TOTAL IMPULSE

JACKSON MODEL ROCKET CLUB
JMRC
HUVARS
HURON VALLEY ROCKET SOCIETY
TRIPOLI ROCKETRY ASSOCIATION, INC.
TOTAL IMPULSE VOLUME 25, NO. 6
NOVEMBER - DECEMBER 2025

THE CURIOUS CASE OF MERCURY

XSSM-N-6 RIGEL TACTICAL CRUISE MISSILE

MYLAR COVERING FOR COMPETITION

CLONING: RECREATING YESTERDAY

NOVEMBER SPORT & NRC LAUNCH

CLUB OFFICERS

President: Scott Miller
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Board of Director: Herb Crites
Board of Director: Michael Lewandowski
Board of Director: Mark Chrumka

MEMBERSHIP

To be a part of the Jackson Model Rocketry Club and Huron Valley Rocket Society means joining our family. We have monthly launches and take part in various educational events. We encourage our members to actively participate in our club projects, run for office in our annual elections, contribute to our monthly newsletter with articles or tips, and offer their expertise to the club. Members also enjoy no launch fees!

Applications are available at a launch or request one from bod@jmrconline.com. Mail the completed form along with a check for the annual membership dues ($30.00 individual or $40.00 family) to our mailing address:

JMRC/HUVARS
C/O Tony Haga
711 Wilwood Rd
Rochester Hills, MI 48309

COMM CHANNELS

There are several ways to keep in touch with JMRC/HUVARS and its 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 serves as our primary e-mail listserv. Follow this link to join, https://groups.io/g/jmrc

YouTube: Check out our launch videos on YouTube. Search for "JMRCtv" and don't forgot to Like the videos you watch and Subscribe to the channel.

Facebook: If you are on FaceBook, search for "Jackson Model Rocket Club JMRC" and request to be added.

Discord: Our new chat channel for broadcasting notifications and interacting with members instantly. Discord is an instant messaging social platform that also supports VoIP (voice over IP). It allows us an opportunity for members to socialize, meet virtually with voice and webcams, ask questions, and more. Click on the invite link to join the server,
https://discord.gg/pq88zUKMF9

On the Cover:

Mark Chrumka's 3D printed Mars Lander on a D12-3 at the November 8th club launch

About Total Impulse

Total Impulse is the official newsletter of the Jackson Model Rocket Club (JMRC), Tripoli Prefecture 96, NAR Section 620 and Huron Valley Rocket Society (HUVARS), NAR Section 463. Published Bi-Monthly, ***Total Impulse*** is a space-modeling newsletter devoted to representing the diversity of interests in today's hobby of model rocketry.

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

Send correspondence to:
Total Impulse
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E-mail: USSMidway@gmail.com

Launch/Event Calendar - 2025

- vNARCON 2026 - Feb 21
- Holiday Party - Feb 7 (Manchester)
- March TBA (Horning 1)
- April 11 (Horning 1)
- LDRS 44 - April 16 - 19 (Pence, IN)
- Crapshoot XI - April 25-26 (Muskegon)
- May TBA (Horning)
- June TBA (Horning)
- NARAM 66 - June 23 - 29 (Muncie, IN)
- July TBA (Horning)
- August TBA (Horning)
- September TBA (Horning)
- October TBA (Horning)
- November 8 (Horning)

NOTE: Launch dates are subject to change without notice. Be sure to check the website or Discord for the latest weather and field information.

OUR CONTRIBUTORS

The following members contributed articles or photos for this issue. Photos by Buzz Nau unless otherwise noted.

Mark Chrumka	Tony Haga
Dale Hodgson	Al de la Iglesia
Scott Miller	Richard Morrow
Buzz Nau	Chris Timm

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EDITOR'S RANGE BOX

It's the turn of the year when you have to get used to writing a new year and start looking forward to the first nice weekend for launching rockets. For many of us, this is the building season. Too cold to fly, so we turn to that build pile we usually ignored when it was too nice to stay inside. I have found that a fair portion of my new rockets are scratch builds from parts or scavenged kits. I've come up with a system that works well for me when I organize these pre-builds, which I share in the article, "Cloning: Recreating Yesterday". I hope there is something there that helps you with your build aspirations.

Mark Chrumka shares his tips and tricks for how to recover from a painting blunder in his Rocketry Workbench column. I'm sure we have all been there, a perfect build, only to be marred by a botched paint job. Read about his methods for making it right again.

Did you know Mercury was once considered for rocket propellant? Tony Haga explores this and how the research led to the ion thrusters of today.

Al de la Iglesia explains a simple solution he developed for two major problems with duration events: visibility and moisture. See how he solved this at the Competition Corner.

Dale Hodgson and his wife have a new home, and you can read about what trouble he can get into as his rockets invade the basement in his View From the Flight Line column.

Finally, Chris Timm and I wrap up the SSM-N-8 Rigel surface-to-surface submarine-launched cruise missile developed by Grumman Aerospace. The concept was a missile ahead of its time, but it helped the development of other programs like the CIM-10 Bomarc and even the SR-71 Blackbird.

Hopefully, with this content and more, you can find something useful and interesting in this final issue of *Total Impulse* for 2025. Happy New Year and we'll see you on the field soon.

LAUNCH REPORT

NOVEMBER SPORT AND NRC LAUNCH

November 8 Horning 1 Field Buzz Nau

As Novembers go, our launch on the 8th went pretty well. It could have been warmer, but it also could have been a lot colder. The winds weren't bad and we didn't have to deal with any precipitation. It was a good end to a good season of flying. In all, we had 14 fliers make 70 total launches, 63 sport flights and 7 NRC competition flights.

Sport Flights

Jeff Zerzy has been putting up impressive flights all summer, especially his clustered HLV with drop off SRB's. He led the pack with 9 flights and one of the most entertaining of the day. His Vesta Intruder flew on a D12-5 and ULA Vulcan on an E12-4. The craziest flight was his EGGO #1 two-stager loaded with an F15-0 to an F15-8. The booster CATO'd almost immediately after ignition and managed to ignite the sustainer which also CATO'd spewing flame from both ends!

Mark Chrumka always brings a lot of models that are pre-prepped and ready to go. His 8 flights included a 3D printed Mars Lander

Dan Weimer's Proteus

Jeff Jerzy's Morning Star Farms SN02 staging

on a D12-3 and 3d printed scale Trailblazer II on a D12-5. He's had some bad luck with the Mars Lander type 3D models in the past, but the Mars Lander put in an excellent flight. Mark also flew a Roachworks 1/12 scale Nike Hercules which flew perfectly. Buzz Nau also made 8 flights. His Estes Star Stryker CATO's on an A3-4T, but did not damage to model. He got in good flights with his Launch Pad Perseus II on an E22-4, 3D Rocketry Circulus on an E16-4, and Estes SR-71 on a C6-5.

Coming in with 7 flights, Richard Buckley launched his Estes Mini Mean Machine twice on A10-3Ts as well as his Estes Nike Smoke on an A8-3 and B6-4. Richard also put in flights with his Big Bertha on a C6-5 and GBU-24 on a B4-4. Also with 7 flights, Andy Tomasch put up 7 flights as well. These included several scratch builds like his Astron Mark and Streak. He also flew his Long Ranger twice on A8-3s.

There were several club altitude contest flights during the launch since this was the last day to compete. Al de la Iglesia put in 2

Buzz Nau's Launch Pad Perseus II

with his Estes Super Alpha on C6-5s. His best flight was to 662 feet, very close to the 673 foot goal. Al put up 3 more flights that included his Estes Der Red Max on an A8-3, Big Bertha on a C6-3, and Nova Payloader on a B6-4.

The CATO plague was not finished. Ramón Robles had a total of three, all with E16-6s! One with his Star Orbiter, a 3D printed saucer, and finally with his Lil' Spite. He also made an altitude contest attempt with his Mean Machine on an E12-4, but the altitude didn't record.

Dan Weimer also made 4 flights including an altitude attempt with his Cobra on a C11-5 to 328 feet. It was recently rebuilt after a previous CATO. Dan's other flights were his scratch built Arcturus on a D12-5, Viper on a B6-4, and Proteus on a C6-3.

Roger Wilfong put up 3 nice flights. His yellow and black scale A4/V-2 flew on a C11-3, along with his Patriot on a B6-4, and HU-VARS Mini-Max on an A10-3.

Ethan Smith had 2 good flights with his Big Bertha named "SpaceX" and "Fly" on a C6-3. Also with 2 flights, Tony Haga flew his Tiny Pterodactyl on an F70-5 and Big Bertha on a C6-5. Herb Crites had 2 flights with guess what? Of course, a Mach Schnell! Herb flew his SLK 54 twice, once on an H250 Green Mojave and once on a H180 White Lightning.

Adeline Miller made a single flight with a 3D saucer named "Rory Me Reindeer" on a D12-3. Rory Beebe had a single flight with a similar saucer named "Bob the Cat" on a D12-3.

Competition Flights

Jay Calvert of the Bumblesaurus Rex team made 3 qualified S4A rocket glider flights totaling 159 seconds and improving their score for the year. Jay made a pair of C Eggloft Altitude flights and also entered them in the club altitude contest. While the flights were DQ'd for NRC due to broken eggs, one flight stayed under the 673 foot and hit 663 feet… one foot higher than Al's flight for the win. Steve Kristal made a single C Eggloft Altitude flight, but did not qualify.

Mark Chrumka's Roachworks 1/12 scale Nike Hercules

Jeff Jerzy's EGGO #1 dual F15 CATO sequence

Tony Haga's Tiny Pterodactyl

Roger Wilfong's A4

Andy Tomasch and Steve Kristal

Jay Calvert's Egglofter just off the piston launcher

Richard Buckley's Nike Smoke

Mark Chrumka's Mega Der Red Max

The Curious Case of Mercury: Rocket Propellant's Toxic Ex

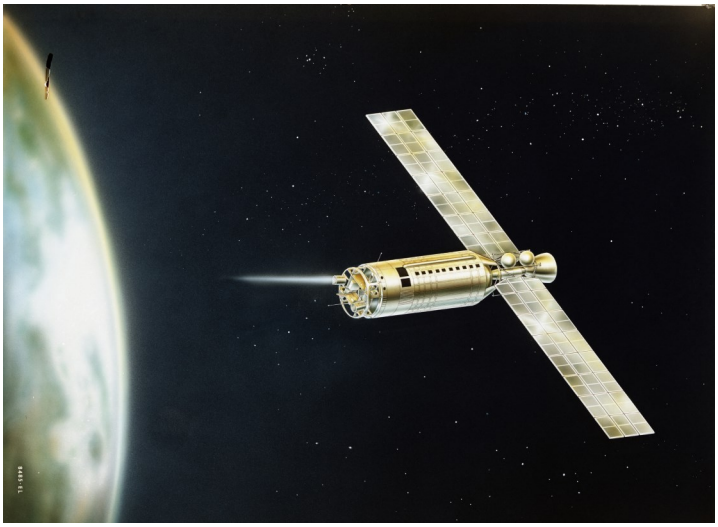
Tony Haga

Those who know me may know that I spent most of my working career working in environmental and industrial hygiene, doing my best to keep the bad stuff out of the working environment. One thing that we spent a fair amount of time on was mercury and its compounds. Being that mercury is a pretty bad actor, I was surprised to see that the material was once considered a rocket fuel, so I thought I would write a bit about what I found out.

