WIKIPEDIA
The Free Encyclopedia

2023 in spaceflight

This article documents notable **spaceflight events during the year 2023**. For the third year in a row, new world records were set for both orbital launch attempts (223) and successful orbital launches (211) in a year.

Overview

Astronomy and Astrophysics

European Space Agency's (ESA) Euclid satellite was launched towards Sun-Earth L2 point by a Falcon 9 rocket on July 1. The satellite observes distant galaxies to study dark matter and dark energy.

ISRO launched Aditya-L1 to study the Sun on September 2.

JAXA launched XRISM (X-Ray Imaging and Spectroscopy Mission) X-ray space telescope and SLIM lunar lander on September 6.

Exploration of the Solar System

On 14 April, ESA launched the Jupiter Icy Moons Explorer (JUICE) spacecraft to explore Jupiter and its large ice-covered moons following an eight-year transit.[1]

The OSIRIS-REx mission returned to Earth on 24 September with samples collected from asteroid Bennu.[2]

NASA launched the *Psyche* spacecraft on 13 October 2023, an orbiter mission that will explore the origin of planetary cores by studying the metallic asteroid 16 Psyche, on a Falcon Heavy launch vehicle.

On November 1, NASA's *Lucy* probe performed a flyby of asteroid 152830 Dinkinesh, revealing it to be a binary pair.[3][4]

Lunar exploration

ISRO launched its third lunar mission Chandrayaan-3 on 14 July 2023 at 9:05 UTC;[5] it consisted of lander, rover and a propulsion module,[6] and successfully landed in the south pole region of the Moon on 23 August 2023. For technology demonstration experiments, hop experiment on the Vikram Lander was conducted and the Propulsion Module (PM) of Chandrayaan-3 was moved from an orbit around Moon to an orbit around Earth.[7]

Russian lunar lander Luna 25 was launched on 10 August 2023, 23:10 UTC, atop a Soyuz-2.1b rocket from the Vostochny Cosmodrome.[8] It is the first Russian attempt to land a spacecraft on the Moon since the Soviet lander Luna 24 in 1974. It crashed on the Moon on 19 August after technical glitches.

JAXA launched SLIM (Smart Lander for Investigating Moon) lunar lander (carrying two mini rovers) and a space telescope (XRISM) on 6 September. SLIM entered orbit around the Moon on 25 December (UTC).

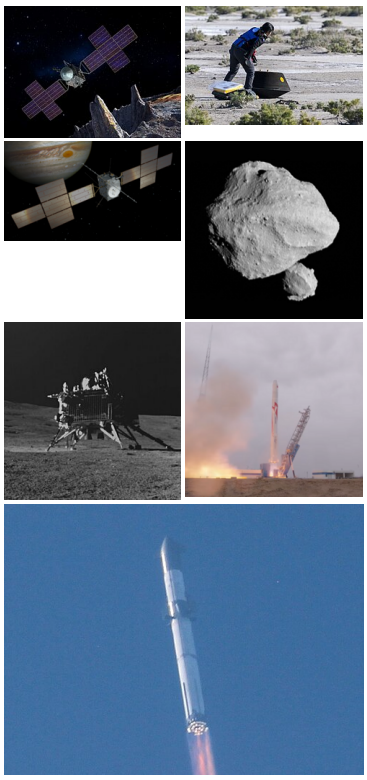
Human spaceflight

A new record for the number of people in space at the same time, though not necessarily all in orbit, was reached on 25 May 2023. 20 people were in space simultaneously, with eleven people aboard the ISS, three on Tiangong, and six on VSS *Unity*.[9] Five days later on 30 May, the record for the number of people in orbit simultaneously was broken as well, with 17 people in orbit at once; 6 people on Tiangong from Shenzhou 15 and 16, 7 people from Expedition 69 on the ISS as well 4 crew members from Axiom-2 also on the ISS.[10][9]

Private Human Spaceflight and Tourism

Axiom Mission 2 private crew mission to the International Space Station was launched on 21 May 2023 on a SpaceX Falcon 9. The mission ended with the successful return of the crew to Earth on 31 May 2023.

2023 in spaceflight



Highlights from spaceflight in 2023[a]

Orbital launches	
First	3 January
Last	30 December
Total	223
Successes	211
Failures	11
Partial failures	1
Catalogued	212
National firsts	
Spaceflight	Oman (suborbital spaceflight due to failed orbital launch)
Satellite	Albania Djibouti Ireland Oman Vatican City
Space traveller	Antigua and Barbuda Pakistan
Rockets	
Maiden flights	Chŏllima 1 Ceres-1S H3-22S Qaem 100 RS1 SK solid fueled TV2

Virgin Galactic *Unity* 25 mission took place 25 May 2023. This was the first mission for Virgin Galactic's suborbital spaceplane VSS *Unity* since 2021. On 29 June 2023, Virgin Galactic flew their first commercial suborbital spaceflight mission, Galactic 01, with their suborbital spaceplane VSS *Unity*. Onboard *Unity* were three employees of the company and three passengers (whose flight had been paid from outside the company) from the Italian Air Force and Italy's National Research Council.[11] On 10 August Virgin Galactic flew their Galactic 02 mission, the first VSS *Unity* flight carrying a space tourist. Galactic 03 mission flew on 8 September, followed by Galactic 04 on 6 October and Galactic 05 on 2 November 2023. All of these crewed suborbital missions were flown by *Unity*.

	Starship
	Terran 1
	Tianlong-2
Retirements	Antares 230+
	Ariane 5
	Atlas V 501
	LauncherOne
	Terran 1
Crewed flights	
Orbital	6
Orbital travellers	21
Suborbital	5
Suborbital travellers	30
Total travellers	51

Rocket innovation

On 10 January, ABL Space Systems' RS1 had its debut flight, but failed to reach orbit.[12]

On 10 February, SSLV rocket developed by ISRO had its first successful orbital launch.

On 4 March, IRGC's Qaem 100 performed its orbital maiden flight following a successful suborbital test flight in 2022. However the vehicle, which was carrying the Nahid-1 satellite, failed to put the payload in orbit.[13][14]

On 7 March, JAXA/MHI H3's maiden flight was terminated in-flight due to failure to ignite the second stage, resulting in the loss of the ALOS-3 land observation satellite.[15]

On 23 March, Relativity Space's Terran 1 had its debut flight. The flight goal, which was to demonstrate the viability of 3D printing for major structural components of a rocket, was achieved when Terran 1 passed max *q* and continued to perform nominally. However, after stage separation, the second stage failed to ignite, ending the mission.[16] Following the failed launch, Relativity retired the rocket in favor of developing the much larger, reusable Terran R vehicle.[17]

On 2 April, Space Pioneer's Tianlong-2 had its debut flight, and successfully reached orbit. It was the first successful launch of a Chinese privately-funded liquid-fueled rocket. Space Pioneer is the first private company to reach orbit on its first attempt using a fully liquid fueled rocket.[18]

On 20 April, SpaceX's Starship had its first test flight,[19] aiming to complete about three-quarters of an orbit and landing in the Pacific Ocean northwest of Kauai.[20] Several engines on the booster failed during the flight and the flight termination system was triggered, ending the flight before stage separation.

On 22 April, Evolution Space completed its first suborbital space flight test with the Gold Chain Cowboy solid-fueled rocket.[21]

On 30 May, the North Korean Chollima-1 made its first orbital launch attempt, carrying the military reconnaissance satellite Malligyong-1.[22] However, the launch failed to achieve orbit when the second stage ignited too early in the mission.[23] The launch vehicle crashed into the Yellow Sea.[24]

On 12 July, LandSpace's Zhuque-2 rocket, in its second flight, became the world's first methane-fuelled rocket to successfully reach orbit.[25]

On 5 September, the sea-launched version of the Ceres-1 launch vehicle, designated Ceres-1S, made its successful debut.

On 15 September, the Firefly Alpha made its successful flight for a tactically responsive mission for the U.S. Space Force.[26]

On November 18, 2023, SpaceX Starship attempted its second flight test, becoming the heaviest rocket to enter space, although the first stage exploded shortly after separation, while the second stage was lost nearly eight minutes after launch. In the same month, they completed the construction of crew access tower at CCSFS SLC-40 launch pad, where they completed 50 launches alone on that launch pad. They also completed 250th Falcon booster landing.

In December 2023, USA broke the world record of most launches by a nation (108), held by Soviet Union in 1982.[27][28] In the same month, they completed 200th successful Falcon booster autonomous spaceport droneship landing.

