EGNOS in Precision Agriculture:
An affordable solution for a wide range of applications

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Carmen Aguilera
European GNSS Agency (GSA)
EGNSS Governance

Political oversight

Programme management

European GNSS Programme Committee

 Execution

European Space Agency

Development contracts

Deployment contracts

Council and European Parliament

Independent advisors

European Commission

Delegation

Assistance and delegation

European GNSS Agency

Assistance tasks to EC

Other tasks delegated by EC

Market preparation

Accreditation, GSMC

GSMC: Galileo Security Monitoring Centre
The European Satellite Programme: EGNOS/EDAS and Galileo

- Global Navigation Satellite Systems (GNSS)
- Compatible with most other GNSS
- Inter-operable with GPS
- 2 first satellites launched in October 2011
- 18 satellites in 2014/15
- Will support 5 services

- Satellite Based Augmentation System (SBAS)
- Measures and improved GPS performance
- Sends corrections to users via satellite or terrestrial links (EDAS)
- Certified for Safety Of Life since March 2011
- Covers most of EU
- Expansion to Africa, Middle East and Eastern Europe
In order for Galileo to be recognized by the downstream market as the second satellite navigation system of choice it is key to deliver early services as soon as 2014/2015.

**Galileo System Testbed v1**
Validation of critical algorithms 2003

**Galileo System Testbed v2**
2 initial test satellites 2005

**In-Orbit Validation**
4 IOV satellites plus ground segment 2011/2012

**Initial Operational Capability**
Early Services for OS, SAR, PRS 18 satellites 2014/2015

**Full Operational Capability**
All services, 30 satellites 2019/2020
The launch of the first two Galileo IOV (In-Orbit Validation) satellites took place in October 2011 from Kourou, in French Guiana.

Second pair followed October 2012.

These satellites are part of the Galileo final constellation.

http://www.youtube.com/watch?v=lbnie1dt-Gs
The major Galileo centres and facilities are located throughout Europe.
Galileo IOV Control Centres operational

Credits: ESA
Galileo IOV ground segment sites completed

Kiruna Galileo TTC Site Completed (Nov 2007)

Svalbard Galileo ULS/GSS Site Completed (May 2008)
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EGNOS, it’s there. Use it!

EGNOS

EGNOS availability

- EGNOS is the European Geostationary Navigation Overlay Service
- EGNOS improves the accuracy of position measurements by sending out signals that correct GPS data and providing information on its reliability
- EGNOS signal is free and already widely used in agriculture
EGNOS improves GPS

1. GPS Constellation
2. Ranging and Integrity Monitoring Stations (RIMS)
3. Mission Control Centres (MCC)
4. Navigation Land Earth Stations (NLES)
5. 3 geostationary EGNOS Satellites

EGNOS position accuracy

GPS position accuracy
The EDAS Service is operational to plug in on EGNOS data via terrestrial channels (internet)

EGNOS data (real-time):
- RIMS raw observations
- SBAS messages

Value-added service provider

EGNOS MCC

http://www.gsa.europa.eu/go/egnos/edas

EDAS on the way – Plug in for free

EDAS is available. This allows any interested party is invited to sign up

Currently the evolution of EDAS is assessed including service and system enhancements

www.egnos-portal.eu
Why Precision Agriculture?

Agriculture challenges:

- Rise in crops demand:
  - Population increase
  - Chemical industry diversification
  - Bio-fuel demand

- Limited resources
  - Limited increase of the cultivable land
  - Water shortage
  - Energy prizes rise

Precision Agriculture has an answer:

- Provides:
  - Increase yield production
  - Better management of resources

- Reduces:
  - Chemical pollution
  - Energy consumption
  - Time
**Application category** | **Application field** | **Required accuracy level**
--- | --- | ---
**Arable** | High-value crop cultivation (potatoes, vegetables)  
Precision operations (sowing and transplanting) | c.2cm  
EGNOS
| Low-value crop cultivation (e.g. cereals)  
Low-accuracy operations (fertilising and reaping) | c.1m  
Dairy | Individual livestock positioning and virtual fencing | 2-5m

**Agro-logistic** | Land parcel identification/ geo-traceability  
Post harvest pick-up  
Supervised tracking of livestock, manure, etc. | c.2.5m

**Legislation/ management** | Field measurement  
Boundary mapping and updating | c.2.5m

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“Precision Agriculture is about doing the right thing, in the right place, in the right way, at the right time”
Traditionally, precision agriculture have been characterised by significant equipment investment and costs related to usage.

EGNOS can offer an affordable precision solution by enhancing the benefits of Precision Agriculture.

- Enhance precision
- Eliminate waste and over-application of fertilisers and herbicides
- Save time and money
- Reduce fatigue
- Optimise crop yields
- Increase profit margins
NPV per technology and farm’s hectares: The case of durum wheat

Example for Durum Wheat

Net present value per technology and hectare

<table>
<thead>
<tr>
<th>Hectares</th>
<th>EGNOS</th>
<th>DGPS</th>
<th>RTK</th>
</tr>
</thead>
<tbody>
<tr>
<td>(50,000)</td>
<td>17</td>
<td>35</td>
<td>97</td>
</tr>
<tr>
<td>(100,000)</td>
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</tbody>
</table>

Source: GSA CBA
A practical example

EGNOS is free

No installation costs neither annual subscription costs are required

EGNOS is widely available all over Europe

1 on 10 tractors in Europe are equipped today with GNSS receivers, most of them are EGNOS enabled

EGNOS is convenient

The application of EGNOS involves:

- 2,36% reduction in time, fuel and seed quantity
- 2,49% reduction in fertilize and Plant Production Products quantities

EGNOS is the best GNSS technology to be applied on a 16 HA farm

on average European farms are 16 HA wide
“EGNOS-only” entry products have taken a pivotal role

**Product characteristics**

- Pass to pass accuracy of +/- 15 cm
- EGNOS-only corrections
- Ideal for fertilising, seeding and spraying
- Entry price, affordable for all farmers

**EGNOS effect on farmers**

- They start with EGNOS
- They appreciate the benefits
- In few years, some of them, migrate to advanced systems to cover new functions
R&D fill technical gaps and pave the way to adoption in High Precision…

Sets up a user forum to present and defend the needs of farmers in the development of GNSS applications and services

Works on system to support in-field and inter-field agricultural logistics activities

…and get ready for Galileo
Farming by Satellite Prize

- New competition to be launched 2013
- Open to young farmers/professionals aged <32
- Last edition with 117 registrations from 25 countries around Europe
- Awarded at SIMA, February 2013
And the winners are…

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>“European Farm Management Information System”</td>
</tr>
<tr>
<td>2nd</td>
<td>“A satellite aided bale collection system”</td>
</tr>
<tr>
<td>3rd</td>
<td>“Vitismart: Digital Maps for limited-size vineyards”</td>
</tr>
</tbody>
</table>
Thank you!

EGNOS

www.egnos-portal.eu

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