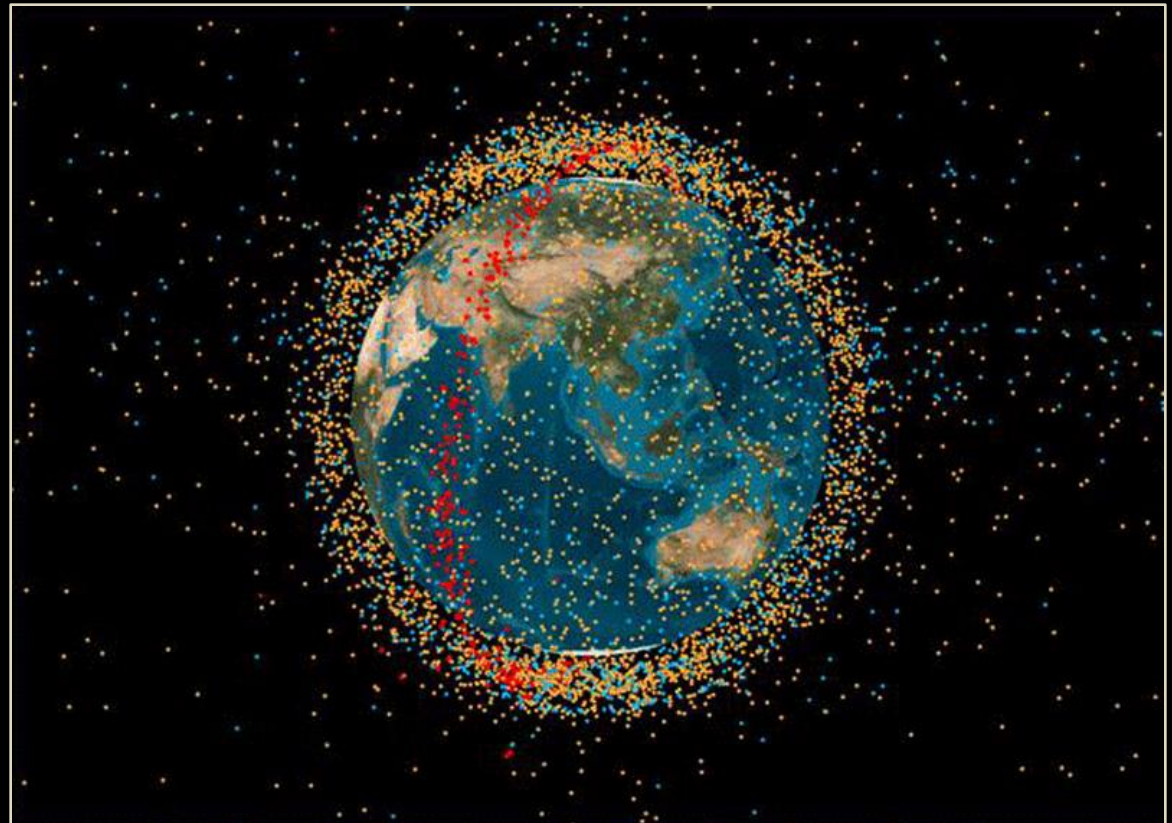


Space Situational Awareness (SSA)

Information about the space environment and its effects on our activities in space. Space debris could damage or destroy those satellites in a collision

It involves

- detecting
- identifying
- tracking
- monitoring orbiting space based objects



Space Environment

Space Situational Awareness (SSA)

- **Tracking of objects in space.**

- ☐ Nearly 1,500 active satellites ,
- ☐ more than 90 countries and private entities.
- ☐ 700,000 space debris

