Space Exploration

It is the discovery and exploration of celestial structures in outer space by means of evolving and growing space technology. It is conducted both by unmanned robotic space probes and human spaceflight.

- We have come a long way long way since Sputnik 1.
- The first age of space exploration has come and gone. As scramble for space has begun, the next century promises to be exciting.

- **Purpose** - to figure out ways to make manned space exploration possible for large amounts of time, so that humans may be able to safely travel far away from Earth in the future.

The Future

- Deep Space exploration.
- Unfolding the mysteries of Sun.
- Understanding the cosmos using space based Gravitational Wave Observatory.
- Missions to the moons of Jupiter and Saturn.
- Lunar Space Station and Lunar Base.
- Expeditions to Mars.
- Asteroid Mining.
- Visiting Andromeda galaxy using solar sail technology.
- AI controlled spacecraft for Interplanetary Manned Travel.

.....and much more.

Image: NASA | Public Domain

Reusable Rockets

SpaceX is the first organisation to design and successfully use a reusable orbital thruster system. It was founded under the belief that a future where humanity is out exploring the stars is fundamentally more exciting than one where we are not.

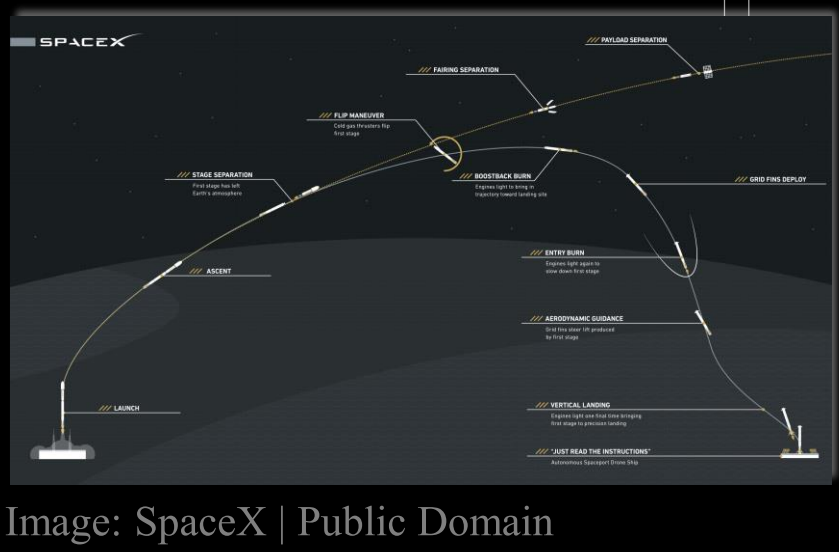


Image: SpaceX | Public Domain

Advantages:

- Substantial reduction in the cost to access the space
- Paving the way for the next phase of space exploration.
- Earth-to-Earth transportation in less than 30 mins.
- Multiple stable visits to Moon and Mars.
- Insight towards the Moon and Mars Base.

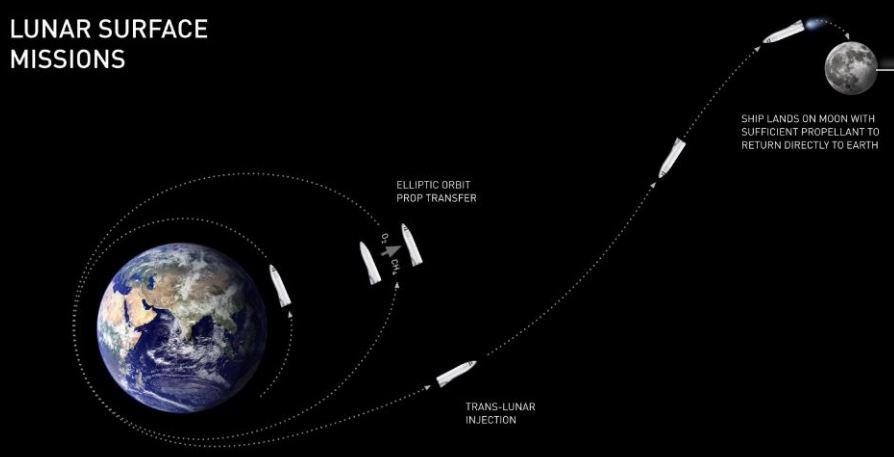


Image: SpaceX | Public Domain

Specifications of Falcon 9:

- Carries DragonX
- Merlin Engines
- Thrust Power – 8934 kN
- Grasshopper landing legs
- Lithium_Aluminium alloy body
- Refill cost – 200,000 USD

Road To The Red Planet

"You want to wake up in the morning and think the future is going to be great - and that's what being a spacefaring civilization is all about. It's about believing in the future and thinking that the future will be better than the past. And I can't think of anything more exciting than going out there and being among the stars."

