WORK PROGRAMME 2009

COOPERATION

THEME 9

SPACE

(European Commission C(2008)4598 of 28 August 2008)

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THEME 9: SPACE

Objective:

The objective of the FP7 space work programme is to support a European Space Policy focusing on applications such as GMES (*Global Monitoring for Environment and Security*), with benefits for citizens, but also other space foundation areas for the competitiveness of the European space industry. This will contribute to fulfil the overall objectives of the European Space Policy, complementing efforts of Member States and of other key players, including the European Space Agency.

I CONTEXT

Policy context

Europe has been active in the space sector for several decades, and activities encompass a wide spectrum ranging from launchers to application satellites. Space activities, through scientific research and especially through their direct applications, are acknowledged as strategic for their contribution to the construction of Europe and the competitiveness of the European Union.

The EU considers the space field as a strategic domain as it can directly contribute to the implementation of a large group of policy objectives, such as:

- *Sustainable Development*, (e.g. through information gathering in support of the Kyoto-protocol monitoring and the actions resulting from the Johannesburg Summit on sustainable development, taking into account also the recent "Lisbon Declaration on GMES and Africa" adopted under the aegis of the Portuguese Presidency).
- *Common Foreign and Security Policy* (e.g. in support of borders control, conflict prevention and crisis management).
- *Lisbon Strategy* (e.g. through better opportunities for Space related industries and geo-information services, improved access to space-based data for services such as GMES).

The Communication on the European Space Policy[1], a joint document of the European Commission and the ESA Director-General, was adopted in April 2007. In contrast to the reception of the White Paper[2] published in 2003, the Member States of both the EU and ESA have given strong political support to the Policy at the fourth European Space Council of 22 May 2007. It provides the overall political **framework** for the development of a viable and strong European space sector which will allow to:

- Develop and exploit European **space applications**, such as Galileo, GMES and satellite communication applications to secure maximum political, economic and social return from the investments in space technologies;

[1] COM(2007) 212 final, 26 April 2007 "Communication from the Commission to the Council and the European Parliament : European Space Policy

[2] COM(2003) 673, 11 November 2003'"Space: a new European frontier for an expanding Union"

- Establish appropriate **funding arrangements** for the operational phase of GMES, in order to ensure the sustainability of the services for users;
- Improve coordination of and to better exploit **synergies between civilian and military programmes** – of course, in full respect of respective competences. This will help to ensure that each sector can take maximum advantage of the investments of the other;
- Invest to **maintain technological expertise** as well as knowledge in space-based science and space exploration, for example through the International Space Station (ISS) and also to maintain independent access to space;
- Develop a more coordinated and coherent approach to **international relations** in space;
- Create for the first time, a **common European Space Programme**, serving as a basis for transparency of European and national space programmes.

A direct support by the EU in the field of Space should act as an incentive to exert leverage on other public players as well as on the private sector, and to encourage them to intensify their investments. Sustaining a competitive industry (including manufacturers, service providers and operators) and providing appropriate services and infrastructures requires new research into new technologies and their exploitation.

The action plan underlying the Space Work programme is based on the European Space Policy. The Work programme follows the direct recommendations of the ESP Communication, the Resolution of the Fourth Space Council, the "GMES Advisory Council" of Member States, the Space Advisory Group, as well as the User Implementation Groups for the GMES Fast-Track Services. All these bodies will also be instrumental in providing guidance to the Commission in the annual update of the Work Programme and of emerging needs, including for GMES information by policy makers.

The strategic role of GMES in the development of the EU's role as a global actor has been outlined in the February 2004 Communication[3] of the Commission, which also identifies the major EU policies to be addressed by GMES services. These can be summarised as follows:

- Europe's environmental commitments, within EU territory and globally, by contributing to the formulation, implementation and verification of the Community environmental policies[4], national regulations and international conventions;
- other EU policy areas such as agriculture, regional development, fisheries, transport, maritime policy, external relations with respect to the integration of the environmental dimension in the respective domains and their specific requirements;
- Common Foreign and Security Policy (CFSP), including the European Security and Defence Policy (ESDP);
- other policies relevant to European citizens' security at Community and national levels[5], notably the potential that exists for application to, e.g., policies related to Justice and Home Affairs activities of the European Union, such as border surveillance.

[3] COM(2004)65 final, 3 February 2004
[4] The 6th Environmental Action Plan (2004 to 2010) addressing climate change, nature and biodiversity, environment and health, natural resources and waste
[5] "A secure Europe in a better world–European Security Strategy" Javier Solana 12/12/2003

A number of GMES services shall contribute to 'achieving by 2008 an **operational** and **autonomous** European capability', as expressed at the June 2001 Gothenburg summit and in a subsequent Council Resolution[6].

In its November 2005 Communication[7], the Commission has confirmed its intention to move *from concept to reality* in supporting a variety of EU policies with geospatial information through GMES, and it has outlined the roles and responsibilities of EU institutions, the European Space Agency (ESA), and their Member States. In particular:

The **EU** will define the priorities and requirements, aggregate the political will and user demand, and ensure the availability and continuity of services. **ESA**, its Member and Co-operating States will develop space technologies and systems in the scope of the European Space Policy, and will, in particular, support and define the technical specifications of the GMES space component, implement it, coordinating centres of excellence across Europe; and advise the EU on future space component requirements. In this context, Member States may strengthen internal co-ordination of related data collection and management activities and federate national demand, contribute to the implementation of the necessary spatial data infrastructures and in-situ components, and support the implementation of the space component.

As a consequence of the above roles and responsibilities, ESA should manage the development of those space infrastructures which are identified for support under FP7, in accordance with the rules of this programme, integrating these activities with its own in this area. The Commission will manage the development of GMES services supported through FP7 and assure optimal integration of data from in-situ monitoring. After the completion of the ESA GMES Service Element projects, the further development and consolidation of such services will be the responsibility of the EC, as an integral part of its Space programme within FP7.

Crucial to the success of the GMES service component is the compliance with the requirements and the guidelines included in the INSPIRE proposal for a directive[8]. FP7 research and development activities for GMES shall therefore contribute to the ongoing INSPIRE implementation, as far as practically relevant. Furthermore, timely, reliable and relevant information on the state of environment should be made available to all and be easily understood. To this end the Commission has proposed[9] to improve, modernise and streamline the present information systems by establishing a European Shared Environment Information System, to which GMES shall contribute, as far as practically relevant.

Beyond GMES and in line with the European Space Policy other topics will be addressed in the current FP7 Space work programme, in particular in view of strengthening the foundations of European Space science and technology, without which it becomes impossible to develop truly autonomous and efficient applications.

These topics are driven in Europe by entities and agencies at European or national level. For this reason, support to upstream and exploitation actions in these topics will provide enhancement of scientific added value through synergies with the European Space Agency and Member States space agencies initiatives in the field of space science and exploration, space transportation and space technologies.

[6] Council Resolution 2001/C 350/02 (13.11.2001)
[7] COM(2005)565 final, 10 November 2005
[8] Directive 2007/2/EC
[9] COM(2008)46 final

Approach

The following paragraphs define the activities and action areas covered by the Space theme of the Framework programme, and highlight a potential range of topics which could be funded during 2007-2013. The roadmap for the Space theme currently foresees annual calls (with the exception of the first call in 2007) with a final call in 2013. This may be revised at a later stage. Some of the research topics mentioned in section I will be funded during 2009 as part of a call published in 2008 – these call topics are specifically elaborated in section II 'Content of calls for budget 2009', together with specific call topic codes (e.g. SPA.2009.1.1.01). Furthermore, some of the topics will be implemented through mechanisms other than a call for proposals (e.g. pre-defined beneficiary support actions, call for tenders) – these are identified in Section IV. Other potential research topics, having already been prioritised for a later call, are outlined in section V, in order to enable applicants to better plan ahead. Calls beyond the call conducted in 2008, however, will still be detailed in annual updates to the FP7 Space Work Programme. Applicants are advised to keep the overall scope and strategic requirements expressed in section I, as well as the actions described in section IV, in mind when responding to specific topics of a call. Furthermore, ethical principles and gender aspects must always be taken into account. The forms of the grant to be used for the different funding schemes mentioned in the Space theme Work Programme are given in Annex 3 of the Work Programme "Co-operation" 2009.

Two main classes of *activities* will be undertaken to achieve the above policy objectives:

- Space-based **applications** at the service of the European Society, with **GMES** (Global Monitoring for Environment and Security) being central to this activity;
- Providing R&D support to the **foundations of Space science, exploration, space transportation and space technology** through synergies with initiatives of ESA or other European, national or regional entities.

The support for the **first activity**, the development of GMES, is to be expressed in four main *action areas*:

i. Support to the **(pre-)operational validation of GMES services and products** based on the integration and harmonisation of related observation data (both satellite-based and in-situ, including ground-based, ship-borne and airborne), starting with the Fast Track Services.

ii. Integrated use and application of satellite communication and satellite navigation solutions with space-based observing systems, and with related non-space systems, for instance for **prevention and management of all kinds of emergency**.

iii. Support to the **coordinated provision of observation data**, both from space-based infrastructure and from in-situ observing systems.

iv. Development of **Earth observation satellites**, which relate to the management of the environment and security, and which complement in-situ systems.

For the **second activity**, the strengthening of foundations of Space science and technology, the support is to be expressed in three more *action areas*:

i. Support to research activities related to **space science** and **exploration**,

ii. New concepts in **space transportation**, and **space technologies** including **critical components**,

iii. Research into reducing the vulnerability **of space based systems and services**.

The following sections provide more explanation on each action area.

1. Action areas in support of space-based applications (GMES)

1.1 (Pre-)operational validation of GMES services and products

A comprehensive Earth observation system, using space borne and in-situ techniques (land, air and sea based) is needed for the delivery and sustainability of well defined operational services, which support the implementation and monitoring of environmental and security policies in the context of sustainable development. Although satellite systems provide a unique and globally available data source for such operational services, their effectiveness depends critically on close integration with terrestrial systems, to exploit the comparative advantage of each. Emphasis will be put on R&D activities, which both

- conduct validation of GMES services and products, and
- achieve integration of terrestrial (in-situ) and space systems into services.

