

# “ISRO’S ACHIEVEMENT ON “PSLV-C25” AND A TACTFUL STEP TOWARDS USA: AN ANALYSIS”

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## *Abstract-*

On Wednesday, 24 September 2014 NASA congratulates ISRO on its successful mission. NASA's Mars Atmosphere and Volatile Evolution (MAVEN) is currently orbiting Mars and had entered the orbit on Monday. NASA Administrator Charles Bolden congratulated India for its Mars success in a statement the space agency released Wednesday (Sept. 24). "It was an impressive engineering feat, and we welcome India to the family of nations studying another facet of the Red Planet. We look forward to MOM adding to the knowledge the international community is gathering with the other spacecraft at Mars," Bolden said. On September 30, 2014, U.S. India is only country which has been successful in its very first attempt. These, are all accomplishments, that will go down as landmarks, in history. Obama stated to Modi that it is for sure that India can emerge as a major power. It somehow gives a positive alarm to lead mutual beneficial relations. In fact two days after prime minister Narendra Modi returned from his successful trip to the United States, foreign policy experts express a deep sense of satisfaction that the India-United States relations which have been dormant in the last few years have been revived.

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**Key words-** foreign policy, spacecraft, NASA, ISRO, MOM, Mutual beneficial relations.

## **Introduction-**

Since 26<sup>th</sup> may 2014, commencement of the Modi Govt has been strengthened foreign policy dynamically. Along with External Affairs Minister Sushma Swaraj, PM Narendra Modi extended neighborhood in Southeast Asia and the major global powers. In pursuit of this, he has made official visits to Bhutan, Nepal, Japan and Brazil within the first 100 days of his administration followed by United States. Recently soon after the Mar Orbiter Mission victory the five days trip included attending the sixty-ninth session of the United Nations General Assembly in New York and giving a talk in New York City's Madison Square Garden to an audience of over 18,000 including Indian diaspora has indicated a strong diplomatic ties with USA. Both Countries embarked towards a new path in the bilateral relationship with the imminent NASA-ISRO Synthetic Aperture Radar (NISAR) mission which is indeed a platform for India to prove better.

The ISRO's (Indian Space Research Organization) impressive maiden interplanetary mission to Mars, Mars Orbiter Mission, got off to a flying start on 5th of November 2013 from the Satish Dhawan Space Centre at Sriharikota. The launch vehicle - PSLV-C25 successful injected the Spacecraft into an Elliptical Parking Orbit around earth. It was a close to ideal launch for the Mangalyan spacecraft, the 25th successful mission carried out by the PSLV rocket, the trusted workhorse of ISRO. The spacecraft first going into orbit around the earth signalled the start of its 300-day voyage to the Red Planet. If everything goes well during this complex and challenging journey through deep space, it will be put into the Mars orbit on September 24, 2014. The orbiter weighs about 1,350 kg and will carry five instruments to conduct a battery of remote-sensing experiments on the accessibility of methane on the Red Planet, its upper atmosphere, its surface features, mineralogy and so on. One of the main objectives of the first Indian mission to Mars is to develop the technologies required for design, planning, management and operations of an interplanetary mission. From technological viewpoint, ISRO is looking at the mission that would help in plan and understanding of a Mars orbiter with a capability to survive and perform Earth bound man oeuvres, cruise phase of 300 days, Mars orbit insertion / capture, and on-orbit phase around Mars. It will also explore

possibilities of deep space communication, navigation, mission planning and management and incorporate autonomous features to handle contingency situations. The scientific objectives which ISRO intends to achieve is the exploration of Mars surface features, morphology, mineralogy and Martian atmosphere."We have gone beyond the boundaries of human enterprise and innovation," Prime Minister Narendra Modi said after the tremendous success of MOM. India triumphed in its first interplanetary mission, placing a satellite into orbit around Mars on Wednesday(24<sup>th</sup> Sept2014) morning and projecting the country into an privileged club of deep-space explorers. Scientists broke into wild cheers as the orbiter's engines completed 24 minutes of burn time to maneuver the spacecraft into its designated place around the red planet.

