Maximizing the benefits of ESA’s Earth Observation Programmes

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Presented by Stephen Ward, Symbios
Overview

- Working with the science community
- Engaging institutional users
- Working with Industry
- Achieving Sustainability
Established Frameworks for International Cooperation on EO

- **ESA**: 19 Member States
- **ESA’s Living Planet Programme**
  
  *Science, Technology, Applications*
- **ESA & EUMESAT**: Operational Satellite Meteorology
- **ESA & EU**: GMES Space Component and Services
- **CEOS**: International Space Agencies
- **GEO**: Global Earth Observing System / Stakeholders
- **GCOS**: Global Climate Observing System / needs
Global observations for Scientific understanding...
Expanding European Earth Observing Capability

Meteorological Missions
- driven mainly by Weather forecasting and Climate monitoring needs.
- These missions developed in partnership with EUMETSAT include the Meteorological Operational satellite programme (MetOp), forming the space segment of EUMETSAT’s Polar System (EPS), and the new generation of Geostationary Meteosat satellites (MSG & METEO satellites).

GMES Sentinel Missions
- driven by Users needs to contribute to the European Global Monitoring of Environment & Security (GMES) initiative.
- These satellite missions developed in partnership with the EC include C-band imaging radar (Sentinel-1), high-resolution optical (Sentinel-2), optical and infrared radiometer (Sentinel-3) and atmospheric composition monitoring capability (Sentinel-4 & Sentinel-5 on board Met missions MET and EPS-5G respectively).

Earth Explorer Missions
- driven by Scientific needs to advance our understanding of how the ocean, atmosphere, hydrosphere, cryosphere and Earth’s interior operate and interact as part of an interconnected system. These Research missions, exploiting Europe’s excellence in technological innovation, pave the way towards new development of future EO applications.
Innovation in Earth Science & EO Applications

First images

Mar 02

Launch

4000+ scientific projects and many operational users

Sep 04

Envisat Symposium Salzburg (A)

Aug 05

Ozone hole 2005

Sep 07

Envisat Symposium Montreux (CH)

Apr 07

B-15A iceberg

Jul 07

Chlorophyll concentration

Jun 10

Hurricane Katrina

Jun 12

CO2 map

Living Planet Symposium Bergen (N)

Jul 12

and many workshops dedicated to specific Envisat user communities

Iceland 2010

L'Aquila 2009

Arctic 2007

Japan 2011

Bam earthquake

Global air pollution

Prestige tanker oil slick

Iceland

2010
Earth Explorer Missions

- Preparing the Future

- GOCE
  17 March 2009

- SMOS
  2 Nov. 2009

- Cryosat
  8 April 2010

- SWARM
  November 2012

- ADM AEOLUS

- EARTH CARE
Maximising Scientific return of Research Missions
=> e.g. GOCE

- All GOCE mission requirements met in full by end 2012
  - Gravity anomalies < 1 mGal
  - Geoid accuracy: ~2-3 cm @100 km res

- GOCE could map gravity signals significantly beyond original goal of spherical harmonic degree 200 (100km)

- From late 2012 until depletion of Xenon gas GOCE will fly 20km lower (235km) to increase spatial resolution of gravity model to 80km

Source: ESA
Developing and validating the Applications with users
Working with Institutional Users

Data User Element

User Groups: National & sub-national public authorities, European institutions, International organizations, NGOs

- User requirements consolidation
- Ground truthing
  - In-situ data access
- Products validation
- Service assessment

- Service Development
  - EO data
- Products
- Service Demonstration
Engaging institutional end-users => 400+ Institutions

DUE Programme Users

- Research Organisation: 29%
- Non-profit Organization: 1%
- Non-govern. Organization: 3%
- Scientific Programme: 5%
- Company: 9%
- Intergovern. Organisation: 7%
- International Convention: 2%
- Ministry or Agency: 44%
supporting multi-lateral environmental agreements
Contributing to GCOS

=> ESA Climate Change Initiative (CCI)

- Cloud Properties
- GHGs
- Ozone
- Aerosol properties
- Sea Surface Temperature
- Sea Level
- Sea Ice
- Ocean Colour
- Glaciers and ice caps
- Ice Sheets
- Land cover
- Fire disturbance
- Soil moisture
Enabling Climate Services

Stakeholders
users, decision-makers

Assessments

Products
Information

Operational
applied research
Prediction
Attribution
Climate services

Basic research

Modelling

Assimilation

Observations, data and analyses

ESA Climate Change Initiative

Data Access

Earth Explorers
ENVISAT/ERS
National Missions
GMES Sentinels
Meteo Missions (EUMETSAT)
Cooperating with GEO Stakeholders - Global Forest Observation Initiative

GFOI Objectives:

- to foster sustained availability of satellite and ground observation in support of national forest information systems
- to support countries in the use of observations for their national forest information systems

Co-leads:

- Australia (CSIRO, DCCEE)
- Norway (NSC)
- USA (USGS)
- FAO
- CEOS (ESA, NSC, USGS)

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>Establishment of GEO FCT task</td>
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<td>2009+</td>
<td>FCT demonstration based on NDs</td>
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<tr>
<td>2010</td>
<td>GFOI Concept plan</td>
</tr>
<tr>
<td>2011</td>
<td>GFOI Implementation plan</td>
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<tr>
<td>2012</td>
<td>GFOI Start-Up Phase</td>
</tr>
<tr>
<td>2013</td>
<td>Commencement of operations phase</td>
</tr>
<tr>
<td>2014+</td>
<td>Operations Phase</td>
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www.geo-fct.org
Large number of national and EU funded R&D projects 1995 – 2002 demonstrated satellite capability to detect oil slicks

Two key roles for ESA (2002–2010)

- Aggregate critical mass of industrial service providers to ensure operational oil-spill detection capability for EU waters

- Cooperate with national and European organizations to develop operational service framework:
  - Qualify service specifications and delivery capabilities
  - Support transfer to user Legal and financial framework

- Transfer to operational EMSA CleanSeaNet achieved in 2007
Working with Industry...
Fostering innovative industrial services:
=> Precision Land Motion Services

**Industrial Sectors**
- Mining
- Oil & Gas
- Civil Engineering
- Utility operators
- Transport
- Insurance
- CO₂ Capture & Storage (emerging)

Long-Term ESA support (15+ years) from R&D to commercial exploitation!
European EO Service industry:

- Approx 3000 persons employed
- Assessed revenues 2006:
  - Services: 306M€
  - Data: 106M€
- Average growth approx 8% per annum
- Estimated revenues 2011: (total): 700M€
Working with European Value Adding Industry

• Increased cooperation with European Industry Trade Association

• Horizon Scanning: Big Issues
  - Climate Change, Sustainable development, Mobile technology, Standards, GMES IO framework, ...

• Industry Position Papers
  (GMES operations, International Development, .....)

ESA UNCLASSIFIED – For Official Use
OGEO was initiated by ESA in 2010 in cooperation with the Oil and Gas sector.

OGEO has become the Earth Observation sub-committee of the International Association of Oil and Gas Producers (OGP).

OGEO promotes the introduction of industrial guidelines for the use of EO data within the Oil and Gas industry.
Working with Multi-lateral Funding Bodies

=> World Bank
=> opportunities for industry

Background:
• World Bank Projects represent significant potential market for EO based information services
• Difficult for EO service industry to get directly involved with such organizations

Scope of ESA activity:
• Build links with teams within World Bank
• Set up well-defined demonstration activities linked to World Bank projects in cooperation with WB staff and in country partners
  • Services provided by Industry
• Expand cooperation to additional priority activities identified in cooperation with WB
• Transfer services to WB funding

Current status
• 15 demonstration projects initiated so far
• Many already transferred to WB funding
Achieving Sustainability...
<table>
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<tr>
<th>Satellite</th>
<th>Main Features</th>
<th>Launch Years</th>
</tr>
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<tbody>
<tr>
<td>Sentinel 1 – SAR imaging</td>
<td>SAR imaging: All weather, day/night applications, interferometry</td>
<td>2013 / 2015</td>
</tr>
<tr>
<td>Sentinel 2 – Multi-spectral imaging</td>
<td>Multi-spectral imaging: Land applications: urban, forest, agriculture,.. Continuity of Landsat, SPOT</td>
<td>2014 / 2016</td>
</tr>
<tr>
<td>Sentinel 4 – Geostationary atmospheric</td>
<td>Geostationary atmospheric: Atmospheric composition monitoring, trans-boundary pollution</td>
<td>2019</td>
</tr>
<tr>
<td>Sentinel 5 / 5P – Low-orbit atmospheric</td>
<td>Low-orbit atmospheric: Atmospheric composition monitoring (S5 Precursor launch in 2015)</td>
<td>2015, 2020</td>
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“Over the 2006-2030 period... the benefits from all the GMES services in full use would equal 130 bn€ (2005 e.c.) or around 6.9 bn€ per year”

For 1 € spent by the European tax payer on GMES, a public return of 10 € can be expected
Benefits are realized when data is used

=> Sentinel Data Policy Principles

- Sentinel data will be made available via a ‘generic’ online access mode → free of charge

- Anybody can access data; no difference is made between public, commercial and scientific use → open access

- Progress on Sentinel data policy:
  - The principles of full and open access with free of charge licenses is reflected in the draft EC regulation for a GMES data and information policy
  - EC delegated act is expected to be finalised in the coming months
- Sustainability of the operational system is the single biggest challenge, for GMES and for EO in general.
Space 2030

TACKLING SOCIETY’S CHALLENGES

- Build a sustainable space infrastructure
- Encourage public use
- Encourage industry initiatives
thank you