European
Global Navigation
Satellite Systems
Agency

Reinhard Blasi

EGNOS and Galileo in Agriculture

European GNSS Agency
Market Development

Agenda

- European GNSS Agency GSA
- EGNOS and Galileo in Agriculture
- Main Applications in Precision Agriculture
- Differences by geography
- Examples of Precision Agriculture and related technologies

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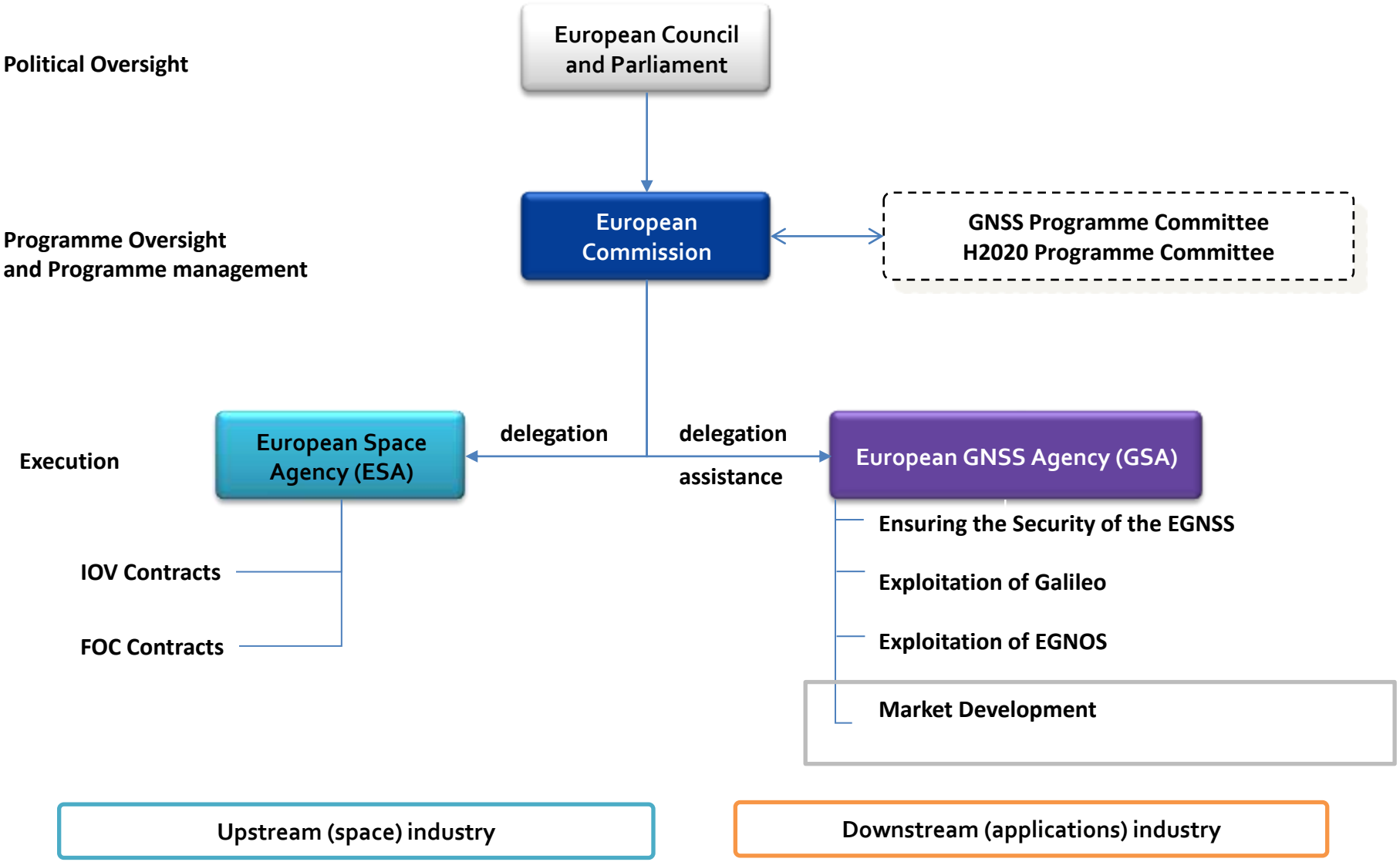
GSA role within EU GNSS programmes



