SMAT Project

Sistema di Monitoraggio Avanzato del Territorio (Advanced Environment Monitoring System)

May 13th 2009





SMAT Project









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 - Objective



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 - Architecture



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-Flv

Payloads (e.g. EO/IR, hyperspectral, radar, ...)







Control Stations

Supervision and Coordination

Station







- 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

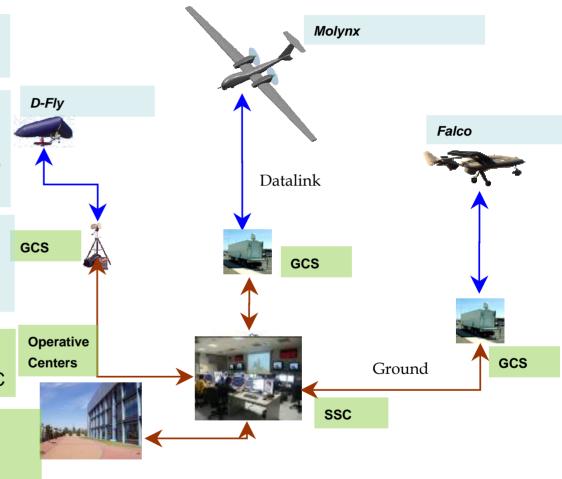
D-Fly – rapid dislocation and possibility to hold over a critical point at very low altitude and speed, acquiring high resolution data.

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

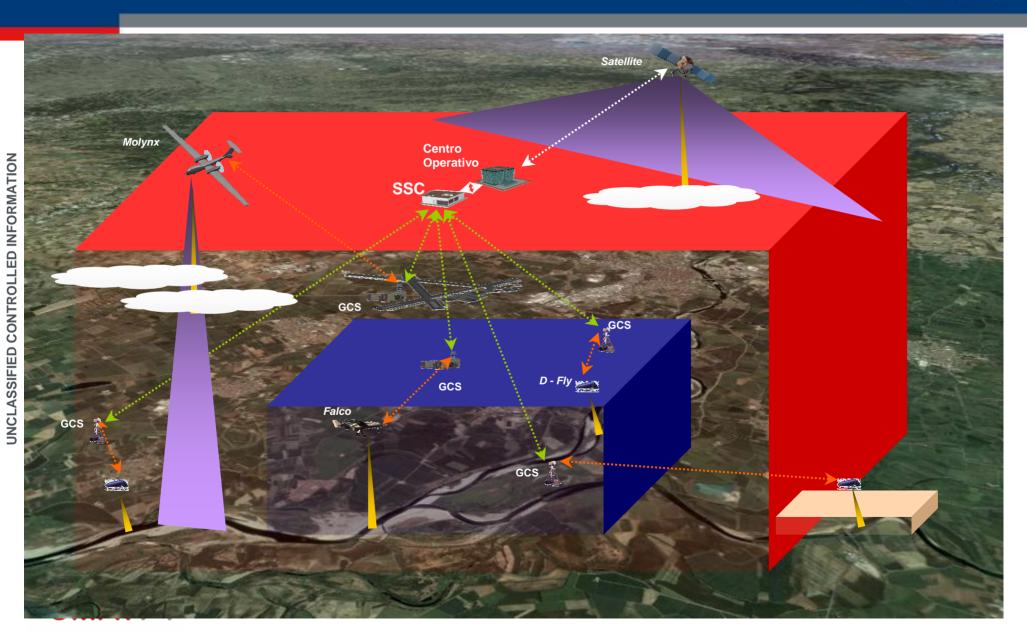
Operative Centres –Centres already present on the territory





SMAT - Operational View





SMAT - Technologies



Integration of a complex and distributed system

Autonomous Flight

UNCLASSIFIED CONTROLLED INFORMATION High altitude and high endurance flight

Diesel/Hybrid Propulsion, power generation system at low impact on the environment

