



**GALILEO**  
Masters



EUROPEAN  
SATELLITE NAVIGATION  
**COMPETITION**  
2006



# GALILEO MASTERS 2006

## THE RESULTS

**SYSTEMS**  
IT - Media - Communications

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**ANWENDUNGSZENTRUM**  
Oberpfaffenhofen





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## Intro

The GALILEO Masters 2006 was again a success story for all participating regions and partners. The winners have now been selected and the Award Ceremony held. What started in 2004 under the patronage of the Free State of Bavaria and with the support of the German Aerospace Center (DLR e. V.) for the creation of new applications and services for the GNSS industry is now a leading European Galileo platform of 10 high-tech regions. The platform with its regions & winners of the competition will present themselves and their activities around the future satellite navigation system Galileo at their SYSTEMS exhibition stand in the SatelliteNavigationArea. This exhibition area, which features some 80 leading German and international exhibitors, concentrates on solutions and services related to the topics of navigation, telematics, location-based services, information logistics, high-end positioning and satellite-based surveying.

The partner regions of Bavaria, Nice/Sophia Antipolis, Göteborg, East of England, Prague, Varese, Noordwijk, Madrid, Hesse and Wallonia already use the competition as an initial impulse for the creation of regional clusters (comprising experts and companies) and to keep small and medium-sized companies in the loop on high-tech related topics. In light of the success experienced, we would like to thank our partner regions all over Europe for their outstanding support. In particular, we would like to thank the Bavarian Ministry of Economic Affairs, Infrastructure, Transport and Technology (BStMWIVT), the European Space Agency (ESA), the German Aerospace Center (DLR e. V.) and the Munich ICT trade fair SYSTEMS for their international support. We would also like to thank the many regional sponsors and regional development agencies who worked hard to ensure that the GALILEO Masters 2006 would reach the level of success that it has.

A total of 650 companies, entrepreneurs, research institutes, universities and private individuals have taken part in the GALILEO Masters over the past three years, resulting in a multiplicity of product developments and technology-driven start-ups in the satellite navigation industry. This year, the process of evaluating the business ideas was undertaken by an evaluation team consisting of 80 international experts from industry and research institutes.

The best products we have seen over the past three years of the competition (and will continue to see in the future) have been convergent products – solutions that combine a GNSS time signal with several other sensors or technologies. The most winning ideas at GALILEO Masters competitions in the past have been products or solutions of this kind.

The level of industry interest in Galileo is growing from year to year, and it is not only the industries downstream of Galileo itself, but also the information and communication industries that are coming closer to Galileo, providing the basis for ongoing success. Due to the growing interest on both a regional and European level, the Anwendungszentrum GmbH Oberpfaffenhofen has already started planning the GALILEO Masters 2007 award, with the participation of an even extended number of partners, possibly including regions such as Queensland, Australia and Quebec, Canada.

For us, the most important question is now how to move forward, generate more combined technologies products and ideas, and communicate them in the different markets in which the people who create and use them are located.

It is you, and everyone else who reads this third results brochure, who can help us in strengthening this important connection between different technologies and different markets.

Kind regards,

Your GALILEO Masters Team

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## **GALILEO MASTERS 2006** **OVERALL WINNER - UNITED KINGDOM / STEVENAGE** **- EAST OF ENGLAND**

### **GeoSynch™ - Seismography using GNSS timing signals**

There are currently multiple commercial seismography applications available, including mineral or hydrocarbon prospecting, groundwater investigations, environmental and hazardous waste site studies, archaeology and civil engineering.

Seismography is based on transmitting pressure waves from a source through the earth or sea, receiving these waves using a network of distributed sensors, and deducing the subsurface composition and features from the received signals. The cost and complexity of seismological surveys vary widely, but the two main drivers are:

- The cost, reliability and weight of cables connecting the sensors
- The cost of large numbers of seismographic sensors

GNSS systems broadcast very precise timing signals that can be used to derive an extremely accurate absolute time reference. This information can be received by seismography sources and sensors equipped with GNSS receivers. Time-tagging both transmitted and received seismic signals with this absolute time reference, and combining it with the measured GNSS positions of the sources and sensors, will remove the need for connecting cables. A single sensor connected to a PC carried in a backpack could be used to perform seismographic surveys.

