

# TOTAL IMPULSE



JACKSON MODEL ROCKET CLUB

TOTAL IMPULSE VOLUME 22, No. 6

JMRC  
HUVARS

HURON VALLEY ROCKET SOCIETY

NOVEMBER - DECEMBER 2022



**50 YEARS AGO: APOLLO 17**  
**NOVEMBER SPORT LAUNCH COVERAGE**  
**CLUB ELECTION RESULTS**  
**ARTEMIS I MISSION**



**CLUB OFFICERS**

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**Board of Director:** Dale Hodgson  
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**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 Wilwood 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>

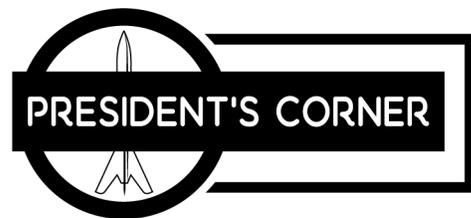
**Facebook:** If you have a FaceBook account search for "Jackson Model Rocket Club JMRC" and request to be added.

**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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Welcome everyone to the November-December 2022 issue of *Total Impulse* and the start of a new year! It was a successful recovery year for our clubs, but a historic year for space exploration. This year we saw a return to the Moon with the Artemis I mission, the deployment of the James Webb Space Telescope that has produced amazing images already, NASA's DART asteroid defense mission, and SpaceX successfully launched 63 rockets..... Sixty-three! That is just a small handful of the wins for the year. What will amaze us in 2023?

I try to capture as much of this news as I can in the Current Events column each issue. It started out including international news, but it became too much, so I have cut it back to just events in the US. Regardless, it has become one of my favorite columns even though it takes a lot of work. What about you? What articles and columns are your favorite? What are we doing right, what are we missing, what should change, and what should we cover more of? That's right, it's time for a new survey. It has been a couple of years since the last one which helped guide and shape the newsletter. When the invitation goes out please take a few minutes to make your voice heard so we continue to provide the news and articles that are important to you!

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**Launch/Event Calendar - 2023**

- January 27-29 vNARCON 2023 (Virtual Event)
- March Pending (Horning)
- April Pending (Horning)
- May Pending (Horning)
- May 21/22 *Crapshoot VIII* (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.

A new year has officially ushered in and the club is full steam ahead for 2023. We are fresh off an election with eager BOD members to see a lot of rockets hit the sky this year. Club renewals are done, insurance is in place, and we are ready for Mother Nature to be kind for an early start to the flying year.

There are many side projects underway to offer additional statistics, enhanced communication options, and equipment on the field to allow more options/flexibility to fly for all. I'm truly excited for what this year will bring and we always encourage more ideas with volunteers to help us further the club to allow more people to succeed in this fascinating hobby. If you have ideas just let us know!

Hopefully 2023 will always keep your pointy end up, the fire end down, and an always reliable recovery system. It is only rocketry, what can go wrong? :-)



**About Total Impulse**

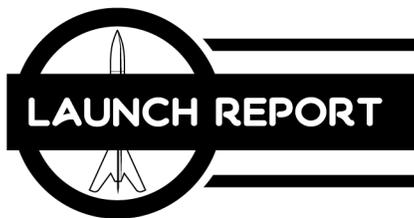
*Total Impulse* is the official newsletter of the Jackson Model Rocket Club (JMRC), Tripoli Prefecture 96, NAR Section 620. Published Bi-Monthly, *Total Impulse* is a space-modeling newsletter devoted to representing the diversity of interests in today's hobby of model rocketry. This newsletter is in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

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**On the Cover:**

(top) Launch of the Artemis I Space Launch System carrying the Orion capsule to the moon on 16 November 2022 - NASA photo (bottom) Panoramic photo of the Taurus-Littrow landing area for Apollo 17. Jack Schmitt gathers samples near the rover - NASA photo



## LAUNCH REPORT

# November Sport Launch

12 November 2022 - Manchester

Our November launch brought us back to reality after a long string of launches with perfect weather. November 12<sup>th</sup> was typical weather for this time of year, overcast, breezy, with a chance of snow flurries. That didn't stop several of us from finishing out the flying season with a fun, though abbreviated, launch at the Horning 1 field.

We had ten fliers in attendance along with Buzz and Scott who provided support and pointed commentary. By early afternoon the snow started in earnest so we packed up shortly afterwards for a total of 23 flights.

It was great to see Bob and Rob Dickinson who made the trip out. We saw Rob at CrapShoot earlier in the year but haven't seen Bob in a while. They put up a nice flight with one of Bob's many V-2s on a Loki G80.



Mark Chrumka's Deuces Wild

The most prolific flyer award went to Michael O'Neal with six launches. They were all successful and included his Tazz with gyro recovery on a B6-4, a Hi Flyer on a C6-5, Mini Honest John on a A10-3T, and two stage Checkmate using a A10-0T to a A3-4T.

Mark Chrumka was next with five flights. Two rockets were 3D printed, the SpaceX Lunar Lander on a E20, and Bomb Rocket which looks like a M64 500 pounder from WWII on a D12-5. He also flew an Estes Sprite on a 1/2A6-2 and a Flis Kits Deuces Wild on a pair of B6-4's.

Al de la Iglesia made three flights, two with his Der Red Max on an A8-3 and C6-5 and his Big Bertha on a C6-3.

It wouldn't be a launch without a Mach Schnell from Herb



Tony Haga's Mini Endeavor

Crites. Herb flew his SLK 54m twice, once with a Loki H160 Blue and then with a Loki H125 Cocktail which looked nice with all the snow coming down at the time.

Little Everett Brockman also made it out to fly his Alpha III. He braved the elements just as well as the rest of us.



Michael O'Neal's Tazz

Tony Haga put in a single flight with his Small Endeavor on a G125, and Dale Hodgson and Fred Ziegler each flew a Scott's 3D printed HPR. Fred's flight went well on a Loki G66 Red, but Dale seemed to have a blow out right at motor burnout with his Loki G94 Blue. The rocket suffered a little damage, but that's the great thing about 3D printing. You can have a new one in a couple days. Dale also flew his Mega Mosquito on an E30.

This concluded our flying for 2022 and it was significant bounce back year from 2021 and 2020. Next year shows signs of being an even better year. We're seeing a lot of new flyers at recent launches and we have a motivated team of officers and directors that are looking for ways to improve operations and participation. Standby for good things happening next year.



