ESA Space Weather Study, Final Presentation: *Study Overview*

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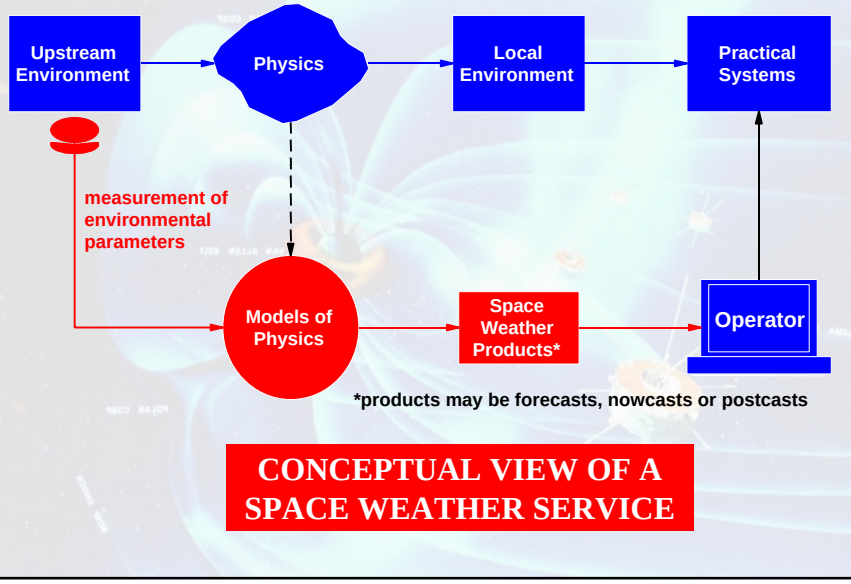
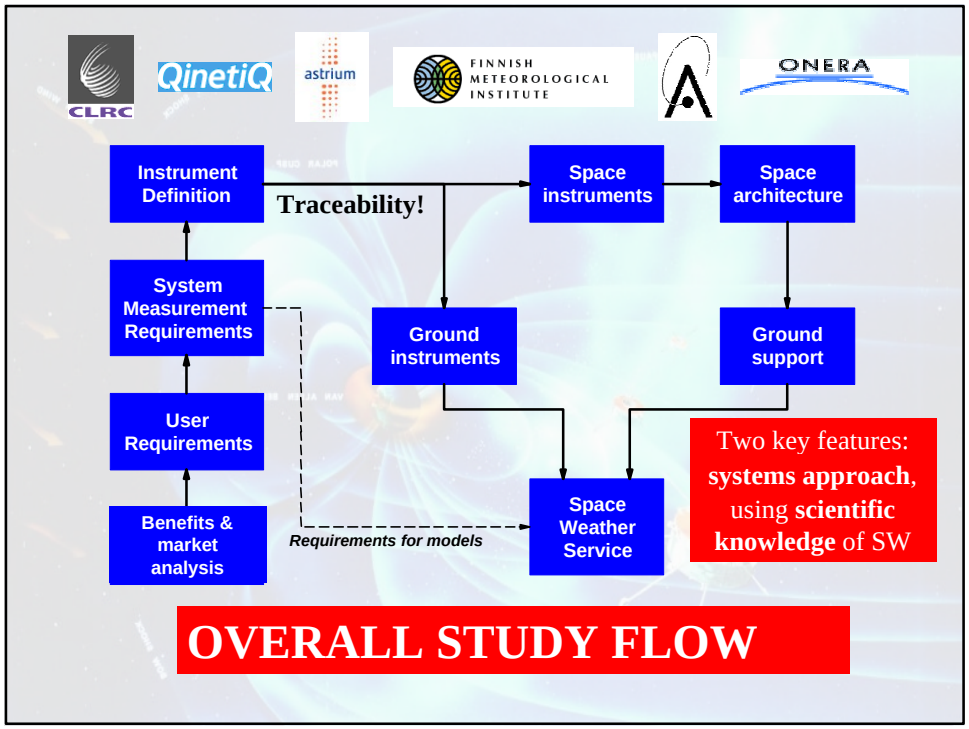
THE STUDY TEAM

- CLRC Rutherford Appleton Laboratory
  - Oxfordshire, UK
- QinetiQ (formerly DERA)
  - Farnborough and Malvern, UK
- Astrium,
  - Stevenage, UK
- Finnish Meteorological Institute,
  - Helsinki, Finland
- Belgian Institute for Space Aeronomy
  - Brussels, Belgium
- Office National d'Etudes et de Recherches Aérospatiales,
  - Département Environnement Spatial, Toulouse, France

