



05 March 2007
SSOM Engelberg Lectures

ESA Programmes
**Earth Observation
Navigation**

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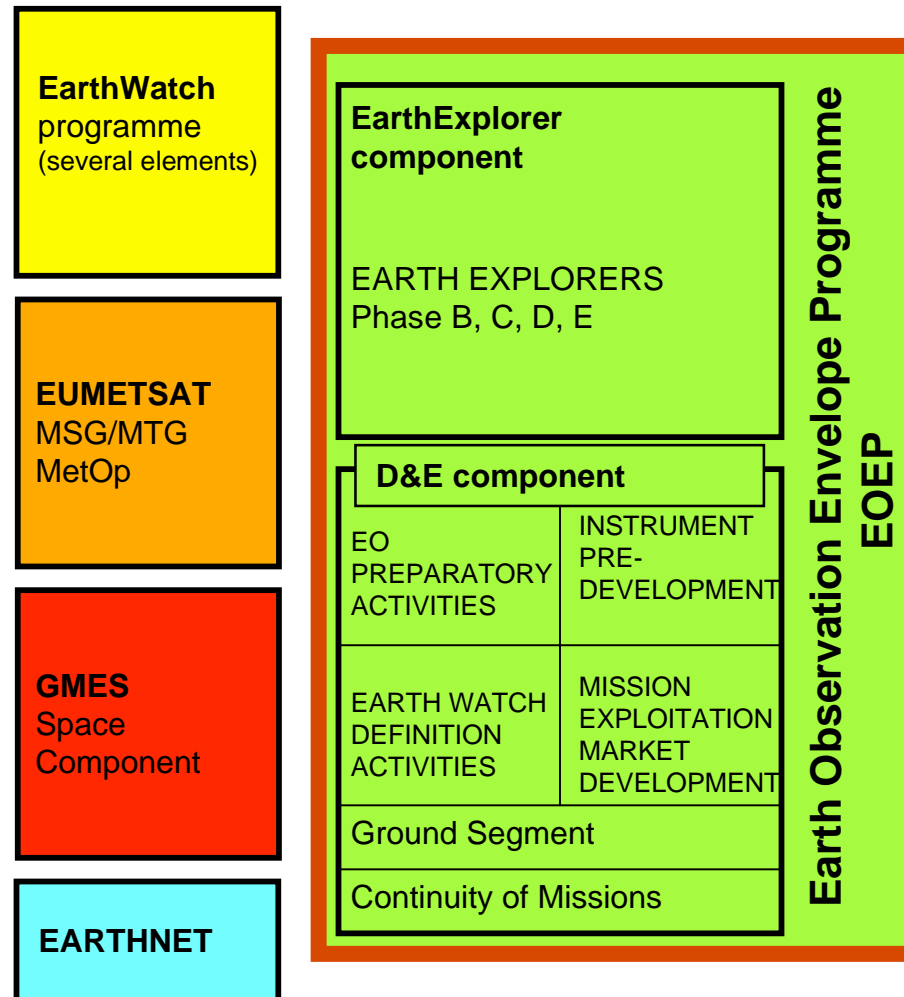


EO: The *Living Planet* Strategy (1997)

- Objectives
 - to keep Europe at the **leading edge of science and technology**
 - to increase the use of EO in formulation, implementation and monitoring of **public policies** and in the provision of **public services**
 - to foster the development of **commercial services**



The *Living Planet* Programme





EOEP: Main features

- Optional ESA programme, through successive periods of nominally five years
 - period 1: 1999-2002
 - period 2: 2003-2007
 - period 3: 2008-2012
- Annual budget ~ 250/300 MEUR
- Offers a secured, long-term and adaptive planning of activities
- Transparent mechanism for approval of the programme content (EarthExplorers and D&E workplans)
- An adjustable ‘balance of activities’ across various lines
- A procurement process based on open competition, with global georeturn guarantees



EOEP: Structure and contents

- EarthExplorer Component
 - Implementation of selected EarthExplorer missions beyond phase A
- Development and Exploitation Component
 - Preparatory activities for EarthExplorer and EarthWatch candidate and selected missions
 - Support to the development of high-level products, services both in academia and industry
 - Multi-mission access to data
 - Continuity of missions



EarthExplorer core missions

- **ESA-led missions to cover the primary research objectives of the Explorer's program:** Earth interior, physical climate, geo-sphere & biosphere, atmosphere & marine environment