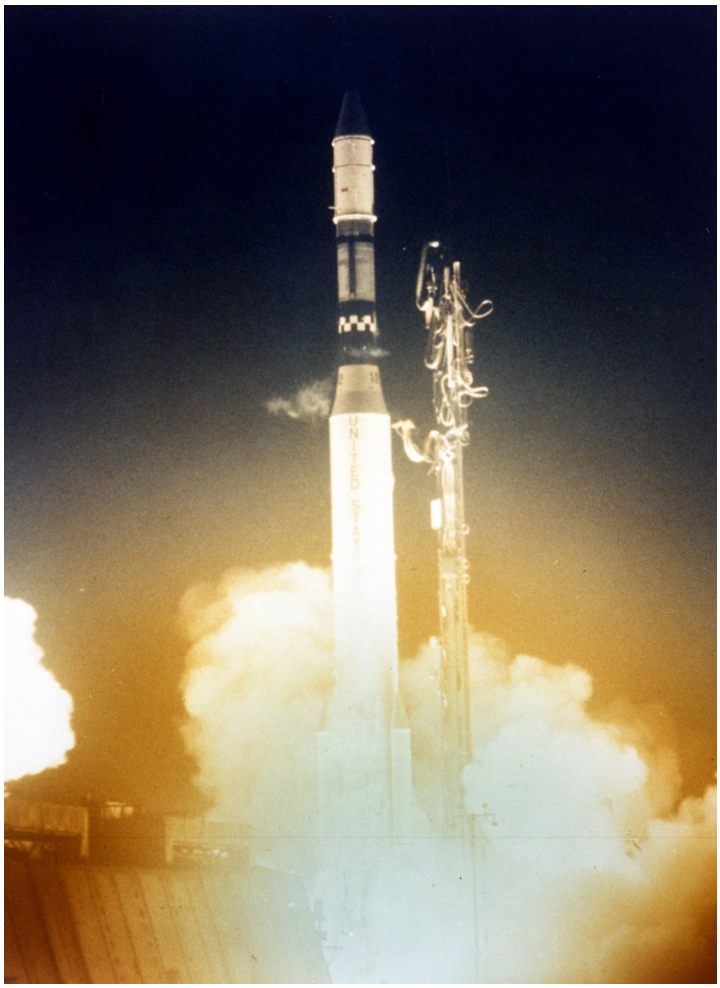
Using mercury was just one of the wild ideas engineers chased in the early days of spaceflight. So it's the 1960s, the Space Race is heating up, and NASA scientists are experimenting with just about everything, including mercury. Yep, that shiny, poisonous liquid metal, as a propellant for rocket engines. Sounds crazy today, right? But back then, it made a surprising amount of sense. Let's dive into this forgotten chapter of propulsion history, why it seemed promising, and why it's firmly in the rearview mirror now.

Why Mercury? The Appeal of a Heavy Metal Propellant

All sorts of efforts were made during the late 50's to increase propellant densities. One thing considered was dimethyl mercury, Hg $(CH_3)_2$, as a fuel. The synthesis is easy, but it is also extremely toxic. John D. Clark says in his book "*Ignition*" that the idea was to burn dimethyl mercury with red fuming nitric acid (RFNA). When he asked Eastman Kodak to make 100 lbs(!) of dimethyl mercury for testing, he was told "No" in no uncertain terms. And for good reason, a dose as low as 0.1ml can kill you. Well, okay then. So, what about metallic mercury? It is the densest known substance which is liquid at room temperature. Just shoot it into the combustion chamber. Should work great, and it was OKed for testing! So, they built a test stand in the middle of the desert (after deciding that New Jersey was not the place for testing) and gave it a go. They used an RFNA-UDMH (Unsymmetrical dimethyl hydrazine) motor and injected mercury through a tap in the chamber wall… And it worked! They used up to 31 volume percent of mercury in their runs and found that at 20 percent, they got a 40 percent increase in density impulse. Fortunately, by that time, other propellants had come along, and testing stopped.



An illustration of the SERT II spacecraft, which was comprised of the Agena upper stage, the experimental thrusters and associated equipment, and two large solar arrays. - NASA photo



A Thorad-Agena rocket lifts off from Vandenberg Air Force Base on February 3, 1970, with the SERT II spacecraft. NASA Lewis Research Center (now, NASA Glenn) managed the Agena Program between 1962 and 1970, with SERT II being the last of the center's 28 successful launches. - NASA photo

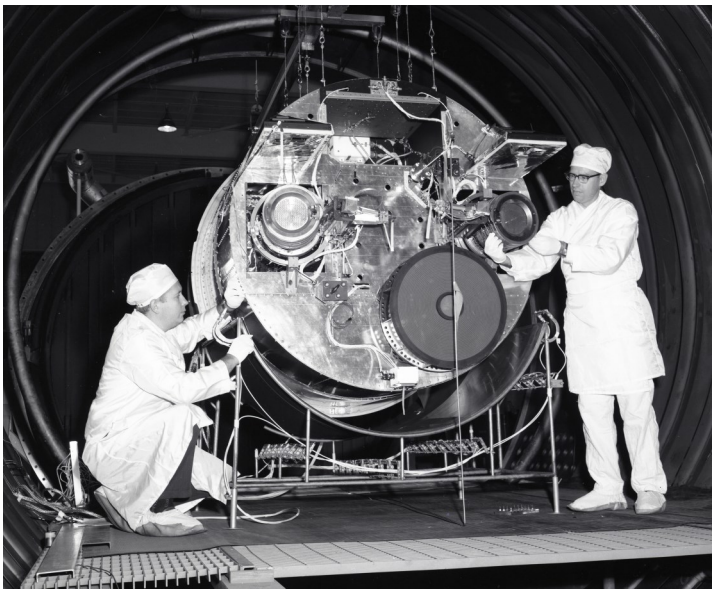
Mercury also popped up at the dawn of **electric propulsion**, specifically ion thrusters. These aren't your fiery chemical rockets; they work by ionizing a propellant (stripping electrons to create charged particles) and accelerating those ions with electric fields for a gentle but super-efficient thrust—perfect for long-haul missions in space.

Early ion thrusters used electron bombardment to ionize the propellant. The first practical ones ran on mercury vapor. Why pick something so toxic? Well, mercury atoms are heavy (atomic weight ~200). In ion thrusters, heavier ions mean better thrust per unit of power because exhaust velocity is tied to ion mass. Higher mass = more momentum for the same acceleration, boosting specific impulse (efficiency) while keeping power needs reasonable. Because mercury is a liquid at room temperature, it vaporizes nicely for feeding into the thruster and is straightforward to ionize compared to some gases.

The big proof-of-concept came with NASA's Space Electric Rocket Test (SERT) program:

- **SERT-1** (1964): A suborbital test that ran a mercury ion thruster successfully for 31 minutes.
- **SERT-2** (1970): Launched into orbit, where one mercury thruster operated for thousands of hours, proving electric propulsion could work long-term in space.

These were gridded electrostatic ion engines, and mercury helped validate the whole concept. Smaller thrusters (5-cm and 8-cm diameter) and even 30-cm versions were developed and endurance-tested for hours on end.



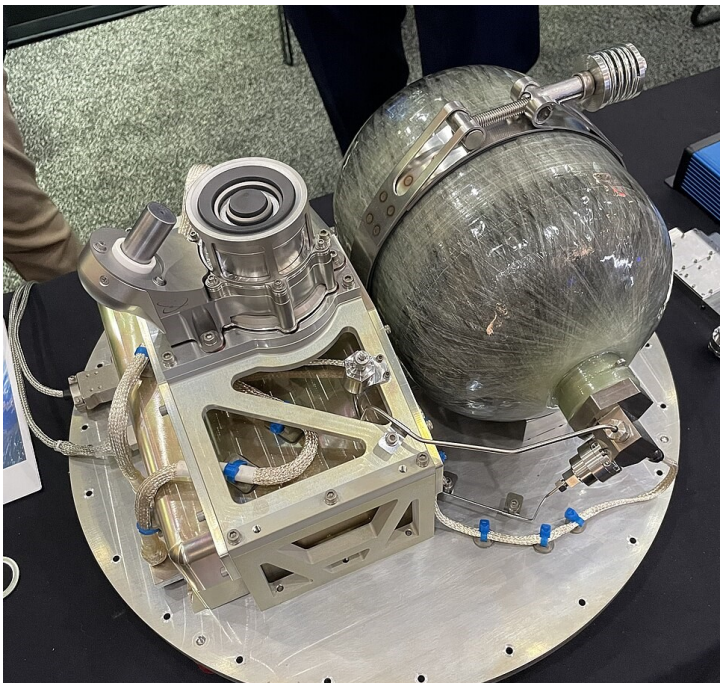
In early 1968, the experimental portion of SERT II underwent six months of testing in Tank 5 at NASA Lewis Research Center's (now, NASA Glenn's) Electric Propulsion and Power Laboratory in conditions that simulated the temperatures and pressures it would encounter in space. The two thrusters can be seen in this photograph. - NASA / Paul Riedel photo

As awesome as the performance was on paper, Mercury had some glaring downsides that became deal-breakers as tech matured:

- **Extreme toxicity**: Mercury is a neurotoxin—heavy exposure causes serious health issues. Handling it on the ground was risky for engineers, and any leak or failure could contaminate facilities.
- **Environmental nightmare**: Exhausted mercury ions could condense or deposit on spacecraft surfaces, causing shorts or contamination. Worse, un-ionized mercury vapor might vent into space... or worse, back to Earth's atmosphere during launch failures.
- **Practical headaches**: Precise flow control was tricky, and it tended to erode or coat thruster components over time.

By the 1970s–1980s, better alternatives emerged. Cesium was tested briefly but ditched for similar reasons. Then came xenon—an inert, noble gas, easy to ionize, non-toxic, and with decent mass (though lighter than mercury). Xenon became the go-to for modern ion thrusters (think Dawn mission or Starlink sats). Today, we're even experimenting with cheaper options like krypton, argon, or iodine.

Mercury use faded out around 1980. Fast-forward to 2022: The Minamata (named after a city in Japan where large amounts of mercury contamination poisoned the local population) Convention on Mercury (a UN treaty to curb mercury pollution) explicitly phased out its use as a satellite propellant by 2025. That killed off any revival attempts, like a short-lived 2010s startup idea for Mercury Hall thrusters. Surprisingly though, the company "Apollo Fusion" was considering manufacturing Mercury ion thrusters as late as 2018.



