Delivering Technologies for Capabilities

EDA R&T 2011 Edition

The first five years of EDA were mainly dedicated to set the tasks and to develop an innovative approach for launching and managing collaborative R&T projects and programmes. It led to quite a good success of more than 600 M€ of R&T investments during the years 2007-2010. To consolidate our European priorities for Defence Research with participating Member States, each of our twelve CapTechs is currently developing a Strategic Research Agenda. We are now entering a more mature phase of taking full benefit of the integrated dimension of EDA with the Capability, Armament Cooperation and Industry & Market branches where Defence Research is part of the overall European landscape of EU Research, following new opportunities offered by the ratification of the Lisbon Treaty. Here a few examples to illustrate these initiatives.

The joint research programme on Unmanned Maritime Systems UMS

The "European Unmanned Maritime Systems for Mine-Counter-Measures and other naval applications (UMS)" represents a major and concrete success as an ambitious technology programme directly connected to Maritime Mine Counter Measures (MMCM), one of the twelve priority actions selected in July 2008 based on the Capability Development Plan. The UMS will prepare the next generation of technologies of the MMCM programme, currently in the preparation phase for delivering an initial capacity by 2018.

This initiative, based on a System of Systems approach, was endorsed by Ministers of Defence in December 2010. It calls for improved interoperability of European UMS, taking into account modularity and open standards/ interfaces to enable plug&play and interchangeability of modules. The UMS is the first EDA R&T programme which launches under its Programme Arrangement a great number of R&T projects (more than 10) while at the same time allowing full flexibility for its contributors to define their own projects, partners and funding levels.

The European Technology non-Dependence

Unrestricted access to critical Technologies is of major importance for a strong European Defence, Space and Security Industrial Base now and in the future. The main objective of the Conference jointly organised with the Hungarian Presidency in Budapest on 13-14 April is to provide a forum for information exchange and discussion regarding the current and future key technologies for which European non-Dependence is relevant. Key issues, challenges, strategies and solutions for improving access to the key enabling technologies for the European Defence, Space and Security Industrial and Technology Base will be addressed.

The Defence Research and the next EU Framework Programme

Since the entering into force of the Lisbon Treaty, Defence Research is enshrined in the Treaty on European Union as an EDA task. In order to shape the future of defence research at EU level, and to aim at complementarity and synergies between European defence, civilian security and space research programmes, the Agency has developed the European Framework Cooperation (EFC), teamed together with the European Commission and the European Space Agency. Defence Ministers tasked EDA to develop EFC programmes on CBRN Protection, Unmanned Aircraft Systems and Situation Awareness. The EFC paves the way for Defence Research at Union level under the future Common Strategic Framework for EU Research and Innovation funding for the period 2014-2020 within the vision EU2020.

Christian Bréant, R&T Director

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1. R&T CapTechs at a glance

A **CAPTECH** is both:

- a **Technology Area** focused on a particular military domain and the technologies associated with it;
- a **Network of Experts** drawn from Member States, Industry, Research Institutes, Academic Institut and Agencies (International, European and National).

Information Acquisition & Processing	Guidance, Energy & Materials	Environment, Systems & Modelling
IAP1 Components	GEM1 Materials & Structures	ESM1 Naval Systems & their Environment
IAP2 RF Sensor Systems & Signal Processing	GEM2 Energetics, Missiles & Munitions	ESM2 Aerial Systems & their Environment
IAP3 Optical Sensor Systems & Signal Processing	GEM3 Ground Systems & their Environment	ESM3 Systems of Systems, Space, Simulation & Experiment
IAP4 CIS & Networks	GEM4 Guidance & Control	ESM4 Human Factors & CBR Protection

IAP1 - Components

IAP1 covers components technologies in the electronics and optronics area. A very active community comprising industry, academia and government experts that focuses primarily on critical and key enabling technologies. The main technology roadmap for IAP1 is represented by the results of the previously conducted DISCOTECH study.

IAP1 had 7 running projects and in 2010, one of the latest most successful projects- KORRIGAN, was concluded. It demonstrated GaN technology circuit design, successful fabrication and testing with outstanding performance. For further developing the critical enabling GaN technology in Europe, the MANGA programme was started with the objective to establish a competitive European industry supply chain for SiC and GaN technologies. For the planned System on the Chip (SoC) project the Technical Arrangement could be signed by the 4 supporting nations (DE, FR, IT, NO). The goal of the EDA SoC project is to give access to the defence equipment manufacturers for designing complex System on chip in an advanced technology and to bring system level integration methodology compliant with security and safety requirements.

Moreover, for the planned programme on Technology for High speed Mixed Signal Circuits (THIMS) an Outline Description could be initiated by 3 supporting nations. The primary objective of this project is to demonstrate the availability of state-of-the-art high-speed mixed signal processes within Europe that provide a cost-effective and secure source of technology for military applications.

SoC and High speed Mixed Circuits are considered as critical key enabling technologies which have the potential to improve performance in various defence systems.

The CapTech had 5 proposed projects for which the funding of the nations and industry is under future clarification. In 2011 further new project proposals are in preparation.

IAP2 – RF Sensor Systems & Signal Processing

IAP2 is one of the most active CapTechs with 8 ongoing projects / programs, 10 new proposals/ideas under preparation, as well as 1 ongoing and 1 newly contracted study. A typical IAP2 CapTech meeting does not have governmental session; it is only organized if needed. Since IAP2 is intensively involved in the identification of R&T goals for the European Framework Cooperation programme on Situation Awareness, two CapTech governmental sessions were organized in 2010.

IAP2 launched two new projects in 2010. TELLUS is looking for enabling technologies for radar and ESM systems in urban terrain. The focus of TELLUS is on light, affordable and energy efficient radar and Electronic Support Measure systems, and the project contains theoretical studies of applicable technologies aiming at a maturity level of about TRL 4. The project FARADAYS was launched due to increasing pressure on governments to transfer more spectrum from public service use to commercial use, including frequency bands used by military radars. FARADAYS will survey military radar frequency issues in Europe, provide solid arguments to protect military radar frequency bands and investigate innovate techniques which can support multiple usage of spectrum.

The study on Enhanced Radar Image Technique (ERIT), launched in 2010 was looking for innovative technical solution able to provide good overall radar image signal processing techniques. The scope of ERIT was the use of SAR/ISAR techniques on highly moving air platforms. The study succeeded in its object since the follow-on project is already in preparation. The other IAP2 study, contracted in December 2010, is aiming to create the technology basis of adaptive, self-learning and anticipative radar. This new generation of radars will enable defence forces to operate majority of radars without the direct involvement of human operators; also respond to the challenges of

rapidly changing and diversified threats, tough operational environments, under-trained/unqualified personnel and reduction of the battle casualties in personnel. In addition, these kinds of radars may provide increased operational flexibility and reduced logistic footprint.

The Group "Scalable Multi-function RF" (SMRF) got new membership (FR and expressed interest from IT). It developed a long-term roadmap for the implementation of programme, and based on that defined three new projects.

IAP3 - Optical Sensors System & Signal Processing

The technical scope of the IAP3 covers electro-optical systems and related signal processing. Electro-optics is one of the 22 priority areas of the R&T Strategy and the pMS experts have identified laser radar technologies (including active imaging), electro-optics countermeasures (with close link to the CDP priority C-MANPADS), hyperspectral and multispectral imaging and image processing as more detailed key technologies. These priorities are represented in the IAP3 project portfolio that consisted of three running projects and one study in 2010. In addition to C-MANPADS, electro-optical sensors are relevant to many other military capabilities like CBRN stand-off detection and intelligence, surveillance and reconnaissance.

Based on the pMS input, EDA launched a study on active imaging to form a common understanding of the R&T priorities in this area. According to the study, the most promising military applications for active imaging are in short term long range target classification/identification and IED detection, and in mid-term spectral 3D imaging systems for hard target detection and identification and airborne mapping and reconnaissance systems. The main technology enablers are availability of cost-effective focal plane arrays, compact spectral lasers, multispectral optics as well as robust real time signal processing.

A study supporting the formation of the IAP3 strategic research agenda was contracted in December 2010. This study includes a forecast of the relevant civilian technology development within the next 10 and 20 years and the needs for defence specific R&T work will be identified. Previous work like the DISCOTECH study (electro-optical components) and Photonics21 (civilian technology roadmap) will be used as background material in order to avoid duplication of work. The results of the study will be ready in December 2011.

IAP4 - CIS and Networks

IAP4 is supporting military requirements in the areas of Command Information Systems (CIS), Communication Systems as Tactical Radio or SatCom, and Network Enabled Capabilities (NEC), thus contributing to the relevant priorities of the Capability Development Plan (CDP).

For EU force operations, usually lacking the comfort of a subscriber line to plug in, a variety of capability challenges have to be tackled in detail. Many of them are related to implications from the Software Defined Radio (SDR) paradigm on next generation military radio "waveforms" (the cybernetics of radio transmission). While work on waveform projects (ETARE, HDR-HF) has progressed, a contract on cognitive radio technologies (CORASMA) was signed and kicked off within a 15 M€ project among 7 Member States (BE, FR, DE, IT, PL, PT, SE).

These technologies will enable intelligent exploitation of the radio spectrum, a resource becoming increasingly difficult to access. From the 2010 Workshop on Collaborative Opportunities, ideas on Body Area Networks and on improved Situational Awareness were added to the IAP4 research topics list, which also includes disruption tolerant networking techniques, intelligent Quality of Service (QoS) schemes across functional layers and Service Oriented Architectures (SOA) in tactical environments, to support the scalability of mission requirements.

"Cyber Space" has rapidly gained crucial relevance to military collaboration. Therefore, increasing consideration will be dedicated to the protection of Information and Communication Systems (Cyber Security, Cyber Defence).

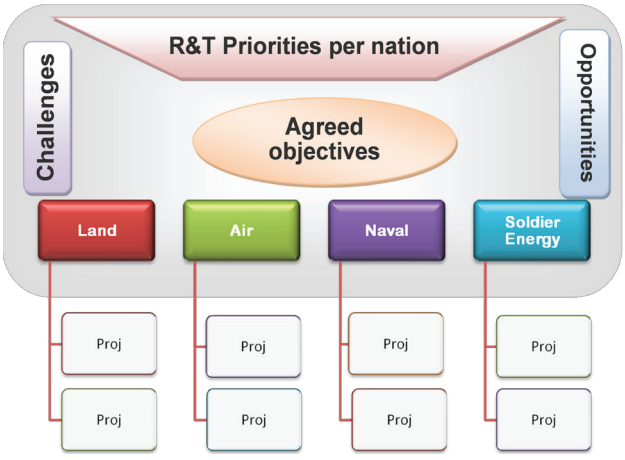
Finally, a contract was awarded to a consortium of institutes and industries from 9 Member States to develop a Strategic Research Agenda for IAP4.

GEM1 - Materials & Structures

Materials are at the basis of all structures and systems by providing the essential characteristics for the behaviour and use of equipment during its life cycle. The study of its performance, (either elemental or functional), and integration in structures and systems in different domains, is fundamental to guarantee permanent improved capabilities.

The GEM1 CapTech comprises a solid group of experts, both governmental, industrial & scientific, that for some years have worked together to find the best shared opportunities to address national and collective strategies.

