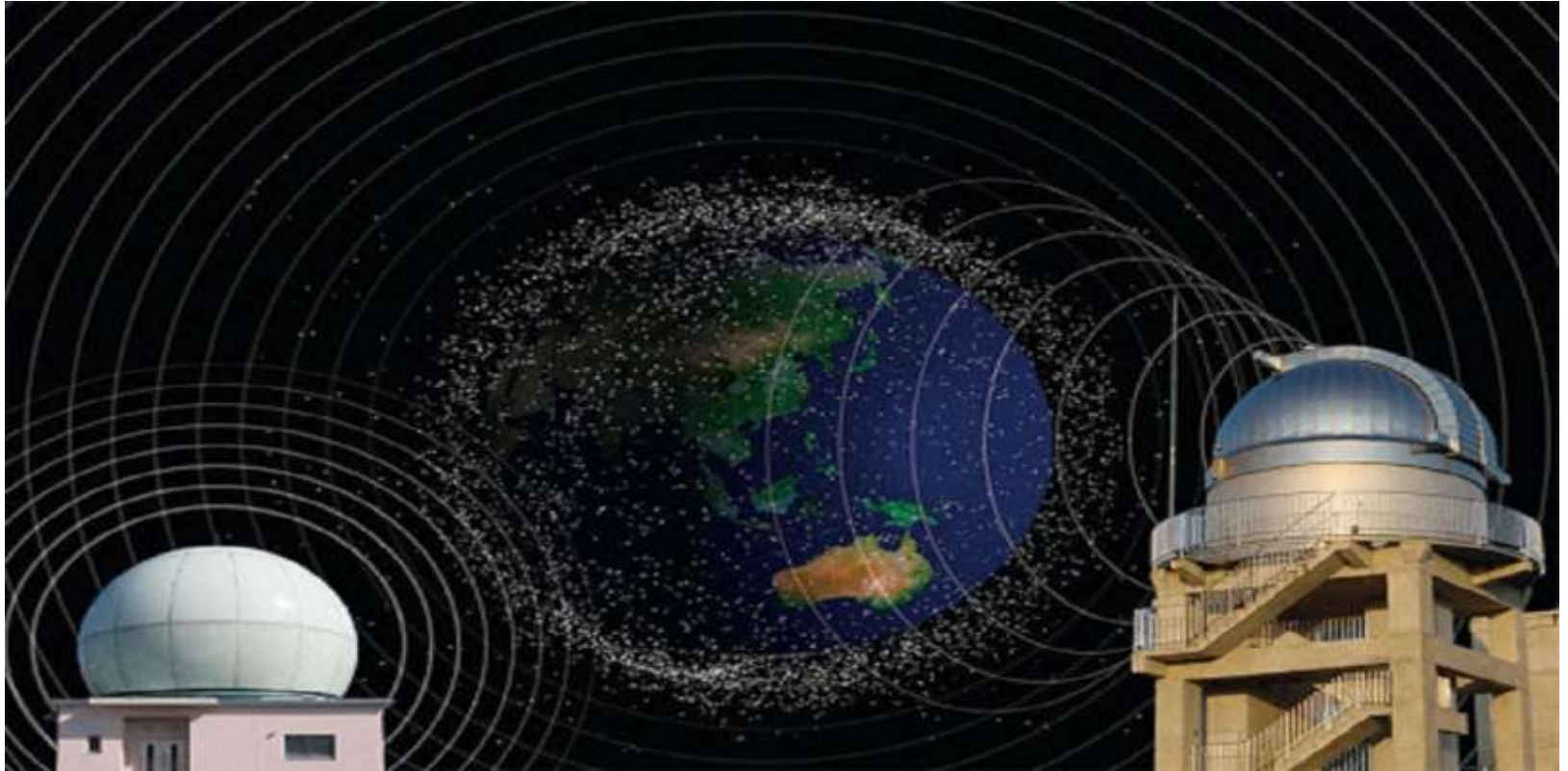




SPACE SITUATIONAL AWARENESS





Flow of Presentation



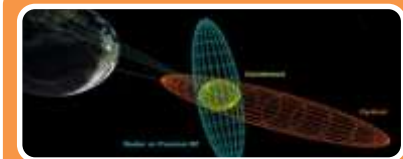
Historical Background



Definitions



India's Space Assets & Threats



SSA Requirements



Flow of Presentation

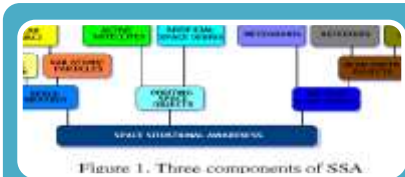


Figure 1. Three components of SSA

Components & Capabilities of SSA



Global SSA Capabilities



Where Does India Stand



Conclusion



Historical Background

- **11 Jan 2007**, China Launched KT-2 Missile towards its Inoperable Fengyung Weather Satellite
- **Feb 2008** USA Destroyed USA 193, an Ailing Military Satellite, Which had Toxix Hydrazine Fuel
- **Feb 2009**, Collision Occurred between US Iridium 33 (Active Communication Satellite) and Russian Cosmos 2251
- This Unacceptable Accidental Collision Catapulted SSA to the Fore



Definition of SSA

As per European Space Agency there are three elements to SSA

- Space Surveillance and Tracking of Objects in Earth Orbit
