



**TECH
ZONE**

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GAGANYAAN

by Jayesh Pattamatta

Gaganyaan, a Sanskrit word that translates to 'Sky Craft,' is an Indian crewed orbital spacecraft intended to be the spacecraft of the Programme. It's designed to carry three people, and a planned upgraded version will be equipped with rendezvous and docking capability. This is a maiden crewed space mission of the Indian Space Research Organisation (ISRO).

The Gaganyaan Programme wants the demonstration of human spaceflight to Low Earth Orbit (LEO) in the short term. However, it will lay the foundation for a sustained Indian human space exploration program in the long run. The motto of the Gaganyaan program is to demonstrate the indigenous capability to undertake a human space flight mission to LEO.

Several new technologies required for Gaganyaan Programme are as follows:

- The human-rated launch vehicle
- Life support system
- Crew escape systems
- Habitable orbital module
- Crew selection and training and associated crew management activities.

The specification of some machines present in the Gaganyaan mission is as follows:

Vikas Engine: On July 14, 2021, ISRO conducted a third long-duration hot test of Vikas engine for core L110 liquid stage of GSLV Mark III at ISRO Propulsion Complex as part of engine qualification requirement of Gaganyaan mission. The Vikas engine is used to power the second stage of the Polar Satellite Launch Vehicle (PSLV), boosters, and the second stage of the Geosynchronous Satellite Launch Vehicle (GSLV) Mark I and II and also the core stage of GSLV Mark III. The propellant loading for Vikas engine in PSLV, GSLV Mark I and II is 40 tons, while in GSLV Mark III is 55 tons.



Vyommitra:

On January 22, 2020, ISRO announced Vyommitra, a female robot accompanying our astronauts on this mission. ISRO decided not to take an animal and preferred to take a humanoid robot to understand better what weightlessness and radiation do to the human body during long durations in space. Vyommitra is expected to onboard with the uncrewed Gaganyaan mission to perform micro-gravity experiments, monitor module parameters, and support astronauts in crewed missions by simulating functions precisely like humans. It can detect and give warnings if environmental changes within the cabin get uncomfortable to astronauts and change the air condition. It can also take up postures suited for launch and tasks and take commands. It can speak Hindi & English and is a multi-tasker.

Agencies working with ISRO for Gaganyaan mission:

- i. Indian Armed Forces
- ii. Defense Research Development organization
- iii. Indian maritime agencies - Indian Navy, Indian Coast Guard, Shipping Corporation of India, National Institute of Oceanography, National Institute of Ocean Technology.
- iv. Indian Meteorological Department

Purpose and benefits of Gaganyaan mission

- 1.They have advanced technology capability for undertaking human space exploration, sample return missions, and scientific exploration.
 2. Progress towards a sustained and affordable human and robotic program to explore the solar system and beyond.
 3. Promote the indigenous robotics industry in the country and create more employment in this industry.
 4. It will be a unique opportunity to inspire the Indian Youth as the Mangalyaan mission did in the past. Moreover, it will steer many students to take their career in Aerospace engineering and other scientific fields.
 5. It will promote R&D and global recognition and relations of India in the scientific field.
- The total cost of the Gaganyaan Programme is approximately ₹ 9023.00 crores, and its uncrewed



SPACESHIP TO THE BURNING BALL

by Jagadish Kothakota

Once the life on earth dared to leave the water and started exploring the landmasses and succeeded in it, Now the life started going around the world to explore the vast universe around us like water around an island. The curiosity spread with the invention of the telescope, and even it doesn't fulfill the thirst of new space aspirants. Then people started Satellites and Rovers and Rockets to send them into space to know about our neighboring planets and their planetarium features. Now we aim to understand



our solar family's head, Mr. SUN, and in this process, many rovers are sent towards the sun, and one such successful rover is PARKER SOLAR PROBE.

