…so much success for Seniors and Juniors.



Those red & white ASP rockets were all built by RMK Krupka's Juniors, some real history recorded on the wall behind.

Krupka World Cup ~ RMK Krupka is best known for setting up one of the most successful international events in the calendar. A key element in this genesis during the 2000s was the construction of a KnaufInsulation insulation production facility in Krupka. KnaufInsulation sponsors this event and numerous others, with the focus always on the development of young people. The Krupka Cup attracts entries from all over the continent, Seniors and Juniors and one of the places prospective champions must visit.

RMK Krupka regularly organises a Modelling School, a project for teaching children from 1st - 5th grade of primary schools in Krupka; for kindergarten children; clients of Arcadia from Krupka and Teplice, plus a local children's home. KnaufInsulation contributes financially to the modelling school, which is attended annually by 300-500 participants. Youngsters learn about the history of cosmonautics and modelling skills. Instead of art lessons, school work, science, or science at school, they spend the morning with us at

Continued next page

the club and learning is so much more interesting for them. All children, since it started in 2001, are satisfied, some of them find their way to our modelling club. Several junior world and European champions come from the Model School. Major players over the decades include:

World Champions – Seniors & Juniors: Bedrich Pavka and Martin Pavka, Marek Pavka, Zdenek Kolar, Bara Pakostová, Julius Benak, František Kontra, Kateřiná Vaniková, Pavel Bronýy.

European_champions – Seniors & Juniors: Martin Pavka, Marek Pavka, Bára Pakostová, Petr Jakubec, Ondřej Skořepa, Jan Sršeň. Bedřich Pavka, Zdeněk Kolář & Pavel Broný.

We've not even scratched it, there are just so many more achievements from other members of RMK Krupka, including World Cup podiums by both Seniors and Juniors.

The People ~ facilities are great, but it's the personalities that make things happen. RMK Krupka was a product of an expanding Technical Culture in ČSSR and was to go on to be the most successful sporting organisation in the whole nation. Thanks are offered to all major players from the earliest times. AMAZING..

The kids don't just build & fly rockets, they draw them too!

Kat'a Vanikova, possibly the greatest Junior talent RMK Krupka has ever seen, celebrates her Gold medal, at 2014's World Space Modelling Champs, in Kaspichan, Bulgaria. Now reading Medicine at Charles University, in Prague.

This is the club's dining facility, a super place to chill out after a day's competing/judging. Fantastic.

The Club's Juniors line up and get ready to boost some birds at 2016's Krupka Cup.

March 2019 Mt Airy Sport Launch Report

By Ed Jackson

With spring reluctantly coming, we held our March launch 4 days before the solstice on a breezy day where the wind never died. The weather was chilly, sunny with a constant wind that never dropped below 10mph and gusted to a high of 19mph. The wind probably kept the more high flying rocketeers at home so this launch was a mostly a low power affair. Learning my lesson from last year's March launch, we changed the theme of the launch from gliders to UFOs which ended up being a more wind friendly theme.

We set up the range with a lighter load of equipment anticipating a slower pace which ultimately proved true. I recall only having a full rack twice during the entire launch and the away pad was used three times. Sarah and I broke

Left: Brownie troop ready to go!
Photo: S. Jackson

TARC team launch.
Photo: S. Jackson

Continued next page

March Sport Launch, Continued

out our kites and took advantage of the wind before people decided to brave the weather with a rocket. Mike Kelly helped up set and showed off some of his winter builds, including an upscale Estes Magician, but decided to hold the maiden voyages for a better day.

As the public launch approached, the pace picked up. A Brownie troop showed up to launch their fleet of the popular Gnome. While most club members launched a token amount of rockets, new comer Buff tallied 13 flights with an array of old and unique rockets including a couple of Star Wars models and a paper scaled-down Blue Bird. An adventurous modeler launched her Hyper Bat three times in staged configuration with the last launch using a C engine on the upper stage that punched the rocket past the trees and out of sight. The TARC team that included club member Bryce Stephens and mentor Kevin Johnson made a qualifying attempt in the mid afternoon that flew without any egg breakage.

We closed up shop ½ hour early with Sarah, Alex and I wind burned and chilled through.

