HACETTEPE UNIVERSITY

DEPARTMENT OF

GEOMATICS ENGINEERING

GMT327

ORBITAL MECHANICS and ASTRONOMY

HOMEWORK -3

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1) Satellite ID: TURKSAT 5B → SATCAT ID: 50212
                              → COSPAR ID: 2021 - 126A

   " Türksat 5B satellite, which is in the High Throughput Satellite (HTS)
class category with at least 20 times more capacity efficiency than Fixed
Satellite Service (FSS) class satellites, and will be the most powerful of the
Türksat satellite fleet with its useful load capacity. Launched in 2021, this
satellite will increase number of active communication satellites in Turkey to five and the
total number of satellites to eight. It has a maneuver life of more than 35 year"

2) Mission Objectives ; " a commercial communications satellite "

3) Classical Orbital Elements ;

   - Semi major axis : 42164 km   - Argument of Perigee : 322, 547°
   - Eccentricity : 0,00038   - True anomaly : 30°
   - Right ascension of the ascending node : 335, 516°
   - Inclination : 0,0718° (ellipse)   2022 Epoch

4) Orbit type ; Geosynchronous (Geostationary)

5) Celestial Sphere ;   e = eccentricity = 0,00038
                                                i = inclination
"e" is the shape of the orbit.   w = Argument of Perigee
The value of "e" is between 0 and 1,   v = True Anomaly
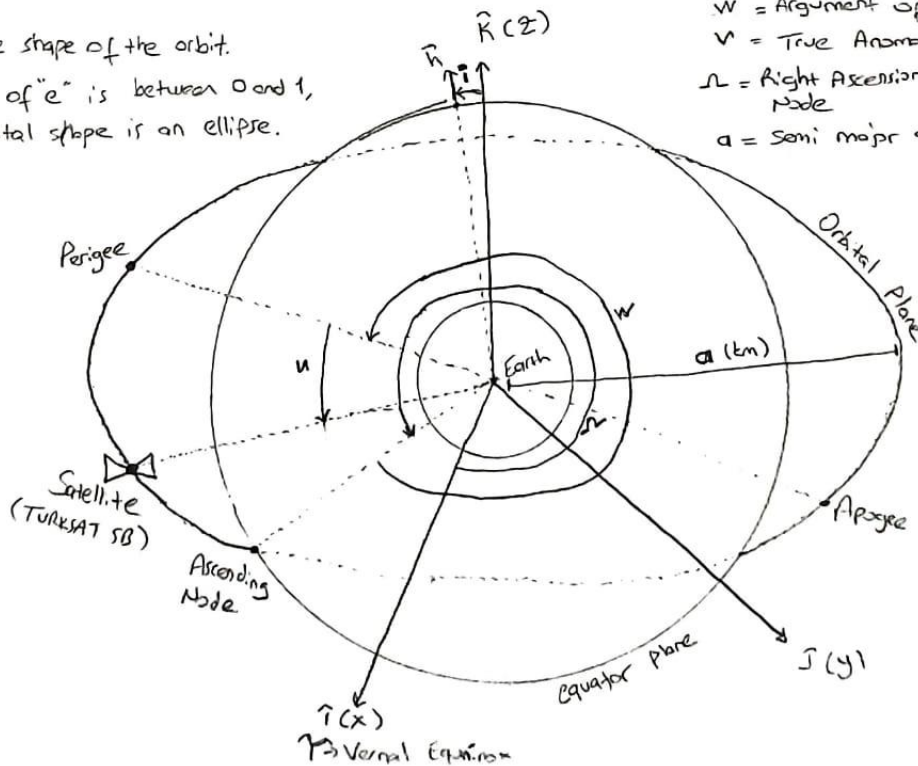so the orbital shape is an ellipse.   Ω = Right Ascension of Ascending
                                                    Node
                                                a = Semi major axis in km

1) Satellite ID : CARTOSAT - 3 → SATCAT ID: 44804
                              → COSPAR ID: 2019 - 081A

"Cartosat-3 is an advanced Indian Earth Observation Satellite built
and developed by Indian Space Research Organisation, which replaced the Indian
Remote Sensing series. It has a panchromatic resolution of 0.25 metres making it
one of the imaging satellite with highest resolution in the world at the time
of launch, in addition launched on 27 November 2019. "

2) Mission Objectives ; Earth Observation,

"Cartosat-3 will address the increased user's demands for large scale urban
Planning, rural resource and infrastructure development, coastal land use and land cover etc."

