POSITIONING of RADIO TELESCOPIC SATELLITES in ORBITS

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Abstract— This paper explains an overview in the area of Positioning of radio telescopic satellites in orbits around the Earth and also in the orbit followed by the earth around the sun. Radio telescopes include infra-red, X-ray, gamma-ray analysis of the celestial bodies, and many such. The acceleratingly, expanding universe throws an intriguing challenge to understand its subtle nature. subjects which need understanding and overcoming potential risks from Meteor belt, study of Orion arm, evaluation of entire cosmic year around super massive black hole, mysteries behind dark matter and dark energy make it a necessary path for the establishment of radio telescopic satellites with respect to the rotation and revolution velocities of the Earth round itself and the Sun as well.

Mineral extractions from outer space controversial subject of extra-terrestrial life, inter-galactic relocation habitat are the realms of developing space sciences which demand the need for deep space exploration. So as to meet these challenging necessities radio telescopic satellites are positioned in orbits around the earth and in an orbit around the sun. The data generated in a month of its Inception will be tremendously greater than that of the data generated in the entire past decade itself.

Index Terms- RTS, LEO, MEO, GEO, RT

I. INTRODUCTION

LOW EARTH ORBIT (LEO):

Typical Uses: Satellite phone, Military, Observation

Orbiting the earth at roughly 160-500 miles altitude, low earth orbit (LEO) satellites complete one orbit roughly every 90 minutes[2]. This means that they are fast moving (>17,000mph) and sophisticated ground equipment must be used to track the satellite. This makes for expensive antennas that must track the satellite and lock to the signal while moving.

MIDDLE EARTH ORBIT (MEO)

Typical Uses: Weather Satellites, Observation

Most of the satellites in this orbital altitude circle the earth at approximately 6,000 to 12,000 miles above the earth in an elliptical orbit around the poles of the earth. As the earth rotates, these satellites cover the entire surface of the earth. Fewer satellites are required to create coverage for the entire earth, as these satellites are higher and have a larger footprint.

GEOSTATIONARY/GEOSYNCHRONOUS (GEO):

Typical Uses: Television, Long Distance Communications, Internet

At 22,240 miles above the earth, craft inserted into orbit over the equator and traveling at approximately 6,880 miles per hour around the equator following the earth's rotation. This allows these satellites to maintain their relative position over the earth's surface[3]. Since the satellite follows the earth, and takes 24 hours to complete it's orbit around the earth, geostationary orbits are also called geosynchronous.

Figure 1: This explains about the altitudes of GEO, MEO, LEO.
<table>
<thead>
<tr>
<th>Orbit Distance</th>
<th>Miles</th>
<th>Km</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Earth Orbit (LEO)</td>
<td>100-500</td>
<td>160 - 1,400</td>
</tr>
<tr>
<td>Medium Earth Orbit (MEO)</td>
<td>6,000 - 12,000</td>
<td>10 - 15,000</td>
</tr>
<tr>
<td>Geostationary Earth Orbit (GEO)</td>
<td>~22,300</td>
<td>36,000</td>
</tr>
</tbody>
</table>

**TABLE 1: ORBITAL DISTANCES**

### II. KEPLER’S LAWS OF PLANETARY MOTION

**Law 1:**

Each planet orbits the sun in an elliptical path with the sun at one focus

![Figure 2: elliptical paths with varying eccentrics](image)

**Law 2:**

The radius vector (from sun to planet) sweeps out equal areas in equal time intervals

### III. POSITIONING OF RT SATELLITES IN DIFFERENT ORBITS AROUND THE EARTH

How ever large the Radio Telescope may be it still suffers from the translucent effect of earth’s atmosphere (filtering gamma, x-ray, uv rays etc). To overcome this we need to put radio telescopic satellites (RTSs) into orbits round the earth. A conventional radio telescope mounted on earth’s surface is enormously large and so are its parametrical statistics. Launching an RTS with similar dimensions is quite a challenging task. To ease off things we can mimic the properties of a radio telescope by forming a geometric array of RT satellites by launching them into orbits round the earth whose dimensions are not as large as that of a typical radio telescope used on earth[11,13].

For achieving this, these miniature Radio telescopic satellites will have to rotate in different elliptical orbits around the earth, upon doing so they will form circular and elliptical antenna arrays of various dimensions. These arrays will contribute to work similar to a large radio telescope mounted on the surface of the earth and gives aid to view the objects in space more clearly than ever before[15]. They align themselves in the form of the perimeter of a circle or an ellipse with different altitudes thus acting like different reflecting points on the parabolic reflecting dish of a radio telescope. All this results in the formation of a virtual radio telescope orbiting the earth.
The different elliptical paths have certain parameters that are needed to evaluate and to form that particular orbit. The statistical parameters of each orbit are uniquely different, those three parameters are
1. Semi-major axis length,
2. Inclination in degrees.
3. Eccentricity
The proposed model in this paper puts forward 6 elliptical trajectories for the Radio Telescopic Satellites, of which two of them would be geo-stationary that is the Radio Telescopes in them would revolve on the equator and these orbits have three satellites each and in the remaining four orbits (which are MEO) two orbits will be on one side of the earth in which one orbit inclined to left and other inclined to right and the same arragement will be made on the other side of the earth where each orbit has two radio telescopic satellites [4,7]. One of the three Radio telescopic Satellites in the first geo-stationary orbit along with other 4 Radio Telescopic Satellites two from each of the two orbits which are on the same side of the first geo-stationary orbit contribute to form a geometric array on the first half of the earth. Similarly one of the three Radio Telescopic satellites in the second geo-stationary orbit along with rest of the 4 Radio Telescopic Satellites two from each of the two orbits which are in the same side of the second geo-stationary orbit contribute to form a geometric array on the second half of the earth. Due to the movement of Radio Telescopes in their orbits around the Earth the shape of the geometric array varies from time to time.

