ESA SSA SWE Services: Status and Near Future Prospects

Space Weather Workshop
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Boulder, Colorado

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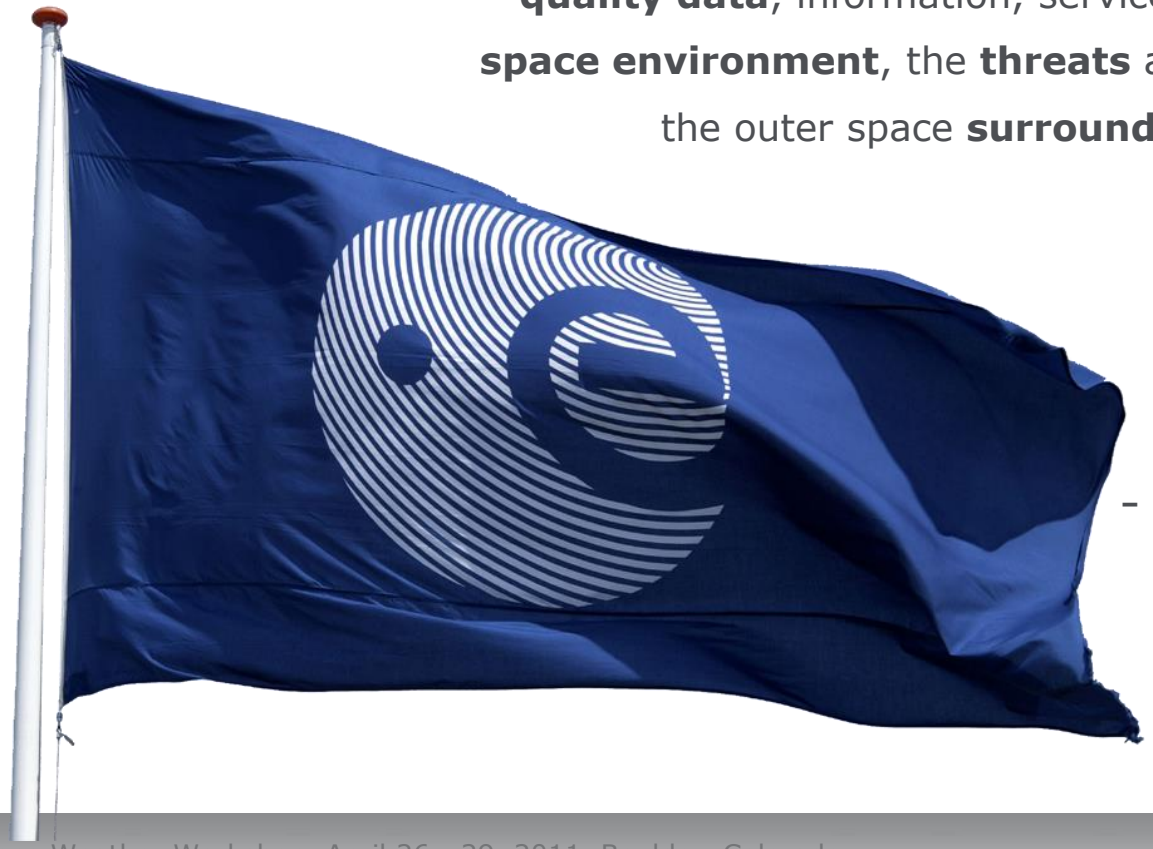
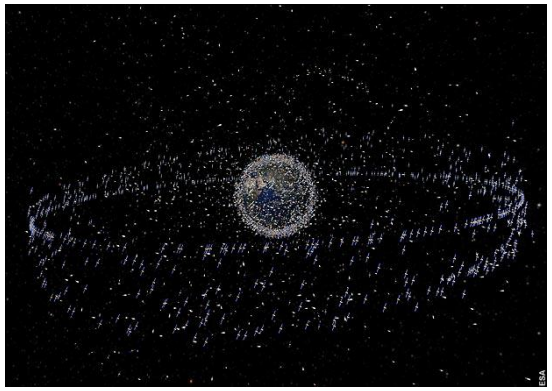
PURPOSE OF THE SSA PROGRAMME

