CIVIL-MILITARY SYNERGIES

IN THE FIELD OF EARTH OBSERVATION

EU, EDA, CSG, ESA Joint Task Force

Final report

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Executive summary

To address civil-military synergies in the field of Earth observation and identify potential areas of implementation, a joint Task Force has been set up by the European Commission, the European Defence Agency, the Council Secretariat General and the European Space Agency (see mandate in annex 1).

During one year of work, eight meetings and consultation of several external experts, including the representatives of the contributing Member States of the MUSIS programme, the Task Force has discussed various areas such as harmonization, standardization, research & technology, current European space programmes and other more general synergy issues dealing with sensitive civil/commercial data, pooling of resources, sharing of user needs as well as international cooperation.

The Task Force has formulated the following five recommendations:

1 - Support research on Hyper-Spectral technologies in both the civil and military domains.

2 - The European INSPIRE directive should be considered by the military for application since it will facilitate the use of commercial data.

3 - The European military users should consider using the future European Data Relay Satellite system (EDRS).

4 - The current ground calibration points used by European civil systems should be listed and the possibility of sharing the military calibration points should be investigated.

5 - The European Digital Elevation Model (DEM) currently under procurement by the EC should be analysed to determine under which conditions it may be used as a common source for an operational reference tool for geo-localization for both civil and military needs.

Finally, the Task Force would like to recall that synergies can only be maximised if they are identified during the phase of the definition of user needs. This requires a strong and continuous support at political and senior management level.

Context and objective

The Council Resolution of May 2007 on the European Space Policy (ESP, Ref 1), jointly developed by the European Commission and the European Space Agency, states that "*space technologies are often common between civil and defence applications and that Europe can, in a user-driven approach, improve coordination between defence and civil space programmes*" (section B.8).

This ambition to explore synergies between the civil and defence domains is fully endorsed by the EU Member States who in the 2008 Council Resolution "Taking forward the European Space Policy" (Ref. 2) identified space and security as one of four new priority areas for the ESP and highlighted the need to "*define the way and means to improve the coordination between civil and defence space programmes in long-term arrangements*".

Indeed, the current situation of space programmes in Europe is characterized by a fragmentation with, on the one hand, military, dual-use and civil programmes at national levels and, on the other hand, civil programmes at commercial and European (ESA and European Commission) levels.

To address synergy issues in the field of Earth observation and identify potential areas of implementation, a joint Task Force has been set up by the European Commission, the European Defence Agency, the Council Secretariat-General and the European Space Agency. More specifically, the main aims of this Task Force are, according to the mandate (annex 1) to:

- Improve harmonization and standardization in Europe in the field of Earth observation,
- Identify complementary research and technology activities among European actors,
- Address appropriate synergies between MUSIS and current European space programmes under development, such as GMES and EDRS.

This document constitutes the final report of this Task Force.

1. Introduction

1.1 Earth observation

The term Earth observation is generally used when referring to satellite-based remote sensing, which provides a whole range of information regarding the Earth's land masses, the oceans, the atmosphere and, in general, the environment and situational awareness, based on imagery or measurements.

Earth observation data, integrated with in-situ data gathered from wider information systems, generate products allowing decision-makers to directly access crucial information, to support their policies and to influence the conduct of other actors or competitors. This paradigm is applicable to both the civil and military domains.

For civil scientific purposes, other measurements include, inter alia, the production of data on the chemical composition of the Earth's atmosphere, reflectance, gravity, magnetism, etc.

Earth observation also has implications for security and defence. The information provided by satellites can help in shaping the security decisions of a nation, or a community of nations, through the evaluation of the economic, geographic and military situation of a given region of interest anywhere in the world, and the corresponding evolution over time.

Imagery from Earth orbit, either optical or radiometric, is a unique capability as it enables the repeated observation of specific regions, at different scales and without the need for approval from any authority. Depending on their orbit and intended function, different satellite instruments have different spectral, spatial and temporal resolutions. Their output is subsequently processed and translated into information fulfilling the user requirements.

The history of Earth observation from space started with military programmes in 1960 (US Corona satellites - see section 1.3).

The first dedicated civil remote sensing satellite was Landsat-1 (then called the Earth Resources Technology Satellite, ERTS), launched in 1972 by the US. Landsat was a pioneering mission, showing how agriculture and the environment on Earth could be observed from space. Since Landsat, many

satellites carrying a wide spectrum of sensors have been placed in Earth orbit. The complexity of Earth observation satellites reached its maximum with ENVISAT, the largest environmental satellite to date, which was developed and is currently operated by ESA.

During the Cold War, military surveillance and reconnaissance were the first applications to use remote sensing from space extensively. The state of the art today is represented by the tactical satellites of the U.S. Department of Defence (DoD). In order to increase the responsiveness, the DoD is investigating some key concepts, such as rapid launch timelines, standards-based bus designs, payloads built using commercial-off-the-shelf (COTS) and government-off-the-shelf (GOTS) sub-systems and direct Secret Internet Protocol Router Network (SIPRNET) connectivity, within a new programme called Operationally Responsive Space (ORS).

The last few years have seen the advent of commercial ventures exploiting and even launching their own Earth observation satellites. Commercial satellites carry high-resolution sensors aimed at new non-scientific users and their development marks a new phase in Earth observation: the products that they generate are purchased by both civil and military users. Modern Earth observation satellites carry high-resolution optical sensors, allowing objects of less than a square metre to be distinguished.

The US government policies have been instrumental in creating the conditions that encouraged private companies to start new businesses based on commercial observation satellites. The relevant national interest went beyond the success or failure of particular companies, but was rooted in broader benefits such as:

- Sustaining the technological leadership of the US industry associated to the space and ground segments of imaging satellite systems,
- Enhancing government access to technological innovation,
- Supplementing US government imaging capabilities during domestic disasters and foreign policy emergencies,
- Reaping larger public benefits from a wider range of civil application of Earth observation data.

Clearly, in the US, the military dimension is very strong but some commercial providers have also emerged (DigitalGlobe and GeoEye), supported by anchor tenancy agreements with the US Department of Defence (see section 1.3).

As a consequence, the industrial capacity associated with Earth observation is clearly a strategic resource, the preservation of which is intimately related to maintaining technology preparedness, prestige and influence in the world community.

In Europe, extensive Earth observation capabilities are available and the EO industry, encompassing satellite manufacturers, satellite operators, data distributors and value-added companies, with the recent trend of combining the last two elements to optimise the service offered, is robust and well developed. In 2009, for Europe, the associated revenues for the space segment alone were at the level of nearly € 1 billion, mainly from institutional customers (see Ref. 3).

Tables I and II of annex 2 show the recent and future development of optical and radar imaging spacecraft in Europe (civil and dual use systems).

The Japan Aerospace Exploration Agency owns and operates ALOS-PALSAR, a polar metric L-Band Radar for environmental research, equipped with the optical PRISM sensor which can achieve 2.5 m ground resolution, which is operated through the SARCOM and EMMA consortia. In addition, Japan has now a military Earth observation system for intelligence gathering (see section 1.3).

India has developed high-resolution operational satellites, both optical and radar, addressing cartography and resources monitoring, to fulfil national interest and seeking revenues through data commercialisation.

China is also currently operating three distinct Earth observation systems: Zi Yuan for resource monitoring (Brazil is a partner), Haiyang for oceanography and Fen Yung for weather forecasting.

Many other emerging countries already possess or plan to acquire their own Earth observation capability.

1.2 The civil dimension of Earth observation

Accurate and detailed images of the Earth's surface can be produced through cameras, radars and specific scanners to improve the accuracy of maps, observe and assist in weather reporting and prediction, assess the impact of humans on the environment, estimate the status of crops and natural resources and provide support for crisis or emergency management. Imagery has a very broad range of applications, spanning across scientific, economic and security domains.

In the long term, the continuous monitoring of the Earth's environment will enable a reliable assessment of the global impact of human activity and the likely extent of future evolutions.

A growing number of Earth observation programmes are available worldwide, even in emerging countries. Their implementation relies on investments coming mainly from governmental institutions and, to a lesser extent, from private commercial enterprises.

In the U.S., the EO sector first focused on environmental observations through large multi-instrument platforms (e.g. NASA Terra, Aqua), with the subsequent trend towards the development of smaller and more focused missions to respond to specific policy requirements (e.g. Earth Science System Pathfinder Missions).

The European Commission is developing GMES, the most ambitious Earth observation programme to date, with the goal of delivering operational information services for environment and security in six main areas: Land, Marine, Atmosphere, Emergency Response, Security and Climate Change. To accomplish this, GMES has been organised in three main components: Services, Space component and In-situ component. ESA Member States and the European Commission have invested significantly in the setting-up of GMES by creating and funding the joint GMES Space Component (GSC) Programme. Its objective is to fulfil the space-based observation requirements in response to European policy priorities. To achieve this target, two types of resources will provide complementary essential space-based observations with a large variety of sensors and relatively high observation frequency:

- The Sentinels (five are planned, see annex 2), which are being developed specifically for the purpose of GMES,
- The GMES Contributing Missions, which are owned by various national and/or commercial entities and have been built for their own purpose. About thirty Earth observation missions are indeed operated by European national or multinational entities which are in orbit today or will

be flying within the next few years. A portion of this vast resource of satellites and sensors can be made available to GMES, after having satisfied their prime national, security or commercial interests.

These Contributing Missions stirred the commercial market with a diverse range of business models being adopted by commercial operators. Examples are given below:

- SpotImage, owned at 80% by EADS Astrium Services, operates and commercialises the SPOT satellites, Formosat and generates significant revenues on the international market. They will commercialise the products derived by Pleiades,
- TerraSAR-X was developed under a Public-Private Partnership (PPP) between Astrium GmbH and the German Space Agency (DLR) and the data and products from the satellite, launched in 2007, are commercialised through EADS Astrium Services, Infoterra GmbH, with DRL able to access data freely for scientific purposes,
- The RapidEye constellation launched in 2008 and operated by RapidEye AG received subsidies from DRL, German state subsidies, and private investors,
- Radarsat - 2 launched in 2007 was developed by the Canadian Space Agency (CSA, associated member of ESA), with the operations passed to MDA after the launch. The satellite was funded by MDA and the CSA, and MDA received further financing through data pre-purchase agreements with the Canadian government. Under this agreement, government departments will receive data free of charge and MDA Geospatial will be responsible for the commercialisation of the data,
- The radar constellation COSMO-SkyMed, developed and operated by the Italian Ministry of Defence and the Italian Space Agency (ASI) is commercialised through the company e-Geos, owned by Telespazio and ASI,
- DEIMOS Imaging is developing the Deimos satellite system in collaboration with SSTL. Deimos will be integrated in the international constellation Disaster Monitoring Constellation.

Integrating these diverse resources into a homogenous architecture of the overall GMES Space Component clearly represents a major challenge, both technically and programmatically. The integrated ground segment enables this by operating and providing access to Sentinel data as well as interfacing with the Contributing Missions, in order to obtain a coordinated data stream to satisfy observation requirements of GMES services.

1.3. The military dimension of Earth observation from space

Earth observation for military purposes has been one of the very first developed applications since the US Corona system was deployed for reconnaissance purposes as early as 1960. Space-based infrastructure is indeed of crucial importance to military remote sensing and Earth observation as it allows for non-intrusive data gathering with worldwide coverage. The associated information generated from these data is particularly relevant at strategic level, for Intelligence, Surveillance and Reconnaissance tasks, as well as for supporting geospatial localization of other applications and products.

The presence of the atmosphere puts however a lower limit on the possible spacecraft altitude, constraining the geometric resolution of the images, while the orbit dynamic constrains the revisit time on the same zone. This makes it necessary to deploy constellations of several agile satellites to improve the responsiveness of the overall system.

In Europe, only three military Earth observation space systems have been developed. These are currently operated at multilateral or national levels:

- The HELIOS II system (led by France with participation of Spain, Belgium and Greece): Two optical and infrared satellites,
- The SARLupe system (Germany): Five radar satellites,
- The COSMO-SkyMed system (Italy): Four radar satellites, also used for civil applications (dual use programme),

In order to allow exchange of data derived from optical and radar images, specific agreements have been signed between France and Germany as well as France and Italy.

The definition of the next generation of these military systems has started and Spain is also currently developing its own national system of one optical satellite, Ingenio. To enhance the exchange of data between these systems, the MUSIS (MUltinational Space-based Imaging System) project has been set up with the aim of establishing interoperability among ground segments, while the development of the space components themselves will remain in the remit of Member States.

Dual use programmes (such as the Italian COSMO-SkyMed system and the French Pleiades system planned to be launched in 2011) are just as relevant for military purposes since they are typically designed from an early stage to support the needs of the civil and military users.

Purely commercial companies, such as SpotImage and Infoterra in Europe, are also providing relevant images used for military tasks. Indeed, most of the images processed today by the European Union Satellite Centre are of commercial origin. This approach is also used in the U.S.: although they operate a large national fleet of military satellites, commercial image revenues from U.S. defence and security agencies reached $ 430 million in 2009 (Ref. 6). Furthermore, the 2010 National Space Policy of USA (Ref. 7) is strengthening this trend. As a consequence, in August 2010, the US National Geospatial Intelligence Agency signed two long-term agreements with the commercial companies GeoEye and DigitalGlobe (contract "EnhancedView", $ 7.3 billion over 10 years). Furthermore, in order to increase flexibility and responsiveness in term of service, the US DoD has started two initiatives: the Operationally Responsive Space (ORS) programme, focused on more reactive small spacecraft and launchers, and the potential hosting of national payloads on board commercial spacecraft, in line with guidance of the US National Space Policy (Ref. 7): "*Work jointly to acquire space launch services and hosted payload arrangements that are reliable, responsive to United States Government needs, and cost-effective*" .

Japan also operates a system for military use (Intelligence Gathering Satellite), using optical as well as radar satellites.

Globally, it is important to note that the number of spacecraft launched for security and defence purposes has been increasing over the last few years and this trend is predicted to continue for the following few years (see figure 1, from Ref. 6).

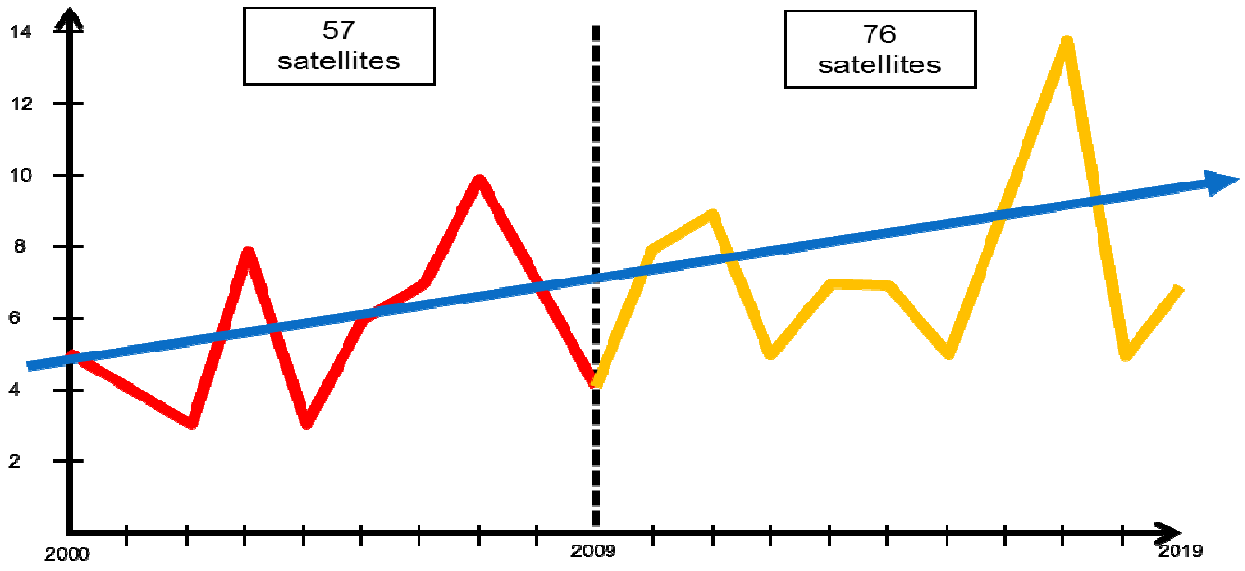


Figure 1: Main defence and dual use satellites launched and forecasts, excluding China (source: Euroconsult, report "Earth observation: defence & security, 2010)

2. Identification of synergies

2.1. Mapping the relevant current activities or lessons learned

2.1.1. In the European Space Agency (see annex 3)

In the frame of the Task Force, ESA has identified Thermal Infrared and Hyperspectral technologies as having high potential for civil/military synergies.

