Voyage to Mars - A foresight

Dr.T.Theivasanthi

International Research Centre,

Kalasalingam Academy of Research and Education (Deemed University),

Krishnankoil-626126, Tamilnadu, India. Mobile: +91-9344643384

E-mail: theivasanthi@gmail.com Web: www.theivasanthi.weebly.com

ORCID: <https://orcid.org/0000-0002-2280-9316>

Highlights:

- 1) Confirming theoretically by analysing the presence of five elements (*Panchaboothams*) in Mars and suggests that Mars will be a possible place for life.
- 2) Comparing the analogies between Hohmann transfer orbit concept and our ancients' astronomical Science knowledge (prior to Hohmann concept).
- 3) Suggestions based on idea for making spacecraft / satellite into particles and sending them through radio waves and assembled them later.

The planet *Mars* is the fourth planet from the Sun. It is the second smallest planet in the Solar System. The name *Mars* imitates the name of “Roman God of War”. The presence of iron oxide (hematite) on its surface gives reddish appearance. Hence, this planet is called as "Red Planet". When it is closed to Earth, it can easily be seen with the naked eye which occurs every two years. Mars has two natural small and irregularly shaped moons, Phobos (about 14 miles in diameter) and Deimos (about 8 miles in diameter). They are named after the characters Phobos (panic/fear) and Deimos (terror/dread). Phobos rises in the west, sets in the east. Their origin is not well understood.

Mars photo sent by Mangalyaan. Courtesy: ISRO

Mars is a terrestrial planet with a thin atmosphere, having volcanoes, valleys, deserts, and polar ice caps. Its mountain, “Olympus Mons” is the second highest known mountain within the Solar System. It has a largest canyon, “Valles Marineris”. Its basin, “smooth Borealis” in the northern hemisphere covers 40% of the planet. The Mars rock revealed- formation of the oldest extant surfaces of Mars, 3.5 to 4.5 billion years ago. Mars has no evidence of magnetic field. It has no oceans and "sea level".

The seasons of Mars are the mostly like in Earth and their lengths are twice than earth seasons because Mars's greater distance from the Sun. Its surface temperatures vary from lows of about -143°C to highs of up to 35°C . Its average distance from the Sun is roughly 230 million km which is 1.52 times more far from the Sun than Earth. Its orbital period is 687 (Earth) days. The day on Mars is only slightly longer than the day of Earth: 24 hours, 39 minutes, and 35.244 seconds. A Martian year is equal to 1.8809 Earth years.

Mars has approximately half the diameter of Earth. The dense is also less than Earth. It consists of minerals containing silicon, calcium and oxygen, metals, and other elements. Low boiling points elements such as chlorine, phosphorus, and sulphur are more than Earth; besides, the most abundant elements are iron, magnesium, aluminium, calcium, and potassium. The polar caps at both poles consist primarily of water ice. Frozen carbon dioxide accumulates as a thin layer over them.

Till 1965, it is believed about the presence of liquid water on the planet's surface. The recent radar data reveals the presence of large quantities of water ice at the poles. It has been observed that the possibilities for water flowing in Mars during the warmest months. In 2013, NASA's Curiosity rover discovered that Mars' soil contains 1.5% to 3% water.

The atmosphere of Mars consists of about 96% carbon dioxide, small amounts of argon and nitrogen along with traces of oxygen and water. Small quantities of Ammonia, methane and formaldehyde recently detected by Mars orbiters claimed possible evidence for life. The German Aerospace Center has discovered that earth lichens can survive in simulated Mars conditions. The simulation is based on temperatures, atmospheric pressure, minerals, and light data from Mars probes. It is essential to note here that methane could also be created in *serpentinization* non-biological process by utilising water, carbon dioxide, and olivine. The *Phoenix* lander data related to the Martian soil illustrate that the soil is slightly alkaline nature (pH 8.3) and contains elements like magnesium, sodium, potassium and chlorine. These elements are necessary for the growth of plants. The presence of five elements (*Panchaboothams*) in Mars i.e. water, fire, air, space, earth (land) indicates / confirms / suggests that it will be a possible place for life.

Ancient Chinese literature confirms that the red planet Mars was identified by the Chinese astronomers before the fourth century BC. In the fifth century, the Indian astronomical text *Surya Siddhanta* estimated the diameter of Mars. In the East Asian cultures, Mars is traditionally referred to as the "fire star", based on the "Five elements".

Mars is son of Earth. Mars is Roman god of war and bloodshed. Spear and shield are the symbol of Mars. Because of the rich content of iron, both Mars soil and hemoglobin of human blood are in deep red color. In astrology, **Mangala** is the name for Mars, the red planet. It is also called **Angaraka** or **Rakta varna** (one who is red in colour like blood) or **Bhauma** ('son of Bhumi') . He is the god of war and is celibate. He is considered the son of Prithvi or Bhumi, the Earth Goddess, nurtured and brought up by 'Bhumi' (earth). Mars orbits the Sun in 687 days. It spends 57.25 days in each sign of the zodiac.

Dozens of unmanned spacecraft, including orbiters, landers, and rovers, have been sent to Mars by the Soviet Union, the United States, Europe, and Japan. Now, it is host to seven functioning spacecraft: five in orbit – the *Mars Odyssey*, *Mars Express*, *Mars Reconnaissance Orbiter*, *MAVEN* and *Mars Orbiter Mission* – and two on the surface – Mars Exploration Rover *Opportunity* and the Mars Science Laboratory *Curiosity*. With the

development of new technologies, various orbiters, landers, and rovers, it is now possible to study astronomy from the Martian skies.

