# Frugal Mars mission launchpad for India in global space market

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The PSLV-C25 rocket carrying the Mars Orbiter Spacecraft blasts off from the launch pad at Sriharikota on November 5, 2013

India's bid to become the first Asian nation to reach Mars sets a new benchmark for frugal interplanetary travel and puts it in a perfect position to grab more of the $300-billion global space market, experts say.

"Everyone wants to do low-cost missions nowadays," Indian science author Pallava Bagla told AFP, adding, "Don't underestimate it because it is a low-cost mission."

The Indian Space Research Organisation—ISRO—staged a flawless launch last Tuesday of its Mars-bound spacecraft, loaded with a camera, an imaging spectrometer and a methane sensor to probe for life on the red planet.

The mission's price, a record low $73 million, "has been an eye-opener of sorts" for the world, Susmita Mohanty, co-founder and chief executive of Mumbai's Earth2Orbit, India's first private space enterprise start-up, told AFP.

That is not only because of the mission's meagre price when compared to its US counterpart, NASA's Maven, due to launch November 18 and costing 10 times as much but also because "the world was largely ignorant about the advanced nature of India's space programme", Mohanty said.

India already ranks among the top six space-faring nations in technological capabilities—the others being the US, Russia, China, France and Japan, Mohanty said.

## 'Biggest bang for buck'

India's successful lunar orbiter mission in 2008—Chandrayaan-1—which cost $89 million got the ball rolling in showing how to carry out space exploration on a minimal budget and the Mars mission enhances its low-cost reputation.

"India's space programme has always given the biggest bang for the buck," said Mohanty.

The secret to the Indian space programme's trailblazing affordability—ISRO has an annual budget of $1.1 billion, one-17th of NASA's—has been "indigenisation of the programme which has helped keep costs low," ISRO spokesman Deviprasad Karnik told AFP.

"The launch vehicle—the PSLV (the Polar Satellite Launch Vehicle) which is a workhorse—and spacecraft are Indian," Karnik said. Also the pay scales of its scientists are far lower than in the West.

The PSLV-C25 rocket carrying the Mars Orbiter Spacecraft on the launch pad at Sriharikota on October 22, 2013

Western sanctions slapped on India after the nation staged a nuclear weapons test in 1974 gave a major thrust to the space progamme and five years ago, the Indian rocket Chandrayaan-1 found signs of water on the moon.

India has come a long way since it began its space programme half a century ago when it set up the first rocket launch pad in a coconut plantation in southern Kerala state. A church was the main office, the bishop's house was converted into a workshop and a cattleshed became the research lab.

Now 21 Indian satellites circle Earth, giving support to telephone operators, broadcast outlets, weather forecasters and providing remote education and healthcare.

ISRO also earns money from launches through its commercial arm Antrix and since 1999 has launched 35 satellites for other nations such as France, Italy, Germany, Belgium, South Korea, Indonesia, Argentina, Israel, Canada, Denmark, Japan, and the Netherlands.

But it wants to do more to exploit the global space market whose 2012 revenues totalled $304.31 billion, according to the Space Foundation, a US-based advocacy and research group, the latest figure available.

Indian ingenuity in cutting costs and "frugal engineering" were on display with the Mangalyaan mission, Hindi for "Mars craft" rocket.

## A slingshot to Mars

Lacking a rocket large enough to fire the satellite directly out of Earth's atmosphere, ISRO had to rely on the famed Indian skill of "jugaad"—creating a cheap alternative solution.

Instead of flying directly to Mars, the 350-tonne vehicle will orbit Earth for nearly a month, building up the speed to "slingshot" its way out of the earth's gravitational pull to embark on its 260-million-mile (400-kilometre) journey.

Scientists and engineers work on a Mars Orbiter vehicle at the Indian Space Research Organisation's satellite centre in Bangalore, on September 11, 2013

Even without a major scientific discovery from the mission, getting a spacecraft into orbit round Mars would highlight Indian technology.

"India is sitting on a space gold mine. Indian companies can leverage the impresssive portfolio of space products and services that ISRO has developed," said Mohanty.

Satellite launch industry revenues totalled $2.2 billion in 2012 while worldwide satellite industry revenues were $189 billion, according to the US Satellite Industry Association.

With foreign space agencies increasingly looking to outsource space

missions to rein in spending, ISRO could compete for multibillion-dollar contracts, experts say.

Success of the Mars mission is by no means assured as recent attempts by both China and Japan have failed but two US rovers and two orbiters and a European satellite are already exploring Mars.

"For Mars, there were 51 missions so far around the world and there were 21 successful missions," ISRO chairman Koppillil Radhakrishnan told AFP before the launch.

He was unfazed at the mission's complexity.

"If it is a failure, then learn. Failure is a stepping stone for success."