

SPACE SITUATIONAL AWARENESS



- Background
 - Purpose
 - Aims
 - Composition
- Space Surveillance (SST)
- Space Weather (SWE)
- Near-Earth Objects (NEO)
- Summary



BACKGROUND

“The objective of the Space Situational Awareness (SSA) programme is to support the **European independent utilisation** of, and **access to**, the **provision of timely and** and knowledge regarding the the sustainable exploitation of **our planet Earth.**”



**SA Ministerial Council
November 2008**

INTRODUCTION

AIMS OF THE SSA PROGRAMME



- Independent utilisation of Space
 - Space assets are critical assets
- Guarantee access to Space
 - Diplomatic,
 - Political
 - Regulatory
 - Technical
- Serve EU “Lisbon Objectives”
 - New Applications
 - New Jobs
 - New Markets



INTRODUCTION

CUSTOMERS FOR SSA SERVICES



- European Governments
 - EU
 - National
 - Regional
- European Space Agencies
 - ESA
 - National
- Spacecraft Operators
 - Commercial
 - Academic
 - Governmental
- Space Insurance
- Space Industry
- Energy
 - Surveying
 - Electrical Grid
 - Power Supply
- Network Operations
- Telecommunications
- Air Traffic Control
- Search and Rescue Entities
- United Nations
- Defence
- Civil Protection



2009 – 2012

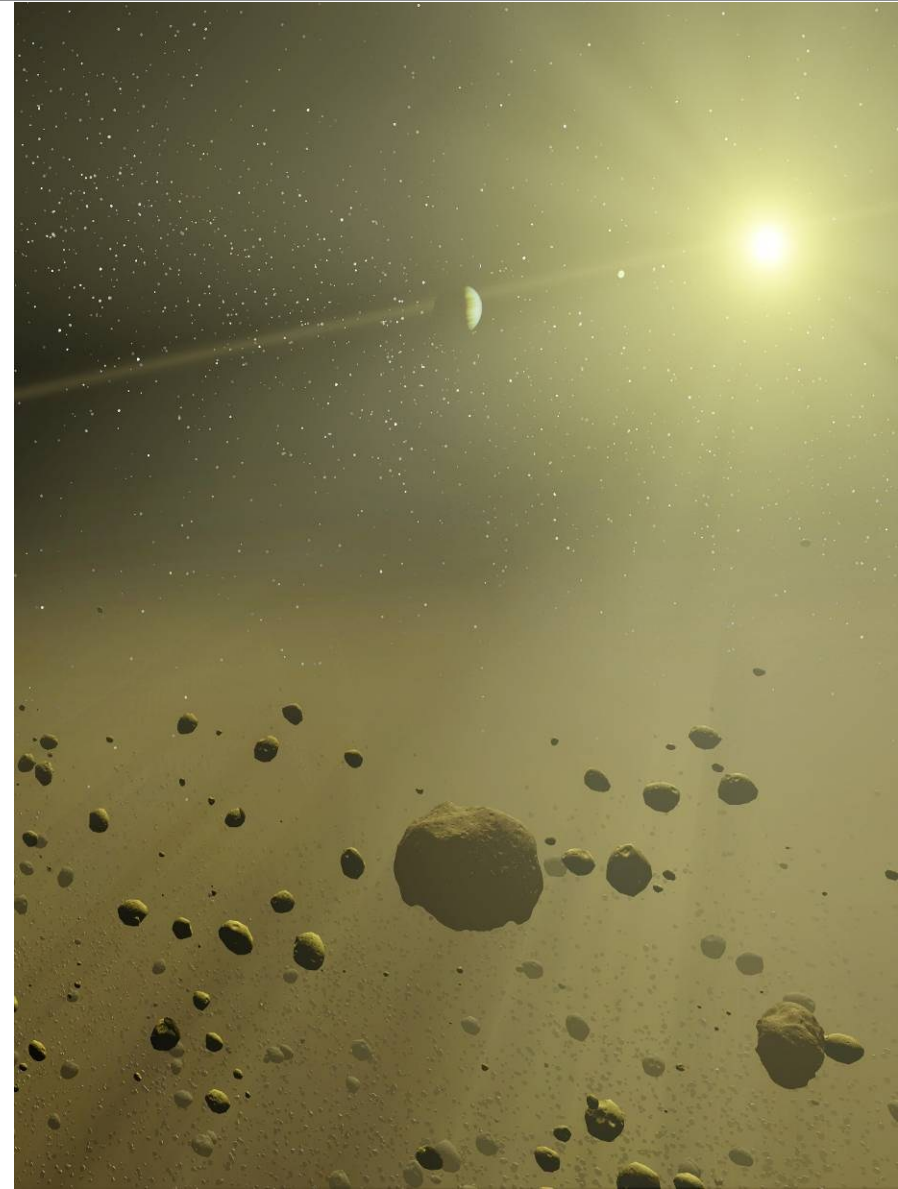
- **Preparatory Programme**

- Governance Definition
- Data Policy
- Architecture
- Federation
- Precursor Services
- Radar Breadboard
- Pilot Data Centres

