ZOG-43

Zog-43
Volume 45 Number 1
January/February 2023
Official NARHAMS Newsletter
Editor: Sarah Jackson

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 public parks in Frederick and Carroll Counties, 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- January/February 2023
Sarah Jackson, NAR 101372

Hello NARHAMSters!

The major news for the club is that we've lost our main field for flying. See President Alex Mankevich's words below.

Model rocketeers of all ages,

NARHAMS has been informed by the Frederick County Div. of Parks and Recreation that they cannot issue us a permit for model rocket launches this year at Old National Pike Park due to the upcoming start of construction.

Frederick County has agreed to keep the door open for NARHAMS to host stand-alone events that would be one-time only, and would not take up too much room in the park. That means something like a Rocket Run event with Mosquitos. Tommi-Leigh herself echoed what New Ed had been saying for some time … after construction is completed at Old National, it could be possible for NARHAMS to return to launching at ONPP. So, absorb and digest this news. We will probably lean on Krimgold a lot this year. We need to keep our thinking caps on for the April Rocket Run, ECRM and the John McCoy Night Launch.

Please let us know if you have any ideas or are willing to help with the search for a new field.

For questions, answers, opinions, files, photos, and more NARHAMS, join the NARHAMS Groups.io. Also checkout the Facebook group, and of course, the website at narhams.org.

Front: The ground crew prepares the Electron for launch on December 18th. The strongback will later tilt the rocket to vertical on its launch platform. Two wrappings of protective white tarp will be removed from the rocket prior to going vertical. *Photo: Alex Mankevich*

Back: A remote camera offers a close-up view of the RS-25 hot fire on the Fred Haise Test Stand at Stennis Space Center in south Mississippi on Feb. 8, 2023. The new engines will help power future Artemis missions to the Moon beginning with Artemis V as NASA explores the universe for the benefit of all. *Photo: NASA / Stennis*

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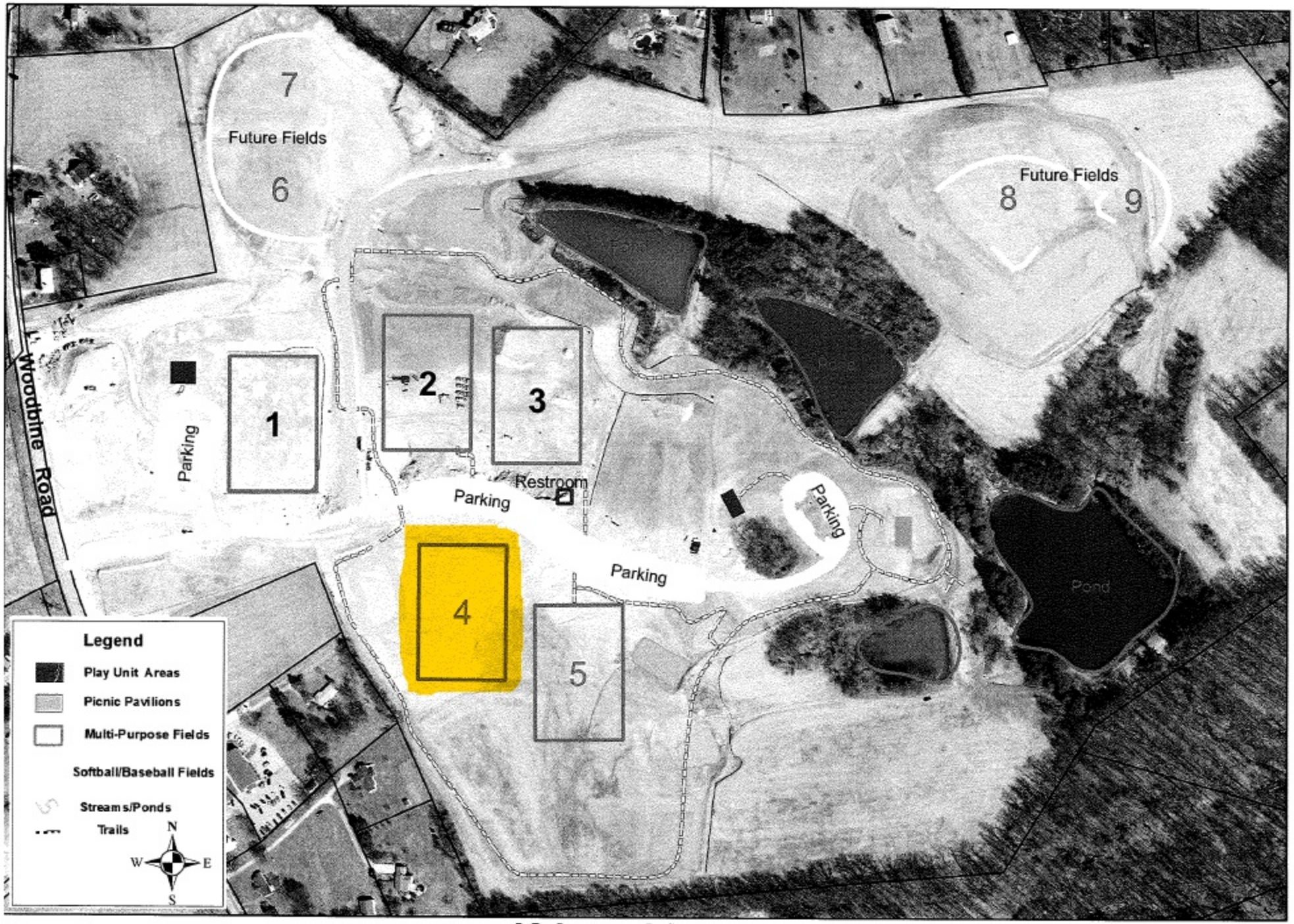