Launches by the numbers:
¼ A - 1, ½ A - 16, A - 6, B - 25, C - 8, D - 2, F - 1, B:B - 2 , B:C - 2

Brownie troop preps their rocket.
Photo: A. Mankevich

Mike Kelly's upscale Magician.
Photo: A. Mankevich

Sarah flying a kite.
Photo: A. Mankevich

From the Zog: *Donation Depot*

By Alex Mankevich - NARHAMS President

NARHAMS is regularly the beneficiary of good-hearted donations of model rocketry kits and components. These donations sometime come from our membership. Other donations are from non-members who have either dropped out of the hobby or need to unload rocketry stuff because they need more space at home, or don't want to transport the stuff as they relocate to another part of the country.

We welcome these donations because we can breathe new life into what they donate. The donors rarely ask for any compensation for their generosity – they simply want to know that their stuff is going to end up in appreciative hands rather than in some a garbage heap.

We can direct donations into a few avenues. One way to utilize the donations is to incorporate their components into the 'Fly-It and Take-It' program. This year's April business meeting is themed to be a build session for this program. We can also incorporate any donation into the Holiday Party raffle, which is a sure way for the kits and components to be given new life. The monthly Goddard launches is another program into which components such as igniter wires, motors, glues and tapes can be directed to serve the greater good.

Recently, we've received a donation of three Estes kits from Mike Kelley. Mike has forwarded the Magician, the Estes SLV and the Astron Explorer. Look for these kits at our next Holiday Party.

Steve Talabac of Clarksville, Maryland, who is a retired engineer from NASA Goddard, contacted us to inquire if we could accept rocketry components that his son had used many years ago. This donation of goodies includes several classes of motors, recovery wadding, an Estes Altitude Finder and two model rocketry books (Alan, are you reading this?!). Alex will peel off what can be used at the Goddard Launches, and the rest will be made available for the membership.

Thank you to both Mike and Steve. You gentlemen are truly paying it forward.

March Meeting Highlights

Ellen Fineran sporting a new look at the March meeting.
Photo: J. Fineran

NARHAMS Club Merchandise

New Online Store for NARHAMS Merchandise:

https://www.cafepress.com/narhams

NARHAMS now has an online store for club mechandise. 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.

Contact your editor before buying. He gets regular discount or free shipping codes from Cafepress. Save your dollars for rocket motors.

March 2019 Goddard Launch Snowed Out

By Ed Pearson

March 3 was the wrap up of NARCON at KSC while NARHAMS came to Goddard for its monthly rocket event. The photo at left shows range crew member Mike Cochran outside NASA's Greenbelt center in snow and sleet. That's why Alex Mankevich (right) gave talks inside on rocketry in lieu of launching.

February Meeting Highlights

By Ed Pearson

Pau's First NARHAMS Meeting: Pau Johnson, son of Kevin and Esther Johnson was born January 13, 2019 weighing in at 7 lbs 4 oz at 20" in length, took time from eating, sleeping and being adorable to visit NARHAMS February 2. Congrats to justifiably proud parents Esther and Kevin.
Photo: E. Pearson

Jen Ash with Andes-origin headgear attended the cold Feb meeting.
Photo: E. Pearson

Your editor gets his time with Pau. Great kid.
Photo: K. Johnson

Right: Zog Alex Mankevich gave a primer on model rocketry.
Photo: E. Pearson

February 2019 Goddard Launch Report:

By Alex Mankevich

It may seem like ancient history to some of our readers as you are reading this article now, but let's not forget that this year started off with a partial federal government shut down. Consequently, the First Sunday Goddard Launch scheduled for January 6, 2019 was cancelled due to the Visitor Center being shuttered. It fell to the February launch to serve as the inaugural Goddard Launch for calendar year 2019.

Despite our recent history of poor launch weather, the conditions for the February launch were not bad. The winds were calm, and the temperature was sort of mild. Fearing that the grass would be too damp/soft for foot traffic, we set up the launch rack on the concrete pad in front of the Delta rocket. There were a few piles of snow on the concrete to remind us that this was indeed a winter month's launch.

