

TRACKING AND ANALYSIS OF THREE IRNSS SATELLITES BY USING SATELLITE TOOL KIT

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ABSTRACT

Abstract Indian space research organization planned to build Indian navigation and tracking system which is independent from global position system, which gives twenty four hours /seven days service to the users in all weather conditions, in this constellation consists of seven satellites which cover the Indian service area 1500 Km from its boundary. This paper deals about, the three Independent regional navigational satellites availability in space segment, coverage area and visibility gap analysis, speed and distance with respect to time and user receiver is simulated by using STK tool kit.

Keyword : - Indian space research organization, School of engineering and technology, Global position system, Independent regional Navigation Satellite System, Satellite tool kit.

1. INTRODUCTION

From the several decades the GPS satellite providing the tracking and navigation service to the user with an appropriate valid data, now Indian space research organization started to develop its own navigation and tracking system for an Indian users [1].

In an Independent regional Navigation Satellite System constellation consists of seven satellites, in which four satellites are geosynchronous orbit and three satellites are geo stationary orbit will be located with the required inclination and equatorial crossings in two different planes [2]. In this scenario only three geosynchronous satellites (IRNSS-1A, IRNSS-1B and IRNSS-1C) are launched and placed in a spaced segment are considered [4]. The IRNSS satellites are used to provide positional accuracies as same as global position system satellites, IRNSS position accuracy is expected around 10 m in land mass and 20 m in Indian ocean within the coverage area of 1500 km [8].

The IRNSS ground station antenna is able to receive the signals from IRNSS and GPS satellites from all the direction and it will keep tracking of these satellites with respect to the availability and time [3]. IRNSS signals consist of a position service and precision service both will be carried on L5 band (1176.45 MHz) and S band (2495.028 MHz) [7]. The navigation signals themselves would be transmitted in the S band frequency (2 – 4 GHz) and broadcast through a phased array antenna to maintain required coverage area and signal strength to increase the accuracy [6] and to validate the received data. The IRNSS setup is to find out the availability of IRNSS satellites especially in L band frequencies in the vicinity of the IRNSS local user

terminal [5]. Where the antenna is used to cover 0 deg - 360 deg in azimuth and elevation angle is fixed at 5 deg from the ground is placed at school of engineering and technology, Jain university.

To view the satellite movement and for visibility analysis we used satellite tool kit software. In this simulation we can observe the IRNSS satellites coverage area and visibility with respect to the user receiver position in 2D and 3D view respectively [1, 2].



Fig-1: Indian service area



Fig-2: Receiver placed at SET

2. METHODOLOGY

The procedure as followed to visualize the coverage area and visibility of IRNSS satellites with respect to the receiver placed at school of engineering and technology (SET). This longitude and latitude are loaded in STK tool and with the help of two-line element sets current data file satellites are loaded.

