TOTAL IMPULSE

JACKSON MODEL ROCKET CLUB
JMRC
HUVARS
HURON VALLEY ROCKET SOCIETY
TRIPOLI ROCKETRY ASSOCIATION, INC.
TOTAL IMPULSE VOLUME 26, NO. 2
MARCH - APRIL 2026

LDRS 44

CRAPSHOOT XI

ARPAT TARGET VEHICLE

APRIL SPORT & NRC LAUNCH

MODELING AEROBEE 350 FINS

CLUB OFFICERS

President: Scott Miller
Vice President: Roger Sadowsky
Treasurer: Tony Haga
Secretary: Buzz Nau
Editor / NAR Advisor: Buzz Nau
Board of Director: Al de la Iglesia
Board of Director: Dale Hodgson
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:

Antigravity Group 10" Nike Smoke, AT M-2000 with (4) Preston N. 54/1750 sparkies at LDRS 44

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.

This newsletter is in the public domain except where otherwise marked. Unmarked articles, photographs, and drawings may be re-printed elsewhere, but credit to the author and this newsletter is expected. Material marked as copyrighted may not be re-printed without the consent of the author.

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

Send correspondence to:
Total Impulse
Buzz Nau, Editor
E-mail: USSMidway@gmail.com

Launch/Event Calendar - 2026

- Holiday Party - Feb 7 (Manchester)
- vNARCON 2026 - Feb 21
- March TBA (Horning 1) - Cancelled
- April 11 (Horning 1)
- LDRS 44 - April 16 - 19 (Pence, IN)
- Crapshoot XI - April 25-26 (Muskegon)
- May TBA (Horning 3)
- June TBA (Horning 3)
- NARAM 66 - June 23 - 29 (Muncie, IN)
- July TBA (Horning 3)
- August TBA (Horning 3)
- 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.

John Brohm
Tony Haga
Al de la Iglesia
Andy Murrell
Roger Sadowsky
Herb Crites
Dale Hodgson
Scott Miller
Buzz Nau
Chris Timm

Table of Contents:

EDITOR'S RANGE BOX

It's experiment time! Prior to starting this issue I asked myself a question, which is a good habit btw. I wondered, "why do I typeset in such a small font?". If I had asked myself that back when we printed newsletters and mailed them to subscribers I would have easily said, "to keep the page count down which reduces postage". But today, when newsletters are stored on a server with relatively inexpensive storage, there is no rational reason to keep issue size down, so starting with this issue I decided to experiment with a larger font size and mixing up column width. I didn't go too crazy (yet), but I did find it a little easier to typeset this issue.

That reminds me, I only have a couple issues left before I have to transition over to a new desktop publishing application. In Microsoft's infinite wisdom, they have elected to discontinue the only reason I subscribe to MS 365…. access to MS Publisher. It's dated and has nuances, but I learned on it, know it's limitations, and it works perfectly for what I need. Time for me to finally learn Adobe Indesign, sigh.

On to this issue, apologies for publishing a little late. Some of us attended back to back to back launches all over the region and it took time to document them. Thanks to the other members that attended these launches for sharing their experiences.

There is also a cool coincidence worth pointing out. In this issue For scale modelers we have an excellent article on fabricating wedge fins by John Brohm. The scale article in this issue is on the ARPAT Reentry Target vehicle which has… wedge fins. So, if you are interested in building an ARPAT, we also have the perfect article for building the fins.

As always thanks for reading and I hope to see you on the launch field soon!

Buzz

LAUNCH REPORT

APRIL SPORT AND NRC LAUNCH

April 11 Horning 1 Field Buzz Nau

April is a fickle month in Michigan and not usually kind to rocket launches. It's the time of year when we can often experience all four seasons…. In a single day. For that reason, we often cancel the first launch attempt in April, but it was different this year. We were surprised with near perfect weather and field conditions on April 11th. It had rained the day before and the Horning 1 field was a little soft, but it improved throughout the day and was never really an issue. In all we put up 63 sport and 4 competition flights for a nice total of 67 launches. We also saw several new faces make it out including a group of Western Michigan University students testing an active air brake system.

Sport Flights

Mark Chrumka led the flight count with 11 launches. He had several notable flights that included his Semroc Satellite Killer on a C6-3, 3D printed Trailblazer II on a D12-5, Quest DCY Delta Clipper on a C5-3, and Estes Crusader Swing-Wing on a C6-3. Mark added trim tabs to the elevators to correct the trim. Mark and I both lost sight of it at ejection, but Al de la Iglesia watched the glider and said the trims tabs made a big improvement.

Next up was Andy Tomasch with 7 flights for the day. Included were four flights of his Not So Long Ranger on B6-4s, two flights for his scratch-built Max Q on C6-3s, and his Estes Streak clone on a 1/4A3-3.

Roger Wilfong made 6 flights, 3 were scratch-builts that included his Aerobee Low on an E30-4, the Umich.edu on a C11-3, and Roger's Tri Motor on three A3-4Ts. Roger also flew an Estes Der Red Max on a B6-4 and HUVARS themed Mini-Max on a 1/2A3-2T. Buzz Nau also made 6 flights for the day. His flights included the Launch Pad Perseus II on a CTI E22-4 and Sky Dart on a B4-2 (both models landed on the outbuilding but were recovered). Other flights included his 3d Rocketry Circulus on an E16-4, scratch built Super Screamer on a C11-5, and scratch-built Super Big Bertha on a D12-3. Those flights managed to stay off the outbuilding.

Mark Chrumka's 3D printed Trailblazer II

Jeremy Chambers, Scott Miller, Jameson Chambers, Tony Haga, and Al de la Iglesia

New members, Jeremy and Jameson Chambers made 8 flights between them. In addition to an Estes Big Bertha on B6s and C6s and a Dynastar Grappler on an E12-4, they made a couple of flights with their Estes Mercury Redstone. The flight with a QJet C12-5 CATO'd, but the B6-4 flight was a great launch and recovery.

Dan Weimer made 4 flights which included our one certification flight for the day. He flew his Apogee Zephyr on an H123-8 for a successful level 1 certification. Dan also flew his scratch-built Sprint 2 on a C6-5, upscale EAC Viper on a B6-3, and scratch-built Arcturus on an E12-6 which CATO'd blowing out the nozzle. Also with 4 flights, Herb Crites put up his Mach Schnell SLK 54 three times on an Aerotech H148, Aerotech H250, and Aerotech H123. He also flew his Mach Schnell SLK 75m on an Aerotech I599 Warp 9.

Coming in with 3 flights, Hayden Garcia launched his Estes Journey once on a B6-4 and twice on C6-5s. This was his first time launching rockets and he made some fantastic flights. Dale Hodgson also put up three flights that included his Miller Motor Works Screw It & Fly 3D printed rocket on a Loki G66, Big Red on a D12-3, and finally Poop Tuber (do we really want to know?) on an Enerjet F20-4. The student project team from Western Michigan University made three flights and active airbrake control system that would attempt to hit exact altitudes. Their rockets included onboard cameras to observe the airbrake system in action. The team was led by Tyler Clendenning who flew the scratch-built Viper twice on J500s and Jupiter once on a J420. All three flights were successful and recovered on field.

Rick Buckley's Nike Smoke

WMU's Viper on a J500

Cooper Wintz, a first-time flyer with us, put up his Estes Crossfire called Fred a couple of times with a B4-4 and C6-5. We hope you had a good time and will be back with us soon! Al de la Iglesia made a couple of sport flights too with his Estes Der Red Max on a B6-4 and Alpha on an A8-3. Rick Buckley also had 2 flights. He launched his Estes Patriot on a B6-4 and Nike Smoke on a B6-4, both great flights. Finally, Tony Haga put up his Big Bertha a couple of times with a B6-4 and C6-5.

Competition Flights

The competition flying was low-key with only a handful of flights. Al de la Iglesia made a couple of 1/2A FAI Streamer Duration flights. The first one snagged a power line but eventually worked its way loose and was recovered. The second was a CATO that pretty much toasted the rocket.

Steve Kristal made an A Altitude flight that hit 393 meters. His second flight was a record attempt for NAR FAI S1B. The two-stage model flew on an A10-0 to an A3-6 and hit 382 meters. He managed to break the record held by none other than Emma Kristal his daughter. Way to go Dad!

Photos - Buzz Nau & Roger Sadowsky

Mark Chrumka preps his Estes Crusader Swing-Wing

Dan Weimer's Zephyr lifts off!

Western Michigan University students prep their active airbrake rockets

Mark Chrumka's Semroc Satellite Killer

Buzz Nau's 3d Rocketry Circulus

WMU's Viper on a J500

WMU's Jupiter on a J420

Hayden Garcia and his Estes Journey

Jeremy Chamber's Estes Mercury Redstone

LAUNCH REPORT

LDRS 44

April 19-19 Pence, Indiana Tony Haga, Dale Hodgson, & Buzz Nau

Tony Haga

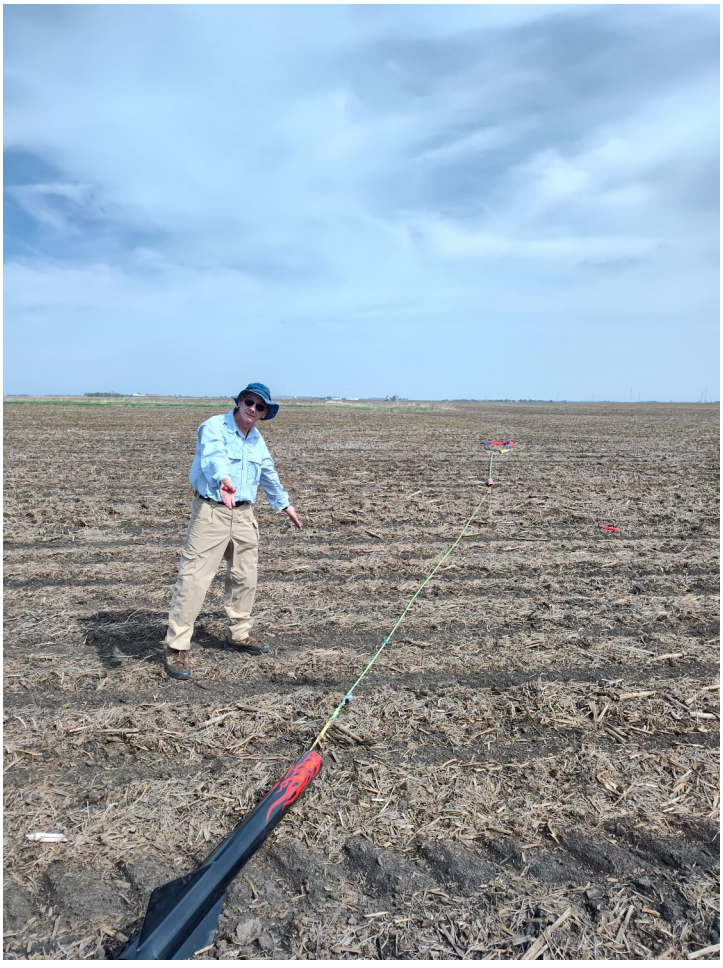
LDRS 44 in Indiana! And only a 6 hour drive. This would be my fifth LDRS (I think) so I knew it was going to be a blast. LDRS this year was hosted by Indiana Rocketry, they host their annual "Thunderstruck" launch each spring that we have been to a few times now. They always put on a great show with a large field (6 square miles) and a well-run range. For this year's LDRS the weather was not too kind, but we still got up some good flights and had a great time.

It rained a good bit Wednesday night and into Thursday morning, so the field was a bit of a mess when we got there for the first day. Our host decided it would be best to delay opening the range until the rain had passed. Buzz, Dale and I volunteered for pad manager spots at the normal 9:00 am starting time but with things delayed, we got pushed into service, lugging launch equipment out to the pads. It was a bit of a muddy mess with the rich soil sticking to the bottom of our boots. I think I gained an inch in height with every step.

The sky began to clear, and the sun felt good. Things started to dry out, but the wind just wouldn't let up. Some brave souls got rockets in the air but after watching a few rockets head off under parachute towards the east at a high rate of speed, we decided it would be best just to do a little shopping and wait for better conditions on Friday.

And Friday was a great day! The morning broke with low winds and high wispy clouds. Now is the time to send some! We got to the field by 8:00am (we skipped the hotel "breakfast") and I quickly got my 4" fiberglass rocket named "Flame On" ready with a CTI L640 "Dual Thrust" 54mm motor. Unfortunately, the rack of pads I was assigned to only had one 1515 rail, so I had to wait for that rack to fly before I could get mine on. It took a while before that rack was clear before I could head back out. But Oh No! The rail I was assigned to was missing it's blast deflector and I let

Tony Haga's "Flame On!" on a CTI L640



Tony with a successful recovery

the rocket drop off the bottom of the rail. When trying to work the rocket back in place I managed to crack off one of the rail buttons. So, I had to pull it back down and head back to the truck for a repair. Good thing I had some JB Quick epoxy in the range box.

After some curing time, I headed back out (now behind schedule) and this time all went well. The L640 lit right up and "Flame On" went up in a hurry to 8800'. We lost sight of the rocket in the hazy cloud cover, but the rocket was equipped with an Eggtimer Quasar altimeter with a built-in GPS transmitter. I was able to track the rocket well with distance and direction, and we spotted the rocket dropping under 'chute about 2500' north of the launch pads. Recovery was quick in the empty field with help from Buzz.

Next up was another 4" fiberglass rocket that I call "Sky Camo" due to the blue and white paint job. This was fitted with a Loki K1127 Blue motor. By now the range was very busy and more bad luck was in store. After a wait to get assigned to a pad I found the Perfectflite altimeter did not have continuity on the main charge. Crap! Back to the shop to see what the issue was. It's worth a note here to say that the Stratologger CF was giving me some odd behavior. I had taken the BP charges off and replaced the connections with bare e-matches for safety. When wiggling wires, trying to find out where the loose connection was, the altimeter decided to fire both e-matches. Some intermittent connection had confused the altimeter into thinking that it had detected apogee with the main firing a couple seconds later. Fortunately I was expecting trouble and was able to jump out of the way. I pulled the entire ebay apart and checked and tightened all the connections and that did the trick. I made fresh charges with new e-matches and put the rocket back together (now I'm way behind schedule). It was midafternoon and the wind was beginning to pick up. I really wanted to get this flight in the air so I went back to the pads in a hurry. This time all went well and "Sky Camo" headed straight up under Loki Blue power to 3900'. Even though this flight was to a modest altitude (for LDRS anyway) we again lost sight in the hazy cloud cover but Buzz spotted it under 'chute to the north very near where my earlier flight landed. The winds dragged the rocket on the ground some until the body tube filled with enough dirt to hold it in place. While packing the rocket up, one of the friendly land owners drove up in his ATV and asked it we needed anything. It was only a short walk back to the road and Buzz's truck so we thanked him greatly but declined his help. By this time now we were all tired and the wind was becoming an issue so we quit for the day and spent the rest of the afternoon packing and watching some of the flights. The field next to the range had lots of rockets hiding in the tall grass so there were a number of people wandering around looking for invisible rockets.

Tony Haga's "Sky Camo" on a Loki K1127

Heavy rain blew in Friday night and continued into Saturday morning. We were told that the range would not open until noon and close early at 4:00pm to allow time for the Tripoli banquet and with more windy conditions expected to last well into Sunday we decided to head back home Saturday morning. Bummer.

I sure wish we had more time to fly, but that's the way it goes with the rocket hobby! There is always next time.

A big "Thank you" to our friends at Indiana Rocketry and the local landowners that are super accommodating. It is always a great time in Pence Indiana.

Dale Hodgson

Well; here I thought that April was going to be just a long boring month but boy, was I wrong! We had our JMRC launch on April 11th, then the very next week LDRS in Pence, IN April 15th-19th and then the Crapshoot with MMAR in Muskegon April 24th-26th. For me, it was a lot of road time; 3 hours to JMRC, 6 hours to Pence and another 6 hours to Muskegon. I racked up a lot of miles but didn't fly all that much. But every mile was worth it. My usual travelling compadres Buzz and Tony were on hand, and we were joined by our very own Herb Crites at the JMRC launch and the Crapshoot. I will have to say at least in my opinion a good time was had by all.

Tony, Buzz and I had a long text debate over whether to even go since the weather was forecast as iffy at best but in the end, we decided it was better to fall on the sword and go and not fly rather than stay home and hear of weather breaks and huge flights. Our first day; Thursday was a

Dale Hodgson and his 54mm Minimum Diameter rocket

bust, we really didn't fly anything since the winds and field weren't all that great. Still though it was a good day to just be there, visiting the many vendors and meeting other people in the hobby. Friday proved to be a better day despite the fact that the winds were fairly strong, but a lot of people still flew; us included. Both Tony and Buzz had a couple of bigger flights but had long walks for recovery.


Dale's 54mm Min Diameter on a Loki I377

The more I watched, the more I thought about getting a tracker. Personal note: Christmas 2026 a tracker will be first on my list. I really wasn't as brave as those two "other" guys, I only had one flight. I flew my 54mm minimum diameter on a Loki I377 cocktail motor. The rocket sat on the pad a second, chuffed once and took off like a bat out of hell. I saw the apogee event and that was it; I lost sight of it because it was a touch hazy. I almost called it lost but when I went out walking with Buzz to retrieve his Falcon, I found mine. Not nearly as far out but completely intact; a very successful flight. I just wished I had seen more of it.

The weather was forecast to be pretty good on Saturday, but we woke up to wind, rain and a very low ceiling. Overnight the forecast sort of flipped; Friday proved to be the better day. Unfortunately, we decided to pack it in and head home. There was another launch to attend the very next weekend.

Buzz Nau

LDRS 44 would be my third trip to the Indiana Rocketry field at Pence Indiana and also my first LDRS. I had a little bit of anxiousness due to the weather forecast as well as the number of registered fliers exceeding 500! Weather was predicted to be a factor with projected rain and high winds. Launch opportunities might be minimized while competing with a lot of others wanting to take advantage of the best conditions.

The event started on Thursday after a fair amount of rain the day before. Dale, Tony, and I had volunteered for the first shift of range duty as pad managers. We ended up spending most of that time setting up pad cells since the start of flying was postponed due to the previous day's weather. Part of the range was muddy, but it dried out nicely as the day went on.


Buzz Nau with his THOY Falcon

Buzz's Falcon on a CTI I216

The wind picked up and though there were about 100 flights for the day, there were also a lot of long recoveries. We decided to wait until Friday to fly as it looked to be the best weather day of the event. When we weren't watching the flights going up, we hit vendors row.

We got an early start Friday. Dale and I were loaded next to one another and he went first. We both lost sight of it after burnout and thought the model might be lost for good. I flew my THOY Falcon on a Cesaroni I216-11 Classic. It was a nice straight boost to about 4,700 feet and I saw it the whole flight. I used a Jolly Logic Chute Release, but unfortunately the main chute worked its way loose at apogee. I was able to keep eyes on it for the entire descent and realized I was in for a long walk. Dale volunteered to help me track it down so we drove over to the edge of the parking area to begin the search. As we got out, we saw Dale's model had landed about 100 yards from the parking area. As Dale retrieved his rocket, I headed out and was met shortly by one of the landowners in his side by side offering to drive me out, and I quickly accepted the offer. We saw several other models along the way and after driving about ¾ of a mile found the Falcon right on the line I had.

After returning, Tony put up his first flight which went out of sight. We caught up with it as the main came out and with Tony's GPS tracker in hand, he and I headed out for it. The Egg Timer tracker worked great and took us right to it.

