

# TOTAL IMPULSE



JACKSON MODEL ROCKET CLUB

TOTAL IMPULSE VOLUME 22, No. 2

JMRC  
HUVARS

HURON VALLEY ROCKET SOCIETY

MARCH - APRIL 2022

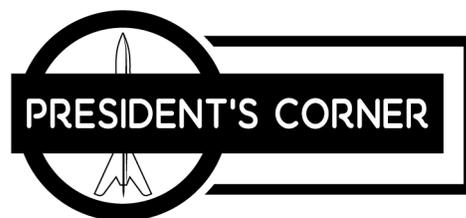


**APRIL SPORT LAUNCH**  
**50 YEARS AGO: APOLLO 16**  
**1954 NACA HYPERSONIC STUDY**



**CLUB OFFICERS**

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**Vice President:** Roger Sadowsky  
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**Communications:** Dan Harrison  
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**Board of Director:** Mark Chrumka  
**Board of Director:** Dave Glover



**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/zc5IC1](https://groupme.com/join_group/28013422/zc5IC1)

**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 the March/April 2022 issue of *Total Impulse*. Apologies for being late. I wanted to make sure to cover the April sport launch and that was the last day of the month.

It's amazing to me how quickly two months pass by and how much is getting done in that relatively short period of time. This month's issue contains a story about the NACA study that produced the requirements for a research aircraft that would become the X-15. The panel at the Langley Research Center produced that study in about four weeks. Not even SpaceX is that fast. Thanks to Chris Timm for his drawings, photos, and research reports.

Also thanks to Dale Hodgson and Tony Haga for their monthly articles and Mark Chrumka for providing a useful model finishing article on enamel paint and how best to apply it.

We're always looking for newsletter submissions big or small. Consider a short review. It's always nice to get a confirmation from a friend on what a new product is like.

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**Launch/Event Calendar - 2022**

- January 28-30 NARCON 2022 (Virtual Event)
- March Pending (Horning)
- April Pending (Horning)
- May Pending (Horning)
- May 21/22 *Crapshoot VIII* (Muskegon)
- June Pending (Horning)
- LDRS 40 - June 9 - 12 (Lucerne, CA)
- NARAM 63 - July 16 - 22 (Springfield, MO)
- July Pending (Horning)

**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.

Change, pivot, adapt, alter, diversify, innovate, advance, acclimate, accommodate, modify, and that about exhausts my euphemism ability but we as a club are trying to do all of the above. Let's do a quick inventory:

Multiple fields: Check! But always looking for another field to add to our inventory as each has pros and cons.

Advanced Launch Equipment: Check! We have wireless capable of low power through complex high power including hybrid, high quality Audio equipment, we even have a grill and Cafe equipment :-)

With over a quarter century under our belts as a club we have acquired a great deal of impressive equipment, knowledge, and a great membership base that actively helps everyone succeed. In our quest to improve we are now looking to expand our versatility including impromptu launch events with or without the club trailer. Given the unpredictability of this world we want to be prepared to keep this great hobby around for all to enjoy. Portable launch equipment is now being developed and implemented to make sure we continue to improve. As a club we have two choices... advance or die off, with that simple choice we will continue to innovate and find creative solutions. I look forward to seeing everyone on the field!

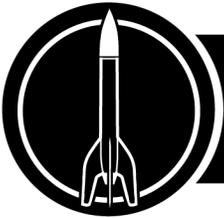
**About Total Impulse**

*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:  
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 Buzz Nau, Editor  
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**On the Cover:** Fred Ziegler and his awesome *Der Red Max* upscale at the April Sport Launch. Unfortunately it didn't fly due to weather conditions, but we hope to see it fly at a launch this summer.



# April Sport and NRC Launch

## 30 April 2022 - Big Icky II

It's Springtime in Michigan. The weather is all over the place, farmers are preparing fields for crops, and rocketeers are desperately trying to get in their first launch of the year. All these things collided on 30 April 2022 as JMRC/HUVARS held our first launch of the year. The weather was typical for Michigan Spring in that it is unpredictable. It was chilly with a strong wind out of the east, but at least the forecasted rain stayed away. The field also had many large patches of recently spread manure. Most had already dried up, but there were fresh areas to avoid. There was some mention of the smell, but to be honest, I'm kinda used to it since I live next to the farm.

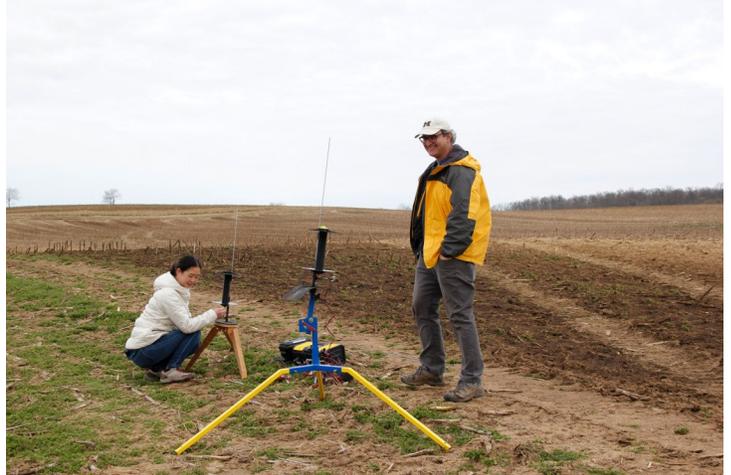
Despite the challenges, we were able to set up in a favorable area of the field and had a decent turnout of the hardiest among us. Again, we were limited to a mis-fire alley setup instead of usual compliment of club ground support equipment, but Tony Haga was able to get some wireless gear from the trailer for high power pads. I apologize for not getting any good launch photos. I'm usually good about double checking my camera settings, but not this time.



Mark Chrumka preps his Big Daddy for launch

### Sport Launches:

The most prolific flyer by far was Mark Chrumka with 11 flights. Most were suitable for the windy conditions including his Astron Birdie, Quinstar, Centuri Point, and Gyroc. He also flew his 3D printed scale Aries that had been damaged at NARAM 61 in Muncie. This time instead of reprinting the body he needs to re-print the nose cone as it recovery system failed to deploy. That is the nice thing about 3D printing rockets. Any damaged parts can easily be replaced with a little time and filament.



Yui Matsumoto and Andy Brown prep Yui's Spool rocket for a drag race

Jim and Paul McLachlan put in 5 nice flights. This included a DX-3 on a F67-6, Harpoon on a G74-6, and a pair of Estes Astrocams flights. They also flew a scale Alamo A-10 air-to-air missile with forward canards that flew surprisingly well especially in the windy conditions.

Andy and Jason Brown and friend Yui Matsumoto put up a couple of Spool drag races on F32's. Andy also flew his 38mm Alien Interceptor on a G104. Yui expressed interest in FAI competition and the World Championships in Austin, TX next year. She spent some time with Steve Kristal going over that.

It was good to see Yitah Wu at the launch. He put in several flights, but unfortunately, I didn't get the details.



Dale Hodgson and his "Scott's 3D Special" after a successful test flight

aged. Fred Ziegler brought several models including his beautiful upscale Der Red Max, but only flew his Lil Dog on a G. Hopefully we can see the Red Max fly later this season. Buzz Nau had one flight with his Semroc Lil Ivan on a B6-6. The motor cato'd, but luckily the model was undamaged.

**Competition:**

With the windy conditions, comp flying was at a minimum. Al de la Iglasia put in some 1/4A streamer duration flights for the Escape Velocity team. The first was a minimum diameter model on a 1/4A-3T. The piston boost was great and managed a decent 33 seconds. The second flight was a cato, so he got in a third flight with a heavier model to 19 seconds. It should still improve our overall standings. Later Al tested a new PD design and whether it was thermals or just lift, it disappeared going up and downrange quickly. The only other competition flight was another 1/4A streamer duration flight by Steve Kristal. He had a great boost off the piston, but his streamer tore off right at the attachment point for a DQ.

The range closed early once everyone pretty much flew what they could in the wind which was only getting stronger. Many of us met for an early dinner at the Bridgewater Bank Tavern for a good meal and more catching up. The situation with MIS and flying there is still, pardon the pun, up in the air. We hope to get in there in May, with Crapshoot in Muskegon on May 21st and 22nd. We'll have to see what fields are available when if MIS slips another month. Stay tuned to the club email for updates.



Yitah Wu and one of his scratchbuilt models

Dale Hodgson flew a couple of beta tests for Scott's 3D printed high power rockets. The shorter one went up on a G150 Blue and the larger one flew on a H90. Both were great flights and neither model suffered any damage.

Tony Haga had one flight with his Tiny Pterodactyl on a F70-5. The model separated, but fortunately was recovered safe and undam-



Mark Chrumka's collection of 3D printed models he brought



Steve Kristal preps his 1/4A Streamer Duration model



## 50 YEARS AGO: APOLLO 16

Apollo 16 has always been a personal favorite moon mission of mine. The crew of Commander John Young, Lunar Module Pilot Charlie Duke, and Command Module Pilot Ken Mattingly are always fun to listen to. I also find John Young's dry humor hilarious. Launched on 16 April 1972, Apollo 16 was the second "J Mission" designated as such due to the enhanced focus on scientific investigation of the lunar surface and moon from orbit. J Missions also included the use of Lunar Rovers to expand the reach beyond the Lunar Module's landing area which for this mission was the Descartes Highlands. Chosen for the expectation of locating signs of volcanic action, Young and Duke were unable to find such evidence during their three EVA's on the surface.

The Saturn V of Apollo 16 was AS-511. It was the eleventh Saturn V to be flown and was similar to AS-510 used for Apollo 15 except the number of retrorockets on the S-1C stage was restored to eight from the reduction of four. AS-510 only had four in a weight reduction change from previous Saturn V's, but post flight data showed the stage came unacceptably close to the rest of the vehicle after staging, thus the change back to the previous configuration. Young and Duke chose *Orion* for the Lunar Module's name as something recognizably associated with the stars. Mattingly chose *Casper* after Casper the Friendly Ghost for the Command Module because "there are enough serious things in this flight, so I picked a non-serious name."



*Apollo 16 Liftoff! - NASA photo*

The launch was nominal as well as the trans-lunar injection (TLI) burn of the third stage. Shortly afterwards, Mattingly performed the transposition, docking, and extraction of the Lunar Module (LM) from the third stage. The crew noticed small debris coming from an apparent tear in the LM's skin. Young and Duke entered the LM and found no issues as a result of the tear. The rest of the journey to the moon was uneventful and the crew carried out experiments along the way.

The braking maneuver to enter lunar orbit insertion went as planned on day four. After decreasing their orbit to just under 20km the crew spent the rest of the day prepping for the landing



*Apollo 16 Crew (L-R) Ken Mattingly, John Young, Charlie Duke - NASA photo*

on day five. It was after Young and Duke had separated *Orion* from *Casper* that Mattingly discovered oscillations in the main engine's backup gimbal system. Under mission rules, such an issue was supposed to result in a mission scrub and an abort of the landing. After several hours of investigation, Mission Control decided the issue could be dealt with and to go ahead with the landing. Due to the delay and continued concern of the backup gimbal, the lunar surface stay would be cut by one day and the third EVA was trimmed by a couple of hours.

Because of the six-hour long delay before being cleared to land, Young and Duke began the descent of *Orion* from just over 20km, the highest altitude of any landing attempt. Despite this, the landing went nearly perfect, missing the target site by 270 meters.



*Mission Control discussing the CM backup gimbal problem - NASA photo*



View of Casper from LM Orion - NASA photo

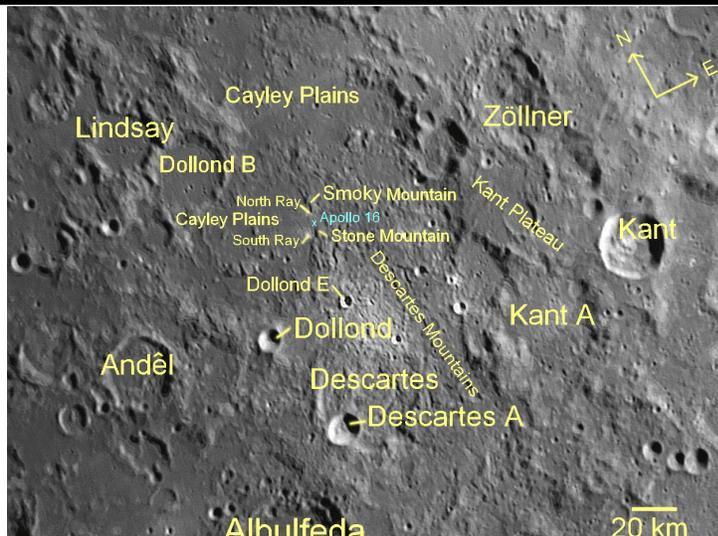
Upon landing the crew prepared the LM for their surface stay, ate a meal, and then slept before the first EVA.

