

# TOTAL IMPULSE



JACKSON MODEL ROCKET CLUB

TOTAL IMPULSE VOLUME 23, No. 2

JMRC  
HUVARS

HURON VALLEY ROCKET SOCIETY

MARCH - APRIL 2023



**APRIL SPORT LAUNCH**  
**3D PRINTED CAMROC CARRIER**  
**SPACE SHUTTLE STS-1 ANNIVERSARY**  
**THUNDERSTRUCK 2023**

**CLUB OFFICERS**

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**Vice President:** Roger Sadowsky  
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**Secretary:** Buzz Nau  
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**Board of Director:** Al de la Iglesia  
**Board of Director:** Dale Hodgson  
**Board of Director:** Herb Crites  
**Board of Director:** Fred Ziegler  
**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](mailto: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 Tony Haga  
 711 Wildwood Rd  
 Rochester Hills, MI 48309

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

**COMM CHANNELS**

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

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

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

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

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

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- Concept \$285            Ground Pounder \$345
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Hello all and welcome to the March April 2023 issue of *Total Impulse*. This issue has a fine number of member contributed articles.

Tony Haga made the short trip to Pence Indiana for *Thunderstruck 2023* which is the same field for NSL East later this year. It sounds like a great field for high power and I hope many of you are able to make the short trip.

Mark Chrumka contributed an article about his 3-D printed Estes Camroc that uses a 808 Keyfob camera. It's a perfect example of bringing back a classic kit and payload using modern technology and techniques.

In Dale Hodgson's column, *A View From the Flight Line*, he explores taking some of the latest kits from Estes with quick and easy ways to enhance them for next level motors that they weren't designed for.

I already have a great article from Herb Crites for the next issue on creating and use of squib charges for dual deployment.

Be sure to check the Club News out as there are new details and dates for the fun contests that will be flown this year.

I apologize for no scale article in this issue. They take more time to write and I'm wrapping up my last couple of months of employment before retirement. Thanks as always for reading!

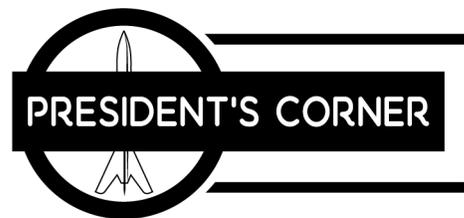
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**Launch/Event Calendar - 2023**

- January 27-29 vNARCON 2023 (Virtual Event)
- April 8 (Horning1)
- May 13 (Horning 1) *Tentative*
- June 10/11 *Crapshoot IX* (Muskegon)
- June *Pending* (Horning)
- WSMC July 1 - 8 (Austin, TX)
- LDRS 41 - July 6 - 9 (Kenosha, WI)
- NARAM 64 - July 29 - Aug 1 (Lordsburg, NM)

**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.



Another flying season is officially underway and the BOD is cranking away behind the scenes to make sure the logistics and business aspects are accounted for to keep the ship upright. This includes all of the non-rocket related activities such as spending funds to clean out the portapotty post launch... definitely not the same procedure of cleaning motor cases an repacking your parachutes so I think it is wise to hire professionals for situations such as this :-).

We as a club have an unusual business model where we don't charge launch fees for current members in an effort to increase attendance and the occasional random flight. I think the model is successful but it definitely needs to be supplemented with other fund raising activities to cover our annual costs. The last couple years have shown a decline in the bank account but I also think it is fair to say the last couple of years were not economically viable for amateur rocketry. Now that we are trending upwards again we are looking for ways to pad our financial stability. We will hopefully bring back our end of the year party that generates a lot of money as well as being a fun time had by all. The party will be several months away so an effort to bridge the gap until our next influx in capital we are looking to bring back other FUNd raising activities that hopefully people enjoy as well as trend our bank account in the right direction. Anything we can do to keep our Treasurer from pulling out the "Verboten" stamp is a win win for all .

I hope we get to see everyone out at the field often and everyone gets a chance to participate in some/all of our events in the works!

**About Total Impulse**

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

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

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

**On the Cover:**

(Front) A view of the Horning 1 launch site courtesy of Herb Crites' Mach Schnell at the April launch. (Back) Mark Chrumka is our member on the cover of the November / December issue of *Sport Rocketry*.



# APRIL SPORT & NRC LAUNCH

JMRC and HUVARS kicked off the 2023 season with our first launch on 8 April from the Horning 1 field. Yeah, it was a little cold and yeah, it was a little breezy, and of course, the only tall tree around collected a sacrifice. Regardless, it was an otherwise successful start to a new launch season. Fourteen flyers put in a total of 56 flights and we had one successful Level 2 certification attempt.

## Sport Flights

Coming in with the most flights of the day was Mark Chrumka with 10. There were several 3D printed models in his tally including the Camroc Carrier (with nose-mounted camera), a staged Cox Nike Zeus, and nicely finished scale Aries. Unfortunately, the Aries ended up as the tree sacrifice, but the other two flew nicely. Mark also flew his Estes SpaceShip One, Hawks Hobbies Super Sprite, and his scale SCUD which suffered a rather vicious cato on a G78 Mohave Green.



Mark Chrumka's 3D printed Aries before and after

Next, with a total of 8 flights was Al de la Iglesia. He flew a mix of new kits like the Super Alpha on B4-4 and classic kits including the Nova Payloader on a B6-4 and National Space Plane on a C6-5. The latter flirted with the big tree, but a timely thermal lifted it clear.

Buzz Nau followed with 7 launches including several up-scales. These were his Argus II (Estes DOM upscale) flying on an E30-4, Cherokee G upscale on an F36-6, and Maxi Scram-Jet on an F26-6. He also flew a Sky Dart on a B6-2 which landed so far downrange that he put away thoughts of more glider flights.

Settled in close to the flight line were Michael O'Neil and the kids who got in 5 flights. With the stiff breeze, Michael

Al de la Iglesia with his Aerotech Initiator

kept things low flying mainly A8 motors in his Apprentice, Cyclone, and Indicator. Michael's kids have a great time at the launches despite the weather and love hearing how everyone's flights went when they walk by.

Also with 5 flights was Herb Crites and two versions of his Mach Schnell's, the SLK 54m and SLK75m. Herb favors the hard-hitting motors. The SLK75m flew with an Aerotech I599N Warp 9 for its one flight. An Aerotech H550 Super Thunder and H220 Blue Thunder lofted the SLK34m on two of its flights.

Dale Hodgson continued testing Scott's 3D-printed high-power rockets by flying his Alien 1 on a Loki G80 for another



Michael O'Neil's Indicator and Cyclone

-er successful test. Dale's other two flights were his Bigger Bertha on an E20 and his 4" diameter Big Bertha on a Loki I430.



Dale Hodgson with his Alien 3D printed by Scott Miller

Our one certification attempt was successfully flown by Michael Lewandowski using a Loki J326 Red in a LOC EZI-65. Michael's EZI-65 used an Eggtimer Quantum altimeter and custom line cutter for dual deployment. Congratulations Michael! He also put in two other flights including an Estes Star Orbiter on an F-15-8.



