Request for Projects - 2015
Rules for applicants

Supporting dual-use technology projects for access to European Structural and Investment Funds co-financing

Appendix 6.5

RfP Priority Technologies

This RfP targets specific technological priorities as presented in this appendix 6.5.

Project Holders to be selected under this RfP will need to clearly identify in the Project Fact Sheet (appendix 6.1) the priority/priorities they intend to serve and demonstrate how they contribute to this/those priority/ies.

R&T Topic I. Name:

Securing and developing defence industrial supply and value chains for critical defence technologies needed for strategic non-dependence in Europe.

R&T Activity Outline:

Global objective:
Securing of innovative, key enabling and R&T intense critical defence and dual use technology value/supply chain capabilities to secure access to the technology for European defence and cross domain industries in the area of electronic and photonic technologies for components and building blocks, e.g. for applications in defence system technologies supporting military capabilities such as surveillance, reconnaissance, electronic warfare/protection and communication including sensors and ITC systems. The objective is to mitigate technology dependency risks for European stakeholders in current and future strategic technology domains which contribute sustainable value added for the European Technology Industrial Base and innovation. In Europe there is e. g. a need to strengthen the supply chain for independent GaN device manufacturing, including inherent European material supply. One of the more critical parts in the supply chain is to provide high quality GaN epitaxial solutions for the component foundries. The primary objective of the project should be to ready the technology for large scale production, improve process repeatability, improve performance and reliability of the devices through innovative materials solutions, and lower the manufacturing cost.

Dual-use technical Issue(s):

Variants of dual use applications of the technologies and value chains are an advantage if they contribute to support and sustain the business case for the defence technology value chain and it's EDTIB. GaN on SiC material is also interesting for the next generation base stations which require complete new architecture to handle the explosive demands in mobile data communication. Not only must the capacity of the network increase but this must be done without increasing the overall carbon footprint. Such solutions can be met by GaN components.

Civil and Military Capability Enabler(s):

The value added to enabling and/or improving military capabilities must be outlined. GaN substrates provides several benefits which enables both the military and civilian markets. The efficiency of GaN HEMT structures enables systems with higher power density and lower energy consumption. GaN devices can also operate efficiently at higher frequencies leading to higher bandwidth and capacity in e.g. mobile base stations.

Capability Need(s) fulfilled:

Innovative radiofrequency, microwave, photonic or integrated processor, curcuits and material/substrate technologies enabling and improving electronic and photonic applications such as payloads, sensors and antennas technologies for future and advanced:

- Aerial Systems
- Satellite Communications
- Space Systems
- Surveillance, Reconnaissance, Electronic Warfare/Protection and Communication Systems
- Autonomous mil. Systems
- Secure, safe and high performance electronic components and/or generic building blocks enabling high efficiency for advanced military systems
- Telecom, G-5 Technology.

R&T Topic II. Name:

Modelling and simulation: materials, processes and structures modelling with relevance to phenomena specific to dual-use applications. Estimated TRL is 3-6.

R**&T Activity Outline**:

Understanding that the EU has a leading position in the development of models for the simulation of materials, processes and structures, the aim of this activity is to provide a framework to integrate existing and/or upgraded models in real applications in relevant scenarios. For this it is required to involve all relevant parties, such as universities, research institutes and European industry.
Development of novel integrated modelling tools for new dual-use polymer composites and ceramic materials going from numerical description at nanoscale (atomistic and molecular level) to implementing a multi-scale modelling approach for process, assessment, selection and validation. Also provide diagnostic and prognostic methods for structures and relevant characterization for dual-use specific phenomena.

Dual-use technical Issue(s):

- Projects will provide and demonstrate models to support material development for dual-use applications (e.g. high temperature matrix, hybrid materials etc.) including characterization of materials (composite, ceramics, etc.) and providing automated algorithms for material and architecture, process and structure selection for specific applications. Model and demonstrate improved mechanical properties (e.g. fatigue stress, sealing properties), response to environmental factors (e.g. water absorption) and contribute to the understanding of dual-use phenomena (e.g. brittle fracture resistance, impact and determination of residual strength considering multiple impacts, including statistical models, adhesive bonding etc.).
- Projects will provide insight into how variability at the micro and meso-scale (e.g. in composites) affects component quality with mechanical performance implications, for example demonstrating how this may be used to minimize weight by optimizing material, process and component design. The consortium should take advantage of existing codes (academia, etc.) and provide testing on industrial demonstrators.
- Projects will address ageing, degradation of properties and fatigue life and incorporate the unpredictability of in-service life of assets and account for the long service life of some systems.