In line with the orientations expressed by the Commission in its latest GMES Communication[10], and the FP7 Specific Programme objectives, the *user-driven development* of GMES services represents the first and foremost responsibility of the EC. Related actions will have to base themselves on, and take into account, user-orientations and guidelines developed already at European level, for example from previous GMES projects, and advisory bodies created at European level[11]. The overall task in this action will be to develop an extended range of GMES services which both

- meet user requirements, and
- for which the economic and societal benefits justify the investment, with a special regard to justification for investment at European level.

In order to build this strong user base for GMES services, it is necessary that needs be identified and updated, and that the service products developed be reliable and effective for operational supply. Typically, public authorities and other decision-makers at all levels (local, regional, national and international) will be among the primary users in receipt of GMES services and products. At European level, users require support in achieving EU policy objectives, for example in the fields of agriculture, forestry, fisheries, environment, climate change, health, telecommunications, safety, security, and transport. The readiness of such users to incorporate GMES information into their

[10] COM(2005)565, Global Monitoring for Environment and Security (GMES): From Concept to Reality

[11] Overall GMES orientations are part of governance discussions in the GMES Advisory Council. Extensive user requirement analyses have been established in GMES Integrated Projects in several application fields, as well as in ESA GMES Service Elements. Specific Implementation Groups representing user communities at European level have been set up for the three Fast Track Services following the GMES FTS Workshops at the end of 2005. Further information can also be obtained from http://www.gmes.info, http://ec.europa.eu/enterprise/space_research/index_en.htm and the EC services.

working methods and decision-making processes is essential. Therefore, the support given within this R&D action area will be expected to also address the familiarization of users with new or enhanced GMES services through dialogue and demonstration activities, promoting:

- knowledge exchange including technology transfer of research on environmental processes and on methodologies,
- training and capacity building.

The Commission has already identified three **Fast Track Services** (FTS) for which capacities will be put in place during 2008: Emergency Response, Land Monitoring and Marine Core Services. The three fast track services and additional pilot services to be supported within this action area are expected to provide the development of a wide range of (pre)operational ***core services*** in Europe, starting in 2008 with the FTS, based on mature technologies and service chains. The geo-data and information resulting from the *core services* projects should be made accessible, without charges, and on a non-discriminatory basis to *downstream* service providers when such activities involve developing, implementing and monitoring community policies related to the environment and security through research activities.

In other application fields, pre-operational services are not yet established, although laboratory techniques and scientific methods are already well advanced[12]. Operational services and end-to-end supply chains remain therefore to be developed and validated. FP7 will undertake **development of pre-operational GMES pilot services in new application fields** with the view of providing Europe with such generic multi-purpose services.

As a result of the first call in 2007, the **three fast track services** and **two pilot services** are already recommended for funding. These *core* services are specifically focusing on European added value.

N.B. In the course of FP7 implementation, the Commission intends also to assess which services might already have attained a fully operational level, with the full support of the relevant users, in which case they would no longer be eligible for future R&D support.

As multi-purpose services, focusing on European added value, *core services* deliver products which are the basis for a wide range of (geographically or thematically) specialized *downstream* products and services, allowing also the harmonization at European scale of services and products delivered at regional or national scale. Complementary to these *core services*, dedicated ***downstream service portfolios***, tailored for specific user needs, should bring together industrial players, institutional users as well as local and private entities to enable the maximum and efficient use of Earth observation data in support of European public policies and future commercial activities.

Starting with 2009, it is foreseen to further **stimulate the emergence and establishment of such downstream services**, to be financially self-supportive at the end of the project, ready to be based on non R&D resources, including commercial revenues whenever appropriate.

Typical examples of GMES services are the *GMES Service Element* projects supported by ESA, which contribute partly to *core service* capabilities in Europe, as well as *downstream services*. Such research efforts will be further developed and strengthened through this Work Programme.

Notwithstanding the separate action on support to the coordinated provision of observation data (see section 1.3 below), it will be necessary to provide already within the service developments also the means for more effective ways of data exchange, in a reliable way, encompassing the development

[12] It should be noted that development and research on specific earth observation and assessment tools, as well as environmental models underpinning future GMES services are undertaken in FP7 theme 6 "Environment (including climate change)".

of data management infrastructures that support the different services and with a guarantee of long-term continuity, whilst ensuring interoperability. Furthermore, GMES service projects are ideally placed to act as pilot projects for the ongoing INSPIRE Directive[13] implementation. They may therefore act as test-beds for INSPIRE, as far as practically relevant and appropriate.

1.2 Integration of satellite communication and satellite navigation solutions with space-based observing systems

Large advances have been made in recent years in establishing European autonomous capabilities in the areas of satellite communication, satellite navigation and space based observing systems. The area in which a synergetic use of these space based capacities can bring particular benefits is the support to the prevention and management of all kinds of emergency. In case of multi-use, methodologies may also have to account for the additional complex requirement of space and ground systems to guarantee integrity, confidentiality and data availability. This action will support specific *user-driven* development of such services, combining all relevant space-based systems, and integrating them with related non-space systems.

In this way, the already multifaceted and integrated nature of GMES, which brings together data from a variety of space-based and in-situ measuring systems, will be further enhanced and enriched by complementary space techniques. For example, these techniques will enable fast and effective communication and accurate positioning for events such as natural or man-caused disasters in a variety of geographical areas. The overall objective is to provide the end-users - e.g. civil protection agencies, search-and-rescue teams, and other life-guarding bodies - with all the required information in a seamlessly integrated, timely, secure and user-friendly fashion. To this purpose, account will be taken of the latest development in relevant satellite communication and navigation technologies (in particular relevant developments in the Galileo system).

1.3 Support to the coordinated provision of observation data[14]

The third action area represents a major step towards the sustained availability of data that are essential to the implementation of (pre)operational services.

Future GMES services, both during their pilot phase and when fully operational, will require an appropriate supply of input data from both space and in-situ observation systems. It will be necessary to identify the most effective way for doing this, in a reliable way and with a guarantee of long-term continuity, based on a coherent Europe-wide approach. The aim is also to support the future development of an appropriate autonomous European capacity in this context, coupled with a perspective of long-term sustainability.

Until now, most R&D actions that aim at developing GMES services have typically obtained their required input data by directly accessing them from the relevant operators (data providers). This approach, while linking directly data operators with their direct customers, i.e. the services operators, lacks a coherent European and inter-service coordination and inter-operability, and often leads to duplications.

[13] COM(2004)516 final, 23.7.2004, Proposal for a Directive Of The European Parliament and of the Council establishing an infrastructure for spatial information in the Community (INSPIRE); also COM(2006)51 final

[14] Coordination and Support Actions with pre-defined beneficiaries for these activities are strongly policy oriented and will not be managed by the Research Executive Agency (REA)

The advantages of a coordinated access to data would include:

- *to the service providers* (and ultimately to the *end users*): a coherent market of data and lower costs, already pre-processed data (e.g. ortho-rectification, digital elevation models) in a coherent way across all other services, and a guarantee of long-term availability of data.
- *to the data providers*: a bulk agreement (rather than separate small agreements), leading to a more stable industrial investment strategy, with better complementarity among different operators.

A coordinated access to data should however retain the capacity to link directly data providers and the service providers, i.e. without creating a centralised operational structure for the distribution of data. It is also expected that this action should provide a functional separation of data providers and data recipients in form of service providers (especially where these two functions may be residing in a single organisation). Giving access to data on equal grounds should give European SMEs participating in the GMES services a real boost to their competitive position.

As far as the **provision of *space-based* data** is concerned, including from non-dedicated missions (e.g. national or commercial missions), **ESA** is seen as the appropriate coordinator of the supply side during the development phase covered by this Work Programme, in full cooperation with the relevant national and European mission operators. First financial support from FP7 has been provided from the 2007 budget line, for a preliminary pilot action with a volume corresponding to EUR 48 million over a three year period. The European Space Agency is managing the GMES Space Component Data Access (GSC-DA) project in the frame of the FP7 space programme as part of the European Space Policy focusing on coordinating the access to space-based observation data to support GMES services. **The GSC-DA should supply the FP7 projects implementing GMES Services with all the required space data in a seamlessly integrated, timely, secure and coordinated fashion. Herein, the FP7 funded three fast track services and the two pilot service projects should be served as a first priority, and other FP7 actions, in particular those implementing downstream services as a second priority.** The GSC-DA aims at providing a comprehensive and coordinated access to such data allowing the capacity to link directly the different Earth Observation (EO) Data Providers and the different Service Providers using coordinating functions. The GSC-DA projects' driver is the EO-Data Access Portfolio (EO-DAP), its maintenance and evolution. The EO-DAP is the portfolio of available EO data products from existing space based sensors that will be provided from the GMES Space Component to the operators of the GMES Services during the GMES pre-operation period 2008-2010, and beyond within an evolution cycle of both Service requirements and EO-DAP data provision.

Since satellites dedicated primarily to GMES services (ESA-Sentinels) will be available only from 2011, the portfolio starts using currently available data from various EO data sources defined as Contributing Missions.

Responding to the requirements of the GMES Services, the EO Data Access Portfolio (EO-DAP) document describes the Earth Observation (EO) data being made available by the GMES Space Component (GSC) to the operators of GMES Services during the GMES pre-operations period, i.e. from 2008 to end 2010. The document identifies the space-based observation needs and describes the GMES EO data package from all the contributing missions, including the conditions (e.g. ordering mechanisms, processing level, delivery timeliness), constraints (e.g. data quantities, satellite tasking, data licensing) and the interfaces between the GCS and GMES Services, and indirectly to the GMES users. A copy of this document will be available from the Commission on request.

For ***in-situ data***, the provision should also be coordinated by relevant European bodies (e.g. the European Environment Agency [EEA], JRC)[15]. Besides the many freely available dispersed in-situ monitoring data, there are a number of basic in-situ data that are indispensable across several GMES services for which the availability should be coordinated on a more systematic basis, and in some cases in real or near real time (e.g. ocean and atmosphere parameters, meteorological data, elevation data, vegetation characteristics, ground survey data, aerial photos, etc). Following the identification of the EEA as suitable body capable of managing an appropriate *Coordination and Support Action* (coordinating or supporting action[16]) in this context, this action will be covered in the 2009 Work Programme (see section IV).

Notwithstanding this coordination, in the frame of the present Work Programme and related call, specific ad-hoc actions for the provision, collection and dissemination of in-situ data relevant to GMES will also require dedicated efforts within the various service-oriented projects (see Section II, Area 1).

No call for proposals will be published for the implementation of this action area, for which the funding support approach is outlined further under the sections "*Other activities*" and "*Priorities for Future Calls*", below.