Hall-effect thruster module with propellant tank and control unit. - Blervis photo

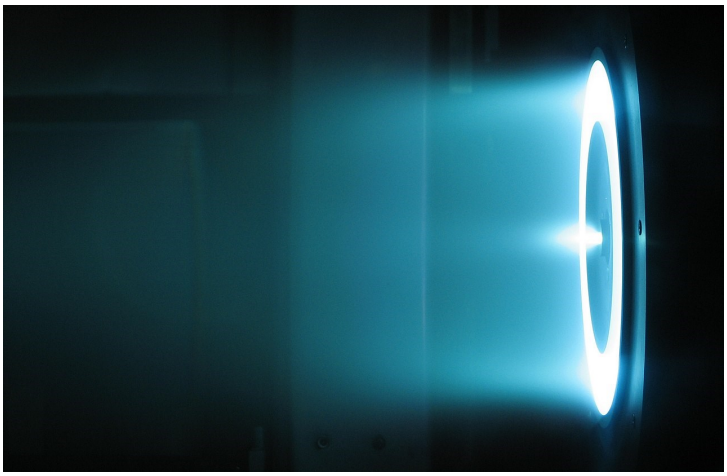
Wrapping It Up: A Cool Footnote in Rocket History

Mercury as a propellant was a bold early bet that helped pioneer electric propulsion—we wouldn't have today's super-efficient ion engines without those SERT experiments. But safety, environmental concerns, and better options rightfully sidelined it. It's a reminder of how rocketry evolves: what seems genius in one era can become a hard no in the next.

Next time you hear about a xenon-powered probe zipping to the outer planets, tip your hat to those mercury thrusters that blazed the trail.

If you want to read more about exotic propellants, I recommend reading a copy of John D. Clark's book "*Ignition*". Though long out of print, it can be found on Amazon or downloaded as a PDF file at: https://archive.org/details/ignition_201612

Clear skies and high deltas!



6 kW Hall thruster in operation. - NASA JPL photo

VIEW FROM THE FLIGHT LINE

Looking Forward: On to 2026

Dale Hodgson

Well, the 2025 flying season is just about over, and we're looking ahead to next year. A few of us are already making plans to attend LDRS 44 in Pence, Indiana, in April. It's a field I've flown a couple of times before, and when the winds are light, it is a spectacular place to be. Yes, there are wind turbines to the east, but so far, there haven't been any problems. The only time I had an issue was when I flew my *'Go Blue 2'* on a J210, and it came down on the only set of powerlines in the vicinity. Not to worry, though; the utilities guys showed up and retrieved the rocket completely intact. She will fly again, but not on that particular motor. The rocket is a bit of a beast, so I'll go bigger, like a K250 or K350 Moonburner. That outta do it. We have our annual banquet coming up soon that I'm looking forward to very much. I missed last year's because of a nasty cold/upper respiratory thing I came down with, but hopefully not this year since I'm just now getting over the same @%)!! right now.

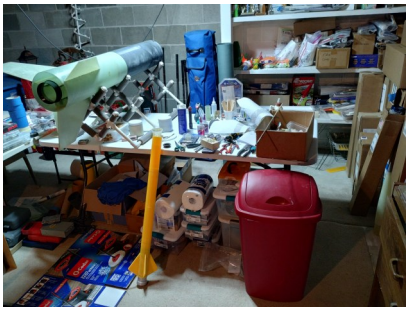
This year I didn't get in as much flying time as I would have liked, but it was decent enough. I did manage to get some bigger stuff in the air at different fields, so I guess that's something.

Some of you may know that Julie and I bought a house, closed on October 7th, and moved in on November 7th. Quite an accomplishment in just over a month. I do have my own rocket room all set up, so I'm looking forward to spending a considerable amount of time downstairs building, dipping igniters, and generally tinkering. In all this moving stuff from one locale, I discovered two things that we all have in common. One is love of the hobby. To me, every launch….from 13mm to 98mm is different and exciting all on its own. There is really nothing repetitive about it; each flight is unique. I have been doing some different things, like flying demo 3D printed birds that Scott designed, but I tweaked just a little bit, and what amounts to 29mm hybrids with 3D plastic fuel grains. Pretty cool stuff. Still, there is some work to do, but it's cool figuring all of this out. I've learned a great deal, that's for sure.

The second thing we all have in common is whether we like it or not; we are all hoarders. Piling up stuff like kits, parts, repair projects and the like. I came to that realization during the move. I lived in my last place for 11 years and had no idea I had acquired so much stuff…kits of all kinds from 13mm competition, gliders, egg-lofters, multi-stage, paper and fiberglass. Plus, all those extra aftermarket parts that go with them…..retainers, altimeters, bays, electronics, rail buttons/guides, shock cords and chutes. I probably shouldn't buy another thing since I have enough to build for probably the rest of my life. But I'm such a sucker that something out there will catch my eye, and I'll have to have it.

All of this I've mentioned doesn't even cover my finished projects which are in a storage unit off site. It's pretty impressive when looking at all the birds in there that can fly. Plus, launch rails, pads and some of the larger parts are stored there as well. It's quite the haul for a rocketeer; gathered over 30 years of building and flying.

All this reorganization did, however, make me rethink…. a lot. I set up my new room in such a way as to have pretty much everything in totes or on shelves. And yes, there is a painting in there. It's a textured modern art thing my sister-in-law had; she was about to throw it out. I took it because it reminded me of a bat. Seems appropriate enough. The trick will be to discipline myself into making sure that when I'm finished with one process or part of a project I put everything away and start again next time. Is it going to be easy? Nope….but, I think in the long run I'll be ok. Julie looked at my room and commented that "you have a lot of rocket stuff." This of course comes from a person who has more Christmas paraphernalia packed away than Bronner's in Frankenmuth….or a Hallmark movie. So, I promised to pare down if she did too. We'll see how all that goes. Getting older means downsizing a bit so I guess it's finally time….or is it?



I think forgotten projects will somehow get finished. I've dipped my toe into multi-staging both low and high power, so I'll pursue that. Competition kits need to be done as well; 'copters, gliders, parachute/streamer duration, and egg-lofters are all present, so I should have no problem picking and choosing what I'm about to do for 2026. As I write this, the UPS guy pulled up; I'm expecting some 3D 54mm retainers that looked interesting. I'll save one unattached to let Scott have a look. He already has some made but I thought I'd increase the knowledge base a little. I can hardly keep up with the guy though; he designed for me a 54mm Aeropack style retainer that threads into the aft end of the first -run Slimline retainers. Those are the style that weren't quite big enough to allow the use of Loki cases. This adaptor solved the problem so I can fly Loki J's and K's; particularly Moonburners, which is a personal favorite. So, it at least on paper looks like I'm all ready for 2026 unless something really cool comes up; either from the 'net or the nether regions of Scott's imagination. Looking forward to it!

The Rocketry Workbench

Repairing Painting Blunders

Mark Chrumka

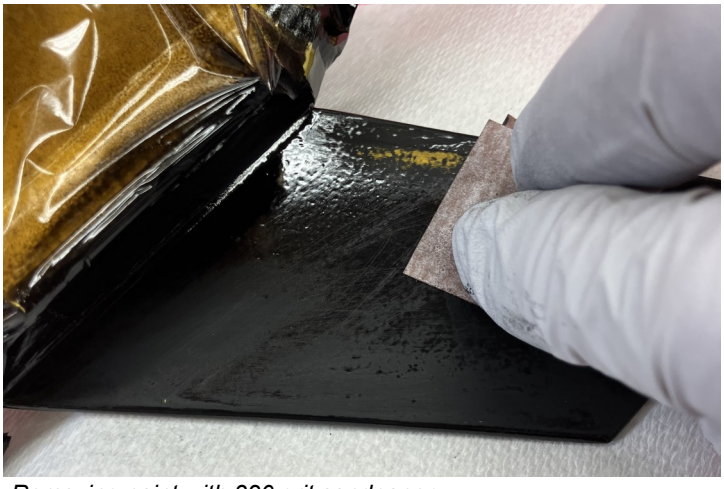
In the previous September-October issue of Total Impulse, I wrote an article on the construction of an Estes Astron Delta to be used as the launch vehicle for my Camroc. Unfortunately, inclement weather prevented the application of finish paint prior to publication. The unfinished model sat on the workbench for a couple weeks until outdoor conditions improved enough to properly complete the model.

Most of us like to paint our rockets by adopting a catalog paint scheme or developing a personal livery to our liking. A minority of rocketeers eschew any thoughts of finishing their models and prefer to “fly it naked”, as they like to say. With the exception of competition models such as gliders, helicopters, altitude, etc., all of my models for the past 30+ years have been painted. I estimate that to be a little more than 300 models.

Catalog photos show the model with a white, yellow, and black paint scheme and some with only yellow and black. I chose the latter livery.

Rust-Oleum “Painter’s Touch” enamel spray paint was used for primer and finish coats. I have had decent results using Rust-Oleum in the past, but the current formulation is not as good as the stuff I used years ago. The first finish coat of yellow was sprayed over the entire model and allowed to cure for a couple weeks. One fin on the booster and one on the sustainer were painted black. This is when things went south.

Fin with paint runs



Removing paint with 320 grit sandpaper

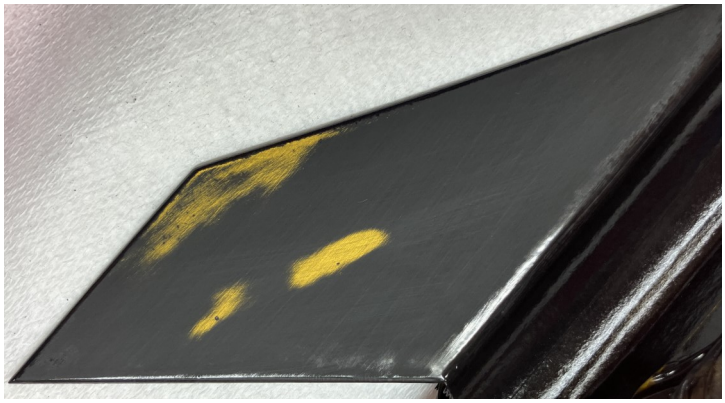
After spray application, I noticed paint drips and runs in a number of areas. I quickly positioned the booster and sustainer in an effort to reduce the impact, but the damage was done.

Removing paint from sandpaper

I considered what could have caused the mess and felt it was due to a combination of factors that included poor lighting, cool temperatures, and minor wind gusts. In other words, operator screw-up. I was in a hurry and sprayed when I shouldn’t have. I also noticed the spray nozzle was delivering more than the usual amount of paint in a sloppy pattern.

After waiting for the paint to cure, everything except the affected fins were masked. Sanding started with 320 grit sandpaper until the majority of drips and runs were removed. The fins were closely scrutinized to ensure against taking off too much paint. Small squares of sandpaper were used to improve access to minute areas. The sandpaper quickly loaded up with excess paint. The sandpaper was frequently cleaned using a paper towel and discarded when it became useless.

