The Budget Session that began this year on 21st February must have been music to the ears of space lovers. President Pranab Mukherjee in his maiden address to the joint sitting of Parliament said, “Several space missions are planned for 2013, including India’s first mission to Mars and the launch of our first navigational satellite. India is well up for launching its first space mission to Mars this year.”

Prime Minister Manmohan Singh had also earlier announced the Mars Orbiter Mission in his Independence Day address in 2012.

Planet Mars
Mars is the fourth planet from the Sun and orbits the Sun at an average distance of about 23 crore km. It is also called the red planet because it appears as a fairly bright, red, star-like object in the Earth’s night sky. It looks like a reddish-orange disk when viewed through a telescope. It is about half the diameter of Earth and about one-tenth Earth’s mass. It surface is almost exactly the same as the surface of the dry land on Earth.

Mars is believed to be about the same age as Earth. It was formed from condensing cloud of gas and dust about 4.598 billion years ago. The distance between Mars and Earth varies as they orbit the Sun. It varies from about 56 million km at their closest approaches to about 375 million km when the planets are on opposite sides of the Sun. Mars has ice caps at its north and south poles. These polar caps grow and shrink throughout the Martian year, just as the polar caps of Earth do.

Life on Mars
Mars is the most Earth-like place in our solar system. So it is only natural to wonder if the similarities extend to the existence of life. People have speculated about the possibility of life on Mars for centuries. Astronomers have often fueled the speculation that life may exist on Mars.

The 19th century Italian astronomer Giovanni Virginio Schiaparelli (1835-1910) reported seeing long straight canals on Mars. Some astronomers also reported seeing evidence for seasonal colour changes on Mars that could be interpreted as evidence for vegetation. American astronomer Percival Lowell (1855-1916) and some other astronomers of the early 20th century believed that the canals indicated the existence of an advanced civilization on Mars.

Lowell proposed that the canals were a planetary-scale irrigation project, carrying water from the wet polar regions to the dry equatorial deserts. However, the idea of canals on Mars began to get doubtful with improved telescopes. Close-up images of Mars from the Mariner spacecraft finally proved the idea wrong. Scientists now know that windblown dust causes the colour changes and that the canals are no more than an optical illusion caused by the limitations of human eyesight at the telescope.

The idea of life on Mars got a dubious boost from photos released on 24 January 2008 of the surface of Mars taken by the Spirit rover. It appeared to show a human-like figure. It was actually a small piece of rock blown up to give the appearance of a human figure. This phenomenon is called pareidolia in psychology, where we often see faces in clouds and coffee stains.

A growing number of scientists still believe that some form of life could exist on Mars. Spacecrafts are still being sent to Mars in search for direct evidence of past or present life.

India’s Mars Mission
Uninterrupted global attention on Mars has induced India’s great interest in the Mars Mission. India has planned an ambitious, short-term programme of Mars exploration – ‘Mangalyaan-1’ – to be launched by the Indian Space Research Organisation (ISRO). Mangalyaan meaning Mars-craft is an
orbit. It will not land on the surface of Mars, but encircle the planet.

This maiden mission to Mars is a “technology demonstrator” project aiming at a successful interplanetary mission. ISRO completed 125 crore (US$23 million) of required studies for the orbiter last year. Thereafter, the Government of India approved the Mars Mission project on 3 August 2012. The total project cost may be about 454 crore (US$ 83 million).

The orbit of Mars is elliptical. Mars happens to be closer to Earth every 26 months. In the near future, there are three windows of opportunity. They are in late 2013, in 2016 and in 2018. Indian scientists are aiming to be ready for the 2013 opportunity. Otherwise we would have to wait another 26 months to launch our Mars-Craft.

**Launching the Spacecraft**

Indian’s maiden Mars probe will lift off from ISRO’s launching pad at Sriharikota in Andhra Pradesh. The space agency will use its trusted warhorse rocket Polar Satellite Launch Vehicle (PSLV-XL) to carry the spacecraft into space. The spacecraft will have bi-propellant system using monomethylhydrazine and di-nitrogen tetroxide as fuel with additional safety and redundancy features for Mars orbit insertion. In mid-October, Mangalyaan will be placed into the Earth orbit, in which the probe will keep revolving in order to achieve the necessary velocity to escape the Earth’s gravitational pull. Then six engine firings will raise that orbit to one with an apogee of 215,000 km and a perigee of 600 km. Finally, it will be sent onto an interplanetary trajectory with the final firing.

The satellite is expected to exit the Earth’s orbit on 26 November 2013 and embark on the journey to Mars, which is expected to last for around 300 days. Scientists will have to navigate the spacecraft from the Earth to Mars in deep space using the Deep Space Network at Byalalu on the outskirts of Bangalore. The ultimate stage, Mars orbit insertion, is planned for September 2014.

Plans have been drawn up to insert the orbiter probe in an orbit around Mars.
on 22 September 2014. That would allow the orbiter to enter a highly elliptical orbit around the planet. The liquid rocket engine, capable of generating a 440-newton thrust, would be required to steer the spacecraft into the Martian orbit. The Mars Orbiter will go around the planet once in three days, its nearest point being only 371 km from the planet’s surface and the farthest point about 80,000 km away.

The spacecraft will have a single solar array with three panels of 1400 x 1800 mm capable of generating 750 watts of power in the Martian orbit. It will also be equipped with a 36 AH Lithium-ion battery for power storage. If the mission of Mangalyaan-1 is successful, India would be propelled to the elite club of five nations comprising the U.S., Russia, Europe, China and Japan that have launched similar missions.

Aims & Objectives
Chandrayaan-1, the 523 kg spacecraft to the Moon, was launched on 22 October 2008 and was inserted into Lunar orbit on 12 November 2008. The Moon is about 3.8-lakh km from Earth. But the planets in the Solar System are too far from Earth. Our nearest planet Mars is at least 560-lakh km away.

So, a spacecraft would need years to reach Mars. This is what makes such an endeavour extremely tough. Work on the Mars Orbiter Mission is going on full steam. Science is only a secondary goal for this mission. The main objective of the mission is to develop the technologies required for designing, planning, and managing operations of an interplanetary mission.

Payloads
Mangalyaan, with a 1350 kg liftoff mass, will carry payloads with a total weight of 14.49 kg. The mass has been scaled down to less than 15 kg against 25 kg planned originally. The payload consists of five instruments:
(a) Mars Exospheric Neutral Composition Analyzer (MENCA)
(b) Methane Sensor for Mars (MSM)
(c) Mars Colour Camera (MCC)
(d) Probe for Infrared Spectroscopy for Mars (PRISM)
(e) Lyman-Alpha Photometer (LAP)

Once in the Martian orbit, the satellite will start taking pictures of the red planet with the colour camera and infrared spectrometer.

Major Goals of Mission Mars
(a) To transfer the probe from Earth-centered orbit to heliocentric trajectory
(b) To insert the probe finally into Martian orbit
(c) To develop force models and algorithms for orbit and attitude computations and analyses
(d) To navigate the probe from Earth to Mars in deep space using the Deep Space Network
(e) To meet power, communications and payload operation requirements of the probe
(f) To re-activate the temporary inactive sub-systems of the probe after a 10-month journey
(g) To study Martian atmosphere and explore things not done previously by other countries
(h) To know how and why the red planet lost water and carbon dioxide
(i) To incorporate autonomous features to handle unforeseen situations
(j) Above all, to successfully enter orbit of Mars regardless of any scientific data return

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