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COMMITTEE AND THE COMMITTEE OF THE REGIONS**

**Global Monitoring for Environment and Security (GMES):
Challenges and Next Steps for the Space Component**

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1. INTRODUCTION

In 2005, the EU made the strategic choice¹ of developing an independent European Earth observation capacity to deliver services in the environmental and security fields, called Global Monitoring for Environment and Security. GMES is firmly rooted on existing capacities and is complemented by additional EU components. This is an important difference to the approach chosen for Galileo.

For the space component, GMES builds on numerous scientific missions that are implemented through ESA² and national space agencies³ programmes. Some EU Member States have established operational capacities, a number of them to address their security and defence needs⁴. Moreover an intergovernmental process is in place through EUMETSAT for operational meteorology. The EU, through GMES, bridges the gaps between these two operational strands to complete the European observation capabilities through the Sentinel space missions⁵. For the foreseeable future it is not foreseen to give GMES a defence dimension.

To date, significant resources have been allocated to develop GMES: through ESA and within the EU budget through the 7th Framework Programme for Research and Technological Development (2007-2013). This investment ensures the development of the Sentinel space constellation and the implementation of data access schemes to the relevant EUMETSAT, ESA and national missions. The foundations are therefore laid for the continuity of European Earth observation beyond 2013, which is a prerequisite for the gradual development of GMES services, for which the Commission ensures the federation of user requirements.

As announced in the 2008 GMES Communication⁶, GMES consists of a space, an in situ and a service component. This Communication deals with the space component of GMES. The Space Component is the principal determinant of the ability of the EU to deliver its ambitions for the EU Earth observation programme because the spaceborne assets dictate by and large the range of services that may be delivered as well as accounts for a significant proportion of the overall cost of the system.

¹ COM(2005) 565, 10.11.2005.

² Including the Earth Explorer Missions, ERS and ENVISAT.

³ Including the French SARAL (Satellite avec ARGOS + Altika), Venus, Megha-Tropiques, Parasol, Demeter and Calipso, the German EnMap and BIRD and the Belgian VEGETATION mission.

⁴ The French Pléiades, the German TerraSAR-X and TandemX and the Italian COSMO-SkyMed. Other national missions include the French SPOT series, the German RapidEye, the Spanish SEOSAT and the UK-led DMC.

⁵ The 6 Sentinel series of missions comprise currently 7 individual satellites and two payloads onboard host spacecraft.

⁶ COM(2008)748 final of 12.11.2008

2. DECISIONS AND ACHIEVEMENTS SO FAR

Overall, the build-up phase of the GMES Space Component is well under way and the first Sentinels are planned to be launched starting in 2012. In addition, since 2008, four pre-operational GMES services have been launched, including:

- A land monitoring service;
- A marine service;
- An atmospheric composition monitoring service;
- An emergency response service.

The contribution of GMES to climate change and security services will need to be further defined.

GMES services currently make use of Europe's science missions, operational meteorological satellites and third-party missions. GMES services have already proven helpful for the EU and the international community, in particular in responding to such disasters as floods and earthquakes in Southeast Asia and the forest fires in Europe in an efficient and timely manner.

The GMES services have been designed and planned to use data from the Sentinels.

On the institutional side, the Commission has set the scene for the architecture, governance and financing aspects of GMES including the Space Component in 2008⁷. In response, the EU Competitiveness Council invited the Commission to report in 2009 on the progress made on preparation of the shift towards the full operational stage of GMES including funding through national and European contributions based on a shared governance approach⁸. The Commission adopted a proposal for a GMES Regulation⁹ and the 6th Space Council¹⁰ reaffirmed the need for the EU to establish a budget strategy within the framework of the definition of the next EU Multiannual Financial Framework.

3. BEING PREPARED FOR THE NEXT STEPS

Following on the development of GMES at pre-operational stage on the basis of combined EU and ESA investments, further steps need to be taken to ensure that the investment taken so far pays off and that GMES becomes fully operational in the most cost-conscious way.