Once I was satisfied that major aberrations were gone, I started using 1500 grit, then 3200 grit pads to obtain a smooth, flat finish.



Sanded fin

Once you start sanding, it can be difficult to notice if an area has been properly flattened. Good lighting is imperative to ensure that high spots and other imperfections have been eliminated. A high intensity LED workbench lamp was used to carefully examine the surface finish. If any imperfections remained, they would become immediately apparent after finish painting.

Finished model

GRUMMAN

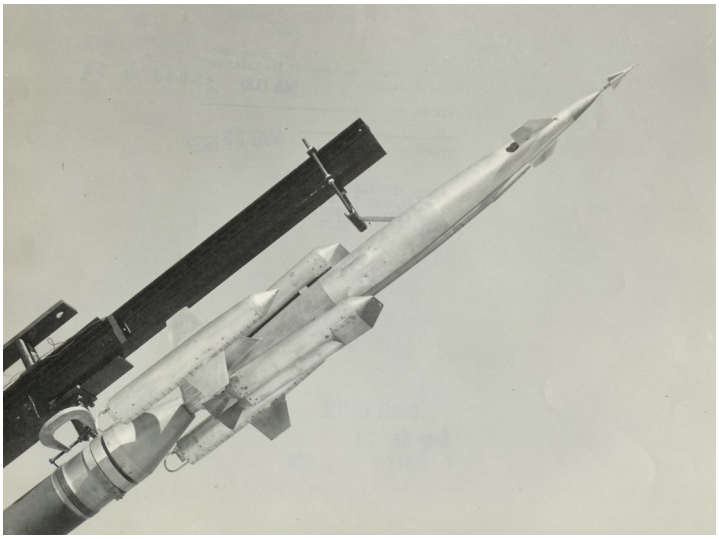
XSSM-N-6 RIGEL TACTICAL CONCEPT

Chris Timm & Buzz Nau

The is the third and final installment on the Grumman XSSM-N-6 Rigel cruise missile program covering the final tactical cruise missile concept.

To recap, the XSSM-N-6 Rigel was a Grumman entry for an early U.S. Navy submarine launched, nuclear-capable, surface-to-surface missile program. Developed from 1946 to 1953, Grumman's approach was a twin-ramjet-powered tactical cruise missile with four solid rocket boosters and a catapult for launching from the deck of a submarine. The 28-inch Marquardt ramjets were mounted on fin tips, while the solid rocket boosters were flush mounted to the body.

The main purpose for Rigel was shore bombardment by submarine. The Rigel program was developed in parallel with the subsonic SSM-N-8 Regulus which used a single solid rocket booster for launch and a turbojet engine for cruise. Rigel was named after a star in the constellation Orion and Regulus after a star in the constellation Leo.



Rocket launched flutter test model - US Navy

Rigel's performance goals were for supersonic speeds (around Mach 2–2.1 during cruise), a range of approximately 500 nautical miles (about 930 km), and a nuclear warhead (likely the W-5 fission bomb or W-27 thermonuclear warhead). The guidance system was a modified LORAN system, requiring relay submarines as beacons for mid-course corrections, followed by a terminal dive. The missile had an accuracy goal of approximately 550 meters CEP (circular error probable).

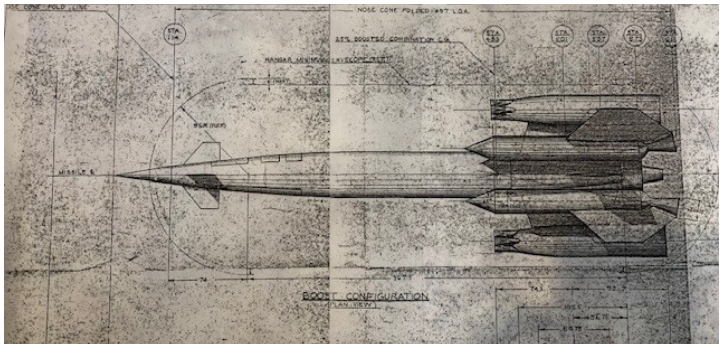
The full-scale tactical concept missile was planned to be about 14 meters long with a wingspan of around 4 meters and a gross weight of approximately 11,800 kg.

While the ramjet engines were test flown from Pt Mugu, California starting in early 1950, rocket propelled scale models of the tactical concept were flown at Wallops Island to validate the design. A full scale mockup was also produced during this time.

Though there were some successes during the single ramjet engine FTV testing, the program was cancelled in 1953 in favor of the simpler and more conventional Regulus. The Regulus would also be cancelled based on the successful Polaris IRBM development program.

Desktop model of the Rigel concept missile - Bonhams auction

There is a Rigel mockup on display at the Cradle of Aviation Museum on Long Island, New York.



General arrangement drawing of the Rigel concept - US Navy

References:

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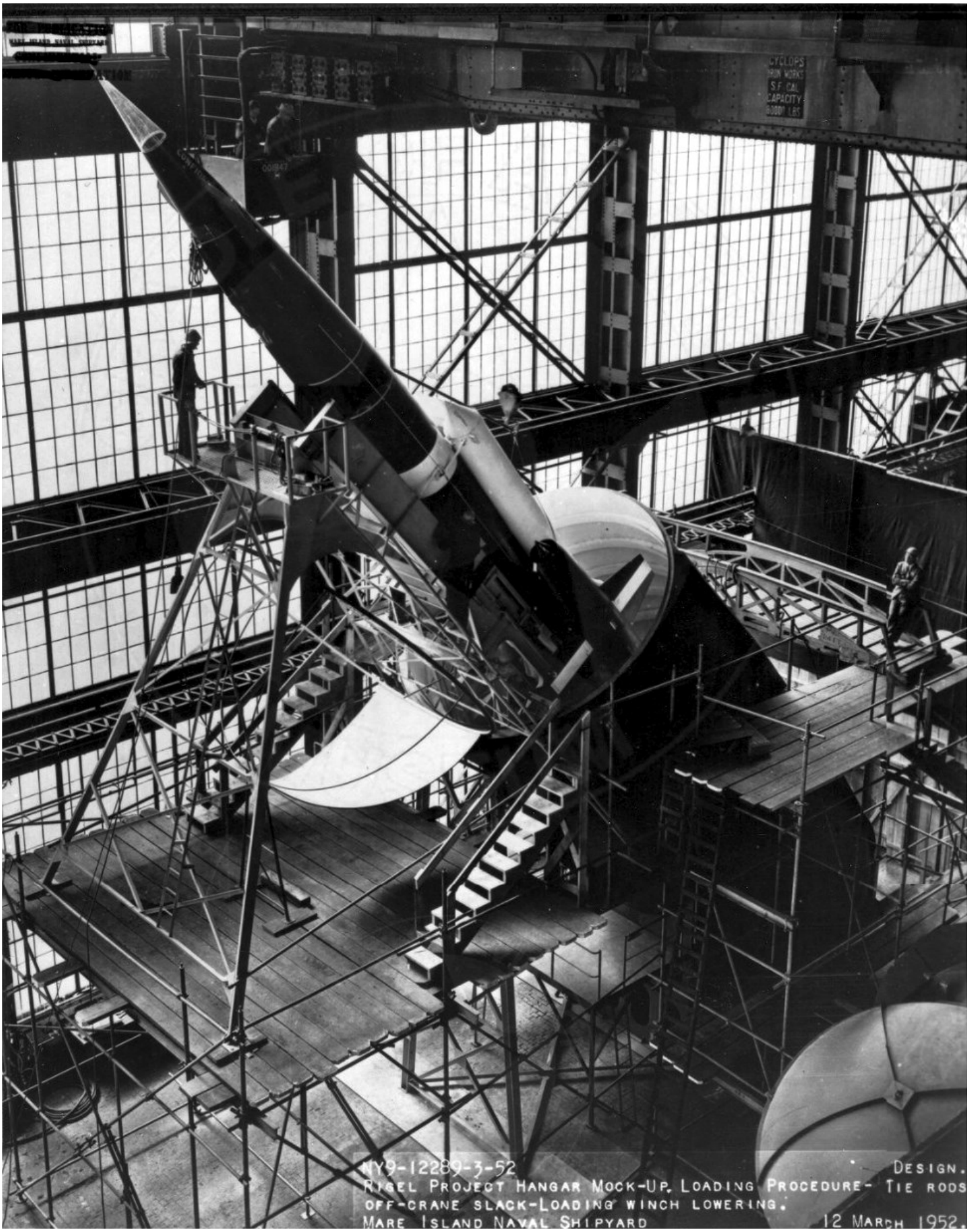
The Evolution of the Cruise Missile, Werrell, Kenneth P., Air University Press, Maxwell Air Force Base, AL, September 1985, Pg 117

The Illustrated Encyclopedia of the World's Rockets & Missiles, Gunston, Bill, Salamander Books LTD, London, 1979, page 90

Bumblebee Program Final Report APL-JHU-TR-55-001, Johns Hopkins University Applied Physics Laboratory (JHU/APL), 1955

U.S. Naval Guided Missiles: A Technical Summary NAVORD Report 6261, Bureau of Ordnance (BuOrd) / Office of Naval Research (ONR), 1958



