TOTAL IMPULSE

JACKSON MODEL ROCKET CLUB
JMRC HUVARS
HURON VALLEY ROCKET SOCIETY
TOTAL IMPULSE VOLUME 21, NO. 2
March - April 2021

Der Big Red Max Build Part 1

3D PRINTED HIGH POWER ROCKETRY

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60 YEARS AGO: VOSTOK I

In Memoriam: Michael Collins

CLUB OFFICERS

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Board of Director: Dale Hodgson
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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@sfsmindustries.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 Bob Dickinson
5668 Big Fish Rd
Goodrich, MI 48438

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

EDITOR'S RANGE BOX

It is currently the first week of May and I just watched SpaceX successfully launch Starship SN-15 through the clouds to 10km, pitch over for a high drag, unpowered descent, come back through the clouds, pitch back upright and nail the landing. We live in amazing times. Meanwhile, we're struggling to get to a point where we can resume rocket launches of any kind. Again, we live in amazing times and it's not always amazingly good.

Though we are making positive strides in resuming launches, it is going unbearably slow. When we are able to resume, we'll be ready to go. Also, it will be great to write launch reports again. Hopefully in the next issue.

With Scott's 3D printed rocket article, I am hoping that this content becomes a regular topic in the newsletter. Several members are active in the area and have produced amazing parts, tools, and rockets.

Thanks to Scott Miller, Dale Hodgson, Chris Timm, Peter Alway, and Tony Haga for contributing content to this issue.

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.

The editor of *Total Impulse* accepts material for inclusion from anyone.
Send correspondence to:
Jackson Model Rocket Club
Buzz Nau, Editor
E-mail: USSMidway@gmail.com

Launch/Event Calendar - 2021

- ~~May 8 *Pending* (MIS)~~
- June 12 *Pending* (MIS)
- July 10 *Pending* (MIS)
- NARAM 62 - July 23 - 30 (Geneseo, NY)
- August 14 *Pending* (MIS)
- September 11 *Pending* (MIS)
- October 9 *Pending* (MIS)
- November 13 *Pending* (MIS)

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.

PRESIDENT'S CORNER

What to do when life gets in the way of your plans?

I guess the next best thing to being out on the range flying is to prepare and invent to avoid excessive lost time when we can get back out there. I personally have wandered in many directions to help me mentally as well as provide progress for the club. My two main topics have been refining python coding and a lot of 3d printing. Python has proven to be extremely universal and also has dialect for microprocessors which could be interesting for flight computers, launch components, etc.

The 3d printing has taken many turns as well. New avionics bays, nose cones, and basically any part that can appear in cad. The hybrid motor game has lots of room to experiment with new grain geometries or even a weeping grain to introduce new fuels during a burn. I hope everyone else has found a means to cope, and if things continue on the positive path we can all be back out on the field to formally test all of our builds and experiments that have been piling up.

See you on the field soon! Scott

On the Cover:

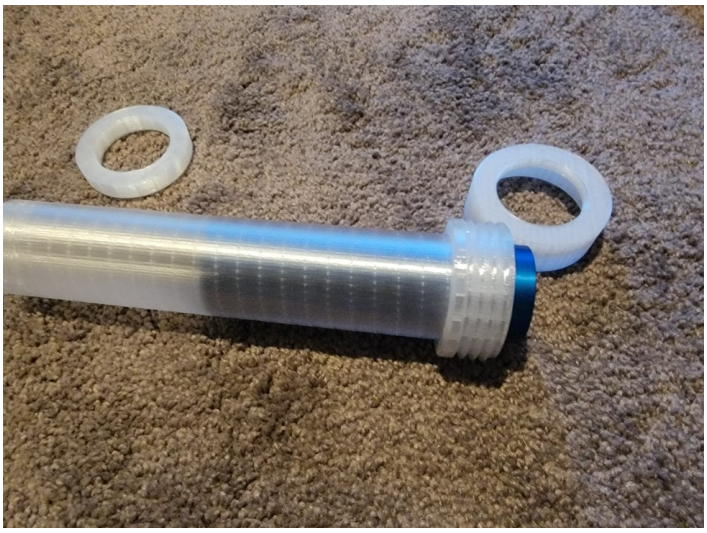
(top - left) The new Estes Der Big Red Max - Estes LLC photo (top - right) Addy Miller holds Dad's 4" dia 3D printed high power rocket (bottom - left) Cosmonaut Yuri Gagarin (bottom - right) Astronaut Michael Collins

Print, Screw, Fly... can it be that easy?

Scott Miller

I have always wondered could there be another way? This has been a universal question that is always finding its way into various topics and now it comes into high power rocketry yet again.
3d printing model rockets have been increasingly more common for a while now but why has it seemed to stall with model size and miscellaneous parts?
With this in mind I challenged myself to design a rocket that is 3d printed, uses zero adhesive, and can fly safely on a high-power motor.

Step 1 finding a material that can hold up to the temperatures of a HPR motor. After a lot of mental debate and research I decided on Polycarbonate. The brand I chose prints at 270C and doesn't start to soften until 220C. This would appear to fall into the safe range of the certified motor limitation of 200C limit. Since we are designing from scratch might as well build in a threaded retainer at the same time.

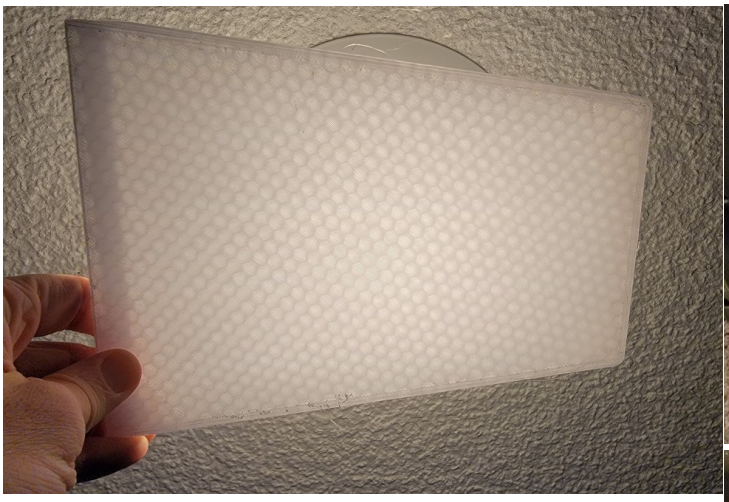


The rest of the rocket can benefit from various materials, with prototype mentality I just went with material I was familiar with and is relatively durable so PetG became the winner.
The next phase is the fin can design, the goal is a Big Dumb Rocket (BDR), thus I went for bulk and strength… no altitude or speed records in the future :-). The centering rings have ribs for fin alignment and tapped holes to 8-32 thread to firmly affix.

The fin pattern is my go-to trapezoidal style that is 10mm thick. I needed it bulky to accept a screw for mounting but made them hollow with hexagon infill structure.

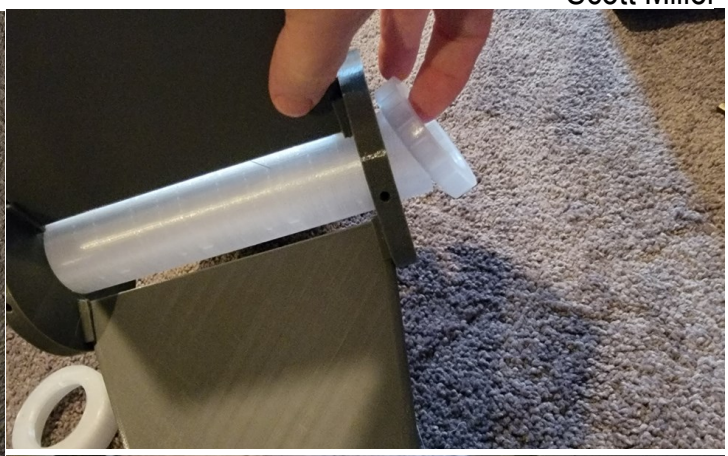
Print, Screw, Fly... can it be that easy?