Michael Lewandowski and his Level 2 Cert EZI-65

Four flyers put in 2 flights each. Tony Haga test flew a Big Bertha for the upcoming Big Bertha contest and it, uh needs a little more work. He also had a great flight with his Small Endeavor on an H118. Speaking of Big Bertha's, Michael Wurn flew his twice. This first flight had a recovery failure but didn't suffer any damage. The second flight was perfect.

In last month's issue, Fred Ziegler wrote an article on up-scaling kits. One of his two flights was a great example from that article, his 220 Swift upscale had a perfect flight



Tony Haga and his Small Endeavour

on an H123-7. Jay Calvert put in two flights with his US Air Force scale-like rocket. One flight used an F52-8 and the other went up on a G75-9.

Our last sport flight was Chris Timm's scale-like Navaho on an E12-4.

**Competition Flights**

Steve Kristal and Andy Tomasch put in the only competition flight, but boy did Steve have a good day, breaking two national records.... and he only put up three official flights! In A Payload Steve hit 188 meters, a record, and his A Streamer caught a boomer for 600 seconds. He also got a respectable 576 seconds on one 1/4A parachute duration flight. Andy also flew 1/4A PD getting 230 seconds from two flights. His two A SD flights totaled 142 seconds. Steve also flew a couple of FAI S1 test flights.

Early Spring launches are so hit-and-miss with the weather. The conditions could have easily been colder and windier. We've had several snow days since the April launch, so we certainly can't complain about a little wind and cold. We must be flexible for the May launch. The alfalfa is already too tall to allow us on the field, so we're in a holding pattern until the first cut. We will post news on the launch date as soon as we have information to pass on.



Steve Kristal's PD model off to the wild blue yonder



Mark Chrumka's SCUD suffers a CATO



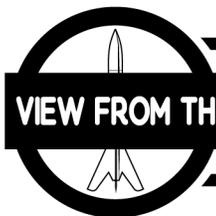
Chris Timm's Navaho



Jay Calvert's US Air Force



Herb Crites' Mach Schnell SLK54m on an Aerotech H210



# VIEW FROM THE FLIGHT LINE AN EASY CHEAT WITH BIG REWARDS

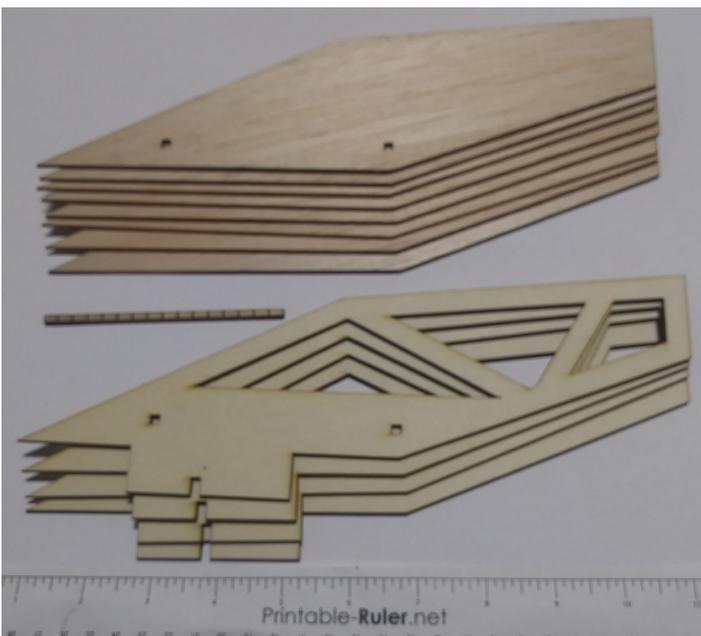
DALE HODGSON

Well, as of this writing, we've had our first launch of the year. I can't even begin to tell you all how much fun that was to be on the flight line again burning some propellant. Of course, I never seem to burn as much as I want to. I spent much of the time catching up with friends and watching flights. I'm still in the middle of testing both a wireless controller (which we used most of the day for high power and it held up beautifully) and tweaking a 3D kit which by the way is in its final version and ready for public consumption. We've put the stubby/Alien version through quite a few flights and are confident the right combo of parts has been reached. Once Scott gets his printer up and running I believe more will be available.

As I watched a bunch of flights it occurred to me that at least for now many of them were either low or mid-power; at least they were this time, but the weather had a lot to do with that. Not too many higher flights with dual deployment were going on but enough to round out a decent day.

For the low and mid-power folks out there, I saw quite a few Estes birds flying with some bigger motors. With the availability of composite motors in 18, 24, and 29mm it really opens up more possibilities for us. Flying smaller rockets with bigger motors is always fun but there are some changes that need to be made. I stumbled onto this quite by accident really since I started building some smaller projects myself. Balsa fins have been a mainstay for our hobby since its inception. The wood is obviously very light and holds up pretty well for BP motors, but these new composites are really stretching balsa to its limit. We do have members that have the ability, patience, and savvy to strengthen balsa with either tissue or paper. Just a suggestion; I think that process merits an article, guys! I've tried it on a couple of projects myself, it takes some patience and skill to pull it off, but the result is worth it....stronger fins with little added weight. That's all well and good but what about the rest of us mere mortals that haven't quite mastered that particular process yet? I was flipping through some online sites that sold kits and stumbled upon upgrade kits for

many of the projects that we fly. To me, it was a bit of an epiphany or call it an "Ah-Ha" moment. There are upgrades that include plywood rings (rather than the paper versions that many of the low-power versions have) and thin, plywood fins...either birch or basswood. These fins aren't too much heavier than balsa but are much, much stronger. Many of these ply fins are through the wall meaning they can be glued to the motor mount rather than a surface-mounted fin that is attached to the body tube only. Yes, there is a weight tradeoff, but this is easily compensated for by switching motors. What these upgrade kits do is allow us to fly those composite motors without the worry of a motor accelerating faster than the paper rings can support, shredding fins on boost, or snapping a fin on a less-than-ideal landing. I was surprised at the variety out there, so I bought a bunch to try. To date, I've upgraded a Super Big Bertha, Doorknob, and Der Big Red Max. I also have two Estes Vapor kits that have upgrades and just today I bought an upgrade for the Hi-Flier XL. I've seen upgrades for the Big Daddy as well and this one has either 29mm or 38mm rings for those that want to *really* stretch the envelope. Remember though to check that CP/CG relationship, when you go this big some nose weight may be in order to keep everything safe and stable during the flight. For me what these little upgrades do is bridge the gap between the Estes/Quest type of rocket and the larger, thicker LOC type. In essence, a smaller, lighter rocket that can handle some punishment provided by composite motors which results in some pretty spectacular flights and a much higher chance of a successful, undamaged recovery. This is all good news because it opens up yet more doors for us and gives us even more options. We can choose to use traditional balsa and fly BP, or upgrade to give us the option of using composites if we choose and the weather/conditions are favorable. I'm all for having as many options as possible open to me as possible; now all I must do is quit messing around out there and get more birds in the air!