This will considerably reduce the minimum cost of seismography surveys, and open up the lower end of the seismography market. It could be used for example by development agencies to locate sites for water wells; to survey potential archaeological sites before starting digs; or by local councils to perform hazardous waste site studies.

The main advantages of the system are:

- **Cost, weight, reliability and portability**
- **Compatibility with existing systems**
- **Flexibility and accuracy**
- **Real-time investigation**
- **Reduced environmental impact and constraints**

The system also has potential applications in scientific seismology and natural disaster management. The accuracy of the GNSS timing signals will allow detailed variations in subsurface stress or composition to be measured over time. Installing a GNSS seismography network in earthquake/tsunami prone or volcanic areas could help predict earthquake or volcanic activity and reduce the impact of these events on the local population.



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## GALILEO MASTERS 2006 REGIONAL WINNERS - BELGIUM / WALLONIA

### **Give Me The Path: a mobility helping system for blind and partially-sighted people**

The idea comprises the use of a small mobile device, such as a Pocket PC or a smartphone to locate and guide people in closed environments such as hospitals, airports, railway stations and supermarkets.

When someone enters a building equipped with the GMTP system, he only has to start the Pocket-PC application and choose his destination.

Currently, our system is based on Wi-Fi technology and a server searches for the person's location. The aim is to replace this Wi-Fi-based location system with Galileo. The main part of the calculation will then be done on the client device instead of the server.

After being located, the client application receives its position, represented by a co-ordinate couple. It then searches for the best way to a chosen destination through the building, with the help of a map drawn by a mapping application we developed. Our system also provides information adapted for blind people, such as surface textures, doors, but also other reference marks such as the noise of an elevator or the smell of a kitchen.

All information is vocally transmitted to the user, thanks to a vocal synthesis engine.

This system currently works but would be greatly simplified and a lot more precise with Galileo technology!

We managed to reach 4m - 5m precision with our Wi-Fi location system. That may seem a tremendous help to blind people; however, remember that they're used to moving with a white cane.

In the end, we'd like to use our system for other applications, in a more commercial way. Imagine you're wandering in a museum and would like to contemplate a certain artwork. You browse a menu and choose the artwork you'd like to be guided to. The system drives you through the museum and, when you arrive at destination, provides information about the artwork you're standing in front of!



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## **GALILEO MASTERS 2006 REGIONAL WINNER - CZECH REPUBLIC / PRAGUE**

### **Non-discrimination and value-added onboard telematics and tolling unit**

Road transport is one of the main mass application fields of satellite navigation systems. Numerous GNSS/GSM applications help to control, manage or watch both fleets and individual vehicles.

In toll collection systems based on communication between an onboard unit (OBU) and electronic toll collection (ETC) infrastructure, the use of GNSS significantly reduces the requirements of this infrastructure. On the other hand, objections concerning long satellite unit installation and the unreliability of correct toll determinations have appeared.

Future European OBUs should operate across all national EU ETC systems, as envisaged by the EC directive on OBU interoperability. OBUs should be also able to provide value-added services to vehicle operators.

**Princip OBU** is part of the effort to create such a satellite device. GSM is used for communication with the tolling system and value-added services and microwave communication used for enforcement and for tolling within microwave ETC systems. The units are technically interoperable with the major EU tolling systems. The unit is the successor of units developed as part of the EUREKA programme. The main focus of development was fast installation, improved satellite position processing, tolled segment determination reliability and the provision of value-added services independent of the tolling function. The unit is controlled and data processed by the neuron network system, which utilises elements of artificial intelligence.

### **No user discrimination**

Thanks to the high sensitivity of satellite positioning data,

the unit does not require any external antennas or sensors for auxiliary inertial navigation system. For this reason, the windshield installation concept was selected. The driver can install a non-discrimination version of the OBU in less than 2 minutes, meaning that no discriminative delay is caused to transiting traffic. The unit is powered from vehicle's lighter socket and its internal batteries ensure its function in the case of the main power being accidentally disconnected.

