Plasma and Radiation Monitoring Workshop: Introduction and context

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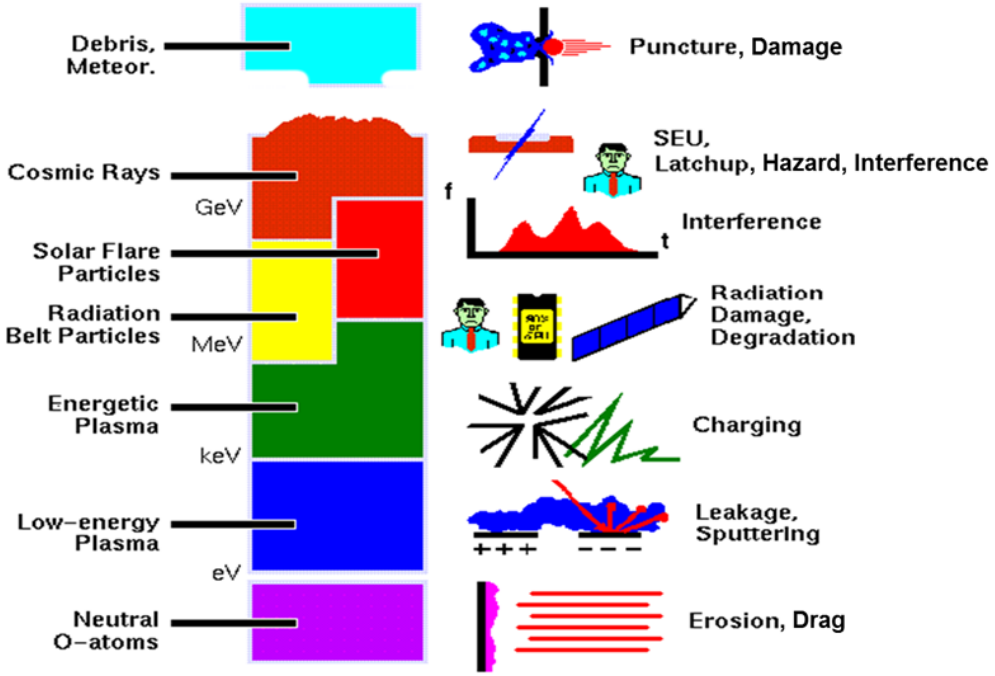
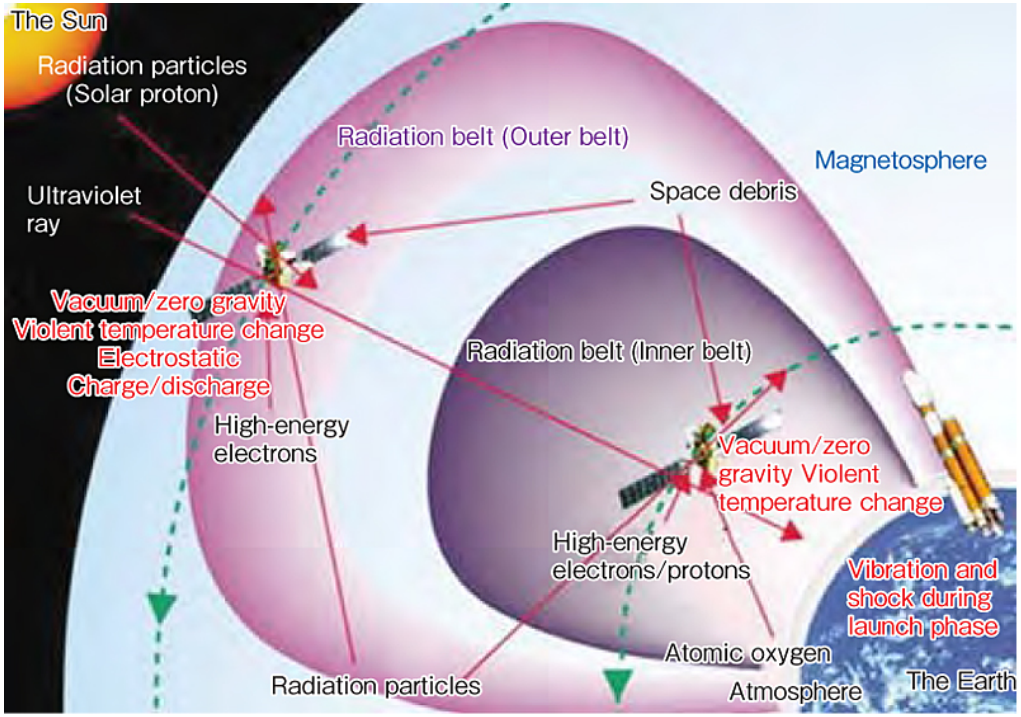
Outline