The first EVA occurred on 21 April and the initial tasks included the extraction and setup of the Lunar Rover and Far Ultraviolet Camera/Spectrograph. The first use of the Lunar Rover discovered the rear wheel steering was inop. Other tasks included the planting of the flag by Duke, while Young setup cameras on the Lunar Rover. Afterwards Young drove the Rover to where the cameras could observe the deployment and setup of the Apollo Lunar Surface Experiments Package (ALSEP) and subsequently the rear wheel steering began working. Next on the agenda was the first geologic trip with the rover and the first stop was Plum Crater, 1.4km from Orion. While gathering samples, Duke collected the largest rock returned from an Apollo mission, nicknamed Big Muley after mission geological investigator William Muehlberger. They made another stop at Buster Crater, 1.6km from Orion before returning to the LM and perform more work on the ASLEP. Duke also took video footage of Young driving the rover. This concluded the first EVA which lasted just over 7 hours.

After a sleep period, Young and Duke embarked on their second EVA and Lunar Rover trip. The goal was to visit Stone Mountain where they would climb the 20-degree slope to reach the "Cinco" or five craters. The second objective was a 20m wide crater called

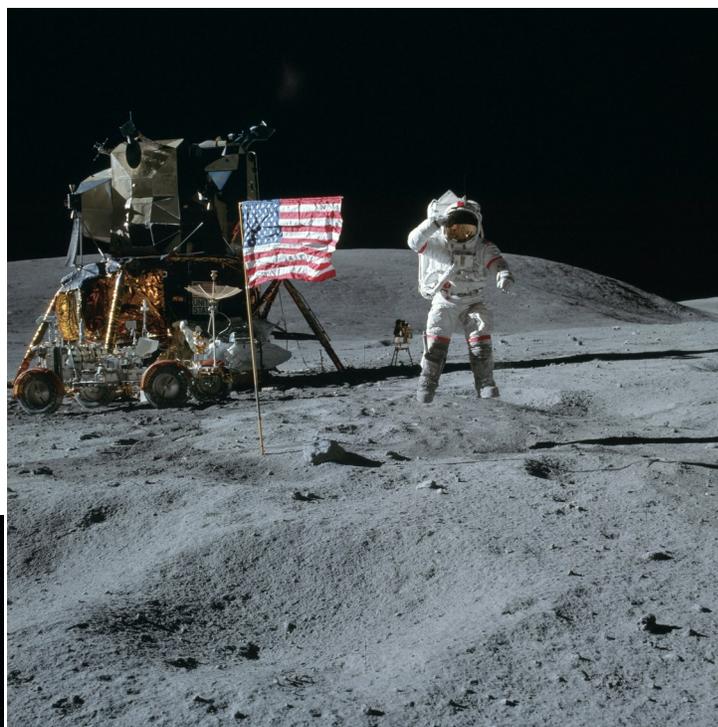


Casper and Earthrise from Orion - NASA photo



Descartes landing area - NASA photo

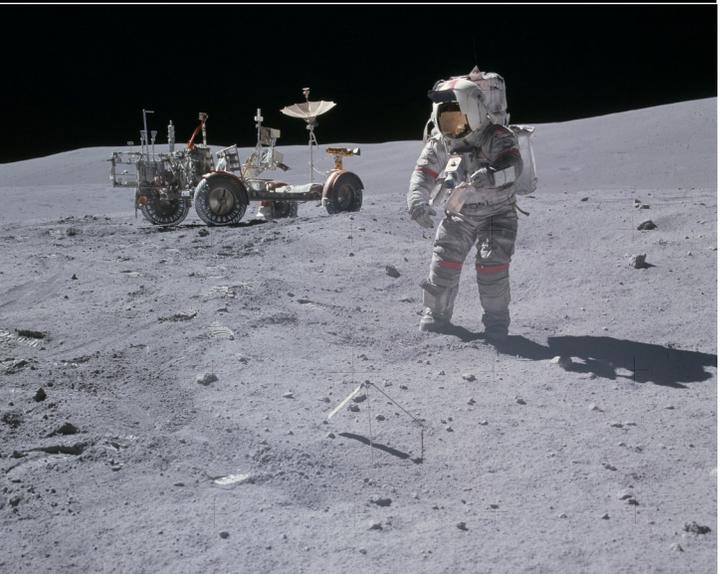
"Station Five". They continued on to a series of "Station" craters attempting to find Descartes material which concluded the rover portion of the EVA. Near the ASLEP and LM they took core samples and conducted several penetrometer tests before ending EVA 2 after 7 hours 23 minutes.



John Young rendering a big ol' Navy salute - NASA photo

For their third and final EVA, Young and Duke were to travel to North Ray crater (4.4km from the LM). This crater was 1km in diameter and was surrounded by large boulders, including one the size of a four-story building nicknamed "House Rock". After they gathered samples, they proceeded to Station 13, a field of boulders .5km from North Ray. From there they returned to the LM and conducted final experiments until it was time to conclude their EVA. Young drove the rover 90m from the LM so it could capture their departure on camera. They entered the LM after 5 hours 40 minutes to prepare their return to Casper.

During the three days of lunar surface exploration, Mattingly was kept busy conducting plenty of his own experiments. After *Orion* dropped to the surface, he brought *Casper* up to a 98km orbit until *Orion* was to return. He had a similar collection of experiments in the Service Module's SIM Bay as those on Apollo 15. The delay in *Orion*'s departure also impacted Mattingly's activities. He ran into several camera problems, some resulting in poor exposures, but the photos of Descartes and *Orion* came out well. The ascent from Descartes was uneventful. Upon docking, the lunar samples were transferred to the CSM. After securing the samples it was time for another sleep cycle before returning home.



John Young collecting lunar samples - NASA photo

and it crashed about a month later instead of lasting a year in orbit. Perhaps they should have put it in the ascent stage.

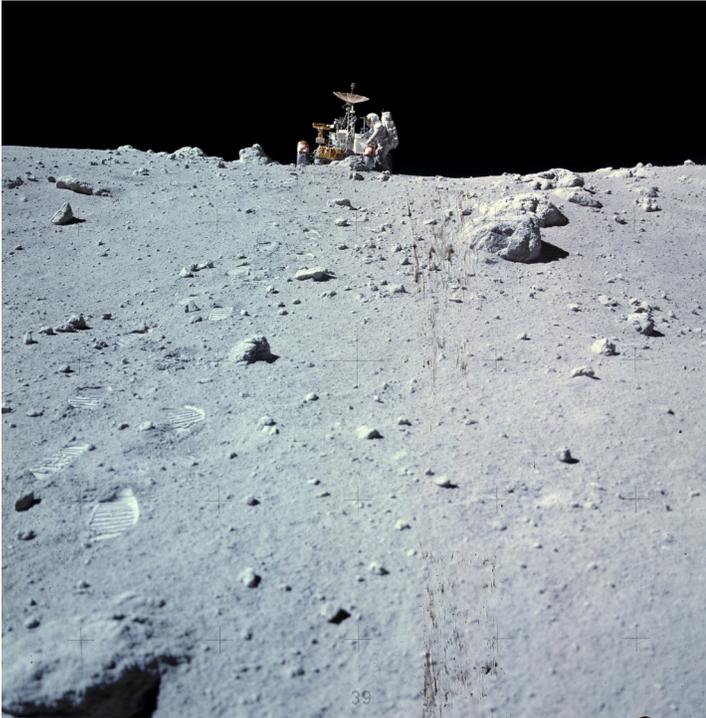
An hour after the subsatellite deployment, the main engine was fired successfully to send Apollo 16 back towards Earth. On the return journey, Mattingly performed an 83-minute EVA to collect film canisters from the SIM bay as well as a microbiology experiment to test microbes in a space environment. The return included a press interview and more experiments.

The re-entry and landing in the Pacific Ocean were textbook. There were no problems or issues and the crew was aboard the USS *Ticonderoga* 37 minutes after landing. In the end, there was no evidence of volcanic activity at Descartes, but the mission was executed professionally with little to no issues.

The Command Module *Casper* is on display at the U.S. Space & Rocket Center in Huntsville, AL. After Apollo 17 John Young and Charlie Duke served as part of the Apollo 17 backup crew. Duke retired shortly afterwards, while Young went on to continue his storied career in NASA. He served as the Commander for the first Space Shuttle flight, STS-1 and was Chief Astronaut from 1974 to 1987. He also Commanded STS-9 and retired in 2007. Ken Mattingly also Commanded Space Shuttle flights STS-4 and STS-51-C before retiring in 1985.



Apollo 16 crew awaiting a ride to the USS *Ticonderoga* - NASA photo



Charlie Duke at the Lunar Rover - NASA photo

The next day prior to the main engine burn that would send the CSM earth bound the crew was to jettison the LM ascent stage and then adjust the orbit to deploy a subsatellite from the service bay. The ascent stage was to be intentionally crashed on the surface to help calibrate and test the seismometers left on the surface, but instead the stage tumbled away out of control and didn't impact the moon for nearly a year. The planned orbit change was cancelled due to continued concerns of the main engine backup gimbal. Instead, the subsatellite was released in the current orbit



Ken Mattingly retrieving film cassettes from the SIM bay - NASA photo



# 1954 NACA HYPERSONIC STUDY

CHRIS TIMM & BUZZ NAU

The North American X-15 is one of most well known and recognized research aircraft to ever fly. The hypersonic x-plane set a multitude of aviation records and even qualified some test pilots as astronauts.

Prior to inviting aerospace companies to submit bids on Project 1226 to build the first hypersonic aircraft, the National Advisory Committee for Aeronautics (NACA) performed feasibility studies for such an aircraft. The investigation began in January 1952 as a recommendation from the NACA Committee on Aerodynamics. Committee member R.J. Woods of the Bell Aircraft Company, designer of the X-1, X-2, and X-5 research aircraft submitted a request to study the basic issues of hypersonic and space flight.



NACA 1954 Suggested configuration wind tunnel model

launching the aircraft. The other was a proposal of using an advanced X-2 design with improved propulsion.

A meeting in February 1954 of the NACA Interlaboratory Research Airplane panel opted to investigate a completely new aircraft instead of pursuing the modified X-2. NACA laboratories were then tasked to produce a detailed study to provide the requirements for the research vehicle. The resulting investigation committee set a goal of having the study complete in four weeks!

