

India

An Evolving Perspective

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From a beginning beaming educational programs via satellite, the Indian space program has quietly developed into one of the world's strongest. However, unlike most other countries who choose to work together at the International Space Station, India has maintained its independence in space. Susmita Mohanty, co-founder of Mumbai-based space company Earth2Orbit, reflects on the historical changes in India's space program.

November 14, 2008

20:06 The Moon Impact Probe (MIP) separated from Chandrayaan-1, India's moon orbiter.

20:31 The MIP struck the lunar South Pole in a controlled manner. It made impact near Shackleton Crater, ejecting underground soil that could be analyzed for the presence of lunar water ice.

Not many people know about Chandrayaan-1. Neither do they know that India has an extensive space program that started in the 1960s, or that India is one of a handful of countries that has satellite building and rocket launching capabilities.

Why is India going to the Moon? Why is India spending any money at all on a space program when there are so many other problems that it needs to allocate resources to here on Earth? The answers lie in the guiding principle that India adopted when it embarked on its space program. Dr Vikram Sarabhai, a scientist and visionary who laid the foundations of the Indian space program, summarizes:

There are some who question the relevance of space activities in a developing nation. To us, there is no ambiguity of purpose. We do not have the fantasy of competing with the economically advanced nations in the exploration of the moon or the planets or manned spaceflight. But we are convinced that if we are to play a meaningful role nationally, and in the community of nations, we must be second to none in the application of advanced technologies to the real problems of man and society.¹

In the early years of the program, Dr Sarabhai demonstrated to the national establishment the benefits of a space program through an experiment: he leased an American satellite to broadcast health and educational television programs to inexpensive ground stations throughout 5,000 remote villages in India. In addition

to space applications, the founding principles also emphasized technological independence. Over the past decades, the Indian Space Research Organization (ISRO) has focused on the indigenization of technology in satellite development, rocket development and ground stations. In the 60s, India was still a fledgling democracy and self-reliance was important in establishing India as a viable nation state.

Its space program has come a long way. India now ranks among the world's top space-faring nations; the other countries being the United States, Russia, China, France and Japan. India's fleet of communication satellites has revolutionized India's telecommunications, television broadcasting, Direct-To-Home services, business communications, rural connectivity, tele-education, tele-medicine, disaster warning and emergency communications. India now has among the world's largest constellations of remote-sensing satellites. Through community-based programs, ISRO has been partnering with schools, farming collectives, fishermen, micro-finance groups, among others. Space-based value-added services are provided to Indians at the grassroots level free of cost. India's government space program has achieved significant success in its stated objectives.

With changing times, the original perspective seems to be evolving – from 'impacting lives to impacting Shackleton Crater'. Or perhaps a hybrid perspective is emerging. This hybrid point of view is edgier and bolder, much like India's newfound confidence in itself due to brighter economic prospects and growing international stature. Indians now want to do both.

Volume 25

146



A close-up of the Moon's surface taken by Moon Impact Probe (MIP) on November 14, 2008 as it approached it after separating from Chandrayaan-1.

If you talk to people in urban India or in small towns, many of them are interested in knowing when 'they' will get to go to space. Indians who stay connected to the world via television and the internet seem to know of Richard Branson's plans for space tourism and will tell you that they look forward to the day when space travel will become more affordable. The Indian establishment isn't sleeping either.

Twenty years from now, when space travel is likely to become mundane like airline travel today, we don't want to be buying travel tickets on other people's space vehicles. – Dr G. Madhavan Nair, Former Chairman, ISRO²

Access to information is among the most empowering realities made possible by India's space program. Indian satellites have made it possible for people to have access to television broadcasts, even in the remotest parts of the country. Therefore most Indians have heard about the Indian-American astronaut Kalpana Chawla who died in the Columbia Space Shuttle accident in 2003. She is such a popular figure in Indian households that commercial advertisements use her story to promote their goods and services, while appealing to Indian aspirations.

PANNITHITTU, India – In this seaside village, the children of farmers and fishermen aspire to become something that their impoverished parents never thought possible: astronauts. 'I want to be prepared

