

# Lecture 24



## **PRINCIPLES OF SATELLITE COMMUNICATION**

**SATELLITE LAUNCHING  
STATION KEEPING**

**SATELLITE STABILIZATION  
TELEMETRY, COMMAND &  
TRACKING SUBSYSTEM**

# WHAT IS THE MECHANISM OF LAUNCHING OF SATELLITE?



- LAUNCH VECHICLE i.e LAUNCHER
- VELOCITY VECTOR & ORBITAL HEIGHT
- ORBIT HEIGHT – 42164.17 KM
- ABOVE FROM SURFACE OF EARTH 35786 KM
- SPACE SHUTTLE – WHICH IS ALSO SPACE TRANSPORTATIONS SYSTEM (STS) BY NASSA
- ALSO CALLED EXPENDABLE LAUNCH VECHILE (ELU)
- RESUABLE LAUNCH VECHILE (RLV)

# SPACE SHUTTLE



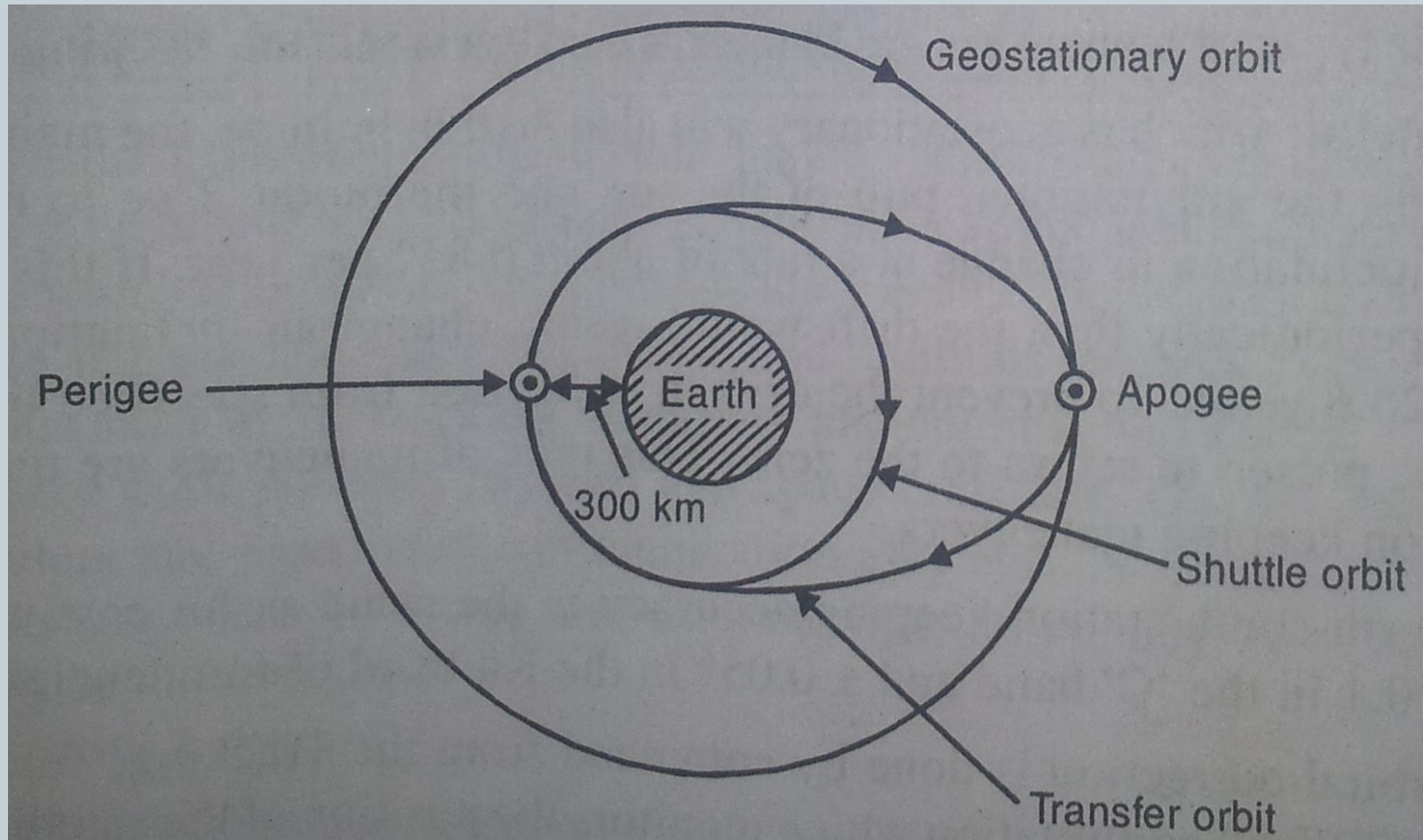
- LAUNCHED IN CIRCULAR ORBIT
- INITIALLY LAUNCH IN LOW ORBIT
- APPROX 300 KM ABOVE EARTH SURFACE
- LATER IN ELLIPTICAL ORBIT
- GEOTRANSFER ORBIT
- HIGHEST POINT IS CALLED APOGEE
- LOWEST POINT IS CALLED PERIGEE
- TRANSFER ORBIT WHICH MINIMIZE THE ENERGY COSTS IS CALLED **HOHMANN TRANSFER ORBIT**