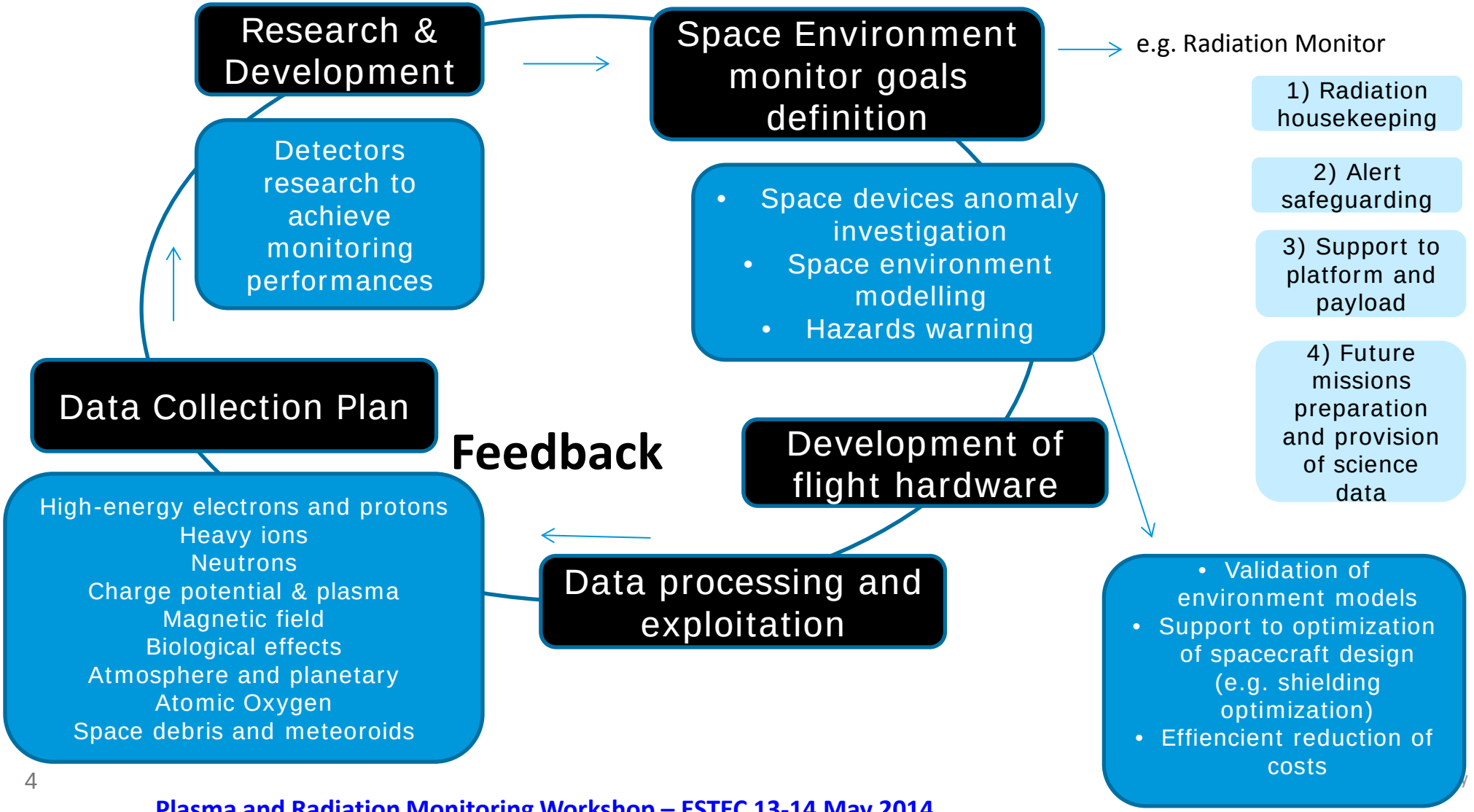
- Space Environment Monitoring in the various ESA programmes
- Role of in-situ Measurements
- Issues and things to aim at
- Harmonisation, coordination and networking
- Expectations for this workshop

