



RAS

GENERAL STUDIES PAPER-II

Volume-II

GENERAL SCIENCE & TECHNOLOGY



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Space Technology

(Communication + Defence + Information)

Satellite }
Shuttle } — both are spacecraft.

Space craft — all those which goes to space e.g. Chandrayaan, Mangalyaan.

Rocket

Missile

Launch vehicle

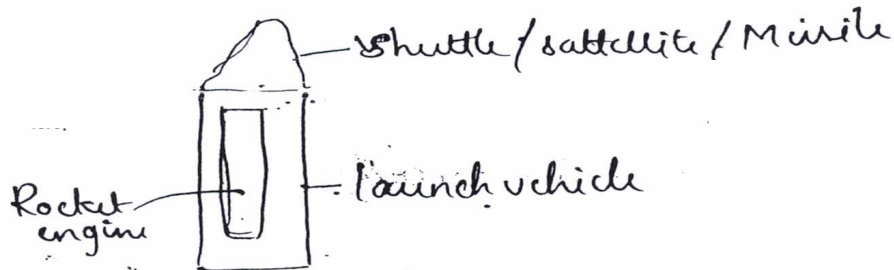
Satellite

- placed in earth orbit (attraction) gravity ≈ 36000 km
- Never comes back
- Multiple uses - commⁿ, infoⁿ, GPS, navigⁿ etc.
- Never used to deliver anything in the space. (not used in space Transport system)

Shuttle

- placed anywhere if you want to
- delivers the objects in space (space transport system)
- Reusable.
- Astronauts and Cosmonauts are same.

Rockets — engines or machines used in Shuttle, Missile and launch vehicle or satellite



Missile and Rocket are only tested

Missiles — used for destructive purpose.

Space Technology also known as Dual Technology — as it is used in Defence

Satellite

 Polar Satellite / Remote Sensing Satellite }
 INSAT / GISAT }
 Indian satellite / Geostationary Sat. }

Launch Vehicle

- 1G — SLV (Satellite Launch Vehicle)
- 2G — ASLV (Augmented)
- 3G — PSLV (Polar)
- 4G — GSLV (Geostationary)

Remote Sensing Satellite

Aryabhata (1975)

Bhaskara

Rohini

SROSS

IRS- 1A, 1B, 1C, 1D, 1E, 1F

CARTOSAT

OCEANSAT

RESOURCESAT

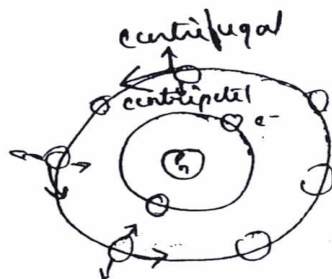
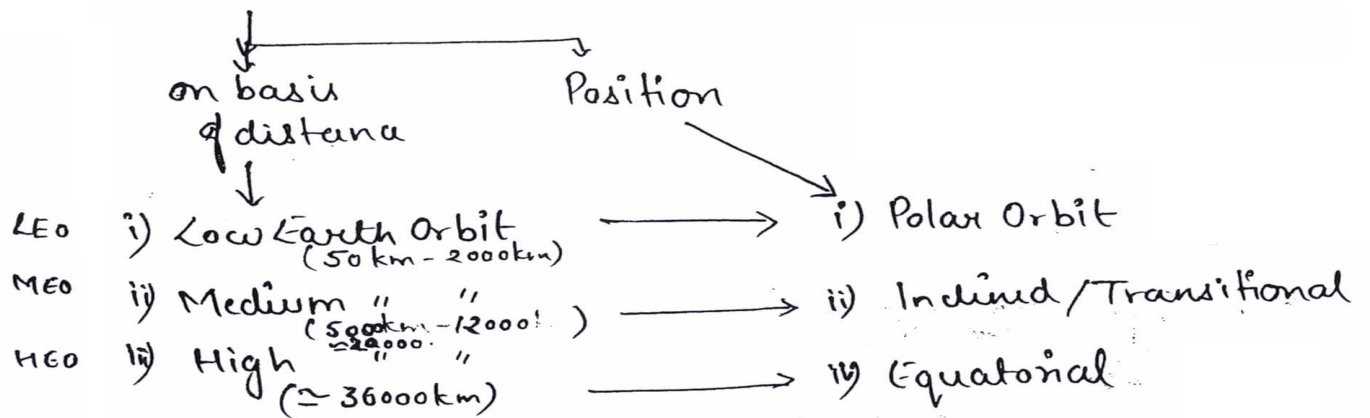
RISAT