Herb Crites' Mach Schnell SLK54m on a Loki H125



Bob Dickinson's V-2 on a Loki G80



## VIEW FROM THE FLIGHT LINE

## 2022: A SOLID YEAR - BUILDING FOR A BETTER 2023.

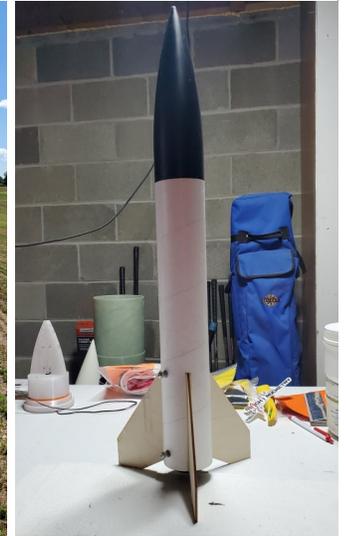
DALE HODGSON

Hard to believe that another year is over but here we are. Another flying season done; but another to look forward to. All in all, it wasn't bad; we did manage to get some flights in at a few launches. It was the most "normal" year yet post-pandemic. Hopefully that trend continues. I think for me personally this year I spent a good deal of it test flying 3D projects hot off Scott's printer. Trust me, it was fun and I have a couple of 3D birds added to the fleet. They have their place that's for sure and knowing Scott; there are more coming. I can safely say that we flew a couple of these designs right up to the point of failure; made improvements and went from there. It was cool to see the progression on how all this came about...flew, evaluated performance, tweaked where necessary and flew again. I already have another in the works for 2023; the original version that had 7 successful flights finally hit the wall so to speak; a Loki I210 Red plus a severed ematch pretty much did that one in. But, there will be another....better, stronger, faster....and higher to borrow a bit of phrasing from "The 6 Million Dollar Man" from what seems like eons ago; or was it just yesterday? I will have it ready; the electronics module for it is done (see articles past about that build) so we should be good to go. I believe the envelope for these 3D's just got a bit bigger so we'll have to see how far we can stretch that one as well.

Moving ahead; I already have my "Fortress of Solitude" set up; rather my winter workbench in my basement. It'll be my go-to place now that it's winter. It's a place where to relax; put my mind in a much better frame and simply build rockets. I already have two going; a LOC Scout 2 that is a fun apogee deploy kit with a 29mm motor mount; perfect for our type of flying. It's pretty much a standard build, although I replaced the launch lug with rail buttons and went with an X-form chute rather than the stock standard chute that came with the kit. It should handle E and F motors effortlessly. I also have an all fiberglass Rocketry Warehouse (now part of Madcow Rocketry I believe) rocket named a "Hurricane



38". The name is a bit of a misnomer though; the airframe is 38mm, the motor tube is set for 29mm. I'm making this one dual deploy. It's a fairly light rocket since all the tubing is thin-wall fiberglass. It should be a good flyer as well. Dual deployment for 29mm you ask? Sure, especially now since there are 29mm I motors out there as well as a quite a few bigger G motors and a number of H motors including a couple of nice long-burns I'm just itching to try. I also have a bunch of other projects I can build if I really get the bug to do so; enough to keep me going through multiple winters if need be. Everything from low power to high power in-



cluding gliders, egg launchers and heli's. It should be quite therapeutic to spend some time down there working away until we can fly again.

I'm always looking for new stuff to try and I just saw something about making igniters and ematches without using a bridgewire for those that "roll their own" so to speak. I will do my research; get the materials I need and give it all a shot just to see how it goes. Not really looking forward to a flying layoff but hey; I have enough to do to keep me sane until we're out there again doing what many of us like to do best....burn propellant to our heart's content.

The last thing I'll mention is the state of the club these days. We just had BOD elections and had more folks run than there were available seats. That hasn't happened in a long while. It tells me that this club is going to stay committed going forward and I'm confident it will. This hobby is such a cool thing to do; everyone from kids to aerospace engineers (and even weird entomologists) can be involved. Nothing like seeing a bunch of excited people on the flight line enjoying a day of flying. We've been a group for a long while now and I have no doubt with the people involved we will be around for a long time to come. Combining HUVARS and JMRC has made us even better. There are a bunch of talented people among the group; we have everything covered from 13mm to 98mm, novice to L3, sport flying to serious competition and kids to some of us a little longer in the tooth. So, here's to a great 2023 season coming up.....it'll be a hoot!

# Impulse Buys

On site motor dealer for your rocketry needs

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# 50 YEARS AGO: APOLLO 17

Buzz Nau

The flight of Apollo 17 marked the conclusion of the program's lunar exploration. Apollo was originally going to include three more lunar missions. Apollo 20 was cancelled in 1969 to allocate a Saturn V for Skylab. This was followed up by the cancellation of Apollo 18 and 19 to help fund development of the Space Shuttle.

As with most missions, Apollo 17 wasn't without controversy and conflict. The original crew consisted of Commander Gene Cernan (third spaceflight), Lunar Module Pilot Joe Engle (X-15 spaceflight), and Command Module Pilot Ron Evans (rookie). Joe Engle was replaced by Harrison (Jack) Schmitt (rookie), after pressure from the scientific community to include a professional geologist. This change did not go over well as Cernan unsuccessfully advocating to keep the original crew together. Engle was given a choice of future programs to fly on between Skylab, Apollo-Soyuz, and the Space Shuttle. He chose the latter and was the Commander for STS-2.



*Apollo 17 Crew (L-R) Jack Schmitt, Gene Cernan, Ron Evans*

wore a head shield designed to detect if cosmic rays were causing the light flashes astronauts noticed in darkened environments. Results concluded that cosmic rays were indeed the likely cause.

Lunar orbit insertion occurred on December 10 and the crew proceeded with preparations for the landing at the Taurus Littrow site, a valley larger than the Grand Canyon on Earth. The site was chosen as a likely spot to collect samples of recent volcanic mate-



*Apollo 17 Liftoff - NASA photo*

The Saturn V for the mission was SA-512 and carried Command Module CM-114 named *America* by the crew in tribute to the support of the nation for the Apollo program. Also onboard was the Lunar Module LM-12 named *Challenger* as a message from the crew to future generations.

Apollo 17 lifted off at 12:33 am on December 7, 1972, after a two hour and forty-minute delay. It was the only Apollo lunar mission to be launched at night. The launch to orbit and trans lunar injection burn all occurred nominally. After separating from the S-IVB third stage, Ron Evans maneuvered the Command Module to retrieve the Lunar Module. The third stage impacted the moon just under three days later and the crash was picked up by seismometers left by Apollo 12, 14, 15, and 16.

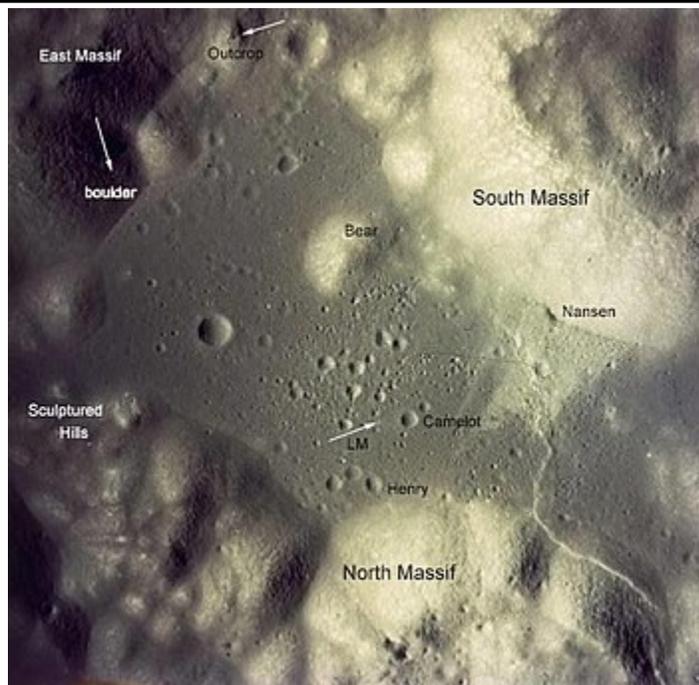
During the transit to the moon the crew took photos and performed experiments. One photo of Earth taken by Schmitt was dubbed "The Blue Marble". Ron Evans made repairs to a sticky CM/LM latch as well as performed an experiment on the light flash phenomena astronauts had experienced during lunar transits. He



*"The Blue Marble" - Jack Schmitt (NASA) photo*



View of CSM America from Challenger - NASA photo



Labeled photo of the Taurus-Littrow landing site

-rial as well as Highlands (bright and dark zones).

