

TOTAL IMPULSE



JACKSON MODEL ROCKET CLUB

TOTAL IMPULSE VOLUME 22, No. 1

JMRC
HUVARS

HURON VALLEY ROCKET SOCIETY

JANUARY - FEBRUARY 2022



vNARCON 2022

REVIEW: ESTES UNIVERSAL ASTROCAM
VELLUM CONSTRUCTION REVISITED



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MEMBERSHIP

To become a member of the Jackson Model Rocketry Club and Huron Valley Rocket Society means becoming a part of our family. We have monthly launches and participate in many educational events. We encourage our members to actively participate in our club projects, running for office in our annual elections, contributing to our monthly newsletter with articles or tips, and offering services to the club in their area of expertise. We have many members comprised of children, men, women, professionals, lay people, educators and people from many other walks of life.

You may fill out an application at a launch or request an application from one of our board members at scott@sfsindustries.com and mail it along with a check for the annual membership dues (\$30.00 individual or \$40.00 family) to our mailing address:

JMRC/HUVARS
 C/O Bob Dickinson
 5668 Big Fish Rd
 Goodrich, MI 48438

Members enjoy participating in club projects, meeting an incredible group of positive people, and no launch fees!

COMM CHANNELS

There are several ways to keep in touch with the JMRC/HUVARS and it's members.

Website: <http://www.jmrconline.org>. Information includes directions to launch sites & schedule, range procedures, and instructions on how to join the club.

Groups.io: The JMRC groups.io site is a place to share files and also serves as our primary e-mail list serv. Follow this link to join, <https://groups.io/g/jmrc>

Facebook: If you have a FaceBook account search for "Jackson Model Rocket Club JMRC" and request to be added.

GroupMe: Our new chat channel for broadcasting notifications instantly using a free download client for IOS and Droid as well as by SMS text messaging. You can join the notification chat after creating a free account and following this link, https://groupme.com/join_group/28013422/zc5IC1

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Heavy Duty Launch Pads For Every Need
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- Concept Mini \$119 Concept X-treme \$325
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Welcome to the January-February 2022 issue of Total Impulse. This is normally a quiet time in the hobby, but vNARCON 2022 helped fill the void. There were a lot of technical sessions as well as those focused on competition for the upcoming World Spacemodeling Championship in Austin, TX next year. The keynotes were informative and some great product reveals were discussed at the Manufacturer's Forum. I highly recommend the experience in the future. It is well worth the \$25 entrance fee.

A couple of the sessions were hosted by club member Steve Kristal and one of those was using paper construction methods for lightweight duration models. He mentioned the early work by fellow club members Al de la Iglasia and Andy Tomasch in this realm. I pulled those two articles from my vault and have reprinted them in this issue. Hard to believe those articles were first published exactly 20 years ago!

Finally, in recent days our times have gone from trying to exasperating. Take pleasure in whatever endeavors you can and find enjoyment in familiar places. My hope is that reading the newsletter is a brief interlude from the chaos surrounding us.

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Launch/Event Calendar - 2022

- January 28-30 NARCON 2022 (Virtual Event)
- March Pending (Homing)
- April Pending (Homing)
- May Pending (Homing)
- June Pending (Homing)
- LDRS 40 - June 9 - 12 (Lucerne, CA)
- NARAM 63 - July 16 - 22 (Springfield, MO)
- July Pending (Homing)
- August 14/15 Crapshoot VII (Muskegon)

NOTE: Launch dates are subject to change without notice. Be sure to call the "launch hotline" at 517.262.0510 for the latest weather and field information or sign up for the JMRC Notification GroupMe chat.



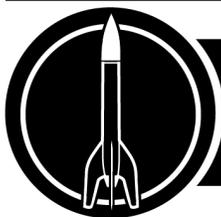
About Total Impulse

Total Impulse is the official newsletter of the Jackson Model Rocket Club (JMRC), Tripoli Prefecture 96, NAR Section 620. Published Bi-Monthly, *Total Impulse* is a space-modeling newsletter devoted to representing the diversity of interests in today's hobby of model rocketry. This newsletter is in the public domain except where otherwise marked. Unmarked articles, photographs, and drawings may be re-printed elsewhere, but credit to the author and this newsletter is expected. Material marked as copyrighted may not be re-printed without the consent of the author.

The editor of *Total Impulse* accepts material for inclusion from anyone.

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On the Cover: A Centuri Space Shuttle launch from Burh Park, Ann Arbor, MI - Buzz Nau Photo



vNARCON 2022

Due to the huge success of NARCON 2021 being held virtually, the same format was used for this year's NAR technical conference. vNARCON 2022 started on Friday, January 28th and concluded on Sunday, January 30th. The event was once again co-directed by Ed LaCroix and Todd Schweim and hosted on the accevents platform. Unlike last year when there were several hiccups with the hosting service, the sessions went smoothly and without interruption except for the Manufacturer's Forum. That however was no fault of accevents as the Manufacturer's Forum was held on Zoom.

Just like last year, I had to make some choices on what to attend, so my report is only on those sessions I was present for. There are others I wanted to attend, but one of the benefits of the virtual NARCON is the recordings of all sessions are available exclusively to attendees for 90 days before they are released to the rest of the membership. I can go back and watch sessions I missed at my leisure.

Friday

The schedule was light on Friday and started at 1:55 PM (EST) with Ed's Opening statement. Technically the event started at 10:00 AM with the Board of Trustees Meeting. Following Ed's statement was the "Insiders Tour of Apogee Components" hosted by owner Tim Van Milligan. The tour began with a historical overview of the company's history which started in 1989 with Ed LaCroix as owner and founder. Since Tim's acquisition of Apogee, the focus has grown from mainly competition components to all aspects of hobby rocketry. While there is a lot of innovation going on in house, Apogee is also a reseller for many popular manufacturers and their products. Apogee also has a significant investment in education. They publish a regular newsletter, how-to videos, and live Q&A sessions for their popular Rocksim rocket design and simulation software. The insider tour was a look behind the scenes of their current facility that included where and how they manufacture parts and components and the video studio. The session ended with a lengthy Q&A period.

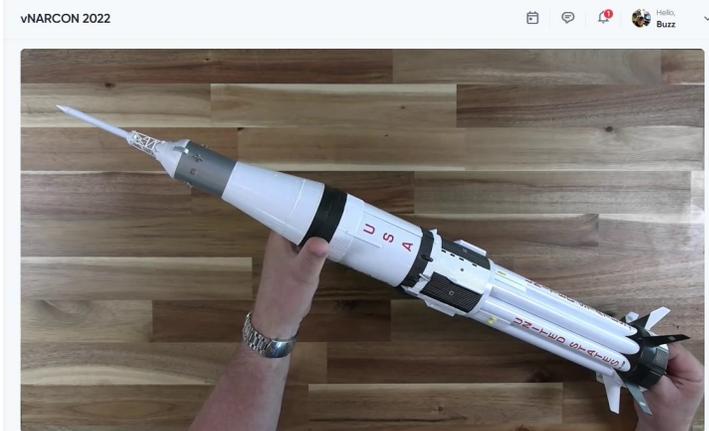


Tour - A Insider's Tour of Apogee Components

The following session was probably one of my favorites. James Duffy's "Why Do I Have Glue in My Hair? Building the Estes Saturn 1B For Both Newbies and Pros" was a detailed record of

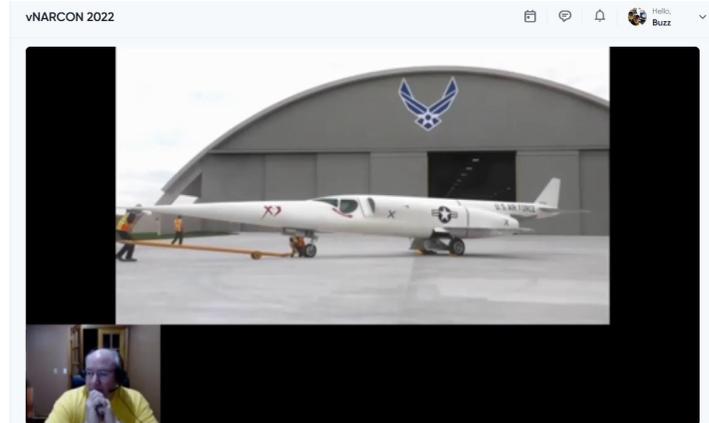


James building one of the nicest scale kits available today from the viewpoint of his work bench. His presentation style and voice lend themselves well for this type of presentation. Afterwards he hosted a live Q&A session to fill out the presentation.



Why Do I Have Glue In My Hair? Building the Estes Saturn 1B For Both Newbies And Pros

Dave Combs was the next session I watched as he presented a video tour of X-planes at the Wright Patterson US Air Force Museum in Dayton, Ohio. If you have never been there personally, I highly recommend the trip. It is one of my favorite museums and can always spend a whole day there when I go. Dave's presentation was well done, and he offered a lot of background history throughout.

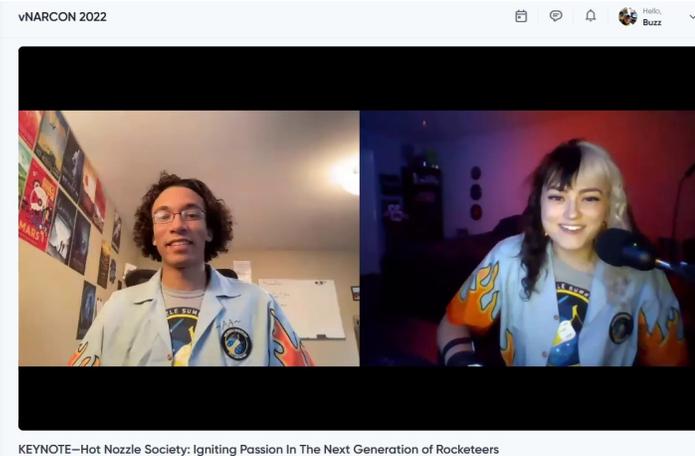


Tour - The X-Planes: The Path to Supersonic Flight and the Space Program

The keynote for Friday was presented by two members of the Hot Nozzle Society, Andrew Adams and Jenna Foertsch. The theme, "Igniting Passion in the Next Generation of Rocketeers" highlighted their efforts to get more youth involvement in the hobby, some-

-thing many of us have had a concern about. They highlighted their successful use the social media in their efforts with over 950,000 Twitter followers, 195,000 on Instagram and 20,000 website visits. It was uplifting to see how well they are doing and the interest in the hobby that they have been cultivating.

Matt Steele from [North Coast Rocketry](#) went over the new additions to the kit line up including the re-release of the popular Corporal missile. Next, Matt showed off what was close to being released. He is working on an Artemis SLS which will include a significant number of 3D printed parts. There is also the Starlaunch 123 which is a Shrox design featuring three parasite gliders that also act as the fins during boost. Third there is the USMX 2100, a 2.6" diameter scale-like kit. Matt wrapped up his presentation by announcing several NCR "bring back" kits to be released before the end of the year. The first two that are confirmed are the Phantom 4000 and A-14 Archer XL, both in the original 4" diameter. This is great news for veteran North Coast fans.



