EU Space programmes contribution to safe and efficient drone operations

OPTICS2 workshop

Carmen Aguilera, Head of Section Transport and operational market development

7th September 2021

EUSPA
European Union Agency for the Space Programme

GSA succeeded by EUSPA

On the 12th May 2021, the GSA succeeded by **the European Union Agency for the Space Programme (EUSPA)***

The user-oriented operational Agency of the EU Space Programme, contributing to **sustainable growth, security and safety** of the EU

*Established under the Regulation of the European Parliament and of the Council establishing the space programme of the Union and the European Union Agency for the Space Programme and repealing Regulations (EU) No 912/2010, (EU) No 1285/2013, (EU) No 377/2014 and Decision 541/2014/EU (EUSPA Regulation)

EUSPA – key tasks

Exploitation Manager of Galileo and EGNOS

- Management, operation, maintenance, improvement, evolution, and protection of infrastructure
- Continuous provision of services

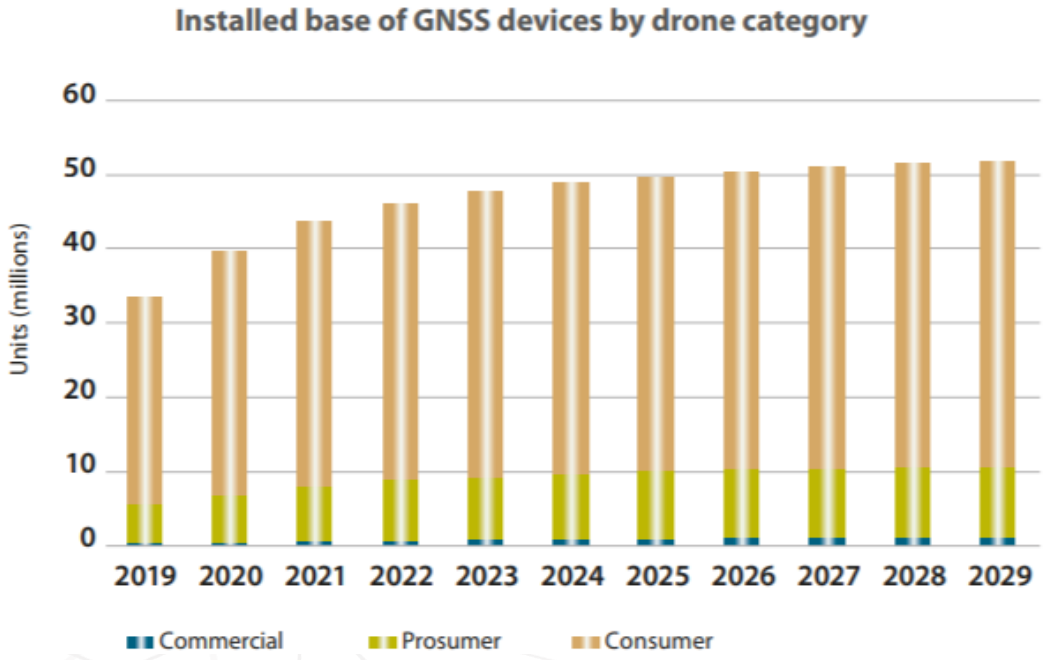
Gatekeeper of security, including

- Security accreditation of all programme components,
- Operational security of Galileo and EGNOS, and
- Operation of the Galileo Security Monitoring Centre

Market development, communications, user uptake, applications and innovation

- For Galileo, EGNOS, Copernicus, and GovSatCom

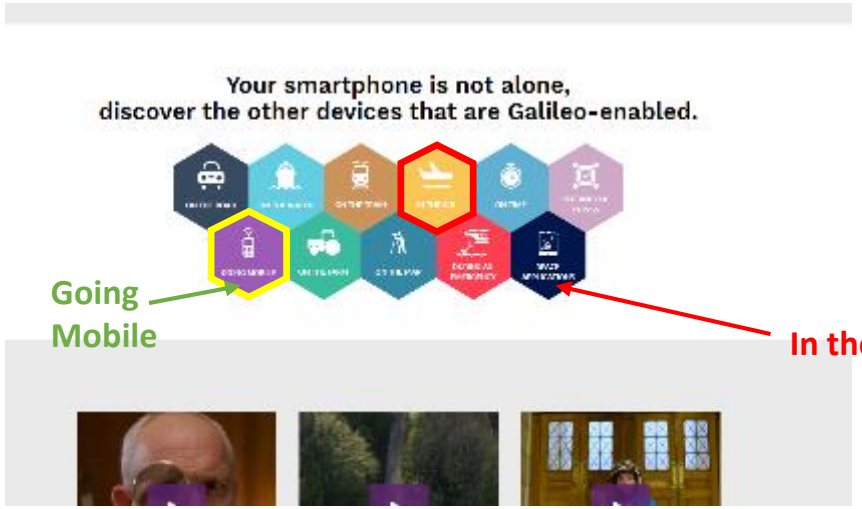
GNSS is a commodity for drone operations, not an option anymore



