

WHEN SPACE MEETS AGRICULTURE

14-15 November 2016 | Matera, Italy

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#WSMA16

What can EGNOS/GALILEO and ICT do for farmers and for the European Agriculture Policy?

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European GNSS Agency



REGIONE BASILICATA








in collaboration with



and the support of



Agenda

-  **European GNSS Agency: GSA**
-  **EGNOS and Galileo services: status & implementation plan**
-  **EGNOS and Galileo contributions to precision farming**
-  **Research Infrastructures and European Open Science Cloud for agriculture**
-  **GSA R&D activities for Galileo and EGNOS**

Agenda



European GNSS Agency: GSA



EGNOS and Galileo services: status & implementation plan



EGNOS and Galileo contributions to precision farming



Research Infrastructures and European Open Science Cloud for agriculture



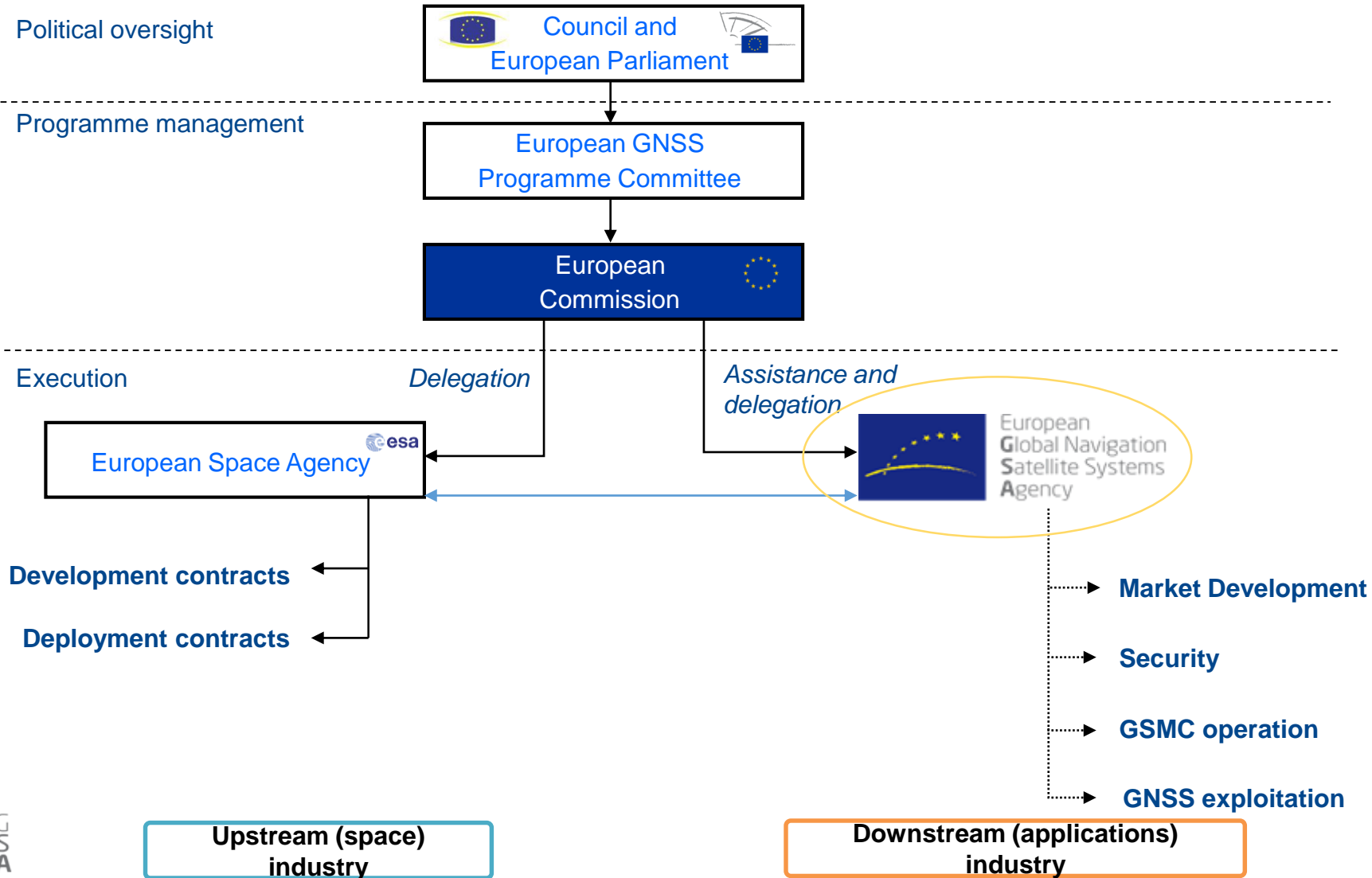
GSA R&D activities for Galileo and EGNOS