Satellite technology

On January 27, ESA reported the successful demonstration of a braking sail-based satellite deorbiter, ADEO, which could be used by space debris mitigation measures.[29][30]

In April, Chinese media first reported on tests of flexible organic solar cells on balloons in the 35 km stratosphere.[31][32]

On 29 July a Falcon Heavy rocket launched the Jupiter-3 (EchoStar-24)[33] communications satellite to geosynchronous orbit. With a mass of over 9 tonnes, EchoStar's Jupiter-3 is the heaviest geostationary satellite ever launched.[34]

On 1 June, Caltech reported the first successful demonstration of solar energy from space via its SSPD-1 spacecraft.[35][36]

Orbital launches

List of orbital launches

Month	Num. of successes	Num. of failures	Num. of partial failures
January	14	2	0
February	12	0	0
March	22	3	0
April	11	1	0
May	19	1	0
June	13	0	0
July	18	0	0
August	21	1	0
September	21	2	0
October	17	0	0
November	15	1	0
December	28	0	1
Total	**211**	**11**	**1**

Deep-space rendezvous

Date (UTC)	Spacecraft	Event	Remarks
21 March	Hakuto-R Mission 1	Lunar orbit insertion	Success[37]
25 April	Hakuto-R Mission 1	Lunar landing	Communications were lost, landing failed.[38]
19 June	*BepiColombo*	Third gravity assist at Mercury	
31 July	*Juno*	53rd perijove	On this perijove *Juno* flew by Io at a distance of 22,000 km.[39]
5 August	Chandrayaan-3	Lunar orbit insertion	Success[40]
16 August	Luna 25	Lunar orbit insertion	Success[41]
19 August	Luna 25	Lunar landing	Communications were lost, crashed onto the Moon's surface.[42]
21 August	*Parker Solar Probe*	Sixth gravity assist at Venus	
23 August	Chandrayaan-3	Lunar landing	Success[43]
24 September	OSIRIS-REx	Sample return to Earth and gravity assist at Earth	Success[44]
4 October	SLIM	Flyby of the Moon	Part of the spacecraft's approach to lunar orbit via a Weak stability boundary like trajectory
Between 13 October and 10 November	Chandrayaan-3	4 Lunar flybys on Earth return	Success[7]
1 November	*Lucy*	Flyby of 152830 Dinkinesh	The spacecraft flew by the asteroid at a distance of 425 km.[45]
25 December	SLIM	Lunar orbit insertion	Success[46]
30 December	*Juno*	57th perijove	On the day of this perijove, *Juno* flew by Io at a distance of 1,500 km. Orbital period around Jupiter reduced to 35 days.[47][48]

Extravehicular activities (EVAs)

Start Date/Time	Duration	End Time	Spacecraft	Crew	Remarks
20 January 2023 13:14	7 hours 21 minutes	20:35	Expedition 68 ISS *Quest*	Koichi Wakata Nicole Mann	First spacewalk of 2023 to finish installation of the IROSA mounting brackets on the starboard side of the station. Wakata and Mann installed cables on the 1B Array at the S6 truss, which was not completed on the last spacewalk, tightened bolts and installed a terminator on a cable along with its connected jumper on the SSDCDC converter box to isolate the 1B array until the IROSA solar arrays are installed following the arrival of SpaceX CRS-28 in June. They also assembled and installed the IROSA mounting bracket onto the 1A array, which was also left incomplete on the last spacewalk. Wakata and Mann were unable to secure the final strut on the 1A solar array because of debris in the guide track of the mounting pad and only one of the jumpers was installed. The astronauts returned the strut to the Quest Airlock and will use special tools to clean the tracks before it is remounted on the next spacewalk. They were also unable to connect the cables for 1A due to time constraints. NASA astronaut Zena Cardman was Ground IV, assisted by JAXA astronaut Akihiko Hoshide, who was the Capcom for the astronauts inside the ISS during the spacewalk.[49][50][51]
2 February	6 hours 41	19:26	Expedition 68 ISS *Quest*	Nicole Mann	Final spacewalk to install the mounting brackets for the 1A solar array in preparation for the delivery of IROSA on SpaceX CRS-28. Tasks included installing the final

2023 12:45	minutes			Koichi Wakata	strut, securing the bolts on the 1A solar array, relocating foot restraints that were left on P6 inboard, and routing cables. NASA astronaut Zena Cardman was Ground IV.[52][53]
9 February 2023 9:10	7 hours 6 minutes	16:16	Shenzhou 15 TSS *Wentian* airlock	Fei Junlong Zhang Lu	They completed a series of tasks, including installing the fourth external pump (Z01-04) on the Mengtian lab module and other tasks related to Mengtian's payload airlock, which allows astronauts to deploy science payloads and small satellites using the station's robotic arms. After successfully completing the installation and commissioning of the extended pump set in the Mengtian experimental cabin, Fei Junlong needs to transfer to the core cabin of Tianhe, remove the foot stopper in the tool box outside the node, and then return to the Mengtian experimental cabin, and install it in the designated location for the second time out of the cabin to install large equipment. For the first time, Fei Junlong held a large-scale foot stopper and an external operating platform to carry out a large-scale transfer, which put forward higher requirements for the safety of the task.[54] It is China's longest spacewalk to date.[55]
2 March 2023 ??:??	? hours ? minutes	??:??	Shenzhou 15 TSS *Wentian* airlock	Fei Junlong Zhang Lu	Fei Junlong and Zhang Lu went out of the cabin again to perform tasks such as the installation of external equipment on the space station. After leaving the cabin, Fei Junlong and Zhang Lu first autonomously transferred to the operating point with the help of the handrail outside the cabin. During the crawling process, Fei Junlong had to take off the two safety rope hooks of the previous handrail and hang them on the next handrail every time he moved a handrail. Repeatedly picking and hanging the hooks was a small challenge and not good for the strength of the astronaut's upper limbs. The equipment that Fei Junlong and Zhang Lu are going to install for the second time out of the cabin has about 20 plugs, and these plugs have protective covers.[56] When installing, you need to pull out the protective covers before inserting the plugs. Do a power test. Other tasks were to dump trash bags during spacewalk.[57]
30 March 2023 ??:??	? hours ? minutes	??:??	Shenzhou 15 TSS *Wentian* airlock	Fei Junlong Zhang Lu	Fei Junlong and Zhang Lu partnered again to perform the third out-of-cabin activity and complete the task of installing and connecting cables across the cabin. There are more than 40 plugs at both ends of the cross-cabin cable, and the work intensity and difficulty are greater than last time. Fei Junlong and Zhang Lu successfully completed this mission in a way that they had not trained before.[58] Other tasks were to dump trash bags during spacewalk.[59]
15 April 2023 ??:??	? hours ? minutes	??:??	Shenzhou 15 TSS *Wentian* airlock	Fei Junlong Zhang Lu	During the fourth spacewalk, the three astronauts of the Shenzhou 15 crew worked closely together inside and outside the cabin, and successfully completed the installation of the fifth extended pump (Z02-01) set outside the Mengtian, the installation and connection of cross-cabin cables, and the external load exposure platform. The installation of support rods and other tasks laid the foundation for the subsequent large-scale extravehicular science and technology experiments. Other tasks were to dump trash bags during spacewalk.[60]
19 April 01:40	7 hours 55 minutes	09:35	Expedition 69 ISS *Poisk*	Sergey Prokopyev Dmitry Petelin	Ninth in a series of spacewalks to outfit *Nauka* and to prepare *ERA* for operations. The spacewalkers used *ERA* to pick up the radiator with the arm where it was relocated at the end of the spacewalk. They closed valves on the nitrogen jumpers, removed covers over the nitrogen jumpers, disconnected the radiator heater cable and capped it, removed bolts and launch restraints, and transferred the radiator over to *Nauka* and installed it into a socket on the forward face where it will be deployed at the end of EVA 4. As part of get-ahead tasks, they will prepare the airlock for transfer to *Nauka* on the next spacewalk and stowed the *ERA* adapter on the airlock. Because of time and issues with matting the radiator the task to jettison the covers was moved to the next spacewalk. This was the longest spacewalk of this expedition and a critical one to get the lab activated.[61]
28 April 13:11	7 hours 1 minute	20:12	Expedition 68 ISS *Quest*	Stephen Bowen Sultan Al Neyadi	Bowen and Al Neyadi, who became the first Arab astronaut to perform a spacewalk, finished routing cables and secured the struts with MLI at the 1B and 1A solar arrays in preparation for the arrival of the IROSA arrays in June. The primary task to retrieve the Space to Ground Antenna (SASA) was deferred to the next spacewalk because a stuck bolt on the electronics box prevented the antenna from being released from the FRAM. NASA Astronaut Anne McClain was Ground IV CAPCOM.[62][63][64]
4 May 20:00	7 hours 11 minutes	03:11	Expedition 69 ISS *Poisk*	Sergey Prokopyev Dmitry Petelin	Tenth in a series of spacewalks to outfit *Nauka* and to prepare *ERA* for operations. The spacewalkers removed bolts, removed covers, disconnected cables, and used *ERA* to transfer the airlock over to *Nauka* where it was installed on the forward facing port. Once the airlock was installed they mated cables and jettisoned their trash which included hardware and covers from the previous spacewalks and this spacewalk. Spacewalk faced a delay when *ERA* entered an uncontrolled roll placing the airlock out of alignment. Prokopyev and Petelin improvised with a little elbow grease and got the airlock rotated into the correct position and got it latched in place. Spacewalk faced another delay when tape was found on the electrical connectors requiring Prokopyev to cut it before the cables were connected.[65][66][67][68]
12 May 15:47	5 hours 14 minutes	23:01	Expedition 69 ISS *Poisk*	Sergey Prokopyev Dmitry Petelin	Eleventh and final spacewalk to outfit *Nauka* and to prepare *ERA* for operations. To wrap up work on *Nauka*, the cosmonauts deployed the radiator, and installed nitrogen and ammonia jumpers to cool the Russian Segment and connected the radiator to electrical power, hydraulics, and mechanical connections. As a getahead task while the radiator was being filled with coolant the cosmonauts installed gap spanners on *ERA*'s boom to allow for translation on future spacewalks.[69][70]
9 June 13:15	6 hours 3 minutes	19:18	Expedition 69 ISS *Quest*	Stephen Bowen	NASA astronauts Steve Bowen and Woody Hoburg exited the station's Quest airlock and installed an upgraded IROSA (International Space Station Roll-Out Solar Array) on the 1A power channel on the starboard truss of the station. Task included removing bolts, deploying the rollers, and installing cables before the solar array