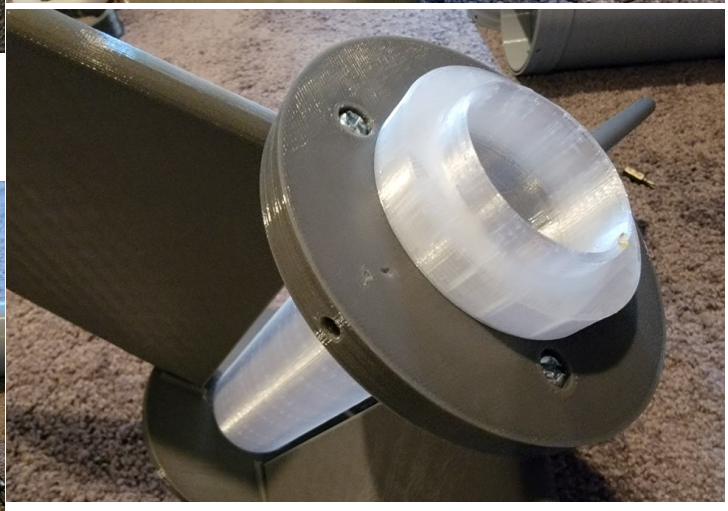
Scott Miller



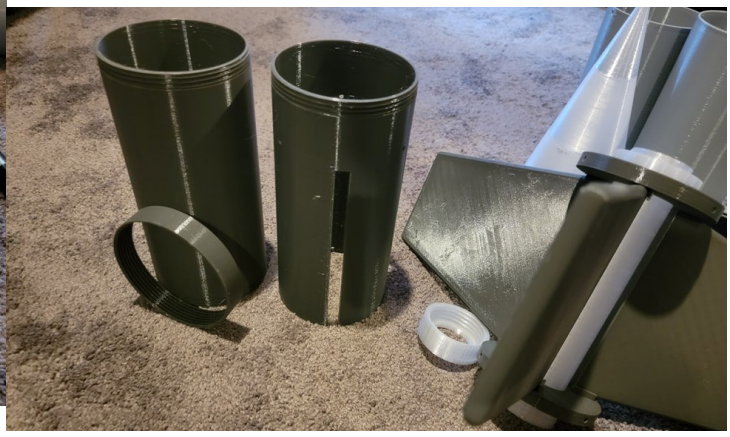
The fins bolt right in place with 8-32 machine threads. I'm assembling this with 1" length screws but the fin is tapped all the way through for the Dale Hodgson's of the world that need to overbuild… not to call anyone out of course ;-)

The motor mount assembly slides in and has a threaded locking disk to hold everything in place.





Fin can complete, next step is some skin for the bones. This portion underwent a lot of iterations and some complete redesigns. My largest printer is only capable of 210mm build volume, so this adds a bit of a challenge unless you want a very short and stubby rocket. The current version went with threaded body tubes with a joining ring so the end user can adjust the length as desired.



Above is a slotted airframe and a full airframe with a joining ring.

Print, Screw, Fly... can it be that easy?

Scott Miller

The fin can airframe slides in place and bolts directly into the centering rings with more 8-32 machine threads. This also doubles as threaded mounting points for rail buttons. The CR is threaded all the way through again in case someone has the need to use longer screws. Dale did not come into mind with that thought process either ;-).

Above is an example of two body sections threaded together ready to go.

Print, Screw, Fly… can it be that easy?

Scott Miller

To cover the top threads, I just printed a half coupler. This is to serve a couple purposes, one to protect the threads but the other is to make the lip more robust to help prevent zippers. Plus, I was lazy and didn't want to make yet another full-length body tube with threads on only one side.

We can throw on a conical 3d printed nose cone and fly it in a short configuration. If we want to make it longer just thread on another section… allows the option to mix and match available colors.

Some questions that may have surfaced is mounting the recovery system. There are options here as well… we can use 8-32 threaded eye bolts to attach the forward centering rings to the fins. Another option is to incorporate a Roger special Gorilla mount with up to three attachment points for redundancy. If the motor is long enough, we could even leverage the MMT locking nut to affix the shock cord. All of these options will fall in line with the screw and fly approach.

So, this begs the next question…. Will it work?

One way to find out, so this will be ready to go for a proof-of-concept flight or twelve when our field becomes available.

Scott

JMRC HUVARS Club News

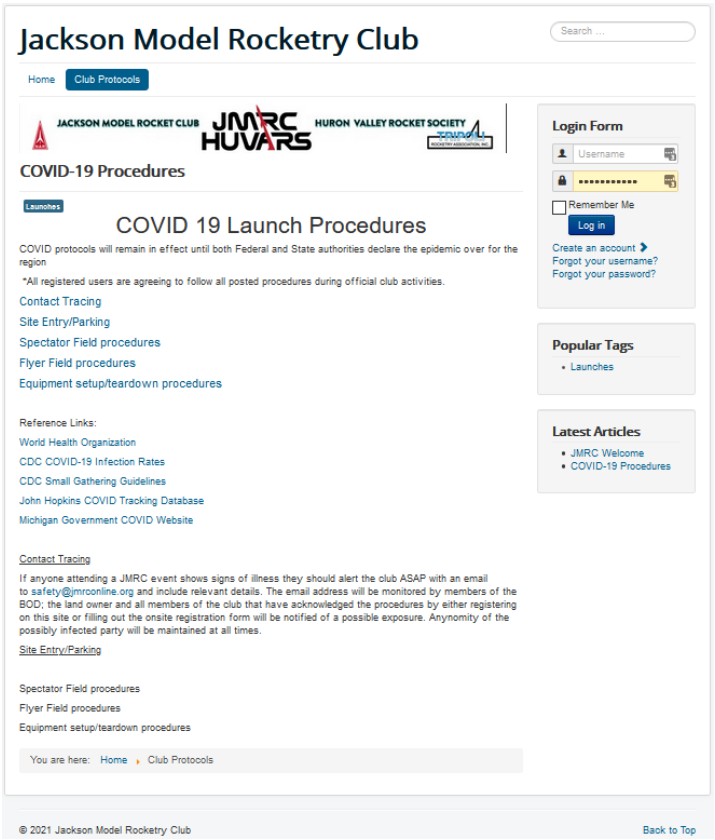
Are We Any Closer to Flying?

This pandemic has been a rough stretch for all of us and some more than others. One thing we can all share in misery is the lack of launching rockets for well over a year now. The metrics that are being used to determine how much the state opens and when have drifted up and down, but are generally on a path to allow us to fly again soon.

The major hurdle we are trying to jump right now is acquiring approval of our Covid protocols for holding events at MIS. Fortunately the BOD had worked on these protocols ahead of time and were able to provide them when MIS let us know they were ready to talk about holding events. Because there is a chance that the MIS lawyers may request changes, we will not be publishing the protocols until the process and language is accepted. We want to avoid old, unapproved copies of the protocol being relied on. We will be contacting MIS this week for any updates and continue to stay engaged with them until we get approval.

Apart from the way we hold our launches, we will also need members attending launches to fill out an attestation that they are not experiencing Covid symptoms or have been exposed/diagnosed recently before the launch. If you have gone to any doctor or dentist appointment this past you likely filled one of these out. Ours will be online to make it easier as well as printed forms on the field.

Stay tuned to the forum as we expect to announce a formal schedule soon.



Member Highlight - Rick Sharp Achieves Level 3!

Rick Sharp attained his level 3 certification on March 20th at a TMO launch in South Charleston, OH. His rocket was 150 inches tall, 8 inches in diameter, and weighed 73 pounds with the motor. He had a 30 inch drogue and 120 inch main chute. The rocket hit 4,500 feet exactly according to the altimeter! Congratulations Rick!

VIEW FROM THE FLIGHT LINE

Estes Der Big Red Max Modifications and Build Part One....Why I Did What I Did

DALE HODGSON - PHOTOS FROM DALE H AND ESTES LLC

Well, it's the end of April; I can't begin to count the number of days I looked up and thought it was a perfect day to fly. For me it's been over a year now with the exception of maybe flying a couple of low powers out in a field nearby. It's tough waiting to hear what will happen next; we will either get to fly or not. As of this writing we are waiting to hear back from MIS to see if we can have access to the campground where we normally fly. The BOD put together a protocol of how we'll run the launches and submitted it. It' pretty much out of our hands now; all we can do is wait.

As most of the readers know I've been stockpiling parts as well as kits. Mostly out of sheer boredom but in looking ahead retirement is now on the horizon. I want to make sure I have plenty to do once that happens. But I recently dipped into the stash pile and pulled out a kit I'm pretty excited about which is a fair departure for me. I was always intrigued with the Estes Der Red Max which in my mind is one of the Estes Classics. Pretty cool looking rocket but for some reason I've never owned or built one; at least until now. Of course, something had to pique my interest so what did Estes do? Come out with a bigger version, the Der Big Red Max. It's a 3-inch upscale with a 29mm motor mount. Now, that grabbed my attention. At first, I thought this time I'm going to build it stock, exactly as the instructions directed. But me being me;

nope, that is not going to happen. When shopping for the kit I came upon an offering from Rocketry Works out of Tucson, AZ. Not only did they offer the kit, they offered an upgrade. Be still my beating heart; upgrade you say? So, I added that to the list but I ended up upgrading the upgrade which I will now explain.

The standard kit (even this larger version) came with paper centering rings, launch lugs, elastic shock cord with corresponding Estes paper cord anchor, plastic parachute and balsa fins that had to be assembled. The one thing that did surprise me is that this kit comes with one of the new 29mm Estes plastic motor retainers. It also came with a forward thrust ring to retain Estes E motors but we can talk about that more later. The airframe was slotted and of high-quality paper, the nose cone injection molded plastic. The fins are so large they came in two pieces and had to be assembled. Not bad unto itself and the fins could always be strengthened by tissuing them once put together but we're talking a 29mm motor tube here. I'm thinking composite motors in addition to black powder to provide a wider selection of what I can put in the thing.