Vehicle checkout, undocking, and descent of the LM went as planned with no issues. Cernan landed Challenger within 700 feet of the planned touchdown point. Right after landing Cernan and Schmitt made preparations for their first moonwalk.

The first EVA (extra vehicular activity) was dedicated to deploying the Lunar Rover and ALSEP (Apollo Lunar Surface Experiments Package). A rear fender of the rover was broken off during deployment when it got caught on Cernan's hammer. This resulted in Cernan and Schmitt becoming covered with lunar dust when driving. They attempted a repair using tape and a lunar map, but the dust interfered with the tape's ability to stick to the parts. Each Apollo mission had unique experiments as part of their ALSEP. For Apollo 17 this included the LACE (Lunar Atmospheric Composition Experiment) module. This mass spectrometer confirmed the existence of a tenuous atmosphere of helium, neon, and argon. The first EVA last 7 hours and 12 minutes.

The second EVA occurred 17 hours later. During the rest period ground controllers came up with a better fix for the Rover fender by taping several maps together to make a thicker patch and attached it to the Rover using clamps from a telescope. This repair lasted until late in the third EVA. The first stop was Nansen Crater, 4.7 miles away. This was the furthest distance of any Apollo EVA and just at the edge of the "walk back limit" in case the rover broke down and they had to return by foot. EVA 2 lasted 7 hours and 37 minutes, the longest duration EVA. Cernan and Schmitt collected 75 pounds of samples, deployed several explosive charges and took gravimeter measurements using an experiment mounted on the rover.

The third and final lunar EVA had the crew visit two stations. The first contained an enormous rock they named "Tracey's Rock" after Cernan's daughter. Another 146 pounds of samples were collected as well as more gravimeter measurements. Before returning to the LM as the last human to walk on the moon Cernan stated, "I'm on the surface; and, as I take man's last step from the

surface, back home for some time to come – but we believe not too long into the future – I'd like to just [say] what I believe history will record. That America's challenge of today has forged man's destiny of tomorrow. And, as we leave the Moon at Taurus-Littrow, we leave as we came and, God willing, as we shall return, with peace and hope for all mankind. "Godspeed the crew of Apollo 17."

Similar to previous missions, Evans kept busy while orbiting in the Command Module by conducting experiments in the capsule, taking photographs, and operating equipment in the SIM (Scientific Instrument Module) bay. So busy that one day he over-



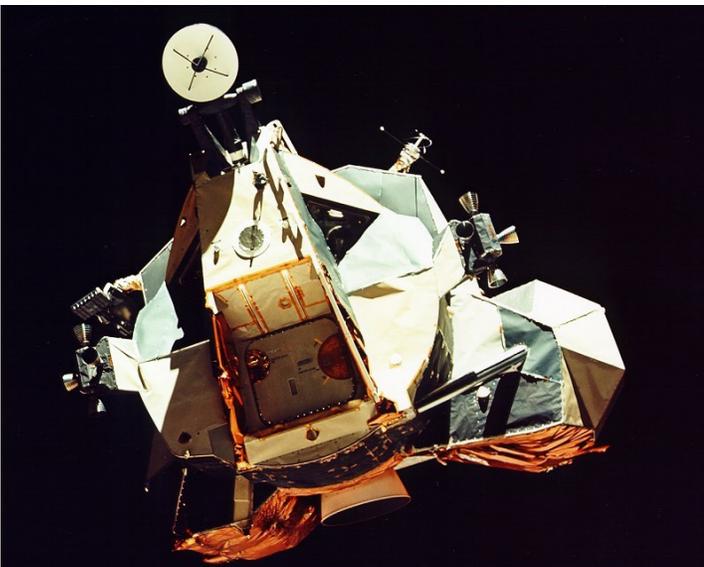
Jack Schmitt next to the US flag with the Earth above - NASA photo

-slept by an hour despite Mission Control's best efforts to rouse him awake. As the time neared to rendezvous with the LM ascent stage, Evans adjusted the orbit of the Command Service Module.

At 5:54pm EST on December 14 *Challenger* lifted off from the moon and docked with *America* two hours later. The Lunar Module ascent stage was jettisoned once equipment and lunar samples were transferred to the Command Module. It impacted the moon two days later and was picked upon seismometers left on the surface. Like previous "J" missions, Evans performed an EVA to retrieve film cassettes from the SIM bay. More experiments were performed by the crew on the return trip. Splashdown occurred on December 19 at 2:25 pm EST in the Pacific Ocean within 4 miles of the recovery ship *USS Ticonderoga*.



Gene Cernan with the Lunar Rover - NASA photo



Challenger returns to CM America - NASA photo

Gene Cernan retired from NASA and the US Navy in 1976. He continued his advocacy of space flight through his book, *Last Man on the Moon* and appearances in several documentaries. He also testified before congress with Neil Armstrong in opposition to the cancellation of the Constellation program. He passed away on January 16, 2017. Jack Schmitt resigned from NASA in 1975 to run for the United States Senate representing New Mexico. He won his election, but lost a reelection bid in 1982. He continues to work as a consultant in several areas related to space exploration and geology. Ron Evans was the backup Command Module pilot for the Apollo-Soyuz mission. Afterwards he worked on the Space Shuttle program until retiring from NASA in 1977 and becoming a coal industry executive. He passed away on April 7, 1990. Command Module *America* is on display in the Space Center Houston Museum at the Johnson Space Center in Houston, Texas.

The Apollo 17 mission marked the last human presence on the



Jack Schmitt at "Tracey's Rock" - NASA photo

moon. As someone who grew up during the Apollo program and moon landings, it is both surprising and depressing that no one has returned in the 50 years since. My eleven-year-old perspective at the time was that Apollo was only the beginning. An orbiting lunar station and surface base would be the next steps and then on to Mars. Half hearted programs and initiatives would start and die over the next 50 years to the point of me becoming skeptical any time new talk of returning the moon came up. I will admit that I am encouraged by the recent activity of SpaceX and the NASA's Artemis program and that we are the closest since Apollo 17 of returning.



