

Europe is building up Galileo, a new global satellite navigation system (GNSS) to be operational after 2010. Galileo is set up as a business; delivering services to different categories of user segments. With the development of Galileo, the European Commission and the European Space Agency, partners in the Galileo Joint Undertaking (GJU), aim to move Europe forward in the location based technology and stimulate innovation and new business.



The **FieldFact** project aims at the introduction and promotion of GNSS use to the European agricultural user community



Consortium

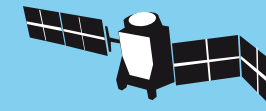
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Galileo Services for satellite location and navigation in agriculture

Galileo

Europe is launching its Global Navigation Satellite System (GNSS) called Galileo which aims to be operational after 2010. Galileo will be interoperable with GPS and on top of that will give:

- ✦ better accuracy
- ✦ better availability
- ✦ better reliability



Galileo offers new services that provide added value to customers. In addition to the 'normal' open signal, Galileo offers integrity and signal authentication, encrypted high accuracy and guaranteed commercial signals and public regulated service.

GNSS in agriculture

Satellite location and navigation is increasingly used in agriculture to provide the farmer and other players in agriculture with accurate and timely information on where and when activities take place. Possible benefits of GNSS use range from higher production efficiency to better soil and water quality and from more efficient work execution to savings in resources like fuel and fertilizer.

FieldFact

The FieldFact project investigates the benefits and opportunities of Galileo in agriculture. The project increases the awareness of the sector of the potentials of Galileo and promotes the platform and associated services in agriculture.



In the FieldFact project demonstrators are developed that show some of the potential of satellite navigation use in agriculture. Also demonstration events about GNSS in agriculture are organized in the Netherlands, Czech Republic, Poland and France.



In Europe the number of farmers that incorporate GNSS techniques in their practice is growing. The better accuracy, better availability and better reliability of the Galileo signal will enhance most of the current GNSS applications in agriculture.

More info on www.fieldfact.com

The FieldFact consortium is: Alterra, PPO, Microsoft (Netherlands), JRC (Italy), Ekotoxa (Czech Republic) and UWM (Poland).



The FieldFact project is managed by the Galileo Joint Undertaking
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Galileo

Galileo is Europe's own global navigation satellite system, providing highly accurate, guaranteed global positioning service under civilian control. Galileo signals are interoperable with GPS and GLONASS, thus allowing the use of signals from both satellite constellations. This will allow users to 'see' 14 to 25 satellites.



The Galileo constellation provides global coverage through 27 operational and 3 in-orbit spare satellites in 3 orbital planes. Image: ESA

- ✦ Galileo will achieve better coverage, especially at high latitudes.
- ✦ The Galileo system includes signal authentication through encryption and is thereby protected against jamming and spoofing.
- ✦ Galileo is planned to be fully operational after 2010.

Galileo is designed to satisfy the requirements of a wide range of users and for that purpose a number of services are set up:

- ✦ The Open Service (OS) provides timing and positioning signals free of charge and is available for mass-market use.
- ✦ The Safety-of-Life (SoL) service offers similar accuracy in position and timing to the Open Service, complemented by a worldwide high integrity level
- ✦ The Commercial Service (CS) encompasses signal encryption and a service guarantee.
- ✦ The Public Regulated Service (PRS) will be encrypted and operational at all times under all circumstances, and will be used for government-authorised applications.
- ✦ The Search and Rescue Service (SAR) facilitates important improvements in the current search and rescue system, among others by strongly improving the precision of the location of received alerts.

Using Galileo and GPS combined improves the performances of satellite navigation:

Characteristic	GPS + WAAS	Galileo + EGNOS	Combined
Spacecraft in orbit	31	33	64
Spacecraft availability (average)	8 – 9	8 – 9	16 – 18
Autonomous integrity	Fair	Fair	Excellent
Worldwide coverage	Good	Good	Excellent
Dilution of precision	1 – 3	1 – 3	0.7 – 2
Interference susceptibility	Low	Low	Very low
Number of signals for safety services protection	2	4+	6+
Frequencies available	1 – 3	1 – 5	2 – 8
Relative receiver cost	1	1	1.2
Autonomous accuracy	1 – 2 m	1 – 2 m	0.6 – 1.3 m

From: McDonald, 2002. The modernization of GPS Plans, new capabilities and the future relationship to Galileo. Journal of Global Positioning Systems 1 1-17

Satellites in agriculture

Global navigation satellite systems (GNSS) like GPS and Galileo are increasingly used in agriculture. Benefits of GNSS use range from higher production efficiency to better soil and water quality and from more efficient work execution to savings in resources like fuel and fertilizer. The most famous application is precision agriculture, the strategy where farmers can vary input use and cultivation methods according to variation in soil and crop conditions in the field. Other applications deal with precise measurement of agricultural fields, an important tool in the control on EU agricultural subsidies.

The motives for GNSS use in agriculture seem to come from three directions:

1. Efforts to improve production efficiency. In an increasingly competitive market environment, farmers have been confronted with a downward pressure on their product prices. In order to cope with this pressure, they are looking for ways to reduce their costs and optimize the use of resources. One of the tools to achieve higher production efficiency is a site-specific management using GNSS. GNSS applications that can contribute to improving production efficiency, are:
 - ✦ Guidance of farm machinery in field operations
 - ✦ Biomass and harvest monitoring
 - ✦ Soil sampling applications
 - ✦ Variable rate application of inputs (water, pesticides, fertilizers)
 - ✦ Surveying in the process of land consolidation
 - ✦ Individual livestock tracking – small scale
2. Efforts to improve authenticated documentation. Actors in the agribusiness chain are motivated to maintain or improve consumers' confidence in agricultural production and the distribution process. To this end, GNSS applications can be used to support traceability or to facilitate the enforcement of animal welfare rules. GNSS applications that can help improve authenticated documentation, are:
 - ✦ Generating unique area ID's for traceability purposes
 - ✦ Tracking of livestock transportation vehicles
 - ✦ Individual livestock tracking – mass scale
 - ✦ Recording of farm machinery movement
3. Efforts to improve the control on public aid use. In view of the scale of direct aid payments to farmers, improvement of the control on public aid use is an important issue. As a major part of agricultural direct payments is area related, GNSS applications could help farmers to declare their areas correctly and help inspectors to check the correctness of farmers' claims. The GNSS application that can help improve the control on public aid use is:
 - ✦ Parcel measurement with handheld device

Virtually all of the applications will be enhanced by the improved accuracy and availability of the signal in space offered by the Galileo Open Service. Applications providing for authenticated documentation, such as the tracking of livestock transporting vehicles or recording of farm machinery movement, would benefit from the authentication signal provided by the Galileo Safety of Life Service. For the purpose of improved control on public aid use, the Galileo's Public Regulated Service could provide the required continuous availability and encryption of the signal.