While ISRO has been researching for a Mars mission since years, the project was only approved by the government in August 2012. It took ISRO just a little over a year to put together the spacecraft and the project. In August 2013, ISRO announced that a mission to Mars will soon be launched, and on November 5th, the PSLV rocket carrying Mangalyaan left for its 300-day journey to Mars. Space history was made today when India's car sized Mars Orbiter Mission (MOM) successfully fired its braking rockets and arrived in Mars orbit today (Sept. 23 EST/Sept. 24 IST) on the nation's first attempt to explore the Red Planet. Indeed MOM is India's maiden interplanetary voyager and "created history."India thereby joins an elite club of only three other entities who have launched probes that successfully investigated Mars - following the Soviet Union, the United States and the European Space Agency (ESA).

#### **Mission Plan of PSLV C25/MOM-**

- November 5: PSLV puts spacecraft into an elliptical orbit, 250 km at its closest to Earth and 23,500 km at its farthest.
- Spacecraft's onboard engine fires five times in the coming days, increasing velocity and lengthening the elliptical orbit.
- December 01 2013 - Departure for Mars: The engine fires for the sixth time, accelerating the spacecraft beyond Earth's escape velocity of 11.2 Km/second
- After a journey of almost 300 days and covering 680 million km, the spacecraft will reach its destination.

- September 24, 2014 – Arrival at Mars: Spacecraft's engine fires to reduce velocity and put it into an elliptical orbit, 365 km at its closest to Mars and 80,000 km at its farthest.

## **ISRO-**

The **Indian Space Research Organization** ISRO is among the largest government space agencies in the world. Its primary objective is to advance space technology and use its applications for national benefit. Established in 1969, ISRO superseded the erstwhile Indian National Committee for Space Research (INCOSPAR). Headquartered in Bangalore, ISRO is under the administrative control of the Department of Space of the Government of India. K. Radhakrishnan is the ISRO's current chairman.

ISRO, the organization which was started in early 1962 by Vikram Sarabai just a few years after NASA was founded in 1958 has reached some admirable milestones in the recent past. Esp after the year 2001, it has been a tremendous achievement for ISRO to reach some milestones

1. ISRO's first satellite – Aryabhata was launched in 1975
2. In 1980, we had the first satellite from India launched by an Indian made launch vehicle.
3. ISRO launched its first lunar probe in 2008 – Chandrayaan which is claimed to have achieved 95% of its objectives.
4. ISRO's moon probe discovered the presence of water molecules in the moon soil
5. It has now launched the moon probe which has successfully entered the orbit and the skies look a little bright from here.

ISRO's Mars Orbiter Insertion is a resounding success, making India the first country to be successful on its maiden Mars mission. Nicknamed 'Mangalyaan', the success of the Mars

Orbiter Mission will boost India's five-decade-old space programme. Prime Minister Narendra Modi congratulated ISRO's scientists and addressed the country on the historic occasion.

Moreover, the Mars Orbiter Mission is India's first interplanetary mission. It was launched on November 5, 2013 from Sriharikota in Andhra Pradesh with the powerful Polar Satellite Launch Vehicle (PSLV) The mission was approved by the Indian government in August 2012 and was executed in 15 months at a cost of Rs. 450 crore (\$74 million).

Today's mission was to manoeuvre the spacecraft and slow its speed using the 440 Newton Liquid Apogee Motor engine aboard the spacecraft to help it enter Mars' orbit. The engine had been idle for almost 300 days and was fired up today for 24minutes to reduce its speed from 22.1 km per second to 4.4 km per second .The challenge lay in getting the probe's trajectory right and slowing it down so it can be captured by Mars' orbit.