- **Monitoring space weather.**

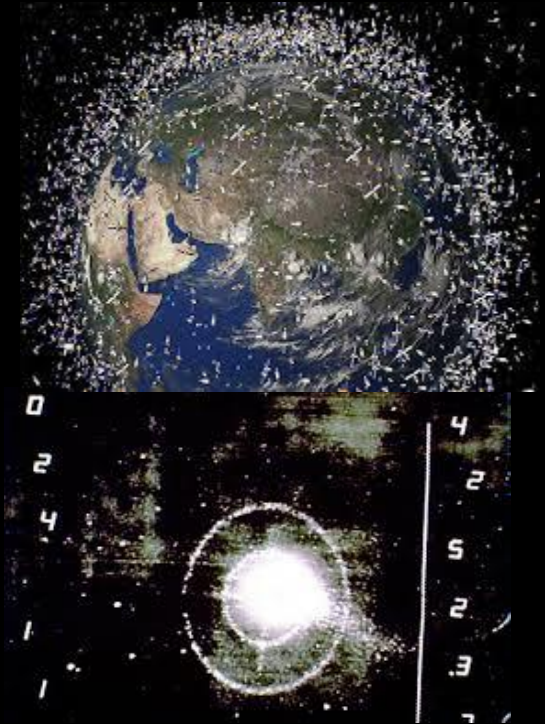
- ☐ solar storms and explosions

- **Characterization of space objects.**

- ☐ Behavior of space objects over time, electromagnetic signals and emissions
- ☐ radar and optical imaging

- **Predicting threats.**

- ☐ Catalog of space objects and
- ☐ provide warning of potential threats ,collisions with debris



Why SSA is important?

- Space used by several nationals for Civilian and military purposes
- Necessary action to avoid potential collision & monitor reentry phase.
- whether actions in space are intentional or accidental ?
- Manage vulnerabilities and mitigate threats objects.



Why is Improving SSA Important?

- Long term sustainability of outer space
- Evaluate impact of their activities and make informed decisions.
- Makes space safer & enables protection of valuable satellites
- Transparency to reduce tensions
- Help verify agreements between countries
- Prevent accidents or misperceptions