1.4 Development of Earth observation space infrastructure

While in the short-term GMES is drawing on existing in-situ and space based observing capacities developed by EU and ESA Member States, the fourth action area addresses the longer-term view and continuity of space-based infrastructures. A new GMES dedicated space infrastructure, to be developed by **ESA** under its *GMES Space Component* (GSC) Programme, is to provide continuity of space data sources in support of GMES services.

No call for proposals will be published for the implementation of this action area, for which the funding support approach is outlined further under the sections "*Other activities*" and "*Priorities for Future Calls*", below.

2. Action areas strengthening of foundations of Space science and technology

Projects supported by the Framework programme in this action area are expected to complement the extensive activities already undertaken by ESA and Member States. In accordance with the development rationale of a European Space Policy, projects should demonstrate the benefit of the EU, ESA and national programmes working in a coordinated way. A particular added value is also seen in contributions which the new EU Member States and the international community[17] can make.

2.1 Support to research activities related to space science and exploration,

[15] This could be based on and/or extend the current Technical Agreement agreed amongst the Group of Four (DG ENV, JRC, ESTAT and the EEA)

[16] Please note, for Coordination and Supporting Actions aiming at supporting research activities and policies the minimum condition shall be the participation of one legal entity. For Coordination and Supporting Actions aiming at coordinating research activities and policies the minimum condition shall be the participation of three legal entities.

[17] See list of ICP Countries in Annex 1 of the Work Programme "Cooperation" 2009

Space plays a leading role in Earth, Universe, Environmental, Physical and Life sciences as a privileged observation tool for our planet and objects of the universe in synergy with ground observations, data analysis and modelling tools and research in laboratories.

The Work Programme on space science is open to international cooperation[17] and should focus on upstream and downstream R&D activities complementing space missions, such as the **optimal preparation of scientific payloads** on future space missions, and an **effective scientific exploitation** of their data. Existing missions produce data sets of potentially immense value for research. Projects should enhance the effectiveness and productivity of the European scientific community in terms of usage of this data (including archived data). Increasing **public awareness** of such activities will also be the subject of this Work Programme.

Current space exploration programmes, in Europe and elsewhere, intend to extend the human presence, in a real or virtual way, through missions to the Moon and to Mars or through automatic missions in direction to objects of the solar system. Complementary to these, and in close co-operation with respective activities undertaken by ESA and national space agencies in this domain, the Work Programme is open to international cooperation[17] and will support upstream research aimed at improving in the long term the capability to **access planets surfaces**, and capability to **move**, to **select** and **collect** and finally **return samples** to Earth.

2.2 New concepts in space transportation, space technologies and critical components

In the context of ensuring European access to space, a new generation of advanced space transportation systems, innovative propulsion structure and energy concepts could reduce in particular the space transportation costs. In addition, space exploration could benefit from the progress made in this area. To that aim the Work Programme is open to innovative upstream research on **consolidating new space transportation technologies** (such as, e.g. new generation solid, electric and cryogenic propulsion and associated components technologies, new space energy generation systems and advanced composite structures).

Innovation in space systems requires long term vision and development of new technologies. Some of them may evolve quickly, requesting continuous research efforts to preserve competitiveness of the European space industry. In addition, the European space sector is dependent on technologies subject to stringent export-control regulations.

The Work Programme will particularly support research activities related to **critical components** (e.g. microwave components for telecommunication and navigation, digital components for data processing and payloads, space borne fibre optic technologies and field-programmable-gate arrays), which are essential for **non-dependence** aspects in the development of space missions of all kinds.

2.3 Research into reducing the vulnerability of space assets

In recent years our reliance on space-based systems has grown to include different fields: satellite communication and earth observation are ubiquitous, as is satellite navigation. A serious threat is posed by the **alarming growth of space debris**, left from launch activities, break-ups in space and obsolete space objects. In response, activities will be undertaken to assess the associated risks, monitoring debris, reducing debris production by preventing generation of new debris and de-orbiting upper stages and spacecraft after mission completion. Additionally, better protection of

spacecraft against damage caused by debris collision should be actively researched. The Work Programme will particularly support coordination activities aiming to **structure research efforts undertaken internationally and at European level**, and research assessing vulnerabilities and their amelioration.

Space weather gives us displays of the aurora, or northern lights. However, at its worst, it is a natural hazard which can catastrophically disrupt the operations of many technological systems, thus causing disruption to people's lives and jobs. **Space storms** (particles or electromagnetic) are a recognised aerospace hazard and can cause major failures, e.g. onboard spacecraft, in electrical power grids, in telecommunications links (satellite, launcher and ground-based). Being a cyclical phenomenon, more accurate prediction, assessment and early-warning capabilities of disruptive events are particularly poignant during the current approach of the next solar maximum (around 2011).

The Work Programme will support European coordination activities both to ensure the open exchange of information on emergencies that may have been caused by space weather events, with the goal of structuring international and European research efforts. The goal will be to both **improve the forecast and prediction of events**, by improved monitoring of the solar activities that are the main cause of space weather, and to identify **best practices to limit the consequences** to space-based (and certain strategic ground-based) infrastructures.

3. Cross-cutting activities

3.1 SME relevant research

Activities in this domain will be embedded *in all the action areas* mentioned in the previous sections above. Applications of GMES and other Space infrastructures typically require very sophisticated, state-of-the-art processing, which are often the result of research and developments done in specialised academic organisations and commercial spin-offs. Typical opportunities for SME participation in GMES are to be found for instance in the development and/or adaptation of methodologies and tools for services tailored for specific applications (including socio-economic dimensions), especially in areas such as land management, biodiversity and the management of the NATURA 2000 sites, soil degradation, urban planning, coastal environment, land and marine resources, air quality. GMES service projects are expected, for instance, to actively integrate such capacities along the entire end-to-end service chain as well as networking actors distributed in the different Member States. SME participation in GMES *downstream services* is particularly encouraged. The use of service provider/User networks within projects is encouraged.

Concerning the space science, exploration, space transportation and space technologies spin-in and spin-off activities could be encouraged.

3.2 International Cooperation

In the context of International cooperation, a diversified approach is a key element in Europe's space policy. Candidates for cooperation among other established or emerging space powers are the United States, Russia, Canada, People's Republic of China, India, and Ukraine. The European Neighbourhood Policy covers relations with Eastern and Southern neighbours (i.e. Black and

Caspian Sea region) and countries of North Africa and the Middle East (i.e. Mediterranean region). The use of space applications can contribute to their economic and social development and support environmental protection.

International cooperation with third countries (ICPC)[18] will be supported in view of expanding the use of earth observation data, and the corresponding data processing and management methods in third countries, and enhancing the relations with established space powers.

In the framework of the European Development Policy space applications such as Earth observation or satellite communications have been recognized as a central tool to support Africa in its sustainable economic and social development.[19] In particular, African and European policymakers and stakeholders got together in Lisbon end-2007 calling for an Action Plan on *GMES and Africa* to be prepared during 2008-9 in close cooperation with the African Union[20], along a wide consultation process that will take place during 2008 with the objective of expressing African needs for the development of GMES-related services and capacities.

Furthermore, for GMES to become the main European contribution to the global 10-year implementation plan for the GEOSS, FP7 GMES projects will also provide opportunities for data exchange with international partners, in the area of environment monitoring (especially in areas such as global climate change), and will encourage the increased use of Earth observation, as well as the development of a system of worldwide observation systems.

All projects conducted in the Theme Space are open for such participation of third parties under the normal participation rules, with the topics mentioned above being of particular interest for international participation. In order to enhance international participation further, a topical call may be considered at later stages, particularly to build on the achievements of FP6 projects dedicated to international cooperation. Specific cooperation actions dedicated to ICPC under the SICA participation rules[21] **are not foreseen**.

Additional activities, like the preparation of dedicated policy studies, can serve as valuable tools to negotiate future cooperative activities with international partners, and to better understand the benefits and risks of cooperation in order to define the scope of cooperative activities with third partners in the field of space. These will be contracted through procurement in the course of 2008 – 2013 as the need arises during the implementation of the European Space Policy, in particular actions related to international relations in space.

3.3 Cross-thematic approaches

The objective of the ERA-NET scheme is to step up the cooperation and coordination of research programmes carried out at national or regional level in the Member or Associated States through the networking of research programmes, towards their mutual opening and the development and implementation of joint activities. It is foreseen to apply, in a limited number of areas, this model of cooperation, in particular between European regions and small or medium-sized member States, to

[18] International Cooperation Partner Country (ICPC) is a third country which the Commission classifies as low-income, lower-middle-income or upper-middle-income country and which is identified as such in the work programmes, see list in Annex 1 of the Work Programme "Cooperation" 2007

[19] COM(2005) 489 final, 12 October 2005, "EU Strategy for Africa: Towards a Euro-African Pact to Accelerate Africa's Development"

[20] under the EU/AU Partnership on Science, Information Society and Space

[21] 2+2 participation rule, used in calls for Specific International Cooperation Actions (SICA) conducted by the FP7 programme of International cooperation activities

the implementation of long-term programmes such as Global Monitoring for Environment and Security (GMES).

European regions and local authorities count in fact among the most frequent, or potential, users of GMES services, in particular in the context of public policies of local interest (e.g. urban development, civil protection, environmental monitoring).

The ERA-NET approach in this context can help coordinate relevant user related actions across different parts of Europe and consolidate user requirements. Likewise, local authorities can aggregate their activities as a way of leveraging increased public support for GMES related developments (e.g. through appropriate infrastructure).

Specific ERA-NET calls will be foreseen as integral part of the Space Theme **at a later stage**, in close conjunction with appropriate GMES service topics.

3.4 Dissemination actions

Activities in this domain will be embedded in all the activity areas mentioned in the previous section above. In particular, activities aimed at promoting the uptake of GMES services and related technologies will be an essential part of all major cooperative projects. Apart from these technological knowledge transfer actions, the GMES Advisory Council as well as a network of National Contact Points (NCP) are seen as instrumental in promoting dissemination to national public authorities and citizens alike. A suitable *Coordination and Support Action* (coordinating action[16]) support in order to achieve better cross-border dissemination and trans-national cooperation has already recommended to receive funding from the 2007 budget. Effective dissemination measures are also of importance as significant wider benefits are expected to arise from the research projects and actions supported under this programme, contributing for instance towards science education and general outreach.

