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NOTE

from :	Secretariat
to :	Delegations
Subject :	Generic Space Systems Needs for Military Operations

In accordance with paragraph 3 of the "Initial Road Map for achieving the steps specified in the European Space Policy: ESDP and Space" (9505/05 of 30 May 2005), delegations will find attached the document "Generic Space Systems Needs for Military Operations".

Generic Space Systems Needs for Military Operations

REFERENCES

a. article 17.2 of the TEU;
b. Headline Goal 2010 (doc. n. 6309/6/04 REV 6 dated 4 May 04);
c. "European Space Policy: "ESDP and Space"" (doc. n. 11616/3/04 REV 3 dated 16 Nov 04);
d. "Suggestions for procedures for coherent, comprehensive EU crisis management" (doc. n. 11127/03 dated 3 Jul 03);
e. "PSC contribution to Green Paper Consultation on the EU Space Policy" (doc. n. SN 2211/1/03 REV 1 dated 11 Jun 03), which includes the paper "Space systems needs for military operations" (9793/03 dated 27 May 2003);
f. the European Security Strategy "A Secure Europe in a Better World" (December 2003);
g. the "Report of the Panel of Experts on Space and Security" (SPASEC) of Mar 2005;
h. "European Union Military Staff Terms of Reference and Organisation" (doc. n. 7934/05 dated 8 Apr 05);
i. "Conceptual Framework on the ESDP Dimension of the Fight Against Terrorism" (doc. n. 14797/04 dated 18 Nov 04);
j. "EU Concept for Military Strategic Planning" (doc. n. 12046/01 dated 25 Nov 01);
k. Existing concepts of Military C2, CIS, INTEL, ISTAR.

A. BACKGROUND

1. Following a detailed study of the military needs issued by the Hellenic presidency on 15 March 2003, the importance of space applications and functions was recognised by the Council on 19 May 2003 as well as in the Presidency report on ESDP, endorsed by the European Council at Thessaloniki on 19-20 June 2003.

2. On 25th June 2003, the PSC contributed to the consultation process of the Green Paper on European Space Policy from the Commission and the European Space Agency[1], recognising the importance of space applications and functions to support and enhance the EU capabilities to carry out crisis management operations.

[1] Doc. n. 11209/03 dated 8 Jul 03.

3. On 27 November 03, the Commission made a presentation on the White Paper on "Space: a new European frontier for an expanding Union - An Action Plan for Implementing the European Space Policy"[2] to the PMG, which then discussed the matter.

4. With the aim of furthering the general discussions on the importance of space applications, the Italian Presidency organised a seminar entitled "Space and Security Policy in Europe" in Rome (2 December 2003). A report, drafted together by six European research institutes, was presented to this seminar, and further published by the EU ISS in December 2003 (ISS occasional papers n° 48).

5. On 09 December 2003, the PSC reiterated its position that further and regular interpillar reflection is needed to ensure that the security and defence aspects of CFSP and ESDP are taken into account during the deliberations on an EU Space Policy and its associated programmes. This interpillar reflection should take into account the work being done in the context of other EU initiatives including the ECAP project groups (such as Space Assets) identified in the Capabilities Conference Declaration, which was endorsed at the GAERC 19 May 2003 and other possible future projects linked to ESDP. In addition, the PSC noted that chapter 3.4 of the Commission White Paper on Space makes recommendations. On this basis, initial work began in Council bodies on possible ESDP aspects of the future European Space Programme.

6. At the same time, a Group of Personalities (GoP)[3] developed the cornerstones of an EU Security Research Programme and the contribution it could make to address the new security challenges. It recognised the crucial character of Space based assets for a secure Europe. A panel of experts gathered by the European Commission published the "Report of the Panel of Experts on Space and Security" (SPASEC Report) of March 2005, which brings together the possible defence and security aspects of the future European Space Programme.

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[2] Doc. n. 14886/03 dated 17 Nov 03.

[3] Co-chaired by European Commissioners Busquin and Liikanen, composed of Security Industry Chairmen and Chief Executives, serving Members of the European Parliament, Heads of major Research Institutes, high-level European Defence Ministry officials, two high-level political figures (Artisaari / Bildt), Commissioner Patten and the High Representative for the CFSP.