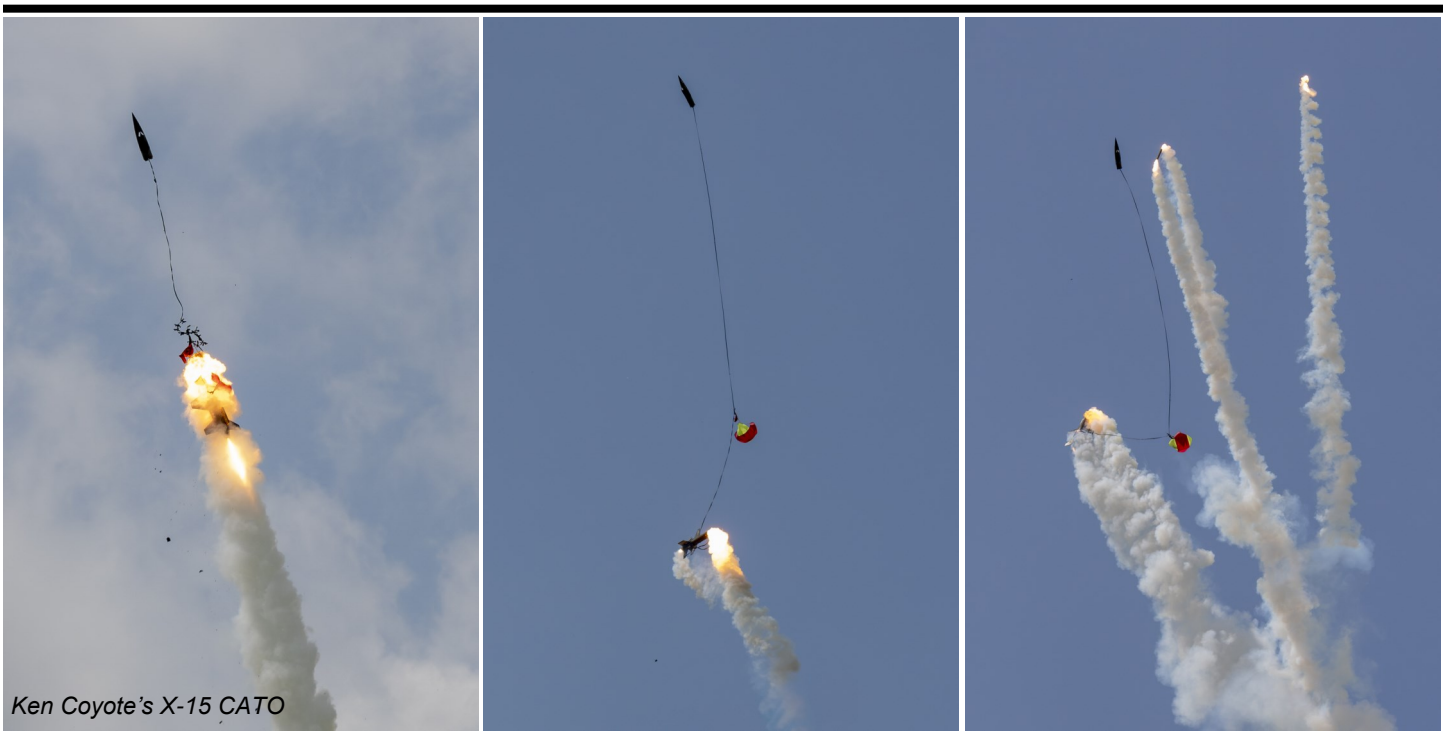
I flew my upscale 4" diameter Citation Patriot on a Loki I405 for my second and last flight. The I405 is one of my favorite motors, and it spanked the Patriot to nearly 4,000 feet. The chute release worked fine, but two shroud lines on the X-form chute cinched the chute making for a fast and hard landing on the soft field. It was hard enough to pop a fin loose, but otherwise it was in fine shape and easily repairable.

Tony had one more flight, and it was another one we lost sight of after the apogee event. I caught sight of it right after the main came out. It was a good thing too since his Egg Timer GPS lost track and never really got it back until it was in the truck. The wind had picked up a lot causing it to be pulled across the plowed field until the body tube filled up with enough dirt.

There was a significant storm overnight and it was still raining in the morning. The range opening was delayed until noon. With that and the forecast for Sunday predicting more wind, we decided to head home early. We didn't fly as much as we wanted, but what we did launch flew well, and we got to witness plenty of cool flights throughout the time we were there.

Congratulations to Indiana Rocketry for another well run event and flight range. Logistics and range layout made for a smooth operation. A big thank you to the land-owners who are providing one of the best launch sites in the Midwest. It is probably the best field I've flown from.

Buzz's upscale Patriot on a Loki I405

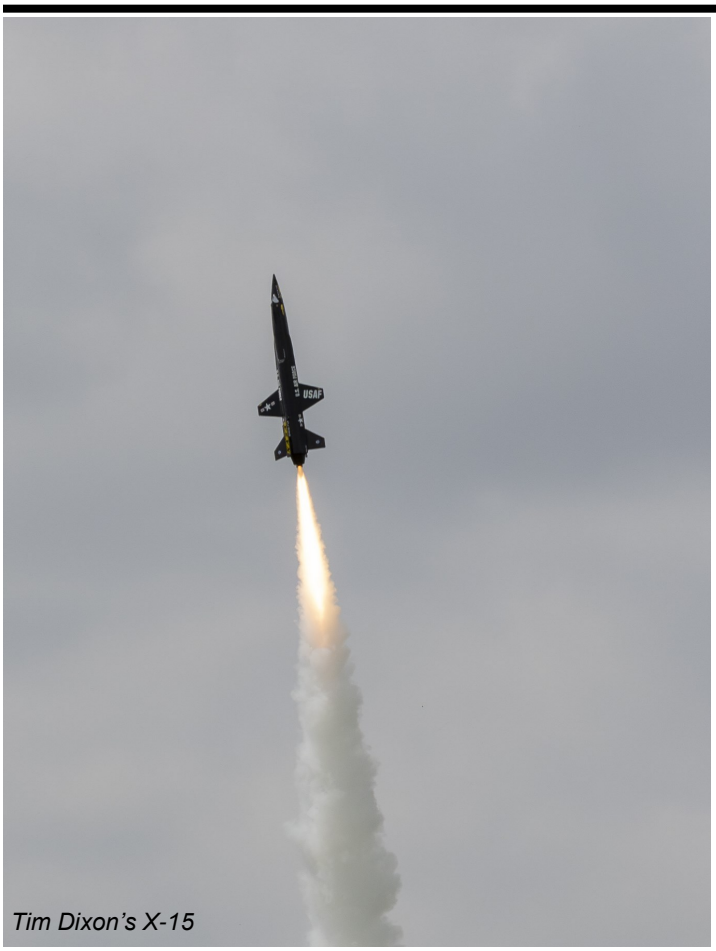


Ken Coyote's X-15 CATO

LDRS 44 - PENCE, INDIANA

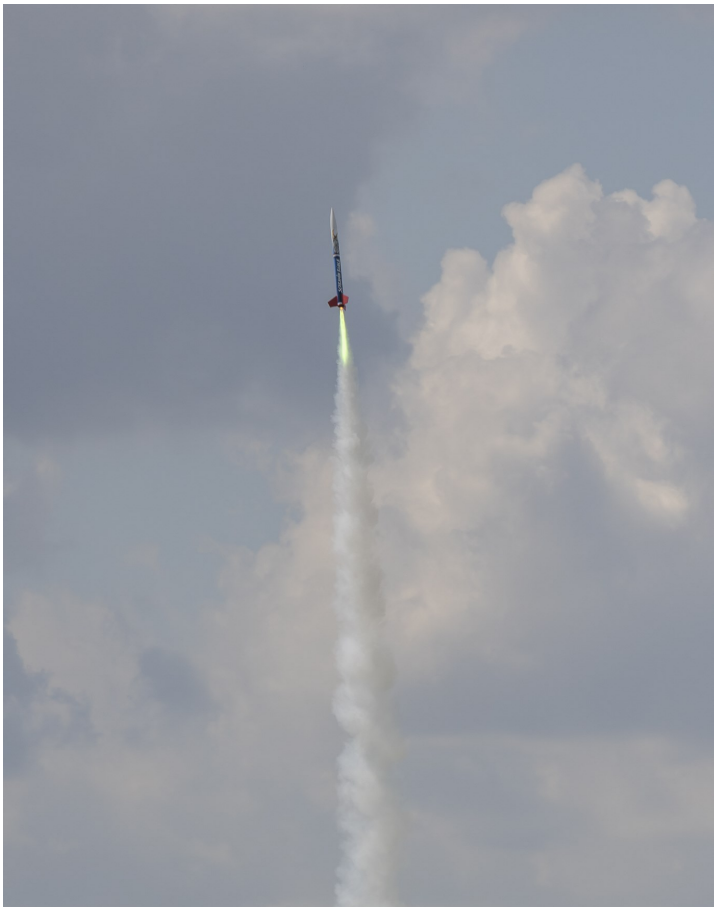
SR-71 that had a dual rear ejection

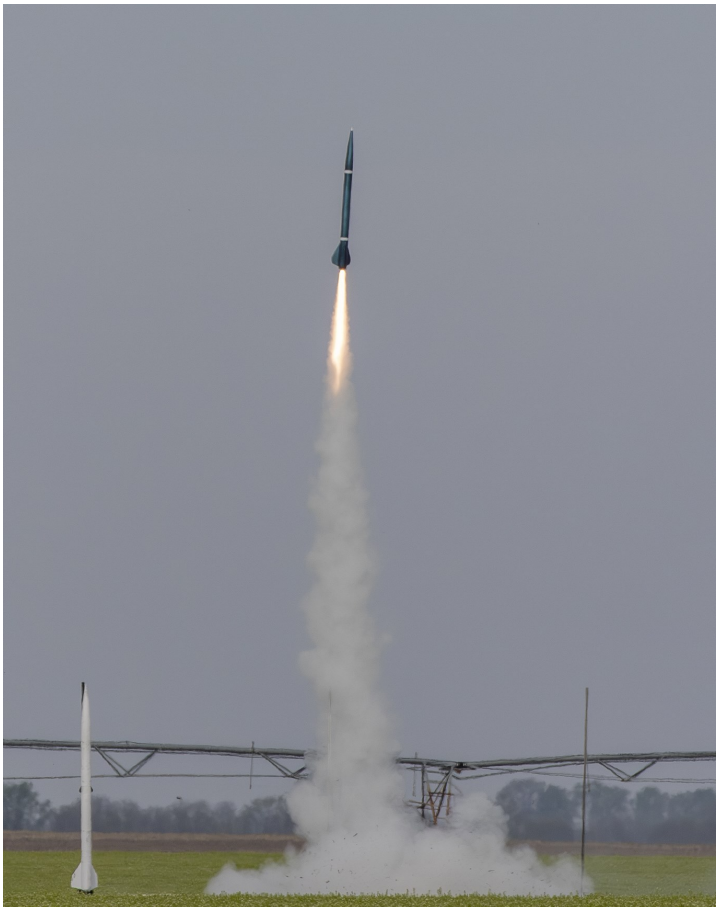
Upscale Black Star Voyager



Tim Dixon's X-15

Upscale Red Nova





LAUNCH REPORT

CRAPSHOOT XI

April 25-26 Muskegon, Michigan

Tony Haga, Dale Hodgson, Herb Crites, & Buzz Nau

The conclusion of *Super April,* a string of three consecutive launch events, was Crapshoot XI flown over the April 25/26 weekend at the MMAR/SMASH field in Muskegon, MI. Several JMRC/HUVARS members attended as well as the hosts that are co-members.

The weather forecast was a mixed bag, so we weren't sure what to expect, though Sunday looked to be the best day. It turned out to be the opposite, as Saturday had near perfect conditions. Even though it was cooler and windier on Sunday, there were still plenty of great flights.

Herb Crites - Witness a Rocketry Miracle

Shortly before I headed west from Sterling Heights to take part in the two-day *Crapshoot 2026* co-launch at Muskegon with our friends from MMAR/SMASH, Lauren, my ever-thoughtful Texas daughter (and good Catholic girl), emailed this…

*"I'm excited to hear all about your launches, flights, and landings. I'm sending **St. Barbara** prayers to the powers that be that all launches are good to go and have a safe return…far away from water. There is apparently a **patron saint of Rocketry**, who knew?!?! I guess I shouldn't be surprised, there's a patron saint for everything."*

(Cue the harp glissando and angelic choir.)

My day's first flight of the Mach Schnell SLK 54m on Saturday morning was on an Aerotech I1299 *Warp Nine* that shot it like a mortar round to about 2300 feet. A steady breeze from the north put all rockets in danger of drifting into Hall Drain—aka *The Big Icky*—but fortunately the winds at altitude seemed calm…at least initially. My veteran bird with many dozens of flights returned fairly close to the pads after giving the rail a 4-degree tilt into the mostly-steady wind.

By noon, that southerly ground breeze was still gentle, but apparently the higher-altitude winds had picked up considerably. And still came straight out of the north toward that water hazard. My second flight of the day for that same rocket would be on a Loki I405, a motor with about a 20% higher total impulse than the previous Aerotech screamer. But I was sure a 5-degree tilt would compensate for the extra *oomph* and again ensure a touch-down near the pads.

With the added compensatory tilt, the apogee event took place at pretty near the same altitude that the first flight had attained, about 2500 feet. But to my surprise, the winds way up there were considerably stiffer than they had been that morning. *And dangerously, blowing at the same southerly azimuth.*

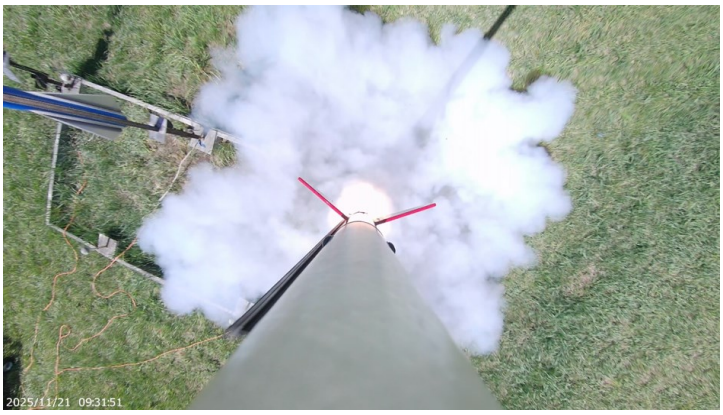


Figure 1--Mach Schnell SLK 54m heads skyward on a Loki I-405 Loki White. (NOTE: My on-board camera's internal clock was in error. Hence, these frames' time stamps read November of last year and some 3 hours early. I'm leaving them displayed, however, so readers may gauge the elapsed time between events.)

Figure 2--With the apogee charge fired at about 2500 feet, the air frame sets sail, headed due south, tail-first, with the rest of the deployed--but JLCR-restrained to 700'--recovery train in tow. (NOTE: Photo inverted for clarity.)

Seemingly as quickly as it was descending, I observed that my rocket and its very long recovery train were streaking *across* the sky, down range, and toward that most feculent of shorelines, officially known as Hall Drain. *(Fun fact—Hall Drain is a designated drain within Muskegon County's complex of drainage systems. Topological sites like drains often take the name of the original property owner or surveyor. Whether or not a Mr. and Mrs. Hall might've proudly doted on their son for having attained immortality for them*

all by lending the family name to what would later become this foul-smelling sewage treatment clarifying pond is lore lost to time.)

Figure 3--Descending under the virtual drogue of a Jolly Logic Chute Release set to release at 700 feet, the Mach Schnell SLK 54m would traverse a first canal, a tree line, power lines, a second canal, and the tall, steep, but narrow dam that contains the richly aromatic Hall Drain.

When the Jolly Logic Chute Release allowed the parachute to open at 700 feet, the bird was already above the southern limits of Muskegon Rocket Range's recovery area. Here, a deep canal, a tree line, power lines, a second canal, and finally *Big Icky*'s slim, northern dam, mark the infamous boundary that many a Muskegon-launched rocket have violated…to their regret and eternal rest.

But not this one, by God. At least not this time.

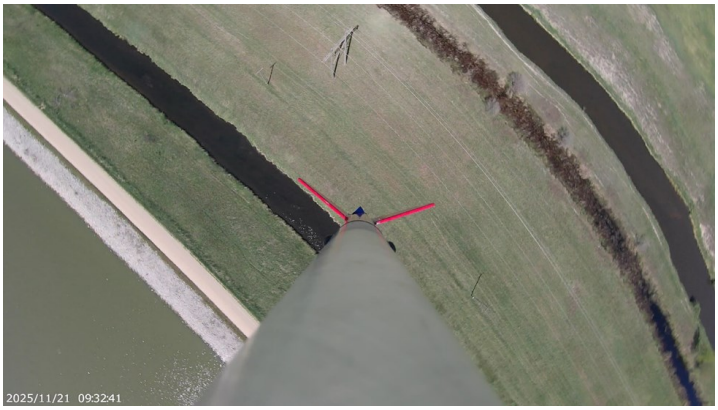


Figure 4--With the Chute Release released. The bird surveys the ground below for its landfall. Big Icky's siren call looms large in that observation.

My on-board camera would record it all; a long, backsliding approach to Hall Drain as the bird descended. The JLCR's release of the chute just over the power lines past the first canal. The bird's final, lazy, anxious descent under a 52" parachute.

And finally, the caboose of the recovery train—the airframe—making landfall just a few feet from the edge of the second canal's grassy north face. The big parachute deflating onto the ground just a few feet from the peak of the dam's artificial ridgeline and roadway that hold back the northern shoreline of *Big Icky*. *An amazing avoidance of five potentially ruinous obstacles.* In this narrow confine, I would discover that the entire recovery train had fallen softly upon the steep, grassy slope next to one *very* vile lake.

Figure 5—As shadow meets shadow-caster on the soft, grassy, northern face of the Hall Drain dam, finally comes the touch down. And, thankfully, NOT the splash-down.

Thank you, Saint Barbara. *Thank you, thank you, thank you!*

Figuring my luck, let alone my Saintly regard, were probably overdrawn after Saturday's adventurous expenditure, I was quite happy to just sit in my lawn chair and *observe* the flights of others on Sunday's conclusion to *Crapshoot 2026.*

Figure 6--Taken from the rocket's on-board Tracki GPS tracker, the history of this flight. Each minute, Tracki sends its precise location via the mobile phone network to its central server. The data is securely accessible by any internet-connected device, both in real-time and as searchable history. Here's the rocket's entire flight history view, from lift-off at the launch pad until our return to the launch site, bird-in-hand.

(In addition to Saint Barb for her miraculous, celestial assistance, many thanks to Mike Jacobs for accompanying me on the hour-long, brush-breaking, ground-level retrieval. We negotiated countless obstacles and dead ends en route to finally locating the precise pathway to retrieve my wayward rocket. But that's a whole 'nother story.)

Tony Haga

Crapshoot was the third weekend in a row for rocket launches. First was our JMRC launch in Manchester, next was LDRS 44 in Indiana and this time was the joint "Crap Shoot" launch with SMASH/MMAR in Muskegon. That's a lot of rocketry!

After breakfast Saturday morning at the IHop (I know, right?) Buzz, Dale and I headed out to the field. The forecast called for a stiff breeze out of the north but the wind didn't bother to show up and it turned out to be a great day to fly with a clear sky and light winds!

First up for me was my 4" fiberglass rocket that I call "Sky Camo". This rocket flew at LDRS on a Loki K1127 and this time would be heading up on a Loki J474 "Cocktail". I added just a bit of angle to make sure to stay out of the "Big Icky". I also installed a Eggtimer GPS tracker just to get a bit more familiar with it. There was a bit of delay while the red part of the cocktail ignited but the boost was good to an altitude of about 1700'. Recovery was easy just to the east of the field with the Eggtimer GPS tracking it the whole way.

Next up was my 3" fiberglass rocket. This is a Mach One Rocketry kit call "Skye Shredder". I had this one ready to fly at LDRS but didn't get the chance due to the weather. Here it was ready to go up on a CTI J400 Smokey Sam. I could have used a bit more thrust as the rocket leaned a bit off the pad but the boost was good and Skye Shredder made it to 2023'. Recovery was good again just to the east of the field.

My final flight of the day was a LOC 3" Iris. I had a couple of CTI Skidmark H motors in the box so I checked to make sure sparky motors were ok to fly. I got the go ahead (grass is nice and green) and equipped the Iris with an H160. Recovery was with a Eggtimer Quark for the apogee deployment and a Jolly Logic shoot release set for 400'. Boost was good but the apogee deployment was very late giving us all a scare. About the time we were all thinking "Oh crap" the apogee charge went off with the Jolly Logic releasing the parachute at about the same time. The rocket landed safely with no damage.

Upon inspection, I found that the Quark never fired the apogee charge. The motor backup charge was what deployed and saved the rocket. It looks like the Quark was damaged at some point and both driver chips were blown. Not sure why, will have to think about that some more. That was it for the day and our evening was spent at the fine Asian Buffet.

Sunday morning broke cloudy, cool and windy. The sun came out by late morning but I didn't really bring anything suitable for the winds the way they were. I called it a day and headed back home. I figured three weekends in a row of rocket was enough.

Thanks to all the crew at Muskegon for another fine launch. I'll be back soon no doubt.

