"FAMOUS PHYSICISTS – CONTRIBUTION TO SCIENCE"

Study project submitted to

Department of Physics

By

B.Sc., (MPC& MPCS) Final year students

GOVERNEMENT DEGREE COLLEGE

KUKATPALLY, MEDCHAL DIST, TS

ACADEMIC YEAR -2020-21

Govt. Degree College, Kukatpally

PHYSICS PROJECT WORK

A.Y: 2020-2021

"FAMOUS PHYSICISTS - CONTRIBUTION TO SCIENCE"

Done By

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B.Sc. Final year students

Project Guide.

Dr. M. Kondaiah

Asst. prof. of Physics

GDC, Kukatpally

MAX PLANCK

Date of Birth : 23 April 1858

Date of Death : 4 October 1947

Inventions : Energy quanta & won Nobel prize

Awards : Nobel Prize (1918), Copley Medal (1929)

Planck made many substantial contributions to theoretical physics, but his fame as a physicist rests primarily on his role as the originator of quantum theory, which revolutionized human understanding of atomic and subatomic processes. In 1948, the German scientific institution Kaiser Wilhelm society was renamed Max planck society. By the age of ten he signed with the name Max and used this for rest of his life. Energy quanta is the foundation of all quantum physics including quantum chemistry quantum field theory, quantum technology. Wave functions of electron in hydrogen atom at different energy levels. Brighter areas represent a higher probability of finding the electron.


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Physics Project work

Chandrayaan - 2

Submitted by

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to

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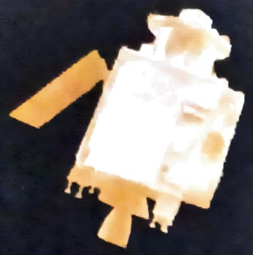


ORBITER
100km from
Lunar Surface

11 PAYLOADS
6 from India
3 from Europe
2 from USA

DISCOVERY OF WATER on Lunar Surface

MAPPING
of Chemicals,
3D Topography

PSLV
Spacecraft mass: 1.4T

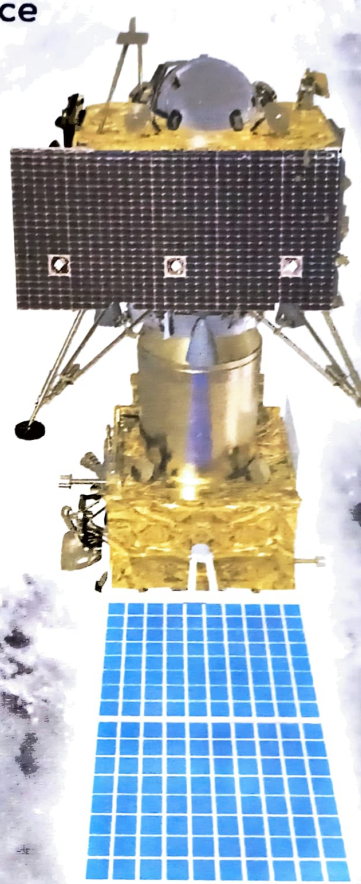
CHANDRAYAAN-1
Oct 2008

ORBITER
100km from
Lunar Surface

VIKRAM LANDER
Softlanding
Near South Pole

PRAGYAN ROVER
Insitu
Experiments

14 INDIAN PAYLOADS
8 on Orbiter
4 on Lander
2 on Rover



Expanding
Lunar
Exploration

GSLV MKIII
Spacecraft Mass: 3.8T

CHANDRAYAAN-2
Targeted- July 2019

MISSION CHANDRAYAAN-2

Introduction: Chandrayaan-2 is the second lunar exploration mission developed by the Indian space Research organisation (ISRO), after chandrayaan-1. It consisted of a lunar orbiter, the vikram lander, and the pragyan lunar rover, all of which were developed in India. It was the first mission in history to attempt soft landing near lunar south pole. The main scientific objective is to map and study the variations in lunar surface composition, as well as the location and abundance of lunar water.