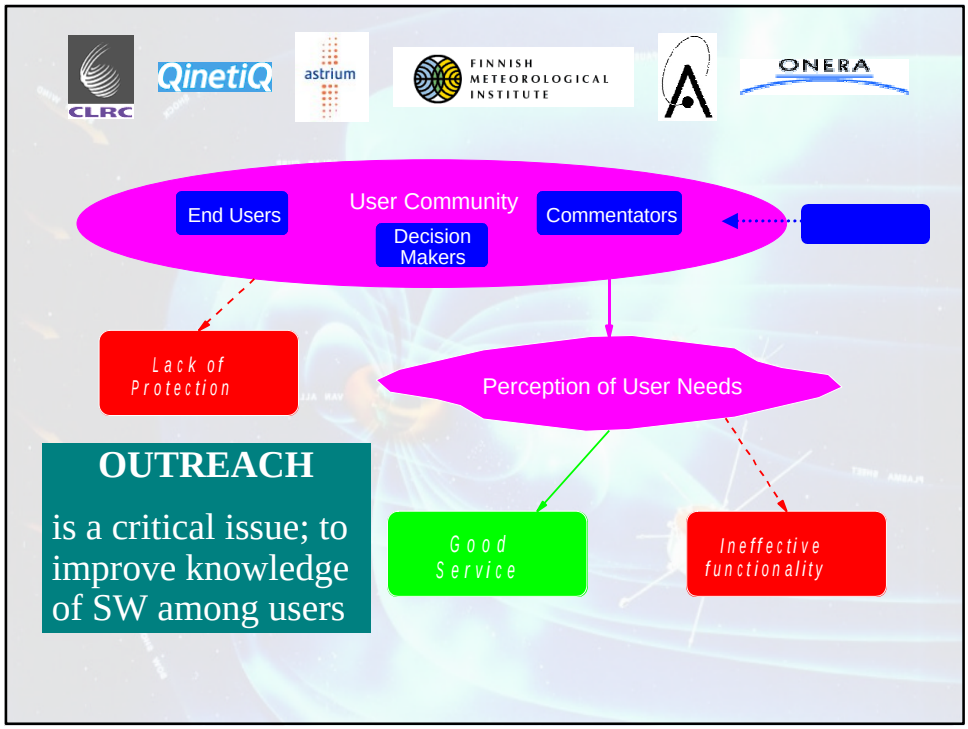
STUDY APPROACH:
study aims and logic



CONCEPTUAL VIEW OF A SPACE WEATHER SERVICE


Instrument Definition
Traceability!
Space instruments
Space architecture
System Measurement Requirements
Ground instruments
Ground support
User Requirements
Benefits & market analysis
Requirements for models
Space Weather Service
Two key features: systems approach, using scientific knowledge of SW
OVERALL STUDY FLOW


SOME KEY RESULTS
just a flavour!
see our later talks for details

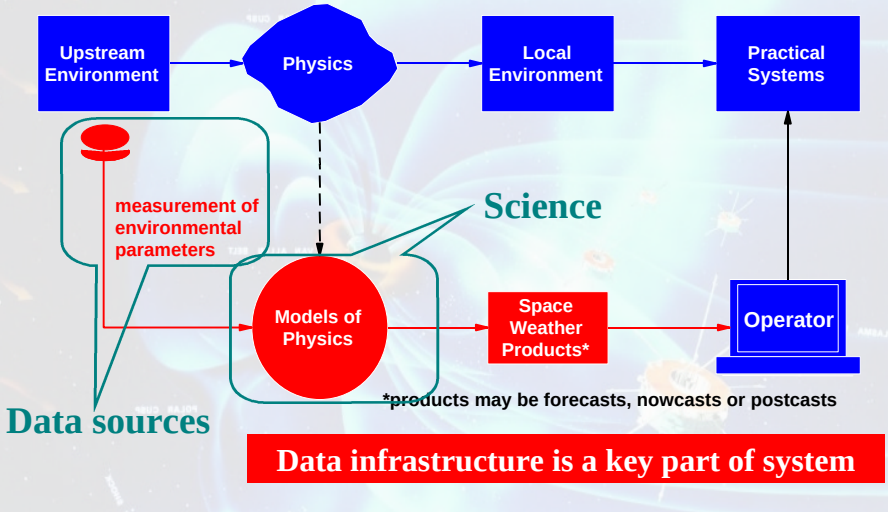


NICHE OPPORTUNITIES

- Study showed demand for specific well-targeted services:
  - e.g. power systems, airlines, geological survey/drilling, ...
- No user demand for over-arching service
  - integration must be justified by technical or financial advantages to users
- User demand provides a series of niche opportunities
  - may be exploited by industry (SMEs), government labs & academia
  - bottom-up (market) approach appropriate here … BUT …