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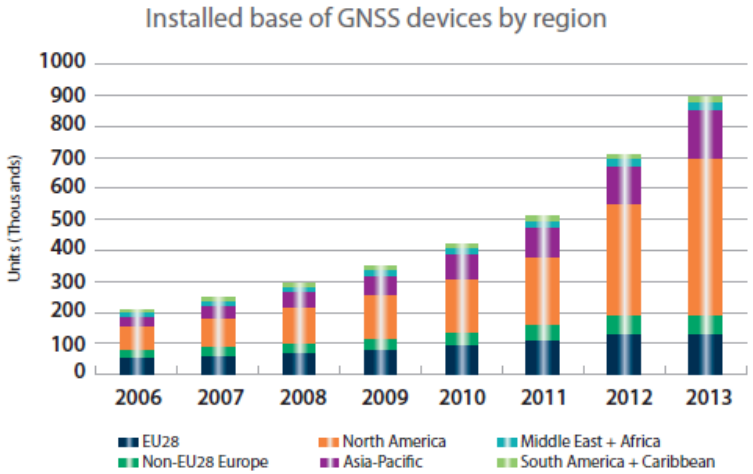
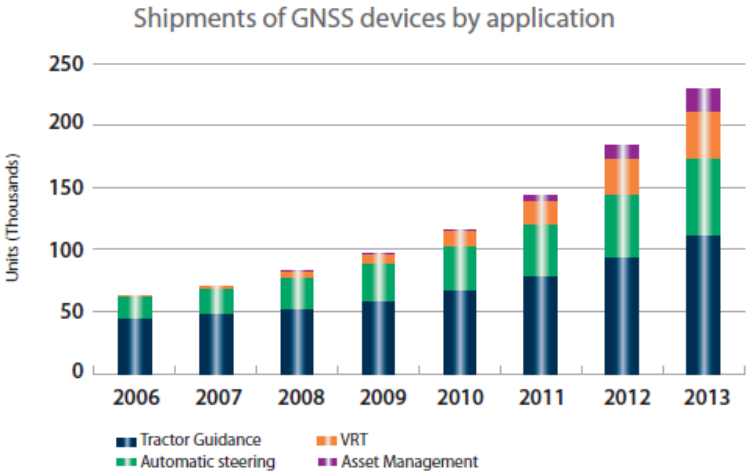
GNSS market in Agriculture

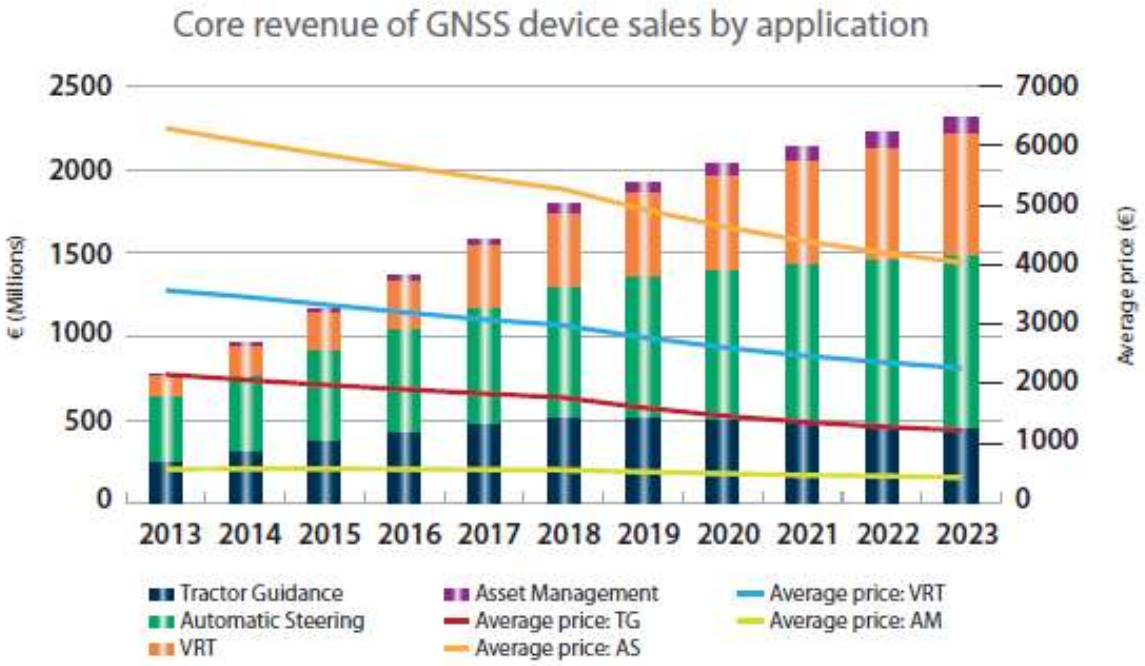




- The uptake of precision agriculture in Europe and worldwide will **continue to grow**
-
- The **Asia-Pacific region** will progressively challenge the role of North America as the largest GNSS market

