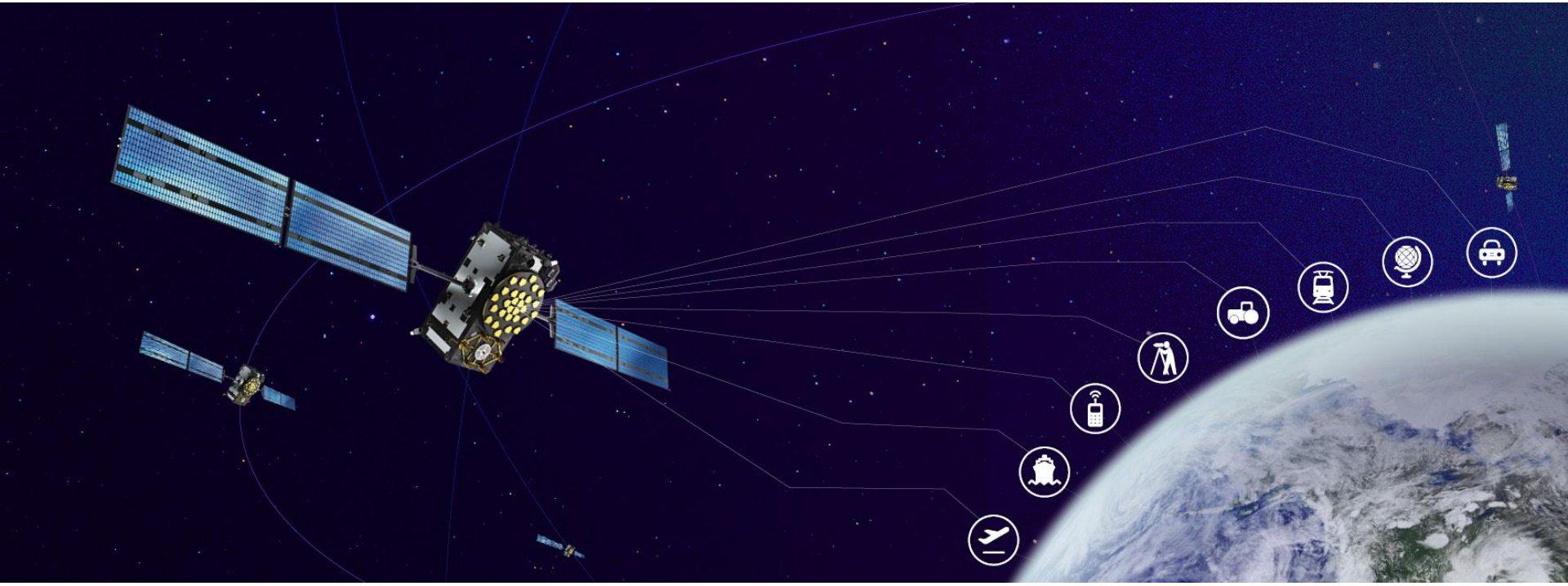

European Global Navigation Satellite Systems Agency

GALILEO EGNOS

NAVIGATION SOLUTIONS POWERED BY EUROPE

E-GNSS and Copernicus: Working together for sustainable development

Copernicus – Czech National User Forum

Gian-Gherardo CALINI
Head of Market Development
European GNSS Agency (GSA)

7 June 2018, Prague

Agenda

- European flagship space programs
- UNOOSA report on EGNSS-Copernicus application synergies for Sustainable Development Goals