European GNSS Agency (GSA)






- Staff: 135
- Nationalities: 21
- Headquarter: Prague, Czech Republic
- Security monitoring centres: Swanwick (UK) and St Germain en Laye (France)
- European GNSS Service Centre (GSC): Torrejon (Spain)



How GSA fits in the EU structure



Agenda




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-  **GSA R&D activities for Galileo and EGNOS**



EGNOS already available serving EU citizens and industry

- Satellite Based Augmentation System (SBAS)
- Improves GNSS performance
- European coverage (but under extension in other regions, e.g. North Africa)
- Available NOW, free of charge and widely adopted in off-the-shelf receivers







Open Service (OS)	Accuracy ~1m, free	Available since October 2009	
Safety of Life Service (SoL)	Accuracy ~1m, compliant to aviation standards	Available since March 2011	
EGNOS Data Access Service (EDAS)	Accuracy <1m, corrections provided by terrestrial networks	Available since July 2012	

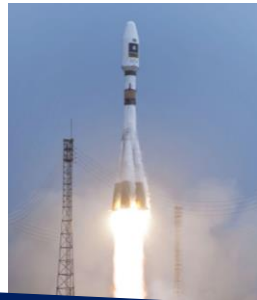
Galileo is the European GNSS offering four services

- Worldwide navigation system “made in EU”
- Fully compatible with GPS
- Open service free of charge, delivering dual frequencies
- Signal authentication will provide trustability



Open Service (OS)	Freely accessible service for positioning and timing	
Public Regulated Service (PRS)	Encrypted service designed for greater robustness and higher availability	
Search and Rescue Service (SAR)	Assists locating people in distress and confirms that help is on the way	
Commercial Service (CS)	Delivers authentication and high accuracy services for commercial applications	

The Galileo implementation plan accelerates providing Initial Services in 2016



2 satellites launched on 24th May
=> Accelerating the implementation

Galileo is implemented in a step-wise approach

- **14 satellites** have been launched
- **18 satellites** are in production/being procured:
 - ✓ 4 to be launched in Q4 2016
 - ✓ The remaining ones by 2020



This November, 4 Galileo satellites
will be launched for the first time by
an adapted Ariane 5 launcher

Initial Operational Capability

Initial services for Open Service (OS),
Search and Rescue Service (SAR),
Public Regulated Service (PRS),
and demonstrator for Commercial Service (CS)

2016/2017

Test signal for

OS Navigation Message Authentication
(OS-NMA) and CS High Accuracy (CS-HA)