VERBOTEN

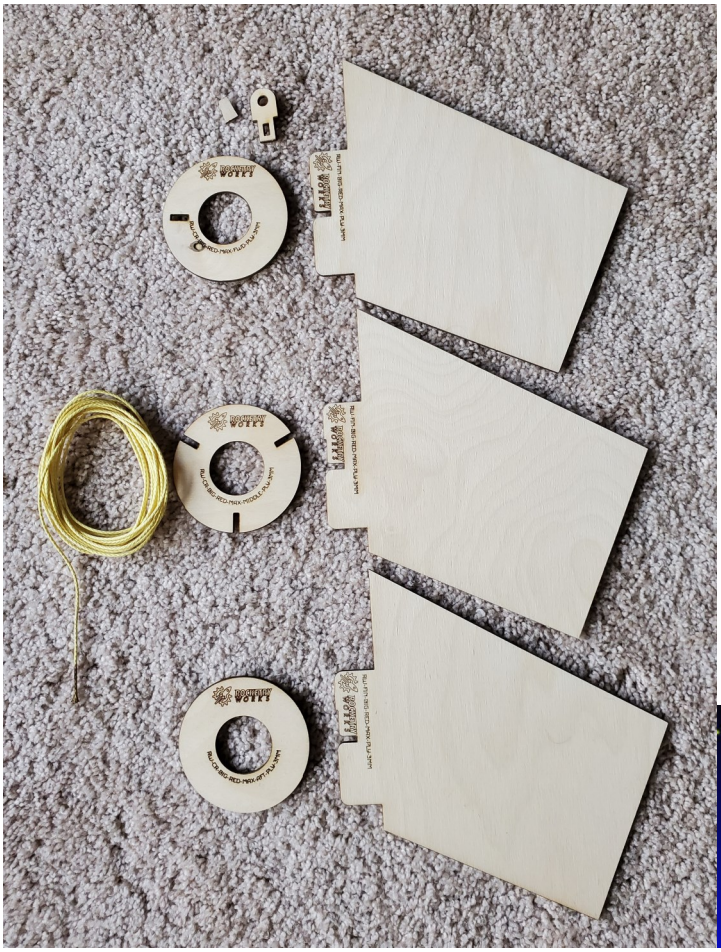
VIEW FROM THE FLIGHT LINE

Estes Der Big Red Max Modifications and Build Part One....Why I Did What I Did

DALE HODGSON

The upgrade kit from Rocketry Works came with some very nicely done ply centering rings, plywood fins and a Kevlar shock cord. Now, we're on the right track, at least in my mind. But even that wasn't enough; at least for me. The shock cord was of high quality; I even did the match test to see if I could get the cord to light; some do…this one didn't. But it was a braided cord. Not bad unto itself but I prefer the flat type. So, I did an upgrade to the upgrade. I went to one of my other personal favorite vendors; Top Flight Recovery and got some 1/8" Kevlar…9 feet of the stuff along with a Nomex sleeve and Nomex chute protector. I replaced the plastic chute (although it did have a pretty cool design on it) with a 30" X-form with black and red panels to keep the theme of the project. There was a ply shock cord attachment that assembled through the front centering ring but I am replacing that with a small eye bolt. I can't help myself; I tend to beef everything up I build at least to a point. To round up the upgrade to the upgrade and original the launch lugs won't be used; I have rail buttons that I will install. Again, personal preference….I've had too many bad experiences with larger kits on rods suffering "rod whip" and going in all sorts of weird directions. So, I fly off a rail whenever I can.

I'm pretty excited to build this one; if I do it right it should be very cool and grab some attention, both in appearance and performance. At this point I think Estes did a great job with the kit and kudos to Rocketry Works for offering an upgrade for those of us that just can't leave well enough alone.



And oh, did I mention that for you scratch builders out there Rocketry Works also offers this same upgrade package for a 4-inch version? I believe either 29mm or 38mm rings are available. Be careful with these upscales though; the original Estes 3" version comes with 1 oz. clay for the nose cone. So, in order to keep CP/CG positions in check you may have to use a bit more clay depending on what the project calls for.

The only thing left to do was the name of this thing. Der Big Red Max is a fine name for the original 3 inch upscale but I got an upgrade; and an upgrade to the upgrade. So, I'm naming this one Der Bigg Redd Maxx. I know, not as cool as Herb's Mach Schnell projects but it's a start.

Part two will be the actual build of this kit including all the upgrades we mentioned this time around. So, even if we're still not flying, I'll have plenty to do and keep my mind occupied. Who knows, that 4-inch scratch build with maybe a 38mm motor mount is in my future……

Nike Cajun Photo Documentation Round NA10.120

Chris Timm scans from Peter Alway archives

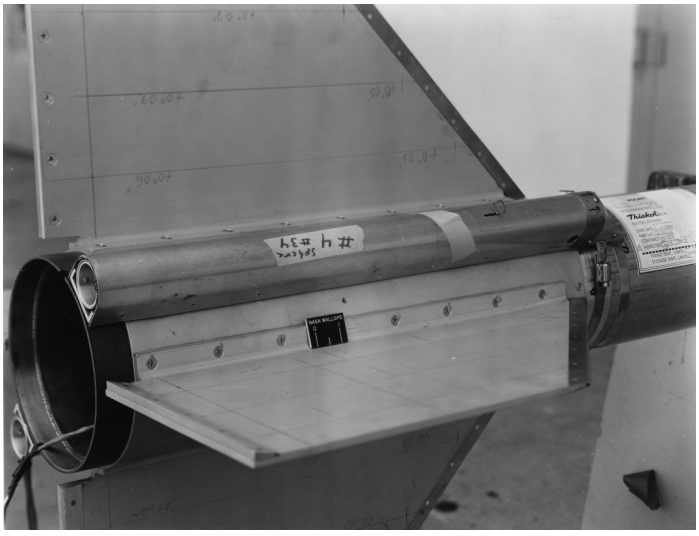
Nike Cajun NA10.120 Flown on 8 February 1965 from Wallops Island with a grenade experiment - NASA photos

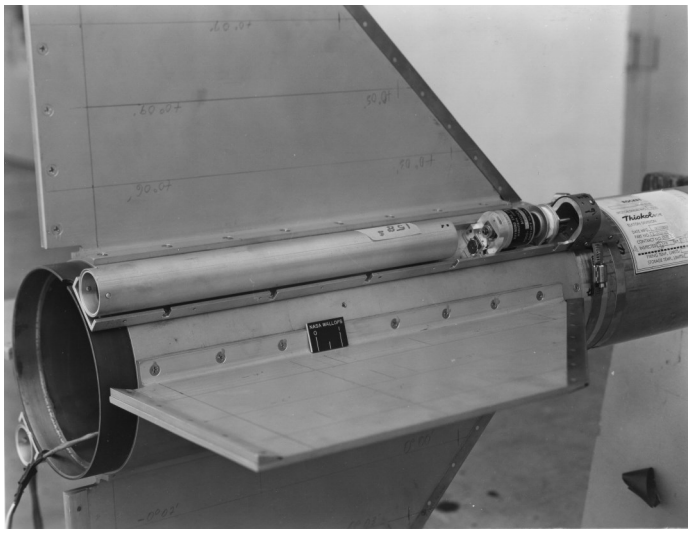

UNITED STATES
UNITED STATES

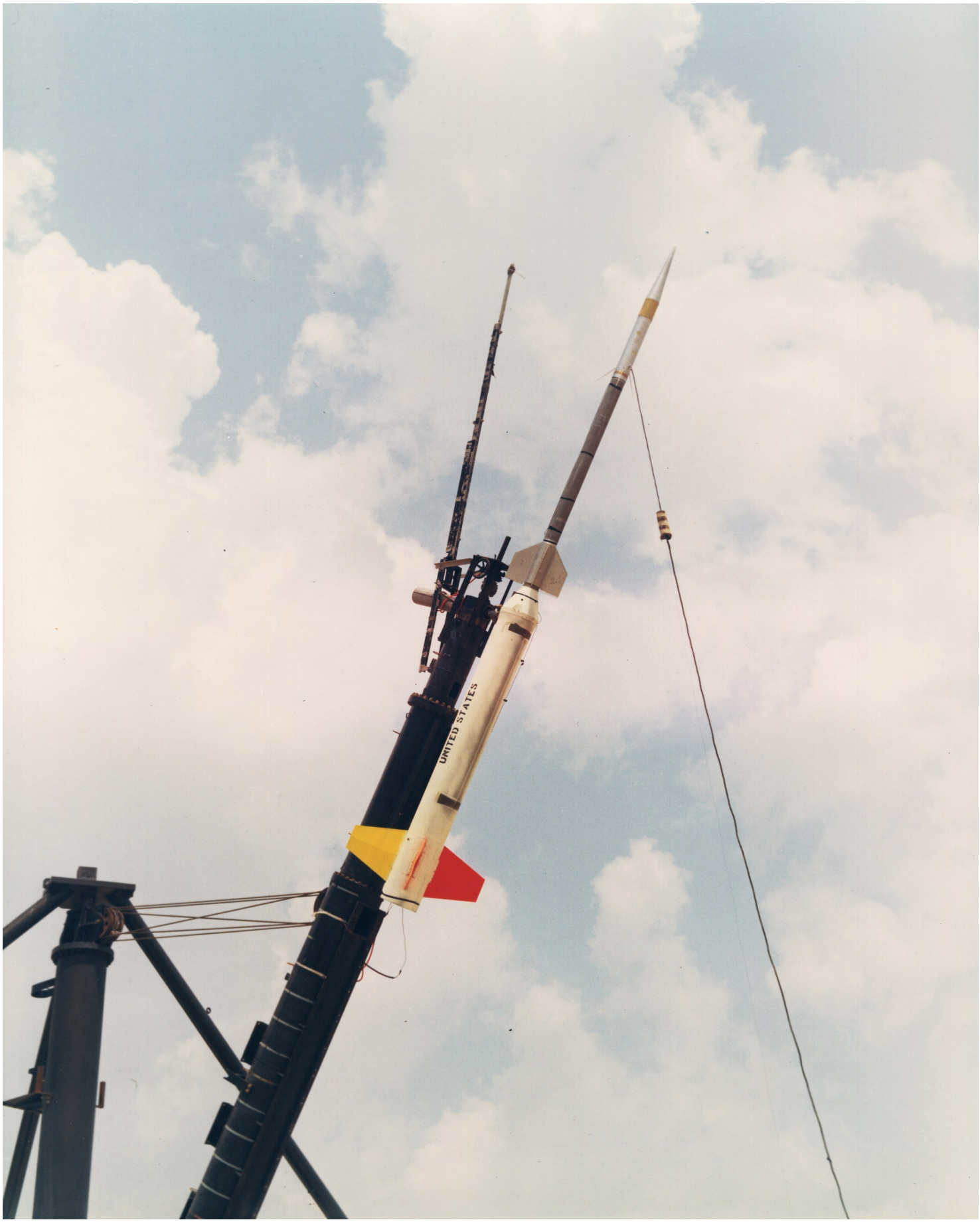
Nike Apache Photo Documentation Round NA14.360

