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Starry Eyes or Serious Potential? - The Rise of India's Space Program

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The landmark success of India's moon launch in October 2008 has all eyes set on the Indian space program. India's space program produces both satellites and launchers. The development-oriented missions of educational communications and remote sensing that were the program's mainstay are now supplemented by plans for human space flight and hopes for a significant share of the US\$2.5 billion commercial launch industry. The United States has resumed space cooperation with India, and is hoping to extend this more fully to the launch area. India's strategic thinking has expanded to encompass a defensive role for its space capabilities. This is yet another manifestation of India re-positioning its position in the global power game.

To the Moon and Back: On October 22, 2008 Chandrayaan-I, India's first unmanned spacecraft, was launched on a two year mission to the moon from the Satish Dhawan space centre at Sriharikota spaceport near Chennai. After orbiting the earth twice Chandrayaan-I will fire towards the moon, taking five and a half days to complete its journey. There are eleven instruments on board, five indigenous and six under international cooperation from the United States, the European Space Agency (ESA) and Bulgaria. The spacecraft will orbit the moon studying the topography and mineralogical content of the lunar surface. Even as Chandrayaan-I successfully begins its journey to the moon, plans are already underway for Chandrayaan-II, the follow up mission in 2011-2012 that will land on the moon with a lunar orbiting spacecraft and a land rover. Anticipating the success of its first Moon mission, Indian Space Research Organization (ISRO) has already signed an agreement in 2007 with Russian space agency Roskosmos to make Chandrayaan-II a joint mission. ISRO will manage the lunar orbiter, while Roskosmos manages the rover.

Humble Beginnings: India's space program has made impressive strides since its inception in the late 1950s. Dr. Vikram Sarabhai, the founding father of the Indian space program, laid the groundwork for a competitive space program with the foundation in 1962 of the Indian Committee for Space Research (INCOSPAR), later re-designated as the Indian Space Research Organization (ISRO).

In the initial stages, India relied heavily on international assistance and cooperation to develop its space program. India's first 300 space launches utilized foreign made – mostly American – sounding rockets and Aryabhata, India's first domestically made satellite, was launched from a Soviet launch vehicle. India's space program faced several setbacks and failures in its early days. In 1979, the first indigenous satellite it launched, Rohini I, crashed into the Bay of Bengal shortly after take off. A year later, ISRO successfully launched its own domestically manufactured satellite. Despite its initial struggles in the 1970's, the Indian space program grew robustly over the next two decades to include 18 departments and centers spread throughout the country. Most notable of these are the ISRO headquarters in Bangalore, the R&D facilities at Vikram Sarabhai Space Centre (VSSC) in Trivandrum, the main launching facilities at Satish Dhawan Space Centre (SHAR) in Sriharikota, and the most recent addition in Bangalore - Antrix Corporation Limited, the commercial wing of India's space program. All of ISRO's commercial and marketing activities

are handled by Antrix, which was specifically created to handle commercial transactions in 1992. The successful launching of Chandrayaan-I brought India into an elite club of nations with space capabilities.

Satellites and Systems - Nuts and Bolts of India's Space Program: While ISRO is the main developer of launch and satellite systems, it maintains two separate agencies and corresponding classes of satellites, the Indian National Satellite (INSAT) for communication, television broadcasting and meteorological studies, and the Indian Remote Sensing Satellite (IRS) for resources monitoring and management. The two existing satellite launch vehicles, the Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV) are used to place IRS and INSAT class satellites in the required orbits.

The PSLV is the space program's workhorse. The most important function of the PSLV is its ability to launch IRS satellites into sun synchronous orbits. Before PSLV, this kind of launch was commercially viable only from Russia. The PSLV had its first successful launch in 1996, three years after its initial introduction. Since then, it has continued to have successful launches - the latest count puts the PSLV at 9 consecutive and 11 total successful launches out of 13 attempts - making it popular with ISRO. The standard version of the PSLV has the capability to launch 1,600 kg to 622 km in a sun synchronous orbit, but with a strap-on booster the PSLV can increase that payload to 1,800 kg. ISRO continues to work on improving the efficiency and increasing the payload of their favorite launch vehicle. The GSLV is a heavier rocket used to launch INSAT satellites primarily into geostationary orbits and can carry heavier payloads for greater distances than its polar counterpart. GSLV had its first successful launch in 2001, followed by a second operational launch in 2004.

Making Space Exploration Work for the Common Man: GSLV's operational launch in 2004 is commonly referred to as EDUSAT, named after the initiative towards satellite-based education. A fairly new launch system, it has seen five launches in the past seven years and it is scheduled to carry out more in the coming decade. EDUSAT, India's first exclusively educational satellite, is an example of India's continued focus on the social and developmental applications of space technology. When India's space program began, ISRO scientists focused on practical applications for a developing country like India. In the 1960s-70s, India was a heavily state-centric nation and this was reflected in the goals and ambitions of its space program. ISRO continues to stress human security projects, such as mass education, weather forecasting, disaster management, communications and navigation. EDUSAT supports an interactive satellite based distance education system which connects urban educational institutions, such as the Indian Institute of Technology (IIT), with rural and semi-urban educational institutions that lack proper resources. EDUSAT consists of more than 45 broadcast and interactive networks, which cover 30,000 classrooms in 20 states across the nation. By all accounts, it appears that ISRO has kept faith with its original intentions of blending an economically viable space program with development-focused technological initiatives.

