Space Weather in the ESA SSA Programme

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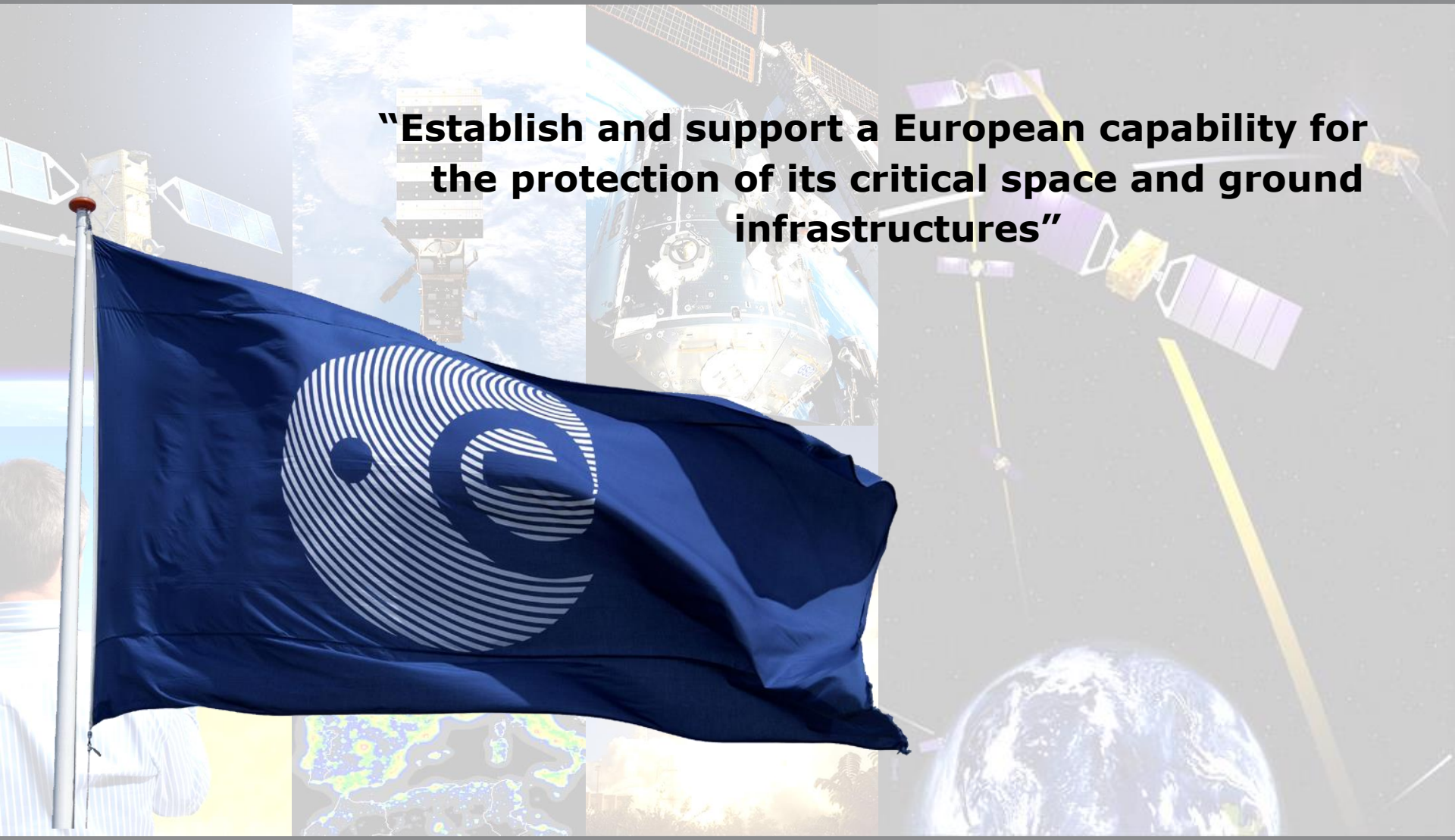
SSA Programme Office, ESA-ESAC

Space Weather Workshop
16-19th April 2013

Europe Depends on Space

- Communications
- Navigation
- Weather Forecasting (Space and Earth)
- Time Reference
- Climate Change Monitoring
- Disaster Management
- Earth Observation (Agriculture, Planning)