GEM1 focused on the understanding and identification of the areas and topics where gaps were recognised whilst sharing ideas opened to common interest. This exercise was done on the basis of an agreed work plan



already established that clustered the group's activity into the domains – naval, land, air and soldier systems; a core team was responsible for each thematic area. The organisation of dedicated workshops in the naval, aerial and soldier systems domains helped in assessing the state of the art and on the definition of trends of cooperation. The remaining workshop for land systems is scheduled for the beginning of 2011 and will contribute to the strategic research agenda (SRA) that is being prepared, which will contain the roadmap for the next 5 to 10 years.

The priority axes of research already identified encompass solutions for the protection of structures taking into account new European regulations (REACH), stealth behaviour or structural and operational performance. Research is also foreseen in improved design concepts to cope with vulnerability problems, weight and cost reduction or the introduction of functional materials. Armouring (including transparent structures) and the increased use of composites and micro/nanomaterial are also part of the shared strategy. Essential in the overall approach is the viability of integration of innovative solutions to operating and new systems while addressing trough-life support related aspects and costs.

To be highlighted the brainstorming around energy solutions particularly for the dismounted soldier, the handling of obsolescence, the European dependency on materials or technologies and the disposal of military equipment. Some of these topics are included in wider national and EDA work strands and will certainly be developed within defined common goals for the next years.

GEM2 - Energetic, Missiles & Munitions

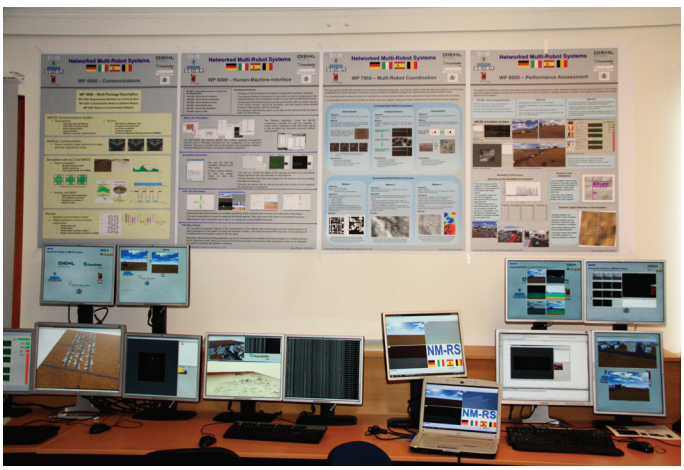
Kicking-off 2010 was a Meeting dedicated to informing the non-Governmental domain on the processes of GEM 2 and recommendations on how to most effectively see project proposals fly. Brainstorming prior and during the meeting resulted in fifteen distinct ideas for projects, two of which have made the transition into proposed cooperations. It is anticipated that more of the ideas will make the transition to actual proposals in 2011 and this marks a significant change for the better in the GEM2's way of working. In addition to this, the projects on "Future Flare Compositions" (FFC) and "Formulation and Production of New Energetic Materials" (FP-NEM) were ready to be signed and are thus up and running.

The Meeting was also important in that it enabled the non-Governmental domain to start thinking about the future of the GEM 2 in terms of priorities and agenda, feeding in the strategies of Governmental representatives. This helped build up momentum for the CapTech Meetings that followed. A Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis identified not only technological issues but also matters dealing with dependencies, European coordination and resource management.

The last CapTech Meeting of the year was held in December back-to-back with the Energetics, Missiles and Munitions (EMMST) Workshop. With the EMMST Workshop being dedicated to consolidating the output of the SWOT analysis in order to identify short term priorities, the CapTech Meeting itself was used to draft the actual Strategic Research Agenda for GEM2 (tentatively titled Energetics, Missiles and Munitions for Crisis Management). The actual document consists of two parts. The first lists the priorities (short and medium / long term) and the second part contains the roadmaps required to deploy the priorities. The first draft of the short term priorities will be finalised in early 2011. An additional workshop will be held in the autumn of 2011 looking at the medium and long term. In parallel, efforts on roadmapping will commence and the first of these are expected to be integrated into the SRA mid-2011. Following this work, the SRA will be operational and will form the base for launching new collaborative activities.

GEM3 - Ground Systems & their Environment

In the recent months, the CapTech GEM3 Ground Systems & their Environment carried on further the development of its activities. Building on the Key Technologies identified in the European Defence Research and Technology Strategy, the CapTech organized in February 2010 its first significant workshop on "Power Sources & Supply Technologies" for Land Systems. With 16 presentations and over attendees 50 attendees from government and industry, this represented a major milestone in the expansion of the CapTech network. The CapTech meeting of October 2010 was hosted by the Czech Republic in Prague, which allowed attendees to take part simultaneously to the Future Soldier 2010 Exhibition and Conference. The CapTech reviewed the capability benefits of Electric Armour for armoured vehicles, with the support of a study managed by the company BMT Defence Services. It also drafted the first chapters of its SRA, starting with the Capability analysis workshop grounded on EDA Capability Development Plan, and the related work strand Landscaping Land Manoeuvre. Following the discussion of technology roadmaps in February 2011, a first draft of the Strategic Research Agenda is planned for mid-2011.



GEM4 - Guidance & Control

The CapTech is proceeding in the preparation of the strategic research agenda (SRA), during 2010 each meeting saw discussions on national priorities and the work continues to be performed within the CapTech experts group. The current aim is to have a working draft at the end of 2011. A workshop on "future guidance and control" will be held in mid-2011 in support of the development of the SRA.

The first meeting was held in Stockholm and hosted by the Swedish Defence Research Agency; the meeting included a back-to-back workshop on indoor navigation. The topic of indoor navigation was also approached in a Capability led operational budget study on 3D positioning that was awarded during 2010, with a kick-off in early 2011. The CapTech is also continuing investigating the possibilities of future collaborative projects in this area during 2011.

From mid-2010 a new moderator became responsible for CapTech coinciding with the organisation of the second meeting. This meeting also allowed the opportunity to include a joint session with GEM2 to discuss common interests, namely on identified capability needs of precision and differentiated effects. Within the area of precision engagement the two CapTechs have a shared interest on missile guidance and guided munitions. On this topic a joint study was awarded during the year focusing on precision guided ammunition, with a kick-off in early 2011. The study is led by EDA's Industry and Market Directorate in the framework of the Key Industrial Capabilities project "Ammunition".

During 2011 the CapTech is pursuing the signatures of the two first projects within the group.

ESM1 - Naval Systems & their Environment

The year 2010 marked a step change in the level of European cooperative R&T investment for CapTech ESM1 "Naval Systems and their Environment". The portfolio of ESM1 increased from a mere 3 projects of about 7 M€ in 2009 to 18 projects of more than 60 M€ in 2010. The significant increase is attributed to the work made during the past two years on the European Defence Research and Technology Strategy priority of Unmanned Maritime Systems. The work resulted in the Programme Arrangement on "European Unmanned Maritime Systems for MCM and other naval applications" (UMS) which was signed by Ministers of Defence in December 2010 (see section on UMS). Significant ESM1 work was conducted towards the building of the technical content of UMS with more than 15 Ad-hoc Working Groups of experts established. In addition, the ESM1 network efforts were directed towards establishing a new form of international collaboration for which UMS was a test case.

In support of the UMS technical content definition the ESM1 completed in 2010 two studies. The first was an overarching study on European Maritime Unmanned Surface Vehicles and the second on Energy Supply for Unmanned Underwater Vehicles. Other R&T activities included ad-hoc work on Radar Cross Section tools, Naval Propeller Noise Prediction, Fuel Cells for unmanned underwater vehicles, Underwater explosions, Maritime Surveillance, Naval Asymmetric Threats (with emphasis on survivability) and Hydrodynamic Optimisation of warships for improved efficiency. The activities aim at launching related collaborative R&T projects in 2011 and 2012.

ESM1 also progressed on its work on the Strategic Research Agenda for the Naval Systems domain which will be used to identify new long term priorities. A study is to be contracted early in 2011 in order to examine all possible areas of interest. The study is expected to provide a clear vision on where R&T investment should be channelled while providing adequate justifications and linking the defence R&T efforts and investment to defence end-user needs and civil activities. A strong consortium has been selected to perform the study. The consortium is led by DCNS (FR) and also includes NAVANTIA (ES), FINCANTIERI (IT), BLOHM + VOSS Naval (DE), DAMEN (NL) and CESA (The Community of European Shipyards' Association). The results of the study are expected to be available by September 2011.

ESM2 - Aerial Systems & their Environment

During the past year the nine nations attending the ESM2 CapTech meetings continued the preparation of cooperative projects, in close collaboration with industry, which takes part to the CapTech meetings and meets in dedicated workshops outside the three meetings that take place annually.

So far 30 projects have been considered, but to give more visibility and to secure the necessary funding for these projects, it was decided to include the review of these projects at the agenda of the R&T directors meeting. Three projects have then been selected: Integrated Simulation of Non Linear Aero-Structural Phenomena arising on Combat Aircraft in Transonic Flight, Electromagnetic Vulnerability Tool for Military Air Vehicle, and ETAP TDP I.1. This project was initiated within the ETAP framework (European Technology Acquisition Programme), aiming at developing manufacturing processes for Low Observable structures.

Other projects have been recently added, like flapping wings UAVs, HECTOR demonstration and halon gases replacement.

In order to define a priority and a roadmap for the ESM2 work, and in line with EDA R&T policy, CapTech members decided to set up a Strategic Research Agenda (SRA), to be finalized by mid-2012.

Three major studies to highlight.

The **SMUVO** study, originated in GEM4 was executed and successfully completed in 2010. It is more detailed in a chapter below.

HECTOR, a cooperative project for defining innovative predictive maintenance tools for helicopters, is part of the ICET JIP and has successfully accomplished two milestones, providing a list of potential sensors and selecting the element for the simulation.

Finally, the "**In-Theater Mobility Capability"** study, originated in the Capabilities Directorate, was ended in 2010, providing pMS with an optimisation tool for the deployment of assets and troops within a terrain of operations. The conclusions of the study, now available, are quite relevant. Furthermore, the Tool delivered is very user friendly and it was decided to organise two training sessions for pMS users in 2011.

Due to the transversal nature of aerospace technologies, ESM2 CapTech is fully integrated with all EDA directorates through the projects, FAS4Europe Study from I&M directorate, UAS, FTH, MIDCAS, and the Military Airworthiness Authorities (MAWA) forum from Armament directorate.

ESM3 - Systems of Systems, Space, Simulation & Experiment

2010 was a year of transition which ends by the engagement in 2011 of a new moderator. A new perimeter of the ESM 03 has been defined for 2011, all included in a draft of actions in Systems of systems (SoS) area. It includes Systems engineering process, exchange of best practices in SoS projects through organization of annual forum, and delineation of tools and methods in and for a battlelab environment.

ESM4 - Human Factor & CBR Protection

ESM4 addresses both Human Factors and CBR protection. These domains require mainly different experts but the CapTech found its way to organize the meetings most efficiently. The CapTech ESM4 network is growing. The CapTech highlights in 2010 are the preparation of the Strategic Research Agenda (SRA) for the Human Factors part of the CapTech and the preparation of the technological content for the Joint Investment Programme on CBRN protection (JIP CBRN) within the European Framework Cooperation (EFC) for the CBR part of the CapTech. For 2011 these will also be the main topics for the CapTech ESM 4.