The mission type chandrayaan-2 composite is lunar orbiter, lander, rover. The operator for chandrayaan-2 composite is Indian space Research organisation (ISRO)

* Mission duration

- Orbiter: ~ 7 years
  Elapsed: 4 months, 6 days
- Vikram lander: ≤ 14 days (planned)
  Achieved: 0 days (landing failure)
- pragyan rover: ≤ 14 days (planned);
  Achieved: 0 days (landing failure)

Spacecraft properties

The spacecraft properties are manufactured by Indian space Research organisation (ISRO)

* Launch mass

combined (wet): 3,850kg (8,490 lb)

combined (dry): 1,308kg (2,884 lb)

Orbiter (wet): 2,379kg (5,245 lb)

Orbiter (dry): 682kg (1,504 lb)

vikram lander (wet): 1,471 kg (3,243 lb)

Vikram lander (dry): 626kg (1,380 lb)

pragyan rover: 27kg (60 lb)

* power

orbiter: 1kW (1.3hp)

vikram lander: 650W

pragyan rover: 50W

Start of Mission

The start of Mission launch date is 22 July 2019, 14:43:12. IST (09:13:12 UTC). The start of Mission Rocket is GSLV Mark III M1. The launch site is Satish Dhawan space centre second launch pad. The start of mission contractor is Indian space Research organisation (ISRO)

Moon orbiter

The orbital insertion: 20 August 2019, 09:02 IST (03:32 UTC)

Orbital parameters

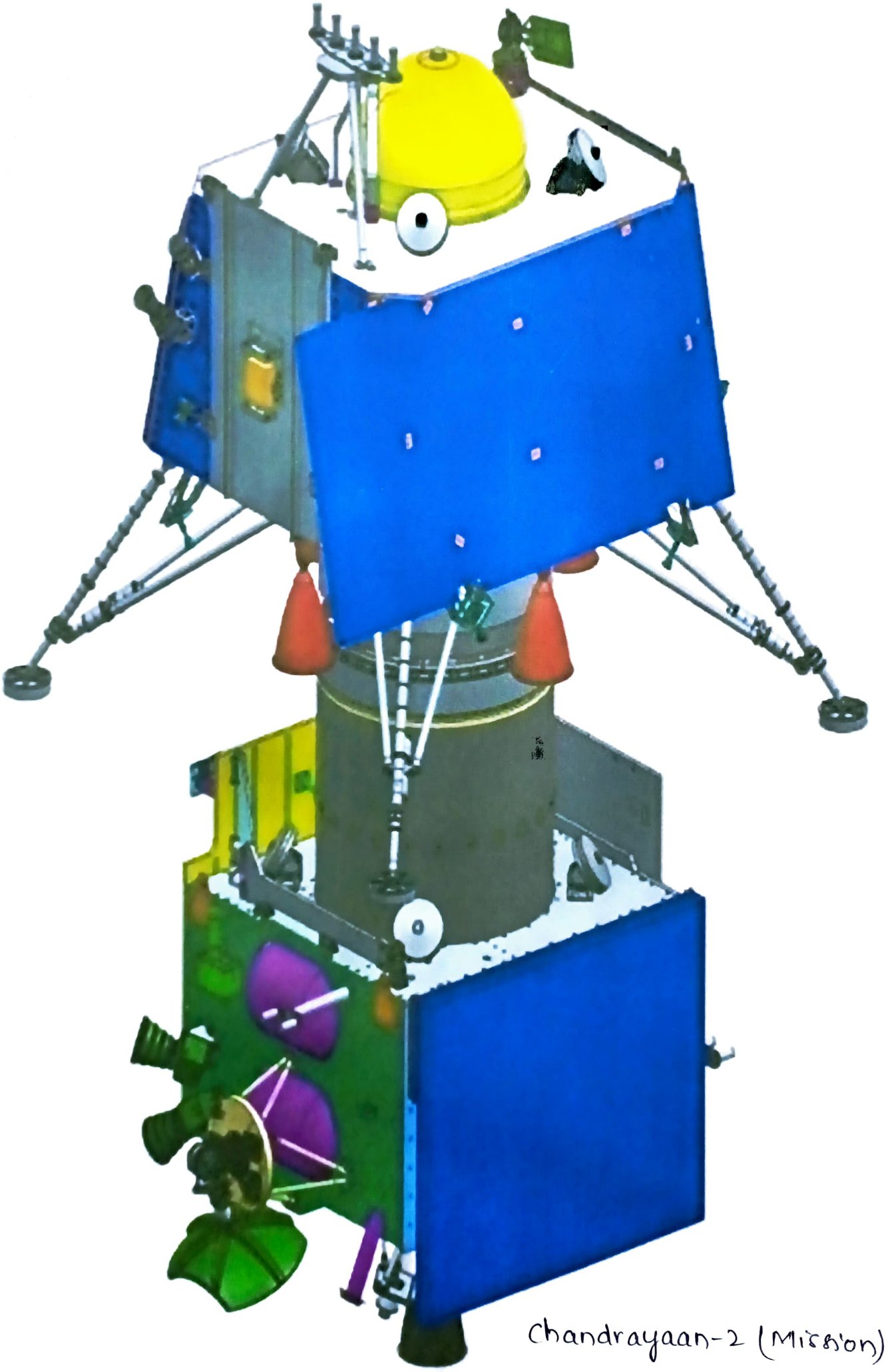
pericynthion altitude is 100km (62mi). The Apocynthion altitude is 100km (62mi). The Inclination is 90° (polar orbit)