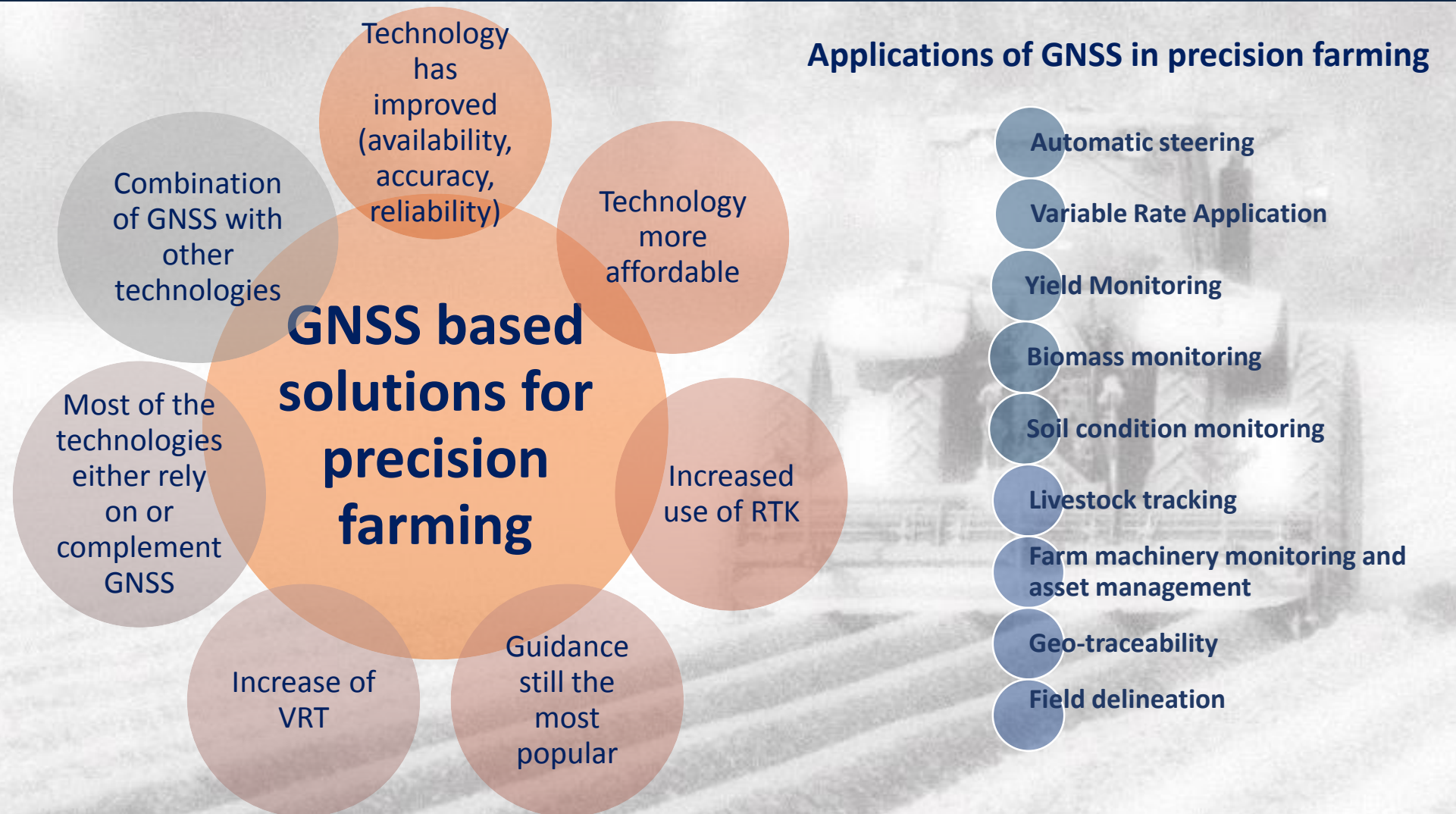
2018/2019

Full Operational Capability

Full services, 30 satellites
An independent civilian infrastructure

2020

GNSS based precision farming solutions and applications available today



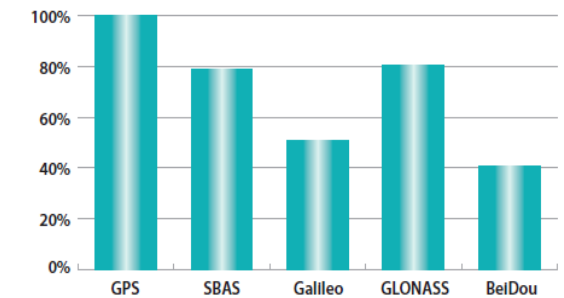
EGNOS provides advantages to both farmers and society

EGNOS...

- offers an affordable solution for precision agriculture
- enables farmers to optimise yields, increase labour productivity and reduce driver fatigue – all with minimal investment
- supports machinery guidance solutions with sub-metre level accuracy, which is suitable for basic-value crop cultivation (e.g. cereals)
- enables more efficient management of farming activities such as spreading, spraying and harvesting



Capability of GNSS receivers – Agriculture segment



EGNOS provides advantages to both farmers (higher profits margins) and society (increased food supply and more environmentally friendly agriculture).

80% of European GNSS enabled tractors are equipped with EGNOS which means alone in 2016 there were more than 16.000 new EGNOS enabled tractors.

Galileo brings further benefits to Precision Farming

Galileo will further improve the performance of GNSS-assisted agriculture and bring benefits in every phase of the farming operation

Galileo Open Service

- More satellites and Galileo signal design and dual frequency capability contribute to **better operations in harsh environment** (e.g., edge of the forest, valleys)
- Galileo Contribution to RTK network result in an improved reliability, availability and accuracy **providing better results in guidance, auto-steering systems** (including repeatability)
 - **Cm-level accuracy** for accurate vehicle travel for Control Traffic Farming (CTF) to reduce soil and crop damage



Galileo Commercial Service

- **Real time corrections across the globe** to improve accuracy for your guidance and auto-steering systems (Precise Point Positioning)
- Only constellation offering corrections directly from Galileo **without dependency of Internet or additional communication channels**
- **Sub-dm level accuracy and cm-level pass-to-pass accuracy** to improve your trajectory with convenience and flexibility
 - **Does not rely on proximity to ground network infrastructure**
 - **Faster convergence time** due to Galileo triple frequency
 - Eliminate overlap and underlap, and reduce operator stress

