BIO SENSOR
Publishable Executive Summary

Soldier Modernisation Harmonisation
-
Bio Sensor Information Demonstrator

Document reference: SK-0000492892-01

Issue: 01

Date: 2012-11-22

Pages: 5

EDA [Contract] n° 11.CAP.OP.148

SAFRAN Sagem

HIDALGO

This document summaries the activities and results of the project "Soldier Modernisation Harmonisation - Bio Sensor Information Demonstrator" carried out by the consortium Sagem, Hidalgo and Institut de Recherche Biomédicale des Armées (IRBA). This study was commissioned by the European Defence Agency under the contract 11.CAP.OP.148.

1 Objectives and Approach

The aims of this study are to generate operational requirements for soldier's health status, to investigate possible sensor solutions and to assess the integration issue in soldier's C4I systems, through a thorough analysis and a validation on a representative demonstration. The project implements a six steps approach:

- WP 1 - Operational Requirements;
- WP 2 - State of the Art of Technology;
- WP 3 - Design and Set-up of the Demonstrator;
- WP 4 - Test and Evaluation Programme;
- WP 5 - Test and Evaluation of the Demonstrator;
- WP 6 - Design of an Integrated Health Monitoring System.

The Project team is based on a European coherent consortium including 3 organizations, both industrial, research and governmental, providing various complementary and relevant competences.

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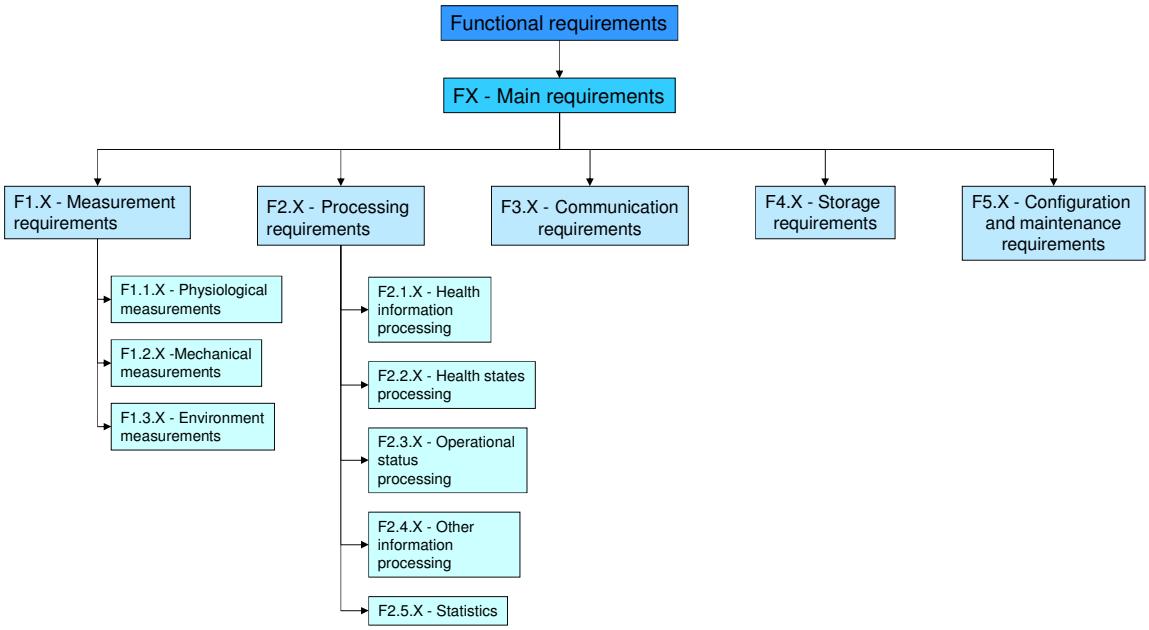
2 Main Project Outputs

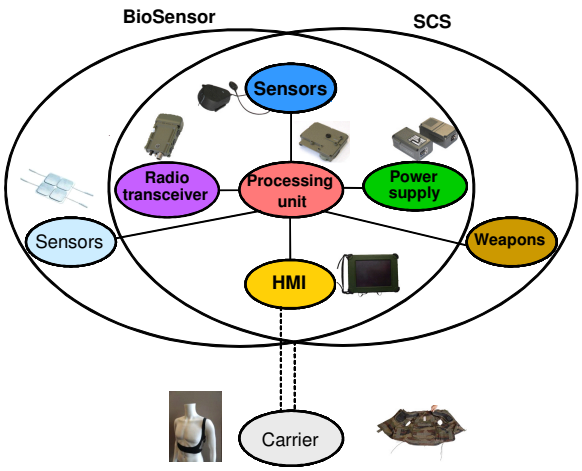
A Functional Analysis is performed to identify realistic **Operational Requirements** for a soldier's Health Monitoring System (HMS), addressing the cognitive, physical and organizational aspects of ergonomics. This analysis considers typical operational situations, highlighting various health events and in line with information to be transmitted between different classes of users.



Hierarchical Breakdown of Functional Requirements

Based on technical and medical expertise, the study focuses on physical health states like traumatic injuries. In addition to health information (e.g. Respiratory rate, Heart rate, Blood pressure…), medical information exchanges include health state for the medical chain and operational states for the hierarchical chain. Scenarios and requirements were shared with pMS, EU and EDA experts during a Workshop held at EDA premises on the 8th of March 2012.

State of the Art of Technology assesses the technologies for standalone biosensors and HMS, including sensors, processing algorithms and communications. A forecast, stretching from 5 to 20 years, of key technology components is proposed, considering ongoing Soldier Modernisation Programs and examples of civil applications.