Tony Haga's Sky Camo on a Loki J474

Tony's Mach 1 Rocketry Skye Shredder on a CTI J400

Tony's LOC Iris on a CTI H Skidmark

Buzz's Cherokee F, Tony's Skye Shredder, & Herb's Mach Schnell

Tony returns with his Skye Shredder

Buzz Nau

It's hard to believe this is the eleventh Crapshoot already with so many fond memories of this launch event with a lot of amazing flights and sharing the fun with friends. Tony Haga, Dale Hodgson, and I arrived on Friday and stayed in Muskegon for the weekend. This was our third launch in three straight weeks we have attended together.

I more than made up for my low flight count at LDRS 44 on Saturday, taking advantage of the great conditions. There was a light wind from the north heading towards the "Icky" (water waste treatment facility), but I think Herb Crites was the only one that came close to it.

I started off with my 3" diameter semi-scale Little John that I kit-bashed from a LOC Forte kit. After seeing so many F15's CATO lately I was a little hesitant to use one from a bulk pack I bought a few years ago. The fears were unfounded as the F15-4 was a perfect motor for the Little John, popping the chute right at apogee, around 600 feet.

Next up was the first flight of my North Coast Hob Goblin on an Enerjet F67-6. No complaints on the flight as it was also a good motor choice with a landing close to the pads thanks to the Jolly Logic Chute Release set for 300 feet. The Hob Goblin reached 1,600 feet with the F67.

My Madcow Honest John went up on a CTI G131-7 Smokey Sam to 1,200 feet. I've flown the HoJo with this motor several times as it is a great combination. Another nominal up and down with a short recovery. Nearly all my flights for the weekend included a Chute Release which worked perfectly every time.

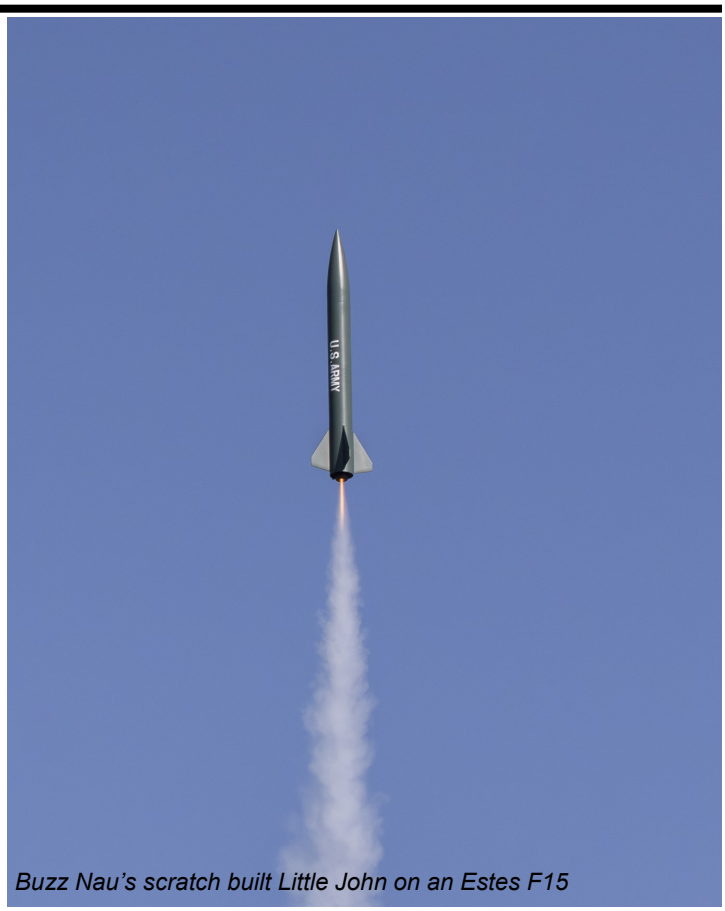
The Argus II is my BT-80 upscale of an Estes Design of the Month plan. Even though it looks big, it is extremely lightweight by using Estes BT-80 tubing and ¼" balsa fins. A CTI F85-6 put it right up around 1,500 feet for another nominal flight and short walk to recover it.

I next flew my fiberglass Cherokee F with a CTI-F31-5 to 1,200 feet. This is a Wildman kit that is a slight upscale to the original Cherokee D. I printed decals for it, and it turned out to be a nice-looking kit. There was no room for the Chute Release, but the recovery walk wasn't far.

My final flight of the day was my Madcow AGM-33 Pike on a Loki H90-8 Red. This was my only flight with issues. The delay was only 3 seconds, though I adjusted it from 14 to 8. Everything held together though, and it landed safely with no damage.

Though Sunday was supposed to be the better day of the weekend, it was not to be. We arrived at the field to cold cloudy conditions with a constant 10mph wind from the East. That shortened the safe landing zone considerably, so I stuck to some smaller, low altitude flights. Richard Buckley showed up Sunday with a new Super Big Bertha he wanted fly with a Jolly Logic Chute Release. It was his first launch with both and both flew well.

My old Centuri Argus was my first flight of the day on a Qjet B14-3. This was a perfect motor for it with ejection right at apogee. A bit of a walk and it landed closer to a full water canal than I would have liked, but still a good flight.



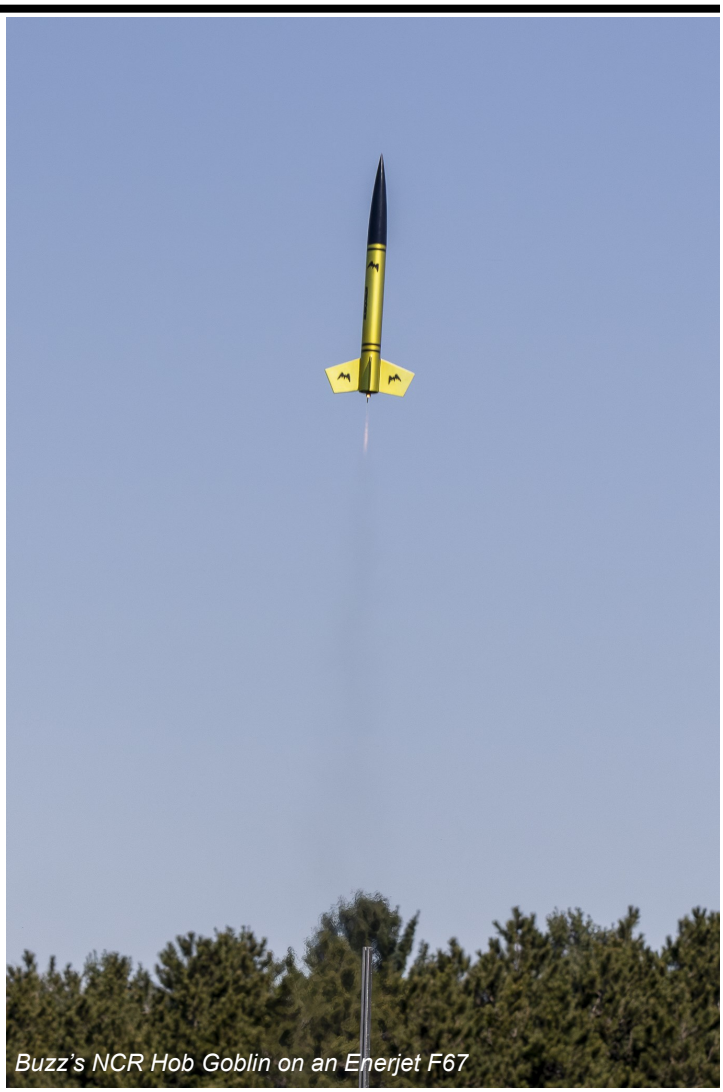
Buzz Nau's scratch built Little John on an Estes F15

Little John was next, again with an Estes F14-4. It weather cocked a little, but a good flight nonetheless with the wind bringing it back for a landing close to the pads.

My final flight for the day was the Centuri Argus again, this time with a Qjet C18-4. Another great flight and I was happy to see the old white lightning motor had no problem lighting.

I want to thank our hosts MMAR and SMASH for another successful Crapshoot launch and Tony and Dale for putting up with me for three weekends in a row!

Buzz's Madcow HoJo on a CTI G131



Buzz's NCR Hob Goblin on an Enerjet F67

Buzz's scratch built Argus II on a CTI F85

Buzz's Cherokee F on a CTI F31

Dale Hodgson
The Crapshoot launch turned out to be a pretty decent weekend, all things being equal. Herb was on hand along with some other JMRC members so we had a pretty good representation from our group. Winds were almost straight out of the north blowing straight at the Icky (that basic cesspool posing as a pond; where it smells bad and electronics are destroyed in seconds should anyone drop a bird into the stuff). So again, I decided to not fly all that high. I'll have to work on that and just fly stuff when I bring it. Maybe it's because I'm older and supposedly wiser, but I miss those days when I was a bit more daring.

I think Herb had the recovery of the day though. He flew one of his Mach Schnell's pretty high. They are a proven design and Herb has all manner of electronics on board: camera, tracker, altimeter and a Jolly Logic chute release. Needless to say, if Herb loses one it's a bit pricey because there is also a motor case involved. Anyway, his flight went up just as it should have. He had his apogee event just as he should have. His main deployed just as it should have. But everything started drifting north, right at the Icky. Fortunately, and I don't know how he pulled this off, the rocked landed just south of the last canal and just north of the Icky. He had a longish recovery in trying to figure out how to get to it but, it's better to have that long walk to an intact rocket rather than a short walk to a pile of parts…or worse.

Tony and Buzz each got in a few flights that if memory serves, went just fine. Me on the other hand not so much. I flew my Alien 3D rocket on a G80; a motor I've used several times before with good success. This time though the rocket took off, went up and came down…..fast. It hit the road just behind us as the ejection charge went off. Remember what I said about a pile of parts? That's just what I had. The only pieces relatively intact were the motor case and a fin. The rest were picked up with a broom and dustpan. Total loss. But Scott Miller told me later on just like a potato chip commercial…"crunch all you want, we'll make more". Later on, I flew my 4" Alpha on a Loki H125. Perfect flight, no issues at all. Then later on I flew a Hy-Flyer XL I had modified, on an E22. Another good flight. After that I tried to fly my upscale Super Bertha on an E55. But, the motor blew out the side and straight up through the cone which deployed everything. Fortunately, very little damage was done, she will fly again.

Dale Hodgson's Alien 3D on an AT G80

Dale Hodgson's 4" Maxi Alpha on a Loki H125

Sunday started out nicely, but the winds started increasing. At least they were from a more favorable direction. Again, both Tony and Buzz did a couple of flights that were just fine. I flew an old PML spare parts rocket on an E22 that was too little motor for that rocket. It made all of maybe 100' altitude, but the chute popped ok and everything recovered intact.

All in all, it was a pretty good April. Should I have flown more? Absolutely…I think I'll have to rethink my game plan for all this. Prep some rockets and fly, baby..fly. As usual though it was a blast hanging out with Tony and Buzz. We seem to have a great time on those road trips. Flying or not, it's well worth the windshield time!

Dale's Super Big Bertha CATOs on an AT E55

Dale preps his 4" Maxi Alpha

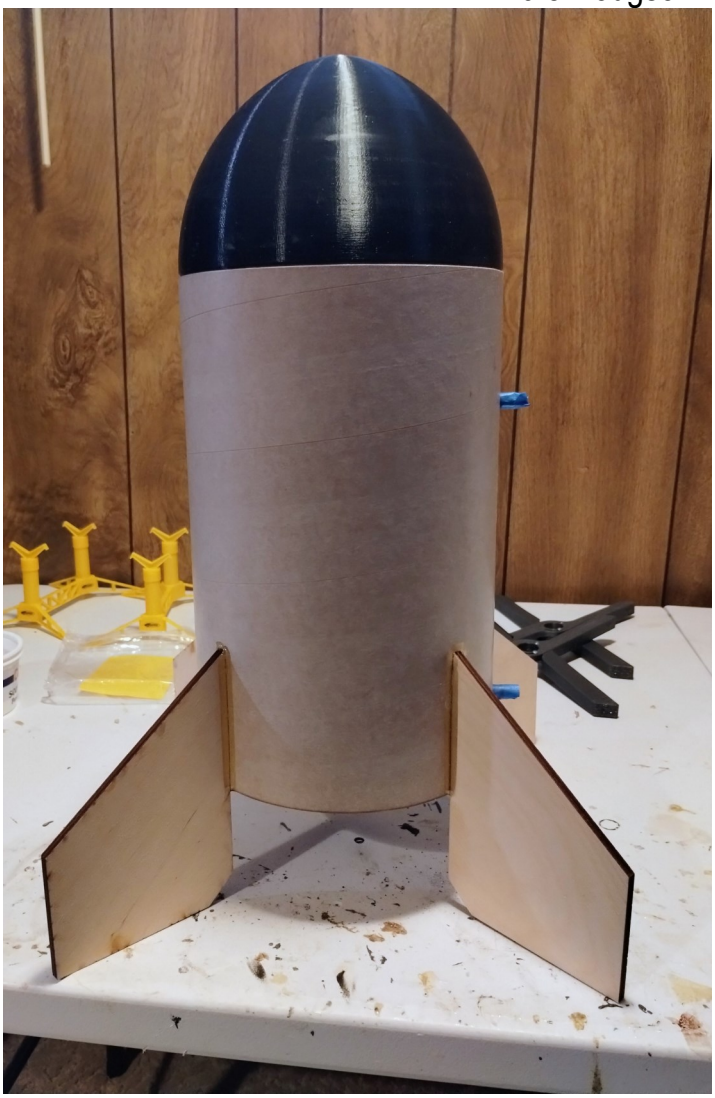
Dale's last moments with his Alien 3D - RIP

VIEW FROM THE FLIGHT LINE

Resolution Busting 101.03

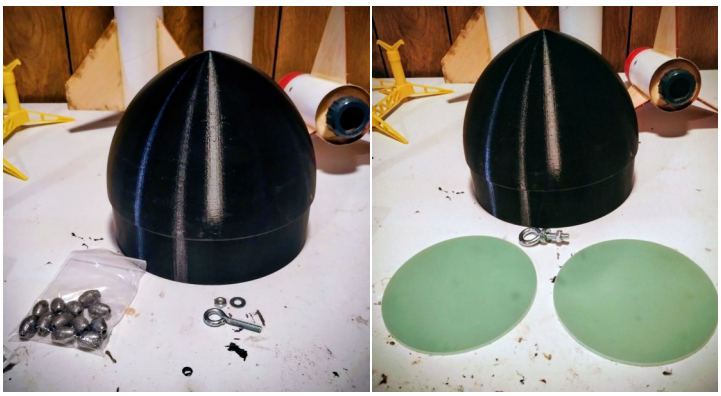
Dale Hodgson

Over the past couple of issues I've shared my journey of New Year Resolution busting. I've picked up a fiberglass/3d printed rendition of an Honest John, then a 29mm black powder motor powered Dynastar AeroDactyl. Now, we'll dive into something I've rarely touched…. odd rocs. Some time back I bought myself a Bullet Bobby XXL from Launch Lab Rocketry. It comes in two versions, a "small" version at 2.6" diameter and 6.75" long and burns 18mm motors. Then there's the behemoth I bought, it's 7.5" in diameter and 19.5" long. This one has a 38mm motor mount which could be exploited but not this time around. The "odd" part of this rocket is the nose cone. It's a 3D rendition to resemble the business end of what appears to be a 38 special handgun cartridge. This poses a good question. Since this clearly puts the rocket into the short and stubby group (Fat Boys, Big Daddys, etc.) the question that often comes up is how is this thing going to balance and be a stable flyer? There is a whole other article out there that can be found in the archive files at Apogee Rockets (*Peak of Flight Newsletter #154*) explaining that the CP (a dynamic CP) of these types of rockets actually "shift" a bit rearward during flight; to the point where it occurs a little bit further than the length of the rocket. It's a mind blower for sure. It's an informative read for those interested. Most manufacturers don't mention this too much, but they do recommend adding a bit of nose weight to shift the CG forward and provide enough distance from the CP to allow for a stable flight. The amount of weight needed is contingent on the size of the motor to be used. Basically, the bigger the motor the more weight is needed.



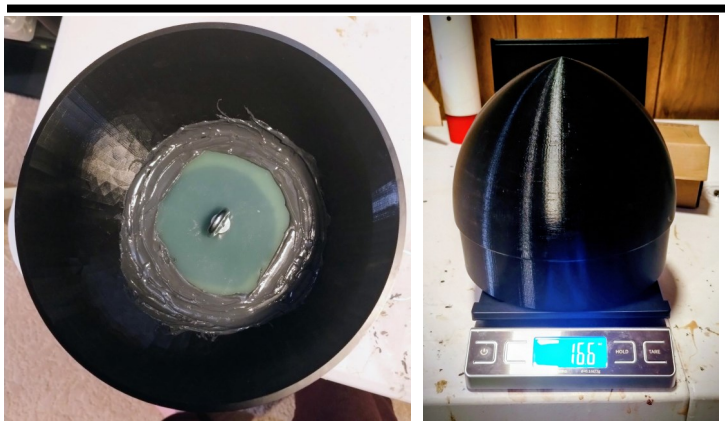
Completed Bullet Bobby XXL waiting for the paint shop

For the BB XXL, Launch Lab provided the extra weight with their "deluxe" version; a number of lead fishing weights to be epoxied into the tip of the nose. It's a simple remedy to be sure and no disrespect to Launch Lab, but there are alternatives. I came up with one that should work out just fine. Personally, I'm not a big fan of lead in the nose. Many years ago, there was a flight of a rocket with a huge N class motor. The weight added was lead shot to the nose cone. Well, the rocket came apart within seconds of launch. The lead shot was expelled and came down on the flight line like metallic hail. Several folks, me included, had our vehicles damaged with small "pings" on the hoods and rooftops. Some even suffered smallish windshield cracks. However, we all understand that these things do happen in rocketry. The owner of the rocket covered the cost (along with launch field insurance) of any needed repairs. I've always retained that memory so again, I'm not a fan of a lot of weight added to the nose.



Stock nose weight and eye bolt (L) Upgrades (R)

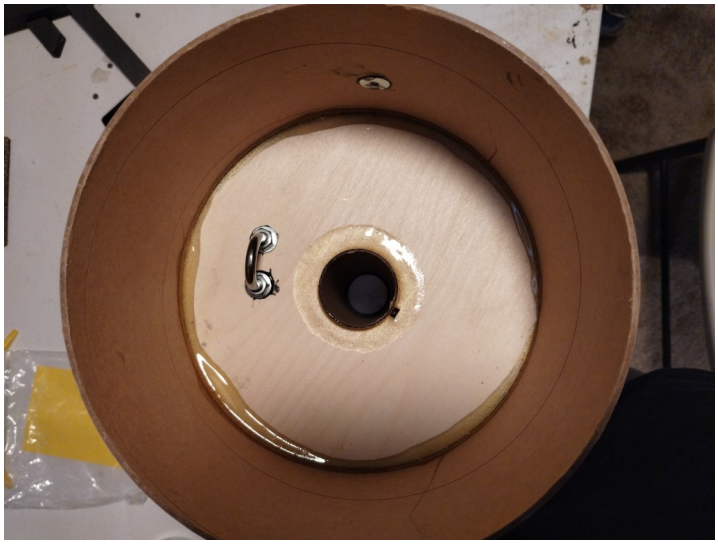
The assembly instructions provided by Launch Lab fortunately did include the weight the nose cone should be to have a stable flight with H, I and J motors. I'm not planning to stretch this envelope too far and only plan on H and I flights. Launch Lab recommended a weight of 16-17 ounces. The nose cone itself weighed about 6 oz or so; I had to come up with some weight that would be a bit safer to haul into the air. I ended up using two 5" diameter G10 bulk



Bulk plates installed and resulting nose cone weight

plates with a larger eyebolt through both bulkheads. To check I weighed the nose cone, bulk plates and eyebolt together.