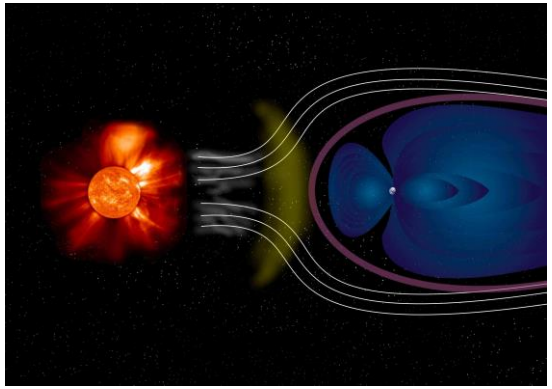
"The objective of the Space Situational Awareness (SSA) programme is to support the **European independent utilisation** of, and **access to, space** for research or services, through the **provision of timely and quality data**, information, services and knowledge regarding the **space environment**,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

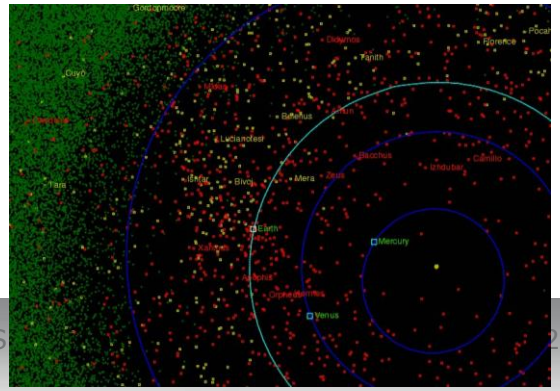


- **ESA Ministerial Council November 2008**

SSA PROGRAMME SEGMENTS







Space Surveillance and Tracking (SST)

- Maintain catalogue of man-made objects in Earth Orbit
- Detection, tracking, correlation and characterisation of all objects above a given size threshold for a given orbit region
- Covers LEO, MEO and GEO
- Prediction and warning of collisions and re-entry events
- Detection of on-orbit explosions, collisions and manoeuvres

Space Weather (SWE)

- Detection and forecasting of Space Weather and its effects
- Monitoring of the sun, solar wind, magnetosphere, radiation belts, ionosphere and disturbances in the geomagnetic field
- Provide SWE effect related services for designers, operators and users of spaceborne and ground based infrastructures
- Statistical monitoring of micro particles of natural or human origin

Near Earth Objects (NEOs)

- Solar system objects with orbits bringing them into close proximity with the Earth
- Includes a few thousand Near Earth Asteroids, Near Earth Comets, solar orbiting spacecraft and larger meteoroids
- Determination of the orbit state and physical parameters
- Identification and ranking of NEO collision risk with the Earth