Apollo 17 crew retrieval - NASA photo

# More Apollo 17 Photos



Jack Schmitt at the rover - NASA photo



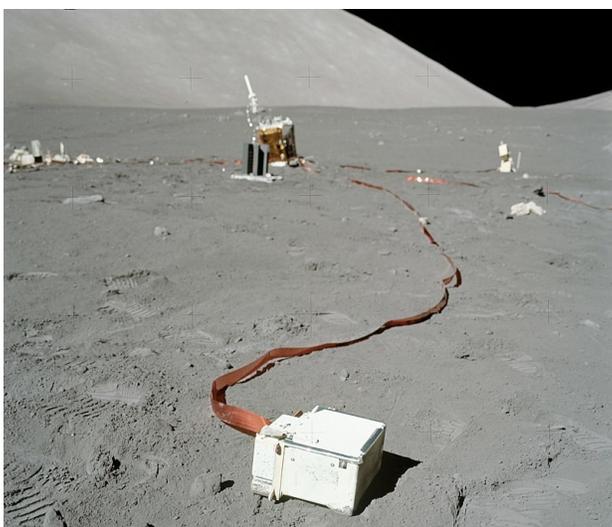
Commander Gene Cernan - NASA Photo



Gene Cernan - NASA photo



Lunar Module Pilot Jack Schmitt - NASA photo



LACE module. ASLEP background - NASA photo



Command Module Pilot Ron Evans - NASA photo



# CURRENT EVENTS IN SPACE EXPLORATION

2022 is closing out with several milestones in space exploration. SpaceX launched an amazing 63 rockets this year and all had successful recoveries of the first stage except for several which were intended to be expended. SpaceX also flew another Falcon Heavy in support of a US Space Force mission. Additionally, SpaceX has four active boosters with over 10 successful landings with B1058 notching its 15th record landing on 12/17/22. Overshadowing these accomplishments a bit was NASA's successful Artemis 1 mission. The Space Launch System (SLS) Block 1 vehicle overcame launcher leak issues and a hurricane to finally launch on 11/16/22. By all reports so far the mission met or exceeded all goals. The only expectation for 2022 that was missed was the first Starship orbital test, but it looks like it might be coming soon.



First up for SpaceX to in the final months of 2022 was the USSF-44 mission for the US Space Force on 1 November from LC-39A at Kennedy Space Center (KSC). The payload required the Falcon Heavy configuration of three Falcon 9's for the boost. The outboard boosters were recovered back at the Cape on Landing Zones 1 and 2. The core booster was expended due to the flight profile and had it's landing legs removed. As with all USSF missions, little is known regarding the mission due to the classified nature other than there were six payloads, one was likely a large communications satellite and the rest were CubeSats that were deployed by a Northrup Grumman Long Duration Propulsive ESPA. All three Falcon 9 boosters were new and had not flown before. The fairing halves were recovered successfully.

Two days later the Hotbird 13G mission flew aboard a Falcon 9 from SLC-40 at the Cape Canaveral Space Force Station (CCSFS). The Eutelsat Hotbird 13G is the second of three telecommunications satellites replacing older ones that provide telecommunications service to Europe, North Africa, and the Middle East. It was the booster's seventh flight which landed on the droneship *Just Read the Instructions*. The fairings were also recovered.



On 12 November another Falcon 9 launched from SLC-40 at the Cape Canaveral Space Force Station (CCSFS) this time carrying the Galaxy 31 and 32 telecommunications satellites. These are IntelSat replacements providing TV broadcasting service for North America. The booster had flown 13 previous missions and was expended due to the flight profile requirements. The fairing halves were recovered.



Mission	Date	# of Satellites	Launch Site	Booster Flt#	Landing Site	Fairings Recovered?
Starlink 4-37	17-Dec-22	54	LC-39A KSC	*15	<i>Just Read the Instructions</i>	Yes
Starlink 5-1	28-Dec-22	54	SLC-40 CCSFS	11	<i>A Shortfall of Gravitas</i>	Yes

\*Record

KSC = Kennedy Space Center

CCFCS = Cape Canaveral Space Force Station



# CURRENT EVENTS IN SPACE EXPLORATION

The third launch in a row from SLC-40 at the Cape Canaveral Space Force Station (CCSFS) was the Eutelsat 10B telecommunications satellite on 22 November. Eutelsat 10B will replace the 10A satellite in 2023 and provide service to maritime and air traffic for North and South America as well as portions of Asia. It was the eleventh and final flight of the Falcon 9 booster, again due to flight requirements. The fairings were recovered.



The next Falcon 9 SpaceX mission was the Hakuto-R M1 and Lunar Flashlight launch on 30 November from SLC-40 at the Cape Canaveral Space Force Station. The payload consisted of the Hakuto-R M1 lunar lander space vehicle for Japan's ispace and NASA's Lunar Flashlight CubeSat. It was the booster's fifth flight and it landed back at the Cape at LZ1. The Lunar Lander is Japan's first attempt at land a vehicle on the moon. It will also attempt to deploy the Rashid rover. The Flashlight CubeSat will map craters at the southern pole.



The Dragon CRS-2 SpX-26 resupply mission to the International Space Station (ISS) was launch from LC-39A at Kennedy Space Center (KSC) on 26 November. The Falcon 9 lifted the Cargo Dragon loaded with supplies and research experiments as part of the Commercial Resupply Service for NASA. One experiment, VEGGIE, will test the ability to grow useful crops aboard the station. EXTRUSION will test the creation of resin structures in a zero gravity environment. The Cargo Dragon also brought new solar arrays for improved power. The booster landed on the dronship *Just Read the Instructions* for it's first landing.



On 8 December OneWeb 15 was launched by SpaceX for the deployment of 40 internet cloud satellites. OneWeb was unable to use ROSCOSMOS and their Soyuz launch vehicles. This is an odd arrangement since SpaceX and Starlink are direct competitors with OneWeb in providing global satellite internet services. India is also providing launch services using the GSLV Mk III. It was the booster's fourth flight which landed at CCSFS on LZ-1.



# CURRENT EVENTS IN SPACE EXPLORATION

On December 16 SpaceX launched the multinational Surface Water and Topography (SWOT) satellite aboard a Falcon 9 from Space Launch Complex 4E at Vandenberg Space Force Base. SWOT is an Earth observation satellite developed by NASA and CNES, France's space agency. It will gather data on the Earth's rivers and lakes in addition to oceans and seas. It was the booster's seventh flight which landed back at Vandenberg at Landing Zone 4. The fairing halves were also recovered.

second attempt by Rocket Lab to recover the first stage booster in mid-air with a helicopter. This attempt also failed due to a drop in telemetry during reentry.



## NORTHROP GRUMMAN

SpaceX launched another Earth Observation satellite on 30 December from Vandenberg Space Force Base on a Falcon 9. EROS-C3 was built by ImagSat International and placed in a retrograde orbit. The booster had flown ten times previously and landed back at Vandenberg on LZ-4. This launch closed out the year for SpaceX which averaged over one launch a week. Incredible!

Northrop Grumman launched another Commercial Resupply Service (CRS-2 NG-18) on 7 November from LP-0A at Wallops Island Flight Facility. The Antares 230+ launch vehicle carried the Cygnus cargo vehicle, S.S. *Sally Ride* to low earth orbit where it docked at the International Space Station with over 8,000 pounds of supplies and equipment. Also aboard were three CubeSats from Uganda, Japan, and Zimbabwe.



Rocket Lab's final Electron launch of the year was the *Catch Me If You Can* mission flown from their facility in New Zealand on 4 November. The payload was an upper atmospheric research satellite for the Swedish National Space Agency. This was to be the



# CURRENT EVENTS IN SPACE EXPLORATION



ULA wrapped up the year with their launch of the JPSS-2 weather satellite aboard an Atlas V 401 on 10 November from Vandenberg Space Force Base. The Joint Polar Satellite System-2 was placed successfully into a polar orbit to provide data for weather forecasting and climate monitoring. The flight also carried the Low-Earth Orbit Flight Test of an Inflatable Decelerator (LOFTID). This successful test was a down-scale of an inflatable recovery system. According to the chief investigator the technology is ready to use on future missions.

