

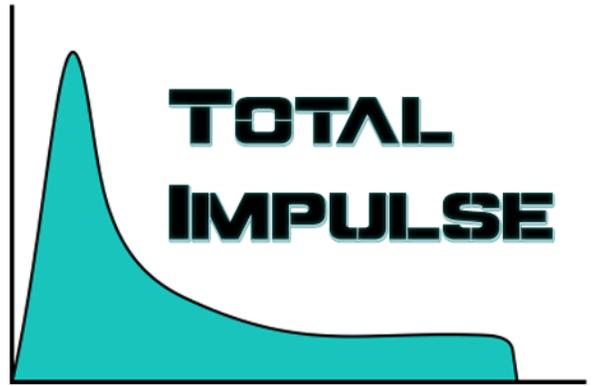
JACKSON MODEL ROCKET CLUB
HURON VALLEY ROCKET SOCIETY



TOTAL IMPULSE VOLUME 19, No. 3



MAY - JUNE 2019



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GPS TRACKING LAUNCH VEHICLE



METROC SOUNDING ROCKET



MINIMUM DIAMETER REPLACABLE SHOCKCORD MOUNT



LAUNCH EVENT COVERAGE



CLUB OFFICERS

President: Scott Miller
Vice President: Roger Sadowsky
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Secretary: Rob Dickinson
NAR Advisor: Buzz Nau
Communications: Dan Harrison
Board of Director: Dale Hodgson
Board of Director: Bob Dickinson
Board of Director: Mark Chrumka

MEMBERSHIP

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

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

JMRC/HUVARS
 C/O Rob Dickinson
 6237 Arroyo Vista Dr.
 Rockford MI 49341

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

COMM CHANNELS

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

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

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

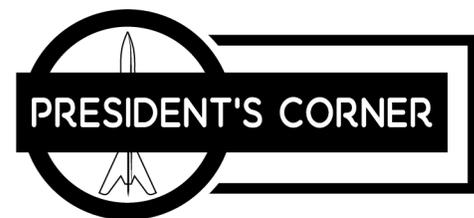
Facebook: If you have a FaceBook account search for "Jackson Model Rocket Club JMRC" and request to be added.

GroupMe: Our new chat channel for broadcasting notifications instantly using a free download client for IOS and Droid as well as by SMS text messaging. You can join the notification chat after creating a free account and following this link, https://groupme.com/join_group/28013422/zc51C1

Fade To Black Rocket Works

Heavy Duty Launch Pads For Every Need
 All pads are powder coated for lasting durability
<https://www.facebook.com/fziegler13/>

Concept Mini \$119	Concept X-treme \$325
Concept \$285	Ground Pounder \$345
TARC Pad \$285	Ground Pounder Heavy \$425
+Shipping	



Welcome to the May - June 2019 issue of *Total Impulse*. We're halfway through the flying season and have had some memorable launches so far. Coming up is our June 15 and July 13 launches as well as Rocketry Festival / NARAM 61 which is practically in our back yard at Muncie, IN. In addition to NARAM there will be Sport Flying the entire 8 days as well as the FAI USA Team fly-offs. Don't forget about Maker Faire. It is occurring around the same time as NARAM, so we may be light on volunteers to help. Please come out for the weekend or one day if you can to lend a hand. It's a great fun and is our top money maker for the year to keep our gear in A+ shape.

This is the 50th anniversary of Apollo 11 and to celebrate we're raffling a brand-new Estes 1/100 Saturn V. Tickets are available at our launches with the final drawing at the annual party / business meeting. You do not need to attend to win. Also, bring out your Saturn V's and other NASA related rockets to the upcoming launches to celebrate.

Finally, don't forget the shirt logo contest (page 9). We have some submissions already that will be online soon. Time is running short to submit your design.

About Total Impulse

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

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

Send correspondence to:
 Jackson Model Rocket Club
 Buzz Nau, Editor
 E-mail: USSMidway@gmail.com

Launch/Event Calendar - 2019

- April 13th (MIS)
- May 4th (TBD)
- CrapShoot VI - May 25,26 (Muskegon)
- June 15th (MIS)
- July 13th (MIS)
- NARAM 61 - July 27 - August 3 (Muncie, IN)
- August 17th (MIS)
- September 14th (MIS)
- October 12th (TBD)
- November 9th (TBD)

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

We're a couple months into our new membership and launch fee model and I must say I am very optimistic about the results. It is absolutely too early to make any concrete observation, but I'm always encouraged to see so many smiling faces at our launches. I think the knowledge of showing up to a launch and flying everything you packed or just sitting back watching the fun and flying nothing all for the same low price of \$0 of launch fees for our members makes a big difference.

The next area I would like to see grow is group projects. Watching people work together on more complex projects will allow the best of everyone's talent shine forward and the rest of the people attending will get to bask in the flight. In an effort to promote group projects I can offer a discount on motors, hardware, etc. if it is something that is not available to the team. This even works well if there is a motor you may only want to fly once, I have offered a discount to anyone that wants to buy the hardware with the contingency that it is used on the specific project. It can be a win-win situation for all involved with a motor used on your project and someone gets discounted hardware.

This could be a great opportunity to venture into new territory as well with just dipping a toe instead of jumping neck deep into a new adventure. Perhaps a hybrid motor peaks your interest but you may not know enough to get started... just let us know and we can point you in many directions to expand your knowledge and interest in rocketry. I guess the general idea I want to convey is don't assume rocketry is a one trick pony and once you have accomplished your individual goals you have peaked. I've been in this hobby for decades and have barely scratched the surface, with electronics, motors, airframes, flying wings, saucers, spools, videography, photography, ground support equipment.... The list can go on forever and we want everyone to explore their interests. If you have an idea and want to pursue it let us know and we as a club can do our best to help you make steps in achieving that goal.

I hope to see everyone on the field and definitely want to hear about all of your ideas and plans for the future!

On the Cover:

(top left) Art Upton with his H capable Estes Ascender (top right) Atlantic Research Corporation's METROC (bottom left) A removable recovery system anchor for minimum diameter rockets by Dale Hodgson (bottom right) The Muskegon launch field from Herb Crites' "Mach Schnell" at CrapShoot VI


LAUNCH REPORT
JMRC April Sport & NRC Launch

We started off our 2019 flying season at the Graves Campground site near Michigan International Speedway (MIS) on April 13th. The weather left a lot to be desired. It was pretty chilly and the wind was strong from the west. With that, we set up on the west side of the campground in an effort to use as much of the field as possible for recovery.

This launch was the first chance for the students from Sylvania Northview High School to attempt their Junior Level 1 flights. We tried to get them in late last year, but our last two launches were cancelled due to weather. There were 21 attempts with 17 that were successful. One attempt suffered a partial recovery deployment. Two were lost to trees and one was not found at all. Considering the wind and altitude the rockets were achieving this wasn't a bad success rate especially for apogee deployments.

Scott Miller assists a student with his Jr L1



The students built the kits individually in class under the supervision of Engineering Instructor Ryan Reed. They flew Wildman Rocketry 2.2" Drago kits with Aerotech H115 Dark Matter motors.

A full line of Junior Level 1 attempts



This is the 4th year that Sylvania Northview High School has done this Junior Level 1 program with a total of 102 students receiving their certification.

In addition to the High School students we also had several A division fliers including Nathaniel Inadori (5 flights) who flew his Flash 5 times on A8-3s. Matthew Sinclair had 8 flights including the Mini Honest John, Yankee, and Payloader. Jonathan Sinclair had 7 flights that included the Sky Writer, Spirit, and Flip-Flyer.

Neil Clennon flew his EAC Viper, Super Nova, and Photon Disruptor for three flights.

Christine Scharrer launched her Skittles rocket loaded with candy, but it weather-cocked across the field and scattered the Skittles far and wide to the North. Christine's dad, Chris flew his Black Brant on a F23 and Lil Squirt on an AT E15.

Dave Glover had an interesting flight with his two stage Twin Factor where the booster motor cato'd and remained on the pad, but the sustainer motor still ignited and flew fine. Dave had six additional flights including his Mega Vertigo, Baby Bertha and Planet

Probe. Sarah Glover put in a single flight with her Mega Mosquito on a D12 -5.

Mark Gryn flew a total of nine flights that was a mix of small rockets and high power. His high-power flights included the Spitfire on a Loki G69 Spitfire motor, Swift XXL on a Loki H100, and Naked & Afraid on a Loki I405.



Fred Zeigler got in one flight with his upscale Goblin on a F51. Buzz Nau also put up a single flight with a rocket called SS (Scott Special) .5. This was a 3D printed BT-55 fin can, motor retainer, and nose cone from Scott Miller. The model was put together without any adhesive and flew great on a B6-4.

Mark Chrumka's 3D Printed Fireball XL5



Jay Calvert of Impulse Buys put up his Star Orbiter on a F27R-8 and AIM-54 Phoenix on a G67R-6.

Rob Kruse got in three flights with his Drifter on D12-5s.

Dan Harrison had two flights including his Darkstar SR that flew on an experimental H motor with a titani-



Mark Gryn's 220 Swift XXL

um nozzle. This was a great flight and the motor performed well. Trevor put up a single FAI practice flight despite the wind.

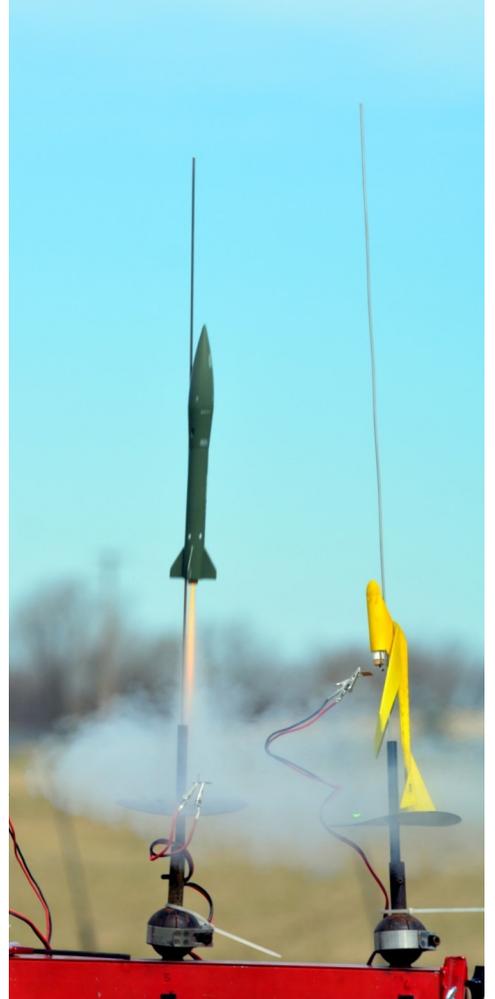
Mark Chrumka had nine flights. Several were high drag, low altitude models like the Snitch, Birdie, The Point, and HUVARS Scimitar. He also flew two 3D printed models, the Firebird XL5 on a B6-2 and scale Aries on a D12-3. Mark got in a decent glide flight with his Quest HL-20. Maybe all that model needs is a 15 knot headwind to glide right.... Mark also got in a nice flight with his Quest X-30 Space Plane. Finally, he flew his boiler plate test vehicle to test drop off boosters as well as a second stage with pop out fins. It appeared as though one of the drop off boosters grabbed the core booster and pulled it free from the second stage before staging.