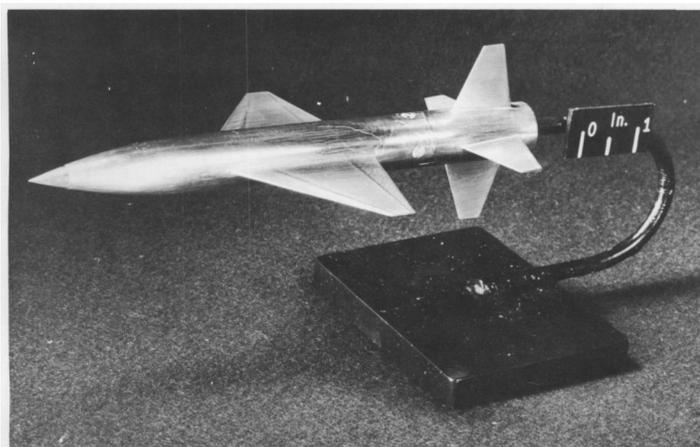


Figure 1.- Photograph of complete-model configuration. L-86687

As a result, The Langley Research Center put together a study group that reviewed previous research and identified structural heating as the main problem to solve. The group did not provide any new options, but did look at past NACA proposals. One included information about the benefit of using a new and improved mothership for

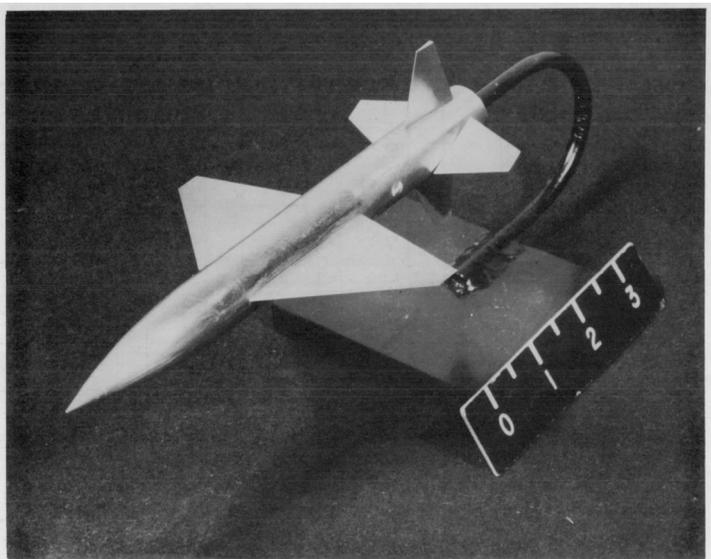


Figure 1.- Photograph of complete model with 10° wedge tail sections.  $i_H = -20^\circ$ . L-88000

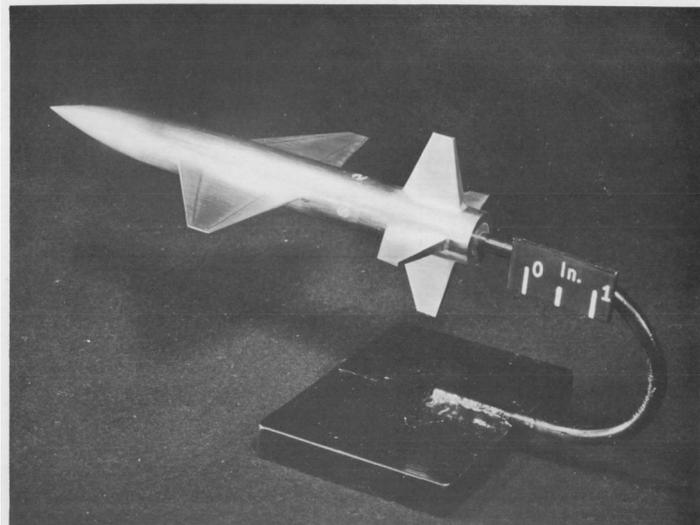


Figure 1.- Complete-model configuration. L-86688

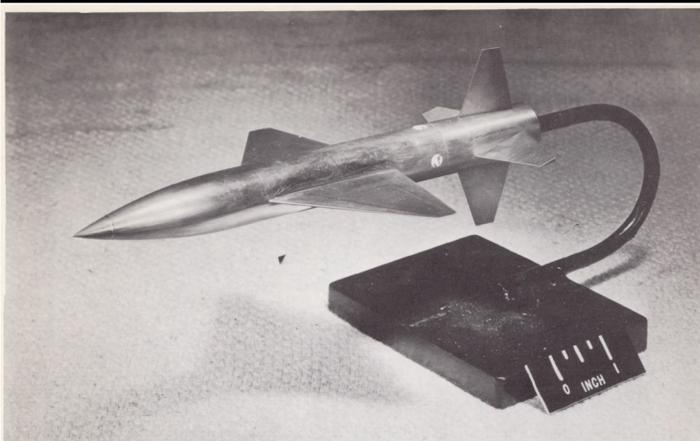
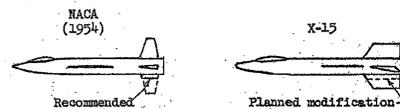


Figure 1.- Photograph of complete model.  $i_H = -8^\circ$ ;  $i_V = 0^\circ$ . L-88040

The resulting study addressed a new air-drop carrier aircraft, propulsion, structural heating, and stability in multiple regions of flight. One wind tunnel investigation considered cruciform fins on the tail for stabilization. The Langley committee submitted their report on 15 April 1954 for a Mach 7 capable research aircraft. This report was part of a larger presentation made to representatives of the Air Force, Navy and Scientific Advisory Board of the Air Force on 9 July 1954 to pitch for the new aircraft. It was recommended to circulate the report amongst the appropriate service committees and industry leaders. The reception was positive and a design competition was proposed. By October 1954 it was agreed by the NACA, Navy, and Air Force, that a joint project should be proposed. The design competition was finalized by the end of 1954 and a bidder briefing was made on 18 January 1955.

Four designs were proposed with North American winning the contract for the aircraft and Reaction Motors for the propulsion system.

The design assumptions made in the Langley report are incredibly close to the eventual X-15 which is amazing considering the tools available in that era of aircraft design, the complexity of the design, and short period of time to complete the research.

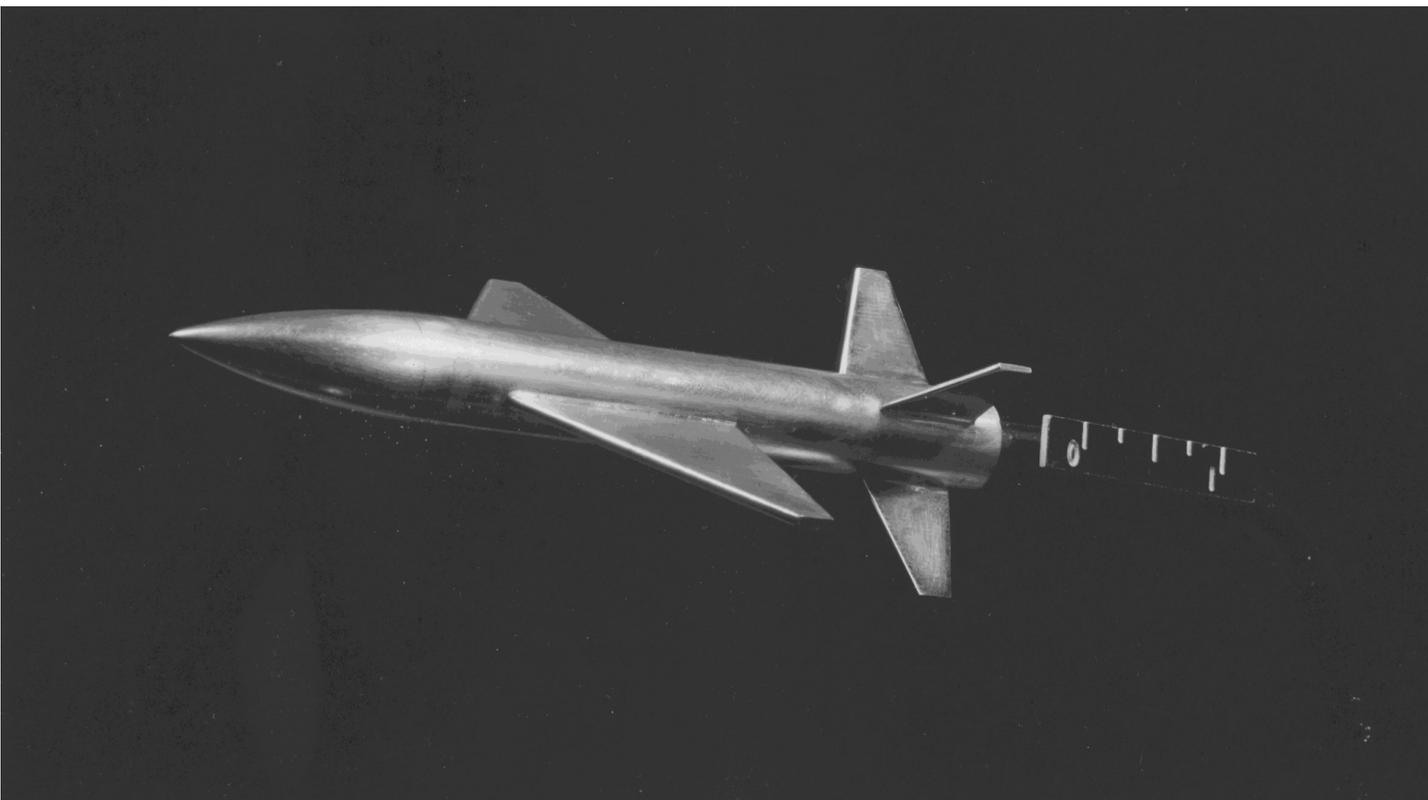


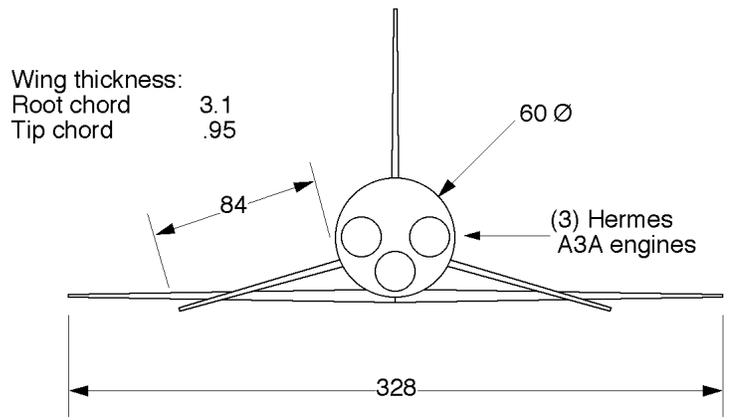
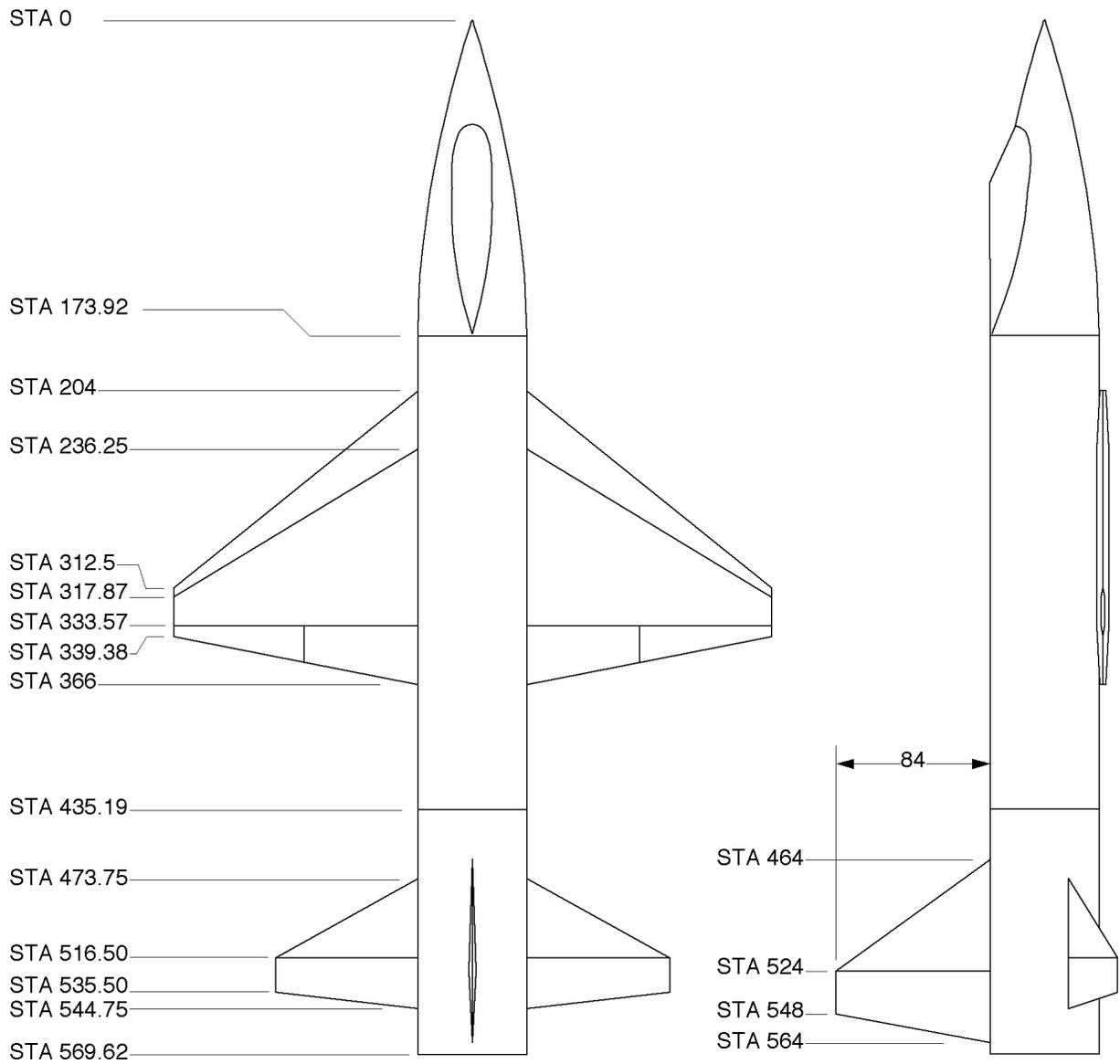
Weight, launch, lb	30,000	33,000
Weight, reentry, lb	12,000	14,600
Thrust, sea level, lb	54,000	50,000
Length, ft	48	50
Span, ft	27	22
Planform loading, lb/sq ft	32	38
Wing		
Section	Conventional, $\frac{t}{c} = .05$	Conventional, $\frac{t}{c} = .05$
Sweep, $\frac{c}{t}$ , deg	30	25
Skin	Inconel X	Inconel X
Internal structure	Inconel X	Titanium
Leading edge	Blunt segmented heat sink, Inc. X	Blunt segmented heat sink, Inc. X
Vertical tail		
Section	$10^\circ$ full wedge	$10^\circ$ full wedge
Brake $\Delta C_D$	0.10	0.05
Horizontal tail	$10^\circ$ full wedge	Conventional section
Lateral control		
Atmosphere	Ailerons	"Rolling" hor. tail
Space	$H_2O_2$ jets	$H_2O_2$ jets
Windshield	Quartz	Quartz
Landing gear	Skid	Skid plus nose wheel