2012 – 2019

- **Operational Programme**

- Implementation of operational system



1. Core Element

SSA Architecture

Governance

Data Policy

Security

Space Surveillance and Tracking Segment

2. Space Weather Element

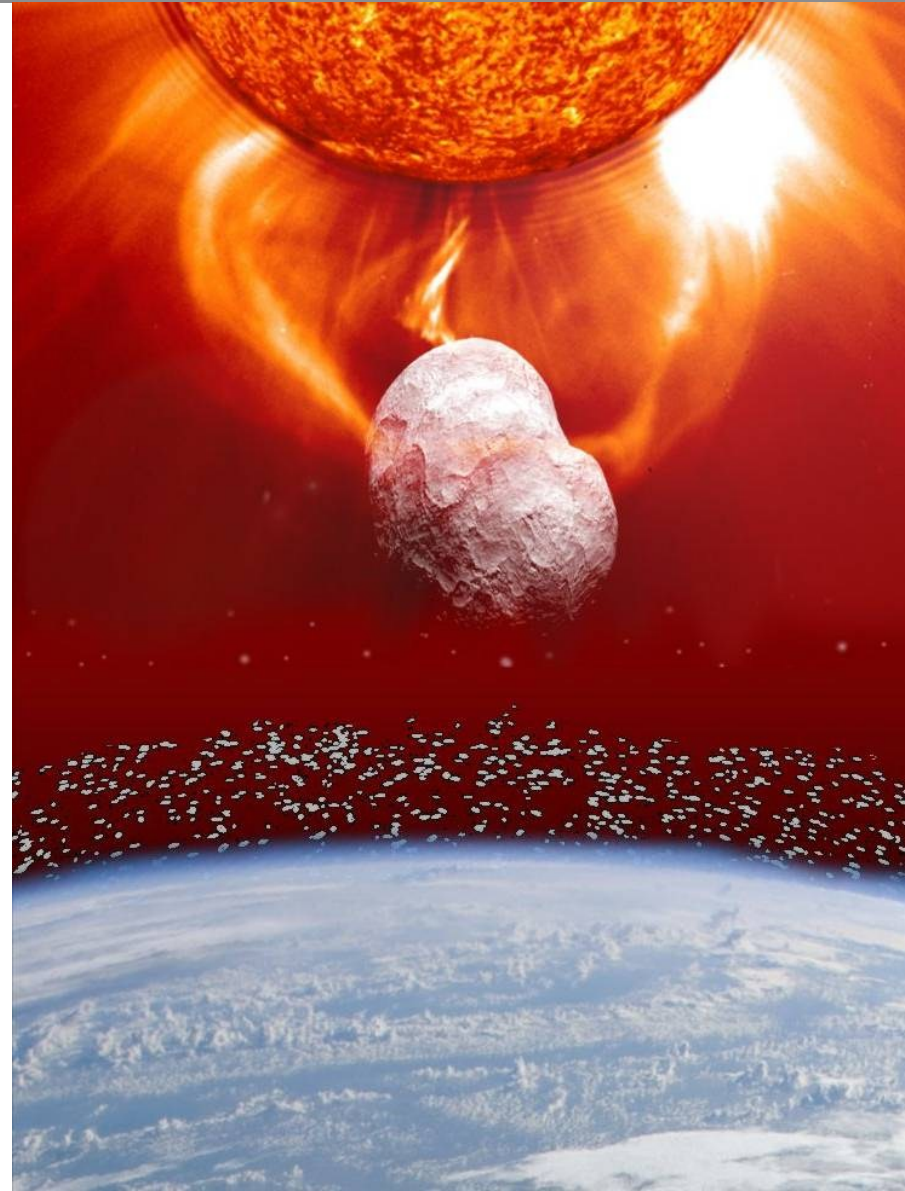
(including NEO activities)