				Woody Hoburg	was picked up by Hoburg with assistance from Canadarm 2 and installed on the 1A solar array on the S4 Truss. The array was deployed at 16:32 hours and is receiving power.[71][72]
15 June 12:42	5 hours 35 minutes	18:17	Expedition 69 ISS *Quest*	Stephen Bowen Woody Hoburg	NASA astronauts Steve Bowen and Woody Hoburg exited the station's Quest airlock to install the final upgraded IROSA (International Space Station Roll-Out Solar Array) on the 1B power channel on the starboard truss of the station. Task included removing bolts, deploying the rollers, and installing cables before the solar array was picked up by Hoburg with assistance from Canadarm 2 and installed on the 1B solar array on the S6 Truss. The array was deployed at 16:51 hours and is receiving power. As part of getahead task they covered the cables in MLI and secured the struts, relocated their foot restraints inboard, and stowed the support beams on the flight support structure for disposal. [73][74]
22 June 14:24	6 hours 24 minutes	20:48	Expedition 69 ISS *Poisk*	Sergey Prokopyev Dmitry Petelin	Prokopyev and Petelin exited the *Poisk* airlock and routed an Ethernet cable to the port experiment frame on the *Zvezda Service Module*, jettisoned experiment hardware including the *TMTC Monoblock* antennas, the highspeed data transmission antenna, and the *Seismo Prognos* payload, installed a data transmission radio onto the port frame, removed experiments from the *Zvezda Service Module,* photographed Zvezda including the thrusters so they can patch the leak, inspected an antenna, and retrieved the *Biorisk* containers. As a getahead they cleaned the windows on the Russian segment, reposition the Plume Measurement Unit, and jettisoned a towel.[75][76]
20 July 2023 05:45	7 hours 55 minutes	13:40	Shenzhou 16 TSS *Wentian* airlock	Jing Haipeng Zhu Yangzhu	They installed & lifted the bracket for panoramic camera B of core module, unlocked & lifted panoramic camera A/B of Mengtian lab module. Zhu Yangzhu became first Chinese flight engineer to conduct an extravehicular activity.[77]
9 August 14:44	6 hours 35 minutes	21:19	Expedition 69 ISS *Poisk*	Sergey Prokopyev Dmitry Petelin	Twelfth and final spacewalk to outfit *Nauka* and to prepare *ERA* for operations. Both cosmonauts ventured outside the station's *Poisk Airlock* to attach three debris shields to the *Rassvet* module. They also tested the sturdiness of the last MLM outfitting called the *ERA portable workpost*, that will be affixed to the end of the European robotic arm attached to the Nauka multipurpose laboratory module.[78][79][80]
25 October 17:49	7 hours 41 minutes	01:30 (next day)	Expedition 70 ISS *Poisk*	Oleg Kononenko Nikolai Chub	The cosmonauts ventured outside and installed a mini radar experiment on *Nauka*, launched a CubeSat which will test solar sails, and photographed the RTOd radiator and closed valves to isolate the radiator and vented residual coolant so plans can be done to fix a leaking cooling line that delayed two US spacewalks. During one of the vents, Kononenko got sprayed and the coolant got on one of his tethers. The tether was placed in a trash bag and stowed externally to decontaminate it, while Kononenko's suit was wiped down to prevent coolant from entering the station. During the radar deployment, one of the hinges got stuck. The cosmonauts will go out on the next spacewalk with a pole and lock the hinges so it can be deployed. During the satellite deployment, the telescoping booms did not come out and ground controllers are working to manually deploy them so the satellite can track the sun.[81][82][83]
1 November 2023 12:05	6 hours 42 minutes	18:47	Expedition 70 ISS *Quest*	Jasmin Moghbeli Loral O'Hara	Moghbeli and O'Hara ventured outside and removed an H fixture from the 3B mass canister on the P4 truss in preparation for the arrival of the struts and the IROSA solar arrays in 2025. They also replaced a damaged Trundle Bearing under Cover 2 which had been giving them trouble in the past and greased the tracks before the new Trundle Bearing was installed on the port SARJ, secured a cable on Camera 8 which was shorting out a light used for dockings, and released wedge clamps on the SASA antenna. The primary task to retrieve the SASA antenna from ESP2 so it can be returned to Earth on SpaceX CRS-29 was moved to the next spacewalk because of issues removing the covers from the SARJ. O'Hara was not secured properly during the removal and had to be assisted by Moghbeli to get the cover stowed. During the spacewalk, the bag containing the grease gun was lost, but the tools were not needed and the bag posed no collision risk to the station. This was the fourth all-female spacewalk on the station, following Christina Koch and Jessica Meir's three spacewalks during Expedition 61.[84][85][86]
21 December 2023 6:10	7 hours 25 minutes	13:35	Shenzhou 17 TSS *Wentian* airlock	Tang Hongbo Tang Shengjie	Tasks included a repair test of the *Tianhe* core module's solar panels, which have sustained minor damage caused by impacts of space debris and micrometeoroids.[87]

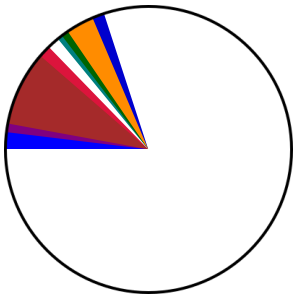
Space debris events

Date/Time (UTC)	Source object	Event type	Pieces tracked	Remarks
4 January	Kosmos 2499	Breakup	85	Energetic fragmentation event; Cause Unknown
11 March	Orbcomm F36	Breakup	7	Unknown; likely energetic fragmentation event caused by a malfunction in the hydrazine orbit adjust system[88][89]
29 June	Kosmos 2143 (Strela-3)	Breakup	6	Unknown; likely energetic fragmentation caused by battery overpressure. Six fragments alongside the primary vehicle.[90]
21 August	Vega VV02 VESPA adapter	Breakup	7	Unknown; likely debris impact[91][92]

Orbital launch statistics

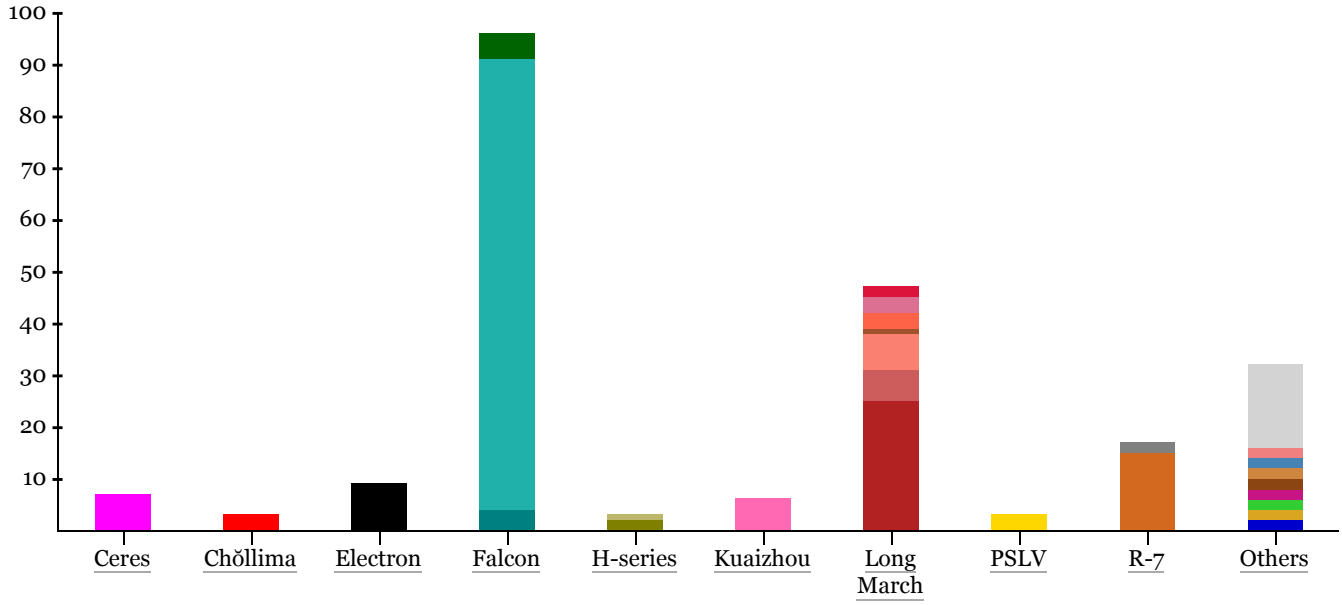
By country

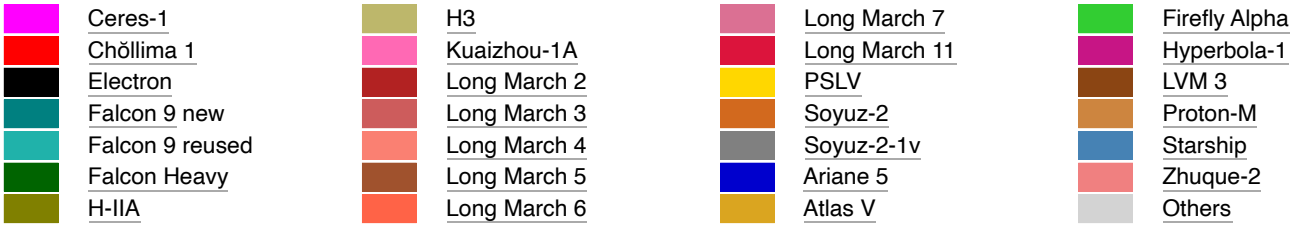
For the purposes of this section, the yearly tally of orbital launches by country assigns each flight to the country of origin of the rocket, not to the launch services provider or the spaceport. As an example, Electron launches from Mahia in New Zealand are counted under USA.