Moon lander

The spacecraft component for Moon lander is Rover. Landing date is 7 September 2019, 01:53 IST (failure) (6 September 2019, 20:23 UTC).

The spacecraft was launched on its mission to the Moon from the second launch pad at the Satish Dhwan space centre on 22 July 2019 at 2.43 PM IST (09:13 UTC) by GSLV Mark III. The craft reached the Moon's orbit on 20 August 2019 and began orbital positioning manoeuvres for the landing of vikram lander. vikram and the rover were scheduled to land on the near side of the Moon, in the south polar region at a latitude of about 70° South on 6 September 2019 and conduct scientific experiments for one lunar day, which approximates two Earth weeks. A successful soft landing would have made India fourth country after USSR, US and PRC to do so. However, the lander deviated from its intended trajectory starting at 2.1 kilometres (1.3mi) altitude, and had lost communication when touchdown confirmation was expected. Initial reports suggesting a crash were confirmed by ISRO chairman K. Sivan, starting that "it must have been a hard landing". The Failure Analysis committee concluded that the crash was caused by a software glitch.

ISRO may re-attempt a soft landing by November 2020 with chandrayaan-3.



Chandrayaan-2 (Mission)

The proposed configuration would included a detachable propulsion module, a lander and a rover.

History

On 12 November 2007, representative of the Russian Federal space Agency (Roscosmos) and ISRO signed an aggrement for the two agencies to work together on the Chandrayaan-2 project. ISRO would have the prime responsibility for the orbiter and rover, while Roscosmos was to provide the lander. The Indian government approved the mission in a meeting of the Union cabinet, held on 18 September 2008 and chaired by prime Minister Manmohan singh. The design of the spacecraft was completed in August 2009, with scientists of both countries conducting a joint review.

Although ISRO finalised the payload for Chandrayaan-2 per schedule, the mission was postponed in January 2013 and rescheduled to 2016 because Russia was unable to develop the lander on time. Roscosmos later withdrew in wake of the failure of the Fobos-Grunt mission to Mars, since the technical aspects connected with the Fobos-Grunt mission were also used in the lunar projects, which needed to be reviewed. When Russia cited its inability to provide the lander even by 2015, India decided to develop the lunar mission independently.

The spacecraft's launch had been scheduled for

March 2018, but was first delayed to April and then to October to conduct further tests on the vehicle. On 19 June 2018, after the program's fourth comprehensive Technical Review meeting, a number of changes in configuration and landing sequence were planned for implementation, pushing the launch to the first half of 2019. Two of the lander's legs got minor damage during one of the tests in February 2019.

Chandrayaan-2 launch was initially scheduled for 14 July 2019; 21:21 UTC (15 July 2019 at 02:51 IST local time), with the landing expected on 6 September 2019. However, the launch was aborted due to a technical glitch and was rescheduled. The launch occurred on 22 July 2019 at 09:13 UTC (14:43 IST) on the first operational flight of a GSLV MK III M1.

Objectives

The primary objectives of the Chandrayaan-2 lander were to demonstrate the ability to soft-land on the lunar surface and operate a robotic rover on the surface. Scientific goals include orbital surface studies of lunar topography, mineralogy, elemental abundance, the lunar exosphere, and signatures of hydroxyl and water ice. The orbiter will map the lunar surface and help to prepare 3D maps of it.