Elon Musk, CEO and Lead Designer, SpaceX

Vision

To make humans a Multi-Planet species.

Challenges

- A huge Spacecraft for Interplanetary Transportation featuring Sleeping Pods, Workout Area, Research Labs, Oxygenator, Water Reclaimer, etc.

- Assurance of water resources and identification of hazards.; coping up with basic problem of radiation.

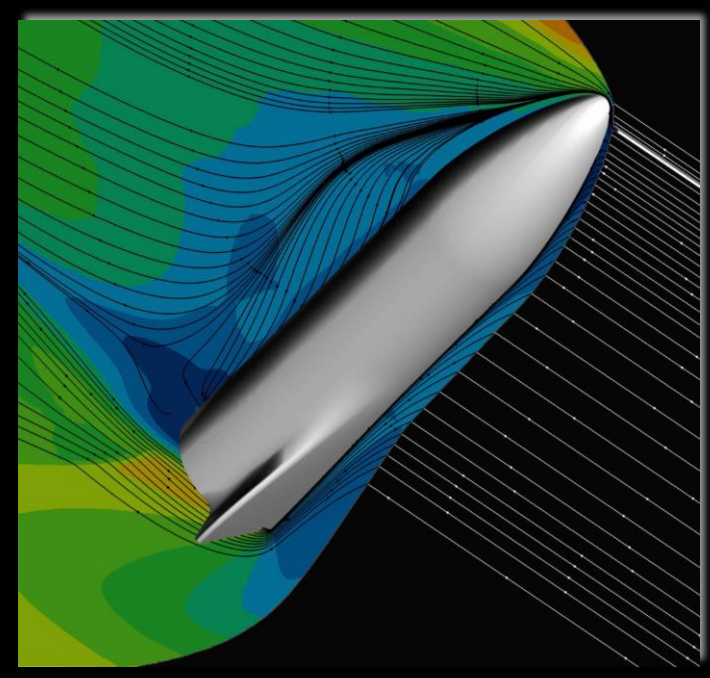
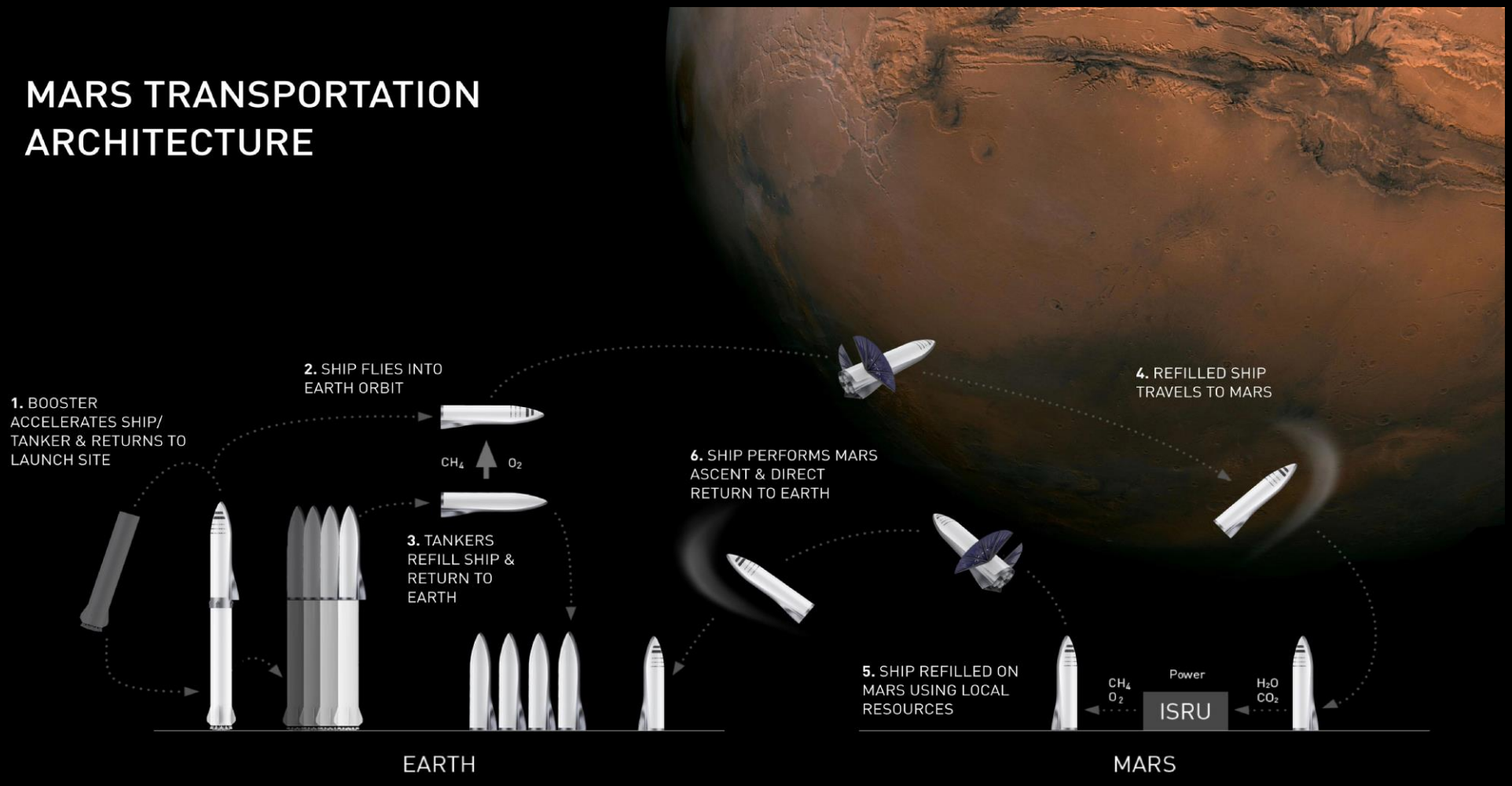