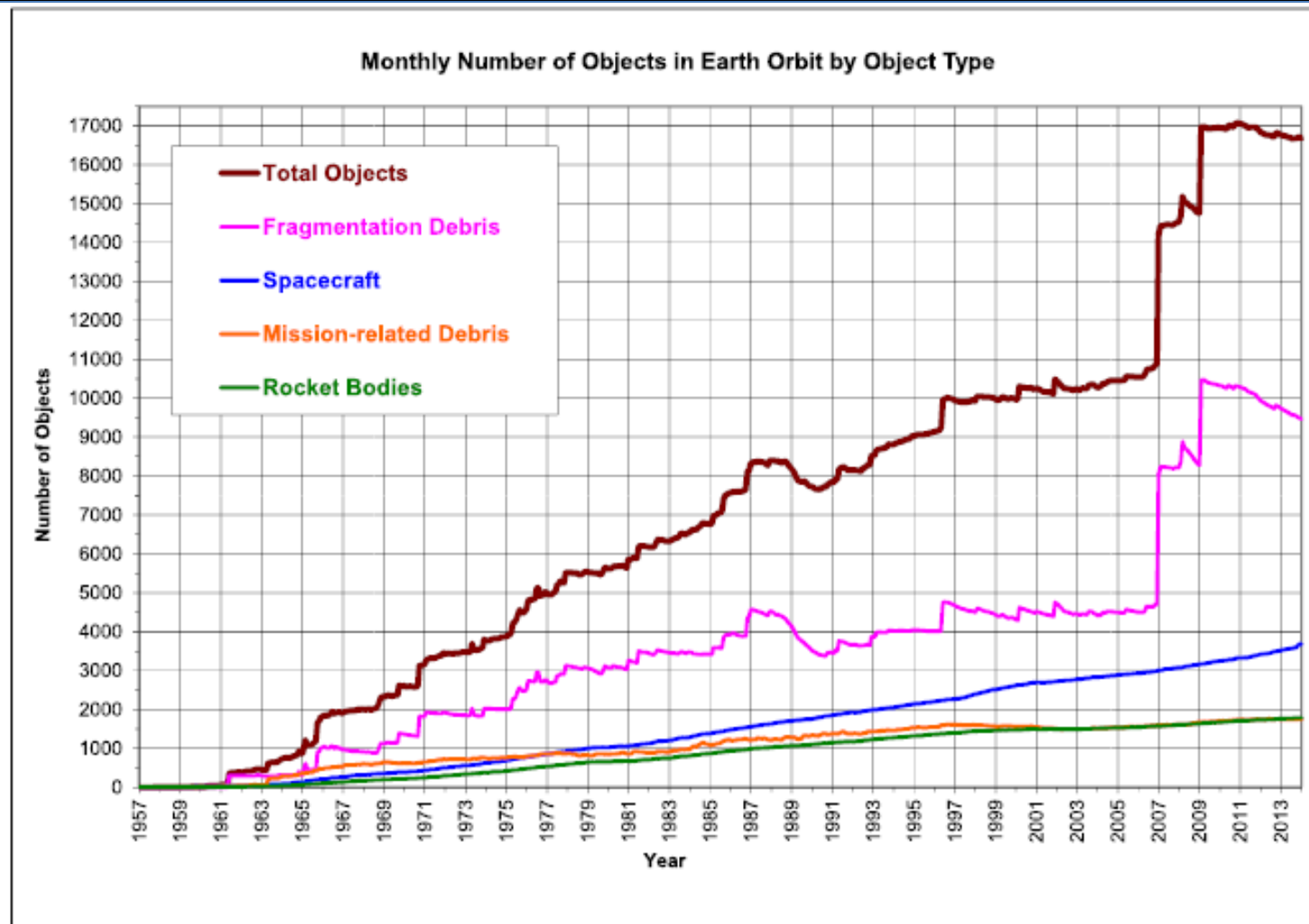
Increasing Trends in Space Activities

Today's Scenario :

- Exponential Increase in Space Junk
- Many countries into Space Domain
- “ Sky is Big ” Mindset
- Low launch cost - smaller satellites
- Desire for enhanced in space activities

