

# **Satellite Based Cyber Resilient Communications**

**Col N S Dabhi  
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# SATELLITE BASED CYBER RESILIENT COMMUNICATIONS

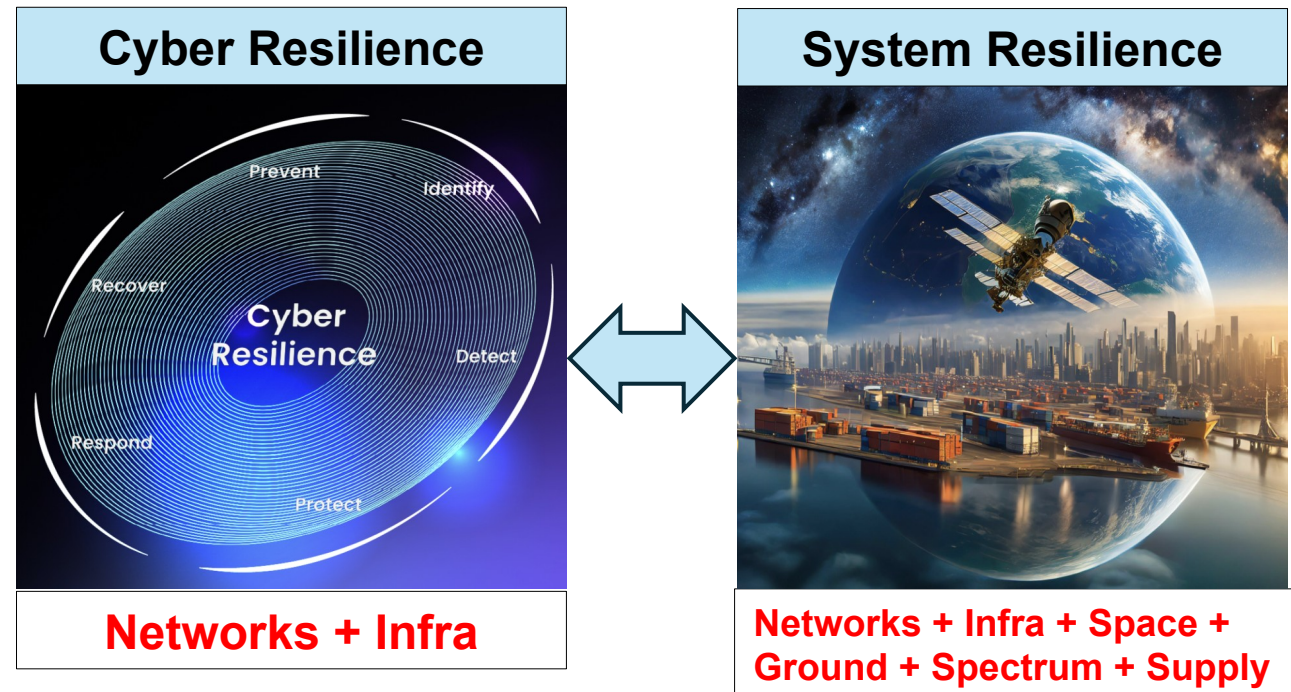
## Resilience

Ability of **systems**, **applications**, and **infrastructure** to continue operating during disruptions and recover quickly afterward while maintaining essential services.

*“The chain is only **as strong as its weakest link**, for if that fails the chain fails and the object that it has been holding up falls to the ground.”*