Space-borne high-resolution thermal infrared (TIR) capabilities would meet the needs of a large number of security-related applications such as crisis management, industrial activities, situational awareness, maritime surveillance, environmental monitoring, water resource management and infrastructure mapping. It also has the potential to detect an assembly of concealed persons, refugees and vehicles generating thermal contrast with their background. These applications would be well supported by imagery at resolution between 5 – 50 m.

Hyper-Spectral Imagery (HSI) is an emerging versatile technology, successfully demonstrated in a variety of diverse applications, which could potentially enable significant advances towards improving the preparation for and execution of security missions. It could enable for example, the detection of chemical or biological contamination, hazardous waste, thermal activity, assessment of underground structures and foliage penetration to overcome camouflage. However, the analysis of HSI data is typically very processing intensive. Real-time applications of HSI will progress with both the computational capability of the processing stations and with the delivery time of the complete set of data from space, which will implicitly require a Data Relay Satellite associated to the operational use of such sensors.

In addition, ESA kicked-off two parallel studies on the GMES Security dimension in June 2010, having the objective of assessing space infrastructure needs (space and ground segment), evaluating to what extent this can be met by existing or planned national or commercial capabilities and, if gaps occur, provide the basis for further dialogue to determine which course of action should be taken. The studies will consider case study scenarios, to gauge the feasibility and the technical readiness of the required information infrastructure. Those scenarios will be provided within the frame of the External Action Working Group, led by the European Commission and the EU Council with the participation of ESA, EDA and user communities.

Furthermore, the following topics will be investigated:

- Cooperation with in-situ assets, coherently with the current GMES approach,
- Options for space and ground infrastructure fulfilling the observation needs,
- Options for the relevant concepts of operation,
- Initial definition of system architectures and technology roadmap.

VHR optical and SAR imaging, Hyper-spectral and Thermal Infrared technologies are expected to lead to new applications. Likewise, the use of the European Data Relay Satellite system (EDRS) for real-time applications, and integration with other data streams, is expected (navigation, in-situ, etc.). Hence, both synergies and new developments are addressed. The results of the studies will be available in September 2011.

ESA is preparing a study on the Ground Segment needed to set up a civil System of Systems (SoS) in the field of Earth observation. Such a study, synchronized with a corresponding activity of EDA for the military System of Systems (see section 2.1.3), will allow the identification of potential synergies in this area between military and civil SoS as well as the associated challenges and potential obstacles. Earth observation from Space is an essential element for security-related applications, and a significant set of related systems currently exists in Europe or such systems are under development and planning at both national and multi-national level. The individual space assets and their associated ground segments, designed for civil or specifically military purposes, can be potential contributors to a wider System of Systems, on an ad-hoc basis. The different ownership arrangements and the independent control of such assets by different user communities indeed pose a particular challenge for the design and interface of the respective ground segments in order to generate added value and ensure near-real time data and products. The planned studies will therefore address the technical feasibility to network the individual ground segments on an ad-hoc basis and investigate the associated constraints and governance issues.

ESA is currently managing prospective activities that may also have an impact on Earth observation for military purposes. The Geo-Oculus pre-project has the objective of enabling Earth observation to an extent not yet feasible with current or planned systems or missions. ESA has identified a lack of capability for a combination of fast response, high-revisit, near-real-time and high-resolution observations. Therefore, the starting point for the study is a geo-synchronous satellite mission with

high-resolution optical imaging instrumentation, real-time control and an agile platform. In this frame, ESA has performed two studies:

- Medium- to high-resolution observation in 'Geo-Oculus',
- Very high resolution observation in 'Towards 1-m from GEO'.

The technology studies will be followed by a system architecture study.

2.1.2. In the European Commission (see annex 4)

The space theme of the Seventh Framework Programme (FP7 Space) has the overall objective of supporting the European Space Policy (ESP), established by a Commission Communication adopted in April 2007 and endorsed by the fourth Space Council in May 2007 (ref.1). FP7 Space is focusing its support on two main areas:

1. The development of space infrastructure and services related to Global Monitoring for Environment and Security (GMES) with a view to developing services benefiting European citizens,
2. The strengthening of space foundations with the aim of fostering the competitiveness of the European space industry.

Security is one of five core areas of GMES presently supported by FP7 Space. Several security-related projects were also supported during FP6, some of which have recently been finalised. Although GMES is a civil initiative, it is acknowledged that its security aspect is of considerable interest to the European defence community. However, GMES remains a civil initiative and potential requirements from the defence side can only be taken into consideration as long as these are compatible with the civil use of GMES. Similarly, there are a series of projects supported by the framework programmes with a dual-use potential in the area of strengthening space foundations.

In this context, the Task Force has identified a series of FP6 and FP7 projects of potential relevance to the defence domain. These projects aim at enhancing *civil* security or developing technology and processes beneficial to civil security, but could as well be of interest for defence users. In fact, several of these projects already have an active participation of defence entities from various EU Member States.

Examples of such projects include:

- *LIMES - Land and Sea Integrated Monitoring for Environment and Security*

The objectives are to develop and validate a set of services to support security management at EU scale and to improve the use of earth observation and other space technologies for security

applications. The applications in this project include maritime surveillance, land border management, surveillance of critical infrastructure, Non Proliferation Treaty monitoring and support to humanitarian missions.

- *G-MOSAIC - GMES services for Management of Operations, Situation Awareness and Intelligence for regional Crises*

This project aims at developing the security core service of GMES. G-MOSAIC will provide intelligence services to the EU and its Member States before, during and after a crisis. This includes route surveillance, assessment of structural crisis indicators, such as population density and agricultural production as well as monitoring of illegal activities such as illegal mining or logging. G-MOSAIC Crisis Management Operations provide intelligence once a conflict has erupted, aimed at supporting EU intervention activities such as peacekeeping, prevention of nuclear proliferation, piracy at sea, illegal immigration, drug trafficking, protection of vital infrastructure and surveillance of weapon proliferation.

- *TANGO - Telecommunications Advanced Networks for GMES Operations*

It focuses on the use of satellite telecommunication solutions with a view to supporting future operational information services and end-users to fulfil their telecommunication needs in the domain of risk and crisis management, maritime services, land cover, atmosphere, security and humanitarian aid.

- *NEWA - New European WAtcher*

The project aims at strengthening the European Space-based Reconnaissance & Surveillance (R&S) Capabilities by developing a radar satellite that would be able to detect and identify moving objects. The ability to detect moving objects will be extremely useful for border surveillance and law enforcement and may be of interest to the defence community.

- *SSA – Space Situational Awareness*

The European Commission and the Council Secretariat-General are involved – together with ESA and EDA - in defining the future governance and data policy of SSA. In addition various research projects support the build up of such a system. They relate to developing ways to de-orbit space debris or disused satellites by using laser technology or solar sails. Another example is scientific work on detection of moving objects in space by the use of radar satellites.

- *EU DEM – EU Digital Elevation Model for geospatial reference data access*

The European Commission is procuring a medium accuracy DEM as the elevation data theme for GMES to support the Land Monitoring (LMCS) and Emergency Response Core Services (ERCS). The new EU-DEM will homogeneously cover the 32 member countries and 6 cooperating countries of the

European Environment Agency. The EU-DEM will provide an underlying 3D geographic framework on top of which additional thematic datasets can be produced and distributed. The EU-DEM may also be used as reference for other existing databases with the aim of making them compatible with each other. It will thus overcome the present situation where such databases can only be compared with great difficulty as they use different reference bases. Although the INSPIRE Directive is designed to make the data formats compatible on a European level, this does not guarantee that the derived products have been calibrated because presently there is no common DEM available.

- *Standardization*

In addition to the projects supported by FP7 and FP6, the European Commission has initiated a process aiming at enhancing standardization in the space domain through CEN, CENELEC and ETSI. One specific area of relevance for further coordination between the civil and defence domains is dual use ground segment interfaces in Earth observation. The Task Force has endorsed the Commission's suggestion to issue a mandate to CEN to continue its work on this specific issue with the aim to achieve common standards by 2013, building on existing efforts in this regard. Once such standards are in place, they will simplify the exchange of space data and derived products between various space systems. Again, these standards will go beyond the INSPIRE Directive which only regulates the compatibility of European space data formats. With the involvement of relevant European and national standardization authorities the focus of this initiative is on hardware rather than on data.

2.1.3. In the European Defence Agency (see annex 5)

The main on-going EDA activities in the field of Earth observation from space cover the whole spectrum of programme activities, from upstream (user needs, R&T…) to downstream (operational aspects…).

EDA has collected military user requirements for surveillance and reconnaissance purposes. This work describes the military, strategic, operational and tactical requirements associated with the EU and for CSDP operations.

The main research and technology activities related to Earth observation from space concern:

- Embarked software, particularly the interface layer between heterogeneous components/applications in on-board data handling architectures. An on-going study aims at mapping the current situation in terms of standards, key players, tools, etc.

- Microsatellite clusters: Formation flying allowing coordinated position and pointing among a constellation of small spacecraft is an attractive alternative solution to large spacecraft. An on-going study aims to assess this concept in the field of a SAR mission.

Other activities not focussed on Earth observation, such as critical space technologies, detectors and sensors, R&T multi-purpose actions, etc., are also on-going but not documented here, since they are not covered by the Task Force mandate.

At operational level, EDA has developed a Concept Capability Demonstrator of an imagery exploitation station allowing operators to import and process a large set of imagery data of various sources: the EUSC is the test centre for this station.

EDA is also involved in the MUltinational Space-based Imaging System (MUSIS), aimed at enhancing the exchange of data between the next generation of European Earth observation military space systems (see section 1.3). Within the overall MUSIS project, EDA is in charge to find new European partners and make the link with the European Union to consider appropriate synergies.

As further discussed in section 1.3, the European military Earth observation space systems are today operated at national level. EDA's interest thus primarily relates to the ground segment with the objective of improving the exchange of data and capacity between these diverse and heterogeneous systems, the MUSIS concept being a prime example. In the future, the System of Systems concept is worth considering. EDA is planning to address this concept from a military perspective in synchronisation with similar ESA activities focusing on the civil case (see section 2.1.1). These results will allow the identification of potential synergies between the military and civil sides.

The military dimension of Earth observation from space is specific at three levels: the sensor performances (requested resolution is more demanding than for civil applications); the operational process from the request to the delivery of data (due to the responsiveness requirement, in particular for the ground segment) and the security aspects. However, for non-military programmes, the same type of specifications already exists but normally with lower performance demands. This provides the opportunity to exploit a large potential of military/civil synergies at technical level.

2.1.4. In the Secretariat General of the Council

An important activity concerns the GMES (Global Monitoring for Environment and Security) data security policy. GMES is due to be partially operational in 2013. Three GMES areas are in particular dedicated to security: border surveillance, support to EU external action and maritime surveillance.

The Council Security Committee Decision[1] created in September 2008 an expert working group dealing with GMES data security. The recommendations on GMES data security policy established by the group have been validated by the Council in January 2010[2].

The European Commission will implement the GMES Regulation by rapidly elaborating in consultation with ESA and Member States the details of the GMES data/information policy as soon as possible, thereby also supporting the build-up of a commercial European Earth observation services sector, and, as a step in answering the recommendations of the Council Security Committee on the data security policy of GMES, to submit in the nearest future a risk assessment of the assets of GMES to the GMES Security Board, which is about to be established.

2.2 Potential synergies and recommendations

2.2.1 At harmonization level (H)

H1 – Ground segment architecture

As mentioned in the consolidated version of the treaty of the European Union (Ref.4, article 42), "*The common security and defence policy shall be an integral part of the common foreign and security policy. It shall provide the Union with an operational capacity drawing on civil and military assets"*. As indeed expressed in the Space Council Resolution of Sept 2008 "*Taking forward the European Space Policy"* (Ref. 2), the GMES programme "*will rely on some dual use observation capacities"*. This addresses national contributing missions having both civil and military applications, such as COSMO-SkyMed and Pleiades.

[1] ST 13571/08 decision to create an expert's sub-area of the Council Security Committee dealing with data security

[2] ST 5213/10 Recommendations on GMES data security policy - Analysis paper

The relevant operational environment is shaped in the form of a “System of Systems”, intended as large-scale integrated systems that are heterogeneous and independently operable on their own, controlled and owned by different actors, but that are networked together for a specific goal.
The individual space assets can be the potential constituents of a System of Systems to generate value-added data and products for security applications in a sustainable fashion. The challenge is to identify options for harnessing the individual ground segments to fulfil specific objectives with highly variable partnerships for ad-hoc observations in a limited time.

The Task Force considers that in the short term priority should be given to the ground segments. Consequently, a concrete case study would cover the synergy between civil and military ground segments. ESA and EDA are currently discussing the technical feasibility of possible ground segment architecture based on the existing or the planned infrastructure is investigated. This will entail a gap analysis of the existing and the required IT security level and identify whether new infrastructure (for example for Command and Control) is needed, including the inherent requirements. Issues will be the constraints dictated by legal and data confidentiality issues, accounting for the non-reciprocity between military and civil information**.**

H2 - Cooperative civil and military system architecture

The Task Force concurs that, in a longer-term perspective, the end-to-end aspect of any integrated system is a critical element for both civil and military programmes, encompassing characteristics such as responsiveness, standard calibration targets and procedures, data product generation including fusion algorithms and data dissemination. The possible technical solutions depend on the options for governance and on the current data security classification.

The Task Force proposes that, in the long term, a feasibility study on options for cooperative civil and military system architectures could be conducted, addressing end-to-end performances based on current user needs. The study should investigate implementation alternatives as driven by possible governance arrangements. This mid-term study would also provide a preliminary impact assessment for each of any of the anticipated choices.

2.2.2 At standardization level (S)

Currently, it is quite clear that using the same standards on both the civil and the military user side will have the potential of at least reducing cost. The military community currently already uses COTS

products when feasible. This could also be done in space applications, particularly Earth observation. For industry working on both civil and military developments, a large set of identical technical standards is applied, provided this does not touch on sensitive issues or create conflict with national security rules. The Task Force considers that in this regime there is still progress to be made on the following axis.