Chris Palmer attempted to launch his "Major Award" on a H123. This was a mannequin leg lamp from the movie, "A Christmas Story" with fins. Unfortunately, the motor cato'd, dropped out the bottom of the leg and then scorched the fish net stockings as it began sky writing.

Other than Trevor's FAI practice flight, the closest we came to competition flights was Steve Kristal testing a new gap staging system on four flights.

Total flights for the day was 118!

Matthew Sinclair's Honest John



Dan Harrison and his Darkstar



JMRC May Sport & NRC Launch

Much like April, we needed to setup on the west side of Graves Campground due to the wind. This time coming out of the north. The temps were chilly again as well, though we got a nice warmup in the afternoon with decreasing winds. Since it was also Star Wars Day (May the 4th) there were a couple of Star Wars theme models in attendance. Total number of flights for the day was 90.

Mike Momenee started off the day with a composite motor two-stage composite attempt flying his Airstart 1 on an I200-8 booster to a G80 sustainer. Unfortunately, the sustainer failed to ignite and was recovered down range. His second flight was his Chute Release 2 on an AT H135-10 White Lightning.



Mike Momenee's two stage composite launch

Dale Hodgson had eight flights from gliders to upscales, to multi-stage, and HPR. Gliders included his Semroc Blue Jay boost glider on a B6-2, Mini Condor on a 1/2A3-2T, and Semroc Hawk on a 1/2A3-2T. All the gliders flew well and just need a slight trim adjustment. His Mozzy upscale Mosquito flew on a E20-4 and Estes Spirit two-stage ARF on a D12-0 to B6-4. Finally Dale flew his LOC Forte' on a H144-6.

Tony Haga put up his Estes Skydart II on a B6-2 for a great glide flight. He also launched his LOC EZI 65 on a SkyRipper I119 for the only hybrid of the day. Tony also flew his

Public Missiles Hydra on a H144.

Buzz Nau had seven flights including his MPC Yankee on a C6-5, Sky Dart clone twice on a B4-2 and C6-3, Hawk boost glider on a 1/2A3-2T, Interceptor clone on a B6-4, Semroc SLS Aero Dart on a D12-5 and Farside clone with a A8-0/A8-0/A8-5 combo. All were recovered successfully.

Peter Alway flew his Baby Bertha Bumblebee Bash on a B6-4 and White Sands V-2 No. 3 on a C6-3.

Jonathan Sinclair put up fifteen flights! These included his Skywriter on a B6-4, Goblin on a D12-5, Yankee on an A8-3, Mini Honest John on an A10-3T, Snitch (C6), X-Wing (A10-3T), Flip-flyer (C6), and Nike Apache (B6-4).

Tony Haga's PML Hydra



Meanwhile, Matthew Sinclair had three flights including his Goblin (D12-5) and THOY Peacock (F29-6).

Kimmy had a single flight, launching her Luna on a G motor for the rocket's successful 25th flight.

Matthew Sinclair's THOY Peacock



Herb Crites flew a batch of various Mach Schnell's including the SLK 54 (short) on an AT G76-7 Mohave Green, the HL e on a H165-10, and SLK 54 three times with a Loki H-144 White, Loki H-160 Blue, and AT H999 Warp Nine.

Rick Arden had four flights including one of the Level 1 cert flights of the day with his MadCow Black Brant II on a Loki H144. The main chute deployed at apogee, but by then the winds were low and it recovered fine on the field. He also flew his Majestic twice, once single stage with an Estes F15-6 and next with a booster (F15-0/F16-6). Both were nice flights though his Estes Trajector on a F15-6 was lost to a tree.

Rick Sharp also had four flights including his TARC Sample 1 on a F39-7, Scarab 54 on a CTI H170, and MadCow Hawk on a CTI H160-10. Rick had a bit of bad luck when his stretch Aerotech Arreauxbee-Hi cato'd on a G79.



Buzz Nau's 3-stage Farside



Christina Scharrer flew a Fliskits Mystic on a B6-6, but you really have to see the paint scheme to appreciate it. It's complex and extremely well done.

Sarah Glover had our other Level 1 cert flight of the day with her Public Missiles BumbleBee on an AT H100-14. She endured one of the longest, most drawn out countdowns in a long time. She took it in good stride and nailed the L1 cert with a perfect flight. Sarah also flew her Mega Mosquito on a D12-5.



Eldred Pickett's "Yes, It's Got A Hemi"

Dave Glover finally got to fly his Starliner futuristic scratch build that was highlighted in the last issue of *Total Impulse* on a H250-9. It was an awesome flight and was recovered softly on the field. He also flew an R2D2 type scratch build made of cups called "Not the Droid You're Looking For", first on a B4-4 and next on a C6-5. Both lights were a bit squirrely but entertaining. Dave also flew his Maxi Vertigo on a F20-4 and BOOH or "Bat



Dave Glover's "Not The Droids You're Looking For"

Out Of Hell" on a Loki G80.

Mike Rangitsch had fourteen flights with five from his Mach 12 using C6-5s. He also flew his Dark Energy on a C6-3, Silver Comet on a D12-3, Der V3 twice on D12-3s, Der Red Max on a B6-4, and Mini Red Max on a 1/2A3-4T Mike's mid power flights included his Better Bertha on an E15-7, Grosser Vati on an E30-7, and Arcas on a H238-10.

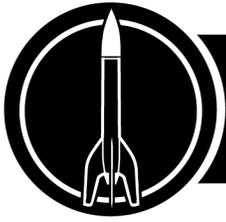
Eldred had a whopping twenty flights including his Sparkle on an I223 Skidmark, "Yes, It's Got A Hemi" on an I350 Smokey Sam, CHAD stage Snitch with a C6-0/C6-3, Rascal on an A8-3, Monarch also on an A8-3, Starhawk on a C6-3, and a whole lot more. Great score Eldred!

Eldred's flight tally was bested by Ron Gutzeit who put up twenty-one flights! Ron put up a wide range of rockets that included a Little Joe on an A10-3T, Birdie on an A10-3T, Alpha Stretch an a D12-3, Nike Smoke on an A10-3T, and V-2 on a C6-3. The V-2 had a very nice camo paint scheme.

No competition flights were flown again this month. By the time the winds started cooperating it was getting too late. I expect to see a fair at the June launch for sure.

Thanks for everyone that showed up early to setup and stay late to assist with the tear down. Big thanks also to Mike and Natalie Jacobs for the donuts they brought. They are always appreciated!

Our next launch is June 15th at MIS. As we close in on the 50th anniversary of Apollo 11 start thinking about bringing your NASA scale models out.



GPS In Model Rocketry Part 3

Low Cost / High Performance Payloader For Under \$30

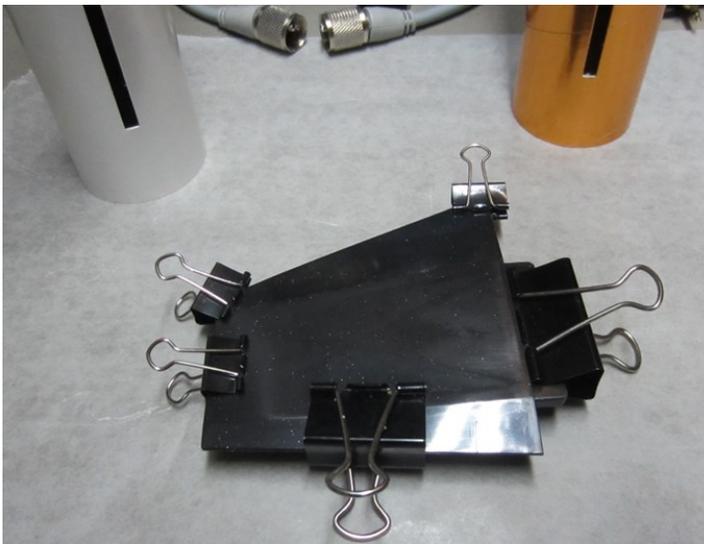
Art Upton

The Build

In order to launch a GPS payload, one needs an adequate launch vehicle. One of the best buys in a mid-power payload rocket is the Estes Ascender for under \$30. It also makes an excellent rocket for Level 1 high power certification. Small to large trackers as well as other experiment boards can fit in the 2" diameter bay. To get them at this great price requires using a Hobby Lobby 40% off coupon or on-line from AC Hobby Supply if there isn't a Hobby Lobby store near you. As of this writing you can get the Hobby Lobby coupon at <https://www.hobbylobby.com/> or on-line from AC Supply here, https://www.acsupplyco.com/estes/ascender_pro.htm. I buy them in 4 packs from AC supply.

There have been several that have said you can't fly these on H motors, but I have with simple techniques that make recovery also more reliable. First, I always paint the body tube on these types of rockets before mounting the fins. This simplifies finishing.

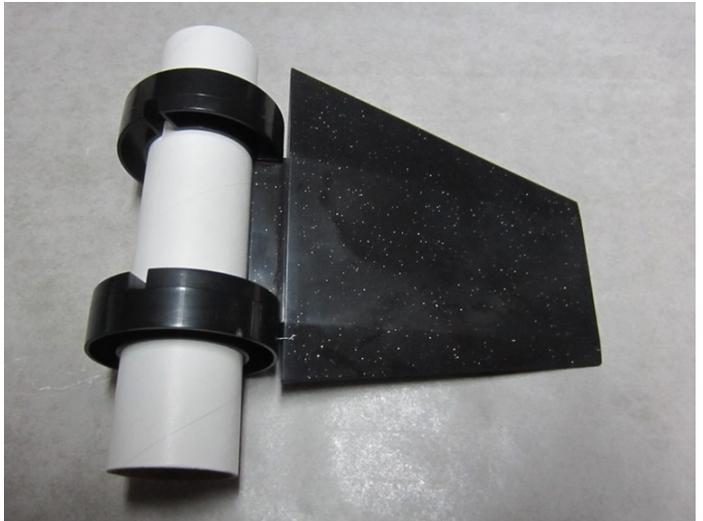
Fin failure happens when not enough glue is used, and many modelers try to use as little as possible so as to not get the glue smuggling up the pre-finish on them. Instead of plastic glue I use plenty of epoxy and alcohol-soaked paper towels to whip off the excess. Then I use binder clips to make sure all the seams are sealed completely. The key here is that no air must get into the seam or they can split when you get to the speeds a H motor will send them. If you missed a spot on a seam you can use CA glue to fill it in.



Now to clean up any mess on the fins when the Epoxy is dried, I wet sand them with 400 grit sandpaper under running water. You then mask off the glue tabs on

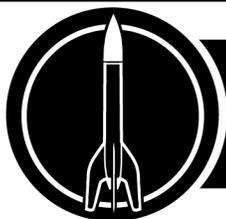
the fins, and I paint them flat black, or any other color you like.

The kit uses these plastic collets to mount the fins. I test fit all the fins and mark the collets on the motor tube for each matching fin. I epoxy the collets to the motor tube and make sure no epoxy is on the inside of the collets, where the fins go, or you won't be able to set the fins in all the way. I then epoxy the forward collet on the outside and only in 3rds on the inside of the bottom collet in-between where the fins will go.