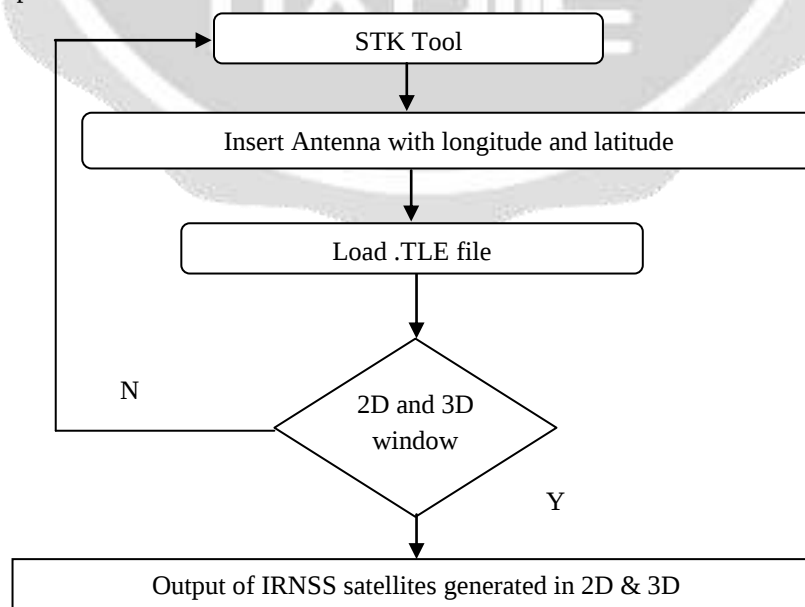


Fig-3: Analysis of IRNSS satellites

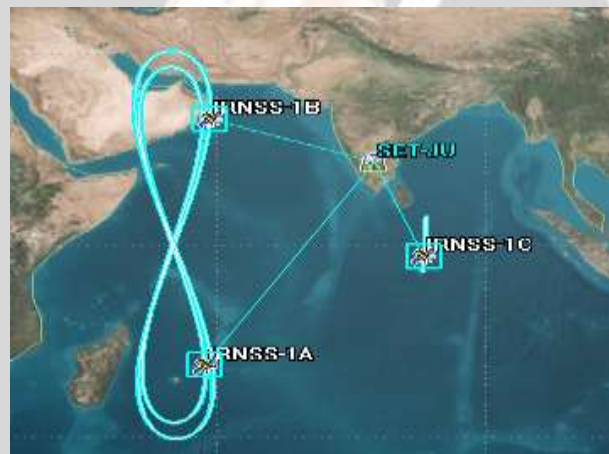
3. APPLICATIONS OF IRNSS

IRNSS satellites providing good accuracy in position and tracking in India compared to the GPS system. The IRNSS applications in following area are shown below,

- a) Navigation in marine system
- b) It as capability to detect and give service on disaster management
- c) Tracking of vehicles with good accuracy
- d) Mapping and Geodetic data capture
- e) Visual and voice navigation for divers

4. RESULTS AND ANALYSIS

IRNSS satellites IRNSS-1A, IRNSS-1B and IRNSS-1C are simulated in satellite tool kit software. It shows the visibility of both satellites in 2D window those are geo synchronous satellites fig [4]. In fig [5] shows that the elevation of satellites with respect to the globe 360 deg. The fig [6] shows the movement of satellites in axis with respect to the receiver. In fig [7] shows that the angular movement of satellites with respect to the time. The fig [8] show the visibility of three satellites with respect to the receiver placed at the ground segment longitude 77.488 and latitude 12.7436. The fig [9] shows the IRNSS satellites distances from the ground station and movement of satellites angle with respect to the time.