# LAUNCHING STEPS

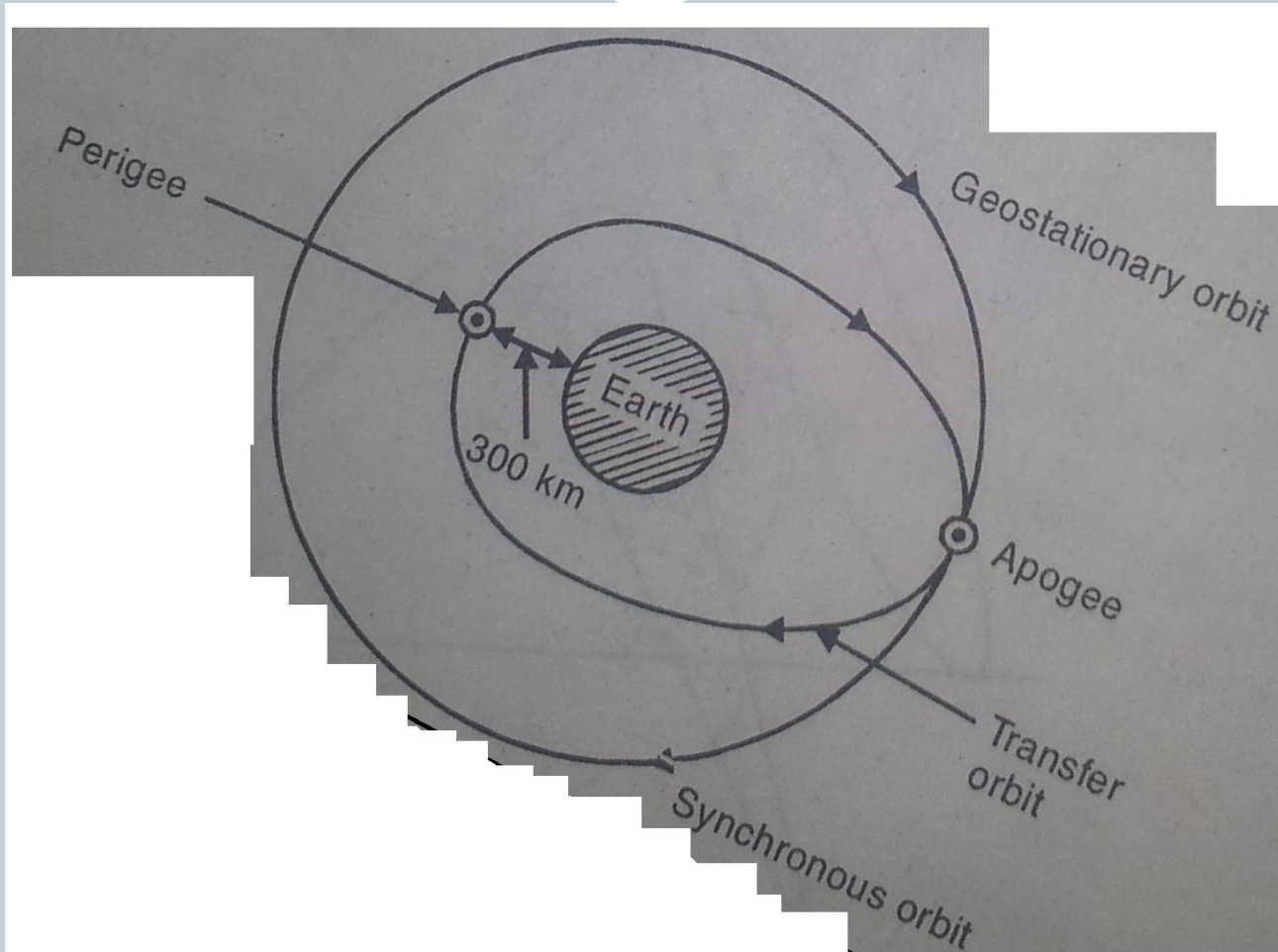


- LAUNCHING SATELLITE WITH SPACE SHUTTLE IS LESS EXPENSIVE
- SPACE SHUTTLE CAN BE REUSED
- FIRST LAUNCHED CLOSE TO THE EQUATOR
- BY THIS FUEL COST IS REDUCED
- BY THIS LAUNCHI

# Launching steps using SPACE SHUTTLE



# Launching steps using EXPANDABLE LAUNCHER



## Continue ...



- AN UN MANNED LAUNCH VEHICLE
- USED TO PLACE DIRECTLY IN AN ELLIPTICAL ORBIT
- ELLIPTICAL ORBIT IS TANGENT TO THE GEOSTATIONARY ORBIT AT ITS APOGEE.
- SATELLITE FIRES ITS THRUSTER ROCKET AT THE APOGEE WHICH PROVIDES ACCELERATION NEEDED TO TRANSFER THE SATELLITE FROM AN ELLIPTICAL ORBIT IN TO A GEOSTATIONARY ORBIT.



# STATION KEEPING



- SATELLITE BE KEPT IN ITS CORRECT ORBIT PATH ALONG ITS ALLTITUDE.
- EQUATORIAL ELLIPTICITY OF EACH CAUSES DRIFTING OF GOSTATIONARY SATELLITE FROM  $75^{\circ}$  TO  $105^{\circ}$
- FOR THIS AN OPPOSITELY DIRECTED VELOCITY COMPONENT IS IMPORTED TO THE SATELLITE BY MEANS OF JETS