Krimgold Park

560 280 0 560 Feet

Upcoming events

Date	Time	Event	Location
April 15th	2:00-7:00 PM	Sport Launch Theme: Open Launch Manager: Jim Baird	Krimgold Park 5355 Woodbine Rd, Woodbine, MD 21797
April 23rd	12:00- 4:00 PM	Rockville Science Day	Montgomery College 51 Mannakee St, Rockville, MD 20850
May 6th	5:30-9:00 PM	Monthly Meeting Topic: Open Refreshments: Open	College Park, MD
May 7th	1:00-3:00 PM	Goddard Launch	Greenbelt, MD
May 20th	8:00 AM-5:00 PM	TARC Finals	The Plains, VA
May 25th	9:00 AM-3:00 PM	Westchester Elementary School 4th Grade Launch Manager: Tom Bagg	Catonsville, MD (See Tom Bagg or Alex Mankevich to volunteer to help with launch)
May 27th - 29th	9:00 AM-5:00 PM	National Sport Launch West 2023	Alamosa, CA
June 3rd	5:30-9:00 PM	Monthly Meeting Topic: open Refreshments: open	College Park, MD
June 4th	1:00-3:00 PM	Goddard Launch	Greenbelt, MD

Electron Launch

Left: The mission logo of the Virginia Is For Launch Lovers mission. *Mission logo credit: Rocket Lab*

The Inaugural Electron Launch From US Soil: A Game of Patience

By: Alex Mankevich – Intrepid ZOG-43 Reporter

An extended game of patience began in July 2018 when Rocket Lab announced that it would be constructing a new launch pad for its Electron small satellite launch rockets somewhere in the USA. Four candidate sites were explored, and eventually the Wallops Flight Facility was chosen in October 2018, beating out Cape Canaveral in Florida, the Pacific Spaceport Complex in Alaska and the Vandenberg Air Force Base in California.

The construction of a new launch pad at the Mid-Atlantic Regional Spaceport (MARS) next to the existing pad 0A was begun in February 2019, and the operational launch site, named Launch Complex 2, was completed ten months later in December 2019. The new launch pad supports small-class launch vehicles using liquid-fueled engines and leverages systems from the neighboring pad 0A. The next hurdle was to receive an operator license from the Federal Aviation Administration (FAA) to launch from Wallops Island using a newly developed NASA Autonomous Flight Termination Unit (NAFTU). Computer coding challenges and a lengthy certification review with the NAFTU prolonged the launch date by nearly one year.

The delayed certification process caused Rocket Lab to cancel its original schedule of launching two highly anticipated missions from Wallops Island. The STP-27RM mission with the U.S. Air Force's Monolith microsatellite as well as the Capstone mission to the Moon were moved to and launched from Rocket Lab's Launch Complex 1 site in New Zealand.

Rocket Lab delivered the Electron rocket that was to power its inaugural flight from US soil to Wallops Island in mid-October

Above: Rocket Lab's Launch Complex 2 (LC-2) is adjacent to the MARS pad 0A. The two launch pads share some ground support and propellant systems. The NASA/MARS water tower readily identifies this launch site as being at Wallops Island. *Photo: Alex Mankevich*

2022. Rocket Lab initially announced in early November 2022 a launch date of No Earlier Than (NET) December 7th. Rocket Lab was contracted to launch three satellites for radio frequency geospatial analytics provider HawkEye 360 on a mission which was appropriately named “Virginia Is For Launch Lovers”. Backup dates for the launch extended from December 7th to 20th. It was to be a night launch with each night’s launch window running from 6:00 pm to 8:00 pm.

A new launch date was set for December 9th in order to provide more time for Rocket Lab to perform final pre-launch preparations. Then the weather decided to have a say regarding the launch opportunities. A persistent pattern of fog, rain and high winds aloft settled into the Mid-Atlantic. Rocket lab reset the launch date to December 13 and the forecast responded by showing an improvement in the weather conditions.

Then came a complication in the form of launch range and airspace availability. This forced a move of the launch date to December 15th. Rocket Lab modified its media schedule upon this delay. The pre-launch press conference was changed to a virtual Zoom event to be conducted on December 14th. The photo opportunities at the LC-2 launch pad, Rocket Lab’s Integration and Control Facility (ICF) and to the media site for the launch were moved to the launch day.