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



# THUNDERSTRUCK 2023

Tony Haga

I haven't been able to get out to a big launch in quite a while so when I saw that Indiana Rocketry would be hosting their Thunderstruck regional launch in Pence Indiana, I decided to make the trip and I'm glad I did. This would be my first trip down there and now I wish I had made many more trips in the past. Weather was good for Friday and Saturday but on Sunday a storm front moved through and the launch was canceled. Lots of flying on those two good days though.

It is about 350 miles from my house to the field, then about another 25 miles to one of the recommended hotels in Danville, IL so I headed out on Thursday to make sure I would have at least two full days to fly on Friday and Saturday. Lots of traffic on I94 heading west but once I made the turn onto I65 south traffic started to thin out some. Then off I65 and onto US 41 and traffic just about disappeared. The landscape becomes very rural and very flat into Indiana farm country. Looks like you could fly a rocket anywhere and recovery would be easy. And wind turbines! Lots and lots of wind turbines. Hundreds of them stretched across the landscape. Indiana generates about 10% of its electrical power from wind farms. Just don't spend too much time looking at the things spinning while driving. Might make you a bit dizzy!

So what time is it anyway? So, we know that Illinois is in the Central time zone but some counties in Indiana are on Central time and some are on Eastern time. So, as you head down there the clock in your vehicle and on your cell phone will jump back and forth. To make it worse, the hotels in Danville, IL will be on Central time but the nearest cell tower is in Indiana. So, your phone will read Eastern time. The field is on Eastern time but your phone will ping a cell tower in Illinois and show Central time. So, take your watch, set it for Eastern time, and ignore everything else.

Driving out to the field on Friday morning was a bit harder than it needed to be. Turns out the navigation in the truck doesn't have an "avoid dirt roads" setting. Ended up going a number of miles on what looked like a freshly lime-stoned road and creating a huge cloud of dust in my wake. I think most of that dust ended up in the bed of the truck covering all my rockets and supplies. It is plenty easy enough to make it to the field on the pavement, just need to make sure what roads are paved beforehand.

The field is huge! Six square miles of flat recovery area with very few hazards (except for the ever-present power lines). The area to the north and west provides the best recovery zones. A wind farm

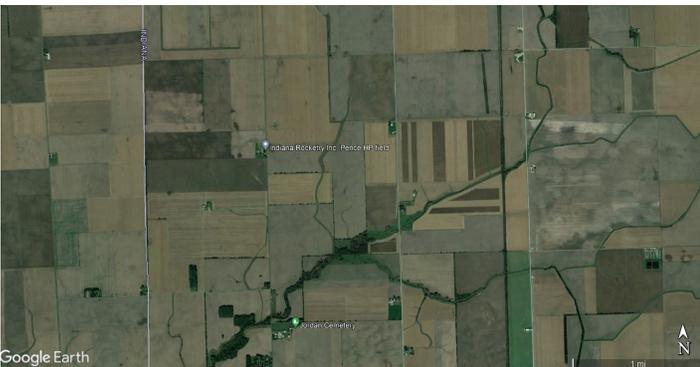
is to the east and farm buildings and a creek to the south but those are still not much of a problem. There was lots of parking available, food and rocket vendors, and, of course, a couple of porta potties.



Field Looking West



Field Looking East, Wind Turbines!



Thunderstruck Field from Google Earth

When I got to the field the weather was cloudy with a few raindrops still falling. The weather said the cloud deck was about 10,000' but most of us agreed that was probably optimistic. A couple of early flights proved that to be the case. I had planned to fly my highest flight as soon as possible but decided I had to wait for the sky to clear up. In the meantime, I could still get something in the air. I prepped "Rapid Oxidation", a 75mm fiberglass and phenolic rocket, and sent it up on an I255.

Recovery was good and the old Perfecflite MAWD reported an apogee of 2828'.



A much bigger crowd was pulling into the parking area with lots of student groups, many of them looking to get an L1 certification

I helped set up a bit and then got the motor box back out. Hmmm, still have this J316. Let's drag *Rapid Oxidation* back out for another flight, that should get me a modest altitude. By now the winds were getting gusty and I didn't want to walk that far anyway. The rocket had a good boost and reach an apogee of 3970'. Tracked it the whole flight and this time it \*just barely\* missed the power line.

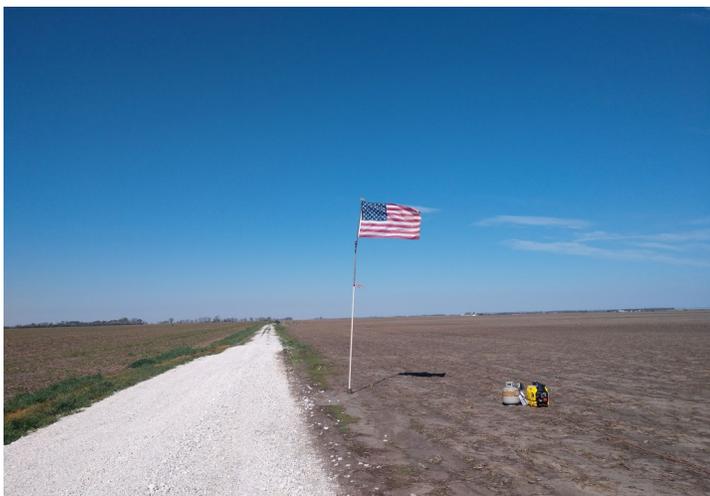
*Rapid Oxidation ignition*

But now the weather was improving! The sky cleared and the wind dropped to near calm. Time to send something. I had talked to Scott beforehand and asked if he had anything in a big 54mm. He dug up a couple. A Loki K527 (red) and a Loki J820 (star-grain white). I took them both but you can guess which one I wanted to fly first. I had prepped the K527 the night before in the hotel so it was just a matter of finishing the rocket. I brought my 3" fiberglass "Grape Shot" and figured with now a clear blue sky and light winds, that was the one to go with. That K527 sent Grape Shot up to about 7700' with a good recovery about a quarter of a mile straight out in the range. That would be my highest flight in quite some time.

With two flights in for the day, I took a break to watch some flights and rest a bit after the recovery walk. But hey, it's only mid-afternoon and I still have a J820 in the box. I could have flown one of the smaller rockets that I brought with me and really send it but I figured I had walked about enough for one day and reloaded Grape Shot for another flight. The fast Loki white J820 sent Grape Shot to about 3900' with a landing almost back on the pad. Most satisfying.



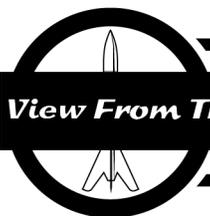
Unfortunately, I did see that power line capture an L1 attempt in almost that same spot. Six square miles of recovery area and a 10-foot-wide power line. Go figure...