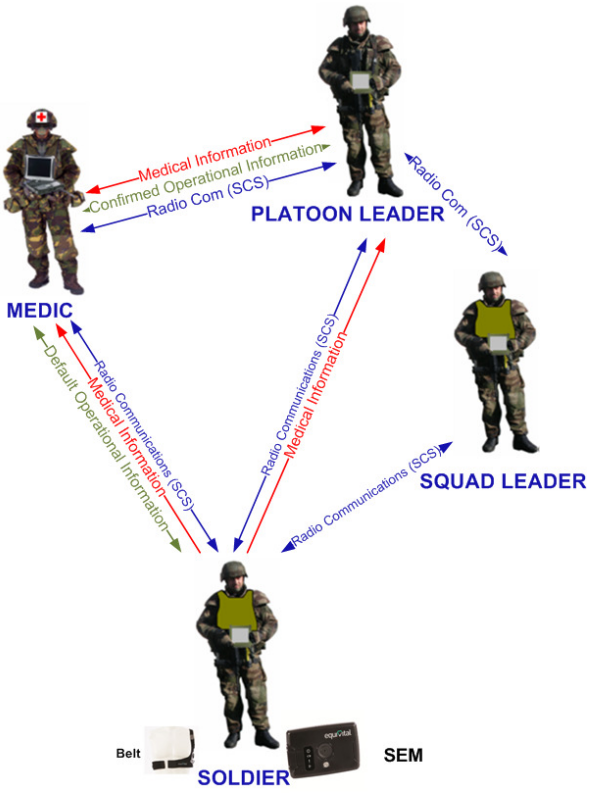


HMS Architecture and Integration in Soldiers' Combat System

Demonstration Set-up consists of the design of a realistic HMS system architecture, based on operational requirements and "state of the art" components, the realisation of the HMS demonstrator itself, integrated in a realistic C4I garment, and the definition of evaluation criteria and representative scenarios.

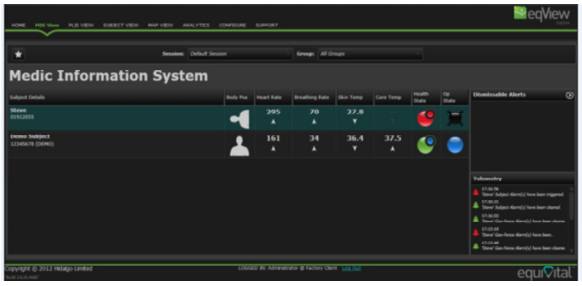
The **Demonstration Phase** is performed in September 2012 at Sagem's Development Centre of Massy (FRA) and includes laboratory and operational tests.

Laboratory testing is used to verify technical capabilities involving the different HMS components and to assess operational situations not feasible with real subjects (e.g. injuries).



HMS Demonstrator – Operational View

"On the field" tests are run to evaluate HMS performances vs. requirements in an operational context.



HMS Demonstration – Live views

Design of an Integrated HMS leads to a draft System Design Document for a HMS integrated in a Soldier' Combat System, considering an optimised architecture and the sharing of functions: power, communications, localisation, processing resources... It includes a first estimation of cost and provides an overall roadmap to reach an operational status.

3 Main Conclusions

This study has allowed identifying the operational requirements for a Health Monitoring System integrated in a Soldier's Combat system. The analysis also assessed data and information needed for both medical and command chains in operational situations.

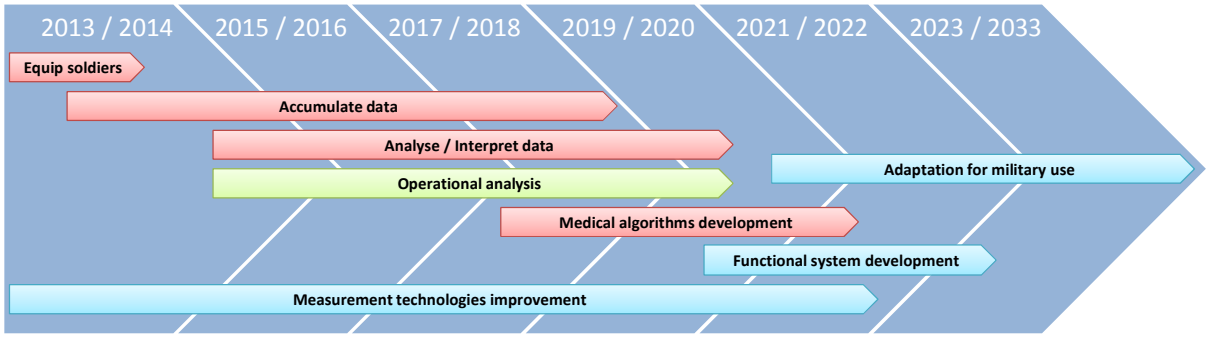
With limited improvements and integration efforts, current technologies and systems can be effectively used in training missions. Such systems will also provide valuable data to improve reliable and self-adaptable medical interpretation algorithms.

The study results identified which technologies are needed and what developments are required to satisfy the needs of such a pertinent HMS. From a sensor point of view, progress will allow improvement in quality and diversity of measures, with an overall expected reduction in mass and power constraints.

Combined and Distributed integration architectures are recommended to limit cost and weight increase of soldier's combat equipments. A Remote architecture is still available for "less digitalized" soldier's combat systems.

Recommendation is clearly to initiate the proposed roadmap, covering 3 different but complementary angles:

- a medical roadmap, in terms of improved automatic diagnosis and algorithms;
- a technical roadmap, regarding evolution of sensors and technology;
- an operational roadmap, to prepare introduction of this new capability in the medical and command chains.



This roadmap should lead to development of a full HMS capability, addressing all operational needs and adapted to the military environment, in a 15~20 years timeline.

International cooperation with civilian and military medical organisations would ease the acquisition of operational data and accelerate validation of effective algorithms.