3. Radar Element

Prototype Development

4. Pilot Data Element

Transversal support for all segments



INTRODUCTION

SSA Participating States

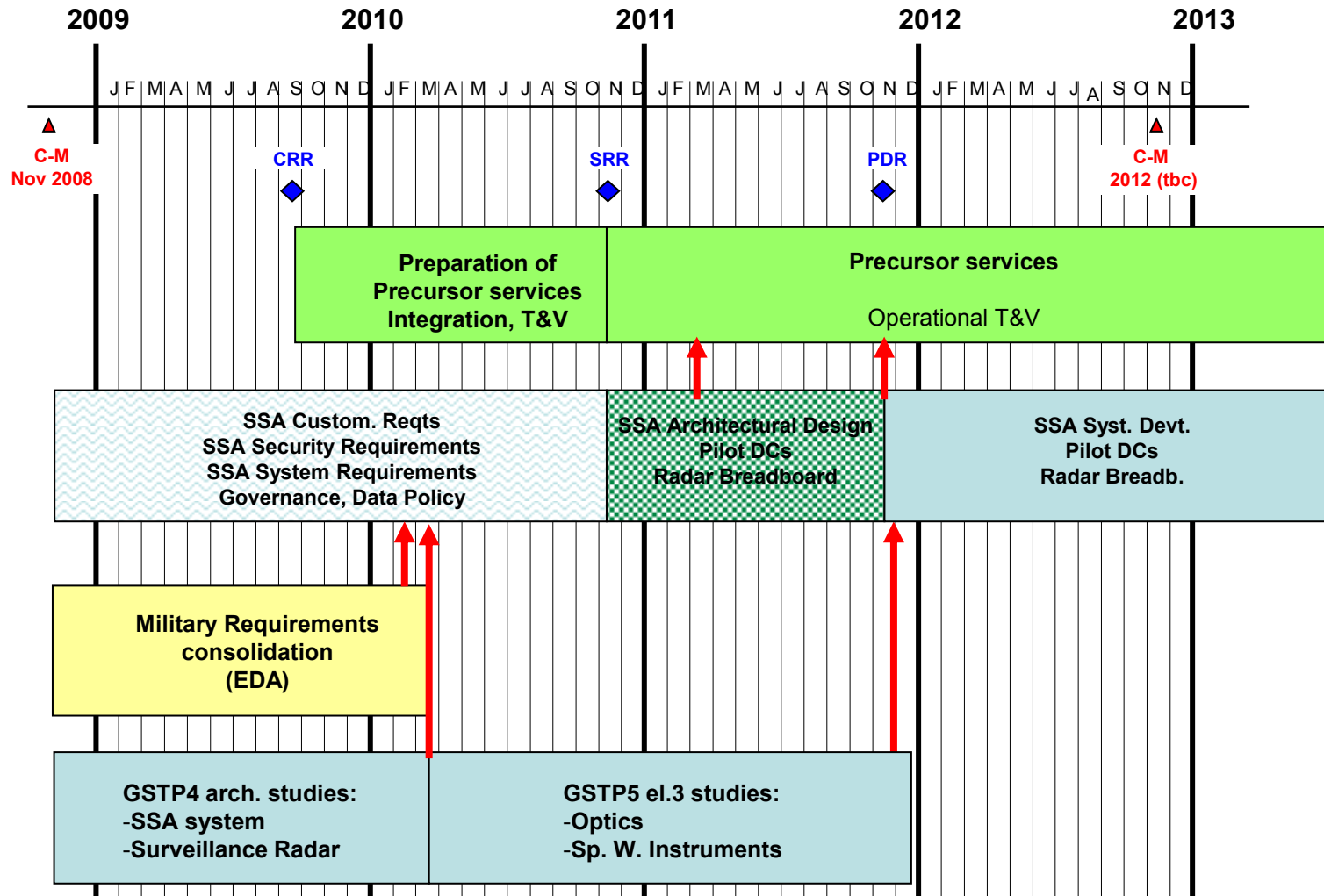


- **Austria**
- **Belgium**
- **Finland**
- **France**
- **Germany**
- **Greece**
- **Italy**
- **Luxembourg**
- **Norway**
- **Portugal**
- **Spain**
- **Switzerland**
- **United Kingdom**



