AHEAD

WP600: Individual Protection Capability Improvements

Executive summary

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1. INTRODUCTION

The main objective of the AHEAD project is to forecast the evolution of the existing or new technologies which can improve the protection of the individual soldier. The AHEAD project is part of the Joint Investment Programme on Force Protection managed by the European Defence Agency, on behalf of its Member States. It is carried out by a Consortium led by Galileo Avionica, with the following partner companies:

- EA - ELETRONICA ASTER S.p.A. (Italy)
- TEK - TEKEVER (Portugal)
- CMMV – Centro Militar de Medicina Veterinaria / LDB Laboratory of Biological Defense (Portugal)
- MUT - Military University of Technology (Poland)
- AFIT - Air Force Institute of technology (Poland)
- PIAP - Industrial Research Institute for Automation and Measurements (Poland)
- IABG (Germany)

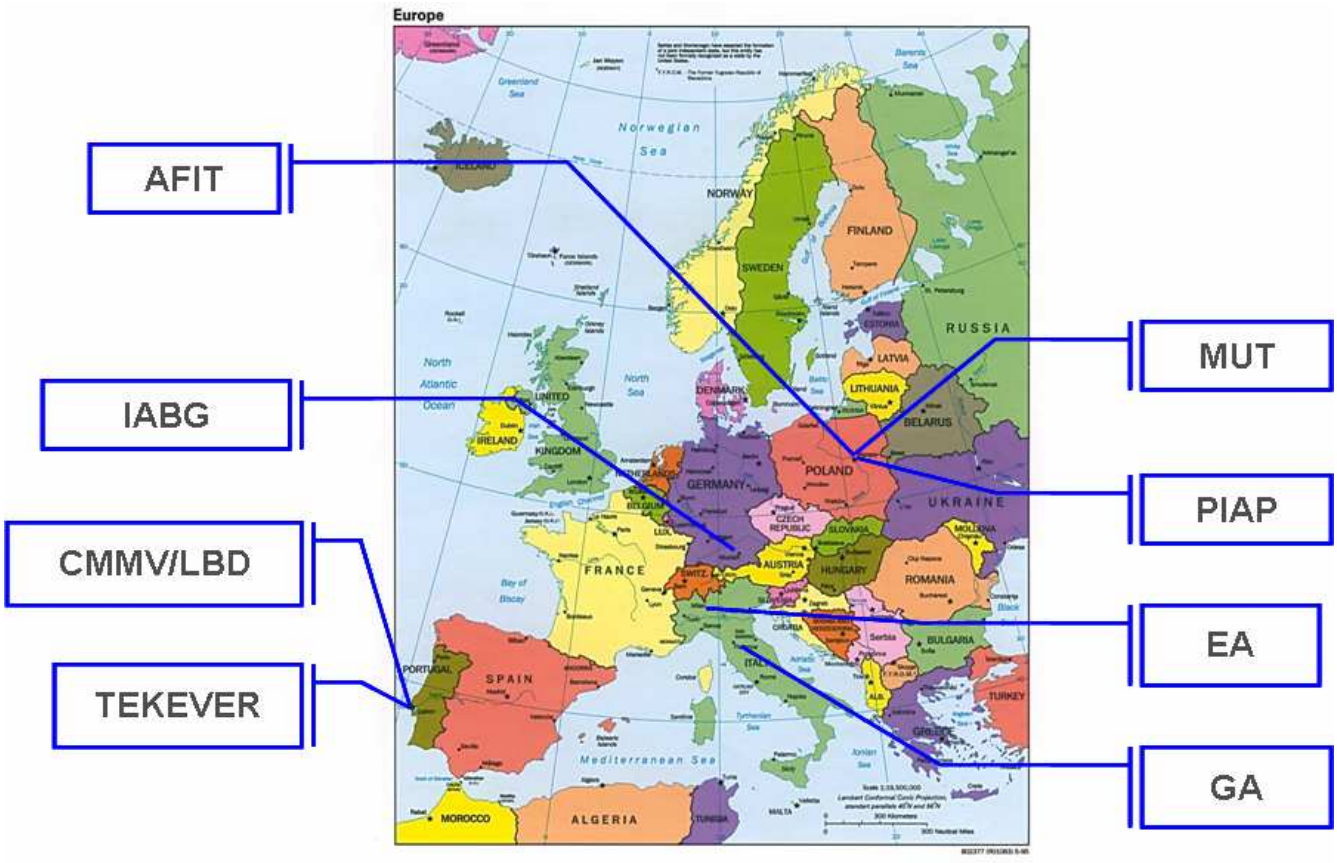

Figure 1 – AHEAD Consortium

The duration of the project was 18 months. The kick off meeting took place in November 2008, and the final report was handed over in June 2010.