### **Tolled road determination**

Map matching algorithms process the satellite navigation information and determine the usage of tolled road segments with high reliability. No additional navigation system or roadside equipment for distinguishing between free and tolled roads that may run parallel to each other is necessary. The mapping data used is organized in blocks for easy upgrades – only several blocks and not whole map need to be upgraded when the road layout changes.

### **Value added services**

Fixed-mount OBUs require about 20 minutes' installation, but can provide value added services. A second GSM channel (paid for by the vehicle operator) can provide all the usual information (such as the current position and vehicle log). These functions run independently from tolling applications.

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## GALILEO MASTERS 2006 REGIONAL WINNER - FRANCE / NICE - SOPHIA ANTIPOLIS

### Scientific calculation of a site's exposure to sunshine

#### Concept

Creation of an Internet site, Solar-Indice.com, linked to a software platform which would use Galileo data to calculate scientifically the annual amount of exposure to direct sunlight for a precise point of a given building (main façade, French window, solar panel locations).

The result of the calculation, expressed in hours per year and accompanied by an historic graph, is delivered by the website in exchange for online payment of a modest charge of just a few euros. Since it is irrefutable, it can be used by all the market players: surveyors, property developers, real-estate professionals, buyers, sellers, but also by professionals in the solar energy sector or, on the other hand, the sun protection sector (sunblinds).

It could become a standard requirement as part of legal information to be entered into deeds of sale, as for the Carrez Law making surface areas obligatory. Solar-Indice could be taken into consideration when comparing and evaluating properties, or used to calculate the yield of solar installations.

#### Connection with the Galileo Project

Starting from a given geographic position, thanks to the reliability of Galileo positioning, it is easy to calculate the visible course taken by the sun (astronomic navigation software) throughout the year for a given location, and thus a theoretical number of hours of sunshine. One would simply have to deduct the obstacles to sunlight (buildings, vegetation...), measured in terms of height and degrees on the horizon to obtain a real, practical index.

### Means of implementation:

- 1 Development of the calculation software: completed
- 2 Creation of the website with online payment and hosting: underway
- 3 Referencing in research engines
- 4 Targetted advertising using Internet flyers
- 5 To be developed: interface to collect Galileo data and calculate the height of obstacles, which could be either manual or automatic, based on the future Galileo positioning device.



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**SIEMENS VDO**



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## GALILEO MASTERS 2006 REGIONAL WINNER - GERMANY / BAVARIA

### A satellite-controlled robot that hoes weeds

In organic farming and in water protection areas, it is illegal to use herbicides to deal with weeds. To keep weeds at bay in these areas, root crops need to be cultivated by hand – a cost-intensive process. It comes as no surprise that such monotonous, strenuous, time-consuming manual activities are not popular. As yet, no machine capable of carrying out this work automatically is available on the market.

One problem faced when developing a machine of this type is that it must be able to detect or “know” where each cultivated plant is located to ensure that it is not confused with a weed and inadvertently removed.

Previous attempts at overcoming this problem by using image recognition systems, infrared cameras or other sensors to distinguish weeds from cultivated plants have not met with success. In the current project, which is sponsored by the Bavarian High-Tech Initiative, each seed is individually planted and its position is determined and stored to an accuracy of approximately 1 cm using satellite navigation technology.

This means that after sowing, the positions of all the plants in a field are known, making it possible to calculate those areas in which hoeing can take place without the risk of damaging the cultivated plant. Since the position of the robot is regulated, it can move to these areas after the weeds have sprouted and successfully carry out the hoeing.

It is also possible to carry out activities such as watering, fertilising or spraying in strictly limited areas. After the European satellite navigation system Galileo has been introduced, we can expect to see increased accuracy and reliability as well as the advent of new potential applications for the robot.

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## GALILEO MASTERS 2006 REGIONAL WINNER - GERMANY / HESSE

### **G-WaLe: Galileo-assisted measurement of water levels**

#### **Summary**

G-WaLe is a Galileo-based system that enables enhanced forecasting of river floods and calibration of river models. Based on data provided by a network of water-borne Galileo receivers deployed in a river, G-WaLe generates the water level profile of a given river sector with high temporal and spatial resolution. Depending on the actual situation, this data is used to calibrate river models or assist crisis management.

