INSTITUTE FOR DEFENCE STUDIES & ANALYSES
रक्षा अध्ययन एवं विश्लेषण संस्थान

IDSA COMMENT

India getting closer to a satellite navigational system

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April 7, 2014

Indian Regional Navigation Satellite System (IRNSS) is expected to become operational in less than a year from now. On 4th April 2014, Indian Space Research Organization (ISRO) has successfully launched the second satellite of this system, the IRNSS-1B, by using one of its most time-tested launch vehicle, the Polar Satellite Launch Vehicle (PSLV-C24). This was PSLV's 25th successive successful flight. The IRNSS will constitute of seven satellites. However, to make the system operational, four satellites are enough. The first IRNSS-1A was launched in July 2013. With two more satellites proposed to be launched during the later part of this year, the system can be expected to be operational by the end of this year or early next year.

IRNSS-1B has been presently launched into a sub-Geosynchronous Transfer Orbit (sub-GTO) and, in the coming few days, it would be finally placed in circular geosynchronous orbit at 55 degree East location with the initial inclination of 31 degree with respect to the equator.

IRNSS is expected to provide two types of services, namely, Standard Positioning Service (SPS) to be provided to all the users and Restricted Service (RS), which is an encrypted service provided only to specific users. This system is designed for a lifetime of approximately ten years. It is expected to offer accurate position information facility to users within the country and up to 1,500 km from the country's political boundary line. This system would provide a position accuracy of better than 20 meters in the primary service area. The performance of the IRNSS-1A which was lunched almost ten months back has been confirmed satisfactory and now shortly ISRO would be starting the orbit test and evaluation process for IRNSS-1B.

With the advent of mobile telephones offering multifunction facilities, using of handheld navigational systems has started taking root in India in the recent past. In coming few years satellite based navigational tools are expected to be in a greater demand within the country. IRNSS offers range of applications from vehicle tracking and fleet management to terrestrial, aerial and marine navigation to integration with mobile phones to providing assistance in disaster management.

Globally, the most commonly known navigation system is the United State's Global Positioning System (GPS). This system has a long history and is in use since 1978 however, it has been made globally available only since 1994 and is presently the world's most utilized system. In fact, all these years satellite navigation has become synonymous with the GPS. Such system offers real-time position, navigation and timing (PNT) services globally.

Although GPS transmits radio signals to users free of cost it needs to be remembered that this system is under the control of the US Air Force. The system essentially came into being for the purposes of military and has significant strategic utility for the United State's security architecture. It has 31 operational satellites flying in Medium Earth Orbit (MEO) at an altitude of approximately 20,200 km. Each of these satellite circles the earth twice a day.

Erstwhile USSR entered into the satellite navigation arena at a much later date than the US. Thereon, Russian constellation called GLONASS became operational in 1995, however subsequently owing to the financial problems the system remained partially functional for many years and was not able to provide global coverage. Since 2011, this system has been once again made functional by the Russian authorities. Presently, the European Union (EU) and the European Space Agency (ESA) is developing their approximately 30 satellite global navigational system called Galileo which is expected to be up and running by 2020. This particular project has witnessed significant delays over a period of time and it is only now with the launching of four satellites it is anticipated that the system would finally evolve as envisaged.

China's progress in the area of satellite navigation is impressive. They began with a three satellite based system called BeiDou Navigation Satellite System. The first satellite in this system was launched on 30 October 2000 and system became operational by 2003. An additional fourth satellite in this system was launched during 2007 and the system has a projected accuracy of 10 meters. China's global navigation satellite system called BeiDou-2 (COMPASS) comprising of 35 satellites (five in geostationary orbit and 30 in MEO) is currently under development. Already, more than half of these satellites have already been launched. This system has started offering services covering Asia-pacific region since December 2012. The entire system is expected to become operational by 2020.

India's current navigational system under development has got a different configuration than other global navigational systems. India's requirements are regional and hence India is presently making investments only to develop a regional system constituting of seven satellites. Conventionally, navigational satellites are positioned in the Medium Earth Orbit (MEO). However, the four satellites of the IRNSS would be in the inclined geosynchronous orbit (IRNSS-1A & 1B are already in this orbit) and the other three satellites would be placed into the geostationary orbit (36,000km above the earth's surface).

Japan is also developing a regional system. Initially, they started with the development of Quasi-Zenith Satellite System (QZSS) as a three-satellite regional system. But, during March 2013 it has been decided that this system would have four satellites while aiming at a final seven satellite constellation in the future. The system is expected to be in place by 2017.

Satellite navigation business market is found offering vast possibilities both for the present and for the future. The growth of this sector also offers significant opportunities to business houses to create new and innovative value-added applications for satellite positioning & navigation market. As per some satellite navigation market reports and estimates by experts, it has been projected that during the coming decade, the usage of navigation system is expected to increase significantly at a global level. The market is

predicted to grow to approximately €250 billion per annum by 2022. Core revenues are expected to reach €100 billion in 2019. New smart phone capabilities alongside integrated technologies and multiple software based applications could revolutionize the market in near future.

Overall, a fully functional IRNSS would help India to reduce its dependence on the GPS and/or GLONASS. For all these years GPS is offering the degraded signal (36 meter accuracy) to all its global users. This degraded single is of no use for the armed forces. With IRNSS in place, in the near future, India would be in a position to fully cater for its strategic requirements.

For commercial use of IRNSS signal various equipment manufacturers would be required to make provisions to incorporate this signal. It may be noted that several equipment manufacturers from the Asia-Pacific region do offer BeiDou-enabled models. Luckily some of the devices available in the market like various phone or receivers have got the facility to accept all kinds of signals including IRNSS. Technologically, IRNSS is expected to provide better signal even for the civilian usages. ISRO has announced that IRNSS-1B has two types of payloads-navigation payload and ranging payload. Navigational payload operates in L5 and S frequency bands while all other global systems operate in L1 and L2 frequencies which are not able to correct the error that creeps in due to the changes in the ionosphere characteristics. The ranging payload consists of C-band transponder for determining the range of the satellite.

The uniqueness of the IRNSS is to have a system with satellites in the geostationary orbit instead of MEO. However, such departure from the global practice could also pose few challenges. Since S-band frequency has never been used in the past few experts are of the opinion that the problems could arise in miniaturizing the receiver antenna for S-band. Also, since the satellites are positioned at high elevation, they could restrict the system for providing accurate indoor applications.

For India development of its own navigational system was the need of the hour for civilian, commercial and strategic purposes. Few years back India had agreed to make significant financial investments into the ESA's Galileo programme. However, finally India was forced to decide against joining this programme because they were denied the military rights of this system. Naturally, India was not left with any option and started articulating the need for the development of its own system around 2006. It is important to note that China has committed to provide Pakistan with a 'military quality' signal of its BeiDou system.

India needs to exploit the 'regional nature' of the IRNSS to the fullest. Apart from the Indian region, this system also has the capability to provide accurate observations covering much of India's extended neighborhood. India could effectively engage various states from Africa, Asia and Oceania region by using 'satellite navigation diplomacy'. Also, it is important to make systematic efforts to develop new markets. There is a need overall to 'steer' these scientific achievements to gain geopolitical and economic advantages.