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Explanatory notes

The purpose of this document is to present the understanding of the GNU consortium on the GMES process to a broad range of present and, in particular, potential future users.

This document likely also provides valuable information to service providers and other stakeholders, including decision makers of the GMES process.

This document does not and is not intended to provide a comprehensive description of the GMES landscape.

URLs

The validity of the URLs provided in this document has been verified in September 2009.

GNU
GMES Network of Users

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Preface to the revised version

As illustrated by some recent headlines found on EC and ESA websites, the GMES process is still very dynamic and far from being finally defined.

- 3 February 2009: "*Signature takes GMES to next phase. Now that the extension to the GMES Agreement between the European Commission and ESA has been signed, ESA can forge ahead and implement the second phase of the GMES Space Component with a further €205 million added to the budget*".[1]
- 20 May 2009: "*The European Commission adopted the proposal of regulation for the GMES programme ... This new investment from the EC brings GMES into an initial operational phase. It is the first concrete step towards the sustainability of the programme. ... In order to complement the running activities funded through framework programme, the European Commission has decided to invest EUR 150 millions more with the objective to make GMES operational by 2014*".[2]
- 23 July 2009: "*ESA and EUMETSAT ... signed on 20 July a Framework Agreement on the Global Monitoring for Environment and Security (GMES) Programme*".[3]

The dynamics of GMES is also demonstrated by the rapid change of information offered on the internet. Many of the citations used to illustrate positions of GMES key players in the previous version of this document are no longer available as the corresponding websites have been thoroughly restructured or have even entirely disappeared. In this revised version, more emphasis is therefore put on legal documentation that will remain available over the years.

This revised version serves two main purposes:

1 It considers suggestions for improvements on the previous version. This mainly comprises the streamlining of the financial section, the provision of additional information on the organisational context of GMES and on the atmosphere and security services.

2 It attempts to make the dynamics of GMES visible and to provide updated information on GMES to the readers. This is done by adding a subsection "*Update*" at the end of each concerned section.

[1] http://www.esa.int/esaLP/SEMAQDXPXPF_LPgmes_0.html

[2] http://ec.europa.eu/enterprise/newsroom/cf/newsbytheme.cfm?searchLevel=1&tpa_id=1004&lang=en

[3] http://www.esa.int/esaLP/SEMU8X3FEXF_LPgmes_0.html

1 Purpose of this document

"*Global Monitoring for Environment and Security*" (GMES)[4], is a European programme [COM (2008) 748] for the implementation of information services dealing with environment and security.[5]

Being a very large activity into which roughly 1.5 billion € will be invested between 2007 and 2013 through the European Commission and European Space Agency alone (see GMES - Financial Context), GMES is subject to a multitude of interests and pressures. While the central role of users within the GMES process is widely acknowledged, many users feel that their involvement could be improved. On this ground, the EC-funded project *"GMES Network of Users"* (GNU) has been established to provide users already involved in GMES with a platform to share their experiences and express their views and wishes.

The purpose of this document is to present our "GNU-understanding" of the GMES process to a broad range of present and, in particular, potential future users of operational GMES services. By stating our views and by providing recommendations, we intend to contribute to a better understanding of both opportunities and limitations of GMES for environmental policy management.[6] This document likely also provides valuable information to service providers and other stakeholders, including decision makers of the GMES process. Having read this document, a potential user should be able to make a qualified decision whether, when and how to participate in GMES.

This document is structured into short sections providing our knowledge and understanding on different aspects of the GMES process. At the end of each section, the "*GNU View*" summarises our point-of-view and provides recommendations towards increasing the usefulness of GMES for users. Last but not least, this document provides a compilation of GMES-related information sources.

This is not a GMES promotional document; for that, see e.g. the publication *"Window on GMES"* available from the website of the BOSS4GMES project (http://www.boss4gmes.eu/).

Many aspects of GMES have significantly evolved since the first version of this document.
In order to keep track of the developments and to document the dynamics of the process, important new information is summarised at the end of each section under a separate subsection „Update".

[4] On occasion of the GMES Forum 2008, GMES was officially renamed *Kopernikus* (press release available under http://ec.europa.eu/enterprise/newsroom/cf/itemlongdetail.cfm?item_id=1761). Due to objections from Poland on choosing the German spelling (the neutral Latin spelling *"Copernicus"* being unavailable due to naming rights issues), the term "*Kopernikus*" has been abandoned by the EC in November 2008 and (re-)replaced by *"GMES"* in all EC websites. However, readers should be aware that there are still websites and documents available using the term *"Kopernikus"* instead of *"GMES"*.

[5] See the official EC website on GMES: http://ec.europa.eu/gmes/index_en.htm

[6] Owing to the need to utilise its resources in a focussed way, GNU addresses the environment related part of GMES but not the Security related one. Nevertheless, many of our findings will apply to the latter as well.

2 Glossary

The following glossary explains acronyms and concepts of relevance to GMES. The information provided in the glossary was put together to our best knowledge. A preceding arrow (→) indicates terms or acronyms for which an explanation is provided in the glossary.

Acronym / Concept	Explanation
CORINE	*Coordination of information on the environment* A programme aiming at gathering information relating to the environment on certain priority topics for the European Union (land cover, coastal erosion, biotopes, etc.).
CS	*Core Service* GMES service providing standardised multi-purpose information common to a broad range of EU policy-relevant application areas (→FTS).
DG ENT	*Directorate General Enterprise and Industry* EC authority responsible for GMES.
DS	*Downstream Service* GMES service serving specific (trans-) national, regional, or local information needs. Downstream Services may be derived from →Core Services or independently of these.
EC	*European Commission* The EC is the GMES process owner and its main funding body. The probably second most important stakeholder is →ESA.
EEA	*European Environmental Agency* EEAis responsible for the coordination of in-situ data for GMES services..
EO	*Earth Observation* Earth Observation is the gathering of information about planet Earth's physical, chemical and biological systems.
ERCS	*Emergency Response Core Service* One of the three Fast Track Services (→FTS).
ESA	*European Space Agency* ESA is responsible for the GMES space component (→GSC) with the →Sentinels as major contribution. It has also funded the →GSEs.
EUMETSAT	*European Organisation for the Exploitation of Meteorological Satellites* *Within GMES, EUMETSAT shall operate →Sentinel 3 (marine part) as well as →Sentinel 4 and →Sentinel 5 (on board EUMETSAT missions).*
FP6	*Sixth EU Framework Programme for Research and Technological Development* FP6 covers the period from 2002 to 2006. Its total budget amounts to € 17.5 billion.
FP7	*Seventh EU Framework Programme for Research and Technological Development* FP7 covers the period from 2007 to 2013. Its total budget amounts to € 51 billion.
FTS	*Fast Track Service* EC-financed operational EO-based services for emergency response, land and marine monitoring. FTS are the first →Core Services with the objective of being "pre-operational" in 2008.
GAC	*GMES Advisory Council* The GAC brings together the EU Member States, the Commission, ESA, and relevant other Agencies active in Earth Observation. It has the main role of maintaining and strengthening the "political ownership" of GMES.

