India Begins Its Journey to the Moon

by Ramtanu Maitra

Oct. 23—On the morning of Oct. 22, India's Polar Satellite Launch Vehicle (PSLV-C11) put the Chandrayaan-1 spacecraft into its initial orbit, the first phase of its journey to the Moon. An orbit-raising maneuver was later performed, with commands issued from the Spacecraft Control Centre (SCC) at the Indian Space Research Organisation (ISRO)'s Telemetry, Tracking and Command Network (ISTRAC) at Peenya, Bangalore.

The craft will continue to orbit the Earth for 15 days, and after two more orbit-raising transfers, it will enter into the lunar orbit. The 32-meter antenna in Bangalore will allow the ISRO scientists to collect the signals from Chandrayaan-1, both in terms of satellite control capability, and the scientific data coming from the various experiments onboard.

This is the first time India has sent a spacecraft to the Moon. It is the sixth country or group of countries to do so, after Russia, the United States, the European Space Agency, Japan, and China.

For Indian space scientists, and the people in general, it was a joyous and long-awaited event. Suspense hung over the mission, as thunderstorms lashed the Sriharikota spaceport for five days and threatened to disrupt the lift-off. However, Team ISRO worked against the odds and succeeded in carrying out what seems to have been a flawless launch.

'Journey to the Moon Has Begun'

G. Madhavan Nair, chairman of ISRO, called the launch success "a historical moment" and "the beginning of a new era" in India's space exploration program. "Our journey to the Moon has just begun. Everything went on perfectly well. It is a remarkable performance by the PSLV." Former Indian President A.P.J. Abdul Kalam, one of the leading scientists who laid the foundation for the Moon mission, said in a statement, "Launching of the mission is the first step and I hope every step of the mission falls at the right place."

One of the mission objectives is to understand the mineralogy of the Moon in much finer detail, and to quantify the precious helium-3 stocks buried beneath its craters.

Astrophysicist N. Sri Raghunandan Kumar pointed out out that once Chandrayaan-1 relays its data on helium-3 stocks to ISRO's master control room, India will have a larger claim on natural lunar resources, when man begins to colonize it in the future. Helium-3 is an isotope of earthly helium. But unlike its poor cousin, which is used to inflate balloons, helium-3 is 100 times more valuable than gold by weight. The gas is touted by scientists as the future fuel for nuclear fusion power plants, and could generate electricity for hydrogen-fueled automobiles.

Helium-3 is clean and less radioactive than uranium, and the Moon is said to have 1 million tons of it. Chandrayaan-1 will explore whether the Moon has even larger stocks of this clean fuel. According to ISRO scientists, helium-3 is present in the Moon's regolith (loose rocks or mantle), just below the surface of its *maria*—the areas once falsely believed to be seas.

Earth, too, has helium-3 reserves, but they are estimated to be less than 200 kilograms.

Senior astronomer Prof. G. Yellaih told Indian news media that the energy needs of the Earth will double in the next four decades, and helium-3 could be used to produce clean electricity. "Helium-3 can be used in fusion reactors to meet the energy needs of the world in the future. India will definitely have a claim over helium-3 by virtue of Chandrayaan-1 mission."

Meanwhile, ISRO chief G. Madhavan Nair said that Team ISRO is working on the second mission, Chandrayaan-2, and that the ISRO and Russian Federal Space Agency have signed an agreement. Chandrayaan-2 would feature a "lander" and a rover for a soft landing on the Moon, likely by the end of next year or early 2010. The instruments for Chandrayaan-2 would be decided after studying the data received from the first mission, Nair pointed out.

The work on this project would be taken up after Chandrayaan-1 starts its task of researching the Moon, Nair told reporters after the spacecraft was launched. "One of the two GSLV [Geosynchronous Launch Vehicle] missions next year could carry Chandrayaan-2," he said.

In addition, the ISRO has revealed that India will launch its proposed manned mission to lunar orbit by 2015. Nair said, "Now we have a little bit of breathing time [after the successful launch of Chandrayaan-1]; we are looking at how we can design a capsule which can carry two astronauts onboard a GSLV rocket."

"This is a very complex and challenging task, first of all to conceive a module, which can predict the condition of human life in space. It is a big challenge in terms of technology and realization," he added.

Selecting and training the astronauts and improving the reliability of the launching system are also complex issues. "Considering all these, we have prepared a project report, and this has been cleared by the Space Commission and is awaiting the government approval. Based on this, we will have the first manned mission from Indian soil before 2015," Nair reported.

"ISRO would try to handle the proposed mission without any help from countries that had prior experience in manned missions. It will be completely driven by us. However, if there is any scope for meaningful collaboration, we will consider it," he said.