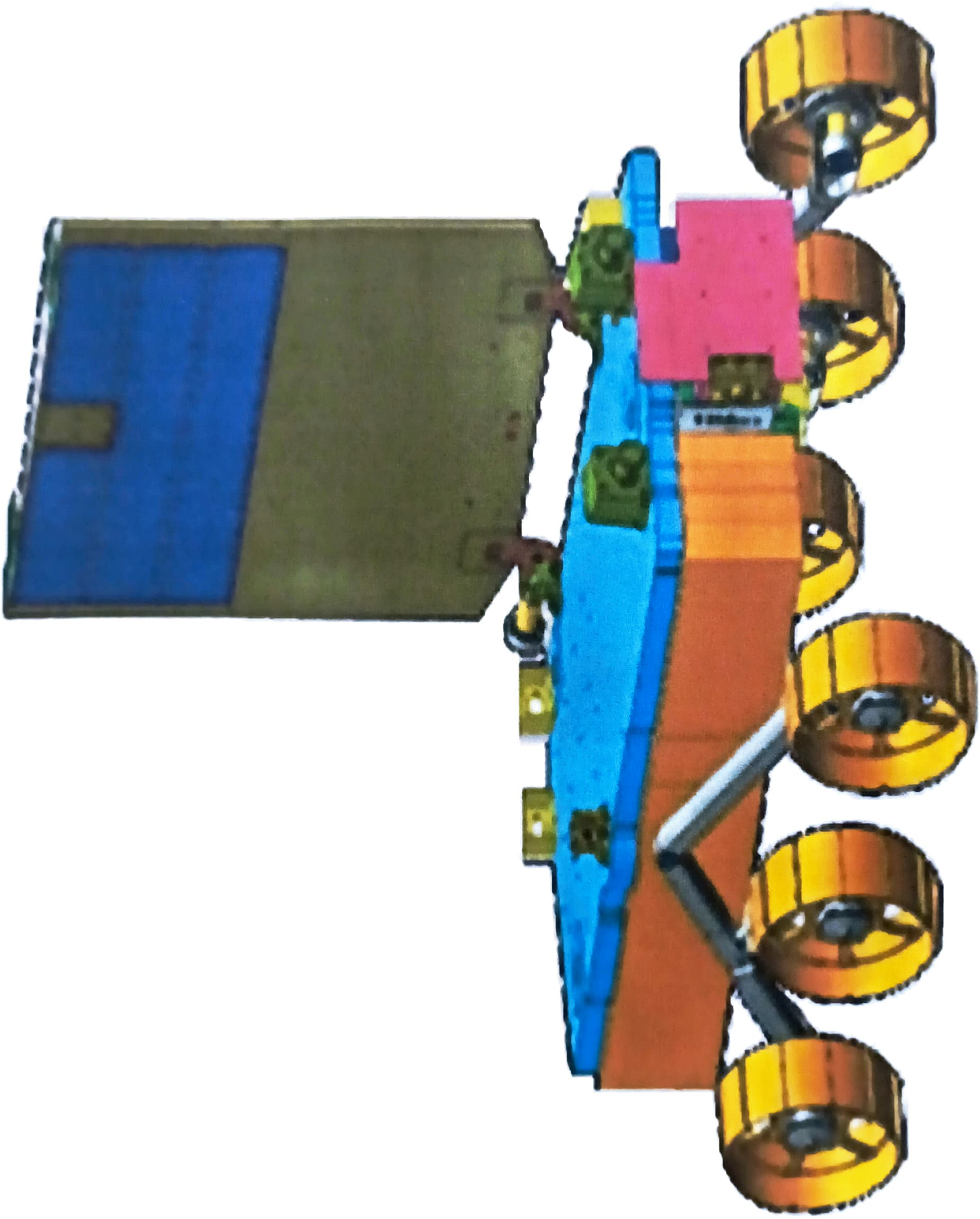
The order onboard radar will also map the surface while studying the water ice in the south polar region and thickness of the lunar regolith on the surface.

Design

The mission was launched on a Geosynchronous satellite launch vehicle Mark III (GSLV MK III) with an approximate lift of mass of 3,850 kg (8,490 lb) from satish Dhawan space centre on sriharikota Island. As of June 2019, the mission has an allocated cost of ₹ 9.78 billion (approximately US $141 million) which includes ₹ 6 billions for space segment and ₹ 3.75 billion as launch costs on GSLV MK III. chandrayaan-2 stack was initially put in an Earth parking orbit of 170 km perigee and 40,400 km apogee by the launch vehicle.

orbiter

As of september 2019, the chandrayaan-2 orbiter was oribiting the Moon on a polar orbit at an altitude of 100km (62mi). It carries eight scientific instruments; two of which are improved versions of those flown on chandrayaan-1. The approximate launch mass was 2,379 kg (5,245 lb). The mass was 2,379 kg. The orbiter High Resolution camera (OHRC) conducted high-resolution observations of the landing site prior to separation of the



Vikram Lander

lander from the orbiter. The orbiter's structure was manufactured by Hindustan Aeronautics Limited and delivered to ISRO satellite centre on 22 June 2015.