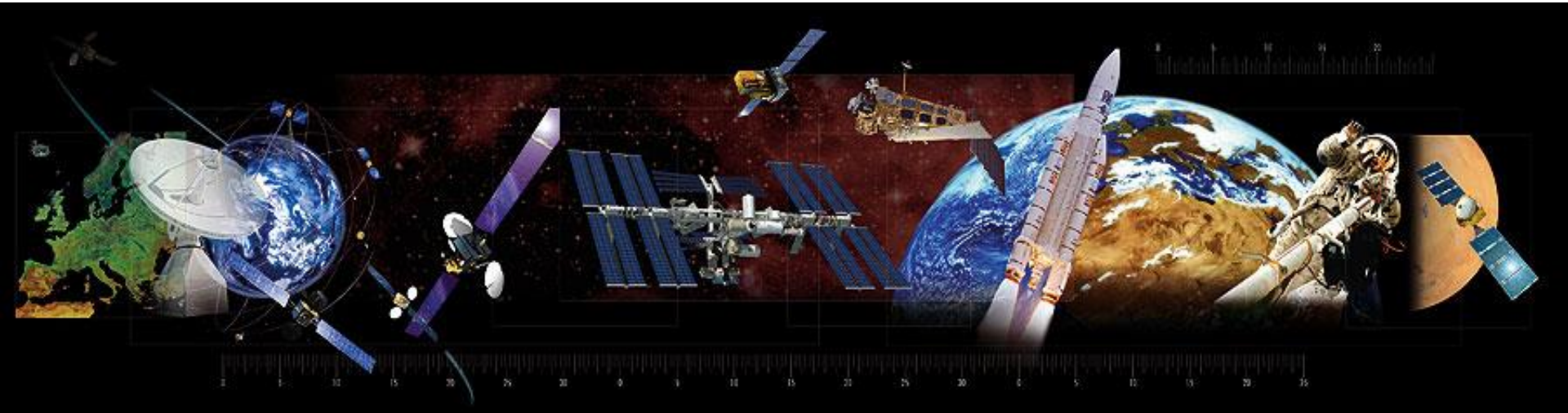
Objective of the SSA Programme



"Establish and support a European capability for the protection of its critical space and ground infrastructures"

Customers for SSA Services

- European Governments
  - EU, EC
  - National
  - Regional
- European Space Agencies
  - ESA, EUMETSAT
  - 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



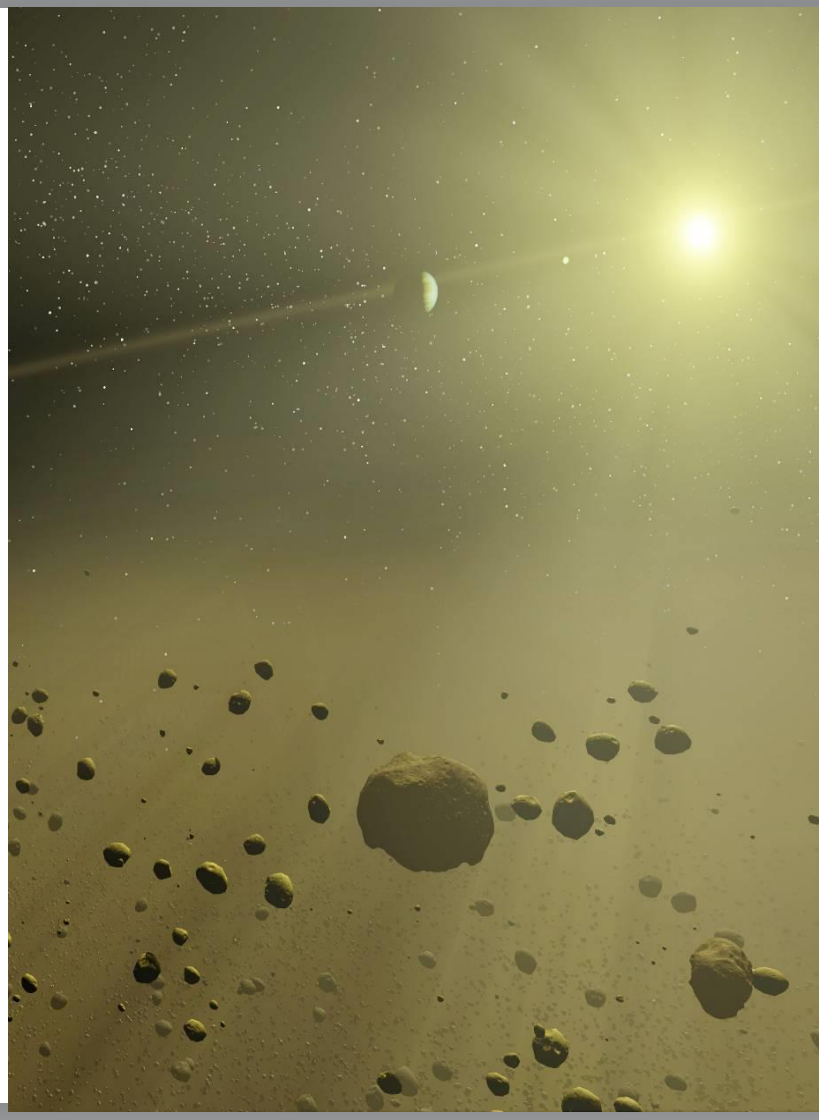
ESA SSA Programme Periods

2009 – 2012: SSA Period 1 (Preparatory Programme)