Image: SpaceX | Public Domain

- Mars entry and landing.



- A cost and fuel efficient, reusable rocket transport system for interplanetary travel.

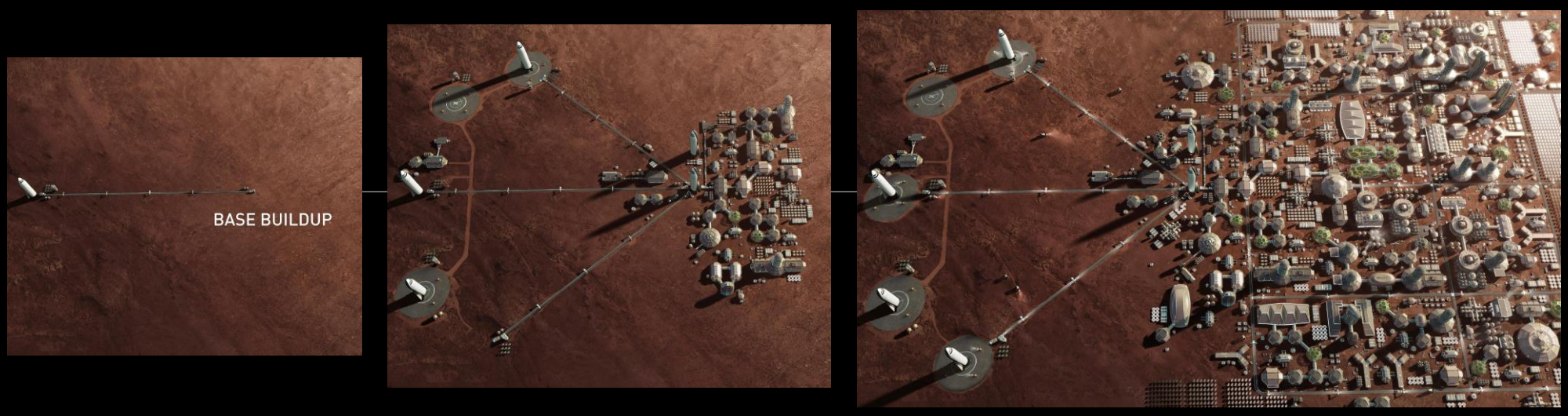


Image: SpaceX | Public Domain

- Setting up of initial power plant, mining and life support infrastructure.
- Physiological and Psychological issues and limitations of homo sapiens.
- Mars Base for human settlement.