SSA Participating States

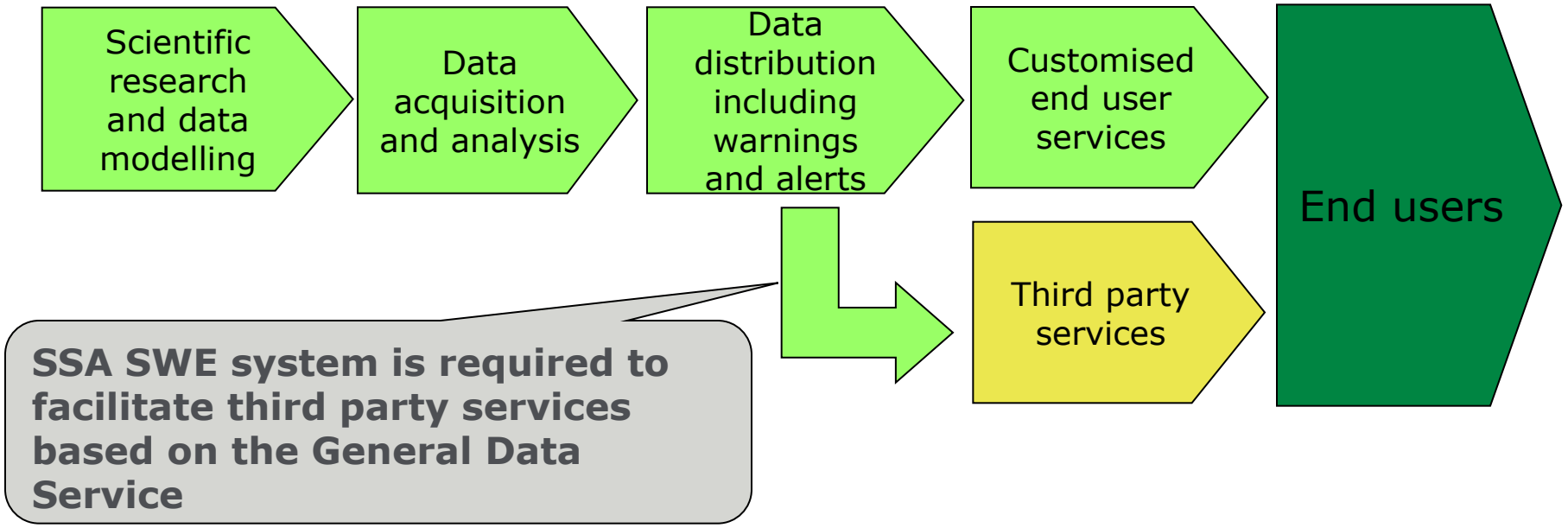
- **Austria**
- **Belgium**
- **Finland**
- **France**
- **Germany**
- **Greece**
- **Italy**
- **Luxembourg**
- **Norway**
- **Portugal**
- **Spain**
- **Switzerland**
- **United Kingdom**

ESA SSA SWE Customer requirements

- ESA has collected service and product requirements from the European SWE users

  => **ESA SSA SWE Customer Requirements Document**

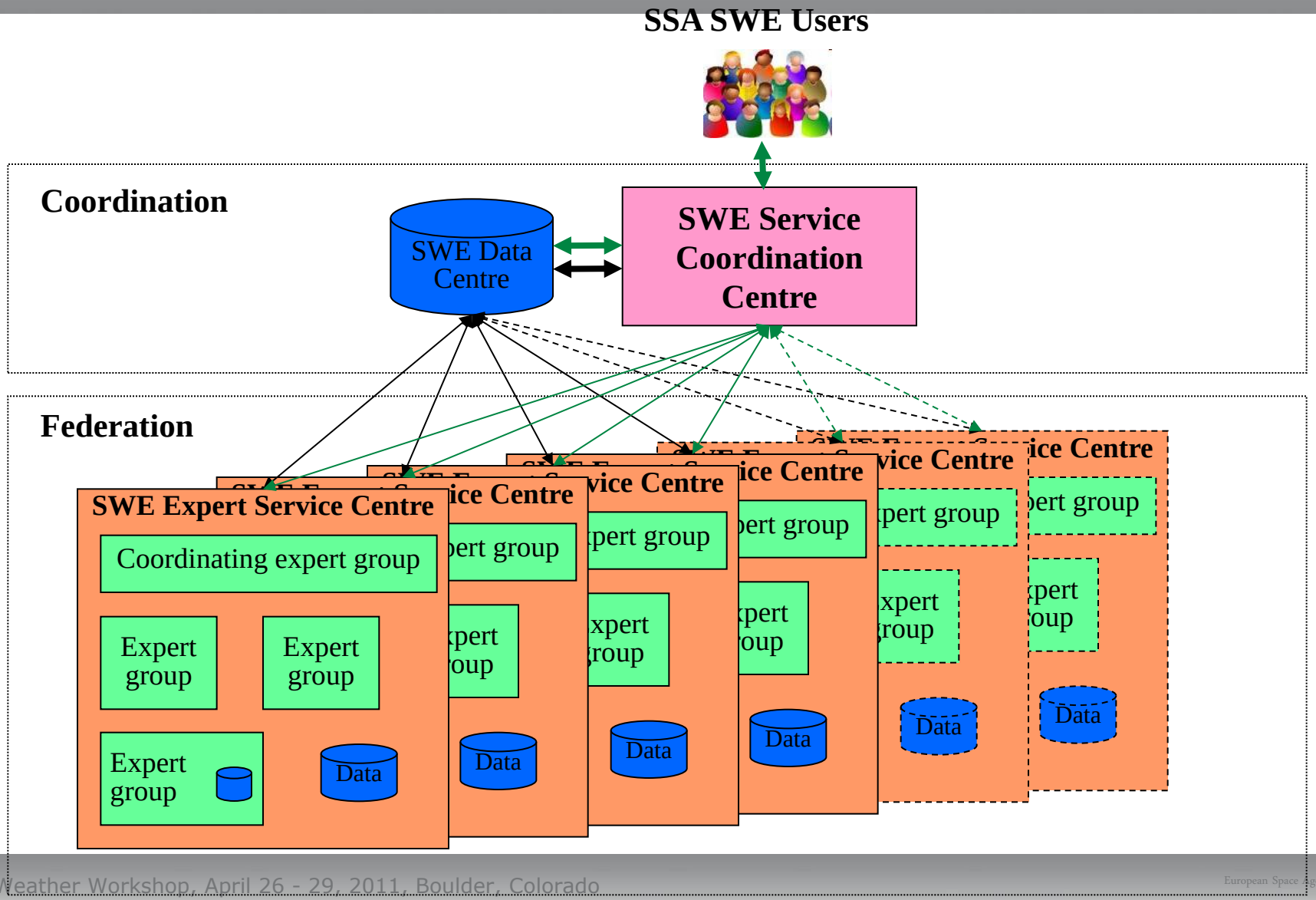
  => a mandate to develop a system providing customised services and products to the end users



