Space Weather Segment Precursor Services – Part-1: Definition and Service Consolidation (SN-I)

Final Presentation Summary to SWWT

13 June 2012

Agenda

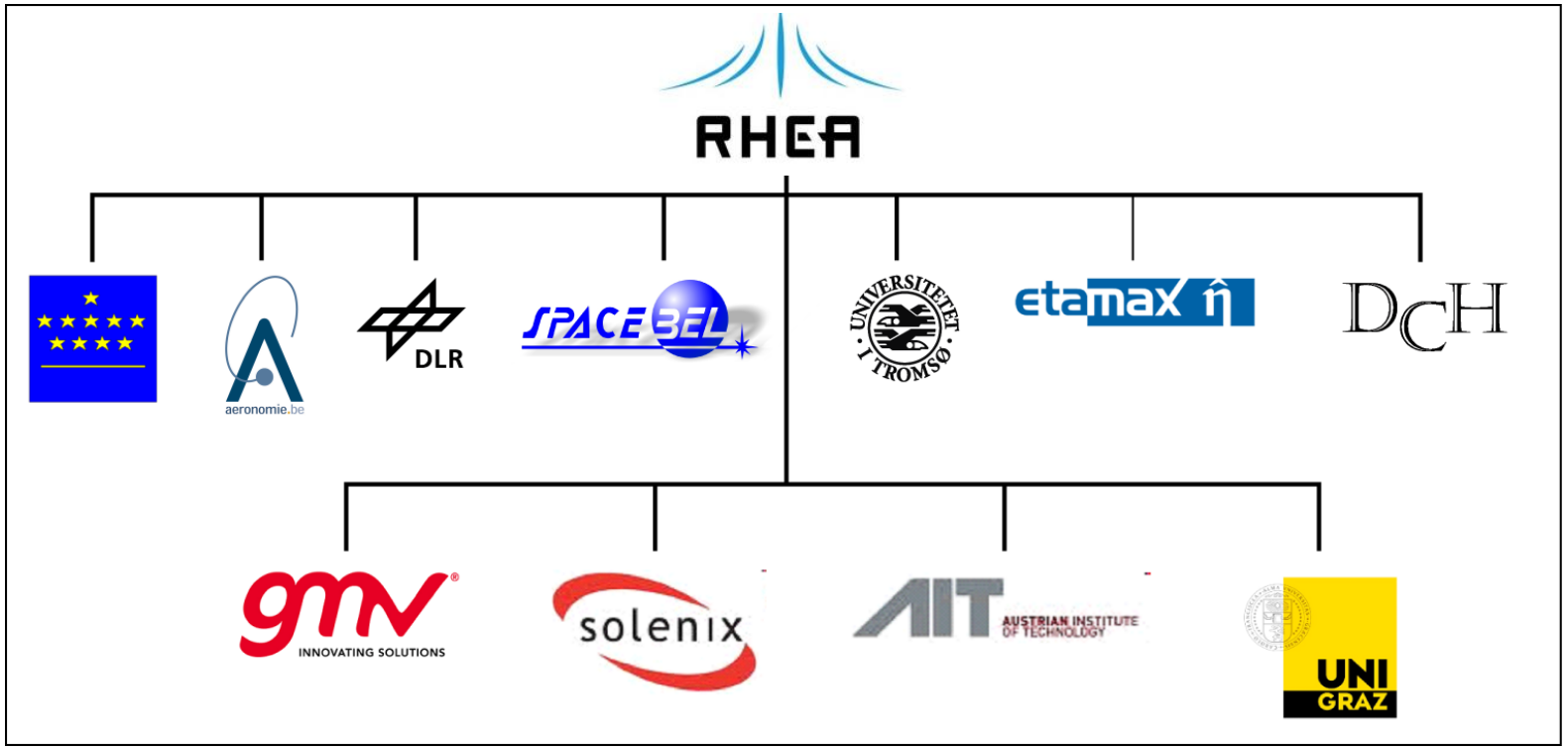
- General overview
- Review of Tasks
- Conclusions

Goal of SN-I

According to the SN-I Statement Of Work, the overall goal of SN-I was:

“to prepare the ground for the development of space weather precursor services and especially to consolidate the service definition with the users in the loop.”