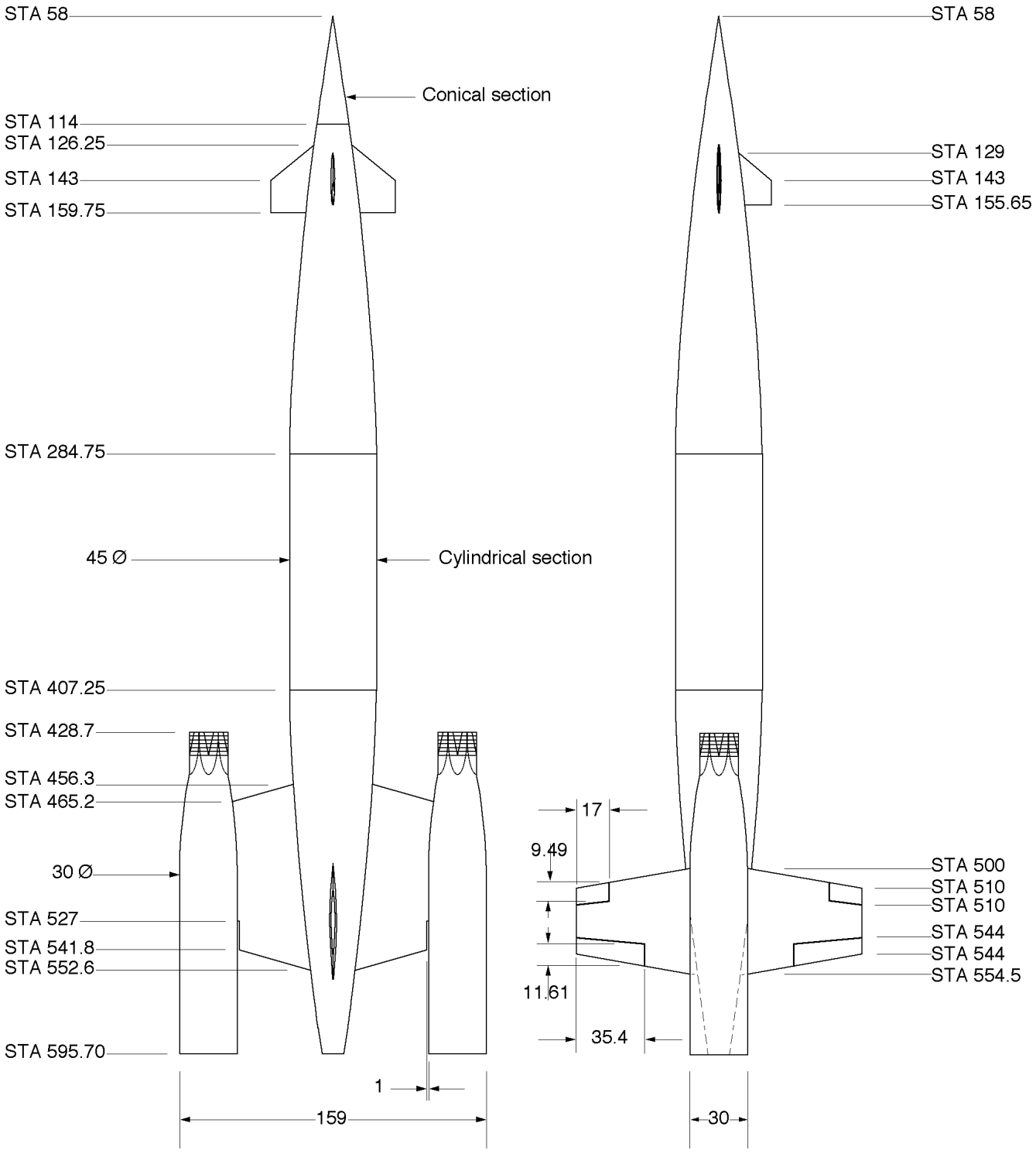
Rigel Tactical Concept Mockup - Cradle of Aviation Museum Archives

XSSM-N-6 RIGEL
Tactical Cruise Missile
Concept

1/80 scale
Dimensions in inches

Sources:
General Arrangement Drawing - Proposed Rigel Tactical Missile, Grumman Aircraft Engineering Corporation drawing no. M7SP1084, 3-30-53.
Project Rigel XSSM-N-6 Report No. G/M 1006 , Grumman Aircraft Engineering Corporation, June 1953.

Cruise configuration

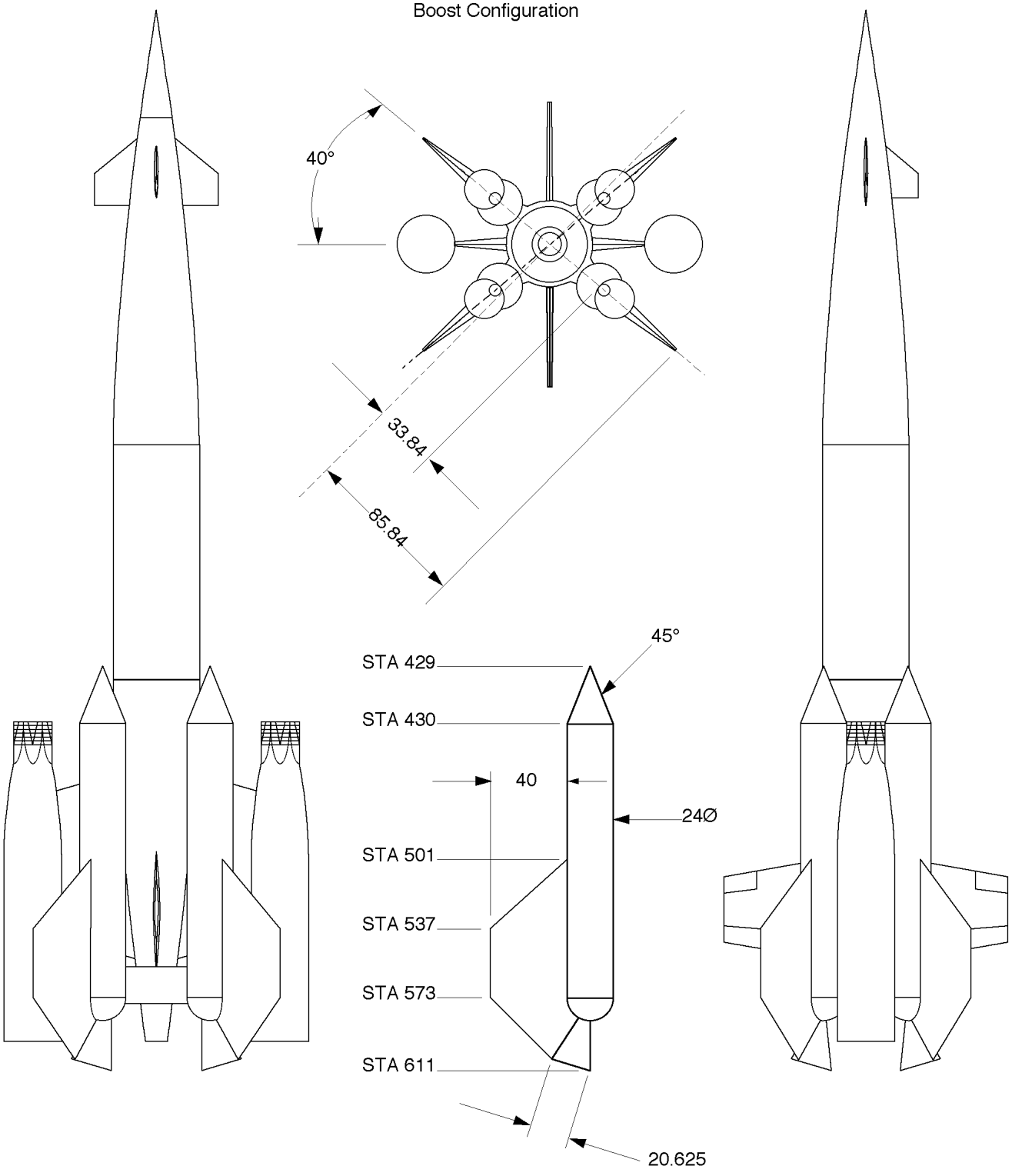


XSSM-N-6 RIGEL
Tactical Cruise Missile
Concept

1/80 scale
Dimensions in inches

Sources:
General Arrangement Drawing - Proposed Rigel Tactical Missile, Grumman Aircraft Engineering Corporation drawing no. M7SP1084, 3-30-53.
Project Rigel XSSM-N-6 Report No. G/M 1006 , Grumman Aircraft Engineering Corporation, June 1953.

Boost Configuration



CLONING: RECREATING YESTERDAY

Buzz Nau

Cloning is often used to describe the process of creating a replica of another living organism, but in model rocketry, it refers to creating a copy of another rocket usually a kit and especially kits that are out of production.

There is a long list of model rocket kits that are no longer produced and building one usually involves buying one from eBay or gathering the plans and materials to clone your own. Cloning is often the easiest (and cheapest) though some sacrifices may need to be made if exact replica parts cannot be obtained. For the most part, the majority of classic kits can easily be cloned.

Where to Start

You may have seen a particular rocket at a launch, in an old catalog, or online. Once you have a model in mind you need plans to see what parts you need to collect. Luckily there are two excellent sources for plans, JimZ Rocket Plans and Ye Olde Rocket Plans. Jimz was the original plan repository with a huge collection of plans by Estes, Centuri, and many other manufacturers. At one point the site became static and Ye Olde Rocket Plans began to fill the gaps at JimZ. Both sites are currently active and updated periodically. Most plans have a detailed parts list, but there is often an additional page of details if there are missing dimensions on the original plans. Both sites also include more than just plans. They also host catalogs, technical reports, and decal files.

JimZ Rocket Plans and Ye Olde Rocket Plans are your go to repositories for classic kit plans, decals scans, and other documents

Parts is Parts

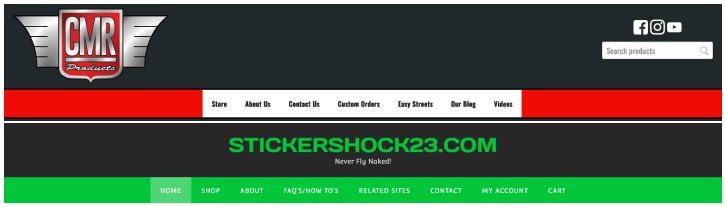
Now that you have the plans, where do you get the parts? Fortunately there are a lot of great options for most parts. You could take an existing kit that contains the parts you need and "kitbash" them into your clone. Estes has improved their parts inventory over recent years including Pro Series parts if you want upscale your clone. Two vendors in particular can provide a majority of needed parts, Balsa Machining Services (BMS) and eRockets. Both vendors have a large selection of tubes, nose cones, and other parts necessary to build accurate clones.

Most of the parts you will ever need for cloning can be found at BMS & eRockets

Another option is 3D printing. If you have a printer (or a friend with a printer!) you can easily print difficult to acquire parts for example, the ramjet parts for a Centuri SST Shuttle 1, the Centuri Quasar nose cone with molded cockpit, or plastic parts for an Estes Interceptor. There are several club members with printers that would gladly print parts for you and deliver them at a launch. We have a 3D Printing discussion chat on our Discord and all members are welcome to join. You can also use our club email server for discussion and part requests.

Decals

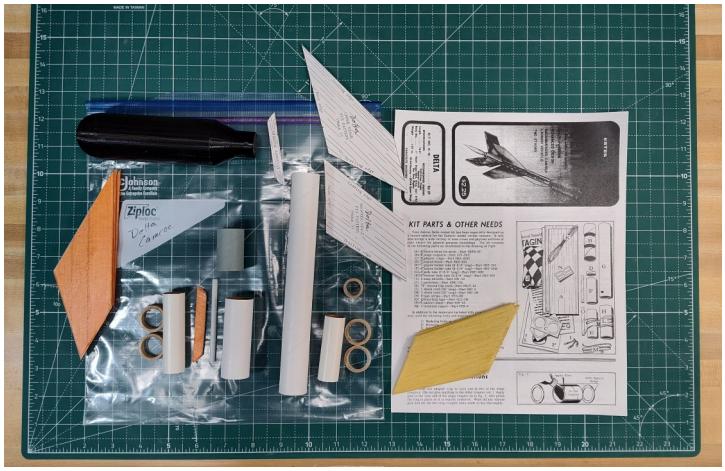
Many kits came with decals and a clone wouldn't be complete without them. Many of the plans on JimZ and Ye Olde Rocket plans also include scans of decals. If you have a color inkjet or LaserJet printer then you can easily print your own using decal paper that is available on Amazon or eRockets. Tango Papa was the go to vendor for kit decals and recently transitioned his decals to cmrproducts.com, an online Railroad Hobby store. If you can't print your own, CMRProducts is a great alternative. Stickershock23.com is also a viable solution especially for upscales as the decals are vinyl. As of this writing, Mark at Stickershock23 has suspended operations until early 2026 for medical reasons.