**SPACE ENVIRONMENT ALARMING : SPACE SITUATIONAL AWARENESS (SSA) –
A MUST**

Space Debris – Changing over time

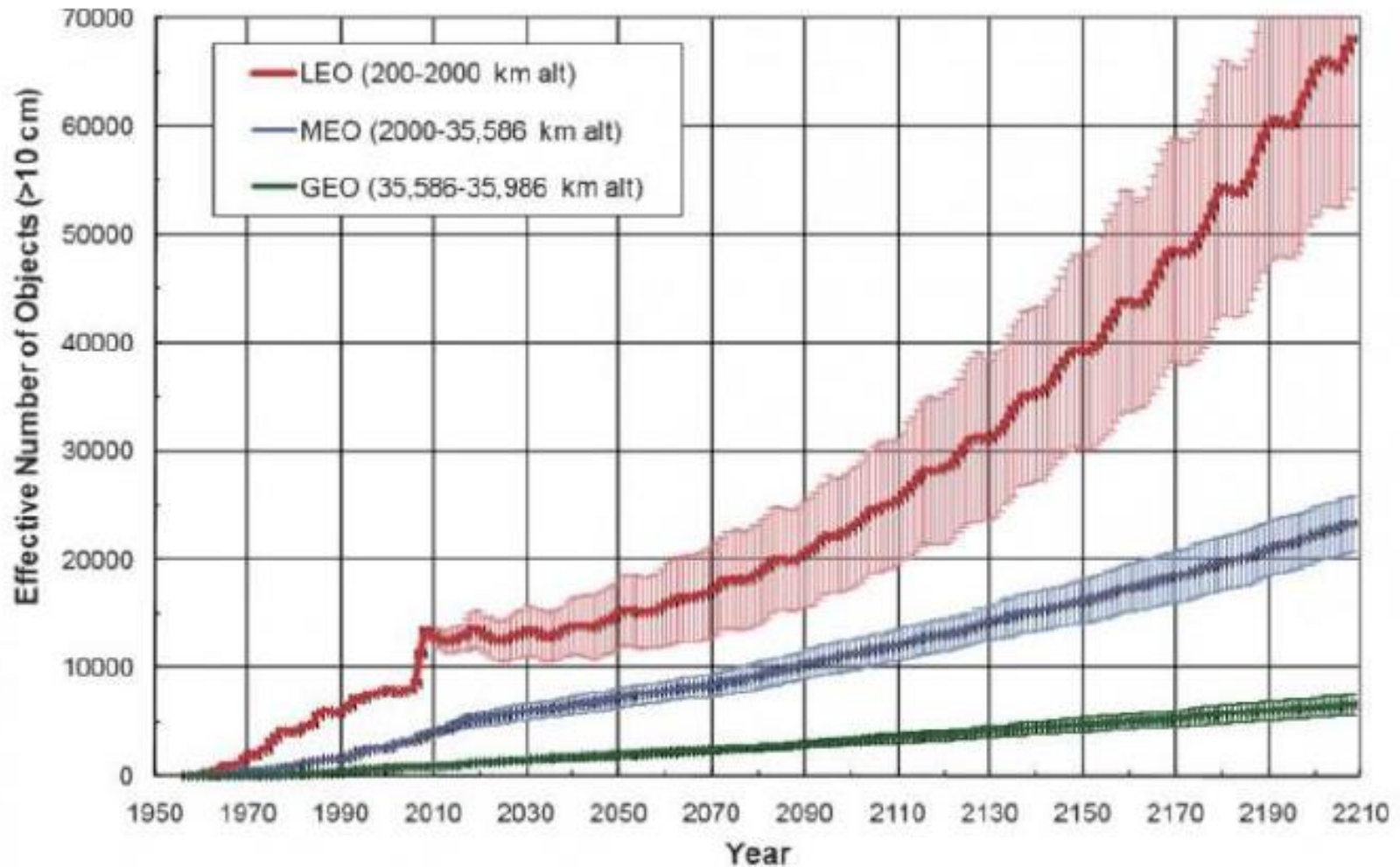


Monthly Number of Cataloged Objects in Earth Orbit by Object Type: This chart displays a summary of all objects in Earth orbit officially cataloged by the U.S. Space Surveillance Network. "Fragmentation debris" includes satellite breakup debris and anomalous event debris, while "mission-related debris" includes all objects dispensed, separated, or released as part of the planned mission.

Courtesy NASA Orbital Debris Program Office: Orbital Debris Quarterly News, Vol. 18, issue 1, January 2014.

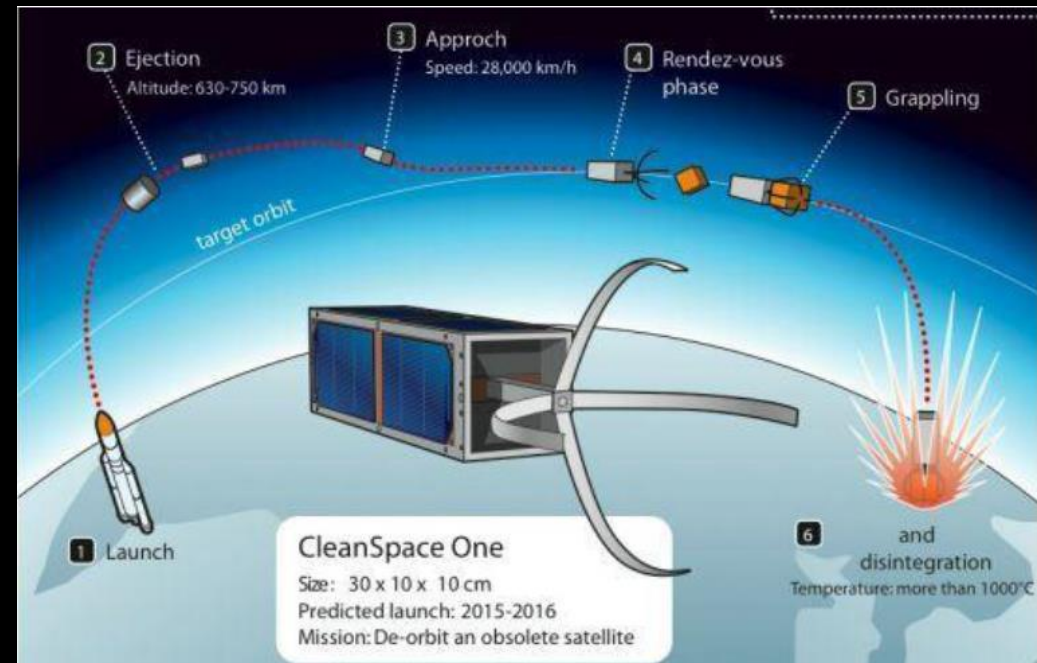
Space Debris – Changing over time

Estimate using “The Kessler Syndrome: a run-away cascade of space debris...upto 2210



Space Debris Reduction – Multiple approaches

1. International cooperation - Inexpensive , but for a better future through joint participants
2. Data Sharing on an international basis for transparency
3. Additional space surveillance
4. Debris Removal/Collision Avoidance plans as a long term plan



Source: <http://actu.epfl.ch/news/cleaning-up-earth-s-orbit-a-swiss-satellite-tack-2/>

International Cooperation

UN COPUOS (Committee on the Peaceful Uses of Outer Space) is forum for the development of laws governing activities in outer space.