I use Kevlar cord for the recovery harness. Drill a hole in between two fins on the top and rear collet, so you can feed the Kevlar cord down thru them and tie it off in the rear like a lariat loop on contest rockets.





GPS In Model Rocketry Part 3

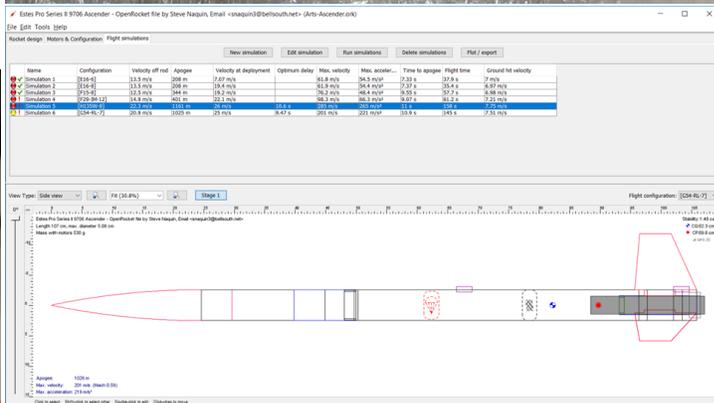
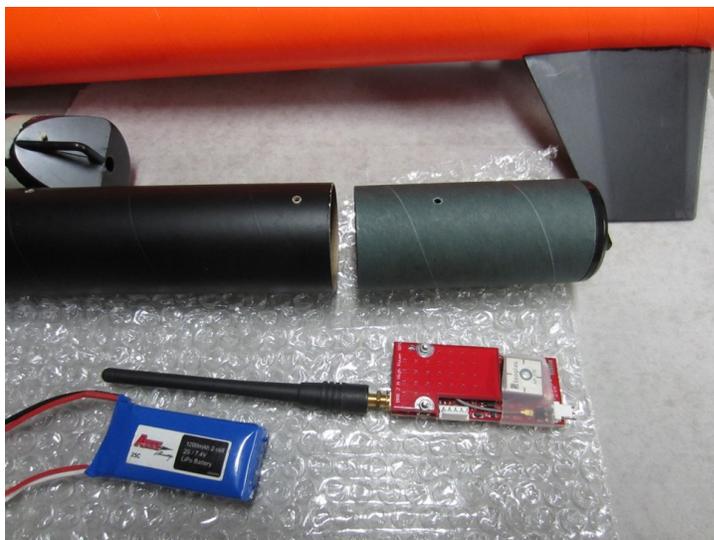
Low Cost / High Performance Payloader For Under \$30

Art Upton

The fins go on after you slide the motor mount / fin attachment can into the body tube and align it with the precut holes seen in the first picture.

I sand the fin tabs to rough up the plastic and get the glue to bite into it better. Test fit all fins and you might need to do some minor sanding to get them to fit all the way down. If they are not all the way down, then high speed flight may allow them to fail.

I do not put huge fillets on the outside, you could choose to do so but I do not. I put a decent amount of epoxy on the fin roots but don't over do it. I also put in some epoxy on the motor tube where the fin will seat as you insert the fins into the pre-painted body tube slot. Have alcohol and pre-soaked paper towels at the ready and push the fin into the body tube slot and into the slots of the collets around the motor tube. Clean up the epoxy that oozes out with the alcohol towels and it leaves me with a nice air seal so no air gets in-between the body tube and the fin.



Putting It To Use

So, to test this rocket I flew out to Las Vegas to meet "Balsa Bill" of Balsa Machining. The event was Tripoli Vegas October Fest at Jean Dry Lake. This was a LDRS site I attended some years back. I packed the rockets in a box and shipped them to me to hold for pickup at the Las Vegas FedEx station.

Bill was the Aerotech motor vendor there, so I acquired my motors on-site from him. The Ascender was flown first on an H135-10, and in the video linked below you can see the output of the Jolly Logic II altimeter.

<https://www.youtube.com/watch?v=XkuxqYmEYrk>

Ascender Pad cam video from Jean Dry Lake H135

<https://www.youtube.com/watch?v=ulPc7u11OvQ>

I never glue my payload bays to the couplers; I use #6 screws on this size rocket to hold the tube to the coupler. I sized the amount of inside bay area so that this larger tracker would fit with the standard antenna. To load it into the payload bay I connect the battery and then wrap it in thin bubble wrap. I also cushion the bottom of the bay with cotton or other soft material and put some more thin bubble wrap at the top to keep the antenna from moving around.

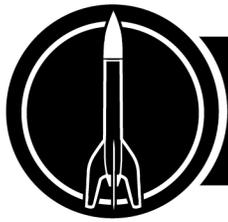
I make sure the screws are not going to short anything out and use the shortest ones I can.

Impulse Buys

On site motor dealer for your rocketry needs

Jay Calvert, Proprietor
03400 22nd Street
Otsego, MI 49078

(269) 694-9618
www.impulse-buys.com
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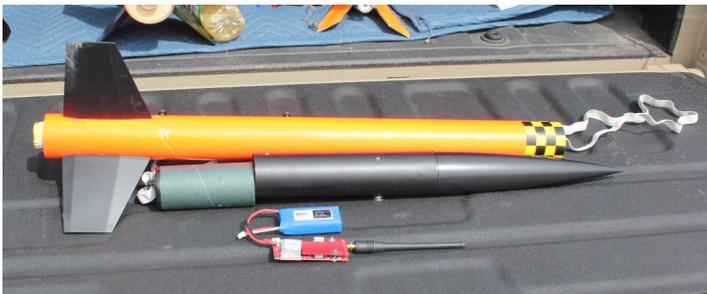
Art Upton

Here is a picture of an Estes Partizon I built similarly. The wood fins were glued with Gorilla glue to the motor tube with no external fillets. I built it so I did not glue the 3 tubes together and used masking tape to hold them in place during flight. This was so it could use a smaller box to ship to FedEx. Note the Kevlar cord also used to make a lariat loop.



Partizon Pad cam video from Jean Dry Lake I205 <https://www.youtube.com/watch?v=G23TYUsGf5E>

Here is a picture of my payload bay as I load up the Big Red Bee 2-meter APRS GPS transmitter.



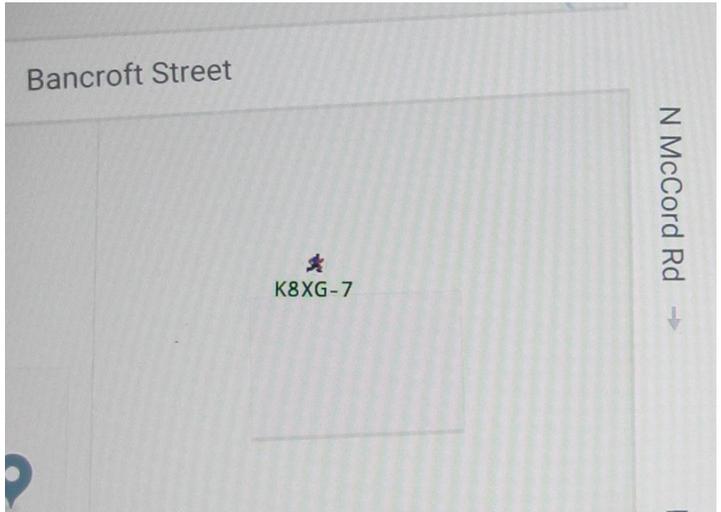
And here in this video is an example of locating the rocket in an exercise at MIS, with the Yaesu FT1DX APRS radio with built in GPS. <https://youtu.be/QiWaX1RiEIA>

You don't have to own an expensive APRS radio, here is a Baofeng UV6R radio I bought for \$19 on sale at a Hamfest, normally \$29. Attached to it with the tie is a MobidLink APRS Bluetooth TNC.



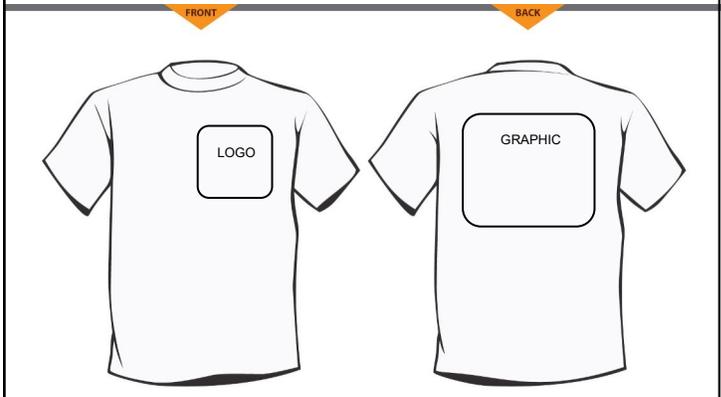
I just rubber band the Mobidlink APRS TNC to the radio.

My Tablet or Cellphone is shown here with APRS-Droid running on it to locate the rocket tracker which is currently, in this exercise, actually inside my truck. This is a Google Map with the Icon of the little man walking towards the tracker. You can change the icon in APRS to be many different ones, including rockets and balloons. In actual practice, you would walk or drive using the map on your phone to locate the rocket easy.



Shirt Logo Contest!!!

JMRC is holding a shirt logo contest. We are looking for designs that express what JMRC is all about and can be printed or embroidered on shirts. It can be a small logo for the front or large one for the back, or a combination of the two. There are really no restrictions on your ideas and imagination. Enter as often as you like. A poll will be created for the membership to vote on their favorite. Entry deadline is June 15, 2019. The winner will get a shirt with their logo in addition to a free, one year JMRC/HUVARS membership. Email Buzz if you have any questions. We're looking forward to seeing what you can do!





CrapShoot VI

Muskegon, MI

Crapshoot is the annual two-day joint launch between JMRC and MMAR held at the Muskegon launch site. In the past few years the weather has also been a crapshoot with rain, wind, heat, cold, you name it. This year was no different with weather conditions on Saturday being less than desirable. There was a stiff wind throughout the day from the wastewater treatment facility with a couple of passing showers. However, it was not the rainout that had been predicted. Sunday turned out to be a perfect day for flying. The winds were low and variable throughout the day with mostly sunny skies. The temperature was comfortably in the 70's.

Saturday

The morning started out OK in that it wasn't storming, but the wind was a miserable nuisance all day. Tom Kurecka brought his finished Altaira N-1 kit that he did a phenomenal job on. First he flew his MadCow 2.6" Honest John on a G80-6 for a nice flight that landed near the launch area though the delay ran long. Next up was the N-1 flying on an Aerotech Metalstorm H115. The boost was perfect until about 200' up when it did a little corkscrew that pointed it more to the northwest and not where Tom wanted it to go. Again, the delay ran long, but recovery was going well



Tom Kurecka and his N-1



until it hooked the power lines and proceeded to entangle itself thoroughly around the lines dashing hopes it would work itself loose. A call was made to try and retrieve it, but it will be up there a while before a possible rescue.

Buzz flew his THOY Peacock on a CTI G53 with a Jolly Logic Chute Release set for 200'. Nice flight, but it still managed to drift a fair distance downwind for a long recovery. Tony spent the day prepping his MadCow Nike Apache and griping about the wind until he decided to wait until Sunday.