S1 – INSPIRE Directive

In March 2007, the EU started a programme for Infrastructure for Spatial Information in the European Community (INSPIRE). The aim is to ensure that the spatial data infrastructures of the Member States are compatible and usable in a Community and transboundary context. The INSPIRE Directive[3] requires that common Implementing Rules are adopted in a number of specific areas. Regulations on Metadata[4], Network Services[5], Data and Service Sharing[6] and Monitoring and Reporting[7] have entered into force.

The development and co-ordination of this initiative is administered by three Directorates-General of the European Commission called the European Commission INSPIRE Team. It consists of DG Environment as the overall legislative and policy coordinator, Eurostat acts as the overall implementation coordinator and the Joint Research Centre is the designated technical coordinator.

As these rules will be implemented over the next few years to govern civil spatial data infrastructure, the Task Force concludes that this initiative should be brought to the attention of the military users or developers of military space applications. The objective would be to give them the possibility to look into their future developments and adopt these procedures and standards for possible enhancements for these applications in terms of civil/military synergies.

S2 – Military standards

[3] OJ L 108/1, 25.04.2007, Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)

[4] OJ L 326/12, 04.12.2008, Commission Regulation (EC) No 1205/2008 of 3 December 2008 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards metadata

[5] OJ L 274/9, 20.10.2009, Commission Regulation (EC) No 976/2009 of 19 October 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the Network Services

[6] OJ L 83/8, 30.03.2010, Commission Regulation (EU) No 268/2010 of 29 March 2010 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards the access to spatial data sets and services of the Member States by Community institutions and bodies under harmonised conditions

[7] OJ L 148/18, 11.06.2009, Commission Decision of 5 June 2009 implementing Directive 2007/2/EC of the European Parliament and of the Council as regards monitoring and reporting

The civil users should in turn, wherever possible, consider existing military specifications or standards where these exist. This could be done by CEN/CENELEC and ETSI within their standardization work. The EC will task them to establish European standards for Space industry, which include issues linked to Earth observation.

The Task Force suggests that the work of these organisations should be implemented in a way that allows increasing synergies between the civil and military fields. A mapping exercise could be included to analyse and distinguish military specifications or standards that may exist in the space domain. Therefore a dialogue with the military should be foreseen to achieve this aim.

2.2.3 R&T (RT)

RT1 – Hyperspectral Technologies

The Task Force has identified that both civil and military users have applications that may require hyperspectral technologies. It is therefore essential to analyse the relevant operational and technical characteristics such as resolution, bandwidth and data volume with a view to developing detectors, optics and data handling subsystems for space platforms for the benefit of both communities.

Recommendation 1: Support research on Hyper-Spectral technologies in both the civil and military domains.

RT2 - Consultations

A joint EC-ESA-EDA report on "Critical Space Technologies for European Strategic Non Dependence" was issued in June 2009**.** All identified technologies are generic, thus relevant for civil as well as military use, with emphasis on non-dependence with regard to non-European technology. The implementation of the findings is now on-going in the 3 institutions (EC, ESA, EDA), and based on an approach that takes into consideration the available financial sources and avoiding duplication.

In terms of technical areas specific for Earth observation, the following topics are worth considering:

- LEO platform (agility, responsiveness, data transfer strategy from/to the Earth, constellation and formation flight, new generation of equipment, etc.),
- Detectors (Visible, Near and Thermal IR, Hyperspectral, new generation of Synthetic Aperture Radar, etc.), in view of the next GMES and MUSIS generation,

- Ground Segment Architectures,
- Calibration/Validation,
- Identification and Data Fusion Algorithms.

The Task Force supports the idea to set up informative technical meetings, at regular intervals, on the ongoing and planned activities relevant to EO which could support the exchange of information between the relevant European and national stakeholders.

RT3 - Harmonisation of civil/military research

The civil Space Community in Europe has recognised the development of technological synergies in various application areas as a research field as an area of high importance. Industrial companies take advantage of harmonisation work for both civil and military markets, as well as the use across various application fields such as space and aerospace. The internal practice of a multi-national company could also be applied as an overarching approach between civil and military R&T areas in a wider environment. The broader the technological R&T basis, the more fields for synergies may be identified. A mapping of European research laboratory facilities would be desirable, including the identification of restrictions that would prevent co-ordinated work.

2.2.4 For the European space programmes, MUSIS, GMES and EDRS (SP)

SP1 – Dialogue creation

Today, there are several national and European space programmes and projects dealing with Earth observation or supporting this (see section 1). Most of the possible synergies lie however at the level of spin-off (transfer of developed technology towards other programmes), and spin-in (use of technology developed by another programme). The benefits in terms of cost, development risk and duration of re-using technical solutions developed for other programmes have been clearly demonstrated in other space fields such as space sciences and telecommunications. The same approach should be applied in the field of Earth observation. Such an approach needs information exchange of two types: information on the developed innovative technical solutions and information on the future technical needs. The current EDA Collaborative Data Base (CoDaBa), compiling the pMS programmes, could be the starting point for the military and dual use space programmes.

The GMES Regulation[8] calls for GMES information to be fully and openly accessible, without prejudice to relevant security restrictions or to the data policies of Member States and other organisations contributing data and information to GMES. This is necessary to promote the use and sharing of Earth observation data and information in accordance with the principles of SEIS, INSPIRE and GEOSS. Full and open access to data should also take into account existing commercial data provision and should promote stronger Earth observation markets in Europe, in particular in downstream sectors, to increase growth and employment.

Since GMES is a user-driven programme, the Commission will ensure that service specifications match user needs. To that end, it will establish a transparent mechanism for regular user involvement and consultation, enabling identification of user requirements at Union and national level. The Commission will ensure coordination with relevant public sector users in Member States, third countries and international organisations.

SP2 - MUSIS

Concerning the MUSIS programme, as stated in section 1.3, some of the national space components are now entering the development phase, limiting the possibilities of reusing technologies developed by other programmes (spin-in). In terms of spin-off (reuse by other programmes of the technologies developed for the MUSIS space components), the opportunities are more favourable but depend on the authorization of the national funding authorities.

The situation is more favourable for the MUSIS ground segment, particularly for the exchange of data and metadata between the contributing member states.

Recommendation 2: The European INSPIRE directive should be considered by the military, since it will facilitate also the use of commercial data.

In the long term, i.e. the post-MUSIS generation and thus falling outside the current Task Force scope, it is worth recalling that synergies are maximized when user requirements are defined, discussed and shared at the start of the programmes. In this regard, the reflection will have also to take into account airborne solutions (aircraft and UAVs).

[8] Regulation (EU) No 911/2010 of 22 September 2010, OJ L 276/1 of 20-10-2010

SP3 – CSDP impact

As demonstrated by the EUMETSAT meteorological services, civil-controlled systems can be relevant for military users. This may also be true for the future civil GMES services, particularly the "horizontal" services (e.g.: rapid mapping) and the Security services. While GMES is still in its build-up phase, the CSDP needs should be considered to maximize the future benefits and civil/military synergies at European level. As adopted by the European Parliament and the Council on 16 June 2010, the regulation for GMES initial operation states[9], that EU Agencies should become part of not only GMES services, but be already involved in certain relevant projects, such as SAFER and G-Mosaic, in order to aggregate service requirements and service provision. This might involve the European Environment Agency (EEA), the European Maritime Safety Agency (EMSA), the European Union Satellite Centre (EUSC), the European Defence Agency (EDA) and the European Agency for the Management of Operational Cooperation at the External Borders (FRONTEX).

When the Lisbon Treaty came into force, the former European Security and Defence Policy (ESDP) was renamed as the Common Security and Defence Policy (CSDP). The Treaty[10] also introduces a new mechanism for capability development, which allows Member States that are willing to enhance military and civil integration between them within the framework of the EU. The EU's interests and objectives could determine the type of contribution in conflict resolution and crisis management through diplomatic, civil and military instruments.

GMES services are already available to a certain extent on an EU level and the system will become fully operational with EU ownership of the Sentinel satellites in the near future. Until this is the case, nations and EU bodies should make available assets currently in place to create best possible results. Even when GMES has become well established, it uses complementary assets to provide all the planned services. Although it has been created as a civil system, it should not be ruled out that services will also be used by military-led or for purely military operations in the future, especially in view of the expected high levels of technological performance. On the other hand, due to overall scarce

[9] European Parliament legislative resolution of 16 June 2010 on the proposal for a regulation of the European Parliament and of the Council on the European Earth observation programme (GMES) and its initial operations (2011–2013) (COM(2009)0223 – C7-0037/2009 – 2009/0070(COD))

[10] OJ C 83, 30.03.2010, p. 38, Consolidated Version of the Treaty on European Union, Section 2 Provisions on the Common Security and Defence Policy, Article 42 (ex Article 17 TEU)

resources, military assets (Ref. 2) should be made available if possible for civil operations under the CSDP. This has already been proved effective at national level.

SP4 - European Data Relay Satellite system

The technical challenges of future Earth observation systems are responsiveness, high resolution with large swaths and hyper-spectral detection, requiring fast download of high data volumes. The European Data Relay Satellite system will constitute an efficient and cost-effective solution, as it will handle a great quantity of data at high speed being in permanent contact with the ground station located in its field of view. Also, it will be a valuable tool for fast spacecraft tasking and direct data dissemination for the benefit of both civil and military users. Defining civil and military needs in terms of communication for the next generation systems and harmonising these from the outset would constitute an effective method of building up concrete synergies for such an enabling capability in Europe.

Recommendation 3: The European military users should consider using the European Data Relay Satellite system (EDRS).

2.2.5 Other areas of synergy (O)

This section addresses more general issues such as the civil/commercial data dealing with security or defence, pooling of resources for improving the quality of both civil and military products, sharing of user needs and international co-operation outside Europe.

O1- confidentiality of information

As stated previously, some civil and commercial services/products related to Earth observation are potentially sensitive for security and sometimes defence issues and thus pose concerns of data confidentiality and information handling at two levels:

- At the civil level, these concerns imply the implementation of suitable governance, data policy and technical solutions. These points should be addressed and defined in such a way it paves the way to technical synergies at the development as well as operation levels with the military systems. Indeed, the US commercial companies GeoEye and Digital Globe have now implemented such measures to cope with the US National Geospatial Intelligence Agency

requirements (see section 1.3). These issues are currently not relevant for the low resolution GMES demonstration services,

- At military level, the use of civil services/products on a routine basis has also technical impacts on ground systems and their operations, particularly to facilitate their integration, while maintaining high system integrity and security. These issues have to be studied as of the definition phase, in order to implement them at minimal cost. This point has already been identified and addressed at national level in most of the current military programmes, which are effectively using commercial data. To address this point at European level, the INSPIRE directive (see section 2.2.1) could constitute a major cornerstone.

The quality of the civil and military remote sensing data and associated products is also highly dependent on "non-technical" factors such as:

O2 – Ground calibration targets

Targets are deployed on the ground surface for civil as well as military systems to calibrate the spectral response of the detectors onboard the satellites as well as the performances of the pointing systems. Intergovernmental and Interagency exchange of information (precise location and characteristics) as well as, in the medium and long terms, pooling for the creation and maintenance of some of these targets would result in a larger number of calibration points which will lead to increase performance of all systems.

Recommendation 4: Ground calibration targets are of high interest for the European Earth observation space systems and play an important role for the quality of the delivered information and products. Thus the current calibration points used by European civil systems should be listed and the possibility of sharing the military calibration points should be investigated.

O3 – Digital Elevation Model (DEM):

Once data are acquired and processed at ground segment level, the geo-localization of the produced images is supported by the use of geospatial reference models, allowing their indexation and facilitating their use. Today, several such reference models exist at civil and military levels as well as at various national levels, covering smaller areas with various different resolutions. The production, dissemination, use and updating of a common single European reference model would not only facilitate image exchange and use but also minimize the resources required. The medium-resolution

Digital Elevation Model (DEM) currently under procurement by the European Commission covering the whole of Europe in the first lot (see section 2.1.2.) could become a reference model for various civil and military European users.

Recommendation 5: The European DEM currently under procurement by the EC should be analysed to determine under which conditions it may be used as a common source for an operational reference tool for geo-localization for both civil and military needs.

O4 - Image analysis

Image analysis to generate information and products, such as maps, is currently mainly performed by human expertise. Image interpretation, particularly for radar images, is indeed a difficult task. The required skill and expertise are equally the same for civil and military images and thus it would be sensible to have the possibility at European level to offer a common approach for the training of the associated staff. In addition, it would enhance common standards of working, the use of common tools as well as data and product exchange between civil and military communities. The EUSC is currently already offering this type of common training on a smaller scale.

The Task Force recommends that training of civil and military experts in the field of image interpretation should become a new axis of activity. An objective could be to map the requirements from all the interested institutions dealing with image analysis.

O5 – Inter institutional consultations

The lowest level of synergy corresponds to downstream spin-off and spin-in, allowing a given programme to benefit from solutions developed independently by another one (see section 2.2.4). However, synergies are maximized when the defined user needs are discussed and shared between civil and military communities at an early stage: this requires a strong political push and support at national as well at European political levels but also from the management of relevant institutions/agencies.

Finally, synergies between civil and military communities may also involve partners outside Europe, even if barriers obviously exist, particularly in the field of security and defence. Some non-European countries are already participating in a few projects of the Seventh Framework Programme (FP7) while Norway has and Switzerland will have special links with the European Defence Agency. Furthermore, it is worth noting that the new US National Space Policy (Ref. 11) appears more open to international cooperation than in the past, potentially creating bridges to the participation of US

companies in the European Union activities. These opportunities, which may prove difficult to implement, need however to be identified and analysed on a case by case base. Since this approach is already followed by the EC, no recommendation needs to be issued in term of implementation.

3. Conclusion

After consultation with external experts, the Task Force has generated recommendations and indicated prioritization for several distinct areas, from upstream issues (standardization/harmonization, R&T, user needs, etc.) to downstream issues (current programmes, operational aspects, etc.). These recommendations should be communicated to the senior management of the participating institutions of this Task Force. Follow on steps shall be the implementation of these recommendations.

The current search for synergies is mainly focused on the downstream side, after programme definition, thus limiting the scope to spin-off and spin-in between defined programmes. Greater synergy could clearly be achieved by first gathering the demand of a wider user group and thereafter defining the programmes as a function of this. Therefore, to ensure maximum synergy, it seems to be necessary to adopt an approach which requires strong and continuous support at political and senior management level.

The Task Force investigated the possibility for civil and military synergy in a very distinct area, namely in Earth observation, but it is clear that the findings may be extended to a wider range of other applications, including non-space applications.

The technology level within the civil and military communities is similar and therefore system sharing and information exchange has become much easier than it was in the past. It is no longer the case that technology is developed for the military community with a possibility of use in the civil sectors. On the contrary, the civil demand has evolved and leads to solutions and products that sometimes even exceed military needs. As a consequence, parallel developments for similar demands for both civil and military users is about to become obsolete. The use of technology across the civil/military border is possible without major technical difficulties, and it is now important to create the political will to reach effective synergies for both sides.