The SN-I Industrial Group



The SN-I Industrial Group

International group of companies coming from all around Europe and lead by RHEA:

- Royal Observatory of Belgium (BE)
  - Lead the assessment of existing European SWE assets and services (Task 1)
  - Contribute data and services for federation (Task 3)
  - Lead the assessment of future European services (Task 5)
- Belgian Institute of Space Aeronomy (BE)
  - Contribute to the assessment of the European SWE assets (Task 1)
  - Port the SPENVIS system to the ESA target platform (Task 3)
  - Lead the user support provisioning during the Operations phase (Task 4)

The SN-I Industrial Group

- SPACEBEL (BE)
  - Lead the consolidation of existing services into the Space Weather dedicated Data Centre (Task 3)
  - Develop the SSA Space Weather Portal (Task 3)
- DHConsulting (BE)
  - Set up and administer the Asset Database (Task 1)
  - Editorial activities for TN-1 (Task 1)
  - Port the ODI database to the ESA target platform (Task 3)
- DLR (DE)
  - Contribute scientific expertise to the assets assessment part of Task 1
  - Contribute ionosphere disturbabnces services for federation to Task 3

The SN-I Industrial Group

- Etamax (DE)
  - Port SWENET to the ESA target platform (Task 3)
  - Coordinate with SWENET service providers for the transfer to the Space Weather Data Centre
  - Port EDID to the ESA target platform (Task 3)
- GMV (ES)
  - Port IONMON to the ESA target platform (Task 3)
- Solenix (AT)
  - Port SEIS-SEISOP to the ESA target platform (Task 3)
- University of Tromso
  - Contribute to the analysis of assets (Task 1)
  - Provide Geomagnetic services for federation (Task 3)

The SN-I Industrial Group

- Austrian Institute of Technology (AT)
  - Contribute space radiation effects analysis services for federation (Task 3)
- University of Graz (AT)
  - Contribute Sun observation services for federation (Task 3)

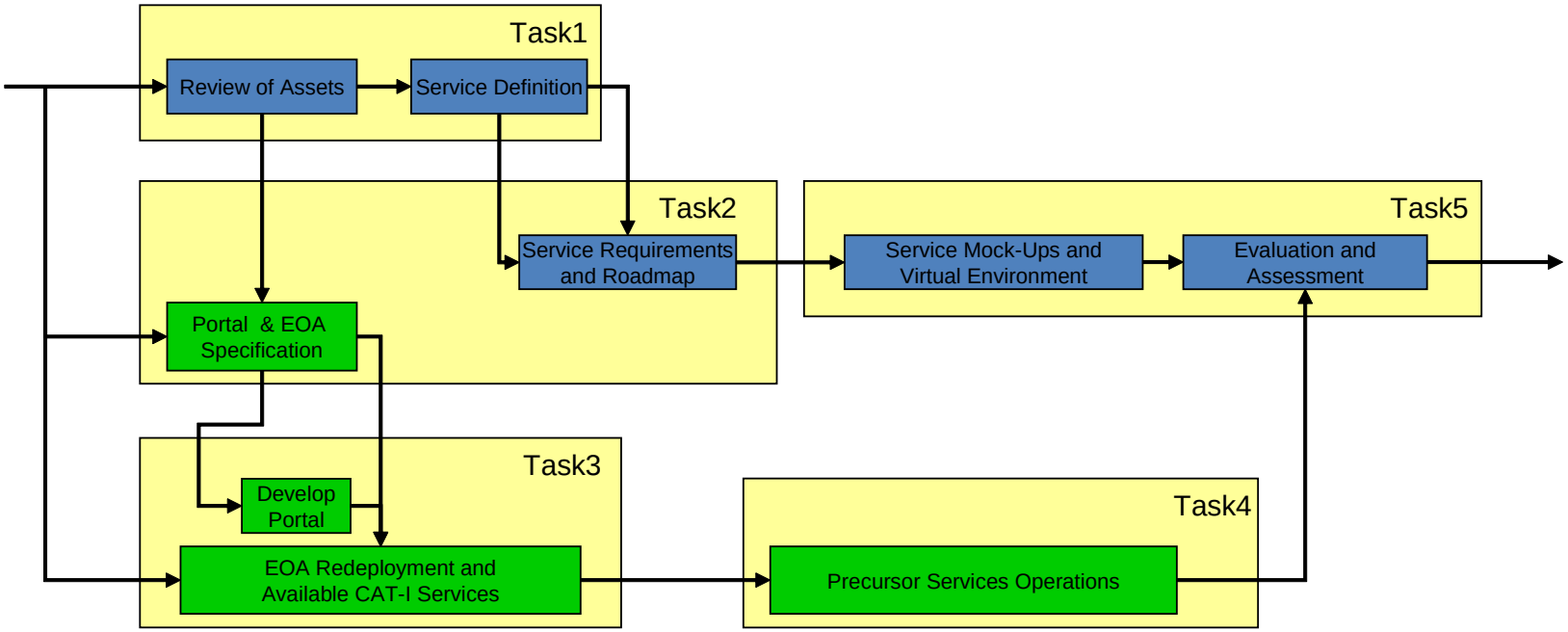
Structure of SN-I

- Task 1: Review of assets and service definition
  - Led by Royal Observatory of Belgium
- Task 2: SWE Services Requirements definition
  - Led by RHEA Systems
- Task 3: Deployment of the initial set of SWE precursor services
  - Led by Spacebel
- Task 4: Initial operation of the services
  - Led by Belgian Institute of Space Aeronomy
- Task 5: Assessment of the service concepts and user feedback
  - Led by Royal Observatory of Belgium