- Examples of E-GNSS and Copernicus synergies

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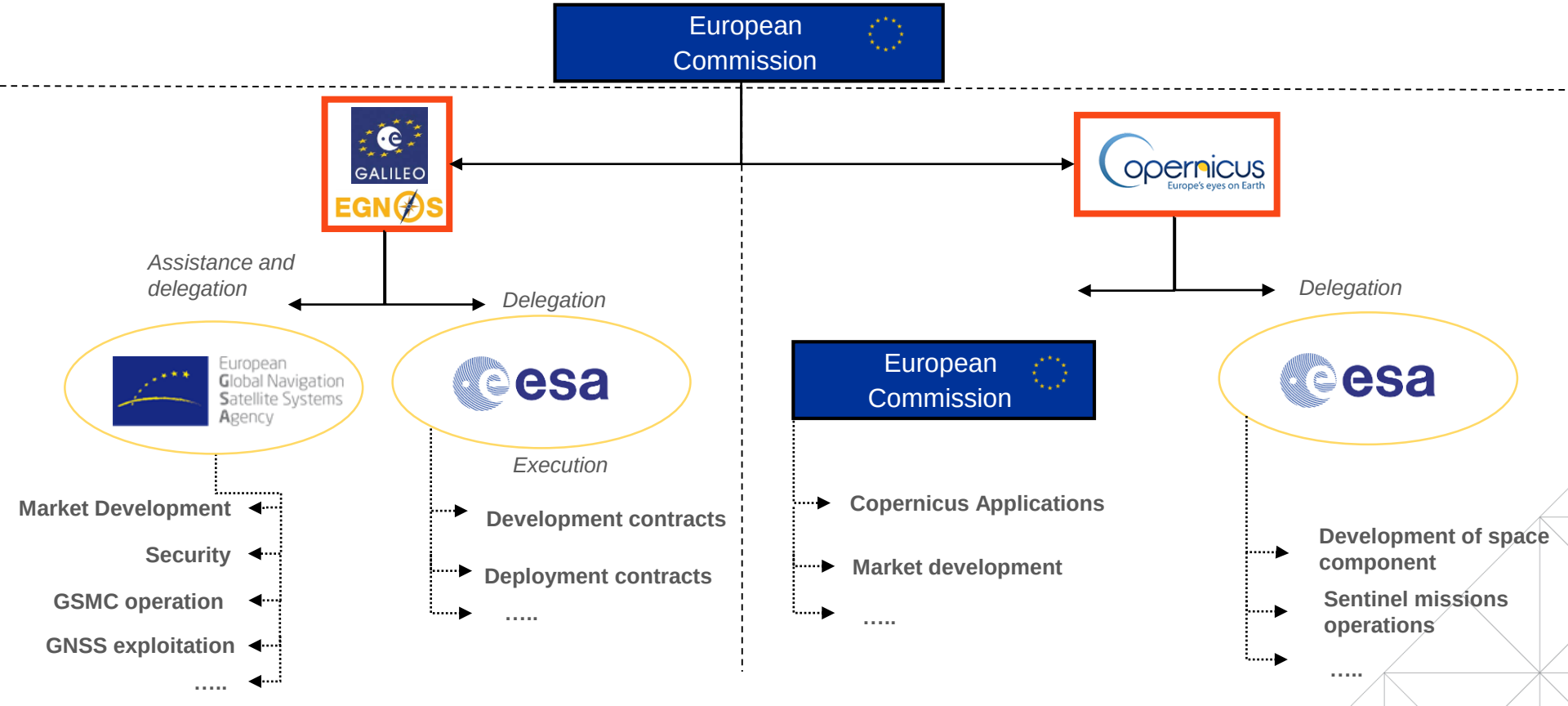
- Examples of E-GNSS and Copernicus synergies

European Commission is the owner of EGNOS / Galileo and Copernicus programs



EGNOS already available serving EU citizens and industry

- Accuracy ~**1m, free**
- Supporting **civil aviation operations** down to Localizer Performance with Vertical Guidance **(LPV)** minima, **compliant** with the **ICAO SARPs**
- Accuracy <1m, **corrections provided via internet**

Open Service (OS)

Safety of Life Service (SoL)

EGNOS Data Access Service (EDAS)

Galileo is the European GNSS offering a wide range of services

- **Freely accessible** service for **positioning, timing** and **navigation message authentication**
- **Encrypted service** designed for **greater robustness** and **higher availability**
- Assists **locating people in distress** and **confirms** that **help is on the way**
- **Freely accessible high accuracy** positioning service
- Authentication service **based on the E6 signal code encryption** and OS-NMA, allowing for **increased robustness of professional applications**

Open Service (OS)

OS-Navigation Message Authentication (OS-NMA)

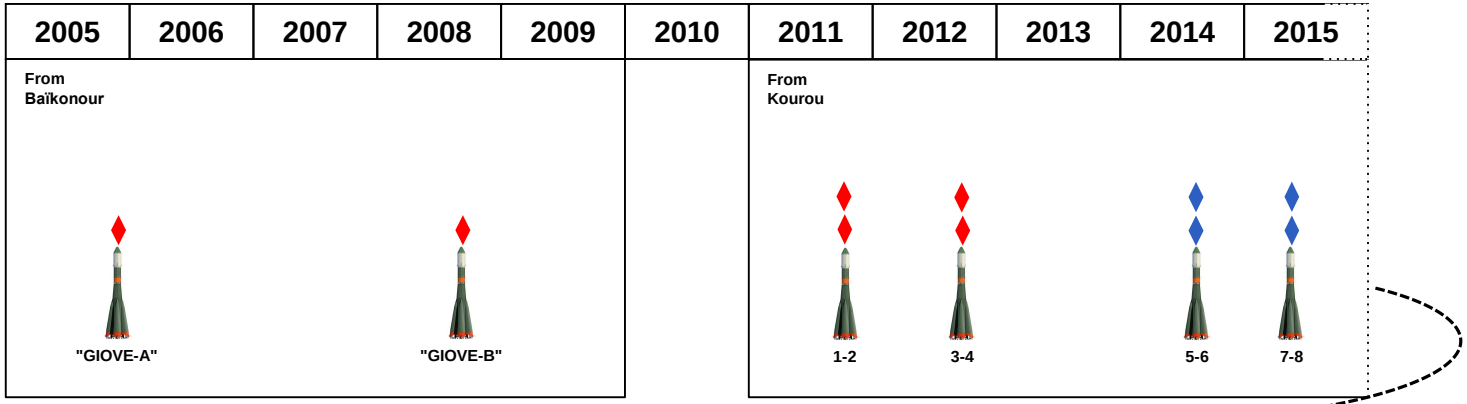
Public Regulated Service (PRS)