#### **Background**

Flood catastrophes caused by rivers are a recurrent threat throughout Europe and the rest of the world. According to UNESCO, more than 2,200 water-related disasters occurred worldwide between 1990 and 2001. River floods accounted for half of these disasters. Flooding affects about 520 million people and their livelihoods annually and claims about 25,000 lives worldwide every year. Flooding is a problem that affects both highly developed countries and emerging countries.

In view of climate changes it is expected that both the frequency and intensity of flooding events may even grow, further increasing the potential of economic and social damage along the highly populated and highly developed riverbanks.

Reliable models are needed to support the design of flood protection systems and to enable the responsible authorities and task forces to issue early warnings in case of floods.

#### **Technical Solution**

A G-WaLe system consists of several (<100) self-contained, football-sized, buoy-like floaters with integrated Galileo receivers, communication and energy supply units. The

floaters are carried to their operational area by mobile vehicles such as cars, ships or helicopters and deployed into water. After being deployed into the river, G-WaLe floaters remain ("anchor") at a more-or-less fixed position while constantly receiving the Galileo signals. The vertical component of the Galileo measurement provides information on the river water level at each floater position. All floaters transmit their positions to a central reference unit, whose position is exactly known. This data provides the water level profile – e.g. a potential flood wave – in a given sector of the river. The data received by the reference station is collected, filtered and processed before being transmitted to a central data management centre. Depending on the actual situation, the data is then used to calibrate river models or to support crisis management.

#### **Advantages**

The system is available on very short notice in the event of emergency. Because of its mobility, the system can be used in remote areas (e.g. mountains) as well as in countries providing only small or no infrastructure. It is useable both for crises management and for regular water level data acquisition to enhance river models. G-WaLe provides data of a yet unknown temporal and spatial resolution. The system is cost efficient.



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## GALILEO MASTERS 2006 REGIONAL WINNERS - ITALY / VARESE

### Hikers' rescue system

Mountains can be very dangerous, particularly if the hiker has incorrect equipment, doesn't take their own capabilities into account, or if they don't remember that weather can change fast. Hikers can encounter a variety of problems (for example, thunderstorms, snake bites, or falls) that often prevent them from reaching help. Before embarking on their excursion, hikers often forget to collect information about how to call for help (such as telephone numbers); moreover, in the panic of an emergency, hikers are often unable to communicate the most important information: their own position! These factors all contribute to increased time between emergency services receiving notification of a problem and the rescue party arriving.

In this scenario, time is the most important factor for a rescue operation to be successful.

The main idea of the system we've conceived and designed consists of having devices, which hikers carry with them, that send GPS information and/or alarms to the system installed at the rescue centre. This system collects all this information and makes it available to the rescue team, which has an overview of the real-time situation at all times. The position of each device will be graphically displayed on the screen on a specific map.

Before an excursion, the hiker should request the device at the shelter/rescue centre, and if an emergency occurs, they are able to signal the problem by pressing a button on the device. However, devices also send positional information regularly at predefined intervals (for example, every minute). The rescue centre receives these signals and can respond immediately.

The devices are equipped with a GPS receiver and GSM/GPRS module; with these characteristics, the devices can send information about their GPS position, their own device identification (unique code id), and events such as "alarm button pressed". Information is sent to rescue centre by GSM technology (SMS) for the reason that in the mountains, the GPRS signal is frequently not enough strong to permit stable communications. Moreover, the device can receive voices calls to predefined numbers (i.e.: rescue service phone number). The device's GPS module is also able to correct its position with DGPS (Differential GPS) correction and send raw data to server for post-processing elaborations.

With this platform solution is also possible to pre-define routes, and use it to monitor whether hikers deviate significantly from their excursion path.

The platform is designed to provide active support to rescue monitoring activities in the mountain setting and to cater to the need expressed by Italian mountain communities to reduce time gap between hiking accidents and rescue service responses; and moreover, assist rescuers during search activities.