Coordination and Support actions (supporting action[16]) examining the implications of technological developments in Space for the European Space Policy, its further implementation, and the benefits for citizens will also be undertaken.

3.5 European Space Policy implementation actions

The implementation of the European Space Policy (ESP) calls for activities defined in the_ ESP Communication and the Resolution of the May 2007 Space Council. In addition to the development of space applications defined earlier, these activities include the appraisal of the organisation of space activities in Europe, as well as the setting up of coordination mechanisms for space programmes in the framework of the European Space Programme, in the field of international relations and security and space.

Coordination and Support actions (supporting action[16]) in order to better understand the opportunities and challenges associated with the implementation process of the European Space Policy will also be undertaken.

II CONTENT OF CALLS

The current planning foresees one call in 2008 covering an annual work programme, for projects to be funded from the 2009 Space theme budget. No further call on these activities is currently planned based on the commitment appropriations of 2009.

Activity: 9.1 Space-based applications at the service of European Society

No separate budgets will be allocated to the three areas of this activity of the call (i.e. there will be only one ranking list covering areas SPA.2009.1.1.01, SPA.2009.1.1.02 and SPA.2009.1.1.03).

Area 9.1.1: Pre-operational validation of GMES services and products

SPA.2009.1.1.01 Stimulating the development of ***downstream*** **GMES services**

Apart from addressing information needs for the management of global issues, the geospatial products and services created by GMES are also key to economic return, providing part of the base of the knowledge-driven economy. Among other possibilities, new commercial spin-offs have to be stimulated, creating innovative services leading to improvement of European competitiveness and sustainable development. **Small and medium sized companies** in the value-adding sector are to be given the opportunity to develop next generation service lines. Such *downstream services* are positioned between the multi-purpose *core services* and the user client, and take full benefit of the wide range of core-service by making an extended use of products made available by these. They are at the same time complementary to the three fast track services (land, marine and emergency response core services as defined in the 1st Call) and the two pilot services (atmosphere and security).

Dedicated **downstream service portfolios**, tailored for specific user needs, are to be stimulated, bringing together political and industrial players to enable the maximum and efficient use of EO data in support of European policies, institutional users as well as local and private entities. Targeting specific user needs, the proposals could be focussing on a very specific application field, or serve a user with a multi-thematic need with regional focus.

In the proposals, work should focus on building on the existing achievements of GMES, especially *core service* geo-information provision, and conduct research exploring innovative new geo-information derived products and service lines, or upgrade existing service lines in the light of new geo-information products.

This part of the Work Programme should also aim at evolving and strengthening those R&D actions which up to now have also been supported under ESA's 'GMES Service Element' Programme and which will be phased out. In this context, all relevant earlier achievements, either in previous funded or other projects, as well as any remaining gaps, will be taken into account.

It is foreseen to stimulate the emergence and establishment of downstream service activities, with the goal to be financially self-supportive at the end of the project, ready to be based on non R&D resources, including commercial revenues whenever appropriate. Equally, it will also be taken into account that provision of innovative services will imply a legal liability in the future operational phase; thus in preparation of future requirements, the proposals need to deliver clear measures of the

quality, within the tolerance levels acceptable by the users, such as precision, reliability, availability and integrity of the products.

Existing and validated experimental practices or methodologies need to be turned into operational prototypes in close interaction and trade-off/validation process with the service users. Projects should be strongly user driven and take into account user needs concerning information and services, and orient themselves along existing guidelines established in previous GMES projects and by advisory bodies at European level. All research, development, demonstration, system implementation, service validation and data provision have to be explicitly traced to documented needs of (named) users. The conclusion of Service Level Agreements should be a valuable tool in this respect. Successful integration into current user practices and their working environment need to be demonstrated.

To build up the pre-operational capabilities, the following topics must be **appropriately** addressed in the activities proposed:

- Organisation and service architecture, including interface / coordination to be assured with the GMES core services providers.
- Sustainability of the service during subsequent operations, by defining and further consolidating the economic model for service provision.
- Analysis of the added value of products derived from core services as inputs for the development of downstream services and, if relevant, proposals for their possible improvements and/or extensions.
- Feedback from relevant institutional end-users, which demonstrates both the acceptance level of the prototypical service, as well as scenarios for integration into the user working methods and resulting decision-making processes.
- Exploration of suitable modalities for agreement processes (e.g. on Quality Assessment) between service mandating authorities, service providers and end-users.
- Interoperability and interconnection of the data processing and delivery systems, taking into account harmonisation policies, directives such as INSPIRE, and standardisation initiatives. (While demonstrating interoperability capabilities, also gaps and shortcomings may be identified which have then to be integrated in ongoing INSPIRE efforts. Furthermore, the impact of harmonisation and the INSPIRE implementation on the sustainability of the services could be examined). To facilitate efficient acquisition and exploitation by both service providers and users, activities will have to include R&D[22] for:
  - improved accessibility to long-term data archives, implementation of meta-data standards, actions to facilitate information retrieval and dissemination;
  - improved accessibility to in-situ systems;
  - adoption of open standards for data documentation, data models and services;
  - integration of tools and services allowing anybody to query, view access and trade the information held by distributed public and private bodies;
  - establishment of a data policy and appropriate security framework.

[22] It should be noted that specific development and research on ICT for environmental management as well as mechanisms for rapid adoption of standards, protocols and open architectures are undertaken in FP7 theme 3 "Information and Communication Technologies" under Challenge 6 "ICT for Mobility and Environmental Sustainability".

- Data validation and fusion from multiple sources; techniques for data assimilation into models, validation of space derived products by means of in-situ data.
- Observation data (satellite, in-situ) collection and delivery, under consideration of both organisational aspects, as well as technical solutions offered by state-of-the-art communication methods (via terrestrial or satellite communication channels). Account should be taken of possible mechanisms of coordinated data delivery.
- Assessment of the type of data and level of spectral, spatial and time resolution expected from the next generation of satellites and in-situ data sources.

Projects should include activities having the goal of disseminating knowledge and increasing public awareness of the results achieved through the integration of space technology and in-situ observation systems. Project output should include an assessment of the type of data and level of spectral, spatial and time resolution expected from the next generation of satellites and in-situ data sources.

In building on existing European capabilities, proposals should also make best use of results and pre-operational geo-information products obtained through previous or ongoing GMES activities[23]. Proposers should clearly indicate how benefit is taken of existing GMES capacities or developments, and what agreements with other operational services, pre-operational services or research projects are in place, or anticipated, for provision of input data streams. Suitable contingency plans and risk analyses with respect to such input data dependencies should also be provided, especially if product delivery is still in a pre-operational development stage.

Space-based observation data necessary to the development of each project will have to be detailed in the proposals. Although it is expected that projects will build upon products generated by *core services*, it is not excluded that additional data **could be made available by ESA on the basis of the GSC-DA C*oordination and Support Action*** (details in Section I, Chapter 1.3). Such requirements and their coherence with the existing DAP of the GSC-DA have to be clearly indicated.

With regard to ***in-situ data*** necessary to the development of each service, the proposals will have to foresee dedicated efforts for their provision, taking any coordination activities of the EEA in this respect into account.

In general in-situ data could include:

(i) data collected by networks of sensors deployed on land, sea, water and in the atmosphere aimed at measuring and providing a complete description of the Earth system.

(ii) surveys aimed at collecting socio-economic data, land cover and land-use data, geology, soil conditions, bio-diversity information and other topographic or geographical data such as for example elevation, administrative boundaries, transport and utility networks etc.

In particular in-situ data should meet the immediate needs of the specific proposed service and should cover, for example, the following requirements:

- Timeliness, in function of the service requirements.
- The provision schemes and their corresponding delivery interfaces (FTP, other internet protocols, dedicated communication schemes);

Similarly specific needs for dedicated in-situ data for the development of each service should be detailed in the proposals. **They should take into account the coordination activities of the EEA**.

[23] Further information on the current development stages in GMES are available from http://www.gmes.info, http://ec.europa.eu/enterprise/space_research/index_en.htm , and the EC services.

Projects should take into account existing capacities and services. Moreover proposals should demonstrate their ability to develop generic and modular capacities.

Funding schemes and projects size: small-medium size *Collaborative Projects* are expected, requiring typically an EC contribution of EUR 1 to 3 million (with upper eligibility limit of EUR 5 000 000 Community requested contribution); also small *Coordination and Support Actions* are possible.

- Expected impact:

The projects will be expected to establish innovative new GMES service capacities towards specified users. In the context of already existing capabilities, projects will be expected to contribute to the integration of new lines into (pre)operational service chains of the GMES downstream services.

Validated scenarios for services meeting the specific user needs will be established, and further insights into the uptake of products, possible business models for operational supply, and the evolution and trends of future sensor needs will be demonstrated. The results obtained will contribute directly to the sustainability and competitiveness of European value-adding services.

The projects should also examine the impact that their products and services could have in a socio-economic context. The projects will reflect the mutual dependency of technology, organisational dynamics, societal issues as well as related legal/economic aspects. This will reinforce European industry's potential to create important market opportunities and establish leadership, and it will ensure sufficient awareness and understanding of all relevant issues for the take-up of their outcome.

In order to boost downstream service activity and business, close collaboration with representative user communities throughout Europe is a primary goal. The projects are expected to be complementary to the three Fast Track Services (land, marine and emergency response core services) and the two pilot services (atmosphere and security) and to make the best use of the products they will provide.

The impact of the validated system should also be demonstrated through pilot tests and exercises, based both on simulation data and on real events, when possible and appropriate.

SPA.2009.1.1.02 Monitoring of climate change issues (**extending *core service* activities**)

Information about Earth physical parameters must sufficiently describe the current status of the Earth environment from regional to global scales, and its evolution in the short to medium-term. A wide range of space- and time-scales has to be considered. Whilst the GMES core services already provide valuable product portfolios containing many of the Essential Climate Variables (ECV) as for instance identified by the second Global Climate Observing System (GCOS) report 2003, specific tailoring of information packages for monitoring of climate change has still to be addressed in GMES. Proposals to integrate core services products and to extend their activities for such information generation or to demonstrate how this could be achieved in the most appropriate way are invited. In particular, the resultant "information package" should include:

- Tailored information and products to assist climate change research to incorporate the monitored essential climate variables such as, for instance, sea level changes, cryosphere (snow cover and ice), sea surface temperature, evolution of atmospheric characteristics

and composition, clouds, land cover and vegetation, deforestation, erosion, hydrological changes, soil moisture trends etc.