GOCE

Earth gravity field
and Geoid
measurements

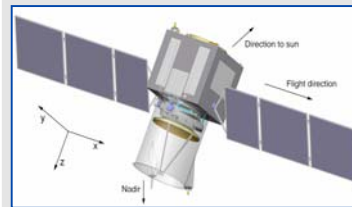
Launch: Dec. 2007



ADM-Aeolus

Windspeed
vectors
measurements

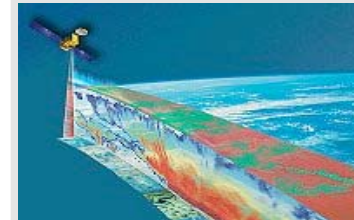
Launch: June 2009



EarthCARE

Clouds, Aerosols
& radiation
measurements

Launch: 2012+





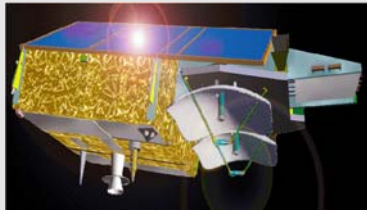
EarthExplorer opportunity missions

- **Add-on missions with specific targets:** Instrument provision to other programmes, small / micro satellite research missions, technology demonstration (incl. new observing techniques)

Cryosat

Ice elevation and ice thickness measurements

Launch: Oct. 2005

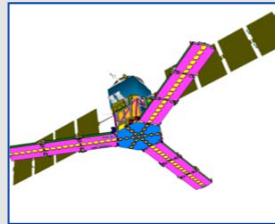


+ recovery 2009

SMOS

Soil moisture and ocean salinity measurements

Launch: May 2008



SWARM

Earth magnetic field & Earth core dynamics meas.