**Fig-4:** Geo synchronous path of IRNSS satellites

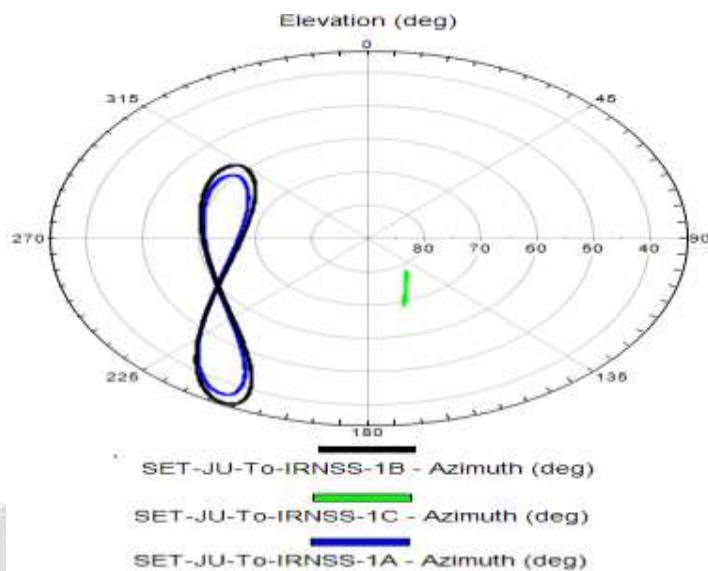


Fig- 5: Elevation plot for three IRNSS satellites

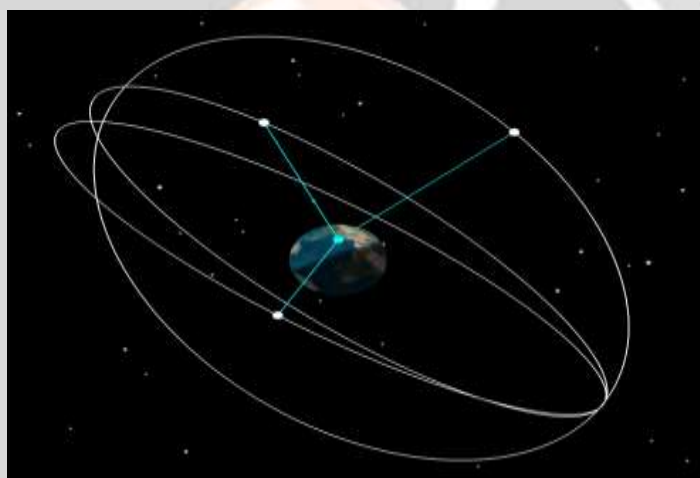


Fig-6: Three IRNSS satellites constellation

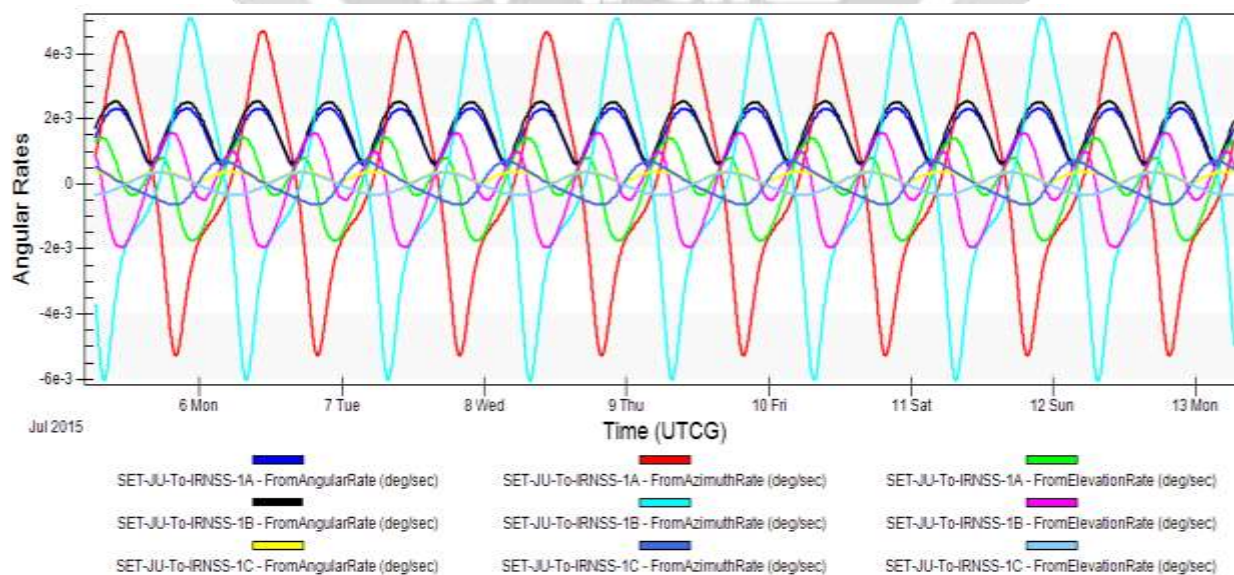
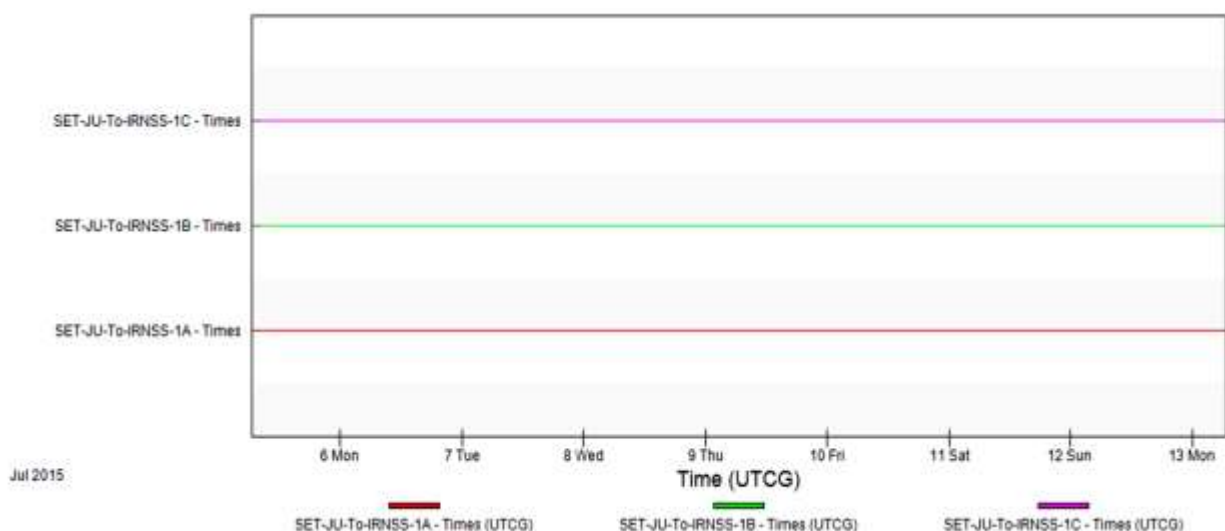
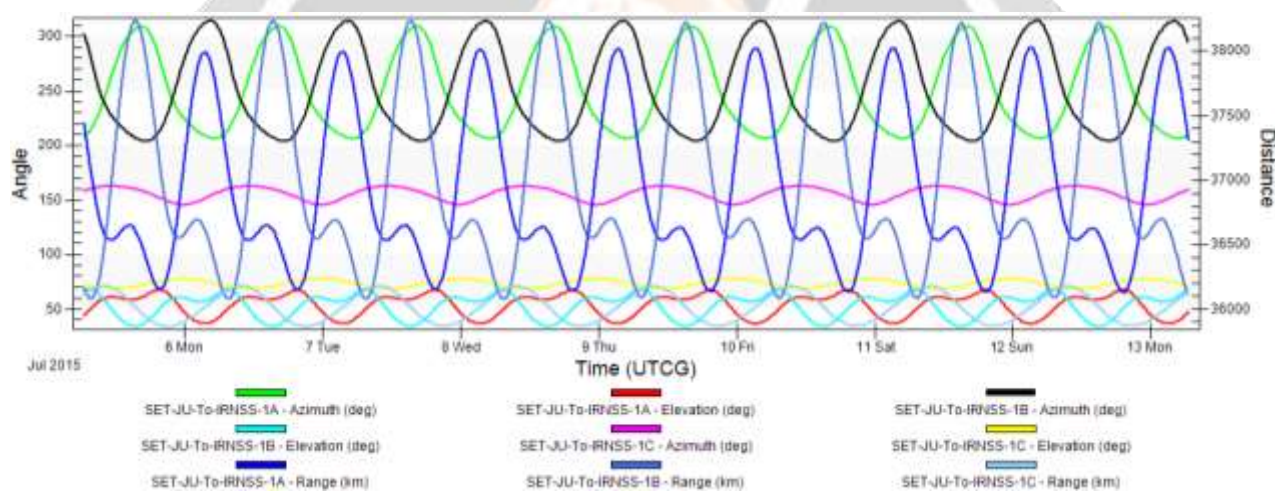


Fig-7: Angular rates of IRNSS satellites with respect to time**Fig-8:** visibility gap analysis of IRNSS satellites**Fig-9:** IRNSS satellites travelling distance and angle with respect to receiver

5. CONCLUSIONS

The three Independent regional Navigation satellites are geo synchronous satellites which are available in all the time with respect to the Indian coverage area are shown in simulation results and also there is no visibility gap found with respect to the receiver placed at school of engineering and technology.

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7. REFERENCES

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