SWE SEGMENT OBJECTIVES FOR SSA P3

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SSA Period 3 Programme Preparation Workshop
September 28, 2015

SSA Programme: Introduction

- **Objective:**
  - Protection of space and ground assets against adverse effects from space
  - Three main areas or segments:
    - Space Weather (SWE)
    - Near Earth Objects (NEO)
    - Technology R&D for Space Surveillance and Tracking (SST)
- **SSA Programme initiated in April 2008** (ESA Council, SSA Enabling Resolution)
- **SSA Programme executed in Periods**
  - Period 1 decided at MC in November 2008 (Prep. Programme)
  - Period 2 decided at MC12 in November 2012
  - Period 3 to be decided in MC in 2016

ESA SSA System 2016

SSA-SWE Users

SSA and collaborating sensor systems

Federated data archives

SSA SWE Coordination Centre
Space Pole, Belgium

SWE Data Centre

swe.ssa.esa.int

SWE Expert Service Centres

Solar Weather | Ionospheric Weather | Space Radiation | Geomagnetic Conditions | Heliospheric Weather

European expert groups and centres of excellence

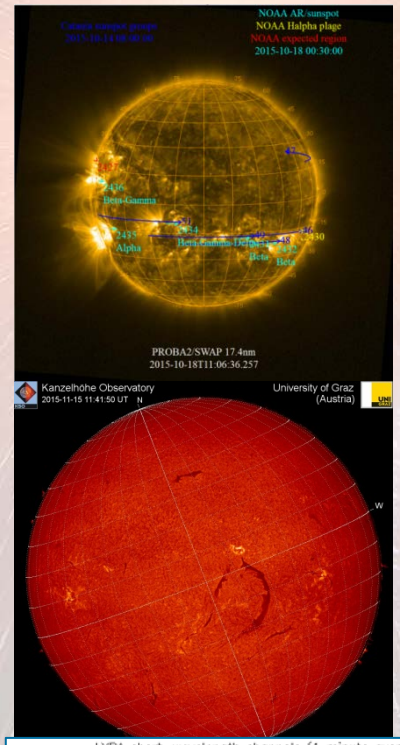
Products and Procedures

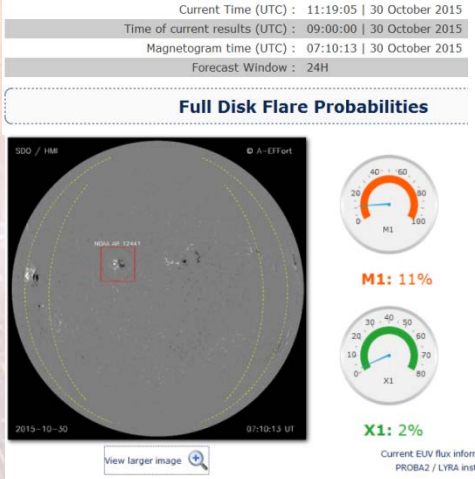
1. SSCC Maintains SWE product catalogue
    a. 40+ federated product elements
    b. Complete list ESC services
2. First line user support
    a. Helpdesk.swe@ssa.esa.int
    b. SWE portal user registration
    c. Ticketing system
3. ESC Interface
    a. Detailed product specific questions relayed to ESCs
4. Network monitoring procedures
    a. Daily/weekly/as needed basis
    b. Monitor service & network performance and usage

