Overview of Future ESA EO Missions

Maria Adams, Head of Future Missions – NERC/BNSC
'Leading a Successful Space Project'
CEOI Training Workshop – 3rd June 2008

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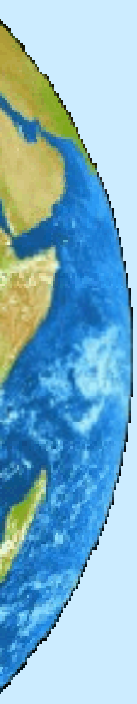
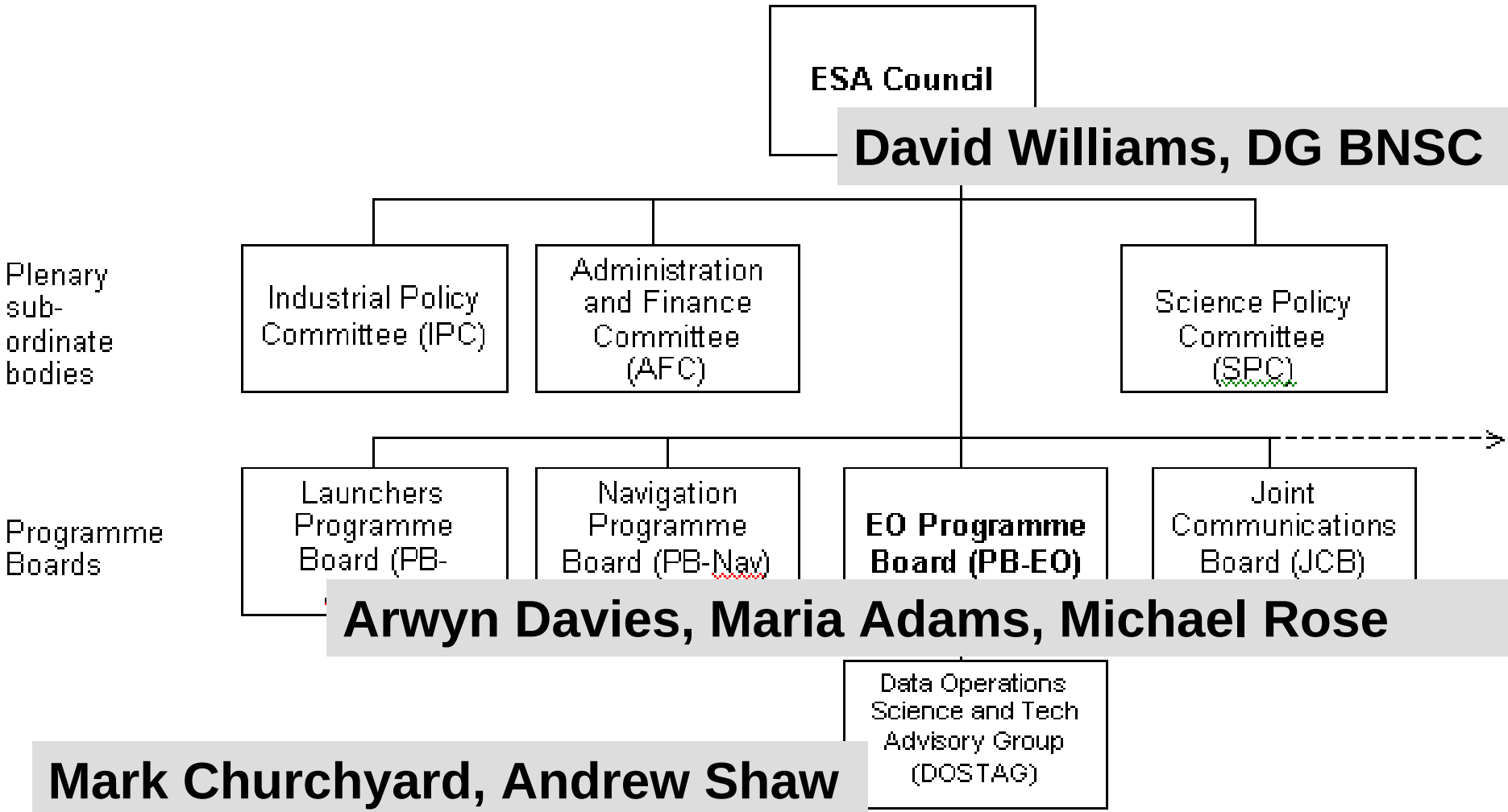