GEO	*Group on Earth Observations* GEO is a voluntary partnership of governments and international organisations. It is coordinating the efforts to set up →GEOSS.
GEOSS	*Global Earth Observation System of Systems* GEOSS will provide decision-support tools to a wide variety of users. It will be a global and flexible network of content providers (→GEO).
GMES	*Global Monitoring for Environment and Security* European initiative for the implementation of information services dealing with environment and security.
Governance	The GMES governance scheme shall provide the instruments necessary for long-term GMES sustainability.
GSC	*GMES Space Component* The GSC consists of dedicated space missions designed to supply data for GMES Services (→Sentinel) as well as other EO data sources providing data for GMES. The GSC is broken down into two development segments plus an operational phase as follows: ➢ Segment 1 (2006 – 2012) consists of the first GMES Sentinel missions (Sentinels 1, 2 and 3) and the "Phase A" studies for Sentinels 4 and 5. It also contains the ground segment development including the integration of and harmonised access to non-ESA data for GMES services. Segment 1 is broken down into Phase 1 (2006-2009) and Phase 2 (2008-2012). ➢ Segment 2 (2008 – 2013) consists of the second generation of GMES Sentinels 1, 2 and 3. It also includes instrument development for Sentinels 4 (two instruments) and 5, pre-operations, operations, payload data ground segment completion and data access. ➢ The Operational Programme (from 2014 onwards) consists of the third and fourth generation of GMES Sentinels 1, 2 and 3 as well as continued operations and data access.
GSE	*GMES Services Element* ESA-financed pilot services targeting specific policy drivers by providing customised products for individual end users.
In situ	Air-, sea- and land-based systems collecting measurements compliant with GMES service requirements.
INSPIRE	*Infrastructure for Spatial Information in Europe* European Directive aiming at the creation of a European spatial information infrastructure that delivers integrated spatial information services to the users.
IP	*Integrated project* Large R&D projects financed by EC through Framework Programme 6.
LMCS	*Land Monitoring Core Service* One of the three Fast Track Services (→FTS).
MCS	*Marine Core Service* One of the three Fast Track Services (→FTS).
Pilot service	→Core services emerging in thematic areas not covered by the →FTS. The first pilot services cover atmosphere and security relates issues.
Remote sensing	Remote sensing is the acquisition of information about an object or phenomenon by a device located a considerable distance from the object or phenomenon. Space-borne remote sensing is a frequently used →Earth Observation technique for observing large or inaccessible areas of the Earth surface.

Sentinel	European satellite program under the GMES umbrella: Sentinel-1 is a radar imaging satellite mission for land and ocean services; Sentinel-2 is a high-resolution optical imaging mission for land services; Sentinel-3 is a global ocean and land monitoring mission; Sentinel-4 and -5 are in a pre-definition stage. They would be atmospheric chemistry monitoring missions, one on a geostationary (Sentinel-4) and one on a low Earth orbit (Sentinel-5).
SEIS	*Shared Environmental Information System* SEIS is a collaborative initiative of the →EC and the →EEA) to establish together with the Member States an integrated and shared EU-wide environmental information system.
Subsidiarity principle	When applied in a European Community context, the subsidiarity principle means that the Member States are responsible for areas which they govern more effectively at their own level, while the Community is given those powers which the Member States cannot discharge satisfactorily at national, regional or local level. The subsidiary principle is intended to ensure that decisions are taken as closely as possible to the citizen.

3 What is GMES?

In the past, there has been no common agreement on the exact nature of GMES. Different stakeholders have underlined different aspects as to what GMES means to them. E.g., while the European Commission communicated GMES as a generic tool to provide information services targeting environment and security, ESA has rather presented GMES as a program for establishing an infrastructure for Earth observation.

As one important step towards building a greater consensus on GMES, all major stakeholders met in Munich in April 2007 and produced the so-called *Munich Roadmap*[7], which communicates the nature of GMES as follows:

- *"GMES is the European solution to respond to the needs of citizens in Europe to access reliable information on the status of their environment."*
- *"GMES addresses … the European policy makers' need of better monitoring the earth system for targeted environmental and security management."*
- *"GMES is an important European asset for international co-operation and partnerships."*

The following introductory statement is provided on the GMES website[8] of the EC:

- *"GMES will be the European programme implementing an Earth observation service system with satellites, sensors on the ground, floating in the water or flying through the air to monitor our planet's environment and to support the security of every citizen."*

There are several aspects as regards the "Global" in GMES:

- GMES aims at providing an operational global EO capacity under European control.
- GMES shall fulfil the European need for information at global level, i.e. GMES shall be a tool for global monitoring primarily targeted at European users.
- GMES is expected to be the main European contribution to the global 10-year Global Earth Observation System of Systems (GEOSS) implementation plan.
- GMES shall be a tool for cooperation linked to development, humanitarian aid and emergency situations worldwide and, more specifically, with Africa.

3.1 Update 09/2009

The published positions of the main stakeholders as regards the nature of GMES have converged during the last year. It is now clear that the GMES process will be controlled by the EC with ESA and EUMETSAT bringing in their expertise on the operation of Earth observation systems (see GMES Governance).

In its proposal for the regulation of GMES [COM(2009) 223], GMES is introduced in article (1) as

[7] http://www.bmvbs.de/Anlage/original_1006811/The-Way-to-European-Earth-Observation-Services-GMES-The-Munich-Roadmap-accessible.pdf

[8] http://ec.europa.eu/gmes/overview.htm

follows:

- *"This Regulation establishes the European Earth observation programme (GMES) (hereinafter "GMES programme") and lays down the rules for the implementation of GMES initial operations."*[9]

As regards the objectives of GMES, article (3) of the proposal for the regulation of GMES [COM(2009) 223] states:

- *"GMES is an Earth observation initiative led by the European Community and carried out in partnership with the Member States. ... Its objective is ... to provide information services, which give access to accurate data and information in the field of environment and security under Community control and are tailored to the needs of a wide range of users. Users include decision-makers at European, national, regional and local levels who develop and implement environmental policies."*

GMES is supposed to become a key tool to support biodiversity and ecosystem monitoring, as well as climate change mitigation and adaptation. While GMES shall mainly serve public authorities, it is also supposed to create opportunities for increased private sector usage of information sources.

In general, GMES has undergone a significant shift in its philosophy. Earlier, GMES was communicated as an initiative to bring tailored services to a large variety of users, using EO as one data source among others. Now, GMES is mainly targeting users on a national to pan-European level using EO as the main information source.

As laid out in the section "What Does GMES Offer Today?", GMES is still a pre-operational programme. First operational GMES services are now envisaged by 2013 [COM(2009) 223, Annex].

The GNU View

- *The diverging views of the main stakeholders as regards the nature of GMES have raised suspicions amongst users that GMES is mainly a tool for financing Earth Observation infrastructure with little resources left for the in situ and services components.*
- *In order to be fully successful for a broader user community, GMES needs to better combine remote sensing, in situ monitoring networks and standardised services in a balanced way to provide information of higher quality and cost effectiveness.*

[9] Interestingly, GMES is referred to therein as a synonym for the European Earth observation programme of the European Community. Does this mean there is no other Earth observation programme of the EC outside GMES?

4 Who is GNU?

GNU stands for "*GMES Network of Users*"[10]. The mission of GNU is to provide an independent platform for users of environmental GMES services and to optimise the socio-economic and technological benefits to users at national/regional level.

GNU attempts to accomplish its mission through the following main objectives:

- To defragment the environmental GMES user communities.
- To enable independent and unfiltered user statements.
- To be a mouthpiece for the needs of GMES users of national/regional level.
- To aggregate and differentiate users' appraisals of GMES products.
- To link data-related and human aspects of the socio-technological system GMES.

The GNU partnership involves sixteen major national and regional level GMES user organisations, a European Topic Centre, four scientific institutions, and two small companies supporting the network. Funding for GNU is provided by the Sixth Framework Programme of the European Commission. The GNU project is coordinated by the Austrian Environment Agency.

All members of the GNU consortium are actively involved in GMES, including utilisation of pre-operational services received through GMES projects and participating in GMES related bodies such as the GMES Advisory Council (→GAC).

GNU federates an "*Extended Consortium*" to broaden and deepen our background and to strengthen the dissemination of GNU results. Further feedback is gathered from the "*International Level Stakeholder Group*" representing organisations or initiatives operating at European or international levels, and bearing different relations to GMES.