The project is divided in six work-packages, being WP100 the Project Management. In WP200 the operational capabilities and functional needs to be improved for the protection of the individual soldier have been identified, as well as the operative scenarios for the today soldier. The Consortium has then proposed an evolution of the “System Soldier” outlining the requirements from the mentioned scenarios (WP200), evaluating the existing (WP400) and novel technologies (WP500) and foreseeing their evolution in sensors, actuators and others devices (WP300) with the possibility to integrate them in intelligent, modular and portable equipments (WP600).

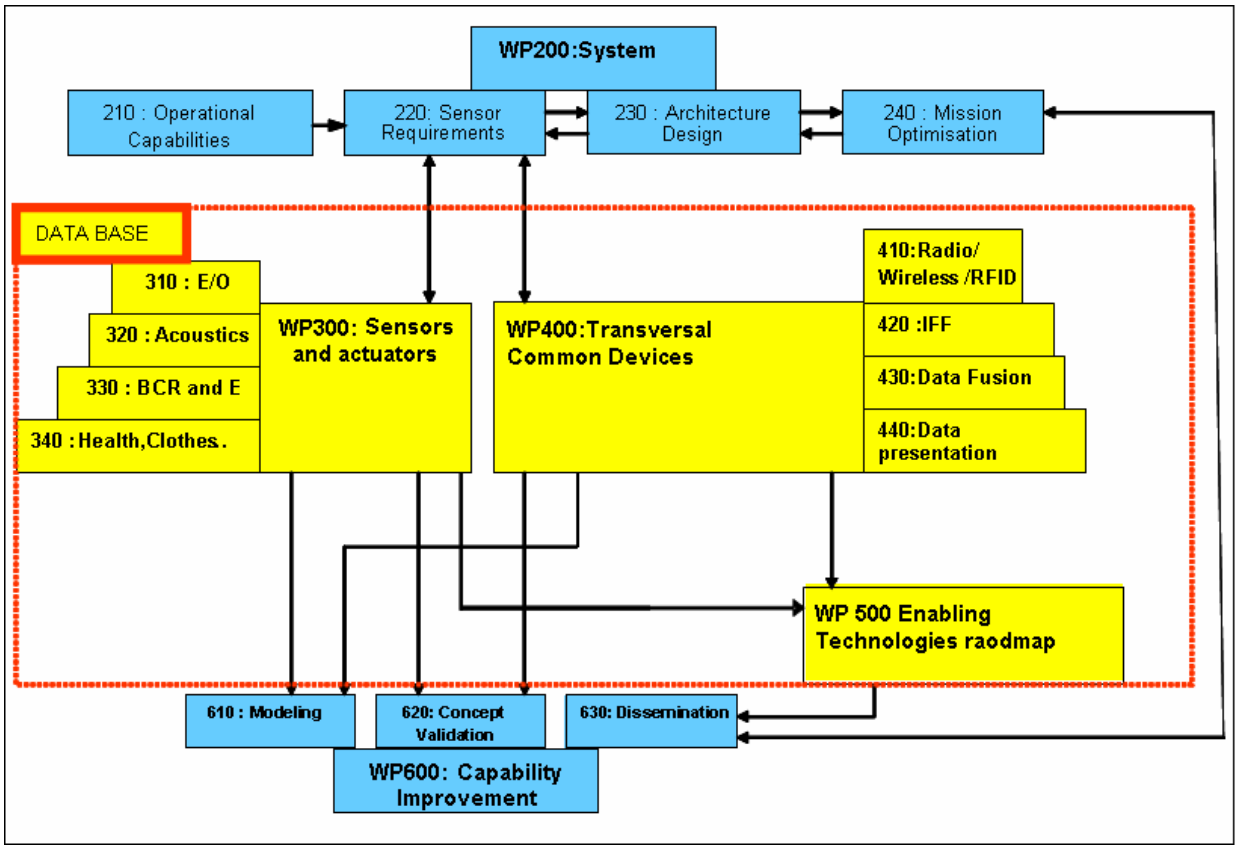

Figure 2 – Organization in workpackages

2. OPERATIONAL CAPABILITIES

The first step achieved in the project has been the definition of the operational capabilities fundamental for individual protection in the urban environment (D-210). Initially, the methodology used for identifying these operational capabilities has been drawn. The approach followed by the AHEAD Consortium was based on two stages. It began with the outlining of the urban environment in 2020, taking into consideration previous works and current conceptions. The description of urban scenarios, concepts of operations (missions, characteristic aspects) and associated threats was compiled from work performed on Future Soldier and Warrior programmes. The analysis of current concepts and explanations of their main points will provide the justification basis for the operational capabilities desired. From here, some operational level capabilities were identified.