Parker Solar Probe

Mission

To revolutionise the understanding of Sun.

Science Objectives

To provide new data on solar activity.

To trace the flow of energy and understand the heating of the solar corona.

Determine the structure and dynamics of the plasma and magnetic fields at the sources of the solar wind.

Explore mechanisms that accelerate and transport energetic particles.

Image: Ed Whitman / Applied Physics Laboratory

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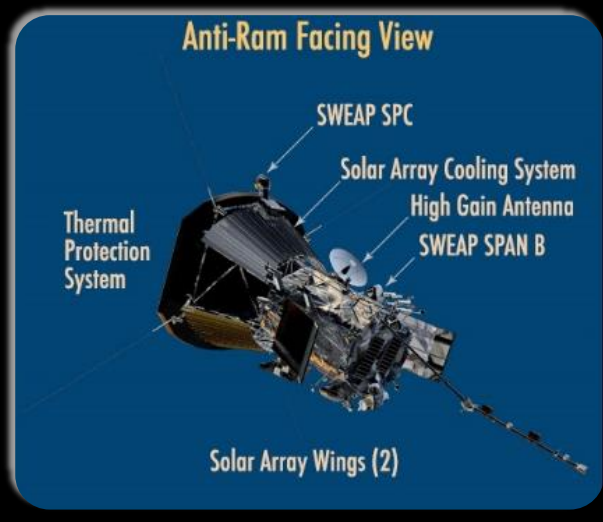
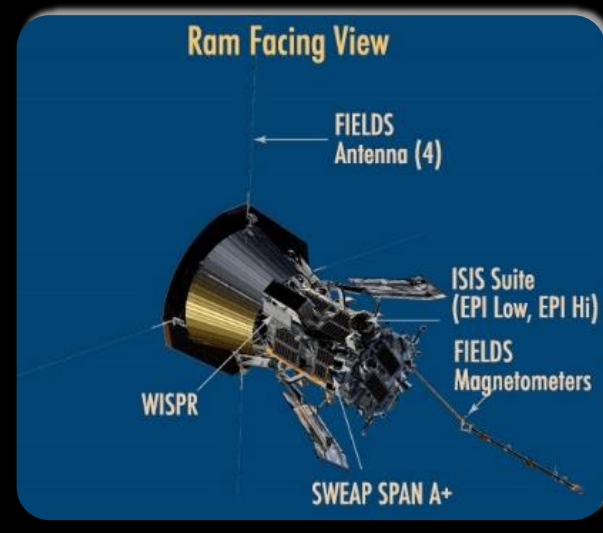
Benefit to Common Man

The mission will contribute critically to our ability to forecast major space-weather events that impact life on Earth. Information gathered by the probe may help us better prepare for violent solar winds, which are streams of charged particle emitted by the sun's corona.
The solar outbursts can affect electrical grids, harm satellites, disrupt electronics, and possibly lead to trillions of dollars' worth of damage.

