GMES Space Component & Sentinel(-2)

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   - Requirements collection & Data Access
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6. GMES Space Component Operations Concept
   - Core ground segment
   - Collaborative ground segment
7. Way ahead/schedule
Programmatic status & Organisation of GMES/ GMES Space Component
GMES aims at developing operational services, following the example of meteorology, but for other domains such as:

- emergency management
- air quality monitoring
- land monitoring
- ocean & sea ice monitoring etc...

In addition, science is needed to create and continuously improve operational services
GMES Overall View

What is their need?

Example Services Provided

Core Services

Information Service

Policy Makers & Public & Private, Commercial

Farming Oil Spill Tracking Air Quality Flood Surveillance

Land Marine Atmosphere Emergency Security

Space Infrastructure & In Situ Infrastructure
GMES Components

GMES is an EU led initiative

- **Services Component – led by EC**
  - Produces information services in response to European policy priorities in environment and security
  - Relies on data from in-situ and space component

- **In-situ component – led by EEA**
  - Observations mostly within national responsibility, with coordination at European level

- **Space Component – led by ESA**
  - Sentinels - EO missions developed specifically for GMES:
  - Contributing Missions - EO missions built for purposes other than GMES but offering part of their capacity to GMES (EU/ESA MSs, EUMETSAT, commercial, international)
1. **Build-up phase**
development of first generation of Sentinels, data access to MS/EUM missions, ground segment, early operations: ~ 2.2 bn€

**Financing — ESA GSC programme**
- 758 M€ Segment 1
- 831 M€ Segment 2

**Financing — EC FP7**
- 600 M€ FP7 Space

Additional funding is required in ~2011 to complete build-up

2. **Operational Programme**
development of recurrent Sentinel satellites, operational access to Member State / Eumetsat missions, GSC routine operations, evolution of GSC: ~ 500 M€/year (2008 e.c.), to be consolidated.

Operational elements expected to be funded by EC, R&D elements by ESA
GSC next programmatic steps

- Consolidate GSC Long Term Scenario
- Prepare GMES/GSC Governance
- Obtain timely funding for Sentinel Initial Operations and GSC build-up completion
- Ensure that operational funding is in place before the launch of the Sentinels
- Consolidate ESA/EC position on the Sentinel and CMs data policy
- Develop the ‘S’ of GMES
GMES Services
ESA Funded GMES Services made the start

MarCoast
PolarView
GSE Land
Forest Monitoring

Promote
Risk-EOS
GMFS

TerraFirma
Respond
Mariss

130 M€ by ESA MS
Period 2003–2011
400+ user organisations
GMES landscape evolution

European Policy Decision Making

National Policy Making


Core Services

Downstream Services

EU Agencies

National GMES Services

Public/Int. Org.

Requirements

EO Data

Harmonized, Sustainable GSC Access & Infrastructure

GMES Space Component

ERS, ENVISAT, Proba, Alos, Landsat, Modis

Sentinels

GMES Contributing Missions (20-30)
Example of land service: Land classification and planning

GSE LAND Urban Atlas
Venice province
Example of marine service: Marine Monitoring

2006 sea Surface Temperature over the Mediterranean

Credits: Medspiration
Example of marine service: Global Sea Level Rise

Sea level rise from several satellite radar altimeters
Example of atmospheric service: CH$_4$ Concentration

2003-2005 ESA's Envisat global atmospheric methane distribution (air mole fractions in parts per billion)

Credits: ESA and University of Bremen
Example of Emergency service: flooding

Flooding management in the Elbe region of Germany – April 2006

Credits: NRSA, USGS, DLR/GMES RISKEOS
Example of Security service: Humanitarian Aid

Abu Shok (Darfur) Internal Displaced Persons camp
GMES Space Component(s)
Space Council Resolution/Role of ESA in GMES: as GSC Coordinator ESA manages

- **the overall GMES Space Component**
  - definition of overall GSC architecture and plan for future evolutions
  - managing GSC overall operations (system responsibility)
  - Coordinating access to Sentinels & GMES missions from national, EUMETSAT and third party satellite owners

- **Is the development and procurement Agency for dedicated space infrastructure**
  - Development of first spacecraft and Ground Segment
  - Procurement of recurrent elements

- **and in addition, ESA is the interim operator of Sentinel 1, - 2 and Sentinel-3**
  - EUMETSAT is the proposed operator of Sentinel-3 (Marine), Sentinel -4 and -5
GMES Space Component(s) & Data Access Coordination...