**Reference:**

Staff Members of the Langley Research Center, *Conception and Research Background of the X-15 Project*, Langley Research Center, Langley Field, VA (1962)

Dunning, Robert W. & Ulmann, Edward, F., *NACA Research Memoranda, L55A21, L55F17, L55B28*, Langley Aeronautical Laboratory, Langley Field, VA, (1954)

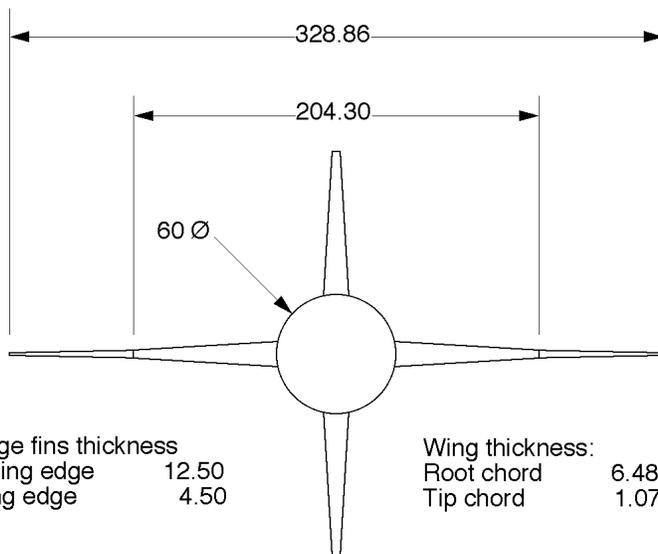
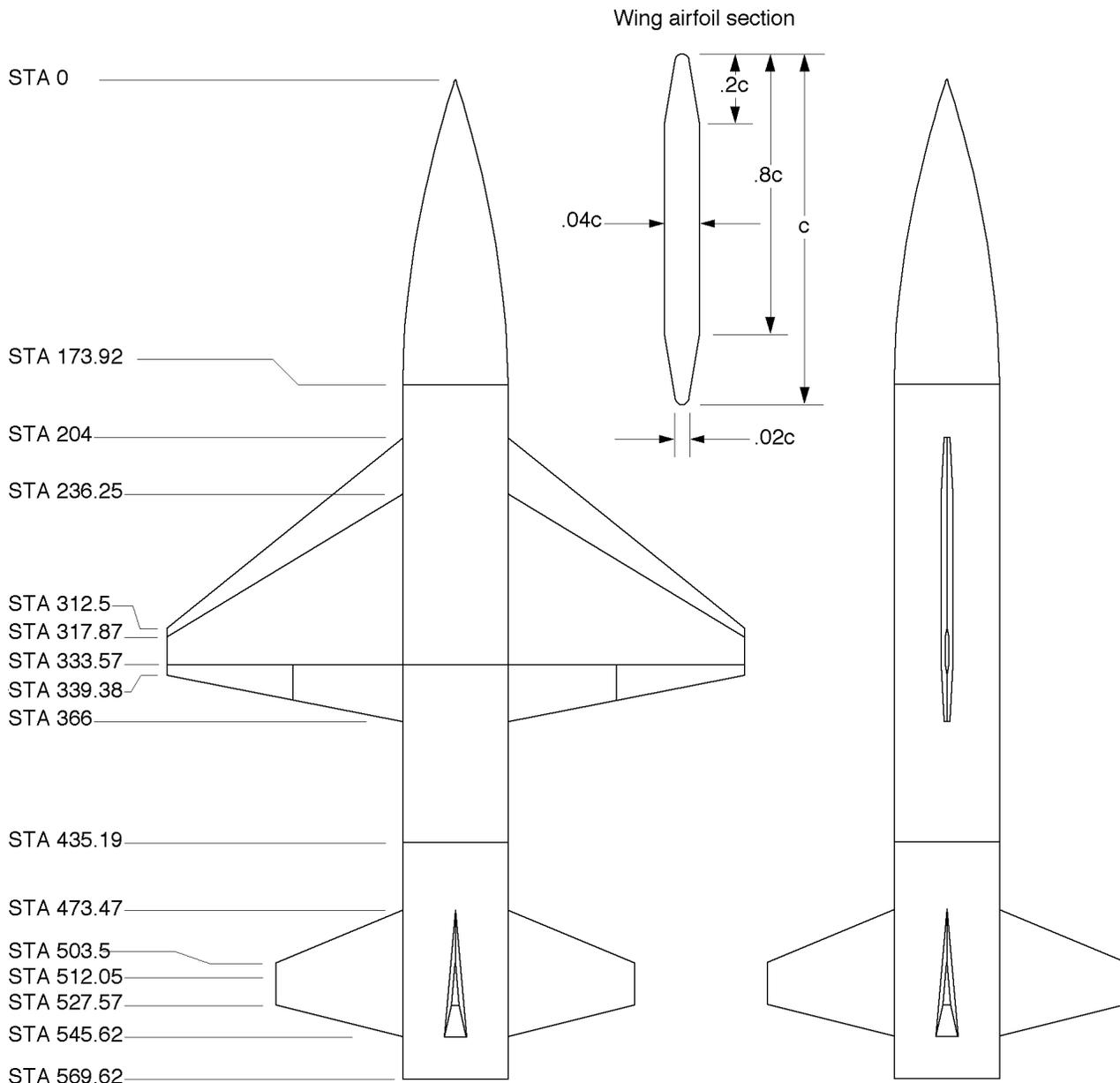




**1954 NACA  
 Research Airplane  
 Suggested Configuration**

1/100 scale  
 Dimensions in inches  
 © 2020 Chris Timm

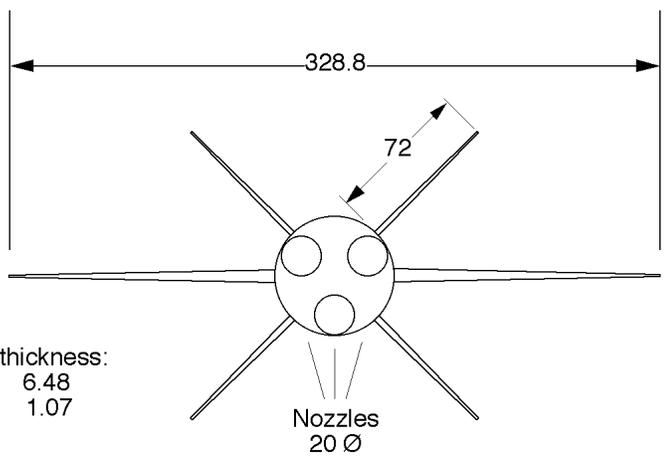
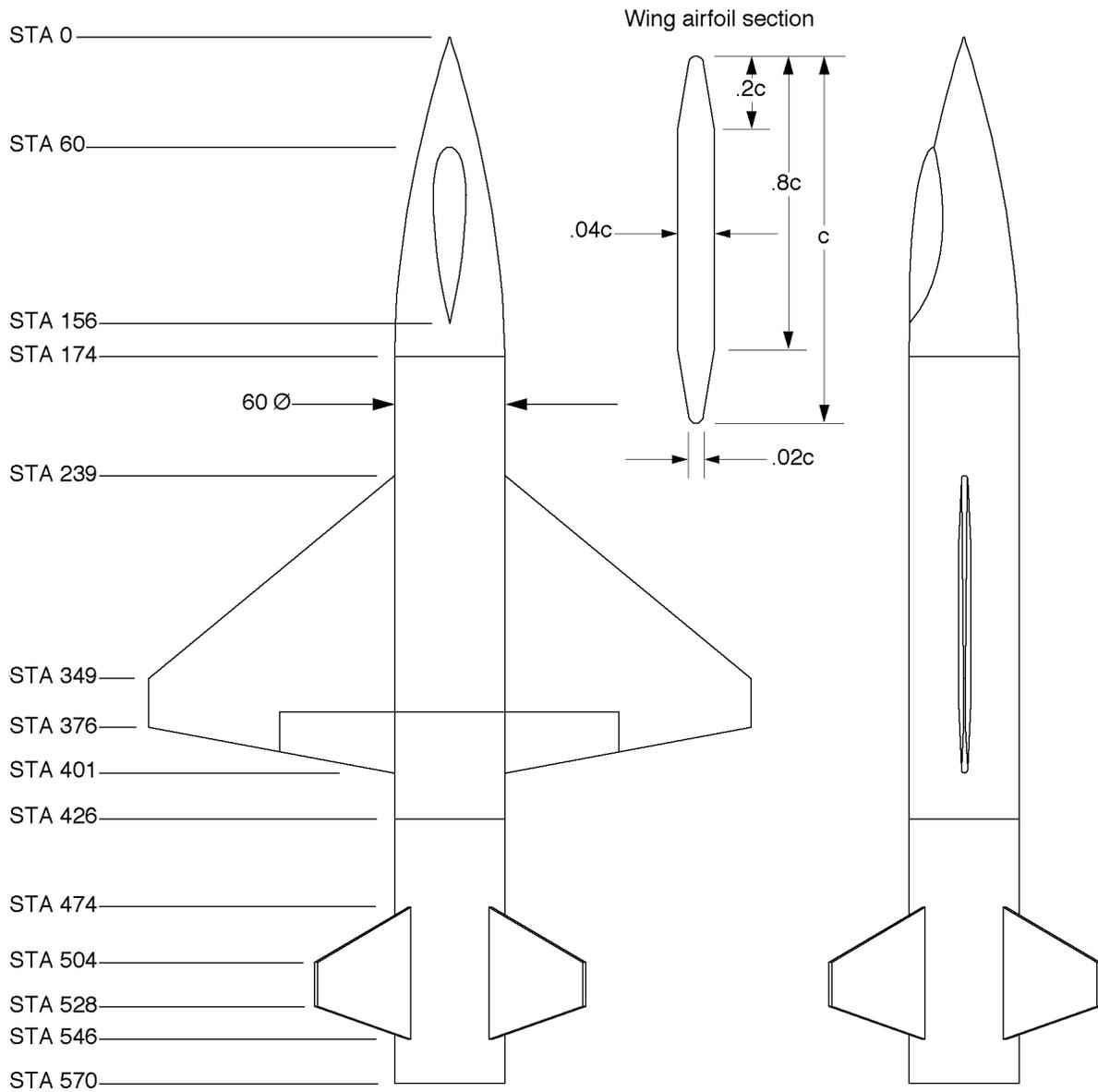
Sources:  
*X-15 Extending the Frontiers of  
 Flight*, Dennis R. Jenkins, pg. 50.



**M-7**

Hypersonic Research  
Airplane  
Cruciform Tail  
1/100 scale  
Dimensions in inches  
© 2020 Chris Timm

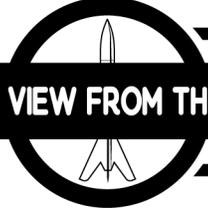
Sources:  
NACA Research Memorandum  
RM-L54L03a, RM-L55A21,  
RM-L55B28, RM-L55D08,  
and RM-L55F17.  
NASA photographs.



Wing thickness:  
 Root 6.48  
 Tip 1.07

**M-7**  
 Hypersonic Research  
 Airplane  
 1/100 scale  
 Dimensions in inches  
 © 2020 Chris Timm

Sources:  
*Research Airplane Study*  
*11 Inch Hypersonic Tunnel*  
*Section, NACA-Langley,*  
 April 1954, Jim Penland.  
 NASA photographs.