List of acronyms

CMPD	Crisis Management Planning Directorate
CSDP	Common Security & Defence Policy
CSG	Council Secretariat General
EC	European Community
EDA	European Defence Agency
EDRS	European Data Relay Satellite system
EO	Earth Observation
ESA	European Space Agency
ESDP	European Security and Defence Policy
ESP	European Space Policy
EU	European Union
EUMS	EU Military Staff
EUSC	European Union Satellite Centre
COTS	Commercial Off The Shelf
DEM	Digital Elevation Model
DG	Direction Générale
DoD	Department of Defence
GEOSS	Global Earth Observation System of Systems
GMES	Global Monitoring for Emergency and Security
GSC	GMES Space Component
HSI	Hyper Spectral Imagery
INSPIRE	Infrastructure for Spatial Information in the European Community
MUSIS	MUltinational Space-based Imaging System
pMS	participating Member State
SAR	Synthetic Aperture Radar
SEIS	Shared Environmental Information System
SoS	System of System
TIR	Thermal Infra Red
TBD	To Be Defined
TF	Task Force
UAV	Unmanned Aerial Vehicle

List of reference documents

Ref.1: “Resolution on the European Space Policy”, Council document 10037/07, May 2007

Ref.2: “Taking forward the European Space Policy”, Council resolution – 2891st Competitiveness (Internal Market, Industry and Research) Council meeting Brussels, 26 September 2008

Ref.3: “Facts & Figures – The European space industry in 2009”, ASD- Eurospace edition July 2010

Ref.4: Consolidated version of the treaty of the European Union, Official Journal of the European Union, C 83/13, 30.3.2010

Ref.5: “Critical space technologies for European non dependence”, EC-EDA-ESA Final Report, 16 June 2009

Ref.6: “Earth observation: Defence & Security, World prospective to 2019”, Euroconsult report, June 2010

Ref.7: “National space policy of the United States of America”, June 28, 2010

Annex 1

Task Force mandate, participants and followed methodology

MANDATE FOR THE ESTABLISHMENT OF A TASKFORCE ON Civil-Military synergies in the field of Earth Observation

1. Background and Mission

- Based on the Outline Description of the EDA Cat. B Project on MUSIS and the specific role assigned to EDA by cMS as regards the identification of synergies between MUSIS and other relevant space activities performed at European level;

- Further to the Council Resolution Taking forward the European Space Policy of 26 September 2008, identifying the setting-up of mechanisms to improve synergies between civil and defence space programmes as an area to be addressed;

- Further to the exchange of letter between EDA Chief Executive and CION Director DG/ENTR in March 2009 on creating a dedicated task force to that effect and associate other relevant European stakeholders taking part in the Structured Dialogue as appropriate;

- Further to the EDA Steering Board meeting at MoD level of 18 May, the Steering Board noting[1] the way ahead on the implementation of the MUSIS Programme, as detailed in the annexed EDA roadmap for the implementation of MUSIS: As an EU recognized organisation with a clear mandate to provide better capabilities in support of ESDP, EDA will ensure the liaison with the European Commission for research and technology projects of Framework Programme 7 and its follow-on that could be of interest for MUSIS but also with other projects like the European Commission's Global Monitoring for Environment and Security (GMES) to help the MUSIS nations in considering appropriate synergies. Other projects such as the European Space Agency's EDRS (European Data Relay System) may also be of great benefit for the space components contributing to the overall MUSIS architecture.

[1] EDA Note for the Steering Board No. 2009/33:

The overall aim of the taskforce is to facilitate a dialogue among European institutional stakeholders in support of the following objectives:

A) Improve harmonisation and standardisation in Europe in the field of Earth Observation;

B) Identify complementary research and technology activities (e.g. on hyperspectral technology) among European actors.

C) Address appropriate synergies between MUSIS and current European space programmes under development such as GMES and EDRS.

2. Description of the mandated work

The joint taskforce is set up to address the following topics:

A) Harmonisation and standardisation issues

- The handling and dissemination of security relevant geospatial data from either civil or military sources, and identification of suitable regulatory mechanisms, taking into account activities carried out at Council level with regard to data security;
- Suitable technical standards for secure exchange of data and associated exchange mechanisms;
- Potential for mandating institutional actors to initiate and harmonise relevant technical standards;

B) Complementary R&T activities

- Further detailing and identification of the specific research topics of mutual interest, where the R&T activity would be of a civil nature (e.g. EC FP7, ESA technology programmes), with also high relevance for defence applications.
- Timeline on which EC and ESA technology programmes would have products of relevance to MUSIS available;

C) Specific synergies between MUSIS and respectively GMES / EDRS space systems

- Complementarities of available space data capabilities in the context of GMES (civil system under civil control) and defence oriented satellites MUSIS, (military system with national missions); e.g. use of GMES data within the overall MUSIS Concept of Operations (GMES wide-area observation capabilities versus MUSIS VHR targeted observations)
- Synergies between future data relay capabilities provided by the EDRS programme and further development of the MUSIS system (e.g.

accommodation of data relay terminals on currently planned and future satellites belonging to MUSIS)

D) Other

- Any other issue falling within the scope of the overall objectives of the establishment of this taskforce and that EDA cMS would like to see addressed.

3. Composition

3.1 The taskforce shall be composed of up to three representatives from each of the participating organisations, namely the European Defence Agency, the European Commission, the Council Secretariat General, and the European Space Agency.

3.2 The taskforce shall be co-chaired by EDA and the European Commission.

3.3 Representatives of the participating organisations' Member States, the European Union Satellite Centre and external experts may be invited to participate as appropriate

4. Recommendations and reporting

4.1 The taskforce shall elaborate recommendations by consensus and regularly report to respective reporting authorities in line with the established plan of work.

4.2 On the work carried out and recommendations elaborated by the taskforce,

- EDA will report to the MUSIS cMS and to EDA Steering Board as appropriate
- EC will report to its respective Committees
- ESA will report to its Member States

5. Timeframe and meetings

5.1 The task force is established for a duration of two years starting 1 October 2009 and can be extended based on mutual decision.

5.2 The task force will meet in principle on a monthly basis.

5.3 The task force will establish a plan of work.

Task Force Participants

European Commission

R. Schulte-Braucks (Co Chair)

P.A. Gleyze

M. Ljungquist

R. Menemes

L. Vitiello

M. Westrup

D. Zimmer (EC coordinator)

European Defence Agency

P. Rey (Co Chair)

Y. De Vries

R. Guercini

U. Karoch

D. Moura (EDA coordinator)

M. Simm

European Space Agency

A. Cicollella

E. Duhamel

Council General Secretariat

P. Chatard-Moulin

C.Morand

External invited experts

Representatives from the MUSIS contributing member states

Representatives from CEN-CENELEC, ETSI and DIN

Representative from the G-Mosaic project of the EC

Followed methodology

This Task Force followed a 3 step approach, with step 1 allowing exchange of information between participants on relevant activities, step 2 focussing on specific points such standardisation issues, specific EC projects (G-MOSAIC) and input from the MUSIS contributing Member States, step 3 for common brainstorming and preparation of the final report.

The Task Force met 8 times, alternatively in EC and EDA, with the following main agenda points:

- 24th November 2009: definition of the methodology and meeting dates
- 27th January 2010: presentation of the relevant activities in each institution
- 17th March 2010: information point on standardization & G-Mosaic
- 28th April 2010: standardization, discussion on the structure of the report
- 2nd June 2010: inputs from MUSIS member states
- 14th July 2010: presentation of the TF progress to Directors
- 8th September 2010: input from the MUSIS member states, synergy identification
- 20th October 2010: finalisation of the draft report.

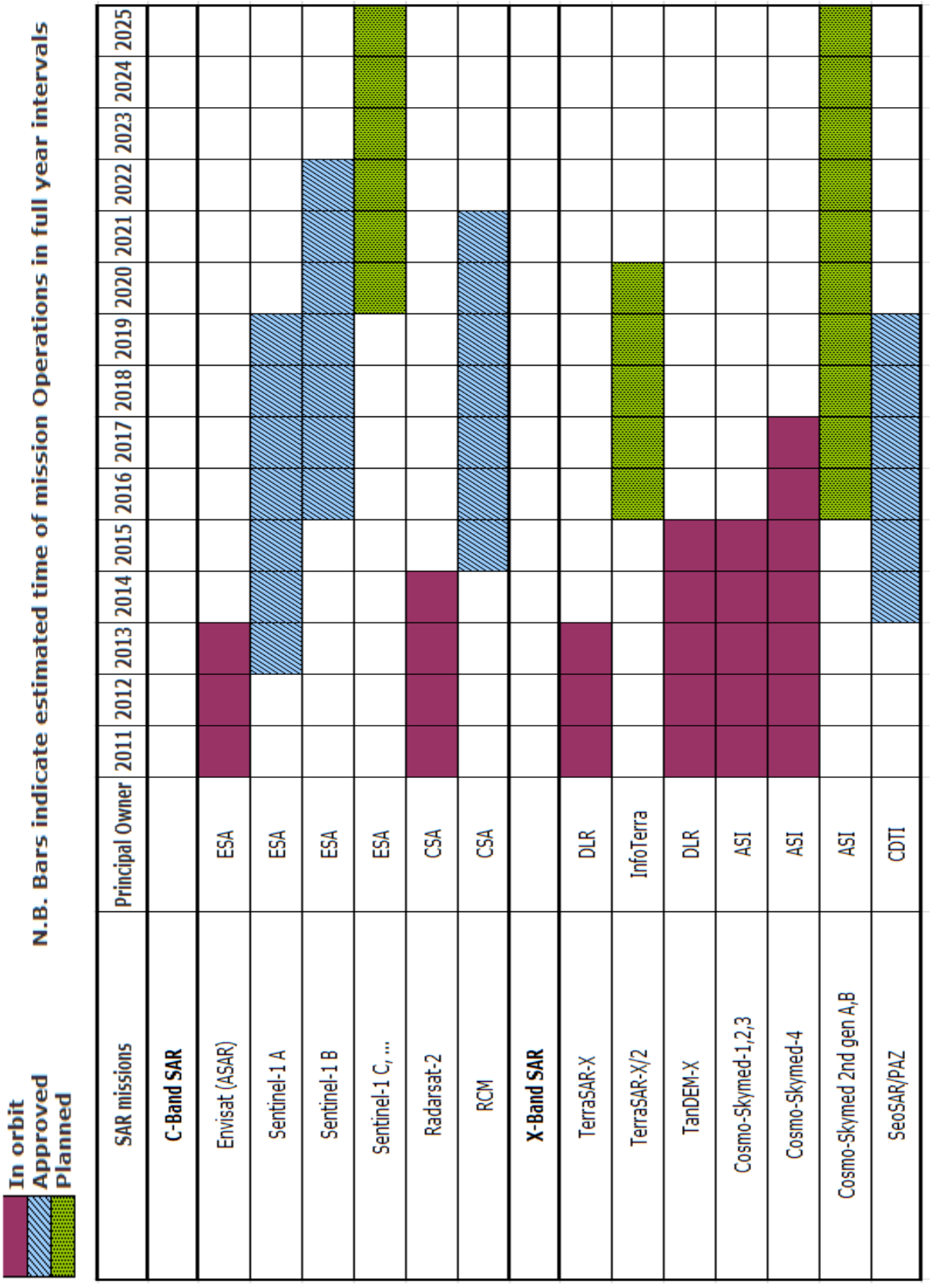
The main outputs and actions of each of meetings have been reported in minutes which may be made available on request to the EC or to EDA.

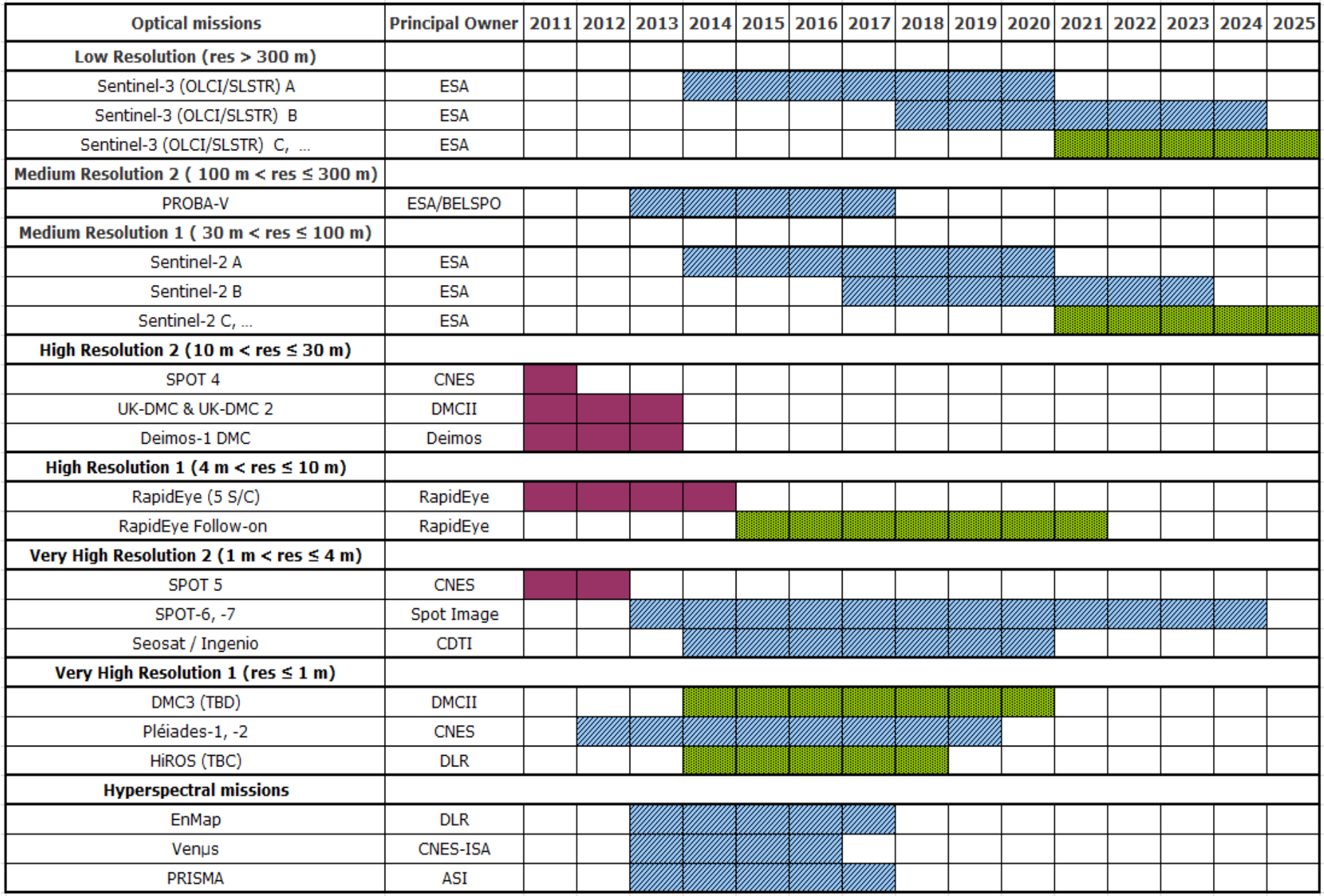
Between the Task Force meetings, working discussion occurred between the nominated coordinators.

Finally, the final report of the Task Force will be presented to the Directors of the participating institutions on the 25th November 2010.