Launch: April 2010



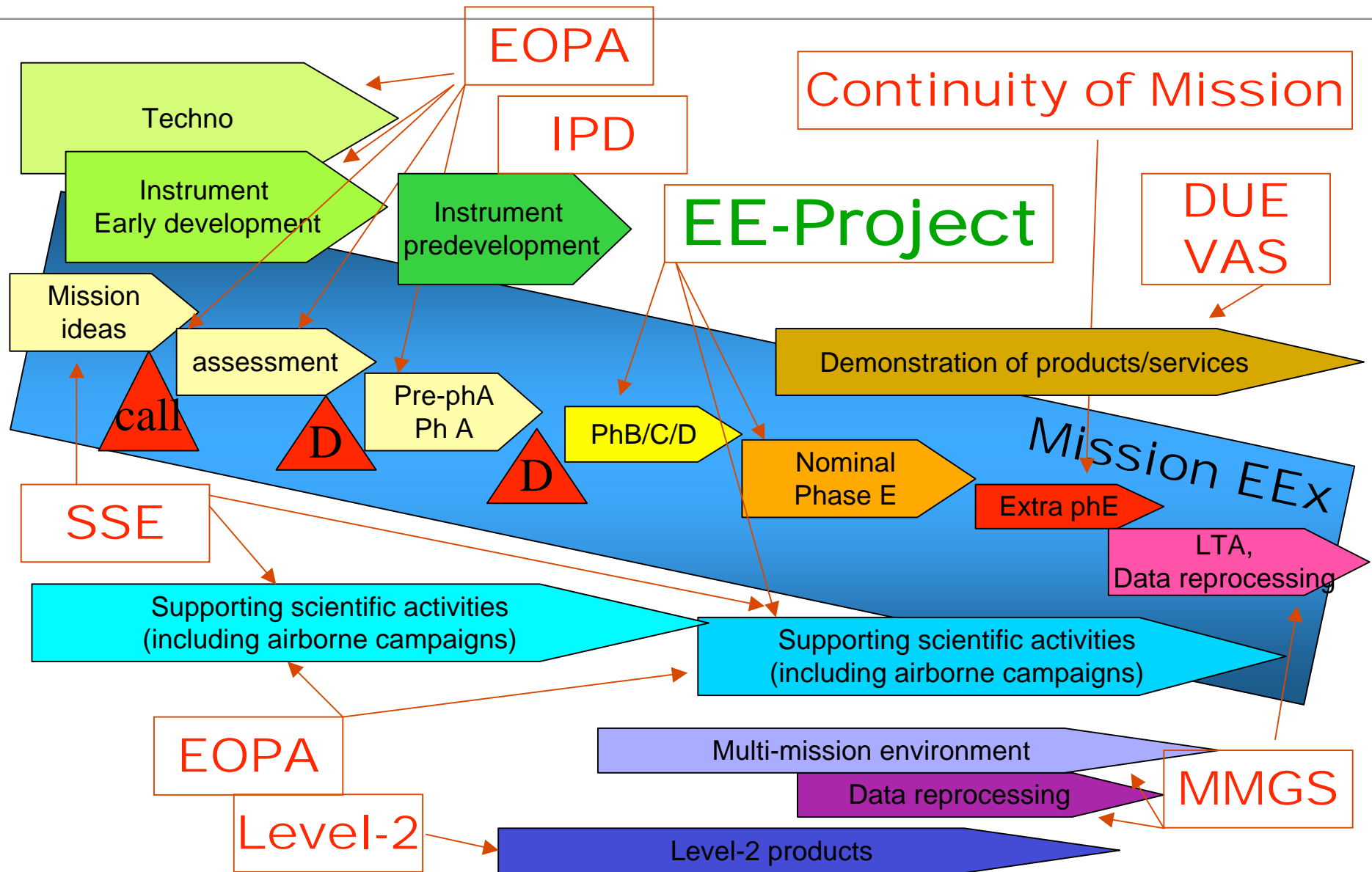


Next EarthExplorer missions

- **EarthExplorer 7:** in pre-phase A
 - *BIOMASS*
Terrestrial biomass observation
 - *TRAQ*
TRopospheric composition and Air Quality
 - *PREMIER*
Process Exploration through Measurements of Infrared and millimeter-wave Emitted Radiation
 - *FLEX*
Fluorescence Explorer Mission
 - *A-SCOPE*
Advanced Space Carbon and Climate Observation of Planet Earth
 - *CoReH2O*
Cold Regions Hydrology High-resolution Observatory
- **EarthExplorer 8**
 - Call expected in 2008 (?)