**VIEW FROM THE FLIGHT LINE**

## *Knockin' the Dust Off Part 3*

DALE HODGSON

Well, here we are April 2022 just two days before our first scheduled launch of the year. It's been so sporadic the last couple of years; yes, we have gotten a couple of launches in but those were just enough to sustain life support. We are at the point now, or at least I am, that there isn't much to write about these days.... or is there? In the works is something I'm having my stepson do for me. I built an all fiberglass Madcow kit; just a little one....29mm 2.6" diameter not even 2 feet tall. Just something to fly for fun, no complications. Although as I think of it, I could stick a Jolly Logic in there for grins and really send the thing. After all, it's all composite. Anyway, what I am having Jeremy do is actually putting the finish on it. It will be hydro-dipped. For those that don't know it's the same process that they do to rifles to have them covered with camo, skulls, stars /stripes, whatever comes to mind. I told him to do whatever he thinks he'd like to do so I guess we'll see down the road. And of course, there's Scott. Gotta watch that guy, he has me into all sorts of little trials and experiments. We're still working on his 3-D print kits; I'll actually be flying two of them if the weather holds this weekend. He has me dipping my own igniters now too so I'll be trying out some of his home-spun special mix. I've used a little of it before and I have to say I prefer it to any of the other mixes I've used. And just this morning we were talking battery packs for altimeters. So, at least there is some tinkering going on; potential articles forthcoming.

I didn't think I'd have another prep article to do but thought it might be prudent, especially this week. By the time this is published the launch will be done but there might be a few useful things that would serve in prepping for future launches. What I'll do here is pretty much outlining how I'm getting ready for the launch after a long layoff. First off, we've been flying mis-fire alleys lately; everyone brings their own ground support to be used and shared if desired. I went ahead and purchased a couple of outfits from my very own Debauchery Brother Fred Ziegler, Emperor for Life of Fade to Black. Once I have everything, I'll be able to fly anything I own, big or small. I even have a tower that Fred fabricated a stand for in case we ever need one at a launch. As it comes to mind though, I'd love to have a small wireless system; then my gear would truly be self-sustaining. Note to self.... talk to Scott and Tony!

Next is since I have so much to fly, old and new I had to figure out just what to bring. It's very easy to bring far more than I'll fly. There's a fine line between just right and excessive; there is only so much room in a truck; albeit it's full size. Two key factors are looking at the weather and the field we will be flying on: in this case Horning's #2. Plenty of room to fly, no issues there. Weather is a big factor though. I've been watching the forecasts very closely for the last week and will continue to do so right up to the point I leave for Michigan. By the way, as I write this...24 hours before launch time...it's cloudless and absolutely dead still. Figures, doesn't it? Anyway, the forecast at this point is no rain but steadily increasing winds in excess of 10mph. For me this says no gliders, and nothing going excessively high unless we're using electronics, whether altimeters or Jolly Logics. That being said however, I'll eliminate my really big stuff so that pretty much shuts down J motors. I'll fly a bit lower and match rockets and motors to accomplish that. So, it may very well be short/stubby day; a 5.5 Fat Boy with an H motor a couple of 4" shorter, beefy rockets with a baby H or G motor. Of course, I'll bring something that will get some

altitude but I already have the Jolly Logics charged up just in case. I'll be content with flying some lower power birds, I have enough to properly fly the field with anything from an A to E or a baby F motor. Seems like a lot but it really isn't. There is enough variety here to get through the day and actually get some stuff in the air which I'm sure goes without saying that it's something we desperately need to do.

I've talked a bit of equipment and flight choices but one thing I haven't mentioned is making sure we are personally prepped. It's supposed to be overcast but still take a second and apply some good sunscreen or wear protective clothing. Skin cancer is nothing to mess with; trust me. There is no shame in covering up, wearing big, brimmed hats and smelling like coconut. Also, we'll be walking around a big field so watch for ticks. Not so much in shorter grass or bare areas but if we have to venture off into taller weeds that's where tick may be hiding. Their populations are already high this year so it's good to keep a lookout for them. Do a tick check throughout the day and when you get home. Yes, ticks do transmit disease, we know that. Good thing though is that a tick has to be attached several hours in order to do so.

Since we're at Horning's there won't be any food available so those that need to, should pack along some lunch. Staying hydrated even this early in the year is paramount so bring water and remember to drink throughout the day. I tend to get a little excited and forget; something I need to work on. We're all set for bathroom availability so at least that's one less thing to worry about. Always good to be prepped just in case though; more than one of us carries a spare roll of toilet paper in our vehicles you know, just in case.

Even if by some chance the weather doesn't cooperate it will still be good to get back to the flight line with all my rocket buds and hang out for the day. And hopefully it will serve to whet the appetite for a great 2022 now that we can get back out there and fly again.





# CURRENT EVENTS IN SPACE EXPLORATION

Space launch activity continues at a steady pace. SpaceX once again leads the pack with nine launches over the past two months. This included five Starlink launches alone and also two crewed flights to the International Space Station. Rocket Lab had two launches with a third that will have flown by the time this is published. This third flight will be an attempt to recover the booster during descent by helicopter. We wish Rocket Lab well in this attempt.

Other news of note, the James Webb Space Telescope has completed its mirror alignment and will be operating as planned some time in June. NASA rolled the Artemis Space Launch System (SLS) to launch

aperture radar satellite is a beta version. Future production versions will be used for Earth observation.



*Without Mission a Beat* was launched nearly a month later on 2 April, also on an Electron launch vehicle from Launch Complex 1A in New Zealand. The payload this time was two Earth observation micro-satellites for Blacksky.



pad 39B for wet dress rehearsals prior to making a launch attempt. The rehearsals did not go as planned as a LOX leak halted testing. The vehicle was returned to the Vehicle Assembly Building (VAB) for evaluation and repair.



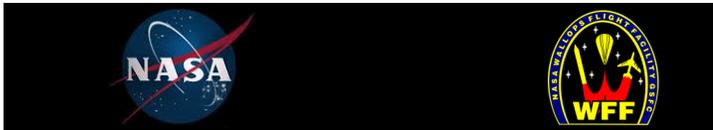
United Launch Alliance's single flight this period was the GOES-T mission. GOES-T is a large weather satellite for NOAA weighing over 5,000 kg.. It flew aboard an Atlas V 541 from Cape Canaveral SFS on 1 March.



Rocket Lab lead off the flights this period with an Electron launch on 28 February. *The Owl's Night Continues* mission flew from Rocket Lab's launch site in New Zealand. The payload, a single 100kg StriX-B satellite, was deployed to a sun synchronous orbit. The synthetic



# CURRENT EVENTS IN SPACE EXPLORATION



# SPACEX

Bolt II, a Terrier-Improved Malemute two stage sounding rocket, was launched on 21 March from Wallops Island Flight Facility. Bolt II (Boundary Layer Transition and Turbulence) was a research vehicle used to test heating and drag in the hypersonic region of flight.

First up for SpaceX was the Starlink 4-9 launch on 3 March from Cape Canaveral Space Force Station. The Falcon 9 lofted 47 Starlink telecom satellites to shell 4. The first stage booster landed for the eleventh time on *Just Read the Instructions*. Both fairing halves were also recovered.



On 7 April two INCAA program sounding rockets, a Terrier-Black Brant and Terrier-Improved Malemute, were launched the Poker Flat Range, AK. The objective was to explore the interactions between plasma and the neutral atmosphere during active aurora.

Starlink 4-10 was next up and flew seven days later on 10 March. This Falcon 9 carried 48 Starlink satellites for the tenth flight to shell 4. It was the fourth flight for this booster which landed on *A Shortfall of Gravitas*. Both fairing halves were recovered as well.



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# CURRENT EVENTS IN SPACE EXPLORATION

On the 19th of March, Starlink flight 4-12 launched from Cape Canaveral lifting 53 Starlink satellites again to shell 4. Another nineteen flights will be required to fill the constellation shell. It was the Falcon 9 booster's eleventh flight which landed successfully on *Just Read the Instructions*. Again, both fairing halves were recovered.

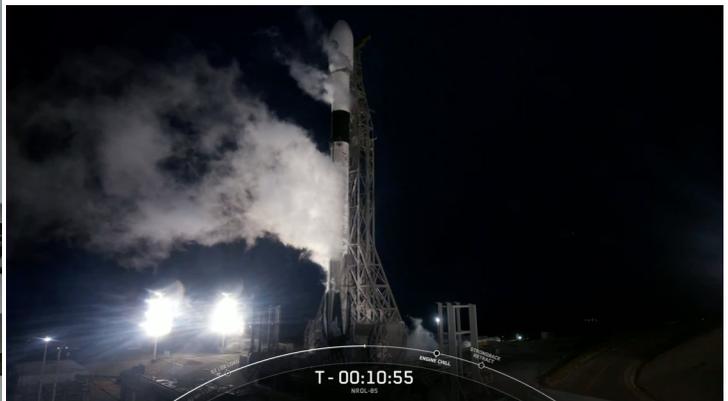
Axiom 1, the first private, crewed mission to the ISS was launched on 8 April from Kennedy Space Center. The Crew Dragon and crew of four astronauts, Commander Michael Lopez-Alegria, Pilot Larry Conner, Mission Specialist Mark Pathy, and Mission Specialist Eytan Stibbe, had planned on a ten day flight, eight days aboard the ISS to conduct experiments and one day each for ascent and descent to and from the ISS. However, due to weather conditions in the landing area in the Atlantic Ocean, the crew remained on the ISS for sixteen days. Fortunately they were not charged for the over-stay. Only Lopez-Alegria had flown in space previously on STS-73, STS-92, STS-113, and Soyuz TMA-9. It was the fifth flight for the Falcon 9 booster which landed on the droneship *A Shortfall of Gravitas*.



Transport 4, a rideshare mission, lifted off on 1 April carrying 20 individual satellites and 40 payloads. This was the fourth dedicated rideshare mission for SpaceX. Included were beta telecom satellites from Omnispace, observation satellites from Satellogic, and a SPACE-LUST ion propulsion satellite that deployed seven cubesats. This was the seventh flight for the Falcon 9 booster which landed on the droneship, *Just Read the Instructions*.



Next in line was another "hush hush" flight for the National Reconnaissance Office. NROL-85 was flown from Vandenberg SFB on 17 April aboard a Falcon 9. The classified surveillance satellite was successfully deployed to a low earth orbit and the booster made its second landing back at Vandenberg Landing Zone 4.



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



# CURRENT EVENTS IN SPACE EXPLORATION

A few days later on 21 April, Starlink 4-14 was launched from Cape Canaveral Space Force Station. Aboard were 53 Starlink satellites that were successfully deployed to shell 4. It was the thirteenth flight for the Falcon 9 booster which landed on the droneship *Just Read the Instructions*. Both fairing halves were also recovered.



Crew-4, launched on 27 April from Kennedy Space Center was the second crewed mission this period, less than two weeks after the Axiom-1 flight. The crew includes Commander Kjell Lindgren, Pilot Robert Hines, Mission Specialist Jessica Watkins, and Mission Specialist Samantha Cristoforetti. Lindgren has flown before on STS-130, the others are all space rookies. They and Crew Dragon *Freedom* will remain at the ISS for six months. The Falcon 9 booster had flown three times already and landed safely on the droneship *A Shortfall of Gravitas*.



Starlink 4-16 was the final SpaceX launch for this two month period. This marked the thirteenth flight to shell 4. The payload consisted of 53 Starlink telecom satellites. This flight also marked the quickest turnaround for a Falcon 9 booster from a previous flight at just over 21 days! The previous record was just over 27 days. It was the booster's sixth flight and it landed aboard the droneship *Just Read the Instructions*. Both fairing halves were recovered as well.