Saturday started out with a clear blue sky, but windy!

The group of college students parked a couple of cars from me were prepping a large rocket to be flown on an "N" motor while listening to "Dark Side of the Moon". Their flight was successful with a long recovery but like I said, it's a big field.

With that, my day was done. I hung around for a bit longer but with Sunday looking like a wash out I decided to clear out by the early afternoon and make my way the six hours back home. I had a great time and met some great people and it was a blast being able to fly high and not worry very much about trees or Big lcky lakes. Looking forward to going back. Indiana Rocketry will be hosting National Sport Launch East from November 10-12, 2023. If you can make it down that way it would be well worth the trip.



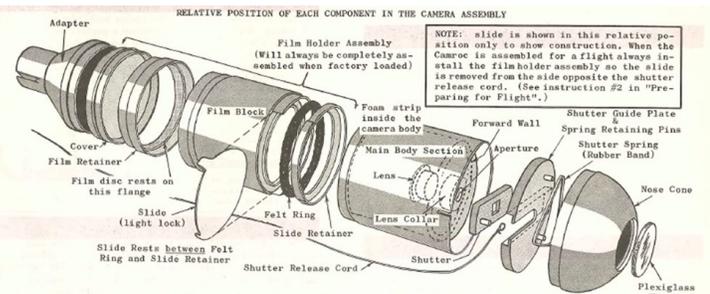
**View From The Build Line**

## **"Eye in the Sky": a 3-D Printed Estes Camroc**

MARK CHRUMKA

The Camroc is on a short list of model rocket kits that I wanted but never obtained as a youngster. Estes initially released the Camroc as a stand-alone kit in the 1966 catalog for \$4.00. It was labeled the "World's First Camera Especially for Model Rocketry".

For its time, the Camroc was a relatively complex device with numerous parts, as noted below. The camera used special 1.5-inch single-exposure Astroman 400 film discs that were positioned in the main body behind the lens. Upon ejection, a string would trip a shutter mechanism that would permit light to enter from a nose cone plexiglass aperture. It was a one-shot deal, so the camera needed to be pointed down for a terrestrial photo. The film had to be handled carefully when removed from the camera body to avoid overexposure. The film could be sent to Estes for development which would result in a 3-inch round photo.



*Original Estes Camroc Assembly*

In 1966, the two-stage Astron Delta (K-16) was the recommended booster vehicle.

In 1969, Estes published "Rocket Plan # 60", which detailed plans for a "Camroc Carrier", which offered an alternate single-stage launch vehicle. The plan became an official Estes kit in 1974 and included a clear payload bay.

I discovered a 3-D printed version of the original Camroc on Thingiverse by "Works-of-Clay" and decided it was my next model rocket project.

The 3-D printed version of the Camroc incorporated an 808-keychain camera which fit into the nose of the Camroc. The nose was designed with 3 holes aligned with the two keychain camera buttons and LED. The camera was turned on by inserting a thin rod through the holes to press the buttons. The camera was secured to the body of the Camroc using 3 small screws.



After printing the camera, I built the Camroc Carrier using Estes Plan # 60. Decals were made from art obtained from the JimZ Rocket Plans website.



*Completed Camroc Carrier*

The initial flight of the model occurred at Horning #1 field on July 2, 2022. A C6-5 motor was used with a 14-inch chute. The model boosted well and recovered safely. However, the nose with the camera came off at deployment and was lost. Fortunately, both items were discovered intact by a flyer and returned later in the year.

After making suitable improvements, the model was launched again at Horning #1 field on a B6-6 motor with a 15-inch chute. This time, the model recovered safely and the camera functioned well.

The camera's video mode was used and delivered good video/audio of the flight. Upon descent, the camera would at times swing and rotate back and forth in a circle which provided a larger area of coverage. Still, photos were extracted from the video that showed the LP and HP pads, in addition to the launch control and parking area. As the camera descended closer to the ground the microphone picked up Tony speaking to others in the area.



*Camroc view of the launch area at the Horning 1 Field*



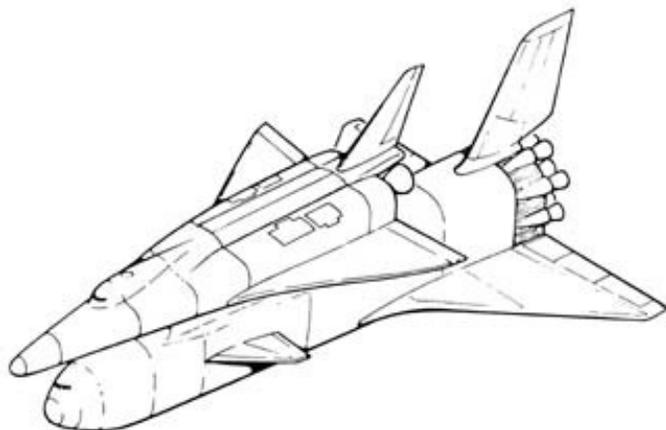
# LOOKING BACK: SPACE SHUTTLE FLIGHT STS-1

BUZZ NAU

12 April marks the 42-year anniversary of the first Space Shuttle flight, STS-1. The Space Shuttle program was the first part of an even larger effort to place a space station in low earth orbit. This overall program was selected as the next NASA program after Apollo. There were many initial design considerations, including various fully reusable systems that comprised a gliding booster and piggyback orbiter. Rockwell's original design was a dual delta wing booster/orbiter combination. The size and cost of such a booster was prohibitive, so a less expensive design that straddled a powered orbiter to a large fuel tank that was assisted by two side boosters was chosen. The Space Shuttle program or STS (Space Transport System) never lived up to its original goals of quick turnarounds between flights and low-cost payloads to orbit. Additionally, two orbiters were lost with both crews. Challenger was lost when an SRB (solid rocket booster) seal failed which resulted in structural failure and eventual explosion of the external fuel tank. Columbia disintegrated during de-orbit when the port wing delaminated due to heat shield damage caused by external tank insulating foam striking the wing during liftoff.



STS-1 crew John Young and Robert Crippen - NASA photo



Initial Rockwell Shuttle Proposal - North American Rockwell

Five Orbiters were built at a cost of \$450m per vehicle, Columbia, Challenger, Discovery, Atlantis, and Endeavour. They would eventually bring to orbit the modules and material to build the planned low earth orbit space station, the ISS (International Space Station), as well as many experiments and satellites including the Hubble Space Telescope. The final Space Shuttle flight, STS-135 occurred on 21 July 2011, just over 30 years after the first launch, STS-1.

The crew for STS-1 comprised of space flight veteran John Young and rookie Robert Crippen. After months of sitting on pad 39A at Cape Canaveral while many problems were discovered and remedied, liftoff occurred on 12 April 1981 becoming the heaviest vehicle to launch to orbit as well as the first with the ability to fly back as a conventional aircraft.