This February's launch served up a reminder in the form of snow piles that we were in a winter month's launch.
Photo: A. Mankevich

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Sarah Jackson took a breather from her check-in duties to watch a launch.
Photo: A. Mankevich

The safety check-in station was handled by Sarah Jackson and Ted Cochran. Jim Miers and Michael Cochran attended to the launch pad assistance. Ole Ed Pearson and Alex Mankevich did the launch photography. Ed Jackson orchestrated it all as firing officer and announcer. Alex assisted a few modelers to assemble their rockets prior to the start of the launch activities.

The Visitor Center staff reported that 159 visitors were in attendance for this launch. Setting up the launch rack on the concrete brought the crowd closer together and gave this launch a more intimate feel. The comparatively mild weather served to keep spirits bright. Mingled in with this crowd was a birthday party group that brought along scores of stomp rockets. Some of their celebrants also launched model rockets as well. The launch was concluded at 2:30 pm.

Ed Jackson is surrounded by his adoring fans. Setting the range up on the concrete pad gave this launch a more intimate feel.
Photo: A. Mankevich

Sarah Jackson working safety/check-in.
Photo: E. Pearson

Jim Miers takes the time to explain to a youngster how it's properly done at the launch rack.
Photo: A. Mankevich

Ted Cochran keeps an experienced eye on a full rack of model rockets as the launch sequence gets under way.
Photo: A. Mankevich

Michael Cochran (left) and James Miers (right) assisted the modelers at the launch pad.
Photo: A. Mankevich

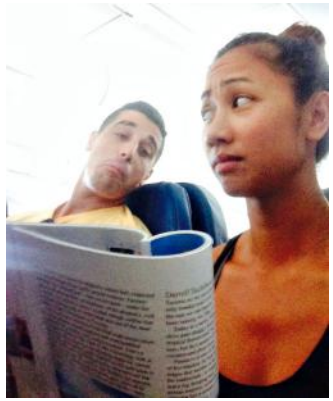
Bits and Pieces

Upcoming Meeting Presentation Topics:

April 6	Open Build for Fly-It/Take-It
May 4	Armed Forces Military Missiles Build
June 1	Contest Model Design and Building

Upcoming Launches/Themes:

April 7	NASA Goddard public launch
April 20	Mt Airy/Egglofter/Easter Bunnies/ NRC
April 28	30th Rockville Science Day
May 17-19	TARC Finals
May 18	Mt Airy Sport Launch/Military Missiles
June 2	NASA Goddard public launch
June 7-9	National Sport Launch
June 15-16	Mt Airy/ECRM-46/NRC/Sport Launch



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.

SpaceX Crew Dragon Demo-1 Mission Booster Landed During NARCON

Eight minutes after liftoff, the Falcon 9 first stage booster landed aboard the Autonomous Spaceport Drone Ship "Of Course I Still Love You," and was returned to Cape Canaveral for reuse.

Photo: Jared Haworth/We Report Space

Competition Corner:
NARAM-61 and Chutes

Kevin Johnson on Folding Competition Chutes

Tim Van Milligan of Apogee Rockets captured this video of our kj and Dave O showing just how to fold a chute. Especially valuable for preps in the field. Click the image to jump to the video. Thanks, Tim!

More Contests:

Steel City Smoke Trail-19, June 1-2, Weber Farm, Grove City, PA. More info: http://www.psc473.org

Can Am Cup FAI Contest, June 7-9, Muskegon, MI. More info: mikemnowak@gmail.com

Apollo 11 50th Anniversary Moon Landing Contest, July 20, Goddard Space Flight Center, see article in this issue

ECRM-46 Events:

1/4A HD
A BG
B Payload (w altimeter)
PMC
Open Spot
*** Any NRC event can be flown, no eggs provided**

Julne 15-16, 2019
Old National Pike Park
Mt Airy, MD

Rocketry Festival 2019

NARAM-61 Events:

1/4A Parachute Duration*
1/4A Helicopter Duration*
A Boost Glide Duration*
B Eggloft Duration*
B Payload Altitude*
C Eggloft Altitude*
C Rocket Glider - Multi-round
E Altitude
Classic Model
Scale
Research & Development

July 27-August 3, 2019
International Aeromodeling Center
Muncie IN

FAI USA Team Flyoffs - July 28-30
Sport Flying July 27 - August 3
NARAM July 31 - August 3

For current info, go to
www.nar.org


SPACE