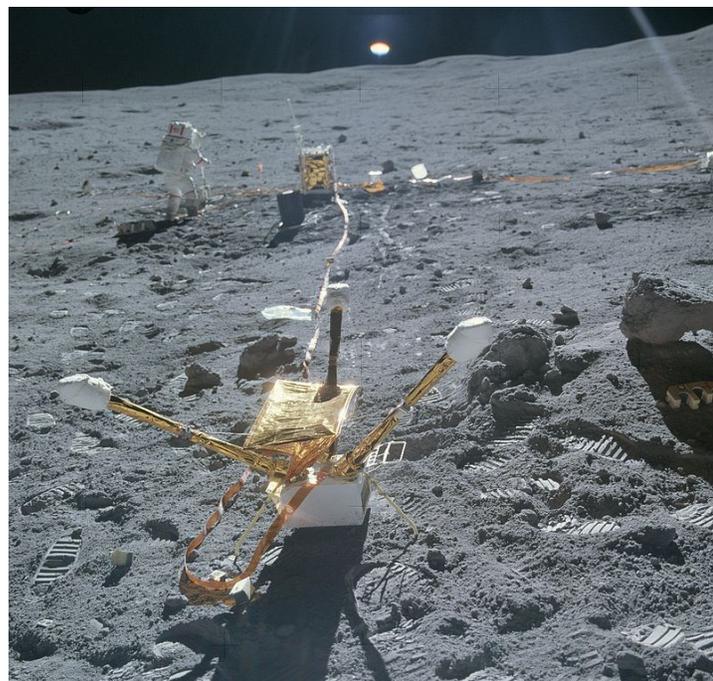
Astra's Rocket 3.3, flight LV0009 successfully flew from the Pacific Spaceport in Kodiak, Alaska on 15 March. This was the second launch for 2022 and second Astra rocket to reach orbit. The payload was funded by Spaceflight Inc and included the S4 Crossover test system attached to the second stage and OreSat0, a 1U cubesat.



Blue Origin's NS-20 mission was a sub-orbital flight on 31 March with their New Shepard 4 vehicle. The vehicle reached 107 km and carried six passengers.



# More Apollo 16 Photographs



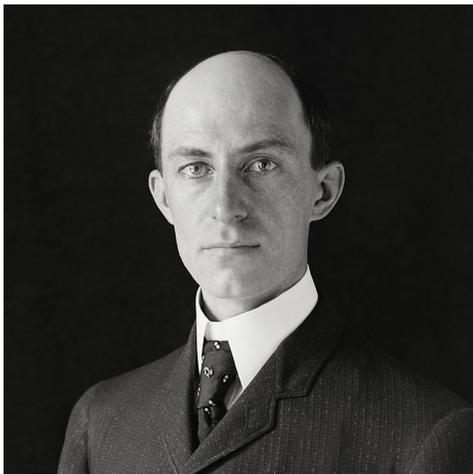


# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

### 155 Years Ago - 1867

April 16: Wilbur Wright born, Millville, IN



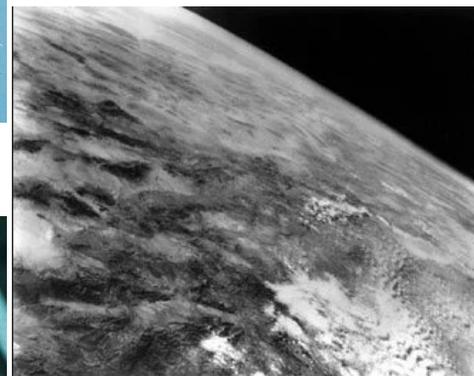
### 95 Years Ago - 1927

March 6: Gordon L. Cooper Jr. born



### 75 Years Ago - 1947

March 7: First photograph taken from space from a V2 rocket 100 miles above White Sands, New Mexico



### 140 Years Ago - 1882

March 10: George Lewis, Director of Aeronautical Research at the National Advisory Committee for Aeronautics (NACA) born

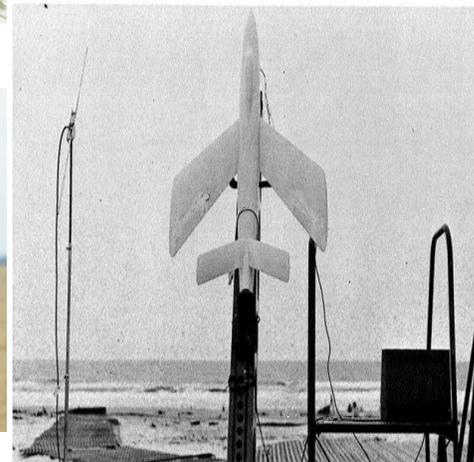


### 90 Years Ago - 1932

March 5: Alan Bean born



April 25: Wallops Flight Research Facility launched its first rocket-propelled model of a complete airplane for performance evaluation (XF-91)



### 110 Years Ago - 1912

March 23: Dr. Wernher von Braun born, Wirsitz, Germany (now Part of Poland)



March 16: Walter Cunningham born



### 85 Years Ago - 1937

March 6: Valentina Tereshkova born, Maslennikovo, Yaroslavl Region, USSR. First woman in space aboard Vostok 6, June 16, 1963

### 60 Years Ago - 1962

March 7: OSO 1 launched Thor Delta from Cape Canaveral  
March 16: Cosmos 1 launched by Cosmos rocket from Kapustin Yar, USSR



# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

## 60 Years Ago – 1962 (continued)

March 17: Kalpana Chawla born



April 24: Cosmos 3 launched by a Cosmos rocket from Kapustin Yar, USSR  
April 24: First transmission of TV pictures in space, via Echo 1  
April 25: Saturn 2 (SA-2 - Project High Water) suborbital test launch for Saturn 1 launched from Cape Canaveral



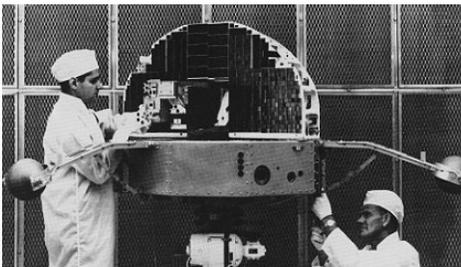
April 26: Cosmos 4 launched by Vostok rocket from Baikonur, USSR

April 26: Launch by Thor Delta of Ariel 1, the first international satellite, a joint project of NASA and the UK

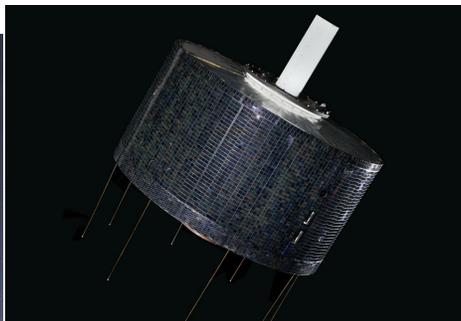


## 55 Years Ago – 1967

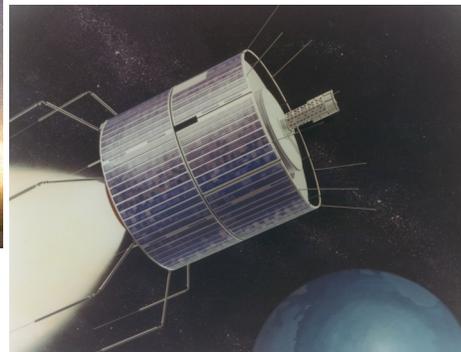
March 8: OSO 3 launched by Delta from Cape Canaveral



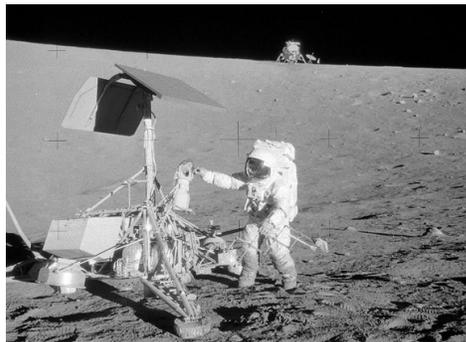
March 22: Cosmos 150 launched by Voskhod from Plesetsk, USSR  
March 23: Intelsat II F-3 launched by Delta from Cape Canaveral



April 5: ATS 2 launched by Atlas Agena from Cape Canaveral



April 17: Surveyor 3 launched by Atlas Centaur from Cape Canaveral landed on Moon April 19



April 20: ESSA 5 launched by Thor Delta from Vandenberg AFB

April 25: Air Force Col. Joseph Cotton and NASA research pilot Fitzhugh Fulton made the first NASA flight in the XB-70A



April 26: San Marco 2 launched by Scout from San Marco Range SMR, Kenya





# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

## 50 Years Ago – 1972

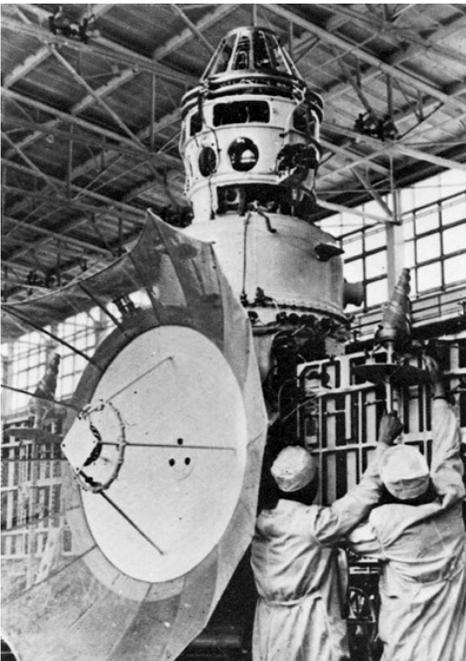
March 2: Pioneer 10 launched by Atlas Centaur from Cape Canaveral



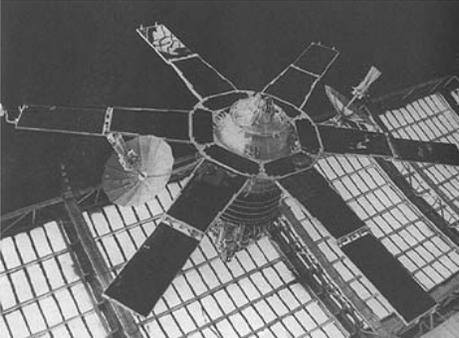
March 11: TD-1A launched by Delta for ESRO from Vandenberg AFB



March 27: Venus 8 (Venera 8) launched by Modified SS-6 (Sapwood) or Molniya from Baikonur, USSR



April 4: Molniya 1-20 & SRET 1 (a French acronym for 'Satellite for Research on Environment and Technology') launched by Molniya or Modified SS-6 (Sapwood) rocket from Baikonur, USSR



April 16: Apollo 16 launched from KSC with astronauts John W. Young, Jr.; Thomas K. Mattingly; and Charles M. Duke, Jr



## 45 Years Ago – 1977

March 10: Uranus rings discovered



March 10: Palapa 2 launched by Delta from Cape Canaveral

## 40 Years Ago – 1982

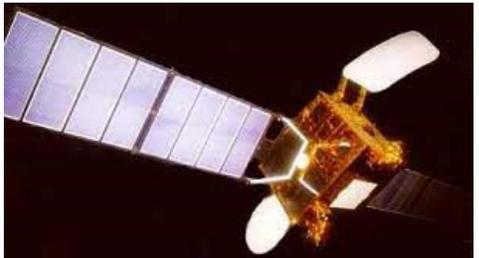
March 4: Intelsat V F-4 launched by Atlas Centaur from Cape Canaveral

March 22: STS-3 (Space Shuttle *Columbia*) launched from KSC. Crew: Jack R. Lousma and C. Gordon Fullerton. Continued testing of Space Shuttle systems for qualification

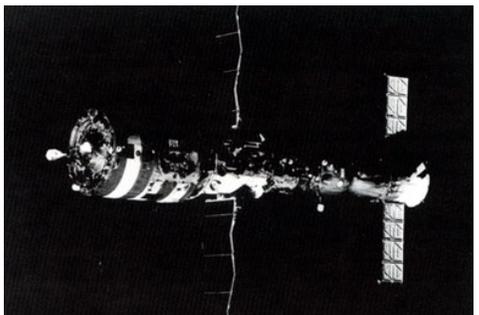
for operational flights. Landed March 30 at White Sands. Mission Duration: 8 days



April 10: Insat 1A (India) launched by Delta from Cape Canaveral



April 19: USSR launches Salyut-7 space station on top of Proton K rocket from Baikonur. Station operated until February 7, 1991



## 35 Years Ago – 1987

March 20: Palapa B 2P Comsat launched by Delta from Cape Canaveral. Owned by Republic of Indonesia

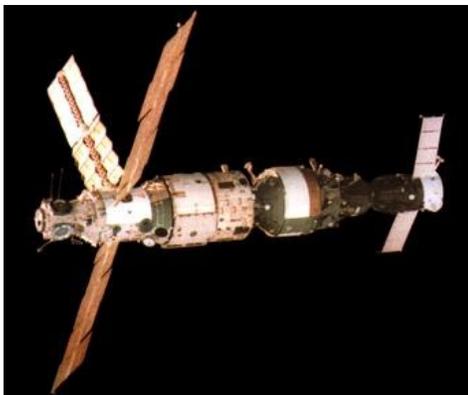


# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

### 35 Years Ago – 1987 (Continued)

March 31: USSR launches space station module Kvant-1 (Quantum) aboard a Proton K rocket from Baikonur. Docked with space station Mir on April 9



### 30 Years Ago – 1992

March 14: Galaxy 5, a commercial communications spacecraft, was launched from Cape Canaveral by an Atlas 1 rocket  
 March 17: Russia launches Soyuz TM-14 to space station Mir from Baikonur. Cosmonauts: Aleksandr S. Viktorenko; Aleksandr Y. Kaleri and Klaus-Dietrich Flade (Germany)



March 24: STS-45 (Space Shuttle *Atlantis*) launched from KSC. Crew: Charles F. Bolden, Brian Duffy, Kathryn D. Sullivan, David C. Leestma, C. Michael Foale, Byron K. Lichtenberg, and Dirk D. Frimout (Belgium).