- Provision of reliable, up-to-date scientific input (especially through the Intergovernmental Panel on Climate Change, IPCC) for the elaboration and implementation of European and international policies and strategies on the environment and society, including in the EU climate adaptation strategy addressing European, national, regional and local levels.

This "information package" should be based on the **generation of time series of observation datasets and reanalyses of past observational data enabling adequate descriptions of the status and evolution of the Earth system components**.

The development of the capacity required for such climate analyses, focused on a service oriented approach, including software tools and instruments for the integrated analysis of different spatial and time scales, is encouraged and should be tailored towards future GMES services[24]. In particular, proposals should ensure that GMES Services, and especially those on marine, land and atmosphere monitoring, which include − or will include in the near future − a global component by design, as well as centres involved in reanalysis of large time series of data, are involved in this "information package" provision. Links with GEOSS and full compliance with the GCOS requirements are also valuable pre-requisites.

Any additional ***space-based observation data*** necessary to the development of each project will have to be detailed in the proposals. Space data will be made available through the ESA GSC-DA grant to FP7 Fast Track Services and Pilot Services from the first Call. However, it is not excluded that some data **could also be made available for the project in this topic** by ESA on the basis of the GSC-DA grant (details in Section I, Chapter 1.3). Such requirements and their coherence with the existing DAP of the GSC-DA have to be clearly indicated.

Funding schemes and projects size: small-medium size *Collaborative Projects* are expected, requiring typically an EC contribution of EUR 1 to 3 million (with upper eligibility limit of EUR 5 000 000 Community requested contribution); also small *Coordination and Support Actions* are possible.

- Expected impact:

Projects will be expected to contribute to establishing a data archive of systematic observation data related to the climate system, for a continuous record of essential climate variables coherent with UN Framework Convention on Climate Change (UNFCCC) requirements.

Projects will be expected to contribute to the consistency of such a dataset, as well as to a sustainable and transparent access to such data for global climate scientific and operational communities.

Projects will be also expected to improve the structure and coordination of the entities involved in the processing and delivery of climate change relevant dataset, in order to avoid dispersion and duplication of activities and to pave the way for a sustainable provision compliant with the requirements of climate analysis communities.

[24] It should be noted that development and research on specific earth observation and assessment tools, as well as environmental models underpinning climate change are undertaken in FP7 theme 6 “Environment (including climate change)”.

SPA.2009.1.1.03 **Integration of SatCom / SatNav with GMES** for prevention and management of emergencies

The objective is to integrate satellite communication and/or satellite navigation solutions with space based observing systems for prevention and management of various kinds of emergency, occurring inside or outside Europe. Building on the results and achievements from actions undertaken in the previous research programmes, the synergetic use of this space based capacities will contribute to the demonstration of value-added services meeting the GMES user needs. Proposals should ensure complementarity and close co-operation with related activities undertaken by other FP7 themes (e.g. Transport, ICT) and by ESA.

The target of this action should be a service platform, with the objective of validating the technological concepts and acknowledging the benefits of an integrated communication / navigation / observation infrastructure with the users. The validation of specific test-beds, based whenever possible and appropriate on real situations, is encouraged. This action will support specific *user-driven* development of such services.

Complementarities of the satellite capabilities with terrestrial capabilities, where appropriate, should be assessed on the basis of a medium to long term view, based on the foreseeable evolution of space-borne and terrestrial communication and navigation technologies (in particular relevant developments in the Galileo system). The related economics should also be addressed as an integral part of the proposed action. This way, the already multifaceted and integrated nature of GMES, which brings together data from a variety of space-based and in-situ measuring systems, will be further enhanced and enriched by complementary space techniques.

The overall objective is to provide the end-users - e.g. civil protection agencies, search-and-rescue teams, and other life-guarding bodies – with all the required information in a seamlessly integrated, timely, secure and user-friendly fashion in their tasks of prevention and management of emergency situations. To this purpose, account will be taken of the latest development in relevant communication and navigation technologies as identified before.

Preference will be given to proposals integrating SatCom and/or SatNav with GMES for the prevention and management of emergencies, however, proposals addressing other GMES applications where this integration can be made in order to fulfil accepted user requirements will also be accepted.

Space-based observation data necessary to the development of each project will have to be detailed in the proposals. Space data will be made available through the ESA GSC-DA grant to FP7 Fast Track Services and Pilot Services from the first Call. However, it is not excluded that some data **could also be made available for the project in this topic** by ESA on the basis of the GSC-DA grant (details in Section I, Chapter 1.3). Such requirements and their coherence with the existing DAP of the GSC-DA have to be clearly indicated.

Funding schemes and projects size: small-medium size *Collaborative Projects* are expected, requiring typically an EC contribution of EUR 1 to 3 million (with upper eligibility limit of EUR 5 000 000 Community requested contribution); also small *Coordination and Support Actions* are possible.

- Expected impact:

Projects will be expected to contribute to the development of a service platform, aiming at validating the technological concepts and demonstrating the benefits of an integrated communication / navigation / observation infrastructure with the users. Where novel communication technologies are integrated to upgrade existing service lines, significant advances in quick and inexpensive access to real-time EO data for governmental, civil protection management, and the commercial end-user are expected. Projects will be expected to highlight the socio-economic impact of such integrated applications, their challenges and their benefits.

For the prevention and management of emergency applications, it is envisaged to reach:

- *An optimisation of the EU capacities in the applications area identified, and especially sharing and mutualisation of service infrastructures and resources, and a streamlining of process allowing to reach a consistent and guaranteed service level.*
- *An efficient use of the integrated space and ground systems for supporting emergency situations and their real-time requirements.*
- *A possible improvement of intervention efficiency, through a seamlessly integrated, timely, secure and user-friendly way in support of the involved actors, the intervention bodies both inside and outside Europe.*

The impact of the validated system must also be demonstrated through pilot tests and exercises, based both on simulation data and on real events, when possible and appropriate.

Activity: 9.2. Strengthening the foundations of Space science and technology

It should be noted that two ranking lists will be established, one for areas 9.2.1 together with 9.2.4, and one for 9.2.2 of this activity. Hence they have their own budget shares allocated to them (see table at the end of Section IV).

Area 9.2.1: Research to support space science and exploration

SPA.2009.2.1.01 Space Exploration

Complementary to, and in close co-operation with respective activities undertaken by ESA[25] and other interested national agencies in this domain, but not duplicating any of these activities, the FP7 Space work programme will support basic and upstream research activities and experiments aimed at improving, in the long-term, the capability for interplanetary travel, access to planets surfaces, and capability to move, to select and collect and finally return samples to Earth and perform their analysis in the frame of Space Exploration activities.

[25] An overview on Exploration activities in ESA can be found under http://www.esa.int/exploration. Technology activities for Exploration covered by ESA can be found especially in the ELIPS and AURORA programme, see also http://www.esa.int/SPECIALS/Aurora/.

The research on exploration should focus on the upstream activities of space missions for strengthening the technological base. Upstream technology activities are high-risk and should encompass basic scientific principles observed, measured, modelled and reported, technology concept and/or application formulated, analytical and experimental critical function and/or characteristic proof-of-concept, component and/or breadboard validation on laboratory environment. They should be kept in the domain ranging **from** basic application oriented research **to** research to prove feasibility.

Funding schemes and projects size: small size *Collaborative Projects* are expected, requiring typically an EC contribution of EUR 1 million (with upper eligibility limit of EUR 2 000 000 Community requested contribution); also small *Coordination and Support Actions* are possible.

- Expected impact:

The proposed actions should enlarge the basic capabilities for exploration by focusing on upstream activities and build jointly with industry the base for future missions.

Further, it is expected to strengthen European cooperation and synergies. Actions should enhance the awareness of the general public of the contribution which space exploration makes to our knowledge of the Earth, universe and environment, thereby stimulating and inspiring a young generation of scientists and engineers.

Area 9.2.2: Research to support space transportation and key technologies

SPA.2009.2.2.01 Space technologies

The space sector is a strategic asset contributing to the independence, security and prosperity of Europe and its role in the world. For Europe to have non-dependent access to critical space technologies is therefore a conditio sine qua non for achieving its strategic objectives. "Non-dependence" refers to the possibility for Europe to have free, unrestricted access to any required space technology. Emphasis for these activities should not be on the advanced nature of their scientific innovation, but on the **expected medium term impact** for Europe to develop or regain the capacity to operate independently in space, e.g. by developing in a timely manner reliable and affordable space technologies that in some cases may already exist outside Europe or in European terrestrial applications.

These include in particular:

- Digital components at the heart of data processing tasks for critical operations on every spacecraft, with a focus on deep sub-micron technology, high capacity reprogrammable gate arrays, high speed digital/analogue and analogue/digital converters and high speed serial links and next generation space qualified microprocessors.

- Microwave components as used in telecommunication payloads, including components enhancing the security of the communication chain, navigation satellites and earth observations/science instruments such as radars, with a focus on Gallium Nitride technologies, Schottky diodes for high-frequency applications.

Activities in this field include, beside others, space evaluation and qualification of critical technologies, in view of utilisation of commercially available technologies. Studies preparing new European capabilities for future Earth observation missions (e.g. detection of moving objects) may also be supported.

To address the strategic challenges on space technologies, FP7 intends to complement current efforts of the space community and to contribute to the European Space Programme. Projects are expected to demonstrate their complementarity and possible synergies with national agency and ESA funded activities, as well as relevant Harmonised European Space Technology Roadmaps[26].

Funding schemes and projects size: small size *Collaborative Projects* are expected, requiring typically an EC contribution of EUR 1 million (with upper eligibility limit of EUR 2 000 000 Community requested contribution); also small *Coordination and Support Actions* are possible.

- Expected impact:

The projects will be expected, first and foremost, to reduce the dependence on critical technologies and capabilities from outside Europe for future space applications, aiming at increasing significantly the share of European components in European satellites*. In addition, projects should significantly contribute to the mass reduction, performance improvement and sustainability of space components, thereby enhancing the technical capabilities and overall competitiveness of European satellites vendors on the world wide market.*

The projects will be expected to open new competition opportunities for European manufacturers by reducing the dependency on export restricted components that are of future strategic importance to European space efforts and to offer European industry non-restricted access to high performance components that will allow increasing its competitiveness and expertise in the domain of space.

