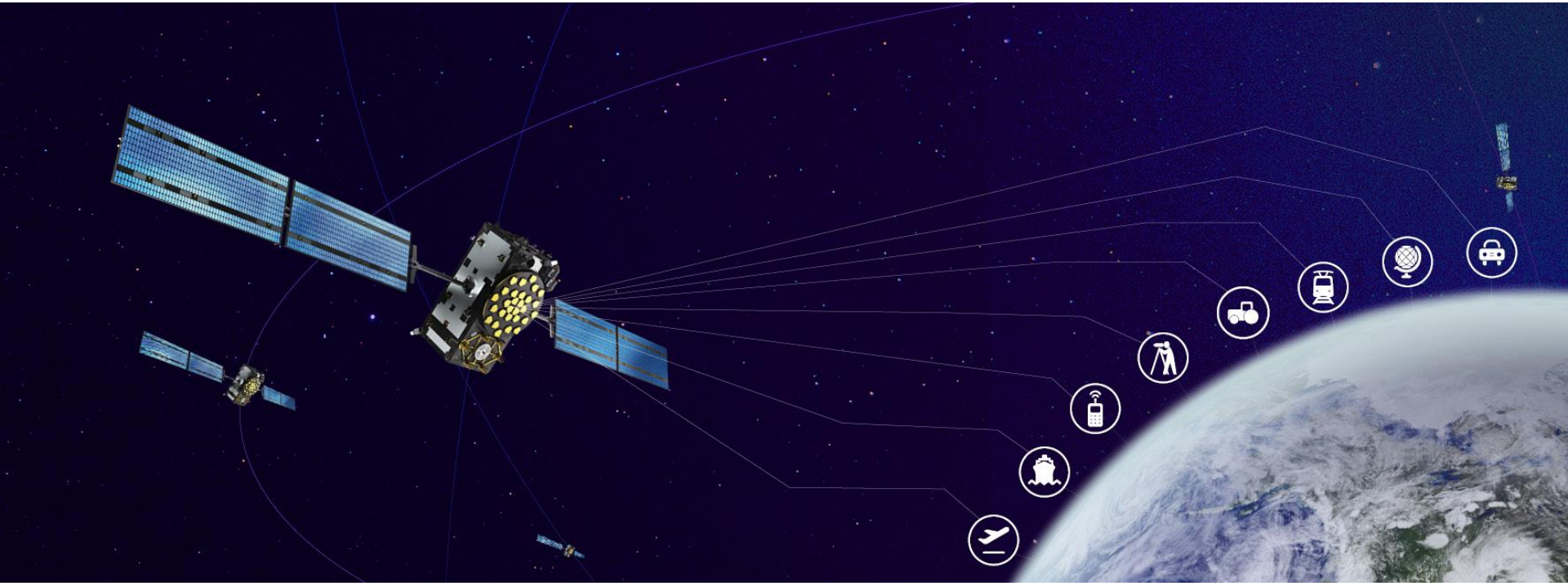


European
Global Navigation
Satellite Systems
Agency

GALILEO EGNOS
NAVIGATION SOLUTIONS
POWERED BY EUROPE

Opportunities for disaster management,safety, drones

Workshop “Deployment of Galileo and EGNOS in Portugal”

Alina Hriscu, Carmen Aguilera

21st September, Lisbon

Disaster management

GNSS/EO Synergies

Drone operations

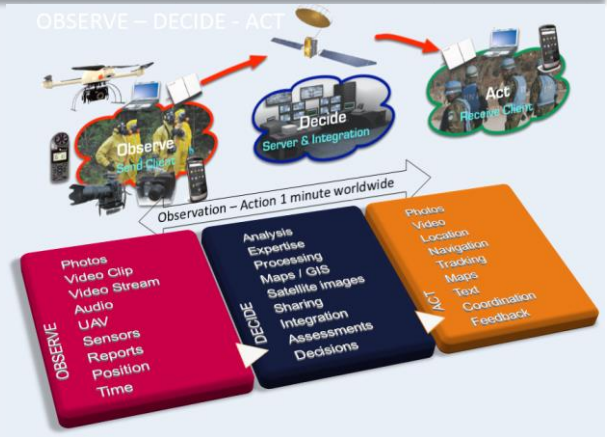
E-GNSS for disaster management

What is the general role for E-GNSS when it comes to disaster management. This is not clear to me