Herb Crites had 4 flights on Saturday with the same rocket, the Mach Schnell SLK 54m. He burned an AT H210R Redline, a Loki H-100 Spitfire, an AT H220 Blue Thunder, and finished the day with an AT H550ST Super Thunder.

Dan Harrison sent up a relatively small rocket with Big Red Bee GPS tracker on a Loki L1400 to 15,000'! The GPS tracker showed the rocket had landed 2.67 miles to the west and led him right to it. It came down in a large group of trees and miraculously most of it came through all way to the ground. The rest was easily pulled from the tree.

Trevor put in a FAI parachute duration flight and tried an Estes Trajector-to-Ascender staged flight, but the second stage failed to fire. The model recovered fine in the tall grass.

Mike Jacobs got in a couple of flights on Loki H100 Skidmarks. Both flights were successful and recovered thanks to Trevor.

Sunday

The morning brought near perfect flying conditions and the burning of mass amounts of newton seconds. Tony Haga had three flights and they were all incredible in their own way. First, he was finally able to launch his MadCow Nike Apache. This was a multistage flight with the Nike booster flying on a CTI I242 and Jolly Chute release. The Apache sustainer flew on a CTI G33 that was ignited by a Perfect-Flite Timer and included a dual deployment ebay. Tony nailed the flight with both stages flying as planned and easily recovered. Next Tony put up "Barbie" on another "Woket" flight, this time powered by an M



Herb Crites' Mach Schnell SLK 54m

hybrid. One of the coolest flights you'll ever see is the "Woket" on a hybrid and this was one of the coolest. The onboard video is hilarious. I give props to Barbie for holding on longer than 8 seconds (half a roll of electrical tape helps). All three chutes deployed perfectly for another easy recovery. Finally, Tony launched his "Grape Shot" on a Loki K627 and again, flight and recovery



Tony Haga's Madcow Nike Apache

the record for most altimeters lost. The most impressive flight was his F Payload Altitude attempt on an AT F10. I believe Jay also had a bad break with one of his egglofter flights ending up in the pines across the road.

Mike Jacobs had two more flights, again with Loki H100 Skids. For 20-year-old builds they look fantastic with really nice air brushed paint schemes.

Dave and Sarah Glover had some great flights throughout the day. Dave tried a core vehicle with two strap-on boosters, but one booster lit way late and the asymmetrical thrust caused it to corkscrew about. Dave's "Double Trouble" also had a problem with one of the clustered F41's failing to light, but the rocket flew fine regardless. Sarah flew her Mega Mosquito and then upped her successful level 1 cert flight from earlier this month by flying her Bumblebee on an I motor for another impressive flight. At this rate Sarah will be launching her Level 2 cert flight in June.

On Sunday Herb Crites flew his SLK54m again on an AT I1299N Warp Nine, an AT I300T Blue Thunder, an AT I200W White Lightning, and finished the day with the Loki K-627LR Loki Red, said to be the most powerful 38mm consumer rocket motor in the world. This flight was Herb's personal best altitude - 6,618 feet and landed just .7 miles to the northeast thanks to the late afternoon calm.

There were plenty of other flights just as cool and impressive as the ones described here. Crapshoot, despite the iffy weather, is the one time each year that we can fly just about anything we want. The launch site has hosted the National Sport Launch and two NARAMs, the host section provides great support and service, and the rocketeers you find there are fun and friendly to hang out with. It's worth the trip out even if it's only for one day... just pick the day with good weather.

were perfect.

Another big flight for the day was Bob Dickinson's Nike Smoke on a M2550 Loki Blue. It was angled out towards the alfalfa field and flew on a huge blue plume. The nose cone was recovered separately on its own parachute and stuck the landing making for an easy recovery in the alfalfa. The booster landed safely nearby.

Conditions were also great for contest flights. Buzz Nau flew his A BG for NRC qualifying. The first flight was a Red Baron, but he figured out the problem and got over 2 minutes in dead air on his second flight. Buzz also flew his Big Blue Bird Zero on a Loki I110-8 and Jolly Logic chute release for an arrow straight flight and

nearby landing. He also got in another 3-stage flight with his Estes Farside clone



Sarah Glover's BumbleBee

using all A motors. The Sky Dart flew twice, his Centuri Quasar clone once on a B4-2, and Estes Interceptor E on a CTI F51-6.

Jay Calvert and Bob Alway also put in quite a few NRC contest flights. Steve Kristal made several altitude record attempts, but I'm afraid he was working on



Dan Harrison's Loki L1400 launch.



And where it landed



Tony Haga's Woket on an M hybrid



ROCKET SCALE DATA

METROC

Chris Timm & Buzz Nau

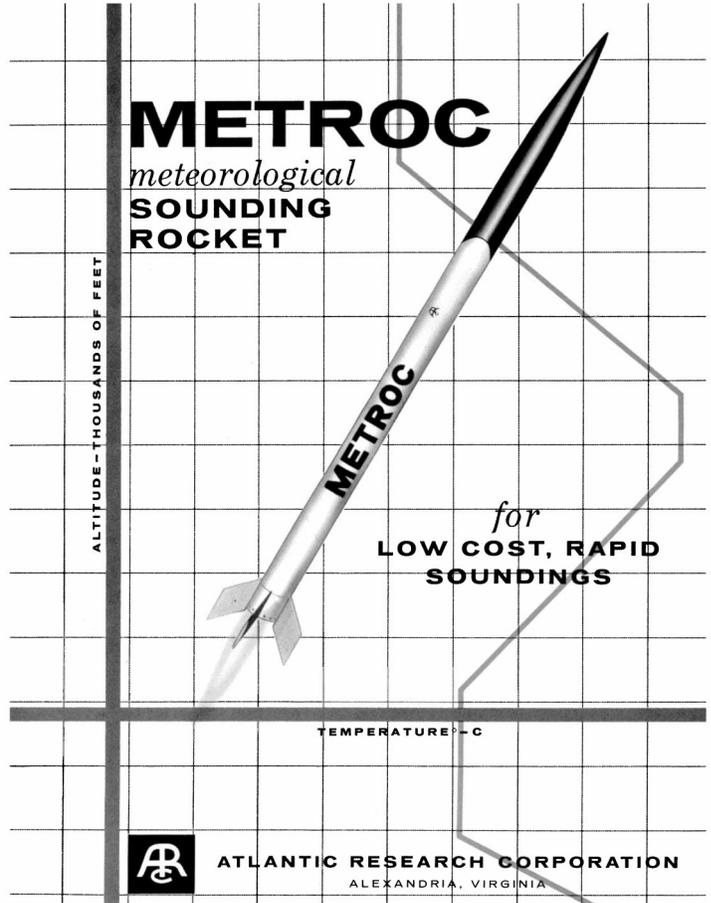
Metroc was an inexpensive meteorological rocket developed and produced by Atlantic Research Corporation. It was ARC's solution for the low end of sounding rocket requirements with the Iris sitting at the top of the requirement spectrum.



The small sounding rocket was 3 inches in diameter, 62 inches tall and weighed a mere 18 pounds. It had 4 sweptback trapezoidal fins mounted to a removable fin unit. It was propelled by an end burning *Arcite* grain in a plastic motor case that produced 130 pounds of thrust and could carry a 3-pound payload to 100,000-feet.

Metroc was designed to replace weather balloons in meteorological soundings. It could attain the target altitude in a fraction of the time required by a weather balloon and would not drift off course due to winds aloft. It was successfully test flown twelve times in 1962 from Wallops Island, Virginia.

It could be launched from its own launcher or in the Arcas breech launcher within a sabot adapter tube. The Atlantic Research developed instrument payload would descend by parachute and could measure temperature, atmospheric pressure,



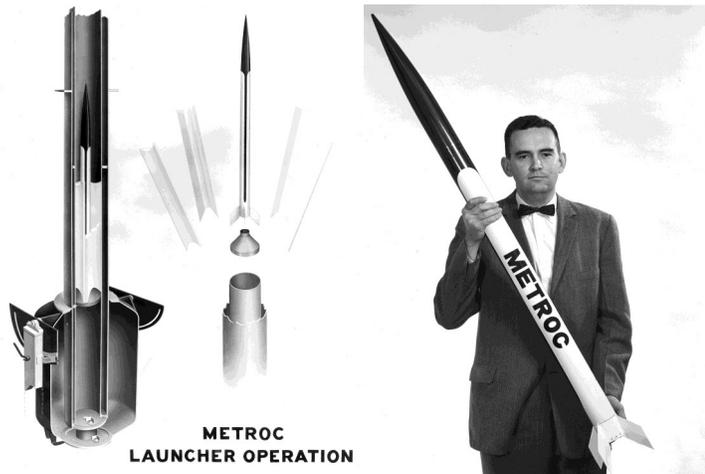
and humidity. It could also carry a bag of chaff (strips of aluminum) that could be jettisoned to measure wind speed by ground radar. There were three instrument payloads developed with the major difference between them being receiver compatibility including one version for US Navy shipboard use.

There was a two-stage version utilizing a 2.75-inch FFAR (folding fin aircraft rocket) as a booster capable of attaining 250,000 feet.

Despite the attractiveness of the Metroc's features and advantages over weather balloons it did not go into production and did not fly beyond the test program.

References:

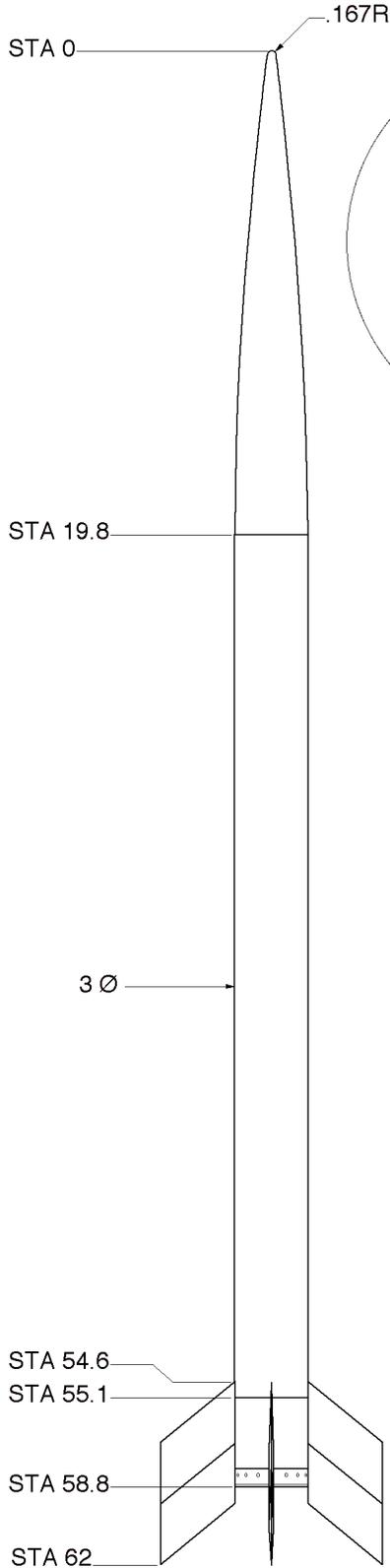
Reilly, Phillip Key, *The Rocket Scientists: Achievement in Science, Technology, and Industry at Atlantic Research Corporation*, Vantage Press New York, NY (1999) p57,58
News from Atlantic Research, Atlantic Research Corporation Alexandria, Virginia (12/28/61)
Metroc, Atlantic Research Corporation Fact Sheet Brochure
Metroc Sounding Rocket to Undergo Wallops' Tests, Aviation Week & Space Technology (1/29/62)
 Atlantic Research Corporation Drawings
 Atlantic Research Corporation Photos courtesy of Dr. Roy Houchin II



Metroc

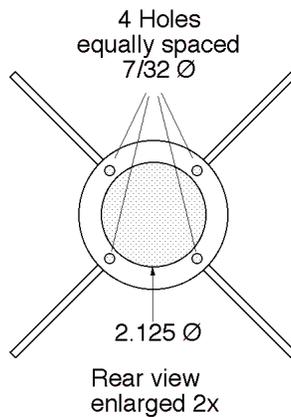
1/8 Scale
Dimension in inches
© 2019 Chris Timm

Sources:
"Metroc," Atlantic Research Corp. fact sheet brochure.
"Metroc," Atlantic Research Corporation drawings
SK4-24048, ED-05-01-37-2, SK3-24214,
Photographs and measurements of Metroc sounding rocket,
by Dr. Roy Houchin II, Air War College.
Various Atlantic Research Corporation photos.

