ESA's contribution to sustainability of outer space through SSA

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Toulouse Space Show '12

IAA/IISL Space & Law Symposium, Session 1d

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Presented by
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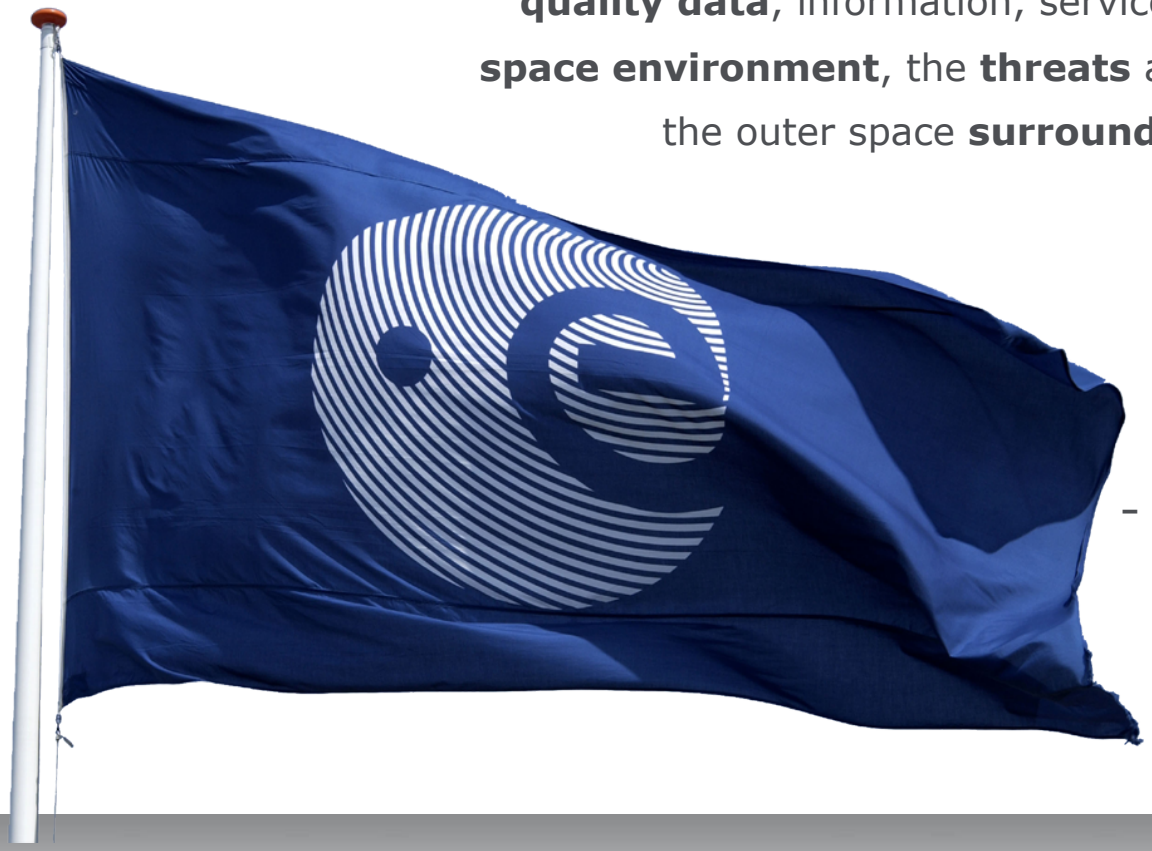
images: (ESA & NASA)

PURPOSE OF THE SSA PROGRAMME

"The objective of the Space Situational Awareness (SSA) programme is to support the **European independent utilisation** of, and **access to, space** for research or services, through the **provision of timely and quality data**, information, services and knowledge regarding the **space environment**, the **threats** and the sustainable exploitation of the outer space **surrounding our planet Earth.**"



- **ESA Ministerial Council November 2008**

AIMS OF THE SSA PROGRAMME

- Independent utilisation of Space
  - **Space assets are critical assets and require protection (collision avoidance, space weather effects) through services provided by a SSA System**
- Guarantee access to Space
  - Diplomatic,
  - Political
  - Regulatory
  - Technical
- Serve EU “Lisbon Objectives”
  - New Applications
  - New Jobs
  - New Markets