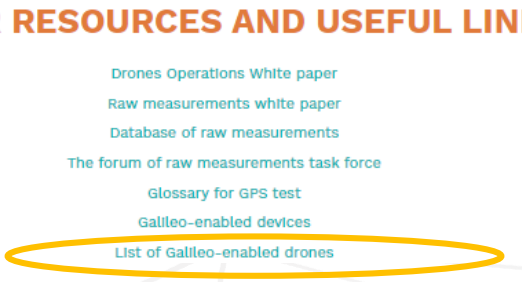
Market and technology trends

- Drones open **a new Global market** for receivers, applications and services
- **>30% of GNSS receiver models** for drones have Galileo/EGNOS inside
- **All use GNSS** and many GALILEO/EGNOS. GNSS is the only choice for demanding applications (e.g. Beyond line of sight)
- **Combining recent and/or disruptive technologies** : MEMS-inertial technology, mini GNSS receivers, digital cameras, aerial robotics

Galileo capable receivers are available in the market and most new drone platforms are equipped



www.gsa.Europa.eu/myGalileoDrone



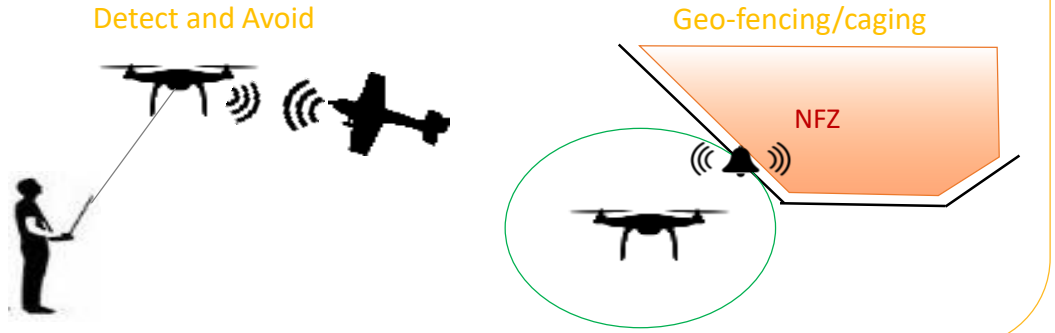
Why Galileo? EGNSS differentiators will support drone operations and implementation of U-Space