Country	Launches	Successes	Failures	Partial failures	Remarks
China	67	66	1	0	
Europe	3	3	0	0	
India	7	7	0	0	
Iran	2	1	1	0	
Israel	1	1	0	0	
Japan	3	2	1	0	
North Korea	3	1	2	0	
Russia	19	19	0	0	
South Korea	2	2	0	0	
United States	116	109	6	1	Includes Electron launches from Mahia Broke world record of most launches by a nation (108) held by Soviet Union in 1982.[93][94]
World	**223**	**211**	**11**	**1**	

By rocket





By family

Family [show]	Country	Launches	Successes	Failures	Partial failures	Remarks
Antares	United States	1	1	0	0	
Ariane	Europe	2	2	0	0	
Atlas	United States	2	2	0	0	
Ceres	China	7	6	1	0	
Chŏllima	North Korea	3	1	2	0	Maiden flight
Delta	United States	1	1	0	0	
Electron	United States	9	8	1	0	
Falcon	United States	96	96	0	0	
Firefly	United States	2	1	0	1	
GSLV	India	1	1	0	0	
H-series	Japan	3	2	1	0	
Hyperbola	China	2	2	0	0	
Jielong	China	1	1	0	0	
Kinetika	China	1	1	0	0	
Kuaizhou	China	6	6	0	0	
LauncherOne	United States	1	0	1	0	Final flight
Long March	China	47	47	0	0	
LVM 3	India	2	2	0	0	
Nuri	South Korea	1	1	0	0	
PSLV	India	3	3	0	0	
Qaem	Iran	1	0	1	0	Maiden flight
RS1	United States	1	0	1	0	Maiden flight
R-7	Russia	17	17	0	0	
Safir	Iran	1	1	0	0	
Shavit	Israel	1	1	0	0	
SK solid fueled LV	South Korea	1	1	0	0	Maiden flight
SSLV	India	1	1	0	0	
Starship	United States	2	0	2	0	Maiden flight
Terran	United States	1	0	1	0	Maiden flight
Tianlong	China	1	1	0	0	Maiden flight
UR	Russia	2	2	0	0	
Vega	Europe	1	1	0	0	
Zhuque	China	2	2	0	0	

By type

Rocket [show]	Country	Family	Launches	Successes	Failures	Partial failures	Remarks
Antares	United States	Antares	1	1	0	0	
Ariane 5	Europe	Ariane	2	2	0	0	Final flight
Atlas V	United States	Atlas	2	2	0	0	
Ceres-1	China	Ceres	7	6	1	0	
Chŏllima 1	North Korea	Chŏllima	3	1	2	0	Maiden flight
Delta IV	United States	Delta	1	1	0	0	
Electron	United States	Electron	9	8	1	0	
Falcon 9	United States	Falcon	96	96	0	0	

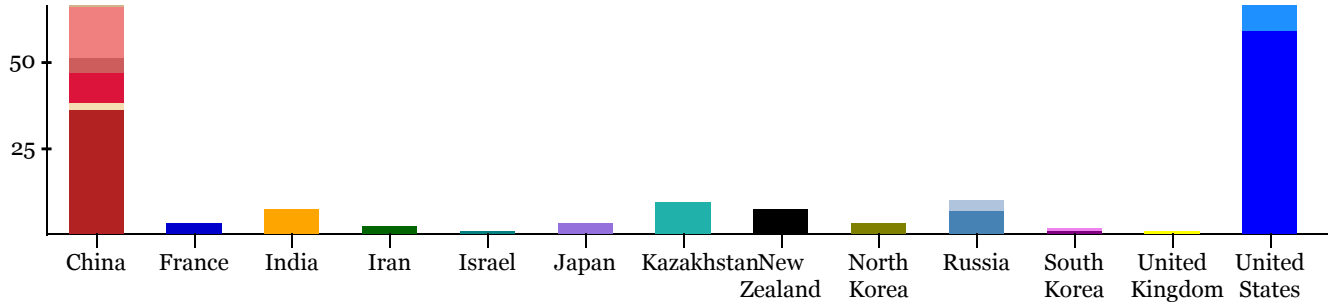
Rocket	Country	Family	Launches	Successes	Failures	Partial failures	Remarks
Firefly Alpha	United States	Firefly	2	1	0	1	
GSLV	India	GSLV	1	1	0	0	
H-IIA	Japan	H-series	2	2	0	0	
H3	Japan	H-series	1	0	1	0	Maiden flight
Hyperbola-1	China	Hyperbola	2	2	0	0	
Jielong 3	China	Jielong	1	1	0	0	
Kinetika 1	China	Kinetika	1	1	0	0	
Kuaizhou-1	China	Kuaizhou	6	6	0	0	
LauncherOne	United States	LauncherOne	1	0	1	0	Final flight
Long March 2	China	Long March	25	25	0	0	
Long March 3	China	Long March	6	6	0	0	
Long March 4	China	Long March	7	7	0	0	
Long March 5	China	Long March	1	1	0	0	
Long March 6	China	Long March	3	3	0	0	
Long March 7	China	Long March	3	3	0	0	
Long March 11	China	Long March	2	2	0	0	
LVM 3	India	LVM 3	2	2	0	0	
Nuri	South Korea	Nuri	1	1	0	0	
PSLV	India	PSLV	3	3	0	0	
Proton	Russia	UR	2	2	0	0	
Qaem 100	Iran	Qaem	1	0	1	0	Maiden flight
Qased	Iran	Safir	1	1	0	0	
RS1	United States	RS1	1	0	1	0	Maiden flight
Shavit 2	Israel	Shavit	1	1	0	0	
SSLV	India	SSLV	1	1	0	0	
SK solid fueled TV	South Korea	SK solid fueled LV	1	1	0	0	Maiden flight
Soyuz-2	Russia	R-7	17	17	0	0	
Starship	United States	Starship	2	0	2	0	Maiden flight
Terran 1	United States	Terran	1	0	1	0	Only flight
Tianlong-2	China	Tianlong	1	1	0	0	Maiden flight
Vega	Europe	Vega	1	1	0	0	
Zhuque-2	China	Zhuque	2	2	0	0	

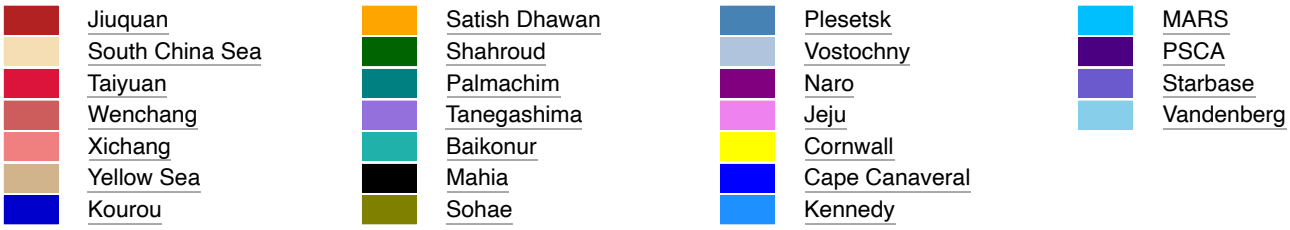
By configuration

Rocket [show]	Country	Type	Launches	Successes	Failures	Partial failures	Remarks
Antares 230+	United States	Antares	1	1	0	0	Final flight
Ariane 5 ECA	Europe	Ariane 5	2	2	0	0	Final flight
Atlas V 501	United States	Atlas V	1	1	0	0	Final flight
Atlas V 551	United States	Atlas V	1	1	0	0	
Ceres-1	China	Ceres-1	6	5	1	0	
Ceres-1S	China	Ceres-1	1	1	0	0	Maiden flight
Chŏllima 1	North Korea	Chŏllima 1	3	1	2	0	Maiden flight
Delta IV Heavy	United States	Delta IV	1	1	0	0	
Electron	United States	Electron	9	8	1	0	
Falcon 9 Block 5	United States	Falcon 9	91	91	0	0	
Falcon Heavy	United States	Falcon 9	5	5	0	0	
Firefly Alpha	United States	Firefly Alpha	2	1	0	1	
GSLV Mk II	India	GSLV	1	1	0	0	
H-IIA 202	Japan	H-IIA	2	2	0	0	
H3-22S	Japan	H3	1	0	1	0	Maiden flight
Hyperbola-1	China	Hyperbola-1	2	2	0	0	

Rocket	Country	Type	Launches	Successes	Failures	Partial failures	Remarks
Jielong 3	China	Jielong 3	1	1	0	0	
Kinetika 1	China	Kinetika 1	1	1	0	0	
Kuaizhou-1A	China	Kuaizhou-1	6	6	0	0	
LauncherOne	United States	LauncherOne	1	0	1	0	Final flight
Long March 2C	China	Long March 2	6	6	0	0	
Long March 2C / YZ-1S	China	Long March 2	3	3	0	0	
Long March 2D	China	Long March 2	12	12	0	0	
Long March 2D / YZ-3	China	Long March 2	1	1	0	0	Maiden flight
Long March 2F/G	China	Long March 2	2	2	0	0	
Long March 2F/T	China	Long March 2	1	1	0	0	
Long March 3B/E	China	Long March 3	5	5	0	0	
Long March 3B/E / YZ-1	China	Long March 3	1	1	0	0	
Long March 4B	China	Long March 4	1	1	0	0	
Long March 4C	China	Long March 4	6	6	0	0	
Long March 5	China	Long March 5	1	1	0	0	
Long March 6	China	Long March 6	1	1	0	0	
Long March 6A	China	Long March 6	2	2	0	0	
Long March 7	China	Long March 7	1	1	0	0	
Long March 7A	China	Long March 7	2	2	0	0	
Long March 11	China	Long March 11	2	2	0	0	
LVM 3	India	LVM 3	2	2	0	0	
Nuri	South Korea	Nuri	1	1	0	0	
PSLV-CA	India	PSLV	2	2	0	0	
PSLV-XL	India	PSLV	1	1	0	0	
Proton-M / DM-03	Russia	Proton	1	1	0	0	
Proton-M / Briz-M	Russia	Proton	1	1	0	0	
Qaem 100	Iran	Qaem 100	1	0	1	0	Maiden flight
Qased	Iran	Qased	1	1	0	0	
RS1	United States	RS1	1	0	1	0	Maiden flight
Shavit 2	Israel	Shavit 2	1	1	0	0	
SSLV	India	SSLV	1	1	0	0	
SK solid fueled TV2	South Korea	SK solid fueled TV	1	1	0	0	Maiden flight
Soyuz-2.1a	Russia	Soyuz-2	8	8	0	0	
Soyuz-2.1a / Fregat-M	Russia	Soyuz-2	1	1	0	0	
Soyuz-2.1b	Russia	Soyuz-2	2	2	0	0	
Soyuz-2.1b / Fregat-M	Russia	Soyuz-2	4	4	0	0	
Soyuz-2-1v	Russia	Soyuz-2	2	2	0	0	
Starship	United States	Starship	2	0	2	0	Maiden flight
Terran 1	United States	Terran 1	1	0	1	0	Only flight
Tianlong-2	China	Tianlong-2	1	1	0	0	Maiden flight
Vega	Europe	Vega	1	1	0	0	
Zhuque-2	China	Zhuque-2	2	2	0	0	