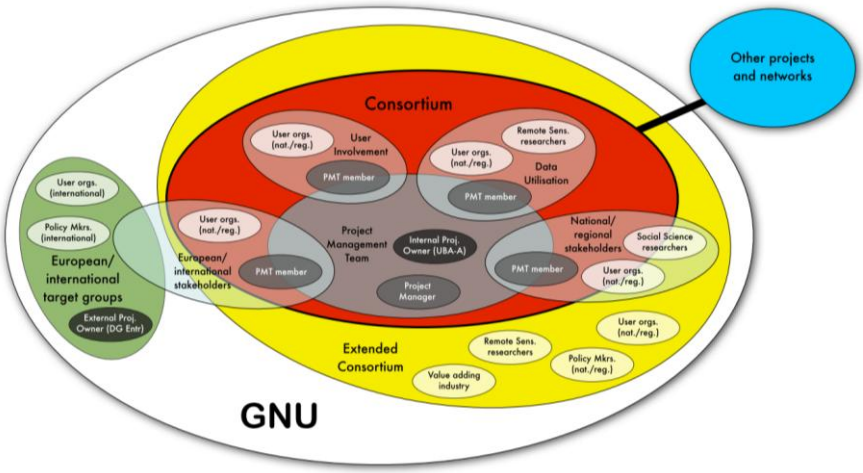

Figure 1: The GNU project organisation (Source: GNU Manual)

[10] see http://www.gmes-network-of-users.eu/ for more information on GNU

5 The Architecture of GMES

The proposed architecture of GMES consists of two major components: observation infrastructure and services, each consisting of two sub-components (see e.g. the Munich Roadmap, footnote 7).

The GMES observation infrastructure would consist of:

- The *"Space infrastructure"*, encompassing
  - Dedicated missions designed to supply data for GMES services,
  - Contributing missions compliant with GMES service requirements.

  ESA would be responsible for the implementation of the GMES space component.
- The *"In situ infrastructure"*, using land-, air-, sea-, and ice-based systems collecting measurements compliant with GMES service requirements.
  The in situ infrastructure would mostly be built upon already established capacities operated by national or regional level institutions. The European Environment Agency (EEA) would be in charge of facilitating the provision of in situ data to the GMES services.

The GMES services would consist of:

- *"Core Services"*, providing standardised multi-purpose information common to a broad range of EU policy-relevant application areas.
- *"Downstream Services"*, serving specific (trans-) national, regional, or local information needs. Downstream information products would predominantly be derived from products of the Core Services, but they may in principle also be directly derived from data provided through the observation infrastructure.

The anticipated time frame for implementing the GMES components is presented in Table 1.

Table 1: Anticipated time frame for implementing GMES components

GMES component	Status quo	Time frame
Space infrastructure	Contracts for building the first satellites of the →Sentinel 1-3 missions have been issued. Contracts for first Sentinel 4 and 5 satellites have not yet been awarded.	Sentinels 1-3 are expected to be launched in 2011-2012. No launch dates for Sentinels 4 and 5 available yet.
In situ infrastructure	Implementation of the in situ is the responsibility of the EU member states.	Not known
Core Services	Three →Fast Track Services are currently being implemented. A limited number of additional →Core Services will follow.	Fast Track Services: expected to be "pre-operational" in 2008.
Downstream Services	FP-7 call targeting the development of →Downstream Services has been issued.	Development of Downstream Serv. likely to start in 2009.

5.1 Update 09/2009

The former distinction between "*Core Services*" and "*Downstrean Services*" as sub-components of the GMES service component has been abandoned. According to the most recent official documents on GMES [COM(2008) 748, COM(2009) 223], the GMES architecture would now consist of:

(a) Service component, ensuring access to information covering the following thematic areas: land monitoring, emergency management, security, monitoring of the marine environment, atmosphere monitoring, climate change adaptation and mitigation.

(b) Space component, ensuring sustainable space-borne observations for the thematic areas referred to in point (a).

(c) In situ component, ensuring observations through airborne, seaborne and ground-based installations for the thematic areas referred to in point (a).

Interestingly, the term *"Core Service"* does not appear in the two above mentioned legal documents at all, while the term *"Downstream Service"* is used in the context of services to be developed possibly based on GMES information products but outside of direct GMES funding schemes.[11] [12] Downstream services are apparently no longer considered being an intrinsic part of GMES. However, the EC is still stimulating the development of downstream services through a dedicated call for proposals (SPA.2010.1.1-01), with the expectation that the such supported services shall be financially self-supportive at the end of the respective project funding.

The GNU View

- *Clear definitions of Core Services and Downstream Services should be provided, clarifying the difference and specifying the interfaces between the two service sectors.*
- *Core Services should provide basic products serving multiple purposes free of charge. One important purpose would be to provide the foundations for Downstream Services.*
- *Core Service product generation should be operated in a modular approach with clearly defined processing levels (e.g. raw data, geo-rectified and calibrated images, derived information) allowing intermediate products to be branched off for downstream usage.*
- *GMES data flows should clearly reflect the subsidiarity principle. That is, Downstream Services serving national and regional users would in parts determine the outputs of the corresponding upstream Core Services.*
- *Building Downstream Services from Core Services may prove problematic as the Core*

[11] COM(2009) 223, p. 12 (8): "*Community action is necessary in the period of 2011-2013 to ... establish operational services ... in areas ... with a proven potential for the development of downstream services.*"

[12] COM(2009) 223, p. 18, article 8, 1(c): "*The data and information policy for actions financed under the GMES programme shall have the objective [to] ... strengthening Earth observation markets in Europe, in particular the downstream sector...*"

Service products will often not meet the resolution required at subsidiary levels.

- *Referring to the previous item, the Core Service / Downstream Service model should accommodate a bottom-up aggregation of data. While it is possible to reduce the detail of local data, it is not possible to increase the degree of detail of European data.*
- *As Downstream Services are not financed by the EU, it is not clear why they are part of GMES at all. This has confused many users.*
- *The role, scope and implementation of the in situ component should be clarified. As has been stated in several previous communications of the EC, the GMES in situ component should in the future have equal weight with the space component.*
- *A strategy for the integration of established individual national and regional operational in situ measurement networks into the overall GMES in situ infrastructure should be devised.*
- *To meet the needs of GMES, existing in situ networks must be completed and adapted. This should clearly be reflected in GMES funding schemes.*
- *The concepts "in situ" vs. "remotely sensed" as well as "ground-based" vs. "space-based" should be clearly defined and be consistently applied. In situ measurements require that the instrumentation be located directly at the point of interest and in contact with the subject of interest. Air-borne imagery of land surfaces should not be considered as an in situ method.*

6 GMES Governance

The GMES governance scheme is still under development. It would provide the management, financial and programmatic instruments necessary to guarantee long-term sustainability of GMES service operations. More specifically, the scheme would have to perform integrating and harmonising functions, such as:

- Establishing data and information access policies including legal issues.
- Federating new users and their information needs.
- Managing GMES information quality and branding.
- Acting as an interface at international level.

The two main GMES management structures existing to date are the GMES Advisory Council (GAC) and the GMES Bureau:

- The GAC brings together the EU Member States, the Commission, ESA, and other relevant agencies active in Earth Observation. It has the main role of maintaining and strengthening the "political ownership" of GMES.[13]
- The GMES Bureau coordinates GMES activities within the EC and has the task of contributing to the long-term sustainability of GMES [C(2006) 673]. Its primary focus lies in delivering the first operational GMES services by 2008.

Governance principles have already been derived for the individual components of the GMES architecture:

- The space infrastructure has the overall objective of guaranteeing the long-term continuity of GMES compliant observations. ESA would be responsible for the implementation of the overall GMES space component.
- The development, operation, and governance of the GMES in situ infrastructure would be contributed by their operating bodies at European, national, and regional levels.
- Core Services would be managed by dedicated governance schemes on the basis of their specific characteristics. These schemes would ensure implementing, controlling and evolving the services, as well as product archiving and data management.
- Downstream Services operation and management would be driven on national or regional levels responding to their specific users. The EC would support the development of these services where appropriate, and monitor them taking into account the Core Services evolution.

GMES governance schemes are currently discussed by the stakeholders. Final propositions for GMES governance are not expected before the end of 2008. Operational implementation of the governance schemes is not expected before 2011. Therefore, significant operational funding will most probably not be available before 2012.