Above: The nearly 60 feet tall Electron rocket stands about one-third the height of the water tower. Portions of the normally black colored rocket body turn white due to frost as the supercooled propellants are loaded. *Photo: Alex Mankevich*

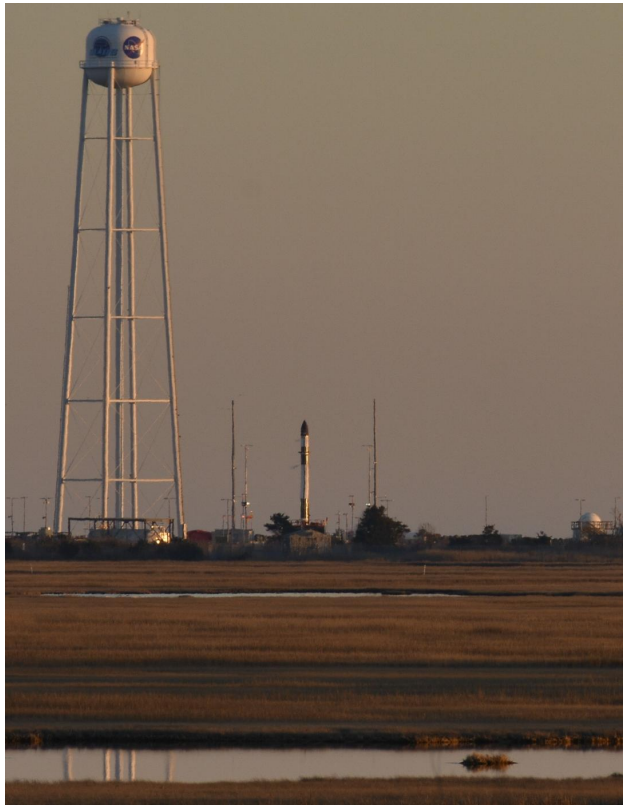
The Electron rocket was at this time on the pad and ready to fly, but NASA and the FAA were continuing to work to close out the final licensing documentation required to approve the autonomous flight termination system software. Yet another launch date was set for Sunday December 18, but that date was to missed as well.

FAA holiday airspace restrictions around the Wallops area prevented launch attempts for the rest of December, and the weather remained unfriendly, particularly with the high winds aloft. Rocket Lab tweeted the following on the evening of December 19th:

Continued strong upper-level winds tomorrow have ruled out the final day of the launch window for our 1st mission from @NASA_Wallops. A new window is now scheduled to open in Jan for the Virginia is for Launch Lovers mission. Team and rocket are ready, so stay tuned for updates!

Rocket Lab set a new 2023 launch date after the holidays. January 23rd was set as the latest launch date with the launch window remaining from 6:00 pm to 8:00 pm. Activity ramped up at Launch Complex 2 when the Electron went on the pad and the launch team performed the final launch readiness review on the afternoon of Sunday January 22nd. Rocket Lab’s weather office was reporting an 85% chance of favorable conditions with the main concern again being high surface winds.

Strong winds aloft got the better of launch plans for Monday evening on January 23rd, and the launch was postponed 24 hours to Tuesday evening. It was still to be a night launch, but sunset moved to within 45 minutes of the beginning of the launch window. The 6:00 pm start of the launch



Above: The setting sun produces a golden glow to the Electron rocket and the MARS water tower just prior to sunset earlier on launch day January 24. *Photo: Alex Mankevich*

window was just after the start of nautical twilight.

The Electron rocket stands about one-third the height of the 309 feet water tower whereas the Antares rocket stands about two-thirds. Portions of the Electron's normally black rocket body turn white due to a coating of frost from the loading of the supercooled propellants. The black colored nose cone (fairing) of the Electron stands in stark contrast to the Antares' white nose cone. Absent from the Electron is the white lattice work of the Transporter/Erector/ Launcher (TEL) system that secures the Antares to its launch pad. The black colored strongback that secures the Electron to its launch platform is situated out of sight of the launch viewers.

Tuesday, January 24th, dawned with much more hope of finally getting a successful launch. This launch day offered blue skies and a whole lot less wind. The lower 40's temperature was tolerable. There seemed to be no major issues in the works as the countdown progressed to the beginning of the two-hour launch window. The night sky darkened considerably at the 6:00 pm hour. A sliver of a crescent moon was positioned well south of the launch pad, so it would not "photobomb" the launch. A plethora of stars obligingly twinkled overhead. The usual night launch concern of condensation build-up on the camera lenses was a non-issue.

The combined light of the nine Rutherford first stage engines was plenty bright enough at engines start-up. As the steam cloud began to billow up, the contrast between an Electron launch and an Antares launch became apparent. The two RD-181 engines of the Antares first stage produce considerably more cloud than the combined nine Rutherford engines of the Electron first stage. The vent direction of the clouds from the launch pads are different. The rocket's first stage plume was unmistakably bright, and the engines combined to provide a satisfying roar. The 3.9 feet wide rocket was quick to slice through the air and rapidly climbed away from the top of the water tower. The flight events of main engine cut off at 02:26 and second stage ignition at 02:32 were readily visible. The crystal-clear night sky afforded a prolonged viewing of the second stage's single engine's burn.

The Electron rocket now joins the Antares and the Minotaur family of rockets that you can see in person was they launch from the MARS down in Wallops Island.

