ESA Space Weather Study, Final Presentation: *Implementation Plan*

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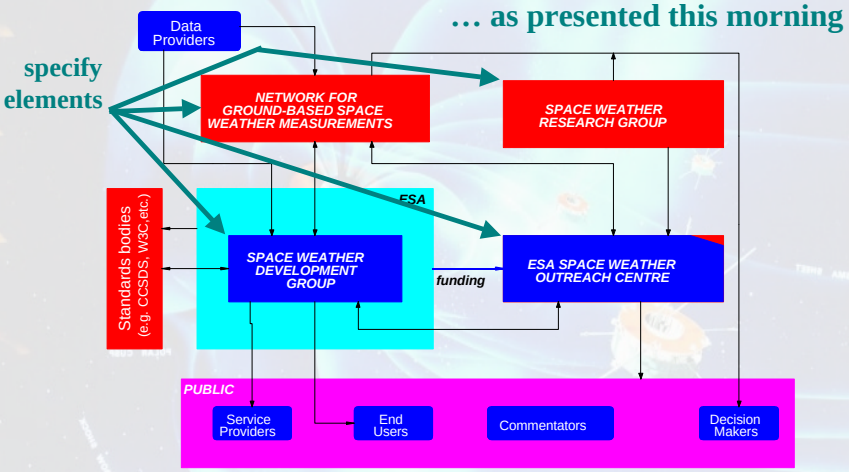
ORGANISATIONAL PLAN

… as presented this morning



SPACE WEATHER OUTREACH CENTRE

- ESA funding, but contract out via open competition
- Contractor to seek additional funding to expand activities
- Build database of information about space weather, provide internet access throughout the member states
- Explain the science underpinning space weather in ways that can be understood by a broader public audience
- Proactively raise awareness about existing European space weather activities in space and on the ground.
- Support other European initiatives that aim to improve awareness of space weather.

… needed to raise awareness of SW issues

NETWORK FOR SW MEASUREMENTS

- Network open to all interested parties
- Start-up funding needed but then should be self-supporting
- Develop and maintain inventory of ground-based assets
- Exchange of knowledge & ideas
- Develop conceptual framework to show how individual SW measurements fit with overall European needs. Provide a basis on which to build strong individual cases for support.
- Study the roles of public, academic and commercial bodies in the operation of SW measurements.

… needed to secure/develop existing assets

SPACE WEATHER RESEARCH GROUP

- Group of independent scientists of international standing
- Periodic review of scientific research needed to improve our knowledge of space weather – monitoring progress, identifying changes in emphasis
- Reviewing progress of research on modelling techniques,
- Linking these reviews to the general progress of STP research
- Providing a public report on its conclusions

… needed to address open science areas

SPACE WEATHER DEVELOPMENT GROUP

- Internal ESA activity during development phase.
- Long-term aim to spin-off when an operational activity
- Provision of advice to potential service providers - may include advice on technical and marketing issues.
- Establishment of a Prototype Space Weather Programme: space weather service, space segment.
- Development and promotion of standards for provision of space weather data, e.g. working with CCSDS

… needed to develop core programme

From SW user requirements

SIBLE SERVICES FOR A PROTOTYPE SPACE WEATHER SERVICE

UR	Products	Application areas
3	Post-event information on radiation levels at altitudes and on routes used by commercial airlines	Calculation of crew (and passenger) radiation exposure and investigation of equipment anomalies
6	Spatially resolved post-event information on geomagnetically induced currents of a sizes.	Electric power transmission organisations telephone companies)
11	Now-casts of ionospheric reflection properties	HF frequency selection for RF systems (civil and military)
12	Now-casts of ionospheric total electron content	Corrections to GNSS location systems and radar systems (civil and military)
16	Now-casts of atmospheric drag affecting LEO spacecraft	Satellite operators (civil and military)

Human impact

Gallileo?

Criteria: (a) useful services, (b) data available in Europe.

PROTOTYPE SPACE SEGMENT

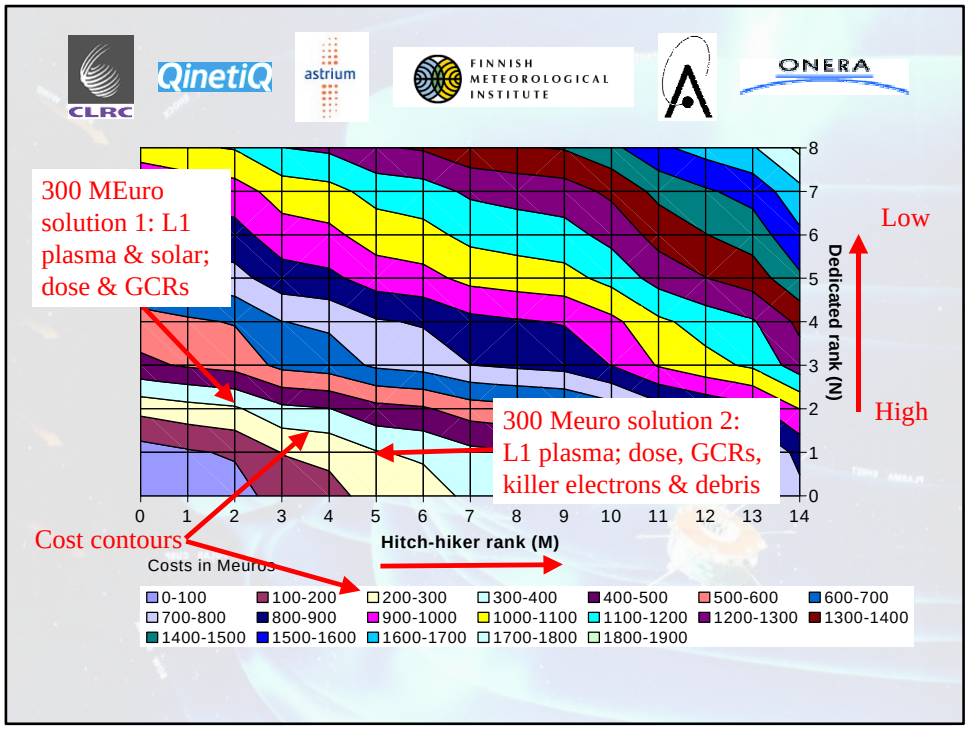
- Space segment study shows that requirements can be addressed by a mix of hitch-hikers and dedicated missions
- How to select that mix?
- Proposed methodology:
  - rank hitch-hikers and dedicated missions
  - calculate cost of implementing all hitch-hitch options up to rank M and all dedicated options up to rank N.
  - produce a colour plot showing the cost of implementing both options up to any combination of M and N
- Method is general; but show example using our ranking