- Dimensions : 3.2 x 5.8 x 2.2 m
- Gross lift-off mass : 2,379 kg (5,245 lb)
- propellant mass: 1,697 kg (3,741 lb)
- Dry mass : 682 kg (1,504 lb)
- power generation capacity : 1000 w
- Mission duration: approximately 7.5 years, extended from the planned 1 year owing to the precise launch and mission management, in lunar orbit.

Vikram lander

The mission's lander is called vikram named after vikram sarabhai (1919-1971), who is widely regarded as the founder of the Indian space programme.

The vikram lander detached from the orbiter and descended to a low lunar orbit of 30 km x 100 km (19 mi x 62 mi) using its 800 N (180 lbf) liquid main engines. It then performed a comprehensive check of all its on-board systems before attempt a soft landing that would have deployed the rover, and perform scientific activities for approximately 14 Earth days. vikram spacecraft crash-landed.

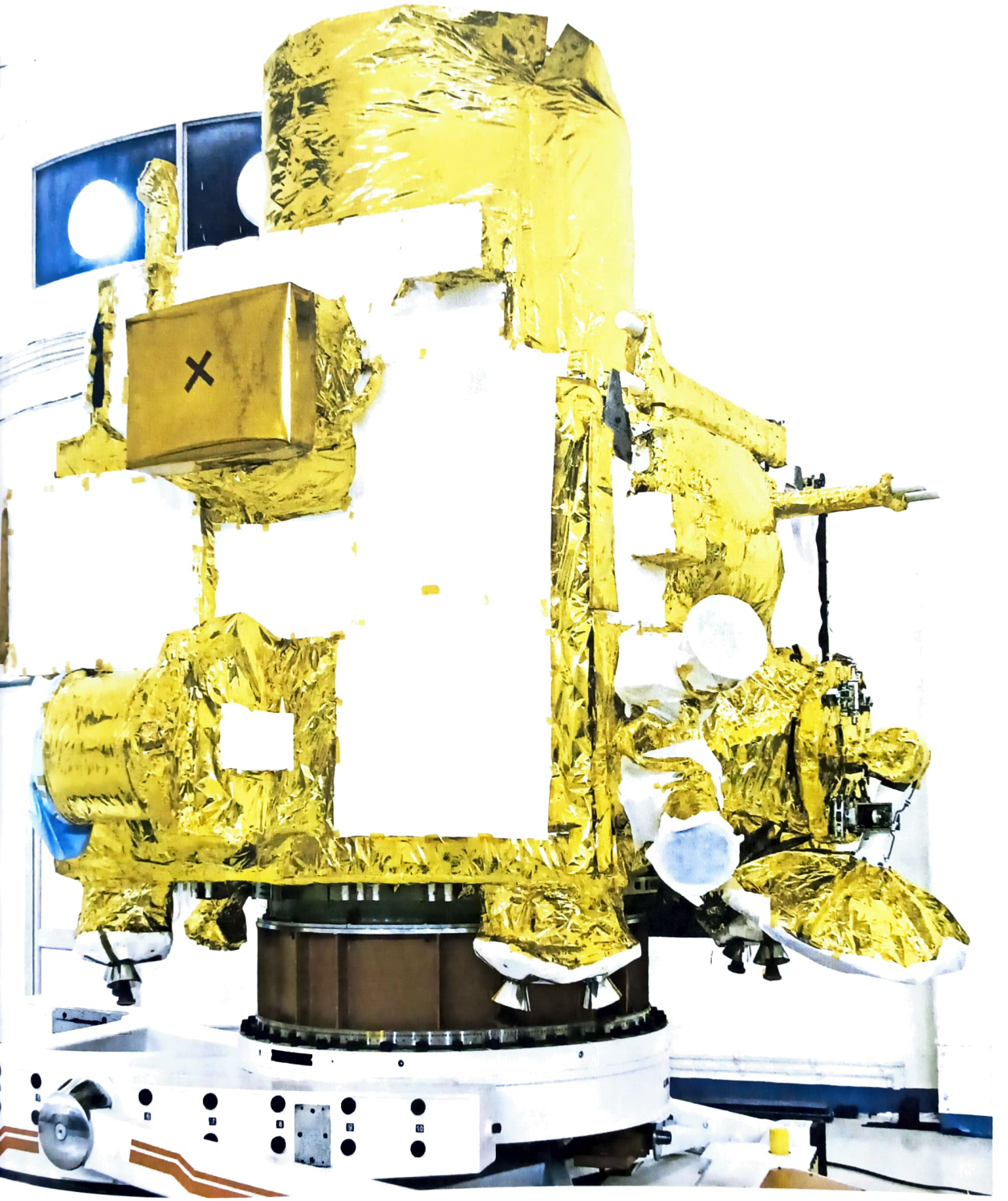
The approximate combined mass of the lander and rover is 1,471 kg (3,243 lb).