In this context, technological spin in and/or bilateral collaborations should be enhanced between European non-space and space Industries and projects will be expected to provide advanced critical component technologies that are of common interest to different space application domains (e.g. telecom, Earth-observation, science, ...).

Area 9.2.3: Research into reducing the vulnerability of space assets

No topics called in the 2009 Work Programme.

Area 9.2.4: Support to new EU-Member States/Associated States

SPA.2009.2.4.01 Support to new EU-Member States/Associated States

[26] See also the ESA Technology Harmonisation and European Space Technology Platform documentation at website http://www.estp-space.eu/. An overview on the Harmonised European Roadmps and European Technology Development Programmes can be requested by contacting ESTMP@esa.int.

Coordination and Support Actions are invited, aimed at increasing public awareness regarding the European Space Policy and industrial space capability in new EU Member States and Associated States to the Framework Programme which are not Member States of ESA, by involving firms, institutions and universities in on-going and planned space activities in ESA and European national space agencies. The technical and scientific domains of space exploration and critical space technologies can be covered, but emphasis should be on activities that:

- Foster the establishment of strong and long-term relations between firms, institutions and universities from Associated States and well-established and well-experienced European space organisations;
- Address specific niche markets, in particular with respect to European non-dependence for critical space technologies;
- Have a future potential for a continuous and sustainable contribution in major on-going and planned European space programmes.

Funding schemes and projects size: *Coordination and Support Actions* (with upper eligibility limit of EUR 1 000 000 Community requested contribution) are expected.

- Expected impact:

The actions will be expected to enhance the potential of these FP7 States to make a continuous and sustainable contribution to major on-going and planned European space programmes. The actions will strengthen the relationship between these non ESA Member States and ESA to pave the way for future cooperation and adhesion to ESA.

These actions will be expected to create or develop increased space capacities without duplicating already existing capacities in ESA (or in ESA Member States scope of activity). The actions will foster dialogue and debate on space science and research with the public beyond the research community, aiming at embracing a new generation of scientists and engineers.

Activity: 9.3 Cross-cutting activities

Area 9.3.2: International cooperation

International cooperation represents an important dimension of all research activities carried out in the Theme Space. General participation in **all above areas** is encouraged through opening up the research activities to researchers and research organisations from all International Cooperation Partner Countries (ICPC) and from industrialised countries. For **all above areas**, the active participation of a relevant third country partner or partners should add to the scientific and/or technological excellence of the project and/or lead to an increased impact of the research to be undertaken. These aspects will be considered specifically during the evaluation.

Regarding GMES, participation of research partners from the ICPC countries (e.g. Latin America, and especially in developing countries), is encouraged.

Regarding Space Foundations and GMES, active participation of partners from Russia, taking into account conclusions from the EU-ESA-Russia Space Dialogue working groups, represents an added value to the proposed research activities.

Additionally to these opportunities, specific actions in the domain of International Cooperation are foreseen as follows:

SPA.2009.3.2.01 International Cooperation

In the framework of the European Development Policy, space applications such as Earth observation or satellite communications have been recognized as a central tool to support Africa in its sustainable economic and social development.[27] The pursuance of the objectives set forth at the initiative "GMES for Africa" and included in the "*Lisbon Declaration on GMES and Africa*" represents a special focus for the proposed research activities in GMES. It is expected that the proposed actions will take into account and support the preparation of an action plan of the European Commission and the Commission of the African Union for the endorsement at the next EU-Africa Summit (2010).

Support could be given to networking between information providers, user networks and centres of excellence in Europe and African Countries, along the priority lines being identified in consultation with the African Union under the *'GMES and Africa'* initiative, with the aim to coordinate better existing GMES research and services activities in Africa.

This should also provide opportunities for more data exchange with international partners, in the area of environment monitoring, and will encourage the increased use of Earth observation, as well as the development of a system of worldwide observation systems.

Funding schemes and projects size: *Coordination and Support Actions* (with upper eligibility limit of EUR 1 000 000 Community requested contribution) are expected.

Area 9.3.5: Studies and events in support of European Space Policy

SPA.2009.3.5.01 European Space Policy Studies

Following the adoption of Council of the Resolution on the European Space Policy in May 2007, the Space Work Programme 2009 supports studies focusing on the implementation and the follow-up development of the European Space Policy, in particular related to the socio-economic dimension of European space activities and European space policy priorities.

Support will also be given to the organisation of conferences and information events to strengthen wider participation in the programme (including that of 3rd countries), and to disseminate results of European research in the Space sector.

Funding schemes and projects size: *Coordination and Support Actions* (with upper eligibility limit of EUR 1 000 000 Community requested contribution) are expected.

[27] COM(2005) 489 final, 12 October 2005, "EU Strategy for Africa: Towards a Euro-African Pact to Accelerate Africa's Development"

III IMPLEMENTATION OF CALLS

- **Call title: Space Call 2**
- Call identifier: FP7-SPACE-2009-1
- Date of publication[28]: 3 September 2008
- Deadline[29]: 4 December 2008, at 17.00.00, Brussels local time
- Indicative budget[30]: EUR 51.5 million
- Topics called:

Activity/ Area	Topics called	Funding Schemes
9.1.1 **Space-based applications at the service of European Society** / Integration, harmonisation, use and delivery of GMES data[31]	SPA.2009.1.1.01 Stimulating the development of downstream GMES services	Collaborative Projects, Coordination and Support Action (supporting or coordinating)
	SPA.2009.1.1.02 Monitoring of climate change issues	Collaborative Projects, Coordination and Support Action (supporting or coordinating)
	SPA.2009.1.1.03 Integration of SatCom / SatNav with GMES for prevention and management of emergencies	Collaborative Projects, Coordination and Support Action (supporting or coordinating)
9.2.1 **Strengthening of Space foundations**/ Research to support space science and exploration[32]	SPA.2009.2.1.01 Space Exploration	Collaborative Projects, Coordination and Support Action (supporting or coordinating)
9.2.2 **Strengthening of Space foundations /** Research to support space transportation and key technologies[32]	SPA.2009.2.2.01 Space technologies	Collaborative Projects, Coordination and Support Action (supporting or coordinating)
9.2.4 **Strengthening of Space foundations** / Research to support new EU-Member States / Associated States[32]	SPA.2009.2.4.01 Support to new EU Member States/Associated States	Coordination and Support Action (supporting or coordinating)
9.3.2 **Cross-cutting activities**[33]	SPA.2009.3.2.01 International Cooperation	Coordination and Support Action (supporting or coordinating)
9.3.5 **Cross-cutting activities**[33]	SPA.2009.3.5.01 European Space Policy Studies	Coordination and Support Action (supporting or coordinating)

[28] The Director-general responsible for the call may publish it up to one month prior to or after the envisaged date of publication

[29] At the time of the publication of the call, the Director-general responsible may delay this deadline by up to two months

[30] Under the condition that the preliminary draft budget for 2009 is adopted without modifications by the budget authority. The budget for this call is indicative. The final total budget awarded to this call, following the evaluations of proposals, may vary by up to 10% of the total value of the call.

[31] No separate budgets will be allocated to the three topics of Activity 9.1. One ranking list will be established covering the three topics (SPA.2009.1.1.01, SPA.2009.1.1.02 and SPA.2009.1.1.03)

[32] For the Activity 9.2, two ranking lists will be established: one for areas 9.2.1 together with 9.2.4, and one for 9.2.2.

[33] For the activity 9.3, two separate ranking lists will be established: one for areas 9.3.2, and one for 9.3.5.

- Eligibility conditions:

  - The eligibility criteria for the different funding schemes are set out in Annex 2 to this Work Programme
  - For Activity 9.1 the maximum eligible EC contribution is EUR 5 000 000, proposals requesting in excess will be ineligible.
  - For Activity 9.2, Areas 9.2.1 and Area 9.2.2, the maximum eligible EC contribution is EUR 2 000 000, proposals requesting in excess will be ineligible.
  - For Activity 9.2, Areas 9.2.4, the maximum eligible EC contribution is EUR 1 000 000, proposals requesting in excess will be ineligible.
  - For Activity 9.3, area 9.3.2 and 9.3.5, the maximum eligible EC contribution is EUR 1 000 000, proposals requesting in excess will be ineligible.

Funding scheme	**Minimum conditions**
Collaborative projects	At least 3 independent legal entities, each of which is established in a MS or AC, and no 2 of which are established in the same MS or AC
Coordination and support actions (coordinating action)	At least 3 independent legal entities, each of which is established in a MS or AC, and no 2 of which are established in the same MS or AC
Coordination and support actions (supporting action)	At least 1 independent legal entity.

- Evaluation procedure:

  - The standard procedures set out in the FP7 Rules for submission of proposals, and the related evaluation, selection and award procedures, will apply
  - The evaluation criteria (including weights and thresholds) and sub-criteria, together with the selection and award criteria for the different funding schemes are set out in Annex 2 to this Work Programme
  - A one-stage submission procedure will be followed.
  - Proposals may be evaluated remotely.

- Indicative evaluation and contractual timetable:

This call in 2008 invites proposals to be funded in 2009. The evaluation is to commence within 2 months of the call deadline, with negotiations of successful proposals commensurate with the 2009 budget expected to commence in the first half of 2009.

Proposals recommended for funding, which cannot be financed from the available budget will be put in a reserve list after evaluation, to allow for later funding in case of availability of additional budget or failure to complete negotiation of a proposal recommended for funding.

- Consortia agreements

The conclusion of a Consortium Agreement is required for any action under the space topic.

- Particular requirements for participation, evaluation and implementation:
  - The minimum number of participating legal entities required, for all funding schemes, is set out in the Rules for Participation. Please note, that for Coordination and Supporting Actions, different minimum participation rules apply depending on whether they are aiming at supporting or coordinating research activities and policies.
  - The forms of grant which will be offered and maximum reimbursement rates are specified in Annex 3 to the Cooperation Work Programme.

IV OTHER ACTIONS

Activities implemented but not subject of a call

The following activities will be supported through funding by the Space theme in 2009, but **will not be subject of a call** under the Space theme:

1) Coordinated provision of in-situ observation data for GMES,
2) Development of GMES-dedicated space infrastructure,
3) Risk-sharing Finance Facility (RSFF).

They are regarded to supplement the activities undertaken as a result of the calls for proposals in the FP7 Space theme. Participants are invited to take benefit of these as appropriate in their proposals (for instance make use of access to the coordinated provision of observation data for GMES, or include the possibility of EIB loans to fulfil the Commissions co-financing requirements).