The CapTech ESM4 "Human Factors and CBR protection" held three well attended formal CapTech meetings in February, June and September. Under its umbrella a successful seminar was organized on the Impact of demographic change among European population on recruitment to and retention in the Armed forces. Further a workshop was held in November dedicated to the SRA preparation.

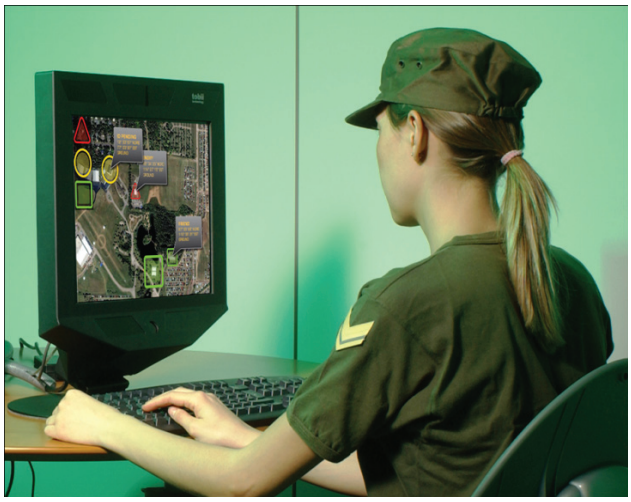
Human Factors (HF)

Besides the mentioned SRA workshop in which the CapTech defined its focus area's for the HF research the other important milestones for the HF part were the signature of the PA and the contract for the project "Fatigue and Overload Detection and Advising Interface - Phase 1 Methodology Identification (FODAI), and the finalization of the study "Friendly Fire Incidents".

The seminar on Demographic Change resulted in an update of the already existing outline description for a project dealing with the analysis and exchange of information regarding the impact of demographic change on recruitment in European Armed forces.

Also medical aspects are going to be discussed in 2011 in CapTech ESM4.

In 2011, the SRA will be developed with an outsourced study. The results are expected end of 2011.



CBR protection

The CapTech advised in 2010 the Management Committee of the JIP CBRN on the technical content of this programme. The programme will include detection & identification, medical countermeasures, decontamination, modelling & simulation, individual and collective protection and integration/CIS issues.

In the CapTech preparation are done for some project proposals on modeling of C-dispersion in urban environments (MODITIC), CB detection (SENTINEL) and test & evaluation and standardization of CB detection methods (T&E BioDIM) and development of Mucosal Anthrax Vaccine. These projects are candidates for 2011.

Work continued on the running project "Establishment and management of a common Database of B agents". A follow on has been discussed for 2011 under the umbrella of the JIP CBRN.

In 2011 the CapTech will be involved in advice regarding the technological description of the Call for Proposals for the JIP CBRN.

2. R&T Projects

Category B projects

The core activity of the EDA R&T Directorate is the generation of R&T projects, funded and managed by different configuration of contributing Members (cM) gathered around some original ideas discussed and incubated at CapTech level.

R&T projects may be of different nature, some of them consisting of simple Information EXchange (IEX) - supported by a Technical or Project Arrangement (TA or PA) without the support of any contract – while some others involve the issuing of contracts to industry for the execution of work plans. Such projects rely on governmental commitment - both financial and in-kind – of cMs, and in some cases involve additional contribution coming from industry. EDA can be appointed as contracting authority or – alternatively - each cM will place a national contract on its own national contractors.

TA/PA signed in 2010

In 2010, participating Member States signed 12 TAs and PAs for R&T projects – one of which covers the arrangement for the programme UMS worth more than 40 M€ – for a total value of approximately 108 M€ (including VAT and industrial co-funding), leading to the placement of 7 contracts by the EDA in 2010. Two projects are implemented through national contracts (FFC and PoMM), one follows a mixed EDA-national contracting scheme (FP-NEM), and UMS represents a framework for the issuing of 11 different contracts. Table 2 lists the projects along with their cM, significant dates and figures. More details can be found on the EDA website.

Projects completed in 2010

In 2010, 5 R&T projects were completed: they are listed in Table 1 For each completed project, an executive summary is published on the EDA website.

Candidate Projects for 2011

The portfolio for 2011 is constituted by 29 candidate projects, involving 14 EDA pMS and Norway: Belgium, Czech Republic, Finland, France, Germany, Greece, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden, and United Kingdom. The total value of the portfolio is about 94 M€.

The complete list of candidate projects updated at 21/3/2011 is reported in Table 3 and 4.

The situation is the following one:

- 6 candidate projects are awaiting their OD to be finalised;
- 4 candidate projects are awaiting all cMs green lights prior to be submitted to EDA SB for approval;
- One candidate project is under silence procedure;
- 8 candidate projects approved by EDA SB are waiting for the negotiation/staffing to be launched;
- 9 PAs/TAs are currently being negotiated or staffed at national level;
- One PA/TA was signed and the contract is being prepared.

Portfolio of R&T contracts

Figure 1 juxtaposes figures for the value of R&T projects completed and those whose contracts were placed by the EDA in 2010, and the value of the portfolio for the candidate projects. Please note that the figures differ from the table related to PAs and TAs, because not all EDA projects are implemented through EDA contracts, and because contracts are usually signed a few months after the signature of the PA/TA.

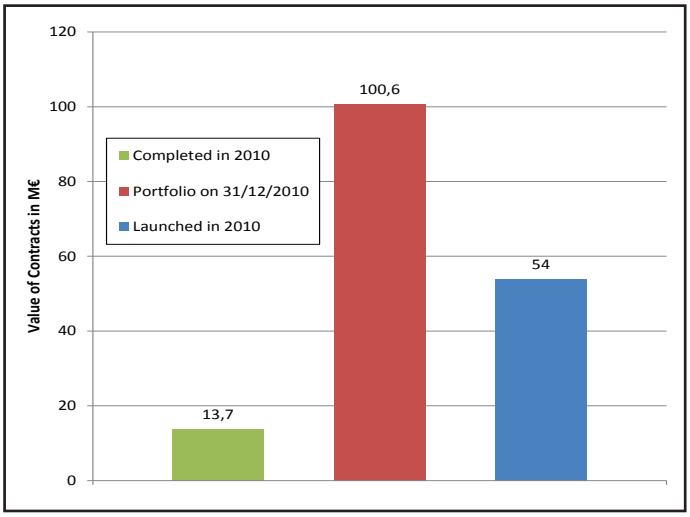


Figure 1 – Flux of EDA R&T contracts in 2010

Acronym	CapTech	Title	cM	Last invoice date	Project value (M€) incl. VAT
COMARMS	IAP2	EW Common Modular Architecture for Mission Simulation	SE, ES	10/3/2010	0.3
ETAP	ESM2	TDP 1.4c	FR, IT, ES	25/05/2010	7.1
NMRS	GEM3	Networked Multi-Robot Systems	IT, BE, DE, ES	25/08/2010	4.7
UGTV	GEM3	Unmanned Ground Tactical Vehicle	IT, FR, GR, DE, FR, PL, PT	15/09/2010	1.2
NEMESIS	IAP2	Naval Environment Modelling & Electro Magnetic Signature of Surface Targets for Improved Simulations	FR, NL	27/09/2010	0.4
				Total	13.7

Table 1 – R&T projects completed in 2010

Acronym/ CapTech	Title	cM Leader	TA/PA signature date	Contract signature date	pprox. Value (M€)
FODAI ESM4	Fatigue and Overload Detection & Advising Interface	IT - DE	20/08/2010	7/12/2010	0.3
MIMiCRA GEM1	Metamaterial Antennas	UK - FR	26/03/2010	6/11/2010	1.7
CORASMA IAP4	Cognitive Radio for dynamic Spectrum Management	FR - BE, DE, IT, PL, PT, SE	10/05/2010	2/10/2010	15
FP-NEM GEM2	Formulation & Production of New Energetic Materials	SE - CZ, DE, FR, IT, NO, PT	26/08/2010	Mixed	4.5
FFC GEM2	Future Flare Composition	NL - UK, DE, FI	21/12/2010	National	1.2
SUBMOTION 2 ESM1	Submarine coupled motions including boundary effects	NO - IT	18/05/2010	6/11/2010	2.7
FARADAYS IAP2	Frequency Allocation for Radars in the coming Years	FR - DE, IT, SE	27/07/2010	0/11/2010	6.2
PoMM ESM1	Protection of marine mammals against active sonar emissions	DE - NO, NL, IT	27/07/2010	National	1.9
HaPS ESM1	Underwater systems for harbour and base protection	SE - DE, IT, NO	25/06/2010	1/10/2010	4.6
RACUN ESM1	Robust acoustic comm. in underwater networks	DE - NO, IT, SE, NL	10/05/2010	4/08/2010	6.4
SoC Platform IAP2	SoC Platform	FR - DE, IT, NO	21/12/2010	Not Signed yet	23
UMS ESM1	Unmanned Maritime Systems	FR - BE, FI, DE, IT, NO, NL, PL, PT, ES, SE	22/12/2010	Not Signed yet	40.1
				Total	**107.6**

Table 2 – R&T projects for which the arrangement was signed in 2010

Acronym/ CapTech	Title	cM Leader	Approx. Value M€	Latest Status
RFBIO IAP2	Biological Effects of Radiofrequency Electromagnetic Fields	NL - SE, UK, IT, FR, DE	N/A	Draft OD
IHEGL GEM2	Insensitive High Explosives for Gun Launches	UK	2	Draft OD
PMH GEM2	Pyrotechnic Munitions Hazard	UK - FI, FR, NL	1,2	Draft OD
UGTV 2 GEM3	Unmanned Ground Tactical Vehicle phase 2	IT - PT, EL	10	Back to CapTech
EMHP GEM2	Energetic Materials with Higher Performance	SE - CZ, IT, NL, NO, DE	5	Back to CapTech
NM-RS 2 GEM3	Networked Multi-Robot Systems phase 2	DE - ES, BE	4,9	Back to CapTech
MLM GEM2	Munition Life Management	NL - DE, BE, SE	3,5	Green lights to be confirmed
IDCRR ESM4	Impact of Demographic Changes on Recruitment and Retention	BE - NL, SE, NO	0,4	Waiting for all green lights
RCS VALID ESM1	RCS simulation and measurement comparison study	FI - NO, SE, DE	0,8	Waiting for all green lights
MODITIC ESM4	Modelling the Dispersion of Toxic Indus. Chemicals in Urban Environments	NO - SE, FR, IT	2,5	Waiting for all green lights
MISSION IAP3	Mid Infrared Semiconductor Laser Modules for Defence Applications	DE, IT, FR	5,5	Under Silence Procedure
NE-AFV IAP4	Network-Enabled Armoured Fighting Vehicle	FR - FI, DE, EL, PT, SE	1,1	EDA SB approval (no PA yet)
IED PROTECTION GEM1	Protection of tracked and wheeled vehicles against IED roadside attacks	SK - CZ, IT, NL	5	EDA SB approval (no PA yet)
MAV ESM4	Development of a Mucosal Anthrax Vaccine	PT - CZ	1	EDA SB approval (no PA)
2B-PROT GEM1	High-tech materials for ballistic impact and blast-wave protection	PT - BE, NL, SK	1	EDA SB approval (no PA yet)
SOCUMOD Ph2 ESM4	Social & cultural modelling of FHQS & the operational environment (phase 2)	SE - FR	3	EDA SB approval (no PA yet)
ECOMOS IAP3	European Computer Model for Optronic System Performance Prediction	DE - IT, NL, SE, FR	1,2	EDA SB approval (no PA yet)
ADM-H GEM4	Autonomous decison-making based coord. techniques for Autonomous Vehicles	IT - FR, NL	5	EDA SB approval (no PA yet)

Table 3 – R&T candidate projects not yet approved by SB or whose PA/TA is being prepared.