Annex 2

Recent and future radar and optical imaging spacecraft in Europe (civil and dual use)




Optical missions
Principal Owner
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Low Resolution (res > 300 m)
Sentinel-3 (OLCI/SLSTR) A
ESA
Sentinel-3 (OLCI/SLSTR) B
ESA
Sentinel-3 (OLCI/SLSTR) C, ...
ESA
Medium Resolution 2 (100 m < res ≤ 300 m)
PROBA-V
ESA/BELSPO
Medium Resolution 1 (30 m < res ≤ 100 m)
Sentinel-2 A
ESA
Sentinel-2 B
ESA
Sentinel-2 C, ...
ESA
High Resolution 2 (10 m < res ≤ 30 m)
SPOT 4
CNES
UK-DMC & UK-DMC 2
DMCII
Deimos-1 DMC
Deimos
High Resolution 1 (4 m < res ≤ 10 m)
RapidEye (5 S/C)
RapidEye
RapidEye Follow-on
RapidEye
Very High Resolution 2 (1 m < res ≤ 4 m)
SPOT 5
CNES
SPOT-6, -7
Spot Image
Seosat / Ingenio
CDTI
Very High Resolution 1 (res ≤ 1 m)
DMC3 (TBD)
DMCII
Pléiades-1, -2
CNES
HiROS (TBC)
DLR
Hyperspectral missions
EnMap
DLR
Venμs
CNES-ISA
PRISMA
ASI

Annex 3

Data sheets of current ESA relevant activities

(1) Title: ESA 1

COMPLEMENTARY EARTH OBSERVATION TECHNOLOGIES FOR SECURITY: THERMAL INFRARED AND HYPERSPECTRAL

(2) Description of Project or Programme Objective :

2.1. Programme Description

Security applications can be supported, to different degrees, by many different types of data. Hyper-Spectral imagery and Thermal Infrared would enable access to capabilities that conventional Optical and SAR observations cannot provide.

Space-borne high resolution thermal infrared capability would meet the needs of a large number of security-related applications such as crisis management, industrial activities, situational awareness, maritime surveillance, environmental monitoring (including monitoring of vegetation, water quality, urban heat islands, volcanos), water resource management and infrastructure mapping. It also has the potential to detect assembly of concealed people, refugees and vehicles generating thermal contrast with their background These applications would be well supported by imagery at resolution between 10 – 50 m (TIR).

Hyper-Spectral Imagery (HSI) is an emerging versatile technology, successfully demonstrated in a variety of diverse applications, which could potentially enable significant advances towards improving the preparation for and execution of security missions enabling, for example, detection of chemical or biological weapons and contamination, hazardous wastes, thermal activity, assessment of underground structures, foliage penetration to detect troops and vehicles (i.e. defeating camouflage).

The analysis of HSI data is typically very processing intensive, which is one reason why HSI has taken so long to come of age. Real time applications of HSI will progress with both the computational capability of the processing stations and with the delivery time of the complete set of data from space, which will intuitively call for a Data Relay Satellite associated to the operational use of such sensors.

Images of a given area from Hyper-Spectral sensors will look far different to the naked eye than they do when appropriate false colour has been added, i.e. their interpretation may not be immediate. Another important feature is the sub-pixel target detection, which allows one to detect targets of interest with sizes smaller than the pixel resolution, and quantitative estimation, which allows one to detect concentrations of different signature spectra present in pixels.

To enable terrain classification, target material detection and identification and other security applications, a space-based hyper-spectral imaging system is expected to provide high-quality radiometric data in the VNIR spectral regime with 5m x 5m spatial resolution pixels. In the MWIR – LWIR spectral range, useful spatial resolution could be of the order of 15-20 m.

Relaxed resolution in the entire spectrum could be suitable to monitor the pattern of toxic materials emitted from industrial sites or the evolution of man-made disasters, such as gaseous emissions and terrain contamination with chemical wastes would suggest a relaxed spatial resolution pixel, of the order of 30 – 50 m.

The aim of this activity will be to identify and characterise the feasibility high-resolution thermal infrared system and Hyper-Spectral concepts particularly aimed at security applications in the GMES context. The activity would at least address the following points:

- Consolidate identification of needs and perform requirement analyses
- Define options of end-to-end architectures for the provision of relevant imagery
- Define a system concept in terms of sub-systems, down to optics, detectors, etc.
- Develop and consolidate the concept, including analysis of complementary activities with the Sentinels, associated data fusion and co-registration concepts, constellation concepts of satellites, operational concepts, interoperability and data flow.
- Preliminary programmatic analyses.

2.2 Management Organization

Requirements should be defined by the EC/EU Council, with ESA fulfilling its role of R&D Agency and EDA being the

interface with the use requirements.

Deliverable: Feasibility Study and consolidation of a R&D roadmap towards an operational use of TIR and Hyper-Spectral technologies.

2.3. Role of EC / EDA / ESA

EC/EU Council: Definition of needs and requirements

EDA: interface with the Defence User needs.

ESA, leads the technical (R&T) parts either with in-house specialists or funding a small dedicated industrial study or with both the arrangements.

(3) Participating member states / agencies:

ESA GSC programme and FP7 participants

ESA and EDA Staff involved for the technical/interface part

(4) Budget / financial impact:

Range 300 - 500 k€

(5) Timeframe / Timelines / Milestones:

Start September 2010

End - October 2011

(6) Responsibility for implementation

EC/EU Council for the definition of the requirements

EDA interface Agency with Users

ESA implementing the R&T part of the activity.

ESA/EDA to write the final report on the feasibility study.

(7) Participating Industries (if any):

Industry of both FP7 and ESA GSC member states can be invited to bid

(8) Participation of Third State, European Community, other public organisation or entity:

Canada is invited as ESA GSC Participant

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

This is an activity addressing complementary observations for GMES which are beneficial for defence issues.

(1) Title: ESA 2

PILOT PROJECT DEMONSTRATING SYNERGIES BETWEEN GMES AND MILITARY SPACE ASSETS

(2) Description of Project or Programme Objective :

2.1. Programme Description

Tactical security applications have in common some identified needs, such as:

- Accurate medium-to-high resolution mapping (5-30 m) to provide an overview of the situation
- Very high resolution (< 1 m) mapping of specified areas within the overview mapping area
- Fast satellite tasking and data delivery to the right people, in near real time

The timeliness specifications for access to tactical data represent a strong design constraint and determine the number of the spacecraft to ensure sufficient coverage, how the service delivery infrastructure has to be organised and the concept of operations. Hence, resolution may be a necessary but not a sufficient parameter for security observations and this opens opportunities for civilian-military synergies.

For example, the GMES Space Component (GSC) could provide up-to-date topographic and cartographic information to support long term intelligence requirements and operations planning. Although the revisit and the delivery times that are currently possible in the GSC are not expected to fulfil tactical information requirements, the availability of long term archives and the systematic optical and SAR observations can enable cueing preventive actions or deeper investigations with military assets. This can be accomplished by flagging significant differences of the actual situation with respect to the standard one, as regards pre-identified mapping of terrain, land covers, shores etc.

Vice versa, situational observations for civilian scopes could require tactical information from defence satellites to face emergency situations and/or civilian crisis. However, the information flow from the military space assets to GMES cannot be warranted.

In both the cases, a concept of operations should harmonise and link all the above elements. The main assumption is that unity of efforts is implemented, i.e. several actors may participate at their own discretion depending on the specific operation regardless of the individual command line or organisational structure. Postulating that collaborative and cooperative paradigms are in place, focusing the diverse capabilities of all the actors toward a common objective on a case-by-case basis, this Pilot Project would aim at identifying:

- Potential synergies between civil (GMES) and military data and products through the existing or planned assets and facilities, throughout the definition of some scenarios of interest
- Military and GMES civil data/product standardisation issues, such that they can be used in conjunction with existing maps by the analysts
- Options for command and control compatible with the above assumptions and accounting for the non-reciprocity of civilian and defence assets, which will lead to ad hoc information exchange models. The variable configuration of the actors for any specific endeavour requires that data ownership principles and their consequence shall be taken duly into account in setting the options
- Interoperability and interdependency concepts with GMES and military assets, in-situ instruments and/or other data sources
- Options for the feasibility of an integrated system of military and GMES intelligence collection capabilities that aims at providing decision makers at all levels, tactical and strategic, with the enhanced situational awareness by integrating sensor data with processed information and intelligence (data fusion architecture)
- Needs and roadmaps for new observations technologies

2.2 Management Organization

It is proposed that :

Under the EU/EC Coordination, EDA/ EU Council (including EUSC) identify real-life case studies of synergies GMES →

Defence in Earth Observation with the relevant requirements and, correspondingly, ESA/EC identify the cases where Defence → Civilian synergies can be beneficial for activities in scope to GMES.

Deliverable: Feasibility study of integrated system military/GMES for intelligence collection capabilities and support to emergency and civilian crisis.

2.3. Role of EC / EDA / ESA

EC/EU Council: Political leadership of the Pilot Project and programmatic requirements

EDA: interface with the Defence User needs.

ESA: technical (R&T) lead, either with in-house specialists or funding a small dedicated industrial study or with both the arrangements.

(3) Participating member states / agencies:

ESA GSC programme and FP7 participants

ESA, EDA Staff involved for the technical part

(4) Budget / financial impact:

300 – 500 k€ (ESA GSC Programme)

(5) Timeframe / Timelines / Milestones:

Start September 2010

End - October 2011

(6) Responsibility for implementation

EC/EU Council for the political/programmatic part of the Project and the definition of the requirements

ESA for the R&T part and the implementation of the activity

EDA: interface between MUSIS and the User needs.

ESA-EDA to jointly write the final report on the feasibility study.

(7) Participating Industries (if any):

Industry of both FP7 and ESA GSC member states can be invited to bid

(8) Participation of Third State, European Community, other public organisation or entity:

Canada is invited as ESA GSC Participant

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

This is an activity addressing by definition technical and programmatic synergies between military assets and GMES.

(1) Title: ESA 3

THE SECURITY DIMENSION OF GMES:

PRELIMINARY INVESTIGATION ON SPACE INFRASTRUCTURE AND CONCEPTS OF OPERATION

(2) Description of Project or Programme Objective :

2.1. Programme Description

Within GMES, the EC indicated:

- Border Surveillance
- Maritime Surveillance
- Support to EU External Actions

as areas for security action in the non-paper "The Security Dimension of GMES" presented at the GMES Advisory Committee (GAC) in November 2008.

GMES intends to provide information to support authorities for security issues. Those authorities have to formulate the requirements for this information at all levels, ranging from operational/ strategic to political. The requirements are needed in quantitative terms, to be able to scope the GMES services and infrastructure. The authorities are confronted with a very wide spectrum of scenarios, varying with geographic location, activities, means and assets at their disposal, level of involvement, etc. Therefore, the requirements, in quantitative terms, vary widely.

ESA/EOP derived a document of observation needs through an analysis of existing EU papers, which are intended as pragmatic assumptions about the possible user requirements and are inferred from existing EU documents, which indicate regions of interest and address possible security activities. The full spectrum of the Petersberg tasks, complemented by maritime and border surveillance actions, is taken as the reference scenario.

The document was sent to the EC, EDA and EUSC for preliminary feedback and provided the starting point for the preliminary assessment of options for technology, concepts of operation and the possible initial architectures of relevant observation infrastructure through two parallel studies within the frame of the GMES Space Component.

The objectives of the GMES security studies are:

- to complete the assessment of future observation needs, to analyse the contribution of existing assets to evaluate to what extent they can be met by existing or planned national or commercial capabilities and, if a gap is detected, determine which option could be preferable.
- to assess options for a space and ground infrastructure that can fulfil the observation needs of possible EU security demands and integrate them with data generated from other sources
- to explore the relevant concepts of operation
- to define relevant architectures and detailed observation requirements and means, with preliminary ROM estimates of the costs and the schedule.

At least six scenarios should be studied, regarding:

- ❖ Peace Making
- ❖ Peace Keeping
- ❖ Law Enforcement
- ❖ Maritime Services (Open ocean, including Border Surveillance)
- ❖ Maritime Services (Coastal zones, including Border Surveillance)
- ❖ Schengen Border Surveillance (Land)

2.2 Management Organization

ESA industrial study, the Invitation to Tender of which is on-going. ESA is both the technical and the contract

Officer.

2.3. Role of EC / EDA / ESA

EC, EDA, EUSC have reviewed the Statement of Work and are members of the Tender Evaluation Boards. The EU Council has also been invited to be part of the Tender Evaluation Board. These organisations will participate to all the phases of the study, providing input and feedback.

(3) Participating member states / agencies:

The tender is open to industries of all ESA GSC programme and FP7 participants

(4) Budget / financial impact:

Two or max. three parallel studies of about 300-500 k€ each

(5) Timeframe / Timelines / Milestones:

ITT closing date is February 2010. Evaluation of proposals is expected in March/April 2010. The kick off will be held in May 2010. Mid Term Review is expected in October 2010. Contract will be finalised on Jun 2011. Progress meetings will be held bi-monthly.

(6) Responsibility for implementation

ESA is both the technical and the contract Officer, responsible for coordination with EC, EDA, EUSC and EU Council

(7) Participating Industries (if any):

Industry of both FP7 and ESA GSC member states are invited to bid.

(8) Participation of Third State, European Community, other public organisation or entity:

Canada is invited as ESA GSC Participant

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

The full spectrum of the Petersberg tasks requires significant adaptive reaction capacity and flexible intelligence and surveillance tools for each operation, in both civilian and defence domains, enhancing potentially common scenarios of interest for both security and defence.

In this study, ESA assume that unity of efforts is implemented, i.e. collaborative and cooperative paradigms are in place focusing the diverse capabilities of all the actors toward a common objective, regardless of the individual command line or organisational structure. This will drive the possible concepts of operations that would govern the security endeavours and constitute an important element of convergence between security and defence issues.

Annex 4

Data sheets of current EC relevant activities

(1) Title: EC 1

Space Industry Standards
Dual Use Ground Segment Interfaces in Earth Observation (EO)
[Task Force 7]

(2) Description of Project or Programme Objective :

2.1. Programme Background and Description

2.1.1 Background

In June 2007, the EC issued a mandate to CEN, CENELEC and ETSI to develop a feasibility study and a work programme in the field of space industry standards. A working group was created under the responsibility of the CEN Technical Board. The work was carried out in two phases :

- Phase 1: Preparation of a feasibility study to identify the current state of play in space standardisation, to identify priorities for a wide range of elements and applications and the actors who should participate in each area of work;
- Phase 2 (ongoing): to state the standardisation needs and prepare a comprehensive standardisation programme (in the form of sectorial dossiers) for each identified space sector and application. The Final Report for phase 2 (version 1) has been issued in July 2009. The president of CEN/BT/WG 202 and the CEN Space Standardization project manager are working to gather to information concerning Task Forces 3 and 10. The Final Report for phase 2 (version 2) should be available in March 2010.

The CEN working group has identified 10 areas on which dedicated task forces (number 1 to 10) have worked on the preparation of the sectorial dossiers. Some of these dossiers have already been finalised, some are expected by the end of first trimester 2010.

2.1.2 Description

This programme intends to develop standards for Dual Use Ground Segment Interfaces in Earth Observation after the phase 1 and 2 of Mandate M/415 issued to CEN, CENELEC and ETSI where the scope and the needs have been specified.
This standardization project shall treat the identification of standardization needs and prepare a comprehensive standardization programme for dual use ground segment interfaces in Earth observation systems. EO systems encompass in the sense of this document imaging systems:

- electro-optical
- hyper spectral
- Infrared
- SAR

In this context „dual use" means that a military Earth observation (EO) system can also be used for civil tasks or vice versa under consideration of military security aspects.