Availability

Enhanced performance in challenging environments

Integrity

Increased accuracy and integrity for UAS applications



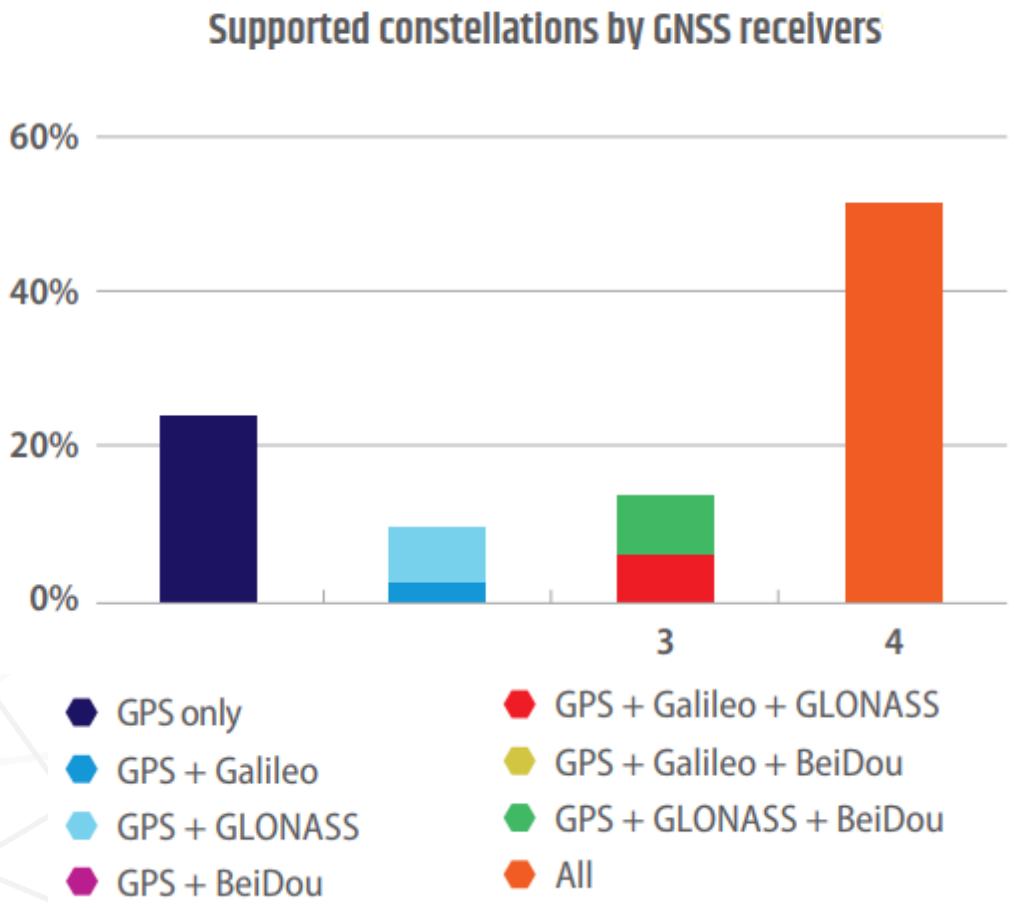
Accuracy

Unprecedented high accuracy for new demanding applications also in the vertical axis, supporting integration in the airspace

Authentication

Embedded cybersecurity features

1. Multi-constellation for better availability



Multi – constellation is already widely used in many applications

The popular way to provide multi-constellation support is to cover all constellations, which represents over 50% of receivers

Main benefits include:

- ✓ Increased availability
- ✓ Increased accuracy
- ✓ Improved robustness

GNSS User Technology Report
ISSUE 3 2020

Accuracy

Galileo HAS can improve the operation and safety of the drones in many application areas

Galileo HAS will provide Precise Point Positioning (PPP) based high-accuracy service with:

- **20 cm H and 40 cm V positioning accuracy**
- **Global coverage**
  - Faster Time-To-First-Fix for Europe
- **FREE of charge**
- **Corrections** disseminated via
  - **Galileo E6** (no need for internet)
  - **Internet** (dual-frequency)
  - **Open standard format** RTCM Compact-SSR

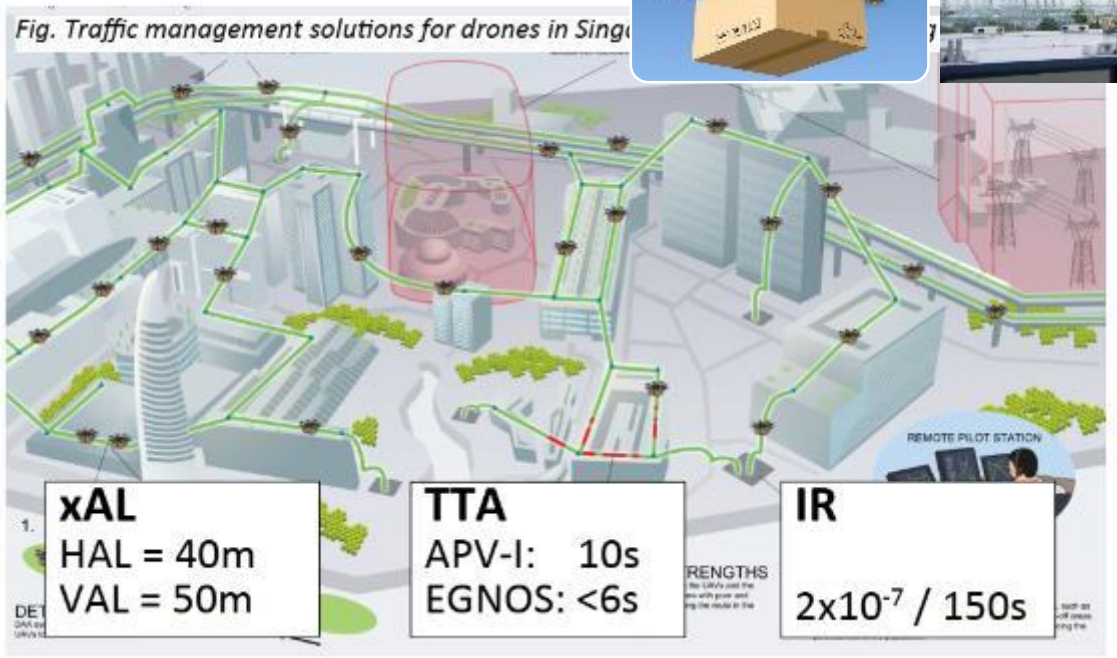
- **Disaster and emergency response**
- **Healthcare** *(e.g. medical delivery, disinfection, etc.)*
- **Urban Air Mobility**
- **Parcel delivery**
- **Infrastructure Survey and Monitoring** *(high-voltage overhead line, wind turbine inspection, solar panels, oil&gas pipelines)*
- **Mining** *(volumetric analysis, as-built survey, etc.)*
- **Marine Surveying** *(mapping of coastal areas and tidal mapping)*
- **Construction** *(documentation of construction progress, DSM/DTM, as-built survey, etc.)*
- **Cultural heritage mapping and monitoring** *(historical buildings and monuments)*
- **Cadastre surveying** *(orthophotos, illegal building detections, mapping, etc.)*
- **Environmental and Agriculture monitoring** *(assessing health of trees/forest, illegal dumping detection)*
- **Mapping** *(data for GIS, DSM/DTM,etc.)*
- **Real-Time traffic control**
- **Law enforcement**
- **Agriculture** *(spraying, NDVIs, crop monitoring etc.)*