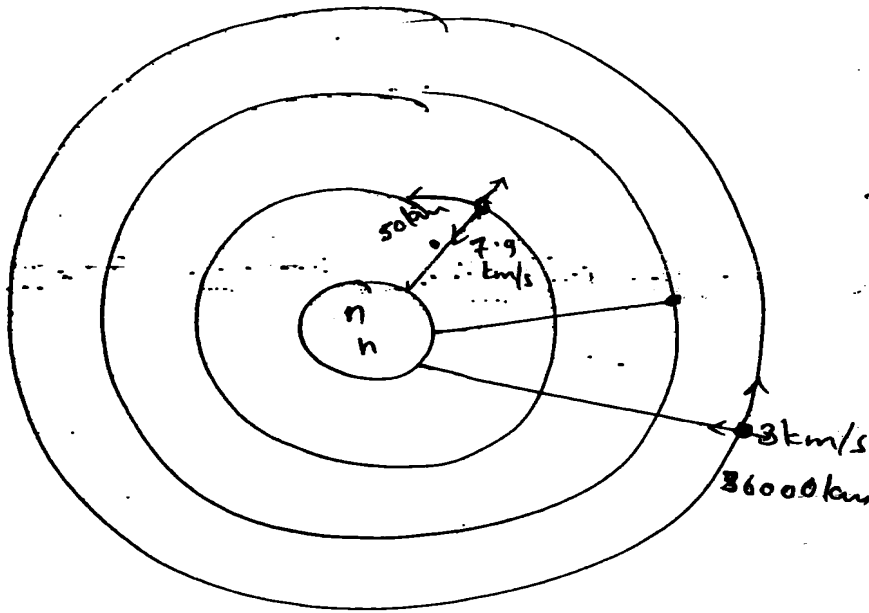
Megha Tropics

SRM SAT

JUGNO

Orbit





acceleration
 is maintained
 to balance the
 centripetal and
 centrifugal forces.
 ∴ The satellite
 does not
 fall.

for equatorial = 3.9 km/s

for polar = 7.9 km/s .

Types of Satellite -

Polar Orbit

Polar Synchronous orbit

Navigation

2011(M) → Geostationary Satellite

Geosynchronous Satellite

Polar orbit

50 km $\rightarrow$ 95 min

1500 km $\rightarrow$ 120 min

— used for mapping purpose

- resources
- melting of ice (in polar areas)
- afforestation, deforestation
- productivity of crop/loss
- attack of forest/insect
- water table
- Disaster Mng.
- weather forecasting
- spy purpose

IKONA
↓
first
Remot
sensi
satellite
by
USA
for
spy
pur

Geostationary orbit

- perpendicular to equator with some inclination acc. to countries.

- remains at same position

satellite revolⁿ = earth rotatⁿ
only $\omega \rightarrow E$ (24 hrs)

* Through IRS-1A, 1D
15 types of agricultural climatic zone in India found through remote sensing satellite. (polar satellite)

IRS - placed in
(Tot. 11) polar sun-synchronous orbit.

Polar Sun synchronous Orbit

- at 800 km
- 98.6° inclination angle

Geosynchronous orbit

Cyco - earth
Synch - together
Chro - time
ous - both.

$\omega \rightarrow E$
 $E \rightarrow \omega$ } in 24 hrs.

Geostationary Orbit

$\omega \rightarrow E$
in 24 hrs

it appears stationary in comparison to the Earth.

Its a kind of Geosynchronous orbit.

(ii)

inclination angle is fixed.