- Monitoring Conditions at Sun, Earth's Magnetosphere, Ionosphere etc
- Near Earth Objects which can enter Earth and Cause Damage

As per USA Strategic Command, SSA is :-

Requisite Current and Predictive Knowledge of Space Events, Threats, Activities, Space Elements (Land & Space Based), with their Limitations and Constraints, to Allow Operational Commanders to Gain and Maintain Space Superiority Over Rol



Need for SSA: Civil Perspective

Enhance National Power & Prestige

Knowledge of RSO critical for Launch Operations

Increased Participation of Private Companies & Corporates

No of RSOs increasing exponentially





Need for SSA: Military Perspective

Space Security & Superiority

- Undeclared Satellite Launch
- Intentional Manoeuvres During Conflict
- Malicious Tests
- Space Robotic Activities

Detect Adversary Space Activities

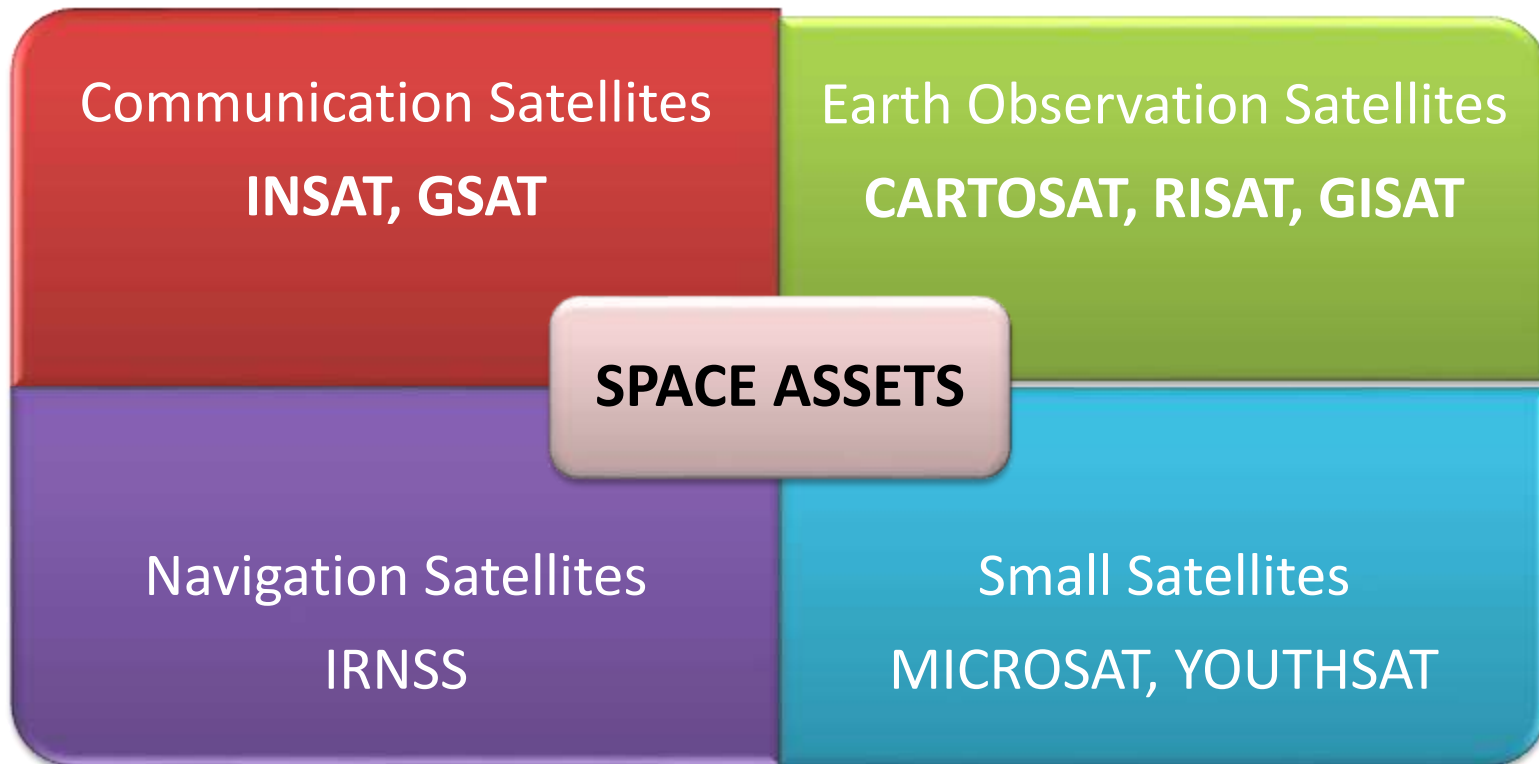
- SIGINT
- ELINT
- COMINT
- Satellite Design, Payload and Employment