Civil and Military Capability Enabler(s):

- RPAS, Provide air and missile defence for deployable forces / Modeling, simulation and experimentation / Enhance logistic support for deployed forces / Maritime patrolling and escorting
- Life extension and through life support dual-use composite platforms
- Increase support for deployable forces
- Improve protection (security and European Armed Forces)
- Reduce maintenance and logistics
- Provide materials, processes and structures for force superiority and new platform design

Capability Need(s) fulfilled:

AAR
RPAS
Maritime Surveillance

R&T Topic III. Name:

Additive manufacturing for dual-use applications

R&T Activity Outline:

Developing materials (metallic and non-metallic), design and manufacturing processes and methods of quality assurance that could be used in the following areas:

- *New Dual-use Products Development:* Design based on conventional design principles and also on innovative designs such as topological optimizations, tessellated or bio-inspired structures.
- *Maintenance and Repair Area:* This technology will be used for programmed maintenance operations/conventional repairs and also to repair systems in remote and extreme locations.
- *Reduced inventory:* This technology could be used to produce parts that are no longer manufactured (obsolescence and unavailability) or that have long lead time or high costs.

Development of streamlined manufacturing processes: Additive manufacturing can be used to shorten manufacturing times by streamlined production and improved yield (reduced waste) by near net shape production.

Dual-use technical Issue(s):

- Development of new materials or materials combinations for Dual-use applications, with adequate physical and mechanical properties
- Post-production treatments: Heat treatments, hot isostatic pressing, surface finish to enhance properties.
- Freedom of Design: Design rules, bio-inspired designs, complex geometries, integrated designs.
- Reproducibility assessment
- Enhance machine capabilities.
- Modelling and Simulation (mechanical behaviour and manufacturing process simulation)
- Inspection and non-destructive testing
- Quality assurance and Certification

Civil and Military Capability Enabler(s):

- Availability, flexibility, unmanned systems application, enhances logistic support.
- Affordability (especially for short series, repairs, etc.).
- Manufacturing in extreme environments
- Allows reducing the energy required for manufacturing.
- It allows manufacturing complex geometries that cannot be manufactured using traditional techniques.
- It allows integrating complex parts in just one component.
- It offers potential cost and lead-time reduction.
- The process is flexible: The same machine/facilities could be used to manufacture different kind of parts; no special tooling is required

Capability Need(s) fulfilled:

RPAS

R&T Topic IV. Name:

New multifunctional coatings, REACH compliant dedicated to dual use applications

R&T Activity Outline:

- Work on Chrome 6 replacement technologies with a goal TRL 6 or more
- Work on external anti erosion and anti-corrosion layers for different applications (aircrafts, landing gears)
- Work on external layers for ice prevention
- Demonstration on some test cases (airplane, helicopters, naval, …)
- Work on new REACH compliant multifuncpaintings

Dual-use technical Issue(s):

- REACH compliant corrosion resistant top coat layers (replacing Cr6,…)
- Electrically conductive coatings for lightning strike resistance
- External layers with predetermined dual use specific functions (anti erosion and/or ice prevention, self-healing, IR signature…)

Civil and Military Capability Enabler(s):

- Adaptability of air systems in different conditions
- Environment friendly.

Topic targeting essential dual use capabilities such as:

- Managing degradation due to ageing and environmental effects
- Impact/damage detection and indication
- Adaptive coatings.

And to:

- Adaptability.

Flexibility.

Capability Need(s) fulfilled:

AAR
RPAS
Maritime Surveillance

Additional Information (this may also relate to conditions)

Background:

- A lot of development in the civil world in coatings to replace Cr6 and Cd, but nothing real new solution at TRL6 level for the moment for dual use specific solutions and long term anticorrosion protection.
- Some developments of 2 layers coatings systems but with low TRL

Due to the TRL 4 to 6 objective of the project a co-funding between the EC and the interested nations could be possible, but with a management of IPRS and dissemination of information like it is done in the MoU EUROPA or in national shedules.

