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ISRO LAUNCHES FIFTH NAVIGATIONAL SATELLITE IRNSS-1E

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ISRO has successfully launched its fifth Indian Regional Navigation Satellite System (IRNSS- 1E), on January 20, 2016 from the second launch pad of Satish Dhawan Space Centre (SDSC) SHAR, Sriharikota.[1] IRNSS – 1E was launched aboard Polar Satellite Launch Vehicle, PSLV- C31, and is the thirty third consecutive successful launch of PSLV.[2] The launch of IRNSS-1E has been preceded by satellites of similar configurations with series 1A, 1B, 1C and 1D aboard PSLV series C22, C24, C26 and C27 in July 2013, April 2014, October 2014 and March 2015.

IRNSS is an independent and indigenous project of ISRO with a constellation of seven satellites planned to provide accurate real-time positioning and timing services over India and region extending to 1500 km around India. Of the seven satellites, three are planned in geostationary orbit (GEO) while remaining four planned in geosynchronous orbit (GSO). With IRNSS-1E now launched in GSO, the constellation now has a total of five operational satellites, four in GSO and one in GEO. The launch of remaining two satellites IRNSS-1F and IRNSS-1G is planned to complete by March 2016.[3] Once all the seven satellites are in place, the IRNSS constellation will cover the complete Indian subcontinent and help provide real-time navigation inputs with accuracy of better than 10m resolution over the mainland and better than 20 meters in the Indian Ocean as well as a region extending approximately 1,500 km around India.[4]

The Global Positioning System (GPS) was conceived by the USA in the year 1973 and the system with 24 satellites achieved initial operational capability providing Standard Positioning Services (SPS) in the year 1993.[5] In addition to USA's GPS system, the other countries that have made considerable progress on space navigation systems include Russia (with its Global Navigation Satellite System (GLONASS)), European Union (Galileo), China (Beidou Navigation Satellite System (BDS)) and Japan

(regional Quasi-Zenith satellite system). While these navigation constellations are progressing in phases, the United States continues to dominate the global space navigation market. Attaining full operational capability of IRNSS will put India in the company of select nations which have their own satellite navigation system.

As all applications for navigational services in India were met using the global navigational systems under the control of global service providers and the continuation of services in times of hostilities was not guaranteed, the Indian government authorised the autonomous satellite navigation project, IRNSS in year 2006 for the Indian sub-continent and its surroundings. The IRNSS series of satellites, like the United States GPS, provides the Standard Positioning Services (SPS) for utilisation by all users and the Restricted Services (RS) that employ data encryption for the authorised users.

All the five IRNSS satellites[6] launched have similar physical dimension of 1.58 metre x 1.5 metre x 1.5 metre. Each satellite is equipped with two solar arrays consisting of Ultra Triple Junction solar cells capable of generating electrical power in the range of 1660 Watts and additionally carries one Lithium-ion battery of 90 Ampere hour capacity. The orientation reference to these satellites is being provided using sun and star sensors. The onboard Attitude and Orbit Control System (AOCS) helps in maintaining the satellites orientation using gyroscopes, reaction wheels, magnetic torquers and thrusters. Each IRNSS uses a propulsion system that consists of a 440 Newton Liquid Apogee Motor (LAM) and twelve 22 Newton thrusters. While the mission life for the earlier four satellites was 10 years, the IRNSS-1E has a mission life of 12 years.

All the IRNSS series of satellites carry identical payloads[7], a navigation payload and ranging payload. The navigation payload operating in L5 band (1176.45 MHz) and S band (2492.028 MHz) is used to transmit navigation services signals to the users. The navigational payload also has a highly accurate Rubidium atomic clock which controls the output frequency. The ranging payload is a C-band transponder which facilitates accurate determination of range of the satellite. These satellites also use Corner Cube Retro Reflectors for laser ranging.

The data inputs provided by a navigational satellite system is being extensively used in commercial services and applications like provision of navigational data (which also caters to visual and voice navigation services), agricultural support, mining operations, mineral explorations, disaster management, tracking of vehicles, logistic management, fleet management, mobile phone services, mapping and landscaping. On the military front, this data is now integral to the success of terrestrial, aerospace and maritime military operations. With back to back

IRNSS launches planned in February and March 2016, the dual use satellite technology will absolve the Indian government of dependence on the services provided by the third party and will increase the self reliance in commercial and military domains at varied levels.

(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])

Notes

[1] "PSLV C31/IRNSS 1E Launch Update: PSLV-C31 Successfully Launches IRNSS-1E into the orbit", at http://www.isro.gov.in/update/20-jan-2016/pslv-c31-irnss-1e-launch-update-pslv-c31-successfully-%03launches-irnss-1e-orbit accessed on January 20, 2016

[2] "PSLV-C31/IRNSS-1E" brochure, at http://www.isro.gov.in/sites/default/files/pslv-c31brochure.pdf accessed on January 20, 2016

[3] "SHAR set to launch 2 satellites in March 2016", at http://www.thehindu.com/todays-paper/shar-set-to-launch-2-satellites-in-march-2016/article7926567.ece accessed on January 20, 2016

[4] "Indian Regional Navigation Satellite System" at https://en.wikipedia.org/wiki/Indian_Regional_Navigation_Satellite_System accessed on January 20, 2016

[5] "Global Positioning System", at http://en.wikipedia.org/wiki/Global_Positioning_System accessed on October 16, 2014

[6] Comparative study of IRNSS brochures available at isro.gov.in

[7] ibid