The 36-orbit flight tested the attitude control and operation of the orbiter's thrusters as well as the payload bay doors. That was when the first sign of a problem was found as the crew was able to see multiple tiles missing from the engine pods. Though that area was determined by ground control to not be an issue, it was unknown what other tiles might be missing in areas that would

cause a problem on reentry. That would be the extent of the problems during the first shuttle flight. After deorbiting, and communications blackout, John Young brought the Columbia in for a perfect landing at Edwards Air Force Base.

The post-launch investigation found several problems which would need to be resolved before the next flight. This included damage to tiles from ice falling off the external tank, and most importantly a shock wave from the SRBs that displaced the orbiter's wing and bent a strut near the booster. This was resolved by spraying high-pressure water at the pad during launch. The ice falling from the external tank would plague the Space Shuttle throughout the program.



STS-1 launch 12 April 1981 - NASA photo



# CURRENT EVENTS IN SPACE EXPLORATION

BUZZ NAU

SpaceX picked up the pace even further during the past two months with 16 launches. The list includes 6 Starlink satellite flights, a Falcon Heavy, and the first test flight of Starship Heavy. Other milestones include the first launch attempt by Relativity Space, 2 Electron flights by Rocket Lab, and the SubTEC-9 Terror-Improved Malemute sounding rocket launch at Wallops Island. Also worth noting was Japan's privately funded iSpace lunar lander failed to make a successful landing on the Moon. It apparently ran out of fuel during the landing attempt and was unable to arrest its descent for a soft touchdown. This was iSpace's first landing attempt with two more under development and construction.

tion on pad LZ-1.

## SPACEX

Starting off on 2 March, SpaceX launched the Crew 6 mission from Launch Complex 39A (LC-39A) at the Kennedy Space Center. The crew consisted of Stephen Bowen (Commander), Warren Hoburg (Pilot), Sultan Al Neyadi (UAE Mission Specialist), and Andrey Fedyaev (ROSCOSMOS Mission Specialist). It was the 8<sup>th</sup> flight for the Falcon 9 booster B1078-1 which landed on the drone ship *Just Read the Instructions*. Mission duration is six months.



SpaceX photo

Cargo Dragon mission CRS-2 SpX-27 lifted off from LC-39A at the Kennedy Space Center on 15 March. This resupply mission brought supplies and experiments to the International Space Station (ISS). It was the 7<sup>th</sup> flight for booster B1073-7 which landed on the drone ship *A Shortfall of Gravitas*.



SpaceX photo

The final launch, completing OneWeb's low earth orbit telecommunications constellation occurred on 9 March. A Falcon 9 lofted 40 OneWeb communications satellites to a polar orbit from SLC-40 at the Cape Canaveral Space Force Station. This brought the total number of OneWeb satellites to 584. It was the 13<sup>th</sup> launch for booster B1062-13 which landed back at the Space Force Sta-



SpaceX photo

Mission	Date	# of Satellites	Launch Site	Booster Flt#	Landing Site	Fairings Recovered?
Starlink 2-7	3-Mar-23	51 v1.5	Vandenberg AFB	12	<i>Of Course I Still Love You</i>	Yes
Starlink 2-8	17-Mar-23	52 v1.5	Vandenberg AFB	8	<i>Of Course I Still Love You</i>	Yes
Starlink 5-5	24-Mar-23	56 v1.5	SLC-40 CCSFS	10	<i>A Shortfall of Gravitas</i>	Yes
Starlink 5-10	29-Mar-23	56 v1.5	SLC-40 CCSFS	4	<i>Just Read the Instructions</i>	Yes
Starlink 6-2	19-Apr-23	21 v2.0	SLC-40 CCSFS	8	<i>A Shortfall of Gravitas</i>	Yes
Starlink 3-5	27-Apr-23	46 v1.5	Vandenberg AFB	13	<i>Of Course I Still Love You</i>	Yes

KSC = Kennedy Space Center

CCFCS = Cape Canaveral Space Force Station



# CURRENT EVENTS IN SPACE EXPLORATION

On 17 March, SpaceX launched the SES-18 & 19 communications satellites from SLC-40 at the Cape Canaveral Space Force Station. The pair of C-band satellites were built by Northrup Grumman for the Luxembourg-based telecommunications company, SES S.A. SES-18 & 19 will provide digital broadcasting services to North America. Booster B1069-6 had flown 5 previous missions and landed on the drone ship *Just Read the Instructions*.

America. Booster B1076-4 had flown 3 previous missions and landed on the drone ship *A Shortfall of Gravitas*.



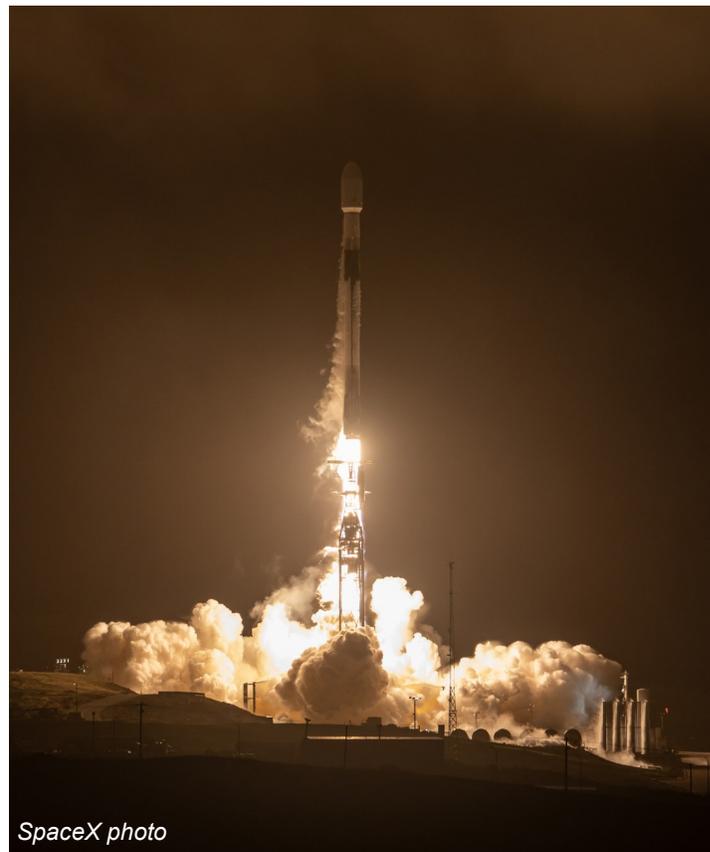
SpaceX photo



SpaceX photo

SDA (Space Development Agency) launched 10 satellites aboard a Falcon 9 from Vandenberg Space Force Base on 2 April. SDA is a commercial vendor for the DoD providing a series of quickly deployed satellites to support the modern warfighter in several layers. The Transport and Tracking Layers 0-1 mission placed 8 communications satellites in the Transport layer and 2 observation satellites in the Tracking layer. All vehicles were built by York Space Systems. More information can be found on [SDA's website](#). This was the second flight for booster B1075-2 which returned to Vandenberg for landing on pad LZ-4.

