

# NavIC

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**Abstract:-** NavIC (Navigation under Indian Constellation) is an operational name of IRNSS (Indian Regional Navigation Satellite System) is a self governing regional satellite navigation system that offers precise real-time positioning and timing services. The name “NavIC” was proposed by our honorable Prime minister of India, Narendra Modi in honor of our country’s fishermen and sailors. It is a constellation of 7 satellites in an orbit altitude of 36,000 km above the earth’s surface, covering the whole India along with an extension of 1,500 km across the boundaries, which even cover up some of our neighboring countries as well.

It would provide us two different types of service:

- **SPS (Standard Positioning System)**  
Accuracy Range: 15-20ms  
For: Common people
- **RS (Restricted Services)**  
Accuracy Range: 5-10ms  
For: Authorised users (Military applications)

## INTRODUCTION

NavIC consists of a total of 7 satellites:

- 4 geosynchronous satellites
- 3 geostationary satellites

Geostationary satellites are constant in their position, situated over the Indian Ocean. Geosynchronous satellites, in pair, revolve in two orbits in a synchronous movement forming a shape of the numerical ‘8’.

All these satellites are tracked by 14 ground stations that are located all across the country. There are ground facilities responsible for NavIC satellite monitoring and ranging, transmission and generation of navigation parameters, network timing and satellite control.

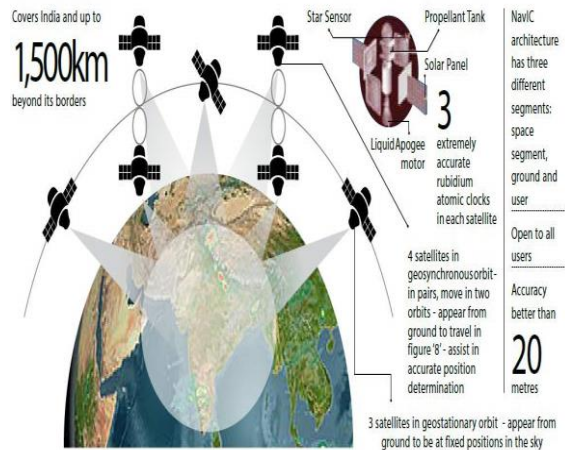
There were a total of 9 launches of satellites till date, out of which 7 of them are working, currently. The first launch (IRNSS 1-A) was made at 1<sup>st</sup> July, 2013. However, it was unsuccessful in its first attempt due to the failure of all the 3 rubidium atomic clock in it, and is out of operational state now. With the latest launch of IRNSS 1-I on 12<sup>th</sup> April, 2018, it completes the constellation of total 7 satellites in the orbit. It was successfully launched from Satish Dhawan Space Centre, Sriharikota, Andhra Pradesh. IRNSS 1-I is a replacement of the unsuccessful IRNSS 1-A. It was total flight of around 19 minutes when the launch vehicle attained a sub-geosynchronous transfer orbit, after which the satellite got detached from the launch vehicle. After detachment, the solar panels, automatically, got deployed.

Now, the control of the satellite would be taken over by ISRO’s Master Control Facility (MCF).

## OPERATION

The satellites revolving in the orbit sends the height, time and position of the particular location through microwave signals and the receiver in the ground stations figure out by calculating the latitude and longitude to produce the real time and position.

NavIC operates under S band (2492.028MHz) and L-5 (1176.45 MHz) band frequency, whereas G.P.S. use only L band frequency due to which it we have to face issues like, for e.g.- when low frequency wave transmits, the G.P.S. speed gets slow and so, it has to be updated again and again.



1. IRNSS 1-A 1<sup>st</sup> July, 2013 Geosynchronous Atomic clock failed
2. IRNSS 1-B 4<sup>th</sup> April, 2014 Geosynchronous Successful
3. IRNSS 1-C 16<sup>th</sup> October, 2014 Geostationary Successful
4. IRNSS 1-D 28<sup>th</sup> March, 2015 Geosynchronous Successful
5. IRNSS 1-E 20<sup>th</sup> January, 2016 Geosynchronous Successful
6. IRNSS 1-F 10<sup>th</sup> March, 2016 Geostationary Successful
7. IRNSS 1-G 28<sup>th</sup> April, 2016 Geostationary Successful
8. IRNSS 1-H 31<sup>st</sup> August, 2016 Geosynchronous Heat shield failed
9. IRNSS 1-I 12<sup>th</sup> April, 2018 Geosynchronous Successful

These satellites are launched with satellites launching vehicles such as PSLV (Polar satellite launching vehicle) where they use gaseous fuel (liquid and solid fuel used before).

The total budget cost of this whole operation was expected to be around Rs. 1,420 cr. But, after the replacement of two additional satellites (IRNSS 1-H & IRNSS 1-I), the total budget cost went around Rs. 2,246 cr.



Fig: PSLV-C39 Liquid Stage at the Vehicle Assembly Building during Vehicle Integration

- Marine, Terrestrial and aerial navigation.
- To prevent disasters
- Tracking vehicles and managing fleets.
- Timing Accuracy
- Geodetic data capture and mapping
- Voice and visual navigation for drivers

#### BENEFITS

- India's own navigation system and so, we don't have to rely on any other nation's services.
- The accuracy range is close to 10-15m, which is much more accurate than the current G.P.S. system that provides an accuracy of 20-30m.
- Another benefit is the messaging interface that is embedded in the NavIC system, which allows the command center to send warnings to a specific geographic area. For e.g.- people living in coastal areas can be warned about a cyclone attack as the satellite would detect its epicenter, at the very beginning.
- Once successfully launched, it can be shared with our neighboring countries as well, which can help us to strengthen the bond.

#### LIMITATIONS

According to recent reports, one drawback came into light is that NavIC signals might get affected by out of band interference due to Wi-Fi signals and LTE as both of them shares the same S- band frequency and are close to each other, especially Wi-Fi transmission. Solution: NavIC receivers should reduced bandwidth between +7.5 and -7.5MHz from +8.25 MHz, if possible, with sharp cut off filters on both ends.

#### CONCLUSION

India, setting up an indigenous regional navigation system, grabbed the post of 5<sup>th</sup> country in the world to have one of their own. This is one big contribution in the making of 'Digital India'.

India felt the need of having their own positioning system, after what happened in Kargil war 1999, when U.S. refused to share their GPS geo-locations of the enemies in our territory, but even then, we managed to emerge victory over them, at last. A cold betrayal leads to the innovation of something stronger and with more accuracy, i.e. NavIC

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