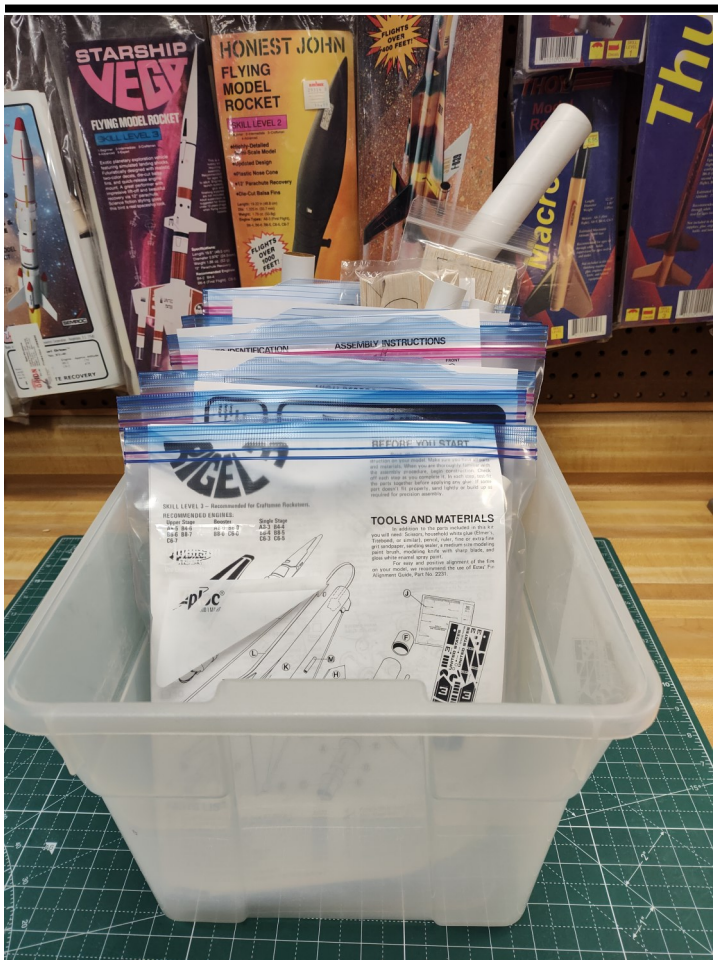
CMRProducts sells the Tango Papa line of rocket decals and Sticklershock23 vinyl decals are especially useful for large upscale decals

Tips & Organization

Good organization can be the difference between an enjoyable build and a hot mess that feels more like a chore than a positive experience. When I find a clone subject I start by printing a copy of the plans and placing it in a 1 gallon Ziplock bag. I usually have several on deck, so I keep them in a bin and not spread out all over the work room. As I collect the parts I place them in the bag and check them off on the plan's parts list. Once the parts are all collected the bag becomes a kit ready to build. I make sure to cut all tubes to length before they go in the bag. The same with fins. Semroc was a great source of laser cut fins and many of them are still available at eRockets. Otherwise, I print out fin templates from the plans on cardstock and cut them from balsa sheets.



Parts collected and cut to size for an Astron Delta with 3D printed Canaroc



Parts packs collected and ready for assembly

Speaking of fins. The old tried and true method of filling balsa grain using dope based sanding sealers has faded away and difficult to find. Another popular method of using thinned Elmer's Fill n Finish is more readily available, but sanding it results in a lot of dust. Most of my building occurs during the winter months, and I can't stand the dust in the hobby room. I've settled on a process that is non-toxic and requires little sanding. Deluxe Materials' Sand'n'Seal is available from many online hobby vendors as well as Amazon. It is a low odor, water based sealer, but it requires more coats than previously mentioned methods. To get around that I've combined the Sand'n'Seal with tissue. In addition to sealing the wood and provider a smooth surface, it also adds a little bit of strength to the fins. The surface isn't mirror smooth, but it looks good after sanding a coat of primer. An alternative to Japanese tissue is Brodak's Covering Tissue. The main difference between it and Japanese tissue is weight. The Brodak tissue is a little heavier, but half the price of traditional Japanese tissue. Both produce similar results. Master modeler John Brohm, is a huge proponent of Silkspan coverings. All three covering materials can be found at Brodak's website as well as your Local Hobby Shop (LHS).

Brodak covering tissue and Deluxe Materials Sand'n'Seal

Astron Drifter and Delta clones ready for paint and finishing

In Closing

Cloning kits is a rewarding activity of resurrecting your favorite classic kits that are no longer available. It will also help improve your general building skills and aid you in scratchbuilding your own designs. Please reach out to me at buzznau@umich.edu if I didn't answer all your questions and you would like more information about any of the material covered in the article.

COMPETITION CORNER

Covering With Mylar

Al de la Iglesia

Introduction

The topic for this competition corner is a little different, as I will show a method I developed for covering competition rocket parts with lightweight ¼ mil aluminized Mylar. When I was building my models to take to the 2025 World Spacemodeling Championships, I had a nagging thought about my S9A Autogyro models. In my test flying over the past year or so, it became evident that my models were hard to see in the sky and might affect the flight time, depending on who is timing the flight. In fact, I did have practice flights in which the model hit a good thermal and went out of sight before the max time of 180 seconds was reached. I could not risk this happening at the WSMC, so I decided to experiment with methods of enhancing visibility. I had tried coloring parts of the S9 rotors with Sharpie markers, but it did not help much unless the model was on the ground. Coloring the airframe by printing on the Vellum before construction was easy, but it did not result in the type of visibility I was looking for. I really wanted to be able to see my S9 models like the parachute of an S3 parachute model with its mylar chute flashing sunlight from miles away. I had used Chrome trim monokote on rotors of previous helicopter designs, but the trim monokote is so heavy compared to the 1/32" thick balsa rotors on my S9 models that it would result in a huge performance hit. I decided that if any material was going to be added to the model, that it needed to be added to the airframe and not the rotors. I had two reasons for this decision. First, from past experience with helicopter models, I have noticed that as the model flies farther away, visibility of the rotors drastically decreases since you are looking at the edges of the rotors and not the bottom. Second, in an S9 model, the weight of the rotating head and rotors must be less than the weight of the airframe for the airframe to hang below the rotors, which helps the rotors to start spinning quickly and prevents the model from losing precious altitude. I decided to try adding lightweight ¼-mil aluminized Mylar to my airframes to achieve my visibility goal.

The Research

I did some internet searching for adhesives and methods used by modelers to bond Mylar to fiber surfaces such as balsa and paper. Free flight models have been attaching Mylar with certain adhesives for many years, but most of the articles that I read involved covering wings such that the Mylar had to overlap itself, and the bond was actually between two pieces of Mylar and not between dissimilar materials, one of which is rather porous, like paper or balsa. Also, most of the glues used were similar to contact cement and often remained rubbery, and I found in my testing that you could easily peel the Mylar off the surface. I could not take the risk of this happening, so I continued my search. I read and did testing with laminating epoxy, which did show promise as the glue would fully cure and bond the Mylar if it was thoroughly cleaned before gluing. But I disliked the mess and cleanup of epoxy as well as the 24hr wait to see if my experiment was successful. Also, I found that it was easy to add too much epoxy and add more weight in glue than the actual Mylar weight itself. I wanted something that was water-based for easy application and clean up and could dry/cure quickly to save time. I then stumbled upon the adhesives used in the scrapbooking world for bonding metal foil and other materials to paper. It seemed to fit all the check boxes; water-based, easy cleanup, no fumes, fast drying, and could be used with heat like an iron on decal.

Since the Mylar I need to bond is aluminized, I thought their materials and methods should work for my project. I bought a jar of iCraft Deco Foil Transfer Gel DUO from Amazon. A 4 oz. jar cost under $10 and was shipped for free the next day. After reading the recommended use instructions on their website, I decided to refine my own application method to reduce or eliminate wrinkling of the vellum, which happens easily with water-based adhesives.

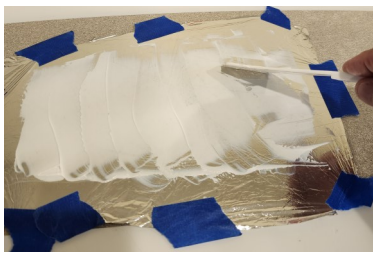
Deco Foil Transfer Gel

The Method

Step 1: Attach a piece of Mylar to a very smooth surface. I use blue painters' tape since it is easily removable and does not leave adhesive after removal. I use a piece of tempered glass, scavenged from a dead microwave oven, for my smooth surface. Stretch the Mylar as much as you can to eliminate wrinkles. Clean the Mylar with 90% isopropyl alcohol and a paper towel. I found that the wrinkles in my Mylar at this step are the limiting factor in how good I can make the final product look. I have not seen a difference as to which side of the Mylar to use, as it is aluminized on one side only.

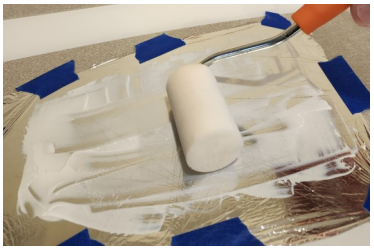
Step 1

Step 2: Use a plastic art spatula to apply a blob of gel to the Mylar, then lightly scrape the gel as thin as possible, and return the excess gel to the container. You won't use much gel; it will go a long way and will dry much quicker as you use less gel.



Step 2

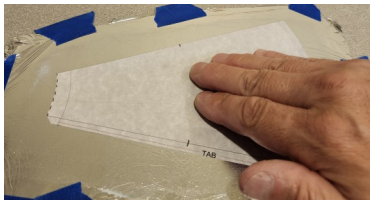
Step 3: Using a dry, small high-density foam roller, roll the adhesive out evenly on the Mylar. You will notice a thin, ghost white, speckled look on the Mylar. Try to remove as much gel as possible without leaving empty spots. If you put on a small amount of gel, it will completely dry in a few minutes. You can tell that it is dry as the white cloudy look disappears. You can also test to see if it's dry by touching an unused area, and it should be tacky but not wet, or leave any adhesive on your finger. Make sure to clean the foam roller and spatula with water



Step 3

before the gel dries. You can reuse the roller many times if you clean it properly between uses.

Step 4: Apply your piece of Vellum or other material. Rub the paper down to ensure a good bond. Some scrapbookers use a burnishing tool, but I just use my finger.



Step 4

Step 5: Heat seal your vellum to the mylar using a covering iron. You can probably do this with a clothing iron, but I don't know what heat setting to use. The online instructions for the gel adhesive give recommendations when using an iron. I found that on my Hobbico iron, I can use a very high heat setting (3) without harming the materials.