The Transporter 7 mission launched on 15 April from Vandenberg Space Force Base, the seventh rideshare mission. SpaceX's Rideshare program dedicates flights for carrying multiple smallsats for as little as \$275k. Transporter 7 included dozens of rideshares from Universities and commercial aerospace vendors. This was the 10<sup>th</sup> flight for booster B1063-10 which landed on pad LZ-4 back at Vandenberg SFB.



SpaceX photo



SpaceX photo

On 7 April SpaceX lifted Intelsat 40 and TEMPO spacecraft from SLC-40 at Cape Canaveral Space Force Base. Intelsat 40 is a communications satellite providing service to Intelsat customers in North and Central America. TEMPO (Tropospheric Emissions Monitoring of Pollution) will measure air quality across North



# CURRENT EVENTS IN SPACE EXPLORATION

The launch we were all waiting for, the first test flight of Starship Heavy, occurred on 20 April. The preflight claim was regardless of the outcome, the flight would be entertaining and it certainly was that. The test plan was for the full stack vehicle to lift off and stage. The booster would attempt a soft landing in the Atlantic while the Starship upper stage would continue on a sub-orbital path to belly flop near Hawaii. The countdown was halted and reset once before 31 of 33 Raptor engines lit on Booster 7. The vehicle remained locked on the pad for approximately 5 seconds before release. After a slow liftoff and unplanned tilt, several more engines failed during boost. The full stack made it through Max-Q, but as it neared staging it departed from controlled flight. It managed to stay intact through several full flips before the flight termination charges disassembled the vehicle. Post-launch video and photos showed footage of pad concrete getting flung everywhere as well as significant damage to the base of the pad (stage zero).

Elon Musk held a Twitter Space Starship Review on 29 April. Youtuber "[Ellie in Space](#)" attended and reported the following information from that chat;

The damage to the pad isn't nearly as bad as it looks. He estimates the pad and next test vehicle will be ready by mid-June to early July (wow!). The item he feels will take the longest to perform is requalifying the flight termination system as it took much longer than expected to rupture the tanks (lag time was 40 seconds!). The vehicle performed better, structurally than expected, for example staying together during uncontrolled flight. Liftoff time will be much quicker on the next flight. The goal is 2.5 seconds from start-up to liftoff. This will also reduce the chance of pad damage. There will also be a water-cooled steel "sandwich" blast deflector for the next attempt. In addition to a switch from hydraulic-controlled steering to electric control, Booster 9 Raptor engines will include many other improvements. Finally, Elon stated that he believes there is a 30% chance of achieving orbit on the next attempt and that he expects there to be 4-5 more test flights this year.



SpaceX photo

Two more satellites for SES S.A., 03b mPower 3 and 4, were launched on 28 April atop a Falcon 9 from SLC-40 at Cape Canaveral Space Force Station. 03b mPower communications satellites provide high-speed, low-latency connectivity from medium earth orbit (MEO). It will only take 11 satellites from this orbit to provide service to 96% of the Earth. It was the second flight for booster B1078-2 which landed on the drone ship *Just Read the Instructions*.



SpaceX photo

After two aborts, a Falcon Heavy carrying the ViaSat 3 Americas communications satellite lifted off on 30 April. The large satellite is the first of three to make up the Boeing ViaSat-3 shell. This constellation will provide service across North and South America. Also included on this flight was the rideshare Arcturus satellite which will provide communications service to Alaska. The mass of both satellites approached 15,000 lb and due to the performance required for the launch, all three boosters were expended. It was the first flight for center booster B1068-1, the eighth for side booster B1052-8, and the third for side booster B1053-3.



SpaceX photo



# CURRENT EVENTS IN SPACE EXPLORATION



The *Stronger Together* mission was flown by Rocket Lab from the Wallops Island Flight Facility on 16 March. The Electron small-lift vehicle carried two satellites for Capella Space to low earth orbit (LEO). The two earth observation satellites use synthetic aperture radar for surface mapping. This was Rocket Lab's second launch from Wallops and there was no attempt to recover the booster.

passed through Max-Q and stage separation was successful. After a six-second coast the second stage single Aeon engine failed to ignite despite indications it was trying to. The flight was a huge success despite the second-stage anomaly.

*Relativity Space photo*



*Rocket Lab photo*

The next flight by Rocket Lab occurred on 24 March from their launch complex in New Zealand. *The Beat Goes On* Electron launch vehicle carried two earth observation satellites for Blacksky. There was no effort to catch the booster by helicopter, but it was recovered from the sea after a soft parachute landing.



On 26 April NASA launched a Terrier-Improved Malemute sounding rocket from the Wallops Island Flight Facility carrying the SubTEC-9 payload. SubTEC 9 was a test of new star tracking technology and a near-instantaneous telemetry data link. There were 14 new technology experiments aboard in total. These technologies are under development by the Sounding Rocket Program Office (SRPO).



*Rocket Lab photo*

## Relativity

Relativity Space made its first launch attempt of the first 3D-printed vehicle, Terran 1. It was also the first attempt to orbit a rocket powered by methane. The Good Luck, Have Fun mission was launched on 23 March from LC-16 at Cape Canaveral Space Force Station. The two-stage small lift vehicle took off with a dummy payload powered by nine Aeon 1 engines. The Terran 1



*NASA photo*



JMRC HUVERS

Club News

**Fun Contest Lineup for 2023**

**Precision Altitude** - Using an online RNG (random number generator), the target for this years precision altitude contest is 1,898 feet. The goal is to fly the closest to the target altitude without going over. The contest will run all season long until our last launch in 2023. The entry fee will be \$5 per attempt and you can try as often as you like. The winner will receive 50% of the pot, second place will earn 25%, and the remaining 25% will go to the club.



**Big Bertha Contest** - We will be holding this contest during the August launch this summer. Be sure to mark your calendar!



Designed by Vern Estes, the Big Bertha is the iconic model rocket throughout the decades. Make Vern proud and enter your Big Bertha in this fun contest.

**Goal**

Make three flights with a single model (Big Bertha) and attempt to score the best in four criteria.

**Rocket Entry**

Per the name, this is a Big Bertha contest. If you don't have a Big Bertha then any rocket with at least 18" of BT-60 and four fins will do. If you wish to build one from scratch you can download the plans here, [Estes Big Bertha #1948](#)

**Events**

A Parachute Duration – Using an A impulse motor and parachute of any size, get a longest possible duration. Remember, you need to get it back for the other events!

B Streamer Duration Spot Landing - That's right, two events in one. Using

a B impulse motor and streamer for recovery get the longest possible duration AND land closest to the target mark that will be placed randomly at the field.

C Altitude (altimeter) – Using a C impulse motor and electronic altimeter reach the highest altitude. I will have a couple of altimeters to loan out if you don't have a suitable altimeter.

