Promote the use of Satellite Navigation through Applications: Italian Initiatives

Mario Caporale
Director, Satellite Navigation Unit
Italian Space Agency
Contents

- Italian Space Agency
- ASI Navigation Unit
- Applications to promote the use of GNSS
  - Aeronautical Macro Project
  - Hazmat Macro Project
  - Maritime Macro Project
- Macro Project Technological Products
- Innovative Applications
The Italian Space Agency (ASI) is a government agency, founded in 1988, having the responsibility:

– to promote, coordinate and manage national programs and bilateral and multilateral cooperation programs

– to promote and support Italian scientific and industrial participation in the European Space Agency (ESA) programs, in harmonization with national programs

Italy's space related policies are devised under the National Space Plan (PSN) that ASI produces every three years
ASI Navigation Unit:

- Participates to the decisional and control committees and technical evaluation structures of European GNSS Programmes (EGNOS, Galileo)
- Promotes, supports and controls national projects, mainly focused on the pre-competitive development of applications related to satellite navigation

The **national projects** answer to a specific public demand:

**Increase the Safety in the Transport Sectors**

according to the National Space Plan polices and the objectives of the Italian Law (10/2001) that finances the initiatives
ASI is launching **Macro Projects** in Transport Application domains to:

- Give an immediate answer to the institutional operational needs, by means of innovative applicative solutions based on the Satellite Navigation Systems (GPS, GLONASS) present or available in a short time frame (EGNOS)

- Pave the way to the Galileo advent, developing the applications in perspective and starting preparing the national infrastructures to fully benefit of Galileo Services

- Experiment future services and components of Galileo to concur, along with other international initiatives, to the system consolidation process

### Italian Macro Projects

<table>
<thead>
<tr>
<th>Year</th>
<th>GPS</th>
<th>ESTB</th>
<th>EGNOS</th>
<th>Galileo – GSTB V2</th>
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Macro Projects Areas

- Aviation

- Hazardous Goods Transportation

- Maritime
Aeronautical Macro Project

- Support En-Route Air Traffic Management

- Monitor & Control Ground Traffic Movement at Airport

Applications:

- Satellite NAV/COM for Aeronautical Services (Surveillance, ATS, AOC)
- Satellite NAV for the Management and Control of the Ground Traffic at Airports

Involved Organizations (Potential):

- Italian Aviation Administration (ENAV, ENAC), Airport Operators and SPs, Airlines, Fire Department, Universities and Research Centres
Project Goals:

- Test and validate satellite NAV/COM services, based on the integration of EGNOS/Galileo and Satellite Communication, devoted to:
  
  - Detect and promptly notify any possible aircraft deviation from the planned route, especially outside the radars and terrestrial communication coverage
  
  - Make available, in real time, the aircraft flight data (position, speed and intended flight path) to the proper organizations (ATC units, CFMU, airports operators, Airlines, military ATC, etc.), regardless the relative aircraft location
  
  - Support the “free routing” in the airspace under the satellite coverage, without being constrained by the location of the terrestrial navigation aids
  
  - Enlarge the ATM SPs operational capability beyond the national borders, in order to operating flights wherever in the European airspace, with the aim at supporting the implementation of the European Single Sky
Satellite NAV/COM for flight services

**Services:**
- Navigation
- Surveillance
- ATS - Air Traffic Service
- AOC – Airline Operational Comm.

**Technology:**
- GPS/EGNOS/Galileo
- Artemis EMS/Inmarsat MSS
- Satellite Data Link System (SDLS)

**Users (Potential):**
- ENAV
- Airlines
- Eurocontrol CFMU (Central Flow Man. Unit)
- Airports
Satellite NAV for the management and control of the ground traffic at airports

A-SMGCS (Advance Surface Management Guidance and Control Systems)

Project Goals:

🔹 Promote the use of the satellite navigation technology for the management and the control of the surface movement of the aircrafts and service vehicles at the airports, to improve the safety and the efficiency in any weather condition

🔹 Test and validate concepts, requirements and technological solutions for the A-SMGCS, to contribute to the definition of national standards, subjected to a possible future regulation
Satellite NAV for the management and control of the ground traffic at airports

A-SMGCS (Advance Surface Management Guidance and Control Systems)

Services:

Surveillance:
- Detect the position of aircrafts and vehicles
- Compose the “traffic picture”, as a combination of information coming from cooperative (DGNSS) and non-cooperative (Radar, etc.) systems
- Give to the controller an elaborated traffic view, that includes the aircraft/vehicle ID

Routing/Planning:
- Support the surface traffic planning and the assignment of routes and schedules to the individual aircraft and vehicle, taking into account the current traffic, the constraints and the external planning schedules

Control:
- Assess the traffic situation and detect conflicts (runway incursions, taxi conflicts) Raise Warning/Alarm
- Prepare conflict resolution plans

Users (Potential):
- ENAV
- ENAC
- Airlines
- Airports
- Airport SPs
- Fire Department

Technology:
- GPS/EGNOS/Galileo
- GBAS – Ground Based Augment. System
- LAAS – Local Area Augmentation System
- Autom. Dependant Surv. - Broadcasting
- Updated Cockpit avionics
- Moving Map Display
Aeronautical Macro
Project

- *trajectory-based Services*, based on combined use of Satellite Data Link System (SDLS) and GPS/EGNOS/Galileo, for Air Traffic Control (in line with “ATM Strategy for the Years 2000+”) and Services to Flight Companies.