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European GNSS Agency: GSA



EGNOS and Galileo services: status & implementation plan



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Research Infrastructures and European Open Science Cloud for agriculture



GSA R&D activities for Galileo and EGNOS

E-GNSS in combination with other technologies to support different applications in agriculture

Most of the technologies either rely on or complement GNSS

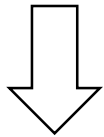




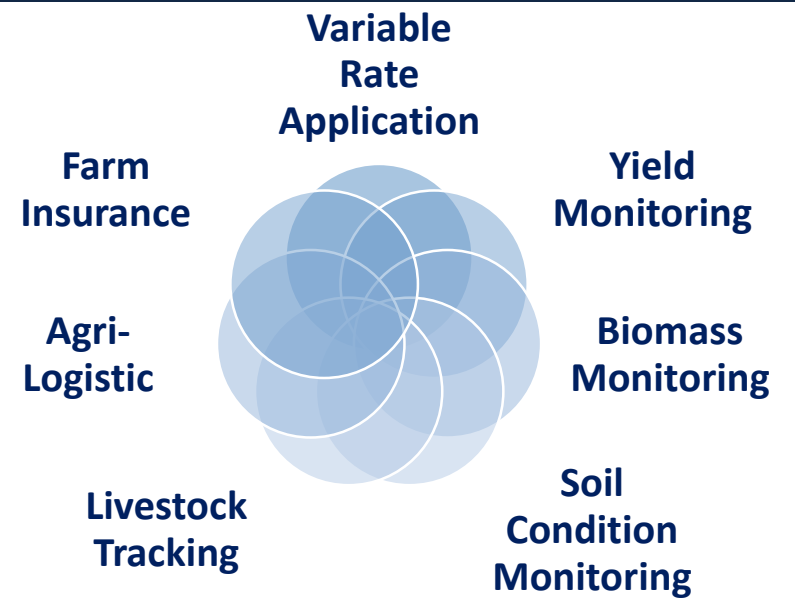
Uptake of Drones in Precision Farming increases the use of GNSS



GNSS is the backbone of commercial drones



- GNSS**
- Informing drone operators about the drone's position
- Allowing for safe navigation



- Forecast : from USD 860mln in 2016 to 4.2 billion in 2022 (**CAGR 30.19%**)*
- Fragmented **regulation over Europe - barriers to the development** of commercial use drones
 - EASA targeting a formal agreement on drone regulation in 2017
 - Regulation in USA and Russia already in place