KEYNOTE—Hot Nozzle Society: Igniting Passion In The Next Generation of Rocketeers

Manufacturer's Forum

The one big glitch of the event was the Manufacturer's Forum as I mentioned earlier. The root cause was the NAR's Zoom license was restricted to 100 seats when well over 200 attempted to connect. There was a fair bit of churn in the chat channels until a new Zoom room was volunteered. The entire forum was eventually held and even though it finished late, it was worth it as a lot of good product news was announced.

Thomas Kindig of [IMPLS Launch Systems](#) led the presenters. IMPLS is a manufacturer of launch controllers and pads mainly for clubs where there is a need to support multiple pads. This year IMPLS announced the addition of their PA-Zazz PA system coming to their product lineup.



Mike Nowak of [Galactic Manufacturing](#) specializes in 3D parts and kit enhancements. This includes upgrades for the Estes Doorknob scale kit, a durable Apollo escape tower for the 1:100 Saturn V, and parts to convert the Estes Mega Der Red Max to a 3" diameter Citation Patriot. He has also worked with Matt on a lot of the 3D printing development at North Coast Rocketry.

Durable 1:100 Apollo Launch Escape Tower Lattice



The presentation everyone is always looking forward to is [Estes Industries LLC](#) represented by VP and General Manager, Bill Stine. He started by showing off several of the latest products including the Universal Astrocam and Super Mars Snooper and added that an upscale Super Orbital Transport was on the way.

PA-Zazz

Public Address System

2 or 4 Speakers
150w RMS x
2 Channels

Custom built System. Choice of wire lengths and number of speakers. 1st Qtr, 2022.

Next up was Dave and Jason from [LOC Precision](#). The main news from Wisconsin is the integration of the Public Missiles Limited (PML) lineup and inventory into their system. Currently the PML website redirects all order links to LOC Precision.



Also coming soon is the next Designer Series Kit, a model by famed Estes designer Bill Simon, the B.O.S.S. It is a futuristic kit with lines similar to the U.S.S. Atlantis from the early 1980's. As far as other releases on the horizon, Bill talked about a builder's kit of the New Shepard which will retail for about half of what the RTF version cost. There is also a New Glenn from Blue Origin kit that will likely be out next year. For SpaceX fans Estes is in the final development of the 1:100 Falcon 9. They are collaborating with SpaceX on the kit who have provided drawings to assist in the development. It should be out in time for Christmas this year and will only be available from Estes and SpaceX. The A3-2T and A3-6T 13mm motors are coming back and due to ship in April or May. In other motor news, Estes is developing a core burning 24mm black powder motor in the E57 to E65 range and should be available next year.



Ray Dipaola, new owner of [FlisKits](#) followed next with great look at what has been going on and new kits in development. Much of the old line up is back in production. Previously, FlisKits was invested in a lot of micro kit development under Jim Flis. Ray on the other hand has been working on larger kits, much larger than the previous lineup. These included upscale versions of the Tres and Deuces Wild. There are also other large kits based on LOC tubing coming soon. One is based on the Sun Probe from the old Thunderbirds series that looks really neat!



[eRockets](#) was next in the lineup with Randy Boadway presenting. Randy spent a little time going over how best to navigate the website and find what you are looking for from eRockets. This was helpful as he also showed some reference tools to assist in determining tube sizes, etc. As far as new products, Randy showed off the Semroc Scissor Wing Transport as well as the Semroc up-scale Orbital Transport that is larger than the Estes version and will fly on 29mm motors. Next was a rundown of glues and adhesives offered by eRockets. In Q&A Randy mentioned the Big Blue Bird Zero kit is delayed and that they are struggling with parts and supplies issues.



Andy Jackson presented for [Aerospace Specialty Products \(ASP\)](#) this year and it was good to see him again. He went over some of the more popular products lately which included sport nylon parachutes in neon colors and micro MX scale kits. He introduced the new 13mm Astrobee D kit with laser-cut bass wood fins, balsa nose cone, water slide decals and wire antennas. They recently had a run of the large 2.6" diameter WAC Corporals. There are a few left and when they are gone it may be a while before they are back.



Rounding out the night was another presenter everyone eagerly awaits, Gary Rosenfield from [Aerotech/Quest](#). Starting off, Gary mentioned it was Aerotech's 40th anniversary. He followed that up with a recap of last year's releases. As for what's new, Gary started out with announcing a new Aerotech/Quest website. It has a modern day look and feel that is becoming popular with web development these days. I'll be honest, I think some of these new web designs are a bit of a pain to navigate and find things, however I did check out the new site since the presentation and it is well-done and easy to navigate. I found it easy to find what I was looking for and the style "didn't get in the way". In new product news, there is the I40N-P long burn Warp-9 motor. It is 38mmx203mm, burns for 10 seconds and retails for \$58.99. Next was the J615ST-20A, the first commercial Aerospike nozzle motor. It is an RMS reload for the 54/852 case, burns for 1.2 seconds and retails for \$98.99. The N1100W is a DMS single use long burn motor using White Lightning propellant, is 98mmx1019mm, burns for 143.4

J615ST-20A Aerospike RMS™ Reload

- World's first certified rocket motor using an Aerospike nozzle
- Fits RMS-54/852 motor hardware
- Super Thunder™ propellant
- 745.5 N-sec total impulse
- 1.2 sec burn time
- 370.5 g propellant weight
- 801.7 g total weight
- Novel exhaust plume
- High-thrust profile for heavy rockets
- TRA certified & CSFM approved
- \$98.99 MSRP each
- Availability and shipping to be announced



seconds and retails for a cool \$1,299.99. (Maybe Tony, Dale, Fred, or Chris can put one to use). The N1975W is similar in propellant, size, and cost. Coming soon will also be some new 24mm Q-Jets. These will be 95mm long starting with the E35 White Lightning. They will have 20% more impulse than an Estes E16, come in 5,8, and 11 second delays, and retail for \$24.99 for a pair. The E35 is followed by the F41 White Lightning. It has almost the same impulse as the Estes F15, but at 60% of the weight. It will have the same delays as the E35 at a price of \$28.99 a pair. Both motors should be released in late Spring 2022. The final bit of big news was the announcement of Aerotech's new facility. It will be over 15,000 square feet of offices, warehousing, manufacturing, as well as a museum, showroom, and retail store. It should be easy to find with the 30-foot-tall Initiator out front and is scheduled to open late this year.

Our New Facility in 2022!



Saturday

My first session on Saturday was Bob Koene's "Improving Your Rocket Finishing Techniques". Bob went through the building and finishing of an Estes Antar kit with tried-and-true techniques along with some newer products. This is an area I've struggled with lately since the absence of a lot of the products I used to use. I was

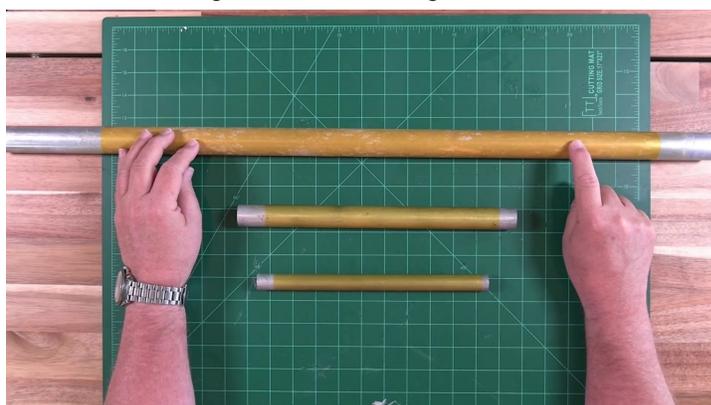


glad I tuned in as Bob discussed a new balsa sanding sealer he found from Deluxe Materials called Sand'n'Seal. It is acrylic based, so the fumes are mild and clean up is with water. I found it on Amazon and have since tried it on a few balsa nose cones. As Bob mentioned, it is very similar to the old dope-based sealer, but without a lot of the negatives.

My next session, "Gather Around the Team Tent—Tales of Spacemodeling Gold, Silver, and Bronze" was hosted by James Duffy and Matt Steele. It wasn't a session on how to compete internationally, but rather a view into the experience of the "Internats". It is significantly different from NAR competition in events and rules. Throw in the international intrigue of competing against fellow rocketeers from around the world and you have a unique and rewarding experience regardless of how well you do and place. It was also good to see JMRC/HUVARS members Dan and Trevor Harrison and Steve and Emma Kristal in many of the slides.



James Duffy ran the next session I attended, "Building Ultralight Fiberglass Airframe Tubes for Sport, Scale, and Competition". I've investigated doing this before, but again, James' presentation style and methodology made the topic interesting and engaging. For a bonus, since there was leftover time, James went over how to build up and strengthen the styrene fins on the Estes Maxi V-2 kit. It was a great demonstration and I plan on doing this with my Maxi V-2... when I get around to building it.



Our own Steve Kristal did the next session on "Building Paper Rockets - Lighter, Stronger, Cheaper (A Complete How-To)". This concentrated on using vellum paper for lightweight, yet "just



<http://www.millermotorworks.com/>

strong enough” airframes. It was nice of Steve to call out me, Al de la Iglesia, and Andy Tomasch for our early contributions to paper rockets. Steve has seriously taken paper rockets to the next level and beyond. With 25 records, I don’t think anyone else has been as successful as Steve and Emma.



Terrill Willard was my last session of the day before the keynote. His presentation, “Parachute Duration; Tips and Techniques for Success” could have easily been passed up as something so basic and easy, but he did a wonderful explanation on material selection, building, and most importantly, packing for maximum and consistent performance. Most competition events really are about being consistent and Terrill’s construction, preparation, and folding techniques can help anyone become competitive in parachute duration. These practices will also translate to successful sport flights.



Parachute Duration; Tips and Techniques for Success

Saturday’s keynote was given by Estes Industries LLC owner John Langford. Boy, I think this discussion could have easily gone on for hours. This was the most in-depth view of the company ever presented. John started with a history of Estes including its various owners over time until John and his team rescued it from a bankruptcy sale. He went over their four-point, five-year plan; Make the company self-supporting, a strong STEM focus, increase competency in engineering and production of small rocket motors, and build ties in professional aerospace. That last point may explain the recent certification of a L2350 motor under the new subsidiary, Estes Energetics.

He expressed the focus early in ownership of providing annual catalogs as in the past. I for one have enjoyed receiving these since 1969. John then showed an org chart of the leadership team showing several familiar faces in the lineup. Next, he displayed the evolving product line from the past few years which included

many of the items from the Manufacturer’s Forum. John discussed the supply chain issues especially due to the pandemic and the importance that they become more independent.

I was really struck by the amount of education outreach they have maintained. Estes and education go back a long way to Robert L. Cannon and all the great work he did. There is a lot more that Estes is doing that I feel has gone largely unnoticed. John then went over recent partnerships with Blue Origin, Pocket Lab, and the National Science Teachers Association.

Next was more detail about Estes Energetics and the goals for that engineering team, to provide “big company capability and small company agility”. The certification of the L2350 was a learning exercise that will pay dividends for future development. He also mentioned they were awarded their first R&D contract in 2021.

Many were waiting to hear about the acquisition of GOEX, a US based black powder manufacturer. Estes Energetics purchased GOEX on January 19th, 2022 and will focus on restarting black powder production with an emphasis on safety, quality, and efficiency. No doubt, this helps them significantly become more self-sufficient.

Also discussed were the Mission and Values statements and the “Estes at 100” vision. Overall, I was impressed with the leadership for what they are accomplishing now and their plan and vision for the future. I believe Estes has never been in better hands.