7. On this background, on 22 Nov 04 the Council approved the document "European Space Policy: ESDP and Space", which defines the contributions that can be made to ESDP by space applications. The document is also intended to serve as a reference for future proceedings with regard to military capabilities, and recommends that a comprehensive Roadmap be developed, including further actions to be taken.

8. On 7 Jun 05, the PSC endorsed the Secretariat document "Draft initial road map for achieving the steps specified in the European Space Policy: "ESDP and Space"", which provides the envisaged planning for the achievement of the steps identified in said document, a prerequisite for the realisation of the overall objectives of the ESDP Space Policy. The draft initial road map is based on the assumption that the civilian and military needs for all actions in the field of the use of space assets for ESDP purposes are compatible, with potential for synergy. This assumption has been confirmed by the "Report of the Panel of Experts on Space and Security" (SPASEC Report) of March 2005.

9. Among the steps mentioned in the draft road map, the first one ("ESDP requirements should be specified on the basis of HLG 2010 and the initial study by the Military Committee") requires that, in order to take into account the timelines for the elaboration of the European Space Programme, the EUMC has to:
   – consider the need to update its document 9793/03 dated 27 May 2003 on "Space systems needs for military operations", drawing on the approved policy (ESDP and Space, doc. 11616/3/04 REV 3 dated 16 November 2004);
   – extract and refine the ESDP requirements for space-based capabilities, in the context of the elaboration of the RC05 (approved by the GAERC in Nov 05).

10. In its meeting on the 8 Jun 05, the EUMC agreed, as a way ahead, that the Military Staff take forward the work on the tasks mentioned above in para 9. On 14 Dec 05, the EUMC agreed to prepare 2 separate documents, one for each of the above mentioned tasks. In particular, the first should indicate "generic space system needs for ESDP military operations" while the second should detail "specific space system requirements drawn from RC 05".

B. AIM AND SCOPE

11. This paper represents a compendium of generic space system needs for ESDP military operations and it is aimed to allow the Commission and Member States to identify possible multiple-use capabilities inherent to civilian systems under development by updating the previous EUMS document entitled "Space Systems Needs for Military Operations" (9793/03 dated 27 May 2003). It is complementary to the Confidential document "Space System Requirements as per the RC 05", which identifies specific endorsed military space capabilities to support EU operations.

C. CHARACTERISTICS OF EU MILITARY CRISIS MANAGEMENT OPERATIONS

12. In accordance with Article 17(2) of the Treaty on European Union, EU Crisis Management Operations include:
    - humanitarian and rescue tasks;
    - peacekeeping tasks;
    - tasks of combat forces in crisis management, including peacemaking.

13. The European Security Strategy "A Secure Europe in a Better World" identifies the following threats:
    - terrorism;
    - proliferation of weapons of mass destruction;
    - regional conflicts;
    - state failure;
    - organised crime.

14. The Headline Goal 2010[4] underlines the commitment of MS to be able, by 2010, to:
    - respond with rapid and decisive action applying a fully coherent approach to the whole spectrum of crisis management operations covered by the Treaty on the European Union;

[4] Doc. n. 6309/6/04 REV 6 dated 4 May 04.

- to act before a crisis occurs (preventive engagement can avoid that a situation deteriorates);
- conduct concurrent operations thus sustaining several operations simultaneously at different levels of engagement;
- respond to a crisis either as a stand-alone force or as part of a larger operation;
- deploy force packages at high readiness.

15. The mission assigned by the "European Union Military Staff Terms of Reference and Organisation"[5] to the Military Staff is to perform:
    - early warning;
    - situation assessment;
    - strategic planning for missions and tasks foreseen in article 17.2 of the TEU, including those identified in the European Security Strategy.