Chris Timm scans from Peter Alway archives

Nike Apache NA14.360. Flown on 24 August 1968 from Wallops Island with an ionosphere experiment - NASA photos






UNITED STATES

CURRENT EVENTS IN SPACE EXPLORATION

What a great time to observe and enjoy the recent successes in space exploration. It has been another incredible period of launches, planetary exploration, and manned missions to space.

SPACEX

The first of nine launches during this period from SpaceX was the Starship SN10 10km test flight on 3 March. This was the third Starship prototype to attempt the belly flop maneuver and land, with SN-8 and 9 both crashing due to engine restart issues in the final moments of their flights. This time all three Raptor engines relit and engines were shut down when no longer needed. As like the previous attempts, SN-10 flew successfully to 10km, performed the aerobrake maneuver, but this time the pitch back worked resulting in a landing albeit a little hard. The vehicle was damaged as a result which led to an explosion likely from leaking methane which destroyed SN-10. Regardless, this was considered a highly successful flight proving the pitchback maneuver could work.

Starlink 17 was the next SpaceX flight the following day on March 4. This was the 20th Starlink launch placing another 60 satellites in the cloud. It was the first flight of this Falcon 9 booster which recovered aboard the drone-ship *Of Course I Still Love You.*

Next up in rapid succession was Starlink 20 on March 11. It was the 6th flight of the Falcon 9 booster after a 46 day turnaround from the previous launch. It was recovered aboard the drone-ship *Just Read the Instructions.* Both fairing halves were also recovered and both had flown before. The payload of another 60 Starlink satellites were deployed increasing the cloud to 1,265.

Three days later, March 14, Starlink 21 was launched at 6:01AM (EDT). It was the 9th flight of the Falcon 9 booster and was recovered by *Of Course I Still Love You.* Booster turnaround was 53 days. The payload was another 60 Starlinks and the 22nd Starlink flight. It is unknown if the payload fairings were recovered. This was also the fastest turnaround for pad LC-39A at just over 10 days.

Starlink 22 was launched 10 days later from Cape Canaveral Space Force Station pad SLC-40. This was the 23rd Starlink flight and 6th of the Falcon 9 booster. The booster landed aboard the

CURRENT EVENTS IN SPACE EXPLORATION

drone-ship *Of Course I Still Love You* and both fairing halves were recovered. These 60 Starlinks increased the total to 1,385 launched (1,319 still in orbit).

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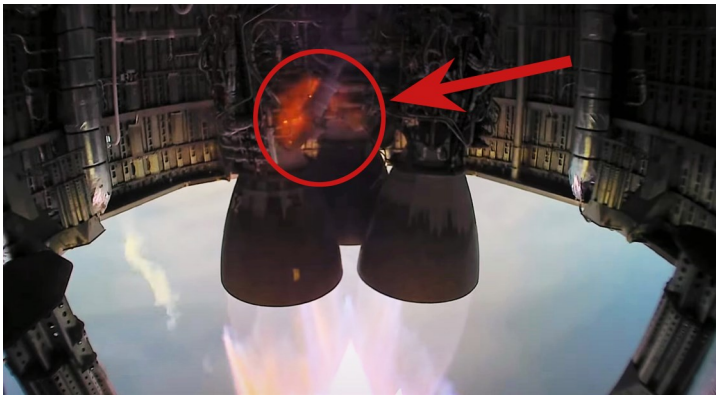
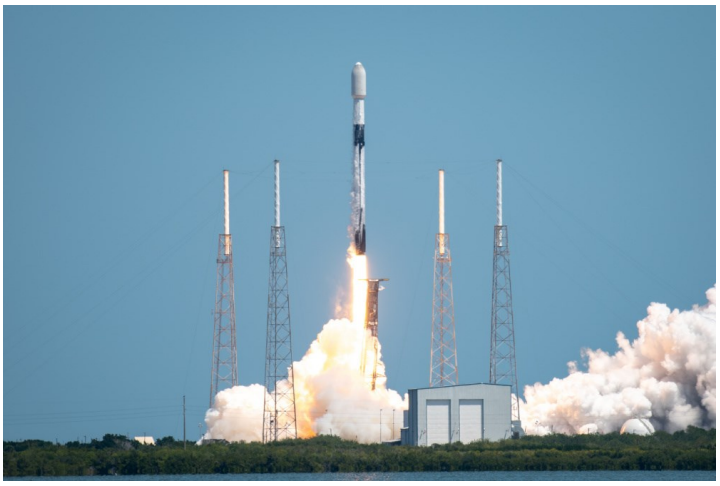
The next Starship prototype, SN-11 was launched on a foggy March 30th. The profile was similar to SN-10, a 10km ascent followed by the aero-brake maneuver, and finally the engine relight and pitchback to a landing. The launch had already been postponed and the weather forecast made it unlikely to fly, but the countdown went on as planned. Onboard video showed a small fire with one engine during ascent, otherwise the flight appeared nominal. Shortly after the pitchback maneuver was initiated the video showed one engine relight before losing signal. The vehicle exploded approximately 600 meters in altitude while still traveling nearly 200mph.



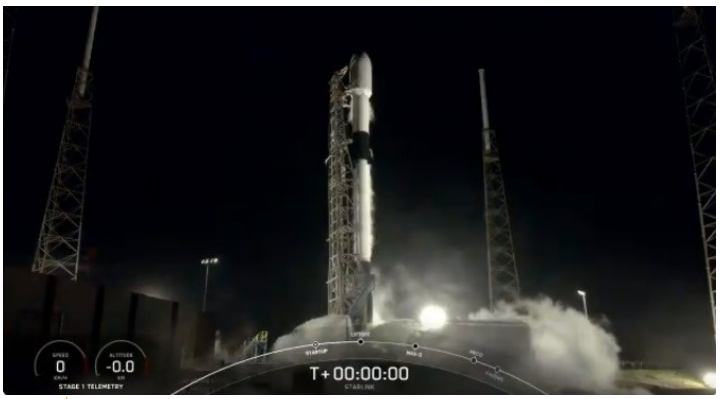
Starlink 23 launched on April 7 from pad SLC-40. The Falcon 9 booster had flown 6 times previously after a 27 day turnaround. The booster landed on the drone-ship *Of Course I Still Love You* and only one fairing half was recovered. The 60 Starlink satellites increased the number launched to 1,445.



On April 16 NASA announced that SpaceX had been selected to deliver astronauts, experiments, and supplies to the moon as part of the Artimis program. The $2.89 billion contract was awarded over Blue Origin and Dynetics. Pending litigation from the losing bidders has put work on hold until this plays out in court.

The second Commercial Crew Transport flight and third crewed flight of a Crew Dragon capsule took place on April 23. The flight delivered NASA astronauts Commander Robert Kimbrough and Pilot Katherine McArthur, Mission Specialist JAXA astronaut Akihiko Hoshide and Mission Specialist ESA astronaut Thomas Pesquet to the ISS. The Falcon 9 booster had flown previously as well as the Crew Dragon capsule. The booster landed aboard the the drone-ship *Of Course I Still Love You.* Crew Dragon docked with the ISS 23.5 hours after launch.

Finishing up this period of SpaceX launches was Starlink 24, launched on April 28. The Falcon 9 booster was turned around in 36 days and had flown six times. *Just Read the Instructions* recovered the booster and both fairing halves were also recovered. The additional 60 Starlinks boosted the total launched to 1,505 (1,438 still in orbit).