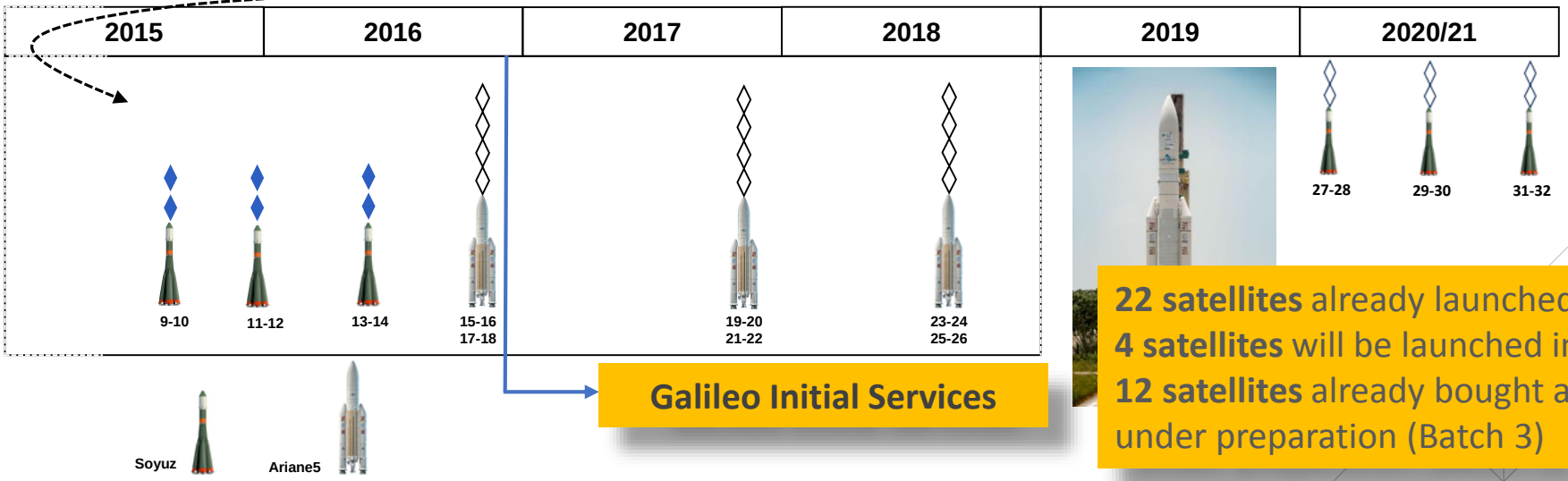
Search and Rescue Service (SAR)

High Accuracy Service (HAS)

Signal Authentication Service (SAS)

Galileo deployment is progressing





Galileo Initial Services

22 satellites already launched
4 satellites will be launched in 2018
12 satellites already bought and under preparation (Batch 3)

Synergies generated by joint use of EGNSS and Copernicus enable a wide range of applications