R&T Topic V. Name:

Advance technologies for through life asset support

R&T Activity Outline:

- Development of automated asset support technologies to reduce in-service equipment maintenance costs including deep maintenance.
- To include SHUM (Structural Health and Usage Monitoring) and prognostics (material modelling) technologies, data mining, exploiting emerging sensors, etc. Progress to condition based maintenance philosophy.
- Smart coatings for health and performance assessment
- Structural materials
- Degradation of materials (fatigue, corrosion), in-service damage, reparability, and maintenance concepts.
- Safety approval process
- Related to National Key Enabling Technologies

Dual-use technical Issue(s):

- Integration, certification and usage philosophy for automated SHUM and prognosis technologies including transportation
- Sensor not principal focus, but exploit current and emerging sensor technologies.
- SHUM design philosophy plus dependence on managing large volumes of real time data via automated "big data" processing, predict (prognostics) future life, and notify when exceedance values reached.
- Reduce conservatism and exploit data for future designs.
- Correlate data output to materials degradation and structural defects (data safety).

Civil and Military Capability Enabler(s):

- Availability, affordability, ageing assets, safety, condition based maintenance
- Maintenance of assets (old and new)
- Autonomy e.g offshore
- Technology demonstrations, parallel working with existing maintenance philosophies.

Capability Need(s) fulfilled:

RPAS
Governmental Satellite Communications
Maritime Surveillance

Additional Information (this may also relate to conditions)

Background: Basic philosophy is not new and exploited in civil aero engines. Other industries needs can be unclear by comparison.. Sensors in general medium to high TRL, integration and certification and operational usage remains low TRL3/4. Basic technologies are available but making work as a complex system through handling/processing large volumes of data and understanding how to use the technology remain challenges. Requires multi-disciplinary teams.

IVHM – Integrated Vehicle Health Monitoring
Sensors can be large and induce internal damage defects
Existing equipment – supplement maintenance and decrease need to do such work including removal of components, etc. (deep maintenance)
New equipment – new sensor technologies to support unmanned assets and also determine state of health, reducing conservatism
Data management can be very large, need to improve the assessment of data and data mining. Correlate data output to maintenance and degradation behaviour or structural defects. Assess databases and indicate when maintenance is needed (maintenance models). Limited database, operational differences, civil engines has a lot of data and processing manner.
Conflict of SHUM + prognosis
Also for human life – H+S requirements
Influence in future design – team for data aggregation – improve design optimization

R&T Topic VI. Name: Unmanned heterogeneous swarm
R&T Activity Outline: - Intelligent sharing of functionality on unmanned heterogeneous platform used at the same time - Automatic/live/immediate retasking of the group when the contact with a platform is lost - High level command architecture and management for an heterogeneous group/swarm - Artificial Intelligence
Dual-use technical Issue(s): - Intelligent sharing of functionality on unmanned heterogeneous platform used at the same time - High level command architecture and management for an heterogeneous group/swarm - Artificial Intelligence
Civil and Military Capability Enabler(s): Use of small or micro platforms to replace a single big one (Air, land, naval, space….)
Capability Need(s) fulfilled: Remote Piloted Aerial Systems Governmental Satellite Communications Cyber Defence

R&T Topic VII. Name: Evolutions and adaptations of small space-based platforms and sensors to provide Space Surveillance and Tracking services.
R&T Activity Outline: Design, modifications and mission concepts for small space-based platforms and sensors aimed at developing SST architectures. Adaptability to cubesat or micro sat. Further improvements in the networking capability of the space based sensors.
Dual-use technical Issue(s): IT architecture, software, space qualification Reliability in space Optics (field of view, lens, image onboard treatment, …) Radar Assessment of big data
Civil and Military Capability Enabler(s): Space Situational Awareness, Space Surveillance and Tracking Earth observation Space networking
Capability Need(s) fulfilled: Space Observation, surveillance and tracking Remote Piloted Air Systems

R&T Topic VIII. Name: Evolutions of applications providing space-based imagery exploitation services
R&T Activity Outline: The activity of these projects shall provide an imagery exploitation service platform to assist the activities performed by imagery analysts, providing application both in the civil and in the military domain. The proposed application can also encompass the treatment and the semi-automatic analysis of big archived multisource data. Corresponding validations and customisations are to be undertaken, and the business case for the application is to be demonstrated. Service level models are to be developed, with appropriate quality of service definitions for the application. Complete integration into the customer's existing business processes and processing chains is to be demonstrated.
Dual-use technical Issue(s): IT architecture, software, space qualification Reliability in space Optics (field of view, lens, image onboard treatment, …) Radar Assessment of big data
Civil and Military Capability Enabler(s): Space Situational Awareness, Space Surveillance and Tracking Earth observation Automatic (re)Analysis of big databases.
Capability Need(s) fulfilled: Space Observation, surveillance Remote Piloted Air Systems