Structure of SN-I

- Two clearly separated paths:
- Roadmap activities
  - Objective: Set the way forward for the European Space Weather services by determining a clear set of service requirements which will be addressed in future activities
- Deployment activities
  - Objective: Create a first iteration of an operational and consolidated data centre dedicated to Space Weather services

SN-I Work Logic



Task 1 review

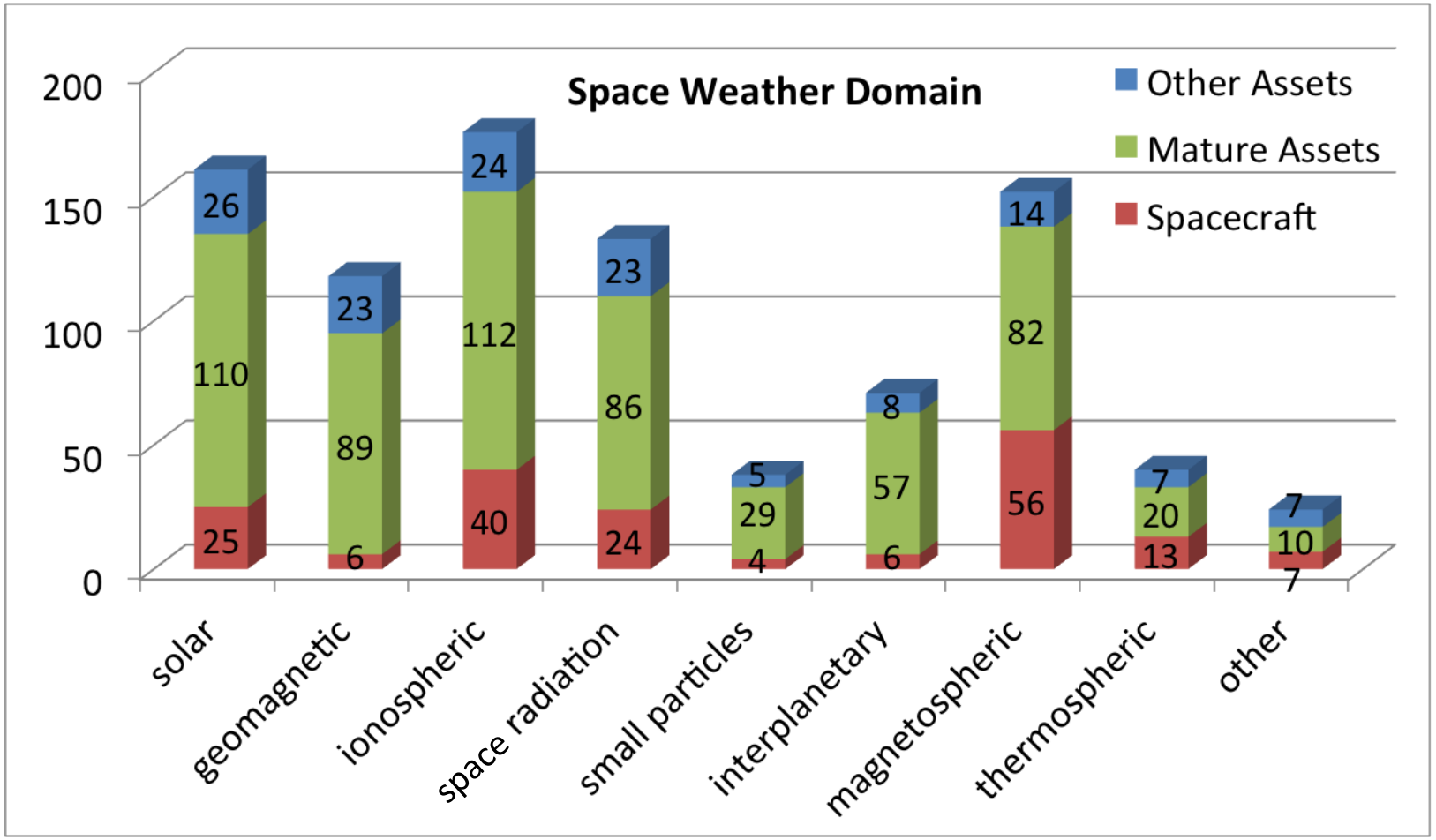
- 400+ assets from around the world were registered in the Asset Database (plus ~160 Experts)
- Asset Database officially closed in June 2012 but still available for reference to SSA programme