Application level

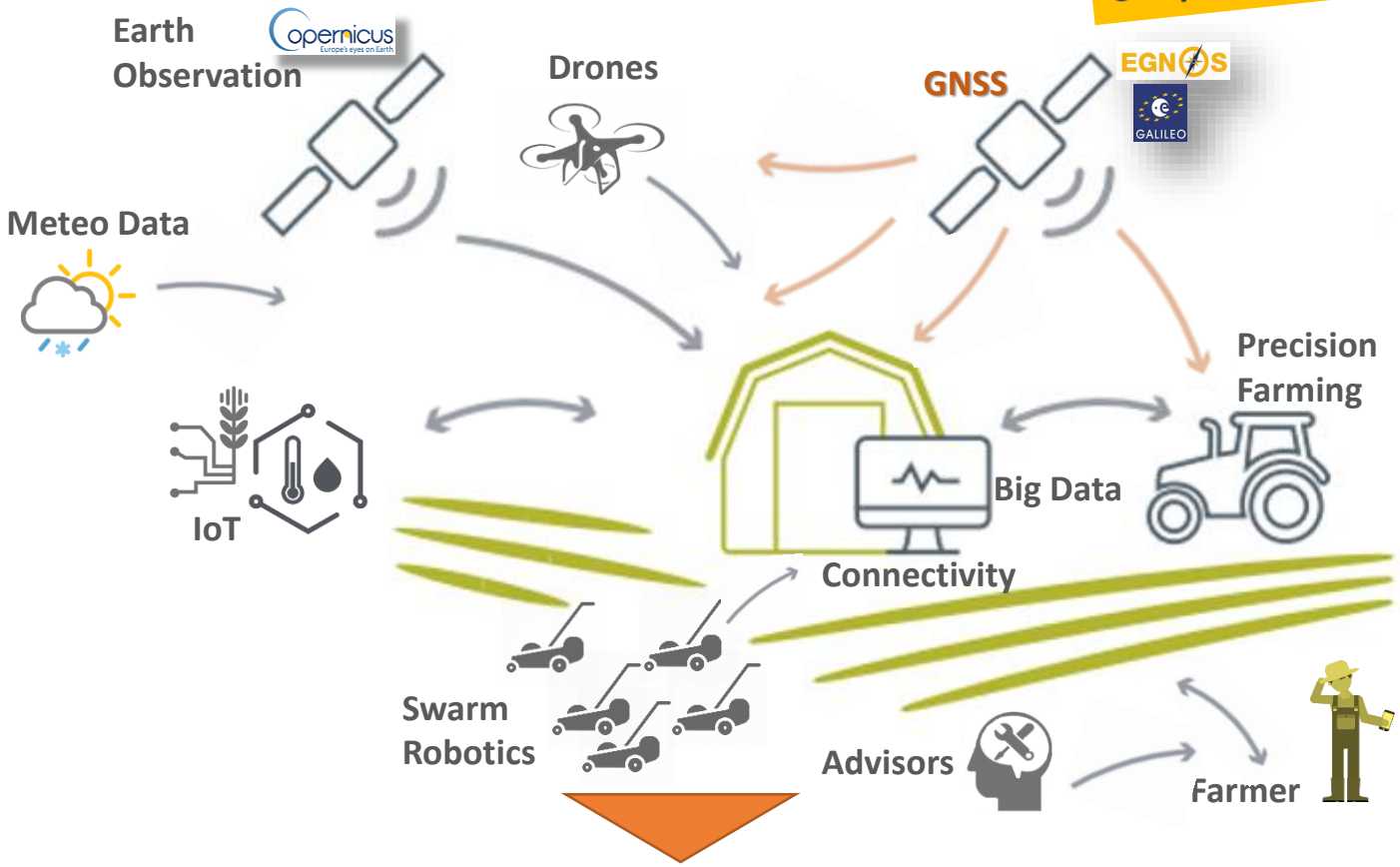
Examples of applications

Biomass monitoring	Urban Planning	Monitor soil condition
Fishery and living marine resources protection	Hydrographical, offshore Surveys	Sea polution control
Environmental management	Natural Disaster management	Volcanic ash monitoring
Critical Infrastructures monitoring	Border surveillance	Crisis Management
Border surveillance	Maritime Safety	Coastal planning and restricted waters

Value Added Applications

Copernicus Europe's eyes on Earth + GALILEO

EGNSS and Copernicus: together for the future digital farming ecosystem



Snapshot into the future

- Precision Farming
- Drones
- Swarm and Autonomous Machinery
- IoT

Synergies with Copernicus

GNSS is the core component or **complements other technologies** in **digital farming ecosystem** (e.g. **Integrated farming management system)**