Support to an EE mission



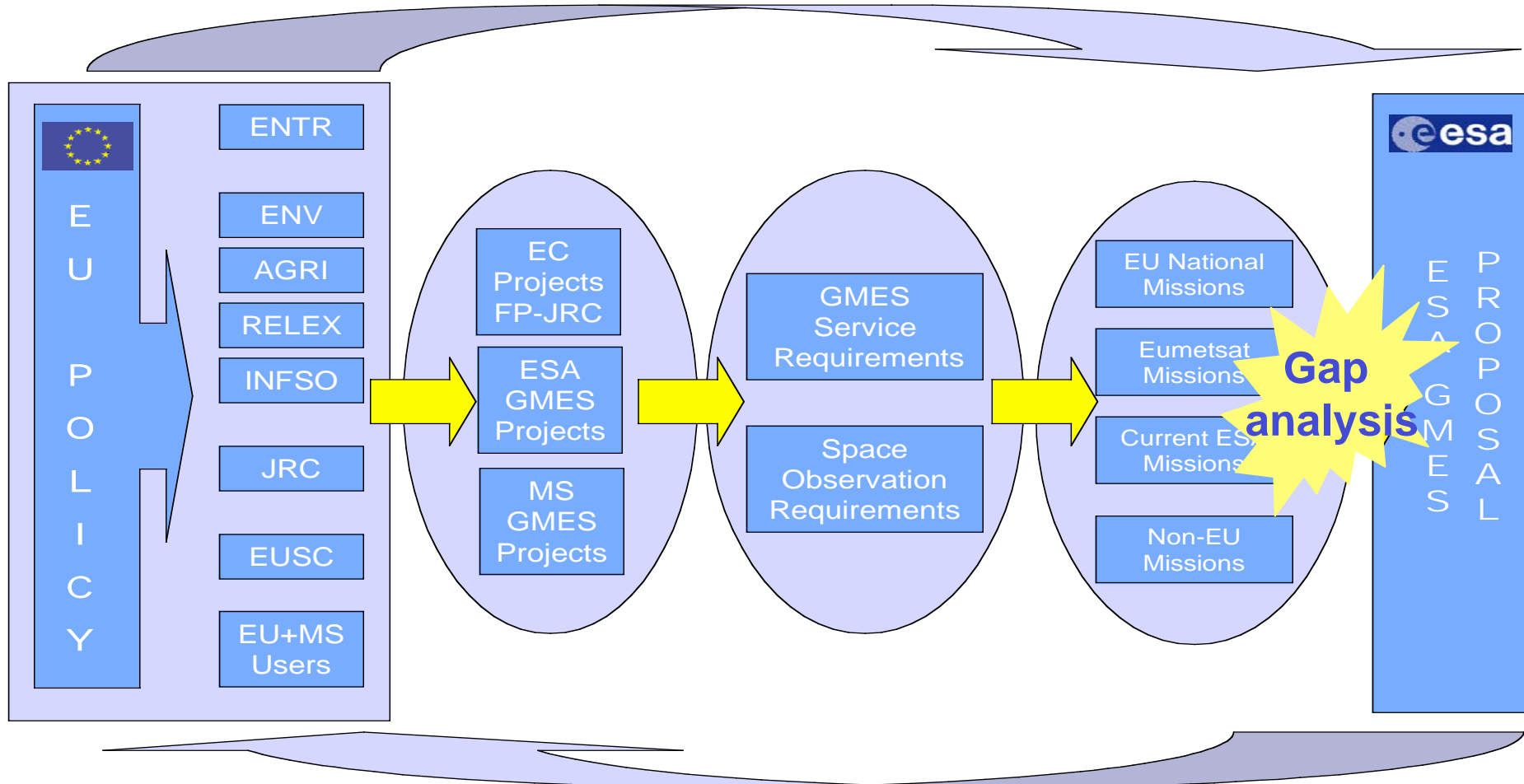


GMES

- Global Monitoring for Environment and Security
 - EU led initiative
 - User oriented
 - 3 Fast Track Services
- Role of ESA in GMES
 - **Coordinator** of the space component:
ESA, national, third party missions
 - **Contributor**:
GMES Space Component Programme (GSC)



Traceability of observation req.



POLICIES ® USERS ® SERVICES ® REQUIREMENTS ® GAP ANALYSIS ® SOLUTIONS



Gap analysis leads to 5 Sentinels

Sent-1 10-30 m SAR for interferometry, ocean, ice, land applications

✓ 0.5-10 m SAR for detailed land mapping

Sent-2 10-30 m multispectral instruments for land mapping

✓ 0.5-10 m optical instrument for detailed land mapping

Sent-3

✓ 100-1000 m wide-swath thermal infrared instruments for sea surface and land temperature measurements

✓ 100-1000 m wide-swath multi-spectral instruments for ocean colour and global land monitoring