Currently 83 Member States are signatories of UN COPUOS

The major activities relating to space security/sustainability are

- **Space debris mitigation guidelines**
- **safety framework for nuclear power source applications**
- **Working Groups on long-term sustainability**



India's Role:

- Indian SSA program integrating existing Radar & optical sensors
- bilateral and multi lateral co-operations with other nations with SSA Capability
- Active member in Inter Agency Debris Committee (IADC)
- Formulation of IADC space debris mitigation guidelines.



India's Role:

Measures implemented to mitigate space debris:

- ✓ Launch vehicle upper stage passivation
- ✓ Collision avoidance analysis & operational implementation
 - ❑ Carried out before every launch
 - ❑ Space object proximity analysis daily basis
 - ❑ collision avoidance maneuvers
- ✓ Space objects reentry estimation campaigns of IADC
- ✓ Long term evolution of space debris



Cyber Attack

- Computer-to-computer attack - undermines the confidentiality, integrity or availability of information.
- We live in an age of Technology enabled warfare and Internet Era.
- Cyber Security is a major threat.



YOU HAVE BEEN
HACKED !

Cyber Attack

The Potential cyber attacks are :

- Unauthorized Intrusions
- Defacements
- Domain Name Server Attacks
- Distributed Denial of Service Attacks
- Computer Worms
- Routing Operations
- Critical Infrastructures
- Compound Attacks

Sources of cyber attacks

- Commercial Gains
- Nation-States
- Terrorist Groups
- Terrorist Sympathizers
- Thrill Seekers & Script Kiddies
- Personal vendetta/ revenge

LESSON LEARNT FROM PAST ATTACKS

- Cyber attacks are increasing in volume, sophistication, and coordination
- Cyber attacks are attracted to high-value targets
- Physical attacks may follow Cyber attacks

THE NEW BREEDS OF ATTACKS

- Nature of threats changing
- Today's attacks sophisticated and successful

NEW UPCOMING CHALLENGES

We are living in the world of Mobile Era

- Additional threats will emerge due to Android based and other mobile devices
- Automobiles will be prone to hacking
- Life saving devices implanted in human beings too will be accessible remotely
- IOT Devices and the network vulnerable to attacks

Safeguarding the Organization property and ensuring of data security from **Cyber Attacks** is the need of the Hour

ISRO – Cyber Security Measures

Information Security Measures

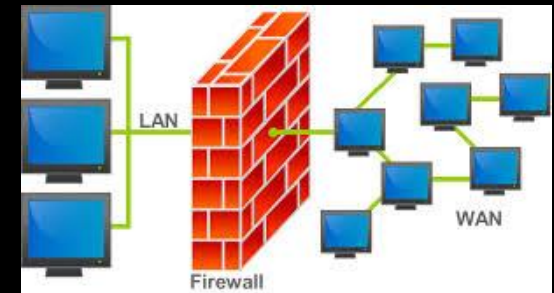
- Space Mission IT Security
- Perimeter Security
- Network Security
- End-point Security
- Email Security
- Web Security
- Data Security



ISRO – Cyber Security Measures

Security Approaches Adopted by ISRO:

- Layered security approach –
 - ❑ Router, Firewall, Unified Threat Management Device,
 - ❑ Private network security measures
- Application software security measures
- Internet & Intranet - physically separate networks



Future plans:

- Unified Secure Internet Gateway
- Centralized monitoring, defense/coordination using technology
- Risk Assessment & Risk Management



Today we have responsibility of creating a
better and safe space for the future of
mankind

*“ Alone we can do so little,
together we can do **so much**”*



THANK YOU