Proactive

- Continuous Satellite Availability During War
- Non-generic but Strictly Focused on Adversary Space Activities and Security



India's Space Assets





Threats to Space Assets

Threats to Space Assets

Natural

Space Weather

Meteorites &
Asteroids

Accidental

Collision
(Satellites & Debris)

Intentional

Jamming- GPS,
Radar & Comm

ASAT Weapons

Maneuverable
Satellites

DEW



Military SSA Deliverables

Debris Detection
and Tracking

Collision Detection

Conjunction
Analysis

Prediction of Threat
from Asteroid/
Meteorite

Space Weather
Threats

Satellite Anomaly
Detection

Satellite
Characterisation

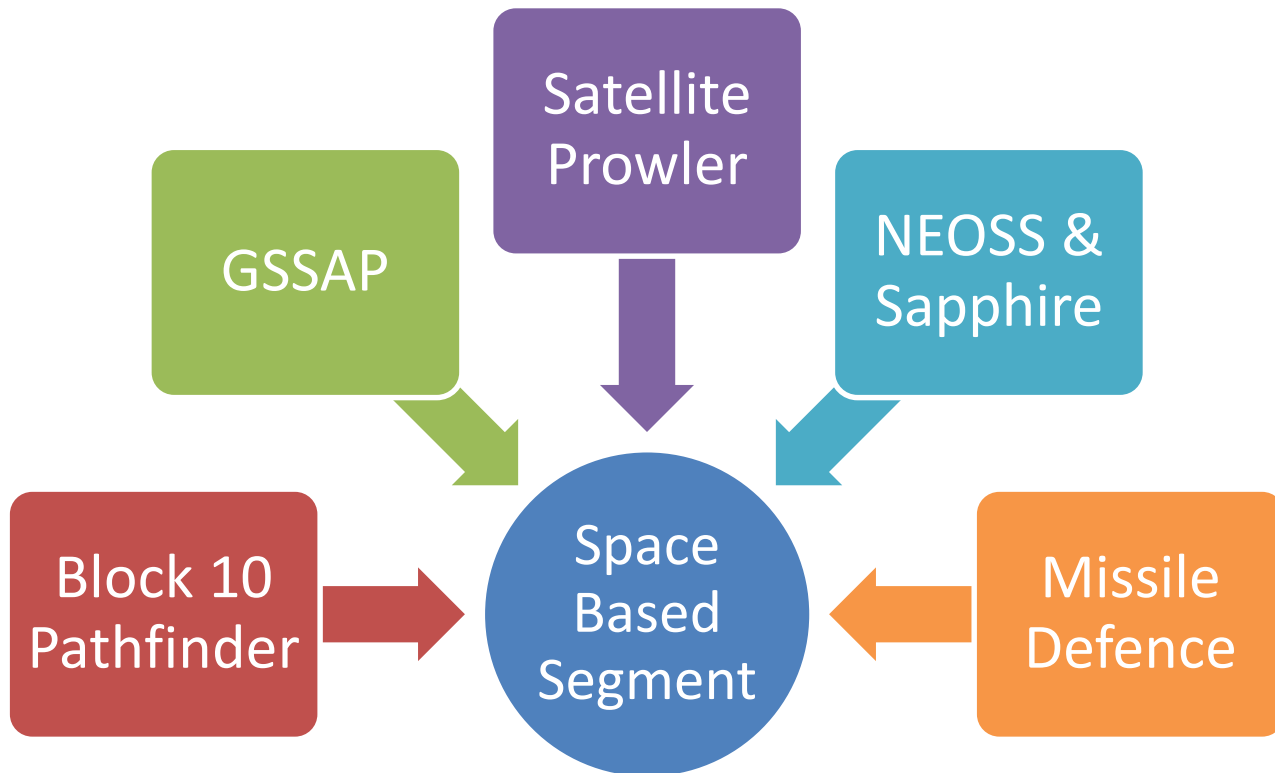
Rendezvous and
Proximity
Operations

Seamless Sensor
Integration



Global SSA Capabilities

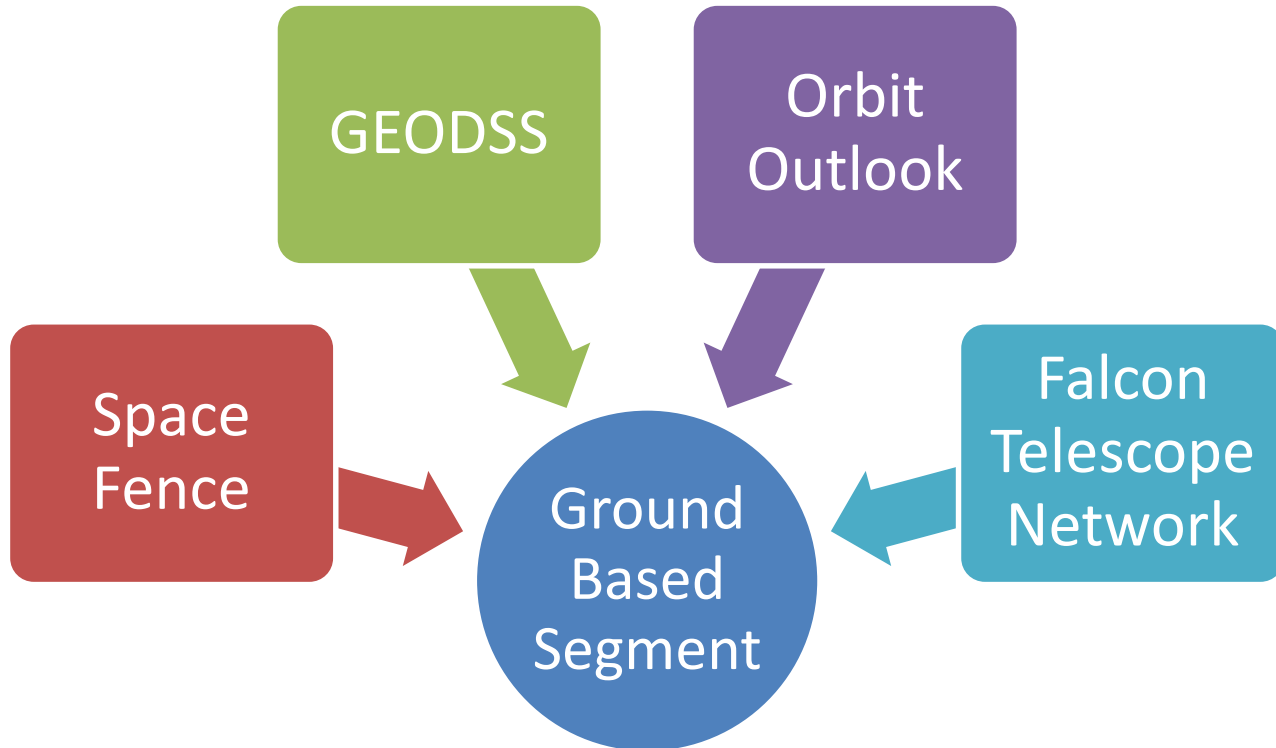