In the short-term, it is important to assure the financing for the operations of Sentinels 1, 2 and 3 A units which are the first to be launched. The Commission's proposal for a GMES programme regulation makes provision for a financial contribution. It is equally important to complete the financing of the build-up phase (development and launch) of Sentinels 1, 2, 3 B units.

Seamless Sentinel data continuity towards the users should be guaranteed through the most cost-effective approach ensuring best value for money. Therefore, there will be a need to ensure the operations and successive replacement by recurrent units of all 12 GMES Sentinel missions. Whilst it is desirable to assure Europe stays at the cutting edge of satellite design, in the context of an operational programme frequent technological upgrades (which always mean a new generation of satellites) should be avoided. All decisions need to be taken by 2011.

⁷ COM(2008) 748, 12.11.2008.

⁸ Competitiveness Council Conclusions "Towards an EU GMES Programme" 16267/08 of 2.12.2008

⁹ COM(2009) 223, 20.5.2009.

¹⁰ Council [Resolution 10500/09](#) of 29.05.2009.

Keeping GMES fully operational in the next decade means a continuous research effort and guaranteed data access from other missions. Indeed, GMES will draw on some 40 missions owned by ESA, EUMETSAT and some EU Member States. Data access schemes for private operators and through international cooperation are being prepared. Although satellite lifetime varies, these missions are, in general, currently planned until roughly 2020. There is also an issue whether Member States intend to continue these missions. For the sake of the continuity and cost-efficiency of GMES, clarity is needed from Member States concerning the planning for the continuation of these missions¹¹.

According to the ESA long term scenario¹² analysis, the financial effort would represent in total some €4 billion for the period 2014-2020. This investment includes estimated annual costs of €430 million for the operational activities and €170 million for R&D. Finally, there is a need to continue the discussion whether the envisaged scope of GMES should be upgraded beyond 2020 or not. This examination will have to take place against observation and information requirements as identified by the EU and the background of an increased frequency of space observations worldwide.

The 6th Space Council invited ESA to consolidate the long term scenario analysis through further consultation with EUMETSAT and Member States owning space infrastructure by the end of 2009. The potential EU contribution to GMES beyond 2013 will be identified against this programmatic context and will be subject to an ex-ante budgetary evaluation within the framework of the definition of the next EU Multi-annual Financial Framework. It is however important to underline that investments in GMES are based on long-term commitments which are associated with long-term financial expenditure.

4. OWNERSHIP AND DATA POLICY

In accordance with its proposal for a GMES Programme Regulation to support the implementation of a full and open access data policy, the Commission intends, in consultation with ESA, to develop a legal and regulatory framework for GMES.

In this context, the ownership of the Sentinels is still an open issue which needs to be clarified. The Council has mandated the Commission to do that¹³. According to the EC-ESA Agreement on the Implementation of the GMES Space Component, ESA currently takes care and custody of the satellites, space systems and other items produced in the framework of the GMES Space Component programme, including the Sentinels, until further arrangements are made.

Ownership confers exclusive rights and control of the property which allows the owner to determine how a given space infrastructure should be used. Hence, ownership is intrinsically linked to governance. The owner of the infrastructure should also be the programme manager in order to be able to make decisions on the nature of the infrastructure, the conditions of its use and the related obligations such as maintenance, liability and asset management.

One possible way forward is that the Commission would become owner of Sentinel infrastructure on behalf of the EU. This approach would be coherent with that being developed for EU-led space applications programmes, notably the European GNSS Programmes (EGNOS and Galileo). However, further discussion with all stakeholders is

¹¹ Planning to commercialise missions, or industrial planning to continue developing certain missions commercially, cannot be a legal commitment but will always be contingent on the viability of the corresponding business models.

¹² ESA/C(2009)36:

¹³ Council [Resolution 10500/09](#) of 29.05.2009.

needed and a final decision will only be taken once priorities and allocations of the new Multi-annual Financial Framework (beyond 2013) have been established.