The Rover work was put on the papers in 1958 by the National Aeronautics and Space Administration (NASA), the space agency of the United States of America whose main idea is to send a probe to as possible as near to the sun and get the coronal features of the sun. But the real works were unable to be put in action because of the price. A sustainable design was ready by the late 1990s but later rejected the 2003 United States federal budget. A new mission named solar probe plus was designed in the late 2010s with a reduced cost of \$1.5 billion in 2009 US federal budget compared to solar probes version of 1990s with few advanced specifications. It was finally named "Parker solar probe" in honor of Astrophysicist Mr. Eugene Newman Parker, who coined the term "solar wind" in 2017. The main goals of this Parker Solar Probe are:

- To find the flow of energy and driving force for solar winds.
- The study of the dynamics and magnetic fields at the production region of solar winds.
- The driving force behind the flow of energy particles.

A hexagonal solar shield is mounted to prevent the Parker from extreme radiation and heat near the sun. A white sheet is also placed to absorb the energy, and the core components or instruments are placed in the center of the Parker for protection. Four light sensors are used autonomously to allow Parker to work, where they detect the traces of light, and it accelerates accordingly to remain Parker in the shade. The main source of power for the Parker is achieved by dual working solar panels placed above it where it provides driving force and trigger the liquid cooling system to maintain its temperature stable. So, it is also called "the only autonomous spacecraft."

Finally, the Parker Solar Probe flew into the sky on 12th August 2018, and it is planned for seven years of life where it completed almost half of its life and reached the nearest point to the sun, which is the closest approach is 10.5 million kilometers. The valuable finding of this probe is the direction and strength of the sun's magnetic and field and its irregular distribution into space on 4th December 2019. Parker also noticed the cosmic dust-free zone of 5.6 million kilometers from the sun due to the sun's vaporization.

