



ISRO GOES FROM STRENGTH TO STRENGTH

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Since the advent of the space age which was heralded by the Soviet Union's launch of mankind's first artificial satellite, Sputnik-1ⁱ, technology has made the utilisation of space a major driver of growth and human wellbeing. Space based capabilities include advent of global voice and data communications, weather tracking and prediction, weather system warning, tracking of resources such as areas under cultivation, irrigation, flooding, etc., remote sensing to detect natural resources and more recently satellite based navigation facilities.ⁱⁱ Most of these activities require the ability to build, launch, and operate space based assets.

Background and Latest Event

India has been on a quest to improve its peoples' lives through application of technology from the nation's independence in 1947. While a lot of this effort went into the setting up of traditional heavy industries and manufacturing attention was also put on the leveraging of space technology for betterment of the country. India entered the space age in the 1960s through formation of the Indian Space Research Organisation (ISRO). ISRO was tasked with development of space capabilities that could be used effectively for the national good. ISRO continued to launch imported rockets from a test range at Thumba to build up a knowledge base for further progress. In later years ISRO graduated to designing and building its own satellites. The first of these were launched on board Soviet rockets as ISRO did not then have the capability for satellite launch. Satellite design and building in this period improved progressively to reach the stage where ISRO could build advanced communication, remote sensing and other specialised satellites on its own. In the early 1980s ISRO commenced development of its own launch capabilities starting with the

Satellite Launch Vehicle (SLV) 3.ⁱⁱⁱ This experimental rocket could place a mere 40 kilograms (kg) of load into orbit, but helped build confidence amongst the ISRO scientists. Further developments in launch technology led to the Augmented SLV (ASLV), Polar SLV (PSLV), and Geosynchronous SLV (GSLV) being developed. Each of these rockets incorporated ever greater payload carrying capacity and opened up more potential areas of the space around Earth to Indian access. However, until recently despite these developments ISRO was limited to the launch of satellites weighing up to approximately 2.5 tonnes into orbit.^{iv} Heavier satellites such as the modern communications satellites built by ISRO required to be launched on board foreign launchers such as the 4.5 ton GSAT4 launched on board the European Space Agency (ESA)'s Arienne rocket. It has been written earlier on this website that the Indian Mars Orbiter Mission (MOM) was constrained to follow an innovative 12 month journey to Mars as ISRO then lacked a rocket powerful enough to launch MOM on a shorter path. Even the GSLV tested over the past few months using cryogenic engines of indigenous design and manufacture was limited to just 2.5 ton lift capability. ISRO had meanwhile designed its heaviest and most ambitious rocket till date, the GSLV Mk III. This rocket is 50% heavier than the earlier GSLV and has ability to carry 4.5 ton payloads aloft. Its first launch was successfully carried out at 0930h on 18 Dec 2014 from the ISRO launch site located at Sriharikota. In this first test flight of GSLV Mk III a suborbital trajectory was planned.^v The mission of this developmental mission was to test the potential crew module built by ISRO for a future Indian manned mission to space as well as to test the atmospheric stability of the GSLV Mk III rocket. This capsule was successfully released from the rocket at 126 km altitude. In its descent the capsule's thermal tolerance and descent system were tested. The capsule after re-entry into the atmosphere at an altitude of 80 km descended, in its terminal part, supported by three parachutes to splash down in the sea about 150 km the Andaman and Nicobar Islands. The capsule launch and re-entry, descent and recovery by Indian Coast Guard vessels were checked out in this mission.^{vi} Apart from proving the GSLV Mk III rocket and its systems the main mission objective of the first developmental flight was the testing of the crew module.

All reports so far of the mission and its progress point towards another textbook demonstration of ISRO's ability to plan and execute its missions near flawlessly. The GSLV Mk III launch and separation of the crew module including its descent proceeded as per plans and expectations. After recovery of the crew module it is being checked in detail for its performance

and modifications required if any. Such testing and learning from the test would potentially build the required knowledge and expertise base for a future manned mission by ISRO.

Analysis

India's space program run by ISRO is a high technology success story of note. ISRO has several achievements to its credit. An underlying factor in ISRO's performance is its use of original thinking and innovation to achieve its aims. Such innovation was amply demonstrated in the planning and execution of MOM. However, despite these achievements ISRO had a gap in its capabilities as regards launch of heavy satellites of 4.5 tons into geosynchronous orbit. The latest successful launch of GSLV Mk III is a step towards closing this gap in capability to make India completely self-reliant for its space capabilities. A heavy rocket in the GSLV Mk III class could also open up other opportunities in space exploration to India. The crew module test indicates that ISRO and India have a long term plan to enhance India's space footprint in order to leverage space abilities for the national good.

These successes should bring cheer to the Indian defence establishment as well as many of the space capabilities already put in place by ISRO or in progress have military and national defence applications also. There is need for the Defence forces to collectively formulate their future requirements and lay out a roadmap of building blocks towards these in sub-component form. The defence forces may also fund development of niche capabilities that could be future force multipliers in their quest to ensure security of the country.

Conclusion

India's space program has been run by ISRO since its formation in the late 1960s. ISRO has achieved many milestones in the past half century including a few world class achievements despite its rather frugal budget as compared to major foreign space agencies. ISRO has effectively leveraged India's innate innovative culture to develop high end capabilities indigenously. The latest successful launch of GSLV Mk III and the test of the crew module add to this list of noteworthy achievements by ISRO. ISRO's achievements add to the nation's power as these indigenous capabilities have the potential to benefit the economy as well as enhancing the

country's defence potential. Hence ISRO's performance is indeed laudable by all Sections of Indian society including the defence forces.

(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))

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ⁱ "Sputnik and The Dawn of the Space Age", <http://history.nasa.gov/sputnik/>, accessed on 18 Dec 2014.

ⁱⁱ "NASA Technologies Benefit Our Lives", http://spinoff.nasa.gov/Spinoff2008/tech_benefits.html, accessed on 18 Dec 2014.

ⁱⁱⁱ "About ISRO", <http://www.isro.org/scripts/Aboutus.aspx>, accessed on 18 Dec 2014.

^{iv} "GSLV MK I & II", <http://www.isro.org/Launchvehicles/GSLV/gslv.aspx>, accessed on 18 Dec 2014.

^v Vanita Srivastava, "GSLV Mark III, India's heaviest rocket, successfully test-fired", <http://www.hindustantimes.com/india-news/isro-launches-india-s-heaviest-rocket-gslv-mkiii/article1-1297750.aspx>, accessed on 18 Dec 2014.

^{vi} Ibid.