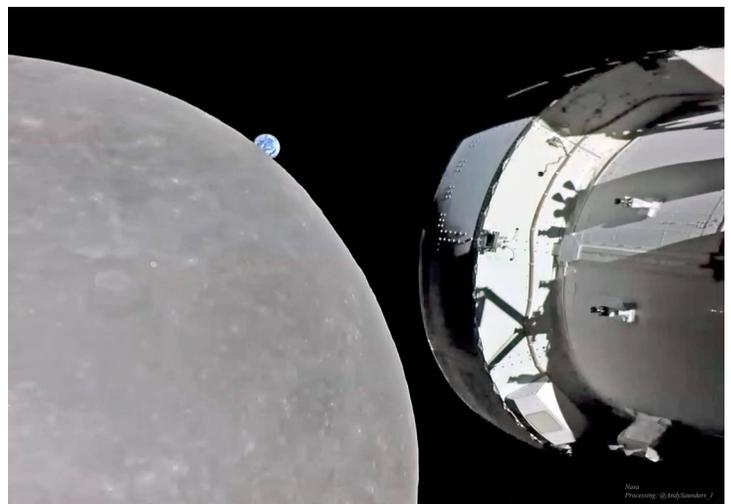


Who else stayed awake to watch the lift-off of Artemis I and our return to the moon on 16 November from Launch Complex 39B at Kennedy Space Center? Despite the trials and tribulations over the past few years it was a launch well worth waiting up for. From launch to landing the mission checked off one goal after another. The flight certified both the Space Launch System (SLS) launch vehicle and Orion capsule for crewed flight.

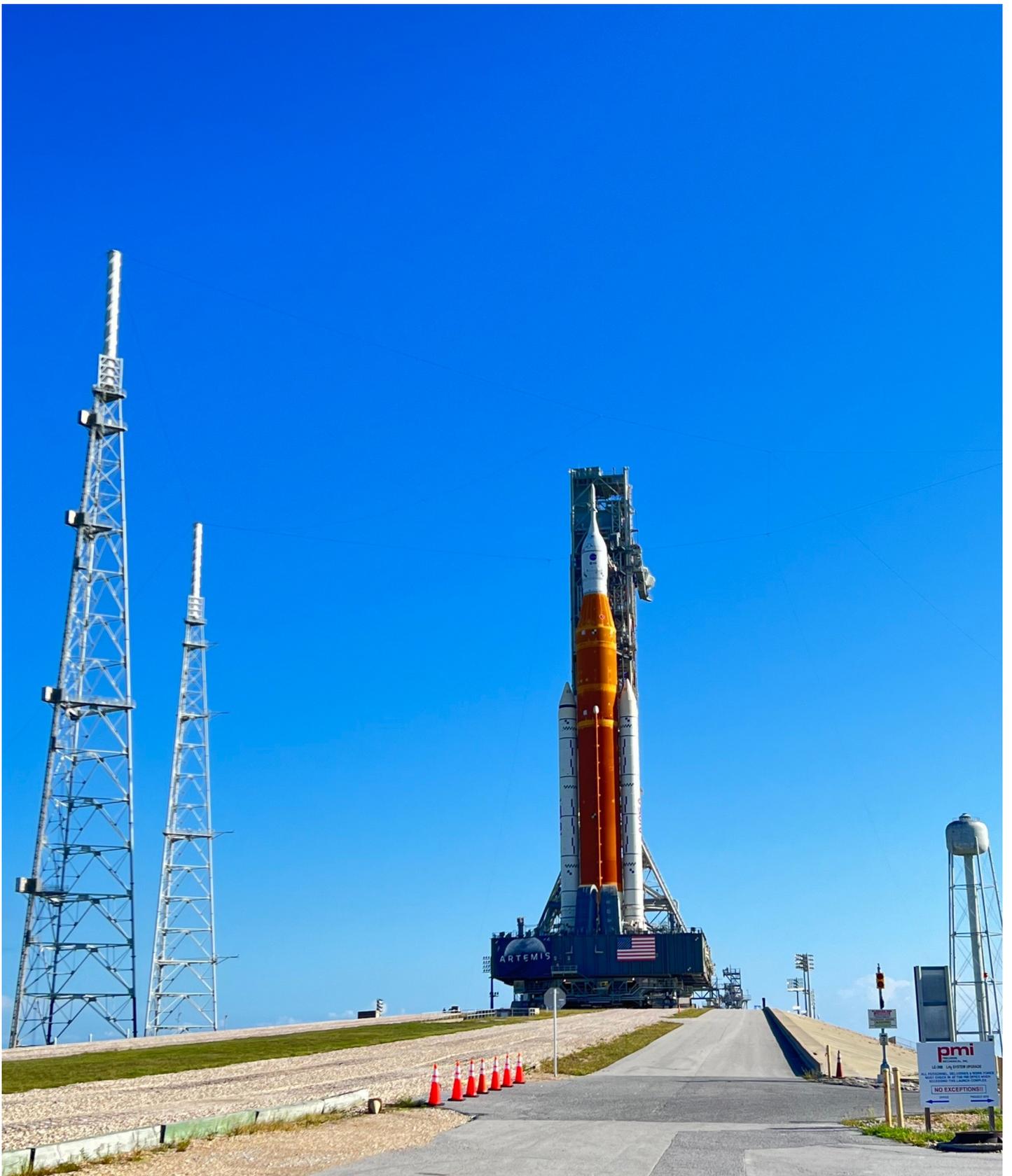
After a five day trip to the moon, the spacecraft entered a Distant Retrograde Orbit (DRO) of the moon passing within 84 miles of the lunar surface. In addition to being extremely stable, the orbit also took Orion further than any other crew rated spacecraft from the Earth. After a burn to leave DRO the Orion “fell” back towards Earth.

Orion spent three weeks in space and landed successfully in the Pacific Ocean. It performed the first US attempt of a “skipped entry” which involves two phases of less intense deceleration.

The mission also carried ten CubeSats within the stage adapter above the second stage. They were developed by other international space agencies as well as US universities, US aerospace industrial corporations, and the Jet Propulsion Laboratory.











# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

## 105 Years Ago – 1917

December 16: Science fiction writer Arthur C. Clarke born. "2001: A Space Odyssey" is one of his most well-known works. He was also the first to propose the concept of geostationary satellites



## 75 Years Ago – 1947

December 23: The transistor is invented by Drs. John Burdeen, Walter H. Brattain, and William Shockley at Bell Labs



## 65 Years Ago - 1957

November 3: Sputnik 2 was launched carrying the dog, "Laika" from Baikonur Cosmodrome



December 6: Vanguard (TV-3) failed to launch and exploded on the launch pad at Cape Canaveral



December 17: First successful firing of an Atlas ICBM, Cape Canaveral



## 60 Years Ago - 1962

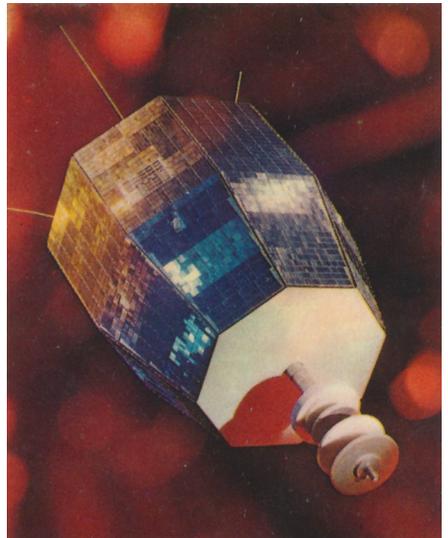
November 9: X-15 No. 2, piloted by John B. McKay crashed at the Dryden Flight Research Center (DFRC)



