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Strategic Research Agenda

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TABLE OF CONTENTS

Research and Technology Priorities for the Next Generation MilSatCom – Coordinated Approach

Recommendation Issued by EDA – PT SatCom

Version: v.2.0

Contents

1 Introduction

1.1 Background

As agreed in the 2nd IDT Command meeting of 16/02/2006, the EDA Satellite Communication Project Team (PT SatCom) has been assigned the task to "*Coordinate the MilSatCom R&T through assessing the requirements and mapping ongoing activities in Europe in order to prepare the replacement of current MilSatCom systems which should occur around 2020*".

Responding to this assignment, during the 5th PT SatCom meeting on 22/01/2007 the Project Team members agreed to launch the **R&T Work Stream** within the PT in order to identify cross-domain technology priority areas to be addressed by future R&T efforts, in alignment with the next generation MilSatCom timeline.

According to the adopted coordination plan, this R&T Work Stream has been composed of three principal phases:

I. Initial collection of information: collecting available technical and policy references, exchange of information with space agencies and with industry and gathering pMS views on future MilSatCom R&T goals (references listed in chapter 2).

II. "*Study to Support the Definition of Future MilSatCom R&T goals*" (EDA-funded project 07-CAP-003): performed by an external contractor, it explores the state of the art and future trends in commercial and military SatCom R&T, dual use potential of the technologies concerned and implications of future MilSatCom procurement strategies on the military-specific R&T priorities in SatCom (ref. [R1]).

III. Issuing follow-up recommendations: formulated by the PT members and based on the information gathered in phases I and II, the recommendation should present the identified requirements and propose an adequate approach to address them.

The outcome of phases I and II has been documented in the references listed in chapter 2. The present document contains the results of phase III.

1.2 Scope and purpose of this document

The document presents the recommendation on the coordinated European approach in addressing the R&T priorities for the Next Generation Military Satellite Communication (MilSatCom) so as to prepare the replacement of current systems that should occur around the year 2020.

The R&T priorities have been identified and recognised by the PT SatCom, on the basis of the collected information and through the analyses conducted within the R&T Work Stream in consultation with the R&T community (references provided in chapter 2).

The recommendation, prepared and supported by PT SatCom members, comprises:

a) **the technical elements**, i.e. (i) specification of the scope of the R&T priorities and (ii) initial definition of the related R&T activities, including their roadmaps and,

when available, budgetary estimations (section 4.2 for military-specific technologies and section 5.2 for dual-use technologies),

b) **the organisational elements**, i.e. proposal of specific tasks to be performed under the coordination of EDA, with the participation of the pMS, with a view to further define and effectively launch the recommended R&T activities (section 4.3 for military-specific technologies and section 5.3 for dual-use technologies).

With regards to those elements, the present recommendation covers only the R&T phase focused on technology research, feasibility, development and demonstration up to "system/subsystem model or prototype demonstration in a relevant environment" (TRL6)[1]. The subsequent "post-R&T" activities (i.e. TRL7 and above: system development, tests and validation – including in-orbit validation), which may constitute a potential object of future cooperation programmes, are not within the scope of this recommendation. Preliminary views on the "post-R&T" activities are, however, brought up in the document so as to provide a sound and realistic timeline perspective for the coherent planning of the R&T activities[2].

The recommendation is produced with the intention to be presented to the EDA Steering Board, subject to prior approval by the IDT Command and positive review of the Agency Management Board. The Steering Board will be requested to:

- **note** the "technical elements", as per item a) above,
- **approve** the mandate for the Agency to work on the "organisational elements", as per item b) above.

Presentation of the document to the Steering Board will, formally, mark the end of the R&T Work Stream in the PT SatCom. The present recommendation will be implemented, subject to the Steering Board decision, with the support of the experts assigned and committed by the interested pMS – presumably, the current members of the PT SatCom and the R&T experts from the relevant CapTechs.

1.3 Intended audience

Prior to submission to the Steering Board, the present recommendation will need to:

- be discussed in the PT SatCom in order to take into account and reflect the views of the pMS; the PT members may invite the R&T experts to join this discussion – as considered necessary,
- be reviewed and approved by the IDT Command,
- obtain the support of the Agency Management Board.

[1] Technology Readiness Level (TRL) scale introduced by NASA and commonly used by space agencies (e.g. ESA) to describe the various stages of technology development. Please, refer to [R39].