Space Weather
User Domains and Services

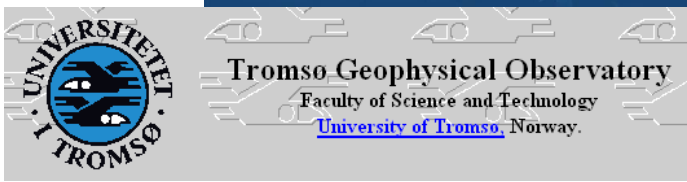
1. Spacecraft designers
    - Environment specification and post event analysis
2. Spacecraft operators
    - In orbit environment and effects monitoring/forecasting, post event analysis, mission analysis
3. Human space flights
    - In flight and cumulative crew radiation exposure, increased crew radiation exposure risk
4. Launch operators
    - In flight monitoring, estimates and forecasts of radiation effects in electronics, atmospheric density forecasts
5. Transionospheric radio link users
    - Real-time and forecast TEC maps, scintillation maps, ionospheric disturbances monitoring
6. Survey and tracking
    - Atmospheric estimates, geomagnetic and solar indices archives and forecast for drag calculation
7. Data services
    - Space weather data archive, event based alarms
8. Non Space Systems Operators
    - Power systems and pipeline operators, airlines, resource exploitation system operators, auroral tourism sector

Utilisation of existing services and assets



SN-I: Space Weather services preparation

- Assessment of the European SWE assets in SN-I activity => **Poster 5 by Eva Robbenrecht**
- First four Expert Service Centres (ESCs):
  - Solar Weather (coordinator: ROB)
  - Space Radiation (coordinator: BIRA-IASB)
  - Ionospheric Weather (coordinator: DLR)
  - Geomagnetic Conditions (coordinator: TGO)

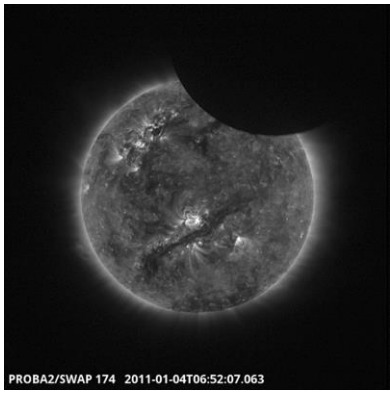


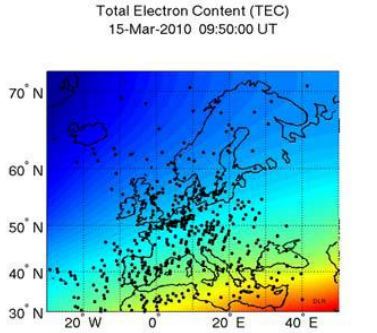
Space Weather
SN-I federated Precursor Services in 2011