Agenda

- European flagship space programs
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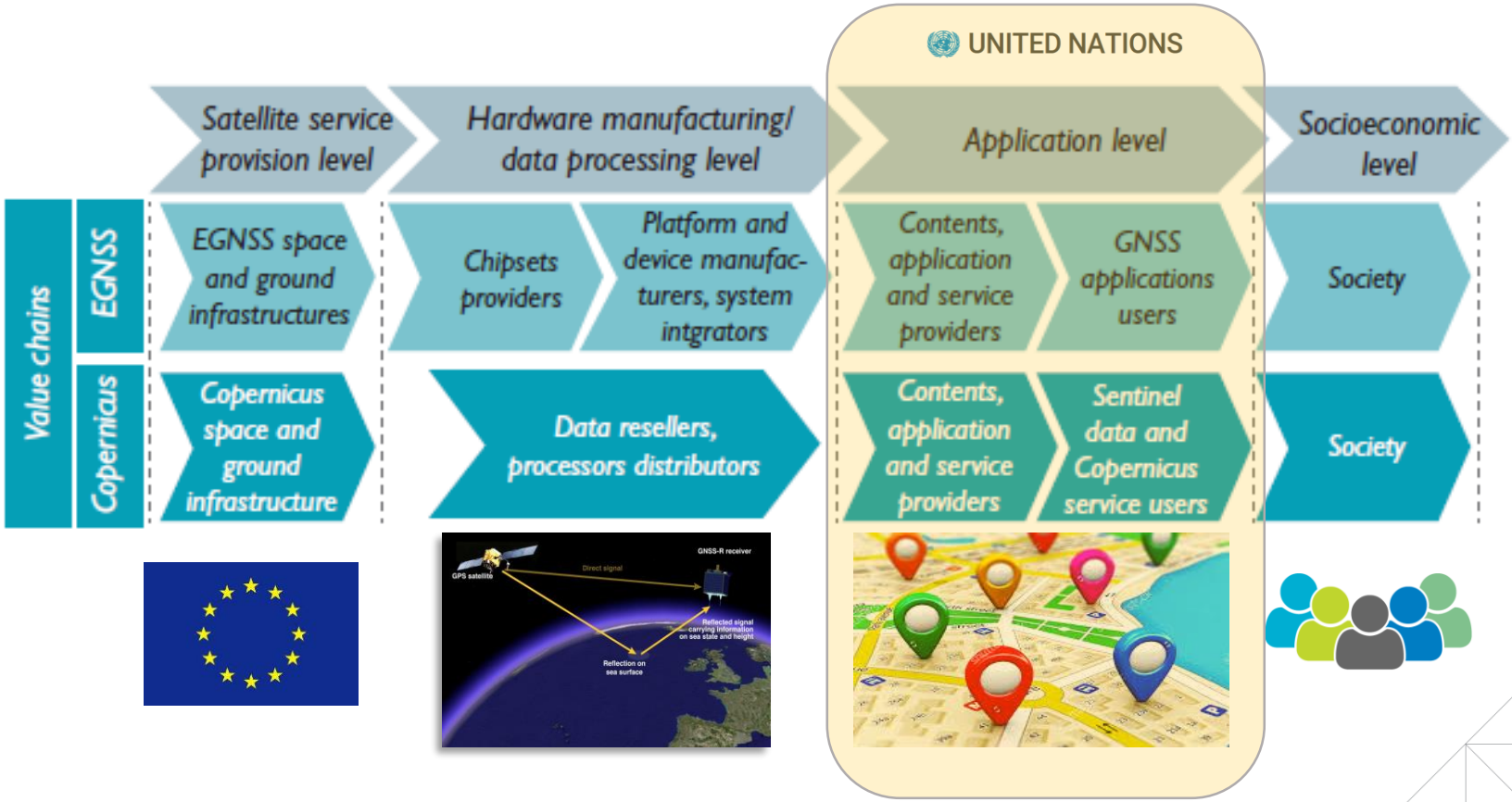
- Examples of E-GNSS and Copernicus synergies

European GNSS and Copernicus for sustainable development

UNITED NATIONS

- The UNOOSA study *"EGNSS and COPERNI*
  Supporting the Sustainable Development Goals.
  Building blocks towards the 2030 Agenda
  published in January
- Analyses the role of EGNSS and Copernic
  supporting the UN Sustainable Developm
- Stresses the potential of EGNSS-Copernic
  synergies stimulating innovation and incr
  the use of space technology

A wide range of application synergies between Copernicus and EGNSS could support Sustainable Development Goals



Agenda

- European flagship space programs
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- Examples of E-GNSS and Copernicus synergies

Example 1: GNSS-Copernicus synergies support optimal application of fertilisers

Agriculture: VRT (Variable Rate Applications)

- Differentiated maps of the crops: health of crops, vegetation index (NDVI)

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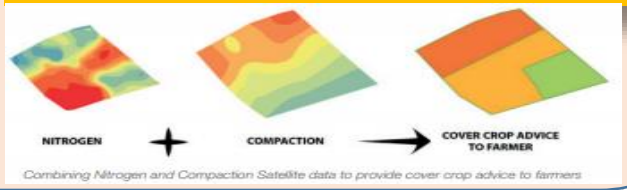
- Location-tagging of soil/plant samples
- Highly accurate positioning of machinery

Synergetic output

- Create a simple guide for farmers on how to best apply fertilisers and pesticides where and when they are most necessary

Benefit

- Lower environmental footprint

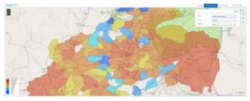


Combining Nitrogen and Compaction Satellite data to provide cover crop advice to farmers

Example 2: EGNSS-Copernicus synergies provide enhanced soil monitoring capabilities

Agriculture: Soil monitoring (humidity, sampling, etc.)