DATA INFRASTRUCTURE

- Basic data is needed to support these services
- Users see provision of this as public sector task
  - routine monitoring of environment, e.g. SSN, Kp, foF2, TEC, etc.
  - dissemination of physical parameters from that monitoring
  - users will not pay for what they see as basic “scientific data”
- This is an important message
  - key issue for Outreach, especially towards decision-makers
  - need to secure existing European data sources as well as develop new sources

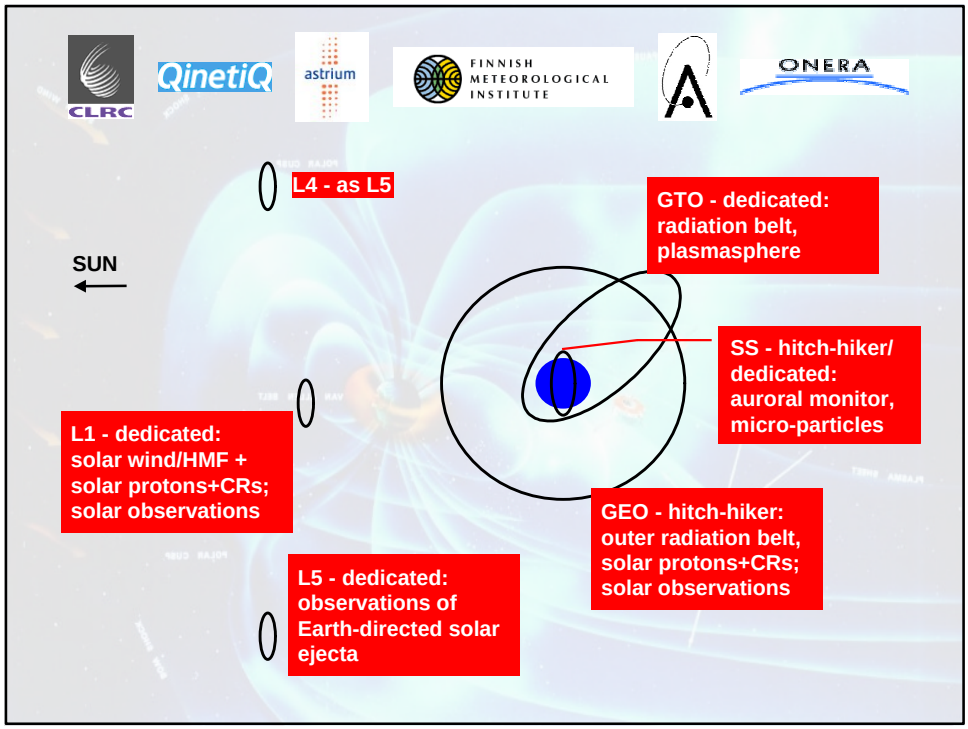


DATA SOURCES

- requirement analysis shows we need a mix of space- & ground-based sources
- ground-based sources have major advantages
  - usually much cheaper and easier to maintain
- but some key requirements must be addressed by space measurements:
  - practicability (EUV/X-ray, in-situ, kHz radio)
  - quality (coronagraphs)

SPACE-BASED MEASUREMENTS

- existing/planned missions provide limited data
  - SOHO is main European mission
  - also smaller European missions, e.g. CHAMP
  - international collaboration helps (especially with US)
  - still potential gap in L1 coverage 2003-2006
- explored hitch-hiker and dedicated mission solutions
- conclude that a mix of the two is required
- see overview on next slide