Overview of space environment





Process of space environment monitoring



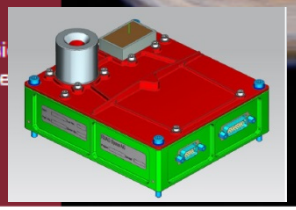
ESA Programmes

FUTURE ESA MISSIONS & RADIATION MONITOR

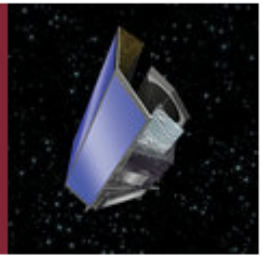
plato
Launch: 2024
Hunting planets beyond our Solar System

juice
Launch: 2022
Europe's first missi
to the Jupiter syste

RADEM

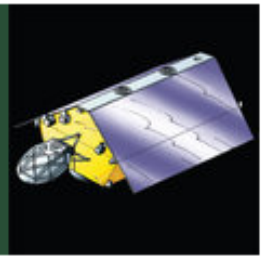


euclid
Launch: 2020
Charting dark matter and dark energy's effects on the Universe

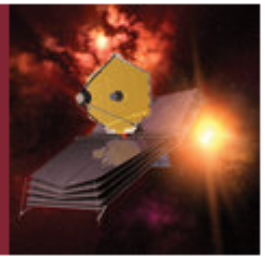


biomass
Launch: 2020
Measuring forest biomass

jason cs
Launch: 2019
Measuring heights of Earth's oceans

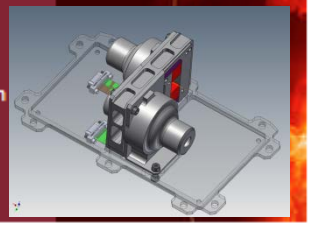


james webb space telescope
Launch: 2018
Contributing two instruments to the next great space observatory



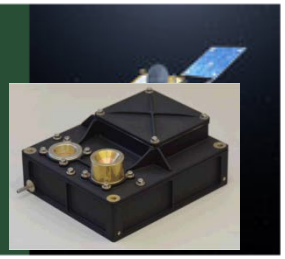
solar orbiter
Launch: 2017
Europe's closest mission to the Sun

EPD



mtg series
Launch: 2017
Meteosat Third Generation

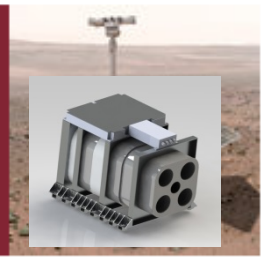
NGRM



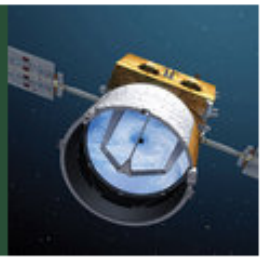
cheops
Launch: 2017
Studying planets around other stars

exomars
Launch: 2016, 2018
Mars orbiter and lander, followed by rover

FREND



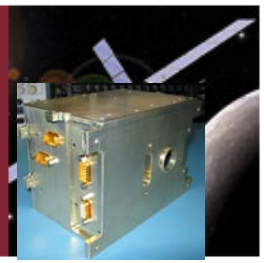
adm-aeolus
Launch: 2015
Mapping Earth's global wind fields