[13] GMES Advisory Council: Terms of Reference. http://traverse.sharepointsite.net/NIVR/gmesgeo/Documenten%20Bibliotheek/Verslagen%20GAC/GAC_TOR.pdf

6.1 Update 09/2009

A proposal for the GMES Governance has been outlined in [COM(2008) 748]. The EC would be responsible for the overall co-ordination of the GMES programme, including institutional, EU budget and programme management and implementation, contribution to market development and international cooperation activities. The EC would be assisted by a Partners Board and a Programme Committee for the implementation of the EU programme. In addition, a Security Board and a User Forum would be established to advise the Commission.

The technical implementation of the programme would be mainly entrusted to European entities which interact with public and private actors.

Space component: The European Space Agency would co-ordinate the implementation of the space component and ensure its long term availability. In the short-term, the following arrangements would be made for the operations of the Sentinel missions co-financed by ESA and the EU:

- ESA would operate space infrastructure in support of land and emergency services, until an operator has been selected;
- EUMETSAT would operate space infrastructure in support of marine and atmosphere services.
- ESA would coordinate with EUMETSAT for the development of the ground segment.

In situ component: The main focus of the implementation of the in situ component is to guarantee sustainability and easy access to in situ data necessary to GMES services. In situ data and observation networks are currently mainly under control of national, regional and local authorities and different European networks. The EEA is expected to play a fundamental role as regards the coordination and implementation of the in situ component.

Services component: To ensure the provision of operational marine and atmosphere services, the EC suggests establishing a network of technical centres at EU level. Land, emergency and security services would be provided under the control of national and regional authorities. The Commission would provide technical support to the design and implementation of services at EU and national levels through its Joint Research Centre (JRC) and Eurostat services.

In 2009, an "*Evaluation of the activities of the GMES Bureau*" has been published[14]. While the work of the GMES Bureau is in general deemed successful (*"The Bureau has made reasonable progress against several of its objectives, at least within the limits imposed by its mandate, resources and institutional setting, and as such we conclude that it has been and is a broadly effective organisation."*), the authors of the study support the GNU claim for an improved user orientation of the GMES Bureau: "*The Bureau has been ... less successful in engaging national policy end-users and industrial users.*"

[14] http://ec.europa.eu/gmes/pdf/studies/gmes_bureau_evaluation_main_report.pdf

The GNU View

- *On the national level, GMES activities should not be led by ministries of technology or finance but by ministries dealing with the environment, forest and agriculture.*
- *On the national level, legally mandated organisations for GMES should be established, taking INSPIRE as a role model.*
- *On the national level, responsibilities for GMES, INSPIRE and SEIS should be linked.*
- *On the national level, user participation should be channelled through GMES focal points.*
- *On the European level, the GMES Bureau should provide an interface between national or institutional user organisations and the European Commission.*
- *Equal opportunities for Member States to participate in GMES should be established. E.g., it is not possible for service providers from non-ESA Member States to participate to the GSEs.*
- *User organisations at European, national and regional level need to be involved in the management structure of GMES on an equal footing with space and industrial partners. This could be achieved through a mandated user forum.*
- *Any proposal for GMES service development should first identify the relevant user community and then explain how the users can be best integrated.*
- *Users should be given the power to define and harmonise service requirements. This includes adequate user funding for the product/service development phases.*
- *The needs of individual national and regional users should be mainly addressed by local service providers, respecting thereby the principle of subsidiarity.*
- *GMES projects aiming at the implementation of services with a European dimension (coverage, directive) should ensure participation of at least one concerned user organisation from every EU Member State.*
- *Appropriate funding should be provided for the adaptation, standardisation and mainstreaming of current data networks, as well as for all required data sources, not only for satellite-based Earth Observation.*
- *After the establishment of operational services, GMES should no longer be financed through the (research oriented) framework programmes but should rather be operated on the basis of a strategic partnership between the EC and the member states.*
- *The mixing of public and private interests is considered an inherent problem of GMES.*

7 GMES – Organisational Context

GMES operates in a complex organisational and legal environment. There are two European activities which have a direct impact on GMES and vice versa: Shared Environmental Information System (SEIS) and Infrastructure for Spatial Information in Europe (INSPIRE).

➔ INSPIRE:[15]: The INSPIRE Directive aims at establishing an infrastructure for spatial information in Europe to support Community environmental policies. INSPIRE is based on infrastructures for spatial information established and operated by the 27 EU Member States. The INSPIRE Directive addresses 34 spatial data themes needed for environmental applications. These themes are subdivided into three annexes: Annex 1 comprises nine themes, including geographic names, administrative units and protected sites. Annex 2 comprises four themes, including elevation, ortho-imagery and land cover. Annex 3 comprises twenty-one themes, including land use, natural risk zones, atmospheric conditions, habitats and biotopes.

Metadata for Annexes 1 and 2 themes shall be available by the end of 2010; metadata for Annex 3 themes shall be available by the end of 2013. Spatial data sets for Annex 1 data themes shall be made available between June 2012 and June 2017; spatial data sets for Annexes 2 and 3 shall be made available between January 2015 and May 2019.

Obviously, many of the INSPIRE themes are of considerable interest to GMES. On one hand, INSPIRE spatial data (e.g., administrative units) might serve as input data for GMES products, on the other hand, GMES products (e.g., land cover) might be used to fill up the INSPIRE spatial data pool. In addition, INSPIRE defines the organisational framework under which GMES derived information shall be made available.

➔ SEIS:[16] [17] SEIS is a collaborative initiative of the EC and the EEA to establish together with the Member States an integrated and shared EU-wide environmental information system. Currently, a wide range of environmental data is being collected across Europe, generating valuable information for policy makers, citizens and business. To maximise the use of this information, SEIS aims to interconnect existing databases and make data easily accessible to all.

As compared to INSPIRE, SEIS is still in an early stage. A detailed implementation plan is not yet available. The European Commission's Communication „*Towards a Shared Environmental Information System*" [COM(2008) 46] outlines the SEIS approach.

There is significant overlap between SEIS and GMES. E.g., in situ data being made available through SEIS might be used for the operational generation of GMES products. On the other hand, GMES products may be part of the environmental information offered through SEIS.

Although the boundaries between SEIS, INSPIRE and GMES are not yet clearly defined, the main characteristics of the three initiatives may tentatively be summarised as follows:

[15] http://inspire.jrc.ec.europa.eu/index.cfm

[16] http://ec.europa.eu/environment/seis/

[17] http://www.eea.europa.eu/about-us/what/shared-environmental-information-system

- INSPIRE focuses on the provision of standards for the exchange of environmental information.
- SEIS focuses on the contents of the environmental information as well as the means how such information is to be provided.
- GMES uses SEIS to obtain in situ data for the generation of its products and INSPIRE for the distribution of its products.

On a global scale, GMES has been designated as the European contribution to →GEOSS.

7.1 Update 09/2009

According to COM(2009) 223, the environmental information generated within GMES shall be in line with the principles of the Aarhus Convention, the INSPIRE Directive and the Shared Environmental Information System (SEIS).

In order to contribute to the coherent and interoperable development of the GMES, INSPIRE and GEOSS initiatives through a coordinated adoption of standards, protocols, and open architectures, the FP-7 funded project *"GEOSS, INSPIRE and GMES an Action in Support"* (GIGAS) has been established.[18]

The GNU View

- *The roles and interdependencies of the three initiatives GMES, INSPIRE and SEIS need to be further clarified.*
- *More specifically, close coordination between INSPIRE and GMES is required.*
- *Compatibility issues between information products must be considered (e.g. land cover as one of the core GMES products should clearly reflect the corresponding implementation provisions of the Annex 2 INSPIRE theme).*

[18] Website of the GIGAS project: http://www.thegigasforum.eu/project/project.html

8 GMES - Financial Context

A coherent picture of the financial context of GMES is hard to achieve from publicly available documentation. Financial information is distributed across various official (e.g., formal agreements, ESA and EC communications) and "semi-official" (e.g., presentations and websites) sources reflecting the state of negotiations at different points in time. Budgets indicated for a given activity sometimes vary considerably between documents (with a tendency to increase with time). In addition, there is thematic overlap between certain activities which makes it difficult to check balances or to add up total costs. What we present here summarises our efforts to shed some light on the GMES financial context from documentation available as of September 2008.