- Assets comprehensively reviewed and categorised by Expert Service Centres
- ESA-proposed services were then categorised based on the maturity of the assets used to provide them:
  - 21 services are suitable for operation (CAT-1)
  - 10 services require some effort to make them operations ready (CAT-2)
  - 6 services require substantial effort to make them operations ready (CAT-3)

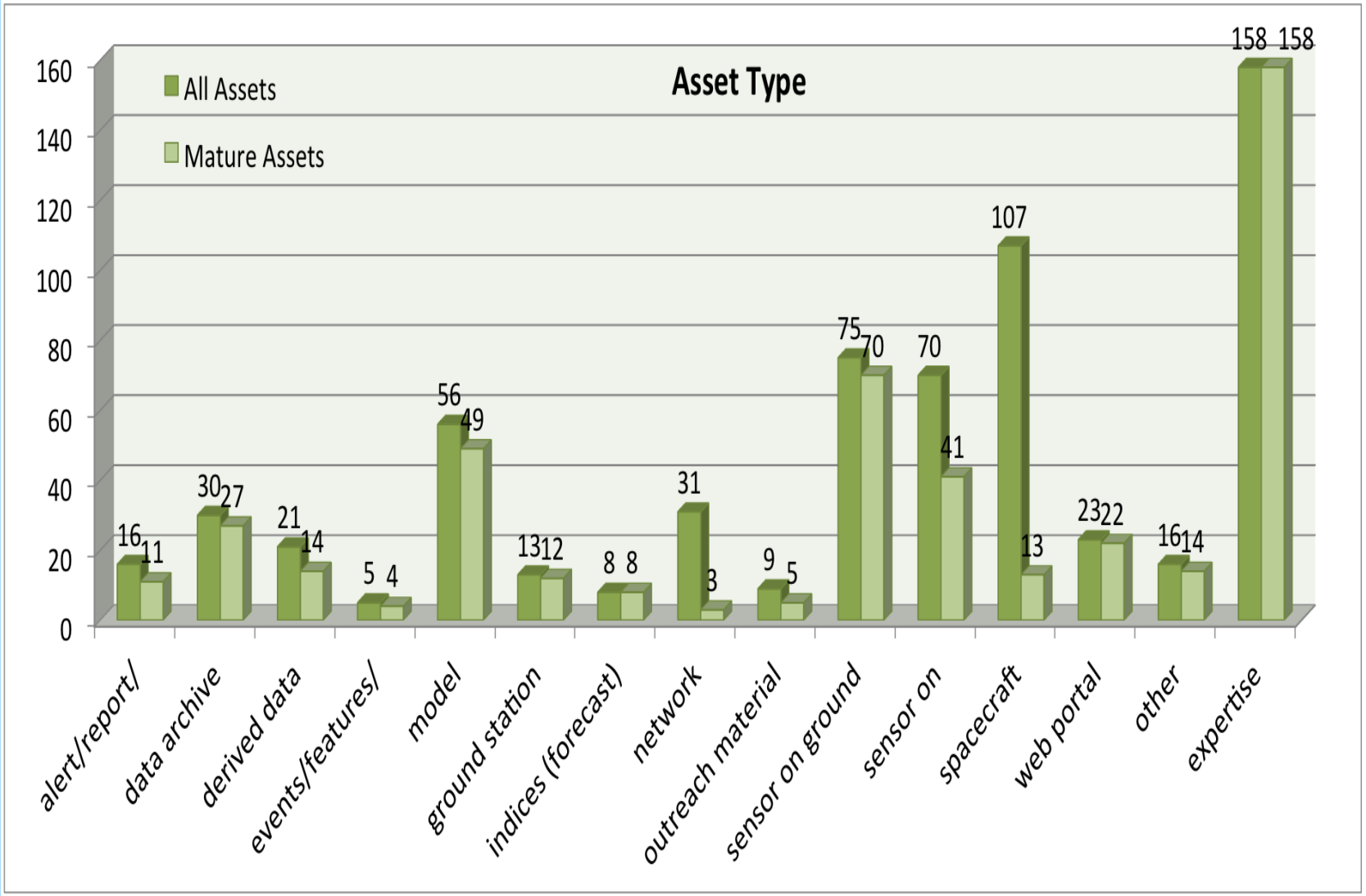
Task 1 review: TN-1

- Main report of 306 pages
  - CRD review
  - Asset summaries and general statistics
  - Service reviews and asset allocation matrices
- Annexes totalling >3500 pages!
  - Full detailed asset reviews including questionnaires to asset owners
  - Full service matrices covering all CRD requirements
  - Requirement traceability per service
  - etc