Carried first Atmospheric Laboratory for Applications and Science (ATLAS-1) on Spacelab pallets mounted in orbiter's cargo bay. Landed April 2 at KSC. Mission Duration: 8 days, 22 hours, 9 minutes  
 April 1: Daniel S. Goldin takes office as ninth NASA Administrator



### 25 Years Ago – 1997

April 4: STS-83 (Space Shuttle *Columbia*) Launched from KSC. Crew: James D. Halsell, Susan L. Still, Janice E. Voss, Donald A. Thomas, Michael L. Gernhardt, Roger K. Crouch, and Gregory T. Linteris. It carried the Spacelab module containing resources for many microgravity experiments and a combustion facility for the study of the rise, spread, and extinction of flames under microgravity conditions. Landing at KSC on April 8. Mission Duration: 3 days, 23 hours, and 13 minutes



### 20 Years Ago – 2002

March 1: STS-109 (Space Shuttle *Columbia*) launched from KSC. Crew: Scott D. Altman, Duane G. Carey, John M. Grunsfeld, Nancy J. Currie, James H. Newman, Richard M. Linnehan, and Michael J. Massimino. This is the fourth servicing mission to the Hubble Space Telescope. Landed March 12 at KSC. Mission Duration: 10 days, 22 hours, 11 minutes

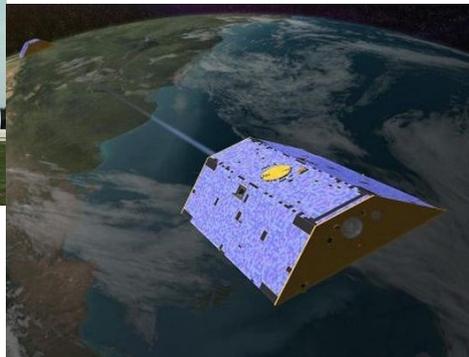
March 1: ENVISAT 1, a European Space Agency (ESA) environmental remote-sensing spacecraft was launched by an Ariane 5 rocket from Kourou, French Guiana. Reported to be the most massive and expensive of the European satellites, it carried ten sensors to monitor global warming, the ozone hole and desertification



March 17: GRACE 1 and GRACE 2 (Gravity Recovery And Climate Experiment nick-named Tom and Jerry) are a pair of American-German, identical, satellites that were launched by a Rockot booster from Plesetsk. They aim to map the local gravitational mini variations caused by sea-level changes, glacial motions, and seasonal melting/freezing of ice sheets



March 1: STS-109 (Space Shuttle *Columbia*) launched from KSC. Crew: Scott D. Altman, Duane G. Carey, John M. Grunsfeld, Nancy J. Currie, James H. Newman, Richard M. Linnehan, and Michael J. Massimino. This is the fourth servicing mission to the Hubble Space Telescope. Landed March 12 at KSC. Mission Duration: 10 days, 22 hours, 11 minutes





# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

## 20 Years Ago – 2002 (Continued)

April 8: STS 110 (Space Shuttle *Atlantis*) launched from KSC. Crew: Michael J. Bloomfield, Stephen N. Frick, Jerry L. Ross, Steven L. Smith, Ellen Ochoa, Lee M.E. Morin, and Rex J. Walheim. International Space Station Flight 8A. Delivered an ISS truss assembly. Landing at KSC on April 19. Mission Duration: 10 days, 19 hours, 43 minutes



nyi to the International Space Station (ISS). It docked with the Zarya module of the ISS



April 25: AIM (Aeronomy of Ice in Mesosphere), an American (NASA) satellite designed to study noctilucent clouds (NLC) or night shining - mainly ice crystal clouds that form about 85 km above Earth's poles, launched on a Pegasus XL rocket from an L-1011 aircraft flying out of Vandenberg AFB

NASA astronaut Peggy Whitson, European Space Agency astronaut Thomas Pesquet, and Russian cosmonaut Oleg Novitskiy (ISS Expedition 50)



April 25: Soyuz TM-34 launched as the third "taxi" flight from Baikonur to the International Space Station (ISS), bringing a "fresh" Soyuz return vehicle. The crew consisted of one Russian, Yuri P. Gidzenko, an Italian astronaut, Roberto Vittori, and the second commercial space tourist, South African Mark R. Shuttleworth. They returned 8 days later on an older Soyuz TM-33



## 10 Years Ago – 2012

April 19: NASA transferred Space Shuttle *Discovery* to the Smithsonian's National Air and Space Museum at formal ceremonies at the museum's Stephen F. Udvar-Hazy Center



## 15 Years Ago – 2007

March 9: FalconSat 3, an American military (DARPA) picosatellite, was one of six DARPA military satellites launched by an Atlas 5 rocket from Cape Canaveral. Built by USAF Academy cadets, it monitored the ambient plasma, and tested a micropropulsion attitude control system

April 7: Soyuz TMA-10 launched by a Soyuz rocket from Baikonur. Crew: consisted of two cosmonauts, Oleg V. Kotov, Fyodor N. Yurchikhin, and a tourist, Charles Simo-

## 5 Years Ago – 2017

April 20: Soyuz MS-04 spacecraft launched by a Soyuz FG launch vehicle from Tyuratam (Baikonur Cosmodrome), Kazakhstan. Crew: Jack Fischer, a NASA astronaut, and Fyodor Yurchikhin, a Russian cosmonaut (ISS Expedition 51), joined



## ENAMEL PAINTING CHEMISTRY

Mark Chrumka found this useful thread on the [Space Modeller's Forum](#) by Michael McMurtrey. This should be interesting for anyone who strives to create a nice finish for their rockets.

Technically speaking, enamel doesn't dry, it cures. It's a fundamentally different process.

Paints such as nitrocellulose lacquers (like automotive lacquers) and aqueous acrylics truly do dry. The binder of these paints is dissolved into solvent (either lacquer thinner or water), and the paint hardens as the solvent evaporates. Dehydrators can be very effective in driving off solvents from these paints - they're obviously designed to evaporate water out of food, and evaporating solvents is very similar. But enamels do not dry; they harden (cure) due to oxidative crosslinking. When an enamel is exposed to oxygen, it starts a chemical process which molecularly hardens the binder - creating a sort of 'shell' as binder molecules link with each other. Heat and convection have a limited effect in speeding this process. It may increase the crosslinking process slightly, but certainly not in the way that it dries solvent. This curing process allows polymers in the paint to set and bond together so when the paint hardens, it will not soften again. This is why you can brush additional coats over the original coats once they have cured. In contrast, lacquer paint dries when the solvent has evaporated and can soften over time or dissolve with the application of additional coats.

If you thin enamels with lacquer thinner, you're not changing the curing time. By introducing a volatile solvent, you're creating a mix that needs to cure and dry. But after the solvent has finished evaporating, the enamel binder still must cure - and the binder will still cure at its own pace.

If you want enamel to cure quickly, the best way is to spray it as thin as possible. This way as much of the paint as possible is exposed to oxygen, and it can all go to work on curing. If you apply enamels thickly, only the outside surface is exposed to oxygen, which can dramatically increase the curing time of the paint deeper in the layer. Spray enamel too thick and it is possible to keep some of the paint from ever completely curing. The outermost portion exposed to air can cure perfectly well - but this cured outer portion becomes a barrier to prevent the paint deeper in the layer from being exposed to oxygen. As a result the paint will always be soft, under a thin cured film.

This is why enamels have such strange application instructions - you must spray or brush everything on at once (within a couple of hours), or you must wait days or weeks to apply another layer. If a layer is applied and it begins (but does not complete) curing, only to be covered by another layer, the first layer will never cure.

Of course applying many thin fully cured layers is a perfectly acceptable (if very time consuming!) way of applying

enamels. But if you try sanding/polishing it, you will see quickly that each of these individually cured layers is distinct. You will clearly see where you've sanded through one to the layer below, rather like sanding through an onion. It makes enamels difficult to apply thickly....(adapted from [Enamel Drying Time](#))

### Thinners versus Reducers

Thinners and reducers are both solvents used to thin paint. These additives make the paint flow better so the result is even, professional coats. While the purpose of the two is basically the same, thinners and reducers are used on very different paints. Using the wrong one could ruin your paint.

### Paint Type

The main difference between thinners and reducers is in the paint type that is being applied. Thinners are for lacquer-based paints. Reducers are used for enamels and urethane-based paints. The two solvents are not interchangeable. For example, if the paint is an enamel-based product, do not use a thinner, but rather a reducer. In addition to making the paint thin enough to spray through a gun, reducers also provide leveling and adhesion to the paint. A combination or blend of different solvents is used to make them.

### Manufacturer Instructions

Each brand of paint will come with instructions on which solvent to use and what the mixing requirements are for the paint and solvent. It is very important that you follow the directions from the manufacturer exactly to get the best results. The paint will usually tell you explicitly to use the manufacturer's recommended thinner or reducer to use, and for good reason: It is formulated to work best with the manufacturer's paint.

### Signs of Mismatched Solvents

Some symptoms that the solvent used was incorrectly matched to the paint include poor gloss and adhesion, dullness, chalking, cracks or splits, blisters, sanding swell, blushing or bleed-through of color. Color bleed is caused by solvents reacting with the undercoats, causing the undercoat color to show through the top finish. The fixes for each symptom are time-consuming and require you to use more paint to complete the job correctly.

### Terminology

Each paint manufacturer uses its own terminology when it comes to solvents. For example, some European companies refer to reducers as "thinners," which can be very confusing. It is very important that the solvent selected matches with the manufacturer's recommendations for which solvents to use, including using the right proportions and taking into consideration various environmental situations, such as hot or humid weather. If you have any questions, you should contact the paint manufacturer directly to verify whether the solvent and paint selected will work together properly before applying it to your model. (Adapted from [Can You Use Paint Thinner as Reducer](#) and [Differences Between Thinners and Reducers](#))



# LAUNCH WINDOWS

Launch dates from SpaceFlight.com

**May 5, 2022**

**Falcon 9 - Starlink 4-17**

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

A SpaceX Falcon 9 rocket will launch with another batch of Starlink internet satellites. The Falcon 9's first stage booster will land on a drone ship in the Atlantic Ocean.

**May 8, 2022**

**Falcon 9 - Starlink 4-13**

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

A SpaceX Falcon 9 rocket will launch with another batch of Starlink internet satellites. The Falcon 9's first stage booster will land on a drone ship in the Pacific Ocean.

**May 9, 2022**

**Long March 7 - Tianzhou 4**

**Launch site: Wenchang**

A Chinese Long March 7 rocket will launch the Tianzhou 4 resupply ship to dock with the Chinese space station. The automated cargo craft will be the third resupply freighter for the Chinese space station.

**May 2022**

**Electron - CAPSTONE**

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

A Rocket Lab Electron rocket will launch NASA's Cislunar Autonomous Positioning System Technology Operations and Navigation Experiment, or CAPSTONE, mission to the moon. CAPSTONE will fly to the moon on Rocket Lab's Photon space tug, entering a unique halo-like lunar orbit to test deep space navigation and communications in the same orbit to be used by NASA's Gateway mini-space station.

**May 16, 2022**

**Falcon 9 - Starlink 4-15**

**Launch site: SLC-40, Cape Canaveral SFS**

A SpaceX Falcon 9 rocket will launch with another batch of Starlink internet satellites. The Falcon 9's first stage booster will land on a drone ship in the Atlantic Ocean.

**May 2022**

**Alpha 1 Multi-payload**

**Launch site: SLC-2W, Vandenberg SFB**

A Firefly Alpha rocket will launch on its second test flight with a rideshare payload consisting of multiple unspecified small satellites.