The funding required to establish GMES is being obtained in a phased fashion, the main contributors being EC and ESA, complemented by direct contributions from the individual Member States. In general, more tangible information is available as regards the funding of the GMES Space Component (→GSC) as is for the development and operation of GMES services and data provision.

Given the complexity in administrating the financing of GMES, EC and ESA have set up a *"financial engineering working group"* to determine how the EC funds can be used for the GSC under the EC Framework Programme 7 (→FP7) rules and provisions. The use of FP7 grants requires the identification of work packages financed by ESA Member States, and work packages financed by the EC, and thus open to the 27 Member States of the EU and Associated States to FP7. As is pointed out in an ESA report [ESA/PB-EO(2007)44]: "*This exercise is heavy but in progress*".

8.1 Space Component

In 2007, ESA estimated the [long term] overall cost of the GSC alone to be € 4.34 billion [ESA/PB-EO(2007)45]. This sum was broken down as follows:

- € 1.174 billion for →GSC Segment 1 (mainly development, launch and operation of a first series of →Sentinels 1-3).
- € 1.200 billion for →GSC Segment 2 (mainly development, launch and operation of a second series of Sentinels 1-3, development of Sentinels 4 and 5).
- € 1.966 billion for the operational programme (2014 to 2023).

8.2 In Situ Infrastructure

No EC or ESA funding is currently anticipated for the GMES in situ infrastructure, as it shall be entirely financed by the Member States. This means that any harmonisation of existing in situ data collecting networks/agencies for GMES purposes has to be achieved by initiatives outside GMES.

8.3 Services

The development of GMES pilot services has until recently been financed by ESA through the so-called GMES Services Elements (→GSEs) and the EC through a number of FP6 Integrated Projects.

These activities were complemented by projects on a national scale aiming at improving the interaction between European activities and national capacities.

The development of GMES Core Services and Downstream Services is mainly funded through FP7 calls. Information on FP7 funding opportunities for GMES can be found at http://cordis.europa.eu/fp7/dc/index.cfm.

8.4 EC Funding of GMES

EC funding of GMES is made available through FP7 for the period 2007 to 2013. The allocation for the space element of FP7 is € 1.43 billion of which approximately 85% (~ € 1.2 billion) is being allocated directly to GMES as follows [ESA/PB-EO(2007)44].

- ~ € 644 million are going to space infrastructure with ESA as the predefined beneficiary.
- ~ € 114 million are made available for coordinated access to space-borne data, also with ESA as the predefined beneficiary. Of these, € 48 million shall be spent during GSC Segment 1.
- The remaining ~ € 458 million are foreseen for EC-funded projects on Core Services and Downstream Services development.

8.5 Update 09/2009

The most recent legal documents on GMES [COM(2008) 748, COM(2009) 223] describe a general strategy as regards the long term funding of GMES. They also give some details about the EC appropriations to the GMES initial operations in the years 2011 to 2013. Even though this is a clear step towards more financial transparency, an overview of what have already been spent on GMES and what the total costs might be in future is still missing.

The building blocks for a GMES funding strategy can be summarised from the above mentioned documents as follows:

- GMES is conceived as a system delivering services of public interest. Its financing is expected to be mainly public.
- As EC financing of the total costs for the necessary infrastructure could violate the proportionality and subsidiarity principles, GMES would be co-financed at European, intergovernmental and national levels.
- FP7 is an R&D tool and, as such, not designed to support GMES initial operations to the extent that these need to be ensured on a more permanent basis.
- User communities are expecting the EU to ensure the sustainability of GMES services and to implement accompanying measures in support of innovation and market uptake in the downstream sector.
- For the period 2011–2013, FP7 funds already allocated to the space theme should be supplemented by non-research funds to cover GMES initial operations.

As regards the different components of GMES, the following principles have been laid out:

- Space: The Community Programme should contribute to the in-orbit availability, operations

and replenishment of space infrastructure currently being co-financed by ESA and the EC.

- In situ: The in-situ infrastructure is developed and maintained by Member States and should remain their responsibility. The Community Programme should support the development of in-situ infrastructure by encouraging pan-European and global data collection and exchange.
- Services: With the exception of a limited contribution to the operation of the emergency response and land monitoring services, the EC contribution to GMES services currently consists in co-financing research activities under the space theme of FP7.

Financial resources amounting to 150 M€ have already been allocated to the implementation of the GMES initial operations for the period 2011-2013, These resources shall be distributed as follows:

- Emergency response services: 12 M€
- Land monitoring services: 26 M€
- Take-up of services by users: 5 M€
- GMES space component operations: 40 M€
- Access to data for services: 24 M€

Accompanying research activities financed under the FP 7 space theme: 43 M€.

The GNU View

- *The financial landscape of GMES is clearly lacking transparency.*
- *Comprehensive and coherent overviews on both past and anticipated future spending on GMES should be made publicly available, e.g. through the GMES website.*
- *The available figures clearly underline the (current) character of GMES of being primarily a mechanism for implementing a space-borne observational infrastructure. The other components of GMES (in situ and services) lack a comparable funding perspective.*
- *The assumption that EU Member States will cover the costs of the in situ component needs further insight and credible cost estimates, as:*
  - *GMES Core Services require the in situ networks to be adapted to their needs.*
  - *A substantial part of the in situ data streams required by GMES Core Services currently relies on goodwill or research.*
- *Under-investment into the in situ component holds a risk that the interface between in situ data holders and EO service providers will not be optimised to suit all stakeholders.*
- *Funding under FP6/7 may be adequate for the development of pre-operational GMES services. Once GMES services are operational, other types of funding need to be established.*
- *There is a need to fully understand and transparently communicate the real costs (both for the funding agencies and for the end users) of developing and operating GMES services.*
- *It should be clarified which budget shares are allocated to global, European / EU and national / local services.*

- *GMES services developed under ESA contracts have been financed at 100%, whereas co-financing of the commercial service providers is required by services developed under EC FP6/7. This might result in inhomogeneous access conditions to GMES services.*
- *Profit is expected by the providers of GMES services. GMES service providers may therefore not be inclined toward making GMES products publicly available free-of-charge.*
- *User involvement shall be adequately funded to enable consolidation and harmonisation of GMES service requirements and thorough service evaluation.*

9 What Does GMES Offer Today?

In 2001, GMES was aimed at achieving an autonomous and operational capability in the exploitation of geospatial information services by 2008. Despite important progress, GMES has not achieved that goal. By mid 2008, a number of individual GMES pilot services have been established in the frame of EC- or ESA-funded projects. Currently covered thematic fields comprise land surfaces, the marine and atmospheric environment as well as emergency response and marine security. GMES pilot services offer partly novel products in sometimes higher spatial resolution or wider area coverage as was previously available within the targeted user groups. In the section on Useful Information Sources, we provide the internet addresses of the most important GMES projects. A comprehensive overview on EC- and ESA-funded GMES projects is available on the EC website on GMES.[19]

GMES pilot services are usually provided on a one-to-one relationship between service provider(s) and end user(s). As a result, currently available GMES products are distributed in a patchwork-like manner, often at local or sub-national scale. A centralised catalogue on all GMES products and services delivered so far has yet to be implemented.[20] It is therefore cumbersome for potential users to get a comprehensive overview on products are services already provided within GMES. Even if they have identified potentially useful products, users will probably face difficulties in obtaining those for a number of reasons:

- Service providers sometimes limit public access to products because they fear that competitors may take advantage of their intellectual property.
- Service providers who have co-funded product generation (as is the case for private companies participating to EC-funded projects) may ask for financial compensation.
- Data protection issues are frequently raised by the direct recipients of a service, especially concerning high spatial resolution data products.