1. BNSC partnership and Interactions with ESA
2. ESA near-future mission opportunities
   - EO Envelope Programme
   - Meteorological Programmes
   - GMES Space Component Programme
3. Summary

BNSC Partnership

ESA Structure – BNSC EO representation



Involvement of UK in ESA EO programmes

- TODAY, the UK participates in a number of ESA's EO programmes:
  - EOEP 3 (ERS & ENVISAT),
  - Meteorological programmes (MetOp, MSG)
  - GMES Space Component Programme
  - EarthWatch GMES Service Elements
  - access to data from Third Party Missions out of Earthnet
- ….TOMORROW, ESA's EO programme builds on 3 key programmes (C-Min 2008):
  - GMES Space Component,
  - Meteosat Third Generation,
  - Climate Change
  - Including Earthnet Activities (TPM & LTDP)

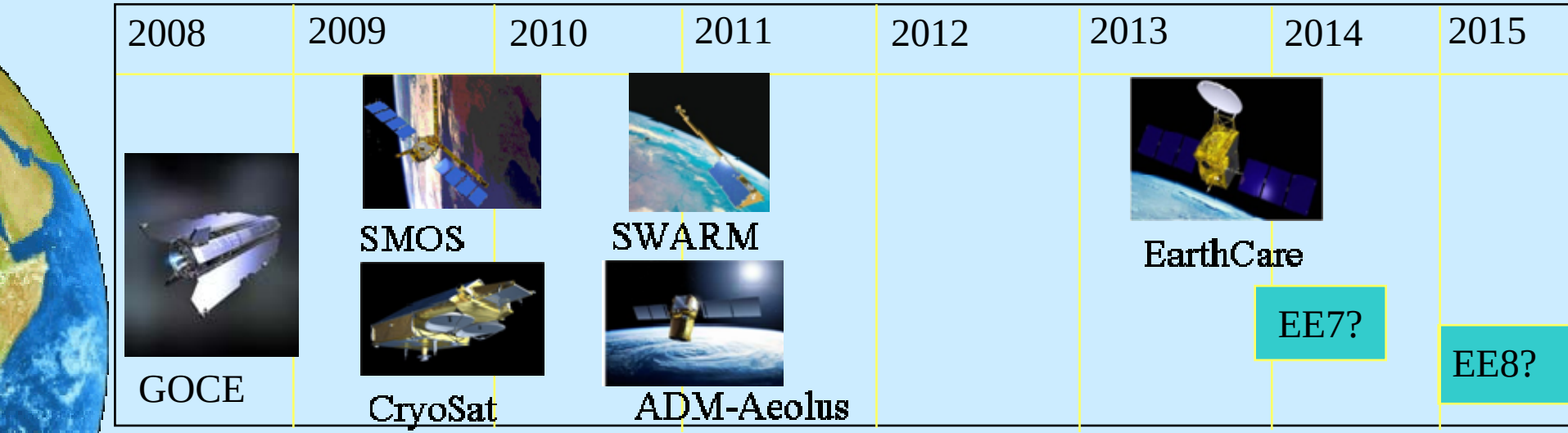
Earth Observation Envelope Programme (EOEP)