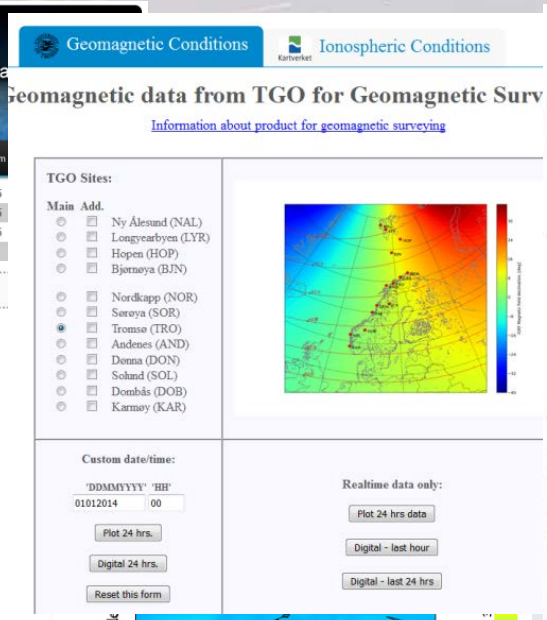
Expert Service Centres in 2016

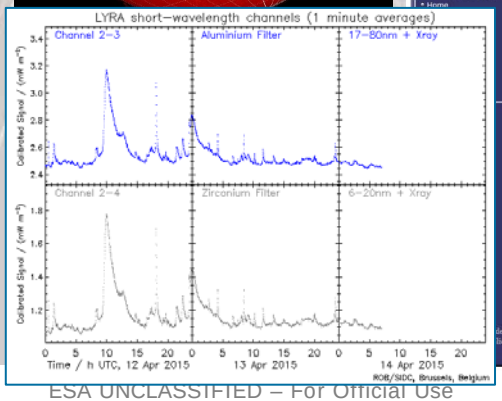
1. Solar Weather ESC
   a. Coordinator ROB
      – KSO Uni Graz, RCAAM, INAF, FHNW
2. Space Radiation ESC
   a. Coordinator BIRA
      – Seibersdorf, NKU, CSR, DLR, MSSL-UCL, PB, U Turku, IAP, SGO
3. Ionospheric Weather ESC
   a. Coordinator DLR
      – NMA, NOA, FMI, INGV, PAS, DTU, IAP, CLS
4. Geomagnetic Conditions ESC
   a. Coordinator TGO
      – SIDC, DTU, FMI, GFZ, IRF, PGI
5. Heliospheric Weather
   a. Coordinator STFC RAL Space
      – Met Office, Univ Graz, CDPP, DHC, U Gottingen, KU Leuven, DTU
6. 34 teams & more to come
7. Total: 140 products

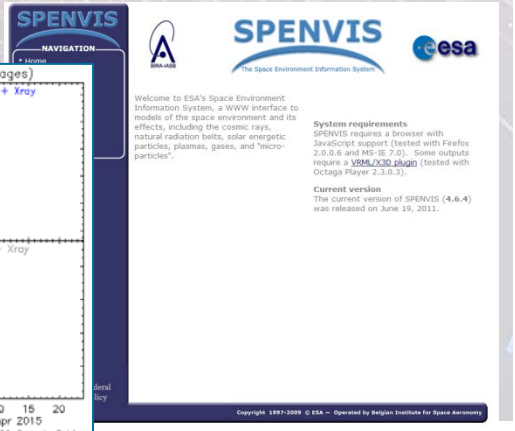
SSA SWE Products and Services
swe.ssa.esa.int