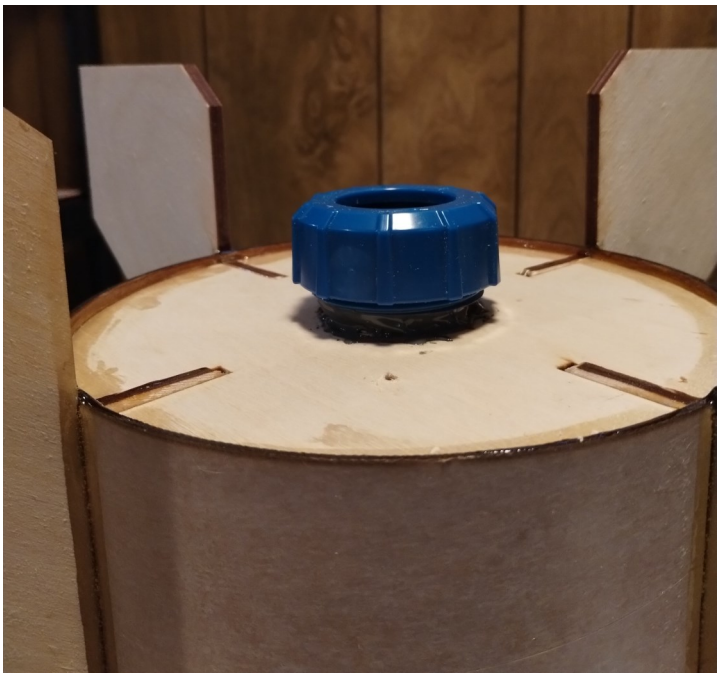
Luckily, it ended up being around 16.6 oz. Add a bit of epoxy, and we are right where we need to be. Refer to the pics to see how this all came together. This setup should work out nicely. Since everything will be attached there is nothing to come apart and no metal shrapnel produced, so I think we have a safer method here. The proof will be in the pudding though. RockSim tells me that everything is cool, but I'll determine that under real launch conditions at the field, right when the button is pushed.



U-bolt added to the upper centering ring

The rest of the build is pretty straight forward although even with this I went just a touch off the beaten path. These next things have everything to do with flying experience over a long time. Mostly it has to do with technique rather than redesigning anything. I just took what they had and made it stronger. The airframe and motor tube are LOC cardboard; the fins are plywood as are the centering rings. For this part of it everything is straight forward assembly. Remember though I usually build mine in sections so that I'm able to have both internal and external fillets on all the fin/motor tube and centering ring joints. Although the assembly does call for some internal filleting I took it to a whole new level. In a nutshell each ring was attached to the airframe and motor tube separately. The fins were glued to the motor tube separately between the first and second ring. All internal fin to motor mount and airframe joints were filleted as were the centering rings. Doing this ensured that no internal joint was left undone. Everything is joined together and plenty strong.

What I did change though was the shock cord mount. The instructions called for the cord to be wrapped around the motor tube and pass through a pre-cut notch in the centering ring. The cord seemed to be sturdy enough and I will probably use it…on smaller rockets. For this one however, I used some pretty stout tubular Kevlar. It's designed to support some serious weight, but it's strong and flexible enough for this particular project. I did make it a little longer than standard though; 15 feet. Instead of wrapping it around the motor tube I added a U bolt to the first centering ring and glued that all together. I'll attach the cord with a quick link and everything will be just fine. Plus, in the unlikely event I need to switch a cord it will be very easy since everything is accessible.



Included 3d printed motor retainer

Another nice thing here is that because of the large diameter, rail buttons are a snap to install. Tee nuts through the airframe with the button screwed into the tee bolt from the exterior provides a safe and secure method of making the rail buttons hold up. One bit of warning though. Install the aft rail button *before* gluing in the aft centering ring since once assembled the bottom rail button tee nut will not be assessable.

This rocket also came with a 3D 38mm motor retainer so that was installed to the end of the motor tube using of course JB Weld because of the temperature tolerance of JB.

The Rocketry Workbench

Crafting Scale Wedge-Shaped Fins

John Brohm, NAR #78048

Introduction

Sooner or later, most scale modelers will encounter a prototype that employs wedge-shaped fins. The Astrobee 1500, the Super Chief, and the Aerobee 350 are just a few of the prototypes that exhibited this kind of fin hardware. That last one, the Aerobee 350, happens to hold my current interest, which means the A350's wedge-shaped fins are sitting directly in my building crosshairs. At 1/10th size the model's fins will be large, necessitating a built-up construction technique that balances weight and robustness while preserving scale fidelity. In this article, I'd like to share with you the approach I've taken to craft accurate scale reproductions of the A350's wedge-shaped fins.

As many model rocketeers will know, the Aerobee 350 Sustainer was fitted with four wedge-shaped fins. Each fin was built up from a matrix of aluminum spars that were riveted together, the resulting framework riveted to a pair of solid root base blocks. The root base blocks provided the means to mount the fins to the A350's airframe. Once constructed, the skeleton fin was covered with type 2014-T6 aluminum sheet alloy, 0.09" thick. Aerojet drawing 1105120 details this construction.

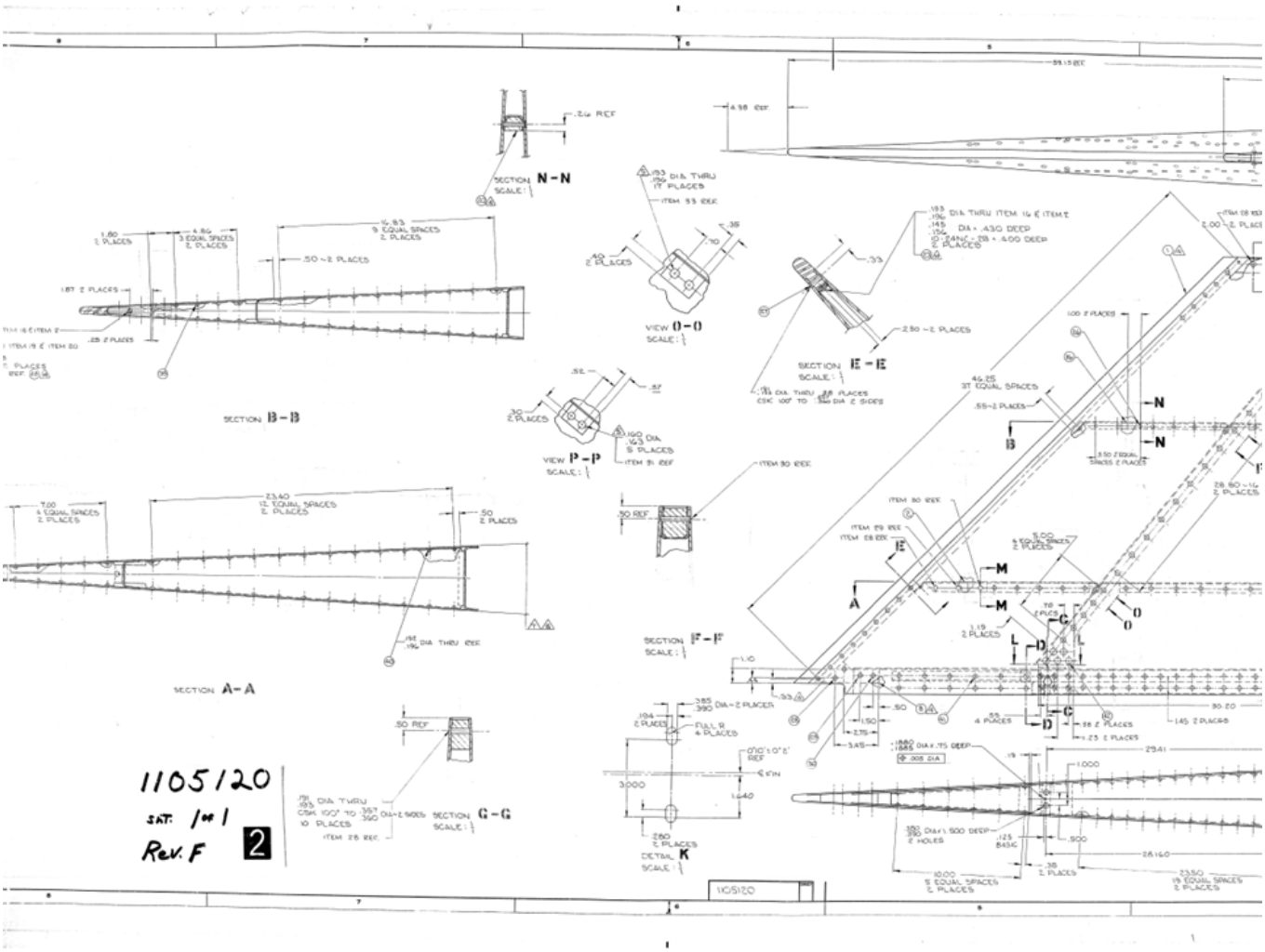


Figure 1: Aerobee 350 Fin Assembly Scan 02

Aerojet Drawing 1105120, courtesy of Josh Tschirhart

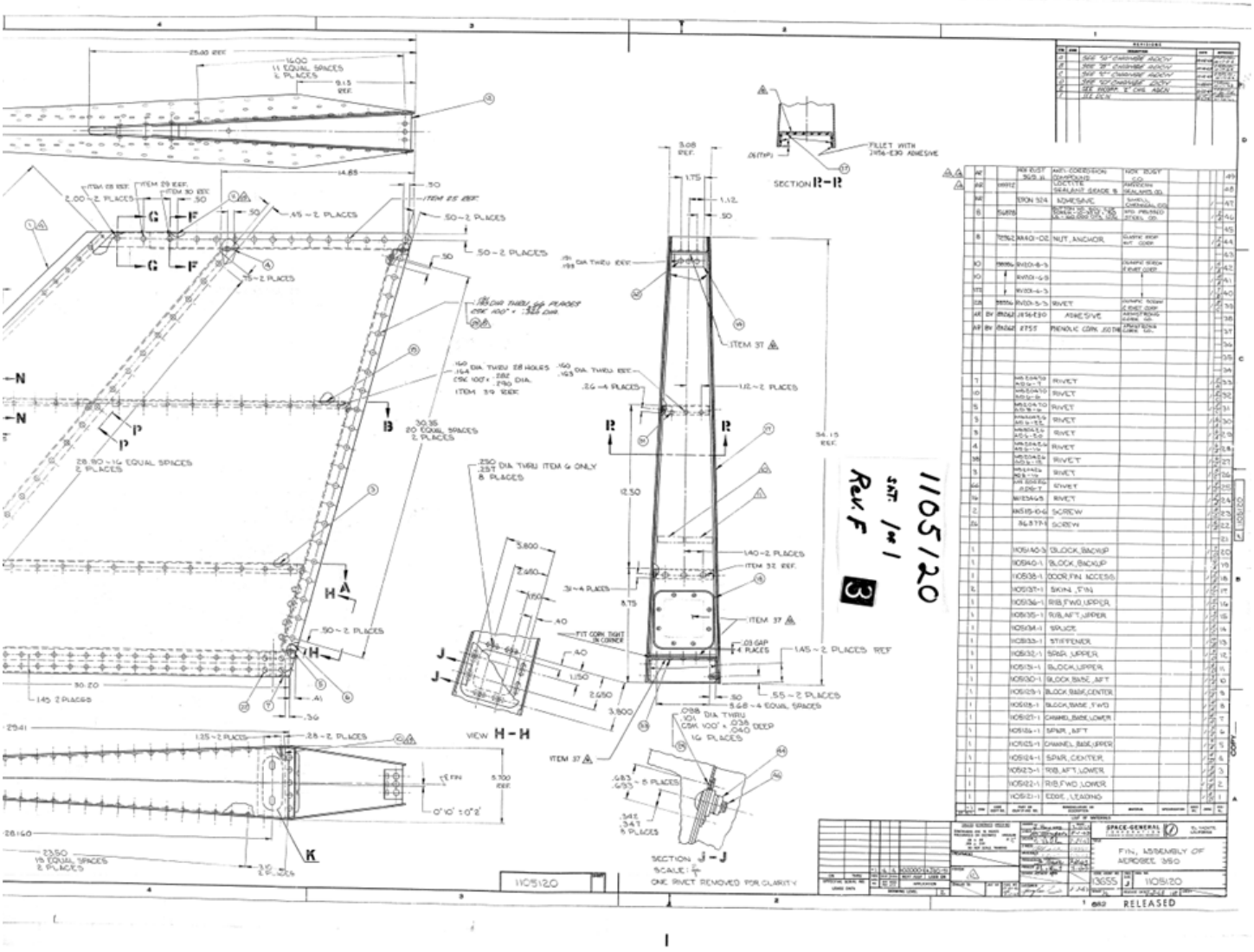


Figure 2: Aerobee 350 Fin Assembly Scan 03
Aerojet Drawing 1105120, courtesy of Josh Tschirhart

Each sustainer fin had a root chord length of 50.00” with a tip length of 25.00”. The perpendicular span, root to tip, was 34.15”. The leading edge was swept 45-degrees; the wedge shape was defined by a 3-degree slope, leading to trailing edge, and a 3-degree taper, root to tip. The trailing edge was swept rearward 15 degrees.

Similar to the other spars and channels that comprised the fin’s skeleton, the trailing edge (the Aft spar) was a formed “U” channel to which the fin skin trailing edges was riveted. The interior of the Aft spar was covered with a 0.15” thick layer of phenolic cork, holes punched at the rivet locations so that the cork insulation could be bonded flush to the spar. The open holes in the cork insulation were then potted with Armstrong Cork Company’s J1156-E30 adhesive to seal each hole. Photo 1 highlights these features.

Like the prototype, the fins on our model will be built up with a set of spars to realize the distinctive wedge shape. But unlike the prototype, our model’s fins will be based on nominal 1/16” aircraft plywood cores, with TTW tabs to secure each fin to the model’s motor mount. Each built up fin will be sheeted with 1/16” balsa, and then covered with 0.010” Styrene fin skins.

Photo 1: A350 Sustainer Fin Trailing Edge
Provided courtesy of Josh Tschirhart

Photos of Flight 17.01GT (Wallops Island June 18, 1965), taken while the round was undergoing integration and pre-flight test activities, provide other helpful views of the sustainer's fins.

Photo 2: FLT 17.01GT (NASA G-66-1698)
Provided courtesy of Al Pizzo/Josh Tschirhart

Photo 3: FLT 17.01GT (NASA G-66-1701)
Provided courtesy of Al Pizzo/Josh Tschirhart

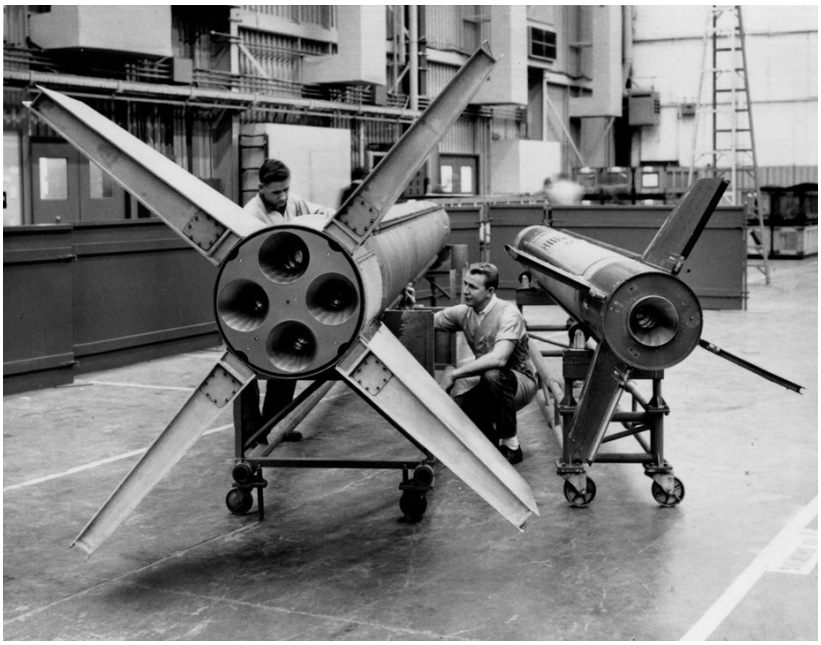


Photo 4: FLT 17.01GT (NASA Photo 65-H-1050)
Provided courtesy of Chris Timm/Josh Tschirhart

The Model Fins

We'll start by creating a set of birch plywood cores. Our target is a nominal core thickness of 1/16", but as it's virtually impossible to purchase warp-free plywood these days, we'll make our own by gluing 1/32" blanks together with their warps opposed.

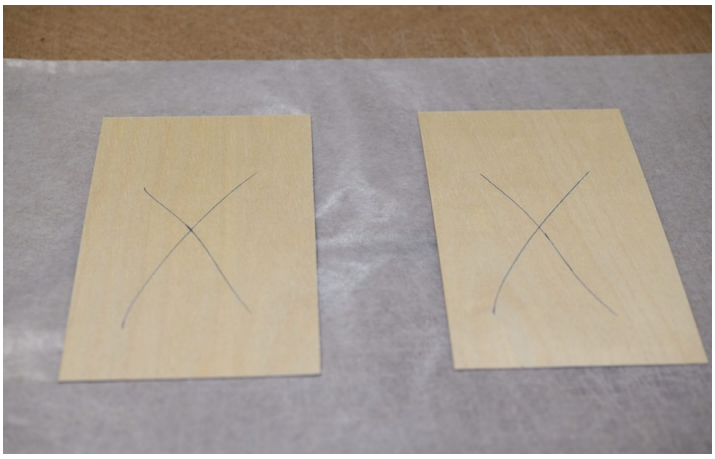


Photo 5: Nominal 1/32" Ply Blanks, Ready for Epoxy

Using 15-minute epoxy for this task provides adequate working time to mate, align, and then press and weight the native blanks together. Once cured we arrive at four very flat, warp-free core blanks, ready for processing.

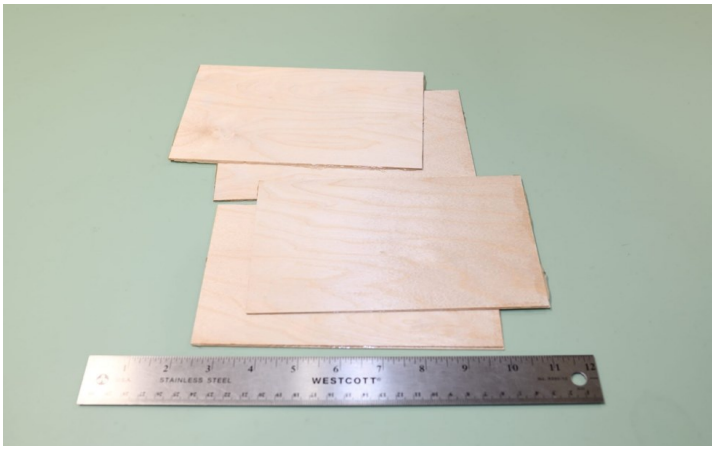


Photo 6: Fin Core Blanks

The final core thickness is approximately 0.070", partly due to variances in the thickness of the nominal 1/32" ply but also because of the adhesive layer that now resides between the 1/32" blanks. This final core thickness is accounted for in the model's fin design so that overall dimensional fidelity can be preserved.

Next, a fin core template was developed in CAD. The template was sized so that the plywood core's leading edge would sit just behind the tangent point with the outer converging fin skins. I picked this point to terminate the plywood core to obviate the chore of sanding/beveling the hard plywood out to the ultimate leading edge of the fin. It's far easier to sand and shape a softer material (balsa), so we'll add a leading edge transition to each fin core after it's built and sheeted, as we'll see.

So with the core's features defined, designed and drafted, a set of fin cores was produced.

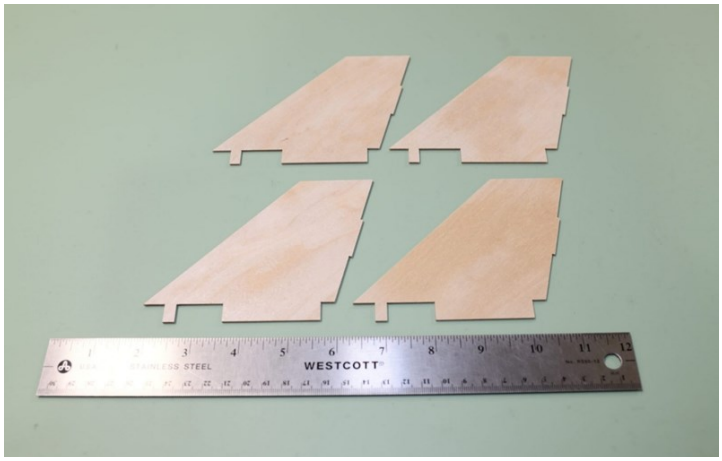


Photo 7: Fin Cores

Next, the fin base plates and aft spars were cut from appropriately scaled pieces of balsa. These components were slotted to accommodate the fin core interlocking tabs.