R&T Topic IX. Name:

EU collaborative “Opensource Virtual World”

R&T Activity Outline:

Since great success on the social media area of product like “ 2nd life” , 3DVirtualWorld, ….Application of virtual world technology on an **opensource system** to facilitate collaborative professional works (distributed planning, briefing, coordination, monitoring, evaluation and de-briefing….) is more and more a solution to face budget constraints when you have to organize projects from many distant locations, throughout Europe for example.
These activities involve different groups of people from different locations who need to interact lively with each other, and a coherent information set. The use of a virtual world environment enabled a high level of interaction among the distributed participants and the data. It also enabled distributed experimentation to be conducted directly from participants’ desks, not necessarily requiring large dedicated physical facilities, and giving the ability to observe 3D phenomena of the experiment as for example, an hologram can be displayed.

Dual-use technical Issue(s):

Modelling and simulation
Cloud computing
Virtual world database, virtual world engine
Distributed simulation

Civil and Military Capability Enabler(s):

Multi-locations meetings with preparation and 2D or 3D displays possibility
Test and Evaluation of product or systems
Experimentation preparation, execution and debriefing

Capability Need(s) fulfilled:

Air to Air Refuelling
Remote Piloted Aerial Systems
Space
Cyber Defence
Energy
Modelling and Simulation

R&T Topic X. Name:

Datacompression systems

R&T Activity Outline:

Study, design and implement (as IP Cores, allowing software and hardware implementations) new high-performance data compression algorithms to cope with the large data sets generated by modern embedded instruments, including integrated encryption algorithms.
Advanced and efficient data compression techniques should be designed, offering excellent ratios with a very low-energy consumption (or processor utilisation) on-board payload data processing systems.
These techniques should be able to handle any kind of data generated by existing or planned detectors: generic data (generic lossless compression), grey scale images (lossless and lossy), multi-band or multi/hyperspectral images (lossless and lossy), etc.

Integrated data encryption is recommended, in order to deliver a complete integrated system with compression and data encryption for more secure communication downlinks.
An added value would be to develop as well the necessary receptor tools, allowing operating directly on the compressed data, thus avoiding the processing and storage overhead caused by the decompression of the on-board algorithm.

Dual-use technical Issue(s):

IT architecture, software, space qualification
Reliability and fidelity of such process (compression-decompression)
Optics (image onboard treatment, crypto compatibility)…)
Fusion of sensors in observation or identification systems

Civil and Military Capability Enabler(s):

Space Surveillance Awareness
SATCOM
Decision making system that receive as input a lot of data from external sources
Systems with “external sensors” (video surveillance, ….)

Capability Need(s) fulfilled:

Cyber
Space
Surveillance systems
Communication systems

R&T Topic XI. Name: Remote Piloted Aerial Systems - technologies to enable Air Traffic Insertion
R&T Activity Outline: There are a number of technologies outlined in the DG Move roadmap for Roadmap for RPAS. Work in areas to compliment these activities could be very beneficial to all airspace users. (http://ec.europa.eu/enterprise/sectors/aerospace/files/rpas-roadmap_en.pdf)
Dual-use technical Issue(s): For insertion in civilian air traffic, the technology is generally dual use.
Capability Need(s) fulfilled: Remote Piloted Aerial Systems
Additional Information (this may also relate to conditions) This work could build on existing technologies that are being developed in member states funded by Member states, EDA and SESAR., for example in sense and avoid technologies.