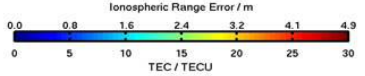
- Solar Weather ESC: SIDC ursigram, sunspot index, forecasts of the Sunspot Index, GPS relevant ionospheric and geomagnetic conditions, CACtus CME detection: daily detection and catalog, NEMO EUV wave detection: catalog only, provisional aa index, monthly activity bulletin, GOES X-ray flare alert CACtus halo CME detection alert, disturbed geomagnetic conditions alert, all quiet alert, Presto, Proba-2 data, SDO data redistribution, …
- Space Radiation: SPENVIS
- Ionospheric Weather: Access to the services from the SWACI system
- Geomagnetic Conditions: Expertise and services on geomagnetism
- AVIDOS air travel background radiation dose estimates (TBC)

PRESTO FROM SIDC - RWC BELGIUM Mon Jan 17 2011, 1233 UT

The fast solar wind speed escaping from the extension of the southern coronal hole, might arrive today. According to the solar wind parameters recorded by STEREO B, we expect the solar wind to rise up to 500 km/s. Active conditions are possible, unsettled conditions are more likely. Other conditions are quiet.

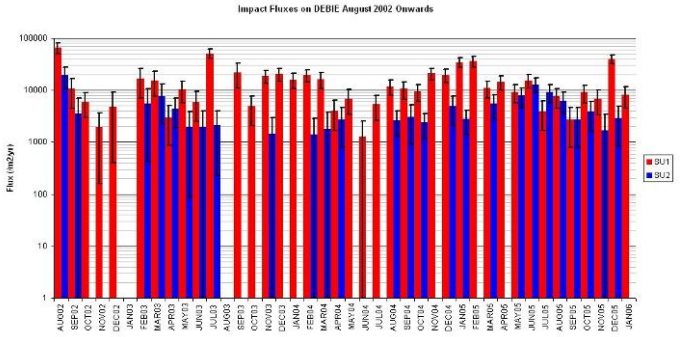


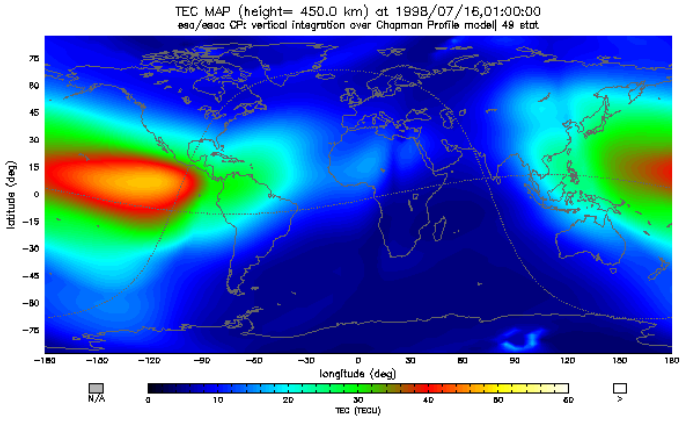


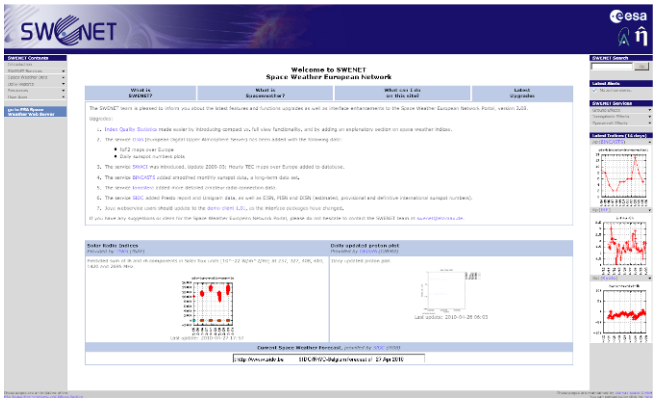


Space Weather
SWE precursor services in the Data Centre

- The applications developed by ESA:
  - Space Environment Data System (SEDAT)
  - European Impact Detector Database (EDID)
  - Space Environment Information System (SPENVIS)
  - Standard Radiation Environment Monitors (SREM)
  - Space Weather European Service Network (SWENET) portal
  - Space Environment System for Operations (SEISOP)
  - Ionospheric Monitoring Facility (IONMON)
- We are also looking at continuing SWENET SDAs in the SSA framework