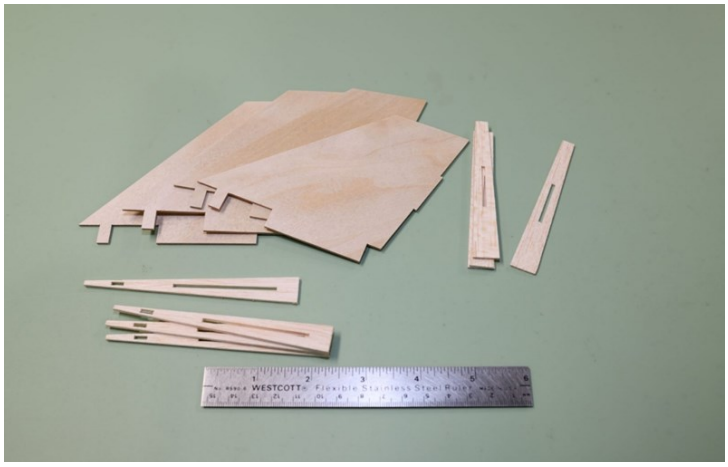


Photo 8: Fin Cores and Spars

A dry fit of the main parts gives us a glimpse of the fin's wedge shape.

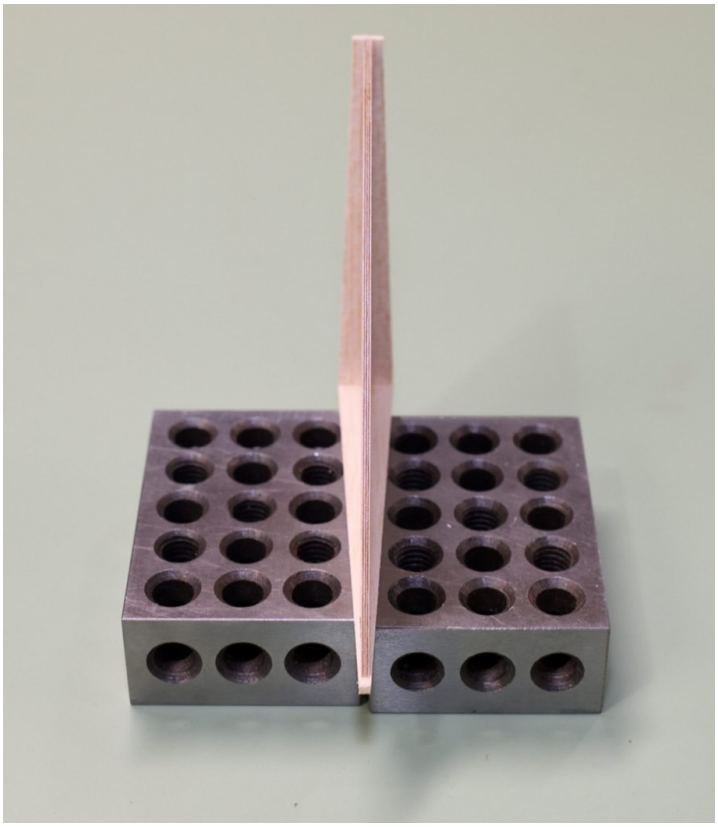


Photo 9: Fin Dry Fit

We'll set up to properly align the parts and with some thin CA we'll glue them together.
Up next – the fin chord ribs.

Fin Chord Ribs

Each fin core needs to be sheeted to complete the finished wedge shape. But just butt-gluing balsa sheet to the core spar edges makes for an unreliable construction joint, and given the wedge shape of the fin its sheeting will easily deform without internal support. To mitigate these issues, we'll add a set of lofted chord ribs that take the wedge slope and fin taper into account.

First, a pair of tapered supports are added to the fin core root base and aft spar – these provide the edge support for the nominal 1/16" balsa sheeting that will be used to cover the fin. The supports are sized to allow the balsa sheeting to sit flush to the outside edge of the root and aft spars.

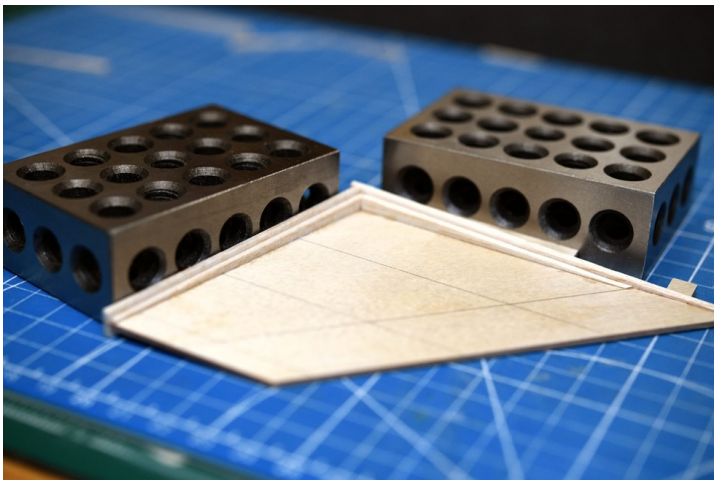


Photo 10: Fin Sheet Edge Supports

Next, a set of tapered chord ribs are added that provide internal support to the sheeting. One will note how the ribs fall short of the leading edge; this is because the sheeting's inside leading-edge face must be beveled so that it will converge with the fin's leading edge when set in place. The chord ribs are designed and sized to meet this internal sheeting tangent line. One might also notice a tiny blue dot in the lower corner of each rib – this dot was added to denote the right angle of the rib. With the rib slope being only 3 degrees it's quite easy to confuse the base angle of the rib, possibly resulting in the rib being placed upside down. The blue dot resolves this confusion.

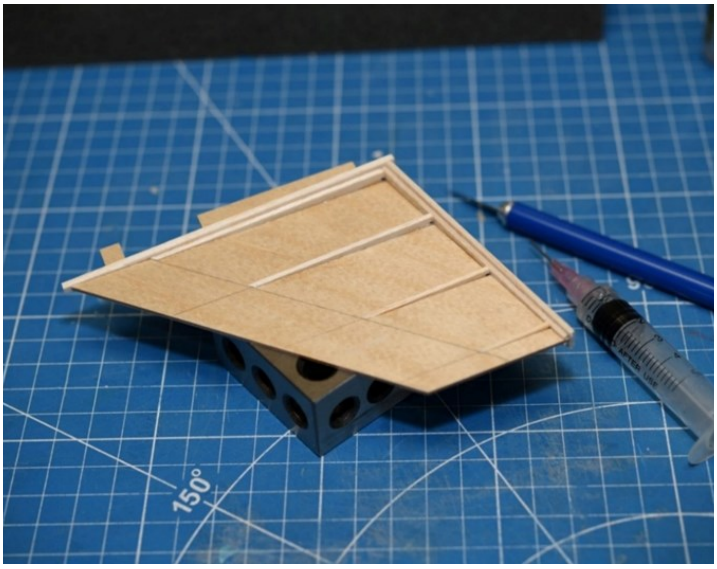


Photo 11: Ribs Glued in Place

Repeating this process we arrive at four skeletal fins, ready for their 1/16" balsa sheeting.

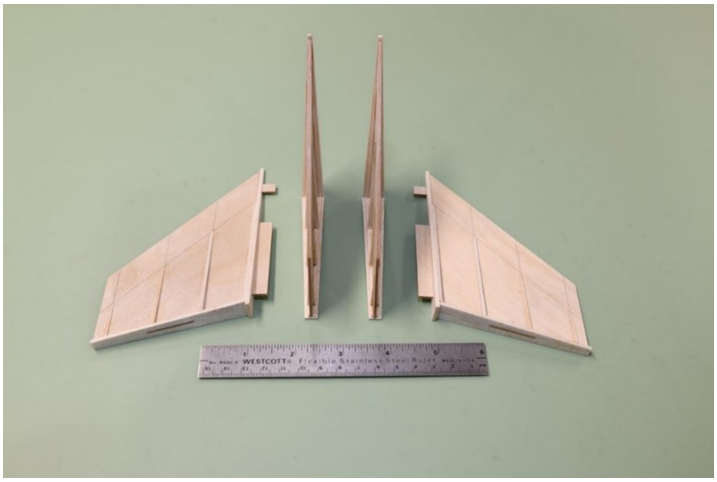


Photo 12: Ready for Sheeting

But first we need to sand a leading-edge bevel into each of the fin sheets in preparation for their installation.

Beveling the Sheets

One of the problems with hand-sanding bevels, tapers and wedges is exactly that – doing it by hand. Too much stock movement, or inconsistent sanding with the block (or both!) usually produces an unsatisfactory result. Our A350 fins require a rather shallow bevel along the inside face of each sheet – we can minimize the hand-sanding variables with a sanding fixture that holds the sheet in place while it's being worked.

A sanding fixture was fashioned from a flat piece of 1" pine upon which a pair of 3/16" square pine stops were added to prevent the stock from moving/sliding while being shaped. The stops were positioned such that the leading edge of the sheet sits flush with the edge of the pine board. Note that a lefthand and righthand fixture is needed.

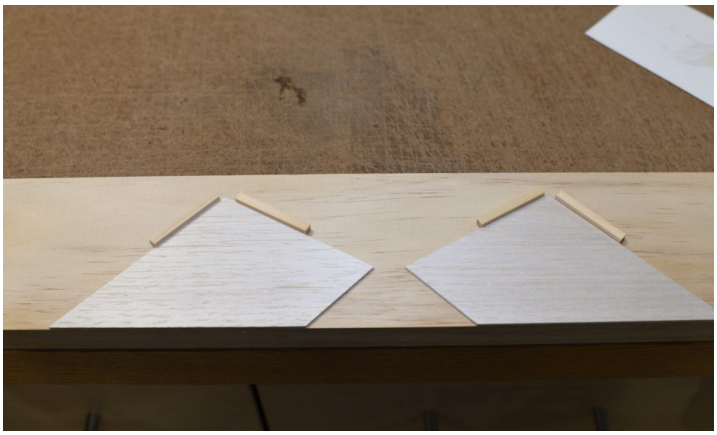


Photo 13: Sanding Fixture

The sheet to be worked is held in place with a strip of masking tape. The leading edge of the masking tape is placed at the bevel's internal tangent line.

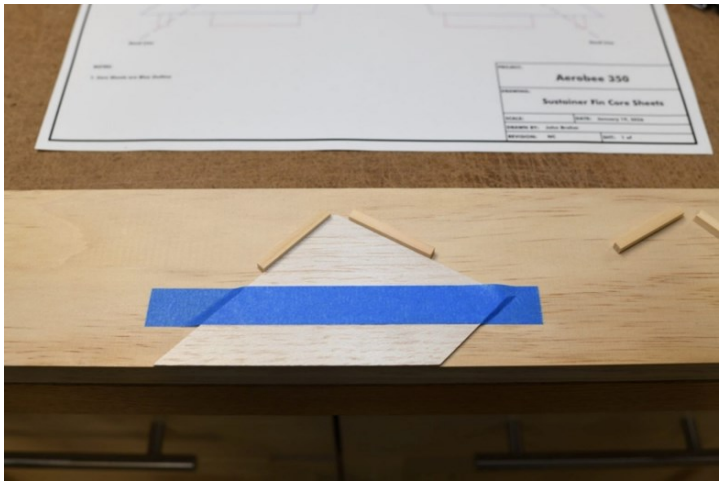


Photo 14: Taped in Place

With some careful, consistent sanding with a progression of grits, taking care to respect the tangent line, a smooth bevel is produced, with the front edge of the sheeting brought to a nominal thickness of 1/64". A straightedge confirms the work.

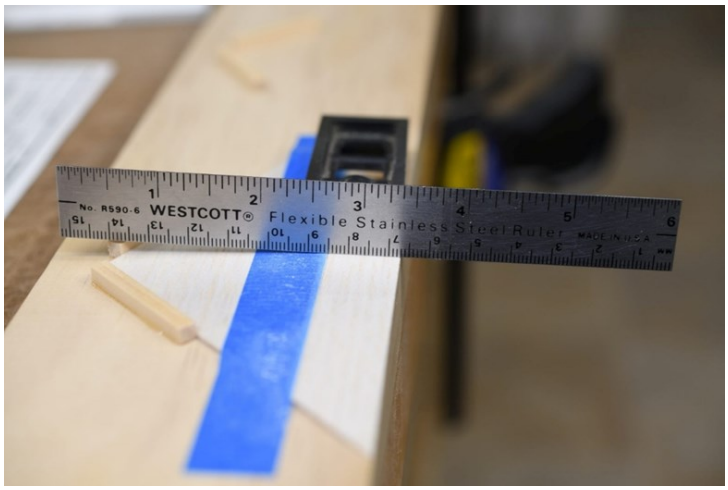


Photo 15: Finished Bevel

With a pair of beveled sheets, we can close up the fin core. Each sheeted fin undergoes a final sanding with some #320 grit. Care is taken while performing the final sanding so as to prevent erosion of the fin's wedge shape.

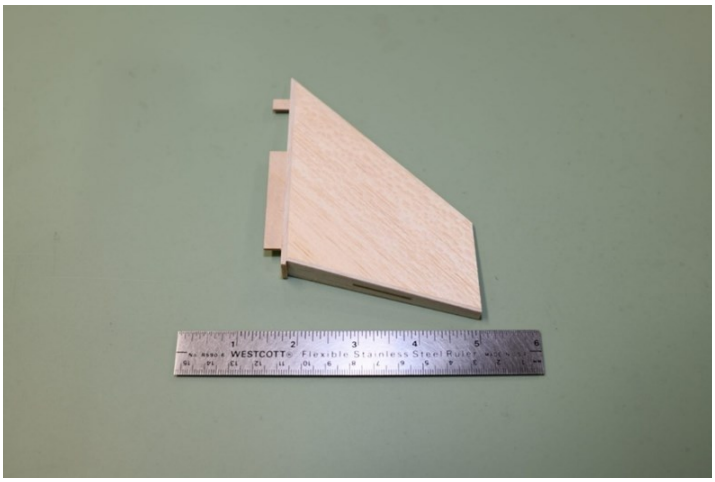


Photo 16: Sheeted Fin

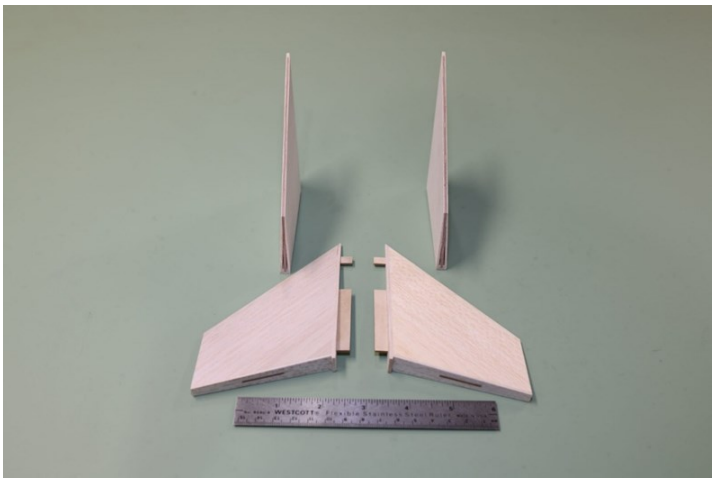


Photo 17: Native Fin Cores

With the final sanding complete, we have a set of native fin cores ready to be fitted with their leading edges. But just before we take that step, we'll close up the open fin tip. We'll do this with a mix of 5-minute epoxy and micro-balloons.

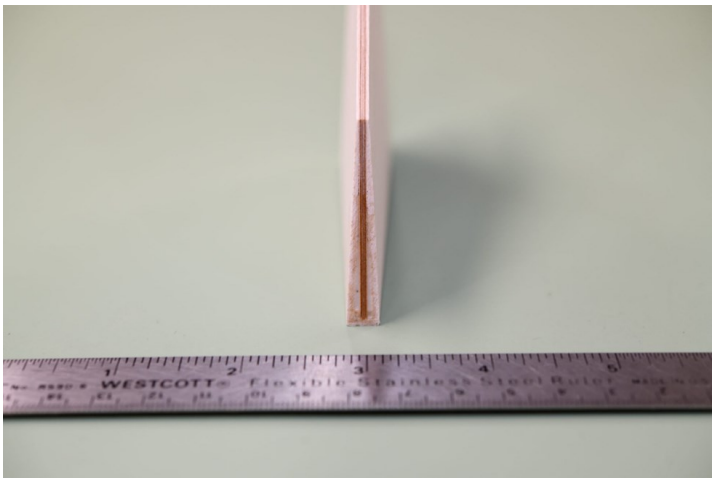


Photo 18: Filled Fin Tip

The Leading Edge

The prototype fin incorporated a solid leading edge molded from a mix of fiberglass and phenolic resin. The leading edge had an exposed chord length of 0.78", and had a milled mating surface designed to fit within the fin sheets as they converged at the leading edge. The fin sheets were then riveted to the leading edge once in place.

At the fin's tip, a solid wedge-shaped block was installed to provide a robust tip support. The following photo highlights these features.

Photo 19: Fin Tip LE and Support Block

We'll size the model's leading edge transition strip such that the tip support block is included in the strip's chord length. Accordingly, the transition strip is fashioned from a length of 0.125" x 0.50" balsa, and will be butt-glued to the leading edge of the fin core.

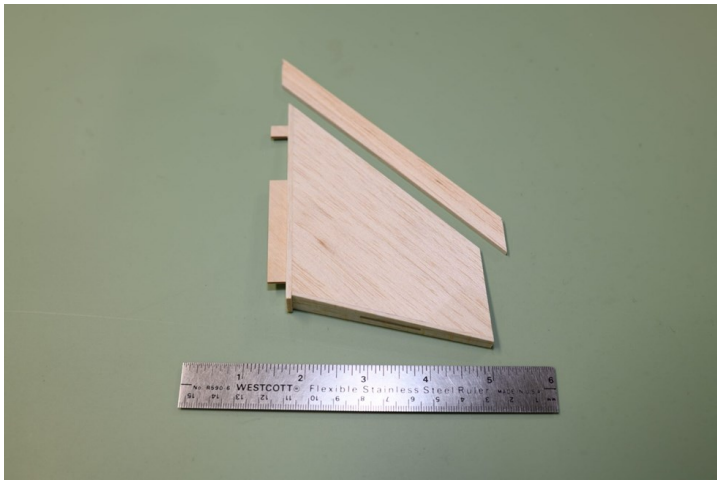


Photo 20: Leading Edge Transition Strip

But which glue should we reach for? We need to use an adhesive that will secure the joint but will be relatively easy to sand. Depending on the balsa's density, adhesives like CA and epoxy can cure too hard as compared to the surrounding balsa, leaving a hard ridge at the joint that could show through the outer 0.010" Styrene fin skins. Even a good aliphatic glue, like Sig's SIG-BOND, can present this risk. So here, we'll opt for an old-fashioned model airplane nitrocellulose adhesive, Ambroid, and we'll mate the transition strip to the fin core with an Ambroid double glue joint.

Sadly, Ambroid went out of business quite a few years ago, so finding a useable tube is a rather challenging proposition. Sig's SIG-MENT was a good substitute, but unfortunately it too has been recently discontinued (although as of this writing it can still be found in some supply chains). But fear not - there are still some excellent substitutes available, such as Duco Cement and Indoor Free Flight Supply's NiCe! adhesive (https://www.indoorffsupply.com/). However, the best Ambroid substitute that I've found (or at least the one I prefer) is the Nitrocellulose Adhesive produced by 3Rivers Archery (https://www.3riversarchery.com/). This stuff looks and smells exactly like the old Ambroid liquid cement of yesteryear.

Photo 21: Nitrocellulose Adhesives

With the Ambroid glue joint cured, we can carefully shape the transition strip in situ with a progression of grits until finally, we arrive at the finished sloped leading edge.

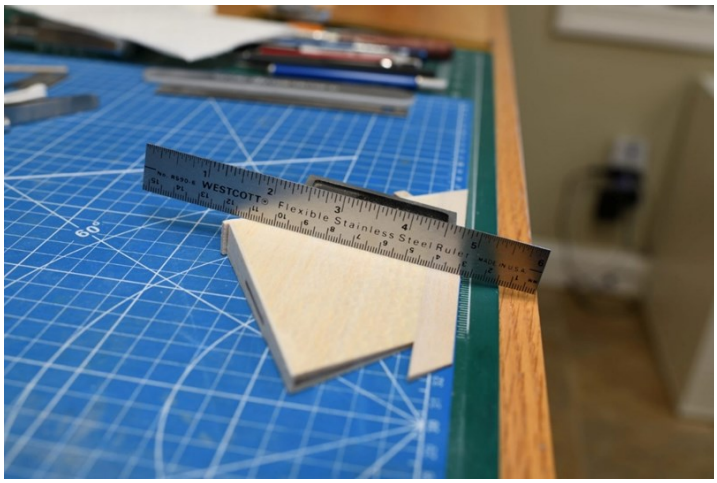


Photo 22: LE Sanding Complete

Provided we minded the fin's slope while sanding each side, then the finished leading edge will have a width of about 0.030". We'll cap this with a length of Evergreen Scale Model's 0.030" diameter Styrene rod. This rod rounds the leading edge and provides a perfect mating surface to weld the front edges of the fin skins with some thin Styrene cement.