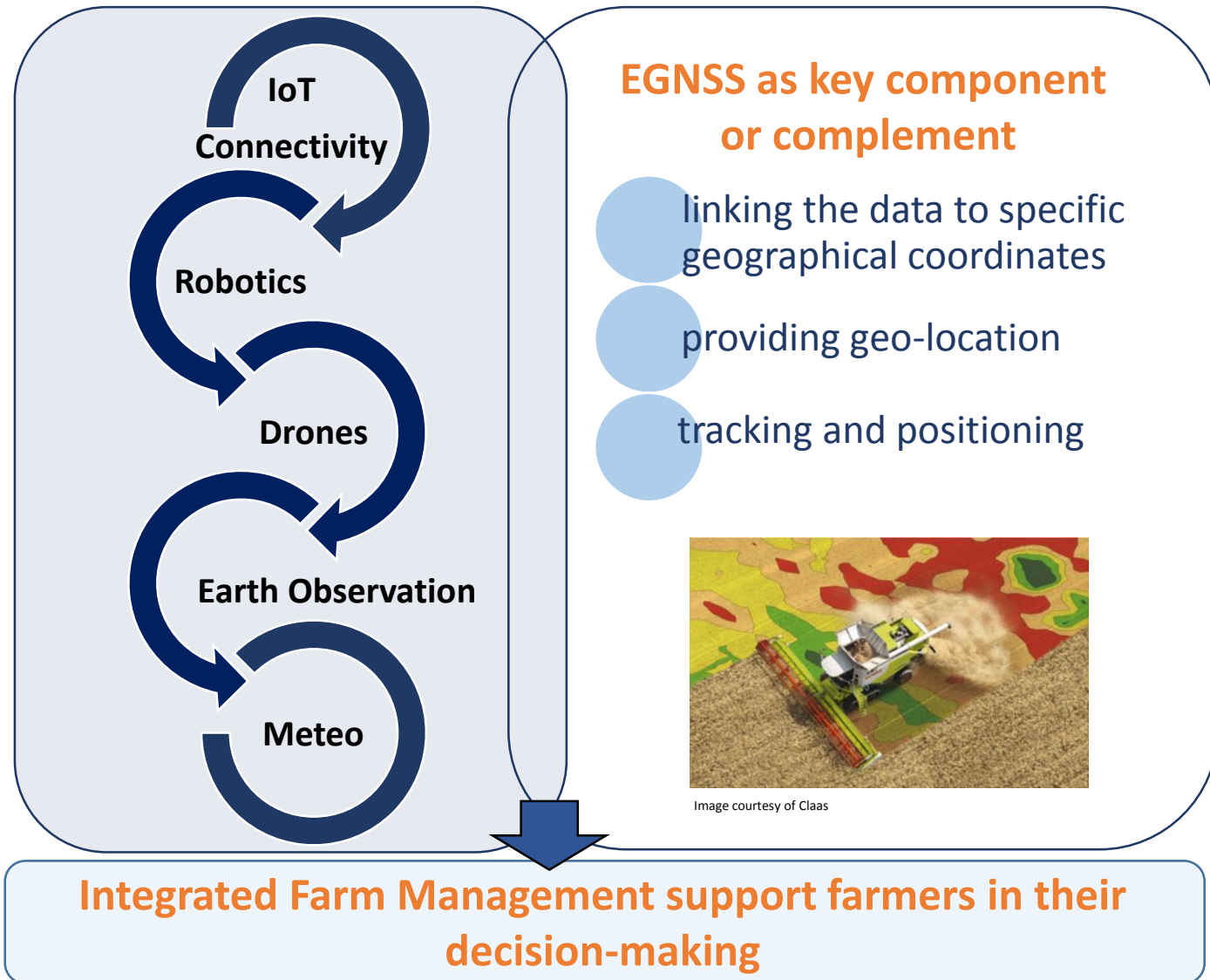
GSA

* <http://www.engineering.com/AdvancedManufacturing/ArticleID/12370/Agriculture-Drones-Are-Exploding.aspx>

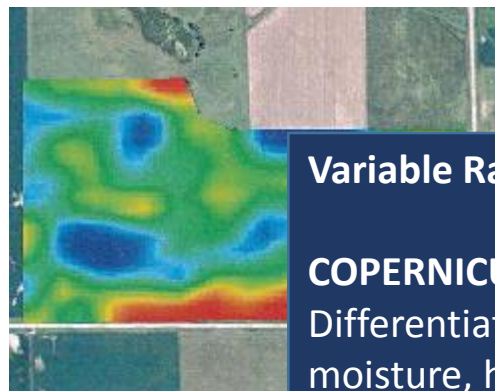
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GNSS is a core component in Integrated Farm Management systems



Synergies with Copernicus to support various agriculture applications



Variable Rate Technologies (VRT)

COPERNICUS

Differentiated maps of the crops (future: soil moisture, health of crops, etc.)

E- GNSS

VRT technology with support of GNSS show where fertiliser/ pesticides should be applied based on VRT application maps

Example

- Lower fertiliser/ pesticides costs
- Higher yield
- Lower environmental footprint
- More efficient use of manpower

GNSS supports the weather forecast

GNSS

Observe Integrate Water Vapour in the troposphere

GNSS support Meteo predictions

Meteo data

Accurate meteorological data (tropospheric delay estimate) helps in PPP computation to reduce convergence time

Meteo data supports accurate GNSS

Continuous observation from GNSS receivers provides an excellent tool for the studying of the earth atmosphere used for numerical weather forecasting, atmospheric research and space weather applications

E-GNSS supports the implementation of the Common Agricultural Policy (CAP)



Integrated Administration and Control System (IACS)



Used for Land Parcel Identification System (LPIS) purposes

Used for On-the-Spot Checks purposes of area based subsidies

Suspicious cases or where the interpretation based on orthophoto does not work

Upload of GNSS measurement delivered by farmers

The parcel location (navigation to parcel)

The area measurement



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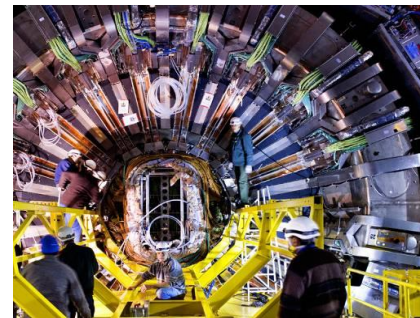
Other sources of data for Agriculture: Research Infrastructures foster and support innovations