Below: A composite of the thick streak (right side) of the 9 engines on the first stage and the thin streak (left side) of the single second stage engine. *Photo: Alex Mankevich*

“Virginia Is For Space Lovers” Electron Mission Launches From Wallops MARS Facility

by Vice-Zog Alan Williams

Some interesting space history was achieved recently at Virginia’s Mid Atlantic Regional Spaceport. The semi-upstart New Zealand-US aerospace firm Rocket Lab successfully lofted its first “Electron” light satellite launch vehicle from American soil at 6:00 pm on January 24th 2023. This was a milestone for the firm, whose previous 33 orbital missions had all flown from its original launch complex near the town of Mahia on NZ’s North Island southeast coast. All previous Electrons have flown there using basically polar orbital paths. Rocket Lab’s Wallops Launch Complex-2 compact Electron launcher is actually tucked in near the Wallops 0-A launcher water tower, to conveniently use that major resource. In MARS-speak it’s designated as launcher 0-C. To see the New Zealand launch facility and Electron vehicle aft details, refer to the August 2020 ZOG-43 front and back pages. A launch graced the cover of the Nov-Dec 2019 ZOG as well.

Viewing the flight:

Your intrepid Zog space rangers had tried to cover the first three December launch attempts “down the shore”, but an unfortunate series of weather, regulatory and dumb luck events pitched the mission forward into the New Year. This time, I simply watched from my driveway in Bowie. (Deciding against photography because of local light pollution issues, out came my trusty Tasco binoculars.) DJ set up on a lake near his home in Lanham. He later reported not acquiring it during climbout. Other club members around the region reported opting to watch on the Rocket Lab website coverage. Just before 6 pm I set myself on the side of my newly, finally (!!!!!) repaired truck. I was joined by a couple of my cross-street neighbors. Just after 6:00, I was about to tell them to ignore that set of airplane lights moving through the trees in the distance when I realized they were going up, not sideways. Time to party!

As it cleared my tree line the flame was an impressive intense orange color. Visibility could not have been better. Though not as bright as some other orbital birds, it was still quite vivid. Through the binoculars I was surprised to see a pronounced pointy-ness to the plume as it lofted higher. A number of families up the street were shouting excitedly. Young neighbor Carter was impressed. The rocket continued upwards, visibly accelerating. As it got somewhere above 25 degrees elevation, the first stage cut out, holding that strong vivid orange flame till shut down.

Searching around with my glasses, I shortly sighted a dimmer wide gas cloud moving toward the southeastern horizon. The second stage plume was much larger, more diffuse and colorless, almost like the tail of a comet. (Also interesting was a slowly flashing sunlit payload shroud, tumbling as the upper stage left for the tropics.) As it snuck out over the ocean, Stage two didn’t seem that impressive til partially eclipsed by some nearby branches. With something close to judge it by, I realized that that it was actually tearing across a bunch of sky. That “five miles a second” thing began to look a lot less majestic and a lot more “YEEEE-HAW!!”! I watched it till it faded into the horizon-haze. I estimate it to have been at least a couple hundred miles downrange by then. As my friend Wayne’s grandson trotted home to his next being-a-kid assignment, he allowed over his shoulder that it had been fun to watch.

Some stuff about the rocket:

The vehicle is only about 60 feet long, and four feet in diameter. On-pad weight is about 28,000lbs. Nine “Rutherford” metal 3-D printed engines burning high test kerosene provide approximately 50,000 lbs. thrust at launch. The orbital insertion “kick” stage used for final orbital delivery uses a proprietary green energy biopropellant.

This would seem to promise only moderate sounding rocket level

performance. But Electron games the numbers by being made with carbon fiber and other low density materials to improve mass fraction. Also helping is the ongoing race to shrink the spacecraft payloads to remarkably small sizes. Many previous Electron missions have lofted science packages not much bigger than shoeboxes.

The Rocket lab team is somewhat cagy about certain aspects of their products. The satellites for this flight were coyly referred to as “geospatial electromagnetic survey systems to study radio spectrum utilization in the mid-Mhz to Ghz bandwidths.” In other words, radio eavesdropping. Sources indicate they will join other spacecraft in listening to battlefield communications as the Russian liberators valiantly attempt to destroy the Nazis hiding in Ukrainian maternity hospitals, powerplants, and refugee shelters.

Eventually it was announced that the special third stage had delivered the three satellites into a circular orbit at 341 miles altitude and a 40.5 degree inclination to the equator. (Thanks, brother Craig for feeding me that item*.) The Hawkeye 360 spacecraft are actually produced in Virginia.

The point of flying them from Wallops is that its mid-latitude launch plane helps complicate the challenge of hiding from an ever-more complex constellation of snooper satellites. More generally, Wallops offers wide choices for orbital paths supporting numerous types of spacecraft for science, defense and commercial needs. And more launch opportunities are available here than at busier Space Flight Centers.