One of the most important actions linked to ownership is the implementation of a data policy aiming to the widest and easiest possible access for the users.

Following the full and open access principle in the proposed GMES regulation, the Commission will suggest the following principles for the Space Component:

- A free and open access data policy for the Sentinels through a free of charge licensing and online access scheme, subject to security aspects. Such an approach aims at maximising the beneficial use of Sentinel data for the widest range of applications and intends to stimulate the uptake of information based on Earth observation data for end users.
- Improved data access conditions negotiated for missions not under the control of the EU, against a financial contribution and provided that it can be cost-efficient. Achieving a partnership approach with the Member States and other nations operating third-party missions should be the ambition.

5. GOVERNANCE

The Commission has proposed to establish and sustain an operational European Earth observation capacity through an EU-led programme. ESA contributes, through its GMES Space Component Programme, to the development phase of the operational EU programme.

Therefore, the implementation of the GMES Space Component will depend on the successful interaction of the following main actors: the European Commission assisted by Member States, ESA as the coordinator of the GMES Space Component, and EUMETSAT. In the view of the Commission, the following assignment of tasks would maximize the synergies between the different partners.

The European Commission will ensure the overall coordination of the EU Earth observation programme including programme management, federation of user requirements, data policy, EU budget implementation and international cooperation and support to market development. The Commission will rely, where relevant, on the scientific and technical expertise, including remote sensing, of its Joint Research Centre.

The Commission will set up a coordination mechanism with the GMES Partners Board through focusing the discussions and facilitating decisions in the relevant boards of other partners (ESA, EUMETSAT, Member States).

ESA is best placed and should therefore continue to act as the development and procurement agent on behalf of the EU.

ESA will also operate, ad interim, space infrastructure for land monitoring and emergency response, until a final operator is identified.

EUMETSAT will operate space infrastructure for oceanography and atmospheric composition monitoring.

ESA and EUMETSAT would have to establish structures in order to adequately manage delegated tasks for and on behalf of the EU.

6. PROCUREMENT POLICY FOR THE GMES SPACE INFRASTRUCTURE

The main objective of the operations phase of the Sentinels is to ensure a continuous data flow towards the users. This will include not only technical aspects, such as the control of the

space infrastructure and data distribution, but also the gradual replenishment of the space infrastructure in the decades to come.

The overall approach for procuring space infrastructure should be identified building on the lessons learnt of the current build up phase of the GMES Space Component and the well-established ESA/EUMETSAT cooperation model for meteorological satellites. The following principles should be included:

- The purpose of procuring space infrastructure is to ensure a continuous availability of Earth observation data. This implies that the development of the follow-on generation and the exploitation of the existing infrastructure take place in parallel.
- The procurement should aim at ensuring best value for money and maintaining technological non-dependence for Europe. It should be implemented through competition whilst ensuring the best possible use of space industrial capacities in Europe. It has to be kept in mind that infrastructure and its exploitation last over long programmatic cycles (e.g. 15-20 years).

7. INTERNATIONAL COOPERATION

International cooperation has always been intertwined with GMES as the European Earth observation capacity. GMES is addressed in bilateral space dialogues between the EU and major space nations, in order to identify ways of balanced cooperation.

The EU conducts a dialogue with the African Union and African regional organisations to examine ways of using GMES in support to development policies.

GMES is also at the heart of the EU contribution to the Global Earth Observation System of Systems (GEOSS): Data sharing principles defined in this multilateral forum form one of the bases for the Sentinel data policy.

In the context of the Committee of Earth Observation Satellites (CEOS), the Space component of the GEOSS, the Commission aims at maintaining a dialogue with international partners and contributes to the virtual Earth observation constellations developed notably in support to climate change observation.

8. CONCLUSIONS

The Commission will be the programme manager of GMES and organise itself accordingly. For the Space Component, this means:

- Finalising the development phase of the current constellation of six Sentinel series and operating the infrastructure to ensure timely and seamless flow of data to the users;
- Preparing the recurrent units and future technological upgrades of the space infrastructure, based on an established user requirement consolidation process.