The preliminary configuration study of the lander was completed in 2013 by the Space Applications Centre (SAC) in Ahmedabad. The lander's propulsion system consists of eight 50N (11 lbf) thrusters for attitude control and five 800N thrusters for liquid main engines derived from ISRO's 440N (99 lbf) Liquid Apogee Motor. Initially, the lander design employed four main liquid engines, but a centrally mounted engine was added to handle new requirements of having to orbit the Moon before landing. The additional engine was expected to mitigate upward draft of lunar dust during the soft landing. Vikram was designed to safely land on slopes up to 12°.

Some associated technologies include a high resolution camera, laser Altimeter (LASA), Lander Hazard Detection Avoidance Camera (LHDAC), lander position Detection camera (LPDC), lander Horizontal velocity camera (LHVC), an 800N throttleable liquid main engine, attitude thrusters, Ka band radio altimeters (KaRA), Laser Inertial Reference & Accelerometer package (LIRAP), and the software needed to run these components.

Engineering models of the lander began undergoing ground and aerial tests in late october 2016, in Challakere in the Chitradurga district of Karnataka. ISRO created roughly 10 craters on the surface to help assess the ability of the lander's sensors to select a landing site.

- Dimensions: 2.54 x 2 x 1.2m
- Gross lift-off mass: 1,471 kg (3,243 lb)
- propellant mass: 845 kg (1,863 lb)
- Dry mass: 626 kg (1,380 lb)
- power generation capability: 650 W
- Mission duration: ≥ 14 days (one lunar day)