Step 5

Step 6: Allow the part to cool before handling, then remove the tape carefully and trim the Mylar using sharp scissors or a new Exacto blade. You can see that the surface isn't perfect as it is difficult to remove all the wrinkles from the Mylar.

Step 6

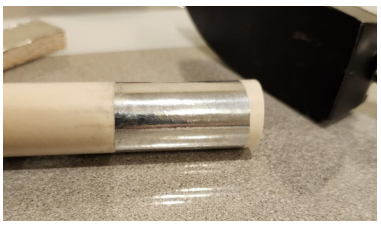
I have found that I can successfully use this method to bond Mylar to many types of paper used to make paper tubes and tail cones. In this photo you can see a Vellum airframe with a parchment/resume paper tail cone both covered in Mylar. I still use Titebond II to attach the tailcone to the body tube and have not had any failure issues, even with the very powerful ejection charges used in the Serbian motors.

Airframe completely covered with mylar

Mylar on Fins and Balsa Surfaces

I also tried applying Mylar to balsa. I used a ¼" thick test block that I sanded with 150 grit sandpaper. I found that I had to apply a very thin layer of the gel to the balsa as well to get good adhesion. It seems that the balsa would absorb the gel from the Mylar and then not stick. No other finishing material was applied to the balsa to get a rather smooth finish.

Mylar on Cardboard Body Tubes



I also tried bonding the Mylar to a standard 24mm white, glassine finished body tube. No preparation of any type was applied to the body tube. I simply ironed the Mylar to the tube in a wrap fashion, where I started at the center and worked toward the edges. It produced a very smooth finish, which seems to cover the seams well, but the tubes I used don't have much of a seam anyway. The Mylar did stick to the tube very well, but it is a little more difficult to iron on a body tube, and wrinkles are much harder to remove.

Future Experiments and Observations

The weight added to an airframe is quite small, but the added benefit is that the airframe is now water-resistant due to the Mylar covering. This is quite important when you have to fly early in the morning and dew is still on the flying field. When I flew my models at the WSMC, I did not notice any issue of water absorption due to humidity either. This was definitely an issue at the North Coast Cup in late July as my bare vellum models absorbed water from the air and the airframes became more and more "squishy" as the day went on. It was also obvious that the flexibility of the airframes was affecting the altitude of my models late in the day, and they were not boosting as straight as they usually do.

As to the goal of increasing visibility of the airframe, when I flew my Mylar coated S9 models at the WSMC, we were easily able to see the flash of sunlight off the models well past the 3 minute max time for the round as it flew up and away in a big thermal. It was almost as easily seen as a small Mylar parachute.

This method could also easily be adapted to make decals that can be ironed on with minimal surface finishing needed. I am also looking to experiment with dyeing the Mylar different colors as I would like to be able to decorate my models differently.

Send me an email with your questions and/or comments. aiglesia@gmail.com

CURRENT EVENTS IN SPACE EXPLORATION

Buzz Nau

SPACEX

As this is the last Current Events update for 2025, let's also recap the year in Space Exploration. SpaceX continues to break launch records with 165 Falcon 9 launches for 2025 (up from a record 134 in 2024). 123 flights were dedicated to Starlink satellite deployment, with over 3,000 added to the telecommunications constellation. There were no Falcon Heavy flights, but 5 sub-orbital Starship Integrated Flight Tests. IFT 10 and 11 were major successes and also the last flights of the Starship Block version. The next flight in early 2026 will be a new Block 3 vehicle from the new Orbital Launch Pad 2. Starship Block 3 progress was setback when Super Heavy Booster B18 exploded during a routine pressure test. As of this writing, there is no official word on the cause.

In the final two months of 2025, SpaceX launched 26 Falcon 9s; 22 were in support of Starlink telecommunications satellites, and 4 were for other missions.

The Bandwagon 4 mission was launched on 2 November from SLC 40 at Cape Canaveral Space Force Station. The dedicated rideshare mission carried 18 payloads for Korea ADD, Exolaunch, Fergani, and others aboard a Falcon 9.

On 16 November, the Sentinel-6B mission was flown by a Falcon 9 from SLC 4E at Vandenberg Space Force Base. Sentinel-6B is an Earth Observation satellite that will measure ocean topography. It will also monitor atmospheric temperature to refine weather prediction models.

Transporter 15 was a dedicated rideshare mission to a sun-synchronous orbit launched on 28 November from SLC 4E at Vandenberg Space Force Base. It deployed 140 payloads, including cubesats, microsats, and orbital transfer vehicles. It was the 30th flight for the Falcon 9 booster.

NROL-77 was the third Falcon 9 launch in support of the National Reconnaissance Office and Space Systems Command on 9 December from SLC 40 at Cape Canaveral Space Force Station. The payload was not announced, but it is suspected to be another deployment of SpaceX Starshield telecommunications satellites.

ROCKET LAB

Rocket Lab performed 21 orbital flights with the Electron launch vehicle in 2025, plus 3 HASTE, sub-orbital launches. This represented a significant increase in flights compared to previous years. Rocket Lab's Neutron heavy lift vehicle did not make a maiden flight in 2025 and has been pushed to mid-2026.

The Nation God Navigates, the 5th mission launched for the Japanese Earth imaging company iQPS lifted off on 5 November from Rocket Lab's LC 1 in New Zealand. The Electron vehicle deployed an iQPS synthetic aperture radar (SAR) satellite to low earth orbit. The goal is to deploy 36 SAR satellites that will provide semi-real time earth imagery day or night and through any weather.

The final Rocket Lab HASTE flight, *Prometheus Run,* took place on 18 November from Complex 2 at Wallops Islande Flight Facility. The Electron vehicle flew a sub-orbital flight trajectory in support of the Hypersonic Accelerator Suborbital Test Electron (HASTE) program with a payload developed by the John Hopkins Applied Physics Laboratory and several secondary payloads.

A BlackSky Gen-3 earth observation satellite was launched by an Electron vehicle on 20 November from LC1 at Rocket Lab's New Zealand launch site. *Follow My Speed* was the third mission for an undisclosed customer.

The *Raise and Shine* (RAISE-4) mission was launched on 13 December at Rocket Lab's New Zealand launch complex. The Electron placed the RAISE-4 (RApid Innovative payload demonstration Satellite-4) in a sun synchronous orbit. RAISE-4 is a Japan Aerospace Exploration Agency (JAXA) satellite for in-orbit evaluation of 15 demonstration components.

The next Electron launch was at Wallops Island Complex 2 on 18 December. The *Don't Be Such A Square* mission deployed research experiments and technology demonstrators to low earth orbit for the DoW.

The Wisdom God Guides was the 6th mission for Japanese earth imaging company, iQPS. The Electron vehicle lifted off on 21 December from the Mahia Peninsula Launch Complex.

BLUE ORIGIN

Blue Origin made 2 orbital flights with their New Glenn heavy lift vehicle in 2025. EscaPADE, mission NG-02, lifted off on 13 November from LC 36 at Cape Canaveal Space Force Station. It carried NASA's twin EscaPADE (Escape and Plasma Acceleration and Dynamics Explorers) spacecraft ("Blue" and "Gold") to a high elliptical orbit. ESCAPADE is a low-cost NASA heliophysics mission under the SIMPLEx program, led by UC Berkeley's Space Sciences Laboratory, with spacecraft built by Rocket Lab.

The mission's primary goal is to study Mars' hybrid magnetosphere and how solar wind strips away its atmosphere. The twin identical probes, based on Rocket Lab's Photon bus will orbit Mars simultaneously from different altitudes to take coordinated measurements.

The flight was historic as the first stage (nicknamed "Never Tell Me The Odds") successfully landed on the droneship Jacklyn in the Atlantic Ocean becoming only the second reusable booster vehicle to make a controlled landing.

ULA

United Launch Alliance (ULA) had 6 orbital launches in 2025, 5 Atlas V's and 1 Vulcan Centaur. This was up from previous years, but short of the 9-12 forecasted due to delays in Vulcan Centaur production. There were 2 launches in the final months of the year.

ViaSat-3 Flight 2 was launched on 14 November aboard an Atlas V 551 rocket, configured with five side-mounted solid rocket boosters from SLC 41 at Cape Canaveral Space Force Station. The ultra-high-capacity broadband telecommunications satellite for Viasat will provide more than double the bandwidth capacity of Viasat's entire existing satellite fleet.

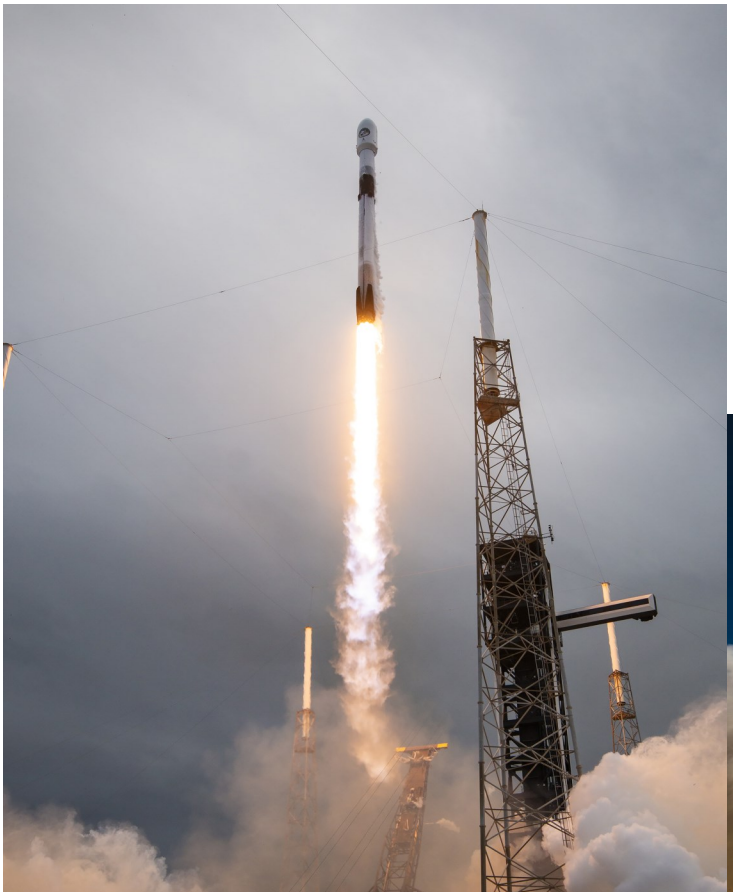
ULA's next flight was another Atlas V 551 rocket, configured with five side-mounted solid rocket boosters, which launched the Amazon Leo (LA-04) mission on 16 December. The flight lifted off from SLC 41 at Cape Canaveral Space Force Station and delivered 27 satellites in support of Amazon's Broadband Constellation.