GMES Service Segment

GSC Coordinated Data Access System

Data Access Portfolio (DAP)

GMES Space Component

GMES Sentinels GS

TT&C Stations

Acquisition Stations

FOS

Sentinels

PDGS

GMES Service Segment

Final end-user Information products

USER Segment

Landsat Science Team meeting, Mountain View, 19 Jan 2010 B. Hoersch
GMES dedicated missions: Sentinels

**Sentinel 1 – SAR imaging**
All weather, day/night applications, interferometry

**Sentinel 2 – Multispectral imaging**
Land applications: urban, forest, agriculture,..
Continuity of Landsat, SPOT

**Sentinel 3 – Ocean and global land monitoring**
Wide-swath ocean colour, vegetation, sea/land surface temperature, altimetry

**Sentinel 4 – Geostationary atmospheric**
Atmospheric composition monitoring, trans-boundary pollution

**Sentinel 5 and Precursor – Low-orbit atmospheric**
Atmospheric composition monitoring

2012, 2014+
2013, 2014+
2013, 2014+
2013, 2014+
2018+
2014, 2020
Sentinel–1: C-band SAR mission

✓ **Applications:**
  - ice and marine/land monitoring
  - mapping in support of humanitarian aid in crisis situations

✓ 4 nominal mutually exclusive operation modes
✓ 2300 Kg spacecraft mass
✓ Sun synchronous orbit at 693 km mean altitude
✓ 12 days repeat cycle
✓ 7 years design life time, consumables for 12 years
### Sentinel-1: C-band SAR mission

- **20 min/orbit** (Orbital period: 98.6 minutes)
- **Daily coverage of high priority areas**, e.g., Europe, Canada, shipping routes.
- **Bi-weekly global coverage**

**Operation modes:**

<table>
<thead>
<tr>
<th>Modes</th>
<th>Resolution</th>
<th>Swath Width</th>
<th>Polarisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stripmap (SM)</td>
<td>5 x 5 m²</td>
<td>&gt; 80 km</td>
<td>HH+HV or VV+VH</td>
</tr>
<tr>
<td>Interf. Wideswath (IW)</td>
<td>5 x 20 m²</td>
<td>&gt; 250 km</td>
<td>HH+HV or VV+VH</td>
</tr>
<tr>
<td>Extra Wideswath (EW)</td>
<td>25 x 100 m²</td>
<td>&gt; 400 km</td>
<td>HH+HV or VV+VH</td>
</tr>
<tr>
<td>Wave (W)</td>
<td>5 x 20 m²</td>
<td>20 x 20 km² at 100 km spacing</td>
<td>HH or VV</td>
</tr>
</tbody>
</table>

*1 day coverage (IW mode) Europe*
Sentinel-2: Superspectral imaging mission

✓ Applications:
  • generic land cover maps
  • risk mapping and fast images for disaster relief

✓ 13 spectral bands (VIS, NIR, SWIR)
✓ Spatial resolution: 10, 20 and 290 km swath
✓ 1200 kg spacecraft mass
✓ 5 days repeat cycle with 2 satellites
✓ Sun synchronous orbit at 786 km mean altitude
✓ 7 years design life time, consumables for 12 years
✓ **Applications:**

- Sea/land colour data and surface temperature
- Sea surface and land ice topography

✓ **1250 kg spacecraft mass**

✓ **Sun synchronous orbit at 814.5 km mean altitude over geoid**

✓ **27 days repeat cycle**

✓ **7 years design life time, consumables for 12 years**
Sentinel-3: mission instruments

- **Ocean and Land Colour Instrument (OLCI):**
  with 5 cameras covering 400 to 1020 nm, binned to 15 (MERIS) & 6 additional bands
  Swath: 1100 km

- **Sea and Land Surface Temperature Radiometer (SLSTR):**
  with 7 AATSR & 2 additional bands,
  with 500 m (solar) and 1 km (TIR) on ground resolution
  Swath: 1160 km/750 km (single or dual view)