CUSTOMERS FOR SSA SERVICES

- European Governments
  - EU, EC
  - 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

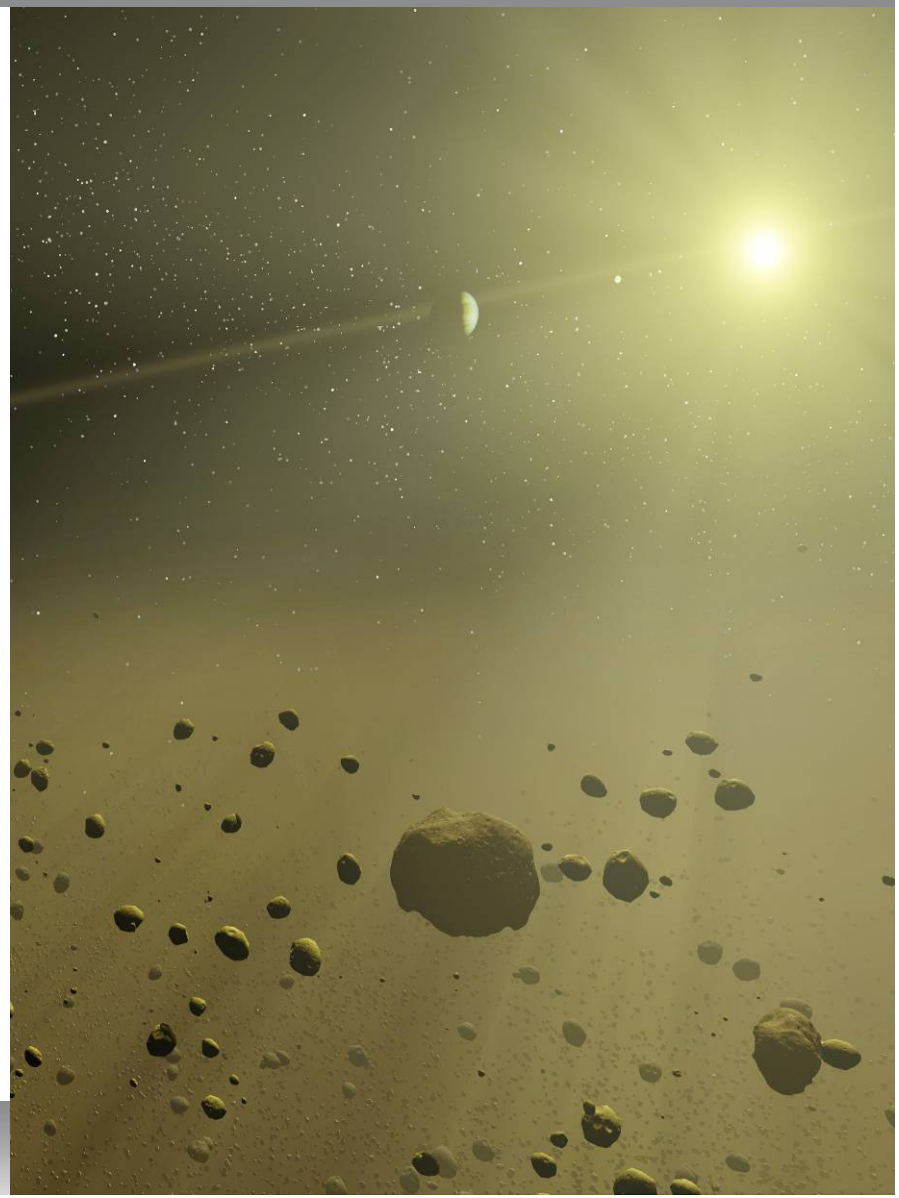
Current Objectives

2009 – 2012

- **SSA Preparatory Programme**
  - Governance Definition
  - Data Policy
  - Architecture
  - Federation
  - Precursor Services
  - Radar Breadboard
  - Pilot Data Centres

2013 – 2020

- **SSA Development & Exploitation**
  - Development of essential components corresponding to the required architecture
  - SSA Exploitation by agreed Operating Entities