- Agricultural field's soil conditions (humidity, composition)
- Evaporation data



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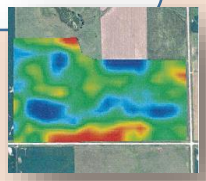
- In-situ measurements of soil parameters (e.g., moisture by GNSS reflectometry)
- Geo tagging local measurements for validation and calibration



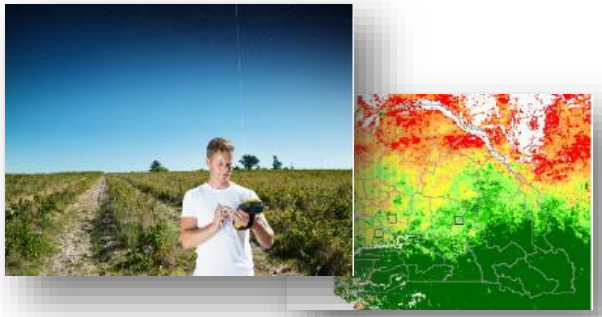
Synergetic output

- Metre and sub-meter level maps of soil parameters
- Targeted irrigations and treatments

Benefit

- Optimised water consumption

Example 3: EGNSS-Copernicus synergies support implementation of Common Agriculture Policy



Agriculture: Farmers' aid control within CAP

- EO used for control with Remote Sensing within Integrated Administration and Control System (IACS)
- Sentinel is very promising to support IACS processes

+

- Land Parcel Identification System (LPIS) purposes
- On-the-Spot Checks purposes of area based subsidies
- Geo-tagging application

Synergetic output

- Ensuring fair subsidies distribution

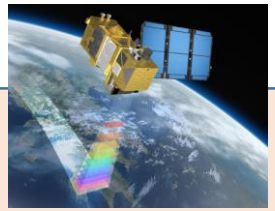
Benefit

- Control and verify farmers' aid applications in CAP
- Decrease the administrative burden

Example 4: EGNSS-Copernicus synergies can improve disaster management

Disaster management applications

- Data from disaster zones are collected



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- Micro drones used to map disaster zone
- Pictures of disaster zone sent by users
- Drones and users' images geo-referenced

Synergetic output

- Interactive solution that provides users with required situational awareness in disasters and emergencies

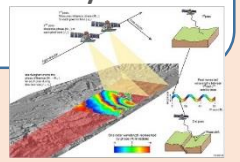
Benefit

- Faster reaction time
- Reducing the impact

Example 5: EGNSS and Copernicus help to monitor landslides

Landslides management applications

- Frequent, worldwide measurements of land masses displacements
- Detection of vertical displacements by In-SAR



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- E-GNSS antennas and receivers to register temporal interpolation and horizontal displacements

Synergetic output

- Monitoring of subsidence, tectonic changes or other environmental hazards

Benefit

- Supporting early intervention

Example 6: EGNSS and Copernicus contribute to smart cities

Urban planning & Mobility

- Monitor urban growth
- Urban green areas
- Land use and its evolution
- Detect illegal landfills
- Change detection

+

- Determine parcels and items such as utilities, infrastructures, etc.
- Understand the mobility habits of citizens (e.g. Traffic Flow Management)

Synergetic output

Enabling inputs for public authorities and spatial planners to design **smart cities**

- Urban planning
- Define new urban corridors
- Infrastructure & utilities monitoring

Benefit

- Traffic and resources optimisation
- Environmental protection
- Reinforce the law

Project examples and success stories

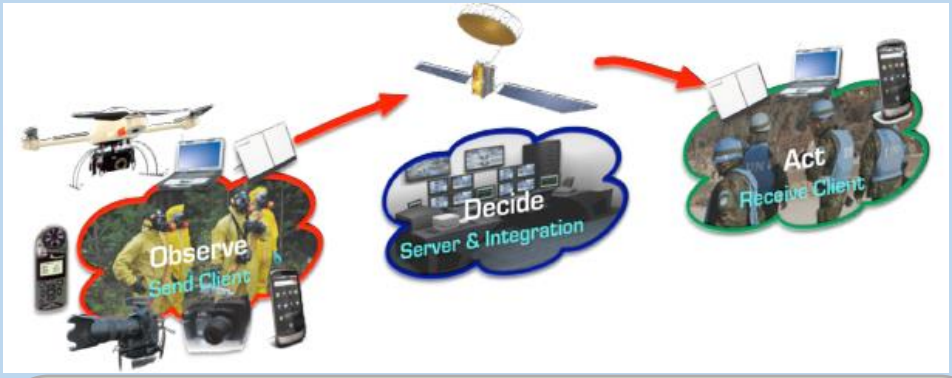
Products available

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

GEO VISION provides users with **situational awareness** through the interactive **mission-critical** visual communications software solution

- Maps and geo-spatial space information in a timely, seamlessly integrated, secure and user-friendly way.