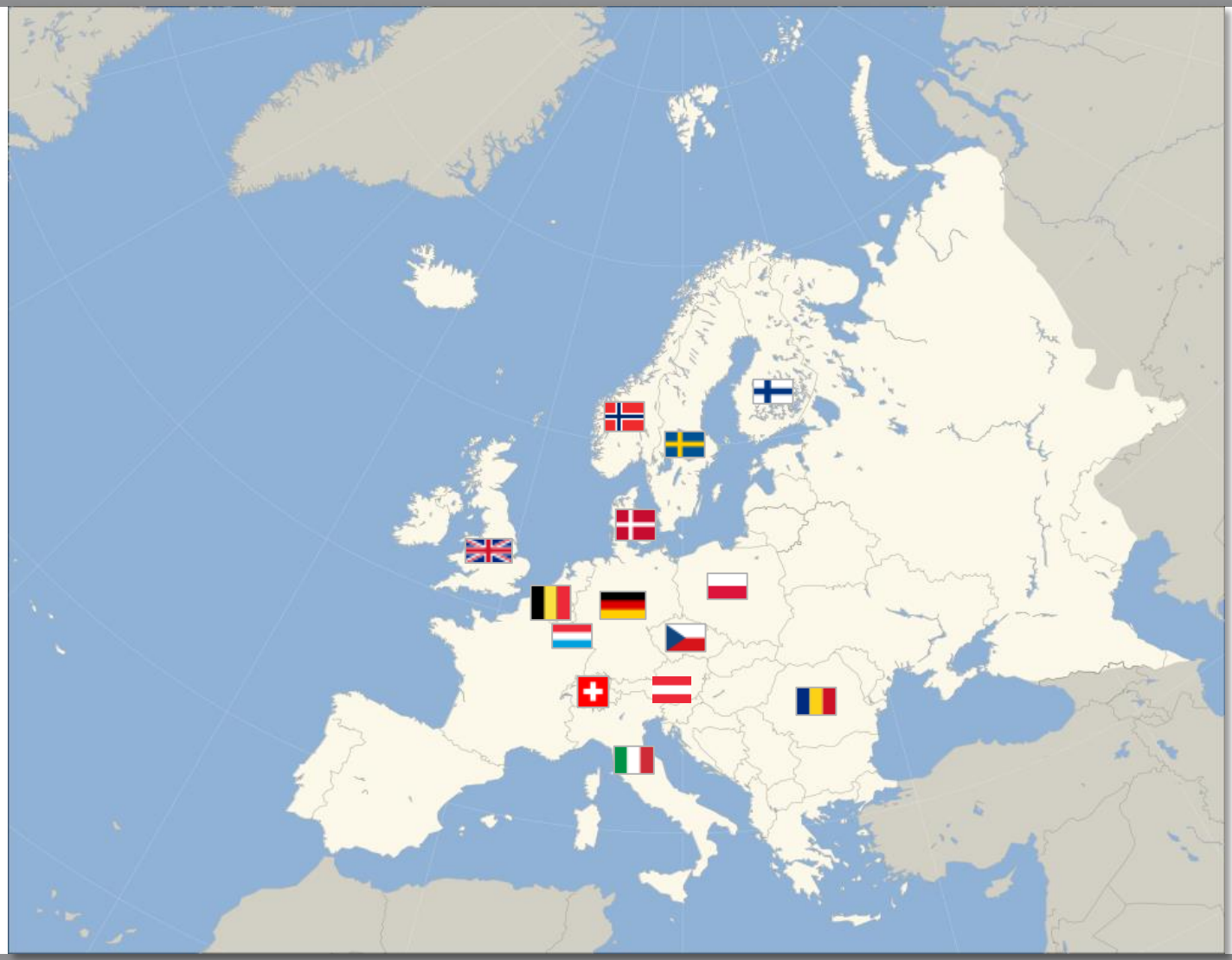
- Mission, customer and system requirements
- Governance Definition and Data Policy
- System Architecture
- Precursor Services
- Radar Breadboard
- Pilot Data Centres

2013 – 2016: SSA Period 2

- Build on results of SSA PP
- Networking of European assets
- Testing & Validation
- Development of applications
- Estabishment of selected new assets



ESA SSA Programme Participants in Period 2



- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- Germany
- Italy
- Luxembourg
- Norway
- Poland
- Romania
- Sweden
- Switzerland
- United Kingdom