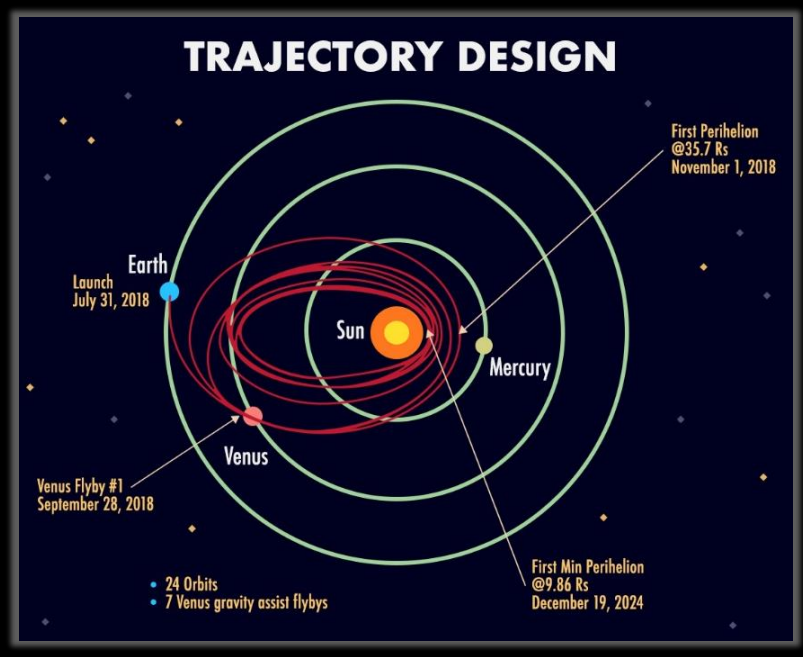
Probe Specifications





Path to Sun

- Speed ~430,000 miles per hour - Fastest Man-Made Probe.
- Closest approach: 3.83 million miles.



- Cost of Mission: 1.5 billion USD.
- Orbit period at closest approach: 88 days.

A Plaque dedicating NASA's Parker Solar Probe mission to its namesake, Eugene Parker, who first theorized the existence of the solar wind.

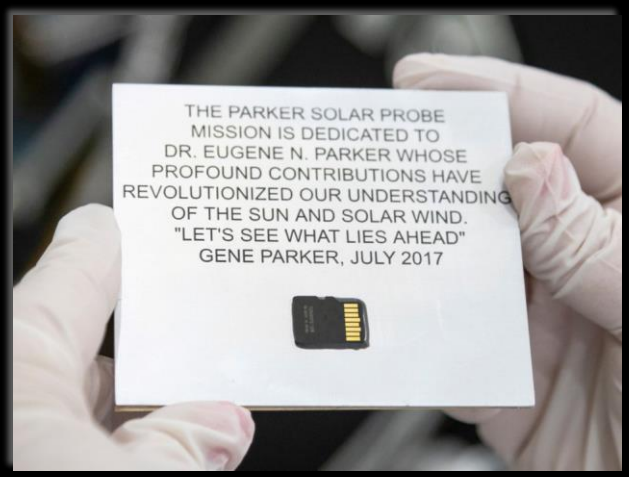
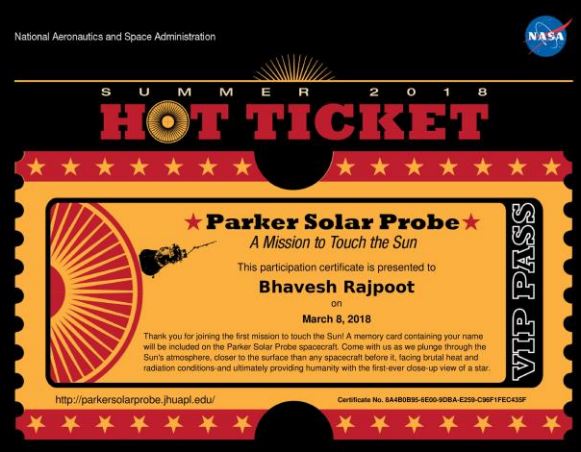


Image: Ed Whitman / Applied Physics Laboratory



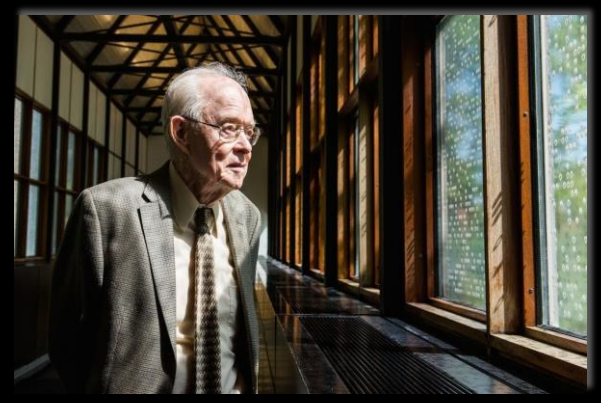


Image: UChicago Creative

Eugene Newman Parker

is an American Heliophysicist who developed the theory of the supersonic solar wind and predicted the Parker spiral shape of the solar magnetic field in the outer solar system.