Acronym/ CapTech	Title	cM Leader	Approx. Value M€	Latest Status
TDP I.1 ESM2	Low observable structures manufacturing	FR - IT, SE	6	EDA SB approval
CLARA IAP4	Cross Layer Quality of Service APIs for Reactive and Adaptive networks and Applications	NL - FR, IT	6	PA/TA under negotiation
THIMS IAP1	Technology for HIgh speed Mixed Signal circuits	FR - NL, DE	6,1	PA/TA under negotiation
RSEM GEM2	The Reduced Sensitivity Energetic Materials for the Higher Performance of the Inertial Confinement	PT - DE, IT	3	TA/PA sent for staffing
MIRACLE 2 ESM3	Micro Satellite Clusters (2)	NO - BE, DE	4,8	TA/PA sent for staffing
SENTINEL ESM4	Chemical and Biological Single Molecule Detection Roaming Robot	PT - DE, IT	1,5	TA/PA sent for staffing
MIDNET IAP4	Military Disruption Tolerant Networks	DE - FI, FR, NL, PL, PT, SE	7,2	TA/PA sent for staffing
AMBASSADOR CD IAP2	Advanced Model-Based Approach to SMRF Specification, Analysis, Development and Obsolescence Reduction - Concept Definition	NL - SE, UK, CZ, DE, ES, FR	0,7	TA/PA sent for staffing
DAVAC IAP2	DeformAble and Vibrating Antenna Compensation	FR - NL	4,2	TA/PA sent for staffing
DMCMS ESM3	Distributed, Multinational, Collective Mission Simulation (Training Programme Definition Phase)	DE - NL	0,3	TA/PA sent for staffing
EKSPLORE GEM4	Exploiting Knowledge in Sensor Processing for tracking Low-level Objects in Realistic Environments	SE - NL	2,4	TA/PA signed

Table 4 – R&T candidate projects currently being negotiated, under staffing, or signed in 2011

3. R&T Employees Gallery

R&T Director

Christian BREANT
02 504 28 80

PhD in Laser Physics and Major General from French MoD, I was previously R&T Director for Defence and Security of the DGA in Paris. Initially in charge of R&T projects in laser and optronics, I later moved to industrial affairs and cooperation. In 2000, I was appointed Director of the Defence Analysis Centre (CAD) in charge of operational analysis and simulation for preparation of the future defence systems.

Directorate Assistant

Isabelle ANGOT
02 504 28 81

With a legal background, I have now acquired more than 10 years of experience in the European Institutions: at the European Commission as Human Resource and Financial Assistant and at the European Parliament as MEP Assistant. I joined EDA in 2010. I am a dynamic and enthusiastic person.

Directorate Assistant

Nadia DEDRYVER
02 504 28 82

With a Public Relations background, I've been working as a secretary for 10 years in different EU bodies. I had the chance to work in various domains such as Press & Communication, Maritime Safety and Public Affairs. I joined EDA in 2006 where I am responsible of the running of the secretariat including finance management.

R&T Programme Manager

Ulrich KAROCK

02 504 28 95

Mechanical Engineer (Production, Quality & Project Management), Deputy HoU Quality Management in Naval Shipbuilding (Bremer Vulkan, DE), Assistant to the Dean of the engineering faculty (University of Hanover, DE), Tutor & research associate (QM Institute, Hanover, DE), Project Officer at EC DG RTD (Aero, Space, Transport & Security); Reserve officer (DE NAVY) at Joint Ops HQ

Project Manager

Alessandro CARROTTA

02 504 28 97

Industrial Engineer with a PhD in Operations Research and Artificial Intelligence sponsored by IBM ILOG (FR). Previously business analyst for McKinsey Italy, project officer at the European Commission (DG INFSO – ICT for Transport) and project manager in the field of Intelligent Transport Systems.

R&T Assistant Director

Information Acquisition and Processing - IAP

IAP4

CIS & Networks

Michael SIEBER
02 504 28 87

Master in Electrical Engineering; various technical responsibilities in the DE Armed Forces - Armaments Organization (munitions, vehicles, robotics, communications, M&S, RF / EO sensors, reconnaissance technology, electronic warfare,); MoD Deputy Director International Armaments Affairs.

R&T Assistant Director

Guidance Energy and Materials GEM

GEM1

Materials & Structures

Utimia MADALENO
02 504 28 86

With a degree in Materials Engineering had a scientific post-graduate in metal-matrix composites at the Tokyo IT. Previously appointed (2005) by J .Solana as WEAO-RC General-Director had also several technical & management responsibilities as EMPORDEF CEO Adviser for Defence & Security R&D, Head of Bureau d'études and aeronautical production.

R&T Assistant Director

Environment Systems and Modelling - ESM

ESM4

Human Factors CBR Protection

Gerlof De WILDE
02 504 28 88

Master of Science in Physics (foundations of quantum measurement). Previously Policy Advisor on (international) R&D within the Defence Research and Development Department of the Ministry of Defence of the Netherlands and researcher at the Royal Netherlands Meteorological Institute.

IAP1

Components

Wolfgang SCHEIDLER

02 504 28 94

Diploma in Physics (Solid State & Laser Physics), State Exam for higher civil service in DE; various technical and project management responsibilities in the German Procurement Agency, BWB/ Technical Center for IT & Electronics, WTD 81 (communications, command & control, homing & reconnaissance, electronic/ optronic components & material, electronic warfare). Previously head of section electronic warfare.

GEM2

Energetic, Missiles & Munitions

Dinesh CHANDRAMOULI REMPLING

02 504 28 89

I hold a Master of Science degree in Electrical Engineering from KTH Royal Institute of Technology in Sweden. Prior to joining the EDA in 2008, I worked for the Swedish Defence Materiel Administration (FMV) where I was co-responsible for the marine electrical systems area for all surface vessels, submersibles and amphibious. In my current capacity I am in addition to being responsible for GEM 2 also the R&T focal point for C-IED and Environmental Issues.

ESM1

Naval Systems and their Environment

Solon MIAS

02 504 28 98

Electrical and Information Sciences Engineer with a MEng and PhD in photonics from Cambridge sponsored by DERA/QinetiQ (UK). Work expertise in optical modulation for displays, telecommunications and human vision with several academic publications and an innovation patent. Reserve Lieutenant for telecommunications in the Cypriot army.

IAP2

RF Sensors System & Signal Processing

Attila SIMON

02 504 28 93

Telecommunications/AirC2 Engineer and Air Force/ Air Defence Operational Officer. Expertise in operation and maintenance of air defence radar and C2 systems. 15 years experience in military R&T project management. Previously Scientific Deputy of Director General in the Hungarian MoD R&T Agency.

GEM3

Ground Systems and their Environment

Antoine VINCENT

02 504 28 92

General Engineer's degree and Master of Science in Aeronautics and Astronautics. Previously engine manager at the French Defence Procurement Agency (DGA), involved in most military aeronautical engine programmes (powerplants for the Tiger, NH90, Rafale, cruise missiles…).

ESM2

Aerial Systems and their Environment

Jérôme GARCIA

02 504 28 90

As an aerospace engineer, I had the opportunity to participate and to manage several military aeronautical projects, both in the French Defence procurement agency (DGA) and in industry. My interest for international relations lead me to head the desk for armaments relations with Russia and the CIS, then for the development of European cooperation in aerospace projects, a task that I am now continuing within EDA.

IAP3

Optical Sensors System & Signal Processing

Jari HARTIKAINEN

02 504 28 91

PhD and docent in physics from University of Helsinki. Previously head of Weapons Technology Division at the Defence Forces Technical Research Institute (PVTT) where the main research areas were electro-optics, signature management, ballistic protections and operational analysis. Before PVTT I worked at the Naval Research Institute mostly in underwater warfare.

GEM4

Guidance & Control

Per Jonas NYGARDS

02 504 28 99

PhD and Docent in robotics from Linkoping University. Previously senior scientist at FOI, the Swedish Defence Research Agency, and part time assistant professor at Linkoping University (LiU). At FOI & LiU I have been working mainly on multi-sensor-fusion and sensor based control issues in missile seekers, unmanned air vehicles, security systems and robotics/UGV research.

ESM3

Systems of Systems, Space, Simulation & Exp.

Jean MARCHAL

02 504 28 34

Armament engineer, I specialized in land systems and I have managed for the DGA, evaluations and expertises on various systems and areas (all types of vehicles, robotics, on board information systems, reliability, human factor, guns...). Then, I belong to the pioneers of Systems of Systems culture and its associated tool: the French Battlelab (LTO). I had published in 2009 the first edition of the French R&T strategic plan for defense and security.

Generic R&T email: randt@eda.europa.eu. All email addresses written firstname.lastname@eda.europa.eu

4. Studies from the Operational Budget

These studies support the activity of the CapTechs, and are prepared within the CapTech in strong coordination with the other EDA Directorates. They are ideally suited for technology watch, preparation of R&T projects (pump prime), general architecture studies, and surveys of the 'state of the art'.

In 2010, 9 studies were completed under the lead of the R&T directorate (see Table 5). Below two examples of the studies are described.

During 2010, 7 studies were contracted (see Table 6), three of them in support of CapTechs strategic research agendas (SRA).

For 2011, a list of 11 studies are planned, they are listed in Table 7

The SMUVO study "Reference Scenarios"

Unmanned vehicles have demonstrated their operational potential for the classical DDD (Dull, Dirty and Dangerous) missions. Currently, they are mostly remotely controlled and steered, rather uninhabited than unmanned. However, the natural trend is to increase their decisional autonomy level in order to reduce the human resources necessary for unmanned vehicle operations. Such autonomy will be related to both self-operation and to multiple vehicle operations when the operational potential can be increased by the coordination of homogenous or heterogeneous teams of vehicles. The European academia has studied many technologies for operation of multiple-vehicles. But, the evaluation of these technologies requires realistic evaluation scenarios. Thus, a need of scenarios and detailed vignettes for Research & Technology (R&T) studies into such operations involving multiple unmanned vehicles could be foreseen.

To avoid unnecessary duplication of work on such scenarios and to foster focused R&T projects, paving the way toward the solution of military needs, a study "Scenarios for Multiple Unmanned Vehicle Operations (SMUVO)" was launched and awarded to BMT Defence services, supported by Newman & Spurr Consultancy Ltd.