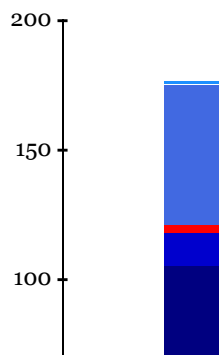
By spaceport

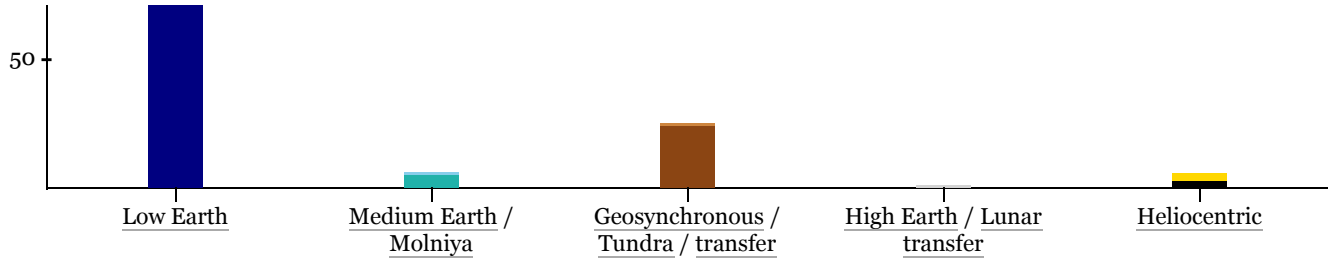


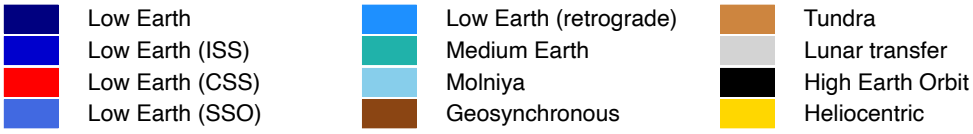


Site	Country	Launches	Successes	Failures	Partial failures	Remarks
Baikonur	Kazakhstan	9	9	0	0	
Cape Canaveral	United States	59	58	1	0	
Cornwall	United Kingdom	1	0	1	0	First launch
Jeju[95]	South Korea	1	1	0	0	First launch
Jiuquan	China	36	35	1	0	
Kennedy	United States	13	13	0	0	
Kourou	France	3	3	0	0	
Mahia	New Zealand	7	6	1	0	
MARS	United States	3	3	0	0	
Naro	South Korea	1	1	0	0	
PSCA	United States	1	0	1	0	
Palmachim	Israel	1	1	0	0	
Plesetsk	Russia	7	7	0	0	
Satish Dhawan	India	7	7	0	0	
Shahroud	Iran	2	1	1	0	
Sohae	North Korea	3	1	2	0	
South China Sea	China	2	2	0	0	
Starbase	United States	2	0	2	0	First orbital launch
Taiyuan	China	9	9	0	0	
Tanegashima	Japan	3	2	1	0	
Vandenberg	United States	30	29	0	1	
Vostochny	Russia	3	3	0	0	
Wenchang	China	4	4	0	0	
Xichang	China	15	15	0	0	
Yellow Sea	China	1	1	0	0	
Total		**223**	**211**	**11**	**1**	

By orbit





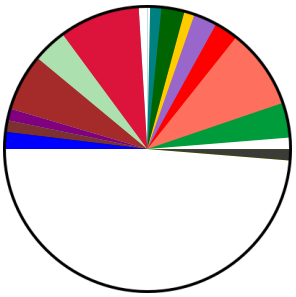


Orbital regime	Launches	Achieved	Not achieved	Accidentally achieved	Remarks
Transatmospheric	2	0	2	0	
Low Earth / Sun-synchronous	185	176	9	0	Including flights to ISS and Tiangong (CSS)
Geosynchronous / Tundra / GTO	25	25	0	0	
Medium Earth / Molniya	6	6	0	0	
High Earth / Lunar transfer	2	2	0	0	
Heliocentric orbit / Planetary transfer	3	3	0	0	
Total	**223**	**212**	**11**	**0**	

Suborbital launch statistics

By country

For the purposes of this section, the yearly tally of suborbital launches by country assigns each flight to the country of origin of the rocket, not to the launch services provider or the spaceport. Flights intended to fly below 80 km (50 mi) are omitted.



Country	Launches	Successes	Failures	Partial failures	Remarks
Brazil	3	3	0	0	
Canada	7	6	1	0	
China	2	2	0	0	
France	2	2	0	0	
Germany	1	0	1	0	
Iran	2	2	0	0	
Israel	1	1	0	0	
Japan	1	1	0	0	
North Korea	7	7	0	0	
Pakistan	3	2	1	0	
Russia	5	4	1	0	
South Korea	1	1	0	0	
Turkey	1	1	0	0	
United States	39	35	4	0	
Yemen	1	1	0	0	
World	**77**	**69**	**8**	**0**	

Notes

a. Clockwise from top-left:

- The Psyche mission to the metal asteroid of the same name launched in October 2023.
- Samples from asteroid 101955 Bennu brought to earth by OSIRIS-REx mission.
- On November 1, NASA's *Lucy* probe performed a flyby of asteroid 152830 Dinkinesh, revealing it to be a binary pair.
- Launch of Zhuque-2, the first successful orbital launch of a methane-liquid oxygen powered rocket in the world.
- Launch of SpaceX's Starship during its Integrated Flight Test from Boca Chica, Texas.

- Image of Chandrayaan-3 Vikram lander on the lunar surface, the landing has made India the fourth country to successfully land a lunar probe on the Moon surface.
- ESA's Jupiter Icy Moons Explorer launched in April 2023.