Volume 25

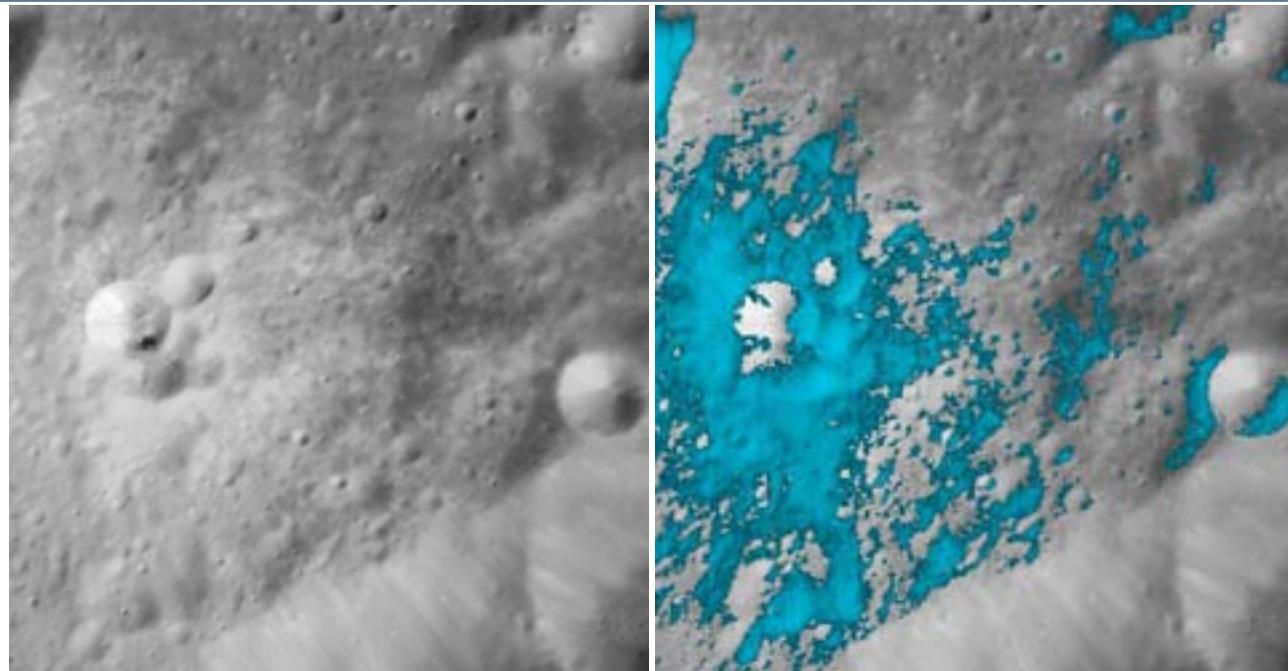
147

in space sciences so I can go to the moon when India picks its astronauts', said Lakshmi Kannan, 15, pushing her long braids out of her face and clutching her science textbook. Lakshmi's hopes are not unlike India's ambitions, writ small. For years, the country has focused its efforts in space on practical applications – using satellites to collect information on natural disasters, for instance. But India is now moving beyond that traditional focus and has planned its first manned space mission in 2015.³

Humans instinctively are more excited about space travel than about space hardware. There are some who find their thrill in building satellites and rockets; there are many others who want to see cheaper, faster and better ways to travel to space. 'Going someplace new' is always exciting for people and Indians are no exception. The more difficult it is, the more fun.

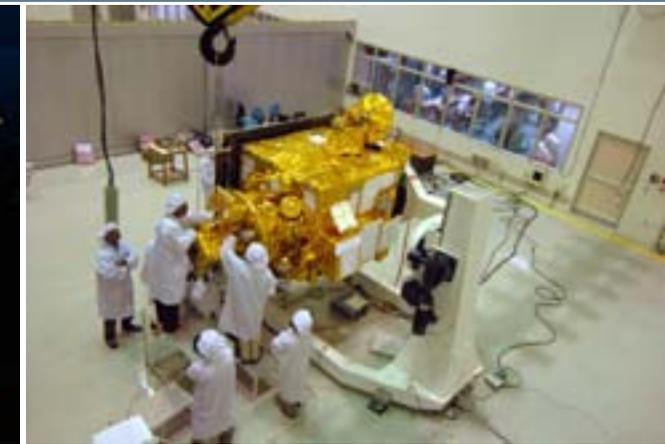
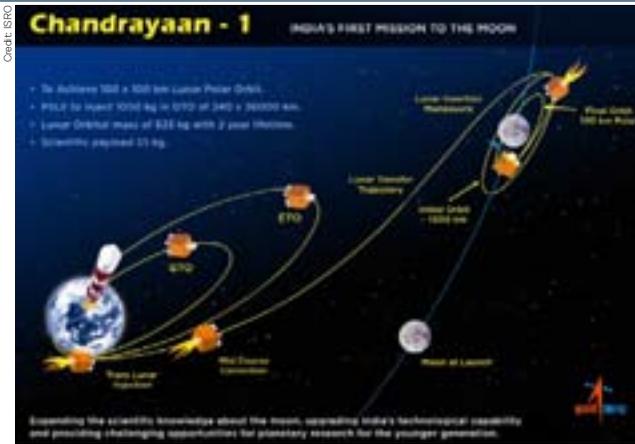
After more than four decades into its space program, India has found itself on the crossroads. The question facing Indian scientists, politicians, bureaucrats, policy makers and private citizens is: We build our own satellites. We launch our own satellites. We have a diverse portfolio of projects where we are improving the lives of our people through value-added space applications. What should we do next?