4.1 Coordinated provision of in-situ observation data for GMES[14]

GMES service validation, operational scenario demonstration, as well as the operational phases requires a comprehensive supply of data from in-situ observation systems. Thus, a specific *Coordination and Support Action* in order to **coordinate** *in-situ data* among the many freely available dispersed in-situ monitoring systems, with special attention to INSPIRE is foreseen to be funded. This action should be coordinated at European level by appropriate bodies and following the principle applied for the provision of Space Data in the first call, the European Environment Agency [EEA] has now been identified as the appropriate body as

- EEA and EIONET (European Environment Information and Observation Network) play a key role in understanding and defining the user requirements at European and national levels across the diversity of environmental and sector related policy areas. According to its

regulation, EEA has the mandate and knowledge to identify cross-cutting issues and synergies, the scope for integrated approaches, and possibilities for improved efficiency and effectiveness in monitoring mechanisms;

- the GMES Advisory Council (GAC) at its meeting in Lisbon on 6 December 2007, has also endorsed the Commission proposal for the creation of an In-Situ Observation Working Group of member state representatives (ISOWG), supported by a technical group bringing together European bodies, with the EEA acting as secretariat for the ISOWG, and chairing the support group;

- the European Environment Agency (EEA) and its network EIONET already are legally mandated to coordinate and harmonize the collection of in-situ environmental data, with more than 300 institutions in Member States being involved, and have already established systems for sharing in-situ data and services. It already manages networks of data providers to provide environmental information and assessment and has for some time played a leading role in identifying the needs for, and coordinating the provision of, in-situ data for individual Core Services.

It is therefore foreseen that the EEA is to receive a grant of up to a maximum of EUR 3 000 000 as *pre-defined beneficiary* over a three year period. Based on the specific capacities provided by EEA in this domain, the European Environmental Agency (EEA), Kongens Nytorv 6, 1050 Copenhagen K, Denmark, (together with additional national and international organisations to be selected through competitive calls, organized by EEA according to the applicable rules and procedures of FP7) will be the direct beneficiary for this funding, through Coordination and Support Action(s) (supporting action).

The EEA will submit a formal grant proposal to the Commission services, which will then be evaluated and negotiated. The standard FP7 evaluation criteria (including weights and thresholds) and sub-criteria for Coordination and Support Actions as set out in Annex 2 to this Work Programme proposal shall apply. In particular the proposal shall demonstrate the added-value to be achieved by the proposed coordinated provision scheme, as well as the clear progress of these activities beyond the scope of any tasks already performed by EEA under its current mandate. Furthermore, the standard FP7 funding rates and conditions for Coordination and Support Actions shall apply.

EC funding to EEA will be contingent upon the conclusion of a grant agreement in compliance with the administrative and financial regulations applicable to the general budget of the European Communities. Further, this action could be based on and/or extend the current Technical Agreement agreed amongst the Group of Four (DG ENV, JRC, ESTAT and the EEA).

The beneficiary shall perform the following tasks:

1. It shall ensure collaboration between the European bodies of the different thematic networks (i.e. meteorology, mapping, civil protection, security, geology, statistics, health) and the GMES implementation Groups, to coordinate the access to, management and procurement of relevant data and information. Furthermore, it shall provide the Secretariat of the In-Situ Observation Working Group (ISOWG) and maintain an on-line forum, and chair the technical support group.

2. It shall identify needs, synergies, gaps, overlaps and other issues related to the in-situ data requirements for the GMES services. Starting from the work of the Implementation Groups

(Emergency Response Core Service, Atmosphere Core Service, Land Monitoring Core Service, Marine Core Service), as well as from the relevant output of the relevant FP6 projects, the activity shall deliver a comprehensive, harmonized and homogenized documentation of in-situ data and observation requirements.

It shall ensure together with EIONET and relevant Commission services the stakeholder involvement in the assessment of current and future policy demands for monitoring the environment and related sectors.

3. In view of the above requirements the activity shall propose a step-wise approach to integrate the in-situ observation assets which are being reported by the Member States with the support of the in-situ Observation Working Group into a long-term sustainable framework. This approach shall take into due account (i) the commitments of the observation infrastructure owner / operators, (ii) the handling of property rights, and (iii) any restrictions on the use and distribution of data.

4. Finally the activity shall provide as early as possible supporting mechanisms for realizing the supply of data products meeting the immediate needs of the three Fast Track Services and the other FP7 service oriented projects (within the Space Theme as well as other FP7 Themes). This data provision will have to be set-up appropriately to serve as well as a proof of concept for the proposed in-situ architecture.

Notwithstanding the status as pre-defined grant beneficiary for this action, EEA will have to comply with reporting obligations to the EC in line with FP7 rules.

In the long-term, this action area may be seen as a preliminary test-bed for all the relevant stakeholders, to gain experience in the very complex issues involved in any long-term scheme to ensure in-situ observation data continuity, which (besides the space observation data) is key for the provision of operational GMES services. Based on the experience gained, further funding for the continuation of this action could be the subject of future Work Programme updates.

N.B. Community support for this action will exclude all contributions to the capital investments of the data source infrastructure.

4.2 Development of GMES-dedicated space infrastructure

As stated in the GMES Communication of 2005, FP7 funding is foreseen to provide a significant part to the *GMES Space Component* (GSC) Programme of ESA, in particular regarding the development of GMES-dedicated space-based infrastructure.

Overall, of order 45% of the FP7 'Space' budget[34] could be made available for this action over the period 2007-2013. Based on the specific capacities provided by ESA in this domain, the Commission has decided to **delegate to ESA the management**[35] of the implementation of the FP7 funding of the GMES Space Component (GSC) Programme of ESA.

[34] Including the corresponding share of support to the horizontal support to cross-cutting activities, as well as of the relevant administrative expenses.
[35] COM Decision …….

The respective annual financial contributions to be provided from FP7 shall be foreseen in the annual updating cycle of the Work Programme, taking account of any update or revision of the GSC. For 2009, a contribution of EUR 68 million is foreseen.

Financial support from FP7 should contribute to the activities proposed by ESA in the GMES Space Component Programme, starting with Segment 1 [36], and followed by Segment 2.

EC funding to ESA will be contingent upon the effective implementation of the GSC programme in the ESA framework and compliance with the administrative and financial regulations applicable to the general budget of the European Communities[37] and with the EC/ESA Framework Agreement[38].

With a view to ensuring the efficient and coherent monitoring and evaluation of the implementation of actions carried out by ESA on behalf of the Commission under the Seventh Framework Programme, an adequate monitoring and control process is put in place. It is in fact assumed that the GSC Programme continues to be developed by ESA in a way that is demonstrably coherent with the emerging user requirements being aggregated by the Commission. ESA shall also regularly inform the Commission of the overall progress of the implementation of the Specific Programme, as well as on the specific results of procurement actions, and shall provide timely information on allocations proposed or funded under this programme.

The issues of security of space infrastructure (e.g. in terms of encryption of data transmission, where necessary) and optimised data relay solutions (e.g. inter-satellite and satellite-to-ground transmission technologies) should also be examined in this context.

It is essential that best use of existing and planned European satellites and ground systems is being made – including those existing in other European agencies and organisations such as EUMETSAT – in order to efficiently ensure the continuity of data necessary to the establishment of GMES services on an operational basis - to the development of which this Work Programme is aimed.

In addition to the GSC technical activities covering development of dedicated satellites, ground segment and data access, a number of additional accompanying activities will also be undertaken by ESA, notably to achieve a significant participation of the non-ESA Member States in FP7, stimulating the active involvement of their industries and research organisations, improving visibility, accessibility and understanding of the tender selection procedures of ESA in line with the EC Financial Regulations and FP7 context. For these activities a variety of funding schemes in line with the EC Financial Regulation may be used. Further information on opportunities is available on Space Theme CORDIS website.

4.3 Risk-sharing Finance Facility

The preparation of operational service capacities, as well as development of the GMES space components correspond to large undertakings and projects, involving long-term investments, with considerable risks for participating industries. Promoters need access to additional cash-flow to fulfil the Commissions co-financing requirements, enabling them to finance more (and more risky) projects. It is for such R&D actions that the Community will improve the access to private sector finance by contributing financially to the 'Risk-Sharing Finance Facility' (RSFF) established by the

[36] ESA/PB-EO(2007)44 of 17 May 2007

[37] Council Regulation (EC,Euratom) No 1605/2002 of 25 June 2002 and Commission Regulation (EC,Euratom) No 2342/2002 of 23 December 2002

[38] COM(2004)85. The EC/ESA Framework Agreement specifies, inter alia (Art.5.3) that: "*Any financial contribution made by one Party in accordance with a specific arrangement shall be governed by the financial provisions applicable to that Party. Under no circumstances shall the European Community be bound to apply the rule of "geographical distribution" contained in the ESA Convention and specially in Annex V thereto.*"

European Investment Bank (EIB). The Space theme is contributing to this funding facility, from its budget, and participants are invited to make use of this FP7 supporting scheme.

Further information on the RSFF is given in the Annex 4 of this Work Programme.

Indicative budget to be allocated as a result of calls and other activities

A total of EUR 125.4 million is to be committed from the 2009 Community budget. Indicative budget allocated to the activities from the 2009 budget is given in the following table:

	2009 EUR million[39]	total
Call FP7-SPACE-2009-1 Activity 9.1 Space-based applications at the service of European Society : 1. Stimulating the development of *downstream* GMES services 2. Monitoring of climate change issues 3. Integration of SatCom / SatNav with GMES	33.5	33.5
Call FP7-SPACE-2009-1 Activity 9.2 Strengthening of Space foundations: 1. Space Exploration 4. Support to new EU Member States / Associated States	5	14
Call FP7-SPACE-2009-1 Activity 9.2 Strengthening of Space foundations: 2. Space Technologies	9	
Call FP7-SPACE-2009-1 Activity 9.3 Cross- cutting activities 2. International Cooperation	3	4
Call FP7-SPACE-2009-1 Activity 9.3 Cross- cutting activities 5. European Space Policy Studies	1	
ACTIVITIES NOT SUBJECT OF A CALL FOR PROPOSALS: 1 Access to in-situ observation data (**EEA**) (re. 9.1) 2 ESA Delegation Agreement (re. 9.1)	3 68	71
OTHER ACTIVITIES 1 FP7 Expert evaluators payments 2 Communication, Impact assessment	0.9 0.5	1.4
GENERAL ACTIVITIES (CF. ANNEX 4)	**1.5**	**1.5**
ESTIMATED TOTAL BUDGET ALLOCATION		**125.4**

[39] Under the condition that the preliminary draft budget for 2009 is adopted without modifications by the budgetary authority.