SSA Programme Structure

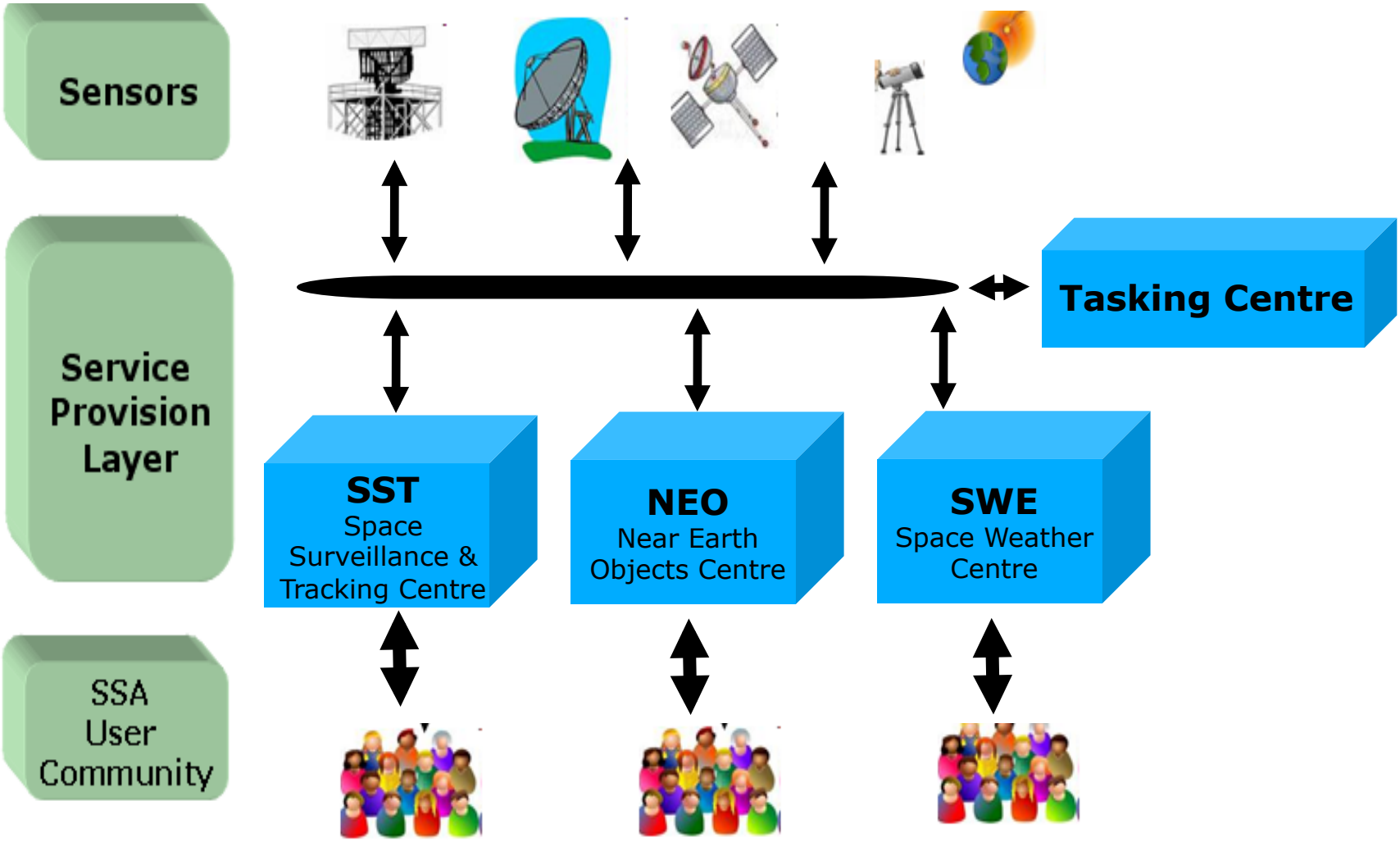
1. Core Element
   - SSA Architecture
   - Governance
   - Data Policy
   - Security
   - Space Surveillance and Tracking Segment
2. Space Weather Element
   - (including NEO activities)
3. Radar Element
   - Prototype Development of demonstrators
4. Pilot Data Element
   - Transversal support for all segments

SSA Participating States

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

European SSA System

SSA Programme Structure

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SPACE SURVEILLANCE (SST)
European Space Agency