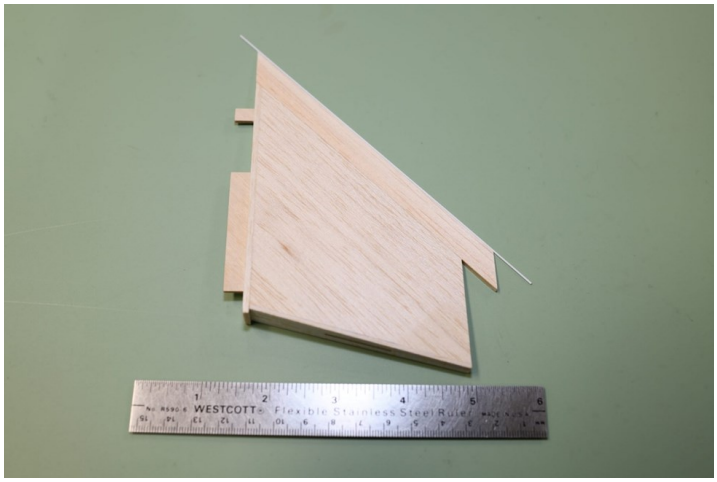


Photo 23: Ready for Fin Skins

The rod plus the two converging 0.010" Styrene fin skins provide the 0.05" LE width we're aiming for. The overhanging LE ends will be trimmed once the fin skins have been placed.

The Fin Skins

We'll begin by preparing a set of fin skins fashioned from 0.010" thick sheet Styrene.

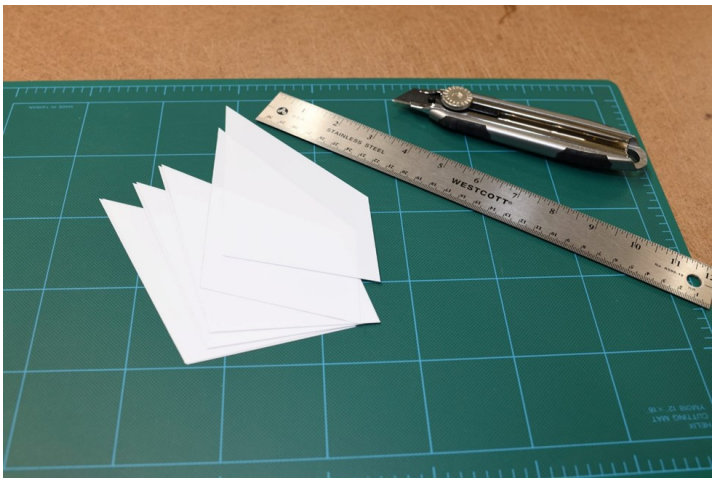


Photo 24: Styrene Fin Skins

But before we apply the skins to the sheeted fin cores, we must first decide how best to represent the surface detail found on the prototype fins.

Our earlier prototype fin photos make plain that the rivets used on the prototype fins were flush to the skin; while they are visible on the unfinished metal fin, they are not so on the freshly painted fins. They would have been partially obscured by the fin's primer, and fully covered by the paint, as the fins were hand painted.

Photo 25: Painting Fins

Provided courtesy of Al Pizzo/Josh Tschirhart

Photo 26: No Visible Rivets

So, we'll ignore the flush surface rivets on the painted fins but will attempt to account for them on the unpainted natural metal fin. This means we'll have two different finishing strategies for the fins – one for the three painted fins, and a second for the unfinished fin.

We must also account for the visible detail in the channel portions of the Aft and Tip spars. Recalling our earlier Photo 1 and considering the following photo, we can see several Aft spar features that must be addressed.

Photo 27: Exposed Root Base Channels

Provided courtesy of Josh Tschirhart

First, there are the exposed ends of the two channels that make up the root base plate (bottom and top). Just above is the access hatch, and then between the two photos we can see how the interior of the Aft spar is covered with phenolic cork, with the various rivet holes in the cork potted with the bonding adhesive, as mentioned previously. We can also see how the fin skin is riveted to the Aft spar channel sides, so we'll add strips of Styrene to build out these edges accordingly. The cork and potted rivet detail will be addressed during the paint and finish stage. So, with our skinning strategy set a Sty-

rene fin skin is glued to each side of the fin core with thin CA. The root channel ends are crafted from scaled pieces from 0.010" Styrene and are cemented in place.

Photo 28: Skinning a Fin

The access hatch (see Photo 4) will be crafted from a scale piece of Styrene but will be cemented in place once the main painting has been completed.

The interior edges of the Aft spar channel are built out with strips of 0.010" and 0.015" Styrene to arrive at the correct scale thickness (channel thickness + cork, each side). The forward edges of the fin skins are glued to the Styrene rod leading edge with Extra Thin Styrene cement. Time to tackle the Tip spar.

Our earlier Photo 19 and the following photo provide a good view of the Tip spar detail.

Photo 29: Tip Spar Detail

Provided courtesy of Josh Tschirhart

One can see how the prototype fin skins are riveted to the Tip spar channel sides, with the back side of the rivets being particularly visible. At our scale factor, Archer Fine Transfers (https://www.archertransfers.com/) G-Scale resin rivet heads (#AR88082) are a good match for this detail, and we'll place the appropriate rivets on pieces of sheet 0.010" Styrene.

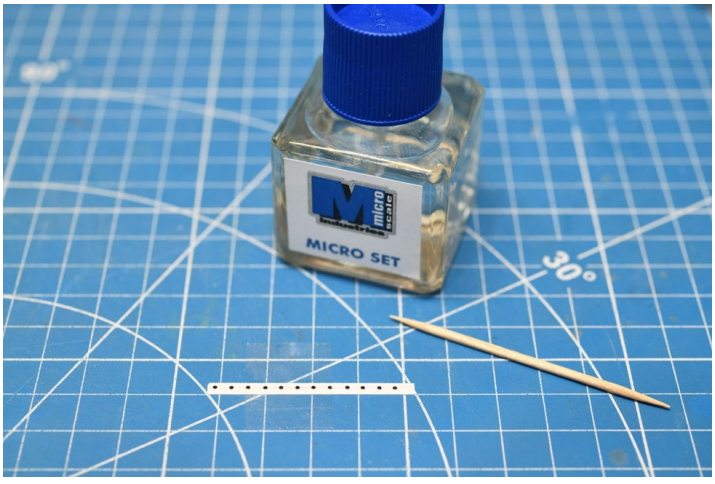


Photo 30: Riveting Stuff

These strips are then cemented in place, with the strip edges lightly sanded to ensure conformity with the fin skin edges.

Photo 31: Tip Rivets in Place

Finally, the leading edge separation line is scored into the fin skins at the appropriate location with a 0.3mm fine engraving blade.

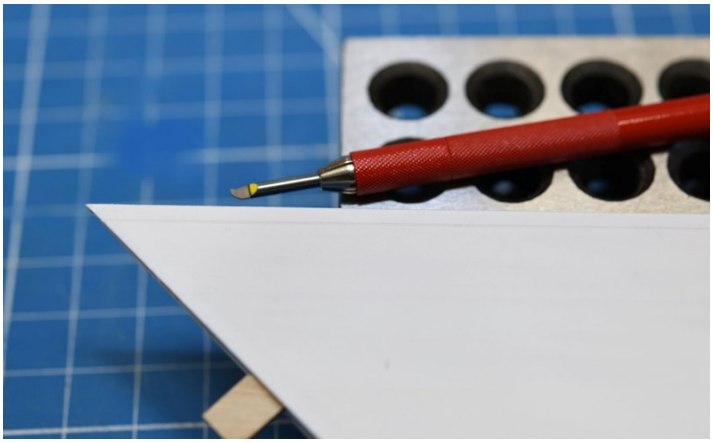


Photo 32: Scored Leading Edge

And with this, our A350 wedge-shaped fin is ready for the Paint Shop.

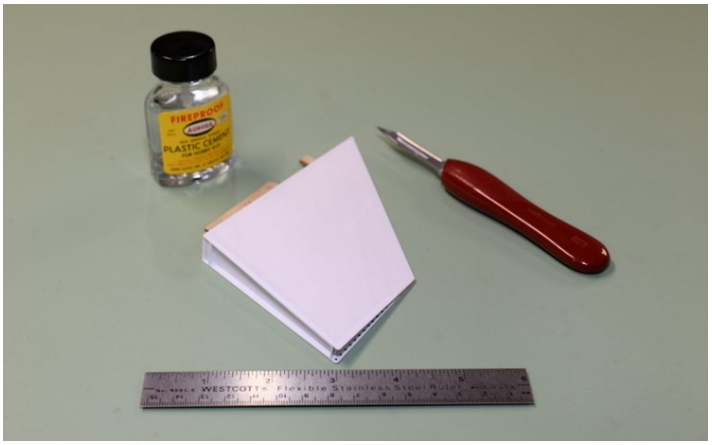


Photo 33: Finished Fin, Ready for Primer

Let's take a quick look at this wedge-shaped fin on the Sustainer's motor mount.

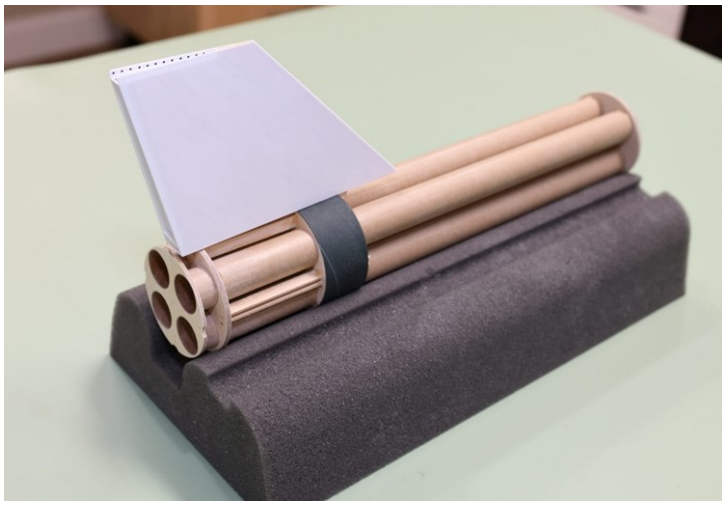


Photo 34: Fin and MMT Dry Fit

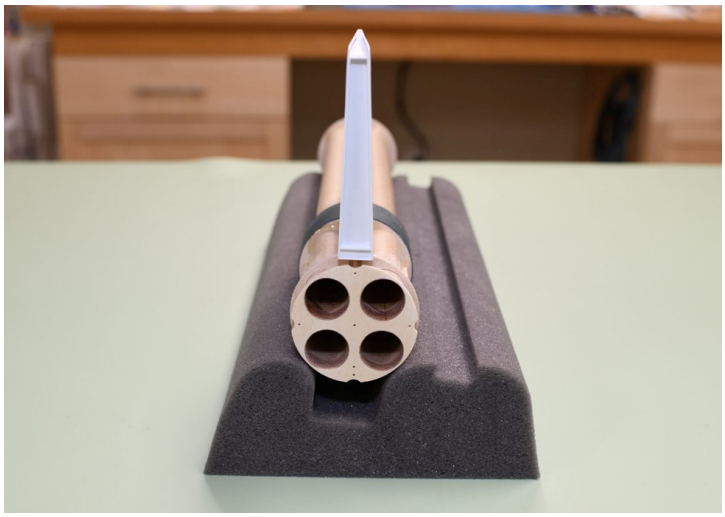
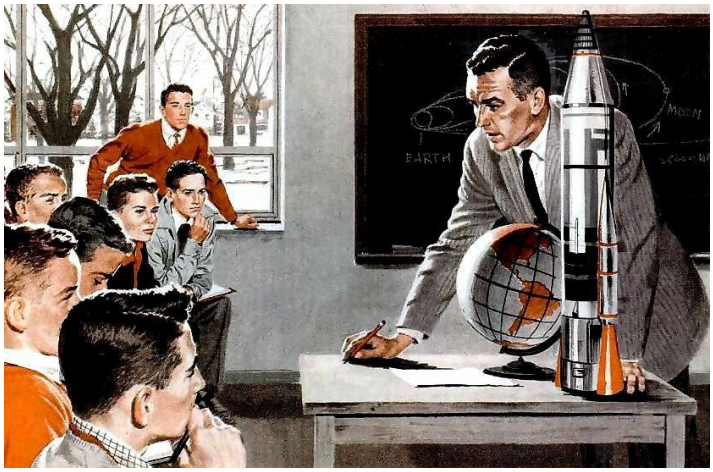


Photo 35: End View

Seems to be coming along quite nicely. We'll finish up the other three fins, and then tackle the paint and finish process. Until then, I hope you've found this article of interest, and as always, best of luck with your scale projects!



ADVANCED RESEARCH PROJECTS AGENCY

ARPAT TERMINAL PHASE REENTRY TARGET

Chris Timm & Buzz Nau

In the late 1950s, as the Soviet Union began deploying intercontinental ballistic missiles (ICBMs), the United States faced a dire strategic challenge: how to defend against nuclear warheads reentering the atmosphere at hypersonic speeds. Early ballistic missile defense (BMD) concepts quickly revealed a core problem, radars struggled to distinguish real warheads from decoys, chaff, or debris inside the dense “threat cloud” created during reentry.

To tackle this, the Advanced Research Projects Agency (ARPA) launched Project DEFENDER in 1958, a wide-ranging research initiative covering boost-phase, mid-course, and terminal-phase BMD technologies. Within DEFENDER, the ARPAT (ARPA Terminal) program concentrated on the terminal reentry phase. A critical need was realistic test data on reentry phenomenology, radar signatures, wake ionization, and discrimination techniques. ARPA therefore developed the three-stage ARPAT Target Vehicle, designed to simulate ICBM reentry conditions.

Development began in 1962 under Army Missile Command oversight (Contract DA-01-021 ORD-12939 and modifications), with Thiokol responsible for the propulsion system. Hughes Aircraft contributed to vehicle integration and testing support, while broader reentry and measurement work including TRAP, (Downrange Measurements) involved General Electric under Air Force Contract AF 04(694)-222. The first flight occurred on 6 December 1963 at White Sands Missile Range after extensive ground static testing. Flights continued into 1965, after which the program fed into wider ARPA/DoD BMD research.

Inert ARPAT target missile No. 201 on the launcher at Wind Sands Missile Range (7 January 1963) - US Army photo

Vehicle Configuration
The ARPAT Target Vehicle used five Thiokol solid-propellant motors in three stages:

- Stage 1 (booster) - 1 × TX-33-41 (Castor) + 2 × TX-19-23 (Recruit, with canted nozzles; a clustered setup previously flown on Trailblazer II).
- Stage 2 - 1 × TX-261-3 (modified high-expansion-ratio nozzle for better high-altitude performance; derived from the Pershing Drop-Test Vehicle).
- Stage 3 (re-entry vehicle) - 1 × TX-306 (new forward-thrust nozzle developed for the program; originally a plenum-chamber design from Nike Zeus).

A 4% scale model underwent supersonic wind-tunnel testing at Aberdeen Proving Ground (Mach 2–4.5) to finalize fin configurations, stability, and aerodynamic coefficients.

Program Role and Flight Profile
The ARPAT Target Vehicle supported terminal BMD feasibility studies. It supplied realistic reentry targets for the AMRAD (ARPA Measurements Radar) at White Sands to practice discriminating warheads from decoys in the threat cloud. It also generated optical, radar, and wake data under the TRAP (Downrange Measurements) program, often observed from KC-135 aircraft.

Typical flight profile:

- Stage 1 (boost): High-thrust acceleration and climb using the proven Trailblazer-style cluster.
- Stage 1–2 separation: Commanded.
- Stage 2: Sustained acceleration into the upper atmosphere.
- Stage 2–3 separation and Stage 3 (reentry): Delivered the RV on a realistic hypersonic trajectory.
- Reentry phase: Focused on observables; surface radiation, gas-cap emission, ablation products, and wakes, at conditions supporting 150,000–200,000+ ft testing for AMRAD and airborne sensors.

The first flight (6 Dec 1963) had a successful boost and separation, but Stage 2 ignition failed for reasons unrelated to the motors. Overall, the program delivered nine flight systems and met its static-test requirements.

Notable Flight: Vehicle F-5 (30 November 1964)
This was the third launch attempt for F-5 after earlier aborts (weather, fuel, optics). The flight was an "outstanding success," with an overall system miss distance of about 550 feet (target, aircraft vectoring, and ground-control loop). An F-106B Delta Dart interceptor, (serial 521) was used for real-time aircraft vectoring. It carried and launched two Experimental ARPAT Interceptors (EAI missiles G013 and G014. Vectoring was excellent, with only minor contributions to miss from timing (late arrival by 0.34 seconds due to thrust profile variations) and small aircraft positioning errors. Gas consumption was adequate but marginal by the end; roll rate was higher than expected; and there were minor telemetry/antenna issues during reentry blackout (+216 seconds). Corrective actions were noted for future flights. This mission clearly demonstrated the integrated ground-air control feasibility.

Legacy
Despite relatively modest production, the ARPAT Target Vehicle was a pioneering solid-propellant reentry simulator. It bridged early-1960s propulsion and aerodynamics work with practical BMD radar and optical testing. Its flights advanced critical understanding of reentry physics, wake phenomenology, and discrimination techniques, all foundational contributions that helped shape decades of U.S. strategic defense. It remains a prime example of ARPA's high-risk, high-reward approach to pushing technological boundaries.