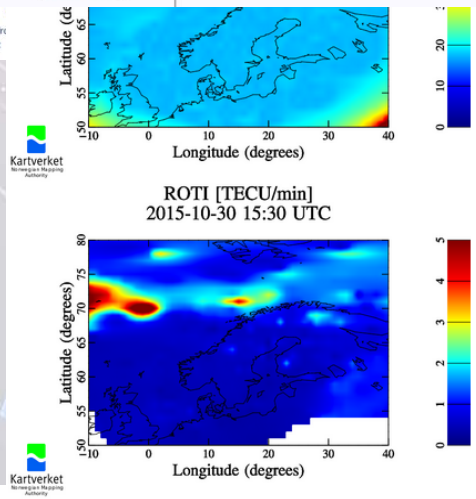


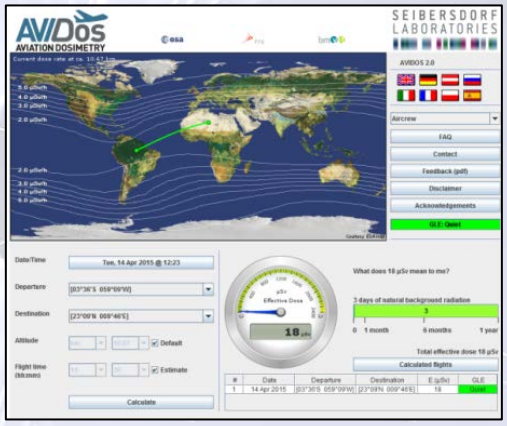










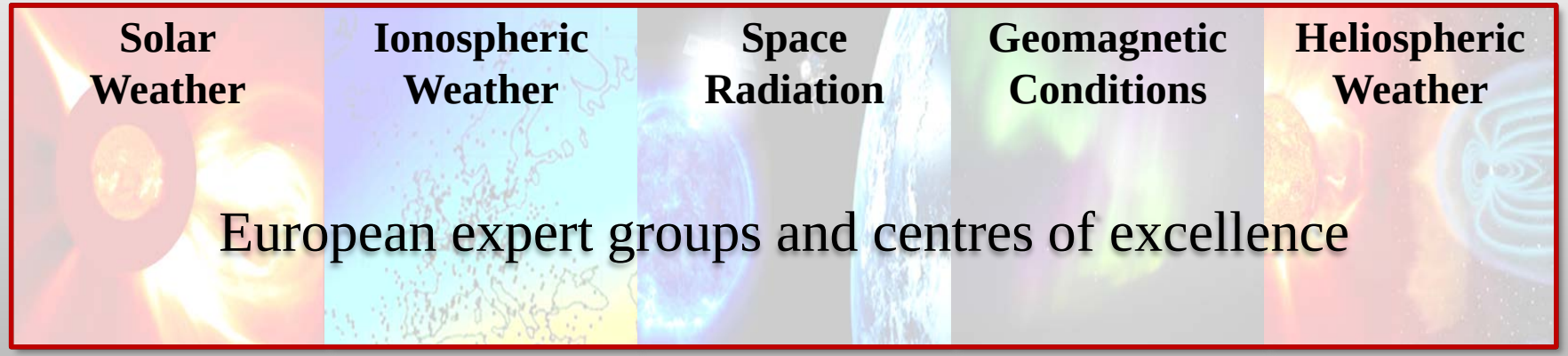



Entering SSA Period 3

SSA SWE System evolution: ESCs

- Federated approach => utilisation of expertise and assets in SSA Member States
- Data processing and service provision through networked ESCs and SSCC => responsibility for services and products
- SLAs with ESCs and key data providers => transition towards operational system
- User requirements for accuracy and timeliness hard to meet, particularly for forecasts
  => significant programme of key algorithm development
- Expansion of existing ESCs through development and R2O activities
- Establishment of new ESCs foreseen

SWE Expert Service Centres

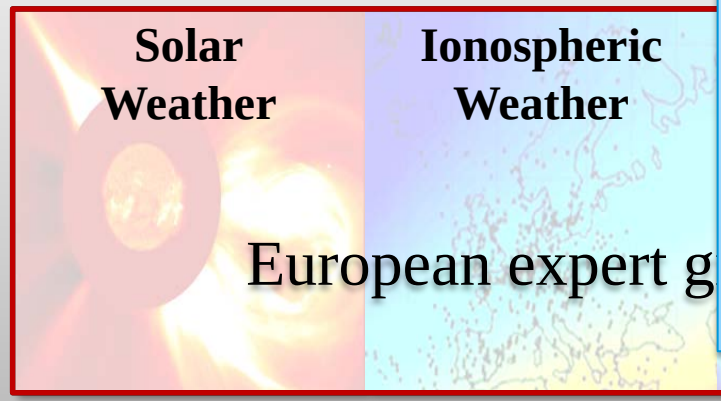


SSA SWE System evolution: SSCC

- First line user support and helpdesk
- Monitoring of SWE system
- Interface with ESCs
- Evolution including new functions:
  - Provision of tailored services
  - Trusted broker for SWE products and services
  - Monitoring according to 3rd party SLAs
  - SWE Data Centre maintenance
  - Monitoring of SWE forecasts
  - Tasking and scheduling of dedicated campaigns
  - Alerts and warnings for severe SWE conditions
- Transition towards operational services with ESC support

SSA SWE System evolution: Data Centres

SWE Expert Service Centres



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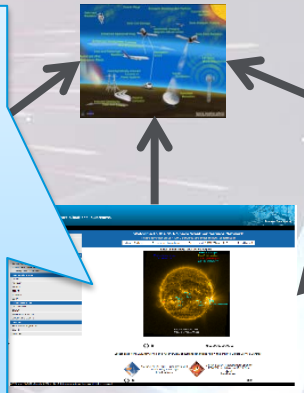
- Repositories for SWE measurements and products
- Primary data centre in Redu
  - Hosting of SWE tools and applications
  - Hosting of SWE Service Portal
  - Data processing capability
- Coming enhancements in P3:
  - Complementing thematic data centres in Member States
  - Data processing of SSA sensor systems
  - Data import and export for federated applications
  - Enhancements for transition towards operational system