Image: NASA/Kim Shiflett

Launch

- Launch: Aug. 12th, 2018.
- Launch Site: Cape Canaveral Air Force Station, Florida.
- Launch Vehicle: Delta IV-Heavy with Upper Stage.

James Webb Space Telescope

A large infrared telescope with a 6.5-meter primary mirror. The telescope will be launched on an Ariane 5 rocket from French Guiana in 2021.

Mission Objectives:

1.To study every phase in the history of our Universe.
2. To study the formation of solar systems capable of supporting life on planets like Earth.
3. To study the evolution of our own Solar System.

Mission Duration:

5 to 10 years

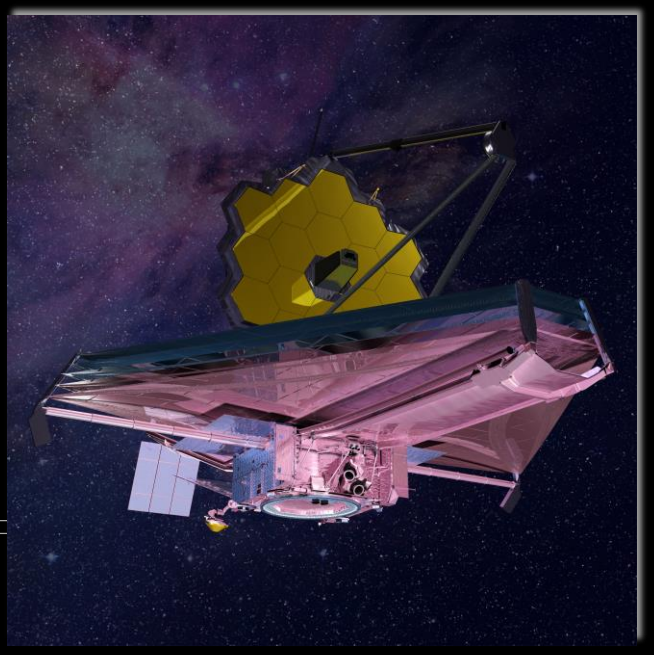
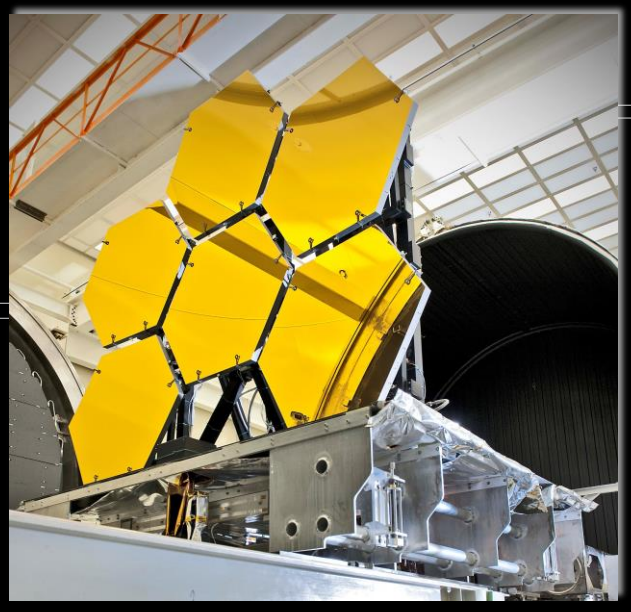