3. Integrity provides a measure of trust on the position

xAL
HAL = 40m
VAL = 50m

TTA
APV-I: 10s
EGNOS: <6s

IR
$2x10^{-7}$ / 150s



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Ongoing definition of integrity levels for different operations and how EGNSS can meet them is ongoing

With Galileo authentication, users can verify that signal comes from a Galileo satellite and not from a potentially malicious source

Authentication

- **Data level**: Navigation Message Authentication

Integrated in the E1-B band for OS.
Aimed at consumer users and offered for free.
Already prototyped and under testing

"Navigation Message Authentication" is defined as the ability of the system to guarantee to the users that they are utilising **non-counterfeit navigation data** that comes from the Galileo satellites and not from any other (potentially malicious) source

Characteristics

- Contributes to **mitigate** a well known **GNSS vulnerability** (spoofing)
- Clear **differentiator w.r.t. other GNSS** available to the civil community
- Fully **backward compatible.** Does not affect users not interested
- Disseminated on the first Galileo frequency (**E1B**)
- **Open access:** asymmetric cryptography. No need to store secret keys in the Rx, just public key
- Long-term **cryptographically secure**

Building the future Urban Air Mobility with EGNSS

Why UAM?

- New solutions to respond to transport needs in cities
- Safe, quiet, sustainable and eco-friendly
- Opens new business opportunities

Why Galileo for UAM?