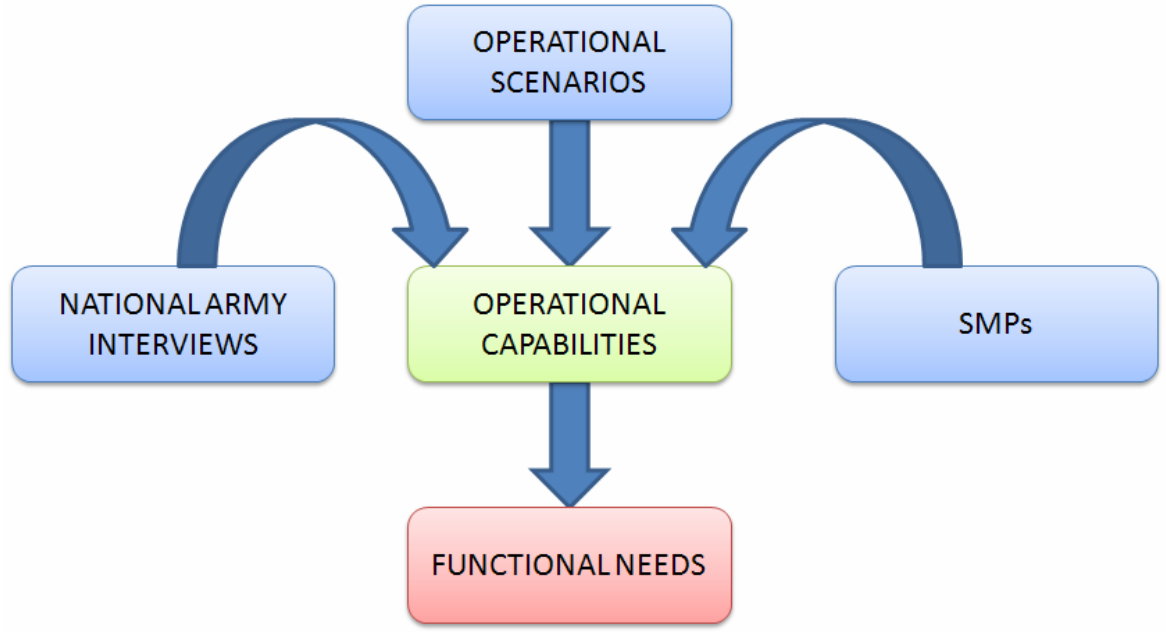

Figure 3 - AHEAD logical flow

The second step consisted of refining the capabilities and/or identifying others through extensive conversations and discussions with the armed forces of the member states involved. The direct consultation with the end-users allowed the direct validation of the capabilities identified in the first step and identification of different ones, the indirect validation of capabilities through the confirmation of threats and operational contexts, and the possibility to define requirements for individual protection. The Consortium then applied its technological and industrial background in translating the operational capabilities into functional needs. The flow described above is represented in *Figure 3*.

The following operational capabilities have been identified as being fundamental to improve own protection and ensure efficient and adequate operations of the soldier (*Figure 4*):

- **the situation awareness**: knowledge of the position and intention of self, friend, foe, neutral and unknown;

- **the detection of different type of threats**, from classical weapons to Chemical, Biological, Explosive and Radiation threats;
- **the contribution to the weapon effectiveness**: the ability to engage the enemy accurately and effectively in any environment;
- **the individual mobility**: the individual must move quickly and silently, in night, day and all weather;
- **the health**: the individual must provide information on his health conditions.