SSA SWE System evolution: Service Portal

- Coming developments in P3:
  - Enhanced data visualisation and analysis tools
  - Advanced user authorisation
  - Enhanced tailoring and customisation for user preferences
  - Continuous improvement of the user experience

SSA-SWE Users

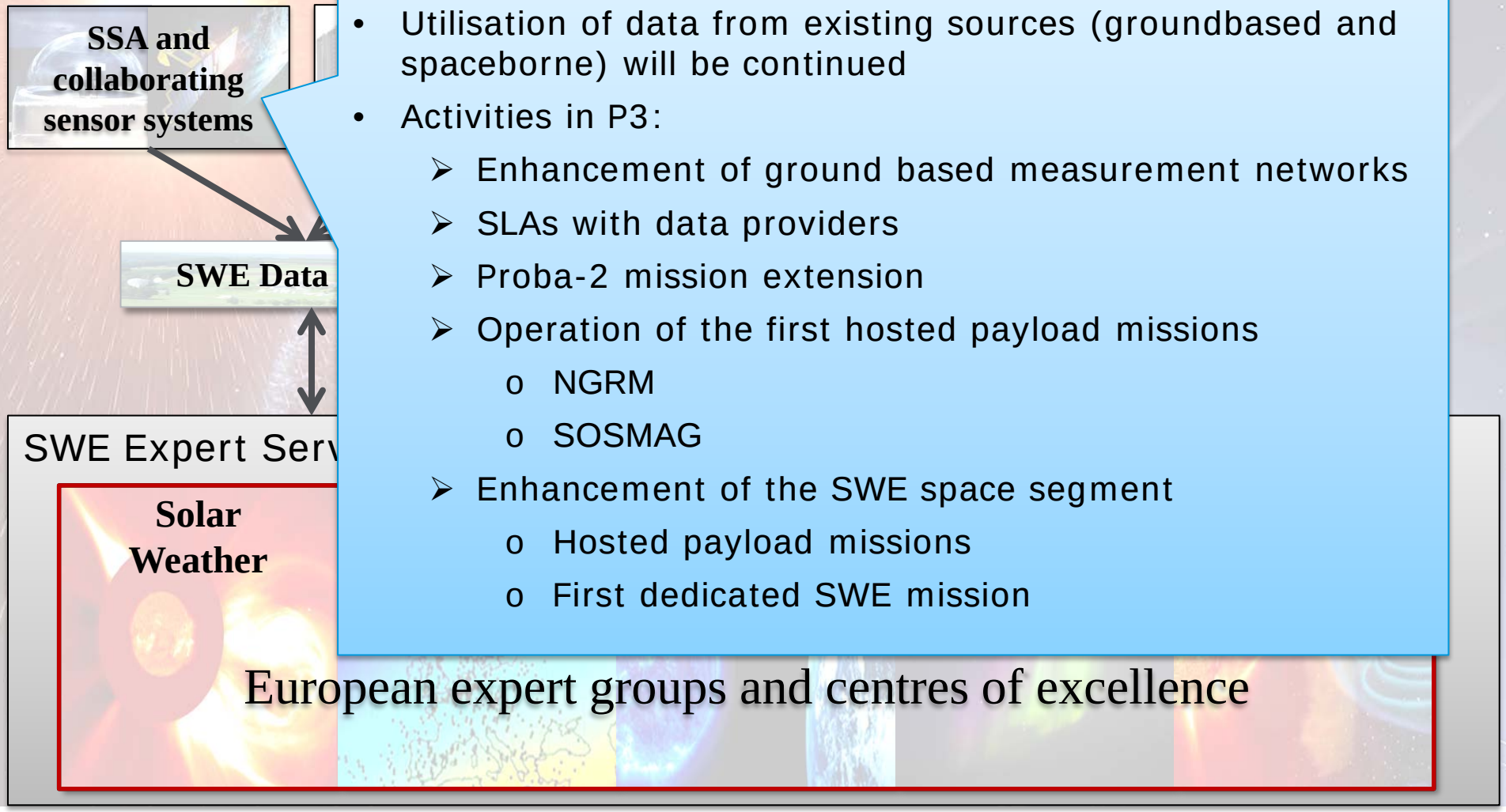


SSA SWE Coordination Centre
Space Pole, Belgium

Solar Weather | **Ionospheric Weather** | **Space Radiation** | **Geomagnetic Conditions** | **Heliospheric Weather**