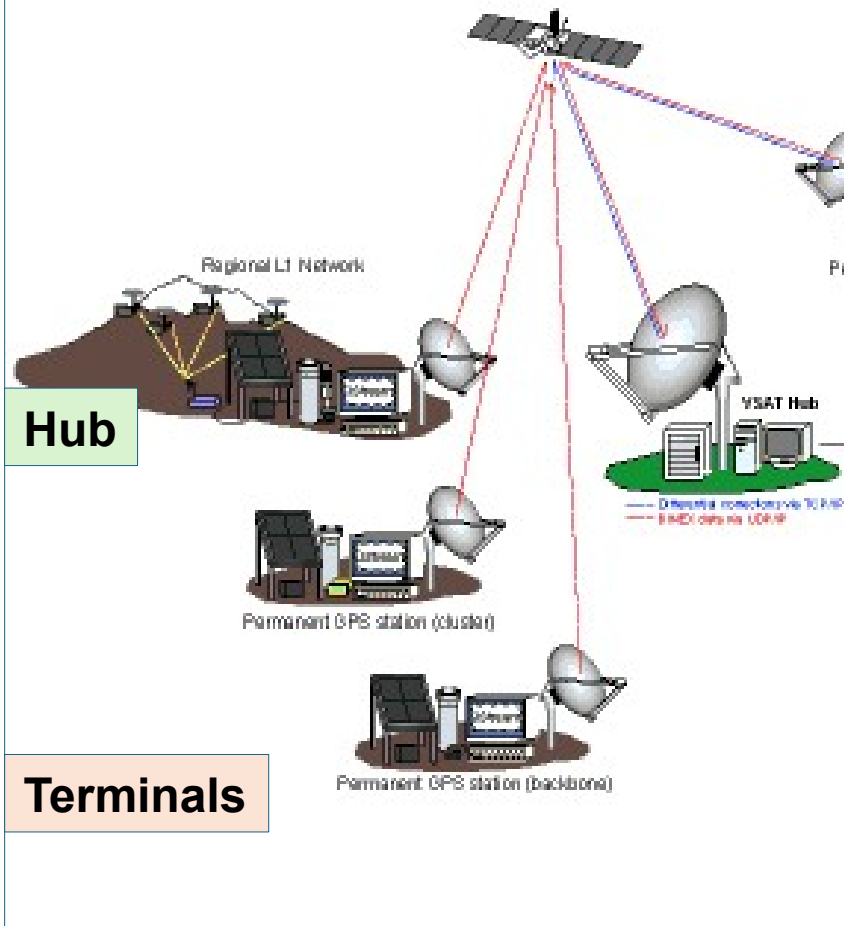
— Thomas Reid

Concept of resilience extends beyond assets and infrastructure to multiple domains and extends even to patterns and **metadata** indicators.



# SATELLITE SYSTEMS

## Space Segment



Cyber resilience critical, but operational assurance only through system resilience

### ❖ SATCOM → Strategic Enabler

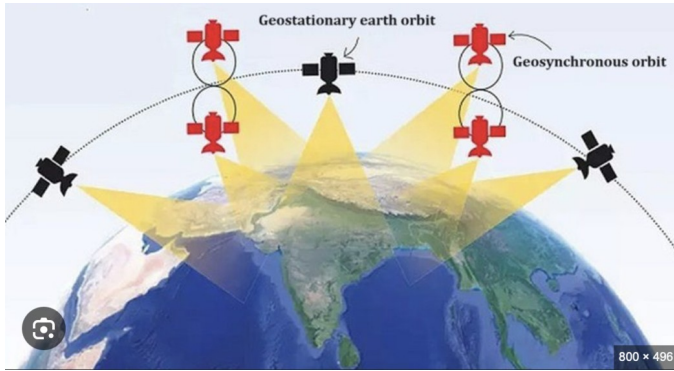
- Distance agnostic, reliable and robust comn
- Remote and inhospitable terrains.
- Spectrum : Congested and contested.
- Diversity wins war.

### ❖ System Resilience vs Resilient System : Must have

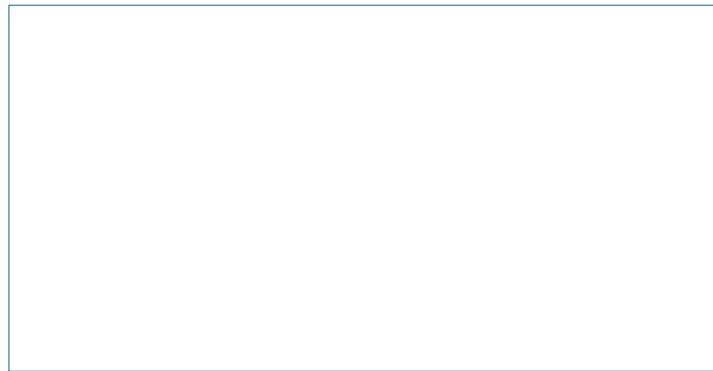
- Space diversity : All eggs in one basket
- Captive ground segment
- Spectrum diversity
- Info sec and Metadata