Indian Space Research Organisation

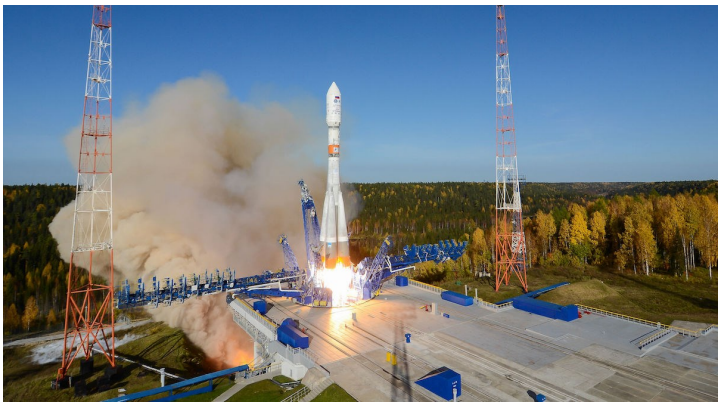
An Indian PSLV-DL was launched on February 28 from the Satish Dhawan Space Centre at Sriharikota, India. It was India's first launch of 2021 and lofted the Brazilian Amazonia 1 Earth observation satellite. It was the 53rd launch of a PSLV and the first commercial application. Eighteen additional satellites were part of the payload including 12 SpaceBEEs, SAI-1 Nanoconnect-2, Sindhu Netra, UNITYsat, and SDSat. All satellites were deployed successfully.

CURRENT EVENTS IN SPACE EXPLORATION

Indian PSLV-DL launching the Brazilian Amazonia 1 Earth observation satellite

РОСКОСМОС

ROSCOSMOS completed five launches during this period starting with the Arktika-M No. 1 flight using a Soyuz 2.1b Fregat-M. The launch occurred on February 28 from the Baikonur Cosmodrome in Kazakhstan. Arktika-M No. 1 deployed the first 10 Arktika meteorological satellites with a lifespan of five years.



On March 22 a Soyuz 2.1a Fregat-M was launched containing the Korean CAS500-1, an Earth observation satellite and several rideshare satellites. The launch was performed by GK Launch Services, a subsidiary of ROSCOSMOS. CAS500-1 will study the Earth using panchromatic and multispectral methods.

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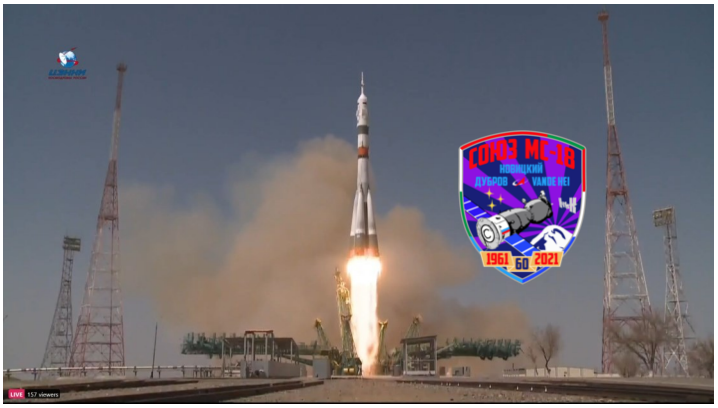
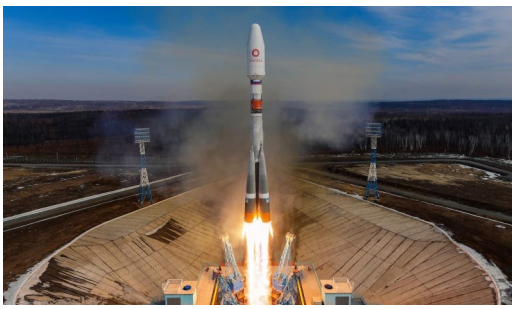
Three days later on March 25 OneWeb 5 was launched atop a Soyuz 2.1b from Vostochny Cosmodrome, Russia. OneWeb, a series of internet communications satellites is an Arianespace program. Arianespace contracts ROSCOSMOS for the launches.

On April 9, Soyuz MS-18 was launched as a ferry flight to the ISS from Baikonur Cosmodrome, Kazakhstan. The crew consisted of cosmonauts commander Oleg Novitsky and flight engineer Pyotr Dubrov, as well as NASA astronaut flight engineer Mark Vande Hei. The crew docked with the ISS just over 4 hours from launch.



OneWeb 6 was launched on April 25, again from Vostochny Cosmodrome, Russia. Payload deployment was successful.



CURRENT EVENTS IN SPACE EXPLORATION

Arianespace also launched Pleiades Neo 3, an Earth observation satellite and several rideshares aboard their small lift Vega launch vehicle from Kourou, French Guiana. The satellites were placed in a sun-synchronous orbit.

Blue Origin conducted another successful test of their New Shepard rocket on April 14. This was another un-crewed suborbital flight, though a crew rehearsal was conducted in the capsule. The vehicle reached an altitude of 106km (66 miles), just above the Karman line of 100km. The booster and capsule were again recovered successfully indicating Blue Origin is close to attempting a crewed launch.

Rocket Lab's one flight over this period was the *They Go Up So Fast* mission launched from their launch complex on Māhia Peninsula, New Zealand. The mission was a rideshare containing 7 satellites aboard a Rocket Lab Electron launch vehicle. All satellites were deployed successfully.

NROL-82, a National Reconnaissance Office satellite, was launched by a United Launch Alliance (ULA) Delta IV Heavy on April 26 from Vandenberg AFB, California. This time the launch was performed on the first attempt and successfully deployed the satellite. This was the 31st mission for the NRO and 13th launch of a Delta IV Heavy.

60 YEARS AGO: VOSTOK I

On 12 April 1961, 60 years ago, Yuri Gagarin made history as the first human to launch into space, orbit the Earth, and return safely.

Vostok 1, a Vostok-K rocket, was launched from the Baikonur Cosmodrome, but at the time it was called Tyratam to confuse the west as to it's true location.

Gagarin was carried aloft in a Vostok 3KA space capsule and automatic systems deorbited the spacecraft at the end of the first and only orbit. There were no communication ships located around the globe, so communications were only possible when the capsule was within range of Soviet ground stations. Instead of riding the capsule to the ground, Gagarin was ejected at an altitude of 7km. The capsule was also recovered by parachute but not at a speed slow enough for the cosmonaut to survive the impact.

Typically the Soviets would have kept a lid on the news until the completion of the mission, however, Chief designer Sergie Korolev contacted the Party Central Committee convincing them make an announcement while Gagarin was still in orbit. His reasoning was that if a rescue was needed it would allow for quicker mobilization and also, should Gagarin land outside the Soviet Union it would prevent foreign governments from declaring him a spy.

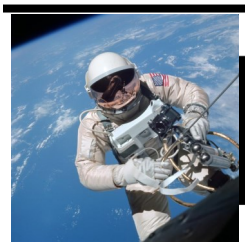
Yuri Gagarin became an instant hero of the Soviet Union and his success was celebrated around the world. It is still an amazing feat for the Soviet Union to complete considering their deficit in technology and industry at the time. Vostok reliability at the time was well below what would have been accepted as man-rated in the US, thus it was a considerable risk that the Soviet Union took to be first in space.

Vostok 1 emphasized even further, the Soviet lead in the space race at the time. They didn't just launch a human into space, they put him in orbit and returned him safely. The US was still months away from achieving this feat.

Unfortunately this would be Yuri's only spaceflight. He was the backup cosmonaut for Soyuz 1 where primary cosmonaut Vladimir Komarov was killed when the capsule's parachutes failed to deploy. Gagarin was removed from consideration for future flights to protect the national hero. He was also prevented from flying solo in aircraft. In 1968 Gagarin and a flight instructor were killed when their Mig-15UTI crashed. There are several theories behind the cause of his crash and we may never really know the truth.

Vostok 1 capsule on display at the RKK Energiya museum—SiefkinDR photo

Yuri's Night - The first Yuri's Night celebration occurred on April 12, 2001, on the 40th anniversary of Vostok 1. It is considered a world-wide celebration of his achievement and an effort to increase the public's awareness on space exploration. Steve Kristal hosted several Yuri Night celebration dinners early on. It seems like forever ago when we met for those. A great time was had by all and maybe next year we can start the tradition back up.



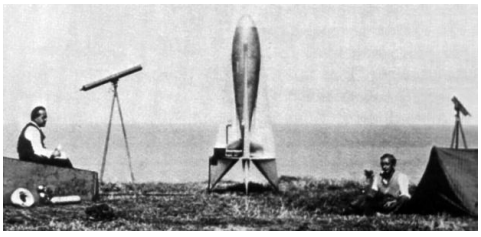
THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

240 Years Ago - 1781
March 13: Uranus discovered by Sir William Herschel, British Royal Astronomer (1738-1822).

95 Years Ago - 1926
March 16: Dr. Robert H. Goddard launched the first liquid-propelled rocket on a farm in Auburn, MA outside Worcester, MA.

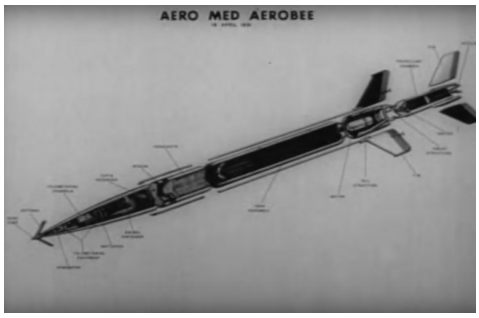
90 Years Ago - 1931
March 14: Johannes Winkler made the first liquid-fueled rocket test in Europe. Bessau, Germany.