Image: Northrop Grumman



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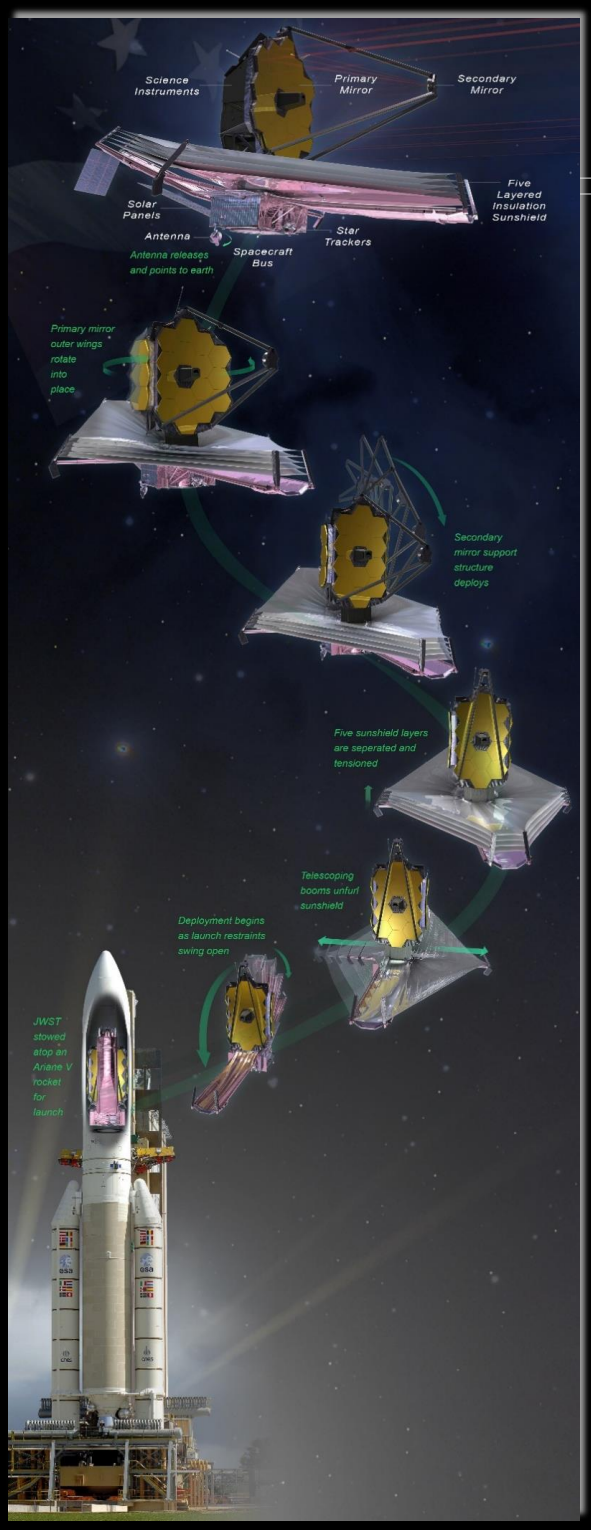

Image: Northrop Grumman

- **Orbit:** 1.5 million km from Earth orbiting the L2 Point
- **Operating Temperature:** under 50 K (-370 °F)

Specifications:

- Total payload mass: Approx. 6200 kg, including observatory, on-orbit consumables and launch vehicle adaptor.
- Clear aperture of primary Mirror: 25 sq. m
- Primary mirror material: Beryllium coated with Gold.
- Focal length: 131.4 m
- Number of primary mirror segments: 18
- Optical resolution: ~0.1 arc-seconds
- Wavelength coverage: 0.6 - 28.5 microns
- Size of sun shield: 21.197 m x 14.162 m (69.5 ft x 46.5 ft)

LIGO-India

It is a planned advanced gravitational-wave observatory to be located in India as part of the worldwide network. The project will be piloted and overseen by Department of Atomic Energy(DAE) and Department of Science and Technology(DST).

Design:

The proposed detector will be a Michelson Interferometer with Fabry-Perot enhanced arms of 4 km length and aims to detect differential changes in the arm-lengths as small as 10-23 Hz-1/2 in the frequency range between 30 to 800 Hz.

Scientific Benefits:

- Increase in the expected event rates, and will boost the detection confidence of new sources (by increasing the sensitivity, sky coverage and duty cycle of the network).
- Improvement in the ability of localizing GW sources in the sky 5 to 10 times of existing accuracy which will enable us to use GW observations as an excellent astronomical tool.

Image: The Virgo Collaboration/CCO

Lead Institutions:

- Institute of Plasma Research (IPR) Gandhinagar
- Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune
- Raja Ramanna Centre for Advanced Technology (RRCAT), Indore.

Project Site:

Dudhala village in Hingoli district,
Maharashtra

Impact on Indian science:

- This project will further inspire frontier research and development projects in India.
- Nature of the experiment is intrinsically multidisciplinary.
- This will bring together scientists and engineers from various fields.