References:
Supersonic Wind Tunnel Tests of the Three-Stage Target Missile ARPAT, Hughes, John M., US Army Material Command Ballistic Research Laboratories, Aberdeen Proving Grounds, MD, March 1968
Fourth Quarterly Report on the Manufacture and Delivery of a Three-Stage Propulsion System for the ARPAT Target Vehicle (U), Dale Jr., W.I., Thiokol Chemical Corporation, Huntsville, AL, 9 September 1963
Fifth Quarterly Report on the Manufacture and Delivery of a Three -Stage Propulsion System for the ARPAT Target Vehicle (U), Dale Jr., W.I., Thiokol Chemical Corporation, Huntsville, AL, 5 November 1963
ARPAT Project Final Post Flight Analysis Report No 5 HS-201 Vehicle F-5 Launch 30 November 1965:, Housego, J.W., Hughes Aircraft Company, Culver City, CA, 11 January 1965

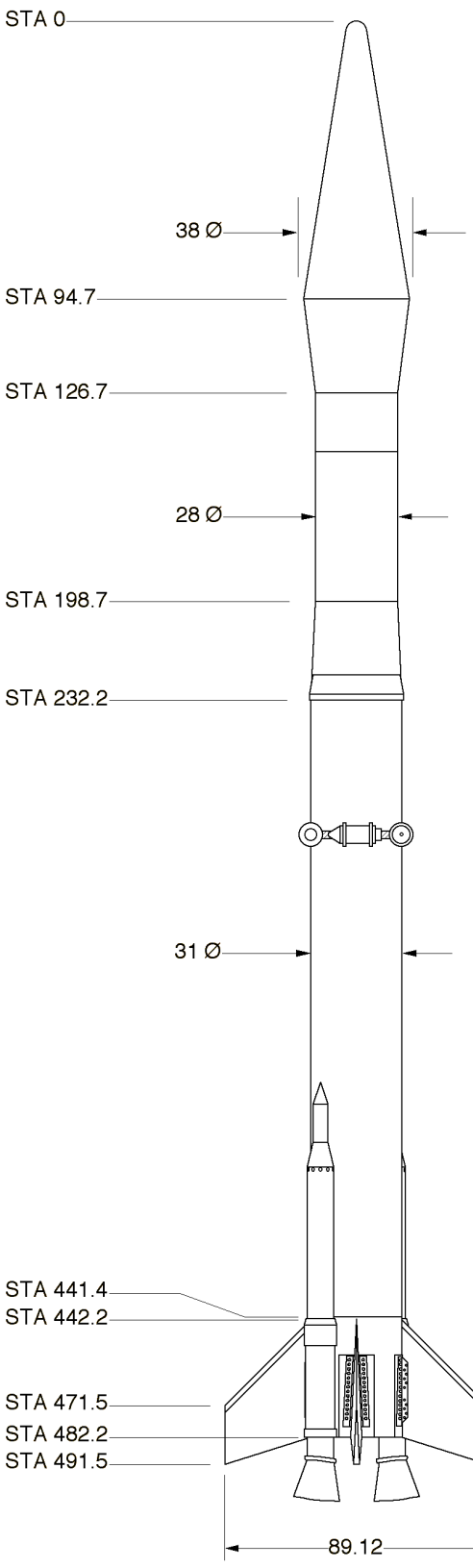
Inert ARPAT target missile - US Army photo

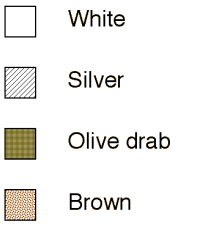
Inert ARPAT target missile No. 201 on the launcher at Wind Sands Missile Range (7 January 1963) - US Army photo

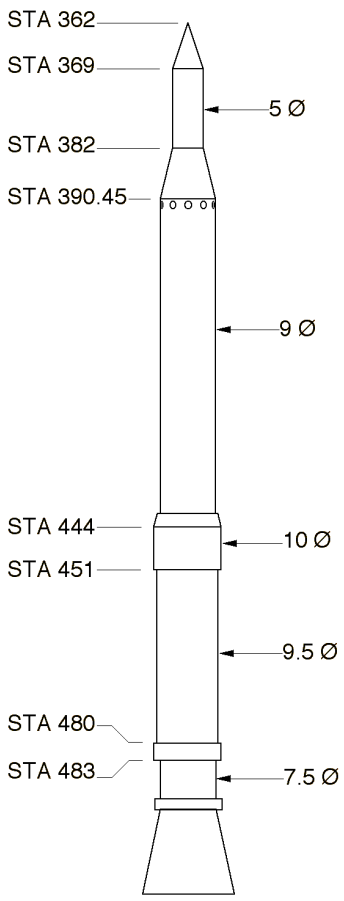
ARPAT

1/60 scale
Dimensions in inches
© 2026 Chris Timm

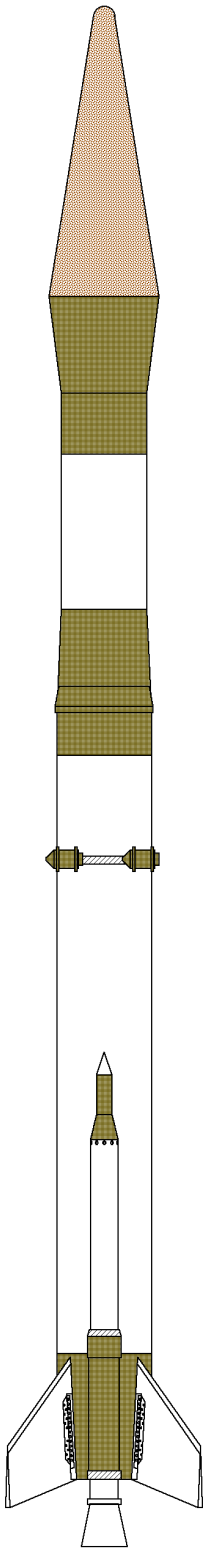
Sources:
Supersonic Wind Tunnel Tests of the Three-Stage Target Missile ARPAT, B.R.L. Memorandum Report No. 1915, March 1968.
Various U.S. Army photographs.







Recruit booster
enlarged 2x



Inert ARPAT target missile No. 201 on the launcher at Wind Sands Missile Range (7 January 1963) - US Army photo

COMPETITION CORNER

Parachutes

Al de la Iglesia

Whether you are flying low power, HPR or competition duration events, when flying rockets the importance of a reliable parachute that opens successfully cannot be underestimated. For this article, I am going to lay out some basics for parachutes that should help you to achieve 100% deployment.

Parachute Construction

For a lightweight competition parachute, there are typically 2 types of materials used; aluminized Mylar or polyethylene. For most duration models, ¼ mil (0.00025") Mylar is easier to use, but is getting harder to find and is much more expensive. 0.31 mil polyethylene is cheap and readily available from Home Depot, but it is heavier and harder to work with than Mylar. For visibility, you should color it with a Sharpie marker or dye. I have tested a poly chute with just baby powder, and it will become a translucent white, which helps with visibility but will become difficult to see more than ¼ mile away, whereas an aluminized Mylar chute can be seen for miles easily. Be careful of using an "emergency blanket" type of material as it is thicker (typically 0.5 mil) and does not open as easily as ¼ mil Mylar. Thicker mylar can be used for sport models and egglofters since the larger weight of the model can help to deploy the chute.

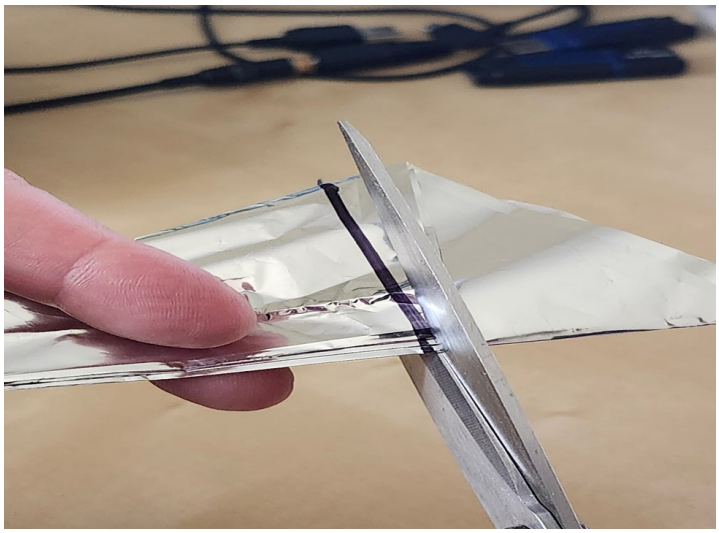
For parachute duration models, I make my parachutes up to 1meter in diameter depending on the event. To cut my chute from the film, I start with a square with a length and width that is at least the diameter of the chute that I want to make. I then proceed to fold the material in half such that it becomes a rectangle, then fold again so that it becomes a small square. Be sure to fold the material so that the center of the chute is always at the same corner. Then fold again to make a triangle, keeping the center of the chute at the vertex of the triangle. Fold it once more and you will get a double triangle with the center of your chute at the vertex between the two longest sides. Next, carefully measure the length of your chute radius along the two long sides of the triangle and mark them with a sharpie. Connect the two points with a straight line and then cut with sharp scissors in a single nonstop motion. A single cut is needed to prevent from making small nicks in the material which then act as failure points where the material can easily tear later.



Folding and cutting sequence

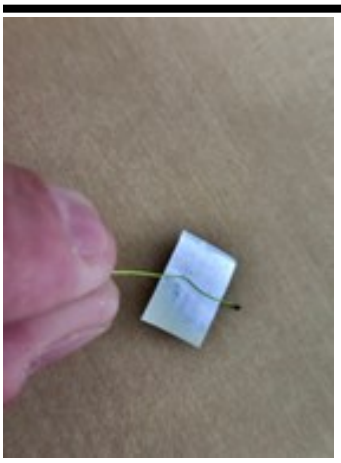


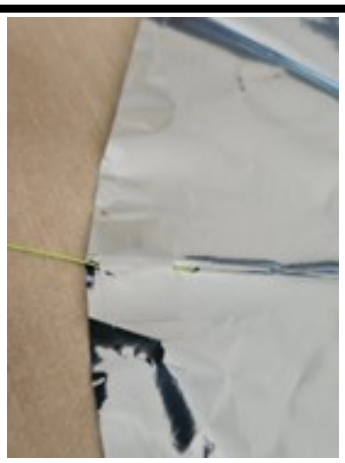


Now that you have your canopy cut, you can unfold it and see how the fold lines make perfect marks for where to attach your shroud lines. The fold lines can be used for either 8 or 16 shroud lines. I normally use 8 lines for most competition models, but I use 16 lines for my large FAI chutes. For shroud lines, I have used many types of materials such as kevlar, sewing thread…etc, but by far the best I have ever used is Fuji Ultra Poly. For competition chutes it is the lightest, smoothest thread I have tried. It is a bit expensive, but a spool will last a long time.

I only use shroud lines made of 100% nylon or polyester. I cut my shroud lines to a length of 1.5x the chute diameter. I melt the attachment end of each shroud line by carefully holding it up to a barbecue lighter, it melts easily and will form a small ball that prevents the shroud line from pulling out from under the tape. I use thin ½" Mylar tape squares to attach the shroud lines to the canopy using the fold lines for perfect alignment. Some people then suggest wicking a tiny drop of CA at each line attachment point, but I do not like anything that stiffens the line, so I don't do it.





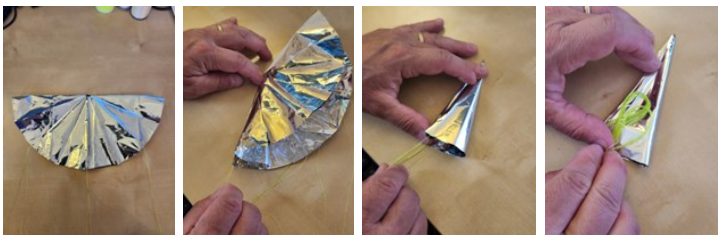
Shroud line attachment

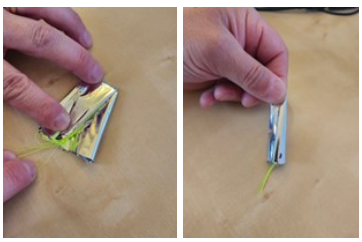
Packing Method

The key to ensuring that your parachute will open 100% of the time is to make sure that it is properly powdered and folded. I buy the small trial size container of baby powder to keep in my range box, but I buy the large container to use at home. I always powder and fold my competition chutes at home on a large table far from anyone since the process can get quite dusty. Before folding a chute, it has to be liberally coated with baby powder on both sides and the shroud lines should be powdered also.

Fold the chute once so it forms a semicircle. Hold the center of your chute with one finger and pull the second shroud line so that it lines up with the first shroud line. Repeat this process with the 3rd through 8th shroud lines. Lay the shroud lines in a figure 8 pattern so that when you fold the top of the chute down, the lines are not caught in the fold. Curl up both sides of the chute and you are done. Insert the chute into your rocket so that the fold goes in first and leaves the shroud lines pointing out of the top of your rocket. Don't forget to attach the chute to your rocket!

When this method is used properly, it will allow the chute to open 100% of the time without tangling, even if you leave the chute folded for months. I used this method to fold my chutes for competition months in advance and I store them in a short piece of body tube so that I can put in my rocket easily on the day of the contest. I rarely ever fold a chute in the field unless I am sport flying and then I still use the same method.





Folding technique

Parachute Protection

The other major factor that affects parachute reliability is getting the chute out of the rocket safely. You have to make sure that the parachute is not too tight in the body of the rocket and that it is protected from the ejection charge. Make sure to use a proper amount of wadding to keep your chute from melting. Mylar chutes are especially prone to melting, even more so than other types of materials. For most of my competition models, I use a plug that I cut from white styrofoam. I use a sharpened piece of blackshaft tubing to twist my way through a sheet of 1inch thick styrofoam to make plugs. Make sure that the plug is tight enough to block the hot gases from getting to the chute, but also loose enough to move smoothly and push the chute out of your rocket. I will often put a small amount of baby powder in the body tube to make it slippery so that the plug moves easily. It does take a bit of practice to get the right feel for how tight or loose a plug should be in a body tube.

Summary

If you use the right materials, folding methods and protection, you can make sure that your rockets will reliably deploy a parachute. Whether it is for competition or sport flying, following a consistent methodology for folding a parachute is of the utmost importance. Once you start using a method like this that works all the time, you can say goodbye to the dreaded wad-o-plastic recovery that can ruin a perfectly good model.

Please email me if you have any questions or comments.

Two PD models at NARAM 65

CURRENT EVENTS IN SPACE EXPLORATION

Buzz Nau

As we enter early May 2026, Starship has yet to fly this year. That doesn't mean progress has stalled as both Booster 19 and Ship 39 have completed successful static fires and the necessary pre-flight testing, with a targeted launch no earlier than May 12.

Flight 12 will be a significant milestone with the debut of Block 3 hardware powered by Raptor 3 engines, and the first Starship launch from Orbital Launch Pad 2. Given all the new hardware and infrastructure changes, it wouldn't be surprising if the May 12 target slips.

Meanwhile, SpaceX continues with a high pace of Falcon 9 launches. Over the last two months there have been 22 missions in support of Starlink and four other missions including a Falcon Heavy launch.

Other launch providers have also been busy over the past two months. Rocket Lab flew four missions, United Launch Alliance completed two, and Firefly Aerospace, Northrop Grumman, and Blue Origin each conducted one. The standout event of the period was NASA's Artemis II mission, marking the agency's return to the Moon.

SPACEX

Transporter 16 was a dedicated RideShare mission launched by SpaceX on 30 March from Launch Complex 4E at Vandenberg Space Force Base. The Falcon 9 deployed 119 payloads to a sun-synchronous orbit which included 57 from Exolaunch, a satellite service provider headquartered in Germany.

On 11 April, the Northrup Grumman Cygnus CRS-2 NG-24 mission was launched on a Falcon 9 from SLC-40 at Cape Canaveral Space Force Station. The Cygnus XL spacecraft delivered over 11,000 lb. of supplies and experiments to the International Space Station. This was the fourth Cygnus launch aboard a Falcon 9.

The tenth and final GPS III global positioning satellite was launched aboard a Falcon 9 on 21 April from LC 40 at Cape Canaveral Space Force Station. The GPS III SV10 mission marks the completion of the GPS III network totaling 32 satellites.

A rare Falcon Heavy launch on 29 April carried the Viasat-3 F3 (Viasat 3 Asia-Pacific) broadband communications satellite to a Geosynchronous Transfer Orbit (GTO) where it will deploy its solar arrays. Launched from pad LC 39A at Kennedy Space Center, ViaSat-3 F is the third and last satellite in ViaSat's next-gen constellation. It will deliver 1 Tbps service across the Asia-Pacific region.

ROCKET LAB

Rocket Lab has also kept a busy schedule starting with the *Insight At Speed Is A Friend Indeed* (BlackSky Gen-3 4) mission launched on 5 March aboard an Electron vehicle from the Rocket Lab Launch Complex 1A at Mahia Peninsula. This was the fourth of five dedicated BlackSky 3rd Gen high-resolution Earth imaging satellites for an undisclosed customer.

Following on 20 March was the Electron *Eight Days a Week*, mission launched from the Rocket Lab Launch Complex 1B at Mahia Peninsula. The payload was StriX-6, the 8th of 26 launches dedicated for Synspective's StriX constellation of synthetic aperture radar (SAR) Earth observation satellites.

On 28 March, Rocket lab launched the *Daughter of the Stars* mission on an Electron from Launch Complex 1a at Mahia Peninsula. The payload was the first pair of satellites for the European Space Agency (ESA) future navigation constellation.

Kakushin Rising was an Electron flight supporting JAXA's Innovative Satellite Technology Demonstraion-4 mission. Launched on 23 April from Launch Complex 1A at Mahia Peninsula, the RideShare mission consisted of eight spacecraft including educational small sats, an ocean monitoring satellite, a demonstration satellite for multispectral cameras and a deployable antenna that uses origami folding techniques to unfold 25 times it's size.

ULA

There were two United Launch Alliance flights over the past couple of months in support of Amazon's Leo (formally Project Kuiper) broadband telecommunications constellation network. LA-05 flew on 4 April and deployed 29 LeoSats. LA-06 launched on 28 April and also delivered 29 LeoSats to the constellation.

FIREFLY AEROSPACE

Firefly Aerospace successfully launched Alpha FLTA007, Stairway to Seven mission, the first Alpha flight in 10 months on 11 March from Vandenberg Space Force Base. The main goal was a return-to-flight test to validate the vehicle systems after the previous mission, FLTA006 failed. Additionally, FLTA007 successfully deployed a Lockheed Martin demonstrator payload to low earth orbit. The mission success paves the way for the Alpha Block II upgrade.

NORTHROP GRUMMAN

It had been quite some time since the last Northrop Grumman Minotaur launch. On April 7, a Minotaur IV lifted off successfully from Vandenberg Space Force Base, carrying the Department of War's Space Test Program mission STP -S29A. The flight deployed a variety of research and technology demonstration payloads into low Earth orbit. One of the highlights is the U.S. Naval Research Laboratory's (NRL) Lightsheet Anomaly Resolution and Debris Observation (LARADO) instrument, which will use lasers to detect and characterize lethal, non-trackable orbital debris.

BLUE ORIGIN

Blue Origin's New Glenn rocket conducted its third flight (NG-3), carrying AST SpaceMobile's BlueBird 7, the second Block 2 satellite, on April 19, 2026, from Launch Complex 36 at Cape Canaveral Space Force Station. The mission achieved the first reuse of a New Glenn first-stage booster, which flew successfully and landed on a droneship. However, the upper stage encountered a problem during its second burn when one of the two BE-3U engines failed to produce sufficient thrust. This placed BlueBird 7 into a much lower-than-planned orbit, rendering the satellite unusable, and was deorbited. The FAA classified the event as a mishap and grounded New Glenn pending a formal investigation and corrective actions.

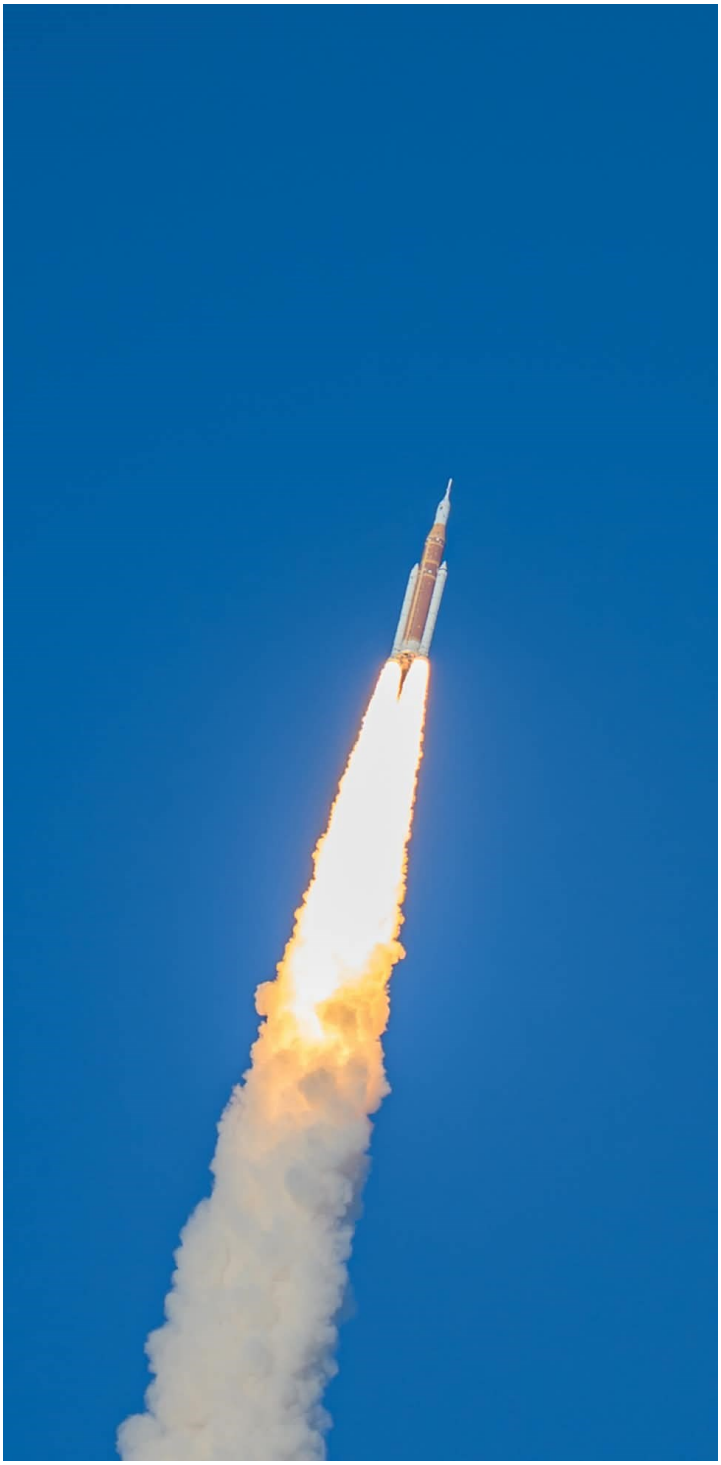
NASA NEWS

NASA's Artemis II mission marked our return to the Moon after more than 50 years. The SLS Block 1 rocket carrying the Orion spacecraft launched successfully on 1 April from Launch Complex 39B at Kennedy Space Center. The four-person crew; NASA astronauts Commander Reid Wiseman, Pilot Victor Glover, and Mission Specialist Christina Koch, plus Canadian Space Agency Mission Specialist Jeremy Hansen, completed a nearly 10-day flight that included a lunar flyby on April 6. At its farthest point, Orion carried the astronauts 252,756 miles from Earth, setting a new record for human spaceflight distance.