- THESE ARE PULSED ONCE IN EVERY 2-3 MONTHS

# CONTINUE .....



- THIS RESULTS BACK THROUGH ITS NORMAL STATION POSITION AND COME TO STOP.
- SAME PROCESS REPEATS AFTER 2-3 WEEKS
- THIS KIND OF MANEUVERS ARE KNOWN AS EAST WEST STATION KEEPING.
- SOME ARE BECAUSE OF GRAVITATIONAL PULL OF THE SUN AND MOON
- CHANGE AT A RATE OF ABOUT  $85^{\circ}$  PER YEAR.

# CONTINUES ...



- THE ORBITAL CORRECTION IS DONE BY COMMAND FROM THE TRACKING, TELEMETRY AND COMMAND EARTH STATION
- THIS MONITORS THE POSITION OF THE SATELLITE.
- ALL E-W AND N-S STATION KEEPING MAUNVERS ARE CARRIED OUT USING SAME THRUSTERS AS USED FOR ALTITUDE CONTROL.

# SATELLITE STABLISATION



- SATELLITE SYSTEM
  - A) GROUND SEGMENT
  - B) SPACE SEGMENT
- SPACE CRAFTS LAUNH SATELLITE IN GEOSTATIONARY ORBIT TO BECOME AN ARTIFICIAL SATELLITE
- NOW SPACE SEGMENTS INCLUDES GEOOUND FACILITIES REQUIRE TO KEEP SATELLITE OPERATIONAL