R&T Topic XII. Name: Remote Piloted Aerial Systems - air vehicle technologies
R&T Activity Outline: Remote Piloted Aerial Systems – The area of RPAS is very dynamic in all market segments. There is the possibility for innovation in all technology areas of platforms in all market segments, from the very small to large platforms. The technologies could relate to any of the platform or sensor systems, or the ground segment.
Dual-use technical Issue(s): Many of the technologies will be dual use. There is a strong probability that military and civil requirements for surveillance in various domains will share a number of common requirements. Some vehicle systems could have specific military characteristics.
Capability Need(s) fulfilled: Remote Piloted Aerial Systems

R&T Topic XIII. Name: Remote Piloted Aerial Systems - certifiable command and control links.
R&T Activity Outline: To enable RPAS to operate beyond visual line of sight there a need to establish a certifiable means of command and control. This may be satellite link or other means. This is a requirement that does not exist in manned aviation, and so represents a unique challenge.
Dual-use technical Issue(s): The technology should be generally dual use, although there could be some areas such as the security of the link that may be particular to the military domain.
Capability Need(s) fulfilled: Remote Piloted Aerial Systems
Additional Information (this may also relate to conditions) This work could build on existing technologies that are being developed in member states funded by Member states, EDA and ESA.

R&T Topic XIV. Name:

Providing an advanced synthetic environment for Cyber Security/Defence Education, Training, Exercise and Technical Test/Evaluation

R&T Activity Outline:

Today Modelling and Simulation for Cyber Security/Cyber Defence is mostly relying on expensive farms of hardware platforms (server computers) or/and pre-fabricated software models – both approaches lacking agility, scalability and flexibility which is necessary to more realistically use a "Virtual Cyber Space" for training, exercise or technical evaluation. R&T activities include, but are not limited to developing a high performance computing runtime environment, standard software finite elements for modelling, process models, and building/supporting simulation federations (with other Cyber and non-Cyber simulators).

Dual-use technical Issue(s):

The dual-use nature of Cyber Space is outlined in the EU Cyber Security Strategy and the EU Cyber Defence Policy Framework; while technology to build a "Virtual Cyber Space" is purely civil, models and federations can be anything from civil to defence.

Civil and Military Capability Enabler(s):

A high performance scalable synthetic environment to enable training/exercise of decision making and operational procedures under "Cyber conditions".

Capability Need(s) fulfilled:

- Cyber Defence
- Training (from awareness to leadership)
- Exercise
- Doctrine development
- Technical test and evaluation
- Interaction of Cyber capabilities with the full spectrum of classical military capabilities (command, inform, engage, protect, deploy)

R&T Topic XV. Name:

Research on biological effects of Radiofrequency signals

R&T Activity Outline:

- Research on literature of biological effects of RF signals
- Epidemiological analysis of populations and personnel close to radar centres or that can be under radar illumination
- In vitro studies
- Cell studies
- Additionally studies on animals

Dual-use technical Issue(s):

Radiofrequency signals are employed by systems like radar with different applications that can be civil like Air Traffic Management and military like the ones used for Surveillance and Military Situation awareness. This kind of signals have specific characteristics not covered by only civil studies like the ones on mobile telephony as the modulations are quite different.

Civil and Military Capability Enabler(s):

Knowledge of the effects on health that will enable a safe use of radar and innovative systems using Radiofrequency Signals in the different domains.

Capability Need(s) fulfilled:

Safe use of:

- Air Traffic Management Radars
- Intelligence, Surveillance and Reconnaissance Systems
- Electronic Warfare / Protection and Communication Systems
- Any other innovative system using RF Signals

Additional Information (this may also relate to conditions)

If studies on animals are performed they should comply with current regulations

R&T Topic XVI. Name:

Research on Sensor Fusion techniques to improve the quality Imaging Systems in diverse atmospheric and lighting conditions and Degraded Visual Environment (DVE)

R&T Activity Outline:

- Image Quality improvement by means of Fusion between IR/VIS/SWIR/IL imaging sensors on a case by case analysis based on application (surveillance, mobility, driving);
- Operating environment (airborne, naval, land) to enhance vision performance not only in all-weather, but also DVE (Degraded Visual Environment)

Dual-use technical Issue(s):

- Definition the most performing sensor set and sensors fusion level
- Integration of data fusion solutions (test bed sensors platforms), including also manned and remoted guidance systems

Civil and Military Capability Enabler(s):

Sensor Fusion Techniques to increase Imaging quality can be used in different applications that can be civil like or used for Surveillance and Military Situation awareness.

Capability Need(s) fulfilled:

- Enhance surveillance capacity in all-weather conditions;
- Increased the mobility of vehicles, ships and helicopters
- Dual use solutions.