SPACE SURVEILLANCE
The Services

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

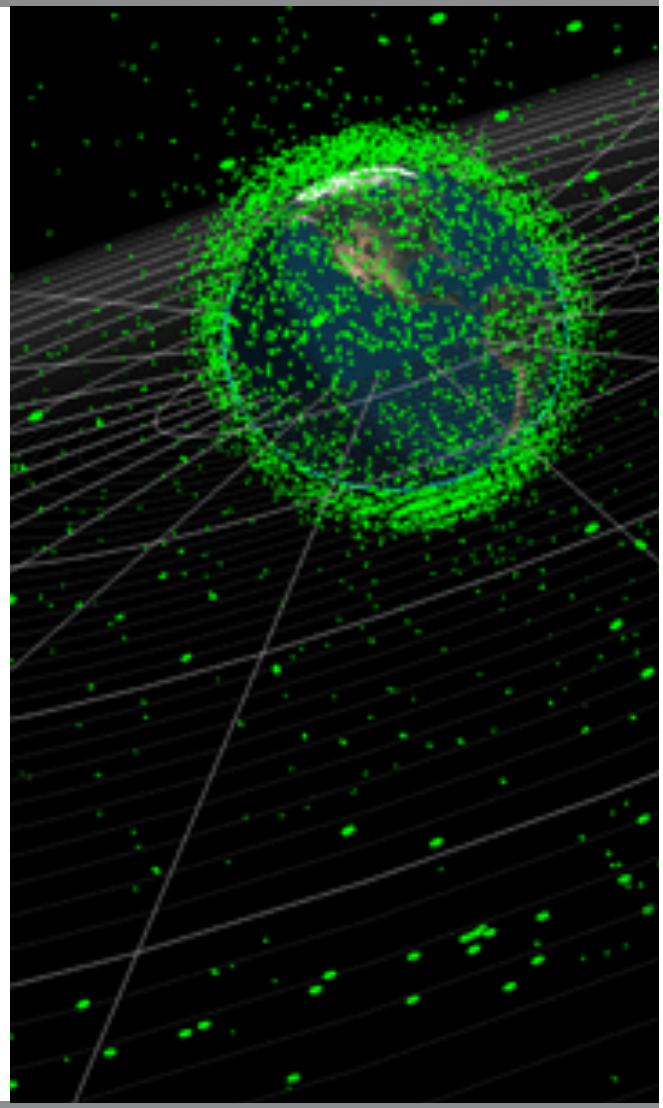
   Monitor and predict the trajectories of all critical Earth orbiting bodies. Calculate potential intersections and assist in the implementation of corrective actions where possible.

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.