[2] In the context of the "post-R&T" activities, PT SatCom draws particular attention to the concepts of:

- "common EDA payload" (i.e. hosting MilSatCom payload – specified jointly by EDA pMS and accessible on a predefined basis to EDA pMS – on nationally-owned satellites)
- "common design" (i.e. specification and standardised design and development of systems, with shared design costs and with the objectives to make the design results available to all contributing members for their national use)

Both concepts (and their possible applicability) will further be discussed by the PT SatCom.

At this stage, the document should be read and reviewed by the staff involved in the work on SatCom and participating in the preparation of consolidated technical and organisational guidelines in this domain – both, in the pMS and in the Agency.

Once approved by the Steering Board, the document will serve as reference to all staff – in the pMS and in the Agency – concerned by the presented technical scope and responsible for assuring resources and support within the adopted action plan – in particular: PT SatCom members, R&T community in the pMS and relevant CapTechs (PoCs, CNCs, CGEs, moderators), EDA officers contributing to the capability, technology, cooperation and industry dimensions in the area of the present recommendation.

1.4 Overview and main highlights

The present recommendation focuses on the **R&T phase** (technology research, feasibility, development and demonstration) of the identified next generation MilSatCom R&T priorities and is based on the information gathered in phases I and II of the R&T Work Stream of the PT SatCom.

The recommendation regarding the technology priority areas for the next generation MilSatCom is not only driven by the **military concerns** and expectations with regards to SatCom (the need for broadband, scaleable, flexible, robust, secure and cost-efficient mobile communication) but is also supported by a more complex **multi-dimensional analysis** related to: the European institutional environment (levels of public financing of space-related activities in Europe, expenditures for SatCom, lack of "integrated approach" in the military domain), international background (state of the art and progress in such countries as US, Russia, Japan, India and China), industrial trends (driven by customer requirements, technology readiness and the reality of the global market), security of supply (balance between the competitivity of the European space industry on the global SatCom market and security of supply for the European military users) and dual-use potential of some technologies (identifying the synergies between the military-specific and dual-use technologies).

In the identified list of specific SatCom technology areas, having direct impact on the functionality and performance of the military operations, approx. 25% need to be addressed by **military-specific** (and military-funded) R&T activities (examples: antenna technologies, on-board processing, inter-satellite links, protection against nuclear/conventional/EMP attack, superconductivity, ...). The recommendations relative to those technology areas and related activities are presented in chapter 4: "Recommendations on military-specific technologies".

The remaining 75% of the identified technology areas represent a **dual-use potential** and can be developed together with civil/commercial stakeholders. This means that the military community must be ready to participate in the civil/commercial programmes. Those technologies and the possible means of participation are discussed in chapter 5: "Recommendations on dual-use technologies".

Both, chapter 4 and chapter 5 are structured such as to distinguish the "**technical elements**" (sections 4.2 and 5.2) and the "**organisational elements**" (sections 4.3 and 5.3) of the recommendation – as defined in section 1.2 above in items a) and b).

The R&T phase, within the scope of the present recommendation, will, logically, be followed by the system development and validation phases, which may include the in-orbit validation, thus implying a significant cost. Those **"post-R&T" activities**, remaining beyond the scope of this recommendation, are referred to in sections 4.2 and 4.3 in order to draw the perspectives of exploitation of the results of the R&T phase. Once merged with the conclusions formulated in the CST[3], the results of the R&T phase will provide tangible milestones and substantial rationale for informed and persistent decisions as to the scope and prioritisation of the "post-R&T" activities – future cooperation programmes to be launched in order to reach the ultimate objectives set for 2020.

1.5 Document history

Version	Date	Status	Comments/Revision
v.0.1	30/11/2007	draft	Creation of the document, draft submitted to PT SatCom
v.1.0	14/02/2008	approved by PT SatCom, submitted to IDT Command	Modifications reflecting the comments received until the 9th PT SatCom of 13/02/2008: • adding section 1.5 (document history) • re-wording of sections 4.3 and 5.3 • scope of R&T priority "P1" in section 4.2.1, Annex 1 and Annex 2 (all frequency bands) • introducing the concepts of "common EDA payload" and "common design approach" in section 1.2 • update of the calendar in Annex 4
v.2.0	10/03/2008	approved by IDT Command	• Modification in section 5.3 (explicit reference to the EU Commission and the European Space Agency in the context of coordination with the civil/commercial developments for dual-use SatCom technologies) • Update of the calendar of work in Annex 4 (Calendar of work on the present recommendation)

[3] The progress of the R&T phase will inspire further work on the long-term Common Staff Target (CST) for MilSatCom – the document of military requirements – for which a dedicated work stream is being launched, with the participation of military experts in the PT SatCom.