Due to a lack of process and product standardisation, current GMES information products are often not interoperable. For example, land cover information is produced in many GMES projects, but cross-cutting harmonisation efforts have not yet yielded satisfactory results. Generally agreed standards as to content and quality of GMES services and products would be a prerequisite for achieving widely supported solutions to users' information needs.

To overcome some of the above mentioned problems, several large EC-funded projects are currently targeting cross-cutting issues such as interoperability and operational structures (BOSS4GMES) or the establishment of geospatial infrastructures (HUMBOLDT).

[19] GMES projects database: http://www.gmes.info/pages-principales/projects/.

[20] Attempts to centralise access to information on services and products are meanwhile being made, a good example being the website http://www.land.eu on the GMES Land Information Services.

An analysis and evaluation of selected GMES projects based on user assessments has been compiled by GNU.[21] The experiences of the GNU participants themselves have been described in another GNU report.[22]

In spite of the above mentioned limitations and shortcomings, GMES has been very successful in a number of fields:

- Users of GMES services have built up good and lasting relationships with their colleagues from other countries. Several GMES projects have set up formalised structures to support intra-project user communication.
- Users have also understood that they need to be given more influence on the GMES process to make GMES truly useful for them.
- Users do now better understand what they can expect from Earth Observation based services and what the limitations of such services are.
- In many cases, participating users have received novel information products in previously not available coverage and / or quality.
- A competent and productive service provider landscape has been developed over the years, able to provide services for large areas at relatively short notice.

While the latter is an important asset for users, there is a danger for a service provider oligopoly to develop: Service providers that have not been part of GMES will hardly be able to compete with their counterparts that have been providing services in GMES. A thorough standardisation of the products as well as the underlying processing steps appears mandatory to avoid service provider oligopolies to develop.

9.1 Update 09-2009

As of September 2009, the availability of GMES products being made available in the frame of individual projects has generally increased. However, there is still no overarching catalogue providing a common entry point for the discovery of GMES services and products.

Currently, a number of *pre-operational* services are being implemented in the frame of FP7 (see section 10, Towards Operational GMES Services). These services are mostly being built upon their finalised FP6- or ESA-funded predecessors. Again, each service family operates their own data catalogue such that it is still very difficult to get a comprehensive overview on the GMES services offered and even more so on areas already covered by service products.

[21] N. Blanes, J. Fons and A. Littkopf: "*Analysis and evaluation of selected GMES projects*". GNU Deliverable 1.2. http://www.gmes-network-of-users.eu/fileadmin/inhalte/gnu/pdf_files/Deliverables/GNU_Previous_Projects_Report_update.pdf

[22] H. Haubold (Ed.): "*Experiences of the GNU consortium members*. GNU Deliverable1.1. http://www.gmes-network-of-users.eu/fileadmin/inhalte/gnu/pdf_files/Deliverables/GNU_Experiences_Report_rev.pdf

The GNU View

- *There has been significant delay from the official GMES schedules. Services that should have been operationally available by 2008 are still in their development stages. Realistic time schedules are essential to avoid frustrations and to increase the trust of potential users.*
- *Due to the prevailing one-to-one relationship between service providers and end users, GMES services primarily serve the needs of their direct recipients which limit their general usefulness.*
- *The lack of process standardisation negatively affects the interoperability of GMES products and increases the risk for service provider cartels to develop. Standardisation and open access to production processes regarding both intermediate and final products is deemed essential for a long-term success of GMES.*
- *A data portal providing information on all GMES services and products delivered (possibly also including direct links to data products) should be published and kept updated.*
- *The infrastructure of the GMES data portal should be established by the EC while the contents should be created by the individual service providers.*
- *Catalogue entries on GMES products and services should be based on an INSPIRE compliant metadata profile with a minimum of mandatory information required to lower the barriers for service providers to create catalogue entries.*
- *Users in GMES projects have taken much profit from communicating with their counterparts from other countries. The structures set up by the different GMES projects to foster user communication should be continued and harmonised beyond the end of the corresponding projects. This includes appropriate funding.*

10 Towards Operational GMES Services

The GMES initiative comprises a group of *vertical* services aimed at monitoring Earth sub-systems (land, ocean, and atmosphere) and *horizontal* services addressing emergency and security issues. These →Core Services are intended to provide standardised multi-purpose information for a broad range of EU policy-relevant application areas.

The Land Information Services[23] shall provide geo-information on the Earth surface regarding land use and land cover changes.

The Marine Services[24] shall combine observations and numerical predictions to provide services supporting the safety and efficiency of maritime transport and naval operations.

The Emergency Services[25] shall provide rapid mapping services in case of humanitarian crises, natural disasters, and man-made emergency situations in a timely manner and with guaranteed quality for all actors involved in the crisis management.

The Atmosphere Services[26] shall support such tasks as gauging the effect of greenhouse gases and aerosols on climate change, on air quality, and on levels of ultraviolet radiation to contribute to the EU's efforts to exploit alternative energy sources, to ensure the health of its citizens, and to meet its environmental obligations under international treaties.

The Security Services[27] shall deliver geo-information about rapidly changing situations on the ground to security services, such as peace-keepers, civil protection authorities, relief and medical agencies and authorities dealing with organised crime or terrorism.

Among the currently envisaged operational GMES services, the →Land Information Services, the →Marine Services and the →Emergency Services have been selected for *Fast Track* treatment [COM(2005) 565], with the objective of being *pre-operational*[28] by 2008. They were selected based on technical maturity, uptake by user communities, relevance for policy making, and long term sustainability of demand and supply[29]. In parallel, the full Core Service portfolio will be developed in order to address the other users' requirements.

Detailed information on the Fast Track Services (FTS) such as anticipated spatial and temporal coverage and resolution, product specifications, etc. can be obtained from the respective strategic

[23] http://www.gmes-geoland.info

[24] http://www.myocean.eu.org

[25] http://www.emergencyresponse.eu

[26] http://www.gmes-atmosphere.eu

[27] http://www.gmes-gmosaic.eu

[28] Unfortunately, the term "pre-operational" is not defined in any of the Fast Track Services' Strategic Implementation Plans. This leaves the potential user without clear information as to what service level can be expected from a "pre-operational" service, e.g. in terms of availability or access conditions.

[29] GMES *"Fast Track Services"*: Draft reports of the implementation groups to the members of the GMES Advisory Council. Cover note, GAC(2007)1, 2007.

implementation plans.[30] As the service and product portfolios of the FTS have not been finally accepted by the EC, modifications may still occur. The first versions of the FTS are currently being developed by a number of FP7-funded projects. In addition, two further pilot Core Services on atmospheric and security related issues are currently being implemented.

10.1 Land Information Services

The fast track part of the land information service consists of two components:[31]

- The *continental component* will provide generic land-cover/land use data covering the whole European continent, including land cover maps and change detection maps (see Table 2, upper panel).
- The *local component* will provide higher resolution data of built-up areas covering all major European agglomerations in an adapted classification scheme (see Table 2, lower panel).