16. The nature of the threats and the missions assigned are global, and operations may be conducted world-wide.

D. SPACE SYSTEMS NEEDS FOR MILITARY OPERATIONS

17. Characteristics of space-based assets. Space-based assets do not necessitate any force deployment to be operated. It means that, contrary to most of the military assets with similar capacities, they can provide data, information and services in a permanent manner and free from any sovereignty or legal constraint. This specificity has some obvious consequences: Space-based systems can respond to a wide spectrum of tasks, especially when no force is deployed on the ground, when legal and sovereignty constraints limit or deny the use of other means. As a consequence, the present study has to encompass the whole tasks given to the military, especially for the support to the strategic/political decision making level. This chapter focuses on the areas where space-based applications could enhance military effectiveness: Communications, Earth Observation, Signal Intelligence, Early Warning, Positioning, Navigation and Timing (PNT). Space Surveillance is also mentioned in order to stress the need for the protection of the systems.

[5] Doc. n. 7934/05 dated 8 Apr 05.

18. Harmonisation of standards. Irrespective of the more specific options identified hereafter, an overriding general need of those who intend to apply space based assets is the smooth integration of satellite services into existing user systems, without the need to redesign interfaces. Interoperability will thus be critical for the role of any space system and this has to be taken into account already in the early stages of the related system developments.

19. Ground segment. The ground segment of the space systems should be capable of providing timely, reliable and accurate geospatial intelligence for direct support to the decision making process, and the planning and the conduct of operations through all levels command.

20. Communications

    a. In accordance with the European Space Policy: "ESDP and Space", "Secure and reliable communications are essential for exercising political and strategic direction of any operation. They are also vital at the operational and tactical level. On external theatres, these capabilities may often depend upon space-based assets, especially where local infrastructure is deficient"[6].

    b. In particular, 3 areas of CIS connectivity have to be considered:
       – at the Political/Military level and down to the OHQ,
       – between the OHQ / EU Ops Centre and its subordinate HQs and
       – to the local theatre CIS (tactical level).

    c. Today, at the political/military level, the majority of EU responsibilities for linkage are being developed along traditional commercially provided methods. Consequently future developments should take into consideration the ease of connectivity, independence and security features offered by SATCOM.

    d. As a generic approach, basic Information Exchange Requirements (IERs) at the strategic level between the OHQ and its deployed subordinate HQs could be supported by EU military satellite links as the preferred option (security features). As a back-up, MS SATCOM or commercial satellite services preferably with military encryption are also effective.

[6] Para II.7.

e. Since the Force HQ is a deployable Command, the local theatre CIS infrastructure and /or general situation will have direct impact on the availability/reliability of traditional land based CIS connections. To overcome such difficulties, SATCOM linkages should also be considered at the operational and tactical level. In particular, due to increasing networking in operations down to the individual soldier (observers, special forces, etc.) there is a need for directly accessible SATCOM.

f. The services that can be provided by space based CIS are:

- very high data rate communications (bi-directional to multidirectional including videoconferencing) and datacast, between strategic fixed users and theatre deployed users (decision and operations management centres, headquarters, harbours, airfields, ISTAR information systems, logistic nodes...);
- high to very high data rate interconnections between space-based, aerial, maritime and ground sensors, platforms and assets, including ISTAR information systems (data relay mission service);
- low to medium data rate communications between mobile terminals (handheld, ground vehicle mounted, aerial platforms and weapons of all kinds) and between mobile terminals and fixed terminals;
- multimedia services for operational and domestic services (audio and videoconferences, satellite imagery data transmissions…);
- traditional services (fax, telephony...);
- netted and point-to-point over the horizon secure voice and data services between strategic fixed users, deployed theatre users and mobile users.

It is desirable to protect communications against jamming and spoofing.

21. Earth observation

a. Military permanent tasks. The following tasks are performed on a permanent basis in routine time by the military, especially for the support to the strategic/political decision making level:

- Monitoring of potential crises;
- Advance Military Strategic Planning.