Pragyan rover

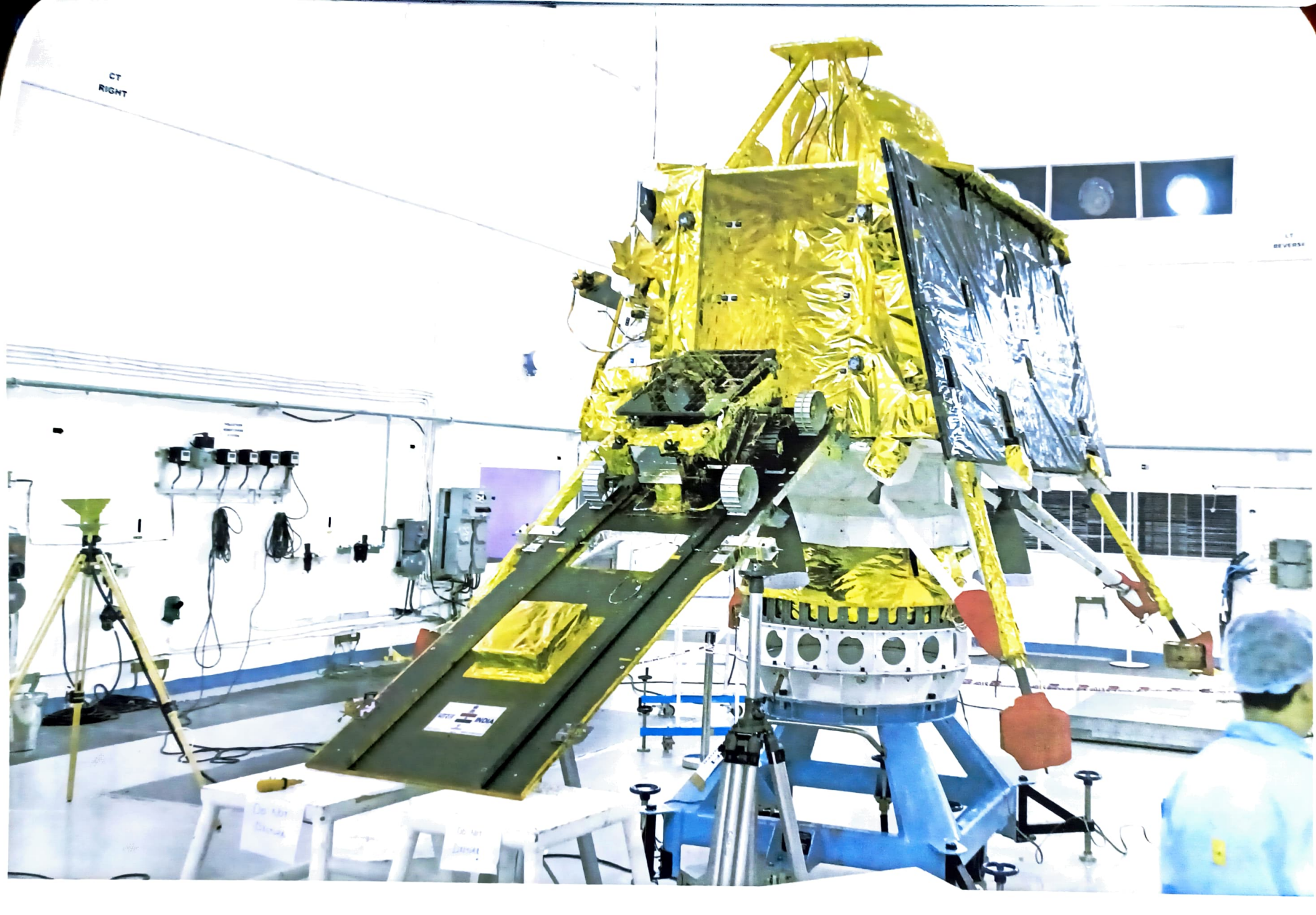
pragyan rover

The mission's rover is called pragyan with a mass of 27kg (60 lb), would have operated on solar power. The rover was to move on 6 wheels traversing 500meters on the lunar surface at the rate of 1 cm per second, perform on-site analyses and send the data to the lander, which would have relayed it to the Mission control on the Earth. For navigation, the rover uses:

- stereoscopic camera-based 3D vision: two 1 megapixel, monochromatic NAVCAMs in front of the rover to provide the ground control team a 3D view of the surrounding terrain, and help in path-planning by generating a digital elevation model of the terrain. IIT Kanpur contributed to the development of the sub-systems for light-based map generation and motion planning for the rover.
- Control and motor dynamics: the rover has a rocker-bogie suspension system and six wheels, each driven by independent brushless Dc electric motors. Steering is accomplished by differential speed of the wheels or skid steering.

The expected operating time of pragyan rover was one lunar day, or around 14 Earth days as its electronics were not designed to endure the frigid lunar night. However, its power system has a solar-powered sleep/wake-up cycle implemented, which could have resulted in longer service time than planned. Two aft wheels of the rover have the ISRO logo and the state emblem of India embossed on them to leave behind patterned tracks on the lunar surface, which is used to measure the exact distance travelled, also called visual odometry.

- Dimensions: 0.9 x 0.75 x 0.85m
- power: 50 w
- Travel speed: 1 cm/sec.
- Mission duration: ≤14 days (one lunar day)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Mission profile

Time line of operations

phase	Date	Event	Detail	Result	
				Apogee/ Aposelene	Perigee/ priselene
Geocentric phase	22 July 2019 09:13:12 UTC	Launch	Burn time: 16 min 14 sec	45,475 km (28,257 mi)	169.7 km (105.4 mi)
	24 July 2019 09:22 UTC	1st orbit-raising maneuver	Burntime: 48 sec	45,163 km (28,063 mi)	230 km (140 mi)
	25 July 2019 19:38 UTC	2nd orbit-raising maneuver	Burntime: 883 sec	54,829 km (34,069 mi)	251 km (156 mi)
	29 July 2019 09:42 UTC	3rd orbit-raising maneuver	Burn time: 989 sec	71,792 km (44,609 mi)	276 km (171.5 mi)
	02 August 2019 09:57 UTC	4th orbit-raising maneuver	Burntime: 646 sec	89,472 km (55,595 mi)	277 km (172 mi)
	6 August 2019 09:34 UTC	5th orbit-raising maneuver	Burn time: 1041 sec	142,975 km (88,841 mi)	276 km (171 mi)
	13 August 2019 20:51 UTC	Trans-lunar injection	Burn time: 1203 sec	–	–