Research infrastructures are **facilities, resources and services** used by the research communities to:

- Conduct research, extending the frontiers of knowledge, and exchange and transmit knowledge
- Train the next generation of top researchers
- Foster and supporting innovation, including industrial innovation



Knowledge-based resources



Major scientific equipment



e-infrastructures



Existing infrastructures provide relevant data for Agriculture



Pan-European RIs (ESFRI) European Strategy Forum on Research Infrastructures

EMPHASIS (flora)	European Infrastructure for multi-scale Plant Phenomics and Simulation for food security in a changing climate
ANAEE (flora)	Structuring Infrastructures for the ANALysis and Experimentation on Ecosystem
LIFEWATCH (fauna)	European Infrastructure for biodiversity and ecosystem research
ICOS (atmosphere)	Integrated Carbon Observation System
ACTRIS (atmosphere)	Aerosol, Clouds and Trace gases Research Infrastructure

RI networks (Integrating Activities)

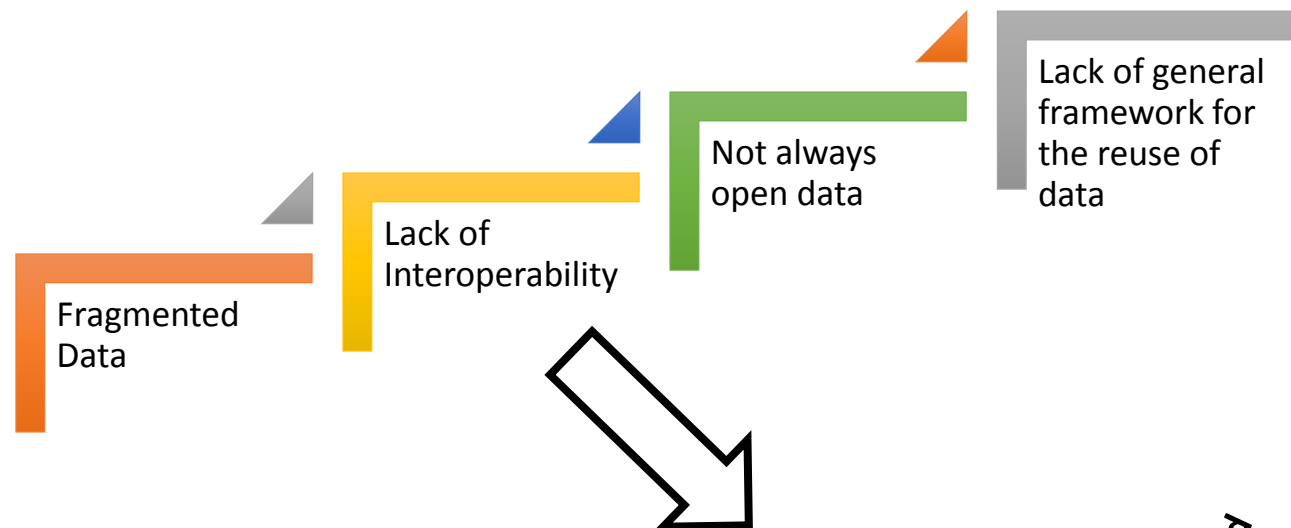
NADIR (fauna)	The Network of Animal Disease Infectiology Research Facilities
EPPN (flora)	European Plant Phenotyping Network
TREES4FUTURE (flora)	Designing Trees for the future
eLTER (flora)	Long-Term Ecosystem Research in Europe

e-Infrastructures		Grant period
ag INFRA	Promoting data sharing and development of trust in agricultural sciences	2011- 2014
TransPlant	trans-national infrastructure for plant genomic science	2011-2015
SemaGrow	Data Intensive Techniques to Boost the Real-Time Performance of Global Agricultural Data Infrastructures	2012 –2015
Organic.Lingua	Organic.Lingua: Demonstrating the potential of a multilingual Web portal for Sustainable Agricultural & Environmental Education	2011-2014