- **RA package:**
  SRAL Ku-C altimeter (LRM and SAR measurement modes), MWR, POD (with Laser Retro Reflector, GPS and DORIS)
Sentinel–4: GEO atmospheric mission

- **Applications:**
  - air quality, climate forcing and stratospheric ozone and solar radiation

- **Instrumentation:**
  - UV-VIS-NIR-SWIR spectrometer and thermal IR sounder
  - cloud imager

- **Spatial sampling 8 x 8 km² and spectral resolution between 0.12 nm (near-IR) and 0.5 nm (UV, visible)
- **Geostationary orbit, at 0° longitude
- **Embarked on MTG-Sounder Satellite and operated by EUMETSAT**
Sentinel–5: LEO atmospheric mission

✓ **Applications:**
  - air quality, climate forcing and stratospheric ozone and solar radiation

✓ **Instrumentation:**
  - UV-VIS-NIR-SWIR spectrometer and thermal IR sounder
  - cloud imager

✓ **Sun-synchronous Low Earth Orbit platform at 824 km mean altitude**

✓ **Spectral resolution between 0.25 nm and 1.1 nm**

✓ **Sentinel-5 embarked on post-EPS and operated by EUMETSAT**
Sentinel-5 precursor: LEO atmospheric mission

✓ **Applications:**
  - air quality, climate forcing and stratospheric ozone and solar radiation

✓ **Instrumentation:**
  - UV-VIS-NIR and SWIR spectrometers
  - no thermal IR sounder
  - no cloud imager

✓ Sun-synchronous Low Earth Orbit platform at 824 km mean altitude
✓ Spectral resolution between 0.25 nm and 1.1 nm
✓ To fill data gaps (2015-2020)
Air quality and climate protocol monitoring missions can be combined due to large overlap of requirements.

System concept driven by air quality geographical coverage and time resolution requirements. Trade-off between geographical coverage and temporal sampling:

<table>
<thead>
<tr>
<th>Option</th>
<th>Latitude range [deg]</th>
<th>Longitude range [deg]</th>
<th>Revisit time</th>
<th>Implementation option</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30 - 65 N</td>
<td>30 W - 45 E 40 N</td>
<td>0.5 - 1 h solar ch. 0.5 - 2 h thermal ch.</td>
<td>1 GEO</td>
</tr>
<tr>
<td>2</td>
<td>30 - 60 N &amp; 30 - 60 S</td>
<td>All</td>
<td>2 h</td>
<td>Constellation of drifting LEO / MEO</td>
</tr>
<tr>
<td>3</td>
<td>All</td>
<td>All</td>
<td>4 h</td>
<td>Constellation of SSO</td>
</tr>
</tbody>
</table>

**Option 1 selected:** lowest cost, synergy with meteorological payload through implementation on EUMETSAT platforms and highest diurnal sampling frequency over Europe.
**L0 Sentinels data volume for archiving (in PB/year)**

- **e.g. one S-2**
  - Uncompressed full-swath square, full band product = 15 GB
  - 1.6 TB of compressed raw images/day (2 sats)

![Bar chart showing yearly and cumulative data volume for Sentinels L0](chart.png)
Sentinel data volume compared to Envisat

Systematic NRT

S1-A

ENVISAT ASAR

GB

0
100
200
300
400
500
600
700
800
900
1000

Systematic NRT (Average S-1 Scenario) [GB/day]
SYNERGY EFFECTS

- Sharing infrastructures and resources & Budget optimisation

- Access to space infrastructure worth 3Bio Euro at a cost of at least 2 orders of magnitude lower…

- Many contributions today for free e.g. ESA (equivalent ~35 Mio Euro licence fees), Eumetsat, CNES
Phases & funding in DA

- DA Grant
- Delegation Agreement
- GSC Ops Phase
- GIO

2007-2010
- 48 ME (FP7 funds ~37 ME EO data)

2010-2013
- Joint funding
  - ESA-EC 50 ME

2011-2013
- + up to 50 ME, tbc

> 2014
- TBD ME
GSCDA Web portal: the entry point

http://gmesdata.esa.int
offering e.g. Large Coverages

European wall-to-wall coverage

20+25m spatial resolution

twice 5.8 Mio km²

Coverage 1

Africa coverage (22/32m) 2009/2010
Once 24 Mio km²

Coverage 2
or repeat coverages &
Systematic daily monitoring

Urban Atlas
2.5m/10m repeat coverage
2006 & 2009/10

Daily land surface monitoring

Daily Arctic Sea Ice Regions,
C-band SAR, NRT...
Open 12 hours/7 days, to be extended to 24/7 soon