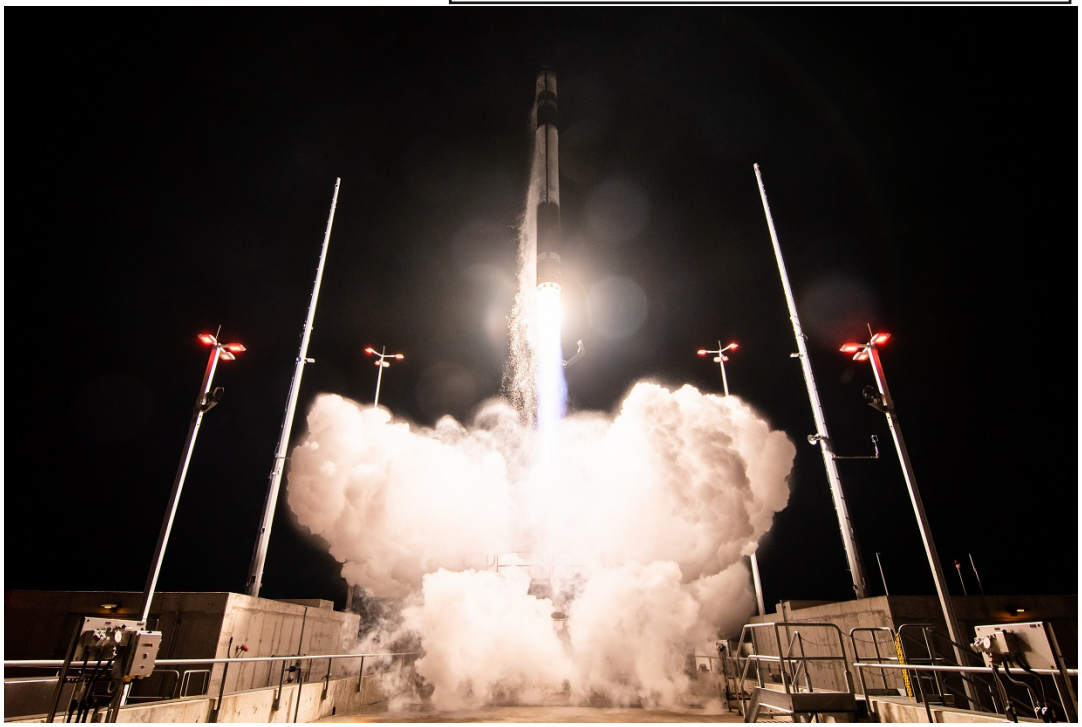
So, we have a first of many Rocket Lab Electrons, to be followed soon by the much larger Newton vehicle (actually being built at Wallops) flying from the big O-A pad. It will be switching turn and turn again with the new Northrop Grumman Antares heavy 330 model, also coming towards operational status.

This time I seem to be almost the only NARHAMSTER to see the flight live, though Mike Cochran spotted some of it through trees in College Park. Sometimes you get lucky. But if the plans of the Rocket Lab gang pan out, we could be seeing perhaps a couple of flights a month from there before long.

*Craig also heard the reason for all those red lights illuminating the Area O-A launch complex. According to Rocket Lab mission control audio, it’s to keep from disturbing sea turtles who nest near that part of the Wallops shoreline. Who woulda thunk it? Also, why does Rocket Lab insist on slapping those cutesy-poo names on their missions? Because they can, of course!

Ed. Note: Seriously, look up the mission names: https://www.rocketlabusa.com/missions/completed-missions/

Below: The mission was Rocket Lab’s 33rd Electron mission overall but the first launched from U.S. soil, introducing a new responsive launch capability to the nation. *Photo: Rocket Lab website/Brady Kenniston*



FIRE Away!

Robin and daughter Charis, run a NAR Section, FIRE Rockets #903, to “[introduce] middle and high school youth to the exciting world of STEM through aerospace principles, career options, model rocketry, and competition.” “Teams of Three Students complete a variety of STEM design challenges, build and launch model rockets, deliver a 10-minute oral presentation, and maintain an Engineering Design Notebook.” The students’ challenge is to build and launch a rocket that must reach an altitude of 500-550 ft and contain a payload of one large hen’s egg during the final launch.

Kevin Johnson shares pictures and information about a launch he helped Robin Houston arrange in February:

The launch (in the snow!) was at Capitol Technology University to support Robin’s FIRE Rocket Challenge. The kids were flying Estes Green Eggs And Ham pay loaders with an altimeter and various additional mass objects on C11-3 motors. Each rocket was supposed to fly two times to collect unballasted and ballasted data. All of the models had at least one safe flight, and only about 4 misfires. They launched from one of the club racks, used their own Pratt Hobbies Sixpack launch controller. One model blew out the motor mount so had a no-ejection, but almost all others were good flights. I flew a Maxi-Alpha III on a D12-3 to about the same altitude as the smaller models on the C11.