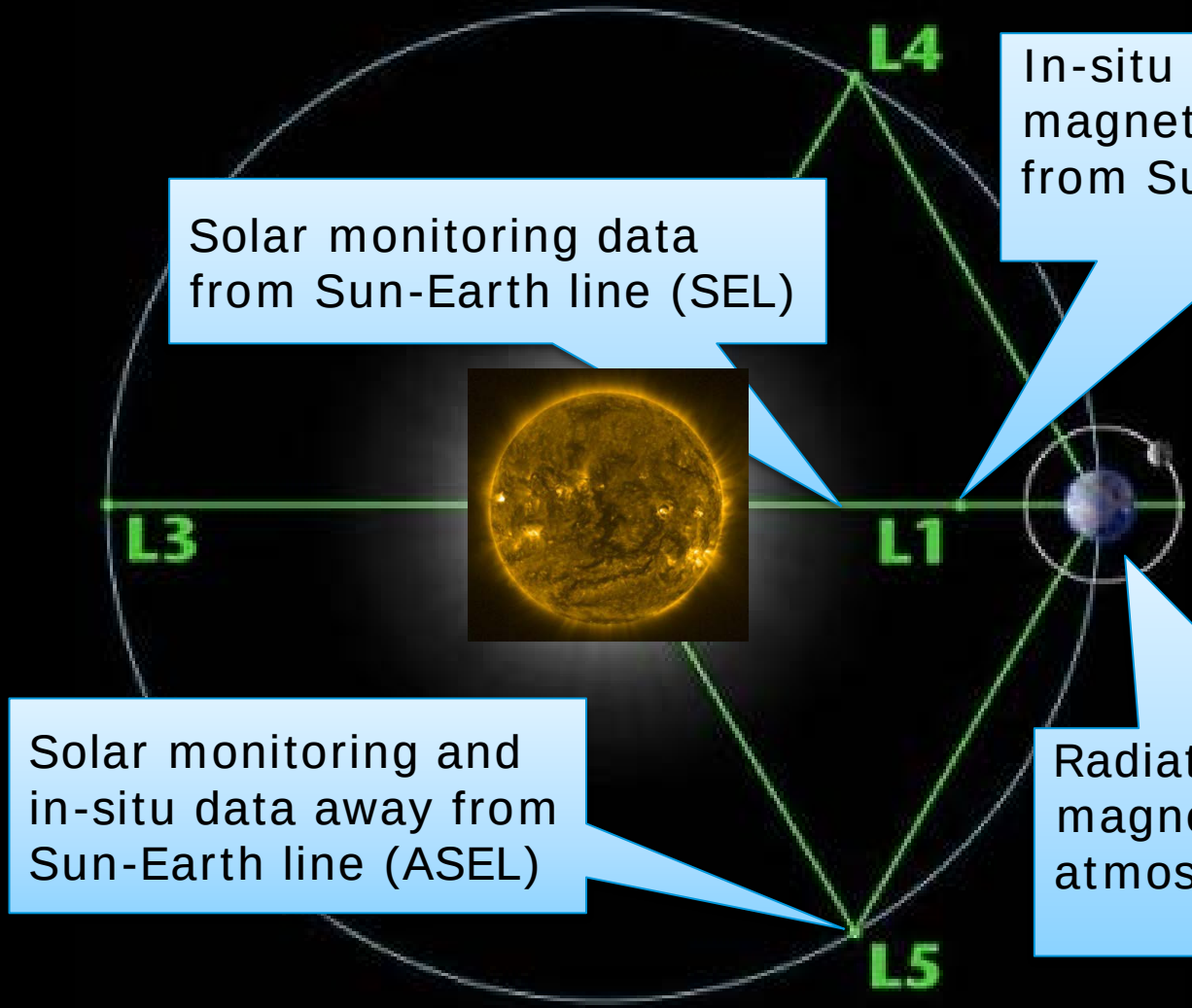
European expert groups and centres of excellence

SSA SWE System evolution: Measurement systems



- Utilisation of data from existing sources (groundbased and spaceborne) will be continued
- Activities in P3:
  - Enhancement of ground based measurement networks
  - SLAs with data providers
  - Proba-2 mission extension
  - Operation of the first hosted payload missions
    - NGRM
    - SOSMAG
  - Enhancement of the SWE space segment
    - Hosted payload missions
    - First dedicated SWE mission