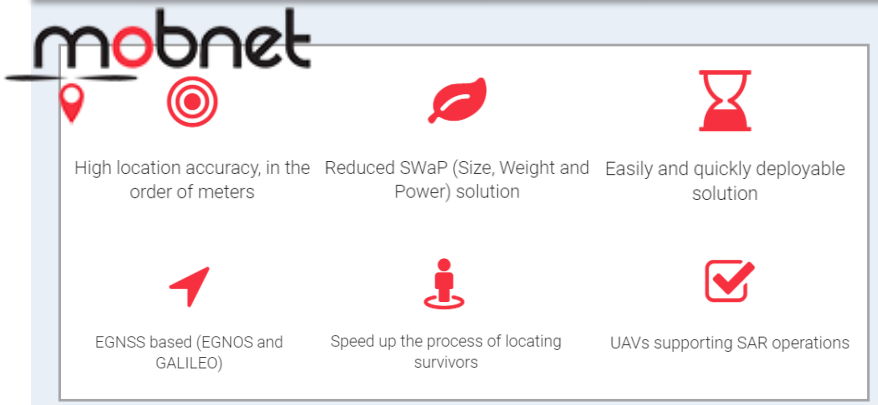
Examples of projects for disaster management

GEO VISION - GNSS driven EO and Verifiable Image and Sensor Integration for mission-critical Operational Networks

- GEO VISION provides users with situational awareness through interactive mission-critical **visual communications software solution**.
- Project is integrating geo-referenced visual data with **maps and geo-spatial space information** in a timely, seamlessly integrated, secure and user-friendly way.
- **Outputs examples**:
  - Smartphone applications: **UN ASIGN application for United Nations**, ASIGN Pro, UAV Pilot App
  - Live Maps for UN
  - ASIGN Field Client for PC



MOBNET - Mobile Network for people's location in natural and man-made disasters



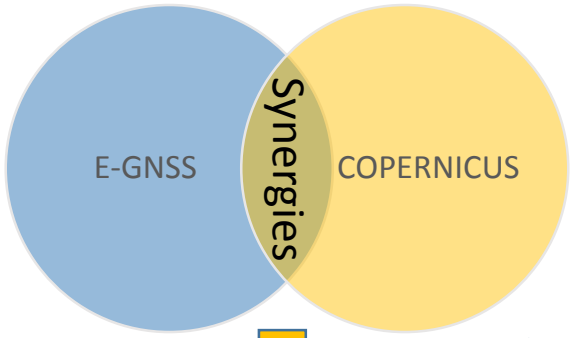
- The main objective of MOBNET is to **locate isolated victims**
- Uses of EGNSS and DCT (Digital Cellular Technologies)
- The feasibility will be illustrated by a **prototype demonstrator**, **integrated within UAVs**
- MOBNET's DCT module to detect trapped people will be an accurate solution that will offer great localization accuracy at **lower cost** and **lighter weight**. Furthermore, the MOBNET **Search and Rescue system** will have a faster speed of deployment than other solutions.

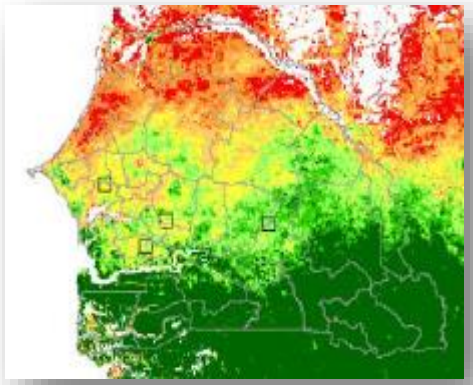
Disaster management

GNSS/EO Synergies

Drone operations

Synergies generated by joint use of E-GNSS and Copernicus by the applications





Galileo/EGNOS together with Earth Observation

Value-added applications

- **Agriculture**
- **Mapping & Surveying**
- **Smart cities**
- **Road transport**
- **Maritime navigation**
- **Emergency/crisis management**
- **Utilities**

Synergies of Copernicus and E-GNSS exist in different market segments

Copernicus Service	Segment	Example applications
Land (CLMS)		Biomass monitoring; Urban Planning; Monitor soil condition; Environmental management
Marine (CMEMS)		Fishery and living marine resources protection; Hydrographical, offshore Surveys; Sea polution control
Atmosphere (CAMS)		Environmental management; Natural Disaster management; Volcanic ash monitoring
Emergency (EMS)		Critical Infrastructures monitoring; Border surveillance; Crisis Management
Security		Border surveillance; Maritime Safety
Climate (C3S)		Volcanic ash monitoring; Coastal planning and restricted waters