Summary of budget allocation to FP7 general activities for 2009 (cf. Annex 4)

	2009
Cordis	EUR 0.424 million
Eureka/Research Organisations	EUR 0.012 million
COST	EUR 1.025 million
ERA-NET	EUR 0.007 million
Total	**EUR 1.468 million**

These general activities will not be administered by the Space Theme, but through the proposed horizontal mechanisms described in Annex 4.

All budgetary figures given in this work programme are indicative. Following the evaluation of proposals, the final budget awarded to calls may vary by up to 10% of the total value of the overall budget, and any repartition of the call budget may also vary by up to 10% of the value of the call. The budget figures for non-call activities may also vary by up to 10% of the stated budget and, in the case of the costs of evaluation, monitoring and review by up to 20% of the stated budget.

V INDICATIVE PRIORITIES FOR FUTURE CALLS

The Work Programme evolution is foreseen to include follow-on activities from the current FP7 call, with the objective to

- strengthen further GMES service developments;
- integrate satellite communication and satellite navigation solutions with space-based observing systems fostering the convergence of these space-based capacities;

- provide an opportunity within FP7 for strengthening international cooperation activities started at the end of the previous Framework Programme, as well as preparing GMES as the European contribution to GEOSS.

Following on from the NCP specific action in the first call, further dissemination actions are envisaged to

- promote the uptake of GMES services amongst users;
- promoting science, education and general outreach;
- examining the implications of technological developments for the European Space Policy.

The following potential topics have been identified already for possible future calls starting in 2010 or 2011:

Activity: 9.1 Space-based applications at the service of European Society

Area 9.1.1: Pre-operational validation of GMES services and products

Development of further GMES core services (follow-on activities)

In some application fields (e.g. water resources management, polar zones monitoring), pre-operational services are not yet established, although laboratory techniques and scientific methods are already well advanced[40]. Operational services and end-to-end supply chains remain therefore to be developed and validated. FP7 will undertake **development of pre-operational GMES pilot services in new application fields** with the view of providing Europe with such generic multi-purpose services.

Moreover, some countries already have a number of established agencies or actions that provide services on an operational basis in related application fields. As novel laboratory techniques and scientific methods are reaching technical maturity, new service capabilities not yet covered or included by these (pre)operational GMES information deliveries become feasible. Therefore, development of **upgraded capabilities** for existing GMES Fast-Track Services, Pilot Services and related (pre)operational services will be undertaken in order to extend the scope of such operational services, and to integrate and validate these capabilities within enhanced service delivery chains (e.g. through a wider geographical coverage, better spatial resolution, a wider range of information provided and improved time response)[41].

Stimulating the development of *downstream* GMES services

[40] It should be noted that development and research on specific earth observation and assessment tools, as well as environmental models underpinning future GMES services are undertaken in FP7 theme 6 "Environment (including climate change)".

[41] Qualitative/quantitative parameters which track the project objectives should be utilised to assess the impact of supported actions: see also Section II on expected impact.

Three fast track services and additional pilot services are expected to provide (pre)operational core services in Europe in 2008, based on mature technologies and service chains. As generic multi-purpose services, core services deliver products which are the basis for (geographically or thematically) specialized products and services. Complementary to these, dedicated **downstream service portfolios**, tailored for specific user needs, bring together a large number of political and industrial players to enable the maximum and efficient use of EO data in support of European policies.

This part of the Work Programme should also aim, through appropriate R&D actions, at continuing and strengthening the actions already supported under **ESA's 'GMES Service Element' Programme**. Care will be taken to take into account all relevant earlier achievements, as well as remaining gaps, if any.

Area 9.1.2: Integration of SatCom with GMES for prevention and management of emergencies

Integration of SatCom and SatNav with GMES for prevention and management of emergencies

The objective is to integrate satellite communication and satellite navigation solutions with space based observing systems for prevention and management of all kinds of emergency. The target should be a service platform, with the objective of validating the technological concepts and acknowledging the benefits of an integrated communication/ navigation/observation infrastructure with the users. Complementarity of the satellite capabilities with terrestrial capabilities, where appropriate, should be assessed on the basis of a medium to long term view based on the foreseeable evolution of telecommunication technologies, the related economics and addressed as an integral part of the proposed action. The validation of specific test-beds, based whenever possible and appropriate on real situations, is encouraged.

Activities not part of calls: Coordinated provision of space-based observation data for GMES and development of Earth Observation Space Infrastructure

As elaborated above in the section 'Approach', GMES service development, validation and operational scenario demonstration requires a comprehensive supply of data from space-based observation systems and the development of dedicated Earth Observation Infrastructure. Overall, of order 8% and 45% of the FP7 'Space' budget[42] could be made available respectively for these actions over the period 2007-2013.

First financial support from FP7 was foreseen in the 2007 budget line, for a preliminary pilot action with a volume corresponding to EUR 48 million over a three year period. First financial support from FP7 is foreseen in the current 2009 budget line for the development of Earth Observation Space Infrastructure, as described in section 4.2.

Based on the experience gained, further funding is envisaged to become part of the delegation agreement of the Commission entrusting ESA with the technical management of the GMES Space Component.

[42] Including the corresponding share of support to the horizontal support to cross-cutting activities, as well as of the relevant administrative expenses.

Activity: 9.2. Strengthening the foundations of Space science and technology

Area 9.2.1: Research to support space science and exploration

Current space exploration programmes, in Europe and elsewhere, intend to extend the human presence, in a real or virtual way, through missions to the Moon and to Mars or through automatic missions in direction to objects of the solar system. Complementary to, and in close co-operation with respective activities undertaken by ESA and other interested national agencies in this domain, the FP7 Space Work Programme will support research aimed at improving the capability to access planets surfaces, to move, to select and collect and finally return samples to Earth in the frame of space exploration activities.

Further analysis and scientific exploitation of space data, adding further added value to the investments made in building European satellites will be supported.

New generations of space missions (science and exploration)

The Work Programme on space sciences and exploration should focus on space missions upstream activities for the strengthening of the technological base.

The R&D activities are crucial for the development of new capacities (vehicles, platforms, instruments) responding to the new generation of space missions. The research objective here is to maintain the network of expertise in order to consolidate the enabling technologies, in particular:

- The technologies allowing new types of observation missions: formation flying, satellite autonomy, interferometry systems, measurement and relative positioning control, measure and transmission of high precision timing.
- New sensors for the different spectrum windows for astronomy.
- The technologies and measurement methods for the future Earth observation missions: specific laser sources, low frequency radars, synthetic aperture optics for observation from geostationary orbits.

Area 9.2.2: Research to support space transportation and key technologies

Space transportation (follow-on activities)

Research should focus on new concepts for emerging strategies such as direct injection to geo-stationary orbit by means of cryotechnic or heliothermic propulsion, advanced structures and new energy generation systems.

Reducing economical risks requires strong simulation capacity and technology validations. Consequently the research activities should address the modelling of combustion and complex fluid movements, behaviour of specific materials for launchers and propulsion, shock analysis, dynamics of the payloads, system integrity monitoring. Due to the technological complexity of the domain, in relevant cases, international cooperation may be considered.

Space technologies (follow-on activities)

To address the strategic challenges on space technologies, FP7 intends to complement current efforts of the space community and to contribute to the European Space Programme.

In the medium and long term the Work Programme will provide research support in the following areas:

- Multiple-use and Spin-in – Synergic actions with the non-space sector in areas of embedded systems, photovoltaics, fuel cells, nano-technologies and robotics.
- Enabling technologies – support the implementation of EU policies

In addition, support to Multiple-use/spin-in should be done through cooperation with other Technology Platforms in related thematic areas and incorporating space needs in related calls and support to Enabling Technologies will be done via related application lines (e.g. Security, GMES and Galileo).

Area 9.2.3: Reducing the vulnerability of space assets

Security of space assets from on-orbit collisions

Space assets, and their associated ground facilities, are sensitive to external events that can endanger their proper functioning, such as space debris, hostile laser or Anti SATellite systems (ASAT), jamming, viruses, natural or men-made electro-magnetic disturbances. These events might have transient effects that can be recovered or have permanent effects leading to the non-functioning of the asset and consequently of its expected services. The research should focus on complementarity with the proposed ESA Space Situational Awareness (SSA) programme, and more specifically on options to reduce the vulnerability of space assets, such as:

- array components, so that partial destruction does not impair the functioning of the affected sub-system;
- risk-minimizing architectures such as multi-orbital constellation architectures;
- advanced anti-jamming & anti-virus techniques;
- identifying activities in the perspective of the setting up of a cost effective European System for space awareness using the existing capacities and aiming at developing new sensors operated from the ground;

Activity: 9.3 Cross-cutting activities

Area 9.3.2: International cooperation

International co-operation in GMES

Proposals will be sought which develop activities to disseminate and implement outside the European Union (e.g. Latin America, and especially in developing countries) products and services derived or customised from current GMES development activities, for instance for risk management, resource management and land planning, marine and atmospheric environment monitoring, and in the domains of management of water resources and security. Proposals addressing Early Warning Systems linked to natural disasters, food security or disease prevention are also encouraged.

Priority will also be given to proposals to study the potential for current and foreseen GMES services to provide the building blocks for the EU contribution to GEOSS. Proposals should assess current services and information products against the GEOSS requirements, identify service/data gaps and barriers such as restrictive data use and re-use policies, and suggest actions.

Area 9.3.3: Cross-border cooperation (and European Research Area Networks)

ERA-NET (plus) for GMES

Local and regional authorities form a mainstay of the GMES user communities. The potential for GMES to be at a service to these important user segments has not yet been fully exploited. For full service implementation awareness and support by local and regional policy makers are needed. Furthermore, only localised implementation of several services will un-lock the synergy potential identified for GMES core services and INSPIRE interoperable contents. The main objective is to demonstrate the feasibility of a federated service capacity and it's applicability to regional users.

Activities developed within the ERA-NET scheme consisting of Coordination and Support Actions networking research programmes carried out at national or regional level, are also regarded particularly attractive in opening the development and implementation of such joint activities.