Increases availability in Urban Environment

High Accuracy and authentication for resilient navigation

DELOREAN

PildoLabs AIRBUS

Bauhaus Luftfahrt Neue Wege geonumerics

CATEC Correos

UNIVERSITAT POLITÈCNICA DE VALÈNCIA EUROCONTROL

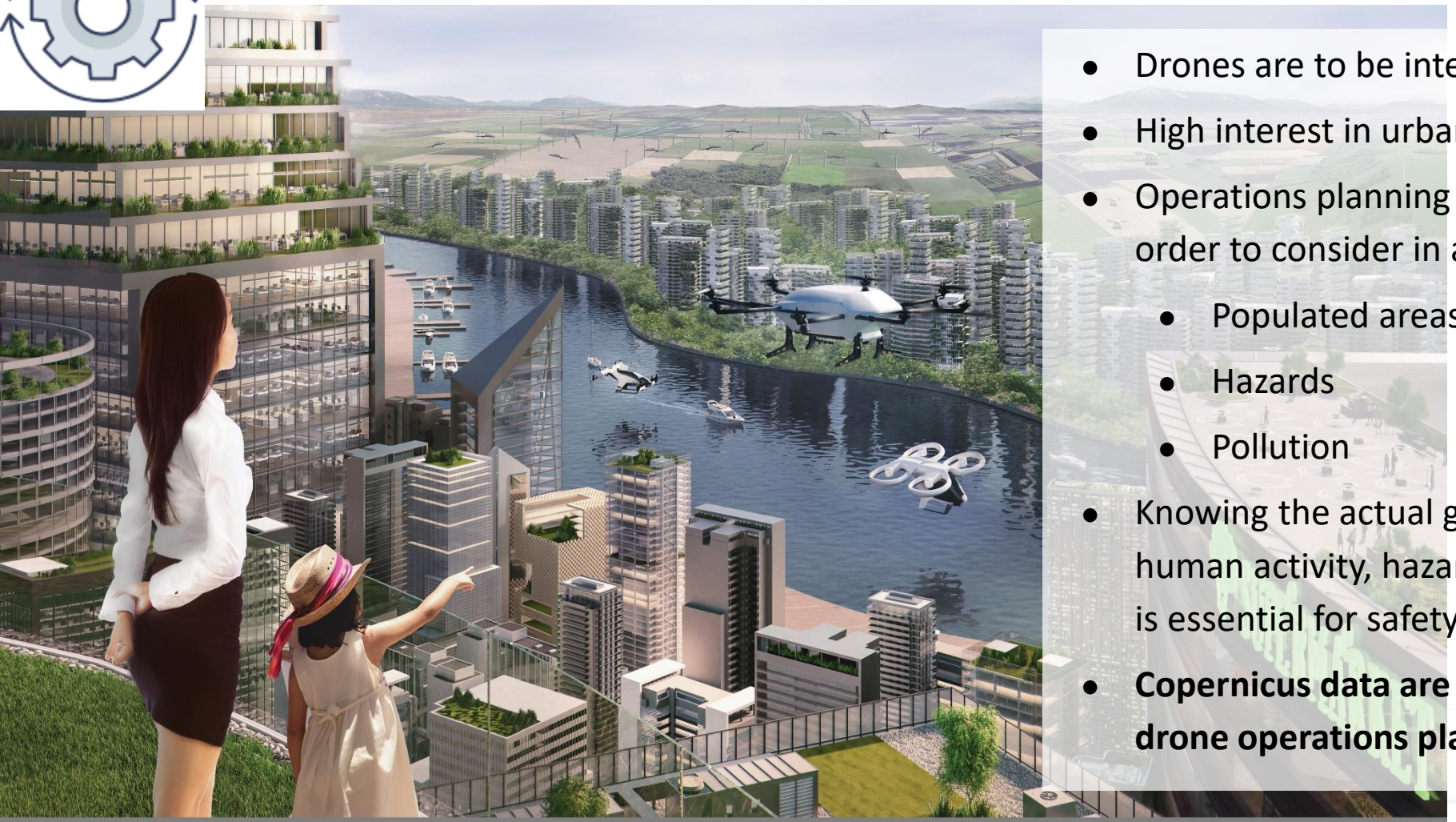
AIRBUS

Passenger Urban Air Mobility

Urban Air Delivery

HORIZON 2020

Copernicus support to Drone operations proposed in the 2020 User Consultation Platform



- Drones are to be integrated safely in the airspace
- High interest in urban air mobility: delivery and air taxis
- Operations planning process is more demanding in order to consider in advance:
  - Populated areas
  - Hazards
  - Pollution
- Knowing the actual ground elements and indicators on human activity, hazardous elements, as well as climate is essential for safety assessment and flight planning.
- **Copernicus data are relevant sources to harmonise drone operations planning.**

Standard Guidelines on the use of Multi-GNSS for drones under development (Eurocae WG 105-62)

- Objective:
  - Support UAS operators in integrating EGNOS and Galileo
  - Support good use of EGNSS in drone operators

- How
  - "Guidelines for the Use of Multi-GNSS Solutions for UAS – Specific Category – Low Risk Operations SAIL I & II".
  - Guidance for drone operators in order to ensure flight safety of their drone operations in connection with the Specific Operations Risk Assessment (SORA) methodology.

- Step-wise approach:
  - Version 1: EGNSS for Low risk. Under internal review, to be finalised by end 2021
  - Version 2: Medium risk operations

Opportunity for funding: Horizon Europe WP 2021-2022

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European Union Agency for the Space Programme

Open for submissions 28 Oct 2021*

2021

Horizon Europe topics	Indicative budget (mln EUR)	Type of action
EGNSS and Copernicus applications fostering the European Green Deal	14	IA
EGNSS applications for Safety and Crisis management	9.3	IA
EGNSS applications for the Digital Age	9.3	IA

Open for submissions Oct 2022*

2022

Horizon Europe topics	Indicative budget (mln EUR)	Type of action
Public sector as Galileo and/or Copernicus user	5.2	PCP
EGNSS applications for Smart mobility	9.5	IA
Copernicus downstream applications and the European Data Economy	9.6	IA
Large-scale Copernicus data uptake with AI and HPC	9.6	RIA
Service developments and demonstrations	9.1	RIA
Designing space-based downstream applications with international partners	5.1	RIA

*** All dates are tentative and subject to change**

More details on the topics along with the Horizon Europe Work Programme 2021-2022 can be found on the EUSPA website

Linking space to user needs

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