R&T Topic XVII. Name:
Integrated CBR detection system.
The aim is to develop new technology for point detection of Chemical Biological and Radiological threat agents.

R&T Activity Outline:

Currently fast and reliable detection of radiological agents is commercially available technology. Fast and reliable detection of chemical agents is possible with some commercially available instruments, be it with limitations such as unfavourable false alarm rates in complex chemical environments, limited number of toxic industrial agents can be satisfactorily detected and agents of low volatility are difficult to detect. Adequate point detection of biological warfare agents is not available but the subject of many development projects. Promising technologies are being developed and include robust DNA multiplication (RT-PCR), detection of specific proteins by mass spectrometry (MALDI-MS) as trigger for subsequent analysis, smart sampling and immunochemical detection. A combination of these technologies will be needed to achieve a system of sufficient speed, agent spectrum and reliability.
The step to be taken is integration of technologies into effectively working detection systems. Such integration must be achieved within a threat area (Bio, Chem) and between those CBR to eventually develop an integrated system for CBR detection.

The required result is a technology demonstrator that is mature enough for testing in a controlled laboratory environment, including an experimental verification of the anticipated detector performance potential. It also includes verification, based on a detector performance model, to evaluate false-alarm probabilities in environments of different chemical and biological complexity and also in environments of significant biological variations.

Dual-use technical Issue(s):

The required integrated CBR detection-system, or even the integrated B-detection system by itself would not only fill an urgent military capability gap, but would also be of great impact for civil use in public health care.
The urgency and complexity of this topic, which is an intersection between public health, crisis management and security for unconventional threats, requires a strategic approach to fill the most urgent gaps in defence against possible future bio threats. The challenges are multiple and only partly under influence of research and technology.

Civil and Military Capability Enabler(s):

R-detection systems; C-detection systems;
Detection mechanisms for infectious disease causing micro-organisms; PCR, Mass Spectrometry;
Detector integration; detector platforms.

Capability Need(s) fulfilled:

Force Protection; protection against CBRN threats; capability to provide rapid and reliable situational awareness of the presence of CBRN threats.

R&T Topic XVIII. Name:
Sustainable decontamination of Chemical and Biological Agents.

R&T Activity Outline:

The requirement is develop novel, effective and sustainable technology for the decontamination of CB contaminated surfaces.

One such technology could be plasma technology, known to be able to kill bacteria, and can leave human tissues intact. It is also known that plasmas are able to mitigate chemically dangerous molecules and radicals. The requirement going far beyond the state-of-the-art. The technology will have to be pushed into a regime where C and B warfare agents can be mitigated. Not only vegetative bacterial cells, but also viruses and spores must be effectively eliminated of spores. Instead of eliminating false odour species from an exhaust, surfaces, in three dimensional perspective, will have to be cleaned from chemical warfare species.

Dual-use technical Issue(s):

There is a requirement for novel technology for decontamination of assets having been in contact with chemical or biological (CB) warfare agents and alike. Current technology is based on mixtures of chemicals that react with CB agents and have cleaning properties. However, the efficacy is limited and in some cases unknown. Moreover current decontamination is logistically burdensome and may pose an environmental problem. Therefore, the challenge is to find alternative decontamination concepts that may resolve these limitations. An important prerequisite is that the technology would have the potential to be used for decontamination of people and thus be safe.
This technology would find military and civil security application, but, if sufficiently sustainable would also be of consideration for medical application: surgical equipment, sterility.

Civil and Military Capability Enabler(s):

R Proper and reliable decontamination concepts and techniques.

Capability Need(s) fulfilled:

Air to Air Refuelling
Remote Piloted Aerial Systems
Governmental Satellite Communications
Space
Cyber Defence
Energy
Force Protection; protection against CBRN threats; capability to rapidly and safely decontaminate CBRN affected materiel.

R&T Topic XIX. Name:
Human factors.
The aim is to develop knowledge on human factors in complex, demanding and technological environments.

R&T Activity Outline:

- Study the interactions among humans, their abilities and limitations to the design of equipment, environments in which they function and jobs they perform in the field of defence and security, with the focus on individual and team performance under complex operational conditions.
- Study social-cultural aspects of human interactions in complex operations.
- Study collaborative decision making processes.

Dual-use technical Issue(s):

Lack of understanding of human factors often lead to non-optimal design of equipment and concepts of operation. Early recognition of human aspects saves costs and enhances the overall performance.