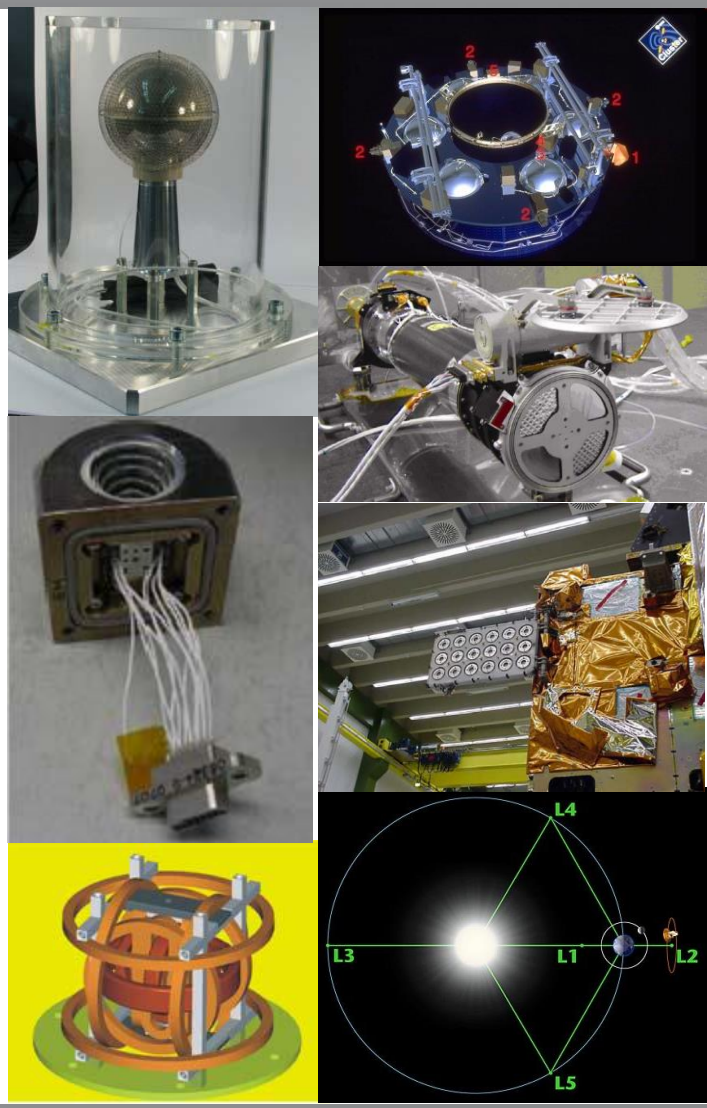


SWE system architecture and infrastructure

- The overall ESA SSA architecture is under definition: all three segments addressed
- Space segment is vital for SWE services:
  - Dedicated activity to address piggy-pack flight opportunities for next generation SWE instruments ongoing

    => over 20 European instruments representing all required instrument types considered

    => the short list for candidate host s/c includes about 25 missions planned for 2014 – 2020
- Need for dedicated missions clearly identified: e.g. solar wind and IMF observations



Summary and next steps

- First SWE services from the SSA PP will be established during summer 2011: Solar weather, Space radiation, Ionospheric weather, Geomagnetic services
- More SWE services will be integrated into the system in next SSA activities in 2011 - 2012
  - Based on existing European assets
  - Focus on covering more user domains
- International collaboration is a significant element of the programme
- SSA PP focuses on testing and validation of the existing services

  => next phase will start the actual development
- ESA SSA Preparatory Programme continues until end of 2012

  => Next phase of the programme will be decided in the next ESA Ministerial meeting

Eight European Space Weather Week

8th European Space Weather Week

Palais des Congres, Namur, Belgium

28th November - 2nd December, 2011

http://sidc.oma.be/esww8/


esa
THANK YOU
http://www.esa.int/esaMI/SSA/index.html
European Space Agency