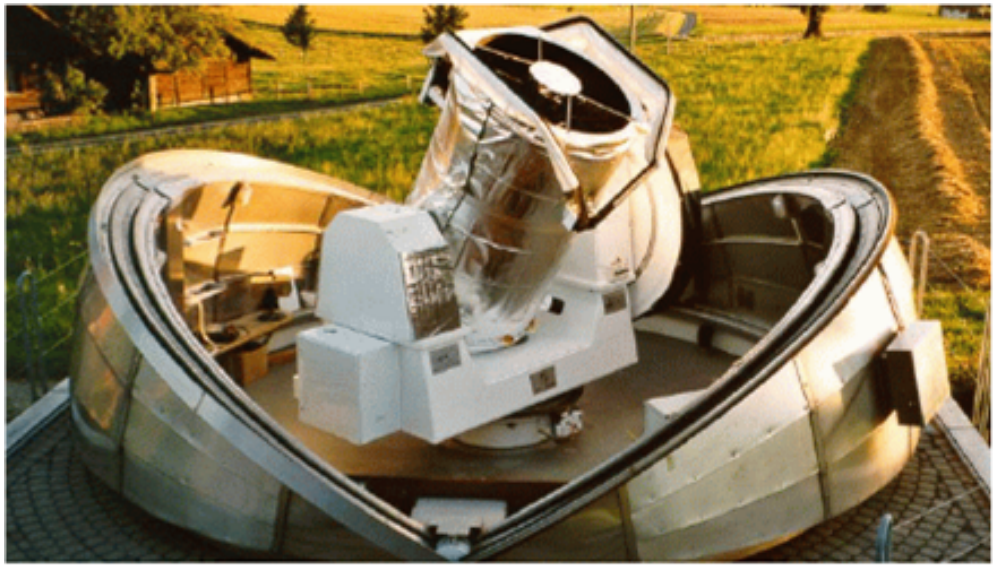


Sensors for surveillance and tracking

Graves (France) – Bi-static surveillance radar

Sensors for surveillance and tracking

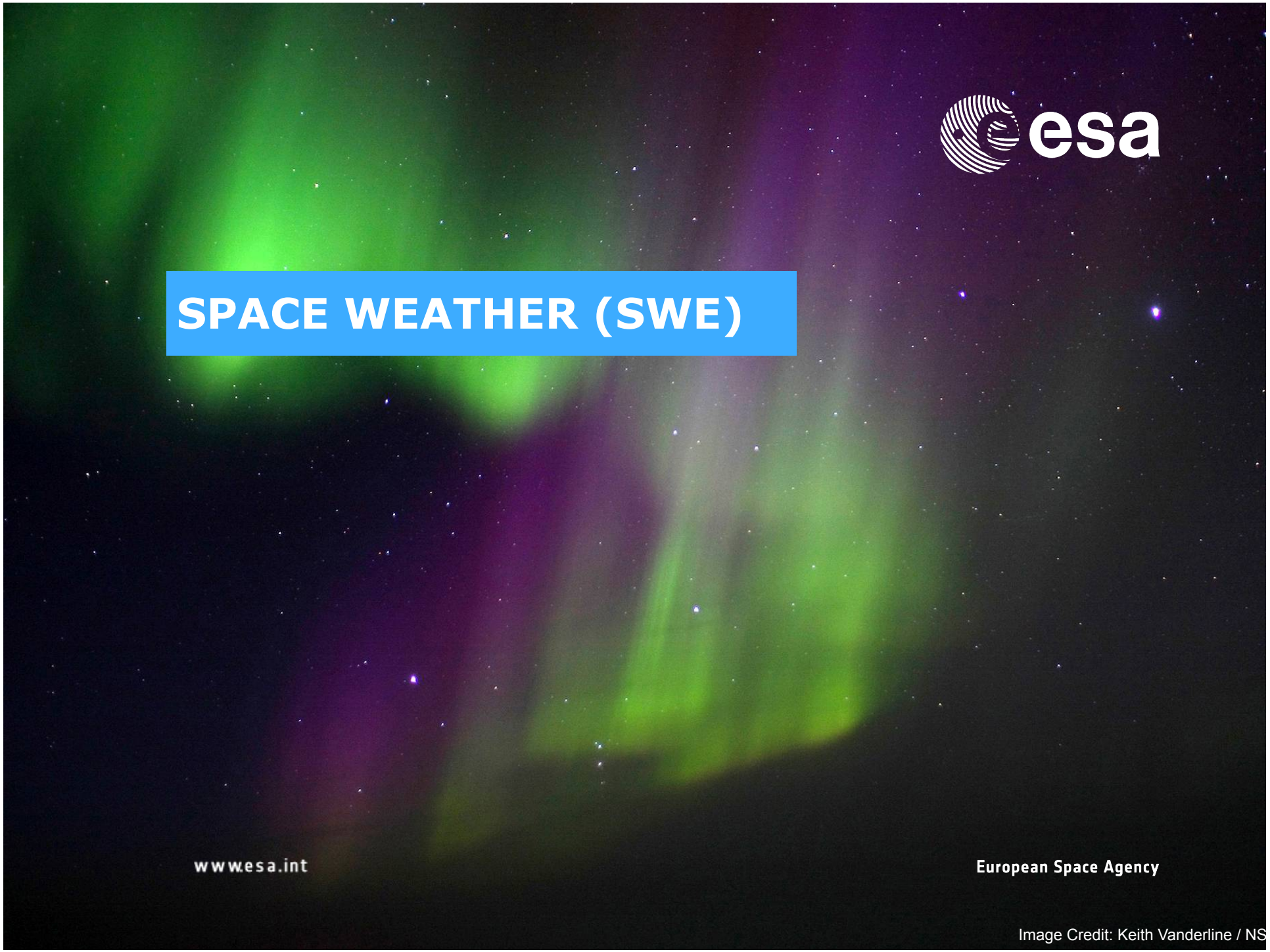
FGAN (Germany) – tracking radar



Zimmerwald (Switzerland) - tracking telescope

Sensors for surveillance and tracking

EISCAT antennas at Svalbard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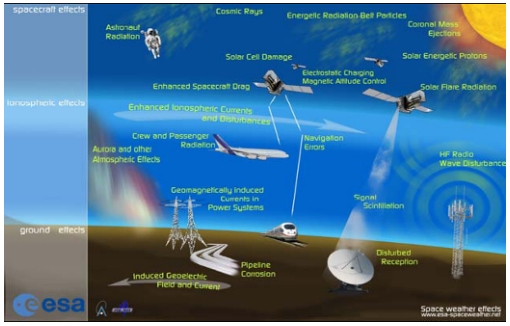
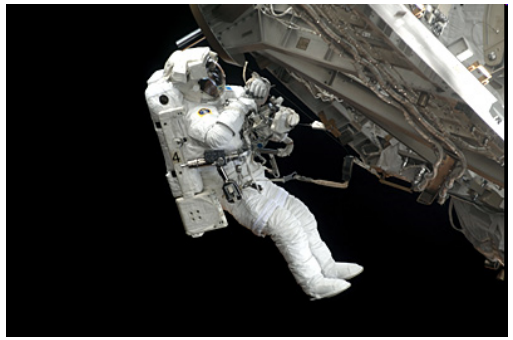
SPACE WEATHER (SWE)
www.esa.int
European Space Agency
Image Credit: Keith Vanderline / NS

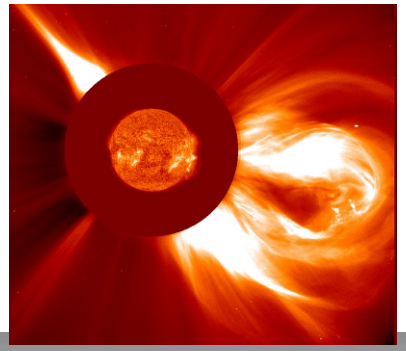
SPACE WEATHER
Space Weather Objectives

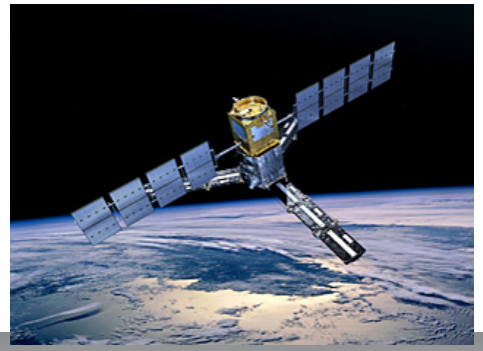
Detection and forecasting of the Space Weather events and the effects it has on European space assets and ground based infrastructure:

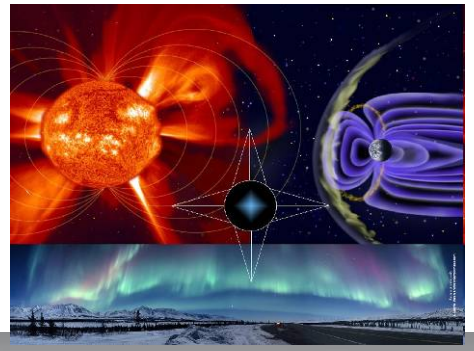
- Comprehensive knowledge, understanding and maintained awareness of the natural space environment
- Detection and forecasting of SWE and its effects
- Detection and understanding of interferences due to SWE
- prediction and/or detection of permanent or temporary disruption of mission and/or service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











images: (ESA & NASA)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NEAR EARTH OBJECTS (NEO)
www.esa.int
European Space Agency
Image (c) David A. Hardy/www.astroart.org

Status of knowledge on NEO environment (most data from NEODyS, 15-Dec-2010)