Sunday

The morning kicked off with the NAR Townhall meeting and as townhalls go it was pretty uneventful. NAR President John Hochheimer went through his normal set of slides, safety (first), a list of current NAR Officers and Trustees, HQ and Staff, Association Stats (membership continues to rise), Section Stats (45% of NAR members belong to a section), and some organization financial thoughts. It does look like the membership guidebook will be going digital this year, which will allow more content and timely updates. This was followed up with details on the finances and recent board activities. Future activities include a budget to support social media which is overdue. I may not be a fan of social media (though I use it a lot), but if we’re going to reach potential youth members then we need to be present where they are. The overall picture is rosy for now, membership is up, sections are up, HPR certifications are up. Everything is pointing up.

I realized I hadn’t picked a session for the slot right after the townhall, so I dropped in on the “Arduino – Build It, Fly It” session hosted by Will Marchant and Bruce Canino. I kinda wish I had of looked more into this before the event. If I had acquired all the parts I could have worked on building one during the session. According to Will some of the necessary parts are out of stock

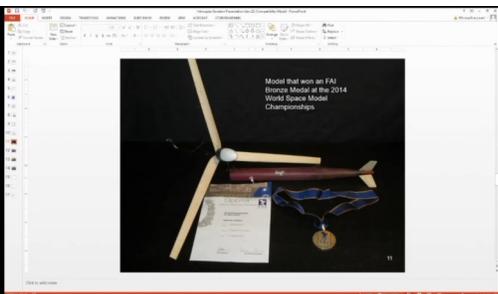
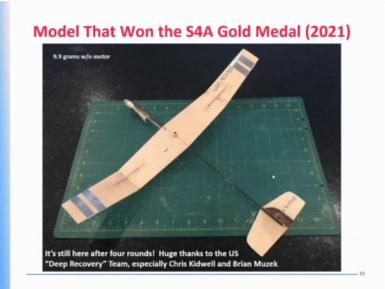
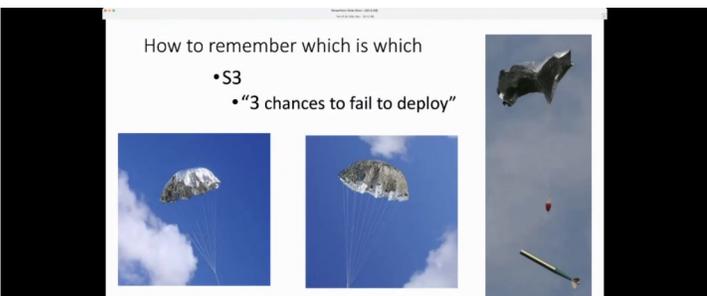
due to the recent supply chain issues. Regardless, it was an informative session and I would like to try building one of these in the future.



Arduino - Build it, Fly it

Will Marchant & Bruce Canino

The rest of my Sunday session were competition related. This is due in no small part to the US hosting the Internats next year. The three sessions were "FAI Streamer and Parachute Duration Secrets" by Steve Kristal, "FAI Rocket Glider (S4)" by Chris Flanigan, and "Helicopter Duration – International Style" by Trip Barber. I've built and flown all of these for NAR competition, but it



was good to see the differences with the international events. All three presenters did a wonderful job with their presentations and these recordings will be valuable for future reference.

The final session of the conference was a tour of the Museum of Flight by curator Geoff Nunn. This presentation was a bit of a disappointment as there were internet bandwidth issues throughout which distracted from what otherwise might have been a good tour. It was nice to see some of the model rocket history on display and items from the Apollo program though I would have preferred to see more of the displays a less of the narrative. Just my two cents.

In closing, vNARCON 2022 was another great event, especially for competition tips and techniques. Whether you are new to contest rocketry or a seasoned veteran, there was a lot of sage advice and information on starting out well or improving. The conference pace felt less hectic than last year and there were fewer technical glitches. Even though I suffer from "Zoom fatigue" due to spending so much time the past couple of years on Zoom and Teams, I enjoy the virtual experience for attending NARCON. It is also an amazing value. Getting two and a half days of valuable rocket content for \$25 is a heck of a deal plus you still opportunities to socialize during the social hour and "beer loft" events. I continue to hope that virtual attendance will be an option in the coming years.



Reprinted from T minus 5 Volume 7 Number 4

The Vellum Revolution

Two HUVARS modelers bring ultra-light contest techniques to the masses

Rocket Boosted Origami

or

How to Build Very Light Contest Rockets from Drafting Vellum Without (Hardly) Even Trying

Andrew D. Tomasch

Background

My major goal for the 1991 contest season was to compete for a spot on the U.S. spacemodeling team flying S4B (B boost glider). Because of the additional rules imposed for the team trials, placing in the top three in the event was not sufficient for a place on the team. In addition, a team member would be required to "qualify" in an additional event to be awarded a place on the team. "Qualification" was defined as attaining a score of at least 60% of the winning score in the event. Thus I was faced with the task of developing models for an additional event, even though my only interest was to fly boost glider. The obvious choice was to develop models for S3A (A parachute duration) and S6A (A streamer duration). Since the same airframe could be used for both events, development of one model would permit two chances to qualify.

The goal, then, was to produce a reasonably competitive model while expending the minimum of effort, since time spent on these ships was robbed from boost glider development and testing. As it turned out, my professional commitments so limited my time (I spent most of the summer out of the country) that the only spacemodeling I was able to accomplish was the production and flight testing of my first S3A/S6A airframe. The S4B, though designed, has yet to be built or tested. However, the flight of my prototype Paper Tiger at MSC in early summer has profoundly changed the local contest scene, and has had impact at the national level. Based on having seen this one model, Buzz Nau and Al de la Iglesia developed a minimum diameter 13 mm model using vellum construction and won A streamer duration with it at NARAM-33 (once the RSO could be convinced it was strong enough to fly) (see Al's article elsewhere in this issue. By the time of Falling Leaf, the majority of competitors were fielding vellum models for the 1/4 A duration events.

Development of the Paper Tiger

The Paper Tiger owes its origins to some good luck. By chance, I was able to obtain a state-of-the-art S6A model constructed by Ukrainian Yuri Gapon (see photo on page 10). This ship follows the current vogue of molding the entire airframe from fiberglass cloth and some sort of resin over a machined mandrel (form). This produces a very light and smooth model. However, the stiffness of the body tube leaves something to be desired, bearing more resemblance to a plastic bag than a rocket airframe. The valuable lesson I learned is that standard rocket construction materials are the moral equivalent of cast iron and boiler plate. The average model rocket is many times heavier than it needs to be to withstand the loads imposed on it during flight. I set myself the goal of matching Gapon's airframe weight of 4.14 g. This brings up another important point: a good scale is an invaluable tool for assessing the weight of new materials. Without accurate weight data, it's difficult to know if progress is being made toward lighter models. The other key ingredient is a notebook to record your observations and ideas.

Initially, I intended to use balsa tubing rolled from 1/32" sheet as the basis of my airframe. This material is very easy to make and much lighter than kraft paper tubing. It has the

Continued on page 11

The VDM-3

Streamer Duration Winner at NARAM 33

by Al de la Iglesia

Plans for the Thrust You Can Trust team's NARAM-winning A streamer duration model appear on page 12. The name is an acronym of Vellum Duration Model, round 3. The first round was developed for 1/4A engines and was much shorter. The second was made this size but suffered bum-through forward of the motor at ejection when flown at MAR 53. This third round was modified for NARAM 33 by the addition of a layer of chrome trim monokote to prevent bum-through. The idea of using vellum tubing was borrowed from Andrew Tomasch and his FAI model design (see his article "Rocket Boosted Origami", elsewhere in this issue). The vellum tube greatly reduces weight and is the major factor in the success of this design.

Don't worry about rolling a tube; the construction is very simple. The first thing you need to do is get a mandrel on which to roll the tube. I have used several types with success: a dowel sanded down to 17/32", a brass or aluminum tube, and a piece of Apogee PT-18. The idea is to get something that won't lose its shape when heated. Make sure the mandrel is about a foot long; if it is too short it will be hard to hold when ironing.

Trace the body tube pattern (including the fin alignment lines) onto 15 pound tracing vellum and cut it out carefully. Cut out a piece of trim Monokote as the plan indicates. I use chrome because it is the lightest, but other colors should work. Stick the Monokote onto the vellum in the cross-hatched area such that when the tube is rolled, the Monokote will be on the inside. On the long, shadowed edge apply a light layer of Elmer's glue (spread it thin with your finger) and allow to **dry** completely. Next wrap the vellum around the mandrel such that the arrows and the overlap tab are all aligned. Temporarily tape the edge down with a few small pieces of masking tape. Iron the joint in the middle and allow it to cool, then remove a piece of tape and do the same thing. Keep doing this until the whole joint has been sealed. When the tube and mandrel are cool, the tube should easily slide off. Put the tube back on the mandrel in order to attach the fins without destroying the tube.

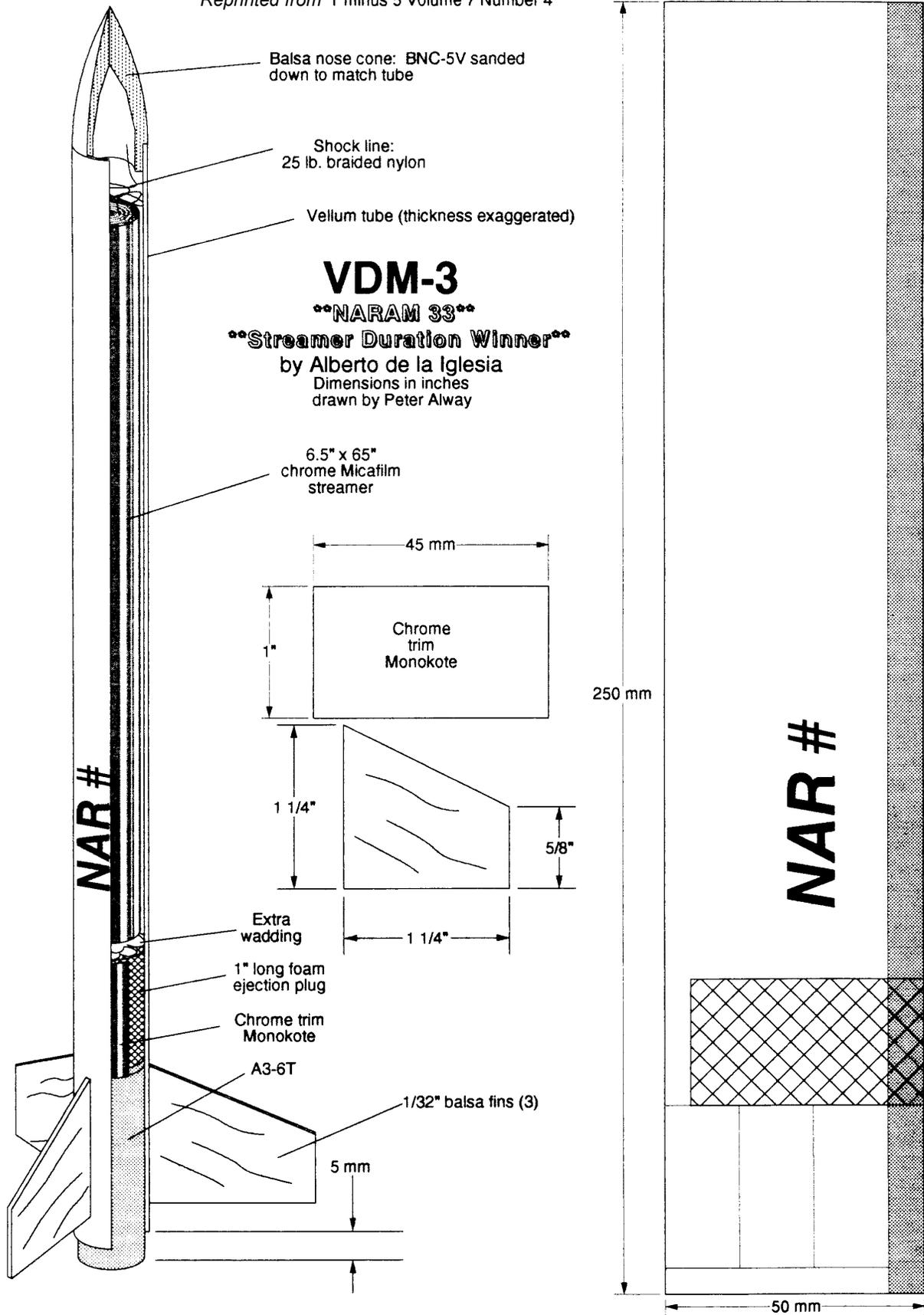
Cut out three fins from 1/32" light balsa, round all edges except the root, and block sand the sides with 320 grit sandpaper. To attach the fins, lightly mist the fin alignment lines with CA accelerator, then apply a thin line of thick CA to the fin root. After it soaks into the fin for a few seconds, stick the fin to the tube carefully. It usually grabs in a second or two. Attach the external shock line at the root of one fin with a thick CA fillet. Then apply thick CA fillets to all the fin joints. When all the CA is dry give the fins one very light coat of clear dope that is thinned 50%.