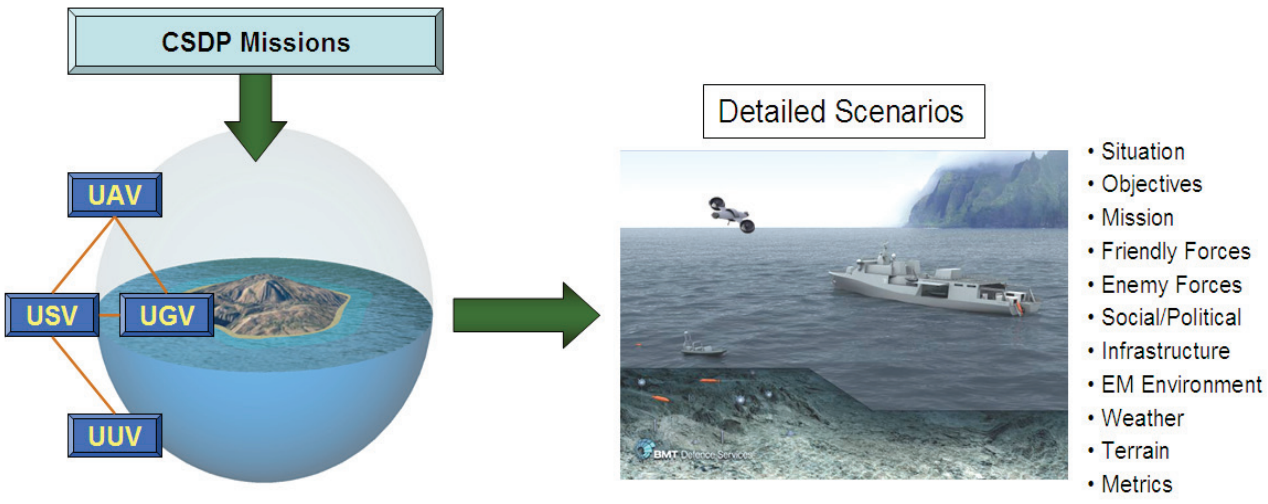
The study puts a comprehensive set of reference scenarios at the EDA pMS disposal to use in the development of unmanned systems. These scenarios can easily be listed or searched thanks to a dedicated tool developed by BMT. This set of scenarios provides for development and evaluation of technologies for operations of unmanned vehicles against realistic evaluation scenarios agreed at a European level. The scenarios are collected in a web-based tool allowing better ease of use than a paper report only. The consortia recommend that the pMS make use of the scenarios and use the possibility to update the scenario collection within the tool.

The study also provides a prioritized list of missions of multiple unmanned vehicle operations in guidance of R&T investment planning by the EDA and EDA pMS.

In support of R&T investment planning the study also identifies key technologies that would need to be developed to allow autonomous or semi-autonomous teams of unmanned vehicles to support CSDP missions.

The ELAV study "Electric Armour"

For several years, some European Member States have been pursuing independently technological development activities in Electric Armour for armoured vehicles (ELAV). Electric Armour is a protection technology complementary to the classical armoured plates fitted on vehicles. Electric Armour is typically implemented through two conductive plates separated by empty space, creating a high-power capacitor. An external threat which penetrates the plates closes the circuit to discharge the capacitor, dumping a great deal of energy into the penetrator and reducing significantly its lethality. This technology offers interesting perspectives in enhancing the protection of the platform. This protection level can be traded for weight to increase the aero-transportability of the platform. This technology



OB Studies concluded in 2010				
Acronym	**CapTech**	**Title**	**k€**	**Contractor**
RADVS	GEM4	Autonomous Navigator Based on Innovative Radar Altimeter	400	MBDA Italia S.P.A.
EMSR	ESM1	Electro-Magnetic Signature Reduction	100	BAe Systems (UK)
TERIFIEC	GEM2	Terahertz for the Identification of Explosive Chemicals	150	QinetiQ (UK)
FFI	ESM4	Cognitive Aspects of Friendly Fire	95	TNO (NL)
ESUUV	ESM1	Energy supply for Unmanned Underwater Vehicule	90	ECA (FR)
MUSV	ESM1	Maritime Unmanned Surface Vehicules	92	BMT Defence (UK)
ELAV	GEM3	Electric Armour for Armoured Vehicule	171	BMT Defence (UK)
ETICE	GEM3	Essential Technical & Industrial Capabilities Expiry - Mapping the 2025 Firepower Technology Supply Chain	400	ISL (French-German Research Institute)
SMUVO	GEM4	Reference Scenarios for Multiple Unmanned Vehicle Operations	177	BMT Defence (UK)
		Total	**1675**	

Table 5 - List of EDA-funded R&T studies concluded in 2010

OB Studies launched in 2010				
Acronym	**CapTech**	**Title**	**k€**	**Contractor**
SIED	GEM2	Signature of IED	250	TNO (NL)
ASAR	IAP2	Adaptive, self learning & anticipative radar	300	ISDEFE (ES)
EDTID	IAP1	Addressing key EU Defence Techn. & Industrial Dependencies	397	FOI (SE)
SRA IAP3	IAP3	SRA “Optical sensors system & Signal processing”	150	TNO (NL)
SRA IAP4	IAP4	SRA “CIS & Networks” Technological Roadmaps	150	GMV (ES)
SRA ESM1	ESM1	SRA “Naval systems” Technological Roadmaps	150	DCNS (FR)
UAS-GA	ESM3	UAS Gap Analysis	400	DCNS
		Total	**1797**	

Table 6 - List of EDA-funded R&T studies contracted in 2010

OB Studies planned for 2011	
CapTech	**Title**
GEM 2	IED Forensics
GEM 2	Dependencies on Fuel
IAP 2	Radar Techno for inside building awareness
IAP 3	NEC technical challenges
GEM 3	Unmanned Ground Sensor Networks for Large Area Surveillance
ESM 1	Underwater Explosions
ESM 1 GEM 1	Innovative structural materials for naval hulls
GEM 1	Innovative armoured protection for land systems.
IAP 3	Electro-optic sensors in urban operations
ESM 4	SRA Human factors

Table 7 - EDA R&T studies planned for 2011

has already been demonstrated, but many efforts are still needed before introduction on platforms in service.

In March 2009, the Swedish Defence Research Agency FOI and the French-German Research Institute ISL hosted a European Workshop on Electric Armour. Electric Armour is indeed one of the fields of interest of the "European Pulsed Power Laboratory" launched by the two research centres, in collaboration with other European research entities. In December 2009, the EDA kicked-off the study "Electric Armour for Armoured Vehicles" (ELAV), hosted by the CapTech GEM3 "Ground Systems & their Environment".

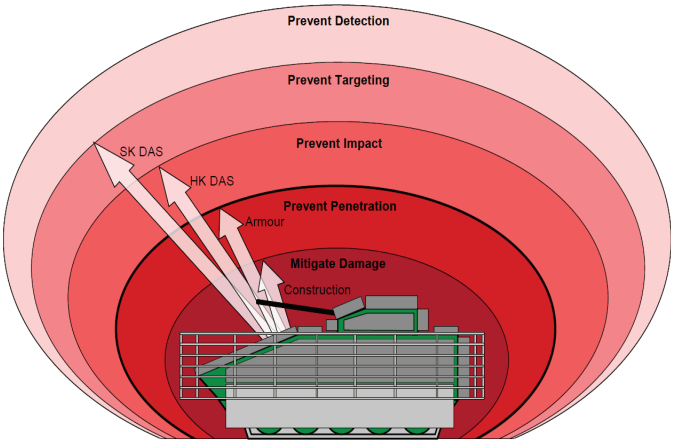
The contractor BMT Defence services outlined two test cases in the study ELAV: one tracked and one wheeled medium weight-armoured vehicle fitted with an Electric Armour system. BMT also carried out a preliminary safety analysis, and proposed an overall architecture for the implementation of the system. In its final report handed over in June 2010, the contractor recommended EDA participating Member States to target collaborative research in 4 technological areas related to high power and capacitors.

It concluded that Electric Armour has the potential to offer a number of advantages compared to classical protection system:

• Reduced total system weight,

• Robustness to ballistic and kinetic energy threats,

• Multiple hits capability. Electric Armour will not by itself protect an armoured vehicle, but will have to be combined with Base Armour, Appliqué Armour and Defence Aid Suits to cover the whole spectrum of threats.



5. Joint Investment Programmes (JIP)

JIP FP - Force Protection

The Joint Investment Program (JIP) on Force Protection was ground breaking when it launched 2007 as the first EDA JIP. With a budget of 55M€ and the cooperation of 20 European governments (Austria, Belgium, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden) four calls for proposals were performed under the oversight by a managing committee representing the contributors.

The topics in the four calls for proposals were:

- Collective survivability – 5 projects contracted.

- Tactical wireless communication and individual protection technology forecasting – 3 projects contracted.

- Data analysis and data fusion – 5 projects contracted.

- Mission planning/training in an asymmetric environment and secured tactical wireless communications – 5 projects contracted.

With the final projects of the fourth call contracted during 2009 the program fully entered the implementation phase in 2010 with 18 running projects. The implementation phase also saw the finish of the first two projects of the program during 2010. The finished projects AHEAD and MUSAS are presented below. During 2011 more projects will finish putting a gradually increased focus on possible follow on activities.

AHEAD – Technological forecast for soldier systems

The project AHEAD ("Advanced Helmet and Devices for Individual Protection") is the first completed contract under the Joint Investment Programme on Force Protection. Its objective is to forecast the evolution of existing or new technologies which can improve the protection of the individual soldier by 2020, with a focus on sensors.

Technological review and forecast

The consortium led Selex Galileo carried out a comprehensive review of the state of the art of the existing soldier systems programmes, covering sensors and actuators (Electro-optics, acoustics, CBRNE, health…) as well as transversal technologies (Radio/wireless, Identification Friend or Foe, Data Fusion, Data Presentation). For more convenience, all the information was entered in a detailed database. To support this effort, the consortium organized in April 2010 at the Military University of Technology in Warsaw on workshop on "Enabling Technologies for Dismounted Soldier Protection". This workshop led especially to the development of roadmaps for a subset of chosen technologies including radiological, explosive, chemical, electro-optical, biological and health sensors.

Operational view

The consortium defined future operational scenarios to assess the benefits of equipment evolution. Combined with interviews of military end-users and the review of current soldier modernization programmes, these scenarios were used to define future operational capabilities by 2020. From the five operational capabilities identified, the consortium derived functional requirements and a system architecture, including detailed requirements for sensors.

Final validation

A significant part of AHEAD was devoted to measuring via simulation the capability benefits brought by this new equipment. The simulation was carried by the company IABG in Munich using the environment MUT/OSIRIS/FIT developed for the German MoD, and the framework NS-2 for simulating communication networks. The simulation revealed the importance of a wider field of view for sensors to enhance system capabilities. Finally, a hardware setup of the AHEAD architecture was assembled and tested at Galileo facilities in May 2010, in presence of Member States representatives. Data fusion and a simple human machine interface were implemented to illustrate the capabilities of the new equipment.