Table 2: Envisaged fast track products of the continental component (upper panel) and the local component (lower panel) of the land information services

Products and deliverables	Spatial resolution	Periodicity
Ortho-rectified imagery	HR (20-30 m)	3-5 years
European image mosaic	HR (20-30 m)	
Land cover mapping at EU level: (to be based as much as possible on harmonisation and/or aggregation of land use/land cover maps produced at National level)	target: approximately 20 classes with 1 ha (or less) MMU, starting with the – Built-up areas, including degree of soil sealing – Forest mapping, including the distinction in broadleaved and coniferous forests	
Land cover change at EU level	20 classes with 1 ha (or less) MMU	

Products and deliverables	Specification	Periodicity
Ortho-rectified images on urban areas	VHR images (≤ 2.5m)	3 years
Image mosaic of urban areas	VHR images (≤ 2.5m)	
Urban Atlas (from 30 to 500 cities)	0.25ha MMU (for all artificial surfaces), 23 classes	
Land cover changes	0.25ha MMU	

[30] http://www.gmes.info/pages-principales/library/implementation-groups/

[31] http://www.gmes.info/pages-principales/library/implementation-groups/land-monitoring-core-service-lmcs/?no_cache=1&download=LMCS_Strategic_Implementation_Plan_Final.pdf&did=49

10.2 Marine Services

Core products of the marine services are derived from observations (satellite and in situ) or from numerical prediction models for areas identified as being of special importance to GMES: Global and Arctic Ocean, Baltic Sea, Mediterranean Sea, North-Western Shelf areas and Black Sea.

Generally, marine services will deliver products in real time, in the form of short term forecasts (10 days), and as archives of observational and optimal estimates of the relevant state variables and the 3-D state of the ocean.

The implementation plan[32] for the fast track part of the marine services provides information on the anticipated marine core products together with their anticipated delivery status at the end of 2008 (see Table 3).

Table 3: Envisaged core products of the marine services. Products expected to be available by 2008 are considered as fast track products

Geophysical State Variable	Marine core products derived from observations	Marine core products derived from models	Products expected to be available by 2008
Sea level, sea surface height	✓	✓	✓
Temperature	✓	✓	✓
Salinity	✓	✓	✓
Currents	✓	✓	✓
Surface winds	✓	✓	✓
Surface waves	✓	✓	✓
Sea ice (extent, concentration, thickness, motion)	✓	✓	✓
Biophysical State Variable			
Attenuation of solar radiation – Note 4	✓		✓
Bio-geochemical State Variable			
Chlorophyll-a	✓	✓	✓
Dissolved inorganic nutrients	✓	✓	
Dissolved O^2	✓	✓	
pCO^2	✓		
Benthic biomass – Note 3	✓		
Sediment grain size & organic content	✓		
Faecal indicators - Note 1			
Oil slicks - Note 2			

[32] http://www.gmes.info/pages-principales/library/implementation-groups/marine-core-service-mcs/?no_cache=1&download=MCS_Strategic_Implementation_Plan_final.pdf&did=50

10.3 Emergency Services

The implementation plan for the emergency services[33] is not providing explicit information on the products envisaged for fast track treatment. On a general level, the emergency services shall provide two types of maps, *reference maps* and *damage assessment maps*.

Reference maps shall be derived from pre-existent data or obtained through pre-event simulations. They will contain information about population, urban and rural habitat, economic assets, main infrastructures (dams, bridges, industrial plants, airports, bus and railway stations, hospitals, stadiums, refugee camps,…), networks (roads, railways, power and water …), possibly completed with DEM information and combined in a GIS working environment. Scaling would range from the overview scale (typically 1:100,000) to the tactical one (1:25,000). Reference maps would mainly be used for continuous monitoring and periodic updating of basic information.

Damage assessment maps are maps either directly derived from in situ data and EO images acquired during the crisis or indirectly obtained through numerical modelling and comparison between post-crisis and archived pre-crisis information. They shall provide information about the event timing, location, extent, level of hazard and damage. Scaling would range from the overview scale (typically 1:100,000) to detailed scales (1:10,000 - 1:25,000). Damage assessment maps would be provided mainly in case of crisis and "on-demand", along with the needed reference maps and the related basic information. They are expected to be delivered within 12-24 hours.

10.4 Atmosphere services

The atmosphere services[34] shall contribute to monitoring the global distribution and long-range transport of greenhouse gases such has carbon dioxide and methane, aerosols that result from both natural processes and human activities, and reactive gases such as tropospheric ozone and nitrogen dioxide. In addition, it shall be evaluated how these constituents influence climate and estimates their sources and sinks.

A number of specific operational products with European coverage are foreseen:

- Maps and data for regional air-quality forecasts.
- Retrospective assessments of air quality.
- Identifications of sources of pollution episodes.
- Toolbox for evaluating possible emergency emission control measures.
- Inputs to local air-quality forecasts, health information and warnings.

[33] http://www.gmes.info/pages-principales/library/implementation-groups/emergency-response-core-service-ercs/?no_cache=1&download=ERCS_Strategic_Implementation_Plan_Final.pdf&did=42

[34] http://www.gmes.info/pages-principales/library/implementation-groups/gmes-atmosphere-core-service/?no_cache=1&download=GAS%20WS%20orientation%20doc%2020061124.pdf&did=53

10.5 Security Services

The GMES security services shall provide the European Union with intelligence data that can be applied to early warning and crisis prevention as well as to crisis management and rapid interventions in hot spots around the world. Service chains shall be developed for each of the following domains:

- Non-proliferation and treaties.
- Crisis indicators.
- Critical assets monitoring.
- Illegal activities.
- Routes and borders.
- Crisis preparedness and planning.
- Crisis management.
- Damage assessment and reconstruction.

GMES security services will be of use both to European and national organisations and entities such as the European Commission, European Council entities (EU military staff, the situation centre) and national institutions such as ministries of foreign affairs, police organisations, intelligence centres, etc.

10.6 Update 09/2009

Currently, pre-operational services are being developed through a number of large FP7 (co-)funded projects which are building upon their respective FP6- or ESA-funded legacy projects (the indicated figures comprise: anticipated total project costs, project start, anticipated project duration):

- Land services, *geoland2* (FP7): 32 M€, Sep. 2008, 50 months.
- Marine services, *MyOcean* (FP7): 55 M€, Jan. 2009, 39 months.
- Emergency services, *SAFER* (FP7): 39 M€, Jan. 2009, 36 months.
- Atmosphere services, *MACC* (FP7): 16 M€, June 2009, 29 months.
- Security services, *G-MOSAIC* (FP7): 15 M€, Jan. 2009, 36 months.
  Still on-going is *LIMES* (FP6): 21 M€, Dec. 2006, 42 months.

As before, each new project implements its individual new websites together with proprietary data distribution mechanisms. As they are still in their initial phases, data products from the new projects have not yet been made available. However, data products from predecessor projects remain mostly available on their respective websites. A showcase in this respect are the websites of PROMOTE and GEMS (MACC predecessors) where a multitude of products on atmospheric parameters can be easily accessed until the MACC website is operational.

Among all GMES services, the emergency response services and the land monitoring services have been selected for GMES initial operations covering the period 2011-2013. This means that (non-research!) funding for continuation of these services after the end of FP7 has already been secured.

The GNU View

- *Users need to be involved in GMES projects as early as from the design and development stages to ensure that the operational dimension they need is effectively taken into account from the beginning of the project cycle.*
- *In order to allow users to assess the utility of any GMES service, documentation on product generation process, product specifications, access conditions, intended usage as well as service level agreements should be publicly available.*
- *A strategy for funding the pre-operational services after the end of FP7 needs to be devised.*
- *It needs to be elucidated in how far GMES services comply with the INSPIRE directive. Diverging developments (e.g. as regards land cover / land use classification) between GMES and INSPIRE need to be avoided.*
- *Cross-project harmonisation between the various GMES services is required.*

11 Opportunities for users

"*As a user-driven initiative, GMES should be designed in such a way that there is continuous user uptake through constant consultation with users and integration of their changing needs in an iterative process"* (Munich Roadmap).

To date, the main way for users to get involved with GMES is through participation at EC- or ESA-funded R&D projects (see What Does GMES Offer Today?). Therefore, the opportunities for users to receive GMES services without actively participating to such projects are still limited. There is no formal procedure for users to subscribe to already established GMES pilot services. The current organisational structure means that for users to become actively involved in any GMES project or service, they depend on a decision by the respective provider.