Then hollowed an Estes balsa cone and finished it the same way as the fins. Make sure the nose-tube joint is as smooth as possible.

You need to make a foam ejection plug for this model as it plays a major structural role. We cut plugs out of 1" white foam on a scroll saw after drawing circles with a compass to the correct size. Other methods, like using a hot wire, or merely shaving a foam block with an X-acto knife, work as well. Most of the different kinds of foam weigh about the same, so choice of material is not important, although blue Dow styrofoam does not crumble as much when cut with a knife.

Continued on page 11

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VDM-3 (continued from page 9)

For our models we use 6.5" X 65" chrome Micafilm with 1/2" accordion folds for 2/3 of the length. Then I accordion fold the next foot and lightly iron it flat. Doing this makes a transition from the flat streamer to the full accordion folds. We discovered this idea by accident and it seems to cause the streamers to flap more and hence stay in the air longer.

Don't use a screw eye in the nose cone-it's too much weight. Glue the shock line in and leave a loop for attaching the streamer. Since there is no engine block, make sure you securely tape the motor on the outside. Don't rely on a friction fit. The model alone weighs about 2-3 grams, gross launching mass is about 20 grams for optimum altitude.

We use a piston and tower combination to prevent tip-off, this baby comes out really fast so keep your eyes peeled. On an A3-6T it goes out of sight, so look for the streamer. At NARAM 33 we blew everyone away by more than 100 seconds with this model. Good luck!

Rocket Boosted Origami (continued from page 9)

additional advantage that it can be covered with Japanese tissue to produce a smooth, colorful, and lightweight tube. Next, I decided to cut down Apogee Nova egg capsules to produce nose cones and tail transition cones. This works, but is awfully expensive and HEAVY. Such a nose cone weighs 1.68 g, with the tail cone at 1.49 g. That's 68% of the target weight in just the cones. Next I decided to eliminate the weight and expense of the tail cone by replacing it with paper. Drafting vellum looked like a nice candidate, since it is very smooth, water resistant, and readily available. I produced a vellum tail cone, bonding the seam with Scotch Magic Transparent mylar tape. This was a remarkably strong, lightweight component (0.23 g). At this point the light bulb went off, and I decided to make a 30 mm body tube in the same way. This proved to be very strong, light (1.38 g), stiff (it holds its shape much better than the fiberglass tubing on Gapon's model), and easy to make.

The final problem was the nose cone. The cut-down nova cone was now just too heavy to justify, given the ultralight nature of the rest of the airframe. I had neither the time nor the inclination to try molding fiberglass cones. Again, the inspiration was Soviet: If conical nose cone is good enough for their launch vehicles, it should be good enough for me. The Chinese get honorable mention in this regard as well, since skyrockets had conical paper nose cones a thousand years ago! The final design uses a 3:1 taper with a balsa tip produced by "machining" soft 1/4" balsa stock in an electric pencil sharpener. The base is made from balsa tubing, with a 1/32" balsa bulkhead to hold it round (0.24 g). A loop of Apogee Kevlar line is bonded with CA to the back of the bulkhead and routed through the bulkhead/tube joint for recovery system attachment. Total nose cone weight is 0.69 g.

Paper Tiger I, flown at MSC, has a rugged tail cone assembly which includes an Apogee Blackshaft core tube, and a rolled balsa ring and bulkhead similar to that of the nose cone at the body tube/tail cone interface. The conical paper tail shroud extends back only as far as the fin leading edges, with the fins bonded directly to the core tube. This produces an absolutely bulletproof tail assembly which should survive unlimited launching. The body tube is attached to the balsa ring with a turn of Apogee 1/r wide mylar tape, and can be removed and replaced. Wadding is from 1" thick white styrofoam "beadboard" (1 lb cu.ft density) cut with a hot wire, as on the Ukrainian model. This provides excellent protection of the recovery system and airframe. The body tube is still serviceable after three launches, but is beginning to show some distortion. The weight of Paper Tiger I less rigging and recovery system is 4.14 g, dead even with Gapon's model, thus achieving my initial goal. A test flight on the then contest-illegal A3-6T at MSC yielded a duration of 90 seconds without the aid of a thermal. The model boosts without tipoff from a 13 mm \times 12" piston, and deploys the recovery system

exactly at apogee.

The drawing on page 14 shows Paper Tiger II, which is an attempt to build the lightest possible airframe using these techniques. Experience has shown that fins can be bonded directly to a vellum airframe tube and have adequate strength (Al and Buzz did this on their NARAM-33 winner). I have had good success with cardstock fins cut from a manila folder. While substantially heavier than 1/32" balsa fins, these are much thinner and smoother, requiring only a few coats of clear dope for a finish and offering less drag. Paper Tiger II therefore employs cardstock fins bonded to a vellum tail cone which extends to the rear of the airframe. The blackshaft core tube has been reduced to a 1/2" ring to which the engine is taped. The external shock cord mount is also bonded to this ring with slow CA. The balsa ring at the tube/tail cone joint has been eliminated, and the bulkhead is laminated from two thicknesses of 1/32" balsa with their grains crossed for stiffness. A single thickness bulkhead inside a 1/4" balsa ring might be a better alternative, resulting in easier assembly and the possibility of body tube replacement as on Paper Tiger I. The bulkhead is perforated with 4 holes to serve as an ejection baffle, offering additional protection for the upper airframe and recovery device. Paper Tiger II weighs in at 3.5 g and represents a breakthrough in lightweight construction, since 4 g seems to be the international standard for lightness. A prototype has been constructed and is ready for test firing. I am confident that it will withstand flight loads. The remaining question is how well the unprotected tail cone stands up to ejection. My guess is that most of the burning debris will hit the baffle plate and not the cone wall. If the cone does suffer significant burn damage, a vellum tube can be inserted in the end of the engine casing or attached to the blackshaft tail ring to focus the ejection forward and prevent it from striking the cone wall.

Vellum Construction for NAR Models

The drawing on page 15 shows one approach to vellum construction applied to produce a 14 mm diameter NAR model. By using a blackshaft tail assembly, a very robust model results. The vellum tubing can be replaced in the event of bum damage. This approach is midway between the old "boilerplate" and an all-vellum airframe. Blackshaft tubing of 14 mm diameter has a linear mass density of 0.127 g/cm, while vellum tubing is only 0.042 g/cm, a factor of 3 difference. Replacing 7" of blackshaft with vellum in the design shown saves 1.5 g, and makes the difference between a 2.4 g model and a 3.9 g one, a savings of 391% for almost no effort. The vellum tube is attached to the tail unit with Apogee chrome mylar tape, and can be replaced in minutes if damaged. Compare the 2.4 g final airframe weight with the 3.5 g for an expended 13 mm engine casing. The model is now 29% lighter than the spent engine!

Construction Hints

The new skills and materials required for these models are minimal. For material I am using Crystalene vellum produced by Keuffel and Esser. It is approximately 0.003" thick and has a surface mass density (useful to know for weight estimates) of 0.0069 g/cm². A pad of 50 sheets 17"x 22" sells for around \$15.00 at Ulrich's in Ann Arbor. While not a trivial expense, this is enough material for perhaps 100 models if care is taken not to waste it, and the actual cost per model is pennies. Vellum models aren't just light, they're CHAD (CHeap And Dirty)!

To produce vellum tubing you need a suitable mandrel. For the NAR model shown, just use a piece of blackshaft tubing as your form. For the Paper Tiger I roll the balsa tubing for the nose cone shoulder first and then roll the vellum tubes around it, ensuring a perfect fit. Cut a blank from vellum, allowing 1-2 mm of overlap at the seam. The required width is

$$W = S + (7T \times D)$$

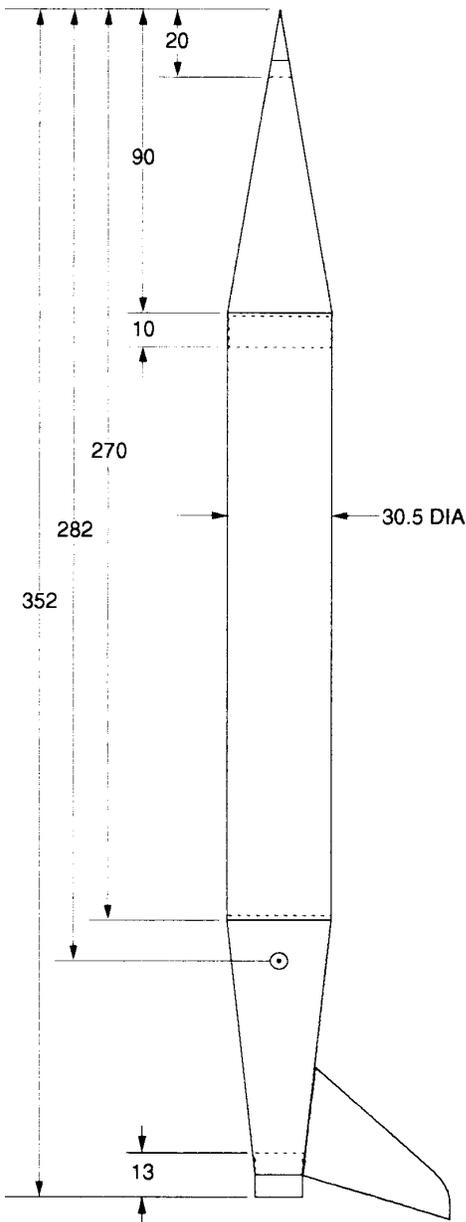
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Paper Tiger II

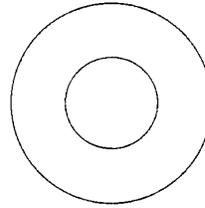
S3A/S6A
by Andrew Tomasz
Dimensions in millimeters
drawn by Peter Alway

Weight: Approx 3.5 grams

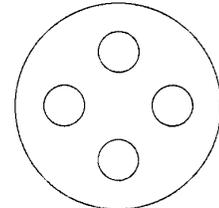
Side view at 1/2 scale.