75 Years Ago - 1946
March 22: First American rocket to escape earth's atmosphere, the JPL-Ordnance WAC Corporal, reached a 50-mile height after launch from the White Sands Proving Grounds.

April 16: First German V-2 rocket launched in the U.S. reached an altitude of five miles from the White Sands Proving Grounds.

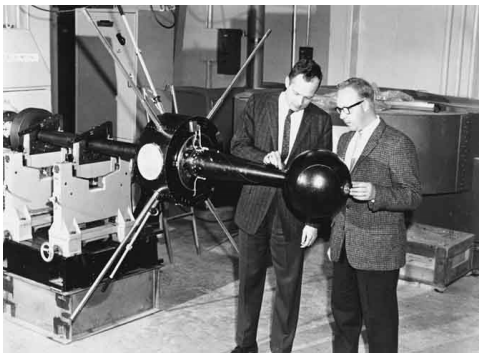
70 Years Ago - 1951
April 18: First Aerobee rocket (Aerobee 12) launched with a biomedical experiment (one monkey and eleven mice). Holloman AFB, NM.



65 Years Ago - 1956
March 14: The Army Ballistic Missile Agency launched the first Jupiter rocket, Cape Canaveral, Fla.

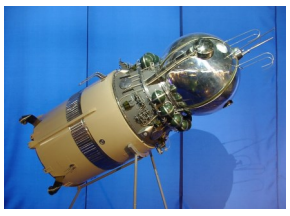
60 Years Ago – 1961
March 9: Sputnik 9 or Korabl Sputnik 4 launched by Modified SS-6 (Sapwood) or Molniya from Baikonur. Payload was a dog named Chernushka.

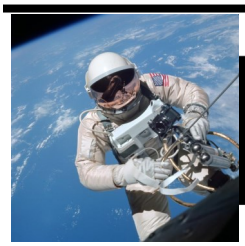
March 25: Explorer 10 launched by Thor Delta from Cape Canaveral, Fla.
March 16: Goddard Space Flight Center, dedicated, Greenbelt, MD.



March 18: Little Joe 5A, a suborbital Mercury capsule test from Wallops Flight Facility. The escape rocket fired prematurely, however, a ground command was sent to separate the capsule from the booster and escape tower. This allowed the main and reserve parachutes to deploy and the capsule was recovered with only minor damage.

March 25: Sputnik 10 or Korabl Sputnik 5 launched by a modified SS-6 (Sapwood) or Molniya rocket from Baikonur. Payload was a dog named Zvezdochka.





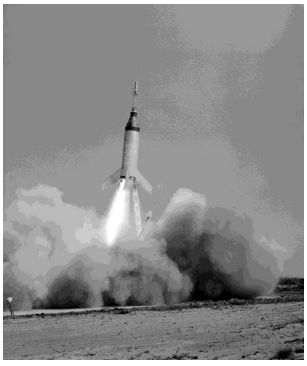
THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

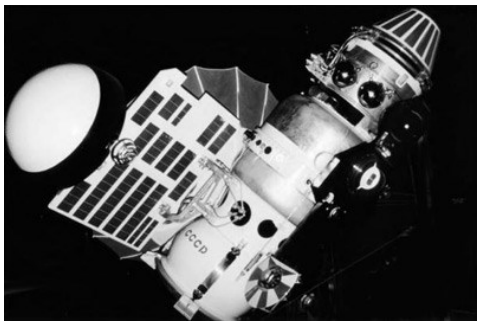
April 12: Vostok 1 carrying Yuri Gagarin was launched from Baikonur, USSR. Gagarin was the first human to orbit the Earth. Vostok 1 was his only spaceflight.

April 25: Mercury Atlas 3 an unmanned capsule test failed to initiate the pitch / roll program and was terminated at 43 seconds. The capsule abort was successful.

April 27: Explorer 11 (S 15) launched by a Juno from Cape Canaveral, Fla.
April 28: Little Joe 5B launched. Suborbital Mercury capsule test from Wallops Flight Facility, VA.

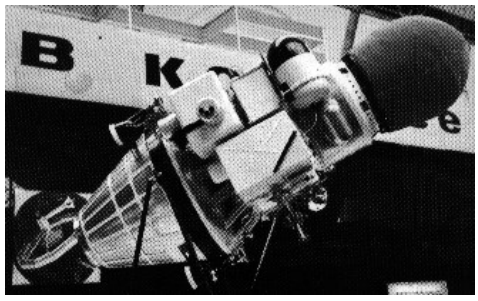


55 Years Ago: 1966
March 1: Venera 3, impacted on Venus making it the first spacecraft to impact on the surface of another planet. Launched on Nov 16, 1965.

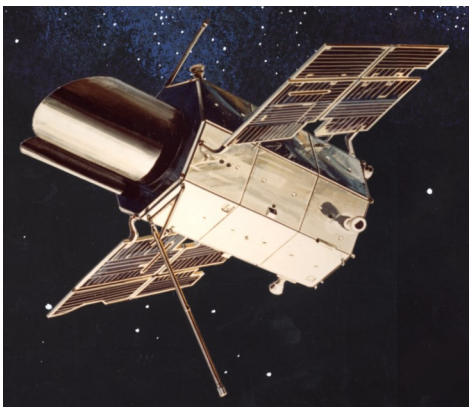


March 16: Gemini Titan 8. First manned docking of two spacecraft, (Gemini 8 with Agena target rocket). Astronauts Dave R. Scott and Neil A. Armstrong launched from Cape Canaveral, Fla. Made emergency landing in Pacific less than 11 hours later.

March 31: Luna 10 or Lunik 10 launched by Molniya or Modified SS-6 (Sapwood) with 2nd Generation Upper Stage plus escape stage from Baikonur, USSR. First artificial moon satellite.



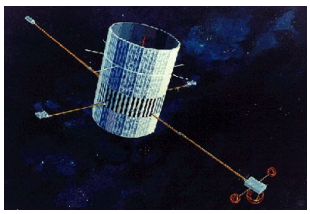
April 7: Atlas Centaur 8 launched containing Surveyor mass model from Cape Canaveral, Fla.
April 8: OAO 1 launched by Atlas Agena from Cape Canaveral, Fla. Satellite was lost after two days due to spacecraft systems failure.

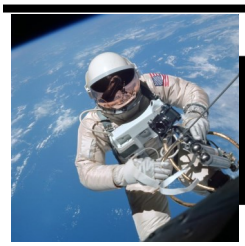


April 23: First test of Saturn 5 engines are tested at Mississippi Test Facility. The test involved a cluster of 5 J-2 second stage engines.

50 Years Ago – 1971
March 9: NASA research pilot Thomas McMurtry completed the first flight in a F-8A modified with Langley researcher Richard Whitcomb's supercritical wing.

March 13: Explorer 43 (IMP-I) launched by a Delta from Cape Canaveral, Fla.

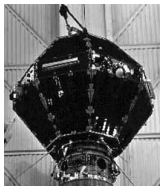




THIS MONTH IN AEROSPACE HISTORY

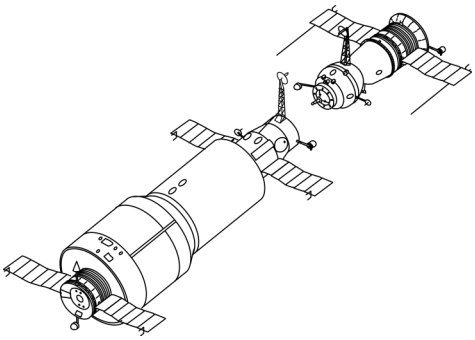
Source—NASA / ROSCOSMOS Archives

50 Years Ago – 1971 (Continued)



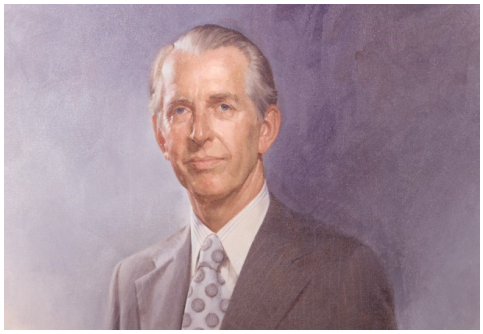
March 31: ISIS 2 launched by a Delta from Vandenberg AFB.

April 19: Salyut 1 launched by a Proton K from Baikonur. First launch of an orbital scientific station.



April 24: San Marco 3 launched by a Scout from San Marco Platform, Kenya.

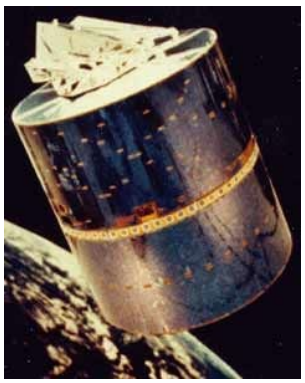
April 27: James C. Fletcher took office as the fourth NASA Administrator.



45 Years Ago - 1976

March 26: RCA-B or RCA-SATCOM-B launched by a Delta from Cape Canaveral, Fla.

April 17: Closest Ever Flyby of the Sun by a spacecraft (Helios 2).



April 22: NATO III A launched by a Delta from Cape Canaveral, Fla.

40 Years Ago - 1981

April 12: STS-1 (Space Shuttle Columbia) launched from KSC. Crew: John W. Young and Robert L. Crippen. First flight of Space Shuttle Columbia, and first flight of the new Space Transportation System. Landed at Edwards AFB, CA. Mission Duration: 2 days, 6 hours.