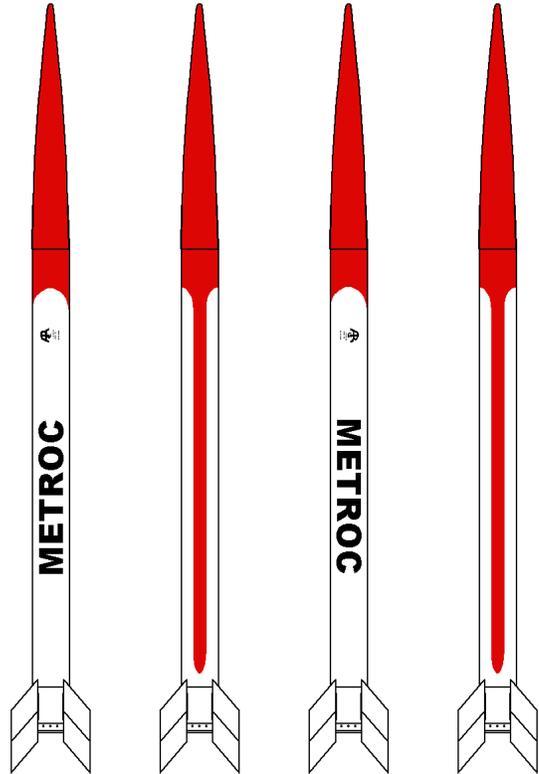


Lettering 1/4 scale

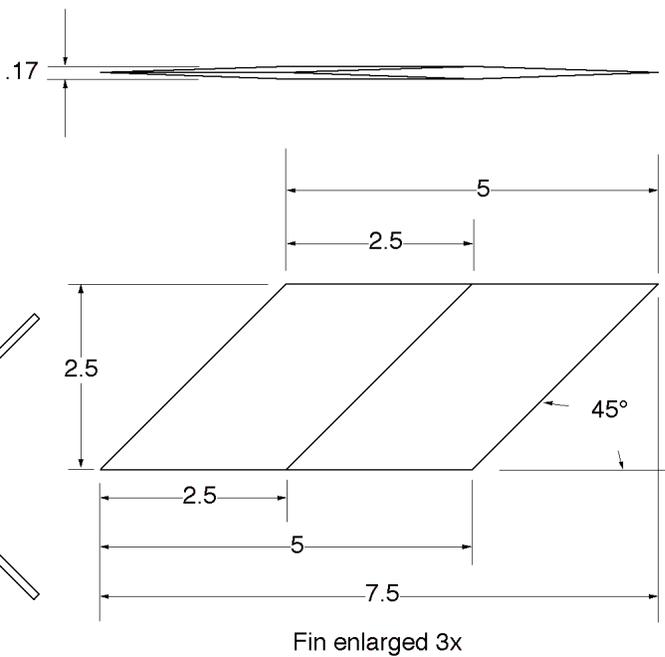
METROC



Color patterns, views 90° apart,
1/16 scale



Colors are red and black



VIEW FROM THE FLIGHT LINE

Always Changing

DALE HODGSON

One of the reasons I love this hobby so much is that it is under constant change. Things are always being improved, made more efficient, work better, etc. Sometimes an old piece of tech or an idea someone comes up with can be modified to fit a particular need. Hence, this little article about something I worked on and have actually tried out on several occasions.

I had always looked for a new and better way to attach a shock cord to a minimum diameter rocket. There just isn't any wiggle room when basically flying a motor tube with fins and a cone. How would you hook on a recovery system? Not too hard when flying dual deploy; hook a shock cord on to the end of a motor with an eyebolt at the forward closure. Simple enough; then have the chute hooked onto the cord that's in the payload section. Easy, pretty much a no-brainer.

But, what about apogee or simple motor deploy; then what? I thought about it for a while and did some searching. I came across a neat little device that Giant Leap Rocketry came up with called a Hardpoint Anchor. It is simply an aluminum tube with struts rather than a solid center. The center is a smaller threaded tube where an eyebolt is secured. Simply attach a shock cord to the eyebolt then glue it in the airframe far enough forward to accommodate the motor you want to fly. It comes in two sizes, 38 and 54mm. Very neat idea but I took it a step further.

I asked the question "what if the cord burns through or needs to be changed; how does one reach the eyebolt in a small airframe? Then it hit me; make the assembly removable; turn the cord anchor into a slider. Scott and I discussed something similar years ago. We looked at the piston recovery harness that Public Missiles uses but theirs is what I would call an "active system" where the ejection charge drives a solid piston forward while these are more "passive" meaning that the ejection charge passes through the slider and pops off the cone (or payload section) and drags the slider forward to a stop. The modification is very simple. Glue a coupler into the airframe and use it as the stop mentioned a second ago. Slide the anchor assembly in from the rear. That way it can be removed from the aft end should maintenance be required.

The only tricky part is to glue the coupler far enough forward to allow you to fly the largest motor you desire for that particular rocket. I've done this for both a 38- and 54-mm project and have flown each several times; it works great. So far so good; what about other diameters? I've done the same for a 75- and 98-mm project using Aeropack internal motor mounts (these were designed to be glued into the airframe and the motor screwed into the mount via a threaded rod in the forward closure). The Aeropacks needed to be modified though a little to be used for this purpose. First, a series of small holes needed to be drilled through the mount to



allow gas to pass if you are using motor backup (both my projects are dual deploy but I utilize motor backup whenever I can as a redundancy).

Then there is that coupler I use for the stop. Not only is it glued in but I also used small screws and tee nuts through the airframe and coupler to give added hold since the stresses at apogee separation are a bit higher since I'm a firm believer in "Miller Charges" to ensure a good booster/payload separation. Note: Miller Charges require ample shock cord lengths! I have flown both the 75 and 98 mm more than once; the assemblies work great.

Note that in all my sliders they are either aluminum (like the original Hardpoint or Aeropack) or fiberglass since I feel these would hold up the best. A paper slider would tend to bind in the airframe and cannot be cleaned if need be to remove ejection powder residues.

I've also made my own slider assemblies for a 29 and 24mm rocket; I have no doubt these will also work great.

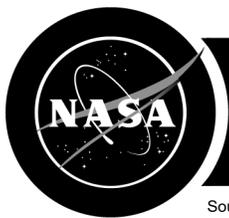
Are there any caveats to fashioning a shock cord harness this way? Yep; the biggie is that the booster airframe needs to be one piece or the slider assembly won't be removable. I propose that a stainless steel "leader" line could be hooked to the end loop of the leader if it is made long enough to almost reach the end of the airframe where it would be accessible. I haven't tried that yet but have used the stainless-steel leader in a fixed harness setup and it holds up just fine. As I am writing this it also occurs to me that this slider setup can also be used on non-minimum diameter projects; let's say a 3, or even 4-inch airframe with a 38 mm motor tube or even a cluster of them. Setup is the same as described, the slider goes in and will slide back to the motor tubes. Once the coupler stop is set in place though it won't be removable so be sure to build it sturdy and use a leader if the airframe is anything less than 4 inches.

I'm sure there are other ways to hook up a shock cord for smaller diameter rockets

(such as a "gorilla" harness that Roger designed and I have flown on numerous occasions). No slider needed here, the gorilla is high tensile strength braided wire that is rubber coated and is glued directly to the motor mount tube under the centering rings. I've had two rockets completely destroyed but the gorillas were completely intact and have been reused. But, that's another story.

See, isn't rocketry fun? If anyone would like to see the slider assemblies up close and personal; just grab me at a launch. I'm sure I will have at least one rocket there with one in place.





THIS MONTH IN AEROSPACE HISTORY

Source—NASA Archives

125 Years Ago - 1894

June 25: Hermann Oberth born, Hermannstadt, Transylvania.



75 Years Ago - 1944

June 13: First V-1's were launched from France against England. Four of eleven strike London.



in good condition. Launched from the Eastern Space Missile Center, FL (Cape Canaveral, Fla).

June 8: X-15 first glide flight, with A. Scott Crossfield at the controls, Dryden Flight Research Facility, CA.



fore THE mission." Astronauts Thomas P. Stafford; John W. Young, Jr.; and Eugene A. Cernan tested all aspects of the lunar landing mission, except the actual lunar landing.



70 Years Ago - 1949

May 3: U.S. Navy launched Martin Viking Rocket No. 1 to altitude of 51.4 miles and a speed of 2,250 miles per hour, from the White Sands Missile Range, NM.



55 Years Ago - 1964

May 15: The Atlantic Missile Range was renamed the Eastern Test Range, FL.
May 28: SA-6 launched by Saturn 1 rocket from Cape Canaveral, Fla. The first flight of an unmanned Apollo spacecraft boiler-plate.



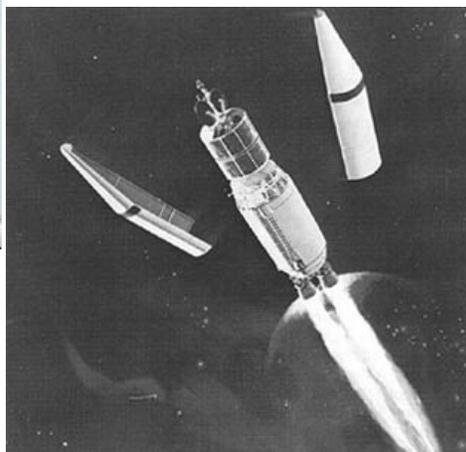
60 Years Ago - 1959

May 1: The former Beltsville Center renamed Goddard Space Flight Center in honor of Dr. Robert Hutchings Goddard, rocket pioneer who achieved first launch of a liquid-propellant rocket.



June 30: Atlas-Centaur-3 developmental flight launched from Cape Canaveral, Fla.