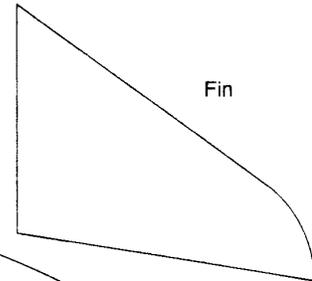
Full size patterns



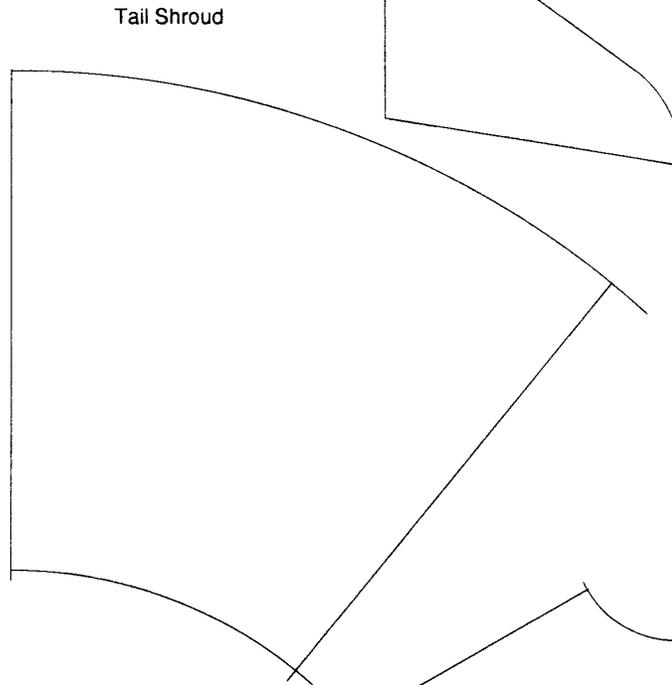
Nose Bulkhead



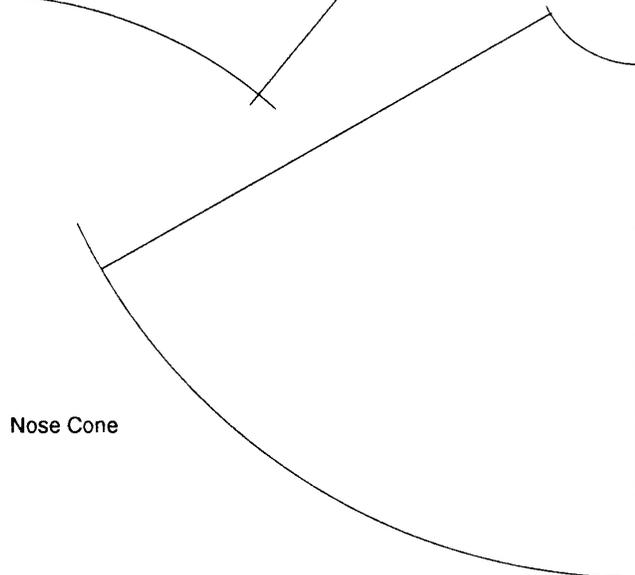
Tail Bulkhead



Fin



Tail Shroud



Nose Cone

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where D is the desired inside diameter, W the width, and S the overlap at the seam. For 13.7 mm tubing this works out to 45 mm or 1.77". A ruler calibrated in decimal inches or millimeters is most helpful for laying out parts, and a precision caliper is better still. I prefer to cut out a large number of blanks and mass produce a lot of tubes at once, allowing plenty of spares for field replacement.

To roll a tube, place a strip of 1/2" wide Scotch brand mag c transparent tape (the "foggy" mylar based material) which is several inches longer than the finished tube adhesive side up on a flat clean table top. The tape can be held down with weights at the ends if desired. The trick is to get your fingers unstuck from the tape without disturbing it. Next, carefully position the vellum blank so that one edge overlaps the tape by approximately 1/4" and smooth it onto the tape, avoiding the adhesive with your fingers. Trim away the extra tape at the ends of the blank with a sharp knife or scissors. You now have a vellum blank with an adhesive edge ready to wrap around your form. Carefully roll the blank around the form and begin to work the seam overlap with your fingers. The trick is to get the un-taped edge of the vellum to tuck under the taped edge without pressing the tape down. When the seam is completely tucked under and you have aligned the blank so the seam is not twisted, press the tape down along the seam from the center outward.

Your first few attempts will probably not work, but a little practice will yield success. Always smooth the tape from the center outward, both when applying it to the blank or on the mandrel, as this will prevent it from bunching up along the seam. Conical shrouds for nose cones and tail cones are made in a similar fashion without a mandrel. Here the trick is to align both ends of the seam properly before smoothing out the tape. I also trim the tape to be 1/4" wide at the base of the cone and to follow the edge of the seam. A standard tab is employed at the cone joint. Note that in all cases the tape ends up on the outside of the finished part.

As mentioned before, slow CA works well for bonding to vellum parts. When using thin cardstock or balsa fins, great care must be taken to insure that the part is flat and warp free before bonding it in place. I tack cement fins in place with Testors green label model airplane cement. For a finish I recommend one or two coats of clear dope thinned at least 50%. This provides additional waterproofing and adds considerable stiffness. Since I have a computer drafting program and digital plotter available, I draw all my blanks for tubing and shrouds with the plotter. This allows me to cover an entire sheet of vellum with accurate, identical patterns, making efficient use of the material. It also allows me to draw my NAR number on the parts with India ink. This is waterproof and can be doped over, although it can bleed slightly if repeatedly brushed over. There is great potential for producing interesting decoration by coloring the vellum with permanent ink markers before assembly. My Redwing Asp round 1, flown at Fallring Leaf in 1/4 A scale altitude, had no paint except for the nose cone. All the black and white markings on the body and fins were done in India ink, adding negligible weight. If you don't have a hot wire to cut foam wadding, cut it "cookie cutter" style with a sharpened piece of blackshaft tubing.

Stability

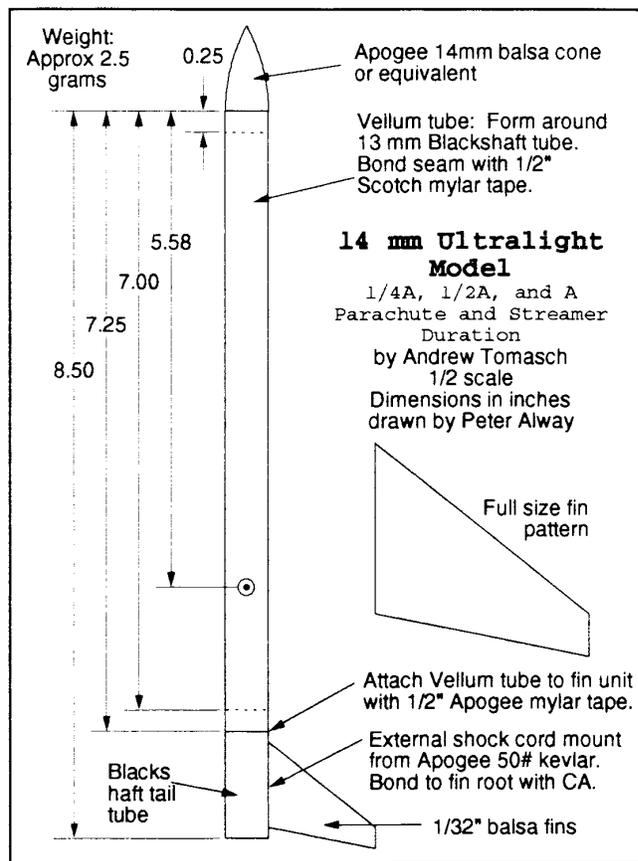
A special note is in order regarding stability. These models are so light that they provide no counterbalance for the engine casing and end up tail heavy. The recovery device therefore provides the forward weight required for a stable center of gravity location. Paper Tiger I carried a 13 g (three times the weight of the airframe!) streamer and was just one caliber stable by Barrowman analysis. In general, the recovery device will outweigh the airframe. Always check the CG location of a new model to see that it's reasonable. A good way to stay out of trouble is to make the models a little longer than usual, giving the recovery system a longer lever arm. Always pack your recovery system as far

forward as possible, particularly heavy elements like the shock cord.

Conclusion

Vellum construction is in infancy, yet has already had an impact on contest flying at both the club and national level. Though not in keeping with the current fashion trends in FAI construction, I feel these techniques will produce models that will be truly competitive. The single biggest improvement yet to be made is to replace the CHAD conical nose cone of the Paper Tiger series with a molded ogive, such as the glass ones being developed by Al de la Iglesia, since the conical cone is at least 0.1 worse drag coefficient, and this translates into haps 100' of altitude. Meanwhile CHAD models like the Paper Tiger make it trivial for anyone to fly FAI streamer and parachute duration. How about a club contest for these two events? We could limit the events to conical nose cones to make it easy for everyone. Let's you develop a more inferiority complex building "paper" Tiger models, let me point out that vellum isn't paper at all—it's a composite of cotton fibers embedded in a binding resin. The proper description for this type of construction might be "thin film composite". And don't limit yourself to vellum. Art and graphic supply stores are full of many different paper and plastic film materials. Drafting mylar comes to mind as useful for higher impulse models. The important thing is to experiment. Just be sure that your experiments are guided by the three fundamental principles of duration flying:

1. Keep it light.
2. Don't make it heavy.
3. It shouldn't weigh too much.





Go Big(ger), or Go Home

DALE HODGSON

Well, the title seems a bit brash; especially after what I did just this morning. I ordered some motors; Estes BP's....13mm and 18mm. Nothing fancy but I wanted to take advantage of a coupon that came with my 2022 catalog. Yes, I get an Estes catalog every year. Even after all these years (I think I got my first one circa 1967 and am still hopelessly hooked 55 years later) I still get a rush at ignition whether it's a 13mm A10 or a 98mm M520 that burns for like an hour. I was thinking though that we all started out with some very small stuff back in the day. Tumble recovery, or rockets like the timeless Alpha, Mosquito, Snitch, all that good stuff gave us what we needed to learn and get better at the hobby. I might even take a trip on the Way-Back machine and build a Sputnik if I can remember how. Sure, we like to see the bigger stuff fly but sometimes it's cool to pay a bit of homage to the past. I think a great way to combine a bit of both worlds here is doing some upscales. Our little stuff made bigger to handle the motors we have become accustomed to in the high-power world.

There are two ways to do an upscale; the first, in its purest form is to take the bird you want to enlarge; do all the calculations necessary, gather parts and scratch build. It's a very satisfying experience to go through all those steps and come up with something really cool. Some folks have been doing it for years and have become quite adept at it. I would suggest anyone wishing to go that route seek out these folks at a launch and pick their brains. One thing that is very consistent about us rocket folks is that we don't mind sharing information. My largest scratch build upscale is a yet to be finished Fat Boy at 11.5 inches. I've been working on it for years and I still have a ways to go but once it's done it should be cool. It's not a "true" upscale though; the airframe is a tad longer than is called for but I wanted a little extra length in case I fly a really big motor in it.