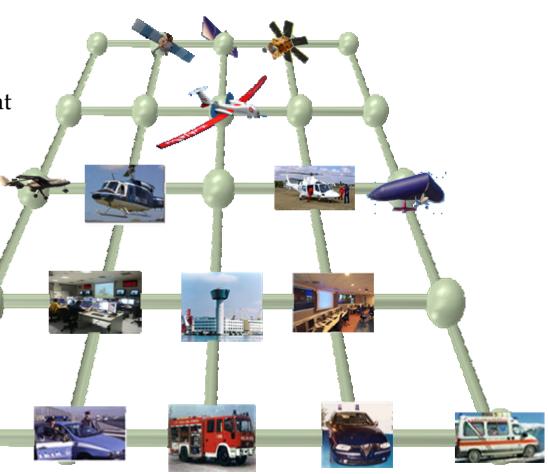
Innovative materials

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

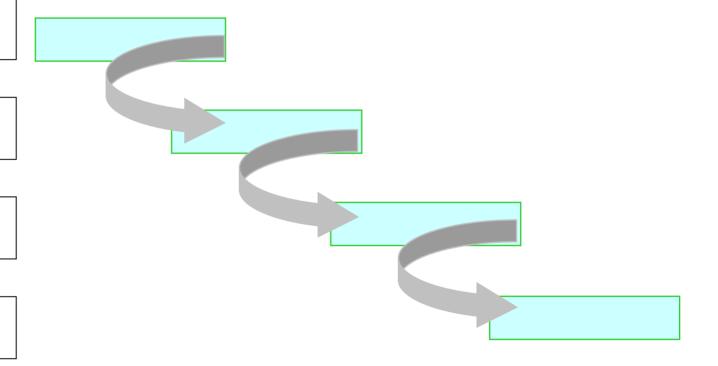
Phase1: UAS, SSC

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



SMAT F1 Platforms

Sky -Y



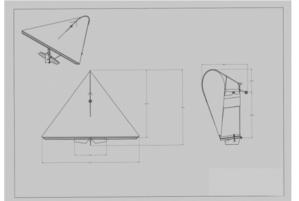
D - Fly

SMATF1





Falco



C - Fly

SMAT F1 - Components



Aerial segment:

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

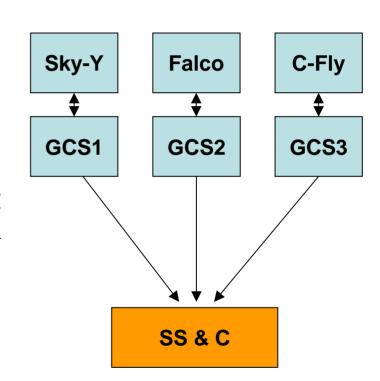
Ground segment:

- 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





Finpiemonte/ Regione Piemonte

Working Group

Research technology

technology

ISMB

Centres

Polito

Unito

Big Big industry industry

Alenia

Selex Galileo

Altec

Axis

Auconel

Blue group

Carcerano

DigiSky

Banks

Envisens

SME

Nautilus

Nimbus

Sepa

Spaic

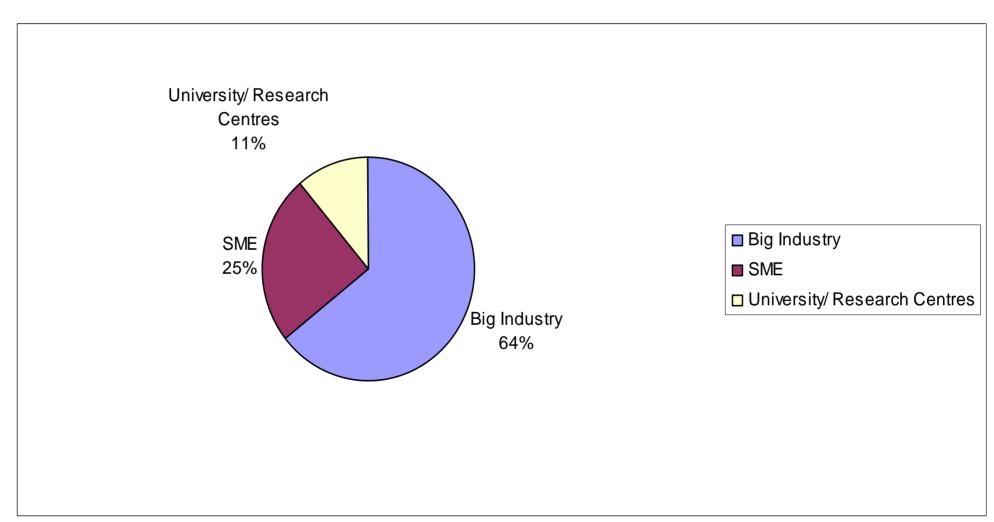
Synarea

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

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SMAT-F1 Workshare

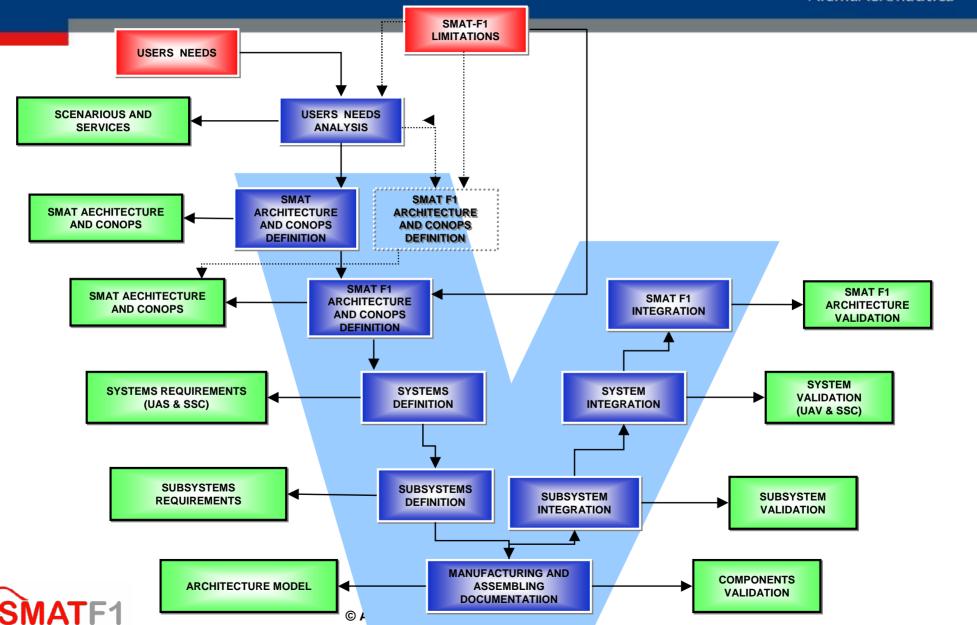






SMAT F1 - Project evolution Process





UNCLASSIFIED CONTROLLED INFORMATION

SMAT F1 - WBS and Schedule



| WP-Tasks | Description | | 2009 | | | | | | | | | | | 2010 | | | | | | | | | | | 2011 | | | | | |
|------------|--|--|------|---|---|---|-----|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|-----|
| | Description | | F | M | A | N | 1 J | J | A | S | О | N | D | J | F | M | A | M | J | J | A | S | О | N | D | J | F | M | A | M J |
| WP1 | Scenarios Analysis/ Technologies | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WP2 WP3 | Requirements and Architecture definition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WP3 | SS&C and UAS definition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WP4 | GCS's and SS&C Interface design and dev. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WP5 | Integration | | | | | | | | | - | | | | | | | | | | | | | | | | | | | | |
| WP6 | Assessment | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WP7 | UAV Airworthiness | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WP8 | Technology Transfer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WP9 | Coordination | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



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

- Government agencies and offices
- Private Industries
- Armed Forces



SMAT F1 – First Results Operational Scenarios



The needs, raised from the interviews, have been mapped into three reference scenarios, as reported below:

Coastal water Regional Flood Pollution Monitoring Scenario Scenario Scenario Monitoring of Detail mapping of project Monitoring sites in Control of the traffic safety chemical water sites for environmental large-scale in case of natural disaster pollution impact assessment (EIA procedures) Environmental inspection Supporting to the Communication network of landfill, dump sites for the Civil Protection in updating of maps and open pits case of natural disaster Supporting to Strategic Control of hazardous Environmental waste Images and data Assessment (SEA) through traceability communication in emergency conditions Control on the spreading Drafting an intervention at soil of animal plan - Civil Protection wasting sludge Monitoring of a Planning of a new road or flood event Control of the connected infrastructure traffic safety Supporting to air quality and weather modeling Info mobility network infrastructure monitoring High-voltage Electricity Transmission Grid Monitoring of Italian railway network





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 - DEMO Mission 1/2



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.

SMAT F1 - DEMO Mission 2/2



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.