May 21: Intelsat III F-4 launched by Thor Delta from Cape Canaveral, Fla.
June 5: OGO 6 launched by Thor Agena from Vandenberg AFB.



May 14: The Moon was used as a relay station for intercontinental transmission. Jodrell Bank, England to Bedford, MA.

May 28: Two monkeys, "Able" and "Baker", were successfully launched atop a Jupiter rocket to an altitude of 360 miles and 1700 miles down-range. They survived



50 Years Ago - 1969

May 9: HL-10 first supersonic flight, piloted by John A. Manke, Dryden Flight Research Facility (DFRF).
May 18: Apollo 10 launched by Saturn V, SA-505 from KSC on "the mission be-



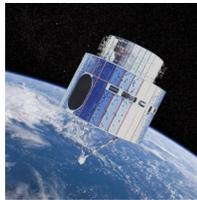
June 21: IMP-5 (Explorer 41 / IMP-G) launched on a Thor Delta rocket from Vandenberg, AFB.

June 28: Biosatellite 3 launched by Thor Delta from Cape Canaveral, Fla.



45 Years Ago - 1974

May 17: SMS-1 (Synchronous Meteorological Satellite-1) launched by Delta from Cape Canaveral, Fla. First prototype geosynchronous orbit weather satellite.



May 19: Luna 22 (lunar orbiter) launched on Proton K rocket from Baikonur.



May 30: ATS-6 (Applications Technology Satellite-6) launched by Titan III C from Cape Canaveral, Fla.

June 3: Explorer 52 (Hawkeye-1) launched by Scout from Vandenberg AFB.



June 24: Salyut-3 launched 2238 UTC by Proton K, Baikonur, USSR.



40 Years Ago - 1979

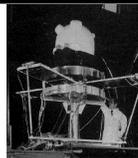
May 1: First time the complete Space Shuttle (Enterprise) configuration was assembled in the VAB & transported to Launch Complex 39A.



May 4: FLTSATCOM-2 launched by Atlas Centaur from Cape Canaveral, Fla.



June 2: Ariel-6 launched on a Scout rocket from Wallops Island.



June 6: Soyuz 34 launched on a Soyuz rocket from Baikonur. Unmanned ferry flight to Salyut-6 space station.

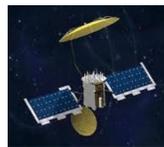


June 27: NOAA-6 launched by Atlas from Vandenberg AFB.

35 Years Ago - 1984

June 9: Intelsat 5 F9 launched from Cape Canaveral, Fla. First launch of the upgraded Atlas/Centaur (Atlas-Centaur-62) launch vehicle.

June 13: NavStar-9 launched by Atlas E from Vandenberg AFB.



30 Years Ago - 1989

May 4: STS-30 (Space Shuttle Atlantis) launched from. Crew: David M. Walker, Ronald J. Grabe, Norman E. Thagard, Mary L. Cleave, and Mark C. Lee. First U.S. planetary mission in 11 years and the first deep space probe on a Space Shuttle mission [Magellan]. It was deployed to Venus. First time a general purpose computer was switched on orbit. Returned to Edwards AFB, CA, May 8th. Mission duration: 4 days.



May 4: Magellan spacecraft launched from Shuttle Atlantis (STS-30). Rendezvoused with Venus on Aug. 10, 1990 to begin planetary mapping mission.

June 10: GPS NavStar satellite launched on Delta 2, from Cape Canaveral AF Station, FL. Spacecraft also designated USA 38.

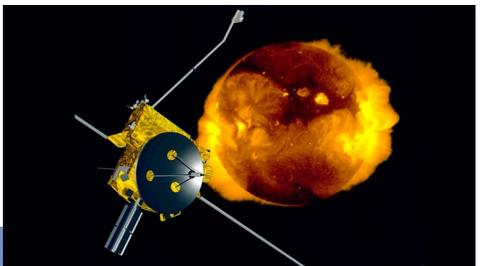
25 Years Ago - 1994

May 9: MSTI 2 (Miniature Sensor Technology Integration 2), a U.S.A. defense spacecraft, was launched from Vandenberg AFB by the last of the now discontinued Scout series.



June 17: Intelsat 702 launched on an Ariane 44LP from Kourou, French Guiana.

June 26: Ulysses became the first spacecraft to reach a polar region of the Sun when it passed over the Sun's southern polar area after a journey of almost four years.



20 Years Ago - 1999

May 18: TERRIERS (Tomographic Experiment using Radiative Recombinative Ionospheric EUV and Radio Sources) launched by a Pegasus XL rocket carried by a L-1011 cargo plane flying out of Vandenberg AFB intended to monitor the solar (not ionospheric) extreme ultraviolet (EUV) spectrum.



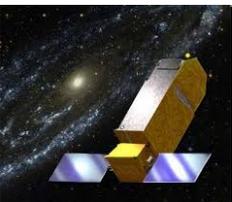
20 Years Ago - 1999- Continued

May 27: STS-96 (Space Shuttle Discovery) launched from KSC as a logistics and resupply mission (2A.1) for the International Space Station. Crew: Kent V. Rominger, Rick D. Husband, Ellen Ochoa, Tamara E. Jernigan, Daniel T. Barry, Julie Payette (Canada), and Russian cosmonaut Valery Tokarev. Julie Payette was the first Canadian to participate in an ISS assembly mission – and the first Canadian to board the International Space Station. Landed at KSC on June 6. Mission duration: 9 days, 19 hours.



June 5: Starshine was a passive reflector that was released from STS 96 by Canadian astronaut Julie Payette. It was a hollow sphere of 48 cm diameter and studded with 878 tiny mirrors which had been polished by school children in Zimbabwe, Pakistan and 16 other countries. Some 25,000 high school students around the world tracked the reflector during twilight hours.

June 20: QuikScat (QUIckSCATterometer) launched by a Titan 2 from Vandenberg AFB to measure ocean winds and directions.



June 24: FUSE (Far Ultraviolet Spectroscopic Explorer) launched by a Delta 2 rocket from Cape Canaveral to study primordial chemical

relics of the Big Bang, from which all the stars, planets and life evolved.

15 Years Ago – 2004

June 16: Intelsat 10-02 launched on a Proton M rocket from Baikonur.



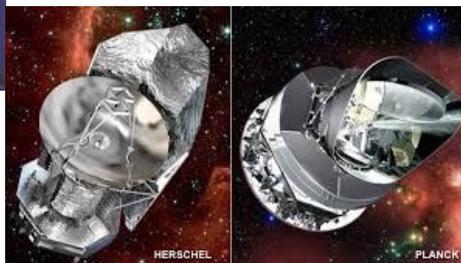
10 Years Ago - 2009

May 11: STS-125 (Space Shuttle Atlantis) launched from KSC. Crew: Michael J. Massimino, Michael T. Good, Gregory C. Johnson, Scott D. Altman, K. Megan McArthur, John M. Grunsfeld and Andrew J. Feustel. This is the fifth Hubble Space Telescope



Servicing Mission. Atlantis' astronauts repaired and upgraded the Hubble Space Telescope, conducting five spacewalks during their mission to extend the life of the orbiting observatory. Landed at Edwards Air Force Base, Calif. on May 24. Mission duration: 12 days, 21 hours.

May 13: Planck, and Herschel, two ESA astronomy satellites, were launched by an Ariane 5 rocket from Kourou. Planck's mission is to measure minute variations in the cosmic microwave background radiation. Herschel operates from an orbital position around the second Lagrangian point and makes infrared observations of stars, galaxies and star-forming regions using a 3.5 m-diameter mirror, the largest yet carried into space.



May 27: Soyuz-TMA 15 launched from Baikonur cosmodrome by a Soyuz-FG rocket. It carried a Russian cosmonaut (Roman Romanenko), an ESA astronaut (Frank De Winne) and a Canadian Space Agency astronaut (Robert Thirsk) to the



International Space Station (ISS). This mission will increase the number of crew members of the ISS to six.

May 31: The Space Shuttle program transferred Launch Pad 39B, originally used to launch Apollo lunar missions, to the Constellation Program.

June 18: LCROSS, the Lunar Crater Observation and Sensing Satellite launched with LRO, the Lunar Reconnaissance Orbiter by an Atlas 5 rocket from Cape Canaveral. LCROSS consists of a shepherding satellite and the attached spent Centaur upper stage. The mission objective is to send the Centaur upper stage into a lunar crater near the south pole of the Moon and observe the impact to look for signs of water in the debris plume.



5 Years Ago – 2014

May 28: Soyuz TMA-13M (Expedition 40). Launched from Tyuratam (Baikonur Cosmodrome), Kazakhstan to the ISS. Delivered the ISS-Rapid Scatterometer (ISSRapidScat) to monitor ocean winds, which reused leftover hardware from the QuikScat scatterometer and demonstrated a unique way to replace an instrument aboard an aging satellite. The Vegetable Production System (Veggie) produced the first salad greens, which may be used to further human habitability in space. Crew members: Reid Wiseman (NASA), Maxim Suraev (Russian Federal Space Agency), Alexander Gerst (European Space Agency).





COMPETITION CORNER

B Payload Altitude

Buzz Nau (T-34 Escape Velocity)

In the September - October 2018 issue I wrote about our A payload altitude entry for NARAM 60. This year the National Rocket Competition (NRC) event is B Payload. As mentioned earlier, the goal in Payload Altitude is to loft a standard NAR payload and altimeter to the highest altitude, this time using B impulse. This can be accomplished with a single B motor or two staged A motors.

The approach is not as straightforward as you might think. A model based on a 13mm airframe and staged A motors would be lighter and suffer less surface drag than an 18mm based airframe, but 13mm A motors have slightly less impulse than 18mm A's and even more of a deficit against the new Quest B4 composite motor.

In addition to higher surface drag, another negative to using the heavier Quest B4 is the lack of a reliable method for piston launching composites. That advantage for black powder motors alone compensates for the impulse shortfall.

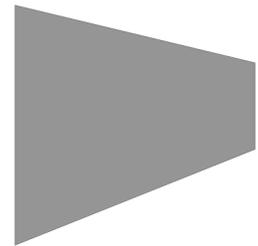
Rocksim analysis appears to confirm this with a staged 13mm A motor design easily outperforming 18mm A-to-A staged or single stage 18mm B designs.

Interestingly the altitude gap between the two 18mm designs is rather small, 50 meters (probably less with a piston) compared to 100 meters between the 18mm B model and 150 meters against the staged 13mm A motor design.

Construction of this model is the same as last year's A Payloader with the exception of adding a short booster. The booster uses the same fins as the sustainer.

We've flown this model once for NRC qualifying with a recorded altitude of 227 meters. The rocket did weathercock, but not drastically. With a straight up boost it should hit closer to the 300 meter mark.

Is this a first place design? Probably not, but should be in the top five and once you're in the top five anything can happen.