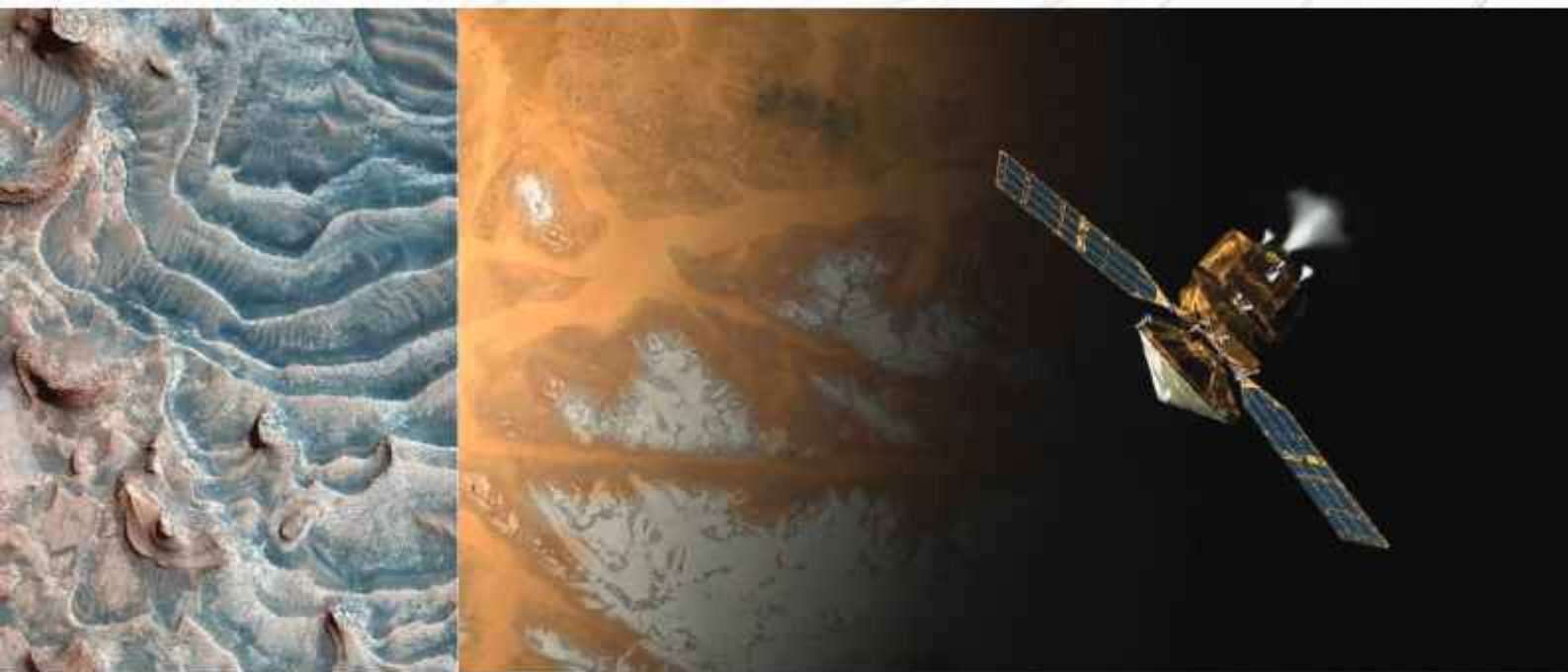


Mars Reconnaissance Orbiter

by Rushik Patel

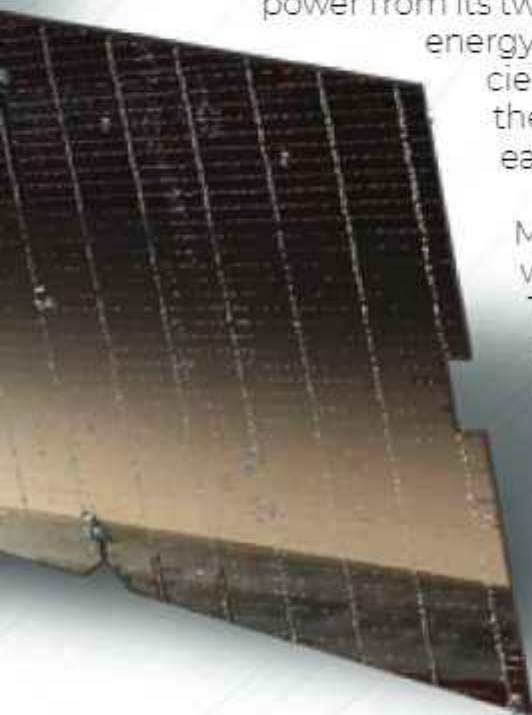
Mars Reconnaissance Orbiter [MRO] is a spacecraft designed to study the geology and climate of Mars and relay data from surface missions back to Earth which NASA operates. It was launched on August 12, 2005, and reached Mars on March 10, 2006. It's currently used to study potential landing sites for human missions to the red planet called Mars. It's built with a high-resolution camera, which sends the images back to Earth. Until now, it has returned 416.864 terabytes of data, which helped the scientists investigate the red planet whether its surface consists of water. It was launched at Cape Canaveral air force station Florida. With the help of this space tech, NASA confirms thousands of massive ancient volcanic eruptions on Mars. Its SATCAT NO is 28788, and its present duration is 16 years, two months, and 24 days; the orbital parameters are 93 degrees and 111 minutes period. On September 29, 2006, MRO took its first picture from its science orbit, from the observations indicating the presence of the action of liquid carbon dioxide or water on the surface of Mars in its recent geological past. Three cameras, two spectrometers, and radar are included in the orbit and science-facility instruments that collect science data. They are expecting that the MRO can obtain about 5000 images per year. The HiRISE camera is the largest ever carried on a deep space mission and has a resolution of 1 micro radian from an altitude of 300 km. SHARAD is an experiment designed to probe the internal structure of the Mars [shallow surface radar]. The total cost of the MRO through the end of its prime mission was 716.6 million dollars. Mars is one of the closest planets to Earth. It's about 140 million miles away, and even it has