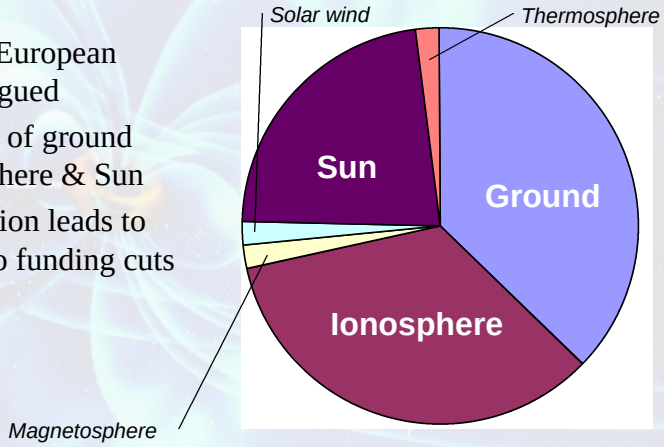


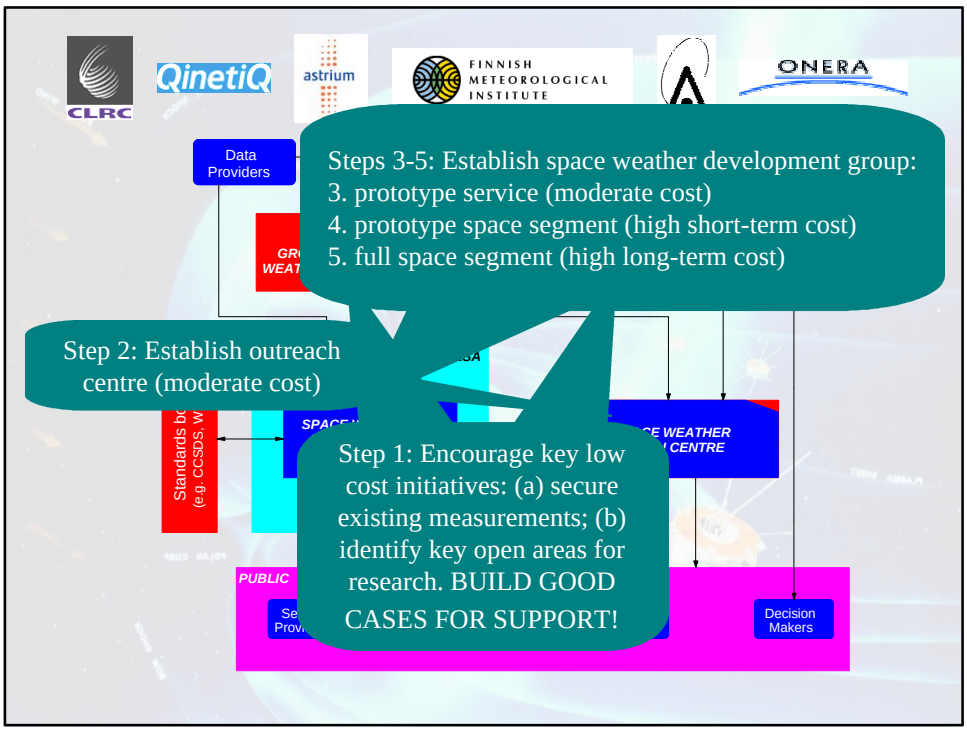
Measurement type	*Network*	*Index*	*Develop?*
Cross-tail electric field (HF backscatter radar network, i.e. SuperDARN)	Y	?	Y
Geomagnetic indices	Y	Y	
Geomagnetic variations	Y		
Ionospheric critical frequencies	Y	Y	
Ionospheric total electron content	Y		
Interplanetary scintillation (remote sensing of heliospheric density and velocity)	?	Y	Y
Secondary neutron fluxes	Y		
Solar 10.7 cm radio emission (Penticton index)		Y	
Solar surface magnetic field (magnetograph)			
Sunspot number	Y	Y	