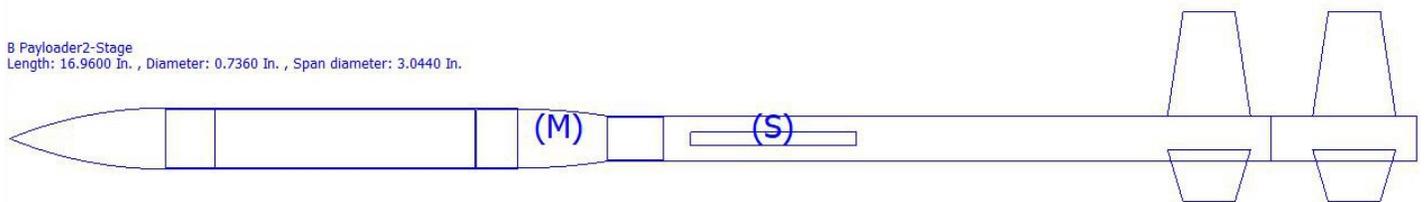


Full Size Fin Template

Parts List

- 1 - Apogee VFNC-18 Nose Cone
- 1 - 17mm NAR Payload
- 2 - Wraps of vellum paper around Payload
- 1 - Apogee 13mm to 18mm VF Transition
- 1 - 13mm Body Tube (8") Sustainer
- 1 - 13mm Body Tube (1.75") Booster
- 6 - Fins from 1/16" balsa
- 1 - 6-8" Parachute
- 1 - MicroPeak or Firefly Altimeter
- 1 - 1" JT-20 Tube Joiner (if using FireFly)

B Payloader2-Stage
Length: 16.9600 In. , Diameter: 0.7360 In. , Span diameter: 3.0440 In.



LAUNCH WINDOWS

Launch dates from Spaceflightnow.com

Listing of upcoming orbital missions from spaceports around the globe

June 5

Long March 11 Jilin 1

Launch time: TBD

Launch site: Yellow Sea

A Chinese Long March 11 rocket will launch two Jilin 1 Earth-imaging satellites for Chang Guang Satellite Technology Co. Ltd. The solid-fueled Long March 11 rocket will take off from an ocean platform in the Yellow Sea on China's first sea-based orbital launch attempt.

June

Electron Make it Rain

Launch window: TBD

Launch site: Launch Complex 1, Mahia Peninsula, New Zealand

A Rocket Lab Electron rocket will launch on its seventh flight from a facility on the Mahia Peninsula on New Zealand's North Island. The Electron rocket and its Curie upper stage will place multiple small satellites into orbit on a rideshare mission arranged by Spaceflight. The payloads include the BlackSky Global 4 commercial Earth observation satellite, two Prometheus nanosatellites for U.S. Special Operations Command, and the ACRUX 1 technology demonstration CubeSat for Melbourne Space Program in Australia. The mission is nicknamed Make it Rain due to the wet weather common in Seattle, the location of Spaceflight headquarters.

2nd Quarter

Pegasus XL ICON

Launch window: TBD

Launch site: L-1011, Skid Strip, Cape Canaveral Air Force Station, Florida

An air-launched Northrop Grumman Pegasus XL rocket will deploy NASA Ionospheric Connection Explorer (ICON) satellite into orbit. ICON will study the ionosphere, a region of Earth's upper atmosphere where terrestrial weather meets space weather. Disturbances in the ionosphere triggered by solar storms or weather activity in the lower atmosphere can cause disturbances in GPS navigation and radio transmissions. The mission's staging point was changed from Kwajalein Atoll to Cape Canaveral Air Force Station in mid-2018. Delayed from June 15, Nov. 14, and Dec. 8, 2017. Delayed from June 14, Sept. 24, Oct. 6, Oct. 26 and Nov. 3. Scrubbed on Nov. 7. Delayed from 1st Quarter 2019.

TBD

LauncherOne Inaugural Flight

Launch window: TBD

Launch site: Cosmic Girl (Boeing 747), Mojave Air and Space Port, California

A Virgin Orbit LauncherOne rocket will make its first orbital test flight after dropping from a modified Boeing 747 carrier aircraft over the Pacific Ocean off the coast of California.

June 11

Falcon 9 Radarsat Constellation Mission

Launch time: TBD

Launch site: SLC-4E, Vandenberg Air Force Base, California

A SpaceX Falcon 9 rocket will launch the Radarsat Constellation Mission for the Canadian Space Agency and MDA. Consisting of three radar Earth observation spacecraft launching on a single rocket, the Radarsat Constellation Mission is the next in a series of Canadian Radarsat satellites supporting all-weather maritime surveillance, disaster management and ecosystem monitoring for the Canadian government and international users. Delayed from November Feb. 18, March and May 16.

June

Rocket Gonets M

Launch time: TBD

Launch site: Plesetsk Cosmodrome, Russia

A Russian government Rocket vehicle with a Breeze KM upper stage will launch three Gonets M communications satellites.

June 20

Ariane 5 DirecTV 16 & Eutelsat 7C

Launch time: 2141 GMT (5:41 p.m. EDT)

Launch site: ELA-3, Kourou, French Guiana

Arianespace will use an Ariane 5 ECA rocket, designated VA248, to launch the DirecTV 16 and Eutelsat 7C communications satellites. Built by Airbus Defense and Space, the DirecTV 16, or T16, spacecraft will provide direct-to-home television broadcasting services over the United States for DirecTV, a subsidiary of AT&T. The Eutelsat 7C satellite, built by SSL, will provide video and television broadcast services over Africa, Europe, the Middle East and Turkey. Delayed from May 10, June 5 and June 12.

June 21

Proton Spektr-RG

Launch time: 1344 GMT (9:44 a.m. EDT)

Launch site: Baikonur Cosmodrome, Kazakhstan

A Russian government Proton rocket and Block DM upper stage will launch the Spektr-RG X-ray observatory. Spektr-RG is a joint project between Roscosmos and DLR, the Russian and German space

agencies. The mission will conduct an all-sky X-ray survey, observing galaxies and large-scale galactic clusters to help astronomers examine the role of dark energy and dark matter in the evolution of the universe. Delayed from April.

June 22

Falcon Heavy STP-2

Launch window: TBD

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

A SpaceX Falcon Heavy rocket will launch the U.S. Air Force's Space Test Program-2 mission with a cluster of military and scientific research satellites. The heavy-lift rocket is formed of three Falcon 9 rocket cores strapped together with 27 Merlin 1D engines firing at liftoff. Delayed from October 2016, March 2017 and September 2017. Delayed from April 30, June 13, Oct. 30 and Nov. 30. Delayed from April.

Mid-2019

PSLV Cartosat 3

Launch time: TBD

Launch site: Satish Dhawan Space Center, Sriharikota, India

India's Polar Satellite Launch Vehicle (PSLV), designated PSLV-C47, will launch the first Cartosat 3-series Earth-imaging and mapping satellite for the Indian Space Research Organization.

June 27

Atlas 5 AEHF 5

Launch window: 1000-1200 GMT (6:00-8:00 a.m. EDT)

Launch site: SLC-41, Cape Canaveral Air Force Station, Florida

A United Launch Alliance Atlas 5 rocket will launch the fifth Advanced Extremely High Frequency (AEHF) satellite. Built by Lockheed Martin, this U.S. military spacecraft will provide highly-secure communications. The rocket will fly in the 551 vehicle configuration with a five-meter fairing, five solid rocket boosters and a single-engine Centaur upper stage. Moved forward from July.

June

Soyuz Arktika-M 1

Launch time: TBD

Launch site: Baikonur Cosmodrome, Kazakhstan

A Russian government Soyuz rocket will launch with the Russian Arktika-M 1 remote sensing and communications satellite. The Arktika-M 1 satellite will provide weather monitoring and communications services over the Arctic region from a highly elliptical orbit.

LAUNCH WINDOWS

Launch dates from Spaceflightnow.com

Listing of upcoming orbital missions from spaceports around the globe

July

Falcon 9 Amos 17

Launch window: TBD

Launch site: Cape Canaveral, Florida

A SpaceX Falcon 9 rocket will launch the Amos 17 communications satellite. Built by Boeing and owned by Spacecom Ltd. of Israel, Amos 17 will provide high-throughput broadband connectivity and other communications services over Africa, the Middle East and Europe. Delayed from May 27 and June.

July

Vega Falcon Eye 1

Launch time: TBD

Launch site: ZLV, Kourou, French Guiana

An Arianespace Vega rocket, designated VV15, will launch with the Falcon Eye 1 high-resolution Earth-imaging satellite for the United Arab Emirates. Built by Airbus Defense and Space with an optical imaging payload from Thales Alenia Space, Falcon Eye 1 is the first of two surveillance satellites ordered by the UAE's military. Delayed from June.

July

Long March 5 Shijian 20

Launch time: TBD

Launch site: Wenchang, China

A Chinese Long March 5 rocket will launch the Shijian 20 communications satellite. Shijian 20 is the first spacecraft based on the new DFH-5 communications satellite platform, a heavier, higher-power next-generation design, replacing the Shijian 18 satellite lost on a launch failure in 2017. Delayed from November 2018. Delayed from January.

July 5

Soyuz Meteor M2-2

Launch time: TBD

Launch site: Vostochny Cosmodrome, Russia

A Russian government Soyuz rocket will launch with the Russian Meteor M2-2 polar-orbiting weather satellite, and more than 40 small satellites on a rideshare flight arranged by GK Launch Services. Delayed from Dec. 6, March and June 27.

July 8

Falcon 9 SpaceX CRS 18

Launch window: TBD

Launch site: Cape Canaveral, Florida

A SpaceX Falcon 9 rocket will launch the 20th Dragon spacecraft mission on its 18th operational cargo delivery flight to the In-

ternational Space Station. The flight is being conducted under the Commercial Resupply Services contract with NASA. Delayed from May 7.

July 9

GSLV Mk.3 Chandrayaan 2

Launch window: TBD

Launch site: Satish Dhawan Space Center, Sriharikota, India

India's Geosynchronous Satellite Launch Vehicle Mk. 3 (GSLV Mk.3) will launch the Chandrayaan 2 mission, India's second mission to the moon. Chandrayaan 2 will consist of an orbiter, the Vikram lander and rover launched together into a high Earth orbit. The orbiter is designed to use on-board propulsion to reach the moon, then release the lander and rover. Chandrayaan 2 was originally slated to launch on a GSLV Mk.2 vehicle, but Indian officials decided to switch to a larger GSLV Mk.3 vehicle in 2018. Delayed from March, April and October 2018. Delayed from Jan. 3, Jan. 30, February, March and April.

July 16

Proton Blagovest No. 14L

Launch time: TBD

Launch site: Baikonur Cosmodrome, Kazakhstan

A Russian government Proton rocket and Breeze M upper stage will launch the Blagovest No. 14L communications satellite to cover Russian territory and provide high-speed Internet, television and radio broadcast, and voice and video conferencing services for Russian domestic and military users. Delayed from April, May 17 and May 23.

July 20

Soyuz ISS 59S

Launch time: 1625 GMT (12:25 p.m. EDT)

Launch site: Baikonur Cosmodrome, Kazakhstan

A Russian government Soyuz rocket will launch the crewed Soyuz MS-13 spacecraft to the International Space Station with members of the next Expedition crew. The capsule will remain at the station for about six months, providing an escape pod for the residents. Delayed from July 5.