NASA NEWS

NASA has a new administrator! After having his initial nomination withdrawn, Jared Isaacman was renominated on 4 November and confirmed on 18 December. A self-made billionaire, he became a civilian astronaut having commanded and funded two private space missions, Inspiration4 and Polaris Dawn. Isaacman is considered a change agent and has stated goals of returning to the moon with a surface station, exploring Mars, and commercial partnerships.

New Glenn NG-2 Liftoff - Blue Origin photo

NASA Administrator Jared Isaacman - NASA photo



SoaceX NROL-77 launch - SpaceX photo

Rocket Lab's "RAISE and Shine" launch - Rocket Lab photo

JMRC HUVARS Club News

Holiday / Winter Party & Annual Meeting
Saturday, February 7, 2026
Noon – 5:00 p.m.
Freedom Township Hall
11508 Pleasant Lake Rd, Manchester, MI 48158.

Our annual party is pot luck affair where we elect our officers and fund raise through a raffle and auction. There is always a lot of great food, cool rocketry items to win, and fun rocketry folks to share a good time with. There is also a white elephant gift exchange. If you wish to participate, bring a wrapped rocket related gift, often less than $15 value, and we will go over the rules at the event.

Please RSVP by January 31, 2026, so we have a rough headcount for seating and tables. Please use the following link to let us know you're coming (and what dish you plan to bring, if you'd like). RSVP Link.

Precision Altitude Contest 2025 Results
We had several altitude contest flights in November bringing the total to 15. Jay Calvert is our winner hitting 663 feet on the last day of the contest beating out Al de la Iglesia by 1 foot!

The target altitude was 673 feet.
Final Standings
1: Jay Calvert (4 attempts) 663 feet
2: Al de la Iglesia (3 attempts) 662 feet
3: Mark Gryn (1 attempt) 630 feet
4: Tony Haga (2 attempts) 630 feet
5: Buzz Nau (2 attempts) 511 feet
6: Dan Weimer (2 attempts) 328 feet
7: Ramon Robles (1 attempt) No data

Precision Altitude Contest 2026
With a new year come a new club altitude contest. The BOD wanted to keep the possible altitude low again in case we find ourselves flying at the smaller Horning Field 3 a lot this year. Using a range of 400 to 800 feet, the RNG (random number generator) came up with **518 feet** which is the goal for 2026. We will repost the rules in the next issue of Toal Impulse.
Precision Altitude Rules:

- At the end of the flying season, have the closest recorded altitude to the target altitude (518 feet) without going over
- Any commercial altimeter may be used
- The cost of entry is $5 and must be paid before the flight
- You must state on your flight card that the flight is participating in the Precision Altitude contest
- You may enter as many times as you like
- We must have at least 10 adult entries during the flying season, or the contest will be extended to 2027

Awards:
Adults (18 and older)
First place is 50% of the money collected
Runner-up is 25% of the money collected
Club fund receives the final 25%

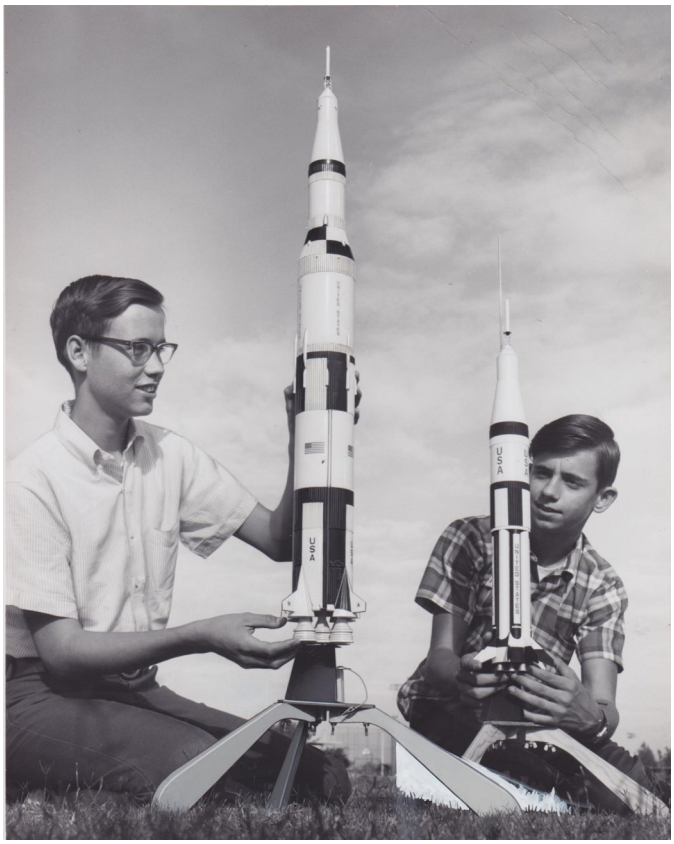
Juniors (Under 18 years old)
Prizes to be announced later for all junior participants

PRESIDENT'S CORNER

2025 is officially in the past, and the new year being rung in, we see a close to the holiday season with several weeks of unpredictable weather that is not usually ideal for rocketry in Michigan. We can hope that the formidable rodent struggles to see his shadow, and our journey forth to the fields can commence as we battle the rocket's main nemesis on earth, known as gravity.

While putting fancy words on the situation doesn't bring our first launch any closer, nor does pinning the blame on rodents residing in other states, it's at least an excuse. In the meantime, we do have things to look forward to in the not-so-distant future. Our Annual Club Party (and meeting) on Feb 7th in Manchester, MI, noon-5 pm. This event has been a staple for our group and is open to everyone: friends, family, neighbors, and anyone looking to have a good time and partake in way too much food with stories to share. We also have raffle and auction items that usually far exceed the normal ratio of goodies to people.

If you haven't blocked off the date and plan to make it out, please make arrangements to do so, as the event is well worth the commute! I do hope we get to see everyone, and in the meantime, don't be shy about using our Forum or Discord server to keep everyone posted on your current project or to ask questions.



LAUNCH WINDOWS

Tony Haga

January 5, 2026
Pandora / Twilight rideshare mission, Falcon 9 Block 5, SpaceX
Launch site: SLC 4E, Vandenberg SFB
The Pandora small satellite was selected in 2021 as an inaugural mission in NASA's Astrophysics Pioneers Program. It includes a 0.45-meter telescope that will enhance our understanding of exoplanet atmospheres by separating exoplanet signals from those of their host stars, as well as studying host star variability through long-duration observations of 20 unique planets using visible-light photometry and near-infrared spectroscopy. Also launching on this launch are ride-share payloads under the "Falcon 9 Twilight mission", including satellites from Spire Global and Kepler Communications.

January 4, 2026
EOS-N1 and others, PSLV-DL, ISRO
Launch site: Satish Dhawan Space Centre, India
Small Earth observation satellite from NewSpace India Limited (NSIL) for an "Indian strategic user". This launch will also carry 18 other ride-share payloads.

January 13, 2026
Flight Two, Spectrum, Isar Aerospace
Launch site: Orbital Launch Pad, Andøya Spaceport
Second test flight of the Isar Spectrum launch vehicle, carrying several cubesats as part of the European Space Agency's "Boost!" program.

January 2026
Flight 12, Starship, SpaceX
Launch site: Orbital Launch Pad 2, SpaceX Starbase
12th test flight of the two-stage Starship launch vehicle. Maiden Flight of Starship V3

January 2026
Gaganyaan-1, LVM-3, ISRO
Launch site: Satish Dhawan Space Centre, India
First uncrewed orbital test flight of the Gaganyaan capsule.

January 2026
Blue Moon Pathfinder, New Glenn, Blue Origin
Launch site: LC 36A, Cape Canaveral SFS
First flight of Blue Origin's Blue Moon MK1 lunar lander.

January 2026
IRNSS-1L (NVS-03), GSLV Mk II, ISRO
Launch site: Satish Dhawan Space Centre, India
This is a replacement satellite for the Indian Regional Navigation Satellite System. The constellation will provide India with an alternative to GPS and will be used for military and civilian use. Located at a geosynchronous orbit, the system will be operated by the Indian government.

February 1, 2026
Michibiki 7 (QZS-7), H3-22, Mitsubishi Heavy Industries
Launch site: Tanegashima Space Center, Japan
QZSS (Quasi Zenith Satellite System) is a Japanese satellite navigation system operating from inclined, elliptical geosynchronous orbits to achieve optimal high-elevation visibility in urban canyons and mountainous areas. The navigation system objective is to broadcast GPS-interoperable and augmentation signals as well as original Japanese (QZSS) signals from a three-spacecraft constellation.

February 5, 2026
Artemis II, SLS Block 1, NASA
Launch site: LC 39B, Kennedy Space Center
Artemis II is the first crewed mission as part of the Artemis program. Artemis II will send a crew of 4, 3 Americans and 1 Canadian, around the moon and return them to Earth. The mission will test the core systems of NASA's Orion spacecraft, including the critical life support system, among other systems, which could not be tested during Artemis I due to the lack of crew onboard.

February 15, 2026
Crew-12, Falcon 9 Block 5, SpaceX
Launch site: Cape Canaveral SFS
SpaceX Crew-12 is the twelfth crewed operational flight of a Crew Dragon spacecraft to the International Space Station as part of NASA's Commercial Crew Program.

February 24, 2026
Flight 3, KAIROS, Space One
Launch site: Spaceport Kii, Japan
Third flight of the KAIROS launch vehicle. 4 satellites will be on board.

February 2026
Elektro-L No.5, Proton-M/Blok DM-03, Khrunichev State Research and Production Space Center
Launch site: Baikonur Cosmodrome
Elektro-L is a series of meteorological satellites developed for the Russian Federal Space Agency by NPO Lavochkin. They are designed to capture real-time images of clouds and the Earth's underlying surface, heliogeophysical measurements, collect and translate hydrometeorological and service data.

February 2026
Korean Multi-purpose Satellite 6 (KOMPSAT-6), Vega-C, Arianespace
Launch site: Guiana Space Centre
Sixth South Korean Earth observation satellite of the KOMPSAT series. It is equipped with a synthetic aperture radar with a ground resolution between 0.5 and 20 meters.

February 2026
STP-S29A, Minotaur IV, Northrop Grumman Space Systems
Launch site: SLC 8, Vandenberg SFB
STP-S29A is a mission under the U.S. Department of Defense's Space Test Program (STP) that will deliver technology demonstrations to orbit and contribute to future space system development, with this launch delivering up to 200 kg of STP cubesats to Low Earth Orbit.

February 2026
Demo Flight, Vikram-I, Skyroot Aerospace
Launch site: Satish Dhawan Space Centre, India
First launch of Skyroot Aerospace's Vikram -I launch vehicle, with several cubesats on board.

OUR MEMBERS IN THE FIELD

Mark Chrumka and his Chinese Long March 2E PMC. He wasn't able to get it launched this time.

Jeff Jerzy and his F15 powered EGGO 1. Both F15's CATO'd in spectacular fashion.

Ramon Robles and his Mean Machine

Dan Weimer and his Arcturus

Richard Bickley and his Nike Smoke

Al de la Iglesia returns his Nova Payloader