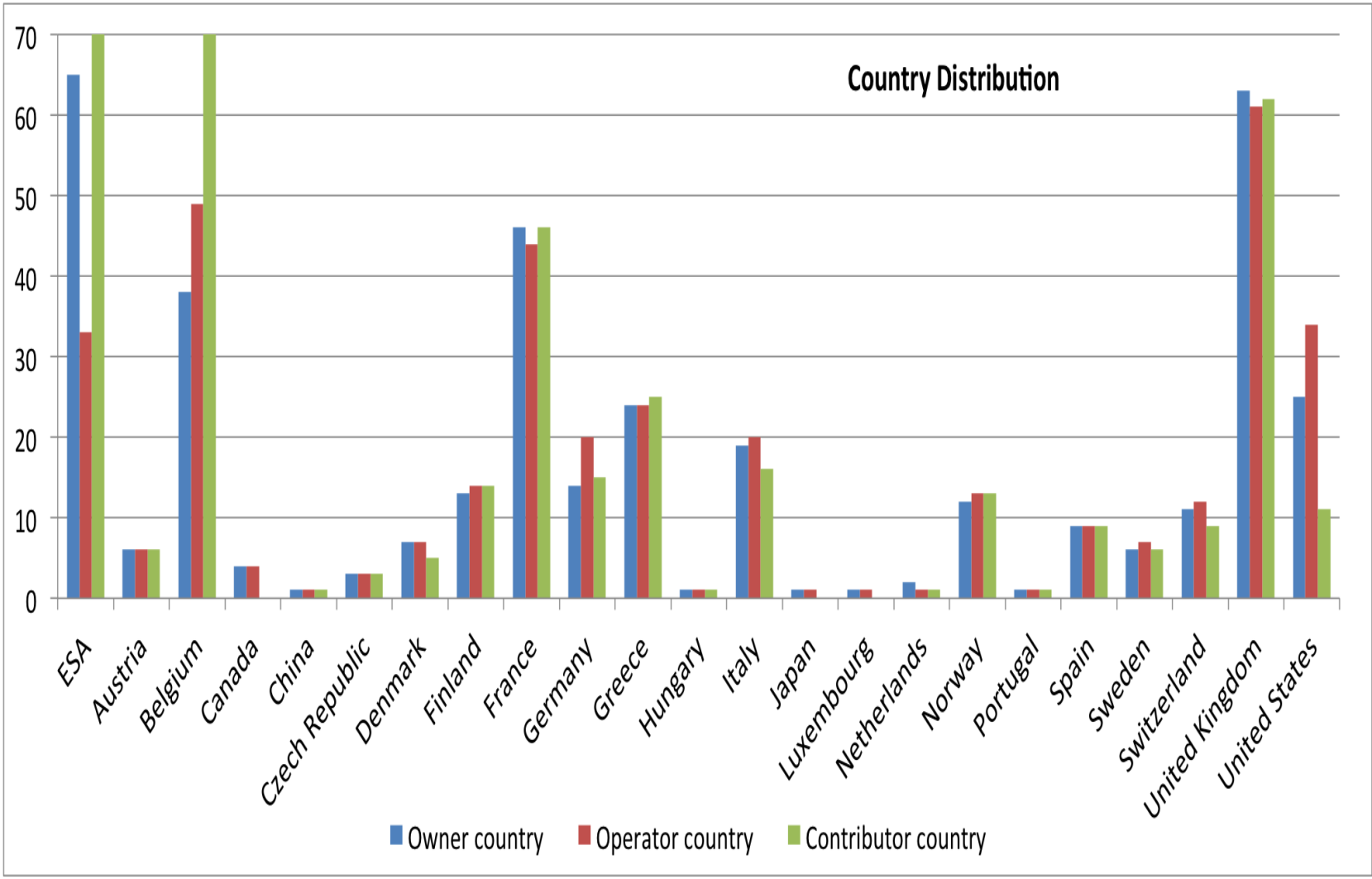
Task 1 review: TN-1



Task 1 review: TN-1



Task 1 review: TN-1



Task 2 review

- **Development Roadmaps for the 37x SWE Services**

- Software Requirements Specifications, for the 37x SWE Services
- Infrastructure Requirements
  - SSCC Reqs
  - Backup Data Centre Reqs
  - SWE Service Portal Reqs
  - SWE Service Software Reqs (low level)

Task 2 Roadmaps & Requirements

- Roadmaps & Requirements are key inputs to Service Definition in the future system

- Roadmaps are a subjective expert opinion of how the SN-I Consortium would recommend they be implemented
- Requirements are an objective guide to how a system engineer will implement a Service

Task 2 Roadmaps: Objectives

- Roadmaps represent for each SWE Service an Expert Concept of how it could be realised
- Assets selected on basis of Asset Owner input and Expert Review with traceability to Asset DB and TN-1 (Task 1)
- Assets selected on technical merit only
- Priority given to mature assets currently providing a service
- Particular requirements then met with selected Assets, with development if needed