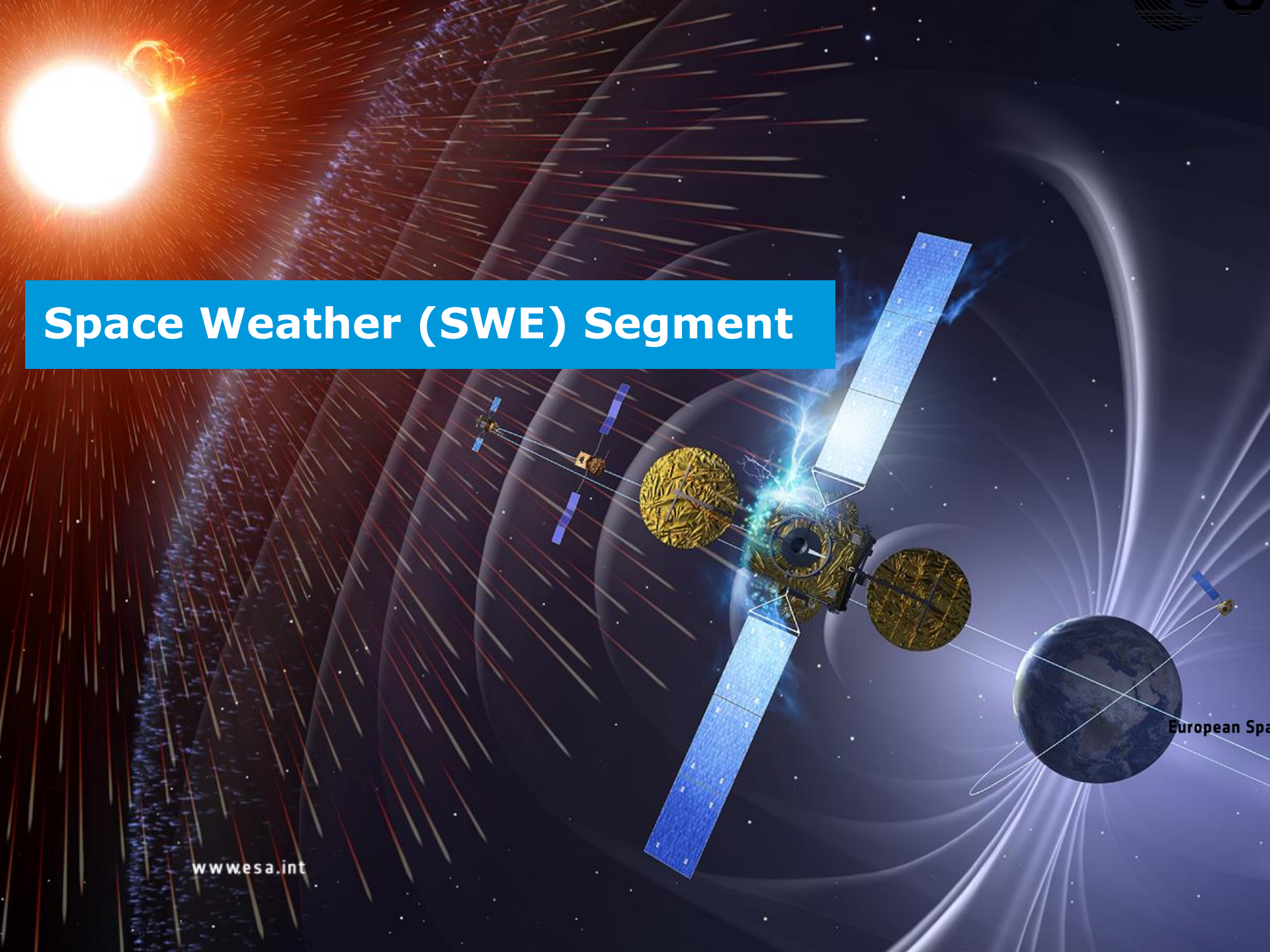
Funding: 46.5 M€

(2012 e.c.)

Participation by Programme Segments

	SWE	NEO	SST
Austria	X		X
Belgium	X	X	
Czech Republic	X	X	
Denmark	X		
Finland	X	X	X
Germany	X	X	
Italy	X	X	X
Luxembourg	X	X	X
Norway	X		X
Poland	X	X	X
Romania	X	X	X
Sweden	X		X
Switzerland	X	X	X
UK	X		

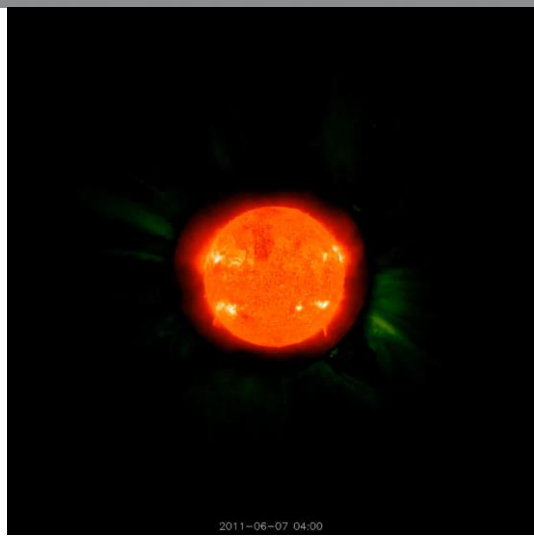
Space Weather (SWE) Segment

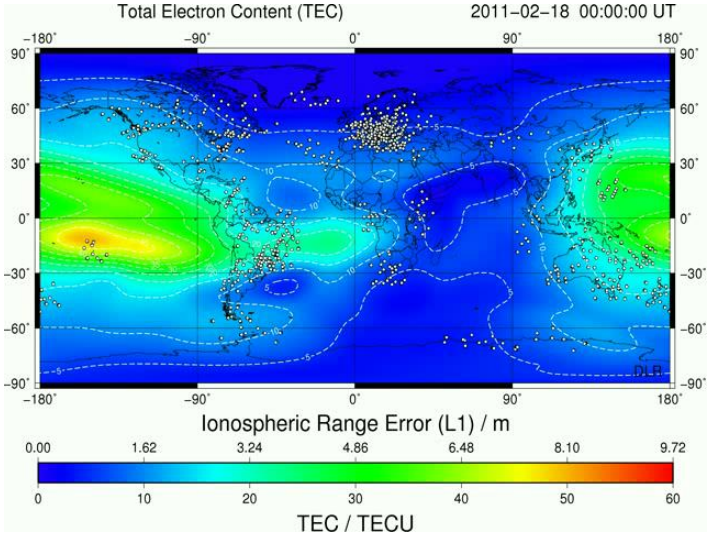


SSA Space Weather System Objectives

Detection and **forecasting** of Space Weather events and the **effects** they may have on European space assets and ground based infrastructure:

- Provision of comprehensive knowledge, understanding and maintained awareness of the natural space environment
- Monitoring the Sun, the solar wind, the radiation belts, the magnetosphere and ionosphere to the extent that it supports SSA SWE services
  - Detection and forecasting of SWE and its effects
- Prediction and detection of permanent or temporary disruption of mission or service capabilities
- Provision of predicted local spacecraft and launcher radiation, plasma and electromagnetic environment data





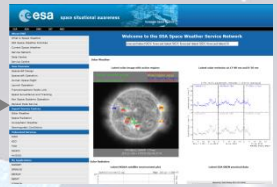
images: (ESA & NASA)