References

1. Davenport, Justin (14 April 2023). "ESA launches JUICE to Jupiter's icy moons atop Ariane 5" (https://www.nasaspaceflight.com/2023/04/juice-launch/).
2. Tillman, Nola Taylor; Howell, Elizabeth (11 November 2022). "OSIRIS-REx: NASA's asteroid study and sample return mission" (https://www.space.com/33776-osiris-rex.html). *Space.com*. Retrieved 11 January 2023.
3. "NASA's Lucy Spacecraft Discovers 2nd Asteroid During Dinkinesh Flyby" (https://www.nasa.gov/image-article/nasas-lucy-spacecraft-discovers-2nd-asteroid-during-dinkinesh-flyby/). *NASA*. 2 November 2023. Retrieved 2 November 2023.
4. Miller, Katrina (2 November 2023). "NASA's Lucy Mission Set Its Sights on 1 Asteroid. It Found 2. - On its way to the Trojan swarms, the spacecraft made a pit stop at a rock named Dinkinesh — and the images it sent back revealed that this asteroid has its own moon" (https://www.nytimes.com/2023/11/02/science/nasa-lucy-mission-dinkinesh-asteroid.html). *The New York Times*. Archived (https://archive.today/20231102214010/https://www.nytimes.com/2023/11/02/science/nasa-lucy-mission-dinkinesh-asteroid.html) from the original on 2 November 2023. Retrieved 3 November 2023.
5. BBC News (14 July 2023). "India's Chandrayaan-3 rocket blasts into space for Moon mission" (https://www.bbc.co.uk/news/live/world-asia-india-66199759). *BBC News*. Retrieved 20 July 2023.
6. "Chandrayaan-3 Details" (https://www.isro.gov.in/Chandrayaan3_Details.html). *ISRO*. Retrieved 20 July 2023.
7. "Returns to home Earth: Chandrayaan-3 Propulsion Module moved from Lunar orbit to Earth's orbit" (https://www.isro.gov.in/Ch3_Propulsion_Module_moved_from_Lunar_orbit_to_Earth_orbit.html). *www.isro.gov.in*. Retrieved 4 December 2023.
8. David, Leonard. "Russia launches Luna-25 moon lander, its 1st lunar probe in 47 years" (https://www.space.com/russia-luna-25-moon-mission-launch-success). Retrieved 11 August 2023.
9. "Jonathan's Space Report | Human Spaceflight: Rides" (https://planet4589.org/space/astro/web/pop.html). *planet4589.org*. Retrieved 30 May 2023.
10. updated, Robert Z. Pearlman last (30 May 2023). "New record! 17 people are in Earth orbit at the same time right now" (https://www.space.com/record-17-people-in-earth-orbit-at-once). *Space.com*. Retrieved 30 May 2023.
11. Jackie Wattles (29 June 2023). "Virgin Galactic has sold 800 tickets to the edge of space. The first customers just took flight" (https://edition.cnn.com/2023/06/29/travel/virgin-galactic-launch-italian-air-force-scn). *edition.cnn.com*. Retrieved 1 July 2023.
12. Foust, Jeff (10 January 2023). "First ABL Space Systems launch fails" (https://spacenews.com/first-abl-space-systems-launch-fails/). *SpaceNews*. Retrieved 11 January 2023.
13. "Identical letters dated 28 April 2023 from the Permanent Representative of Israel to the United Nations addressed to the Secretary-General and the President of the Security Council" (https://digitallibrary.un.org/record/4010031/files/S_2023_302-EN.pdf?ln=en) (PDF). Retrieved 15 October 2023.
14. "Qaim-100 satellite carrier has failed" (https://twitter.com/projectmeshkat/status/1696221535332184088). Retrieved 15 October 2023.
15. Roston, Michael; Dooley, Ben; Ueno, Hisako (7 March 2023). "New Japanese Rocket Is Destroyed During First Test Flight to Space" (https://www.nytimes.com/2023/03/06/science/japan-rocket-h3-launch.html). *The New York Times*. ISSN 0362-4331 (https://www.worldcat.org/issn/0362-4331). Retrieved 7 March 2023.
16. Wall, Mike (23 March 2023). "Relativity Space launches world's first 3D-printed rocket on historic test flight, but fails to reach orbit" (https://www.space.com/relativity-space-terran-1-test-launch-failure). *Space.com*. Retrieved 25 March 2023.
17. Sheetz, Michael (12 April 2023). "Relativity goes 'all in' on larger reusable rocket, shifting 3D-printing approach after first launch" (https://www.cnbc.com/2023/04/12/relativity-all-in-on-terran-r-rocket-shifting-3d-printing-approach.html). *CNBC*. Retrieved 13 April 2023.
18. China 'N Asia Spaceflight [@CNSpaceflight] (2 April 2023). "🚀 History made on April 02, 2023! Liftoff at ~08:48UTC, SPACE-PIONEER's Tianlong-2 successfully launched Jinta cubesat from Jiuquan Satellite Launch Center. 🎉 World's first startup to successfully launch a liquid fueled rocket to orbit on first attempt" (https://twitter.com/CNSpaceflight/status/1642456128020951040) (Tweet) – via Twitter.
19. Baylor, Michael. "Starship-Super Heavy (Prototype) | Orbital Test Flight" (https://nextspaceflight.com/launches/details/6754). *Next Spaceflight*. Retrieved 30 December 2022.
20. Clark, Stephen (13 May 2021). "SpaceX outlines plans for Starship orbital test flight" (https://spaceflightnow.com/2021/05/13/spacex-outlines-plans-for-around-the-world-starship-test-flight/). *Spaceflight Now*. Retrieved 15 May 2021.
21. Messier, Doug (25 April 2023). "Evolution Space Launches Rocket on Suborbital Flight From Mojave Desert" (https://paraboliccarc.com/2023/04/25/suborbital-launches/). *Parabolic Arc*. Retrieved 26 July 2023.
22. AP (31 May 2023). "North Korea spy satellite launch fails as rocket falls into the sea" (https://indianexpress.com/article/world/north-korea-first-spy-satellite-launch-fails-8637856/). *The Indian Express*. Retrieved 31 May 2023.
23. "Why does North Korea want a spy satellite so badly, and what went wrong with its attempt to launch one?" (https://www.cbsnews.com/news/north-korea-spy-satellite-malligyong-1-chollima-1/). *www.cbsnews.com*. 31 May 2023. Retrieved 1 June 2023.
24. Yoonjung Seo; Junko Ogura; Brad Lendon (31 May 2023). "North Korea says satellite launch fails, plans to try again" (https://edition.cnn.com/2023/05/30/asia/north-korea-south-korea-projectile-alert-intl-hnk/index.html). *edition.cnn.com*. Retrieved 31 May 2023.
25. Jones, Andrew (12 July 2023). "China's Landspace reaches orbit with methane-powered Zhuque-2 rocket" (https://spacenews.com/chinas-landspace-reaches-orbit-with-methane-powered-zhuque-2-rocket/). *SpaceNews*. Retrieved 12 July 2023.
26. Schnautz, Risa (14 September 2023). "Firefly Aerospace Successfully Launches U.S. Space Force VICTUS NOX Responsive Space Mission with 24-Hour Notice" (https://fireflyspace.com/news/firefly-aerospace-successfully-launches-victus-nox-with-24-hour-notice/). *Firefly Aerospace*. Retrieved 15 September 2023.
27. Jonathan, McDowell (10 December 2023). "Launch Totals by year" (https://planet4589.org/space/stats/out/tab1a.txt).
28. "Jonathan's Space Report | Space Statistics" (https://planet4589.org/space/stats/launches.html). *planet4589.org*. Retrieved 10 December 2023.
29. Young, Chris (9 February 2023). "ESA successfully deploys braking sail for deorbiting small satellites" (https://interestingengineering.com/innovation/esa-braking-sail-deorbiting-small-satellites). *interestingengineering.com*. Archived (https://web.archive.org/web/20230209164837/https://interestingengineering.com/innovation/esa-braking-sail-deorbiting-small-satellites) from the original on 9 February 2023. Retrieved 15 February 2023.
30. "Show Me Your Wings: Successful In-flight Demonstration of the ADEO Braking Sail" (https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Shaping_the_Future/Show_Me_Your_Wings_Successful_In-flight_Demonstration_of_the_ADEO_Braking_Sail). *www.esa.int*. Archived (https://web.archive.org/web/20230213235840/https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Shaping_the_Future/Show_Me_Your_Wings_Successful_In-flight_Demonstration_of_the_ADEO_Braking_Sail) from the original on 13 February 2023. Retrieved 15 February 2023.