Stolen from Tipu Sultan's Armory

India's space odyssey has a very long history. Between 1750 and 1799, two generations of rulers in what was then the state of Mysore (now Karnataka, where the city of Bangalore is located), Haider Ali and Tipu Sultan in the southern part of India had made use of rockets for military purposes, and used them effectively to defend their territory in their war against the British. Tipu Sultan had 27 brigades, each with a company of rocket men called Jourks. In the Second Anglo-Mysore War, at the Battle of Pollilur (Sept. 10, 1780), Haider Ali and Tipu Sultan achieved a grand victory; a contributing factor was that some British ammunition was set on fire by the Mysorean rockets.

At the Battle of Seringapatam in 1792, Indian soldiers launched a barrage of rockets against the British troops, followed by an assault of 36,000 infantrymen. Although the Indian rockets were primitive by modern standards, their sheer numbers, their noise and brilliance turned out to be highly effective in disorienting British troops. During the night, the rockets were seen as blue lights bursting in the air. Since Indian forces were able to launch these rockets from both the front and rear of the British line, they threw the British off guard. The bursting rockets were usually followed by a deadly shower of rockets aimed directly at the soldiers.

Almost seven years later, at a battle of the fourth Anglo-Mysore war at Srirangapattana, the capital of Tipu Sultan, in April 1799, British forces led by Arthur Wellesley (later, Duke of Wellington) ran from the battlefield when attacked by rockets and musket fire of Tipu Sultan's army. Unlike other contemporary rockets, whose combustion chambers were made of bamboo, Tipu Sultan's rockets used iron cylinder casings that allowed greater pressure and thrust, and had a range of almost 1.5 miles.

Vastly outnumbered, alas, Tipu Sultan lost that war, and the British troops raided the fort to kill the "Tiger of Mysore," as he was called. At the end of the war, more then 700 rockets and sub-systems of 900 rockets were captured and sent to England. British rocket artillery pioneer William Congreve examined the Indian specimens and did some reverse engineering to make copies that were later used successfully in a naval attack on Boulogne (1806), the siege of Copenhagen (1807), and also against Fort Washington (New York) during the War of 1812.

Some Indian historians claim that "the rockets' red glare" in the U.S. national anthem refers to the burst of rocket fire designed by Tipu Sultan, copied and used by the British colonials.

Nehru and Sarabhai

Following the end of the British Raj in 1947, India focused all its energy on nation-building, economic and industrial development, with a prime focus on science and technology. Indian rocketry was reborn under the supervision of Prime Minster Jawaharlal Nehru, and the leadership of Prof. Vikram Sarabhai. At the time, looted by the British, India was a poor country on the precipice of collapse, and so, investments in space and nuclear technology were considered "elitist" by many Indians. Addressing this concern, Sarabhai, a visionary and a physicist par excellence, told a gathering where India's involvement in the frontline technologies was questioned: "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 space-flight. 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."

The formal beginning of India's space program was in 1962, when the Indian Committee for Space Research (INCOSPAR), led by Professor Sarabhai, decided to set up the Thumba Equatorial Rocket Launching Station (TERLS), in the state of Kerala on the southern tip of India, very close to the Earth's magnetic equator. Upon launching the first sounding (research) rocket (Nike-Apache) on Nov. 21, 1963, Sarabhai shared with his team his dream of an Indian Satellite Launch Vehicle.

Almost nine years after his mysterious death at the age of 52, Sarabhai's dream was realized, in July 1980, when India launched the Satellite Launch Vehicle (SLV), by a team handpicked by Sarabhai himself. Later, India developed a series of launch vehicles. The most important of which is the Polar Satellite Launch Vehicle, which lifted the Chandrayaan-1 into orbit. It is an expendable launch system operated by the ISRO. It was developed to allow India to launch its Indian Remote Sensing (IRS) satellites into Sun synchronous orbits, a service that was, until the advent of the PSLV, commercially available only from Russia. The PSLV can also launch small satellites into geostationary transfer orbit (GTO).

India carried out the first launch of the more powerful Geosynchronous Satellite Launch Vehicle (GSLV) on April 18, 2001. GSLV development was significantly aided by Russian technology; the project ran into problems when the United States imposed sanctions against India. Upon the dismantling of the Soviet Union, Russia joined the Missile Technology Control Regime (MTCR) in 1993, disrupting the supply of missile technology to India, which is not a signatory of the MTCR.

Indo-Russian cooperation on space technology was revived, and the GSLV-D1 successfully launched on April 18, 2001, using an imported Russian cryogenic engine. But India began developing its own cryogenic engine, needed for the GSLV. Since then, India has come up with its own version of a cryogenic engine, which is capable of placing 2,500 kilogram payload into geostationary transfer orbit.