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## GALILEO MASTERS 2006 REGIONAL WINNER - NETHERLANDS / NOORDWIJK

### **Real World and Virtual World Integrated by GNSS Satellite; Real-time Racing**

iOpener, a young dynamic organisation headquartered in the Netherlands, is shaping up to be a leader in interactive concepts. Focussing on creating an optimal user/consumer experience, the organisation brings together a team of seasoned professionals with backgrounds in television, Internet and telecommunications.

The organisation's initial product offering is aimed at the rapidly expanding gaming market. What can better create an optimal experience than when real 'objects' are integrated into the virtual world? With this visionary idea, iOpener's founder, Thiag Liang Ong, devised a new technology which is defined in the 'real-time racing' patent.

The patent's technology is used in iOpener's 'real-time racing' game, through integrating GNSS data together with the cars' data and track data into a virtual console/online game.

"This innovative technological breakthrough will enable players to join the game and compete in real-time directly against professional racing pilots when an actual live race is going on. Gamers will be able to join the excitement and suspense of the real race, and try to beat real-world, professional pilots and other virtual gamers right from their own homes", says Andy Lüring, Commercial Director of iOpener. His colleague Lex Knobben adds: "The market's reaction towards this new exciting value-added feature in the gaming world has been phenomenal, and the concept can be leveraged for all auto, motor and other racing games."

The proof of concept is currently under development for the real-time racing product, and is now ready for further investment to develop a marketable version of the 'real-time' game, which is expected to launch in the consumer market by the end of 2008.

Looking to the future, iOpener has already identified a number of other games where GNSS technology can be used to integrate the real world and the virtual world, including several value-added 'serious' gaming concepts. Combining the 'user generated content' Internet era with GNSS, iOpener is also exploring concepts by which to connect personal GNSS devices to the (mobile) Internet.

iOpener is convinced that GNSS will play a pivotal role in the realisation of the integration of the real and virtual worlds, and will leverage this to strengthen its position as market leader in this area.



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## **GALILEO MASTERS 2006 REGIONAL WINNER - SPAIN / MADRID**

### **Electronic seal for ISO cargo containers**

The idea consists of designing and developing an active electronic seal for ISO cargo containers as an alternative solution to traditional mechanical seals by using RFID techniques linked to the Galileo system for increased accuracy and integrity, as well as to benefit from its certified services and availability. In fact, Galileo will be a very good tool for bringing innovation and progress in this field.

An active seal can register its position, container ID, ISO type, the cargo being carried, the cargo manifest number, an encrypted seal code ID and ship route information, as well as any information required when transporting dangerous goods. All data registered by the seal may be transmitted to third systems.

All this information, together with dynamic positioning from Galileo, will be the basis for implementing real-time tracking and tracing facilities for cargo containers within maritime transport, and in particular, for both short sea shipping links and motorways of the sea. These facilities may help to increase not only safety and security, but also reliability of schedule from shipping lines. Also, the system may help to implement voyage consultation facilities for users and road transport operators. Further to this, this kind of tracking may also help to simplify customs procedures.

Active seals can initiate transmissions as well as respond to interrogation. Therefore, active seals may travel under standby

regimes, waking up by request from external systems, and thus optimising power supply time from batteries.

Expressed user needs for greater range and the ability of signals to wrap around obstructions in terminal operating environments prompted the international standardization groups working on electronic seal and read/write container RFID standards to add active RFID protocols.

The system will be able to handle immediate reporting of breach or tampering so that authorities may interrupt improper activity or act to foil criminal intent. Some technologies can accomplish this within a certain area, such as port terminals, but use of satellites is necessary in the field of maritime transport.



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# GALILEO MASTERS 2006

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## EXPERT MEETING

NICE -  
SOPHIA ANTIPOLIS



## KICK-OFF MEETING

UNITED  
KINGDOM



## KICK-OFF MEETING

PRAGUE



## KICK-OFF MEETING

NETHERLANDS



## KICK-OFF MEETING

SPAIN



## EXPERT MEETING

GERMANY/  
BAVARIA



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