Figure 4 - Operational capabilities for individual protection

3. ARCHITECTURE AND SCENARIOS

On the base of these operational capabilities a new architecture for the soldier of the future has been presented and described in detail (D-230F), taking the existing SMPs as a basis from which AHEAD can be forged. The main objective of the architecture is to guarantee the provision of the operational capabilities identified, as well as a design that is as modular and as flexible as possible. The architecture proposed facilitates interoperability between national sub-systems, components and philosophies as well.

The AHEAD architecture was validated through a SW simulation in the context of three typical infantry scenarios in an urban operative environment (D-610) and a HW live demonstration (D-620) which show the improvement of situational awareness by the selected technical solutions in an operational mode. The objective of the simulation experiment and the live demonstration was to demonstrate how new sensors or integration of sensors making part of AHEAD architecture will enhance the Protection Capability of Infantry Forces.

Finally, D-240F document analysed how the tasks of the soldiers are improved by means of the AHEAD equipment based on the use of new and/or updated sensors. The optimization of these tasks during a mission have been analysed by means of the impact of new AHEAD equipment on the five operational capabilities identified as the fields to be developed in order to increase the self-protection of the individual soldier.

Moreover, the main steps forward the implementation to AHEAD architecture in a real soldier system have been drawn, with particular emphasis on the main issues joined to the “helmet system” and to the “central core”, as well as some suggestions on the researches need to easy the implementation of the AHEAD system. This concept have been translated in the sensors/technologies specifications and requirements needed to be implemented in the proposed architecture D-220F.

4. SENSORS AND TRANSVERSAL TECHNOLOGIES

A deep analysis on the state of the art and the evolution in term of hardware performances and capabilities for the sensors and devices identified as usable inside the proposed architecture has been drawn, with particular attention to the choice of the most suitable type to be integrate in the live demonstration.

These types of sensors, actuators and technologies that bring additional advantages to the AHEAD concept, have here be taken into consideration:

- Electro-optical sensors: low light level cameras, APS CMOS sensors, CCD, micro uncooled IR cameras, cooled and uncooled sensors, wide angle IR optics, diffractive optics in D-310;
- Acoustic sensors useful do detect and locate small caliber fire arms shooters in D-320;
- Biological, Radiological, Chemical and Explosive sensors in D-330;
- Others Sensors D-340, that are the technological areas covered are health sensors technologies, auto medication technologies, wireless sensor networking, personnel identification, body armour and energy scavenging.

A Data Base (D-540) with the indications of the readiness of the available sensors/devices today, what their forecasts in terms of size and costs including order of magnitude of needed investment for the specific application as been created. This is the reference output to be used for dissemination at the end of the AHEAD project, and can be assumed as a basis for future activity.

Even with the most modern technologies at the level of sensors and actuators, there are a number of technologies that can be considered as critical enablers for improved systems, especially in the new network centric operations scenarios. These technologies, transversal to any system, correspond to the system level technologies responsible for establishing the links between sub-systems and components/sensors as well as for collecting data coming from the sensors and presenting these data to the soldier in the most appropriate and beneficial way.

Then, in addition to sensors, the same deep analysis was performed for these technologies here defined as “transversal”. The technologies and the related devices that can improve the AHEAD system and its functionalities include communications technologies (radio, wireless, RFID, personal area networks and possible adaptations of civilian and existing techniques to military equipment) (D-410), IFFN (Identification of Friend-Foe-Neutral) (D-420), increased processing power for data fusion and subsystem data as well as analysis of data fusion of sensors (D-430), data presentation (D-440) and power management (D-450).

The study performed on these enabling technologies has been addressed overall towards the definition of the state of the art, the trade off between size, power, consumption, performances, costs and the reached level of maturity. Some innovative concepts for the application of these technologies in system concept AHEAD architecture have been proposed. All the typologies of technologies investigated aimed at the protection of an individual soldier with characteristics of affordability (reduced cost), miniaturization (size), increased operating capabilities, power consumption reduction and integration.

Roadmaps and future trends in the development of the technologies behind different types of sensors (radiological, chemical, explosives, biological, health and electro-optical sensors) have been presented in D-530, assessing their impact on the overall AHEAD system. The choices of

which technologies to investigate further came from the knowledge of the enabling technologies which are behind the sensors and devices selected for established operational concepts in urban environment.