SWE Segment objectives in SSA Period 2

- **Networking of available national and European SWE assets**
  - PP catalogued sensors, data, data centres, applications & service centres
  - P2 will also enhance service coordination, user support
- Continuation of the **preparation of SWE additional services** building on achievements of the Preparatory Programme
- Continuation of the **Proba-2** operations and exploitation
- Implementation of the **first flight opportunities for hosted payload SWE instruments** and planning for the future HP missions
- **Exploitation of SWE instruments**, as well as **data** and European centres of expertise
- **Study** (phase A) of a **mission** to ensure availability of **solar wind, IMF and coronagraph data** from L1
- **Studies** of mission concepts **for enhanced SWE monitoring and forecasting** with sensors away from the Sun-Earth line
- SSA-SWE **technologies** development

SSA/SWE Precursor System 2013

SSA-SWE Users



SSA-SWE Service Portal: swe.ssa.esa.int

SWE Data Centre
Redu, Belgium

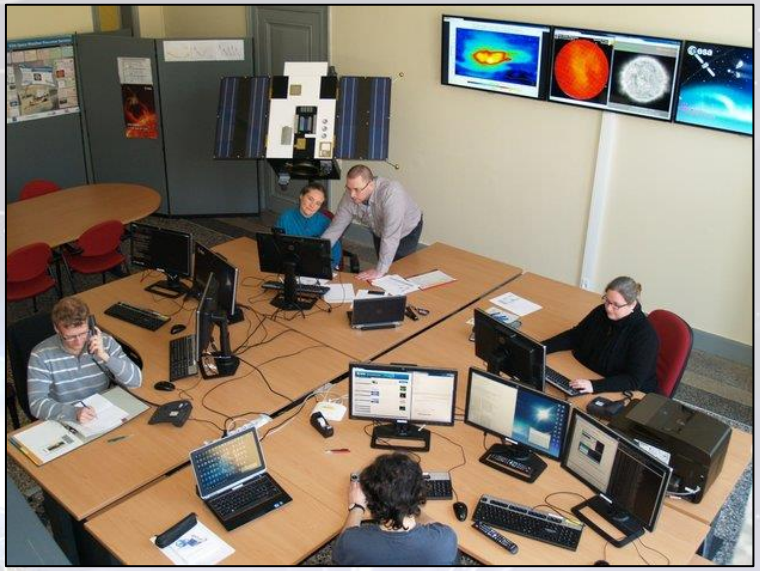
SSA Space Weather Coordination Centre
Space Pole, Belgium

SWE Expert Service Centres

Solar Weather	Ionospheric Weather	Space Radiation	Geomagnetic Conditions	Heliospheric Weather
ROB, Belgium (coord.) Uni. Graz, Austria	DLR, Germany (coord.) NMA, Norway NOA, Greece CLS, France	BIRA, Belgium (coord.) AIT, Austria UOA, Greece	TGO, Norway (coord.) FMI, Finland	TBD

SSA Space Weather Coordination Centre (SSCC)

- Established in Space Pole, Brussels
- SSCC is the first point of contact for SSA-SWE help and information:
  - Operates the SWE Helpdesk
  - operates and maintains the SSA-SWE Data Centre
  - monitors the availability and accessibility of the SSA-SWE services
  - coordinates the second level user support through ESCs
- SSCC is operated by
  - Belgian Institute of Space Aeronomy
  - Royal Observatory of Belgium
  - Space Application Services
  - Spacebel S.A.

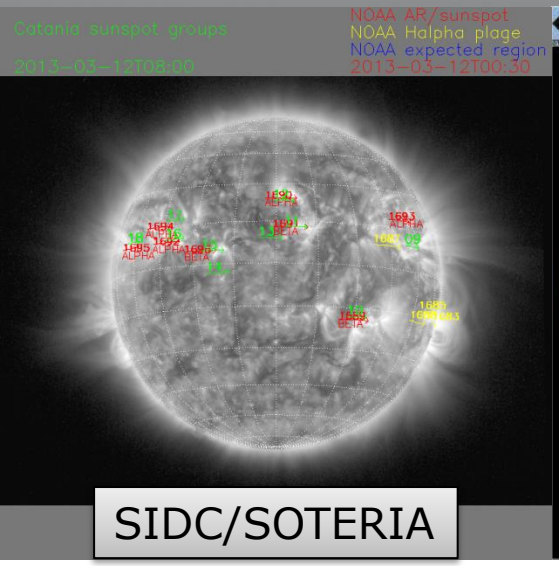


SSA SWE Coordination Centre

Space Pole
Avenue Circulaire, 3 - Ringlaan
1180 Uccle - Ukkel (Brussels)
BELGIUM

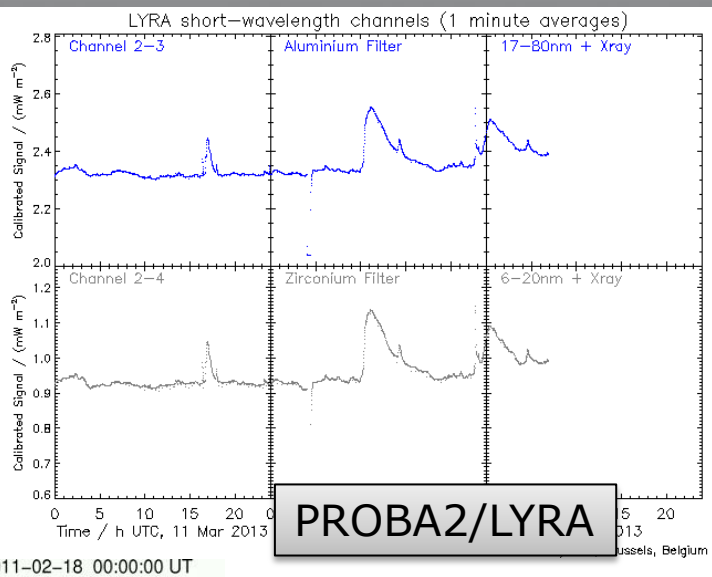
Tel: +32-2-7903-913
Email: helpdesk.swe@ssa.esa.int