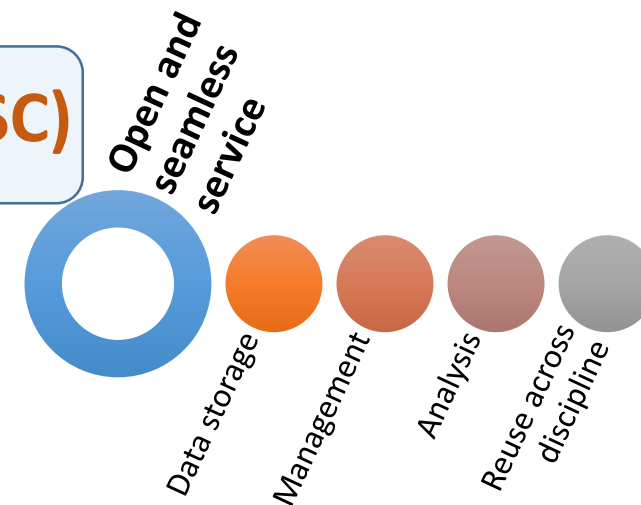
RIs data

- Typically data in-situ
- Not completely connected to satellites observations (E-GNSS, Copernicus)

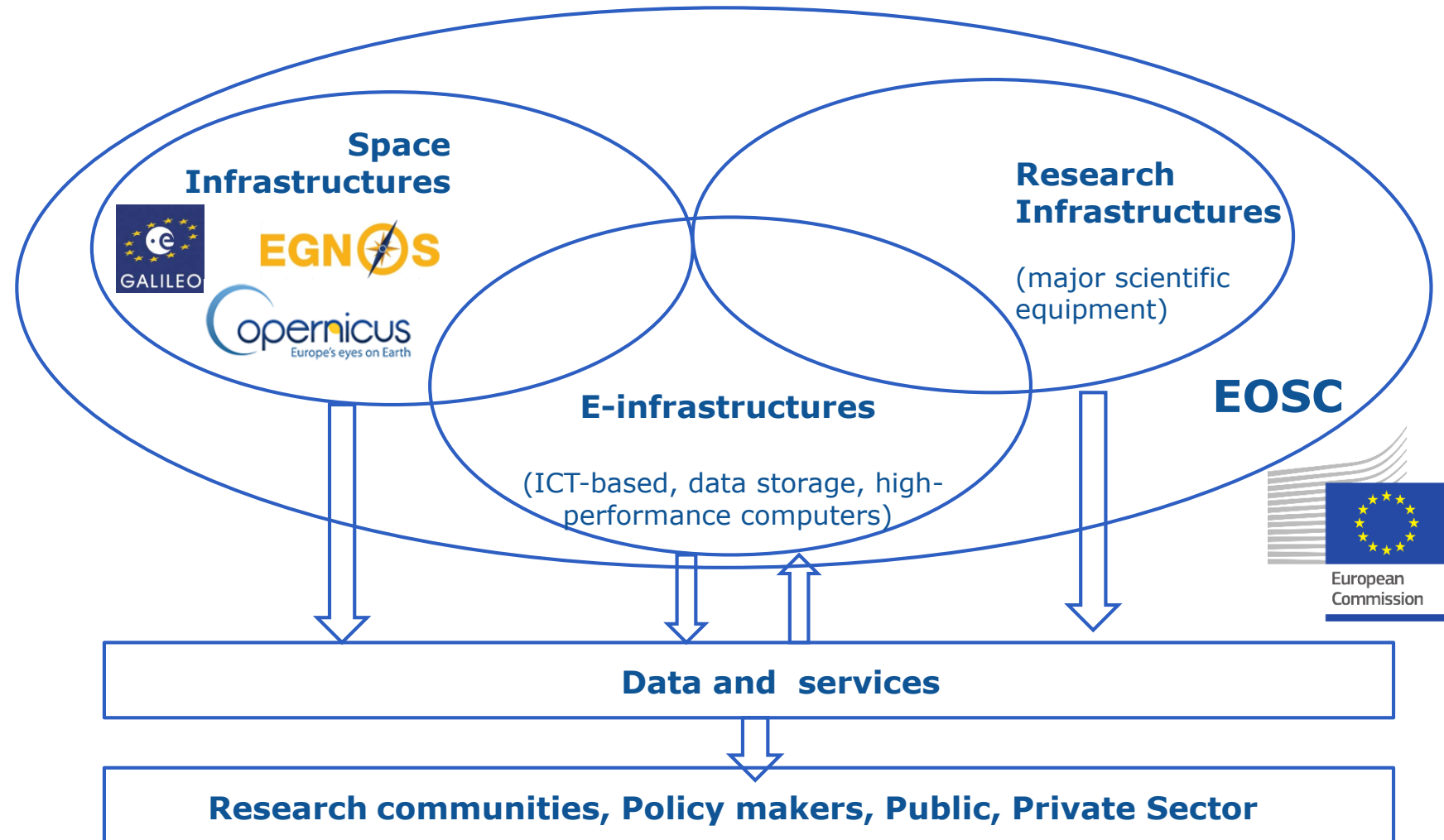
European Open Science Cloud (EOSC) contributes towards the integration of various RIs data in Agriculture