You can read more about the challenge here- https://www.firerockets.org/

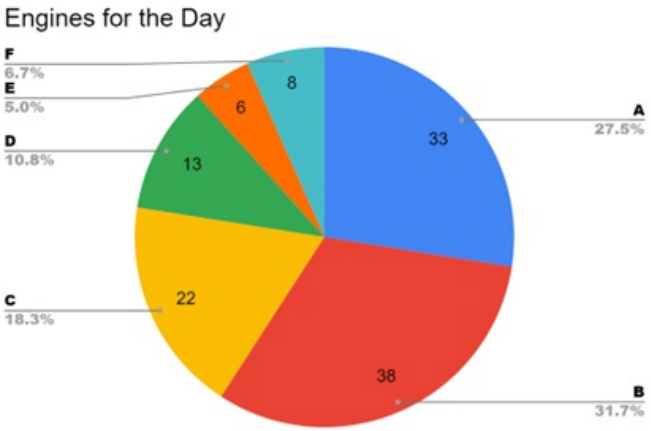
February 2023 Club Launch Report

by Ed Jackson

The February launch was a breezy, chilly day with a westerly wind that started at the normal 10:00 and extended through to 4:00. We were at our alternative park, Krimgold in Winfield/Woodbine and had the park to ourselves. We set up on the middle lower field which gave us a length of the park to recover our rockets. Since this park does not allow tents or a PA we chose to go with a minimal setup of a single rack and used a small personal amplifier rather than shouting the launch out. The "Mr. Mike" set-up worked well and is now a permanent part of System One.

The breezy day did not deter the four TARC teams that showed up who utilized the length of the field to recover their two sectioned, 850ft launches. In addition to the TARC teams a number of newbies and veteran club members help round out the launches to make the launches constant without being overly busy.

Thanks to Jim M. and Alex M. for helping set up and Jim M., Daniel, Ted C., John V, and Dr Crombie for helping clean up.



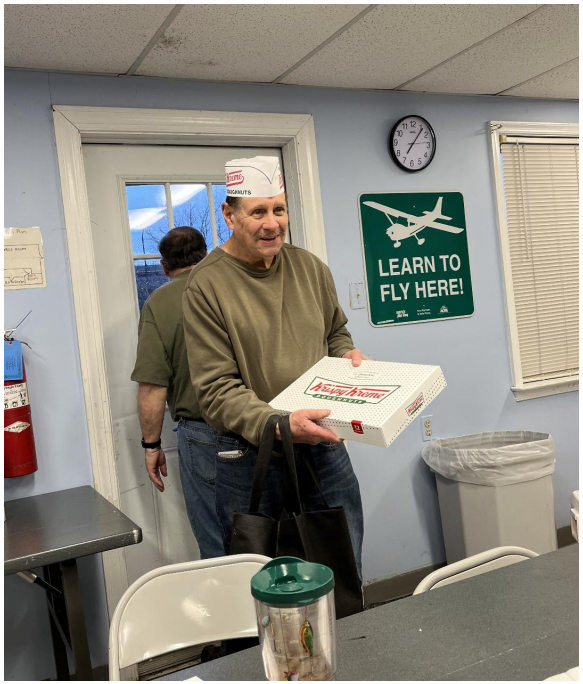
Unofficial, non-NAR launch awards:

Motors to Burn (most flights) – Bill Stec; 15 Rocket
Do it Again! (Most flights of a single rocket) – William Clark; "Ticking" 6 times
Where did it go? (Highest Flight) – John Volpe; Exocet on a F42-6
Why me? (Most Unlucky Flight) – John Volpe; Big Dude, Cluster launch with a single engine CATO
I have rockets! (Largest variety of rockets) – Bill Stec; 13 Rocket

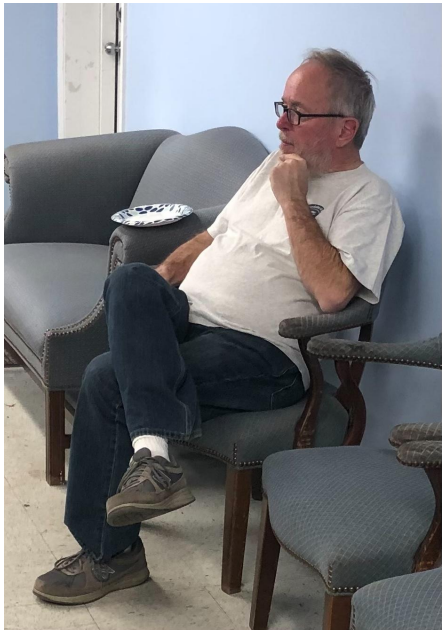
Numbers

Total Flyers:36 Total Engines:87 Equivalent as As:653 Equivalent HP Engine: (1)J, (1)H,(1) F

Meeting Notes



Why You Should Go To Meetings: Good Deeds Recognized and Food



Clockwise from bottom left: Fabrice Derullieux at January club meeting. He provided the yummy food. *Photo: Ed Pearson;*

Refreshments at January's club's meeting. *Photo: Ed Pearson*;

Jim at January's meeting. Recognition and Thanks to Club Advisor Jim Miers for helping the club locate/secure our annual holiday venue, for making a sizable donation to the Greenbelt Volunteer Fire Department matching the club's donation, (and for not writing long-run sentences!) BTW, he supported multiple TARC teams practice during December's brutally cold club launch. *Photo: Ed Pearson;*

Ole Ed brings the Krispy Kremes. *Photo: Brian Beard*;

The NARHAMS crew cleans and repairs equipment at the February meeting. *Photo: Sarah Jackson*

Rocketry Power Categories (A Guide for the Perplexed)