Resilient System : Secured Metadata + COMSEC + TRANSEC

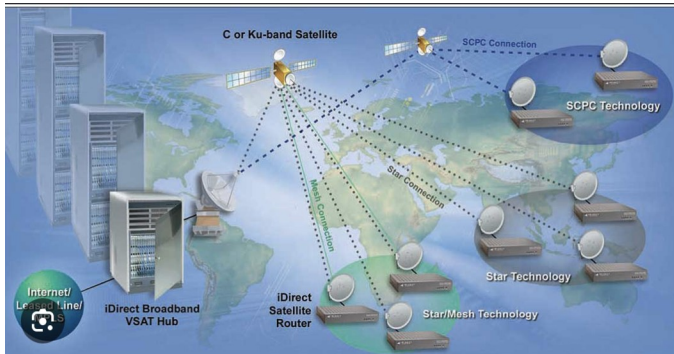
# SYSTEM RESILIENCE : CURRENT YARDSTICK



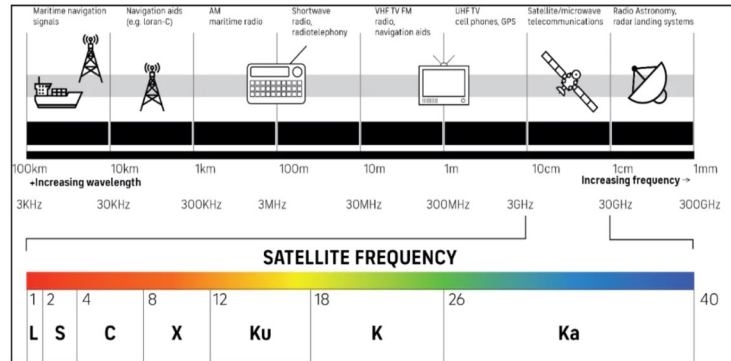
**Space segment diversity**



**Spectrum Diversity**



**Ground Segment Diversity**



**Band Diversity**

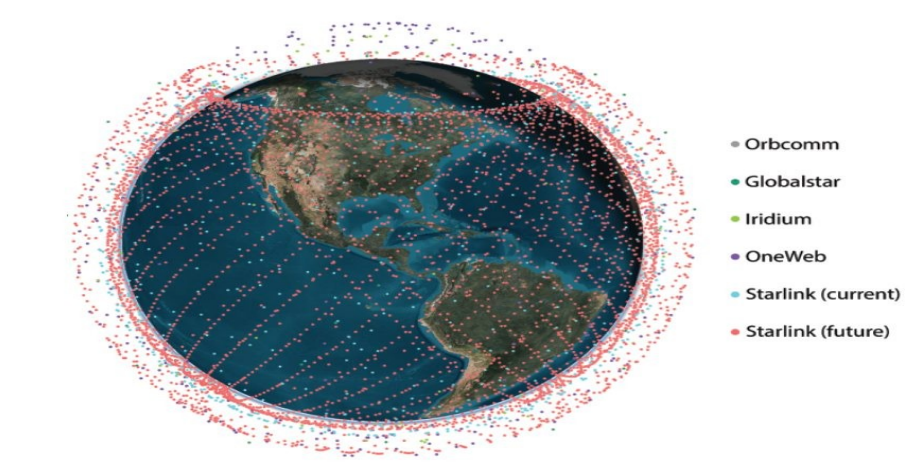
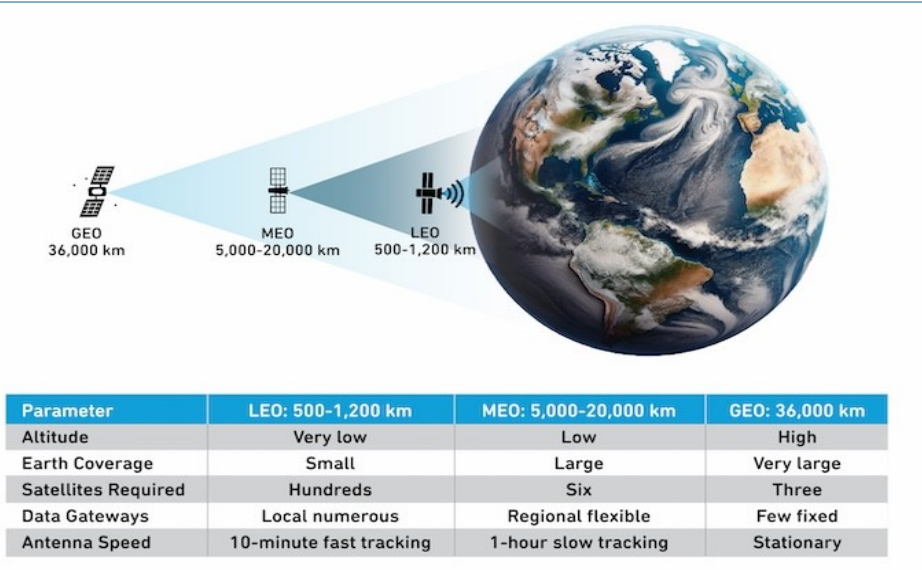