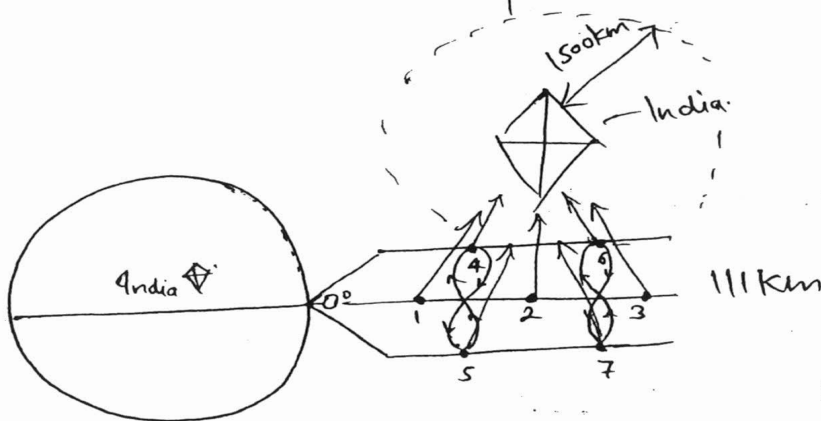
Geosynchronous Orbit

$\omega \rightarrow E$ can move
 $E \rightarrow \omega$ in both direction

(used $\omega \rightarrow E$ since) it's easy

inclination angle is varying (bubbling)

$\therefore$ Bubbling is $\&$ changing of position of geosynchronous satellite.



eg. INSAT

1, 2, 3 - geostationary
4, 5, 6, 7 - geosynchronous

- * Polar satellite never used for navigation / communication
- * Geostationary also we cannot use " (it cannot be used beyond $60-70^\circ$) but used for communication 😊



ISAC
at
Bangla

Navigation (GPS)

for navigation purpose (24-36) satellites are used in an inclined orbit.

(India has not sent any satellite in inclined orbit).

Grows of 4 satellite.

Launching Station

- i) Kourou (French Guyana)
- ii) Cape Canaveral (Florida)

India always use French Guyana.

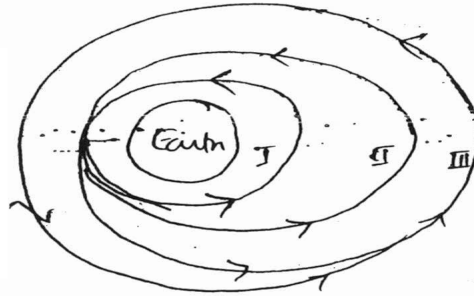
Why French Guyana is a launching station of India?

(i) Location of French Guyana -

- a) near to equator (earth's gravity is less)
- b) towards the eastern coast.

↓
at the time of uplift
it is easy to rise.

c) safe for people and property.



- I - transfer orbit
- II - intermediate orbit
- III - circular orbit

Institutional Set up

1962 - GOI set up a committee for Space Research

1969 - On the recommendation of this committee
ISRO was formed.

1972 - DOS established (Dept. of Space) and
ISRO was brought under it.

ISRO has various regional centres -

(i) ISAC - ISRO Satellite Application Centre
in Bangalore.

- How we develop our satellite

(ii) VSSC - Vikram Sarabhai Space Centre
in Tiruvananthapuram.

- Launch vehicle development centre

(iii) SOSC - Satish Dhawan Space Centre in
Sriharikota (AP)

- Launching station of India.
- old name was SHAR

- iv) SAC - Satellite Application Centre in Ahmedabad
- Data acquisition centre (all satellite based data are stored ^{here} ~~there~~)

Satellite

① Remote Sensing Satellite or Polar Satellite

- i) Payload : LISS camera (Linear imaging self scanning)
WFS camera (wide field sensor)
Panchromatic camera

Payloads are those devices installed in the satellite for any purpose.

ii) Functions

1st Remote sensing satellite was placed in 1975 - Aryabhata.