In particular, this sectorial dossier shall cover the standardization needs for interfaces of Earth Observation systems to ensure the interoperability of these systems with respect to mission planning aspects, download, archiving; distribution, and processing images taken by different sensors from different EO systems

Related to this working group are the harmonization efforts of ECSS, NATO Standardization Agency, OGC and HMA. All existing standards and harmonization of these initiatives shall be implemented as far as possible.

The identified gaps with respect to standardization efforts lead to the tasks described below

It is mandatory for all tasks to be standardized on international, at least on European level to enforce the interoperability of Earth observation systems.
For the technical proposal **12 tasks** were defined:

- Task 1: Multi-user and multi-sensor mission planning
- Task 2: Download strategies
- Task 3: Image data
- Task 4: Image meta-data
- Task 5: Requirements for interoperability of image data
- Task 6: Image data processing procedures
- Task 7: Image data dissemination procedures

- Task 8: Image processing levels
- Task 9: Download segments
- Task 10: Archiving requirements, image updates, traceability, historical protocols
- Task 11: Distribution networks, user requests
- Task 12: Security aspects and requirements

2.2 Management Organization - Proposed SDO

The recommended SDO is CEN, possibly in cooperation with ECSS, NSA and ISO.

Related existing harmonization initiatives are STANAG, CCSDS, OGC, HMA and different ones from ECSS.

2.3. Role of EC / EDA / ESA

The European Commission will issue the mandate of phase 3 to produce the standards. EDA and ESA are invited to participate to the relevant standardization working groups.

(3) Participating member states / agencies:

(4) Budget / financial impact:

Estimated budget of 40 man years to be shared between stakeholders. Possibility of cofunding by the European Commission

(5) Timeframe / Timelines / Milestones:

The proposed standardization work is expected to last several years and should therefore be planned as a series of standardization efforts with an approximate duration of 3 to 6 years for each effort depending on the standardization bodies involved.

Different standardization efforts are planned for the individual topics which can have a variety of durations.

This step-by-step project organization is proposed to create a more manageable work flow and to allow the objectives of the later phases to be revised and refined based on the results of the early phases.

(6) Responsibility for implementation

Specific Working Group at CEN level

Comité Européen de Normalisation (CEN)

Avenue Marnix, 17 B-1000 BRUXELLES

Tel : +32 (0)2 550 08 11 Fax : +32 (0)2 550 08 19

(7) Participating Industries (if any):

EADS DCS, OHB-System, Astrium Services

Manufacturers: all satellite equipment providers, including satellite system developers, satellite terminal manufacturers and many other satellite equipment manufacturers.

Operators and service providers: Satellite operators, including terrestrial network operators with satellite components; likewise satellite service providers including multi-service terrestrial service providers with a satellite component.

Commercial users: Users, who are buying data coming from space-borne EO systems and use them for their own benefit.

(8) Participation of Third State, European Community, other public organisation or entity:

DLR, BWB (Federal Office of Defence Technology and Procurement, Germany), LSE Space Engineering and Operation Germany.
Research bodies: universities and other research organizations.
Military users: Users, who use space-borne EO data for surveillance and reconnaissance reasons.
Standardization bodies: satellite standards require global co-ordination and co-operation with organizations such as ECSS, NSA/ESA, ISO TC20 SC13/CCSDS, OGC and ESA HMA.

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS / relevance to other civil / military applications:

Standardization of Dual Use Ground Segment Interfaces in Earth Observation should be of interest for MUSIS which includes in its four space components two dual programmes, the Italian Cosmo-Skymed and the High Resolution contribution from Spain.

(1) Title: EC 2

Space Industry Standards

Disaster Management [Task Force 9]

1. Integrated Warning System (IWS)
2. Emergency Telecommunication Services (ETS)
3. Geospatial Data for Disaster Management (GDDM)

(2) Description of Project or Programme Objective :

2.1. Programme Background and Description

2.1.1 Background

In June 2007, the EC issued a mandate to CEN, CENELEC and ETSI to develop a feasibility study and a work programme in the field of space industry standards. A working group was created under the responsibility of the CEN Technical Board. The work was carried out in two phases :

- Phase 1: Preparation of a feasibility study to identify the current state of play in space standardisation, to identify priorities for a wide range of elements and applications and the actors who should participate in each area of work;
- Phase 2 (ongoing): to state the standardisation needs and prepare a comprehensive standardisation programme (in the form of sectorial dossiers) for each identified space sector and application. The Final Report for phase 2 (version 1) has been issued in July 2009. The president of CEN/BT/WG 202 and the CEN Space Standardization project manager are working to gather to information concerning Task Forces 3 and 10. The Final Report for phase 2 (version 2) should be available in March 2010.

The CEN working group has identified 10 areas on which dedicated task forces (number 1 to 10) have worked on the preparation of the sectorial dossiers. Some of these dossiers have already been finalised, some are expected by the end of first trimester 2010.

2.1.2 Description

This programme intends to develop standards for Disaster Management after the phase 1 and 2 of Mandate M/415 issued to CEN, CENELEC and ETSI where the scope and the needs have been specified.

2.1.2.1. Integrated Warning System

The objective is to combine most common broadcast systems to timely deliver warning messages and instructions to the population

- Broadest audience reach
- Precise geographical scoping
- Authentication, anti-spoofing

Expected benefits:

- Transmission of same alerts over the largest variety of broadcast networks
- Targeting specific geographical areas without relying on a priori knowledge of network coverage
- Cross-border over-spill management
- Auditing preparedness and actual reach
- Intrusive warning specifications

2.1.2.2. Emergency Telecommunication Services (ETS)

It aims at developing standards for telecommunication services in Disaster Management using resources pre-deployed or prepositioned for fast deployment.

- Mainly for authority-to-authority communications
- Rely essentially on private networks, but opportunistically would use any that are available
- Often include temporary telecom network for the victims (Telecommunications for Disaster Relief)

Ad-hoc networking.

Redundant and overlapping, complementary and interoperable, integrated space and ground solutions.

- To enable the implementation of software and applications compliant with agreed standards that can interconnect and easily exchange data with one another in the command posts and that can be fallback solution for local-to-local communications.

2.1.2.3. Geospatial Data for Disaster Management (GDDM)

The objective is to set standards for Digital value-added maps (DVAM)

- Improvement of emergency teams efficiency by harmonisation of both the content and the pictorial representation of the maps.
- Facilitating the work of international teams in Disaster Management.
- Reduction of the amount of data to be transmitted by telecommunications means to emergency teams.
- Facilitating the search and reuse of geospatial products, even after the event (e.g. for experience feedback), thanks to metadata

Geo-referenced data distribution:

- Facilitating geo-referenced data distribution to support decisions of Coordinating Centres and actions in the field
- Optimizing usage of the remotely sensed data derived product
- Improving geo-referenced data distribution in downgraded modes (especially when infrastructure cannot perform web services efficiently, because of a lack of bitrate for example);.

2.2 Management Organization – Proposed SDO

2.2.1. Integrated Warning System (IWS)

ETSI EMTEL past and current work seems to be based on considerations close to the subject discussed here. Network interfaces partly falls into the work plan of ETSI/SES/SatEC group, in particular their two active work items: Multiple Alert Message Encapsulation over Satellite ("MAMES" under reference DTS/SES-00310) and Emergency Communication Cell over Satellite ("ECCS" under reference DTR/SES-00313).

It should be noted that, in the international arena, the Internet Society (ISOC) has participated to launching the "Public Warning Network Challenge" - a call for collaborative action in order to make public warning systems a reality

2.2.2. Emergency Telecommunication Services (ETS)

- ETSI/SES/SatEC working on Satellite Emergency communication with the following items:
  - Infrastructure network for civil securities and professionals
  - Emergency Communication cell over satellites
- ETSI/SES/MSS working on Mobile Satellite Systems.
- ETSI/SES/BSM working on Broadband Satellite Multimedia systems.

2.2.3. Geospatial Data for Disaster Management (GDDM)

Digital value-added maps (DVAM): CEN/TC 287

Geo-referenced data distribution: ETSI/SES/SatEC

2.3. Role of EC / EDA / ESA

The European Commission will issue the mandate of phase 3 to produce the standards. EDA and ESA are invited to participate to the relevant standardization working groups.

(3) Participating member states / agencies:

(4) Budget / financial impact:

Estimated effort of 500 man days (IWS), 1000 man days (ETS) and 600 man days to be shared between shareholders. Possibility of cofunding by the European Commission.

(5) Timeframe / Timelines / Milestones:

IWS : step 1 – 6 months, step 2 – 18 months (maximum)
ETS : step 1 – 6 months, step 2 – 18 months (maximum)
GDDM : step 1 – 6 months, step 2 – 18 months (maximum)

(6) Responsibility for implementation

The Task Force is currently not able to recommend a SDO to perform the standardization activities. But in the three fields proposed (IWS, ETS, GDDM) ETSI working group are suggested.

European Telecommunications Standards Institute

650, route des lucioles - 06921 Sophia Antipolis - France

Tel.: +33 (0)4 92 94 42 00 - Fax: +33 (0)4 93 65 47 16

(7) Participating Industries (if any):

EUTELSAT SA, SES ASTRA, EADS Astrium, RAI, AnsuR Technologies AS, Alcatel-Lucent, HISPASAT SA, TELESPAZIO.

(8) Participation of Third State, European Community, other public organisation or entity:

CNES, DLR, ESA, EUMETSAT.

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS / relevance to other civil / military applications:

Military forces in the world are more and more involved in supporting and rescuing civilian in disaster crisis (e.g. typhoon-New Orleans, earthquake-Haiti). Due to this tendency, EDA could have interest in the disaster management standardization field activity which is linked with some specific military missions in favour of civilian.

(1) Title: EC 3

GMES services for Management of Operations, Situation Awareness and Intelligence for regional Crises (G-MOSAIC)

(2) Description of Project or Programme Objective :

2.1. Programme Description

Keeping Europe safe

Being a global actor the EU has a responsibility to pioneer solutions to today's complex security challenges. Enhancing Europe's ability to attain a peaceful global society, the project G-MOSAIC helps in ***supporting EU External Relations policies.***

Reaction to a crisis often proves to be too late. Effective intervention should ideally take place before a situation deteriorates, to minimise damage. This is why **intelligence information is of paramount importance to help keep Europe safe** from threats arising, from the proliferation of Weapons of Mass Destruction (WMD), or the violence of ethnic conflict, state failure and regional crisis.
The project G-MOSAIC will provide intelligence to the EU and its Member States before, during and after a crisis occurs.

In particular, G-MOSAIC **Situation Awareness and Intelligence applications** provide information on major **Threat Warning Factors**. Such factors include monitoring of critical assets as part of efforts to combat WMD proliferation. They also consist of extended routes surveillance, and assessment of structural crisis indicators, such as population density and agricultural production, and monitoring of illegal activities such as illegal mining or logging that contribute to a better understanding of where regional crises - state failure, ethnic conflicts, or government instability - might occur.

Moreover, G-MOSAIC **Crisis Management Operations** provide intelligence once a conflict has erupted, aimed at **supporting EU intervention activities** in the form of preparedness, crisis management, damage assessment, reconstruction and resilience.
G-MOSAIC's activities will be devoted to developing and exploiting GMES services as assets supporting security related activities on external regional crises situations, whilst contributing to identifying the Core and Downstream geo-spatial intelligence services in the framework of the current status of the GMES Initiative.

Peacekeeping, nuclear proliferation, piracy at sea, illegal immigration, drug trafficking, protection of vital infrastructure such as pipelines, and assistance to European residents in crisis areas, are but some of the areas where GMES can provide Europe with an autonomous source of information and with products and services that will deliver timely and reliable information to European decision-makers.

In order to support such tasks, G-MOSAIC is developing **seventeen service chains** in close cooperation with its users, in the field of Intelligence & Early Warning and Crises Management Operations:

Non-Proliferation & treaties
1. Monitoring of nuclear decommissioning sites
2. Continuous surveillance of nuclear facilities

Crisis indicators
3. Exploitation of natural resources
4. Population pressure
5. Land degradation

Critical assets monitoring
6. Critical assets monitoring
7. Critical assets event assessment

Illegal activities
8. Illegal mining
9. Illegal timber logging
10. Illicit crops

Routes & borders
11. Monitoring of activities
12. Migration routes and settlements

Crisis Preparedness and Planning
13. Contingency plan preparation

Crisis management

14. Terrain analysis and mobility assessment
15. Logistic and deployment operations

Damage Assessment and Reconstruction

16. Post-conflict Damage assessment
17. Support to post-conflict reconstruction

2.2 Management Organization

e-Geos S.p.A

2.3. Role of EC / EDA / ESA

EC supports external relation policies directed to maintain peaceful global society, G-Mosaic supports the EU´s ability to react to a Regional Crisis outside Europe

(3) Participating member states / agencies:

European Commission services such as External Relations, Development and Environment Directorate Generals, and the Office for Humanitarian Aid (ECHO), European Union bodies such as the EU Military Staff, the European Council Situation Centre, and also Member States Ministries of Foreign Affairs are among this project's reference users.

(4) Budget / financial impact:

EU Contribution: EUR 9.6 million
Estimated total cost: EUR 15.3 million

(5) Timeframe / Timelines / Milestones:

Starting date: 1/1/2009
Duration: 36 months

(6) Responsibility for implementation

Sergio Proietti G-MOSAIC Project Coordinator

(7) Participating Industries (if any):

e-Geos, EADS Astrium, Infoterra, GMV, Indra, Thales Alenia Space

(8) Participation of Third State, European Community, other public organisation or entity:

EUSC, JRC, DLR

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

G-Mosaic may demonstrate intelligent (and intelligence) networks with a structure and content that may be of relevance to a military and dual-use system like MUSIS or SSA at a later stage.

(1) Title: EC 4

TANGO: Telecommunications Advanced Networks for GMES Operations

(2) Description of Project or Programme Objective :

2.1. Programme Description

Identifying the needs for satellite telecommunication

The TANGO project focuses on the use of satellite telecommunication solutions to serve the needs of the Global Monitoring for Environment and Security (GMES) community. It aims at supporting their future operational information services and the associated end-users when expressing their telecommunication needs in the domain of risk and crisis management, maritime services, land cover, atmosphere, security and humanitarian aid.

With a large involvement of GMES key players, TANGO implements a bottom up approach to identify the requirements to further adapt, develop, integrate and demonstrate satellite telecommunication innovative solutions. The TANGO solutions are developed to meet various needs, such as improved and faster data collection, fast data dissemination, provision of GMES data products to the end-users, early warning systems and ad-hoc networking.

TANGO Common Telecommunication Service Platform (CTSP)

The project is developing TANGO “Common Telecommunication Service Platform”, a unique interface for GMES service providers, which will enable fast access to various telecommunication solutions and optimise capacity sharing among the GMES users. The project will define the conditions for an operational exploitation of the TANGO platform, based on adequate partnership.

TANGO demonstrations contribute to marine and emergency response core services. Demonstrations also integrate satellite telecommunication solutions with on-going developments in the framework of risk and crisis management, fisheries management, maritime surveillance, support to humanitarian aid and security. This covers the generic demonstrations planned within TANGO, and actual support to other GMES projects demonstrations. In both cases, TANGO brings to the GMES service providers the telecommunications and CTSP offer.