I mentioned there were two ways to upscale; this is the second way which is by far the easier way to go. All one has to do is search the 'net and our various suppliers. There are ready to assemble kits out there where all the parts are pre-made. All that has to be done is simply as-



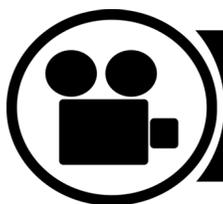
semble the rocket. Of course, modifications can be made if one wishes but for the most part these rockets are fairly complete and ready to put together. Some out of necessity are dual deploy but some aren't. I was looking at my own inventory and was pretty surprised at what I have. All the kits listed here were and are available although some are a little hard to find:

- Alpha: 4.0 in. diameter
- Big Bertha: 2.6 in. diameter, 4.0 in. diameter *Very hard to find; limited run. Google "NSL Big Bertha"
- Cherokee: 4.0 in. diameter
- Der Red Max: 3.0 in. diameter
- Fat Boy: 5.5 in. diameter
- Mosquito: 2.6 in. diameter, 5.5 diameter
- Nike Smoke: 4.0 in. diameter
- 220 Swift: 4.0 in. diameter

One huge advantage is that some of the kits in original scale were so small they were difficult for me to put together because I tended to get glue just about everywhere. These larger versions are easier for me to handle; just like those fat pencils we all had in kindergarten and first grade...bigger parts are simply easier to deal with. The other advantage is because of their size we can actually watch a Swift and a Mosquito fly. Before the advent of 13mm those two rockets were notoriously hard to see and get back since all we had at the time were 18mm motors. Of course, we were cramming C6 motors in those little things but that's quite another story.

There are many others out there; I noticed LOC carries an upscale Goblin. Madcow has several upscales as well but they call them by slightly different names; my guess is to avoid legalities or something like that. No matter, upscales are good projects to do either by scratch-build or kit.

Now, all I need to do is find some bigger gliders. I have a couple already that handle D motors; I guess those would count as upscales too since they are larger versions of their original forms. And people wonder why we have so much fun??



Product Review: Estes Universal AstroCam

The Estes Universal Astrocam rocket camera is a relatively new product from Estes and is an offshoot from their Astrocam Starter Set which includes the Astrocam and BT-50 size carrier rocket. The Astrocam is fitted into a specially formed nosecone. The package also includes an Electron Beam launch controller and Porta-Pad II.

The Universal Astrocam comes with the camera, universal holder, Tyvek paper straps and rubber bands. It is packaged in nicely decorated box and includes a set of directions for the camera and camera/holder combination.

Specs:

- Video Format: AVI
- Video Resolution: 1920x1080
- Photo Resolution: 2560x1440
- Frame Rate: 30fps
- Interface Type: USB 2.0 Type A
- Storage: 16GB Micro DS Card included (~90 min recording capacity)
- Weight Alone: 9.5gm
- Weight w/Holder: 11.9gm
- Length: 52mm
- Width: 21mm
- Thickness: 12mm



The first impression once you take the camera out of the box is it is small... really small! The picture on the box gives the impression that it is bigger. Once you see it you realize it could easily go up on a BT-5 size model. It is light-weight as well. It weighs a tiny 9.5 grams compared to the 19.4 grams of the #32 808 cam. Using the universal holder



Screen capture from the Universal Astrocam



Screen capture 808 #16 normal lens (cropped)



Screen capture 808 #32 wide angle (cropped)



808 #32 (left) Astrocam (right)

only adds 2.4 grams. The Astrocam is also smaller than the popular 808.

The 16gb Micros SD is removable so it can be interfaced with a computer separately or in the camera. The Astrocam also supports Micro SD cards up to 128gb in capacity.

I haven't tested the actual battery life. The instructions state a run time of 40 minutes. Make sure you have a charging source if you plan to use it multiple times during the day.

I also haven't been able to test it in flight since it's been rather cold and windy here in Michigan lately, but I did shoot some video in the hobby room to compare it with my #16 and #32 808 cameras. The picture quality is similar to the 808's and I prefer it over the wide angle lens of the #32 808.

It didn't take 3D prints to start showing up for Astrocam carriers. Jamie Claye has uploaded a new version of his popular Cineroc payload section to fit the Astrocam as well as several nose cone carriers from BT-5 to BT-50. You can find these on PrusaPrinters.org. I have printed several including the Cineroc payload and they all fit well.



Various 3D printed nose cone carriers for the Astrocam and an 808 sled

With any luck we will start seeing some better weather soon and I can get in some flights with the Astrocam. The mounting system makes it easy to put it on nearly any rocket you have. There's almost no reason not to put it on whatever you are flying. The Astrocam retails for \$49.99 but has been on sale for 50% off.



3D printed Cineroc Payload Carrier



Impulse Buys
 On site motor dealer for your rocketry needs
 Jay Calvert, Proprietor (269) 694-9618
 03400 22nd Street www.impulse-buys.com
 Otsego, MI 49078 Jay@impulse-buys.com



CURRENT EVENTS IN SPACE EXPLORATION

Of the recent space flights, SpaceX blew away all other providers with a staggering 8 launches. They are on track for meeting their goal of averaging one launch a week this year, though they did experience a strange mishap with one group of Starlink satellites. They also received news from the FAA that the environmental study for Starship launches from their Starbase facility in Boca Chica is delayed again. This hasn't slowed down the work going on there as well as Starbase II construction at Cape Canaveral. On February 10, Elon Musk delivered his second Starship update with a fully stacked Starship as a backdrop. During the presentation Musk stated he still expected approval to launch from Starbase soon and showed a video simulation of a Starship flight to Mars. If things go south at Boca Chica it would take up to 8 months to prepare the Cape Canaveral site for a Starship launch.

The final bit of non-launch related news for SpaceX was the announcement of the Polaris Dawn program. Building on the success of the Inspiration 4 mission last year, Jared Isaacman will command (and fund) a Crew Dragon flight no sooner than quarter4 2022. The crew of four will spend 5 days in the highest earth orbit ever flown to study the effects of space radiation on humans, they will also attempt the first EVA from a Crew Dragon capsule. This is the first of three Polaris launches with the third possibly being the first crewed Starship flight.



SPACEX

On January 6 SpaceX lofted Starlink Group 4-5 from Kennedy Space Center aboard a Falcon 9 for their first launch of the year. The mission carried 49 Starlink telecom satellites to shell 4. Both fairing halves were recovered and the booster landed safely on the drone-ship *A Shortfall of Gravitas*. It was the booster's 4th flight.



Starlink Group 4-6 was the next SpaceX flight on January 19. This Falcon 9 lifted off from Kennedy Space Center with a payload of 49 more Starlink satellites to shell four. This was the booster's 10th flight and landed successfully on the drone-ship *A Shortfall of Gravitas*. Both fairing halves were also recovered.



On January 31 the Cosmo-Skymed Second Gen FM2 (CSG-2) mission was launched by a Falcon 9 from the Cape Canaveral Air Force Station. CSG-2 is an Italian Space Agency Earth Observation satellite and was successfully placed into a sun synchronous orbit. The booster had flown twice previously and landed back at the Cape on Landing Zone 1.



One-week later on January 13, Transporter 3 launched from Cape Canaveral Space Force Station carrying 105 satellites to a sun-synchronous orbit. This was the third flight solely dedicated to small ride share satellites. It was the 10th flight for this Falcon 9 booster which landed back at the cape on Landing Zone 1. The ride share satellites included CubeSats, PocketQubes, and orbital transfer vehicles.





CURRENT EVENTS IN SPACE EXPLORATION

Two days later on February 2, another Falcon 9 launched the classified NROL-87 observation satellite for the National Reconnaissance Office from Vandenberg Air Force Base. It was the booster's first flight and landed back at Vandenberg on Landing Zone 4.



flight which landed on the dronship *Of Course I Still Love You*. Both fairing halves were recovered.



The next day, February 3, SpaceX launched the sixth group of Starlink satellites (Group 4-7) to shell 4 aboard a Falcon 9 from Kennedy Space Center. The booster had 5 previous flights and recovered safely aboard dronship, *A Shortfall of Gravitas*. Both fairing halves were also recovered. Though the deployment of 49 Starlinks was successful, most of them later fell back to earth, burning up in the atmosphere. A recent solar geomagnetic storm was to blame for the losses.



A Black Brant IX sounding rocket launched Jan. 9 at 12 am ET from NASA's Wallops Flight Facility carrying the DXL mission to study the origin of soft x-rays in our galaxy that impact technology in Earth's atmosphere.



There wouldn't be another SpaceX launch for nearly three weeks. On February 21 Starlink Group 4-8 lifted off from Cape Canaveral Air Force Station with 46 telecom satellites for shell 4. This was the eleventh flight for the Falcon 9 booster which landed aboard the dronship *A Shortfall of Gravitas*. Both fairing halves were recovered.

The final SpaceX launch of this period was four days later on February 25. This was another Starlink flight, Group 4-11, this time from Vandenberg Air Force Base. The payload was 50 Starlink satellites which were successfully deployed to shell 4. It was the booster's 4th





CURRENT EVENTS IN SPACE EXPLORATION



Virgin Orbit held the *Above the Clouds* flight on January 13. The *LauncherOne* vehicle was flown from the Mojave Air and Space Port aboard *Cosmic Girl*, a modified 747-400 mothership. The *Above the Clouds* mission included payloads from the Department of Defense, SatRevolution, and Spire Global. The launch zone was over the Pacific Ocean and LauncherOne successfully deployed the satellites to low earth orbit.



Astra attempted their first launch from Cape Canaveral on February 10. The ELaNa 41 payload aboard the Astra Rocket 3.3 failed to reach orbit after the vehicle staged incorrectly resulting in a loss of the second stage. Onboard video footage seemed to indicate that the stages failed to separate until the upper stage ignited. That resulted in the upper stage going out of control likely due to damage from abnormal staging. ELaNa or Educational Launch of Nanosatellites is a NASA program to give students experience in aerospace fields.



On January 21, United Launch Alliance (ULA) flew a pair of USSF-8 (Geosynchronous Space Situational Awareness Program) satellites aboard an Atlas V 511 vehicle. The launch occurred at Cape Canaveral Space Force Station. The GSSAP satellites will operate in a near geosynchronous orbit above the equator to support Space Force's space surveillance operations.



Northrop Grumman launched an Antares 230+ on February 19 carrying the Cygnus NG-17, SS *Piers Sellers* ISS resupply spacecraft. Named after NASA astronaut Piers Sellers for his efforts in developing the International Space Station. In addition to the 8,000 pounds of research, hardware and crew supplies, the spacecraft NG-17 will also perform the first ISS orbit reboost by a Cygnus.