Starting the liquid engine was crucial in controlling the velocity of the craft as it enters Mars' orbit. If this attempt had not worked, ISRO would have made another attempt using eight fuel powered thrusters. The Mars Orbiter Mission or MOM was conceived, planned and implemented by ISRO on an extremely modest budget of Rs 450 crore or \$67 million..

### **PSLV-C25/MOM-**

The Polar Satellite Launch Vehicle, usually known by its abbreviation PSLV is the first operational launch vehicle of ISRO. PSLV is capable of launching 1600 kg satellites in 620 km sun-synchronous polar orbit and 1050 kg satellite in geo-synchronous transfer orbit. In the standard configuration, it measures 44.4 m tall, with a lift off weight of 295 tonnes. PSLV has four stages using solid and liquid propulsion systems alternately. The first stage is one of the largest solid propellant boosters in the world and carries 139 tonnes of propellant. A cluster of six strap-ons attached to the first stage motor, four of which are ignited on the ground and two are air-lit. The Polar Satellite Launch Vehicle (PSLV) caters to the requirements of launching satellites into Sun-Synchronous and Low Earth Orbits. PSLV is a Fourstage vehicle with alternate Solid and Liquid propulsion stages. The booster stage along with the strap-on motors and the third stage are solid motors while the second and Fourth stages use liquid engines. PSLV

has the capability to launch 1750 kg class satellites into 600 km Sun-Synchronous Polar Orbit (SSPO) and 1425 kg satellites into Sub-Geosynchronous Transfer Orbit (Sub GTO) of 284 km X 21000 km. The vehicle has provision to launch multiple satellites. PSLV has successfully accomplished 2 developmental and 21 operational Missions in a row. It has established itself as a work horse operational launcher of ISRO and has a demonstrated reliability of 0.96. Currently two variants of PSLV are operational, namely PSLV-XL (with six extended strap-on motors attached to the First stage) and PSLV-Core Alone (without strap-on motors). PSLV-C25/Mars Orbiter Mission employs the PSLV-XL version which has already been used in Four earlier Missions.

India's Mars mission – the Mars Orbiter Mission – or as informally known: *Mangalyaan* - is built with a cost of Rs. 454 crores ( Rs. 12 per km). It is the cheapest Mars mission, ever! It's a historic moment for India and space research worldwide as ISRO's Mars Orbiter Mission (MOM), dubbed as *Mangalyaan*, successfully entered the Martian orbit. The tense moments in the control station was followed by rounds of applause when the mission director, Kiran Kumar, announced the successful ejection of MOM into the elliptical orbit of Mars, which meant success for India's maiden Mars mission. *Mangalyaan*, which means "Mars craft" in many Indian languages, is said to be the size of a Tata Nano car. The craft was launched in November 2013, aboard India's Polar Satellite Launch Vehicle-C25 rocket. *Mangalyaan's* mission was to gauge India's ability to place a spacecraft in Martian orbit and develop technologies that would be required for future interplanetary missions.

### **Mars Orbiter Mission: Chronology of events:-**

Following is the chronology of events that traces the journey of *Mangalyaan* which lasted over 300 days:

5 November 2013: ISRO's PSLV C25 launches India's Mars Orbiter Mission from Sriharikota, Andhra Pradesh.

7 November 2013: First Earth-bound manoeuvre performed.

8 November 2013: Second Earth-bound manoeuvre performed.

9 November 2013: Third Earth-bound manoeuvre performed.

11 November 2013: Fourth Earth-bound manoeuvre performed.

12 November 2013: Fifth Earth-bound manoeuvre performed.

16 November 2013: Sixth Earth-bound manoeuvre performed.

1 December 2013: MOM leaves Earth's orbit, Trans-Mars Injection performed.

4 December 2013: MOM leaves Earth's Sphere of Influence of 9.25 lakh km radius.

11 December 2013: First course correction manoeuvre performed on the spacecraft.

11 June 2014: Second course correction manoeuvre executed.

22 September 2014: MOM enters Mars' Gravitational Sphere of Influence; 440 Newton Liquid Apogee Motor test-fired after over 300 days of dormancy; last trajectory correction manoeuvre performed.