- Geo-referenced visual data
- Guidance of intervention teams



Commercialized products:

- Software systems for mission-critical multimedia communications: **ASIGN, ASMIRA, and AIR.**
- 3 applications developed: UN-ASIGN, ASIGN Pro, Inmarsat-ASIGN

Customers:

- BASARNAS (SAR organization in Indonesia)
- IGAD (Intergovernmental Authority encompassing 8 countries in Africa)
- Oslo Police District

EU funds: 999,654 EUR

ANSUR (NO), D'Appolonia SPA (IT), UAB (ES), D.M.A.T. Consulting KG (AT), Johanniter Unfall Hilfe (DE), UN Institute for Training and Research

Project examples and success stories

Prototypes available

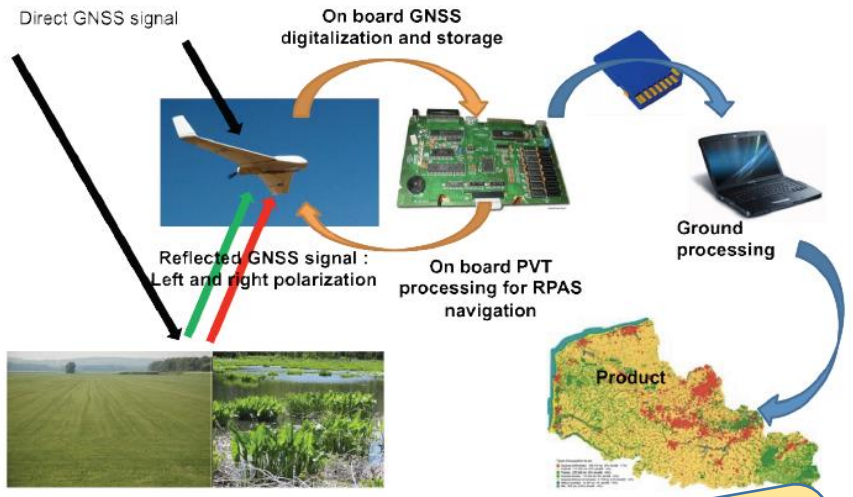
MISTRALE: GNSS for high-resolution humidity maps with high refresh rate

H2020

GNSS Reflectometry (GNSS-R) sensor embedded on a dedicated **Unmanned Areal System (UAS)** platform using the GNSS reflected signature

- full picture of the global soil moisture situation on a very large areas
- limited resolution
- no flexibility on the data refresh rate

- geo-location of in-situ sensors
- almost continuous measurements
- only on limited areas



EU funds: 2,599,246 EUR

M3 Systems (BE), ENAC (FR), Starlab (PT), CNES (FR), Aerovision (NL), L'Avion Jaunen(FR)

GNSS dual use: navigation and reflectometry

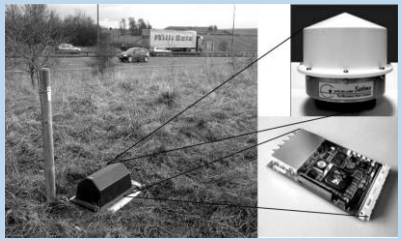
Project examples and success stories

Product under development

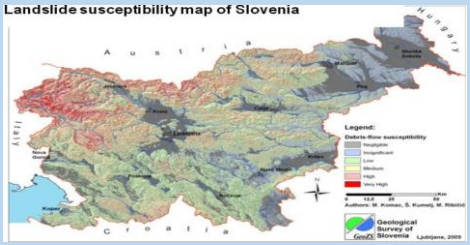
GIMS - Geodetic Integrated Monitoring System

Low-cost system based on EGNSS, Copernicus SAR and other in-situ sensors, for **monitoring ground deformations** with a focus on landslides and subsidence.