Synergies with Copernicus support different applications: Examples

Example 1: VRT (Variable Rate Applications

- differentiated maps of the crops (future: soil moisture, health of crops, etc.).
- highly accurate positioning of machinery

- Precise application of the fertilisers, pesticides, etc., where and when they are most necessary
- Lower environmental footprint
- More efficient use of manpower

Example 2: GIS data collection

- Engaged to obtain the basic layer of maps
- Create additional layers and geo-referencing points of interest

- Mapping of infrastructures by utility companies
- Determine bounderies and land features by farmers, forestery and park managers
- Local authorities mapping park benches, street signs, underground water pipes, etc

Example 3: Smart Grids

- Grid infrastructure stability (superstructure, high-voltage transmission lines, other construction elements)
- Provide sub-millisecond coordinated timing

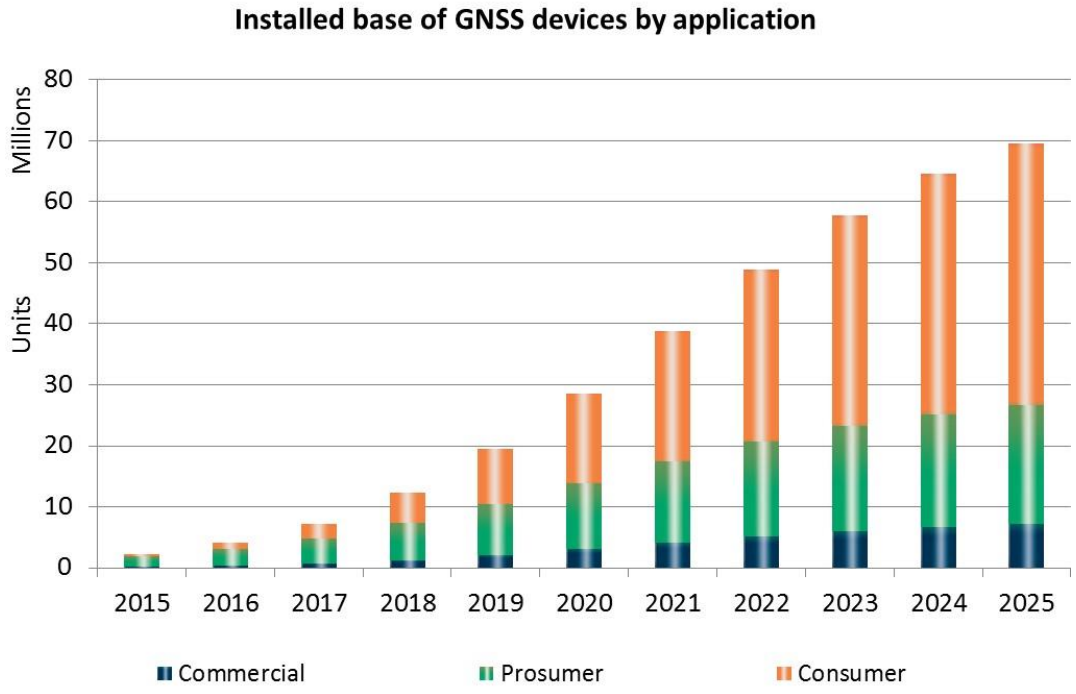
Accurate timing coordination essential to work efficiently and to synchronise different network operations

Disaster management

GNSS/EO Synergies

Drone operations

The drone market is booming!



- The number of drones is predicted to exceed all other aviation user groups combined, by an order of magnitude
- For most ambitious applications in BVLOS, GNSS is the only choice

E-GNSS benefits for RPAS and GSA activities



E-GN**SS for RPAS:**

- Increased accuracy, availability, integrity, and resilience against spoofing and jamming
- Authentication possibilities
- Geo-fencing applications
- Better time to first fix and acquisition sensitivity for TTFF

GSA activities:

- Contribution to a roadmap of harmonised implementation of drones in EU non-segregated airspace
- Participation in different working groups, and contribution to
- R&D support

RPAS Geofencing need robust navigation based on E-GNSS

Geo-Fencing: 'Virtual barrier' of a specific real-world geographic area or volume

