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A STEP CLOSER TO SATELLITE NAVIGATION SELF SUFFICIENCY

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Introduction

Accurate navigation has been a prime requirement from the time mankind started to move from place to place. The invention of vessels such as ships, land surface transport vehicles and aircraft have led to ever greater importance being placed on reliable navigation aids. Earlier such navigation assistance systems utilised radio waves transmitted by transmitters based at several widely separated locations on the planet. With passage of time the potential of satellite based navigation was realised when the US introduced its "Navstar" Global Positioning System (GPS) for military as well as civil—with somewhat reduced accuracy— users in the 1980s. this was followed by the erstwhile Soviet Union, later Russia, introducing its own Global Navigation Satellite System (GLONASS). China commenced development and deployment of its Beidou / Compass system and the European Union (EU) started to work on the Galileo global satellite navigation system. All these satellite based navigation systems mentioned above are similar in that they aim at global coverage. Countries that do not own satellite navigation systems are forced to use foreign satellite navigation systems on the basis of international or bilateral agreements.

Indian Endeavours at Satellite Navigation

Indian military and civil operators have seen and experienced the utility of satellite based navigation through use of American GPS receivers for navigation and execution of operational military missions. The fact that the provider of GPS signals could potentially block or degrade these to suit his own purposes led to a decision to prudently utilise both the American GPS and Russian GLONASS in parallel on the assumption that denial or degradation of both these at the same time is much less likely. While doing so the advantage of having a completely Indian satellite navigation system did not escape

attention. The costs and technological complexities of setting up a satellite navigation system may have proven to be a road block initially. The first step in the development of an indigenous satellite based navigation system was the GPS Aided GEO Augmented Navigation (GAGAN) system. This system is essentially an elaborate wide area coverage differential GPS system in its essence and does not reduce dependence upon foreign owned and operated satellite navigation systems. Thus while the GAGAN may be adequate for civil use, it falls short of the control and assured availability requirements of Indian military operators. This led to the design and development of the Indian Regional Navigation Satellite System (IRNSS). The IRNSS has been explained in some detail on this website earlier. IRNSS comprises a mere seven satellites of which three are in geo-stationary orbit and four are in geo-synchronous orbit[1]. Through is unique configuration IRNSS reduces satellite requirements to just seven while restricting coverage to about a swath of +/- 40 degrees latitude and between 40degrees E and 140 degrees E in longitude [2]. This configuration covers the Indian landmass and about 1,500 kilometers (km) beyond Indian borders and coastlines and thus meets most Indian military and several civil requirements.

Four of the seven IRNSS satellites were put into orbit successfully over the previous months. On January 20, 2016 the 33rd successful mission of the Polar Satellite Launch Vehicle (PSLV) in its PSLV XL [3] version placed the fifth IRNSS satellite— IRNSS-1E— in orbit[4]. With this launch five of the planned seven satellites are in orbit. While waiting for completion of the satellite constellation, tests of the IRNSS have been in progress and the existing four satellites have been providing accuracy of under 20 m for about 18 hours per day[5]. Once the complete set of seven satellites are in position 24 hour coverage with high accuracy should be available to Indian users.

It is probable that suitable Indian companies have already been tasked to develop receivers for IRNSS signals. Such receivers once tested and cleared for service would guarantee that Indian military and other users have access to high quality accurate satellite navigation signals free from interference. While developing IRNSS receivers it may be prudent to include reception of GPS and GLONASS signals in the same receivers as was done earlier for the dual GPS-GLONASS receivers. Building in such redundancy could provide fall back options in situations of the IRNSS satellite constellation coming under kinetic or electronic attack.

The complete IRNSS space component is likely o be available during year 2016 with the seven satellite IRNSS becoming available to end users by the last months of 2016. This bodes well for the greater strategic autonomy of Indian military forces.

In addition there are several spin off uses for satellite navigation signals for the Indian economy at large. These range from efficient logistics tracking to greater efficiency in setting up of essential surface infrastructure.

Conclusion

Starting with simple map and compass systems, through land based radio transmitters for navigation guidance the state of the art in navigation assistance today is satellite based navigation systems. After dependence on foreign satellite navigation systems, India is steadily but surely moving towards a fully independent Indian owned and operated satellite navigation system in the IRNSS. With five satellites already in orbit and the last two due to be launched in the next five months the full availability of this satellite navigation system is getting closer. This is good news for all Indian users of satellite navigation signals.

(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] "Indian Regional Navigation Satellite System (IRNSS)", http://isp.justthe80.com/space-applications/indian-regional-navigation-satellite-system-irnss, accessed on January 20, 2016.

[2] Ibid.

[3] U Tejonmayam, "Isro's PSLV-C31 places IRNSS-1E satellite in orbit", http://timesofindia.indiatimes.com/india/Isros-PSLV-C31-places-IRNSS-1E-satellite-in-orbit/articleshow/50648970.cms, accessed on January 20, 2016.

[4] Ibid.

[5] "Fifth navigation satellite set for launch on January 20", http://www.thehindu.com/news/cities/bangalore/fifth-navigation-satellite-set-for-launch-on-january-20/article8120775.ece, accessed on January 20, 2016.