The natural next step is planetary exploration. India has now committed itself to robotic and human exploration of space. India is building a crew transportation system to launch humans into space. It is also working towards setting up a residential astronaut training facility



These images show a very young lunar crater on the side of the moon that faces away from Earth, as viewed by NASA's Moon Mineralogy Mapper on the Indian Space Research Organization's Chandrayaan-1 spacecraft. On the left is an image showing brightness at shorter infrared wavelengths. On the right, the distribution of water-rich minerals (light blue) is shown around a small crater. Both water- and hydroxyl-rich materials were found to be associated with material ejected from the crater.

Image: ISRO/NASA/JPL-Caltech/USGS/Brown Univ



Top to Bottom: Left to Right: (1) Chandrayaan-1 mission profile, (2) Chandrayaan-1 undergoing prelaunch tests, (3) PSLV on its way to the launch pad, (4) PSLV on the launch pad, (5) PSLV-C 11 launch.

on the outskirts of Bangalore. Chandrayaan-1 was India's first robotic mission to the Moon. It included an orbiter and an impact probe. Chandrayaan-2 will land a rover on the Moon. And Chandrayaan-3 will likely be a sample return mission. India also has plans to explore Mars. India is building a space hyperplane and contemplating space solar power.

While India welcomes international instruments to fly onboard its lunar spacecraft, it steadfastly refuses to participate in the International Space Station (ISS) program where sixteen nations have contributed funds, hardware and services for the orbiting human outpost. Instead, India has chosen to build its human space program from scratch – another case in point that demonstrates loyalty to the idea of technological independence. There are only three countries in the world that can independently launch humans into space – US, Russia and China. India plans to be the fourth. There are some who say that there is an invisible space race between India and China. Maybe, maybe not and even if there is one, China is the hare and India is the tortoise.

In 2007, India's then President, A.P.J. Abdul Kalam outlined India's future space endeavors during a speech at Boston University.

Kalam said that India understands that global civilization will deplete earthly fossil fuels in the 21st century. Hence, he said, a 'space industrial revolution' will be necessary to exploit the high frontier's resources. Kalam predicted that India will construct giant solar collectors in orbit and on the moon, and

will mine helium-3 – an incredibly rare fuel on Earth, but one whose unique atomic structure makes power generation from nuclear fusion potentially feasible – from the lunar surface. India's scramjet Reusable Launch Vehicle (RLV), Kalam asserted, will provide the 'low-cost, fully reusable space transportation' that has previously 'denied mankind the benefit of space solar-power stations in geostationary and other orbits'.⁴

For centuries, Indians have been rather introverted, culturally. They rarely took the trouble to go and invade other lands, but instead were busy defending themselves against invasions. In recent years, there has been a cultural shift and the Indian perspective is becoming extroverted.

Until the late 90s, India had a rather inward-looking space program. And unlike its Western counterparts, the Indian space program barely invested any money or time on its PR machinery. As India grows economically and asserts itself in matters of global diplomacy, the Indian perspective is starting to become outward looking. Not only is India bound for the Moon and Mars, it is also starting to look beyond its shores and contemplate ways to develop a thriving private aerospace sector to compete in the global space marketplace.

The annual global space market is around US\$ 160 billion. India should capture at least a fourth of the market, if not more. In the years ahead, the Indian government will have to take steps to radically reform their national space policy, deregulate the space sector and let private companies take the lead, while letting ISRO

focus on R&D. India needs to improve competency in high-tech and high-skill manufacturing, provide stimulating employment for an increasingly educated workforce, and promote diversification of its knowledge industries.

Another important dimension of the Indian perspective on space exploration derives from the Indian psyche that does not quite see the Earth and its planetary neighbors as disconnected entities, but rather as part of a cosmic whole. Indian calendars, festivals, rituals, myths and folklore all feed into a *unified perspective of the universe* where Moon, Mars and everything out there are an integrated, seamless whole. Going to the Moon then cannot just be about conquering frontiers or leaving footprints and planting flags; it is also about finding ourselves and our place in the grander scheme of the universe. Indians tend to be philosophical and these romantic views are part of that wider exploration where inner space is as important as outer space.

The Indian perspective on its space program is transforming from a largely pragmatic one to an increasingly romantic one, from space applications for improving life on Earth to space exploration for finding life on other planets, and extending human presence in space. Apparently, Shackleton Crater is one of the preferred locations to set up a permanent human presence on the Moon. So what exactly was India thinking when it shot the probe into Shackleton Crater nearly two years ago? Was it just to go find water ice? Or was it a little more than that?

- 1 'Introduction', Indian Space Research Organization (ISRO). At <http://www.isro.org>.
- 2 Pallava Bagla, 'India's growing strides in space', *BBC*, Wednesday, April 30, 2008.
- 3 Emily Wax, 'India's space ambitions taking off', *Washington Post*, November 4, 2010.
- 4 Mark Williams, 'India's Space Ambitions Soar', *MIT Technology Review*, July 30, 2007.