- 19 SAFER calls handled
- 158 scenes delivered
  - 68 new planning
  - 90 archived products
- Acquisition speed increasing, with some GMES Contributing Missions < 2 days from notification to delivery!
Long-Term Plan for Sentinel and GMES Contributing Missions during Operations Phase: Requirements

~18 months turnaround

Access to existing GCMs

Data Access Portfolio V1.0
DAP V2.0
DAP Vx

~3-5 years turnaround

Planning of future missions

PBEO, HLSB Space Council
New Internat. Missions
New National Public Missions
New Commercial Missions

Service/User Requirements

Available Missions (operational, approved)

Gap analysis

What needs to be asked? What to be developed? Short, mid and long term?

What acquisition capacity needs to be provided?

Integration, Validation, Contracts, Agreements = coherent Ops Management of GSC towards GMES Service Component

Landsat Science Team meeting, Mountain View, 19 Jan 2010
B. Hoersch
Focus: Sentinel-2
### Mission

- **Overall Mission Lifetime**: 15 years (2 satellites)
- **Nominal In-Orbit Lifetime**: 7.25 years
  - Consumables for additional: 5 years
- **Nominal Orbit Sun Synchronous**: 786km mean altitude
  - 10:30 LTDN
- **Global revisit time**: 5 days (2 satellites)
- **Maximum Imaging/ Orbit**: 40 minutes
- **High Quality Mission Products**: Level 0, 1a, 1b, 1c, 2a
Satellite Payload: Multi Spectral Instrument (MSI)

- Pushbroom Multi Spectral Imager
- SiC Telescope
- Separate VNIR & SWIR Focal Plane Assembly (FPA)
- SWIR passively cooled 13 Spectral Bands VNIR & SWIR (443nm – 2190nm)
- Spectral Resolution 15nm – 180nm
- Spatial Resolution 10m, 20m and 60m
- Swath 290 km
- Radiometric Resolution 12bit
- Radiometric Accuracy < 5%
MSI Spectral Bands

- B1: Aerosols
- B5: B7: B8a: Vegetation Red-edge
- B9: Water-vapour
- B10: Cirrus
- B11: Snow / ice / cloud discrimination
- B12: Forest biomass above ground, lignin and starch
- B2: 400 nm
- B3: 600 nm
- B4: 800 nm
- B6: 1000 nm
- B8: 1200 nm
- B10: 1400 nm
- B11: 1600 nm
- B12: 1800 nm
- B10: 2000 nm
- B12: 2200 nm
- B12: 2400 nm

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B. Hoersch
European Space Agency
- **Ground Station Scenario**
  - Core Stations: Kiruna, Svalbard, Maspalomas, Prince Albert
  - Reliability/availability: > 0.7 / 97%
  - Geogr. Land Coverage: -56° to +83° latitude

**Launcher**
- Nominal: Vega (1400kg)
- Back-Up: Rockot (1160kg)

All land & coastal surfaces between -56° & +84° Latitude
Effective Coverage Time

Coverage time over Europe in summer with 2 satellites (ds)

Maximum effective coverage time for SC1 & SC2 (days) (<15% cloud cover; 68% confidence)

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European Space Agency
Potential Data latency: from acquisition to downlink

- 4 CGS
  - no NRT forcing: Average 6.3 h
  - with Europe NRT forcing: Average 7.6 h
### Image Quality Performance

#### Geometric Performances

<table>
<thead>
<tr>
<th>Description</th>
<th>Without Processing</th>
<th>After Image Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>A priori accuracy of image location: 2km max (3σ)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy of image location: 20m (3σ)</td>
<td></td>
<td>After image processing without control points</td>
</tr>
<tr>
<td>Accuracy of image location: 12.5m (3σ)</td>
<td></td>
<td>After image processing with control points</td>
</tr>
<tr>
<td>Multi-temporal registration:</td>
<td></td>
<td>After image processing with control points</td>
</tr>
<tr>
<td>3m (2σ) for 10m bands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6m (2σ) for 20m bands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18m (2σ) for 60m bands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-spectral registration for any couple of spectral bands:</td>
<td></td>
<td>After image processing with control points</td>
</tr>
<tr>
<td>3m (3σ) for 10m bands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6m (3σ) for 20m bands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18m (3σ) for 60m bands</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Product Definition