✓ radar altimeters for ocean observations at high inclination orbit

✓ radar altimeters for ocean observations at low inclination orbit

✓ radar scatterometers for sea surface wind speed and direction

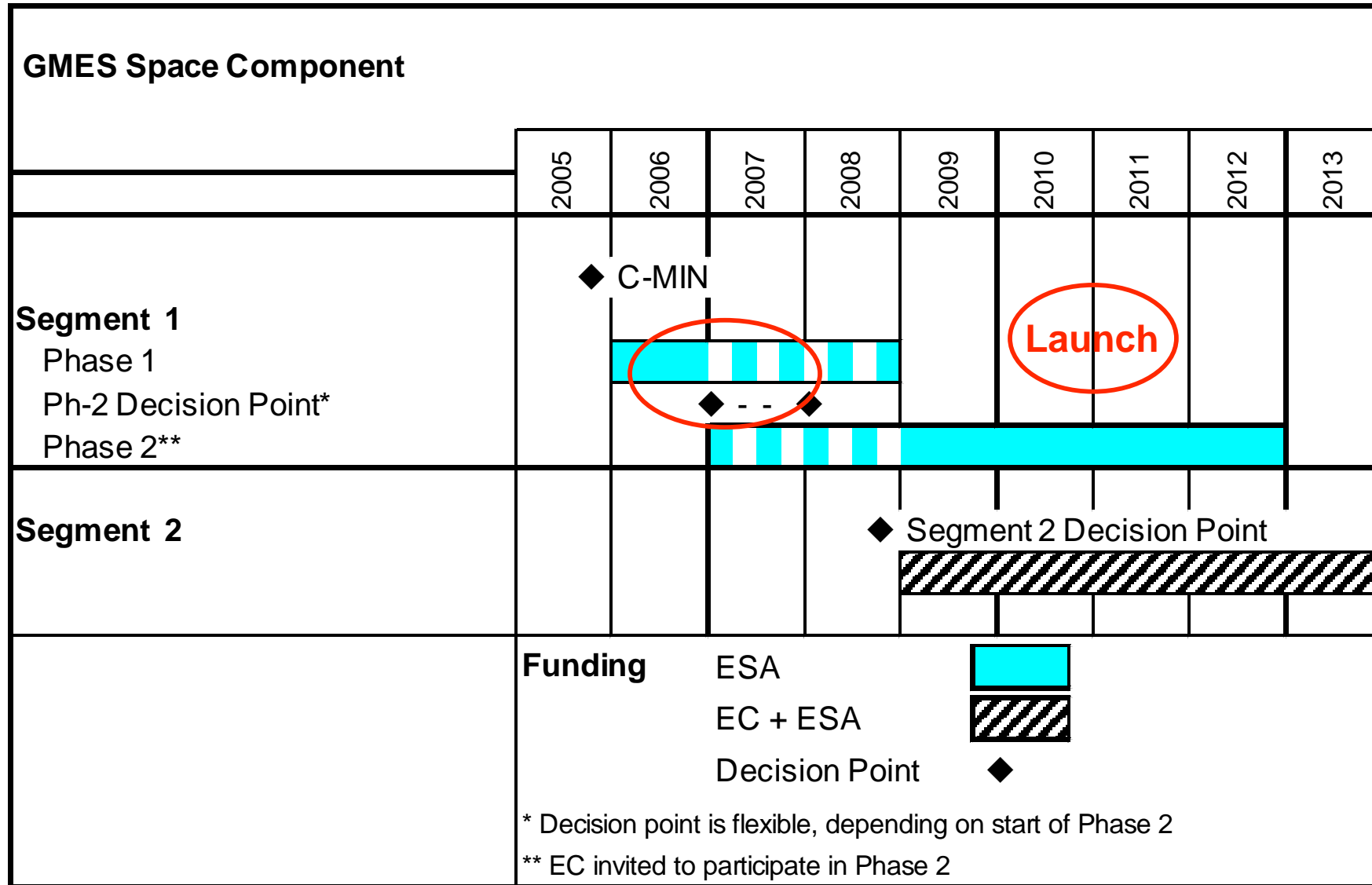
Sent-4-5

✓ atmospheric chemistry instruments for trace gas composition, pollution and climate change monitoring (low and geo orbit)

✓ 100-500 m infrared instruments for fire monitoring **FIR**



Implementation schedule





Joint ESA-EUMETSAT programmes

- Meteosat
 - geostationary orbit
 - Meteosat Second Generation (MSG): operational
 - Meteosat Third Generation (MTG)
 - Instruments
 - Imager
 - Lightning imager
 - Infrared sounder
 - Ultra-violet sounder (Sentinel-4)
 - 1 or 2 platforms?
 - Phase A: kicked-off, lasts until Q2/2008
 - Phase B: will start in 2008 (exact date tbd)



Joint ESA-EUMETSAT programmes

- MetOp
 - polar orbit
 - MetOp-A launched on 17-Oct-2006
 - post-MetOp programme will start in a few years (replenishment of MetOps as from 2019 on-wards)





Navigation programmes

- Current situation of on-going programmes
 - EGNOS
 - GALILEO
- Major players
 - European Union
 - European GNSS Supervisory Authority (GSA)
 - European Space Agency (ESA)
 - Merged Consortium (MC)
- Future landscape?



European GNSS Evolution programme

- Optional ESA programme
- Goals
 - to accompany operational introduction of existing systems (EGNOS/GALILEO)
 - to prepare next generation systems
- Timing/budgets
 - Phase 1: 2007-2008, 30 MEUR
 - Phase 2: 2009-2013, ~ 300 MEUR
- Programme participants
 - ESA member states
 - GSA?