The SLS rocket and Orion spacecraft performed well overall. The launch met all objectives, Orion's life-support and avionics systems operated reliably in deep space, and the crew successfully conducted manual flight tests and other planned operations. The spacecraft splashed down precisely on April 10, 2026 (5:07 p.m. PDT), in the Pacific Ocean southwest of San Diego, just 2.9 miles from the target landing site, after traveling more than 694,000 miles.

Key highlights included the first human views of the lunar far side since Apollo, the debut crewed use of Orion and SLS, and valuable data on deep-space habitability. Minor issues arose, a toilet malfunction (frozen urine vent line) that was resolved by rotating the spacecraft toward the Sun, plus a small post-mission helium leak in the service module, but none that affected crew safety or mission success. Artemis II has cleared the way for future crewed lunar landings under the Artemis program.

By chance, club member Andy Murrell was in Miami at the time for business the day of the launch. He made a mad dash to Titusville and made it there with two minutes to spare before the launch and was able to take some great photos.



Artemis II launches to the Moon - Andy Murrell photo

The latest Minotaur IV rocket delivers multiple Space Test Program satellites to Low Earth Orbit - Northrop Grumman photo

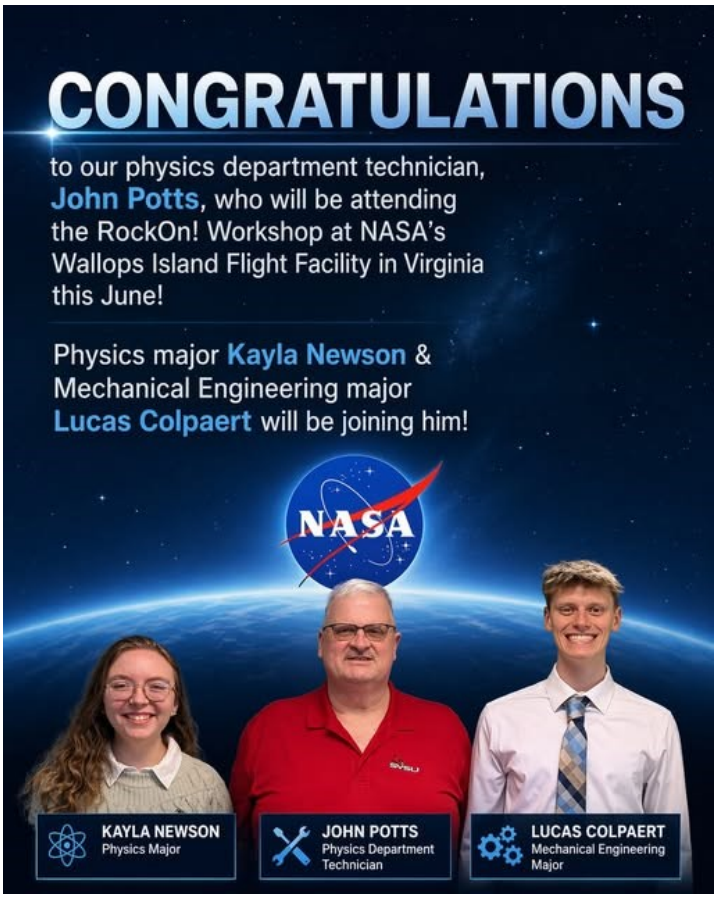
Artemis II Liftoff - Andy Murrell photo

Falcon Heavy with Viasat-3 F3 broadband communications satellite awaits liftoff - SpaceX

Firefly Alpha FLTA007, Stairway to Seven lifts off from Vandenberg SFB - Firefly Aerospace

JMRC HUVARS Club News

John Potts Attending NASA RockOn! Workshop
It was recently posted on Facebook by Saginaw Valley State University that Lucas Colpaert, Mechanical Engineering major, Kayla Newson, Physics Major, and **John Potts**, Physics Department Technician, will be attending the RockOn! Workshop at NASA's Wallops Island Flight Facility in Virginia. The team will build a science payload that will ride up on a sounding rocket and gather data during the rocket flight. Make sure you get your NAR number on that sounding rocket John!



Maintenance Day a Success
On March 28 we held our annual maintenance day at Buzz's house to go over our launch and ground support equipment for a thorough cleaning and to replace or repair anything amiss. Thanks to everyone who showed up to give a hand!

Annual Altitude Contest
Enter at any launch this year and as many times as you like, $5 for adults, juniors under 18 yo are free. The target is 518 feet, get the closest without going over. The winner and runner up at the end of the year receive a portion of the money collected. The junior winner will receive a trophy.

New Members
Jeremy and Jameson Chambers

PRESIDENT'S CORNER

Roger and I started this club roughly three decades ago with the goal to fly rockets and give that opportunity to everyone interested regardless of age. Over the years we have seen a lot of great rocket folks join us and fly a lot of different types of rockets. These variances range from Micro Maxx through N motors; inclusive of solid, hybrid, and even tribrid propellants. On top of that, the many different recovery types witnessed over the years.

Historically our launches have varied drastically in attendance. We have had launches that required flyers to wait for two or three rack cycles for a pad to open up. On the flip side, we have held launches that only saw a single flight. The number of flights is irrelevant, as long as it's safe to fly, and we don't damage the landowners field, we will be there at the bare minimum to hang out and have a good time. When these ebbs and flows occur it is usually traceable to a few attributes. Good or questionable weather, time of year, economy allowing/disallowing disposable funds for a hobby, etc. As mentioned earlier, thirty years grant a lot of data.

I, for one, love data. I even hold a job that lets me play with data for a living if you want to know my level of crazy :-). An interesting data point for our club recently popped up… we have had several people reach out to our distribution list (DL) "bod@JMRConline.org" in the past few weeks seeking memberships and information. Before I go further, I think this is phenomenal and want to encourage it more!!! The curious element, this DL has been in place for several years and hasn't seen much traffic generally. Perhaps we hit a new stream or other means of outreach to get our club reaching new levels? I do like my data, and I also know when I'm out of my depth. If this influx of interest is linked to social media or other means that I don't generally participate in then consider my interest piqued. The goal of outreach and getting as many people interested regardless of age is still our goal. If anyone has thoughts or suggestions please use the DL, discord server, group message board, or tell us in person at the next launch.

We as a club want to grow and advance with everyone.

LAUNCH WINDOWS

Tony Haga

May 1, 2026
Starlink Group 10-38, Falcon 9 Block 5, SpaceX
Launch site: SLC-40, Cape Canaveral SFS
A batch of 29 satellites for the Starlink mega-constellation.

May 12, 2026
Dragon CRS-2 SpX-34, Falcon 9 Block 5, SpaceX
Launch site: Cape Canaveral SFS, FL, USA
4th commercial resupply services mission to the International Space Station operated by SpaceX. The flight will be conducted under the second Commercial Resupply Services contract with NASA.
Cargo Dragon 2 brings supplies and payloads, including critical materials to directly support science and research investigations that occur onboard the orbiting laboratory.

May 2026
The Grain Goddess Provides (iQPS Launch 7), Electron, Rocket Lab
Launch site: Launch Complex 1, Mahia Peninsula
Synthetic aperture radar Earth observation satellite for Japanese Earth imaging company iQPS.

May 2026
StriX Launch 9, Electron, Rocket Lab
Launch site: Launch Complex 1, Mahia Peninsula
Synthetic aperture radar satellite for Japanese Earth imaging company Synspective.

May 2026
Amazon Leo (LE-03), Ariane 64 Block 2, Arianespace
Launch site: Launch Area 4, Guiana Space Centre
Amazon Leo, formerly known as Project Kuiper, is a mega constellation of satellites in Low Earth Orbit that will offer broadband internet access. This constellation will be managed by Kuiper Systems LLC, a subsidiary of Amazon. This constellation is planned to be composed of 3,276 satellites. The satellites are projected to be placed in 98 orbital planes in three orbital layers, one at 590 km, 610 km and 630 km altitude. 35-40 satellites will be carried on each Ariane 6 launch.

May 2026
Onward and Upward, Spectrum, Isar Aerospace
Launch site: Orbital Launch Pad, Andøya Spaceport
Second test flight of the Isar Spectrum launch vehicle. This launch will carry 5 cubesats and 1 non-separable experiment as part of European Space Agency (ESA)'s “Boost!” program.

May 2026
CAS500-2 & Others, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
The South Korean CAS500-1 and -2 satellites will image the Earth in pan-chromatic and multi-spectral modes using the AEISS-C (Advanced Earth Imaging Sensor System) payload, with a ground resolution of 0.5 m in panchromatic mode and 2 m in color mode.

May 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.

June 1, 2026
Swift Rescue Mission
Launch site: Kwajalein Atoll
Contracted by NASA under the Small Business Innovation Research Phase 3 contract, Katalyst Space Technologies' LINK servicing spacecraft will rendezvous and attach to NASA’s Neil Gehrels Swift Observatory to re-boost its orbit. This aims to demonstrate a key capability for the future of space exploration and extending the Swift mission’s science lifetime in gamma ray astronomy.

June 16, 2026
Progress MS-35 (96P), Soyuz 2.1a, ROSCOSMOS
Launch site: 31/6, Baikonur Cosmodrome
Progress resupply mission to the International Space Station.

June 25, 2026
LOXSAT 1
Launch site: Launch Complex 1, Mahia Peninsula
OXSAT 1 is a demonstration satellite of a complete cryogenic oxygen fluid management system in orbit, developed by Eta Space and sponsored by NASA's Tipping Point program. The system will be integrated on a Rocket Lab Photon-LEO satellite bus and collect critical cryogenic fluid management data in orbit for 9 months, demonstrating capabilities of in-space cryogenic storage and transferal. Eta Space plans to use technology developed for this mission to develop a truly commercial depot intended to serve multiple customers in the future.

June 2026
Rivada 7, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
24 satellites for Rivada's internet constellation.

June 2026
SDA Tranche 1 Tracking Layer E, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Tranche 1 Tracking Layer E is one of five missions by the United States Space Force Space Development Agency (SDA) for the Proliferated Warfighter Space Architecture (PWSA) Tranche 1 Tracking Layer constellation, which will provide global indications, warning, tracking, and targeting of advanced missile threats, including hypersonic missile systems.

LAUNCH WINDOWS

Tony Haga

June 2026
Rivada 8, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
24 satellites for Rivada's internet constellation.

June 2026
Transporter 17, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Dedicated rideshare flight to a sun-synchronous orbit with dozens of small microsatellites and nanosatellites for commercial and government customers.

June 2026
Rivada 9, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
24 satellites for Rivada's internet constellation.

June 2026
SDA Tranche 1 Transport Layer A, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Tranche 1 Transport Layer A is one of six missions by the United States Space Force Space Development Agency (SDA) for the Proliferated Warfighter Space Architecture (PWSA) Tranche 1 Transport Layer constellation, which will provide assured, resilient, low-latency military data and connectivity worldwide to the full range of warfighter platforms from Low Earth Orbit satellites.

June 2026
VICTUS HAZE Jackal, Firefly Alpha Block 2, Firefly Aerospace
Launch site: SLC-2W, Vandenberg SFB
True Anomaly's Jackal Autonomous Orbital Vehicle (AOV) will support U.S. Space Force Space Systems Command's VICTUS HAZE Tactically Responsive Space (TacRS) mission with operations in orbit proximity with another spacecraft built by Rocket Lab National Security. The spacecraft, once completed, will remain on call until the U.S. Space Force provides the notice to launch. The Firefly team will then have 24 hours to transport the payload fairing to the pad, mate the fairing to the Alpha rocket, fuel the rocket, and launch within the first available window.

June 2026
SDA Tranche 1 Transport Layer D, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Tranche 1 Transport Layer D is one of six missions by the United States Space Force Space Development Agency (SDA) for the Proliferated Warfighter Space Architecture (PWSA) Tranche 1 Transport Layer constellation, which will provide assured, resilient, low-latency military data and connectivity worldwide to the full range of warfighter platforms from Low Earth Orbit satellites.

June 2026
Transporter 17, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Dedicated rideshare flight to a sun-synchronous orbit with dozens of small microsatellites and nanosatellites for commercial and government customers.

June 2026
SDA Tranche 1 Transport Layer A, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Tranche 1 Transport Layer A is one of six missions by the United States Space Force Space Development Agency (SDA) for the Proliferated Warfighter Space Architecture (PWSA) Tranche 1 Transport Layer constellation, which will provide assured, resilient, low-latency military data and connectivity worldwide to the full range of warfighter platforms from Low Earth Orbit satellites.

June 2026
H3-30 Test Flight, H3-30, Mitsubishi Heavy Industries
Launch site: LP-2, Tanegashima Space Center
Test flight of the H3-30 variant of the H3 launch vehicle with 3 LE-9 engines in the first stage and no SRBs. The flight will carry a dummy main payload (Vehicle Evaluation Payload 5, VEP-5) and several hitchhiking small satellites.

June 2026
MRV-1, Falcon 9 Block 5, SpaceX
Launch site: Cape Canaveral SFS, FL, USA
The SpaceLogistics MRV-1 is a mission extension payload including a mission robotic vehicle (MRV) and multiple mission extension pods (MEPs).

June 2026
Flight 12, Starship, SpaceX
Launch site: Orbital Launch Pad 2, SpaceX Starbase
13th test flight of the two-stage Starship launch vehicle. Maiden Flight of Starship V3.

June 2026
SDA Tranche 1 Transport Layer E, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Tranche 1 Transport Layer E is one of six missions by the United States Space Force Space Development Agency (SDA) for the Proliferated Warfighter Space Architecture (PWSA) Tranche 1 Transport Layer constellation, which will provide assured, resilient, low-latency military data and connectivity worldwide to the full range of warfighter platforms from Low Earth Orbit satellites.

MMW Miller Motor Works

LAUNCH WINDOWS

Tony Haga

June 2026
T1H-1, Themis Demonstrator, European Space Agency
Launch site: LC-3B, Esrange Space Center
First low-altitude hop test of a Themis demonstrator, with a targeted altitude up to 100 m.

June 2026
VICTUS HAZE Puma, Electron, Rocket Lab
Launch site: Launch Complex 1, Mahia Peninsula
VICTUS HAZE will see Rocket Lab design, build, launch, and operate a rendezvous proximity operation (RPO) capable spacecraft. U.S. Space Force Space Systems Command (SSC)'s Space Safari's VICTUS HAZE mission will be an exercise of a realistic threat-response scenario and on-orbit space domain awareness (SDA) demonstration. Once the spacecraft build is complete, Rocket Lab will be entered into a Hot Standby Phase awaiting further direction. Once the exercise begins, Rocket Lab will be given notice to launch the spacecraft into a target orbit. After reaching orbit, the spacecraft will be rapidly commissioned and readied for operations. Rocket Lab will configure a Pioneer class spacecraft bus to meet the unique requirements of the VICTUS HAZE mission.

June 2026
SDA Tranche 1 Transport Layer F, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Tranche 1 Transport Layer F is one of six missions by the United States Space Force Space Development Agency (SDA) for the Proliferated Warfighter Space Architecture (PWSA) Tranche 1 Transport Layer constellation, which will provide assured, resilient, low-latency military data and connectivity worldwide to the full range of warfighter platforms from Low Earth Orbit satellites.

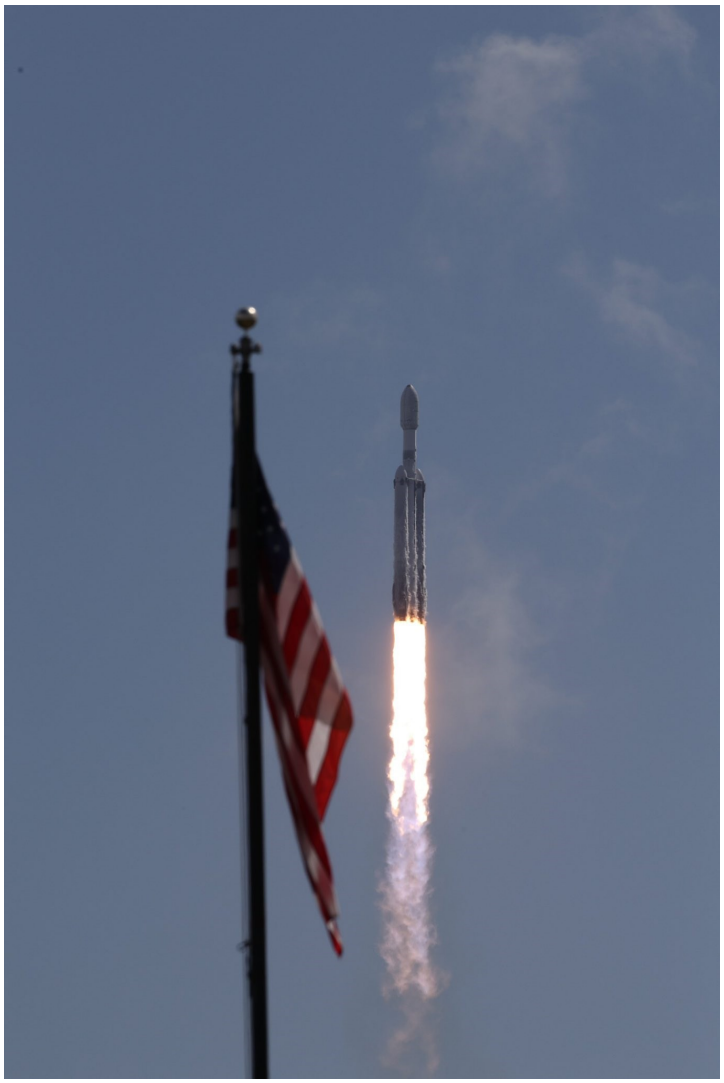
June 2026
SDA Tranche 1 Transport Layer C, Falcon 9 Block 5, SpaceX
Launch site: SLC-4E, Vandenberg SFB
Tranche 1 Transport Layer C is one of six missions by the United States Space Force Space Development Agency (SDA) for the Proliferated Warfighter Space Architecture (PWSA) Tranche 1 Transport Layer constellation, which will provide assured, resilient, low-latency military data and connectivity worldwide to the full range of warfighter platforms from Low Earth Orbit satellites.

June 2026
9 x Globalstar-3, Falcon 9 Block 5, SpaceX
Launch site: Cape Canaveral SFS, FL, USA
The Globalstar global mobile communications network offers global, digital real time voice, data and fax services via its Low Earth Orbit satellite constellation. The constellation operates in a 1410 km orbit inclined at 52 degrees.

June 2026
MTG-I2, Ariane 64, Arianespace
Launch site: Launch Area 4, Guiana Space Centre
Third of EUMETSAT's third generation of weather satellite.

June 14, 2026
Soyuz MS-29, Soyuz 2.1a, Russian Federal Space Agency (ROSCOSMOS)
Launch site: 31/6, Baikonur Cosmodrome
Soyuz MS-29 will carry three cosmonauts and one astronaut to the International Space Station aboard the Soyuz spacecraft from the Baikonur Cosmodrome in Kazakhstan. The crew consists of Roscosmos cosmonauts Pyotr Dubrov and Anna Kikina, as well as NASA astronaut Anil Menon.

Launch dates from spacelaunchschedule.com



Falcon Heavy Viasat 3 mission - SpaceX photo

Dan Weimer with his Apogee Zephyer L1 Cert

Tony and Scott going over Dan's L1 cert attempt

Tony Haga and Herb Crites at Crapshoot XI

Dale Hodgson at the 11 April launch

Scott Miller assisting the WMU students

Buzz Nau with his upscale Patriot at LDRS 44