- Radius around a point or location
- Predefined set of 2D/3D boundaries

Geo fencing for RPAS: Program airspaces/classes with suitable flight permissions

→ Send alerts to pilot/operator when RPAS approaches the restricted area

→ Program RPAS operation (e.g to automatically turn back) when approaching restricted areas

GeoFencing relies on GNSS: high accuracy and integrity is a must

EGNOS

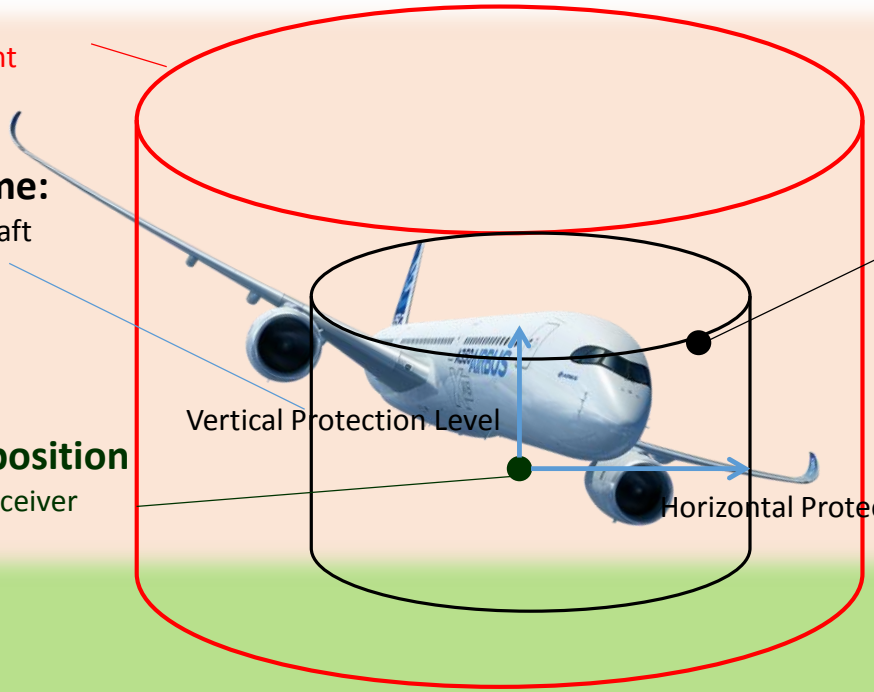
GALILEO

- High accuracy (Horizontal + vertical)
- Multi-Frequency Rx provide 2X availability, accuracy than GPS alone
- Integrity data (EGNOS)
- Worldwide availability (Galileo)
- Galileo Authentication = valid GNSS source
- Lightweight and integrated solutions available

EGNOS integrity = trust on the position source

Alarm volume:
Depending on the flight procedure

Protection volume:
computed by the aircraft with EGNOS



Aircraft True position
Unknown to the pilot

Aircraft estimated position
Obtained by the aircraft receiver EGNOS+GPS

Approach	HAL,VAL (m)	TTA (s)	IR (-/s)
APVI	40,50	10	10^{-7}/150
CATI	40, 10-15	6	10^{-7}/150

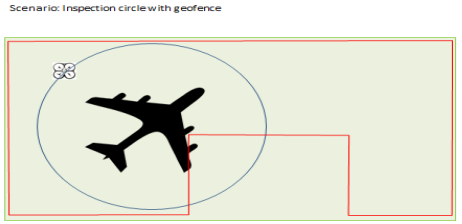
Ongoing test prove EGNOS and Galileo benefits for robust navigation and geofencing

1

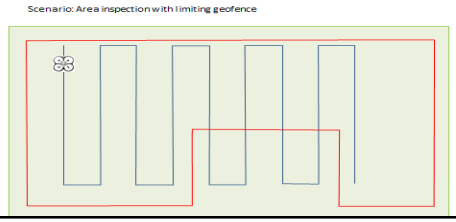
Precise take-off and landing on power substations