31. "Using flexible organic solar cells in the stratosphere" (https://techxplore.com/news/2023-04-flexible-solar-cells-stratosphere.html). *Science China Press via techxplore.com*. Retrieved 28 May 2023.
32. Xu, Zihan; Xu, Guoning; Luo, Qun; Han, Yunfei; Tang, Yu; Miao, Ying; Li, Yongxiang; Qin, Jian; Guo, Jingbo; Zha, Wusong; Gong, Chao; Lu, Kun; Zhang, Jianqi; Wei, Zhixiang; Cai, Rong; Yang, Yanchu; Li, Zhaojie; Ma, Chang-Qi (15 December 2022). "*In situ* performance and stability tests of large-area flexible polymer solar cells in the 35-km stratospheric environment" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10029844). *National Science Review*. **10** (4): nwac285. doi:10.1093/nsr/nwac285 (https://doi.org/10.1093%2Fnsr%2Fnwac285). ISSN 2095-5138 (https://www.worldcat.org/issn/2095-5138). PMC 10029844 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10029844). PMID 36960222 (https://pubmed.ncbi.nlm.nih.gov/36960222).
33. Krebs, Gunter (6 May 2022). "Jupiter 3 / EchoStar 24" (https://space.skyrocket.de/doc_sdat/jupiter-3.htm). *Gunter's Space Page*. Retrieved 7 May 2022.
34. "Falcon Heavy | EchoStar 24 (Jupiter 3)" (https://nextspaceflight.com/launches/details/6944). Retrieved 25 July 2023.
35. "In a First, Caltech's Space Solar Power Demonstrator Wirelessly Transmits Power in Space" (https://www.caltech.edu/about/news/in-a-first-caltechs-space-solar-power-demonstrator-wirelessly-transmits-power-in-space). *Caltech*. 1 June 2023. Retrieved 9 June 2023.
36. "Scientists demonstrate wireless power transmission from space to Earth for first time" (https://www.independent.co.uk/space/space-earth-wireless-power-beamed-b2353588.html). *The Independent*. 8 June 2023. Retrieved 9 June 2023.
37. Foust, Jeff (21 March 2023). "Japanese lander enters lunar orbit" (https://spacenews.com/japanese-lander-enters-lunar-orbit/). *Space News*. Retrieved 22 March 2023.
38. Komiya, Kantaro; Roulette, Joey (25 April 2023). "Japan's ispace assumes failure in bid to make first commercial moon landing" (https://www.reuters.com/technology/space/japans-ispace-prepares-worlds-first-commercial-lunar-landing-2023-04-25/). *Reuters* – via www.reuters.com.
39. "NASA's Juno Is Getting Ever Closer to Jupiter's Moon Io" (https://www.nasa.gov/feature/jpl/nasa-s-juno-is-getting-ever-closer-to-jupiter-s-moon-io). 26 July 2023. Retrieved 28 July 2023.
40. Grey, Charles (6 August 2023). "India's Chandrayaan-3 Successfully Inserted Into Lunar Orbit" (https://airspacenews.net/indias-chandrayaan-3-successfully-inserted-into-lunar-orbit/). *AIR SPACE News*. Retrieved 6 August 2023.
41. Anatoly Zak [@RussianSpaceWeb] (16 August 2023). "Confirmed: Luna-Glob lander enters orbit around the Moon as a result of two-impulse maneuver starting at 11:57 Moscow (4:57 am EDT). Orbit reached at 12:03 Moscow. All systems work well, according to Roskosmos…" (https://twitter.com/RussianSpaceWeb/status/1691794362815107314) (Tweet) – via Twitter.
42. "Luna-25 crashes into moon after orbit maneuver" (https://spacenews.com/luna-25-crashes-into-moon-after-orbit-maneuver/). Space.com. 20 August 2023. Retrieved 20 August 2023.
43. Jones, Andrew (23 August 2023). "Chandrayaan-3: India becomes fourth country to land on the moon" (https://spacenews.com/chandrayaan-3-india-becomes-fourth-country-to-land-on-the-moon/). *SpaceNews.com*. Retrieved 23 August 2023.
44. Warren, Haygen (24 September 2023). "Historic OSIRIS-REx asteroid samples successfully return to Earth" (https://www.nasaspaceflight.com/2023/09/osirisrex-landing/). *NASASpaceFlight*. Retrieved 29 September 2023.
45. Jonathan McDowell [@planet4589] (2 November 2023). "2.2 AU from the Sun, the Lucy space probe flew 425 km from minor planet (152830) Dinkinesh at 1654 UTC Nov 1. Lucy now continues in solar orbit for another Earth gravity assist in December 2024 before heading back out to the Main Belt and beyond" (https://twitter.com/planet4589/status/1719894213909786933) (Tweet) – via Twitter.
46. Jones, Andrew (25 December 2023). "Japan's SLIM successfully enters lunar orbit, gears up for precision moon landing" (https://spacenews.com/japans-slim-successfully-enters-lunar-orbit-gears-up-for-precision-moon-landing/). *SpaceNews.com*. Retrieved 26 December 2023.
47. Lea, Robert (2 January 2024). "NASA Juno spacecraft reveals Jupiter's volcanic moon Io like never before in spectacular new images" (https://www.space.com/nasa-juno-spacecraft-jupiter-moon-io-photos). *Space.com*. Retrieved 3 January 2024.
48. Talbert, Tricia (8 January 2021). "NASA Extends Exploration for Two Planetary Science Missions" (https://www.nasa.gov/feature/nasa-extends-exploration-for-two-planetary-science-missions). *NASA*. Retrieved 8 January 2021.
49. Dodson, Gerelle (13 January 2023). "NASA to Provide Coverage of US Spacewalk, Preview News Conference" (http://www.nasa.gov/press-release/nasa-to-provide-coverage-of-us-spacewalk-preview-news-conference). *NASA*. Retrieved 14 January 2023.
50. Lavelle, Heidi (20 January 2023). "Astronauts Begin Spacewalk to Prep for Station Power Upgrades" (https://blogs.nasa.gov/spacestation/2023/01/20/astronauts-begin-spacewalk-to-prep-for-station-power-upgrades/). *blogs.nasa.gov*. Retrieved 20 January 2023.
51. Garcia, Mark (20 January 2023). "Spacewalkers Wrap Up First Spacewalk of 2023" (https://blogs.nasa.gov/spacestation/2023/01/20/spacewalkers-wrap-up-first-spacewalk-of-2023/). *blogs.nasa.gov*. Retrieved 20 January 2023.
52. Lavelle, Heidi (2 February 2023). "Astronauts Begin Spacewalk to Continue Power System Upgrades" (https://blogs.nasa.gov/spacestation/2023/02/02/astronauts-begin-spacewalk-to-continue-power-system-upgrades/). *blogs.nasa.gov*. Retrieved 2 February 2023.
53. Garcia, Mark (2 February 2023). "Spacewalkers Complete Construction Job to Upgrade Station Power" (https://blogs.nasa.gov/spacestation/2023/02/02/spacewalkers-complete-construction-job-to-upgrade-station-power/). *blogs.nasa.gov*. Retrieved 2 February 2023.
54. "《面对面》揭秘神十五乘组四次出舱细节" (http://mp.weixin.qq.com/s?__biz=MzI2NzQ0OTgxMA==&mid=2248145080&idx=2&sn=d17d8ecd6e7b916fff52c5232cf0d3da&chksm=eaf5fc05dd82751390ba0b259895762a00fae6d4790a15c7bbdd321f480b405595e24858298f#rd). *Weixin Official Accounts Platform*. Retrieved 17 August 2023.
55. "China's Shenzhou 15 astronauts take their 1st spacewalk outside Tiangong space station (video)" (https://www.space.com/china-shenzhou-15-astronauts-first-spacewalk-tiangong). Space.com. 10 February 2023. Retrieved 10 February 2023.
56. "《面对面》揭秘神十五乘组四次出舱细节" (http://mp.weixin.qq.com/s?__biz=MzI2NzQ0OTgxMA==&mid=2248145080&idx=2&sn=d17d8ecd6e7b916fff52c5232cf0d3da&chksm=eaf5fc05dd82751390ba0b259895762a00fae6d4790a15c7bbdd321f480b405595e24858298f#rd). *Weixin Official Accounts Platform*. Retrieved 17 August 2023.
57. "官方丨神舟十五号乘组刷新中国航天员单个乘组出舱活动纪录 工程全线加紧备战空间站应用与发展阶段首次飞行任务" (http://mp.weixin.qq.com/s?__biz=MzI0NTU3MTk1Nw==&mid=2247532272&idx=1&sn=6943b862b6bedcc40bab4128014626d6&chksm=e94eb6eade393ffc1576ebbf37666ee1d24df5737d4f4d3b6acffa728d4a0277df8e0f0a1c0f#rd). *Weixin Official Accounts Platform*. Retrieved 16 April 2023.
58. "《面对面》揭秘神十五乘组四次出舱细节" (http://mp.weixin.qq.com/s?__biz=MzI2NzQ0OTgxMA==&mid=2248145080&idx=2&sn=d17d8ecd6e7b916fff52c5232cf0d3da&chksm=eaf5fc05dd82751390ba0b259895762a00fae6d4790a15c7bbdd321f480b405595e24858298f#rd). *Weixin Official Accounts Platform*. Retrieved 17 August 2023.
59. "官方丨神舟十五号乘组刷新中国航天员单个乘组出舱活动纪录 工程全线加紧备战空间站应用与发展阶段首次飞行任务" (http://mp.weixin.qq.com/s?__biz=MzI0NTU3MTk1Nw==&mid=2247532272&idx=1&sn=6943b862b6bedcc40bab4128014626d6&chksm=e94eb6eade393ffc1576ebbf37666ee1d24df5737d4f4d3b6acffa728d4a0277df8e0f0a1c0f#rd). *Weixin Official Accounts Platform*. Retrieved 16 April 2023.