Civil and Military Capability Enabler(s):

Better (understanding of) human performance and human-machine interactions in security and defence.

Capability Need(s) fulfilled:

Human factors are underpinning several capabilities.

R&T Topic XX. Name:
Energy Harvesting.

R&T Activity Outline:

The energy demands of military equipment continues to grow, forcing different thinking about how energy to power electrical systems can be provided in a sustainable way and how overall efficiency can be improved. This activity seek to develop a novel energy harvesting system, which capitalises on the conversion of energy from natural movement into electrical energy for either direct use or storage. Several areas or novel technology show promise in this area from flywheel technologies in ships to motion generators attached to soldiers. The activity seeks to uncover disruptive technologies that will have applications in all fields were natural motion can be harnessed – wave motion, human activity etc.

Dual-use technical Issue(s):

- Power generation from kinetic motion has obvious applications in both the civilian and military field. Several prototype systems have been developed to TRL 4; however, to deliver the benefits within fielded systems will require addition R&T activity:
  - Measuring and characterising the achievable power outputs from different devices for different scales of build and for different motion displacements.
  - Integrating energy storage functionalities into the core design to enable higher voltage pulses over short duration and perhaps additional generation through EM process.
  - Characterisation of the possible power outputs in different environments - wave motion, human motion etc and understanding metrics such as power output versus weight.
- Such technologies should have obvious applications for energy supply to sea based systems such as weather and navigation buoys and at larger scale for power generation from wave motion.
- From a dual use perspective, the same developments would support military sonobuoy development, energy harvesting for dismounted soldiers and a multitude of other areas. Additional study work could offer insight into further potential applications.

Civil and Military Capability Enabler(s):

Energy Efficiency
Renewable power for military applications
Dismounted soldier systems
Autonomous Maritime energy systems.

Capability Need(s) fulfilled:

Sustainable defence capabilities.

R&T Topic XXI. Name:
Water and Waste Management.

R&T Activity Outline:

Water is an increasingly precious resource for both military and civil use and, in some warmer European countries, security of its supply has reached a critical point. Over time, water and associated waste management processes have remained largely unchanged with traditional collection, distribution and drainage networks in operation, which do not generally operate efficiently or with any regard for improved sustainability, where, for instance, clean rainwater is allowed to flow into waste systems without first capitalising on its purity. Modern electronic fluid management systems could be used to use water more effectively and also to recover pure water from waste within an integrated cycle. This topic aims to develop a novel water and waste management system at small facility scale, which could be used at both military and civilian sites.

Dual-use technical Issue(s):

- Water and waste management is an area of obvious dual-use applicability.
- Focus on generic building management system with potential for use at both fixed and deployed military sites.
- Possible integration with Renewable energy systems and SMART grid technologies.

Civil and Military Capability Enabler(s):

Energy Efficiency
Renewable power for military applications
Reduced environmental impact.

Capability Need(s) fulfilled:

Sustainable defence capabilities.
Improved logistics and basing.
Improved environmental impact.
Core technology has universal use in military sites both at home and deployed.

R&T Topic XXII. Name:
Persistent Autonomy of Unmanned Maritime Systems.

R&T Activity Outline:

Maritime Patrolling and Escorting – Preservation of sea lines of communication, Maritime Surveillance.

Maritime Patrolling and escorting means being able to act at sea. A requirement of the EU Maritime Security Strategy is Protection – protection of sea lines of communication, trade, infrastructure. This area of technology development will increase MS capabilities in this important domain.

The level of autonomy, robust acoustic communication methods with surface, aerial and underwater vehicles as well as the ability to recharge vehicles on station all contribute to increasing the effectiveness and flexibility of UxV's. Unmanned vehicles mission planning and re-planning during operations all increase the effectiveness and success of operations.

Dual-use technical Issue(s):

This technology by its nature is Dual Use. There is considerable interest in both civil and military domains in preserving sea lines of communications and in Maritime surveillance.

- Autonomy - offshore.
- Maintenance of assets.
- Reliability at sea.
- Launch and recovery.
- Energy.

Civil and Military Capability Enabler(s):

The use of modular lightweight vehicles to replace large, specific mission defined vessels.

Capability Need(s) fulfilled:

RPAS.
Maritime Surveillance.