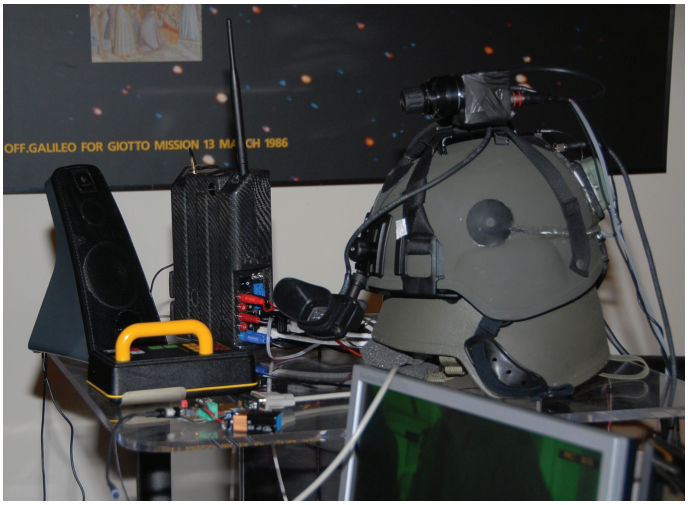


Figure 2 Hardware demonstration of AHEAD equipment at Selex Galileo premises in May 2010.

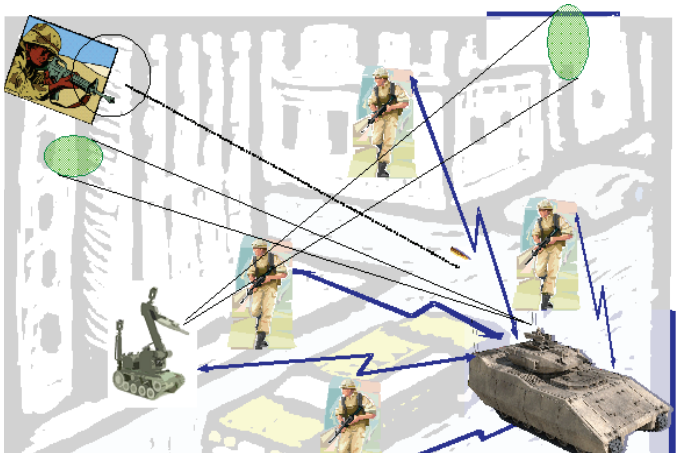
Conclusion

The executive summary of the project is available on EDA website. The full deliverables may be obtained via the national representatives members of the JIP-FP management committee.

Musas – Technologies for SNIPER Detection

Multi Sensor Anti Sniper System (MUSAS) is one of the two JIP-FP projects addressing sniper detection before and after the first shot. The project started in February 2008 and had a duration of 30 months. The total value of the project was 5.75 M€.

The MUSAS sensor technologies include passive electro-optical sensors, radars and acoustic sensors integrated in



one system and the sensor information is fused in order to improve the sensor performance. MUSAS deploys its subsystems on every element of a squad (patrolling vehicle, dismounted soldiers and a support unmanned ground vehicle, UGV). It considers also the deployment of fixed elements aimed to protect a stationary placement (e.g. a military base) and a quick-deployable configuration to defend a fixed area during a shorter period (e.g. an evacuation route). The MUSAS system is designed to be integrated into the Future Combat Soldier (FCS) and its Communications and Information System (CIS).

cM representatives witnessed a demonstration of the MUSAS in an urban environment in July 2010. In the tests the demonstrator met or exceeded the user requirements among others for angular coverage, sniper location both before and after the shot, the detection and false alarm probability for detection after the shot and the weight for fixed and UGV deployments. The tests also proved the benefits of sensor fusion as the fused results were clearly better than those of the best single sensor. The main items for future development work are the extension of the detection distance in particular in the "before the shot" case, the reduction of false alarm in "before the shot detection" and the reduction of weight of the MUSAS system in vehicle deployment.

JIP ICET - Innovative Concepts and Emerging Technologies

The JIP-ICET is EDA's second joint investment programme with 11 contributing members and a budget of 15.6 M€. Nine R&T projects and two technology studies were started under JIP-ICET in 2010. The projects were selected from the total of 65 proposals submitted under three calls for proposals. The experts of the contributing Members evaluated all proposals using four criteria: R&T innovation, management, value for money and cooperation. In all calls the ICET Management Committee followed the recommendations of the evaluators and selected the proposals that had received the highest scores. The European Commission was consulted during the evaluation phase in order to avoid duplication of work between the 7th Framework Programme and JIP-ICET.

The selected projects and studies are listed in the table below and their publishable abstracts are posted on the EDA website. They cover 8 specific R&T grouped under the following three clusters:

- Improved Autonomy;
- New Solutions for Materials and Structures;
- Data Capture and Exploitation

One of the JIP-CET objectives was to encourage SMEs, academic institutions and non-governmental labs to participate in European defence research cooperation. This has been clearly achieved as two thirds of consortium members in both calls belong to these groups as shown in the figure 3. The result is due to several factors: JIP-ICET deals with emerging technologies where academic institutions often have the best expertise, open competition made it easier for new players to participate in defence technology cooperation and the ICET rules explicitly require that at least one consortium members must be an academic institution, a SME or a non-governmental laboratory.

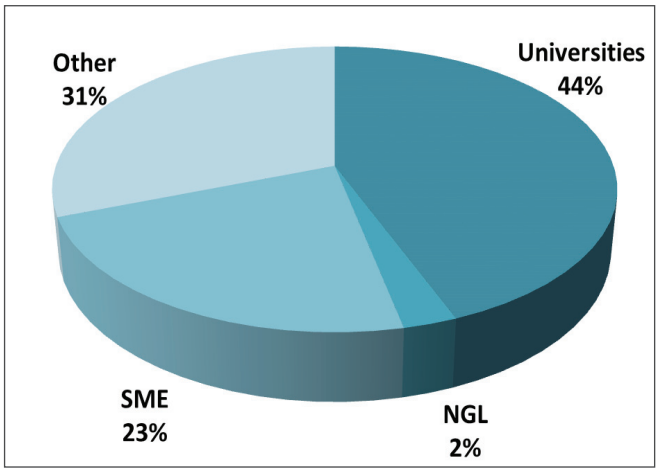


Figure 3 The members of successful ICET consortia according to the organisation type. NGL means non-governmental laboratories and other includes large companies and governmental laboratories.

In addition to the R&T projects, the ICET Management Committee decided to launch two technology studies addressing metamaterials in radar applications and nanomaterials integrated into textiles for protection applications. These two studies forecast relevant civilian technology development in 10 and 20 years and identify areas where defence specific R&T work is needed to fulfil future capability requirements.

The duration of ICET projects is two years so the last project will end by the end of 2012. The discussion on a possible follow-on programme was started in autumn 2010 based on a proposal by one cM and it will continue in 2011 after the completion of the work of the Disruptive Technologies Group of LoI6+1 countries (LoI+NL).

Acronym	Project name	Start date	Project value
HECTOR	Helicopter Fuselage Crack Monitoring and Processing through on-board Sensors Network	16/12/09	2,2 M€
SESAMO	Sensors for Structural Health Monitoring	2/02/10	1,6 M€
SARINA	SAR-based Augmented Integrity Navigation Architecture	19/02/10	2,3 M€
NICE	Nonlinear Innovative Control designs and Evaluations	18/03/10	2,3 M€
APIS	Array Passive ISAR adaptive processing	12/7/10	1,9 M€
NANOCAP	Novel NANOstructured optical Components for CRBN detection and high performAnce oPto-microwave links	12/7/10	1,9 M€
E-STAR	Explosive detection - Spectroscopy, Terahertz technology And Radar	6/10/10	2,0 M€
PATCH	Personal biological Aerosol Tester for exposure Control with High efficiency	14/10/10	1,4 M€
METALESA	Metamaterials for active electronically scanned arrays	25/11/10	1,3 M€
METAFORE	Forecasts in Metamaterials with Extreme Parameters for Disruptive Antennas, Radomes and Cloaking in Radar Applications	25/11/10	0,35 M€
SARAPE	Synthetic Aperture Radar for all weather penetrating UAV application	29/11/10	1,6 M€
NANOTEX	Forecast Study on Nanomaterials Integrated into Textiles for Protection Applications	13/12/10	0,3 M€

Table 8 - Contracted JIP-ICET projects and studies

UMS

The "European Unmanned Maritime Systems for Mine-Counter-Measures and other naval applications (UMS)" is the third EDA Category A programme. It represents the first major and concrete success of an ambitious technology programme directly connected to Maritime Mine Counter Measures (MMCM), one of the twelve EDA's Capability Development Plan urgent actions decided by Member States in July 2008. Through R&T, demonstrators and de-risking studies, the UMS is expected to prepare the next generation of technologies of the Category B Armament programme MMCM, currently in the preparation phase for delivering an initial Capacity by 2018. The UMS initiative is a direct output of the European Defence Research and Technology (EDRT) Strategy together with the newly created system-CapTech on "Naval Systems and their environment", as it addresses one of the twenty-two Research and Technology (R&T) priorities agreed by the governmental representatives of Member States. In addition it attempts to improve the current collaboration means by enabling coordination, reducing administrative burden and decreasing the idea-to-contract period associated to R&T project generation.

Ten EDA participating Member States (Belgium, Finland, France, Germany, Italy, Netherlands, Poland, Portugal, Spain and Sweden) and Norway are contributing to the four-year 53M€ programme which aims at improving Naval capabilities by improving the capabilities of Unmanned Maritime Systems through a system-of-systems approach while taking into account the notions of interoperability, modularity, inter-changeability of modules and standardisation. As mentioned above, UMS projects focus mainly on MCM (influence minesweeping; drifting mines detection; and buried mines detection and neutralisation) but also address other naval applications including Harbour Protection and Anti- Submarine Warfare. In addition, the programme includes projects with transversal impact, studying issues such as: underwater communications; improved autonomy; network enabled coordination; interfaces and standards; and even safety and regulations for unmanned maritime vehicles. A systems-integration group has also been established to coordinate the programme and examine future UMS R&T topics such as UMS launch-and-recovery, torpedo defence and energy supply for unmanned underwater vehicles.

The programme will allow the involvement of a wide range of entities including European navies, national laboratories, universities and industries. It will also increase opportunities for contributing Members to co-operate with each other and to exchange information and know-how. A considerable network of more than a hundred experts has already been established and is envisaged as the main EDA forum for addressing R&T for Unmanned Maritime Systems in the future. Several new UMS-projects are already in the pipeline including Systems-Launch-Recovery-Handling-Docking, Fuel Cells for Unmanned Underwater Vehicles, Computer aided detection and classification; and Collaborative Surface Ship Torpedo Defence. If discussions on future projects are successful, the UMS Programme will be expanded to include them under its umbrella.

JIP CBRN within EFC

The European Commission (EC), the European Defence Agency (EDA) and the European Space Agency (ESA) aim at maximising complementarity and synergy of civilian security, space and defence-related research activities. This synchronisation of Research & Technology (R&T) investment takes place in the context of the European Framework Cooperation (EFC). More concretely the EC, EDA, and ESA explore possible cooperation in the fields of chemical, biological, radiological and nuclear protection (CBRN), unmanned aerial systems and situation awareness capabilities, the latter covering sensors, cyber security and information management.