decent sunlight. In Mars, the weather is cold compared to Earth; we can even grow plants by compressing the atmosphere in Mars as it mainly consists of CO₂ and a few other element traces. Now Elon Musk is trying to launch the Space X project to establish the human society on Mars, and Space X is working on the stainless steel rocket that will be reusable and carry people to Mars. The Mars Reconnaissance Orbiter is made of carbon composites and aluminum - honeycombed plates, but mostly it is made up of carbon composites. Most of the mass and volume of the spacecraft take the titanium fuel tank. The spacecraft's total mass is less than 2,108 kg, with an unfueled dry mass of less than 1,031 kg. MRO gets all of its electrical power from its two solar panels as the Mars are close to the sun, so it uses solar energy. Each solar panel uses 5.35 m * 2.53 m. It consists of high-efficiency triple-junction solar cells. It can convert more than 26% of the sun's energy directly into electricity, which produces 32 v, so each panel produces more than 1000 watts of power.

MRO has two rechargeable Nickel hydrogen batteries, which will be helpful in the spacecraft when it is not facing the sun. The telecom subsystem in MRO is the best digital communication system by using turbo codes. MRO can communicate with other space crafts through the antenna. The spacecraft carries two 100v x band amplifiers. In September 2009, they found pure water ice; after being exposed, it gradually sublimates away. The ice was found in four places in total. At last, on August 4, 2011, NASA announced that MRO detected flowing salty water on the surface of Mars. Therefore on September 28, 2015, this was confirmed at the news conference.



The Opportunity Rover

by Aditya Hegde

Every space geek who has done their homework would know of the infamous rover named, "Opportunity" which had been exploring Mars since 2004. And for those who have not, they must have heard of it at least once when it uttered its final message before going dark forever, the words being, "My battery is low, and it's getting dark."

Opportunity, lovingly known as 'Oppy' by the public, was a robotic rover operating on Mars, was made by the Jet Propulsion Laboratory at NASA. It worked on MARS for 5352 sols (from 2004 to mid-2018), which exceeded its initial lifespan by 14 years and 46 days, Earth time. This

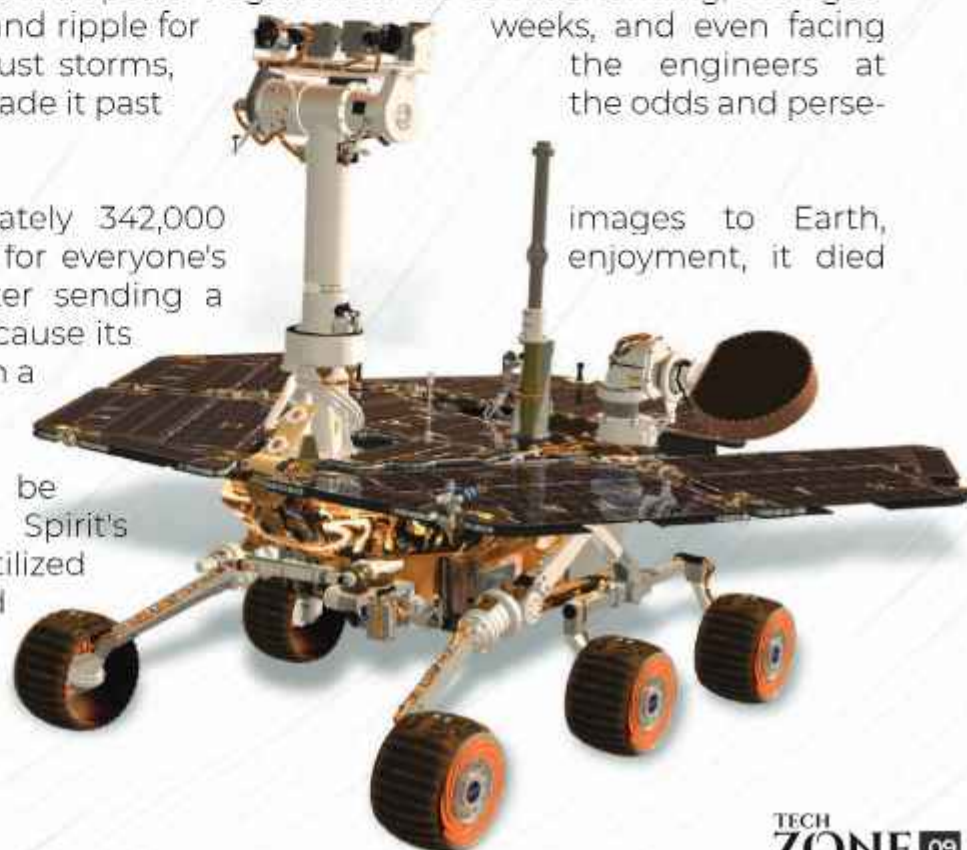
was accomplished by carefully monitoring its batteries and by hibernating during events such as sandstorms. By June 2018, it had traveled 45.16 kilometers.