SWE SPACE SEGMENT: KEY MEASUREMENTS



In-situ solar wind and magnetic field data from Sun-Earth line

Solar monitoring data from Sun-Earth line (SEL)

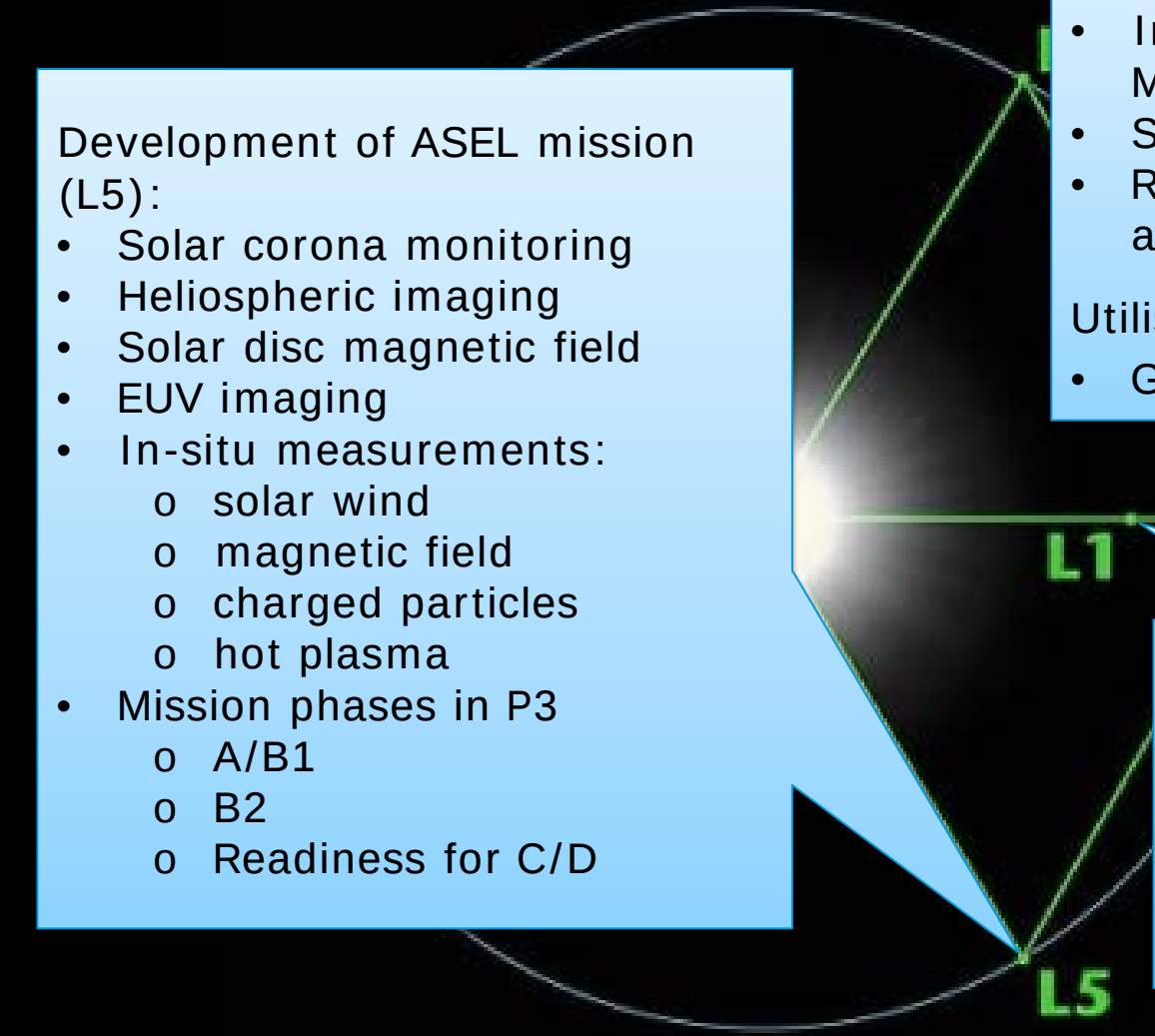
Solar monitoring and in-situ data away from Sun-Earth line (ASEL)

Radiation environment, magnetic field and upper atmosphere data

SWE SPACE SEGMENT: P3 PRIORITIES

Development of ASEL mission (L5):