**Iron-man III** - We will be holding this contest at the September launch, so mark your calendar!

Just like the past Ironman contests. Build a single model to be flown in three events. Cost will be \$10 which will get you motors needed to fly the events. The motors for Iron-man III will be 18mm 1/2A6-0's and 1/2A6-4's. The models need to accommodate 18mm motors and be two-stage. Prizes will be awarded to the top three overall performers



**Events**

- **Double Spot Landing** (booster and sustainer!)
- **Streamer Duration**
- **Altitude** (with an altimeter)

**Free Alpha III Kit for Kids**

During our last board meeting, several members discussed the need to reach out to more fliers, to increase club activity and the need to attract more youth to our launches.

Al de la Iglesia would like to offer a free rocket kit (Estes Alpha III) to any flier who is 18 years old or younger at our next club launch. The flier (or parent/guardian) must be a club member or join at the launch. Limit one free rocket kit per youth.

Please send an email to Al at [aiglesia@gmail.com](mailto:aiglesia@gmail.com) to let him know that you are interested and how many youth are attending so that he can bring enough rocket kits.



Camroc view of Horning 1 Field looking West



# LAUNCH WINDOWS

Launch dates from SpaceFlight.com

**May 2, 2023**

**Falcon 9 - Starlink 5-6**

**Launch Site: SLC-40 CCSFS**

A SpaceX Falcon 9 rocket will launch another batch of Starlink V1.5 internet satellites.

**May 2/3, 2023**

**Electron - TROPICS 3 & 4**

**Launch Site: Launch Complex 1B, Mahia Peninsula**

A Rocket Lab Electron rocket will launch the second pair of small CubeSats for NASA's TROPICS mission. The Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats, or TROPICS, the mission will measure environmental and inner-core conditions for tropical cyclones.

**May Falcon 9 - Starlink 5-9**

**Launch Site: SLC-40 CCSFS**

A SpaceX Falcon 9 rocket will launch another batch of Starlink V1.5 internet satellites.

**May 2023**

**Falcon 9 - Starlink 6-3**

**Launch Site: SLC-40 CCSFS**

A SpaceX Falcon 9 rocket will launch another batch of second-generation Starlink V2 Mini internet satellites.

**Early May 2023**

**Falcon 9 - OneWeb & Iridium Next**

**Launch Site: SLC-4E, Vandenberg SFB**

A SpaceX Falcon 9 rocket will launch 15 spare satellites for OneWeb's first-generation global internet network and one prototype for OneWeb's Gen2 second-generation network. Five spare satellites for Iridium's voice and data relay fleet will also be launched on this mission

**May 10, 2023**

**Long March 7 - Tianzhou 6**

**Launch site: Wenchang, China**

A Chinese Long March 7 rocket will launch the Tianzhou 6 resupply ship to dock with the Chinese space station. The automated cargo craft is the fifth resupply freighter for the Chinese space station.

**May 2023**

**Long March 2F - Shenzhou 16**

**Launch site: Jiuquan, China**

A Chinese Long March 2F rocket will launch the Shenzhou 16 spacecraft with three Chinese astronauts to rendezvous and dock with the Chinese space station in low Earth orbit. This is China's 11th crewed space mission, and the fifth to the Chinese space station.

**May 15, 2023**

**Electron - TROPICS 5 & 6**

**Launch Site: Launch Complex 1, Mahia Peninsula**

A Rocket Lab Electron rocket will launch the third pair of small CubeSats for NASA's TROPICS mission. The Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats, or TROPICS, the mission will measure environmental and inner-core conditions for tropical cyclones.

**May 17, 2023**

**Falcon 9 - Axiom Mission 2**

**Launch site: LC-39A, KSC**

A SpaceX Falcon 9 rocket will launch a Crew Dragon spacecraft on the program's 10th flight with astronauts. The commercial mission, managed by Axiom Space, is commanded by former NASA astronaut Peggy Whitson. Paying passenger John Shoffner will serve as the pilot of the mission. Two commercial space fliers from Saudi Arabia, Ali AlQarni and Rayyanah Barnawi, will also be on the approximately 12-day mission to the space station.

**May 2023**

**Falcon 9 - Starlink 2-9**

**Launch Site: SLC-4E, Vandenberg SFB**

A SpaceX Falcon 9 rocket will launch another batch of Starlink internet satellites. This mission will deploy the Starlink satellites into a high-inclination orbit inclined 70 degrees to the equator.

**TBD, 2023**

**Delta 4-Heavy - NROL-68**

**Launch Site: SLC-37B, CCSFS**

A United Launch Alliance Delta 4-Heavy rocket will launch a classified spy satellite cargo for the U.S. National Reconnaissance Office. The largest of the Delta 4 family, the Heavy version features three Common Booster Cores mounted together to form a triple-body rocket. This is the penultimate flight of a Delta 4 rocket.

**May 21/22, 2023**

**Falcon 9 - Badr 8**

**Launch Site: SLC-40 CCSFS**

A SpaceX Falcon 9 rocket will launch the Badr 8 communications satellite for Arabsat based in Saudi Arabia. From geostationary orbit, Badr 8 will provide communications coverage for Arabsat customers over Europe, the Middle East, and Africa. Badr 8 also hosts an optical communications payload developed by Airbus.

**May 24, 2023**

**Soyuz - Progress 84P**

**Launch Site: Baikonur Cosmodrome**

A Russian government Soyuz rocket will launch the 84th Progress cargo delivery ship to the International Space Station. The rocket will fly in the Soyuz-2.1a configuration.

**2nd Quarter, 2023**

**Falcon 9 - O3b mPOWER 5 & 6**

**Launch Site: SLC-40 CCSFS**

A SpaceX Falcon 9 rocket will launch the third pair of O3b mPOWER broadband internet satellites into Medium Earth Orbit for SES of Luxembourg. The satellites, built by Boeing, will provide internet services over most of the populated world, building on SES's O3b network.

**May 2023**

**Vulcan Centaur - Peregrine**

**Launch Site: SLC-41, CCSFS**

A United Launch Alliance Vulcan Centaur rocket will launch on its inaugural flight with the Peregrine commercial lunar lander for Astrobotic. The Peregrine robotic lander will carry multiple experiments, scientific instruments, and tech demo payloads for NASA and other customers. The mission will also launch two prototype satellites for Amazon's Kuiper broadband constellation. The Vulcan Centaur rocket will fly in the VC2S configuration with two GEM-63XL solid rocket boosters, a short-length payload fairing, and two RL10 engines on the Centaur upper stage.

**June 1, 2023**

**Falcon 9 - SpaceX CRS 28**

**Launch site: LC-39A, KSC**

A SpaceX Falcon 9 rocket will launch a Dragon 2 spacecraft on a cargo resupply mission to the International Space Station. The Falcon 9's first-stage booster will land on a drone ship in the Atlantic Ocean. The flight is the 28th mission by SpaceX conducted under a Commercial Resupply Services contract with NASA.