b. Monitoring of potential crises relies on Intelligence and requires to undertake two complementary functions: Early Warning and Strategic Surveillance.
Early warning aims at characterising threats that could trigger or aggravate a crisis/conflict. It consists in identifying a series of specific activities or indicators that are linked either individually or together to a less identifiable activity. Its fulfilment requires timely acquisition of reliable information over multiple areas in the world. The spectrum of required information is huge and varies in accordance with the original factors (human, economics, religious, military…) of the threat to detect.
Strategic surveillance consists in gathering and analysing a series of specific activities or indicators, in order to assess thoroughly and regularly an existing crisis situation or threat.
Amongst others, strategic surveillance encompasses the identification and evaluation of proliferation activities, the verification of arms control and disarmament agreements, the implementation of treaties, the monitoring of post-crisis developments (implementation and/or the respect of peace/cease fire…), the surveillance of terrorism activities, the tracking of movements and emplacements of refugees…

c. Advance military strategic planning, as defined in the EU Concept for Military Strategic Planning[7], requires regular, precise and detailed situation assessments and up-to-date collections of geospatial data. They include for instance the description and status of road networks, the spotting of any potential helicopter landing sites, the location, status and description of all the airfields and port installations, the positioning and environment of the embassies and consulates, the location and analyses of all military installations (including air and coastal defences)…

d. For both the above-mentioned military permanent tasks, access to data derived from space-based Earth observation systems (SBEOS) is increasingly needed to provide the required information. Skilled and experienced image analysts provide relevant geospatial intelligence by processing and analysing data originating from SBEOS.

[7] doc. n. 12046/01 dated 25 Nov 01.

e. This contribution should meet the following requirements to be considered as valuable:
   – image acquisitions on any location on the Earth;
   – the image collection fulfilled in a timely manner in order to satisfy the decision making process. In other words, the reaction time between the imagery tasking and the dissemination of the information must be perfectly controlled and compatible with the intelligence cycle pace and the decision-making process. Notably, when a significant incident requiring urgent assessment is reported, access to SBEOS should allow last minute programming of priority mission requests on any location on the Earth, and corresponding images should be made available to the analyst **DELETED** after tasking.

f. The imagery requirements to fulfil those permanent tasks can be estimated as follows:
   – low resolution panchromatic and multispectral mosaics to provide the necessary background geographic information. When weather conditions do not allow easy acquisition of optical images (e.g. for tropical areas), optical images can be replaced by SAR imagery;
   – medium resolution panchromatic and/or multispectral images including near infrared band (used for instance for detection and localisation of troop deployments or refugee camps, classification of cultivation, detection of missile or artillery systems…);
   – high-resolution panchromatic images. Half of these panchromatic footprints should be coupled with multispectral images to create true-colour composite images. These images are used for instance to detect mass graves, to estimate numbers of refugees, to analyse nuclear facilities, to recognise terrorist training camps and facilities, to spot and describe potential helicopter landing sites, to describe airfields and port installations, to elaborate detailed GIS products...
   – Synthetic Aperture Radar (SAR) provide the ability to acquire images independent from daylight and weather (detection of half-buried infrastructure, detection of camouflaged infrastructures, characterisation of troop deployments…);
   – very high resolution and extreme high resolution imagery are used respectively for reconnaissance and identification of military significant objects;
   – thermal infrared used to complement optical visible or SAR images, in order to detect, analyse and identify observed materials;
   – stereoscopic imagery to create Digital Elevation Models (DEMs) for 3D viewing.

g. Military non-permanent tasks. These tasks require rapid access to intelligence and geographic data to update local situation assessments and to support the decision process.

h. Access to information derived from SBEOS data is needed to contribute to these tasks. However, the global needs in quantity terms cannot be evaluated. It mainly depends on the geographic footprint of the crisis area and on the set of geospatial intelligence already gathered at previous stages. On the other hand, time constraints that generally characterise these phases put stronger demands on reactivity. Notably, SBEOS should allow last minute programming of mission requests and corresponding images should be made available to the analyst **DELETED** after tasking.

i. Conduct of military operations. Considering SBEOS unique capabilities, access to SBEOS would complement other observation means (e.g. aircraft) and contribute in an essential manner to the acquisition of data and information for direct use at all levels of command.

j. Data provided by SBEOS can be effectively used to enhance:
   - Intelligence, by providing IMINT in support of:
     - theatre situation assessment;
     - preparation and employment of forces and weapons systems;
     - assessment of the result of operations;
     - detection and monitoring of activities;
     - elaboration of descriptive documents;
   - Geographical support by improving and updating geospatial information systems for the theatre;
   - Meteorological, Oceanographic and Hydrographic information to assist situational awareness, the deployment of weapon systems and conduct of operations.