Mars Orbiter Mission (MOM) is also known as ***Mangalyaan*** ("Mars-craft" from Sanskrit-*mangala*, "Mars" and *yana*, "craft, vehicle"), a spacecraft launched on 5 November 2013 (previous plan for launch on 28 October 2013 postponed due to poor weather) by the Indian Space Research Organisation (ISRO) at Satish Dhawan Space Centre (Sriharikota, Andhra Pradesh), using Polar Satellite Launch Vehicle (PSLV) with fuel-saving Hohmann transfer orbit concept. After 298 days with 780,000,000 km (480,000,000 mi) distance travel, it is orbiting Mars since 24 September 2014. MOM has been inserted into Mars orbit 41 hours earlier than actual orbit insertion plan at an altitude of about 1300 miles from Mars. Its on-orbit life is six-ten months. A minimum of 20 kg of fuel is necessary for the six-month life span but it has been left with 40 kg of fuel.

The mass of MOM was 1,350 kg including a liquid fuel engine with 852 kg propellant (the bipropellant combination monomethylhydrazine and dinitrogen tetroxide to achieve the thrust necessary for escape velocity from Earth). The aim was to gradually build up the necessary escape velocity (11.2 km/s) to break free from Earth's gravitational pull while minimising propellant use. Electric power required for MOM is generated by solar panels for maximum of 840 watts power generation and stored in Li-ion battery. It carries five instruments (15 kg mass) that will help advance knowledge about Mars to achieve the objectives of MOM.

During the year 2008, after the launch of lunar satellite Chandrayaan-1, the low cost project MOM mission concept began. The total cost of this project is ₹454 crore (US\$74 million) only. MOM is India's first interplanetary mission. It makes India the first Asian nation to reach Mars orbit on its first attempt. ISRO is the fourth space organisation in the world which has sent the spacecraft to Mars successfully. Earlier, Soviet space program, NASA, and the European Space Agency have sent their spacecraft to Mars.

The MOM mission is a "technology demonstrator" project. It helps to develop the technologies such as design, planning, management, and operations related to the future interplanetary missions. The primary objective is to showcase India's rocket launch systems, spacecraft-building, operations capabilities and incorporation of autonomous features to handle contingency situations. Investigating the surface features, morphology, mineralogy and atmosphere of the Mars planet utilising the indigenous scientific instruments are the next objective of the MOM mission.

The Spacecraft Control Centre is monitoring *Mangalyaan* spacecraft. This controlling centre has been situated at ISRO Telemetry, Tracking and Command Network (ISTRAC) in Bangalore with support from Indian Deep Space Network (IDSN). Communications are handled by Amplifiers and coherent transponders. The antenna array consists of low, medium and high-gain antenna. It is used to transmit and receive the telemetry, tracking, commanding and data to and from the IDSN. On 19 May 2017, *Mangalyaan* spacecraft has completed the 1,000 days in the Mars orbit. It remains in good condition.

Jantar Mantar of Delhi was built to observe, predict the times and movements of Sun, Moon and other planets. January every year on Makar sankranti Day, the sunrays fall on the Sivalinga for one hour passes between Nandi horns of **Gavi Gangadhareshwara Temple**, Bangalore. **Gandhi Mandapam** in Kanyakumari has been built in a manner that the sun rays fall exactly over the ash filled urn on October 2, the birth day of Mahatma Gandhi. **On**

Chithirai 1, 2, and 3 (April) the Sunrays fall on the Lingam **Sri Yoganandheeswarar temple**, Thanjavur, Tamilnadu. These are excellent instances to show that ancient Indians were experts in the Astronomical Science. These are analogies to Hohmann transfer orbit concept but prior it. This concept (Launch opportunities for a fuel-saving Hohmann transfer orbit occurs every 26 months) has involved in Mangalyaan. These are good replies for the criticism cartoon which was published in The New York Times on 28/9/2014 (in which an Indian farmer with a cow knocking on a door of the "Elite Space Club") after India's successful MOM.

ISRO plans to send follow-up mission named *Mangalyaan 2* to Mars by the year 2020 with orbiter and stationary lander. The Mars Trace Gas Mission orbiter has been planned to launch with the purposes to explore about the methane content as well as its decomposition products such as formaldehyde and methanol of the Mars. During a meeting in 30 September 2014, NASA and ISRO officials signed an agreement to establish a pathway for current future joint missions to explore Mars.

Nanotechnology, android robot and space elevator will be used for Mars voyage, in future. Using tough/low weight nanomaterials like carbon nanotubes / grapheme and nanofuels will reduce weight of spacecraft. **Android** is a robot or synthesised mechanical product. It has been created to look as well as to perform like human being. Advancements in robot technology have designed functional and realistic humanoid robots. It will correct / repair faults in spacecraft. A **space elevator** is a proposed type of space transportation system, conceived as a cable fixed to the equator and reaching into space. Strong and light material like Kevlar can be used as the tether material for elevators. Climbers carry cargo up and down through the cable to reach space without rocket. The concept is applicable to all planets and celestial bodies have gravity weaker than Earth (such as the Moon or Mars). Japanese company Obayashi has planned to operate a 60,000-mile space elevator by 2050, at a fraction of the cost of space shuttles. **It is suggested that making spacecraft / satellite into particles and sending them through radio waves and assembled them at Mars as original (like sending / receiving of commands / photos to and from Mars) is a better option instead of all above technology. Will it be succeeded in future?**

References / Sources: Mars Orbiter Mission - Wikipedia. 2018. *Mars Orbiter Mission - Wikipedia*. [ONLINE] Available at: https://en.wikipedia.org/wiki/Mars_Orbiter_Mission. [Accessed 03 Sep 2018].

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International Research Centre,
Kalasalingam University,
Krishnankoil-626126, Tamilnadu, India.
Phone: 04563-258084.

Mobile: +91-9344643384

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