- **Tractor Guidance** remained the most widespread GNSS-based application in Agriculture
- **Automatic Steering**, which requires a higher level of accuracy, grew significantly thanks to increased adoption in developed countries.
- **Variable Rate Technologies** (VRTs) are also starting to be increasingly adopted by farmers.
- **Asset Management** solutions are now starting to complement in-field solutions.

Core revenue of GNSS in Agriculture segment

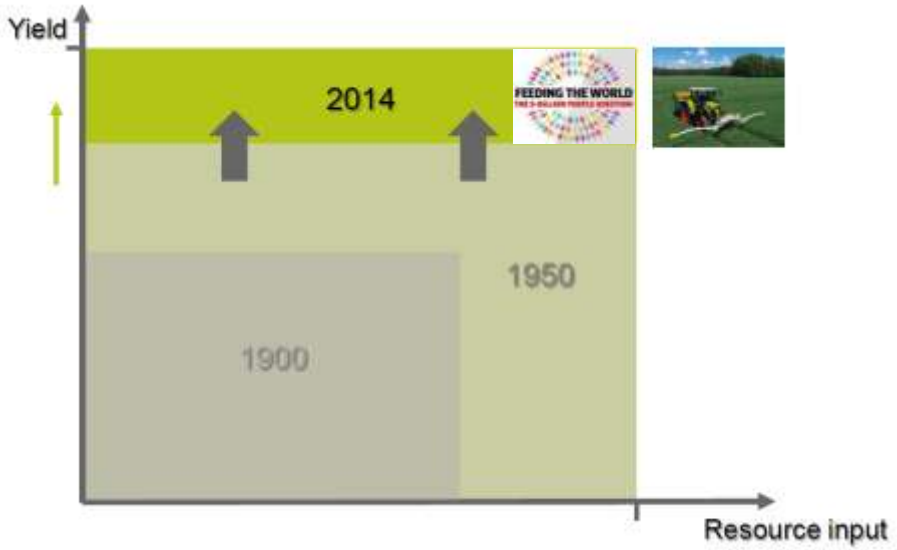


Growth of advanced applications will push revenues despite the pressure on prices

Market and technology drivers in high Precision Agriculture support high long term growth

Market trends

- Increased demographic pressure on yield with limited resources available
- Market reaction:
  - Consolidation of farms foster Precision Agriculture
  - GNSS-based solutions in farms show measureable cost savings and while increasing the yield

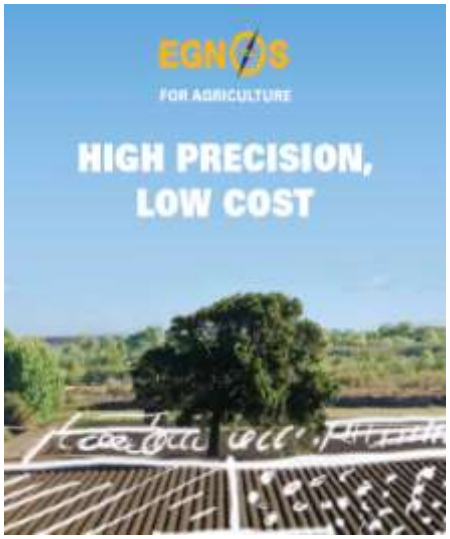


Technology trends

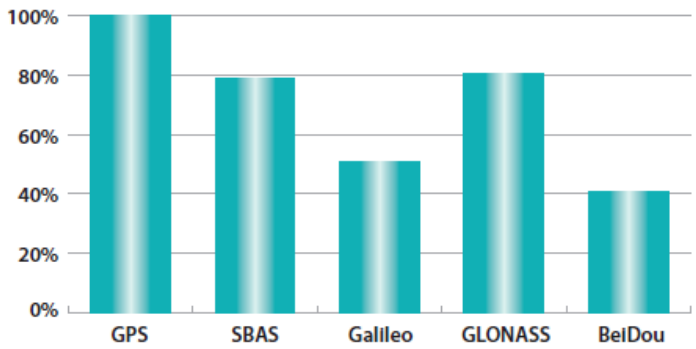
- SBAS solutions opening markets at entry-level prepare users for more advanced solutions
- Dual frequency and dual-constellation expected by Galileo and GPSIII (L1/L5 resp. E1/E5)
- Emerging role of PPP solutions vs. traditional RTK
- Use of big data for integrated farming across different equipment supplied by different hardware brands