**Secure Metadata**

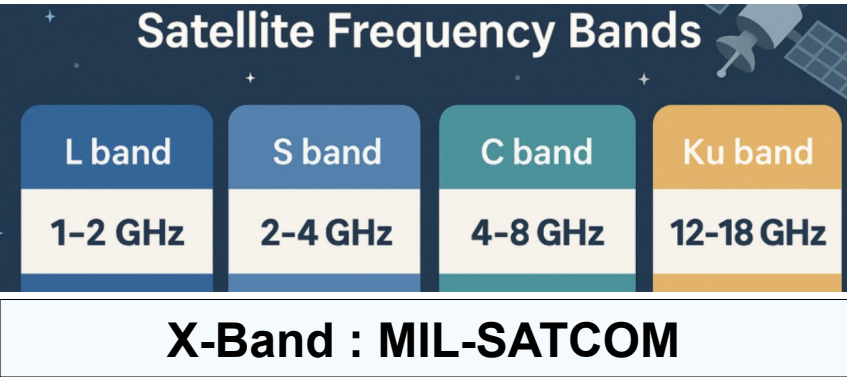
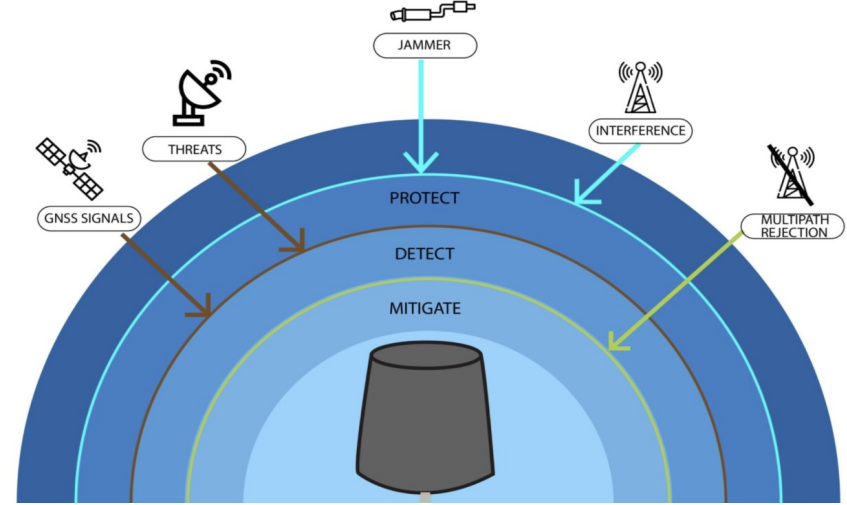
**Encryption**

**Diversity + Metadata security + Encryption = Resilient System**

# SYSTEM RESILIENCE : EMERGING TREND



**Lower Orbits , Massive scale**



**SATCOM evolving towards LEO/MEO constellations and X-Band Mil Networks**

**MCF TTC Location → Direct bearing on Metadata**

# FELT NEED

## Resilient SATCOM : Must Have

- **Indigenous LEO Constellation**
- **X-Band : Military Band**
- **MCF TTC for constellations**
- **Mid-Band crisis : C and Ext-C**



# WAY FORWARD

## Must Have

- **Indigenous LEO Constellation**
- **X-Band : Military Band**
- **MCF TTC for constellations**
- **Mid-Band crisis : C and Ext-C**



## Way Ahead

- **Whole-of-Nation approach**
- **Evolve national capability**
- **Establish sovereign MCF TTC**
- **Protect SATCOM stakes in Mid-Band**



**JAIHIND**

**TEEVRA CHAUKAS**