THIS MONTH IN AEROSPACE HISTORY

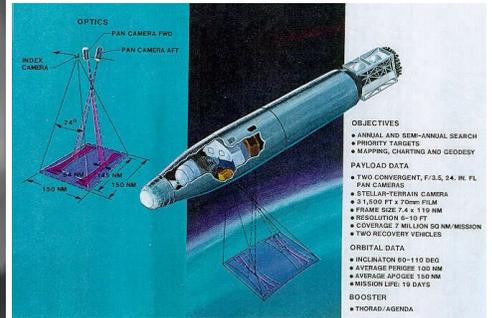
Source—NASA / ROSCOSMOS Archives

90 Years Ago – 1932

February 19: Joseph Kerwin's birthday

January 26: Ranger 3 launched by Atlas Agena from Cape Canaveral

February 27: Discoverer 38 (Corona Mission 9030) launched by Thor from Vandenberg AFB. The last Discoverer named Corona mission



55 Years Ago – 1967

January 11: Intelsat II F-2 launched by Delta from Cape Canaveral. Also known as Pacific 1

January 26: ESSA 4 launched by a Delta from Vandenberg AFB



60 Years Ago – 1962

January 3: NASA announced name of two-manned spacecraft, "Gemini"

January 13: Discoverer 37 launched by Thor Agena from Vandenberg AFB

January 24: Composite 1 (Navy), GREB IV, Lofti III, Injun II, and Surcal launched by Thor Ablestar from Cape Canaveral



February 8: Tiros 4 launched by Thor Delta from Cape Canaveral

February 20: Mercury Atlas 6 (MA-6), Friendship 7 launched with astronaut John H. Glenn the first American to orbit the earth from Cape Canaveral



January 27: Apollo I/AS 204 fire at 6:31 p.m., EST, Cape Canaveral. Astronauts Virgil I. "Gus" Grissom, Edward H. White II, and Roger B. Chaffee die in capsule fire

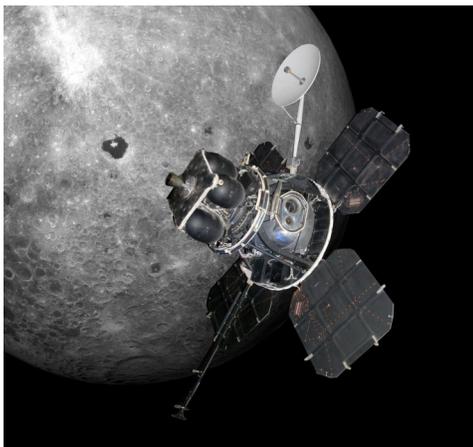




THIS MONTH IN AEROSPACE HISTORY

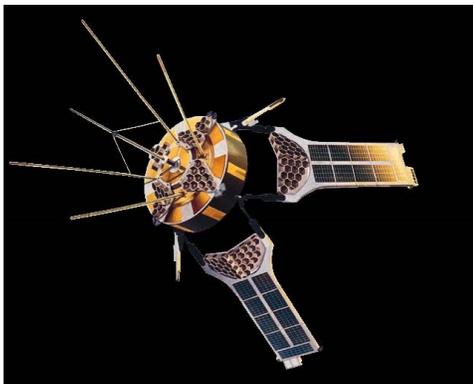
Source—NASA / ROSCOSMOS Archives

February 4: Lunar Orbiter 3 launched by Atlas Agena from Cape Canaveral



February 8: French satellite Diademe 1 launched by Diamant A from Hammaguir, Algeria

February 15: French satellite Diademe 2 launched by Diamant A from Hammaguir, Algeria



50 Years Ago – 1972

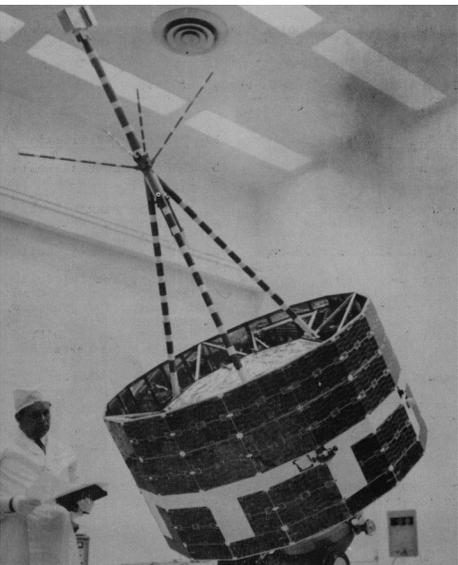
January 5: President Richard M. Nixon announced decision that U.S. will build a reusable space shuttle



January 22: Intelsat IV F-4 launched by an Atlas from Cape Canaveral



January 31: HEOS A-2 launched by a Delta from WSMC



February 14: USSR launches Luna 20 (Lunik 20) by Proton K from Baikonur which soft lands on the Moon four days later. A rotary-percussion drill retrieved samples from the surface which were returned to Earth by capsule on February 25



45 Years Ago -- 1977

January 27: NATO III-B launched by a Delta from Cape Canaveral



February 7: USSR launches Soyuz-24 from Baikonur. Cosmonauts: Viktor V.Gorbatko and Yuri N.Glazkov. Ferry flight to Salyut-5 space station

February 18: Enterprise, the first space shuttle orbiter, was flight tested at Dryden Flight Research Center



40 Years Ago – 1982

January 15: RCA-IV or Satcom 4 launched by Delta from Cape Canaveral



February 25: Westar IV launched by Delta from Cape Canaveral



THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

35 Years Ago – 1987

February 5: Soyuz TM-2 launched from Baikonur. Yuri V. Romanenko and Aleksandr I. Laveykin docked with space station Mir. Romanenko established world space record of 326 days in space

February 12: SDS launched by Titan 34D for DOD from Vandenberg AFB

February 26: GOES 7 launched by a Delta from Cape Canaveral

25 Years Ago – 1997

January 12: STS-81 (Space Shuttle Atlantis) launched from KSC. Crew: Michael A. Baker, Brent W. Jett, Jr., John M. Grunsfeld, Marsha S. Ivins, Peter J. K. Wisoff, and Jerry M. Linenger. Fifth Mir docking. Astronaut John Blaha, who had been on Mir since September 19, 1996, was replaced by astronaut Jerry Linenger. Landed at KSC on January 22. Mission Duration: 10 days, 5 hours

a Saudi Arabian satellite were launched using the Ariane-44L launch vehicle from the Kourou Space Center

20 Years Ago – 2002

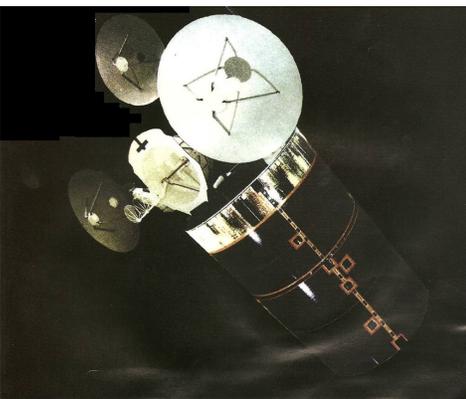
February 5: HESSI (High Energy Solar Spectroscopic Imager) solar flare observatory launched by a Pegasus XL rocket which was released from a L-1011 aircraft flying out of the Cape Canaveral AFS. Renamed Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) on March 29, 2002

February 23: Launch of Intelsat 904 aboard an Ariane 44L from Kourou

15 Years Ago – 2007

January 10: SRE 1, India's first recoverable capsule, was launched by a PSLV-C7 rocket from Sriharikota. It was a technology demonstrator for the planned 2010 launch of a lunar mission

February 17: THEMIS 1, THEMIS 2, THEMIS 3, THEMIS 4, and THEMIS 5, a fleet of nearly identical NASA magnetospheric satellites were launched by a Delta 2 from Cape Canaveral on 17 February 2007. As part of Time History of Events and Macroscale Interactions during Substorms or THEMIS, they are designed to track the origins of substorms within the Earth's magnetic field, which produce auroras



30 Years Ago – 1992

January 22: STS-42 (Space Shuttle Discovery) launched from KSC. Crew: Ronald J. Grabe, Stephen S. Oswald, Norman E. Thagard, David C. Hilmers, William F. Readdy, Roberta L. Bondar (Canada), and Ulf D. Merbold (ESA-Germany). Carried in the cargo bay was the International Microgravity Laboratory 1 (IML-1) a pressurized manned Spacelab module, to explore in depth the complex effects of weightlessness on living organisms and materials processing. Landed January 30 at Edwards Air Force Base. Mission Duration: 8 days, 1 hour

February 10: Russia launches Soyuz TM-25 aboard a Soyuz-U rocket from Baikonur. Cosmonauts: Vasili V. Tsibliyev, Aleksandr I. Latuzkin, Reinhold Ewald (Germany). Ferry flight to space station MIR



February 11: STS-82 (Space Shuttle Discovery) launch from KSC. Crew: Kenneth D. Bowersox, Scott J. Horowitz, Mark C. Lee, Steven A. Hawley, Gregory J. Harbaugh, Steven L. Smith, and Joseph R. Tanner. Second in a series of planned servicing missions to the orbiting Hubble Space Telescope (HST). Landed February 21 at KSC. Mission Duration: 9 days, 23 hours, 38 minutes



January 22: First exoplanet discovered (PSR B1257+12 B)



February 26: Superbird B1, a Japanese communications satellite, and Arabsat 1C,





LAUNCH WINDOWS

Launch dates from SpaceFlight.com

March 1, 2022

Atlas 5 - GOES-T

Launch site: SLC-41, Cape Canaveral Space Force Station

A United Launch Alliance Atlas 5 rocket will launch GOES-T, the third next-generation geostationary weather satellite for NASA and NOAA. GOES-T will orbit 22,300 miles above the equator to monitor weather conditions across the United States. The rocket will fly in the 541 vehicle configuration with a five-meter fairing, four solid rocket boosters and a single-engine Centaur upper stage.

March 3, 2022

Falcon 9 - Starlink 4-9

Launch site: LC-39A, Kennedy Space Center

A SpaceX Falcon 9 rocket will launch with another batch of Starlink internet satellites.

March 4, 2022

Soyuz - OneWeb 14

Launch site: Baikonur Cosmodrome

A Russian Soyuz rocket, marketed by Arianespace, will launch 36 satellites into orbit for OneWeb, which is developing a constellation of hundreds of satellites in low Earth orbit for low-latency broadband communications. The Soyuz-2.1b rocket will use a Fregat upper stage.

March 8, 2022

Falcon 9 - Starlink 4-10

Launch site: SLC-40, Cape Canaveral Space Force Station

A SpaceX Falcon 9 rocket will launch with another batch of Starlink internet satellites.

March 2022

Electron - BlackSky 16 & 17

Launch site: Launch Complex 1A, Mahia Peninsula

A Rocket Lab Electron rocket will launch two small second-generation satellites for BlackSky's commercial fleet of Earth observation spacecraft. Rocket Lab has nicknamed this mission "Without Mission a Beat." Delayed from September, December.

TBD, 2022

SSLV - Demonstration Launch

Launch site: Satish Dhawan Space Center

India's Small Satellite Launch Vehicle (SSLV) will launch on its first orbital test flight. Consisting of three solid-fueled stages and a liquid-fueled upper stage, the SSLV is a new Indian launch vehicle de-

signed to carry small satellites into low Earth orbit. Delayed from September and December 2019. Delayed from January and December 2020. Delayed from April.

TBD 2022

SSLV - BlackSky Global

Launch site: Satish Dhawan Space Center

India's Small Satellite Launch Vehicle (SSLV) will launch on its first commercial mission with four Earth observation satellites for BlackSky Global, a Seattle-based company. The rideshare mission for BlackSky is being arranged by Spaceflight.