Examples of Space Weather Data & Applications Already Available

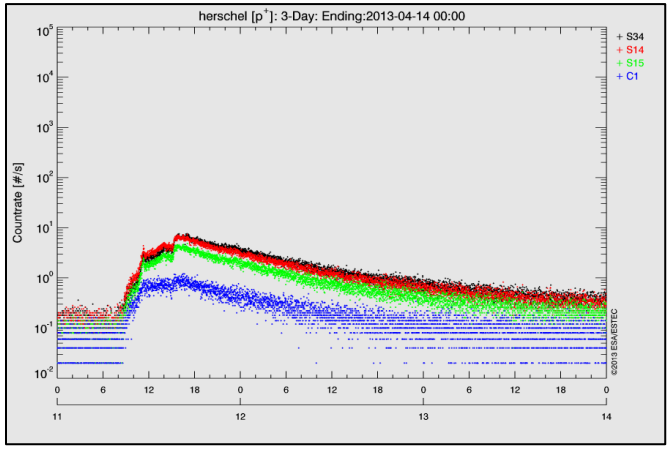


SIDC/SOTERIA

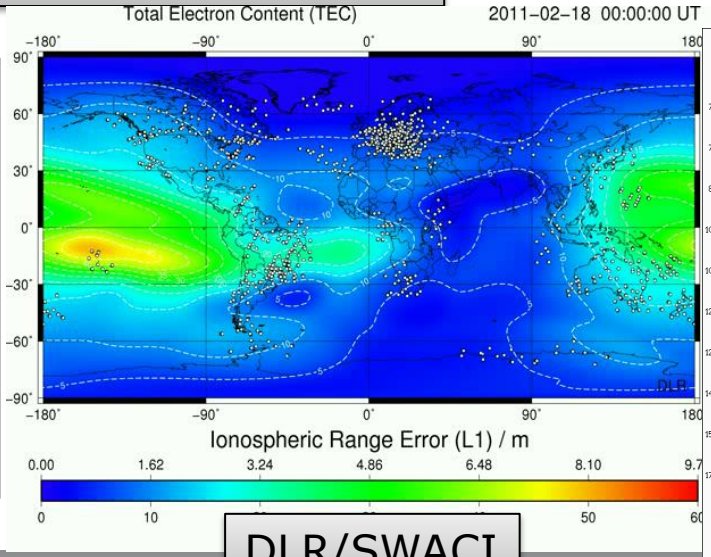
Uni Graz-Kanzelhoehe



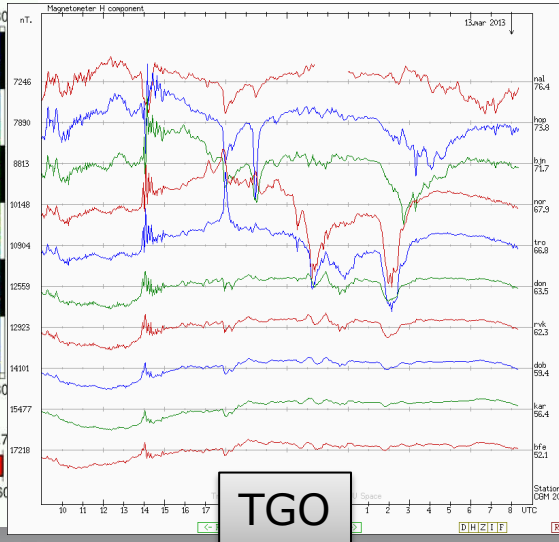
PROBA2/LYRA



SREM (Herschel)



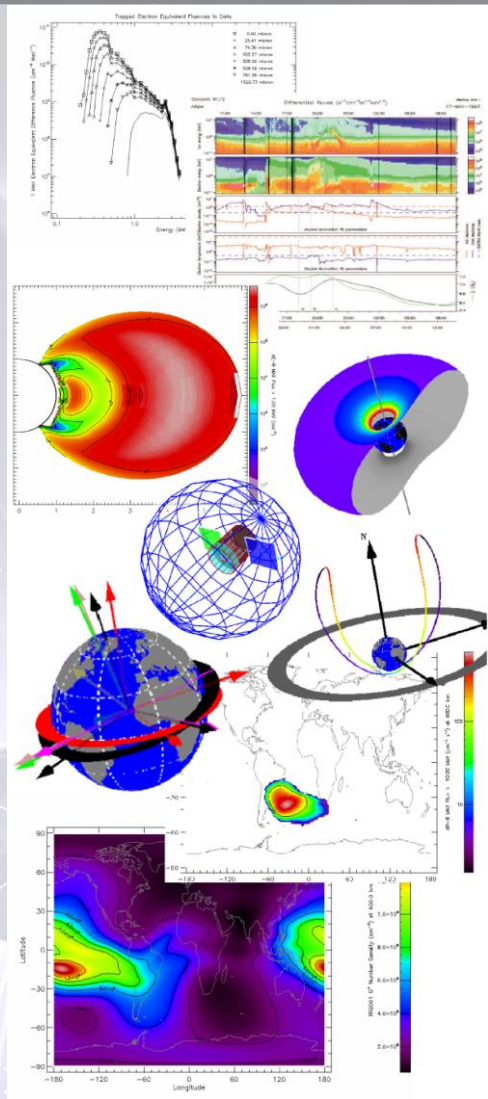
DLR/SWACI



TGO

Expert Service Centre (ESC) Evolution

- ESC profile to be further elaborated during Period 2
  - Focussing on their role as thematic centres of expertise
  - Provision of 2nd line expert support to SWE users
  - Evaluation of new applications/products through targeted campaigns run together with the users.
  - Organisation of regular workshops with users
  - Targeted development of services
  - Service performance metrics and monitoring
  - Recommendation for updates of service roadmaps
- ESC network will expand to
  - Existing ESCs will include new Expert Groups
  - Include new ESC(s)