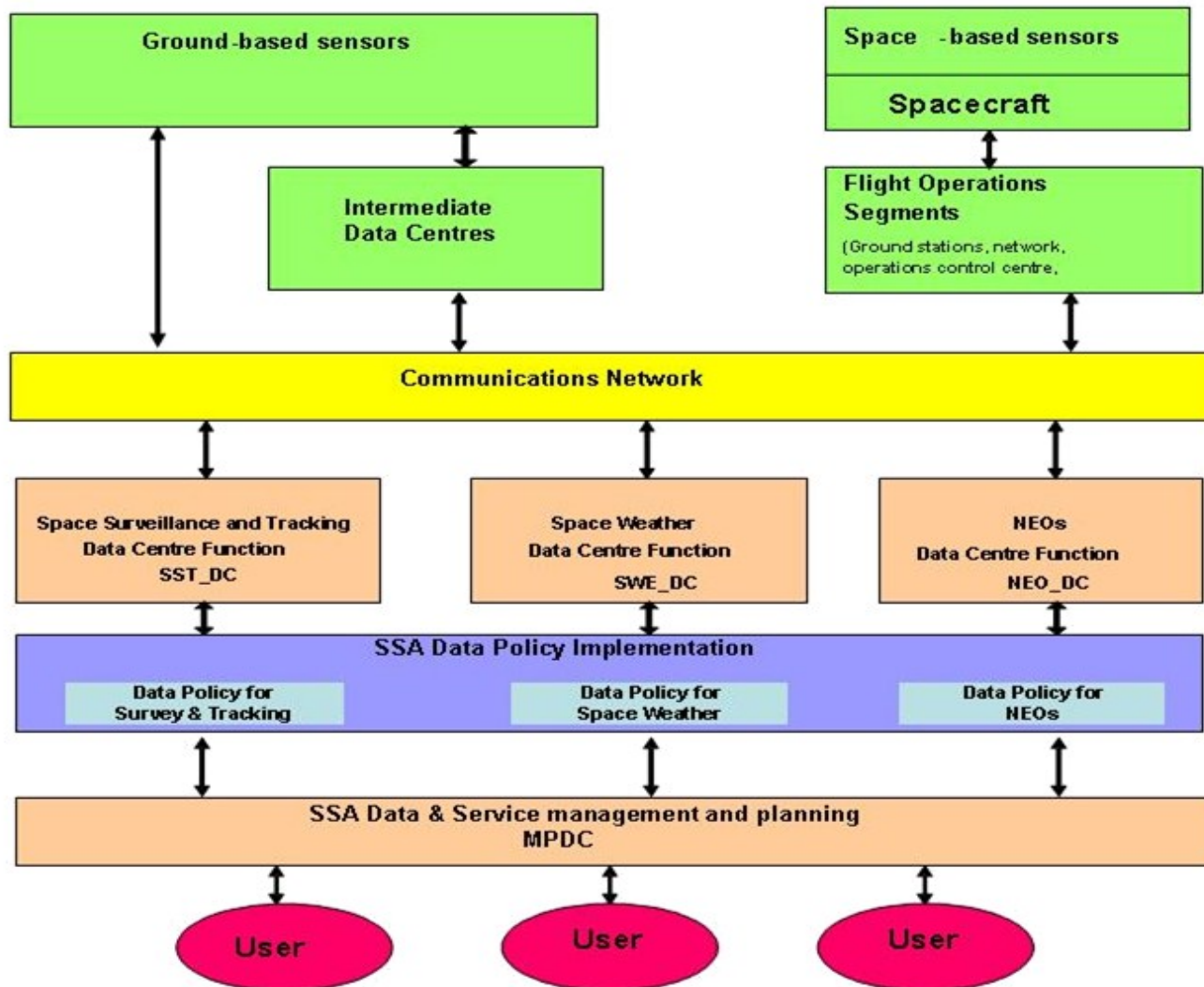
INTRODUCTION

SSA Programme Schedule



INTRODUCTION

SSA Programme Structure





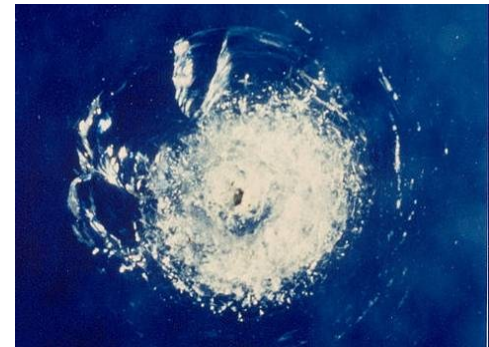
SPACE SURVEILLANCE

SPACE SURVEILLANCE

The Challenge

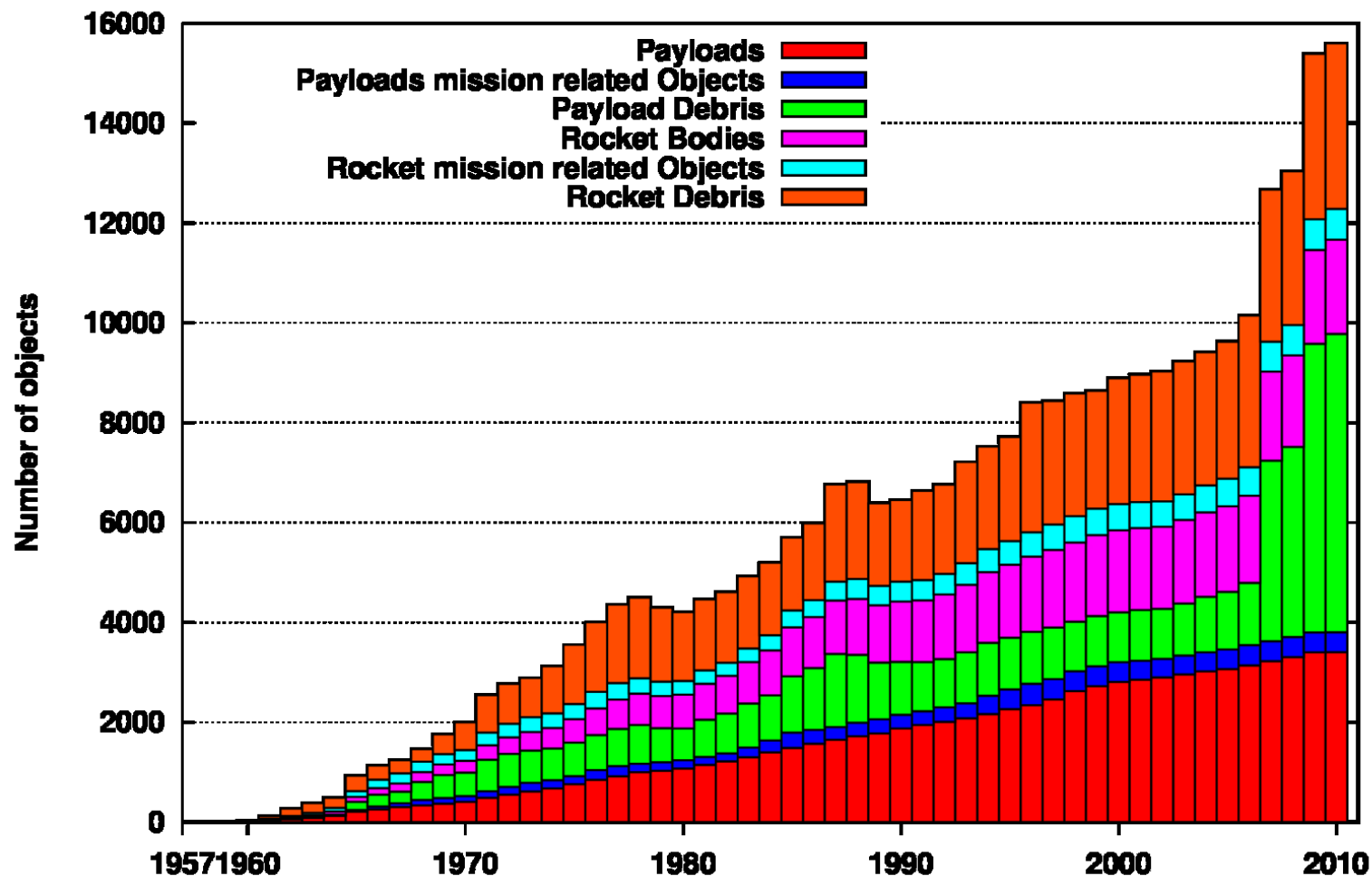


- Support independent access to Space
 - Requires a timely, accurate and rational awareness of the orbital population
- Secure the operation of European Space Assets
 - Requires the prediction of threats and assistance to mitigate those threats
- Protect lives from potential Space-borne hazards
 - Forecast where uncontrolled re-entry may impact populated land-masses and issue appropriate warning.

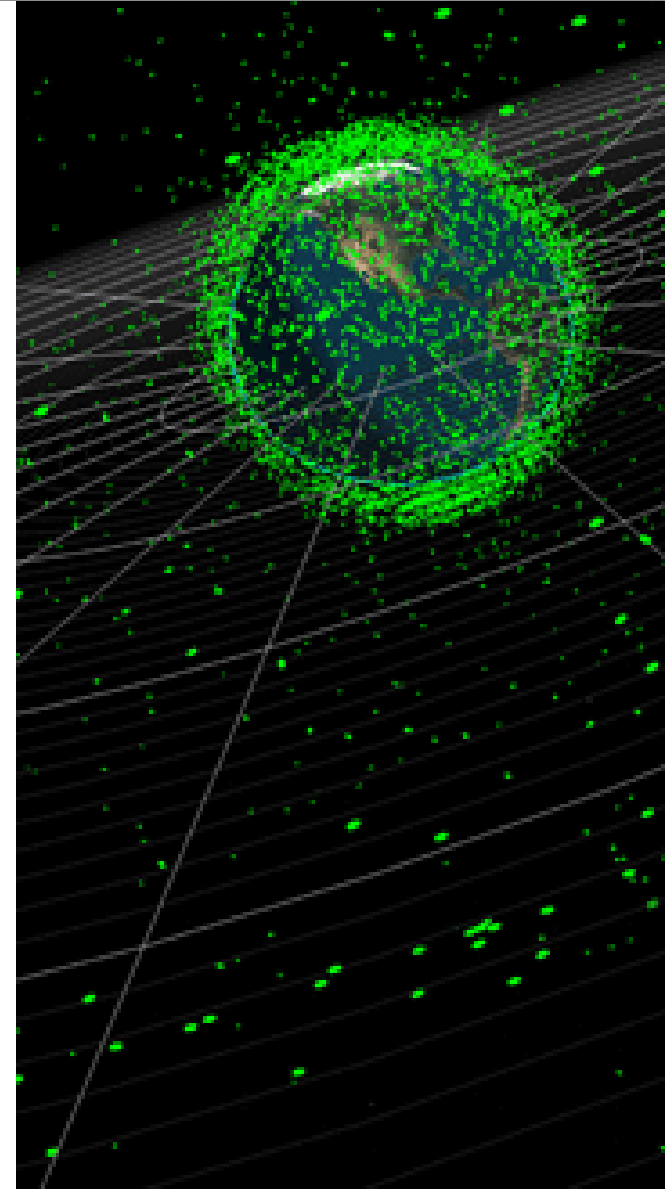


Catalogued Objects in Orbit as of January 2010

[Source: ESA DISCOS database]



1. Launch and Early Operation (LEOP)
Provide orbit data where necessary and confirm event success (such as separation)
2. Contingency Situations
Assist in cases where location of satellite is unknown or state is uncertain.
3. Mission Support
Survey and tracking of passive objects or components
4. Collision Avoidance
Monitor and predict the trajectories of all critical Earth orbiting bodies. Calculate potential intersections and assist in the implementation of corrective actions where possible.
5. Re-entry prediction
Track decay trajectories and calculate the potential impact area(s).
6. Space Traffic Awareness
Detection of insertion orbits, fragmentation and overall situation in near Earth orbit.