Early 2022

Falcon Heavy - USSF 44

Launch site: LC-39A, Kennedy Space Center

A SpaceX Falcon Heavy rocket will launch the USSF 44 mission for the U.S. Space Force. The mission is expected to deploy two spacecraft payloads directly into geosynchronous orbit, one of which is the military's TETRA 1 microsatellite.

Early 2022

Starship - Orbital Test Flight

Launch site: Starbase, Boca Chica Beach

A SpaceX Super Heavy and Starship launch vehicle will launch on its first orbital test flight. The mission will attempt to travel around the world for nearly one full orbit, resulting in a re-entry and splashdown of the Starship near Hawaii.

March 18, 2022

Soyuz - ISS 67S

Launch site: Baikonur Cosmodrome, Kazakhstan

A Russian government Soyuz rocket launched the crewed Soyuz MS-21 spacecraft to the International Space Station with the next team of three cosmonauts to live and work on complex. The crew is led by commander Oleg Artemyev, with flight engineers Denis Matveyev and Sergey Korsakov. The rocket will fly in the Soyuz-2.1a configuration.

March 19, 2022

Electron - CAPSTONE

Launch site: Launch Complex 1A, Mahia Peninsula

A Rocket Lab Electron rocket will launch on its second mission from a new launch pad at the Mid-Atlantic Regional Spaceport at Wallops Island, Virginia. The Electron rocket will carry NASA's Cislunar Autonomous

Positioning System Technology Operations and Navigation Experiment, or CAPSTONE, mission to the moon. CAPSTONE will fly to the moon on Rocket Lab's Photon space tug, entering a unique halo-like lunar orbit to test deep space navigation and communications in the same orbit to be used by NASA's Gateway mini-space station. Moved from Launch Complex 2 in Virginia to Launch Complex 1A in New Zealand.

March 30, 2022

Falcon 9 - Axiom Mission 1

Launch site: LC-39A, Kennedy Space Center, Florida

A SpaceX Falcon 9 rocket will launch a Crew Dragon spacecraft on its sixth flight with astronauts. The commercial mission, managed by Axiom Space, will be commanded by former NASA astronaut Michael López-Alegría. Paying passengers Larry Connor, Mark Pathy, and Eytan Stibbe will also be on-board for the 10-day mission to the International Space Station. The Crew Dragon will return to a splashdown at sea. Delayed from Feb. 21.

April 2022

Falcon 9 - Transporter 4

Launch site: SLC-40, Cape Canaveral Space Force Station

A SpaceX Falcon 9 rocket will launch the Transporter 4 mission, a rideshare flight to a sun-synchronous orbit with numerous small microsatellites and nanosatellites for commercial and government customers.

April 5/6, 2022

Soyuz - Galileo 29 & 30

Launch site: ELS, Sinnamary, French Guiana

An Arianespace Soyuz rocket, designed VS28, will launch on a mission from the Guiana Space Center in South America. The Soyuz will carry two Galileo full operational capability satellites for Europe's Galileo navigation constellation. The Soyuz-2.1b (Soyuz ST-B) rocket will use a Fregat upper stage. Delayed from late March.

April 2022

Space Launch System - Artemis 1

Launch site: LC-39B, Kennedy Space Center

NASA's Space Launch System heavy-lift rocket will launch on its first test flight with an uncrewed Orion spacecraft. The mission, known as Artemis 1, will place the Orion spacecraft into orbit around the moon before the capsule returns to Earth for



LAUNCH WINDOWS

Launch dates from SpaceFlight.com

splashdown in the Pacific Ocean. Ten small CubeSat rideshare payloads will also launch on the Artemis 1 mission.

April 2022

Atlas 5 - USSF 12

Launch site: SLC-41, Cape Canaveral Space Force Station

A United Launch Alliance Atlas 5 rocket will launch the USSF 12 mission with Wide Field Of View, or WFOV, experimental missile warning satellite for the U.S. Space Force. WFOV hosts a new type of infrared staring sensor in geosynchronous orbit to detect the heat from missile launch plumes. The USSF 12 mission will include additional rideshare payloads. The rocket will fly in the 541 vehicle configuration with a five-meter fairing, four solid rocket boosters and a single-engine Centaur upper stage.

April 15, 2022

Falcon 9 - Crew 4

Launch site: LC-39A, Kennedy Space Center

A SpaceX Falcon 9 rocket will launch a Crew Dragon spacecraft on its seventh flight with astronauts. NASA astronauts Kjell Lindgren, Robert Hines, Jessica Watkins, and European Space Agency astronaut Samantha Cristoforetti will launch on the Crew Dragon spacecraft to begin a six-month expedition on the International Space Station. The Crew Dragon will return to a splashdown at sea.

April 2022

Ariane 5 - MEASAT 3d & GSAT 24

Launch site: ELA-3, Kourou, French Guiana

Arianespace will use an Ariane 5 ECA rocket, designated VA257, to launch the

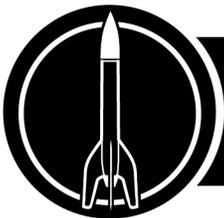
MEASAT 3d and GSAT 24 communications satellites. Built by Airbus Defense and Space for MEASAT, a Malaysian operator, MEASAT 3d is a multi-mission communications satellite outfitted with C-band, Ku-band, and Ka-band payloads for direct-to-home TV broadcasting and internet services over Asia, the Middle East, and Africa. GSAT 24 is a direct-to-home TV broadcasting satellite for the Indian Space Research Organization.

2nd Quarter, 2022

Falcon Heavy - USSF 52

Launch site: LC-39A, Kennedy Space Center, Florida

A SpaceX Falcon Heavy rocket will launch the USSF 52 mission for the U.S. Space Force. The mission will launch an unspecified military payload on this mission.



JMRC
HUVARS

Club News

Flying Field Update

The Board of Directors has started an email campaign to the new management at MIS (Michigan International Speedway) in an effort to re-establish flying dates at the Graves Campground launch site. We have not received any replies yet, but we are still hopeful that the new owners will respond soon. It is unlikely that we will have a launch in March. Generally the long range forecast isn't optimistic and the farm fields will likely be muddy regardless. Our goal is to restart launch activities for 2022 in April.

We will have Horning's 1 and 2 launch sites with Horning 1 likely being available throughout the Summer after hay cuttings (roughly every four weeks, weather depending).

We will look for opportunities to use the larger Horning 2 field when we can.

The club is always looking for new fields. If you have potential site in mind please reach out to the board.

NAR Section Grants Available for 2022

The NAR provides \$250 grants to sections for the purchase of safety and launch operations equipment. With the joining of our two sections we can request up to \$500. We are still looking for ideas from the membership for ways we can improve our launch operations. Let the BOD know if you have an idea which we could apply towards a grant application. It doesn't have to be one big thing and many small things add up. We have considered investing in a new PA system and if anyone knows what is good and is not, please contact any of the board members. We would appreciate the information.

Big Bertha Contest

I know many of us have built Big Berthas just for this contest and are longing to participate. I will schedule this as soon as our flying schedule for the year has been established. I can't wait to fly this contest too. Hang in just a little while longer.

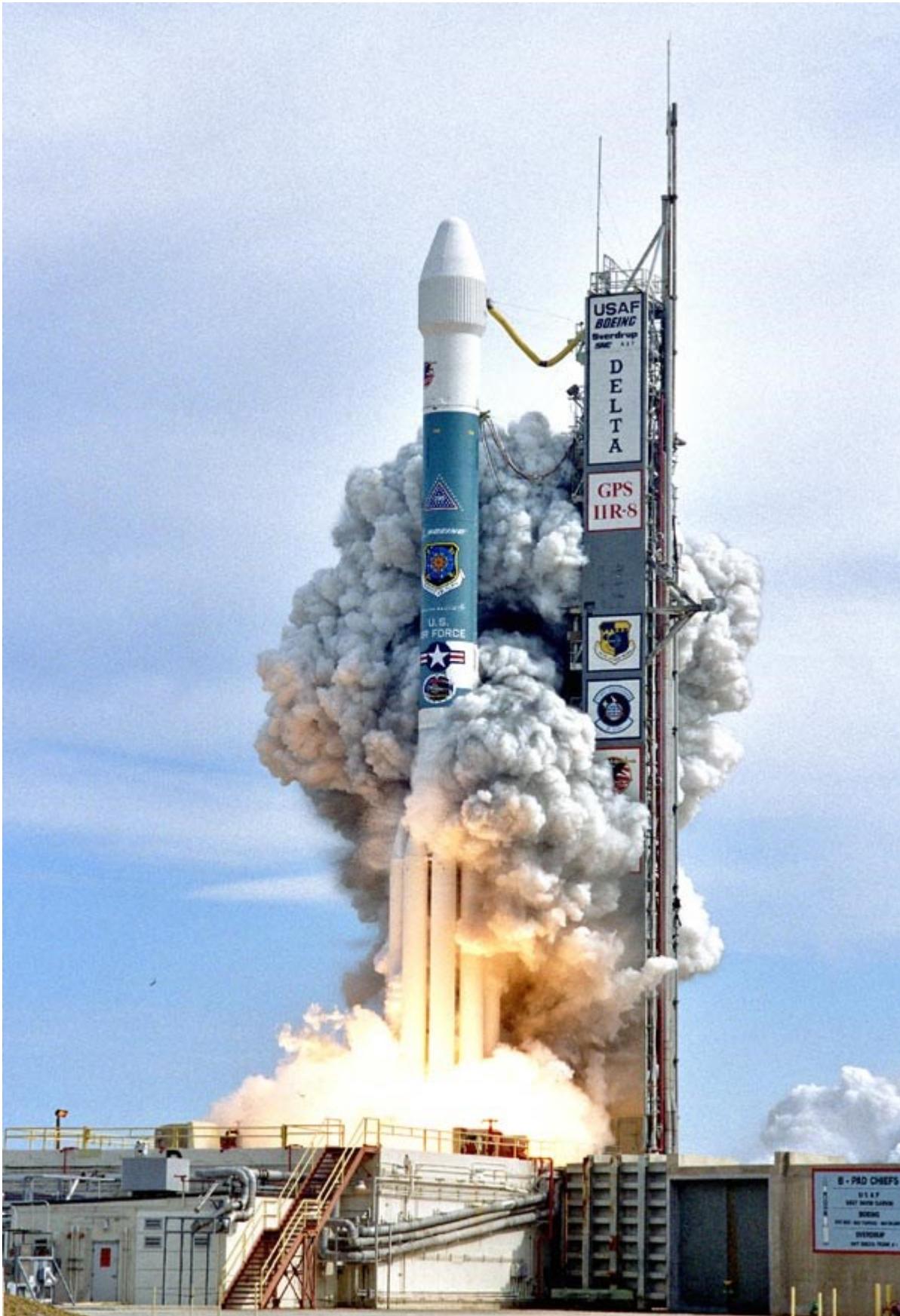
JMRC/HUVARS Design Contest

I am suspending this for the time being in hopes that once we start flying again there will be more interest in submitting designs. I would really like to see at least 10 entries submitted. Right now we're standing at two.

Upcoming Fun Event / Contest Ideas

The only other upcoming fun contest will be Iron Man III. If you have any ideas for future fun events or contests please let the board know so we can schedule it for an upcoming launch.





GPS IIR-M-8 Delta II Launch 8/17/09—NASA Photo

Delta III 8930 w/Orion 3 Telecom Satellite— NASA Photo