During its mission on Mars, exploring the Red planet of our solar system, it found and studied various meteorites (such as Heat Shield Rock) and spent two years studying and circling the Victoria Crater. It survived weak and relatively moderate sand storms with ease and completed the journey to the Endeavour Crater, making it to NASA's hall of fame as one of its most successful endeavors. Its specific goal was to explore a vast amount of regolith (ancient, leftover sedimentary rock just above bedrock). This was to find evidence of past water activity on Mars, making it the first robot to identify and characterize sedimentary rocks on a planet other than Earth. Moreover, it also holds the record for the longest drive on a planet other than the Earth, beating the previous record of 39 kilometers.

It held a vast amount of emotional and sentimental value to its creators at NASA and most other geeks who knew of the little robot. It was called "The little rover that could." Despite slipping on the slopes of Eagle Crater on its initial landing, then getting its wheels stuck in a sand ripple for two mission-threatening dust storms, NASA and the rover itself made it past weeks, and even facing the engineers at the odds and persevered for 14 years.

After returning approximately 342,000 which were posted online for everyone's in Perseverance Valley after sending a final touching message because its solar panels were covered in a layer of sand during a sandstorm.

It has not, and will never be forgotten, with its and Spirit's lessons being carried and utilized in all of today's research and rover designs.



images to Earth, enjoyment, it died

The Eyes of Space

by Palak Goel

The observations about the universe were based entirely on those made with the naked eye. The stars and planets were big bright circles in the sky, and we tried our best to make sense of it. Then finally, in 1610, Galileo entered the scene with the telescope. This proved to be revolutionary and completely changed the way humankind viewed space and the universe. However, progress cannot be restrained, and a socio-scientific revolution quickly ensued within a few years.

In the coming years, the architecture and complexity of telescopes changed and grew, most importantly, their power. They were placed away from city terrain and as far above the haze of atmosphere as possible. After whom the Hubble Telescope had been named, Edwin Hubble had used the largest telescope of his time in the 1920s at an observatory known as Mt. Wilson Observatory near Pasadena in California to explore galaxies beyond the one in which we reside.

The Hubble Telescope is the first major optical telescope to be placed in space, the ultimate mountaintop. It was way above the atmosphere's distortion, much farther away from rain clouds and light pollution, winning to itself an obstructed view of the universe. Scientists have used it to observe the most far-off and distant stars and galaxies and the planets in our solar system. Its 2.4m mirror ensures that we get the best possible look at the stars beyond our own.