<table>
<thead>
<tr>
<th>SL: NO</th>
<th>ORBIT</th>
<th>SEMI-MAJOR AXIS</th>
<th>INCLINATION</th>
<th>ECCENTRICITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GSO-1</td>
<td>70000</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>2</td>
<td>GSO-2</td>
<td>-70000</td>
<td>0</td>
<td>0.7</td>
</tr>
<tr>
<td>3</td>
<td>MEO-1</td>
<td>70000</td>
<td>225</td>
<td>0.7</td>
</tr>
<tr>
<td>4</td>
<td>MEO-2</td>
<td>70000</td>
<td>-225</td>
<td>0.6</td>
</tr>
<tr>
<td>5</td>
<td>MEO-3</td>
<td>-70000</td>
<td>225</td>
<td>0.8</td>
</tr>
<tr>
<td>6</td>
<td>MEO-4</td>
<td>-70000</td>
<td>-225</td>
<td>0.6</td>
</tr>
</tbody>
</table>

Table 2: different statistics of RT satellites around the earth

IV. POSITIONING OF RT SATELLITES IN SINGLE ORBIT AROUND THE SUN

Positioning of Radio Telescopic satellites at different points in the orbit followed by the earth around the sun:

To have a better understanding about the topic mentioned above lets first review with the Keplers laws. Keplers 1st law states that “all planets move in elliptical orbits with a star at any one of the foci “, Keplers 2nd law states that “the line that connects a planet to the star sweeps out equal areas in equal times “ [18]. The model proposed in this paper describes about positioning of radio telescopes in the orbit followed by the earth round the sun. The very purpose behind this model is to rectify the fact that RT satellites cannot view the the universe in the way they should ,this is because of earths atmosphere which is acting as a filter, hindering most of the data reception by the RT satellites back down on earth[9]. Viewing through
radio telescopes is an elegant way of studying universe. But still the cloud cover and other ecological cycles on the earth interferes the working efficiency of radio telescopes\[20,21\]. The ozone layer does its job of shielding us from UV, gamma, x-ray and other harmful radiations, which are the basic requisites for a radio telescope so as to have an effective way of analyzing a celestial object. To eliminate this defect, this paper suggests of launching radio telescopic satellites into the orbit followed by the earth around the sun. These would revolve with a velocity similar to that of the earth but equally spaced and located at different positions on the entire orbit. It takes earth duration of 6 months to reach perihelion if started at aphelion and vice-versa[7]. During this entire period the radio telescopes on earth fails to grasp other radiations incident on to the rest of the orbit. This drawback can be overcome by positioning RT satellites at 12 different positions aiding to view the universe specks where earth cannot (because of course of revolution).

<table>
<thead>
<tr>
<th>SL: NO</th>
<th>SATEL-LITE NAME</th>
<th>SEMI-MAJOR AXIS ( in km )</th>
<th>INCLINATION (degrees)</th>
<th>ECCENTRICITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>RTS-1</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>2.</td>
<td>RTS-2</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>3.</td>
<td>RTS-3</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>4.</td>
<td>RTS-4</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>5.</td>
<td>RTS-5</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>6.</td>
<td>RTS-6</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>7.</td>
<td>RTS-7</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>8.</td>
<td>RTS-8</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>9.</td>
<td>RTS-9</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>10.</td>
<td>RTS-10</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>11.</td>
<td>RTS-11</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
<tr>
<td>12.</td>
<td>RTS-12</td>
<td>149598262</td>
<td>7.155</td>
<td>0.016710219</td>
</tr>
</tbody>
</table>

**TABLE 3: DIFFERENT STATISTICS OF RTS REVOLVING ROUND THE SUN**

Even though the parameters mentioned in the table-2 are same for all the 12 Radio Telescopic Satellites, their separation varies in time and distance.

**CONCLUSION**

The paper finally explains Positioning of radio telescopic satellites in different orbits around the earth and in the orbit followed by the earth around the sun, so as to have a dynamic view of the celestial objects in the space, which contributes to gather enormous amounts of information in a very less time which matters a lot in the space science.
This plot explains the Middle earth orbit RTS, with semi-major axis 70000 kms, eccentricity 0.6, and inclination -225 degrees.

This plot explains about Middle earth orbit RTS with semi-major axis -70000 kms, eccentricity 0.8, and inclination 225 degrees.

This plot explains about Middle earth orbit RTS with semi-major axis -70000 kms, eccentricity 0.6 and inclination -225 degrees.

Figure 3: Middle Earth Orbit RTS inclined left

Figure 4: middle earth orbit RTS inclined right

Figure 5: Middle Earth Orbit RTS inclined left

Figure 6: Middle Earth Orbit RTS inclined Right
This plot explains about all the orbits of Radio Telescopic satellites.

Figure 7: The orbits of Radio Telescopic Satellites around the Earth.

This plot explains about the RTS positioned in the earth orbit around the sun with the semi-major axis 49598262 kms, eccentricity 0.016710219, and inclination 7.155 degrees.

Figure 8: The RTS positioned around the sun in the earths orbit.

REFERENCES