35 Years Ago – 1986

March 6: Vega 1, USSR Comet Halley flyby.

March 9: Vega 2, USSR Comet Halley flyby.

March 10: Sakigake, Japan, Comet Halley flyby.

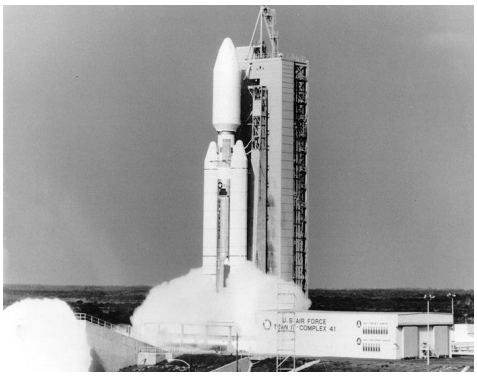
March 13: Giotto, ESA Comet Halley flyby.

March 28: ICE, Comet Halley Distant flyby.

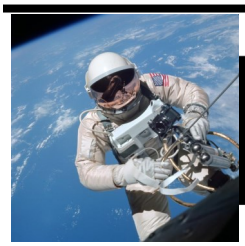
April 18: Titan 34D exploded shortly after lift-off from Vandenberg AFB destroying the last KH-9 Hexagon reconnaissance satellite.

30 Years Ago - 1991

March 8: First Titan IV launched from Vandenberg AFB carrying a DoD payload.



March 31: ALMAZ-1 (“Diamond”) launched by the U.S.S.R. using a Proton-K rocket booster. The flight program provided filming the Soviet Union and other countries in the interest of geology, cartography, oceanography, ecology, and agriculture.



THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

30 Years Ago - 1991 (Continued)
April 5: STS-37 (Space Shuttle Atlantis) launched from KSC. Crew: Steven R. Nagel. Kenneth D. Cameron. Linda M. Godwin, Jerry L. Ross and Jay Apt. The Gamma Ray Observatory (later named Compton Gamma Ray Observatory) was deployed on the 7th with the Shuttle landing at Edwards AFB, CA on April 11. Mission Duration: 6 days.

April 28: STS-39 (Space Shuttle Discovery) launched from KSC. Crew: Michael L. Coats, L. Blaine Hammond, Guion S. Bluford, Gregory S. Harbaugh, Richard J. Hieb, Donald R. McMonagle, and Charles Lacy Veach. DoD Mission AFP-675 launched into orbit on May 1. Landed at KSC on May 6. Mission duration: 8 days 7 hours.

25 Years Ago - 1996
March 22: STS-76 (Space Shuttle Atlantis)

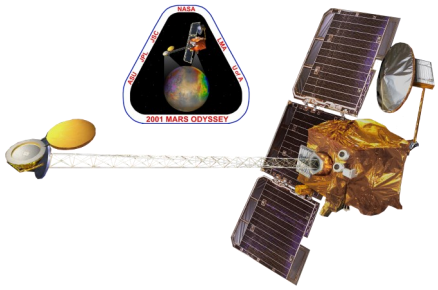
launched from KSC for 3rd docking with the Russian Mir station. Crew: Kevin P. Chilton, Richard A. Searfoss, Linda M. Godwin, Michael R. Clifford, Ronald M. Sega, and Shannon W. Lucid (Shannon Lucid would be left onboard Mir). Landed at Edwards AFB on March 31. Mission Duration: 9 days, 5 hours.

20 Years Ago – 2001
March 18: XM 2 (better known as XM Rock) is an American geosynchronous radio broadcast satellite that was launched by a Zenit 3SL rocket from the Sea Launch Odyssey platform on the equatorial Pacific. The satellite carries two transmitters (3 kW each) in the S-band to relay 100 channels of digital quality music uplinked in the X-band from one or more ground stations.

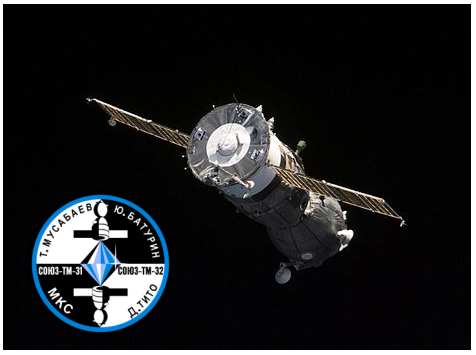
March 21: STS-102 (Space Shuttle Discovery) launched from KSC. Crew: James D.Wetherbee, James M. Kelly, Andy S. W. Thomas, and Paul W. Richards. International Space Station (ISS) Flight 5A.1 Delivered a multi-rack Italian container (Leonardo MultiPurpose Logistics Module, LMPLM) to the Destiny Module of the ISS and exchanged Expedition 2 crew for Expedition 1 crew: James S. Voss (up); Susan J. Helms (up); Yury V. Usachev (up); Sergei Krikalev (down);; William M. Shepherd (down); Yuri P. Gidzenko (down). Landed March 21at KSC. Mission Duration: 12 days, 19 hours.

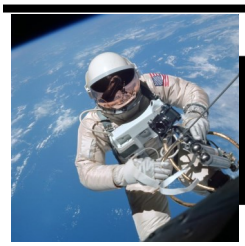
March 23: The Soviet/Russian orbital laboratory Mir, returned to Earth, scattering fragments in the South Pacific Ocean.

April 7: Mars Odyssey, an orbiter designed to map and search for water on Mars, was launched by a Delta 2 rocket from Cape Canaveral. It reached Mars on October 23.



April 28: The Russian Soyuz-TM 32 launched from Baikonur by a Soyuz-U rocket carrying Talgat A. Musabayev and Yuri M. Baturin. This mission also carried the first commercial space tourist, U.S. businessman Dennis Tito. Launch of the first “taxi” flight to the ISS (6A), bringing a fresh Soyuz crew return vehicle for the ISS crew.





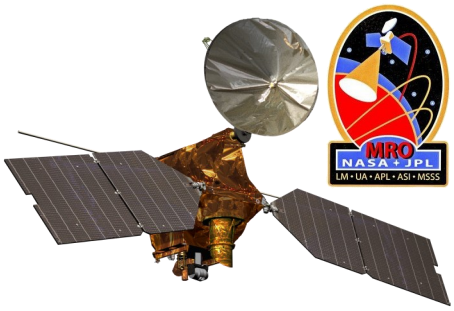
THIS MONTH IN AEROSPACE HISTORY

Source—NASA / ROSCOSMOS Archives

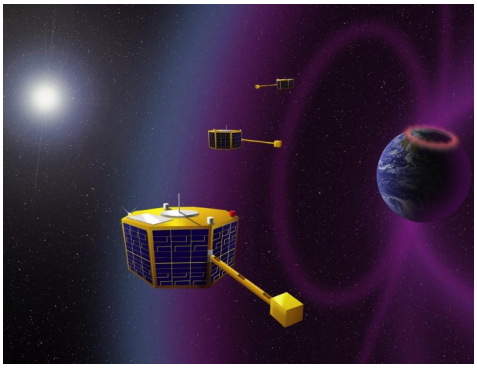
April 19: STS-100 (Space Shuttle Endeavour) launched from KSC. Crew: Kent V. Rominger, Jeffrey S. Ashby, Chris A. Hadfield, Scott E. Parazynski, John L. Phillips, Umberto Guidoni (Italy), and Yuri V. Lonchakov (Russia). Mission to install Canadarm-2 on the ISS, and to transport an Italian cargo container, Raffaello. Landing May 1, 2001 at Edwards AFB. Mission duration: 11 days, 21 hours.

15 Years Ago – 2006

March 10: Mars Reconnaissance Orbiter (MRO) orbit insertion.

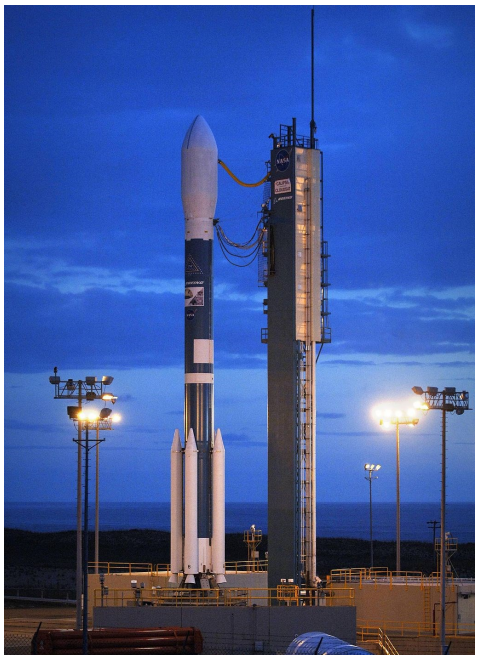


March 22: ST5-A, ST5-B, and ST5-C were the first three microsatellites in the Space Technology 5 mission of NASA's New Millennium Program. They were launched by a Pegasus XL rocket that was released from a Lockheed L-1011 plane flying out of Vandenberg AFB.