EDA has been mandated by its participating Member States to develop the cooperation modalities under the EFC in close consultation with EC and ESA. In support of such coordination the three organisations will provide each other relevant project information relating to the preparation of calls for proposals or invitations to tender, the evaluation of these proposals or tenders as well as the implementation of research activities. EC, EDA and ESA will equally take part in workshops and seminars throughout the life of the EFC where appropriate.

Protection against CBRN threats is the first mature topic within the EFC. The EDA contribution will take the form of a Joint Investment Programme (JIP-CBRN), with a centrally managed budget funded by all contributing Members (cM). The cooperation will encompass research activities identified under the security research theme of the Union's seventh research framework programme (FP7 SEC), the EDA JIP-CBRN and under relevant ESA programmes, following a harmonised timetable. The JIP-CBRN will be overseen by a management committee comprising one representative from each cM. This committee will be chaired by EDA and will also comprise non-voting representatives from the EC and ESA. In 2010 the Management Committee had two meetings in June and October.

CBRN Protection is an important dual use domain in which Member States are prepared to jointly invest at a European level. In view of emerging CBRN threats mid- to long-term, Member States see a need for enhanced technological development. End users require that the CBRN detection technologies must be high in performance and low in detection thresholds in a miniaturised, unmanned, self-movable and autonomous way that is much easier to handle. Stand-off detection of B and C threat agents is needed to have more time to react and protect. As a consequence, the scope of the JIP CBRN programme ranges from emerging technologies to CBRN protection as an operational capability. Therefore, the technical content has

to cover the aspects of prevention, protection, responding and recovering, leading towards a CBRN system with the potential to integrate and transform the expected results of the research program into future capabilities.

The JIP-CBRN will provide a broad framework to conduct cooperative research in the fields of basic and applied science, to carry technology development up to the level of demonstration projects.

In 2010 the preparation work has been done on the technological content and the rules governing the programme within the EFC.

In the coming months, the interested Member States will work together on the formal programme arrangement, aiming at its signature in the May 2011 Ministerial EDA Steering Board, in order to allow for the first call for proposals to be launched in July 2011, synchronised with the next FP7 SEC call.

6. Transversal issues

Dialogue with industry

The EDA maintains a structured dialogue with the European Industry through regular contacts with National Defence Industry Associations (NDIAs) and the AeroSpace and Defence Industries Association of Europe (ASD). The contacts enable the R&T Directorate to disseminate information on its current activities while at the same time allowing industry to provide its views.

The EDA R&T directorate contributed to the development of a document on "NDIA Best Practices" currently undertaken by the EDA I&M directorate with the aim of enhancing the European cooperation of NDIAs. The R&T directorate's contribution was based on concrete examples from its activities including the EDRT Strategy implementation, the work of the CapTechs, the various R&T Programmes and the outcomes of the 2009 "All-on-board" R&T Workshop.

Discussions with ASD addressed elements of the European Defence Research and Technology Strategy and in particular efforts to enhance the European Defence Technological and Industrial Base, improve technology push and advance means for enabling better R&T collaboration on a European basis. This included exchanges on the European Defence Research Centres, IPRs, financial regulations, the CapTech Strategic Research Agendas, the European Framework Cooperation, the CapTech Way-of-Working and most importantly the issue of European technology dependencies. On the last topic, ASD provided concrete material for further evaluation through a dedicated EDA study and the foreseen EDA conference on European Technology non-Dependence, advocating the need for a European solution to the issue. The issue of non-dependencies is expected to be a central point for discussions throughout 2011 and beyond.

Finally, ASD representatives provided regular updates to both EDA and national R&T points of contact on their view of CapTech performance based on the number of cooperative projects launched and the participation of industry. The overall conclusion was that the industrial performance in the CapTechs was very positive despite the difficult financial climate.

For the near future, the EDA R&T directorate will look for inputs from industry on the updating of the European Defence Research and Technology Strategy "Means". The "Means" are elements for improving the efficiency of delivering R&T results. In addition, inputs from industry will be sought for quality assessment of current R&T efforts.

ETAP: a collective work in EDA- CAP, I&M, R&T

The European Technology Acquisition Programme (ETAP) results was formed in 2001 by the 6 LoI nations (France, Germany, Italy, Spain, Sweden and united kingdom) joining their efforts in fostering the development of technologies for Future Combat Air Systems.

So far, the Programme has launched 15 Technology Development Programmes (TPDs) worth 118M€, having in view to develop the technologies needed for the Future Combat Air Systems (FCAS) post 2020. Coordination of these TDPs is done thanks to a study guiding the whole ETAP programme, the Global System Study (GSS), aimed to indicate the most cost-effective technologies to be developed in order to reach a given capability requirement.

With the view of simplifying the contractual process, ETAP Nations asked EDA to award on behalf of ETAP the TDP 1.4c (high bandwidth communications-data link). Following the success of this test-case, ETAP nations decided to consider EDA as the reference contracting agency for future TDPs. Thus, in 2011 EDA will work on the award of a new TDP transferred: "Low Observable Manufacturing".

Both organisations agreed upon the interest of coordinating their activities, in order to avoid duplication of work and mutually benefit from their respective work strands. As a consequence, more meetings are held together, and information is provided to ETAP about the development of CapTech ESM2 "Aerial Systems" and the Key Industrial Capabilities Project "Future Air Systems" which looks at the future size and shape of the Defence Aerospace Industrial Base.

EDRC Portal

The EDRT Strategy anchored on EDA headline goals and work strands is the guiding foundation for mobilising most cooperative measures. In implementing it, with the support of member states, one of the goals was to improve and facilitate the means of cooperation while providing a better knowledge

of the geographical distribution of European research capabilities.

The initiative promoted by Germany and France to create a reliable source for acquiring the best skills in defence research was a starting point for EDRC. It setup a common understanding to allow EDA to investigate ways to leverage awareness of the defence technology competences in Europe by designing a pilot tool to become a portal.

In 2009 the EDRC database was made operational to allow member states to evaluate its performance and invite research providers to start up populating with required information.

The year 2010 was used to promote EDRC and allow sufficient time to assess the receptivity and deficiencies of the tool whereas identifying possible improvements.

Poland has provided a short assessment report that supported the introduction of a number of modifications that will allow a more interactive use the EDRC database. Subscribers will receive alerts on new entries and notification of EDA or pMS calls for research activities. Moreover, it will allow the share of information or studies in different technology domains if wished by stakeholders.

All European research providers willing to participate in EDA research activities will have a privileged forum to promote own skills. In return they also benefit from immediate information on opportunities for cooperation and a panoply of choices for partnerships. The EDRC portal will be officially launched in 2011.

Bridging the Security Research

In the past years increased attention was given to the civil research programmes due to the full implementation of the Security Research Programme that started in 2007 as an integral part of the 7th Framework Programme.

Since then EDA is represented in the Security Advisory Group (independent expert group) and in the Security Programme Committee (with the member states). This role provides the visibility and the possibility to share and coordinate research topics that address similar civil-military technologies.

During 2008-2009 EDA, together with a significant number of stakeholders, had also the opportunity to contribute to the European Security Research and Innovation Agenda (ESRIF) that setup the medium and long-term security challenges. The report was published by DG-Enterprise by the end of 2009 and its recommendations have been used to plan future research.

Within this context, the exercise of shared brainstorming involve intra and extra-EDA dissemination and collection of ideas to try to assess and cover existing technological gaps while avoiding unnecessary duplication of efforts and contributing to consolidate the industrial technological base.

Although the exchange of information between EDA and the Commission (mainly with DG ENTR) cover several activity areas of shared interest, 2010 can be considered a turning point to create a common framework to align pooled research domains. The convergence of several factors among which the financial crisis and the adoption of the Lisbon Treaty guided MS to envisage the merging of civil-military strategies. The European Framework Cooperation (EFC) is the expression of a joint research effort between the Commission, the European Space Agency and EDA.

As a consequence, the Commission, ESA and EDA were requested to analyse best practices to allow the implementation of common work stands starting by covering CBRN, UAS and Situation Awareness (SA). More concretely, a taskforce was set in place to cover the legal and technical aspects among the three institutions.

The legal working group underlined the fact that differences in the membership and on ways to secure user rights may cause difficulties in the disclosure and use of information; therefore hinder the cooperation due to interruption of the flow of information among EC-ESA-EDA. Creative solutions and search for more soft mechanisms for contracting and funding are object of analysis in the course of 2011.

Throughout 2010 the EDA JIP on CBRN has been prepared and details can be found in this Report. Relevant calls (2010-2011) within the Security Programme have been aligned with EDA's envisaged topics in the JIP CBRN. To be noted that in the preparation of the 2012 Security Programme the Commission adopted an Orientation Paper that include the reference to coordination aspects with defence research and to EFC.

The UAS programme is under preparation and a Conference was jointly organised with the Commission. The topics to be addressed under SA have been partially identified and cross-referenced within EDA activities and with EC and ESA. For these two programmes more detailed work is planned for 2011-2012.

General Rules and Procedures and General Provisions

On the 10 June 2010 the EDA Steering Board in R&T formation approved the "General Rules and Procedures Applicable to Ad Hoc R&T Projects and Programmes of the EDA" and the associated "General Provisions Applicable to Ad Hoc R&T Projects and Programmes of the European Defence Agency". These set of rules will enter into force immediately and will help to improve cooperation in the field of Research and Technology, presenting to pMS and Industry new and more flexible intellectual property provisions suited for Governments and Industry needs alike.

7. Contributing to crisis management issues

Sustainable Energy Supply for Crisis Management

Forces deployed by EU Member States in the frame of EU-led Crisis Management Operations (CMOs) are today heavily dependent on fossil fuels. Combustion engines provide the required energy regardless of theatre or platform. Relying on regular fuel convoys for resupply is costly and imposes an increased risk, particularly evident in the case of ground-based CMOs where convoys are easy targets for insurgents.

There are two essential means to reduce the dependence of deployed military bases on external supplies of fuel:

a) Increasing energy efficiency and reducing energy consumption: the cheaper energy is the energy which you do not consume, using for instance better insulation for compounds and increasing awareness among personnel in and outside theatre.

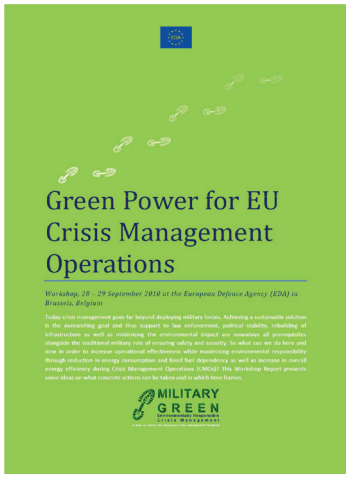
b) Producing the energy locally using novel renewables such as solar, wind, water and energy along with efficient energy storage technologies.

Reducing dependency on fossil fuel not only increases safety of lives and reduces life-cycle costs it also reduces non-European dependencies as well as the through-life environmental impact. The EDA Energy work strand, driven both by capability requirements and technological opportunities, thus also falls under the realm of EDA's initiative on Environmental Responsibility. The through-life approach is the tool used to identify where actions need to be targeted, taking into account both the materiel and operations life-cycles.