3) Classical Orbital Elements ;

- Semimajor axis : 6885 km
- Eccentricity : 0,00130
- Right ascension of the ascending node : 23, 385°
- Inclination = 97, 3788°

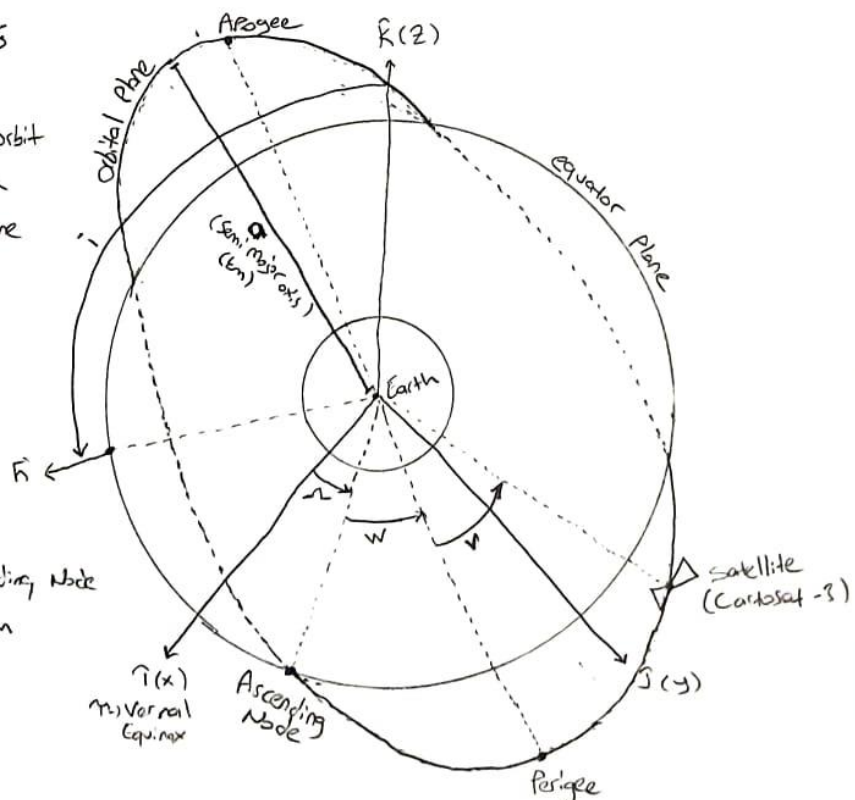- Argument of Perigee : 34, 129°
- True anomaly : 30°

2022 Epoch

4) Orbit type ; Sun - synchronous

5) Celestial Sphere ;

"e" is the shape of the orbit
The value of "e" is between
0 and 1, so the orbital plane
shape is an ellipse.

i = inclination
W = Argument of Perigee
ν = True Anomaly
Ω = Right ascension of Ascending Node
a = Semi major axis in km
e = eccentricity = 0,00130

1) Satellite ID: NAVSTAR 63 (USA-203) → SATCAT ID: 34661
→ COSPAR ID: 2009-014A

Constellation: GPS Constellation

"USA-203, also known as GPS IIR-20(M), GPS IIRM-7 and GPS SVN-49, is an American navigation satellite which was intended to become part of the Global Positioning System. It was the sixth of seven Block IIRM satellites to be launched and launched on 24 march 2009."

2) Mission Objectives; "Navigation"

"Designed to provide users with three-dimensional location and navigation information around the world."

3) Classical Orbital Elements;

- Semi major axis: 26559 km
- Eccentricity: 0,01231
- Right ascension of the ascending node: 263,049°
- Inclination: 54,9643°

- Argument of Perigee: 55,636°
- True Anomaly: 30°

2022 Epoch

4) Orbit Type; Medium Earth orbit (Semi-synchronous orbit)

"This satellite was chosen for the GNSS given in the assignment."

5) Celestial Sphere;

"e" is the shape of the orbit. The value of "e" is between 0 and 1, so the orbital shape is an elliptic.

Ω = Right ascension of Ascending Node
i = inclination
e = eccentricity = 0,01231
v = True Anomaly
w = Argument of Perigee
q = Semi major axis
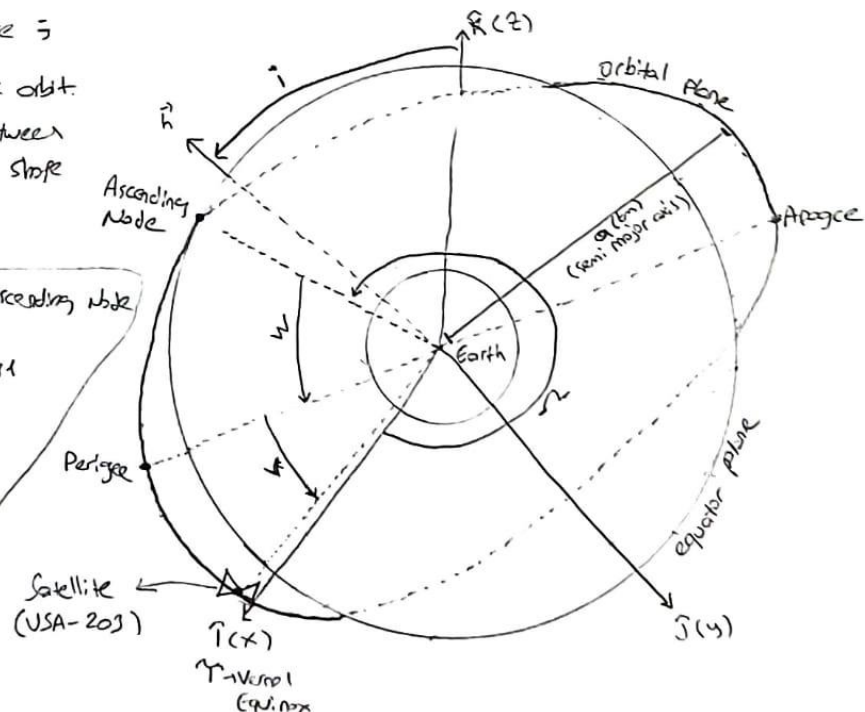
1) Satellite ID: ASTRO-H (Hitomi) → SATCAT ID: 41337
→ COSPAR ID: 2016-012A