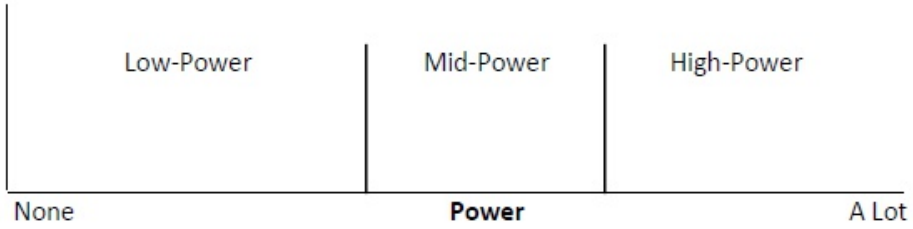
James Miers

"Always act like you know what you are doing. Stick to it --- and give it plenty of oomph."
---- George Booth

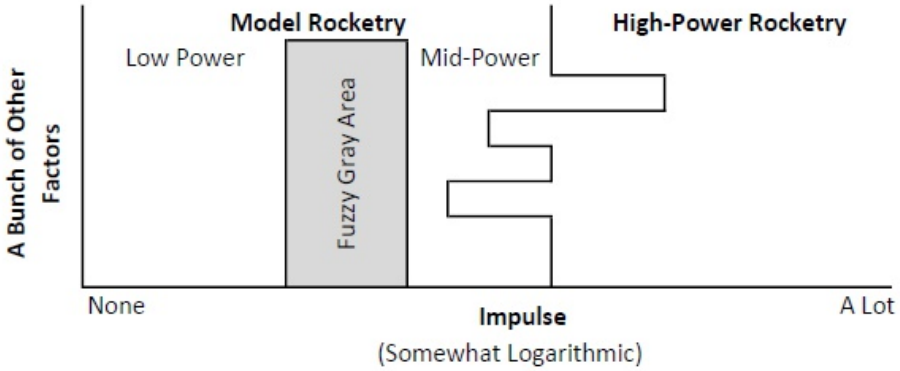
In a very general sense (we will except the occasional odd-ball), sport rockets come in the same basic form; nose, body, and fins. However, they come in a very wide range of sizes, which is a good thing. There are Oz rockets and there are Dorothy rockets; the Oz rockets are great and powerful and the Dorothy rockets small and meek, but all rockets, regardless of size, still fall along the same broad spectrum of reaction propulsion ("we trust in thrust," as the sign said). All that variety in scale adds interest to the hobby.

This article discusses size categories as commonly used within the hobby so that you, too, can sound like you know what you are talking about when conversation turns to rocket sizes and the terms low-power, mid-power, and high-power are being tossed around.

At first sight, the distinctions between these three categories appears obvious, perhaps something like this:



However, after some study of the issues involved, a more realistic chart might look like this:



One issue is immediately obvious, that the term "power" is a characteristic of the motor and not of the rocket itself. Any rocket will require its motor performance fall within some range, neither too low (when it might not move at all) nor too high (which could be catastrophic), although most sport rockets can handle a reasonable range. But the question remains, are we making distinctions based on particular rockets (size or weight or some other factor), or rather on the motors with which they are being flown (by whatever performance factors are pertinent)?

And what does the term 'power' actually mean? In the case of sport rocketry at any level, we often use the term synonymously with impulse, the motor's average thrust multiplied by its burn duration, measured in Newton-seconds (Ns), or in pound-seconds if you are still stuck in the Imperial. This is one measure of a motor's performance, although there are others, including thrust levels, which could also make a difference in classification.

I start with high-power because understanding what is meant by the term is straight-forward, being defined by specific laws and

regulations; two separate sets of laws and regulations, in fact. Each set makes its distinction based on multiple factors, including motor impulse, average thrust, lift-off mass, and propellant mass, so that the factors will consider both the rockets and relevant motors. Because both sets of laws are exactly defined, we can use them to determine an exact, albeit somewhat convoluted, cut-off between what is a high-powered rocket and what is not. Within the hobby, when we use the term "high-power" in conversation, we can all agree on exactly what we mean.

The first set of laws and regulations is in the United States Federal Code. You can find the exact definitions at 14 CFR § 101.22 if you are just that interested. The other set is the National Fire Protection Association's (NFPA) Code for High-Power Rocketry; definitions at NFPA 1127 paras. 3.3.13.1 et seq. I will restrict the discussion to the NFPA, since it already includes all the size and propulsion limits found in the federal code, with some others besides.

The NFPA publications 1122 and 1127 concern model and high-power rocketry respectively, and draw the line between them based on two separate issues; those being what are high-power motors and what are high-power rockets. For these purposes, whatever other restrictions may be, NFPA 1127 places an outside limit of 40,960Ns (equivalent to a single O motor) combined lift-off impulse for what it treats as high-powered rocketry. Anything above that is beyond the scope of this article.

Under NFPA 1127, a motor is considered high-power if it meets any of the following conditions:

1) Propellant mass exceeds 125g
2) Impulse exceeds 160Ns
3) Average thrust exceeds 80N

In addition, under NFPA 1127, a rocket is considered high-power if it meets any of the following conditions:

1) It is propelled by any high-power motor (as defined above)
2) It has a lift-off mass exceeding 1,500g
3) Its propellant mass exceeds 125g for all motors combined
4) Its motor impulse exceeds 320Ns for all motors combined

The National Association of Rocketry subjects high-power rocketry to its own safety code, which applies to any rocket which meets these conditions.