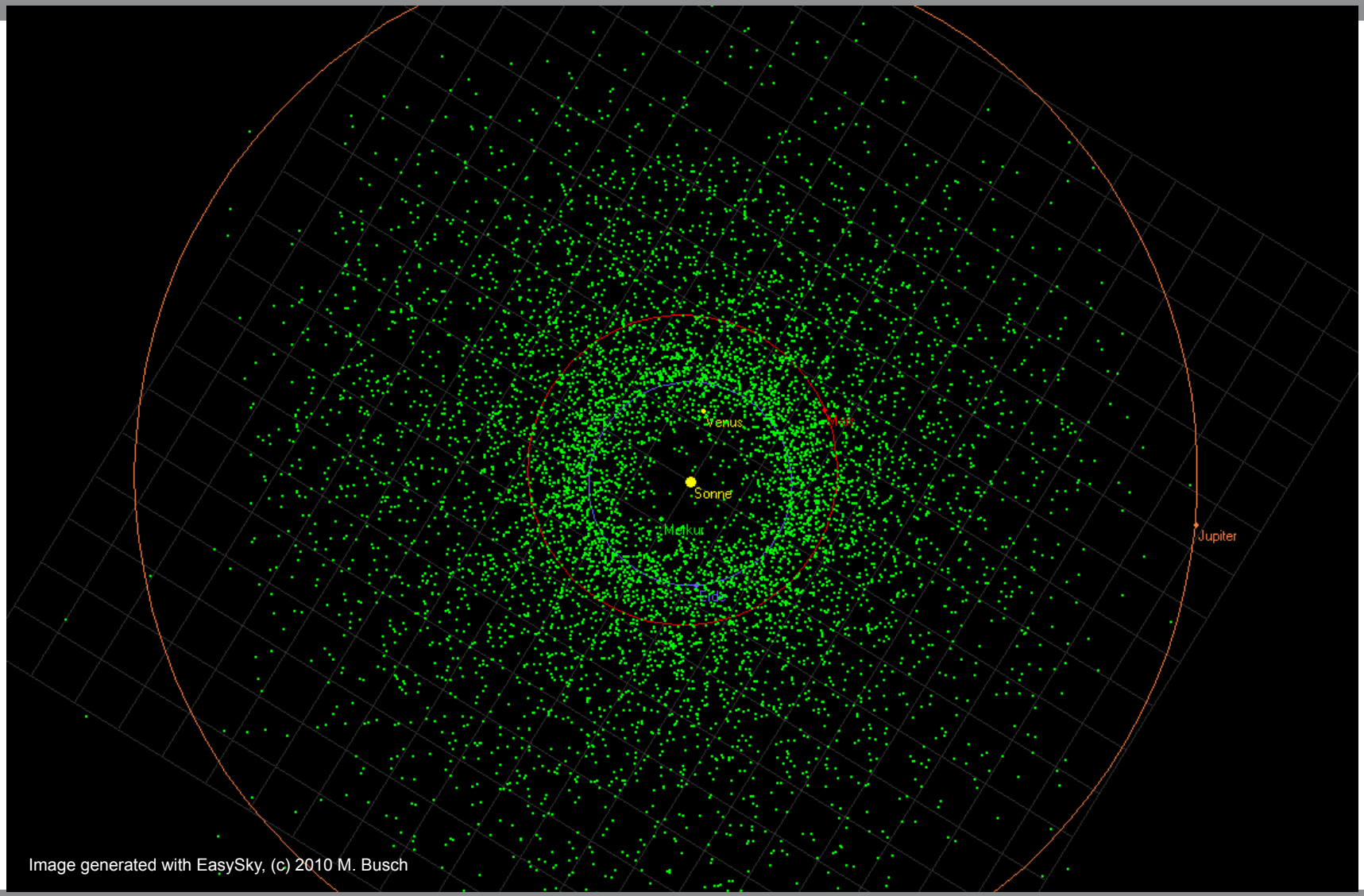
- > 400,000 known asteroids
  - 7655 known NEOs
  - 294 in risk list (NEOs with non-zero chance of impact with Earth during next 100-200 years)

- It is estimated that we know:
  - 90% of NEOs larger 1 km in diameter (total ≈ 1050)
  - 5% of NEOs larger than 140 m (total ≈ 100,000)
  - 0.5% of NEOs larger than 40 m (total ≈ 1,000,000)

- Largest NEA: 1036 Ganymed (≈ 38 km)
- Largest Asteroid: Ceres (≈ 950 km)data

images: (ESA & NASA)

NEAR EARTH OBJECTS
All known NEOs (Sep 2010)