Note - 1 July - 7 June
↓
Study of satellite

2). INSAT/GSAT Satellite -

- INSAT satellites are multipurpose satellite

a) for communication and infoⁿ

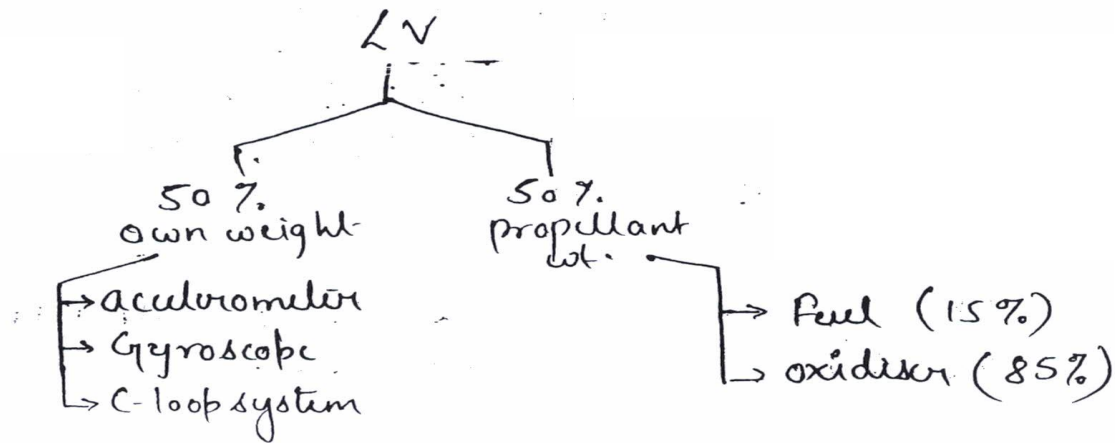
[telecommⁿ, satellite news gathering, business
networking, internet, DTH, etc., search
and rescue operation.]

b) In regional GPS system, these satellite
also help. (e.g. GAGAN, IRNSS)

payload of INSAT satellite we will discuss in
Communication Tech. Chapter.

- 1st successful INSAT satellite was INSAT 1B
(earlier name was INSAT and now GSAT)

Launch Vehicle Technology



- accelerometer used for acceleration of LV
- Gyroscope provides specific direction to LV
- C-loop sys. is overall programme of LV.

Solid fuel = HTPB (Hydroxyl terminated Poly-butadiene)

Liquid " = UDMH (unsymmetrical dimethyl) hydrazine

O = N_2O_4 (Nitrogen Tetraoxide).

Stages of Launch Vehicle

1G - SLV - 1 stage $\left\{ \begin{array}{l} S \\ S \\ S \\ S \end{array} \right.$

Solid
liquid

2G - ASLV - 5 stage $\left\{ \begin{array}{l} S \\ S \\ S \\ S \\ S \end{array} \right.$

3G - PSLV - 4 stage $\left\{ \begin{array}{l} S \\ L \\ S \\ L \end{array} \right.$

4G - GSLV - 3 stage $\left\{ \begin{array}{l} S \\ L \\ \text{Cryogenic stage} \end{array} \right.$

SLV —

- it can carry 50 kg wt. of satellite in low earth orbit.
- Now it's not in use.
- 1st launch vehicle used by India was SLV-III under leadership of A.P.J. Kalam (it was successful) (1979)

Note : Antix work under ISRO for commercial purpose.

ASLV

- carrying capacity 150 kg in ~~LEO~~ (Low Earth orbit)
- retired.
- some of ASLV has been changed under the development of certain missiles.

PSLV

Polar satellite launch vehicle.

Variants —

— PSLV	} developed
— PSLV-CA	
— PSLV-XL	
— PSLV-HP	} developing
— PSLV-3S	

1st PSLV — variants of PSLV	in 1993 — PSLV-D1	IRS-1E	Fail
	1994 — PSLV D2	IRS-P2	successful
	D3		
	C1		
↓			
↓			
variant of PSLV CA	— 2008 — PSLV-C9	if successfully carried max. no of satellite in one operation	
	right now 2nd rank		