Edward Hubble

Telescope in space after seven-year wait

By HARRY F. HOUSTON
Associated Press Writer
CAPE CANAVEL, Fla. (AP) — Seven years, the Hubble Space Telescope is where it belongs out of this world and to search of others, an idea that they may have been behind at the beginning of time.
Less than 100 miles after it made its space debut, the shuttle Discovery on Tuesday, the \$1.5-billion telescope sent its first test data signal. At the sign-off, a rocket and three engines at the Goddard Space Flight Center in Maryland where astronauts launched their spacecraft.
"As soon as we can get, everything looks pretty good," said astronaut Steve Hawley from the shuttle. Hawley's job on Wednesday will be to keep the telescope oriented for a 15-year stay in space.
Discovery, trading an air of white smoke into a brilliant blue

DISCOVERY
Mission Schedule

LIFTOFF
Tuesday, April 24 at 7:04 a.m. EDT. Discovery will ascend a 322-mile-high orbit.

CRISTAL ACTIVITY
Discovery will pass the Hubble Space Telescope on-orbit 7 days, 8 hrs and 53 min after launch.

LANDING
Set for 3 days, 1 hr, 15 min after launch.

News article on Hubble

The launch of the Hubble Telescope and its deployment in April 1990 proved to be the most notable headway in astronomy after Galileo's telescope. Over thirty years, it has provided some of the best insights into the mysteries of the universe, helping us understand more about this place we currently live. With its invention, our view of the universe and our position within it has never been the same.

The Hubble telescope



TO THE STARS

by Palak Goel

Humans have always looked to the skies and wondered what's outside the planet we inhabit and if any of those shining balls would become our homes in the future. Mars, the celestial object adjacent to Earth in the solar system, has always been the primary candidate for relocation. But, thanks to SpaceX, the brainchild of Elon Musk, this might be possible sooner than we expect. This aerospace giant aspires to land the first individuals on Mars by 2026 and expedite the eventual colonization of Mars.

The seeds of this idea were sown in 2001 when Elon Musk imagined "Mars Oasis," a scheme to land a miniature trial greenhouse comprising grains with dehydrated gel on Mars to start seedlings on the soil of Mars. By 2011, Musk wished to achieve colonization goals within 2040. With the advancement in technology, that time gap kept decreasing. They have continually improved transportation aspirations, and their projects, such as the Falcon 9, have completed many missions already. These schemes will eventually culminate in the unique moon project. Japanese billionaire Yusaku Maezawa will be part of a commercial flight to the moon on a SpaceX vehicle, becoming the first commercial passenger to land on the lunar surface.

Before any crews travel to Mars, there would first be multiple cargo missions to transport the requisite equipment, habitats, and supplies. These would include machines that would produce oxygen, methane, and fertilizers from the atmospheric carbon dioxide and nitrogen on Mars. With all the required cargo in place, it would be possible for humans to start settling on the red planet finally. Musk hopes for a self-sustaining city to arise on Mars by 2050. Once it is established, there should be no difficulty in setting up more colonies.



We have always been enamored with space, and now that we have seen and explored everything with the help of technology, going into space ourselves seems the next logical step. It was initially the moon, and now it is Mars. Once we have reached there, we will go further because that is what drives us. Whether it is through the help of Elon Musk, Jeff Bezos, or any other curious man, space travel is a certainty and not just scenes that appear in science fiction movies. Though it has only been a hundred and twenty years since we could fly, we are developing technologies faster than ever and ensuring that the future is as bright as it can be.



SPACEX

SPACE ELEVATOR

by Srikumar

Imagine how cool it would be if you could take an elevator to the moon. A space elevator is one such concept that allows you to do so

So, what is this space elevator? As the name suggests, it is an elevator capable of transporting cargo or even people to outer space. Its core part is a cable called tether, anchored to the Earth's surface and extends to space.