July 24

Ariane 5 Intelsat 39 & EDRS-C

Launch time: TBD

Launch site: ELA-3, Kourou, French Guiana

Arianespace will use an Ariane 5 ECA rocket, designated VA249, to launch the

Intelsat 39 and EDRS-C communications satellites. Built by SSL, the Intelsat 39 satellite will replace Intelsat 902 and provide broadband networking and video distribution services in Africa, Europe, the Middle East and Asia, plus broadband connectivity for mobile users in the Indian Ocean region. The EDRS-C satellite, built by OHB System AG, will be the second node in the European Data Relay System, a network developed by the European Space Agency and Airbus Defense and Space providing high-speed laser communications links between low-orbiting satellites and ground stations. EDRS-C also carries a hosted steerable Ka-band communications payload named Hylas 3 for Avanti Communications. Delayed from June.

July 25

Delta 4 GPS 3 SV02

Launch window: TBD

Launch site: SLC-37B, Cape Canaveral Air Force Station, Florida

A United Launch Alliance Delta 4 rocket will launch the U.S. Air Force's second third-generation navigation satellite for the Global Positioning System. The satellite is built by Lockheed Martin. The Air Force previously planned to launch the third GPS 3-series satellite on this mission. The rocket will fly in the Medium+ (4,2) configuration with two solid rocket boosters. Delayed from Nov. 1, Dec. 13 and April 4.

July 25

Falcon 9 Crew Dragon Demo 2

Launch time: TBD

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

A SpaceX Falcon 9 rocket will launch a Crew Dragon spacecraft on its first test flight with astronauts on-board to the International Space Station under the auspices of NASA's commercial crew program. NASA astronauts Doug Hurley and Bob Behnken will fly on the Demo-2 mission. The Crew Dragon will return to a splash-down at sea. Delayed from June.

July 31

Soyuz Progress 73P

Launch time: TBD

Launch site: Baikonur Cosmodrome, Kazakhstan

A Russian government Soyuz rocket will launch the 73rd Progress cargo delivery ship to the International Space Station. Delayed from June 5.



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



CURRENT EVENTS IN SPACE EXPLORATION

SPACEX

April 12, 2019

AEABSAT-6A MISSION

On Thursday, April 11 at 6:35 p.m. EDT, Falcon Heavy launched the Arabsat-6A satellite from Launch Complex 39A (LC-39A) at NASA's Kennedy Space Center in Florida. The satellite was deployed approximately 34 minutes after liftoff.

Following booster separation, Falcon Heavy's two side boosters landed at SpaceX's Landing Zones 1 and 2 (LZ-1 and LZ-2) at Cape Canaveral Air Force Station in Florida. Falcon Heavy's center core landed on the "Of Course I Still Love You" droneship, which was stationed in the Atlantic Ocean. You can watch a replay of the launch webcast below and find out more about the mission in our [press kit](#).



April 20, 2019

CREW DRAGON TEST CAPSULE EXPLOSION

A SpaceX spokesperson reported, "Earlier today, SpaceX conducted a series of engine tests on a Crew Dragon test vehicle on our test stand at Landing Zone 1 in Cape Canaveral, Florida. The initial tests completed successfully but the final test resulted in an anomaly on the test stand. Ensuring that our systems meet rigorous safety standards and detecting anomalies like this prior to flight are the main reasons why we test. Our teams are investigating and working closely with our NASA partners."

NASA Administrator Jim Bridenstine also [released a statement](#):

"The NASA and SpaceX teams are assessing the anomaly that occurred today during a part of the Dragon Super Draco Static Fire Test at SpaceX Landing Zone 1 in Florida. This is why we test. We will learn, make the necessary adjustments and safely move forward with our Commercial Crew Program."

The Crew Dragon test vehicle anomaly occurred on the same pad used for Falcon 9 booster recoveries. Contamination from the explosion prevented its use for the CRS-17 Falcon 9 booster recovery. That Falcon 9 booster was recovered at sea successfully.

May 6, 2019

DRAGON RESUPPLY MISSION (CRS-17)

On Saturday, May 4, SpaceX launched its seventeenth Commercial Resupply Services mission (CRS-17) at 2:48 a.m. EDT, or 6:48 UTC, from Space Launch Complex 40 (SLC-40) at Cape Canaveral Air Force Station, Florida. Dragon separated from Falcon 9's second stage about 9 minutes after liftoff.

The Dragon spacecraft supporting the CRS-17 mission previously supported the CRS-12 mission in August 2017. Following stage separation, SpaceX landed Falcon 9's first stage on the Of Course I Still Love You droneship, which was stationed in the Atlantic Ocean. You can watch a replay of the launch webcast below and find out more about the mission in our [press kit](#).



May 24, 2019

STARLINK MISSION

On Thursday, May 23 at 10:30 p.m. EDT SpaceX launched 60 Starlink satellites from Space Launch Complex 40 (SLC-40) at Cape Canaveral Air Force Station, Florida. SpaceX's Starlink is a next-generation satellite network capable of connecting the globe, especially reaching those who are not yet connected, with reliable and affordable broadband internet services.

Falcon 9's first stage for this mission previously supported the Telstar 18 VANTAGE mission in September 2018 and the Iridium-8 mission in January 2019. Following stage separation, SpaceX landed Falcon 9's first stage on the "Of Course I Still Love You" droneship, which was stationed in the Atlantic Ocean. Approximately one hour and two minutes after liftoff, the Starlink satellites were deployed at an altitude of 440km. They then used onboard propulsion to reach an operational altitude of 550km. You can watch a replay of the launch webcast below and find out more about the mission in our [press kit](#).





CURRENT EVENTS IN SPACE EXPLORATION



NASA NEWS

April 17, 2019
RELEASE 19-031

Northrop Grumman Heads to Space Station with New NASA Science, Cargo

Northrop Grumman's Cygnus spacecraft is on its way to the [International Space Station](#) with about 7,600 pounds of [science investigations](#) and cargo after launching at 4:46 p.m. EDT Wednesday from NASA's Wallops Flight Facility in Virginia.

The spacecraft launched on an Antares 230 Rocket from the Virginia Mid-Atlantic Regional Spaceport's Pad 0A at Wallops and is scheduled to arrive at the orbiting laboratory around 5:30 a.m. Friday, April 19. Coverage of the spacecraft's approach and arrival will begin at 4 a.m. on NASA Television and the agency's [web-site](#).

Expedition 59 astronauts [Anne McClain](#) of NASA and David Saint-Jacques of the Canadian Space Agency (CSA) will use the space station's robotic arm to capture Cygnus, while NASA's [Nick Hague](#) monitors telemetry. The spacecraft will stay at the space station until July.

Read More at <https://www.nasa.gov/press-release/northrop-grumman-heads-to-space-station-with-new-nasa-science-cargo>



April 18, 2019

Hubble Celebrates 29th Anniversary with a Colorful Look at the Southern Crab Nebula

In celebration of the 29th anniversary of the launch of NASA's Hubble Space Telescope, astronomers captured this festive, colorful look at the tentacled Southern Crab Nebula.

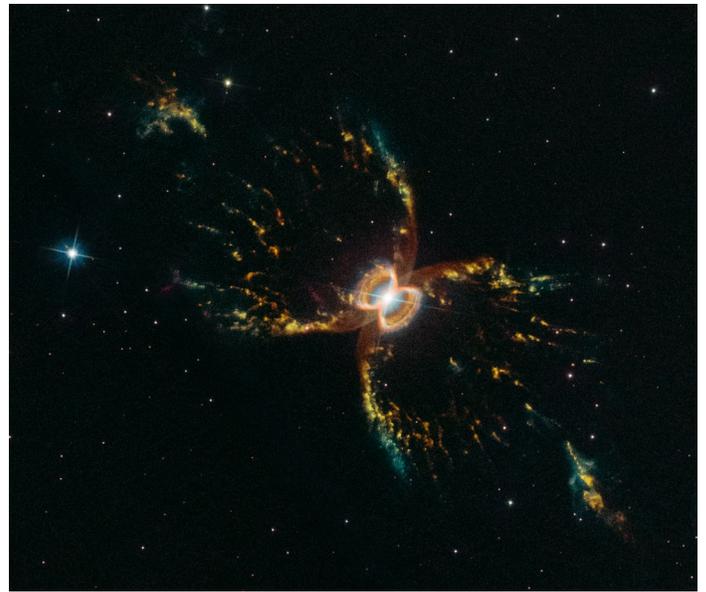
The nebula, officially known as Hen 2-104, is located several thousand light-years from Earth in the southern hemisphere constellation of Centaurus. It appears to have two nested hourglass-shaped structures that were sculpted by a whirling pair of stars in

a binary system. The duo consists of an aging red giant star and a burned-out star, a white dwarf. The red giant is shedding its outer layers. Some of this ejected material is attracted by the gravity of the companion white dwarf.

The result is that both stars are embedded in a flat disk of gas stretching between them. This belt of material constricts the outflow of gas so that it only speeds away above and below the disk. The result is an hourglass-shaped nebula.

Read more at

<https://www.nasa.gov/image-feature/goddard/2019/hubble-celebrates-29th-anniversary-with-a-colorful-look-at-the-southern-crab-nebula>

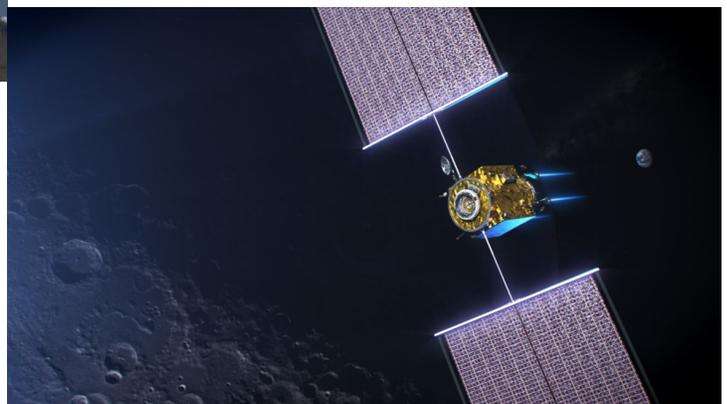


May 22, 2019

NASA Administrator Makes Artemis Moon Program Announcement

Link to NASA's strategic plan for Lunar Exploration,

https://www.nasa.gov/sites/default/files/atoms/files/america_to_the_moon_2024_artemis_20190523.pdf



Christine Scharrer's Mystic



More Photos From the April Launch



Dan Harrison's Darkstar

Mark Chrumka's X-30 Space Plane



Jay Calvert's AIM-54 Phoenix

More Photos From the May Launch



Sarah Glover's Mega Mosquito

Buzz Nau's Interceptor clone



Peter Alway's No 3 V-2

More Photos From CrapShoot VI



Mike Jacob's Loki Power



Bob Dickinson's Nike Smoke



Dave Glover's Double Trouble



Buzz Nau's Sky Dart



Tony, Scott, Dan, and Mike take Barbie and the Woket out for a ride

OUR MEMBERS IN THE FIELD



Dan Harrison at CrapShoot VI



Eldred Pickett preps some of his 20 flights for the day



Chris Palmer and his lampshade trophy



Christine Scharrer and her Fliskits Mystic



Sarah Glover and her Level 1 PML BumbleBee



Rick Arden and his Level 1 Madcow Black Brant II