**May 19, 2022**

**Atlas 5 - CST-100 Starliner Orbital Flight Test 2**

**Launch site: SLC-41, Cape Canaveral**

**AFS**

A United Launch Alliance Atlas 5 rocket, designated AV-082, will launch Boeing's CST-100 Starliner spacecraft on second uncrewed test flight to the International Space Station. This mission was added after Boeing's decision to re-fly the Starliner's Orbital Flight Test before proceeding with the Crew Flight Test. The rocket will fly in a vehicle configuration with two solid rocket boosters and a dual-engine Centaur upper stage.

**May 2022**

**SSLV - Demonstration Launch**

**Launch site: Satish Dhawan Space Center**

India's Small Satellite Launch Vehicle (SSLV) will launch on its first orbital test flight. Consisting of three solid-fueled stages and a liquid-fueled upper stage, the SSLV is a new Indian launch vehicle designed to carry small satellites into low Earth orbit.

**May 25, 2022**

**Falcon 9 - Transporter 5**

**Launch site: SLC-40, Cape Canaveral SFS**

A SpaceX Falcon 9 rocket will launch the Transporter 5 mission, a rideshare flight to a sun-synchronous orbit with numerous small microsattellites and nanosatellites for commercial and government customers.

**May 2022**

**Falcon 9 - Starlink 4-18**

**Launch site: Cape Canaveral**

A SpaceX Falcon 9 rocket will launch with another batch of Starlink internet satellites. The Falcon 9's first stage booster will land on a drone ship in the Atlantic Ocean.

**TBDS, 2022**

**SLV - BlackSky Global**

**Launch site: Satish Dhawan Space Center**

India's Small Satellite Launch Vehicle (SSLV) will launch on its first commercial mission with four Earth observation satellites for BlackSky Global, a Seattle-based company. The rideshare mission for BlackSky is being arranged by Spaceflight

**June 3, 2022**

**Soyuz - Progress 81P**

**Launch site: Baikonur Cosmodrome**

A Russian government Soyuz rocket will launch the 81st Progress cargo delivery ship to the International Space Station. The rocket will fly in the Soyuz-2.1a configura-

tion.

**June 2022**

**Long March 2F - Shenzhou 14**

**Launch site: Jiuquan**

A Chinese Long March 2F rocket will launch the Shenzhou 14 spacecraft with three Chinese astronauts to rendezvous and dock with the Chinese space station in low Earth orbit.

**June 7, 2022**

**Falcon 9 - SpaceX CRS 25**

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

A SpaceX Falcon 9 rocket will launch a Dragon 2 spacecraft on its fifth 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.

**June 2022**

**Falcon 9 - Nilesat 301**

**Launch site: SLC-40, Cape Canaveral SFS**

A SpaceX Falcon 9 rocket will launch the Nilesat 301 geostationary communications satellite. Nilesat 301, built by Thales Alenia Space, will provide digital broadband and internet connectivity services for the Egyptian operator Nilesat. The Falcon 9's first stage booster will land on a drone ship in the Atlantic Ocean.

**June 2022**

**Astra Rocket 3.3 - TROPICS 1 & 2**

**Launch site: SLC-46, Cape Canaveral SFS**

A commercial small satellite launch vehicle developed by Astra will launch the first 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, mission will measure environmental and inner-core conditions for tropical cyclones.

**June 2022**

**Vega C - LARES 2**

**Launch site: ZLV, Kourou**

An Arianespace Vega C rocket will launch the LARES 2 satellite for ASI, the Italian space agency. The spherical LARES 2 satellite is covered in laser mirrors to enable precise tracking from the ground, enabling research into geodynamics and general relativity. This will mark the inaugural flight of Europe's new Vega C rocket, featuring a more powerful first stage motor, an enlarged second stage, an improved liquid-



# LAUNCH WINDOWS

Launch dates from SpaceFlight.com

fueled upper stage, and a new payload fairing design.

## June 2022

### Falcon 9 - O3b mPOWER 1, 2, 3

#### Launch site: SLC-40, Cape Canaveral SFS

A SpaceX Falcon 9 rocket will launch the first three 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. The Falcon 9's first stage booster will land on a drone ship in the Atlantic Ocean.

## June 18, 2022

### Atlas 5 - SBIRS GEO 6

#### Launch site: SLC-41, Cape Canaveral SFS

A United Launch Alliance Atlas 5 rocket, designated AV-097, will launch the U.S. Space Force's sixth Space Based Infrared System Geosynchronous satellite, or SBIRS GEO 6, for missile early-warning detection. The rocket will fly in the 421 vehicle configuration with a four-meter fairing, two solid rocket boosters, and a single-engine Centaur upper stage.

## June 22, 2022

### Ariane 5 - MEASAT 3d & GSAT 24

#### Launch site: ELA-3, Kourou

Arianespace will use an Ariane 5 ECA rocket, designated VA257, to launch the MEASAT 3d and GSAT 24 communications satellites. Built by Airbus Defense and Space for MEASAT, a Malaysian operator, MEASAT 3d is a multi-mission communications satellite outfitted with C-band, Ku-band, and Ka-band payloads for direct-to-home TV broadcasting and internet services over Asia, the Middle East, and Africa.

## June 2022

### Astra Rocket 3.3 - TROPICS 3 & 4

#### Launch site: SLC-46, Cape Canaveral SFS

A commercial small satellite launch vehicle developed by Astra 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, mission will measure environmental and inner-core conditions for tropical cyclones.

## Late June 2022

### Falcon Heavy - USSF 44

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

A SpaceX Falcon Heavy rocket will launch the USSF 44 mission for the U.S. Space Force. The mission is expected to deploy two spacecraft payloads directly into geosynchronous orbit, one of which is the mili-

tary's TETRA 1 microsatellite. The Falcon Heavy's two side boosters will land on drone ships in the Atlantic Ocean, and the core stage will be expended.

## TBD 2022

### Starship - Orbital Test Flight

#### Launch site: Starbase, Boca Chica Beach

A SpaceX Super Heavy and Starship launch vehicle will launch on its first orbital test flight. The mission will attempt to travel around the world for nearly one full orbit, resulting in a re-entry and splashdown of the Starship near Hawaii.

## June/July 2022

### Falcon 9 - SES 22

#### Launch site: SLC-40, Cape Canaveral SFS

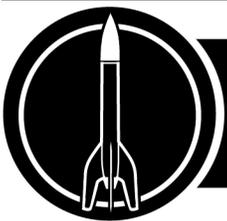
A SpaceX Falcon 9 rocket will launch the SES 22 communications satellite for SES of Luxembourg. Built by Thales Alenia Space, SES 22 will provide C-band television and data services in the United States.

## Mid-2022

### Falcon 9 - SARah 1

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

A SpaceX Falcon 9 rocket will launch the SARah 1 radar remote sensing satellite for the German military. SARah 1 is the first of three synthetic aperture radar satellites for the German military.



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Club News

## Flying Field Update

The Board of Directors continues to work with the new management at MIS (Michigan International Speedway) to re-establish our flying privileges. They have responded to our emails, and while the process has been slow, we remain optimistic in re-establish flying dates at the Graves Campground launch site.

Until the MIS contract is complete, Horning 1 will be the primary field after hay cuttings (roughly every four weeks, weather depending). We will look for opportunities to use the larger Horning 2 field when we can.

## NAR Section Grants Available for 2022

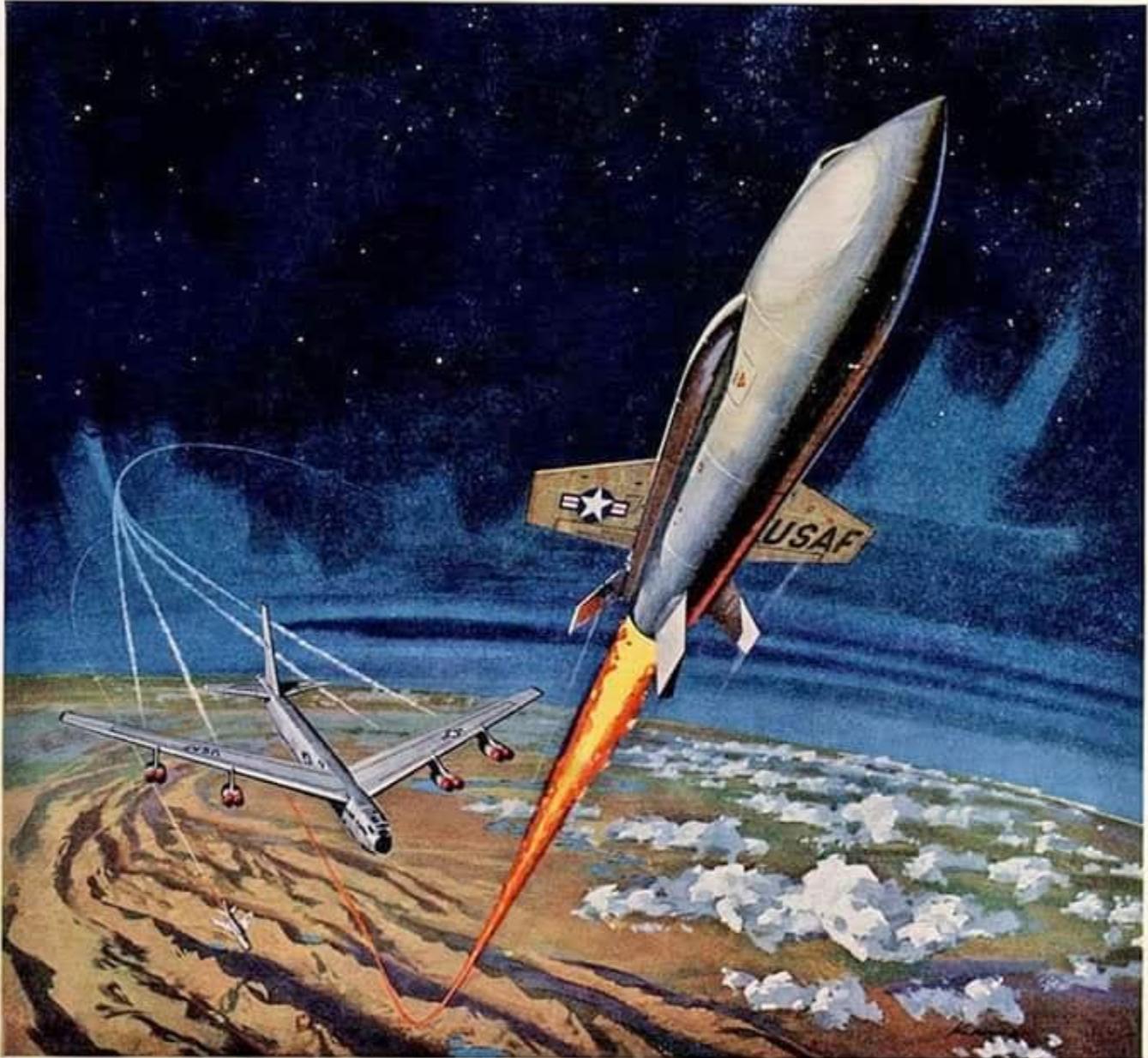
The NAR provides \$250 grants to sections for the purchase of safety and launch operations equipment. With the joining of our two sections we can request up to \$500. We are still looking for

ideas from the membership for ways we can improve our launch operations.

Let the BOD know if you have an idea which we could apply towards a grant application. It doesn't have to be one big thing and many small things add up. We have considered investing in a new PA system and if anyone knows what is good and is not, please contact any of the board members. We would appreciate the information.

## Change in Membership Applications and Dues Address

Since we're flying again and spending money, it's time to reinstate annual dues (\$30.00 individual or \$40.00 family). The mailing address is Tony Haga, 711 Wildwood Rd, Rochester Hills, MI 48309. You can also pay using the PayPal button on our [Blog Site](#) or in person at a launch.



**X-15 AWAY** ... **TARGET: 100 MILES UP!** On a day surprisingly soon 45,000 feet above Wendover, Utah, North American's rocket-powered X-15 research plane will be released from a modified B-52 to take man 100 miles into outer space. Throughout the flight trajectory, radio contact between the X-15, the mother ship, chase planes and the ground will be maintained by custom-designed units from a Collins CNI (communication, navigation, identification) system, similar to the electronic packages Collins is providing for the new military jet aircraft.



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Vintage Ad

# OUR MEMBERS IN THE FIELD



*Al preps a 1/4A Streamer Duration model*



*Steve also preps a 1/4A Streamer Duration model*



*Yitah and Yui wait for a lull in the wind*



*Jim and Paul ready their Alamo scale model*



*Yui and Andy ready their Spools for a drag race*