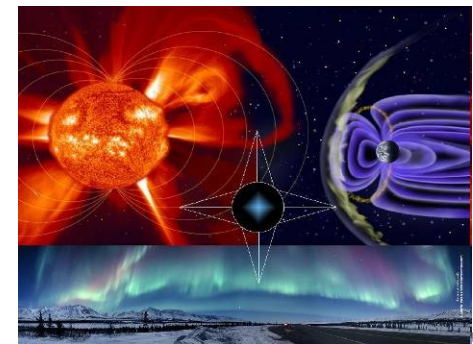
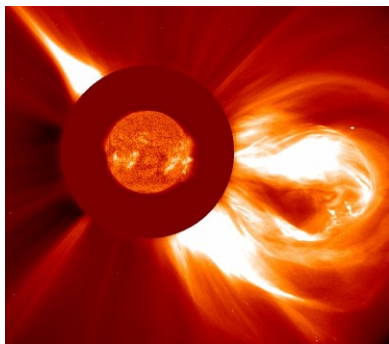
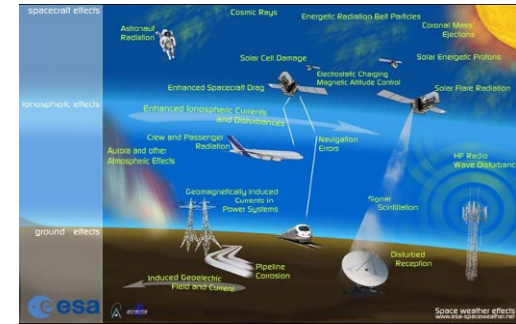


SPACE WEATHER *The Objective*

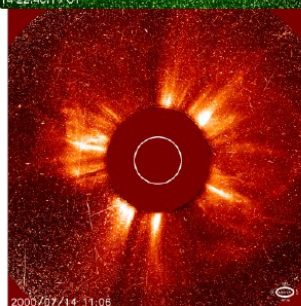
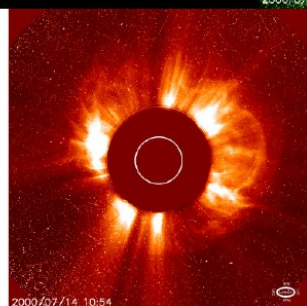
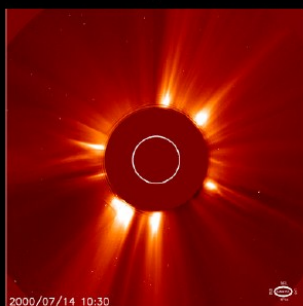
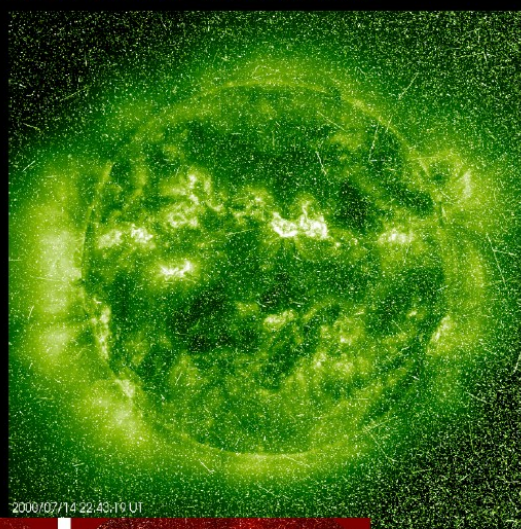
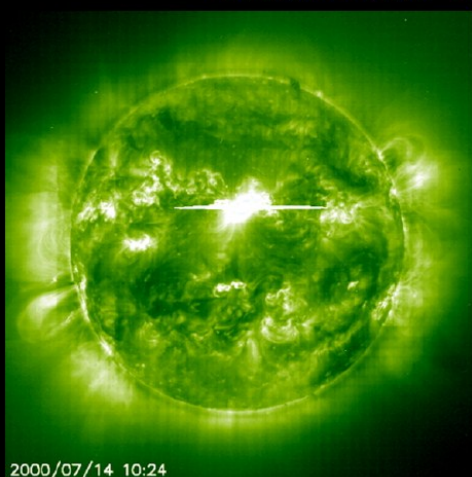


Detection and forecasting of the Space Weather events and the effects it has on European space assets and ground based infrastructure:

- Comprehensive knowledge, understanding and maintained awareness of the natural space environment
- Detection and forecasting of SWE and its effects
- Detection and understanding of interferences due to SWE
- prediction and/or detection of permanent or temporary disruption of mission and/or service capabilities
- provision of predicted local spacecraft and launcher radiation, plasma and electromagnetic environment data



A strong solar flare triggers the largest particle storm of this solar cycle near solar maximum