EXAMPLES OF GROUND-BASED SPACE WEATHER MEASUREMENTS

EXISTING MEASUREMENTS

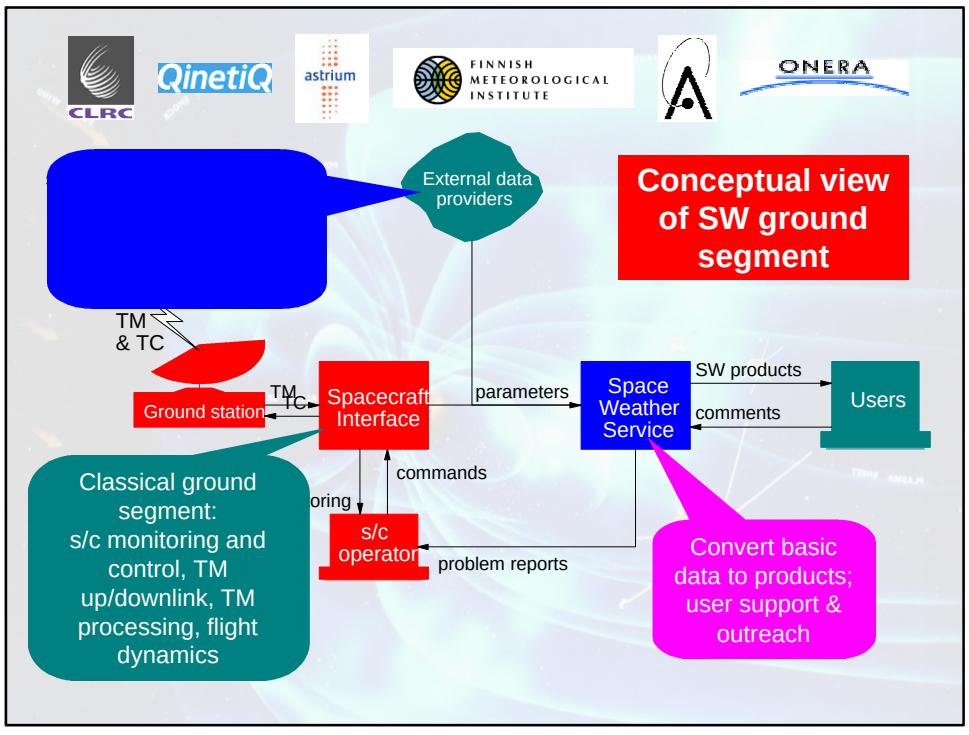
- ~100 existing European systems catalogued
- good coverage of ground effects, ionosphere & Sun
- but fragmentation leads to vulnerability to funding cuts

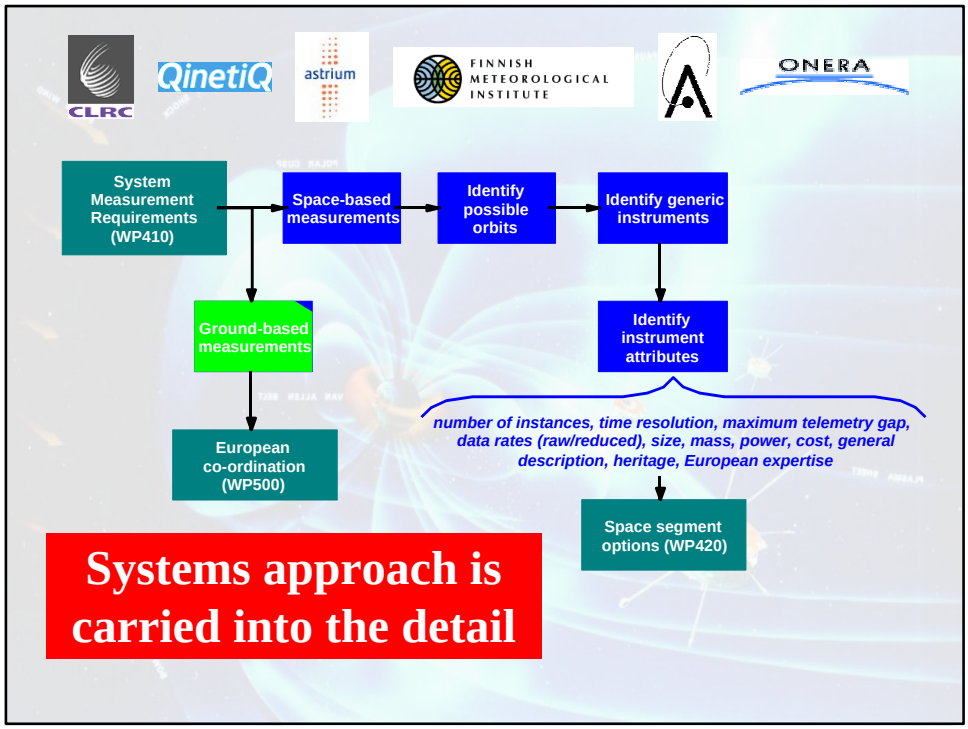




More during the day

Implementation Plan at ~5 pm!

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FINNISH METEOROLOGICAL INSTITUTE
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System Measurement Requirements (WP410)
Space-based measurements
Identify possible orbits
Identify generic instruments
Ground-based measurements
Identify instrument attributes
European co-ordination (WP500)
number of instances, time resolution, maximum telemetry gap, data rates (raw/reduced), size, mass, power, cost, general description, heritage, European expertise
Space segment options (WP420)
Systems approach is carried into the detail