In particular, the "security demonstration" was successfully performed on 27th-28th May 2009 in the Island of Madeira. This exercise was organised and coordinated by the European Union Satellite Centre (EUSC) in collaboration with several partners from different technical areas, among which EADS Astrium (TANGO project coordinator), CNES (Centre National d’Etudes Spatiales), Infoterra France, Charles University (Czech Republic) and Avanti. The demonstration simulated an evacuation of EU nationals affected by a crisis situation outside EU borders. The scenario was integrated in the framework defined by the European Union and benefited from the support, guidance and implication of representatives from the EU Situation Centre (Brussels).

The interfaces between the CTSP and the telecommunications solutions adapted within the project are defined. The core functions of the CTSP prototype are specified. A prototype has been used during specific demonstrations to validate key objectives: cost reduction and facilitated access to telecommunications solutions.

TANGO has collected the telecommunication requirements through contacts with major GMES projects. A systematic approach for assessing the needs has been established, relying on the definition of a clear and agreed terminology and TANGO reference architecture. The requirements were added to a database through a dedicated web interface developed within the project. As a result, a public document summarising the key benefits expected from telecommunications in the various themes is now available.

2.2 Management Organization

2.3. Role of EC / EDA / ESA

EC to provide satellite telecommunication solutions to serve the needs of the Global Monitoring for Environment and Security (GMES)

(3) Participating member states / agencies:

United Nations Operational Satellite Applications programme (UNOSAT), Switzerland
European Union Satellite Centre (EUSC), Spain
Joint Research Centre (JRC), Belgium
Centre National d'Etudes Spatiales (CNES), France

(4) Budget / financial impact:

EU contribution: € 4.995.500
Estimated total costs: € 8.883.300

(5) Timeframe / Timelines / Milestones:

Starting date: 01/11/2006
Duration: 36 months

(6) Responsibility for implementation

EADS Astrium
31, rue des Cosmonautes - 31402 Toulouse Cedex 4 - France
http://www.teladnetgo.eu

Contact:
Sophie Defever
Phone: +33 5 62 19 76 06 - Fax: +33 5 62 19 94 94
E-mail: sophie.defever@astrium.eads.net

(7) Participating Industries (if any):

EADS ASTRIUM SAS, France
Avanti Communications Ltd, UK
Synoptics Integrated Remote Sensing & GIS applications BV – Microsoft, The Netherlands
Infoterra GmbH, Germany
SES Astra S.A., Luxemburg
SPOT IMAGE S.A., France
Politecnico Di Torino (Turin Polytechnic University), Italy
Collecte Localisation Satellites SA (CLS), France
Worldspace France, France
Univerzita Karlova v Praze (Charles University), Czech Republic
EADS Security Networks, France
NEWTEC CY N.V., Belgium
Netherlands Organization for Applied Scientific Research (TNO), The Netherlands
SkyCat Group Limited, UK
SpaceChecker N.V., Belgium
Navigs SARL, France
INESC INOVACAO Instituto de Novas Technologias (INOV), Portugal
INFOTERRA France SAS, France
POLITECHNIKA POZNANSKA (Poznan University of Technology), Poland
Space Research Centre, Poland

(8) Participation of Third State, European Community, other public organisation or entity:

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

Provide satellite telecommunication solutions that may serve military needs as well (i.e. in SSA

(1) Title: EC 5

LIMES: Land and Sea Integrated Monitoring for Environment and Security

(2) Description of Project or Programme Objective :

2.1. Programme Description : **Developing services in support of security applications**

The LIMES project supports the Global Monitoring for Environment and Security (GMES) initiative by providing expertise and developing services for security applications, applying innovative solutions based on earth observation technology and on its integration with satellite telecommunication and navigation capacities where relevant.

The applications mainly concern maritime surveillance, land border management, surveillance of critical infrastructure, Non Proliferation Treaty monitoring and support to humanitarian missions. The LIMES project has the following main objectives:

- Define, develop and validate a pre-operational set of services to support security management at EU scale adding value to the present information chains in the field of security. The services will exploit the full capabilities of satellite and in-situ technologies.
- Close the research gaps in terms of information tools to improve the use of earth observation and other space technologies for security applications, by enabling decision support tools and developing a platform for the provision of the services.
- Set up a framework for cooperation between Member States and EU bodies, in order to develop common operational procedures to improve access, archiving, exchange and processing of information according to secure access policies.

Demonstrations of pre-operational services have been successfully carried out during the project life time in the following three clusters:

Maritime Surveillance

Services are developed in collaboration with coast guards, customs and FRONTEX for:

- Coastal and open-water surveillance, including surveillance of maritime border and over the Exclusive Economic Zone of the EU. The test areas are: North and Baltic seas, Atlantic approaches to the EU and Mediterranean Sea.
- Sensitive cargo surveillance (e.g. cargoes containing hazardous material, fuel, weapons, precious goods, etc.) at EU level. Services have been tested in the Mediterranean Sea.
- Area surveillance outside the EU including non-EU coasts and sensitive hot spots.

Land and infrastructure surveillance

- For land border management, services are developed in collaboration with FRONTEX and relevant border guards. The test areas are situated along the Eastern EU land borders.
- For critical infrastructure surveillance, a set of services is being developed in Spain for gasification plants and pipeline in collaboration with ENAGAS, future developments include port security. Services are also supporting event planning (Zaragoza expo).
- In support of Non Proliferation Treaty (NPT) monitoring, the objective is to improve information products to respond to the needs of users such as the International Atomic Energy Agency.

Humanitarian relief and reconstruction support

In this domain, the main users are civil protection agencies, NGOs active in the humanitarian aid sector, the Red Cross family and UN Agencies.

- The information services support aid planning, resource allocation (food, water, infrastructure, etc) and population monitoring. Information products will be provided for actions in Yemen, Nigeria and Darfur.
- For emergencies and crisis management, the fast provision of updated geospatial information is foreseen combined with the appropriate use of emergency satellite communication and navigation mobile systems.

2.2 Management Organization

2.3. Role of EC / EDA / ESA

Provide expertise and develop services for security applications, applying innovative solutions based on earth observation technology and on its integration with satellite telecommunication and navigation capacities where relevant.

(3) Participating member states / agencies:

Joint Research Center
Norwegian Defence Research Establishment, Norway
United Nations Office for Project Services
Italian Civil Protection – DPC, Italy
European Union Satellite Centre

(4) Budget / financial impact:

EU Contribution: 11.980.000 €
Estimated total cost: 21.248.000 €

(5) Timeframe / Timelines / Milestones:

Starting date: 01/12/2006
Duration: 42 months

(6) Responsibility for implementation

Coordinator:
Telespazio S.p.A.
Research & Development Department
via Tiburtina 965 - IT-00156 - Rome
http://www.fp6-limes.eu

Contact:
Giovanni Cannizzaro
Tel: +39 06 40793384
giovanni.cannizzaro@telespazio.com

(7) Participating Industries (if any):

Telespazio S.p.A., Italy
Deutsches Zentrum fur Luft-und Raumfahrt e.V., Germany
Thales Alenia Space Italy, Italy
Thales Alenia Space France, France
GMV S.A.,Spain
QinetiQ Ltd, UK
Astrium SAS, France
Istituto Affari Internazionali, Italy
Kongsberg Satellite Service AS, Norway
THALES Communication SA, France
D'Appolonia, Italy
Definiens, Germany
GAF AG, Germany
Infoterra Ltd, UK
Joanneum Research Forschungsgesellschaft m.b.H, Austria
Paris Lodron Universität Salzburg ZGIS, Austria
Université Louis Pasteur Strasbourg I, France

Space Research Centre, Poland
Société Wallonne de Photogrammétrie, Belgium
National Observatory of Athens, Greece
Centro Italiano Ricerche Aerospaziali, Italy
Space Engineering, Italy
Fondation pour la Recherche Stratégique, France
4C Technologies, Belgium
GEOAPIKONISIS Ltd, Greece
Università degli Studi di Pisa, Italy
Institute for Electromagnetic Sensing of the Environment – CNR, Italy
University of Rome “La Sapienza”, Italy
Università degli Studi di Trento, Italy
Universitat Politecnica de Catalunya, Spain
Hellenic Coast Guard, Greece
Centre for Research & Technology - Hellenic Institute of Transport, Greece
Spot Image S.A., France
Coastal and Marine Resource Centre, University College Cork, Ireland
Ingenieria y Servicios Aeroespaciales S.A, Spain
ATOS Origin Sociedad Anonima Española, Spain
Technische Universität Bergakademie Freiberg, Germany
Flyby Srl, Italy
Institut de Recherche pour le Développement, France
Italian Red Cross, Italy
Planetek Italia, Italy

(8) Participation of Third State, European Community, other public organisation or entity:

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

Maritime Surveillance and Land and infrastructure surveillance that may possibly be used in a military environment

(1) Title: EC 6

GMOSS: Global Monitoring for Security and Stability

(2) Description of Project or Programme Objective :

2.1. Programme Description: **Integrating research activities**

The network of Excellence GMOSS has been launched in March 2004 in the context of the GMES programme comprising 22 contractors from 11 European countries. The primary objective of GMOSS is to integrate the European community concerned with the use of Earth Observation for civil security applications through joint research and training activities, sharing resources and infrastructure, and exchange of expertise and staff.
Joint activities included an analysis of the potential of remote sensing data for threat analysis and early warning, the monitoring of critical infrastructure and damage assessment, monitoring of borders and the migration of people; as well as benchmarking of recent data analysis and visualisation concepts and techniques.
The GMOSS approach is research-oriented rather than operations-oriented. GMOSS addresses a wide and heterogeneous community covering academic research, service providers, user organisations, Commission services. By integrating remote sensing data analysis, social science and the analysis of key threats and risks, GMOSS contributes to the EU awareness of the security dimension of GMES.
Iraq, Iran, Zimbabwe and Kashmir: what can we learn from Earth Observation?
The GMOSS work program has focused on joint work on 4 test cases relevant for European security or prone to natural disasters: Iraq, Iran, Kashmir, and Zimbabwe. Methodologies such as rapid mapping, specific feature extraction, image automatic interpretation, geographic information system modelling for decision support have been tested and different solutions have been compared and benchmarked. Information have been provided to representatives of the European Commission on pipeline sabotage in Iraq, nuclear facilities in Iran, land reform in Zimbabwe and damage assessment in Kashmir.

Near-real time crisis management
Two near real-time exercises have been performed evaluating the efficiency of internal collaboration and the effectiveness of tools and strategies in a realistic emergency scenario. End users and various Directorates General of the European Commission have been integrated in these exercises.

Spreading GMOSS expertise
The expertise of GMOSS is disseminated through summer schools and training seminars, targeting primarily young professionals in both the research and the end-user domains, such contributing to capacity building of EU and non-EU institutions. GMOSS supports the development of GMES services through its work on:
- the integration of socio-political background assessment and remote sensing methodologies
- benchmarking of data suitability and data evaluation strategies
- training and seminars
- near real-time exercises and rapid mapping.

The GMOSS proposal of possible new applications for remote sensing data analysis concerns among others the use of:
- night lights data for monitoring the impact of disasters and the movements of refugees
- low-spatial high-temporal resolution sensors for monitoring conflict-related explosions and/or fires
- automatic satellite image matching techniques for precise damage assessment of buildings
- radar and optical sensors for automatic detection of moving targets.

2.2 Management Organization

2.3. Role of EC / EDA / ESA

With GMOSS the EU contributes to awareness of the security dimension of GMES integrating remote sensing data analysis, social science and the analysis of key threats and risks.

(3) Participating member states / agencies:

(4) Budget / financial impact:

EU contribution: € 6.000.000
Estimated total cost: € 6.000.000

(5) Timeframe / Timelines / Milestones:

Starting date: 01/03/2004
Duration: 48 months

(6) Responsibility for implementation

Deutsches Zentrum für Luft und Raumfahrt e.V., DLR
Oberpfaffenhofen - D-82234 Wessling

(7) Participating Industries (if any):

The GMOSS Consortium

Deutsches Zentrum für Luft und Raumfahrt e.V., DLR, Germany
Forschungszentrum Jülich GmbH, Germany
Technische Universität Bergakademie Freiberg, Germany
Bundesamt für Geowissenschaften und Rohstoffe, Germany
Department of Computer and Information Science, Linköpings Universitet, Sweden
OD Science Application, Sweden
FOI Swedish Defence Research Agency, Sweden
Commissariat à l'Énergie Atomique, France
Centre National d'Études Spatiales, France
King's College London, UK
QinetiQ, UK
Centro di Ricerca Progetto San Marco, Italy
Dipartimento di Ingegneria e Fisica dell'Ambiente - Università della Basilicata, Italy
Joanneum Research, Austria
University of Salzburg, Center for Geoinformatics, Austria
Patrimony of the Royal Military Academy, RMA, Belgium
Technical University of Denmark, Denmark
The Netherlands Organisation for Applied Scientific Research, the Netherlands
European Union Satellite Centre, Torrejon, Spain
The Joint Research Centre, Italy
United Nations Office for Project Services, Switzerland
Swisspeace, Switzerland

Associated partners

Fachhochschule Hof, Germany
International Institute for Geo-Information Science and Earth Observation (ITC), The Netherlands
Institute of Methodologies for Environmental Analysis (CNR-IMAA), Italy
Threat Analysis and Solutions (TAAS), Austria
Centre Morris Janowitz, France
Definiens AG, Germany
Laboratorio di analisi e modelli per la pianificazione (LAMP), Italy
University of Salamanca, Spain
Technical University of Vienna, Austria
Bonn International Centre for Conversion (BICC) Germany
University of Pavia, Italy
European Academy Bozen/Bolzano, EURAC, Italy
Service Régional de Traitement d'Image et de Télédétection (SERTIT), France

(8) Participation of Third State, European Community, other public organisation or entity:

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

Develop or use sensor technologies, that may also be used in military applications

(1) Title: EC 7

GNU: GMES Network of Users

(2) Description of Project or Programme Objective :

2.1. Programme Description: **Connecting GMES users**

GNU aims at structuring the GMES demand side by setting up an independent platform that will become the focal point to express European GMES users' needs for environmental applications and their feedback on GMES products. Likewise GNU will foster a systematic dialogue between the stakeholder communities.

The main objectives of the project include:

- De-fragmentation of the environmental GMES user communities: currently user federations of GMES projects are isolated from each other, owing to the topical approaches (land, forest, air, marine, etc.), and there is a need to address cross-cutting issues.
- Enable independent and unfiltered user statements: so far GMES user groups exist only within the frame of projects led by service providers. Often these users have no or little access to project resources which makes it difficult for them to exchange information.
- Be a mouthpiece for the needs of GMES users at national and regional levels: European level users are already well represented in various bodies, but this is not the case for users that operate on subsidiary levels.
- Aggregate and differentiate user appraisals of GMES products: GMES projects have brought about a wealth of different products. There is a need to prioritise and catalogue GMES data products to facilitate access by users to the products most suitable for their needs.
- Link data-related and human aspects of GMES: most problems in GMES projects relate to communication issues rather than to technology development, however these issues have not always been properly addressed. An investigation of user-provider relations will provide the basis for efficient modes of collaboration.