USA





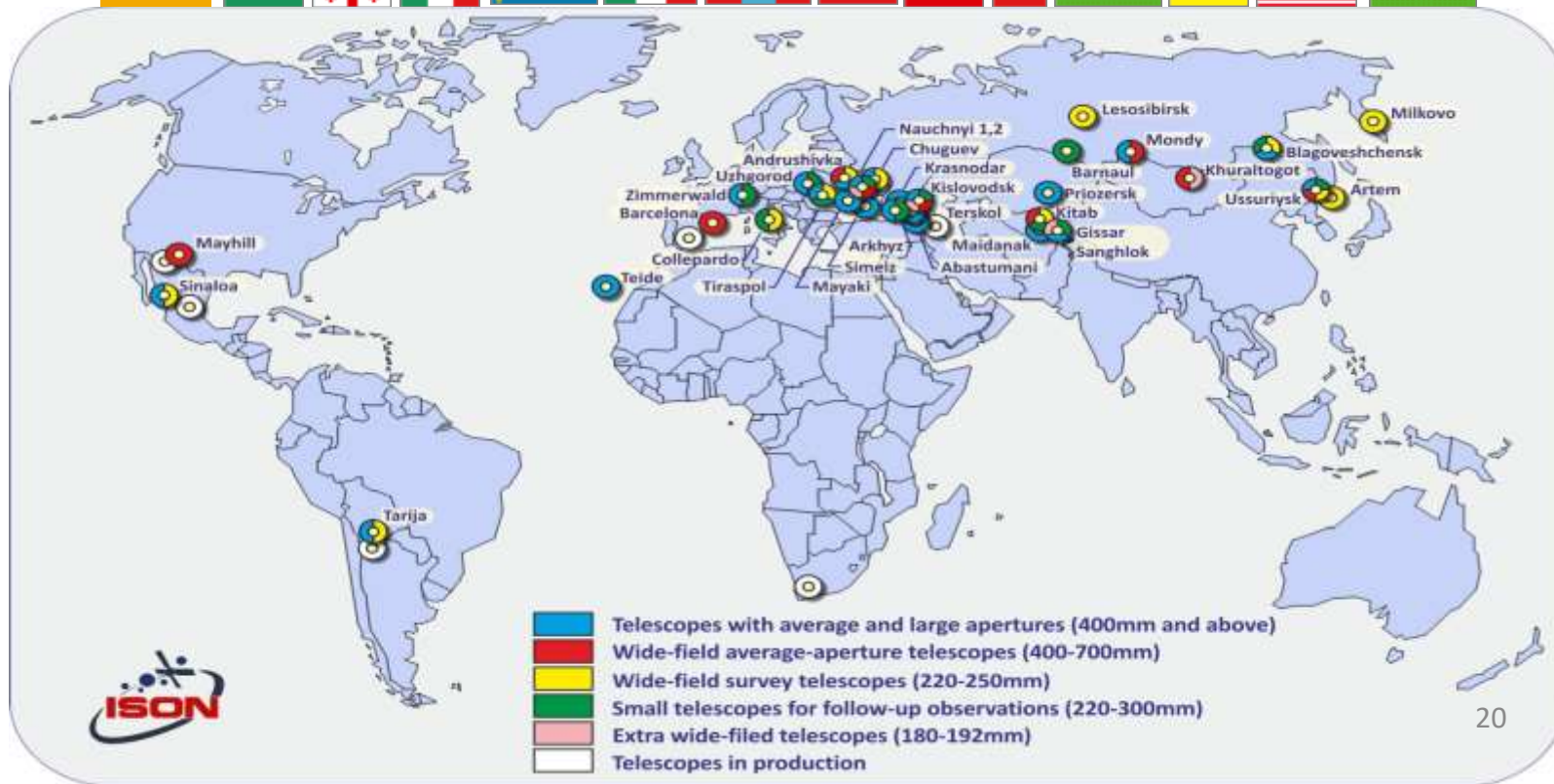
Global SSA Capabilities

USA





International Scientific Optical Network





Global SSA Capabilities

European Space Agency

- ESA satellites Proba-2 and 3, SOHO, Gaia and Swarm are tasked with SSA
- It has at least a dozen ground facilities located in Europe and South America
- German Tracking & Imaging Radar at FGAN
- French GRAVES