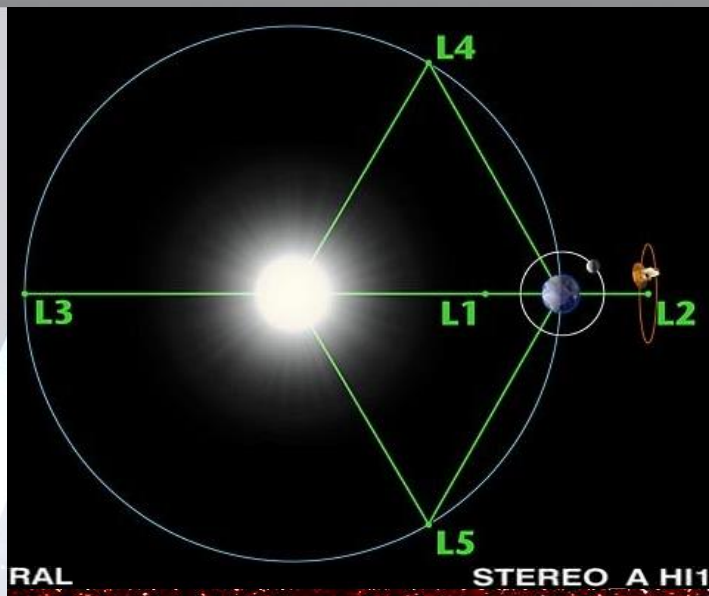


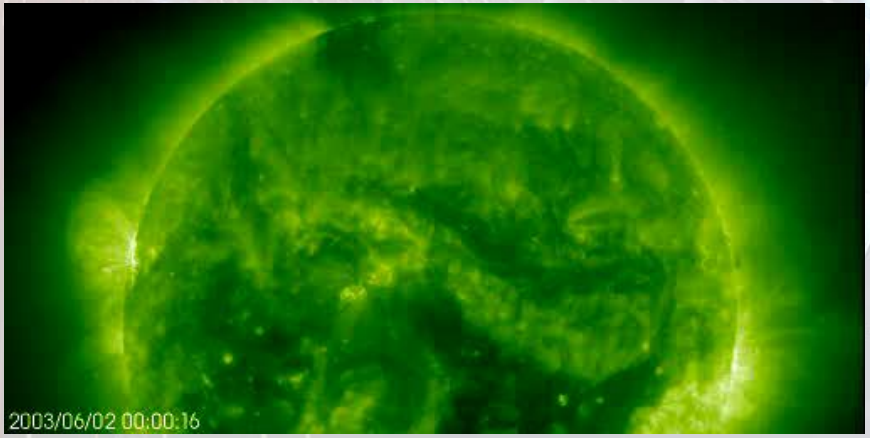
Concepts for enhanced SWE monitoring

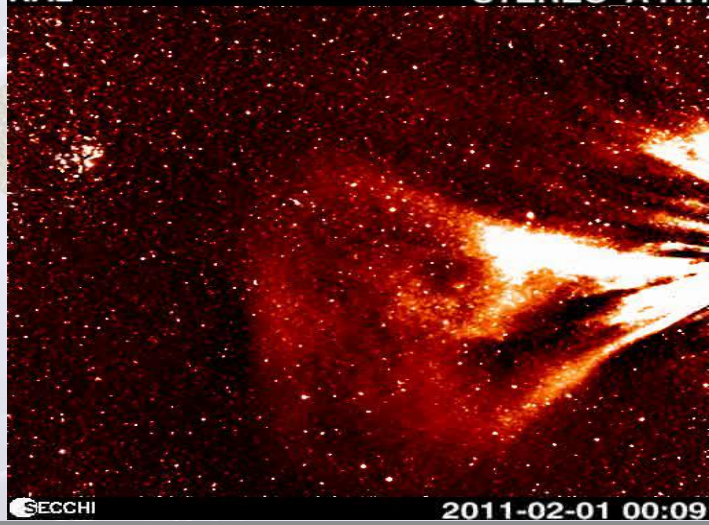
In-situ L1 observations are critical for forecasting

EUV imaging of the solar disc from L5 point gives an opportunity for early detection of potentially hazardous active regions

In-situ observations of particles and fields in L4 gives ahead information about well connected particle events (SEPs)