Selenocentric phase	20 August 2019 03:32 UTC	Lunar orbit insertion 1st lunar bound maneuver	Burn time: 1738 sec	18,072 km (11,229 mi)	114 km (71 mi)
	21 August 2019 07:20 UTC	2nd lunar bound maneuver	Burn time: 1228 sec	4,412 km (2,741 mi)	118 km (73 mi)
	28 August 2019 03:34 UTC	3rd lunar bound maneuver	Burn time: 1190 sec	1,412 km (877 mi)	179 km (111 mi)
	30 August 2019 12:48 UTC	4th lunar bound maneuver	Burn time: 1155 sec	164 km (102 mi)	124 km (77 mi)
	1 September 2019 12:51 UTC	5th lunar bound maneuver	Burn time: 52 sec	127 km (79 mi)	119 km (74 mi)
	2 September 2019 7:45 UTC	1st deorbit Vikram separation	Burn time: 4 sec	128 km (80 mi)	104 km (65 mi)
	3 September 2019 3:20 UTC	1st deorbit burn	Burn time: 4 sec	128 km (80 mi)	104 km (65 mi)
	3 September 2019 22:12 UTC	2nd deorbit burn	Burn time: 9 sec	101 km (63 mi)	35 km (22 mi)
	6 September 2019 20:08 UTC	powered descent	Burn time: 15 min	Landing (planned	Landing (planned)

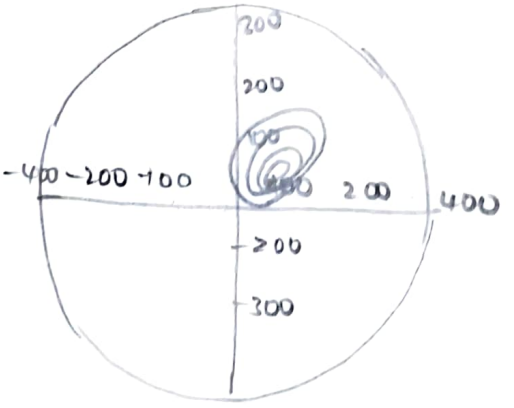

S200
INDIA

Launch:

Finally chandrayaan-2 was launched on baard the GSLV MK III M1. launch vehicle on 22 July 2019 at 09:13 UTC (14:43 IST) with better than expected apogee as a sult of the cryogenic upper stage being burned to pletion, which later eliminated the need for one of the rogee-raising burns during the geocentric phase of mission. his also resulted in the saving of dround 40 kg fuel n board the spacecraft.

Immediatly after launch, multiple obeervations of a low moving bright object over australia were made hich could be related to upper stage venting of residual LOX/LH2 propellant after the main burn

Geocentric phase:



Vikram seperation

After being placed into a 45,457 x 169 km parking orbit by the launch vehicle, the chandrayaan-2 spacecraft stack gradually raised its orbit using on board propulation over 22 days. In this phase, one perigee-raising and five apogee-raising burns were performed to reach a highly ecentric orbit of 142,975 x 276 km followed by trans-lunar injection on 13 August 2019. Such long Earth-bound phase with multiple orbit-raising manoeuvres exploiting the oberth effect was required because of the limited lifting capacity of the launch vehicle and trust of the spacecraft's on board populsion system. A similar strategy was used for chandrayaan-1 and the Mars orbiter Mission during their Earth-bound phase trajectory.

On 3 August 2019, the first set of Earth images were captured by the L14 Camera on the Vikram lander, showing North American landmass.

Team :

Key Scientists and engineers involved in the development of chandrayaan-2 include

* Ritu Karidhal - Mission Director
* Muthayya Vanitha - Project Director
* K. Kalpana - Asscociate project Director
* G. Narayanan - Associate project Director
* G. Nagesh - Project Director
* Chandrakanta kumar - Deputy project Director
* Amitabh singh - Deputy project Director (Radio frequency systems)