Components

- 1) Base Station: This is the anchor; the cable will be connected on Earth. Various theories are being formulated on where to build this. It could be either on international waters or places with high altitudes, but where ever it is built, its structure would be designed to handle the pressure and support the cable.
- 2) Cable: This is the core component; a cable needs to support both the climbers and its weight, so deciding the material used to make this is very crucial so, a material of high strength and lightness is required. Currently, diamond nano threads are considered a candidate to make these cables.
- 3) Climbers: The cable moves up and down in a typical elevator, but the cables cannot move in a space elevator as they will be anchored at the base station. So, the climber is a box or container which climbs up the cable.
- 4) Apex Anchor: Its main purpose is to act as an opposing weight so that the centrifugal force acts on it and the elevator would be able to synchronize with the earth rotation

How Does it work

If we were to build a space elevator, the gravitational force, which is very high at the base station, would constantly pull the cable towards the Earth, and the centrifugal force which acts above the geostationary orbit would pull the counterweight away from Earth; these competing forces will see to that the cable will be held straight up over a single position on Earth. Then once this is achieved, the climbers could go up and down the cable by mechanical means.



- As it is evident, once this is built, the cost of traveling to space would exponentially reduce, and we will be saving a ton of fuel as well.
- Traveling to space would be so feasible that we could travel every day with multiple climbers.
- It has a massive lift-off capability; the initial lifting capability starts from 14MT to 79MT, and as the growth in the tether material increases, the capability will also increase proportionally.
- Colonization on the moon and Mars would now be possible faster.
- It could propel humans to deep space as the climber already has attained the escape velocity at the end of the elevator. We could use it as a gravitational slingshot to reach Jupiter and further travel from there into deep space.

Challenges

- The first one would be to find a material strong enough to build the elevator.
- The cable is put under constant tension, so it stands straight, raising a question of its durability.
- One major problem would be Debris that is orbiting the Earth. If any of it collides with the cable, the elevator will take significant damage; it may even collapse.

Comment

The concept has great potential, and it would significantly contribute to space exploration, the environment, and the economy. Yes, it has a few potential challenges scientists and researchers are constantly working to synthesize a material strong enough to build this project, and the project is estimated to be available to us in 20 years, so we as newly evolving engineers will be playing an excellent role for technologies like this to succeed.



India's First Solar Mission

by Swathi Kiran P

Aditya is a Sanskrit word that translates to "Sun" in English. Aditya-L1 is a planned coronagraph spacecraft to study the solar atmosphere. It was developed and designed by ISRO and many Indian research institutes. A Satellite placed in the halo orbit around the LaGrange point 1 (L1) of the Sun-Earth systems has the significant advantage of continuously viewing the Sun without any eclipses. The L1 point is 1.5 million kilometres away from earth. The satellite has six payloads with a great extent of science scope and objectives. This project got approved in January 2008, and it is to be launched during 2019-2020 by PSLV-XL from Srihari Kota.

Aditya-1 was meant to observe only the solar corona, outer layers of the Sun, extending to thousands of km above the photosphere is called the corona. Corona has a temperature of more than 1million degrees kelvin. There are still some unanswered questions about how corona gets heated to high temperatures. It takes 109 earth days to reach halo orbit after launch. The satellite has diverse objectives. It also includes coronal heating, solar wind acceleration, coronal magnetometry, origin, and monitoring of near-UV solar radiation. Besides the Aditya L-1, ISRO has planned eight launches in 2021, including the PSLV-C51, which was launched in February carrying Brazil's Amazonia-1 optical earth observation satellite and 18 co-passenger satellites from India and US.

The primary payload is coronagraph. The payloads with science objective and leadership institute for developing this payload are Visible Emission Line Coronagraph (VELC), Solar Ultraviolet Imaging Telescope (SUIT), Aditya Solar wind Particle Experiment (ASPEX), Plasma Analyser Package for Aditya (PAPA), Solar Low Energy X-ray Spectrometer (SoLEXS), High Energy L1 Orbiting X-ray Spectrometer (HELIOS), Magnetometer.



Satellite at L-1 point can view the Sun all the time, even during the eclipse, because the satellite is at halo orbit around L1. The launch mass of the satellite is 1,475kg (3,252 lb). And payload mass is 244kg (538 lb). According to ISRO, the expected launch date is between 2019-2021. However, due to corona pandemic situations, the launch has been delayed but now it is scheduled to launch in the third quarter of 2022.