Protons unleashed by the flare begin striking SOHO in minutes

and hours (even days) later high-energy protons were still smacking SOHO

- Solar array degradation
- Spacecraft anomalies
- CCD instrument “blinding”
- Increased atmospheric drag (orbit degradation, launch errors)
- Telecommunication disturbances (civil & security applications)
- Satellite navigation errors and integrity failures
- Hazards to human health (in space and in aircraft)
- GIC effect on ground infrastructure



NEAR-EARTH OBJECTS

NEAR-EARTH OBJECTS

The Challenge



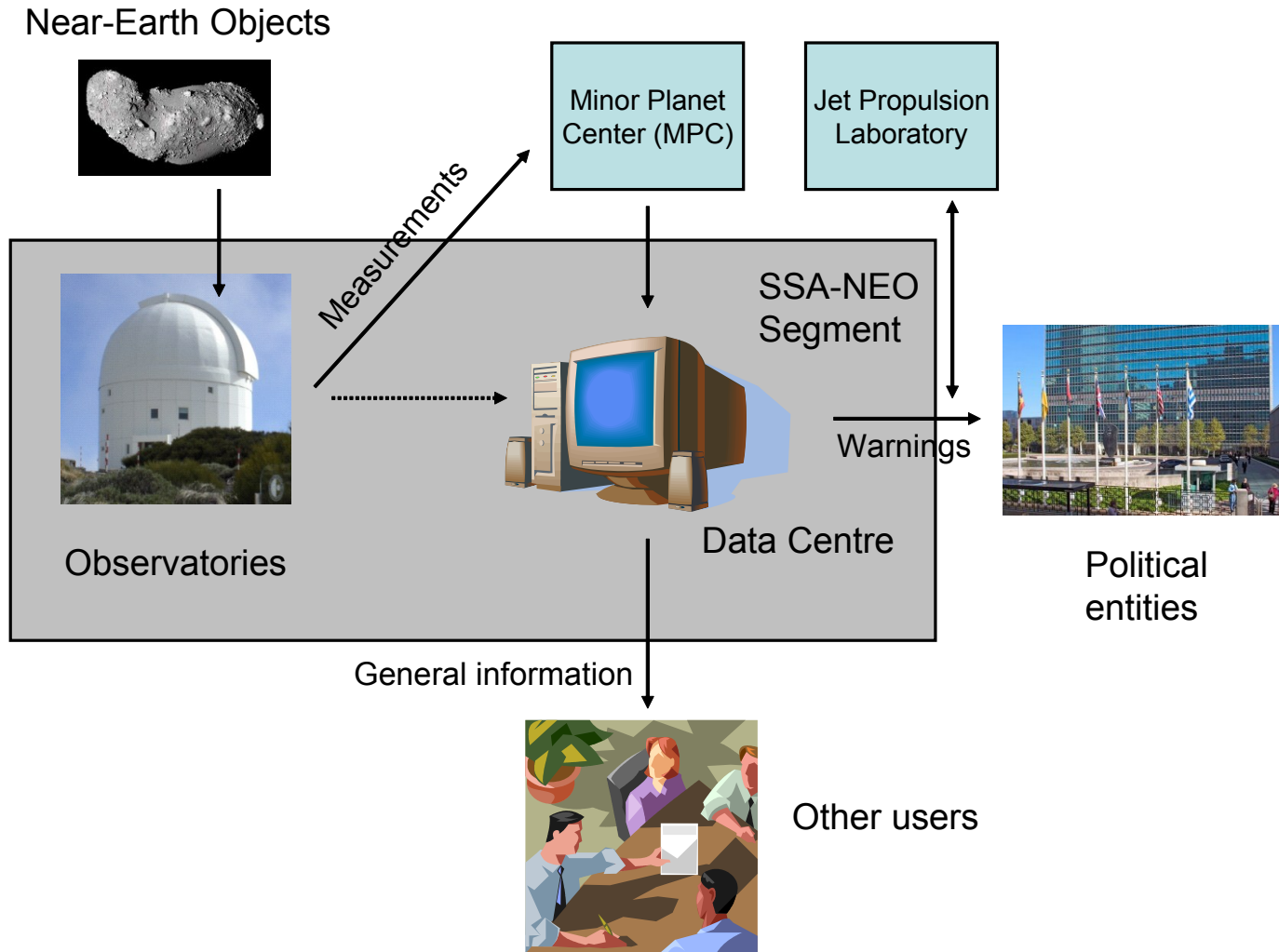
- The impact of an asteroid on the Earth releases devastating kinetic energy causing:
 - Blast waves
 - Tsunamis
 - Atmospheric disturbances
 - Electromagnetic changes