Ongoing GMES projects are in general not able to accommodate new users as project resources are distributed among the partners from the project start. Only in rare exceptions may additional funds be made available or resources internally shifted to accommodate new users and their respective service providers. Consequently, users currently not involved in GMES projects will usually not be able to receive GMES services before the availability of operational GMES services, i.e. not earlier than 2011 to 2013. Users who wish to obtain GMES products at an earlier stage should therefore consider active participation to FP7 or national R&D projects aiming at the development or operational implementation of GMES services.

Another option to receive GMES services would be to establish a business relationship with GMES service providers on a bilateral basis. In this case, the relationship between service provider and customer would probably be organised on a purely commercial basis. However, the customer would still take advantage of the know-how that the SP has acquired from his participation in GMES.

11.1 Update 09/2009

The possibilities for (new) users to take profit from GMES have not much changed since the first version of this document. Still, there exists no formal process to access GMES information products, including standardised quality information and service level agreements. Still, information on already available GMES products or services is scattered across many project specific web portals.The best way for users to obtain tailored GMES products is still to take part in projects aiming at the development of GMES services.

The GNU View

- *A formal procedure should be devised to grant new users access to established GMES services independent of service providers.*
- *It is hoped that opportunities for (new) users to take profit from GMES will be widening with the advent of the first operational GMES services between 2011 to 2013.*

12 Conclusions and recommendations

12.1 Update 09/2009

Since 2008, the communicated scope and time frame of GMES has become clearer and appears more realistic from a users' point-of-view.

- The main focus of GMES lies now on establishing and operating a European space-based Earth observation infrastructure in order to provide information services to mainly national and pan-European users.
- In addition, GMES is supposed to provide standardised basic information layers which may be used "as is" but which may also serve as a basis for service provision by independent third party service providers on the subsidiary level.
- In situ data for GMES would in principle be obtained from monitoring networks operated independently from GMES by the Member States. GMES would support in situ activities only where the existing networks are insufficient for EO information product value adding purposes.

Preliminary funding of operational GMES land information and emergency services has been secured for the period 2011-2013.

The GNU View

- *Through participation to GMES services projects, users have:*
  - *learnt to better identify and define their requirements towards space-borne EO-based services.*
  - *understood that sustainable services can only be based on common requirements (unfortunately, such common requirements have not been specified yet).*
  - *built up good relations with their counterparts in other European countries.*
- *The user community of GMES services should be more clearly and transparently identified so as to integrate the truly responsible organisations from European down to regional level, taking as such the European subsidiarity principle into account.*
- *Insufficient funding for process harmonisation or standardisation led by user federations is a threat to the development of sustainable and marketable GMES services.*
- *Today, GMES services projects are managed by data suppliers which makes that very little of the financial resources are reaching the actual users. Users would have a much better influence on the service generation process if they were directly provided with the resources and would then select and subcontract the service providers themselves.*
- *While the recent (2008/2009) clarifications as regards the scope of GMES are very welcome, many false expectations could have been avoided on the users' side if this new GMES strategy would have been devised and communicated earlier.*

- *It is mandatory to bring more stability into the GMES process to allow users to take sustainable decisions as regards GMES. It needs to be avoided to have users invest into the uptake of a GMES service only to see this service being abandoned soon after.*
- *Information on scope, architecture, funding and governance of GMES should be made available in a comprehensive and transparent manner on the GMES website of the European Commission and be updated regularly.*
- *Space-borne EO can only provide a limited subset of the information required by the targeted user segments. To better meet user requirements, the provision and integration of in situ data and statistical information should get a more prominent place in the GMES process.*
- *The way it is organised today, GMES is seen by many as a program put mainly into place to finance space infrastructure and the corresponding applications.*
- *The scope of the GMES in situ infrastructure shall be clearly specified. This will allow users to better assess what they can expect from GMES in terms of in situ data.*
- *GMES services should be based on open standardised processes to achieve transparency and to foster the development of a competitive service provider landscape.*

13 Useful Information Sources

FP6 project "GMES Network of Users"

- Website of the GNU project: http://www.gmes-network-of-users.eu.

Websites on GMES by major GMES stakeholders

- Website on GMES run by FP7 project SWIFT (http://www.ist-swift.org/):
  - Main page: http://www.gmes.info/
  - GMES library: http://www.gmes.info/pages-principales/library/reference-documents/
  - GMES project database: http://www.gmes.info/pages-principales/projects/
- EC website on GMES run by the EC: http://ec.europa.eu/gmes/index_en.htm
- European Space Policy: http://ec.europa.eu/enterprise/space/index_en.html
- ESA website on GMES: http://www.esa.int/esaLP/LPgmes.html

Websites of ESA-funded GMES Services Elements (GSEs)

- GSE Forest Monitoring: http://www.gmes-forest.info/
- GSE GMFS (food security): http://www.gmfs.info/
- GSE Land: http://www.gmes-gseland.info/
- GSE MarCoast (marine and coastal environment): http://gmes-marcoast.com/
- GSE MARISS (maritime security): http://www.gmes-mariss.com/
- GSE Polar View (polar areas): http://polarview.org/
- GSE PROMOTE (atmospheric monitoring): http://www.gse-promote.org/
- GSE Respond (humanitarian relief): http://www.respond-int.org/respondlive/
- GSE Risk EOS (risk management): http://www.riskeos.com/actus/pge/index.php?arbo=0
- GSE Terrafirma (ground motion hazard) http://www.terrafirma.eu.com/

Websites of EC FP6-funded projects developing pre-operational GMES services

- GEOLAND (land cover and vegetation): http://www.gmes-geoland.info/
- MERSEA (marine environment and security): http://www.mersea.eu.org/
- PREVIEW (risk management): http://www.preview-risk.com/
- GEMS (atmospheric constituents): http://gems.ecmwf.int/
- LIMES (security): http://www.fp6-limes.eu/

Websites of EC FP6-funded projects supporting GMES implementation

- Boss4GMES (operational implementation of GMES): http://www.boss4gmes.eu/

- HUMBOLDT (harmonisation of spatial information): http://www.esdi-humboldt.eu/
- TANGO (satellite telecommunication for GMES): http://www.teladnetgo.eu/

Websites of EC FP7-funded projects developing pre-operational GMES services

- geoland2 (land information services): http://www.gmes-geoland.info/
- MyOcean (marine services): http://www.myocean.eu.org/
- SAFER (emergency services): http://www.emergencyresponse.eu/
- MACC (atmospheric services): http://www.gmes-atmosphere.eu/
- G-MOSAIC (security): http://www.gmes-gmosaic.eu/

Important European or global initiatives with GMES relevance

- INSPIRE (spatial information infrastructure): http://www.ec-gis.org/inspire/
- SEIS (environmental information system): http://ec.europa.eu/environment/seis/
- GEOSS (global earth observation): http://www.earthobservations.org/geoss.shtml

Official EC and ESA documents

- COM(2001) 609: Commission Communication from 23 October 2001, "*Outline GMES EC Action Plan (Initial Period: 2001 – 2003)*"
- COM(2004) 065: Commission Communication from 3 February 2004, "*Establishing a GMES Capacity by 2008 - Action Plan (2004 – 2008)*"
- COM(2005) 565: Commission Communication from 10 November 2005, "*From Concept to Reality*"
- C(2006) 673: Commission Decision from 8 March 2006, *"Creating a Bureau for Global Monitoring for Environment and Security (GMES)"*
- COM(2008) 046: Commission Communication from 1 February 2008, *"Towards a Shared Environmental Information System (SEIS)"*
- COM(2008) 748: Commission Communication of from 12. November 2008, "*Global Monitoring for Environment and Security (GMES): we care for a safer planet*"
- COM(2009) 223: Commission Communication from 20 May 2009, *"Regulation of the European Parliament and of the Council on the European Earth observation programme (GMES) and its initial operations (2011–2013)"*
- ESA/PB-EO(2007)44, *"GMES Space Component Programme. Report of the Director General regarding the transition to Phase 2 of Segment 1"*
- ESA/PB-EO(2007)45, *"Preliminary Considerations for the Long-Term Scenario of the GMES Space Component"*