November 16: SA-3 (Saturn I rocket) is launched from Cape Canaveral



December 13: Relay 1 is launched by a Thor Delta from Cape Canaveral



December 14: Mariner 2 flies past Venus. First successful planetary flyby



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



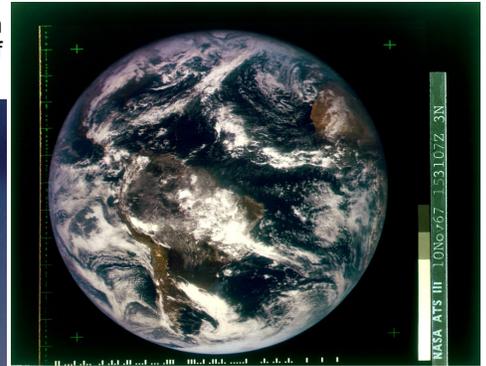
# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

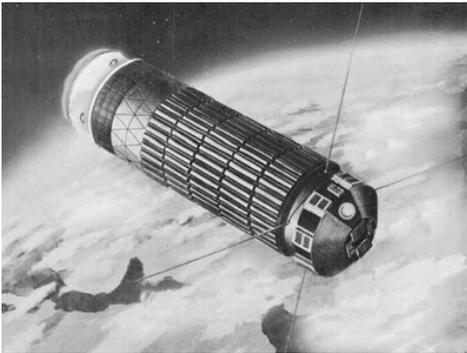
## 60 Years Ago - 1962 (Continued)

December 16: Explorer 16 is launched by a Scout from Wallops Flight Facility

November 9: Apollo 4 is launched from KSC. First successful launch and flight of Saturn V launch vehicle

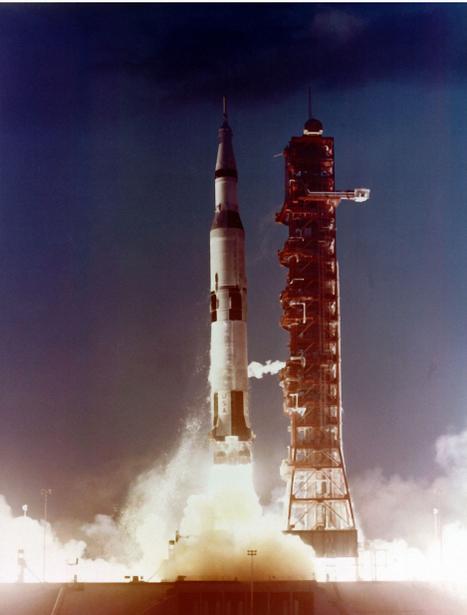


November 15: X-15 No. 3, piloted by Major Michael J. Adams crashed at the Dryden Flight Research Center (DFRC)



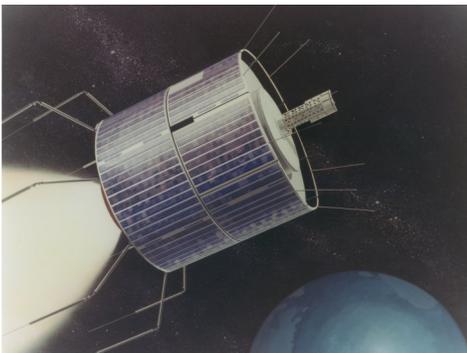
## 55 Years Ago - 1967

November 5: ATS 3 is launched by an Atlas Agena from Cape Canaveral



November 10: ESSA 6 is launched by a Thor Delta from Vandenberg AFB

November 29: Wresat 1, the first Australian satellite, is launched at Woomera



November 7: Surveyor 6 is launched by an Atlas Centaur from Cape Canaveral



November 10: The Applications Technology Satellite (ATS-3) sends the first pictures of the entire globe of the Earth

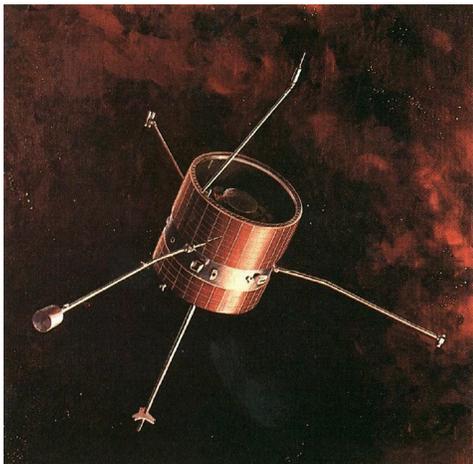


# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

### 55 Years Ago - 1967 (Continued)

December 13: Pioneer 8/TTS-1 is launched by a Thor Delta from Cape Canaveral



December 7: Apollo 17 launched aboard a Saturn V (SA-512) rocket from Cape Canaveral. Landed on Moon the on December 11 in the Taurus-Littrow region. Crew: Eugene A. Cernan, Ronald E. Evans, and Harrison H. Schmitt. This was the last Apollo moon mission



December 20: Last flight of M2-F3 program piloted by John Manke at Dryden Flight Research Facility (DFRF)

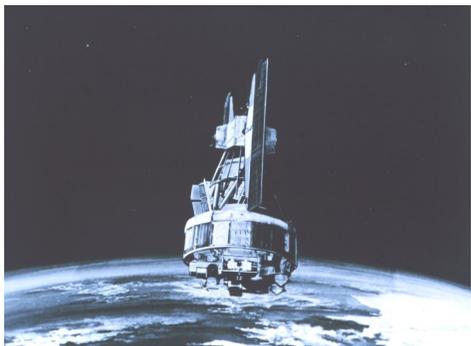


### 50 Years Ago - 1972

November 9: Anik 1 (Telesat 1) is launched by a Delta from Cape Canaveral



December 11: Nimbus 5 is launched by a Delta from Vandenberg AFB

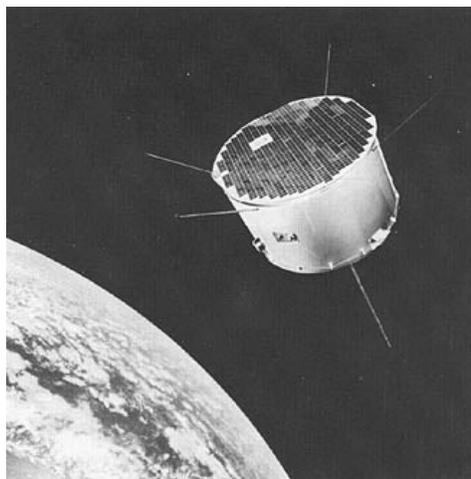


### 45 Years Ago - 1977

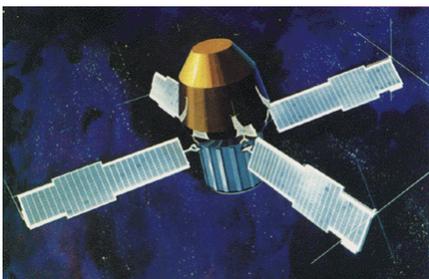
November 23: Meteosat 1 is launched by a Delta from Cape Canaveral