- **Level 0** and **Level 1A** are system products and correspond respectively to raw compressed and uncompressed data.
- **Level 1B** is radiometrically corrected
  - Dark signal, pixels response non uniformity, optical & electrical crosstalk, defective pixels, restoration, and binning for 60m bands.
  - Geometric model refined using Ground Control Points (GCP) from a global reference image (geometric model is appended to the product but not applied).
- **Level 1C** provides orthorectified top-of-atmosphere reflectances with a sub-pixel multi-spectral and multi-date registration.
- **Level 2A** provides orthorectified bottom-of-atmosphere reflectances
  - Enhanced Cloud Screening
  - Atmospheric Corrections
    - Thin Cirrus & Haze, Aerosols
    - Slope and Adjacency effects correction
    - Reverse modelling of atmospheric scattering, solar irradiance, and direct/diffuse transmittance, etc
  - Ready to support Geophysical variables extractions
    - FAPAR, LAI, Leaf chlorophyll content, Simplified land cover classification
Sentinel-2
Tiling Reference System

- Global Reference System in UTM space
  - UTM: World is divided into 6°x8° grid zones
  - Each grid zone is split into 100x100km UTM
L1C/L2A Images are orthorectified and geocoded into the preset and invariant UTM grid

- All tiles covered by the image along the swath are created, archived and accessible separately (tiles ~500MBytes each)

- In Addition: Planned to provide also a TCI (True-color image) in full res
- Max 40 min/orbit duty cycle; power/energy constraints current assumptions: 24 (-30) min /orbit acquisition (490 Mb/s)
- Systematic recording and downlink (520 Mb/s) of data to minimum 4 core ground stations in X-band & alternatively EDRS/Ka-band, tbc
- Systematic processing up to level-1C/2A with near-real-time capability (< 3hours from data sensing for tbc areas),
- Generation of predefined cloud-free coverage products for GMES data users
- Long-term archiving and download access to the data, download latency optimised for recent data
- Start of operations planned summer 2013
Subsystem PDGS/GS schedule

- PDGS SRR Dec 2009...
- GS PDR start in Q2/2010
- PDGS ITT in Q4 2010
- PDGS CDR in Q3/2011
- ...GS ORR Q3/2012
Sentinel Data Policy
“Full and open access to Sentinel data to all users”

This includes

- Anybody can access acquired Sentinel data
- Licenses for the Sentinel data are free of charge
- Online access with users registration including acceptation of generic T&C

ESA/EC joint principles for the Sentinel Data Policy

  i. approved by ESA member states at PB-EO in September 2009, and
  ii. to be approved by EC as part of Regulation of the European Parliament and the Council at the end of 2010
What does it mean?

Technically: Improved availability and easier access to EO data, simple data dissemination system and interfaces to users

Politically: Continue international trend for full and open access to EO data, in line with GEO data sharing principles, setting context for future data policies

Economically: Supports growth of VACs’ business, thus enabling growth and job creation; Increased uptake of EO data opens new markets and supports development of new products
The Sentinel Data Policy is one element of the overall GMES Data and Information Policy.

The Sentinel Data Policy is applicable to data derived from Sentinel missions (1-5, S-5 precursor) and the respective core ground segment.

Sentinels = result of a gap analysis of available satellite capacities in Europe. Access to GMES Contributing Missions (public, commercial) is and will remain essential.

Future Sentinel missions will be selected on the same basis taking into account the complementarities between Sentinel and Contribution mission data. This is elaborated in the GSC Long Term Scenario.