# LAUNCH WINDOWS

Launch dates from SpaceFlight.com

**June 10, 2023**

**Falcon 9 - Transporter 8**

**Launch Site: SLC-4E, Vandenberg SFB**

A SpaceX Falcon 9 rocket will launch the Transporter 8 mission, a rideshare flight to a sun-synchronous orbit with numerous small microsattellites and nanosatellites for commercial and government customers. The launch site changed from Cape Canaveral Space Force Station to Vandenberg Space Force Base.

**June 2023**

**Falcon 9 - SDA Tranche 0B**

**Launch Site: SLC-4E, Vandenberg SFB**

A SpaceX Falcon 9 rocket will launch 18 Tranche 0 demonstration satellites for the U.S. military's Space Development Agency. The launch is the second of two Falcon 9 missions to carry SDA demonstration spacecraft for a future constellation of military missile tracking and data relay satellites.

**June 2023**

**Falcon 9 - WorldView Legion 1 & 2**

**Launch site: SLC-4E, Vandenberg SFB**

A SpaceX Falcon 9 rocket will launch the first pair of WorldView Legion Earth observation satellites for Maxar Technologies. Maxar plans to deploy six commercial WorldView Legion high-resolution remote sensing satellites into a mix of sun-synchronous and mid-inclination orbits on three SpaceX Falcon 9 rockets.

**2nd Quarter, 2023**

**Falcon 9 - Türksat 6A**

**Launch Site: SLC-40 CCSFS**

A SpaceX Falcon 9 rocket will launch the Türksat 6A communications satellite for the Turkish operator Türksat. Türksat 6A is the first geostationary communications satellite to be built in Turkey, with development led by TÜBİTAK Space Technologies Research Institute and Turkish Aerospace Industries.

**June 21, 2023**

**Ariane 5 - Syracuse 4B & Heinrich Hertz**

**Launch Site: ELA-3, Kourou, French Guiana**

Arianespace will use an Ariane 5 ECA rocket, designated VA260, to launch the Syracuse 4B and Heinrich Hertz communications satellites. Syracuse 4B, built by Airbus, will relay secure communications between French military aircraft, ground vehicles, and naval vessels, including submarines. The Heinrich Hertz satellite, built

by OHB, will test new communications technologies on a mission funded by the German government. This will be the final launch of an Ariane 5 rocket.

**June 23, 2023**

**Falcon Heavy - USSF 52**

**Launch Site: LC-39A, KSC**

A SpaceX Falcon Heavy rocket will launch the USSF 52 mission for the U.S. Space Force. The Falcon Heavy will launch an unspecified military payload on this mission. Delayed from October 2021 and 2nd Quarter 2022. Delayed from October.

**TBD, 2023**

**Falcon Heavy - Jupiter 3/EchoStar 24**

**Launch Site: LC-39A, KSC**

A SpaceX Falcon Heavy rocket will launch the Jupiter 3/EchoStar 24 broadband communications satellite. Built by Maxar, Jupiter 3/EchoStar 24 is a Ka-band high-throughput ultra high-density satellite for EchoStar's Hughes Network Systems. Jupiter 3/EchoStar 24 will support in-flight Wi-Fi, maritime connections, enterprise networks, backhaul for mobile network operators, and community Wi-Fi solutions across the Americas.

**June 2023**

**Falcon 9 - IM-1**

**Launch site: LC-39A, KSC**

A SpaceX Falcon 9 rocket will launch the IM-1 mission with the Nova-C lander built and owned by Intuitive Machines. The IM-1 mission will attempt to deliver a suite of science payloads to the surface of the moon for NASA's Commercial Lunar Payload Services program.

**July 2023**

**Antares • NG-19**

**Launch Site: Pad 0A, Wallops Island**

A Northrop Grumman Antares rocket will launch the 20th Cygnus cargo freighter on the 19th operational cargo delivery flight to the International Space Station. The mission is known as NG-19. The rocket will fly in the Antares 230+ configuration, with two RD-181 first-stage engines and a Castor 30XL second stage. This will be the final flight of an Antares 230+ rocket before a redesign with new U.S.-made engines.

**July 2023**

**Falcon 9 - Galaxy 37**

**Launch Site: SLC-40, KSC**

A SpaceX Falcon 9 rocket will launch the Galaxy 37 C-band television broadcasting

satellite for Intelsat. The spacecraft was built by Maxar. The Falcon 9's first-stage booster will land on a drone ship in the Atlantic Ocean.

**July 2023**

**Falcon 9 - Polaris Dawn**

**Launch site: LC-39A, KSC**

A SpaceX Falcon 9 rocket will launch a Crew Dragon spacecraft on the program's 11th flight with astronauts. The Falcon 9's first-stage booster will land on a drone ship in the Atlantic Ocean. The Polaris Dawn mission will be commanded by billionaire Jared Isaacman, making his second trip to space. He will be joined on the all-private mission by pilot Scott "Kidd" Poteet, and SpaceX employees Sarah Gillis and Anna Menon.

**July 2023**

**Falcon 9 - Euclid**

**Launch Site: KSC**

A SpaceX Falcon 9 rocket will launch the Euclid mission for the European Space Agency. Euclid is an astrophysics mission with a telescope and two scientific instruments designed to explore the evolution of the dark universe. It will make a 3D-map of the universe by observing billions of galaxies out to 10 billion light-years, across more than a third of the sky. Euclid will be launched to an observing orbit at the Sun-Earth L2 Lagrange point.

**July 21, 2023**

**Atlas 5 - CST-100 Starliner Crew Flight Test**

**Launch Site: SLC-41, CCSFS**

A United Launch Alliance Atlas 5 rocket, designated AV-085, will launch Boeing's CST-100 Starliner spacecraft on its first mission with astronauts, known as the Crew Test Flight, to the International Space Station. The capsule will dock with the space station, then return to Earth to land in the Western United States. NASA astronauts Butch Wilmore and Suni Williams will fly on the mission. The rocket will fly in a vehicle configuration with two solid rocket boosters and a dual-engine Centaur upper stage.

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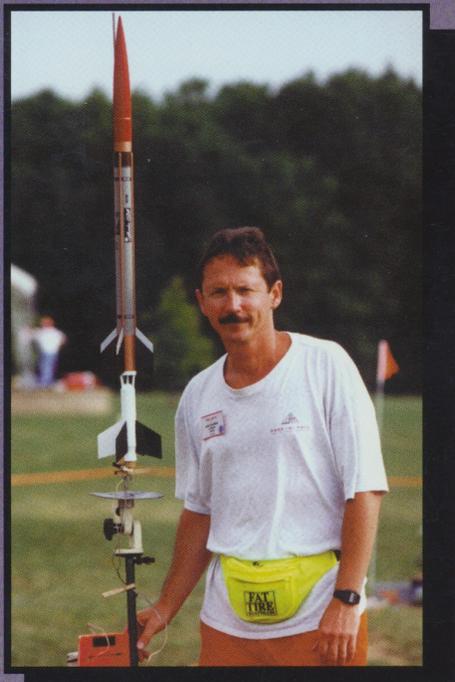
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