December 16: Aeros 1 (A) is launched aboard a Scout rocket from Vandenberg AFB



November 16: Explorer 48 (aka SAS-2 or B) is launched by a Scout from San Marco Facility, Kenya



December 10: USSR launches Soyuz 26 aboard a Soyuz rocket from Baikonur. This was a ferry flight to Salyut-6 space station. Cosmonauts: Yuri V. Romanenko and Georgi M. Grechko





# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

### 40 Years Ago - 1982

November 11: STS-5 (Space Shuttle *Columbia*) launched from KSC. Crew: Vance D. Brand, Robert F. Overmyer, Joseph P. Allen, and William B. Lenoir. First Shuttle operational mission to deploy two commercial communications satellites, SBS 3 for Satellite Business Systems and Anik C 3 (Telesat 5) for Telesat Canada. Landed November 16, at Edwards Air Force Base



### 30 Years Ago - 1992

November 8: Germany launched the Maxus sounding rocket from Kiruna, Sweden. The Maxus Program was the result of collaboration between Germany and Sweden that was sponsored by the European Space Agency

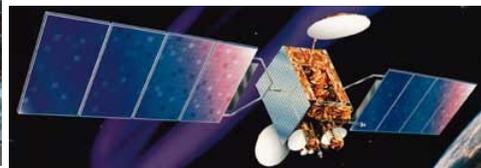


### 25 Years Ago - 1997

November 19: STS-87 (Space Shuttle *Columbia*) launched from KSC. Crew: Steven W. Lindsey, Kevin R. Kregel, Winston E. Scott, Kalpana Chawla, Takao Doi (Japan), and Leonid K. Kadenyuk (Ukraine). Carried the United States Microgravity Payload (USMP-4). Landed Dec 5, at KSC. Mission Duration: 15 days, 16 hours, 35 minutes



December 22: Launch of Intelsat 804 aboard Ariane 42L rocket from Kourou, French Guiana



### 35 Years Ago - 1987

November 24: NASA released a report to the Congress on an extended-duration Space Shuttle orbiter. The report examined key aspects of a program that would allow the Shuttle to perform Earth-orbital missions for as long as 16 days

December 21: USSR launches Soyuz TM-4 aboard a Soyuz rocket from Baikonur. This was a ferry flight to the Mir space station. Cosmonauts: Vladimir G. Titov, Musa K. Manarov, and Anatoli S. Levchenko



December 2: STS-53 (Space Shuttle *Discovery*) launched from KSC. Astronauts David M. Walker, Robert D. Cabana, Guion Bluford, Jr., James S. Voss, and Michael R. Clifford. Classified Department of Defense primary payload. Landed at Edwards Air Force Base. Mission Duration: 7 days, 7 hours, 19 minutes



### 20 Years Ago - 2002

November 23: STS-113 (Space Shuttle *Endeavour*) launched from KSC. Crew: Paul Lockhart, James B. Wetherbee, Michael E. Lopez-Alegria, John B. Herrington, Kenneth B. Bowersox, Donald R. Pettit and cosmonaut Nikolai M. Budarin. International Space Station (ISS) Flight 11A. Delivered P1 (P-One) Truss and exchanged the Expedition Five and Six crews. Landed Dec 7 at KSC. Mission Duration: 13 days, 18 hours, 47 minutes





# THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

## 20 Years Ago – 2002 (Continued)

November 26: NASA set a world record for the largest balloon successfully launched, when it flew a 60 million cubic foot balloon carrying a 1,500-pound scientific payload to the fringes of space



December 10: TDRS-10 (TDRS-J), for Tracking Data and Relay Satellite, launched aboard an Atlas 2A rocket from Cape Canaveral



December 14: Adeos 2, also known as Midori 2 ("Green"), a Japanese (NASDA)



remote sensing spacecraft launched by a H-2 rocket from Tanegashima Space Flight Center along with three other satellites: Fedsat, Micro-labsat, and WEOS

## 15 Years Ago – 2007

November 7: Japan's Selene lunar orbiting spacecraft Selene (or Kayuga) captured first high-definition photos of Earth rise and Earth set

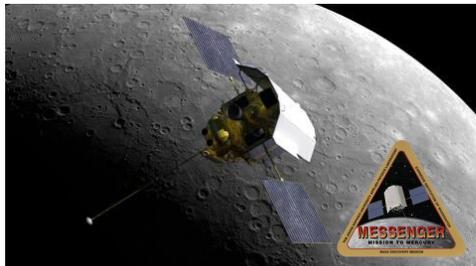


## 10 Years Ago – 2012

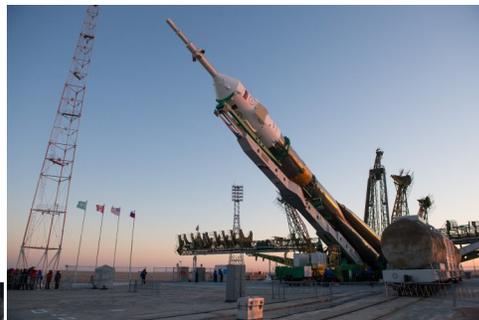
November 2: Space Shuttle *Atlantis* arrived at its new home at the Kennedy Space Center Visitor Complex



December: The Messenger spacecraft discovers water ice in Mercury's polar regions



December 19: Soyuz TMA-07M launched from Baikonur cosmodrome by a Soyuz-FG launch vehicle. It carried Russian cosmonaut Roman Romanenko, Canadian astronaut Chris Hadfield, and US astronaut Tom Marshburn to the International Space Station (ISS)



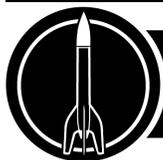
## 5 Years Ago – 2017

November 18: MiRaTA (Microwave Radiometer Technology Acceleration) launched by a Delta II 7920 from Vandenberg AFB



December 17: Soyuz MS-07 launched by a Soyuz FG launch vehicle from Baikonur Cosmodrome. Crew: U.S. astronaut Tingle, Russian Anton Shkaplerov, and Norishige Kanai of the Japan Aerospace Exploration Agency. (ISS Expedition 54)





JMARC  
HUVERS

Club News

### Election Results: Our New Officers and BOD for 2023

Our elections for officers and board of directors concluded in November. Thanks to everyone who made nominations and took part in the elections. Your input and participation is greatly appreciated. There were only single nominations for officers, so as a reminder here are your club officers for the next year;

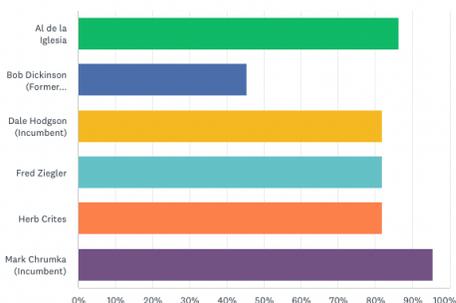
- President - Scott Miller
- Vice-President - Roger Sadowsky
- Treasurer - Tony Haga
- Secretary - Buzz Nau

Below are the results of the Board of Directors election. Many thanks to Bob Dickinson for participating. Bob served for many years as our Secretary and we are all grateful for his service. His support contributed to the success of our club over the years.