Money, Money, Money - India's Scientific Powerhouse: Today, ISRO is complementing development oriented projects like EDUSAT with commercial ventures. ISRO anticipates new revenues from the highly lucrative satellite industry, which includes broadband Internet Protocol (IP) services, defense and military applications, and leasing options to telecommunication providers. Although ISRO, a relative newcomer to space exploration, has a much shorter list of commercial ventures than its counterparts in the United States and Europe, it has made impressive strides. In April 2007, the PSLV conducted its first commercial launch of a foreign satellite for the Italian Space Agency, AGILE, for US \$11 million. Then, in January 2008, the PSLV launched an Israeli satellite, TECSAR, followed by another successful launch in April 2008 of ten satellites on the same launch vehicle. April's launch broke the record of maximum satellites launched simultaneously by any international space program; a record previously held by Russia at eight satellites in a single launch.

Antrix, ISRO's marketing arm, has been selling Indian products and services to global customers, thereby increasing ISRO's market share in space services. For financial year 2006-07, it clocked in revenues of approximately US\$ 1.36 billion from leasing transponders, selling remote sensing images and launching other countries' satellites. Senior ISRO officials have admitted that they hope to corner 10 percent of the global space market within the decade. This will put it in competition with the United States, Russia, China, and the European Space Agency in offering commercial space services.

Reaction from Washington: The Next Steps in Strategic Partnership (NSSP) statement released by President Bush in 2004 paved the way for U.S. - India cooperation in the area of civilian space programs. Subsequently, in 2005, the U.S. Department of Commerce eliminated several licensing restrictions associated with nuclear-related exports and re-exports to India and also removed six Indian entities, including three ISRO organizations, from the United States' "Entity List" of organizations and individuals banned from any commerce with the United States on nonproliferation grounds. Some ISRO organizations still remain on the Entity List, but the signature of a space cooperation agreement in June 2005 and the presence of two U.S. instruments on board Chandrayaan-I represent a major breakthrough in U.S.-Indian space cooperation. The U.S. and India have negotiated, but not signed, a Technology Safeguards Agreement and have been discussing a Commercial Space Launch Agreement, which in turn would further facilitate technology transfers and space cooperation between the two countries.

Star Wars: As ISRO grows, India is also facing competition from its rapidly expanding counterpart - China. The Chinese space program continues to provide low-cost space technology and launch services to the West. In June 2008, the Chief of the Indian Army, General Deepak Kapoor, warned that China's growing space capabilities were a threat to India's security interests. While trade has increased substantially between the Asian powers in the last decade, the relationship continues to have a competitive slant, particularly in the area of military and strategic interests. China's shoot down of a defense communication satellite; and recent cyber attacks on India originating from China; have caused alarm within the military establishment. India's Defense Ministry has announced plans to introduce an aerospace command that will be jointly run by the Indian Army, Navy and Air Force. ISRO will provide technical support to this undertaking, in conjunction with the Defense Research and Development Organization (DRDO). Additionally, India's dynamic private sector will reportedly also provide assistance to the aerospace command, although it is yet unclear the extent to which the private sector will be involved.

New Delhi's Space Ambitions: ISRO has always been a civilian program, but it has ties with the Indian military that go back many years. India's traditional "space for peaceful means" approach is gradually being supplemented with an open acknowledgement of the defense implications of space technology. India's military hawks emphasize that future defense capabilities will rely on space-based surveillance, reconnaissance and tracking.

The next logical step following the success of Chandrayaan-I is a manned mission to the moon. ISRO has scheduled the first manned flight to launch by 2014, as a cooperative venture with Russia, and a moon landing is set to take place in 2020. So far, there has only been one Indian astronaut in space; in 1984, Rakesh Sharma spent a week aboard the Salyut 7 space station under the Russian Intercosmos program. If ISRO's plans for a manned mission succeed, India will be propelled into the elite three-member club of space powers who have successfully launched humans into space - the United States, Russia and China.

Four decades ago, the exorbitant costs of a manned mission and the absence of a development oriented goal would have made such a mission nearly impossible. Today, India's thriving economy has made such dreams affordable, and India's concept of its development agenda has expanded to include the possibility of discovering new lunar sources of energy and minerals. Critics question the wisdom of a developing nation with one of the poorest populations in the world investing billions of dollars into moon missions and satellite launches. Proponents of the space program, however, insist that India is simply repositioning itself as a global leader and that technological advances will only strengthen India's position as a power player. Indeed, it has been suggested by several strategic analysts that India's interest in exploration and human space flight capability suggests that India is seeking to employ the 'soft power' as well as 'hard power' elements of space - global recognition of India's technological and scientific prowess in addition to the defense applications of space technology - in order to be recognized as a serious global and regional power. India participation in the space game not only changes the context in which traditional western powers like the United States and the European Union cast their own ambitions, being internationally renowned as a major science and technology power will provide India with additional leverage in the global arena.

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