2

Geofencing test for aircraft inspection

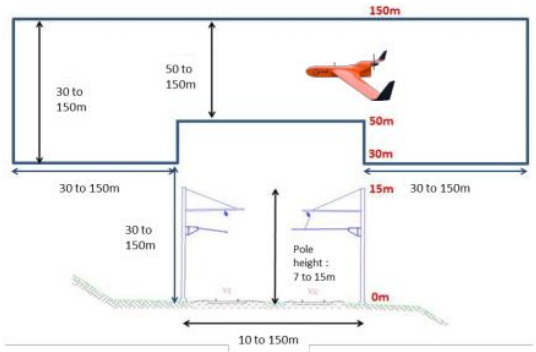


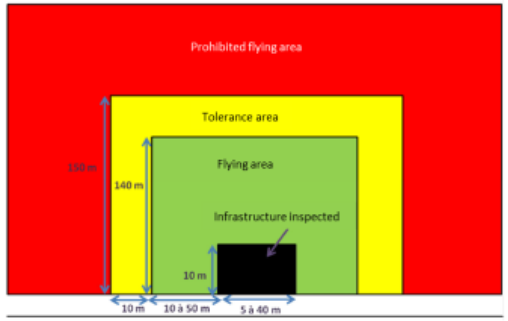
Geofencing in field surveillance



3

Railway inspection





GSA supported on-going RPAS projects

SkyOpener project

Consortium

Objectives

- Develop command and control link that uses communication through multi-band satellite and radio
- Develop detect and avoid functions based on GNSS and other satellite communications
- Develop complete (and scalable) system to manage the full operational process:
  - Starts with initial mission request by final customer
  - Ensures the RPAS management and ATM during all phases of flight
  - Focus on VLL operations
- Demonstrate developed systems with flight tests through e-TOD and LiDAR

→ Contribution to the definition of a system that tackles safety, security and privacy issues arising with the operation of RPAS in civilian airspace. Final goal is for economical, efficient and beneficial civilian applications made possible with UTM system operations.

REAL project

Consortium

Objectives

- Develop and integrate a navigation and surveillance sensor (EGNOS + ADS-B) in 2 different RPAS
- Develop CONOPS with supporting safety assessment for the approval of operations
  - Take-off and landing in VLOS
  - En-route/operational fase of flight in BVLOS
  - All operations will happen within RLOS
  - Demonstration will firstly be done in segregated airspace (Scenario 1) – if assessed positively trials in non segregated airspace (Scenario 2)
  - DAA not part of the safety case
  - ADS-B for surveillance & EGNOS for navigation
- Perform flight tests validating the navigation and surveillance functions
- Adapt existing flight procedure design criteria by considering RPAS specific performances

GSA supported on-going RPAS projects

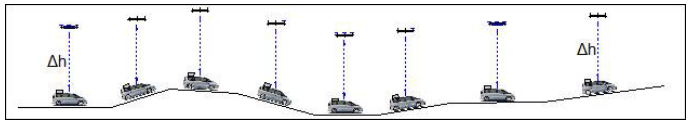
Mapkite project

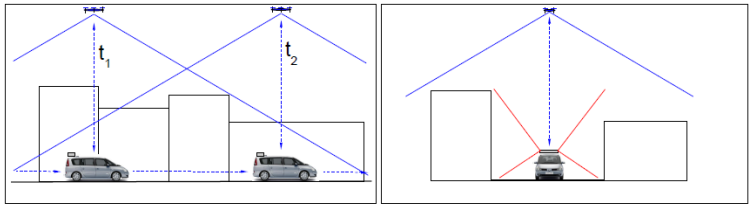
Consortium

GRID-IT, engemap geoinformação, geonumerics, unesp, EPFL École Polytechnique Fédérale de Lausanne, TopScan, CAT UAV, uavision, deimos engenharia

Objectives

- Build a mature E-GNSS enable prototype of a tandem terrestrial-aerial data acquisition system (Close range mapping, corridor mapping)
- Demonstrate services, and therefore the technical and commercial feasibility of this concept





Easy-PV project

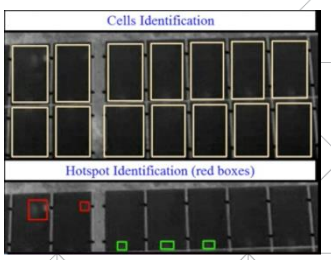
Consortium

Sistematica, Aalborg University, TopView Looking Over, entec, DEEPBLUE consulting&research, Alpha consult

Objectives

E-GNSS high Accuracy System improving PhotoVoltaic plants maintenace

- Provide real time and cost effective service as direct response to the growing need expressed by several maintainers and photovoltaic field owner to enhance the energy production of their plants
- Show the added value of E-GNSS high accuracy solutions for RPAS operations



Linking space to user needs

Get in touch:

www.GSA.europa.eu

EGNOS-portal.eu

GSC-europa.eu

UseGalileo.eu