- This programme forms the **backbone to ESA's EO activities** with the development primarily,of **science missions** but also **pre-operational Earth Watch missions** (e.g: EUMETSAT and GMES)
- This is a rolling programme carried out in programmatic periods of generally 5 years. EOEP3(2008-2012) ~ 1.3Bn€
- EOEP is science-led.
  - Science challenges are set out in ESA's Science strategy*
  - ~60% allocated to implementation of science missions
  - Selection of Earth Explorer missions undertaken by the Earth Science Advisory Committee (ESAC)
  - Mission Advisory Group behind the implementation of each mission
  - Support to Science Elements (new mission concepts and novel observations and applications)
- EOEP also supports Instrument pre-development activities (Long Lead Items up to TRL 5 on selected missions) – strong relationship with previous TRP and GSTP activities
- NERC is currently financially committed to EOEP and regards the programme as its primary means for procuring new missions/data.

* '*The Changing Earth – New Scientific Challenges for ESA's Living Planet Programme*' (ESA SP-1304 - July 2006)

Earth Observation Envelope Programme

EOEP-3 is the 3rd phase of EOEP covering the period 2008 - 2012



Programme covers

- 2 Earth Explorer missions (incl. Earthcare) and preparation for 3rd
- Continuity of mission operations including ERS-2 to 2008 and ENVISAT to 2010
-'Evolution' of the ground segment and exploitation of data products
- Support to Earth Watch pre-operational mission development (incl. Eumetsat MTG and Post-EPS, completion of GMES pre-development)
- Future instrument development

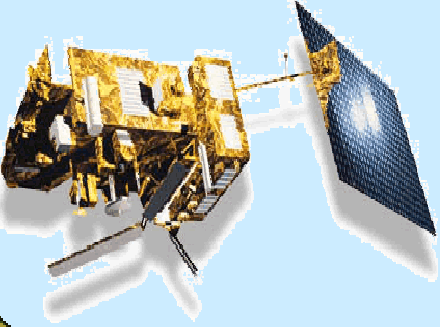
EOEP: Earth Explorer 7 missions

- The six missions under Pre-Phase A studies, as ranked by ESAC, are:

  - BIOMASS – terrestrial **BIOMASS** observation
  - TRAQ – **TR**oposphere composition and **A**ir **Q**uality
  - PREMIER – **PR**ocess **E**xploration through **M**easurements of **I**nfrared and millimetre-wave **E**mitted **R**adiation
  - FLEX – **FL**uoresence **E**xplorer **M**ission
  - A-SCOPE – **A**dvanced **S**pace **C**arbon and **C**limate **O**bservation of **P**lanet **E**arth
  - CoReH2O – **Co**ld **Re**gion **H**ydrology **H**igh-resolution **O**bservatory

- Down-selection to 3 missions for Phase A studies at February 2009 PBEO meeting, upon recommendations by ESAC
  - ultimately down-selected to one mission for implementation (in principle)
  - No timetable in place for next call for missions (EE8)

Return



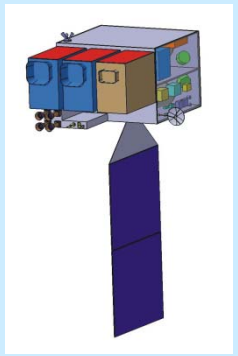
Meteorological Programmes

- Future programmes to focus on continuity of European Polar System (Metop) & Meteosat series (MSG)
- Successful partnership & financial model: Eumetsat sets the user requirements and contracts ESA to provide the series of operational satellites – ESA funds the first satellite mission (R&D activities)
- DIUS interests via ESA, with Met Office via EUMETSAT
- MTG B/C/D/E1 (2008 – 2015)
  - Total programme costs: ~3Bn€; EOEP covers on-going pre-development activities,
  - Phase B/C/D/E1 funding (860M€) at ESA C-Ministerial in November 2008 - PBEO preparations are nearly finalised
- Post-EPS B/C/D/E1 (2011 – 2019)
  - Phase A funding available under EOEP
  - Phase B/C/D/E1 funding at C-Ministerial in 2011