The project consortium includes environment agencies and ministries; specialist agencies on air, forestry and land information; SMEs for support work; and research organisations. The consortium intends to closely interact with an outer network made of national and regional level stakeholders including service providers, European and international stakeholders, and other projects and networks.

Joint work of the consortium

The partners exchange experiences and good practices, collect and interpret GMES related documents, with the aim of acquiring a common state of knowledge.

Evaluating GMES products

The partners define criteria to evaluate GMES data products, develop common validation standards, set up a meta data base of GMES data products and prioritise these products. An analysis of the response from GMES stakeholders will provide ways to optimise the impact of GMES data products in relation to different stages of particular policy cycles.

2.2 Management Organization

Federal Environment Agency Austria

2.3. Role of EC / EDA / ESA

Connecting GNU to other activities

The consortium sets up links with European and international level stakeholders, other projects and networks, in order to exchange experience and information. Results are presented and discussed with national stakeholders including industry, researchers, policy makers, and users.

(3) Participating member states / agencies:

(4) Budget / financial impact:

EU contribution: € 1.099.467
Estimated total costs: € 1.099.467

(5) Timeframe / Timelines / Milestones:

Starting date: 01/10/2007
Duration: 36 months

(6) Responsibility for implementation

Coordinator: Federal Environment Agency
Spittelauer Lände 5 - 1090 Wien - Austria
http://www.gmes-network-of-users.eu

Contact: Herbert Haubold
Tel: +43 1 313 04/5910 - Fax: +43 1 313 04/5400
E-mail: herbert.haubold@umweltbundesamt.at

(7) Participating Industries (if any):

Federal Environment Agency, Austria
Agency for Land Information Flanders, Belgium
European Forest Institute, Finland
Ministère de l'écologie, du développement et de l'aménagement durables, France
Federal Environmental Agency, Germany
Informus, Germany
Thuringian State Institute for Forestry, Game and Fishery, Germany
Agency for Environmental Protection and Technical Services, Italy
Latvian Environment, Geology, and Meteorology Agency, Latvia
Netherlands Organisation for Applied Scientific Research (National Geological Survey), the Netherlands
Norwegian Institute for Air Research, Norway
Transparent World, Russia
Slovak Environmental Agency, Slovakia
European Topic Centre on Land Use and Spatial Information at the Autonomous University of Barcelona, Spain
GeoVille, Luxemburg
Swedish Environmental Protection Agency, Sweden
National Environmental Research Council (British Geological Survey), UK
Environment Agency of England and Wales, UK
Joanneum Research, Austria
Wuppertal Institute for Climate, Environment, and Energy, Germany
Ecologic, Austria
Siberian Centre for Environmental Research and Training, Russia

(8) Participation of Third State, European Community, other public organisation or entity:

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

GNU may show intelligent (and intelligence) networks with a structure that may be of relevance to a military system like MUSIS or SSA at a later stage.

(1) Title: EC 8

GOSIS: GMES Organisational and System Integration Scenarios

(2) Description of Project or Programme Objective :

2.1. Programme Description

GMES governance

The GOSIS project provided assistance to the European Commission in preparing for operational Global Monitoring for Environment and Security (GMES). In particular, GOSIS focused on the organisational aspects of GMES, i.e. how GMES will deliver its services and infrastructure components, who should be involved, what are the relationships between players, what governance and funding sources to use.

Aspects of GMES studied

- An analysis of "GMES communities" – groups of existing users of geo-information for environmental and security purposes who could benefit from GMES services and infrastructure, such as the oceans, land, civil protection, and humanitarian aid and security communities;
- An examination of a wide range of potential governance structures for GMES;
- Investigation of a range of related communities such as meteorology and related initiatives and programmes (e.g. INSPIRE, EIONET);
- Development of a generic value chain for GMES information services and mapping of the GMES fast-track projects;
- Introduction and discussion about a system of systems engineering approach, with the phased integration of new and legacy systems at European and Member State level.
- A legal study to provide more insight into GMES institutional and scoping scenarios, particularly in the context of satellite data;
- The development of three possible governance models based on the balance of functions between the different key organisations involved in GMES.

Three models for GMES governance

After consideration of a wide range of options, the project has presented three potential models for GMES, in particular looking at the role of a central GMES management body - the GMES Authority - and its interfaces and integration with other key players in the GMES domain. The models all acknowledge the need to integrate new and legacy systems and work with a range of user and provider organisations in Europe.

In the Centralised Model the GMES Authority effectively becomes synonymous with GMES itself. The key assumptions in this model are that the GMES Authority manages all GMES funds and as such has overall political, managerial and technical responsibility for the programme.

The Current Competences Model sees the GMES Authority working in partnership and networking with a large range of supplier and user organisations.

In the Services Centric Model the GMES Authority is primarily a coordination body between a number of baseline service providers. The main funding, managerial and technical roles are channelled through the service organisations.

2.2 Management Organization

2.3. Role of EC / EDA / ESA

Find a model for GMES Governance

(3) Participating member states / agencies:
(4)Budget / financial impact:
EU contribution: € 398.935 Estimated total costs: € 398.935
(5) Timeframe / Timelines / Milestones:
Starting date: 18/02/2004 Duration: 24 months
(6) Responsibility for implementation
ESYS plc 1 Occam Court, Occam Road Surrey Research Park Guildford, Surrey GU2 7HJ United Kingdom
(7) Participating Industries (if any):
(8) Participation of Third State, European Community, other public organisation or entity:
(9) Cooperation opportunity / Opt-in arrangement:
(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:
Find a model for GMES Governance, may be of value for future governance in SSA

(1) Title: EC 9

HUMBOLDT – Development of a Framework for Data Harmonisation and Service Integration

(2) Description of Project or Programme Objective :

2.1. Programme Description

HUMBOLDT aims to facilitate cross-national harmonisation of spatial data and at supporting the implementation of the European Directive INSPIRE (Infrastructure for Spatial Information in Europe) in applicat ions related to GMES (Global Monitoring for Environment and Security). This four -year project started in October 2006. The project is funded by the European Commission within the 6th Framework Programme and co-ordinated by Fraunhofer Institute for Computer Graphics , located in Darmstadt, Germany. 28 partners from 14 European countries collaborate on the development of IT solutions to support the harmonisation of spatial data to be used within Spatial Data Infrastructures (SDIs).

The availability of data is – despite ongoing efforts – still highly scattered and heterogeneous. In HUMBOLDT, harmonisation is understood as a process of transforming the available geo-data into information, which can be used across various applications and information products. It is the intention of HUMBOLDT to base on the existing know-how within and outside the GI community to manage and advance the process of the implementation of a European Spatial Data Infrastructure. High-quality and easily accessible geo-information will deliver enormous value to different fields of application in politics, government, research and business.

The software framework and tools that are being developed in HUMBOLDT can be integrated into existing SDIs to to support spatial data and service providers in offering harmonised spatial information. Besides the HUMBOLDT framework, which supports the search for existing data and transformations according to given information product specifications, an essential element of the project is the development of user-driven, crossborder, GMES-related application scenarios in which the different components are applied and tested under realistic conditions. In this context, the HUMBOLDT User Community plays a significant role and is encouraged to get involved in project activities.

2.2 Management Organization

Fraunhofer-Institut für Graphische Datenverarbeitung, IGD, Germany

2.3. Role of EC / EDA / ESA

The EC has the political aim to harmonises the provision of spatial data on European scale and has put in place the INSPIRE directive. HUMBOLDT is developing capabilities to implement better and more efficient the INSPIRE directive on European Spatial Data Infrastructure.

(3) Participating member states / agencies:

(4) Budget / financial impact:

EU Contribution: EUR 7.9 million
Estimated total cost: EUR 13,2 million

(5) Timeframe / Timelines / Milestones:

Starting date: 1/10/2006
Duration: 48 months

(6) Responsibility for implementation

Eva Klien, Fraunhofer IGD, Project Coordinator

(7) Participating Industries (if any):

- Fraunhofer-Institut für Graphische Datenverarbeitung IGD, Germany
- ETRA Investigacion y Desarrollo, Spain
- Help Service Remote Sensing, Czech Republic
- LogicaCMG UK, UK
- Institut Géographique National, France
- Intergraph CZ, Czech Republic
- Intergraph Deutschland, Germany
- ETHZ - Swiss Federal Institute of Technology Zurich, Switzerland
- Delft University of Technology, Netherlands
- University of Rome “La SAPIENZA”, Italy
- Institute of Geodesy, Cartography and Remote
- Sensing (FOMI), Hungary
- Marine Information Service 'MARIS' BV, Netherlands
- KTU Regional Science Park, Lithuania
- INI-GraphicsNet Stiftung, Germany
- Technische Universität München, Germany
- University of the West of England, UK
- Institut Français de Recherche pour l'Exploitation de la Mer, France
- National Environment Research Council, UK
- Hellenic Centre for Marine Research, Greece
- Telespazio, Italy
- GISIG - Geographical Information Systems International Group, Italy
- Consiglio Nazionale delle Ricerche, Italy
- Forest Management Institute, Czech Republic
- Instituto Geográfico Português, Portugal
- Collecte Localisation Satellites, France
- Högskolan i Gävle, Sweden

(8) Participation of Third State, European Community, other public organisation or entity:

(9) Cooperation opportunity / Opt-in arrangement:

HUMBOLDT has published an open source project which allows the key results to be used and developed further by anybody.

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

HUMBOLDT may develop capabilities to interface various heritage Spatial Data Infrastructures (SDI) which may be applicable beyond the cartographic domain.

(1) Title: EC 10

New European WAtcher (NEWA)

(2) Description of Project or Programme Objective :

2.1. Programme Description

The New European WAtcher (NEWA) project aims at strengthening the European Space-based Reconnaissance & Surveillance (R&S) Capabilities by providing technological assessment of current/planned capabilities and Building the European dimension for the development and establishment of Space-based NEWA **solutions for moving object detection and identification**.

Moreover the focus of the project will be on **Space radar assets in support of Security-related applications** (border surveillance, law enforcement, etc). Fundamental steps for NEWA are **to identify the technological gaps** that prevent from the establishment of Space-based EU R&S capabilities, identifying state-of-the-art techniques and/or innovation concepts and establishing technological goals in the mid term and an EU shared sustainable roadmap.

Funding scheme: Coordination and Supporting Action (Support Action).

2.2 Management Organization

Thales Alenia Space Italia S.p.A.

2.3. Role of EC / EDA / ESA

In the context of the European Space Policy, this study identifies technology areas vital for Europe's competitiveness and independence from outside sources.

(3) Participating member states / agencies:

It is an industrial consortium of 7 partners from IT, FR, ES, UK

(4) Budget / financial impact:

EU Contribution: EUR 580.000
Estimated total cost: EUR 785.000

(5) Timeframe / Timelines / Milestones:

Starting date: first semester 2010
Duration: 18 months

(6) Responsibility for implementation

Thales Alenia Space Italia S.p.A.

(7) Participating Industries (if any):

THALES ALENIA SPACE ITALIA S.p.A., TELESPAZIO SPA, INDRA ESPACIO SA, VEGA Group, THALES SYSTEMES AEROPORTES

(8) Participation of Third State, European Community, other public organisation or entity:

ISTITUTO AFFARI INTERNAZIONALI (IT), UNIVERSITAT POLITECNICA DE CATALUNYA (ES)

(9) Cooperation opportunity / Opt-in arrangement:

(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:

The project aims to reinforce European Space-based Reconnaissance & Surveillance (R&S) Capabilities by providing technological assessment of current/planned capabilities and Building the European dimension for the development and establishment of Space-based **solutions for moving object detection and identification**. It could have a large impact both for future GMES (MUSIS) capabilities and other civil/military applications.

(1) Title: EC 11

EU-DEM (Digital Elevation Model) FOR THE INITIAL GMES SERVICE FOR GEOSPATIAL REFERENCE DATA ACCESS

(2) Description of Project or Programme Objective :

2.1. Programme Description

Under the direction of the European Commission's Directorate-General for Enterprise and Industry (DG ENTR), and Prime Contractor Indra Espacio, Intermap Technologies will deliver a middle-precision DEM to the European Commission as the elevation data theme for its Earth Observation Programme (GMES) in particular to support the Land Monitoring (LMCS) and Emergency Response Core Services (ERCS). Intermap will create the new EU-DEM as a seamless Digital Elevation Model (DEM) covering the EEA38, i.e. the 32 member countries and 6 cooperating countries of the European Environment Agency.

Since 1998 the GMES (Global Monitoring for Environment and Security) initiative has aimed at monitoring the environment by using multiple sources of Earth observation data in order to provide strategic information for everyone.

The EU-DEM will provide the European GMES User Community with consistent mid-scale DEM coverage. This continuous, homogenous DEM will provide an underlying 3D geographic framework on top of which additional thematic datasets can be produced and distributed. The EU-DEM will also enable the assessment, analysis and monitoring of geospatial relationships between combinations of databases and therefore contribute to the European Spatial Data Infrastructure

The challenges presented by the lack of consistency, coverage, precision and licensing in the elevation datasets currently available from commercial and public sources presented a formidable technical obstacle to their individual consideration as the source for a new pan-European DEM. The EU-DEM will be created as a merge of the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) GDEM data with Shuttle Radar Topography Mission (SRTM) data supported by Intermap's high-precision NEXTMap® Europe data. The publicly available SRTM and GDEM datasets offer strengths and shortcomings. Intermap will manually edit and fuse these two datasets using their experience in editing large elevation datasets. This will provide a reliable solution for a homogenous full-coverage

By conflating the higher spatial resolution of GDEM with the better vertical accuracy of SRTM this hybrid DEM will have a posting of 1 arc-second and a vertical accuracy of about 7m RMSE. A systematic horizontal offset in the GDEM data will be removed through the use of the high precision NEXTMap elevation dataset. The EU-DEM will be a significant improvement over the presently available pan-European elevation datasets through provision of precise and unambiguous x, y, and z location information

There will also be a transition mechanism for sustainability of the elevation data theme for future support of the Commission's European and global GMES Programme activities. The methodology employed offers a solution to large regional-scale elevation requirements on a global stage.

2.2 Management Organization

Indra, Madrid	-Prime Contractor	• Project Management • Middleware • Client Showcase
Intermap, Munich	- Sub-Contractor	• EU-DEM • Validation
AGI – Aerogeodezuos Institutas, Kaunas	- Sub-Contractor	• Hydrography • Validation

2.3. Role of EC / EDA / ESA

Procurement of a public available DEM for GMES Core Services
(3) Participating member states / agencies:
See 2.2
(4) Budget / financial impact:
Contract value: EUR 2,080,000 EC contribution: EUR 250,000 (Lot 1 – European Coverage)
(5) Timeframe / Timelines / Milestones:
Timeframe: 2010-2012 Duration: 36 months
(6) Responsibility for implementation
European Commission DG Enterprise
(7) Participating Industries (if any):
(8) Participation of Third State, European Community, other public organisation or entity:
Independent third-party verification: Eleven independent agencies have validated the NEXTMap data, including independent accuracy validation and verification reports from the Institut Geographique National (IGN) in Paris, France, and the Istituto Geografico Militare (IGM) in Florence, Italy.
(9) Cooperation opportunity / Opt-in arrangement:
(10) Relevance or impact to MUSIS or GMES / relevance to other civil / military applications:
Public available geospatial Reference data for GMES initial services could be used by multiple other users handling Earth Observation data (civil and military)

Annex 5

Data sheets of current EDA relevant activities

Restrictive access only