European Open Science Cloud (EOSC)



European Open Science Cloud (EOSC) is a federation of existing infrastructures/initiatives



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Applications R&D

The 2017 H2020 Call promotes the EGNSS use in Professional Market

- Opening date: **8th November 2016**
- Deadline **1st March 2017**
- **8 €mln budget**
- **Scope:**

Developing new innovative applications, building also on the EGNSS differentiators in combination with Earth Observation and Copernicus services, with commercial impact.

- **Areas:**
 - Agriculture
 - Surveying and Mapping
 - Timing & Synchronisation
 - Other Professional Applications

- **Expected Impact:**
 - **Improve the productivity and decrease the environmental impact (agriculture)**
 - **Development of highly innovative applications taking advantage of EGNSS added value**
 - **To contribute to coping with emerging network and synchronisation needs (accuracy, robustness)**



The screenshot shows the Horizon 2020 Participant Portal interface. The main heading is 'RESEARCH & INNOVATION Participant Portal'. Below this, there are navigation tabs for 'HOME', 'FUNDING OPPORTUNITIES', 'HOW TO PARTICIPATE', 'EXPERTS', and 'SUPPORT'. A search bar is visible with the text 'Search PP'. The main content area displays 'EU Programmes 2014-2020' with a list of topics. The selected topic is 'TOPIC : EGNSS professional applications'. The details for this topic are: Topic identifier: GALILEO-3-2017, Publication date: 14 October 2015, Types of action: IA Innovation action, single-stage, DeadlineModel: single-stage, Planned opening date: 08 November 2016, and Deadline: 01 March 2017 17:00:00. The time zone is (Brussels time). Below this, there is a section for 'Horizon 2020' with details: Pillar: Industrial Leadership, Work Programme Year: H2020-2016-2017, Work Programme Part: Leadership in Enabling and Industrial Technologies - Space, Call: H2020-GALILEO-GSA-2017. A 'Topic Description' section is also visible, starting with 'Specific Challenge: Professional applications are covering different market segments. Precision agriculture, mapping and surveying have been the pioneers in the use of GNSS since the early years. The challenge is to make these applications more affordable, easy to use and integrated with other solutions and technologies.'

Success story: GEOPAL FP7 project

Improve logistics for European farmers

GEOPAL is a (GNSS) based system useful to plan logistics in agriculture for European farmers



- Improves the efficiency of in-field and inter-field logistic activities:
 - Fleet management and logistics (operations management tools and the required ICT systems)
 - Coordination, mission and route planning functionalities for field machinery
 - Closed loop integrated optimal planning, execution of automated field operations and monitoring



GNSS and big data

- GEOPAL product provides high accuracy
 - > by using of the EGNOS system and GNSS signal

The AgriTechnica 2015 medal is shown, featuring the text 'AGRI TECHNICA 2015' and 'MATERA'.

- Won the **prestigious medal AgriTechnica 2015**: November 2015 (via CLAAS route-optimizing software)

Farming by Satellite contest: Fostering innovation that trigger new applications and business ideas



The screenshot shows the top of a website for the 'Farming by Satellite Prize'. At the top, there is a row of logos including GSA, the European Union flag, the European Environment Agency, Science For A Better Life, CLAAS, Copernicus, GALILEO, and EGNOS. Below this is a navigation bar with the 'FARMING BY SATELLITE prize' logo and a 'MENU' button. The main content area has a dark blue background with the text: 'How can we use **Satellite Technologies** to Improve **Agriculture** and Reduce **Environmental Impact**?'. Below this is the subtitle: 'A competition for students and young people across Europe and Africa.' On the right side, there are white line-art illustrations of a satellite and a control console. At the bottom right, a red banner with white text reads: 'Submission deadline: 15 December 2016'.

A full analysis of GNSS receiver capabilities is available in the GSA's Technology Report



Available for
download



[HTTP://BIT.LY/2CGARXF](http://bit.ly/2CGARXF)

2016 GNSS USER TECHNOLOGY REPORT

An in-depth analysis of 3 GNSS Macrosegments :

- MASS MARKET SOLUTIONS
- TRANSPORT SAFETY AND LIABILITY-CRITICAL SOLUTIONS
- HIGH PRECISION, TIMING AND ASSET MANAGEMENT SOLUTIONS



MANY THANKS!

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