Task 2 Roadmaps: Layout

- Overview and Summary from input documents (SOW, CRD, TN-1)
- Service Requirements
- Mature Asset Subset
- Identification of Appropriate CAT-1 assets for Redeployment or Federation
  - Evaluation of the Service provision offered by the CAT-1 assets
- Identification of Potential non CAT-1 assets for Federation
  - Evaluation of enhanced Service provision offered via additional non CAT-1 assets
- CRD Requirements fulfilled
- Analysis of gaps preventing the provision of a full service
- Development Roadmap towards the provision of a full service
- Deployment Roadmap
- Critical Items

Task 2 Roadmaps: Challenges

Class A	Class B
Ready to implement now (9)	Some effort required (12)
93023 SST/arv	93001 SCD/arv
93016 LAU/mcp	93025 SST/ion
93017 TIO/tcr	93024 SST/for
93018 TIO/tcf	93010 SCH/for
93030 NSO/tou	93008 SCH/orb
93028 NSO/air	93002 SCD/orb
93029 NSO/res	93013 LAU/for
93003 SCD/pst	93034 GEN/lst
93021 TIO/for	93036 GEN/alm
	93035 GEN/for
	93005 SCO/pst
	93004 SCO/orb

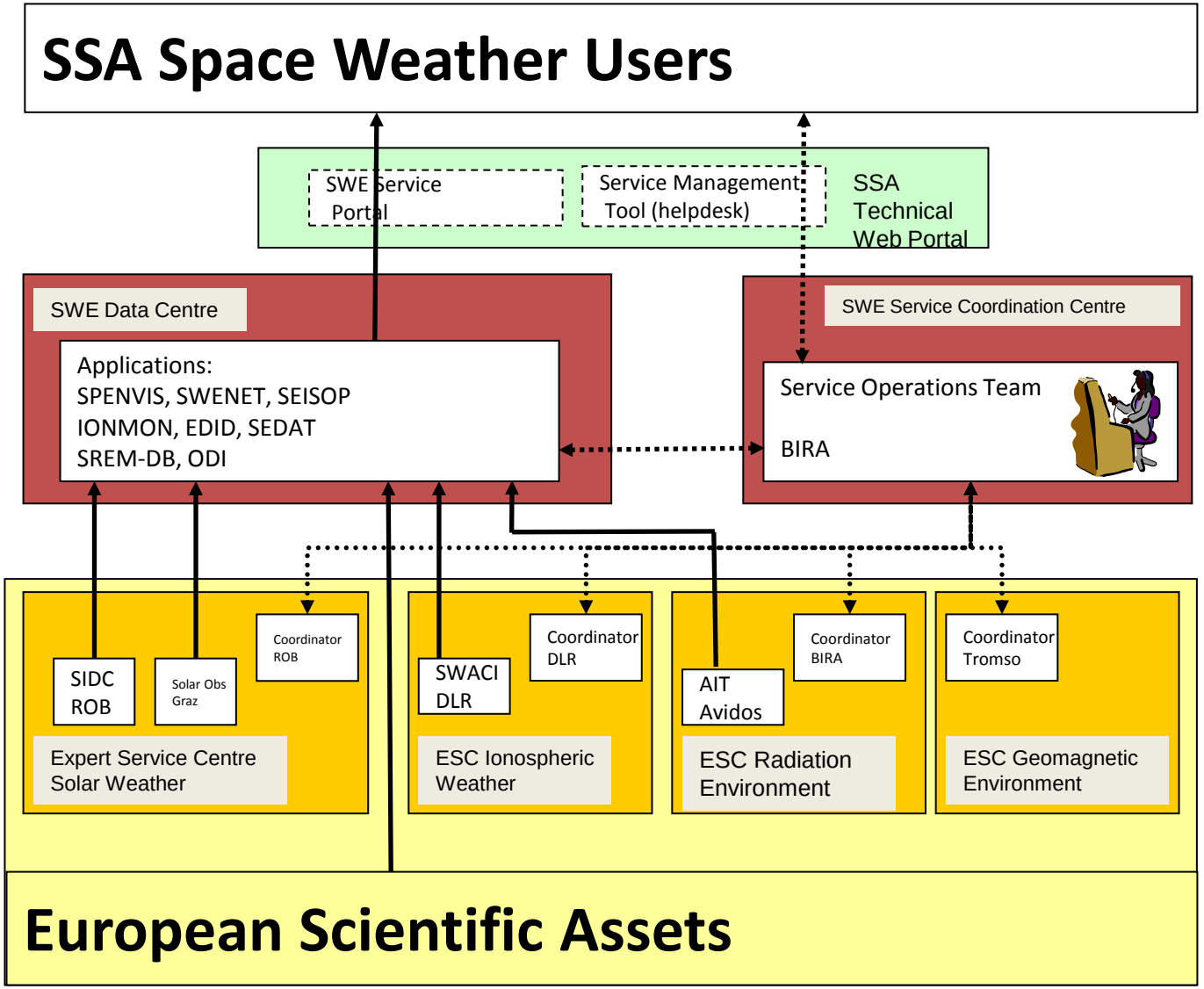
Task 2 Roadmaps: Challenges

CAT-2	CAT-3
Significant development needed (10)	Major development needed (6)
93033 GEN/arv	93037 GEN/mod
93039 GEN/spm	93011 LAU/orb
93022 SST/atm	93015 LAU/ios
93019 TIO/qua	93014 LAU/drg
93020 TIO/sci	93038 GEN/3rd
93006 SCO/for	93027 NSO/ppl
93012 LAU/pst	
93026 NSO/pow	
93009 SCH/pst	
93007 SCO/ana	

Task 3&4 review

- Provide easy access to an initial set of software assets relevant to SWE Services