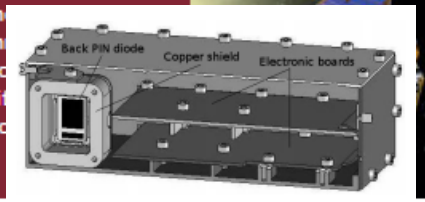
earthcare
Launch: 2015
Studying the roles of clouds and aerosols in our climate

bepicolombo
Launch: 2015
Europe's first mission to Mercury

BERM



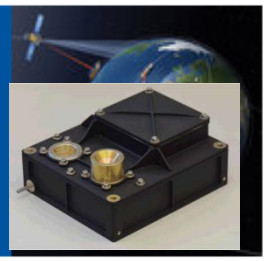
lisa pathfinder
Laun
Tech
demo
gravi
detec



smallgeo
Launch: 2014
New small platform for geostationary telecommunications

edrs
First launch: 2014
Geostationary satellites for relaying satellite data

NGRM



FLYING ESA MISSIONS & RADIATION MONITOR

alphasat
Launch: 2013
Innovative satellite telecommunications platform
MFS

galileo
First launch: 2011
Europe's global satellite navigation system
EMU

rosetta
Launched: 2004
Deep space comet rendezvous mission
SREM

herschel
Launched: 2009
Far-infrared astronom
mission
SREM

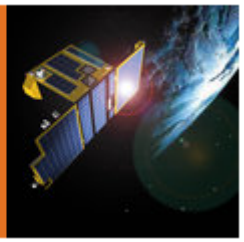
planck
Launched: 2009
Mapping the cosm
microwave
background
SREM

metop series
Launched: 2006, 2012
Polar meteorolog
services

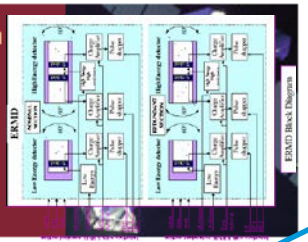
sentinel family
First launch: 2014
A portfolio of operational Earth observation missions

integral
Launched: 2002
Gamma-ray astronomy
SREM

proba series
Launched: 2001, 2009, 2013
Technology demonstration microsatellites



xmm-newton
Launched: 1999
X-ray astronomy

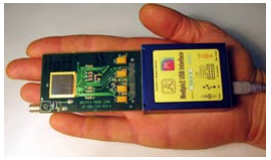


columbus
Launched: 2008
Europe's ISS research laboratory

SREM

EPT

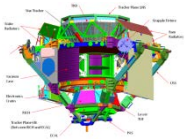
SATRAM



ALTEA/Alteino

Matryoshka

DOSTEL

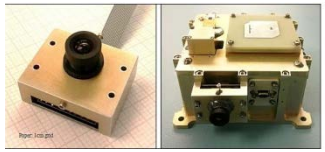


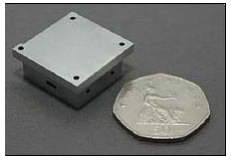
AMS-02

Many more monitors from national projects

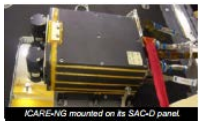
- TechdemoSAT (UK): HMRM, MuREM, CHAPS, LUCID
- SAC: ICARE and CARMEN (France)
- Resurs-D1 : PAMELA (Italy/Russia)
- Las Dos Torres (Spain)
- Tritel/COCORAD (Hungary)
- Human Spaceflight: ESA EucPAD (Germany, Austria, Ireland, Finland)
- Etc…