"ASTRO-H (also known as Hitomi) is an X-ray astronomy satellite commissioned by the Japan Aerospace Exploration Agency (JAXA) for studying extremely energetic processes in the universe. It was launched on 17 February 2016."

2) Mission Objectives; X-ray astronomy.

"Hitomi mission objectives are to; Study of the structure of the universe. How do black hole develop, and how do they impact the surroundings? How are Galaxy clusters created and how do they evolve? etc..."

3) Classical orbital Elements;

- Semi major axis : 6945 km
- Eccentricity : 0,00118
- Right ascension of the ascending node : 146,445°
- Inclination = 31,0035°

- Argument of Perigee : 195, 682°
- True Anomaly : 30°

2022 Epoch

4) Orbit Type ; LEO (Low Earth Orbit)

5) Celestial Sphere;

"e" is the shape of the orbit.
The value of "e" is between 0 and 1,
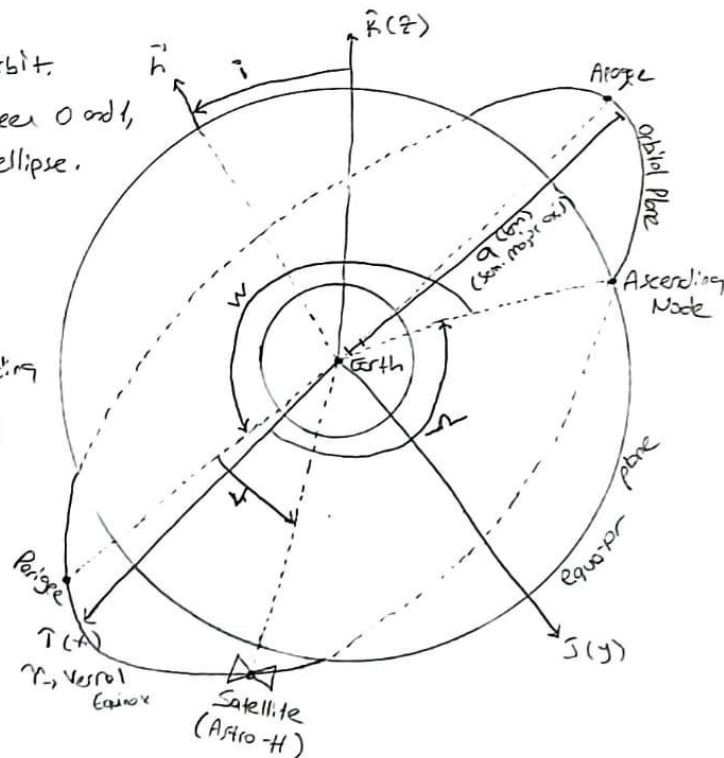So the orbital shape is an ellipse.

Λ = Right Ascension of Ascending Node
e = eccentricity = 0,00118
W = Argument of Perigee
V = True Anomaly
i = inclination
a = semi major axis in km

1) Satellite ID: MOLNIYA 3-50 → SATCAT ID: 25847
   → COSPAR ID: 1999-036A

" Molniya satellites were military and communications satellites launched by the Soviet Union from 1965 to 2004. These satellites used highly eccentric elliptical orbits known as Molniya orbit, which have a long dwell time over high latitudes. They are suited for communications purposes in polar regions, in the same way that geostationary satellites are used for equatorial regions. It was launched on 8 July 1999 "

2) Mission Objectives : "Military and communications (intelligence)"

3) Classical Orbital Elements :

- Semi major axis : 26551 km
- Eccentricity : 0,73431
- Right ascension of the ascending node : 311, 102°
- Inclination : 63, 2777°

- Argument of Perigee : 282, 432°
- True Anomaly : 30°

2022 Epoch

4) Orbit Type : molniya orbit

" This satellite was chosen for the Communication / Intelligence given in the assignment. "

5) Celestial Sphere :

"e" is the slope of the orbit.
The value of "e" is between
0 and 1, so the orbital shape
is an elliptic.

e = eccentricity = 0,73431
i = inclination
a = semi major axis
v = True Anomaly
w = Argument of Perigee
Λ = Right ascension of Ascending Node