Global SSA Capabilities



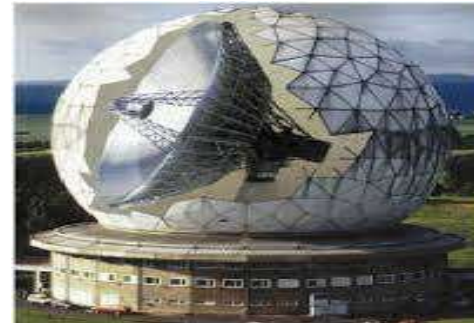
Altay Optical Tracking and Imaging Facility



Global SSA Capabilities



TIRA



FRENCH - GRAVES



Global SSA Capabilities

China

- Phased Array Radars for Tracing of Objects in LEO till 3000Km Altitude
- Operates Yuanwang Tracking Ships
- Operates Telescopes from Purple Mountain Observatory at Nanjing
- Tracking Facilities at Nagari (TAR) for Indian Satellites and at Patagonia (Argentina) for US Satellites
- Operates 'Tinyan'- Worlds Largest Radio Telescope with 500 Aperture



SSA Data Collation

Data Collection

- Optical
- Radar
- RF
- Laser Ranging

Data Processing

- Dbase Management
- Data Analysis
- Data History

Data Output

Data Sharing

Oversight and Coordination

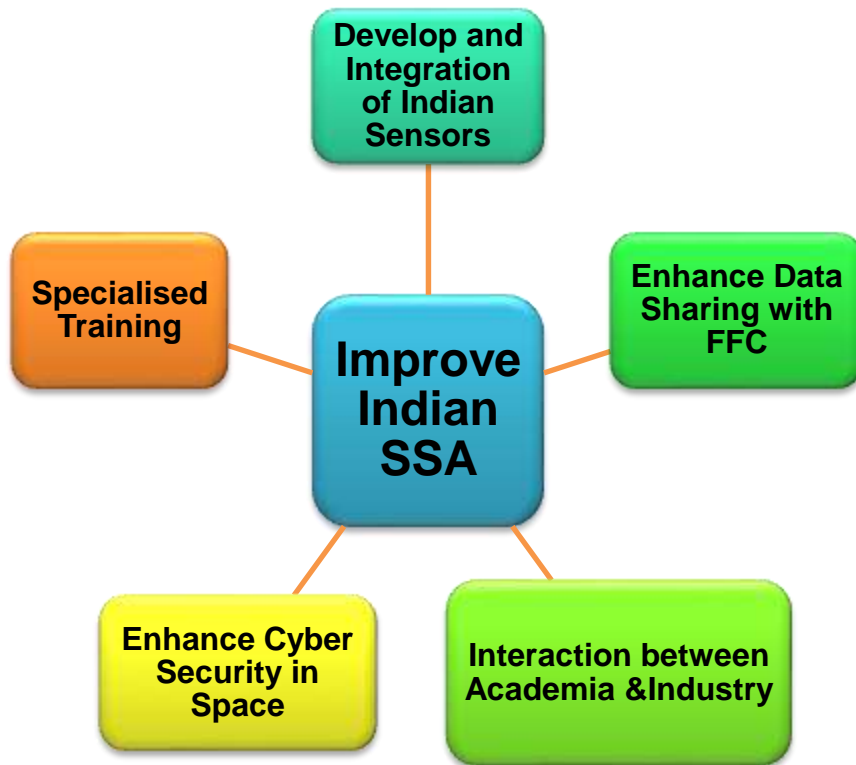


Holistic Approach

- **Civilian and Military pursuing separate capabilities**
- **National SSA program to be developed**
- **Military SSA – drawn from the seamlessly integrated National SSA**
- **Approach to be from sharing of Data within the FFCs to development of own integrated network of sensors**



Way Ahead





THANK YOU