- *Take-off and Landing Services*, in airports, requiring high performances and extensive use of local augmentation of satellite navigation (GBAS CAT 1,2,3).

- *Surface movement in Airport services* (A-SMGCS), (runaways) to improve operational safety, in any environmental conditions.
Project Goals:
Develop a pre-operational **Wide Area System for Monitoring, Management and Control of Hazardous Goods (HAZMAT) Transportation** in multi-modal (road, rail, sea and inland waterways) transport

**Major Functions:**
- **Monitoring:** collection, processing and distribution of information to relevant users
- **Management:** use of information for planning purposes
- **Control:** optimisation of the transport operational aspects

**Involved Organizations (Potential):**
- Ministry of Transport
- Regional and Local Administration
- Civil Protection
- Fire Department
- National Red Cross
- Environment Protection Agency (APAT)
- Universities e Research Centres
**Knowledge & Prevention**

**Analysis:**
- Vulnerability
- Hazard

**Decision:**
- Prevention
- Mitigation

**Emergency**

**Analysis:**
- Damage (type, size)
- Emergency Response (potential)

**Decision:**
- Response
- Recovery
HAZMAT Macro Project
Pre-Event – Route Selection

- List of Dangerous Goods
- List of Transportation Systems
- List of Routes

Alternatives

Scenarios (Uncertainties)

Risk Assessment Models
Environmental Impact Models
Economic Models (Sustainability)

Consequence Assessment

Display GIS/Route Consequence

Decision Making Process

Stakeholders

- Health Impacts
- Environmental Impacts
- Benefits

Satellite Technology (NAV, TLC, EO)
HAZMAT Macro Project
Emergency Response

Satellite Systems
Navigation - EO
Mobile Communications
Command & Control

Location of Accident

Open-Architecture GIS-Based
Decision Support System
1. **Dangerous Goods Transport Knowledge & Prevention**
   - Transport planning
   - Dangerous Goods movement control
   - Knowledge & prevention (preparedness)

2. **Emergency Management Support**
   - Accident control & management
   - Damage mitigation
   - Field support system

Vehicle positioning control (instant by instant);
Dangerous Goods parameters monitoring;
Contingency routing management;
Continuous link between vehicles and Control Center;
Links between vehicles and Service centers;
Coverage according to the area of interest (local, regional,..);
Public Administration links (Civil Protection, Police, Fire Brigades, Hospitals);
Project Goals:

- Improve the **Safety of Navigation**
- Improve the efficiency of the administration in **Search and Rescue** and **Law Enforcement** at sea
- Develop and test the use of **EGNOS** (MTB, ESTB, EGNOS) for **maritime applications**, also with the aim at paving the way to the Galileo System
- Experiment the integration between Automatic Identification System (AIS) and Vessel Traffic System (VTS)
- Complement Dangerous Goods Services by the satellite navigation and communication technologies

**Involved Organizations (Potential):**

- Ministry of Transport
- Coast Guard
- Harbor Authorities
- Environment Protection Agency (APAT)
- Universities e Research Centres
- **Traffic Monitoring and Control Services**, to support current Vessel Traffic Services (VTS), based on the use of Automatic Identification System (AIS), with use of satellite navigation;

- **SEA MOTORWAYS Services**, to improve transport efficiency while increasing safety at sea, with the use of satellite navigation;

- **Search & Rescue Services**, significantly improved by GALILEO
Applications, for local, coastal and deep sea navigation:

- **Traffic Monitoring and Control**, in support to Vessel Traffic Services (VTS) already existing, based on AIS (Automatic Identification System), using newcoming satellite technologies (EGNOS and the future GALILEO)
  
  - Speriment the **integrity concept**, the signal guarantee, introduced by EGNOS and GALILEO while setuping a process of review of procedures and rules currently in operation, on the light of the technological enhancement induced by GALILEO
  
  - Analyse further the establishment of local elements networks, necessary for improve accuracy, from one side, and monitor signal interferences, from the other side
Support to Sea Highways, where the efficiency of transportation, which plays an important role to affirm this transport modality with respect to the terrestrial one, can proficiently use the satellite navigation

- Speed up of loading and unloading of goods in the harbours, guarantee of respect of arrivals and departures, not to waste the advantage deriving from fast ships. In this context the local elements play an important role in many aspects related with the port area.

Search and Rescue, which will be particularly enhanced by GALILEO, improving the performances of the current COSPAS-SARSAT System

- Improvement in the localisation of distressed people, the alert time will be dramatically reduced, giving back to the distressed people the acknowledge of the distressed message.
Pursuit Innovation through Research

- Navigation Local Components

- Technological Improvement for the Traffic Management Control Centres, in various transport modes

- New Terminals, for various transport modes (SW Radio, Ibrid., MMI, …)

- Service Centres (EO, Meteo,.. Contents Prod.)
Some application themes (as example):

- Satellite Navigation Support to Emergency Number 112
- Satellite Navigation Support to Local Meteo Forecast
- High precision movement monitoring by combined use of Satellite Navigation and Earth Observation
- Support to High Energy Cosmic Rays Research throughout Sparse matrices of simple detectors
- Network of Stratospheric Platforms for Traffic monitoring, Environmental Surveillance and Information Dissemination
- INDOOR Positioning and Localisation
- RTK Applications of Satellite Navigation