- **Vertical displacements** (via synthetic aperture radar interferometry InSAR)



- Horizontal displacements
- Temporal interpolation a
- Geo-localisation of the in-situ sensors



Features of upcoming products:

- Register deformations with millimetric level accuracies and daily acquisition rate
- Real-time alerts in case of sudden movements

I2GPS - Integrated Interferometry and GNSS for Precision Survey

EU funds: 1,714,237 EUR

Geomatics Research & Development (IT), Saphyrion (CH), Geonumerics (ES), CTTC (ES), Slovenja Geological Institute (SI), ComoNExT (IT)

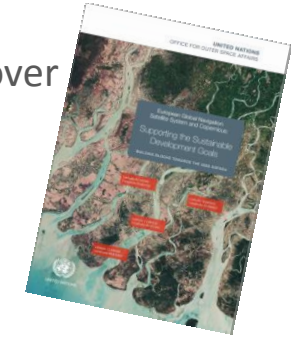
SMEs integrate EO, GNSS and other sources in customized solutions

Products available

UNITED NATIONS

A Polish software company*, offering customized solutions to enable smart cities, based on geospatial data

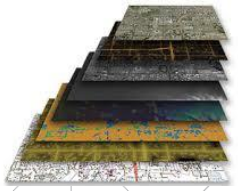
- ✓ The solutions are integrating geospatial data from Earth Observation and GNSS in:
  - ✓ monitoring and optimization of water supply in cities and regions
  - ✓ smart parking solutions
  - ✓ monitoring of air quality over cities



A Romanian start-up* that produces geo-referenced data providing solutions to farmers, city and land administrators

- ✓ Project portfolios range from determining flood areas and conducting preparatory studies for new infrastructure to 3D modelling for city planners and building companies

- ✓ Geo-referenced data is obtained using **EGNOS, Galileo and Copernicus** data in complementarity with other sensors (IMU, UAV, etc.)



* Presented SMEs should be understood as examples, names of the companies have been removed to ensure equal treatment.

Linking space to user needs

How to get in touch:

GSA Newsletter

GNSS YouTube Channel

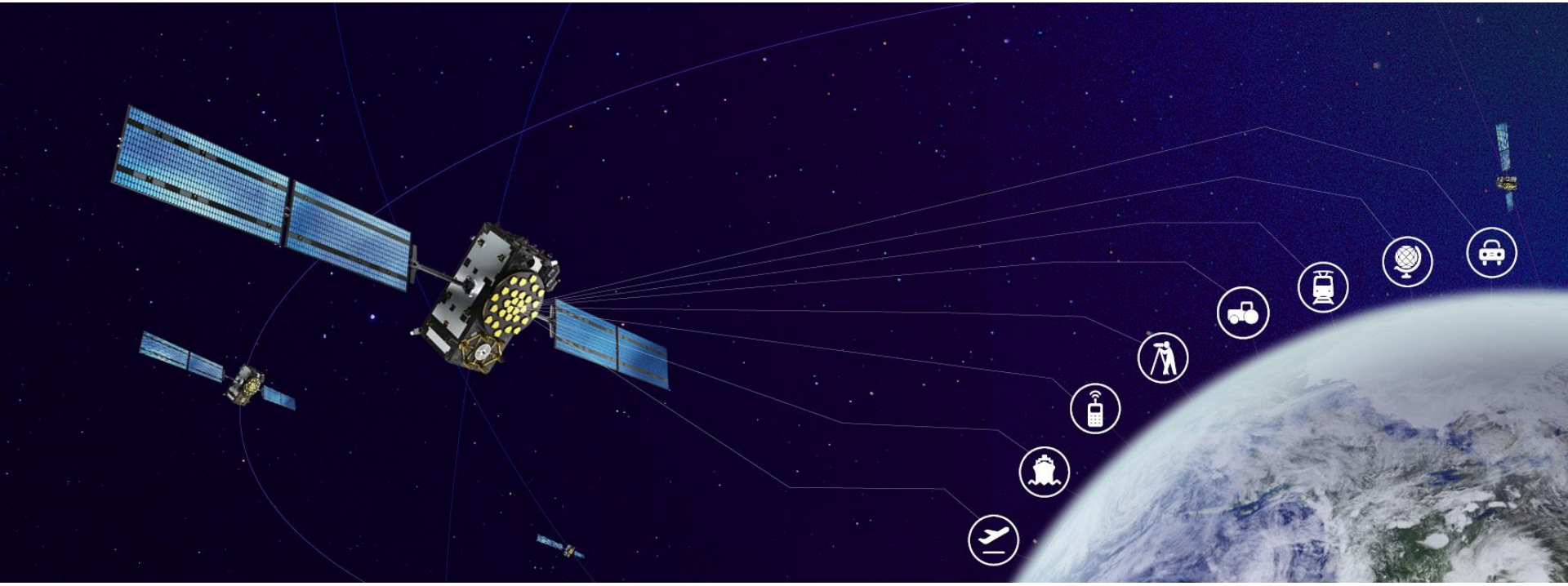
GSA Twitter - @EU_GNSS
EGNOS Twitter - @EGNOSPortal

European GNSS Agency LinkedIn Page
GNSS Market, Research & Development

GNSS Facebook page

GNSS Slideshare Page (presentations)

www.GSA.europa.eu



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Thank you!

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