k. Access to SBEOS should:
   - provide world wide coverage;
   - be protected against jamming and deception actions;
   - ensure the availability, the security and the integrity of the image data.

l. Practically, SBEOS should contribute to the detection, reconnaissance and identification of any targets of interest (including camouflaged and obscured targets), day and night, in all weather conditions. Targets of interest encompass so-called military targets (air defence artillery, battle tanks…) and relevant infrastructures (bridges, power installations…). It should also contribute to detect situation developments as the evolution of activities, infrastructures, systems and equipment.

m. SBEOS should allow the elaboration of DGI (digital geographic information) products and image maps with scales up 1:50,000 with precise geographical positions.

n. Reaction time between SBEOS tasking and final delivery of the IMINT and geospatial products must be minimised. Consequently, tasking, reception, processing and analysis of the data and images should either be performed directly at OHQ or FHQ level using deployable ground stations or through stand-off facilities securely connected with high bit-rate to all levels of command.

o. SBEOS' integration and interoperability with other systems is of the highest importance. In particular, EU SBEOS should:

– be fully integrated within any EU Network Centric Operations – (NCO) architecture, in particular the ISTAR network;

– produce a standard format (to be defined), ready for fusion with intelligence from other collection assets: e.g. IMINT, HUMINT and others;

– ensure interoperability with MS and NATO systems.

p. SBEOS revisit times should allow daily acquisitions of panchromatic or SAR high resolution images over the same location in the theatre.

Access to SBEOS should allow last minute programming of priority mission requests over the theatre and corresponding images should be made available to the analyst **DELETED**

22. Signal Intelligence (SIGINT)

a. SIGINT makes use of electromagnetic broadcasts to obtain intelligence. SIGINT concerns:

– the characterisation and the location of telecommunications and radar systems (ELINT);

– the access to the content of the communications (COMINT) in particular via relevant satellite communications (including mobile satellite services), to obtain information on documentation/content, situation and action.

As a key element for intelligence gathering and in order to support operational missions, in particular targeting and mission preparation, space-based SIGINT systems are designed to contribute to the detection and characterisation of any related civil and/or military activity by:

– monitoring potentially hostile activities in order to disrupt the command, control and intelligence of the potential enemy;
– supporting counter-terrorism operations;
– elaborating a common operational picture;
– detecting emitters with a high degree of accuracy.

b. To fulfil their objectives, SIGINT systems must (in all relevant spectrum bands):

– collect signals and/or characterise the signal (frequency, type of modulation, pulse characteristics...);
– locate with high accuracy the emitters.

The SIGINT space segments should therefore:

– include the appropriate sensors;
– provide world wide coverage;
– be able to collect signals in an area as large as possible during over fly;
– be as flexible and robust as possible in order to provide timely information on dedicated areas of interest;
– be protected against jamming and spoofing actions;
– ensure the availability, the security and the integrity of the SIGINT data.

Taking into account that the effectiveness of space based SIGINT systems is strongly dependent on the architectural design and actual performance of the user ground segment, this should be designed to be able:

– to maximise the intelligence gathering capacity through the timely co-ordinated use of all existing types of sensors;
– to integrate any new space asset without excessive modifications;
– to ensure the availability, the security and the integrity of the imagery data.

Additional work will be needed to define the sharing of signal processing workload between the satellites and the user ground segment.

SIGINT systems' integration and interoperability with other systems is of the highest importance. In particular, EU space-based SIGINT systems should:

- be fully integrated within any EU Network Centric Operations – (NCO) architecture, in particular the ISTAR network;
- produce a standard format (to be defined), ready for fusion with intelligence from other collection assets: e.g. IMINT, HUMINT and others;
- ensure interoperability with MS and NATO systems.