**24 September 2014:** MOM reaches the intended orbit around Mars, making India the first country in the world to have successfully launched its mission to the Red Planet on the very first attempt.

### **Objectives of the mission:-**

The primary objective is to conduct meaningful experiments such as looking for signs of life, taking pictures of Mars and studying the Martian environment. It will look for evidence of methane, whose presence can indicate if earth's closest neighbour has an environment to support life. The mission will include exploring the planet's surface features, morphology, mineralogy and atmosphere by indigenous scientific instruments. It would also help fill the technology gaps in interplanetary explorations.

### **India's step towards US –**

On Wednesday, 24 September 2014 NASA congratulates ISRO on its successful mission. NASA's Mars Atmosphere and Volatile Evolution (MAVEN) is currently orbiting Mars and had entered the orbit on Monday. NASA Administrator Charles Bolden congratulated India for its Mars success in a statement the space agency released Wednesday (Sept. 24). "It was an impressive engineering feat, and we welcome India to the family of nations studying another facet of the Red Planet. We look forward to MOM adding to the knowledge the international community is gathering with the other spacecraft at Mars," Bolden said. On September 30,

2014, U.S., India to Collaborate on Mars Exploration, Earth-Observing Mission In a meeting Tuesday in Toronto, NASA Administrator Charles Bolden and K. Radhakrishnan, chairman of the Indian Space Research Organization (ISRO), signed two documents to launch a NASA-ISRO satellite mission to observe Earth and establish a pathway for future joint missions to explore Mars. While attending the International Astronautical Congress, the two space agency leaders met to discuss and sign a charter that establishes a NASA-ISRO Mars Working Group to investigate enhanced cooperation between the two countries in Mars exploration. They also signed an international agreement that defines how the two agencies will work together on the NASA-ISRO Synthetic Aperture Radar (NISAR) mission, targeted to launch in 2020. will make global measurements of the causes and consequences of a variety of land surface changes on Earth.

American space agency has been incredibly supportive of our Mars Orbiter Mission. NASA's futuristic Deep Space Network (a collection of huge satellite antennas around the world that allow for navigation in interplanetary space) has been crucial to the mission, helping the Mangalyaan navigate the space where India's own Deep Space Network has no reach. Around the time when MOM was to be launched, American Government was facing a government shutdown and despite that, NASA stood by its word of providing communications and navigation facilities for the mission. Two weeks after MOM's launch, NASA's MAVEN, the mission of which is to study the upper Martian atmosphere, was launched and it made its orbital insertion two days ago. ISRO & NASA now plan to work closely together, sharing findings of either missions. The success of India's Mars Orbiter Mission, affectionately nicknamed MOM, brings India into an elite club of Martian explorers that includes United States, the European Space Agency and the former Soviet Union. The success of the Mars Orbiter Mission, lauded for its low price tag of \$74 million, will boost India's five-decade-old space programme that newly elected Prime Minister Narendra Modi aims to enlarge with better infrastructure and technology.



## **PM Narendra Modi's trip to USA- (25<sup>th</sup> Sept to 30<sup>th</sup> Sept 2014)-**

Indian Prime Minister Narendra Modi has visited New York and Washington, D.C. from September 25-30. This was his first visit to the U.S as leader of the world's largest democracy and the first opportunity for the prime minister and President Barack Obama to meet. Modi was also engaged with congressional leaders, the private sector and members of the Indian diaspora. The goal was to build on the India-U.S. relationship, which had bilateral, regional and multilateral dimensions. It also encompassed interaction in the fields of economics and trade, energy and climate change, cyber-governance, counter-terrorism, counter-proliferation, and defense issues, as well as health and immigration. Apart from these during delivering speech at New York City's Madison Square Garden he mentioned that Journey to Mars cheaper than auto ride, metaphor of cost of travel by auto in Ahmedabad to the expenditure incurred in the landmark Mars Orbiter Mission (MOM) which India accomplished in the very first attempt. "A one-kilometre auto rickshaw ride in Ahmedabad takes Rs 10 and India reached Mars at Rs 10 per kilometre which is really amazing.