European GNSS Evolution programme

- Work plan 2007/2008: elements
 - initial assessment of new system architectures
 - development of an EGNOS Evolution Platform
 - initial technology activities
 - support to applications



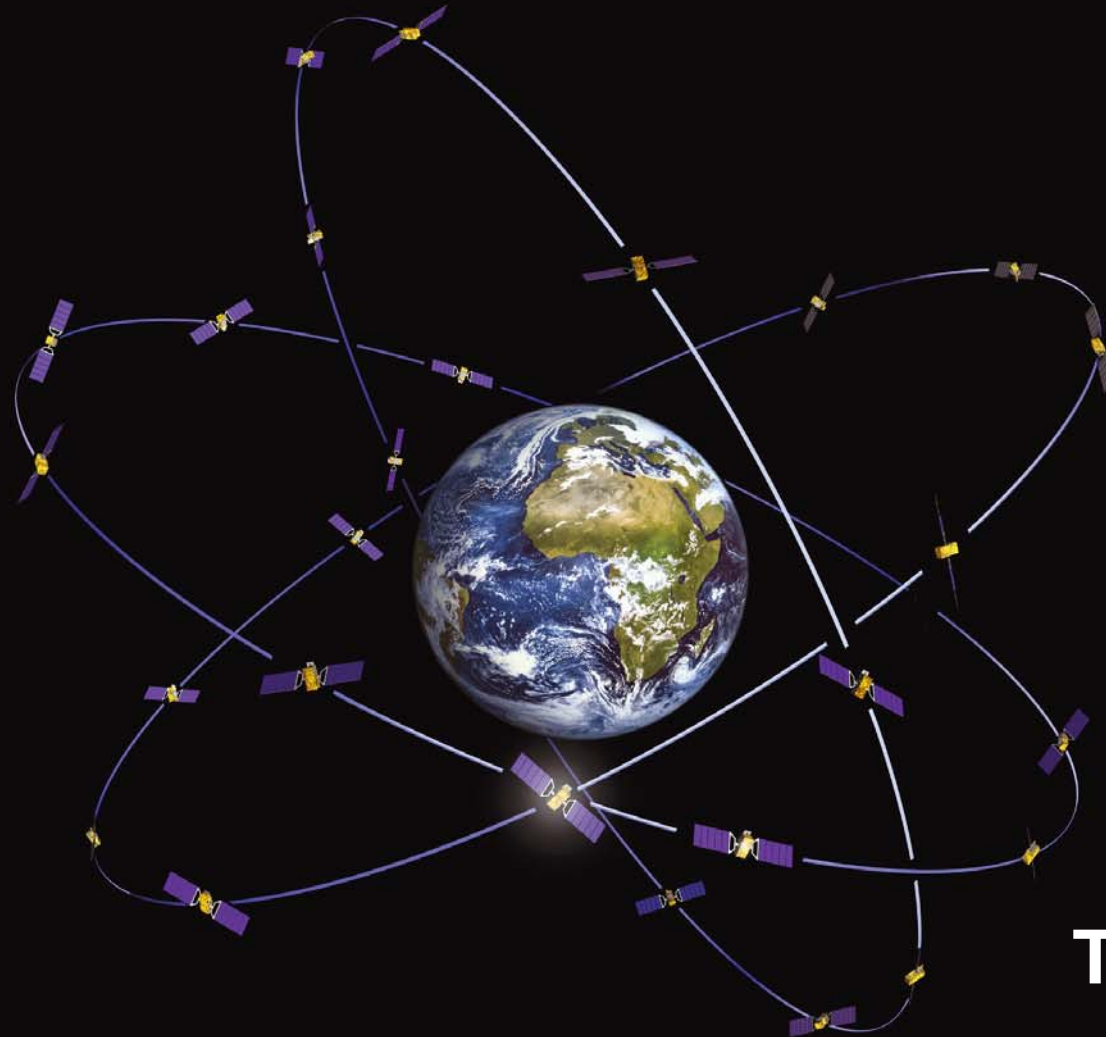
European GNSS Evolution programme

- Work plan 2007/2008: activities
 - EBB Development of Caesium Clock for Space (Q2/2007, OC)
 - Narrow-Band Laser Diode for Optically-Pumped On-Board Caesium Clock (Q2/2007, OC)
 - Prototype Development of Ground Caesium Clock (Q2/2007, OC)
 - etc.



Conclusions

- Earth Observation
 - EOEP: annual work plans, EE8
 - GSC: preparation for future via EOEP
 - MTG, post-EPS
- Navigation
 - GNSS Evolution Programme, phase 2 (starts in 2009)
- Specific situation for Swiss actors
 - no georeturn rules for financial contributions from EU
 - CH not (yet) part of relevant EU agencies
- **Good ideas, endurance, patience!**



Thank you!

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