Please welcome new board members Al de la Iglesia, Herb Crites, and Fred Ziegler! We're happy to have them onboard and look forward to their help driving the club.

Vote for Board of Directors (no more than five) RESUME LINK

Answered: 22 Skipped: 0



ANSWER CHOICES	RESPONSES
Al de la Iglesia	86.36% 19
Bob Dickinson (Former Secretary)	45.45% 10
Dale Hodgson (Incumbent)	81.82% 18
Fred Ziegler	81.82% 18
Herb Crites	81.82% 18
Mark Chrumka (Incumbent)	95.45% 21
Total Respondents: 22	

### Officer and Board Meeting this February

The club officers and BOD will meet this February to discuss club goals and initiatives for 2023. Continuity of operations and a flight schedule will be a priority item, but we welcome input from the membership. If you have something you would like added to the agenda be sure to comment on the post in our Groups.io email. We will report out in email and in the next issue of *Total Impulse*.

### NAR Section Grants Available for 2022

NAR grants will also be discussed at the board meeting. 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.

### Fun Contest Lineup for 2023

**Big Bertha Contest** - 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.

#### Vehicle

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.

**Random Altitude** - This will be like the "Current Year Altitude" event we used to run all summer long. Rather than using the current year as the target altitude, we will use a random number generator to pick an altitude between 1500 and 2500 feet. Otherwise, the same rules apply, get closest to the target altitude without going over. It will run all season long for 2023. The entry fee will be \$5 per attempt. The winner will receive 50% of the pot, second place will earn 25%, and the remaining 25% will go to the club.

**Iron-man III** – 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. We're still working out the details, but the models will likely be 18mm and 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)

### Winter Projects

Let us know what you are working on over the winter break. Whether it's just a note on the Groups.io email forum, photos, or a full fledged article, consider sharing what you are working on, big or small. It will help spur the imagination on others and give us all something to look forward to when the flying season starts.

### Newsletter Survey

We will post a new survey in January to the club requesting feedback on the newsletter content. We held a retrospective survey before which helped shape the newsletter content, but it is feedback we need to request on a regular basis. The main purpose of a club newsletter is to provide news and information that is valuable to the membership. Let your voice and priorities be heard. Please take some time once the survey link is posted to our email list and answer a few questions to help improve the news we provide. Your participation is greatly appreciated!



# LAUNCH WINDOWS

Launch dates from SpaceFlight.com

**January 2, 2023**

**Falcon 9 - Transporter 6**

**Launch site: SLC-40, CCSFS**

A SpaceX Falcon 9 rocket will launch the Transporter 6 mission, a rideshare flight to a sun-synchronous orbit with numerous small microsattellites and nanosatellites for commercial and government customers. The Falcon 9's first stage booster will return to Landing Zone 1 at Cape Canaveral Space Force Station.

**January 2023**

**Falcon 9 - OneWeb 16**

**Launch site: SLC-40, CCSFS**

A SpaceX Falcon 9 rocket will launch 40 satellites into orbit for OneWeb, which is developing and deploying a constellation of hundreds of satellites in low Earth orbit for low-latency broadband communications. This will be the second launch of OneWeb satellites with SpaceX, and OneWeb's 16th launch overall. The Falcon 9's first stage booster will return to Landing Zone 1 at Cape Canaveral Space Force Station.

**January 2023**

**Falcon 9 - Starlink 2-4**

**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.

**January 2023**

**Falcon Heavy - USSF 67**

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

A SpaceX Falcon Heavy rocket will launch the USSF 67 mission for the U.S. Space Force. The mission will launch the Space Force's second Continuous Broadcast Augmenting SATCOM, or CBAS 2, military communications satellite and the Long Duration Propulsive ESPA 3A, or LDPE 3A, rideshare satellite hosting multiple experimental payloads.

**TBD, 2023**

**Falcon 9 - Starlink 2-2**

**Launch site: SLC-40, CCSFS**

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 after flying southeast from Cape Canaveral.

**January 18, 2023**

**Falcon 9 - GPS 3 SV06**

**Launch site: SLC-40, CCSFS**

A SpaceX Falcon 9 rocket will launch the U.S. Space Force's sixth third-generation navigation satellite for the Global Positioning System. The Falcon 9's first stage booster will land on a drone ship in the Atlantic Ocean.

**January 2023**

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

**Launch site: SLC-40, CCSFS**

A SpaceX Falcon 9 rocket will launch the first two 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.

**January 2023**

**Falcon Heavy - ViaSat 3 Americas**

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

A SpaceX Falcon Heavy rocket will launch the ViaSat 3 Americas broadband communications satellite. ViaSat 3 Americas is the first of at least three new-generation Boeing-built geostationary satellites for ViaSat. A small communications satellite named Arcturus will launch as a secondary payload for Astranis.

**Early 2023**

**Falcon 9 - SES 18 & SES 19**

**Launch site: Cape Canaveral**

A SpaceX Falcon 9 rocket will launch SES 18 and SES 19 communications satellites for SES of Luxembourg. SES 18 and 19, built by Northrop Grumman, will provide C-band television and data services over the United States.

**TBD, 2023**

**SSLV - 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.

**TBD 2023**

**Starship - Orbital Test Flight**

**Launch site: Starbase, Boca Chica**

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.

**1st Quarter, 2023**

**Falcon 9 - O3b mPOWER 3 & 4**

**Launch site: SLC-40, CCSFS**

A SpaceX Falcon 9 rocket will launch the second 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.

**February 16, 2023**

**Soyuz - Progress 83P**

**Launch site: Baikonur Cosmodrome**

A Russian government Soyuz rocket will launch the 83rd Progress cargo delivery ship to the International Space Station. The rocket will fly in the Soyuz-2.1a configuration.

**February 19, 2023**

**Falcon 9 - Crew 6**

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

A SpaceX Falcon 9 rocket will launch a Crew Dragon spacecraft on the program's ninth flight with astronauts. The Falcon 9's first stage booster will land on a drone ship in the Atlantic Ocean. NASA astronauts Stephen Bowen, Warren "Woody" Hoburg, UAE astronaut Sultan Al Neyadi, and Russian cosmonaut Andrey Fedyaev will launch on the Crew Dragon spacecraft to begin a six-month expedition on the International Space Station.

**February 2023**

**Falcon 9 - Inmarsat 6 F2**

**Launch site: Cape Canaveral**

A SpaceX Falcon 9 rocket will launch the Inmarsat 6 F2 communications satellite for London-based Inmarsat. Built by Airbus Defense and Space, the satellite carries L-band and Ka-band payloads to provide mobile communications services to airplanes and ships.

**February 2023**

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

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

Arianespace will use an Ariane 5 ECA rocket, designated VA259, to launch the Syracuse 4B and Heinrich Hertz communications satellites. Syracuse 4B will relay secure communications between French military aircraft, ground vehicles, and naval vessels. The Heinrich Hertz satellite will test new communications technologies. The small Ovzon 3 geostationary communications satellite for the Swedish company Ovzon will also be on this launch.

# OUR MEMBERS IN THE FIELD



Fred Ziegler is also testing Scott's 3D printed HPR's



Herb Crites preps another Mach Schnell flight



Mark Chrumka and his large scale SCUD B



Al de la Iglesia prepping for the Big Bertha Contest



Dale Hodgson with one of Scott's 3D prototypes



Buzz was in a different field in Oct-Nov