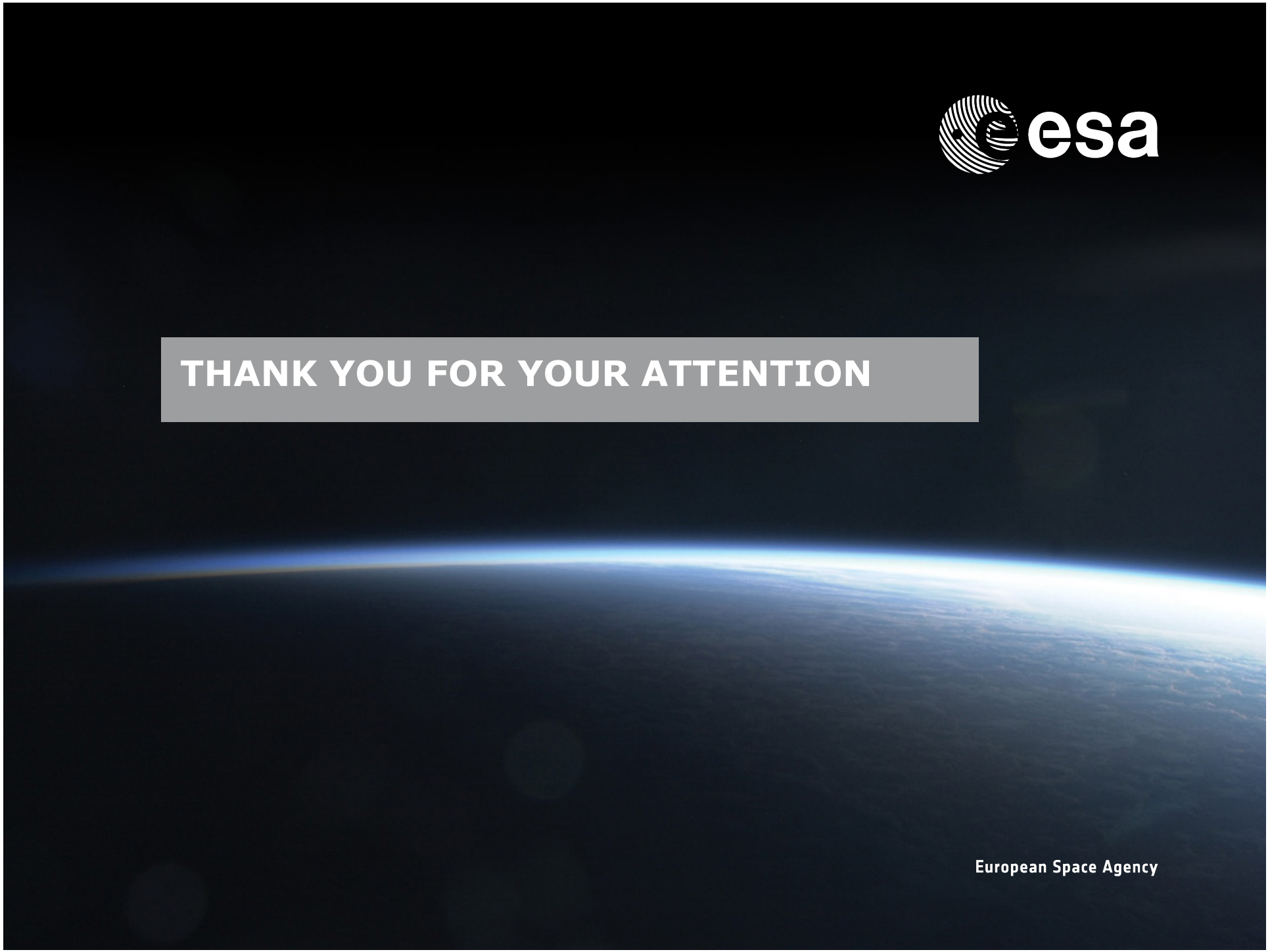


Need for an autonomous European System

- Operating Entities
- Security Environment
- Data Policy for the distribution of SSA information
- Development management structure for the SSA key components (e.g. radars, telescopes)
- Roles of ESA, EDA, National Agencies in the development
- Roles of National MODs and EUSC in the SSA exploitation
- Type of budgetary structure, e.g. mixture of national and EU funding?

Programme proposal for the ESA Council on Ministerial Level in November 2012 is currently prepared

images: (ESA & NASA)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THANK YOU FOR YOUR ATTENTION
European Space Agency