The Commission will further examine the issue of ownership, including the option of becoming owner of the Sentinel infrastructure jointly funded by the EU and ESA.

Subject to successful adoption of the proposed GMES Programme Regulation, the Commission will pursue the implementation of a free and open access policy for the Sentinel data.

In line with the 6th Space Council Resolution, the Commission will propose a funding strategy on the basis of a consolidated ESA long term scenario analysis, including the design of

adequate instruments and funding schemes for the Space Component bearing in mind the cost-effectiveness of the GMES operations.

The Commission, in coordination with ESA, will conduct dialogues with Member States, and with EUMETSAT and its Member States to address synergies with other European Earth observation strands and analyse the added value of community action.

ANNEX : A Brief Overview of the GMES Missions

The GMES Space Component comprises **6 series of Earth observation Sentinel missions**. Some 12 missions split into six constellations are currently under development.

The Sentinel series comprise constellations of a number of units¹⁴. This is the answer to the user requirements for the implementation of GMES services, which expressed the need for observation continuity and seamless access to data, redundancy in the context of an operational system and increased frequency of observations.

- **Sentinel 1: High-resolution microwave imaging**

The build-up phase of the Sentinel 1 series comprises an initial constellation of two satellites (known as the A and B units). Sentinel 1 carries a Synthetic Aperture Radar (SAR). It provides all-weather capability and is useful for land applications and provides overview data under adverse weather conditions for emergency response and security. SAR interferometry has proven scientific value for terrain motion monitoring. The launch of the Sentinel 1 A is due for mid-2012. The B unit is planned although some of its elements remain unfunded to date.

- **Sentinel 2: High-resolution multispectral imaging**

The build-up phase of the Sentinel 2 series comprises an initial constellation of two satellites (known as the A and B units). Sentinel 2 is useful for land applications and provides overview data for emergency response and security. The launch of the Sentinel 2 A is due for 2013. The B unit is planned although some of its elements remain unfunded to date.

- **Sentinel 3: Medium-resolution multispectral imaging and altimetry**

The build-up phase of the Sentinel 3 series comprises an initial constellation of two satellites (known as the A and B units). Sentinel 3 is useful for global land and ocean colour monitoring. It also carries an altimeter providing complementary observations to those of the Jason series. The launch of the Sentinel 3 A is due for 2013. The B unit is planned although some of its elements remain unfunded to date.

- **Sentinel 4: Atmospheric composition monitoring from geo-stationary orbit**

The build-up phase of the Sentinel 4 series comprises atmospheric composition monitoring instruments to be embarked onboard EUMETSAT spacecraft for the Meteosat Third Generation (MTG) mission. The launch is foreseen in the 2017 timeframe and will depend on the launch dates for the MTG mission.

- **Sentinel 5: Atmospheric composition monitoring from low-Earth orbit**

The build-up phase of the Sentinel 5 series comprises atmospheric composition monitoring instruments to be embarked onboard EUMETSAT spacecraft for the post EUMETSAT Polar Orbiting System (known as post-EPS mission). The first launch is foreseen in the 2019 timeframe and will depend on the launch dates for the post-EPS mission.

A Sentinel 5 precursor satellite is currently under development to be launched in 2014 to fill in the gap between the ESA ENVISAT mission and the Sentinel 5 instruments to be embarked onboard the EUMETSAT post-EPS mission.

¹⁴ Known as the A and B units flying simultaneously, whose operations will cover the 2013-2020 timeframe, followed by the C and D units as foreseen in the ESA long term scenario.

- **Jason-CS mission: high-precision altimetry**

Continuity of high-precision altimetry missions in support of ocean surface topography as a follow-on to the Jason series.

In addition the GMES Space Component programme relies on **some 40 missions owned by Member States, ESA, EUMETSAT and other third parties** to meet the needs for GMES services. These missions are listed in the ESA GMES Space Component Programme Declaration and they are referred to as contributing missions. Data access schemes are in place to assure the availability of their data for GMES services.