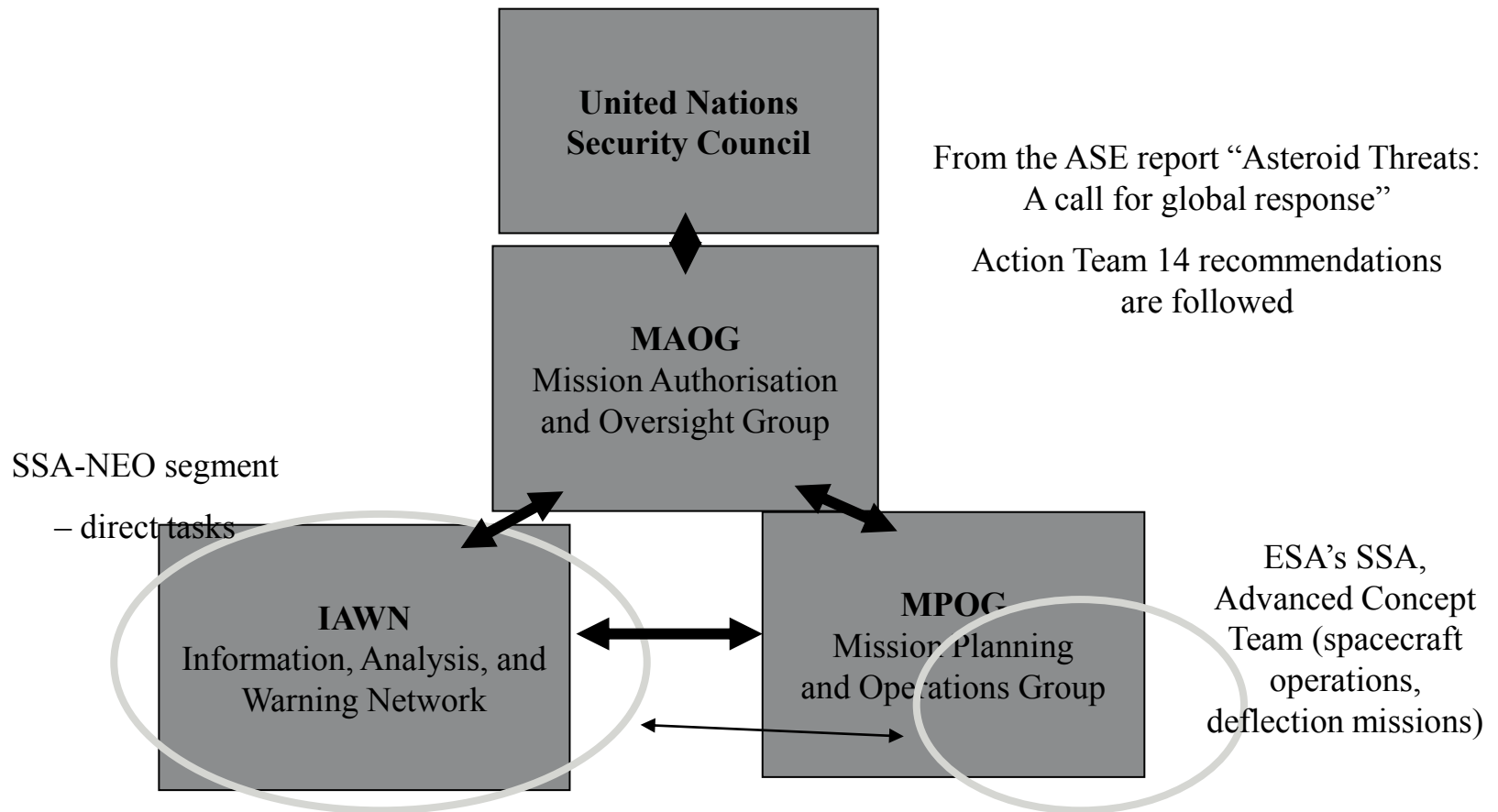
NEO diameter	Megaton TNT Equivalent	Average interval
75 m	10 to 100	1,000 years
350 m	1,000 to 10,000	16,000 years
3 Km	1,000,000 to 10,000,000	1,000,000 years

NEAR-EARTH OBJECTS

The Solution



- SSA-NEO – link to UN activities



Current SSA-NEO involvement in international activities



- A large part of the direct SSA-NEO work fits into the 'Information, Analysis and Warning Network (IAWN)'
 - Participated in the IAWG Workshop in Mexico in Feb 2010
 - SSA-NEO has started performing asteroid survey and follow-up
- ESA's mission analysis and other technical expertise support the envisaged work of the Mission Planning and Operations Group (MPOG)
 - E.g. Don Quijote study (asteroid impactor), Marco Polo study (sample return mission)
- Policy discussions are supported
 - Involved in Action Team 14 reporting to the UN COPUOS
 - D. Koschny member of newly formed IAU working group on NEOs

SUMMARY

SPACE SITUATIONAL AWARENESS *Summary*



- European SSA Preparatory Programme
 - 3 to 4 year duration
 - Three segments
 - Space Surveillance and Tracking (SST)
 - Space Weather (SWE)
 - Near Earth Objects (NEOs)
 - Precursor programme to:
 - Federate existing assets
 - Begin precursor services
 - Produce architectural and system design
 - Create governance and data policy
 - Develop bread-board radar for SST
 - International cooperation a central theme





THANK YOU