SMAT Project
Sistema di Monitoraggio Avanzato del Territorio
(Advanced Environment Monitoring System)
May 13th 2009
SMAT-F1 is a research project funded by the Regione Piemonte (Italy), managed by Finpiemonte and promoted through the Promoter Board of Piedmont's Aerospace District. It is also co-funded by European fund for regional development (F.E.S.R.) within the regional operative program 2007/2013.
SMAT main objective is to define, design and develop an Advanced Environment Monitoring System, based on Unmanned Air Systems (UAS)

The system will be able to cover different potential needs, such as:

- Surveillance of areas subject to natural disasters (landslides, floods, earthquakes, fires)
- Border patrol
- Surveillance of areas subject to human intervention.
- Specific areas monitoring for prevention purposes
- Territory surveillance for planning purposes
SMAT is organized into three segments: aerial, ground and communications. Its architecture will be integrated with the existing surveillance network.

**SMAT main components**

**Aerial Segment**
- Innovative UAV platforms:
  - Molynx
  - Falco
  - D-Fly
- Payloads (e.g. EO/IR, hyperspectral, radar, ...)

**Ground Segment**
- Control Stations
- Supervision and Coordination Station

**Communications**
- Wireless (data-link)
- Landlines and control centres
**SMAT - Main Components Functionalities**

**Molynx** – surveillance of wide areas at high altitude and high speed

**Falco** – monitoring of limited areas at medium altitude (above/below clouds) and medium speed, rapid intervention, possibility to monitor a single point

**D-Fly** – rapid dislocation and possibility to hold over a critical point at very low altitude and speed, acquiring high resolution data.

**GCS** – Controls the aircraft, plans the route; performs a first data analysis. Transmits data to SSC

**SSC** – Performs a further data analysis received by GCS. Disseminates data to Operative Centres. Transmits mission data to GCS

**Operative Centres** – Centres already present on the territory
SMAT – Operational View
SMAT - Technologies

• Integration of a complex and distributed system
• Autonomous Flight
• High altitude and high endurance flight
• Diesel/Hybrid Propulsion, power generation system at low impact on the environment
• Innovative materials
• Advanced SW and HW systems to control the mission and the flight
• Navigation systems based on EGNOS/Galileo
• Advanced Remote sensing Sensors
• Advanced Communication Network
SMAT-F1 is the first phase of the wider SMAT project

Phase 1: UAS, SSC Integration

Phase 2: Functional System DEMO

Phase 3: Prototype design and dev.

Phase 4: Industrialisation
SMAT F1 – Objectives

• General Objective

Demonstrate the integration of the three UAS with the Supervision and Coordination Station (SS&C)

• Specific Objectives

  – Define system requirements and system architecture
  – Design and develop the SS&C
  – Integrate the UAS with the SS&C
  – Demonstrate the system operability by performing a specific mission
SMAT F1 - Platforms

SMAT Platforms

Molynx

Falco

Falco

D - Fly

Sky - Y

C - Fly

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Aerial segment:
- Demonstrator and prototype platforms:
  - Sky – Y
  - Falco
  - C - Fly
- Real time communications
- Proper remote sensing sensors

Ground segment:
- Ground Control Stations with proper links to SS&C
- SS&C: Monitoring of the information received from the three GCSs
- SS&C: Limited mission control
- SS&C: Limited data fusion capability
- SS&C: Representative Hardware
- SS&C: Representative HMI
- SS&C: Preliminary Housing

Communication segment:
- Commercial Links
SMAT F1 - Stakeholders

Finpiemonte/ Regione Piemonte

Working Group

- SME
- Big industry
- Technology

Potential users: Protezione Civile, Guardia di Finanza, ..

Certification authority: ENAC, ENAV

- Axis
- Auconel
- Blue group
- Carcerano
- DigiSky
- Envisens
- Nautilus
- Nimbus
- Sepa
- Spaic
- Synarea

Banks

university
Research Centres

ISMB
Polito
Unito

Big industry

Alenia
Selex Galileo
Altec
SMAT-F1 Workshare

- Big Industry: 64%
- SME: 25%
- University/Research Centres: 11%

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SMAT F1 - Project evolution Process

1. USERS NEEDS
2. SCENARIO AND SERVICES
3. SMAT ARCHITECTURE AND CONOPS
4. USERS NEEDS ANALYSIS
5. SMAT ARCHITECTURE AND CONOPS DEFINITION
6. SYSTEMS REQUIREMENTS (UAS & SSC)
7. SUBSYSTEMS REQUIREMENTS
8. ARCHITECTURE MODEL
9. MANUFACTURING AND ASSEMBLING DOCUMENTATION
10. COMPONENTS VALIDATION
11. SMAT F1 LIMITATIONS
12. SMAT F1 ARCHITECTURE AND CONOPS
13. SMAT F1 SYSTEMS DEFINITION
14. SMAT F1 SUBSYSTEMS DEFINITION
15. SMAT F1 SYSTEM INTEGRATION
16. SMAT F1 SUBSYSTEM INTEGRATION
17. SMAT F1 VALIDATION
18. SYSTEM VALIDATION (UAV & SSC)
19. SUBSYSTEM VALIDATION
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SMAT F1 – First Results

The following interviews have been performed to investigate the potential users needs:

- Government agencies and offices
- Private Industries
- Armed Forces
The needs, raised from the interviews, have been mapped into three reference scenarios, as reported below:
At present, System Architecture and System Requirements definition is on-going using the previously described scenarios and operational requirements.

Moreover a Simulation Environment has been generated in order to simulate the three identified scenarios with the objective to validate the system concept and architectural model.
SMAT F1 demonstration will be performed through the execution of a surveillance mission during which the three UAS will jointly carry out the monitoring tasks.

An area located in the south of Piemonte has been identified as suitable for demonstration purposes. Within the area, civil air traffic is prohibited, except flights previously cleared and it is characterised by the following features judged relevant for the project:

- Mountains
- Hills
- Plain terrain
- Basins
- Agricultural Areas
- Industrial Areas
- Freeways
- Railways

As shown in next slide, inside the area, specific objects (3 bridges, 2 stretches of rivers and a fielded area) relevant for monitoring mission have been identified. Each monitoring task of SMAT-F1 primary mission has been assigned to one UAS component, on the basis of the main UAS characteristics.
The possibility to implement the SMAT F1 mission as proposed has to be agreed with certification authorities.

In particular, the possibility to operate the UAS within the selected test area is pending certification authorities acceptance.

In the framework of WP7, the procedures and the evidences necessary to obtain the permits to fly in this area will be defined and will be proposed and agreed with the certification authorities.