ESA/EC joint principles for the Sentinel Data Policy
i. approved by ESA member states at PB-EO in September 2009, and
ii. to be approved by EC as part of Regulation of the European Parliament and the Council at the end of 2010.
Implementation of the joint principles for the Sentinel Data Policy defined in

- the **GSC operations concept**: defines functionalities of the core and collaborative ground segment, and
- the **HLOP**: defines the priorities in data acquisition/provision applicable to all Sentinel missions during the operations of the GSC, and
- the **Terms and Conditions** for the use of the Sentinel Data.
GMES Space Component Operations Concept
GSC Operations Concept

- is based on
  - Sentinel missions 1-5
  - GMES Contributing Missions
  - coherent
    - data access management (mission capacity analysis etc)
    - technical interfaces (Data access integration layer)

- and includes
  1. The **GSC core ground segment** and
  2. The **collaborative ground segment** (= national ground segment facilities and GMES services), applicable to both, Sentinel and Contributing Missions
The **GSC core ground segment** will
- ensure all basic services up to level 2 data products
- mainly be based on systematic product generation & online data distribution
- maintain a well-defined product list (products and combined data sets/coverage)
- include a data access integration layer (multi-mission planning, user registration, download and data delivery services for Sentinels and data from GMES Contributing Missions)

The **collaborative ground segment** (= national ground segment facilities and GMES services) will complement the GSC core ground segment through
- Regional and national products (e.g. data formats and algorithms)
- Service specific delivery mechanisms (e.g. direct downlink)

The Sentinel Data Policy is applicable to data from the GSC core ground segment.

Special agreements will be put in place to regulate data policy issues for the collaborative ground segment.
TBC: S-2 & LDCM potential acquisition stations

Need to simulate various stations scenarios

- S-2 Core stations assumed (from simulations)
- Landsat/LDCM? ICs
- Alternative S-2 Core stations, which may be selected in ITT
Potential Sentinel collaborative GS: regional dissemination partners?
- European Data Relay satellite (EDRS)
- Direct downlink capabilities versus priorities (Near Real-time versus quasi real-time)
- GSC Facilities competitive selection process & outcome
- Sharing across Sentinels incl. conflicts in x-band downlinks
- Core vs Collaborative ground segment:
  - National collaboration opportunities
  - International collaboration opportunities
- Technical project phasing versus programmatic programme phasing
- While European requirements process gathering is well established, National Requirements process is tbd
- Etc.
ESA will generate a **Sentinel High Level Operations Plan (HLOP)**, which will:
- define the priorities in data acquisition/provision applicable to all Sentinel missions
- prioritise user access for different types of users

Priorities are applied *only in case of technical or financial constraints* or incompatibility of requirements exceeding the satellite or ground segment capacity.

Aim is to **minimize** the cases for which a *priority scheme* is needed → maximisation of **systematic** acquisition, systematic processing and systematic data availability.

Conflicts may occur due to:
- Instrument planning and operation modes conflicts
- Product generation capacity
- Data delivery capacity
### Sentinel data for GMES and other uses

<table>
<thead>
<tr>
<th>GMES Use</th>
<th>Other Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core Services</td>
<td></td>
</tr>
<tr>
<td>Downstream Services</td>
<td></td>
</tr>
<tr>
<td>Any other GMES Services</td>
<td>Utilisation by Participating States</td>
</tr>
<tr>
<td></td>
<td>International cooperation agreements</td>
</tr>
<tr>
<td></td>
<td>Science Use</td>
</tr>
<tr>
<td></td>
<td>Other Operational use</td>
</tr>
</tbody>
</table>

- **Free Access**
- **Priority management in case of conflicts through HLOP**

**Sentinel Data Policy**
Tbc Priority 1: Europe mainland and Europe Seas/Coasts

ALL possible acquisitions systematically
24h/NRT3h at end user

Selected acquisitions on-demand for Maritime Emergencies/ Surveillance in NRT3h

Selected acquisitions on-demand for Maritime Surveillance in NRT3h

Summer only
ALL possible acquisitions systematically 24-48h/NRT3h for selected emergency areas on-demand
Tbc different Priority areas
Next Steps

– Prepare draft Ops Concept for Presentation to Feb PB-EO
– Consolidate Member States comments
– Prepare Final Ops Concept for Presentation to May PB-EO
– HLOP to May PBEO
– GSC Facilities ITT Q4/2010
– Continue to seek national/international collaborative ground segment agreements
– Continue to follow requirements as expressed by all stakeholders, and consolidate operations concepts /prepare Phase E of the Sentinels