60. "官方丨神舟十五号乘组刷新中国航天员单个乘组出舱活动纪录 工程全线加紧备战空间站应用与发展阶段首次飞行任务" (http://mp.weixin.qq.com/s?__biz=MzI0NTU3MTk1Nw==&mid=2247532272&idx=1&sn=6943b862b6bedcc40bab4128014626d6&chksm=e94eb6eade393ffc1576ebbf37666ee1d24df5737d4f4d3b6acffa728d4a0277df8e0f0a1c0f#rd). *Weixin Official Accounts Platform*. Retrieved 16 April 2023.
61. Garcia, Mark (10 April 2023). "Botany, Heart Research Ahead of Dragon Departure and Spacewalks" (https://blogs.nasa.gov/spacestation/2023/04/10/botany-heart-research-ahead-of-dragon-departure-and-spacewalks/). *blogs.nasa.gov*. Retrieved 11 April 2023.
62. Donaldson, Abbey (17 April 2023). "NASA Sets Coverage of Spacewalk, News Conference for Station Upgrades" (https://www.nasa.gov/press-release/nasa-sets-coverage-of-spacewalk-news-conference-for-station-upgrades). *nasa.gov*. NASA. Archived (https://web.archive.org/web/20230418144026/https://www.nasa.gov/press-release/nasa-sets-coverage-of-spacewalk-news-conference-for-station-upgrades/) from the original on 18 April 2023. Retrieved 25 April 2023.
63. Garcia, Mark (28 April 2023). "Astronauts Begin Spacewalk to Upgrade Station Power" (https://blogs.nasa.gov/spacestation/2023/04/28/astronauts-begin-spacewalk-to-upgrade-station-power/). *blogs.nasa.gov*. Archived (https://web.archive.org/web/20230428185427/https://blogs.nasa.gov/spacestation/2023/04/28/astronauts-begin-spacewalk-to-upgrade-station-power/) from the original on 28 April 2023. Retrieved 28 April 2023.
64. Garcia, Mark (28 April 2023). "Astronauts Wrap Up Spacewalk for Station Power Upgrades" (https://blogs.nasa.gov/spacestation/2023/04/28/astronauts-wrap-up-spacewalk-for-station-power-upgrades/). *blogs.nasa.gov*. Archived (https://web.archive.org/web/20230429091257/https://blogs.nasa.gov/spacestation/2023/04/28/astronauts-wrap-up-spacewalk-for-station-power-upgrades/) from the original on 29 April 2023. Retrieved 28 April 2023.
65. Pearlman, Robert Z. (24 April 2023). "Russian spacewalk to move airlock outside space station postponed" (https://www.space.com/russian-iss-spacewalk-airlock-move-postponed). *Space.com*. Archived (https://web.archive.org/web/20230429122317/https://www.space.com/russian-iss-spacewalk-airlock-move-postponed) from the original on 29 April 2023. Retrieved 25 April 2023.
66. Garcia, Mark (1 May 2023). "Cosmonauts Prep for Wednesday Spacewalk as Astronauts Relax" (https://blogs.nasa.gov/spacestation/2023/05/01/cosmonauts-prep-for-wednesday-spacewalk-as-astronauts-relax/). *blogs.nasa.gov*. Archived (https://web.archive.org/web/20230501170908/https://blogs.nasa.gov/spacestation/2023/05/01/cosmonauts-prep-for-wednesday-spacewalk-as-astronauts-relax/) from the original on 1 May 2023. Retrieved 1 May 2023.
67. Garcia, Mark (3 May 2023). "Cosmonauts Begin Spacewalk to Move Experiment Airlock" (https://blogs.nasa.gov/spacestation/2023/05/03/cosmonauts-begin-spacewalk-to-move-experiment-airlock/). *blogs.nasa.gov*. Retrieved 3 May 2023.
68. Garcia, Mark (3 May 2023). "Cosmonauts Move Experiment Airlock and Complete Spacewalk" (https://blogs.nasa.gov/spacestation/2023/05/03/cosmonauts-move-experiment-airlock-and-complete-spacewalk/). *blogs.nasa.gov*. Retrieved 4 May 2023.
69. Graf, Abigail (12 May 2023). "Cosmonauts Begin Spacewalk to Deploy Radiator" (https://blogs.nasa.gov/spacestation/2023/05/12/cosmonauts-begin-spacewalk-to-deploy-radiator/). *blogs.nasa.gov*. Retrieved 12 May 2023.
70. Garcia, Mark (12 May 2023). "Cosmonauts Deploy Radiator and Complete Spacewalk" (https://blogs.nasa.gov/spacestation/2023/05/12/cosmonauts-deploy-radiator-and-complete-spacewalk/). *blogs.nasa.gov*. Retrieved 12 May 2023.
71. Garcia, Mark (9 June 2023). "NASA Astronauts Begin Spacewalk to Install Solar Array" (https://blogs.nasa.gov/spacestation/2023/06/09/nasa-astronauts-begin-spacewalk-to-install-solar-array-2/). *blogs.nasa.gov*. Retrieved 10 June 2023.
72. Garcia, Mark (9 June 2023). "NASA Spacewalkers Complete Solar Array Installation" (https://blogs.nasa.gov/spacestation/2023/06/09/nasa-spacewalkers-complete-solar-array-installation/). *blogs.nasa.gov*. Retrieved 10 June 2023.
73. Garcia, Mark (15 June 2023). "Astronauts Begin Spacewalk to Install Roll-Out Solar Array" (https://blogs.nasa.gov/spacestation/2023/06/15/astronauts-begin-spacewalk-to-install-roll-out-solar-array/). *blogs.nasa.gov*. Retrieved 15 June 2023.
74. Garcia, Mark (15 June 2023). "NASA Spacewalkers Finish Installing Roll-Out Solar Array" (https://blogs.nasa.gov/spacestation/2023/06/15/nasa-spacewalkers-finish-installing-roll-out-solar-array/). *blogs.nasa.gov*. Retrieved 15 June 2023.
75. Garcia, Mark (22 June 2023). "Cosmonauts Begin Spacewalk to Replace Station Hardware" (https://blogs.nasa.gov/spacestation/2023/06/22/cosmonauts-begin-spacewalk-to-replace-station-hardware/). *blogs.nasa.gov*. Retrieved 22 June 2023.
76. Garcia, Mark (22 June 2023). "Cosmonauts Finish Spacewalk After Replacing Station Hardware" (https://blogs.nasa.gov/spacestation/2023/06/22/cosmonauts-finish-spacewalk-after-replacing-station-hardware/). *blogs.nasa.gov*. Retrieved 22 June 2023.
77. "China's Shenzhou 16 astronauts complete 1st spacewalk (video)" (https://www.space.com/china-shenzhou-16-astronauts-first-spacewalk). Space. 21 July 2023. Retrieved 26 July 2023.
78. Bardan, Roxana (7 August 2023). "NASA Sets Coverage of Roscosmos Spacewalk Outside Space Station" (http://www.nasa.gov/press-release/nasa-sets-coverage-of-roscosmos-spacewalk-outside-space-station). *NASA*. Retrieved 7 August 2023.
79. Garcia, Mark (9 August 2023). "Cosmonauts Begin Spacewalk for Station Upgrade Work" (https://blogs.nasa.gov/spacestation/2023/08/09/cosmonauts-begin-spacewalk-for-station-upgrade-work/). *blogs.nasa.gov*. Retrieved 9 August 2023.
80. Garcia, Mark (9 August 2023). "Cosmonauts Finish Spacewalk Installing Shields and Relocating Hardware" (https://blogs.nasa.gov/spacestation/2023/08/09/cosmonauts-finish-spacewalk-installing-shields-and-relocating-hardware/). *blogs.nasa.gov*. Retrieved 10 August 2023.
81. Garcia, Mark (16 October 2023). "Spacewalk Dates Adjusted; Cargo Operations Begin the Crew's Week" (https://blogs.nasa.gov/spacestation/2023/10/16/spacewalk-dates-adjusted-cargo-operations-begin-the-crews-week/). *blogs.nasa.gov*. Retrieved 18 October 2023.
82. Graf, Abby (25 October 2023). "Cosmonauts Begin Spacewalk to Install Scientific Payloads and Inspect Radiator" (https://blogs.nasa.gov/spacestation/2023/10/25/cosmonauts-begin-spacewalk-to-install-scientific-payloads-and-inspect-radiator/). *blogs.nasa.gov*. Retrieved 25 October 2023.
83. Graf, Abby (25 October 2023). "Cosmonauts Finish Spacewalk Following Hardware Installs and Inspections" (https://blogs.nasa.gov/spacestation/2023/10/25/cosmonauts-finish-spacewalk-following-hardware-installs-and-inspections/). *blogs.nasa.gov*. Retrieved 26 October 2023.
84. Garcia, Mark (3 October 2023). "Crew Preps for Spacewalks to Analyze Microbes, Replace Hardware" (https://blogs.nasa.gov/spacestation/2023/10/03/crew-preps-for-spacewalks-to-analyze-microbes-replace-hardware/). *blogs.nasa.gov*. NASA. Archived (https://web.archive.org/web/20231018035521/https://blogs.nasa.gov/spacestation/2023/10/03/crew-preps-for-spacewalks-to-analyze-microbes-replace-hardware/) from the original on 18 October 2023. Retrieved 4 October 2023.
85. Garcia, Mark (1 November 2023). "Two Spacewalkers Exit Station for Communications, Solar Array Work" (https://blogs.nasa.gov/spacestation/2023/11/01/two-spacewalkers-exit-station-for-communications-solar-array-work/). *blogs.nasa.gov*. NASA. Archived (https://web.archive.org/web/20231102000443/https://blogs.nasa.gov/spacestation/2023/11/01/two-spacewalkers-exit-station-for-communications-solar-array-work/) from the original on 2 November 2023. Retrieved 1 November 2023.
86. Garcia, Mark (1 November 2023). "Astronauts Complete Spacewalk, Dragon Launch Moves to Nov. 7" (https://blogs.nasa.gov/spacestation/2023/11/01/astronauts-enter-station-complete-spacewalk/). *blogs.nasa.gov*. NASA. Archived (https://web.archive.org/web/20231108191056/https://blogs.nasa.gov/spacestation/2023/11/01/astronauts-enter-station-complete-spacewalk/) from the original on 8 November 2023. Retrieved 1 November 2023.

87. "Shenzhou-17 crew completes first spacewalk | english.scio.gov.cn" (http://english.scio.gov.cn/chinavoices/2023-12/22/content_116896451.htm). *english.scio.gov.cn*. Retrieved 23 December 2023.
88. Orbital Focus [@OrbitalFocus] (17 March 2023). "From Space-Track: The 18th Space Defense Squadron (18 SDS) has confirmed the breakup of Orbcomm FM 36 (#25984, 1999-065E), which likely occurred March 11, 2023, at approximately 0145 UTC. As of March 16, 18 SDS is tracking 7 associated pieces at an estimated 792 km altitude..." (https://twitter.com/OrbitalFocus/status/1636692364914819076) (Tweet). Retrieved 3 April 2023 – via Twitter.
89. @planet4589 (17 March 2023). "The jump is a propulsive orbit adjust, which makes the likeliest cause some kind of bad event in the hydrazine orbit adjust system" (https://twitter.com/planet4589/status/1636729839532101637) (Tweet). Retrieved 3 April 2023 – via Twitter.
90. "Strela military communications satellite family" (https://www.russianspaceweb.com/strela_comsat.html#kosmos2143).
91. Jonathan McDowell [@planet4589] (22 August 2023). "7 new debris objects cataloged from the Vega VV02 launch in a 23:50 LTDN sun-sync orbit, consistent with a breakup of the VESPA adapter upper section, object 39162. Possibly the result of an impact by a small object?" (https://twitter.com/planet4589/status/1693810817760678191) (Tweet) – via Twitter.
92. "Objects detected in the vicinity of ClearSpace-1 debris removal mission target" (https://www.esa.int/Space_Safety/Objects_detected_in_the_vicinity_of_ClearSpace-1_debris_removal_mission_target). *ESA*. 22 August 2023. Retrieved 23 August 2023.
93. Jonathan, McDowell (10 December 2023). "Launch Totals by year" (https://planet4589.org/space/stats/out/tab1a.txt).
94. "Jonathan's Space Report | Space Statistics" (https://planet4589.org/space/stats/launches.html). *planet4589.org*. Retrieved 10 December 2023.
95. "GYUB (South Korean Solid Fueled LV)" (https://space.skyrocket.de/doc_lau/gyub.htm). *Gunter's Space Page - space.skyrocket.de*. Retrieved 18 December 2023.

External links

- Bergin, Chris. "NASASpaceFlight.com" (http://www.nasaspaceflight.com).
- Clark, Stephen. "Spaceflight Now" (http://www.spaceflightnow.com).
- Kelso, T.S. "Satellite Catalog (SATCAT)" (https://celestrak.com/satcat/search.asp). CelesTrak.
- Krebs, Gunter. "Chronology of Space Launches" (http://space.skyrocket.de/directories/chronology.htm).
- Kyle, Ed. "Space Launch Report" (https://web.archive.org/web/20091005063125/http://www.spacelaunchreport.com/). Archived from the original (http://www.spacelaunchreport.com/) on 5 October 2009. Retrieved 13 August 2022.
- McDowell, Jonathan. "GCAT Orbital Launch Log" (https://planet4589.org/space/gcat/data/derived/launchlog.html).
- Pietrobon, Steven. "Steven Pietrobon's Space Archive" (http://www.sworld.com.au/steven/space/).
- Wade, Mark. "Encyclopedia Astronautica" (http://www.astronautix.com).
- Webb, Brian. "Southwest Space Archive" (http://www.spacearchive.info/index.htm).
- Zak, Anatoly. "Russian Space Web" (http://www.russianspaceweb.com/).
- "ISS Calendar" (http://spaceflight101.com/iss/iss-calendar/). *Spaceflight 101*.
- "NSSDCA Master Catalog" (https://nssdc.gsfc.nasa.gov/nmc/). *NASA Space Science Data Coordinated Archive*. NASA Goddard Space Flight Center.
- "Space Calendar" (http://www2.jpl.nasa.gov/calendar/). NASA Jet Propulsion Laboratory.
- "Space Information Center" (http://spaceinfo.jaxa.jp). JAXA.
- "Хроника освоения космоса" (http://www.cosmoworld.ru/spaceencyclopedia/chrono/index.shtml) [Chronicle of space exploration]. *CosmoWorld* (in Russian).

Generic references:
Spaceflight portal