Camps

Some Member States have already equipped forward operating basis with solar panels and wind mills to reduce their energy dependence. Others are still at the conceptual stage, but acknowledge the urgency of the issue.

In February 2010, the CapTech GEM3 Ground Systems & their Environment organized a workshop on Power Sources & Supply Technologies for Land Systems, which featured 16 presentations and over 50 attendees from government and industry. In parallel, EDA Capabilities Directorate organized in November 2009 a workshop on Renewable Energy for Military Applications, covering all service areas. This meeting included a gathered a large panel of military end-users, logisticians, armament and R&T experts. Both directorates opted to join their efforts and organized in September 2010 a first common workshop Green Power for EU Crisis Military Operations. This workshop was followed by two meetings on Energy Supply for Camps in November 2010 and March 2011. The group is planning a conference on "Lessons Learned and Opportunities Identified" to be held early May 2011 in the frame of the Hungarian EU Presidency.



These workshops were instrumental in landscaping activities carried by EU Member States and industry to reduce the dependence on fossil fuels in military operations. They also prepared the ground for follow-up activities, including:

- The collection of statistical information on camp fuel consumption, in order to model fuel consumption
- The definition of a strategy and of a high level vision with a target objectives for the use of renewable energy sources
- The development of guidelines to increase energy efficiency
- The harmonization of capability requirements
- The definition of possible collaborative projects to close the capability gap.

As far as possible, EDA policy will continue to draw from the efforts of other crisis management organisations within the EU, NATO and UN.

Marine Vessels

2010 saw the follow-up work of the EDA study on Overall Platform Energy Efficiency (nominated for a Green Initiative award in 2009). The study, conducted by CapTech ESM1 "Naval Systems and their Environment" identified from a systems perspective where tangible actions could be taken to increase efficiency on-board surface ships. The spin-off activities from this are two. One is a working group, launched in the autumn of 2010, focusing on optimising the hull aspects with regards to energy. The second, also launched in 2010, is an effort looking at novel energy supply technologies for Unmanned Underwater Vehicles.

Soldiers

The increased weight that soldiers are carrying these days is a direct consequence of equipping solders with more technical systems. The systems require energy that is typically supplied by heavy and bulky battery packs. EDA efforts have during the past year focused on two things. One is two look at novel compact energy storage and conversion technologies. The second is to look at making the components, at semi-conductor level, more energy efficient. In October 2010, the CapTech GEM1 Materials & Structure organized with the support of the Swedish Defence Research Agency FOI a workshop on Energy for Soldier Systems, which ran in parallel to the Future Soldier 2010 conference in Prague.

C-IED – Counter-Improvised Explosive Devices

Primitive but effective forms of intimidation and terror, Improvised Explosive Devices (IED) see an ever increasing employment both in theatre and in the homeland. Although the term IED has surfaced in later years, the phenomenon dates back several centuries. While the devices still remain relatively simple in design, the means of deployment have evolved and the numbers in theatre have increased immensely. The respect and consideration for collateral damage and lives of bystanders has also reduced among insurgents making IEDs an even more grim threat.

The EDA efforts on Counter IED are a benchmark for cross-directorate teamwork. Pushing the boundaries of what EDA can do, the project Theatre Exploitation Laboratory (Demonstrator), denoted TEL(D), has brought capability experts on IED exploitation, forensics scientists and procurement officers together to deliver the first European Level 2 Exploitation capability. With the Capability Directorate leading on the Common Staff Requirement and R&T leading on the drafting of the Technical Specification, the EDA procurement was launched in June of 2010 following the ministerial green light a few months earlier. Supported by an expert panel from pMS the Technical Specification was completed in record time by mid-September enabling the subsequent launch of the tendering process and Contract signature before the end of the year with the Spanish company Indra coming out as the winner.

The parallel Capability Directorate lead efforts were dedicated to the administrative arrangements and manning of the system once deployed. Procured by EDA, the equipment will be taken into theatre for a pre-defined period of time by a Lead Nation, following approval by a Steering Board. The Lead Nation will then be responsible for the system and its wellbeing while ensuring that the entire capability is operational supported by all pMS, in particular with regard to manning. The Level 2 Exploitation capability will be deployed into theatre around mid-2011.

With the Capability Directorate launching activities within Prevention, focusing on Training (Search and Manual Neutralization Techniques) and Route Clearance (with R&T in support), 2010 saw R&T continue to direct its efforts towards Mitigation(projects running in both JIP-FP and GEM 1) and Detection (projects running in JIP-FP and JIP-ICET). Looking specifically at Detection, the final report of the Operational Budget (OB) study Terahertz for the Detection of Improvised Explosive Chemicals (TERIFIEC) was delivered in January 2010. The OB study Signatures of IEDs (S-IED), an eighteen month study, was awarded in December and is expected to be launched in early 2011.

Having adopted the scenario-based approach during the autumn of 2009, the C-IED Detection Expert Group continued its efforts during 2010 with the aim of producing a Scenario-Based Assessment of Technologies for IED Detection report along with a Recommendation for Future Investments report. The Expert Group also took time out to map and analyse past, present and planned activities within the seven contributing pMS (efforts have been made to attract more pMS to contribute and these will continue in 2011). The ambition is to finalise the assessment and recommendations reports during the spring of 2011. Getting non-Governmental entities on-board, such as industry and academia, is essential for a fruitful outcome. For this reason a dialogue phase between and Government and non-Government representatives will commence after the finalization of the recommendations. The aim is to establish a forum for conveying the capability requirements and the Government's assessment of where investments should be made in order to get feedback. This will also enable project proposals to crystalize as well as facilitate non-Governmental networking and consortia-building. This phase is tentatively scheduled for the second half of 2011.

8. Figures for 2010

EDA-FUNDED R&T STUDIES

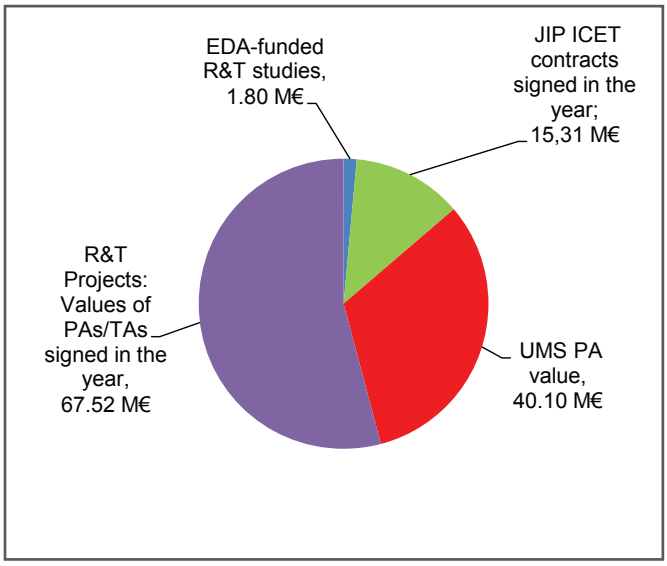
1.80 M€ committed for 7 new studies.

CATEGORY A R&T PROGRAMMES

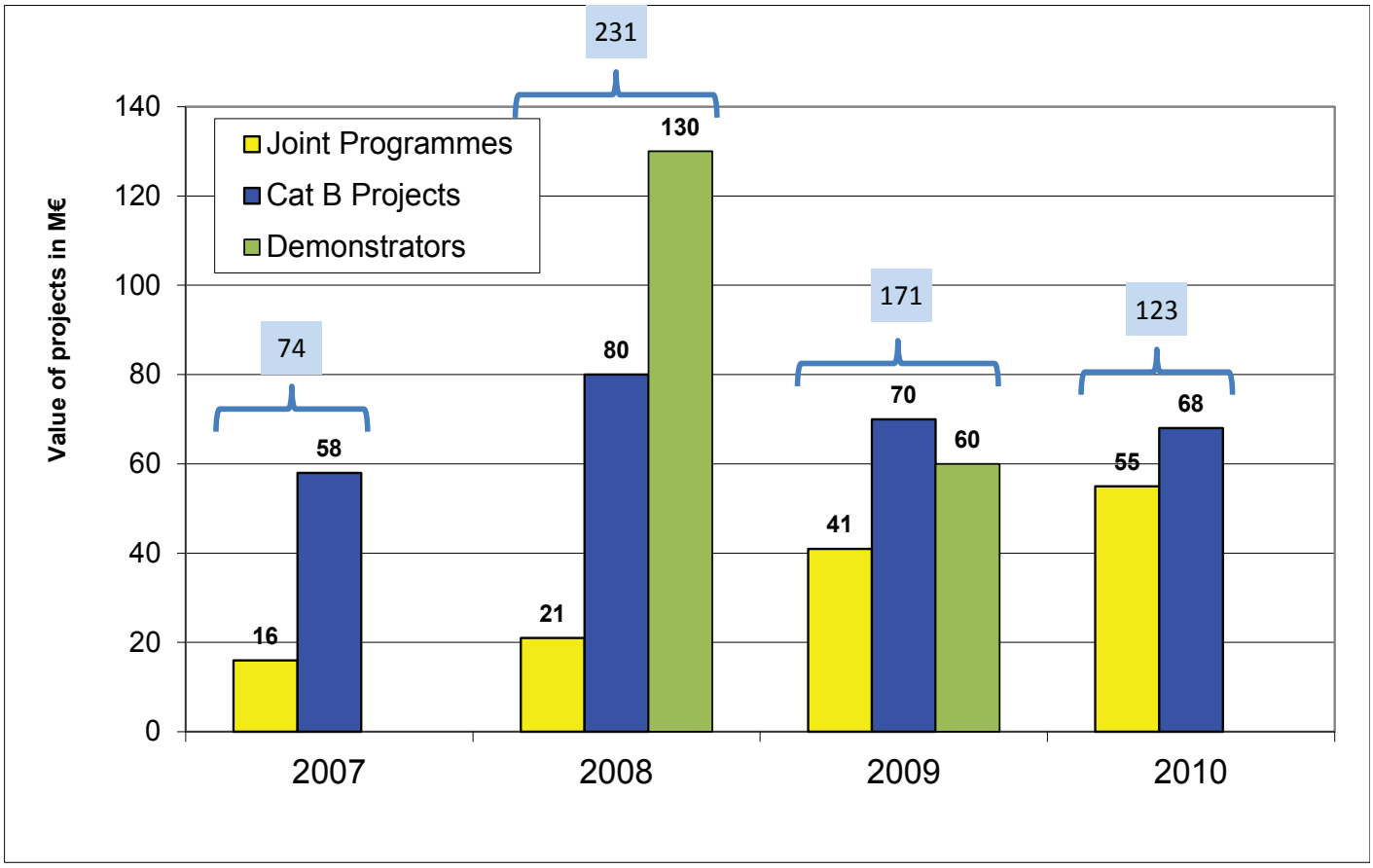
15.31 M€ committed for 10 JIP- ICET contracts (incl. VAT and co-funding).
40,1 M€ committed for the UMS PA (incl. VAT and co-funding).

CATEGORY B R&T PROJECTS

67,52 M€ committed for 11 new Project or Technical Arrangements.



European R&T investments through EDA (~600M€ in 4 years)



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