Source of chart: Claas Agrosystems

EGNOS for Agriculture



Capability of GNSS receivers – Agriculture segment



- ✓ Increases the ***accuracy*** of GPS positioning
- ✓ ***Pass to Pass accuracy typically 15-30cm***
- ✓ Available in almost 80% of commercial receivers models
- ✓ Offers corrections over the whole Europe and expanding into ***Africa and the Middle East***

GSA

EGNOS

GALILEO

EGNOS for Agriculture

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.

Optimised use of seeds, fertilizers and herbicides – reduction of fuel and driver fatigue >> increased productivity

Advantages to farmers (higher profits margins) and society (more environmentally friendly agriculture)

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Galileo in Agriculture

Galileo will further improve the performance of GNSS-assisted agriculture.

Galileo Open Service

- Benefits of using Galileo Open Signal with other GNSS constellations (to be available from the Initial Services phase):
  - signal design minimizing the multipath errors;
  - better availability and accuracy;
  - better results in harsh environment such as urban canyons and under tree canopy;
  - single and dual frequency (E1, E5).

Galileo Commercial Service

- High Accuracy services for professional applications:
  - PPP (Precise Point Positioning) service/corrections available worldwide (Galileo E6 channel);
  - corrections available through signal in space not depending on geostationary satellites;
  - faster convergence time than existing PPP solutions (via triple frequency capability);
  - accuracy comparable to RTK.

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EGNSS Enable new applications in Precision Agriculture

Most commonly used applications

Machine Guidance

Auto-steering

VRA

Asset Management

Other applications

- Biomass monitoring
- Soil sampling
- Land consolidation
- Livestock tracking
- Virtual fencing
- CAP field boundary management
- Environmental management

Pictures' sources:
http://innovationstelevision.com
http://news.cision.com
http://agreport365.com

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EGNOS has a wide range of applications

Application category	Application field	Required accuracy level
Arable	High-value crop cultivation (e.g. potatoes and vegetables) and/ or precision operations (sowing and transplanting)	2-5cm
	Low-value crop cultivation (e.g. cereals) and low-accuracy operations (fertilising and reaping)	c.1m
Dairy	Individual livestock positioning and virtual fencing	2-5m
Legislation/ management	Field measurement and boundary mapping and updating	c.1 m or better
Agro-logistic	Land parcel identification/ geo-traceability, post harvest pick-up and supervised tracking of livestock, manure, etc.	c.2.5m

GALILEO application domain

EGNOS application domain

GSA

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EGNSS use in Europe

Value of capital stock per hectare as a proxy for EGNSS adoption in Europe

Most of Europe utilises advanced farming techniques

Source:
FAO Stat

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European EGNSS R&D Programmes support competitiveness of the EU industry

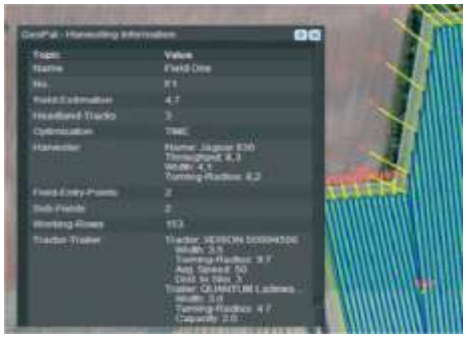
GNSS and big data

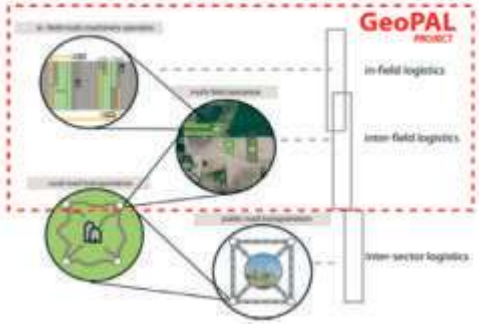
The **GeoPal** project supports logistics operations on the farm.