March 30: Soyuz-TMA 8 launched by a Soyuz FG rocket from Baikonur Cosmodrome. It carried three astronauts (a Russian, Pavel Vinogradov, an American, Jeffrey Williams, and a Brazilian, Marcos Pontes) to the International Space Station (ISS). Pontes returned on Soyuz TMA 7.

April 28: The two meteorological satellites CloudSat and CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observation) were launched by a Delta 2 rocket from Vandenberg AFB. They work in concert with the three earlier satellites (Aqua, PARASOL, and Aura), all forming what is called A-Train. All five have almost the same orbit, crossing the equator within 15 minutes of each other.



10 Years Ago – 2011

March 17: NASA's MESSENGER spacecraft successfully achieved orbit around Mercury at approximately. This marks the first time a spacecraft has accomplished this engineering and scientific milestone at our solar system's innermost planet.

April 4: The Russian Soyuz TMA-21 launched from Baikonur by a Soyuz launch vehicle. The Soyuz-TMA 21 spacecraft carried a crew of three and docked with the International Space Station (ISS) Poisk module on April 6. Crew: Alexander Samokutyaev, Andrey Borisenko, and American astronaut Ron Garan. It was dedicated to the 50th anniversary of Yuri Gagarin's first manned space flight.

5 Years Ago – 2016

March 18: Soyuz TMA-20M launched by a Soyuz FG launch vehicle from Tyuratam (Baikonur Cosmodrome), Kazakhstan. Crew: Soyuz Commander Aleksey Ovchinin (Russian Federal Space Agency – RSA), Oleg Skripochka (RSA), and NASA astronaut Jeff Williams. (ISS Expedition 47). Installed Bigelow Expandable Activity Module (BEAM) prototype inflatable habitat. Jeff Williams set NASA record for cumulative time in space—534 days.

March 23: Orbital's Cygnus (OA-6), its fifth operational cargo resupply mission to the ISS was launched by an Atlas V 401 launch vehicle from Cape Canaveral.

In Memoriam: Michael Collins

The Apollo fraternity lost another brother on 28 April when astronaut Michael Collins passed away from cancer at the age of 90.

I'm sure many of you are like me in that you like all the astronauts throughout NASA's history, but some are your favorites. Michael Collins has always been one of my favorites. He had a great dead pan sense of humor, never seemed to get caught up in the hype from being an Apollo astronaut, but was very well aware of his place in history. Collins wrote several books after his NASA career including his autobiography, *Carrying the Fire: An Astronaut's Journey* and *Liftoff: The Story of America's Adventure in Space.* They are considered two of the best books about spaceflight. He also appeared in several documentaries and had a way of speaking that was informative, fun, and grabbed your full attention.

His flying career began in the USAF flying F-86 Sabres and culminated in his selection to the US Air Force Flight Test School at Edwards AFB. After returning to operational status Collins applied for and was accepted into the third group of 14 astronauts.

Collins' first flight was as pilot on Gemini 10 with Command Pilot John Young. The major objectives included rendezvous and docking with an Agena Target Vehicle and two EVA's performed by Collins. The second EVA involved Collins using a hand held maneuvering unit to traverse the space between the Gemini capsule and Agena. This was the first time an astronaut spacewalked to another vehicle. The task was difficult as there were no handholds

to assist in holding on as well as retrieve a Micrometeor Collector. Though he was successful in retrieving the experiment, it was subsequently lost out of the cabin during his struggle to get back in requiring assistance from Young.

Collins is best known however as the Command Module Pilot for the first manned lunar landing, Apollo 11. There was no doubt he was aware of the pressure on the crew. In interviews he explained that should something happen to the lunar lander crew of Neil Armstrong and Buzz Aldrin, he would be helpless to assist them and would have had to make the long trip back alone.

There was a chance that Collins could have been chosen as a Lunar Module Commander had the Apollo program extended beyond Apollo 17, but instead he took the position as the Assistant Secretary of State for Public Affairs upon President Nixon's request. This was not a good fit, so he requested and was assigned as the Director of the yet to be built, National Air and Space Museum. He was successful in acquiring funding for the museum and seeing it open in time for the US Bicentennial celebration in 1976.

Fair winds Michael Collins.

LAUNCH WINDOWS

Launch dates from SpaceFlight.com

May 4, 2021
Falcon 9; Starlink V1.0-L25
Launch time: 1901 GMT
Launch site: LC-39A, KSC, Fl
A SpaceX Falcon 9 rocket will launch the 26th batch of approximately 60 satellites for SpaceX's Starlink broadband network, a mission designated Starlink V1.0-L25.

May 2021
GSLV Mk.2; GISAT 1
Launch time: TBD
Launch site: Satish Dhawan Space Center, Sriharikota, India
India's Geosynchronous Satellite Launch Vehicle Mk. 2 (GSLV Mk.2), designated GSLV-F10, will launch India's first GEO Imaging Satellite, or GISAT 1.

May 17, 2021
Atlas 5; SBIRS GEO Flight 5
Launch time: TBD
Launch site: Canaveral Space Force Station, Fl
A United Launch Alliance Atlas 5 rocket will launch the U.S. Space Force's fifth Space Based Infrared System Geosynchronous satellite, or SBIRS GEO 5, 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.

May 27, 2021
Soyuz; OneWeb 7
Launch time: TBD
Launch site: Vostochny Cosmodrome
A Russian Soyuz rocket will launch 36 satellites into orbit for OneWeb, which is developing a constellation of hundreds of satellites in low Earth orbit for low-latency broadband communications. The Soyuz-2.1b rocket will use a Fregat upper stage.

TBD
Electron; STP-27RM
Launch time: TBD
Launch site: Wallops Island, Va
A Rocket Lab Electron rocket will launch on its first mission from a new launch pad at the Mid-Atlantic Regional Spaceport at Wallops Island, Virginia. The launch customer is the U.S. Air Force, and the mission will launch an experimental mission for the Space Test Program called Monolith with a space weather instrument.

June 1, 2021
Falcon 9; SXM 8
Launch time: 0425 GMT
Launch site: Cape Canaveral, Fl
A SpaceX Falcon 9 rocket will launch the SXM 8 satellite for SiriusXM. The satellite will replenish SiriusXM's fleet providing satellite radio programming to consumers across North America.

June 3, 2021
Falcon 9; SpaceX CRS 22
Launch time: TBD
Launch site: LC-39A, KSC, Fl
A SpaceX Falcon 9 rocket will launch a Dragon 2 spacecraft on its second cargo resupply mission to the International Space Station.

June 17, 2021
Falcon 9; GPS 3 SV05
Launch period: 17th or 18th
Launch site: Canaveral Space Force Station, Fl
A SpaceX Falcon 9 rocket will the U.S. Space Force's fifth third-generation navigation satellite for the Global Positioning System. The satellite was built by Lockheed Martin.

June 23, 2021
Atlas 5; STP-3
Launch time: TBD
Launch site: Canaveral Space Force Station, Fl
A United Launch Alliance Atlas 5 rocket will launch the STP-3 mission for the U.S. Space Force. The STP-3 rideshare mission will launch the STPSat 6 satellite and several small satellites.

June 2021
Minotaur 1; NROL-111
Launch window: TBD
Launch site: Wallops Island, Virginia
A U.S. Air Force and Northrop Grumman Minotaur 1 rocket will launch a classified spy satellite cargo for the U.S. National Reconnaissance Office.

June 2021
Vega; Pléiades Neo 4
Launch time: TBD
Launch site: ZLV, Kourou, French Guiana
An Arianespace Vega rocket, designated VV19, will launch the Pléiades Neo 4 Earth observation satellite for Airbus. Pléiades. The Vega rocket will also launch multiple rideshare payloads.

June 29, 2021
Soyuz; Progress 78P
Launch time: TBDLaunch site: Baikonur Cosmodrome
A Russian government Soyuz rocket will launch the 78th Progress cargo delivery ship to the International Space Station. The rocket will fly in the Soyuz-2.1a configuration. Delayed from March 19.

July 1, 2021
Soyuz; OneWeb 8
Launch time: TBD
Launch site: Vostochny Cosmodrome,
A Russian Soyuz rocket will launch 36 satellites into orbit for OneWeb, which is developing a constellation of hundreds of satellites in low Earth orbit for low-latency broadband communications. The Soyuz-2.1b rocket will use a Fregat upper stage.

July 2021
Falcon 9; Transporter 2
Launch time: TBD
Launch site: Canaveral Space Force Station, FlA SpaceX Falcon 9 rocket will launch the Transporter 2 mission, a rideshare flight to a sun-synchronous orbit with numerous small microsatellites and nanosatellites for commercial and government customers.

July 2021
PSLV; RISAT 1A
Launch time: TBD
Launch site: Satish Dhawan Space Center, Sriharikota, India
India's Polar Satellite Launch Vehicle (PSLV), designated PSLV-C52, will launch the Indian RISAT 1A radar Earth observation satellite.

July 15, 2021
Proton; Nauka
Launch time: TBD
Launch site: Baikonur Cosmodrome, Kazakhstan
A Russian government Proton rocket will launch the Nauka laboratory module to the International Space Station. The Nauka module, or the Multipurpose Laboratory Module, will also carry the European Robotic Arm to the space station.

July 2021
Falcon Heavy; USSF 44
Launch time: TBD
Launch site: LC-39A, KSC, Florida
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 military's TETRA 1 microsatellite.

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