  - EDID
  - IONMON
  - ODI (incl SREM database)
  - SEDAT
  - SEISOP
  - SPENVIS
  - SWENET
- Develop a User Portal to provide a single starting point for access, plus contextual information, real-time data etc
- Establish infrastructure to support initial pre-operations via SSCC

Task 3&4: Service Delivery logic



esa

RHEA

aeronomie.be

DLR

SPACEBEL

UNIVERSITETET I TROMSØ

etamax

DCH

gmv INNOVATING SOLUTIONS

solenix

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

UNI GRAZ

ESA - Space Situational Awe

esa space situational awareness

European Space Agency

ESA SSA SWE SST NEO

About SWE
- What is Space Weather
- SSA Space Weather Activities
- Current Space Weather
- Service Network
- Data Centre
- Service Centre

User Domains
- Spacecraft Design
- Spacecraft Operation
- Human Space Flight
- Launch Operation
- Transionospheric Radio Link
- Space Surveillance and Tracking
- Non Space Systems Operation
- General Data Service

Expert Service Centres
- Solar Weather
- Space Radiation
- Ionospheric Weather
- Geomagnetic Conditions

Federated Services
- SIDC
- KZO
- TGO
- SWACI
- AVIDOS

My Applications
- SWENET
- SPENVIS
- SEISOP
- SEDAT
- IONMON
- EDID

Coming Events
- European Space Weather Week

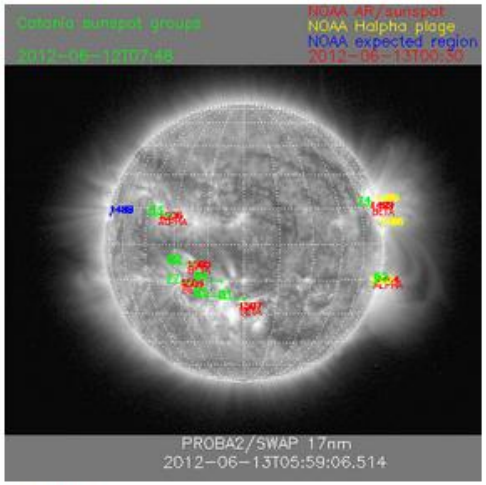
Site Information
- Helpdesk
- Contact

Sign-In
- You are not signed in.
- Sign In
- Register

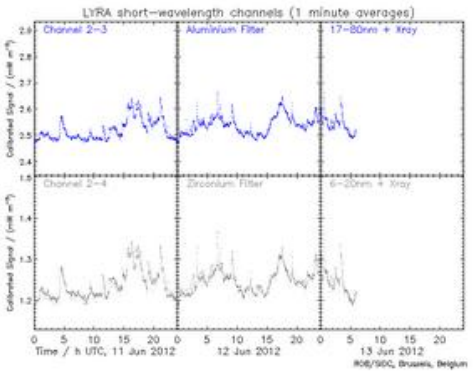
Welcome to the SSA Space Weather Service Network