23. Early Warning (for Missile Defence)

a. The objective of early warning space capabilities consists in the world-wide, timely detection of missile firings from assets placed in highly-elliptical or geostationary orbits. While early warning satellites are mainly used for the launch detection of ballistic strategic (intercontinental) and medium range missiles, in a pre-crisis situation these systems could also be used to:

- monitor the activities of potentially proliferating countries (missile development activities, frequency of test firings);
- measure the performance and characteristics of the missiles being tested;
- determine the signature of these missiles;
- monitor and detect launches even when EU countries are not involved.

b. During crisis operations, space-based early warning systems could be used to:

- alert the forces and national authorities of an incoming threat, providing impact prediction information (time and location) of the strike to enable the use of protection measures, and direct consequence management operations;
- cue counterforce actions against the incoming missiles;
- locate the launch site with sufficient precision to allow the identification of the aggressor and provide evidence to high level decision makers.

24. Positioning-Navigation-Timing (PNT)

a. Space based positioning and time distribution systems have become indispensable to all military forces and civilian units since the fielding of the first generation of satellite radio navigation systems. These are today vital to the conduct of all operations, from the most sophisticated command and control systems down to the individual element. For civilian as well as for military operations, precise and secure knowledge of the position of own troops, that is essential for the conduct of the operation and the safety of our personnel, is heavily dependant upon satellite radio navigation systems and reliable communications. These systems are required to provide a permanent and world-wide precise and universal reference of position and timing to the users. Although all MS employ PNT systems, the ability to navigate accurately is already integrated to the many MS systems (platforms, vehicles, ships aircraft).

b. PNT receivers can be installed on-board a full range of assets and platforms: all types of spacecraft, aircraft, UAV/UCAV, ships, vehicles and weapons. Ground troops require handheld versions of such receivers. Satellite radio navigation systems provide invaluable support, in order to execute search and rescue operations or in places where friendly forces have to be extracted.

c. All kinds of Crisis Management Operations need an uninterrupted and guaranteed access to the highest precision available, thus, signal integrity must be guaranteed under all circumstances. To be military useful systems require:

- a high level of ensured availability from the acquisition of sensitive components and equipment to operations;
- a high level of operations continuity by appropriate anti-jamming and anti-spoofing capabilities;
- a capability of local denial of access to hostile entities without disturbing the use of the system by friendly forces;
- a selective denial of access to selected user groups;
- a selective jamming capability in the local area of responsibility;
- a high level of protection and security of all elements of the ground segment.

25. Space surveillance

a. Although Space surveillance might be seen mainly as a civilian activity for scientific and civil protection operations, it could also have military utility:

- to acquire and maintain a sufficient knowledge of the environment in space, in order to safeguard the functional capabilities of own satellites;
- to monitor allied satellites, in order to detect any damaging risk due to either aggression or collision with debris:
  - to characterise any aggression against these satellites;
  - to observe and possibly forecast space weather[8] in order to protect own space-based assets;
- to assess the main capabilities of space-based systems:
  - to verify the application of international treaties in outer space[9];
  - to participate in the strategic evaluation of technological and operational capabilities of other countries/organisations;
- to provide decision makers with pertinent intelligence in order to take into account the situation in space within the decision process or the planning/conducting of operations.

b. To be militarily useful space surveillance systems would need to be able to provide information concerning:

- the main characteristics of satellites, and in particular:
  - orbit parameters;
  - activity status (wealth…);
- the main characteristics of potentially threatening debris, and in particular :
  - trajectory data;
  - physical parameters (size…);
- pertinent information related to space weather and Near Earth Objects (NEO).

[8] e.g. solar activities.

[9] The treaty of January, 25th, 1967 forbids the deployment of weapons of mass destruction in outer space.

Using links with other intelligence sources, the system should provide the following products and services:

– up to date space situation, including information needed to perform a threat assessment:
  - activity status of own satellites and subsequent support delivered;
  - activity status, main performance and orbit prediction of other satellites;
  - trajectory prediction for atmospheric re-entering spacecraft or debris;
– alert cues in order to avoid:
  - any collision due to either aggressor or flying debris;
  - any deterioration due to potentially destructive space environment parameters ;
– intelligence dossiers including imagery of on-orbit satellites, with a required image quality to allow the detection, the identification and the technical analysis of spacecraft and other space objects according to their physical size, their trajectory or orbiting altitude.