SUMMARY OF DEDICATED OPTIONS

Rank	Description	Rationale
1	L1 solar wind & HMF + solar protons	Upstream solar wind monitoring
2	L1 solar observations	Solar monitoring
3	Energetic particles + cold plasma	Radiation belt & plasmasphere monitoring
4	Coronagraph to L4/l5	Viewing Earth-directed CMEs
5	Coronagraph & Radio Wave Detector to L4/5	Viewing Earth-directed CMEs
6	Auroral imager, Debris monitor	Auroral monitoring
7	Auroral imager	Auroral monitoring
8	Magnetometer	Magnetospheric dynamics

SUMMARY OF HITCH-HIKER OPTIONS

Rank	Description	Rationale
1	Dose monitor	Human safety
2	High energy ion detector	SEUs
3	High energy electron spectrometer	Killer electrons
4	Debris monitor	Debris impact
5	Medium energy electron spectrometer	Killer electrons
6	High energy ion detector	Rad belt
7	High energy ion detector	Rad belt
8	EUV photometer	Drag, HF
9	UV photometer	Drag, HF
10	X-ray photometer / spectrometer	Flares - SEPE
11	Auroral imager	Oval size
12	Coronagraph	Solar obs
13	Whole disk imager	Solar obs
14	Magnetograph	Solar obs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astrium
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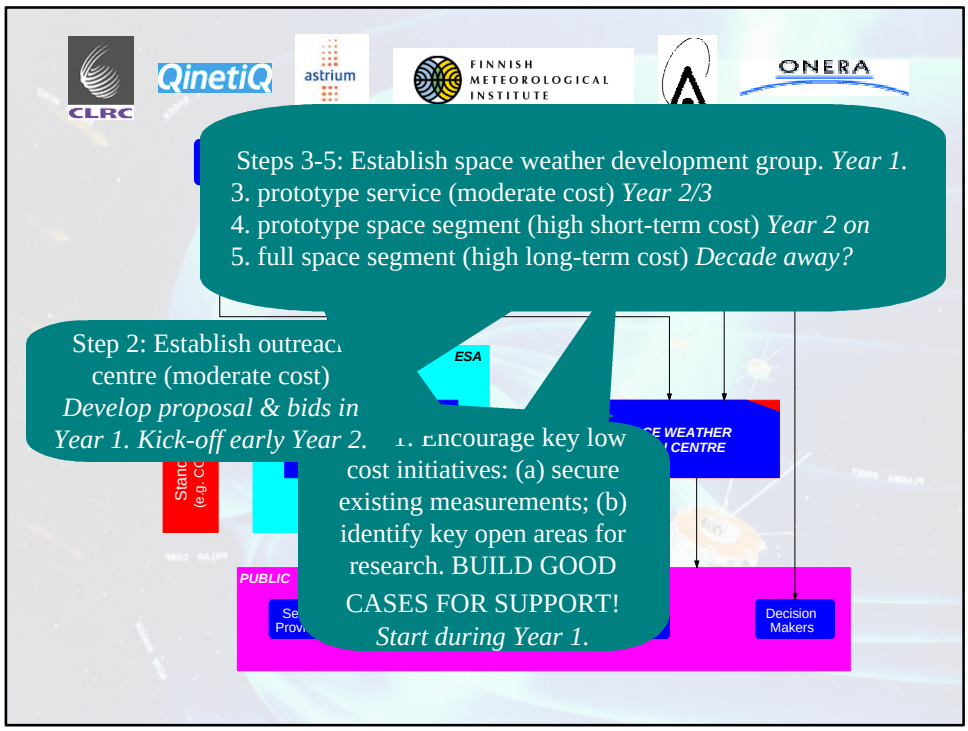
300 MEuro solution 1: L1 plasma & solar; dose & GCRs
300 Meuro solution 2: L1 plasma; dose, GCRs, killer electrons & debris
Low
High
Dedicated rank (N)
Hitch-hiker rank (M)
Cost contours
Costs in Meuros
0-100
100-200
200-300
300-400
400-500
500-600
600-700
700-800
800-900
900-1000
1000-1100
1100-1200
1200-1300
1300-1400
1400-1500
1500-1600
1600-1700
1700-1800
1800-1900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Steps 3-5: Establish space weather development group. Year 1.
3. prototype service (moderate cost) Year 2/3
4. prototype space segment (high short-term cost) Year 2 on
5. full space segment (high long-term cost) Decade away?
Step 2: Establish outreac
centre (moderate cost)
Develop proposal & bids in Year 1. Kick-off early Year 2.
1. Encourage key low cost initiatives: (a) secure existing measurements; (b) identify key open areas for research. BUILD GOOD CASES FOR SUPPORT! Start during Year 1.
ESA
PUBLIC
Decision Makers