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TECHNOLOGY FOR NATIONAL SECURITY:

INDIA'S SPACE CAPABILITIES CONTINUE TO IMPROVE

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Space related research and exploitation activities commenced in India with the establishment of the Indian National Committee for Space Research (INCOSPAR) in year 1962. Work to establish the Thumba Equatorial Rocket Launching Station (TERLS), near Thiruvananthapuram, was also started in 1962. Indian Space Research Organisation (ISRO) was formed in November 1969.[1] India started its entry into the business of space rocket launches with the launching of imported sounding rockets from TERLS. ISRO has come a very long way since its humble beginnings in the 1960s. PSLV C-23, the twenty third commercial mission of the rocket, launched in the fore noon hours of 30 June 2014 put a total of five satellites into orbit with very high accuracy.[2]

Background

A nation's space capabilities comprise several connected elements. The more important of these are the ability to:-

- Manufacture space craft including satellites,
- Manufacture unmanned scientific probes, and manned spacecraft.
- Manufacture and launch rockets able to get these space craft into outer space are an essential capability for a space faring nation.

- The last important capability is the ability to control the launch and operation of spacecraft through use of suitably located space craft control facilities.

India started its early experiments with space through launch of imported sounding rockets from TERLS in the 1960s. The first rocket launched by India was an imported Nike-Apache rocket launched on 21 Nov 1963. By 1967 India had succeeded in manufacturing its first indigenous sounding rocket, the RH-75. The next step was to manufacture satellites domestically. Then lacking a satellite launch capability these initial satellites were launched on Soviet and /or European launch vehicles. Meanwhile work continued on developing an indigenous satellite launch capability. The first successful launch of India's first satellite launch vehicle (SLV)-3 took place on 18 July 1980. The SLV-3 had limited capability but its success in turn led to development of a range of rockets including the Augmented SLV (ASLV), Polar SLV (PSLV) and the currently under development Geosynchronous SLV (GSLV).

Current state of Indian Launch Capabilities

By far the most successful SLV developed by India till date is the PSLV. This rocket underwent its mandatory developmental flights followed by a string of successful commercial launches. PSLV has now had 26 successful flights till June 2014.[3] This record demonstrates the PSLV's maturity and reliability. In addition to launching polar orbit satellites into Low Earth Orbit (LEO) this rocket can also place satellites into geosynchronous transfer orbit. Until November 2013 PSLV had successfully launched as many as 70 satellites (30 Indian and 40 foreign satellites). The launch record includes the insertion into orbit of multiple payloads in one mission. On 28 April 2008 PSLV C-9 placed 10 satellites into orbit.[4] This record demonstrates the high capabilities in launch vehicles developed by India's ISRO. PSLV can place payloads weighing 1600kg into 620 km polar orbit or 1060 kg into geo-synchronous transfer orbit.[5] Specially modified versions of the basic PSLV rocket were used to launch India's first mission to the moon, Chandrayan-1, and the Mars Orbiter Mission (MOM) which is expected to enter orbit around Mars in September 2014.[6] The entire Chandrayaan-1 mission was accomplished at a cost of about $76 million.[7] The MOM was executed at a cost of just $70 million. PSLV has demonstrated great precision in satellite orbit insertion, a capability that helps increase satellite useful life due to lesser need to use scarce on-board satellite fuel for satellite orbit correction.

This technical skill coupled with the very low cost of development and execution make India's successes in space even more noteworthy.

The capabilities of PSLV make it a globally competitive satellite launch vehicle able to compete on favourable terms with more advanced space faring nations in the satellite launch market. However, the limitation of PSLV is the limited payload that it can carry aloft. The GSLV in various marks is being developed to fill the gap in India's heavy spacecraft launch capability. Currently the GSLV is still under development. It has demonstrated the ability to lift between 2000 and 2500 kg into orbit in its last development flight. Development of an indigenous cryogenic engine which is required in the upper stages of a heavy lift rocket took time to reach completion. A few development flights were affected by faults not linked to the indigenous cryogenic engine that led to loss of the rocket. However, it is expected that these problems have been suitably resolved. The next developmental GSLV launch, of the Mk-III model of this rocket, is expected in August 2014.

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Potential Security Payoffs of Space Capabilities

To be a major player in the satellite launch market India requires focusing on achieving enhanced performance targets including the ability to place heavy (4ton to 6 ton) satellites into orbit, both low earth orbits (LEO) and Geosynchronous transfer orbit (GTO). Then there will be need to establish a reliability track record similar to that achieved with PSLV. This will enable India to compete head to head with Russia, China European space agency (ESA) and China in the global launch market. The proven ability of ISRO to undertake advanced space missions at a fraction of the cost of other major space faring nations attempting similar missions is a great

advantage for India. A spin off of this enhanced launch capability will be the ability to quickly replace or launch new satellites essential for national security as and when required at relatively short notice. Further space exploration efforts would also be assisted by the ability to accurately place heavy payloads into orbit at comparatively lower cost than other space launch providers. This latter capability could one day conceivably lead to the ability to harness space resources, such as minerals in asteroids, for national security needs.

Such advanced launch capabilities, possibly leading on to single stage till orbit (SSTO) or / and reusable launch systems, could enable India to hold its own if the weaponisation of space becomes a reality at some future date. The track record established by ISRO leads to optimism on this count. The model followed by ISRO could also serve as a model for other sectors of India's economy and industry.

Conclusion

India has made great strides in developing and then enhancing its satellite launch capabilities from its humble beginning in the 1960s. Today the PSLV has established an enviable track record of performance and safety. This rocket has become ISRO's workhorse. Efforts to develop the GSLV to its logical full capability are ongoing. The GSLV is expected to fill the heavy lift gap that remains in India's launch capability. Given ISRO's track record till date it can be optimistically predicted that the next few years will see the GSLV reaching a level of maturity and reliability to compare with the PSLV. Such launch capabilities would serve to enhance India's security as well as providing opportunities for economic and scientific advancement.

(Disclaimer: The views and opinions expressed in this article are those of the author and do not necessarily reflect the position of the Centre for Air Power Studies CAPS)

[1] "Historical 40th Anniversary of ISRO – Outreach", http://planetarysocietyindia.blogspot.in/2009/08/historical-40th-anninversary-of-isro.html, accessed on 02 July 2014
[2] "5 things you need to know about the PSLV-C23 launch", http://www.business-standard.com/article/current-affairs/5-things-you-need-to-know-about-the-pslv-c23-launch-114063000426_1.html, accessed on 02 July 2014.
[3] PSLV", http://www.isro.org/Launchvehicles/PSLV/pslv.aspx, accessed on 02 July 2014.
[4] Ibid
[5] Ibid.
[6] Ibid.
[7] "Indian space Research Organisation", http://www.isro.org/scripts/faq.aspx, accessed on 02 July 2014.