HMRM

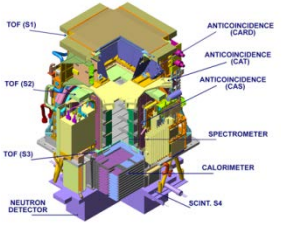

MuREM


CHAPS

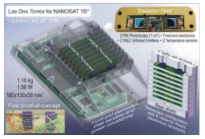

LUCID



ICARE



PAMELA


Las Dos Torres


Tritel

Space Environment Monitoring requirements

- Each mission has special requirements and responds to the space environment in a different way
- Known issues:
  - “Background” and instruments damage (Science)
  - Charging (Science)
  - Mixed environment (EOP)
  - Long mission duration (EOP)
  - High lifetime dose (Telecom/Navigation)
- Radiation exposure minimization major mission design driver
  - Radiation and Plasma Monitoring is a necessary component of the overall system reliability assurance

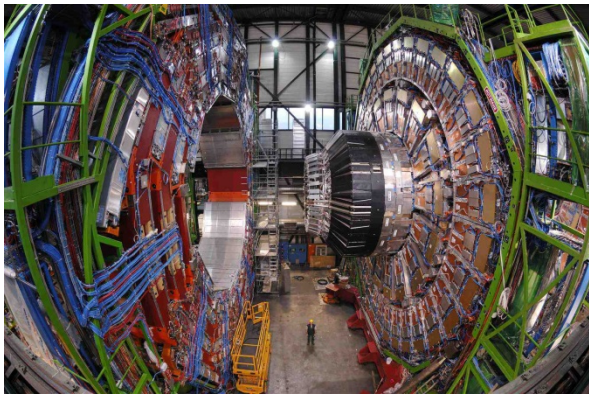
Space environment measurements role

- In-flight monitors must address:
  - Space Environment models and effects especially for key or poorly known environment and new technologies.
  - Platform requirements (alerts, operations, housekeeping)
  - Transport of radiation/plasma interaction simulation
  - Validation of methods of analysis (computational tools, models) and ground-based testing with the objective of identifying uncertainties and margins.
- Provide data for wider "community" application
  - e.g. Space Weather Segment of SSA
- Dedicated "science-class" instruments on appropriate platform
  - ultimate solution to modelling needs
- Develop policies for data distribution

Issues and things to aim at

- Funding strategies & programme issues:
  - Perennial problem with "valley of death" (difficulty to go from relatively low funding for prototypes to qualified and embarked flight models);
  - Opportunities growing for project-specific support (often with specific national constraints);
  - SSA promoting a broader view and foreseen to allow instrumentation development and deployment
  - National interests that benefit the European community through collaborations
  - Costs still too high, difficulty to fund integration on spacecrafts

CMS Total cost: ~ 400 Meuro
Weight: 12500 tonnes
Price/kg = ~ 30 euro/kg !!



Harmonisation, coordination and networking (I)

- ESA & member states agreed to better coordination of activities in technology domains (TDs)
- TD 4 = **space environments and effects;**
- Formal harmonisation in 2006, updated 2009; next update 2015.
- Review of:
  - Needs (future European programmes)
  - Global landscape
  - Activities in member states
  - Capabilities in member states
- Preparation of a **roadmap** of coordinated ESA, national developments
- Used to support R&D programme preparation (ESA TECNETs, etc.)

Harmonisation, coordination and networking (II)

- Work done within **SEENoTC** (Space Environments and Effects Network of Technical Competences) to identify, discuss, propose R&D:

  http://space-env.esa.int/index.php/SEENoTC.html

- Community events:
  - Round tables
  - Workshops
  - Final Presentation Days
  - Conferences (e.g. RADECS, NSREC, European Space Weather Week)

Motivations for attendance

- Involvement in different plasma, radiation, dosimetry, space weather activities and consequently interested in the experiences and results of others developments.
- 1) Catch up with the status of play in the fields 2) Networking
- This is the place where requirements on space radiation data are expressed and where state-of-the art developments of radiation measurement instruments are discussed.
- Importance of the topic addressed by the WS
- Satellite Operators: interest in the use of small radiation / plasma instruments as hosted payloads on commercial satellites; also in the use of such sensors for spacecraft anomaly investigation.
- Future business
- Sounds like a fun day out for the family!


THANK YOU