Solar Weather

Latest solar image with active regions

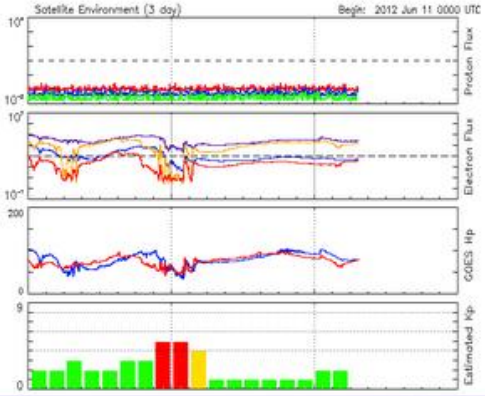


Latest solar emission at 17-80 nm and 6-20 nm

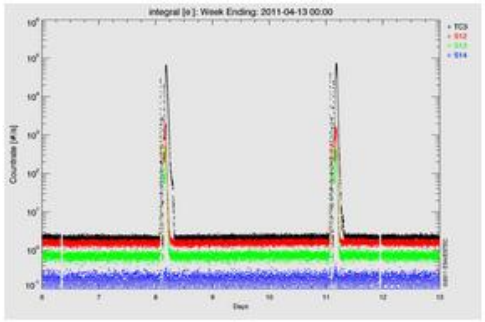


Solar Radiation

Latest NOAA satellite environment plot



Latest ESA SREM practical data



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  - AVIDOS
- My Applications
  - SWENET
  - SPENVIS
  - SEISOP
  - SEDAT
  - IONMON
  - EDID
- Coming Events

Spacecraft Operation

Spacecraft operations are by nature complex and remote and every satellite's operational environment poses a range of potential risks ¿ often a unique combination for a given orbit. The implications of interruptions of operations, data transfer and service provision, are serious, both in terms of cost and capability, thus it is imperative to mitigate against all operational risks to the fullest possible extent.

More ...

Services

SPENVIS — Environment models and Effects tools

SEDAT — Environment models and Effects tools

SEISOP — Correlate space weather events with anomalies

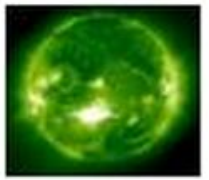
SWENET — Space weather data and data products

Data

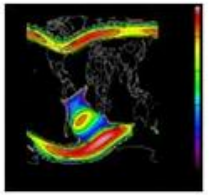
EDID — Database of impact events in orbit

Expert Support

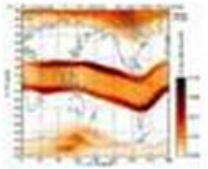
Solar Weather



Space Radiation



Ionospheric Weather



Geomagnetic Conditions

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- Federated Services
- SIDC

This service is federated via ESA by SIDC

SIDC - Solar Influences Data Analysis Center

Predicted 10CM Flux: 134 Predicted AP index: 013 visit us a

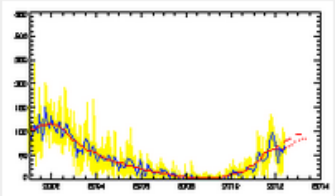
SIDC Ursigram

3-day Forecast of Solar and Geomagnetic Activity: Latest Issue and Archive

PRESTO FROM SIDC - RWC BELGIUM Sun May 27 2012, 1321 UT

Catania sunspot group 56 (NOAA AR 1492) produced a C3.1 flare peaking at 05:52 UT today. The flare was accompanied by coronal dimm
eruption arcade and a CME that was directed eastward. The CME is unlikely to arrive at the Earth. We expect more flaring activity at the C-lev
active region, with an isolated M-class flare possible but unlikely.
The SEP flux is now still fluctuating around the event threshold due to the CME associated with the eruption at W120 yesterday evening.
The Earth is currently inside a slow (around 350 km/s) solar wind flow with average (around 4 nT) interplanetary magnetic field magnitude.
quiet geomagnetic conditions.

SIDC Data Products and Services





Task 5 review

*"**to assess and refine all the anticipated SSA SWE services as defined in Task 1 with the user in the loop in an 'as realistic as possible' environment**."*

- Original idea was to use mock-ups
- Later agreed to assess and validate the definition of the services, work logic and critical items
- Via User Assessment Workshop
  - held at ROB, Tuesday June 12th

Task 5 User Workshop

Domain	#srv	Expert users present + later	/ contacted	
Spacecraft designers	3	0 + 2	/ 3	
Spacecraft operators	4	1 + 2	/ 4	
Human space flights	3	1 + 0	/ 2	
Launch operators	6	0 + 1	/ 3	☹
Transionospheric radio link	5	2 + 1	/ 5	
Survey and tracking	4	0 + 2	/ 4	☹
Data services	6	3 + 7 10	/	
Non space system operators	5	3 + 1	/ 6	

Task 5 User Workshop

Next steps

- Identify additional expert users (eg LAU, SST)
- Collect all the answers by June 20
- Compilation of the reports by end of June and submission to ESA

Results of the project

- A comprehensive analysis of the existing European assets to provide Space Weather services
- A set of Service Requirements derived from Customer Requirements
- A comprehensive set of Strategic Roadmaps
- A pre-operational service-providing system deployed at ESA consolidated infrastructure
- A support team with clearly identified operational procedures
- An assessment of the service definitions as established in SN-I