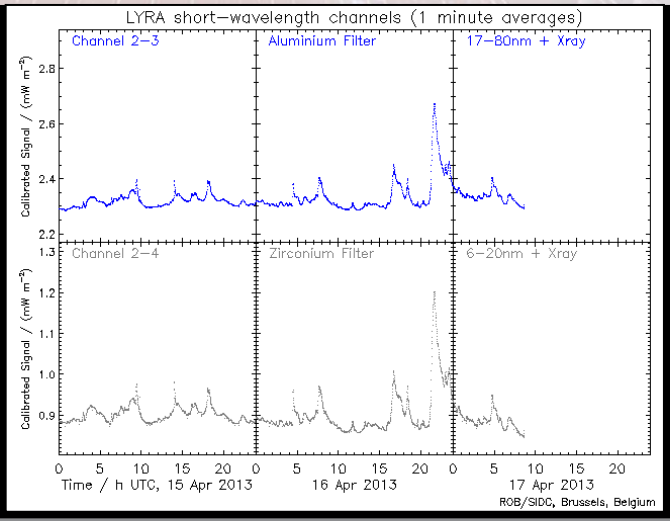


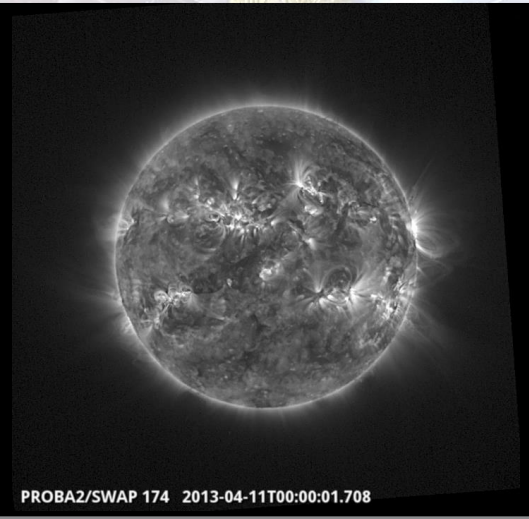


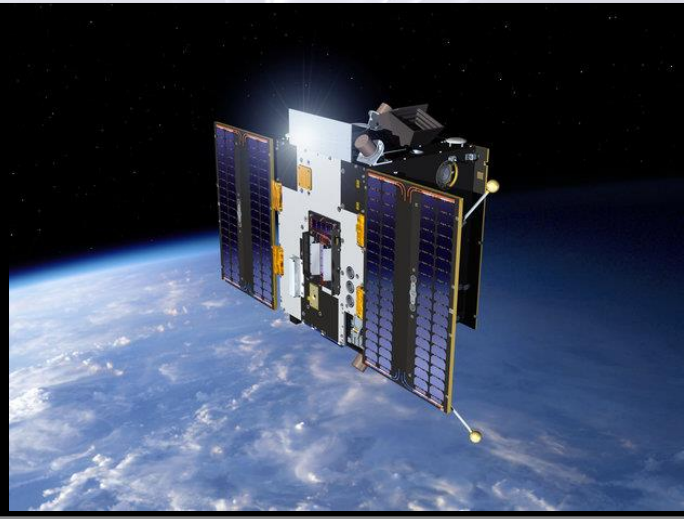


Proba2 mission extension

- Responsibility of Proba2 mission management is transferred from SRE to SSA on 1st July 2013
- Mission Operations Centre (MOC) is funded by the SSA Programme for 18 months from 1st July
- Science Operations Centre (SOC) funding by SRE until December 2014 is assumed
- If s/c remains healthy, funding of the MOC and SOC may be continued until December 2016



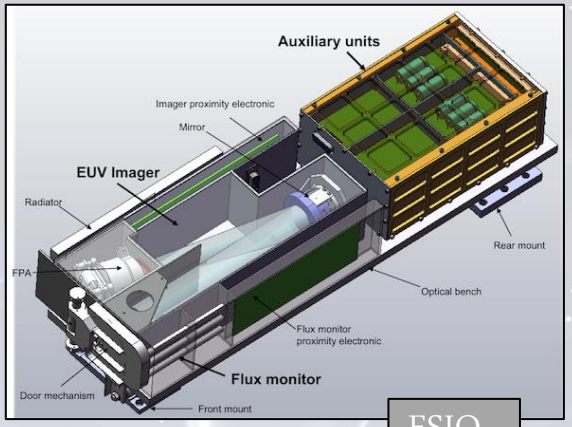




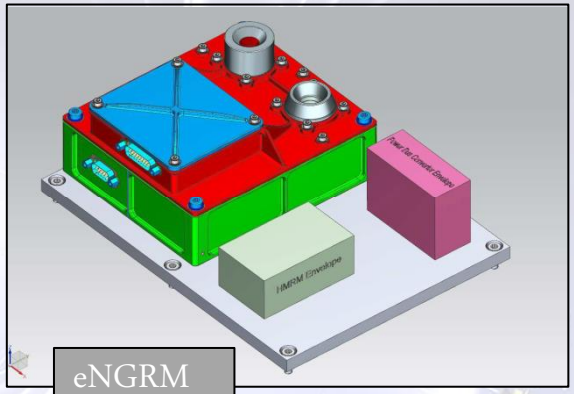
SSA-SWE hosted payload missions

- Opportunities for SWE hosted payload missions have been analysed in SN-II activity lead by Astrium GmbH
- Analysis included
  - 40 European SWE instruments
  - 10 candidate host missions
  - Ground segment configurations
- Analysis for each mission included a detailed mission implementation design plans
- First mission to be implemented is NGRM onboard EDRS-C platform
- Other investigated missions included e.g. MetOp-C, Galileo FOC, Jason-CS...

SEPS-LEED



ESIO



eNGRM


THANK YOU!
For more information:
http://www.esa.int
http://swe.ssa.esa.int
http://sst.ssa.esa.int
http://neo.ssa.esa.int
European Space Agency