One conclusion that can be drawn from the NFPA definitions is that, in some cases, what is a high-power rocket might not be an absolute. There are situations where the same rocket may be classed either high-power or not depending on the motor it is flying with.

Where to draw the line between low-power and mid-power is entirely subjective. Both are subject to the same rules and limits under NFPA publication 1122 (which deals with model rockets), and both are classed together as 'type one amateur rockets' under the federal law cited above. There are no laws or regulations setting out where or how to distinguish one from the other, or otherwise defining what either low-power or mid-power even means and your opinion is likely as valid as anybody else's. Both categories are covered together by the NAR's Model Rocket Safety Code, which makes no reference to either term.

Some modelers I have talked to understand the distinction to be based on motor impulse, and would consider anything flying up to 20Ns (through a single D motor) as low-power, with impulses over 20 and through 160Ns range (E – G motors) as mid-power. This distinction is reflected in the Model Rocketry Safety Code's stand-back requirements, but not everybody agrees this should be so, and you might well draw the line somewhere else.

Other modelers view the issue altogether differently, judging a particular rocket by its size or lift-off mass in comparison to other rockets which have a different size or lift-off mass, but without reference to any specific quantity, so when drilling down into particulars you will find the differences to be interpretive rather than absolute, and ultimately return to the realization that the issue turns as much on the motor being used as it does on the rocket itself. Accordingly, while you may not know exactly what low and mid-power rockets are, you will know them when you see them.

In Conclusion:

For purposes of informal conversation most of this does not really matter and we do not need to worry about any of it. You can have all the fun in the world flying 1/8A through G motors, build what you will, and keep your hobby activities consistent with the Model Rocket Safety Code.

Only if you are building and flying larger models will you need to pay attention to weight and motor characteristics to ensure you are not inadvertently exceeding the limits set by law and the Safety Code. A kitchen scale will give you a quick check as to whether you are over the weight limit. Usually, you are not. If you are designing clustered models to fly with E or F impulse motors, you will need to be aware of your propellant mass limits. For the Estes black powder motors (the most likely culprits), the limits are: two F motors is ok (three is too many), and three E motors is ok (four is too many) (a 6x D12 cluster also puts you over the limit, but how many of us would attempt such a thing?).

Beyond that, build and fly whatever you enjoy, and if informal conversation turns on whether your latest rocket should be considered this-power or that-power, it probably is, especially if you want it to be, or not, if you don't.

Ed. Note: Linked to where you can find copies of CFR and NFPA. The NFPA requires a log in.

Above: Jim Miers at the August 2013 Sport Launch. With a low power rocket. *Photo: Jim Filler*

Cloning the Estes TK-4 mini-Brute Hornet

By John Brohm, NAR #78048

Introduction

Left: Estes TK-4 Hornet

Joining the mini-Brute line in 1972, the Hornet was a BT-30 based model that made use of the new mini T motors.

I thought the model would make a good stablemate for my Estes #0817 AERO-HI, so a clone was assembled in short order. The model made use of some old BT-30 stock I had acquired from Carl McClawhorn some years ago.

Construction

Construction was per plan [(est0804.pdf (spacemodeling.org))] but for the fins, where I substituted 1/16” thick basswood for balsa, finishing them with Silkspan and three coats of Nitrate dope. The BMS-supplied nose was sealed with Brodak Sanding Sealer.

Left: Native Hornet Clone

Finishing

The 1972 catalog photo presents the model in a rather charmless livery, so I opted instead for the marginally jazzier kit face card scheme as seen in our earlier Photo 1.

Above: Photo 3: TK-4 Hornet, Estes 1972 Catalog (Ninfinger Productions: 1972 Estes Hornet)

he model a little more serious.

The paint is airbrushed lacquer from GSI's Mr. Color line, the yellow GSI's #329 FS13538 Yellow, the black GSI's #2 Black. Masking was accomplished with Tamiya tape. The topcoat is airbrushed GSI's GX100 Super Clear Gloss III. A quick, fun build, and a clone of one of the earliest vehicles using the then new mini-T motors.

Below: mini-Brute Shelf Buddies

I couldn't bring myself to add the mini-Brute ladybug marking, instead going with the little Hornet marking found on the big Centuri #5341 Magnum Hornet decal sheet (Magnum Hornet (spacemodeling.org)). To me, the Hornet decal just seemed to make t

Left: TK-4 Hornet, Complete

Off the Range

NARHAMSters Out and About

Top Left: In an undated photo, Ole Ed Pearson mingles with an unsavory crowd. *Photo received from Michael Cochran*.

Top Right: John Larson, at HobbyWorks, Laurel, displays a beautifully done Alpha (I) he recently finished. *Photo: Ed Pearson*

Bottom Right: Alan Williams examines a holiday gift from DJ Emmanuel: an MPC mini-engine ASP-1 model rocket kit. The kit dates from the 1970s; they've been seen on EBay going for about $80. *Photo: Ed Pearson*