- Solar corona monitoring
- Heliospheric imaging
- Solar disc magnetic field
- EUV imaging
- In-situ measurements:
  - solar wind
  - magnetic field
  - charged particles
  - hot plasma
- Mission phases in P3
  - A/B1
  - B2
  - Readiness for C/D



Hosted payload missions:

- In-situ measurements in GEO, MEO, LEO and HEO
- Solar UV, EUV, X-ray flux
- Remote sensing of upper atmosphere

Utilisation of European missions:

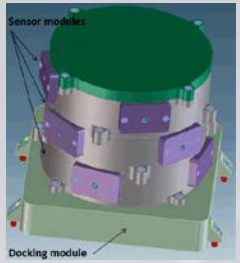
- Galileo, MTG, MOS,...

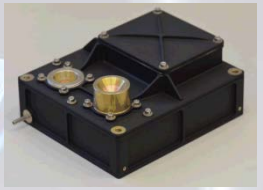
Ensured other SEL data availability:

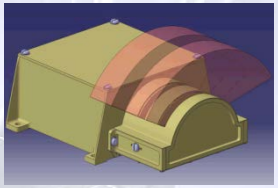
- In-situ L1 + solar imaging
- Potentially through agreements with international partners

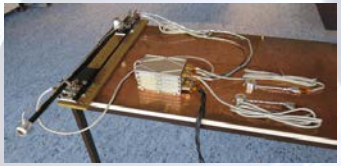
SWE TECHNOLOGY DEVELOPMENT

- Prototyping new instrument technologies in coordination with ESA TRP, GSP and GSTP
  - Focus on operational instruments for SWE observations
- Flight opportunities for instruments
  - Enhancement of SWE space segment by hosted payloads
  - Raising TRL of the instruments for operational missions
  - Search for regular flight opportunities
- Development of GS technologies for advanced data processing
  - VSWMC
  - end-to-end simulations
  - Tools for space environment and s/c analysis





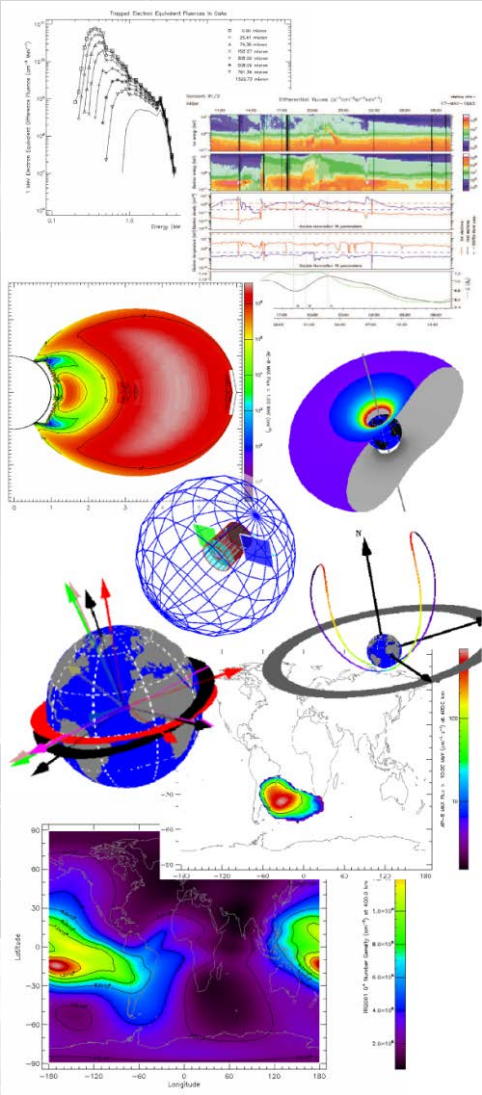




Utilisation of scientific advances for SWE forecasting

- Accurate SWE forecasting is a key challenge
  - Required for effective mitigation of SWE hazard
  - Current skill mostly below user thresholds
  - “Understanding space weather to shield society: A global road map for 2015-2025 commissioned by COSPAR and ILWS”
- SWE Segment activities support scientific research targeting key areas including:
  - Technology for advanced data processing
  - Model validation and inter-comparison
  - SWE data archive & latest data service
- R2O activities building on ESC experience in P2

=> **utilisation of scientific advances to improve SWE capabilities**

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