### **Conclusion-**

In a nutshell, it is matter of proud for all Indians, for the first Mars mission from India reaching a resounding success takes India to the honors of being the first Asian country to reach Mars. ISRO has made tremendous progress over the years, like the director, Mr Radhakrishnan, said. Mangalyaan have sent 3D image, now its time for celebrating success and on the other hand according to Modi- Our scientists have achieved this at a cost which is lesser than some Hollywood movies defines that how India can use the technology skillfully and tactfully .It is authenticated that, for such a historical victory it has been included a indigenous effort in fact a pan-Indian effort, stretching from Bangalore to Bhubaneswar, and Faridabad to Rajkot. None of the nations have been successful in maiden attempt, India is only country which has been successful in its very first attempt. These, are all accomplishments, that will go down as landmarks, in history. Obama stated to Modi that it is for sure that India can emerge as a major power. It somehow gives a positive alarm to lead mutual beneficial relations. In fact two days after prime minister Narendra Modi returned from his successful trip to the United States, foreign policy experts express a deep

sense of satisfaction that the India-United States relations which have been dormant in the last few years have been revived.

## References

- "India becomes first country to enter Mars' orbit on their first attempt". *Herald Sun*. 24 September 2014 in Morning 8:15 Indian Time. Retrieved 24 September 2014.
- "Mars Orbiter Spacecraft completes Engine Test, fine-tunes its Course". *Spaceflight 101*. 22 September 2014. Retrieved 2014-09-24.
- "India celebrates Mars mission 'cheaper than a movie'", *The Telegraph*, 4/10/2014.
- "India celebrates putting satellite into orbit around Mars" *The Telegraph*, 4/10/2014.
- "Isro, Nasa set up joint Mars working group", *Times Of India*, 02/10/2014.
- Lakshmi, Rama. "Modi's speech in Nepal shows India is paying attention to its neighbors". *The Washington Post*. Retrieved 6 August 2014
- "Mangalyaan sends photo of dust storm over Mars's northern hemisphere", *Times Of India*, 30 Sep 2014,
- A faster, cheaper Mars orbiter, *THE HINDU*, September 25, 2014
- Available on- <http://www.telegraph.co.uk/news/worldnews/asia/india/11119362/India-celebrates-Mars-mission-cheaper-than-a-movie.html>
- Available on- <http://www.telegraph.co.uk/science/space/11117714/India-celebrates-putting-satellite-into-orbit-around-Mars.html>
- [facebook.com/isroofficial](https://www.facebook.com/isroofficial)
- [http://en.wikipedia.org/wiki/Mars\\_Orbiter\\_Mission](http://en.wikipedia.org/wiki/Mars_Orbiter_Mission)
- <http://www.thehindu.com/sci-tech/science/indias-mars-orbiter-to-reach-red-planet-in-33-days-isro/article6344664.ece>
- <http://www.thehindu.com/sci-tech/science/interview-with-isro-chief-dr-k-radhakrishnan-isro/article6431827.ece>
- In depth: India's Mars Orbiter has made it to the top, *THE HINDU*, September 24, 2014
- [twitter.com/isro](https://twitter.com/isro)
- US, India to collaborate on Mars exploration, *THE HINDU*, 1 OCTOBER, 2014.
- V. Koteswara Rao, Scientific Secretary, "ISRO, Mars Orbit Insertion"
- [www.isro.gov.in](http://www.isro.gov.in)
- "Narendra Modi Successful visit to US", *The economics times*, 4<sup>th</sup> oct 2014 .