MTG will provide continuity of EUMETSAT Services

1977 — 2002 — 2017

MOP/MTP ***MSG*** ***MTG***



1 observation mission:
-MVIRI: 3 channels
-**Spinning** satellite
800 kg

2 observation missions:
- SEVIRI: 12 channels
- GERB
Spinning satellite
Class 2-ton

3/4 observation missions:
- Combined Imager: 16 channels
- Infra-Red Sounder
- Lightning Imager
Twin configuration, 3-axis stabilised satellites
Class 3-ton

Possible Chemistry Mission UVS coordinated with ESA for implementation via GMES Sentinel 4

Global Monitoring for Environment and Security GMES

• 'Global Monitoring for Environment and Security' is a joint initiative designed to deliver data and information services to underpin the development of EU environment and 'security' policy which is supported by a combination of satellite and in-situ data collection activities.

•**the GMES Space Component Programme (GMES SCP)**

– **jointly funded** by ESA and the Commission,

– this programme focuses on the **coordination of an overall space infrastructure for GMES** , to include national European infrastructure and capabilities, as well as, the implementation of the ESA GMES space component (**the series of Sentinels**) developed to meet the **service requirements set by the Commission**.

– Europe's space infrastructure contribution to Global EO System of Systems (GEOSS) - Group for EO (GEO).

•UK partnership interests - Defra have the overall policy lead on GMES, with DIUS increasingly taking a lead on the space elements - NERC and MoD involvement

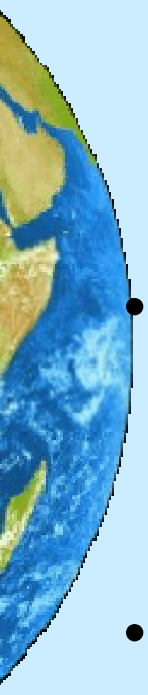
GMES Space Component Programme

- Total GMES programme ~ 2.3€bn
- Programme divided in 2 Segments
- Segment 1 : 1.23Bn€, ESA = 758M€ (2006-2012)
  - Phases B/C/D and launch of Sentinels 1A, 2A and 3A
  - Pre-development of Sentinels 4 and 5
  - Related Ground Segment Activities
  - Data access
- Segment 2: ESA = ~1Bn€ at C-Min in November 2008 (2009-2016)
  - 2nd units of Sentinels 1, 2, 3 = 60% of costs
  - Sentinel 4 (2 UV-VIS-Near IR instruments on MTG-S) = 188M€
  - Sentinel 5 pre-cursor mission = 115M€ excluding instrument (UV-VIS, SWIR spectrometer, Dutch in-kind contribution)
  - Initial Sentinel 5 instrument (UV-VIS-near IR-SWIR pre-developments = 5M€ - launched on Post-EPS

Summary: EO mission opportunities

- Near-term opportunities:
  - EE7: mission & instruments
  - MTG: mission & instruments
  - GMES SCP:
    - Sentinel 4 instruments
    - Sentinel 5 instruments
    - Sentinel-5 Pre-cursor mission and instrument
- Future opportunities:
  - EE 8, EE9
  - Post-EPS mission & instruments
  - Follow-on Jason-3, SMOS, ADM-Aeolus missions
  - Follow-on GMES missions TBD

Positioning for future ESA opportunities: Key points



- Knowing the customer(s):
  - Importance of understanding user requirements at European level (science, operational meteorology, Commission operational requirements) and at national level (programme funders) and
  - Importance of developing close relationships with the relevant communities
- Importance of technology development/ establishing leads in novel technologies and industrial positioning with activities starting at TRP level, with seedcorn funding provided nationally (CEOI), and ultimately, implemented through ESA EO programmes
- Awareness of ESA processes:
  - Missions selection procedure for different programmes
  - Geo-return principle on ESA subscriptions : ultimately dictates European ‘teamings’ and potential roles

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