The system assists farmers in improving efficiency during in-field and inter-field logistic activities. GEOPAL covers the following 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.

http://www.geopal-project.eu/





Risk Management related applications based on EGNSS and remote sensing

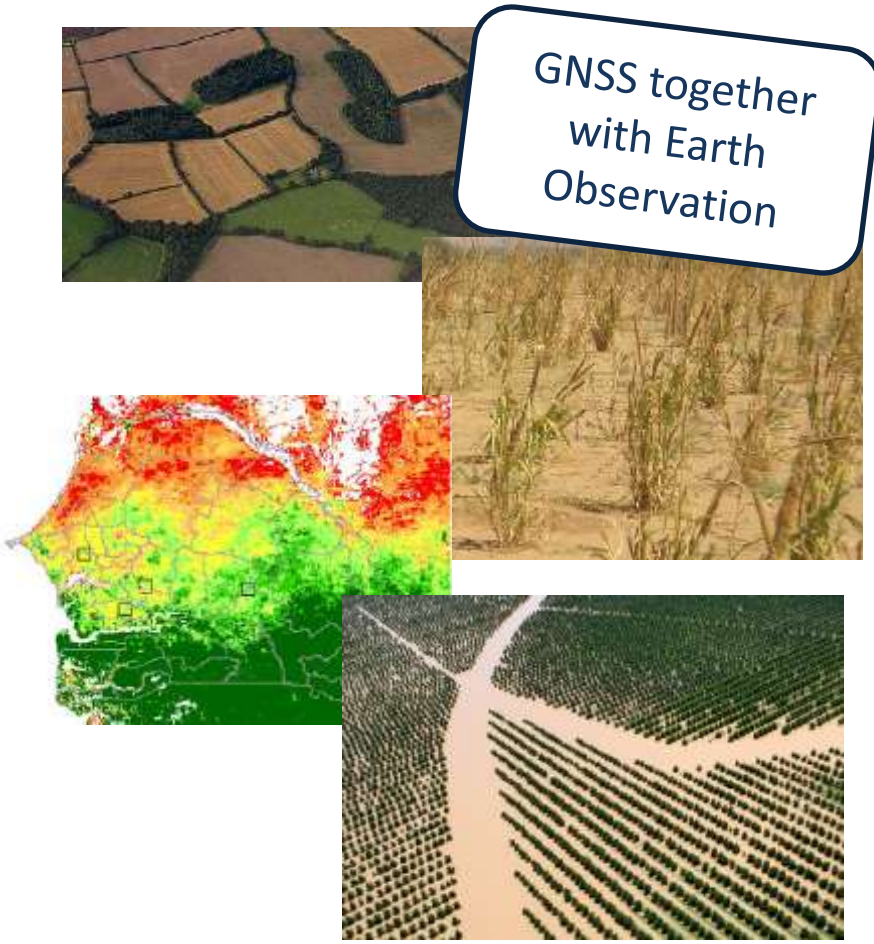
IncREO (Copernicus FP7 project)

Risk management applications

- Use of remote sensing for **crop monitoring, damage and risk assessment**
- Crop damage assessment (**floods, hail, drought**)
- Natural hazards and **risk provision**

e.g. FLOODS

- Identify inundated areas
- Detect Maximum flooding depth
- Measure flow velocity
- Visualization of the drainage process



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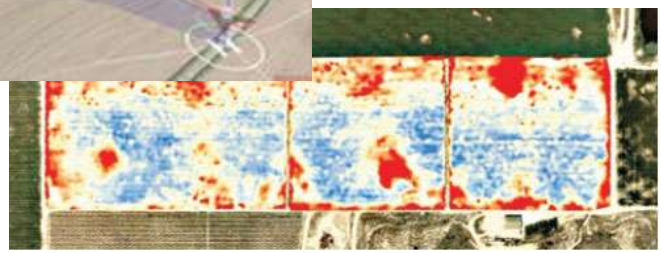
Synergies on EGNSS and remote sensing enable new applications for real time sensing information

GNSS together with Remote Sensing



Unmanned Aerial Systems (UAS) are an up-and-coming method in providing farmers with (near) **real time sensing information** for precision agriculture applications such as:

- water stress monitoring
- detection of nutrient deficiencies
- crop diseases

The EU funded project FieldCopter provides state-of-the-art **multi-spectral cameras on UAS** that deliver the right information in the right time on the right spot, developing a complete solution for UAS sensing.

Already using EGNOS + remote sensing mounting in UAVs

THANK YOU!

QUESTIONS?

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