For any large manufacturing or retailing enterprise knowing exactly where its goods and supplies are in the world is essential. Fully understanding and optimising a global logistics and supply chain requires a complex monitoring system, key to the company’s efficient operation.

The GALAPAGOS (GALileo-based seamless and robust Positioning Applications for Logistics Optimisation Processes) project is working to demonstrate a positioning system designed specifically for logistics applications and in particular for container tracking. The system is based on high sensitivity satellite navigation receivers augmented by EGNOS data.

This 15-month project commenced work in February 2009 and received funding through the EU’s Seventh Framework Programme for Research.

**Seamless and robust solution**

The proposed GALAPAGOS system uses multiple communication methods to provide robust and seamless monitoring as part of a specialised operational logistics system.

“The system must always be able to provide a position for the container, box or other object in the logistics process,” says Philipp Brandes of OECON, a company based in Germany and the project’s coordinator. “This is what we mean by a robust and seamless positioning system: robust in this context means stable positioning data, and seamless means a location wherever the container is – whether inside a building or outside in transit.”

To achieve this aim, GALAPAGOS is integrating a number of different technologies. The core technology is based on high sensitivity global navigation satellite system (GNSS)
receivers augmented by assistance data provided by the EGNOS Data Access System (EDAS).

In addition other positioning technologies such as GSM (mobile phone) and WiFi /WLAN can be incorporated to improve continuity and availability of the positioning information in complex environments – such as inside large warehouses. Ad hoc networks can also be used to establish short and fast communication connections between individual containers.

In this way the GALAPAGOS system can guarantee provision of seamless data as objects move along the supply chain during a complete logistic operation.

**Three modules**

GALAPAGOS is developing three types of autonomous module for use in tracking elements along the logistics chain.

The first module uses GNSS and GSM to report its position back to a logistics data centre but cannot communicate with other components in the system.

Positioning using GSM signal triangulation is not very accurate compared to the high precision obtainable via assisted EGNOS data. However GSM provides reasonable positioning information in environments that are difficult for GNSS reception.

“Obviously to operate GNSS systems needs line of sight to the satellites,” explains Brandes. “In large indoor storage areas or factory complexes this is not possible so we must fallback on GSM location data to maintain continuity.”

In addition the project is developing an ad-hoc networking element largely based around OECON’s radio frequency identification tag technology that allows accurate relative positioning between slave and master modules in the same location.

The second GALAPAGOS module also uses GNSS and GSM for positioning, with the addition of ad-hoc networking capability and communication with other modules in its neighbourhood.

“This allows this second type of module to act as a master unit for other logistics elements,” explains Brandes. “The related ‘slave’ elements would be equipped with the
third type of GALAPAGOS module that only has the ad-hoc networking capability and is very simple, very cheap and very easy to attach to a container."

All the modules have low power consumption and long battery life. The first two, more complex modules, are expected to have a battery life of up to two years.

**Server side**

But robust positioning is only one part of the complete logistics solution. How the data is stored, analysed and reported is just as important for a comprehensive logistics operation.

The logistics user must have easy access to the data,” explains Brandes. “It is possible that the organisation will need to monitor hundreds of thousands of individual elements in their supply chain. So the system needs to create comprehensible reports and analysis summaries that allow logistics managers to understand what is happening to their units. Queries such as how long it took for a container to move from one plant to another location, or the history of a particular container during one month – for example how long did it stay with a supply partner or how long was ‘idle’ in a storage area – need to be available on demand.”

The core aim of the project is to provide this information so that managers can optimise their logistics process. “The more data that the managers have to hand, and the more comprehensible it is, the better the logistics system can be optimised,” comments Brandes.

The positioning modules transmit data to the data centre every few hours, usually between five and six times a day. This is a reasonable frequency for most logistics operations. The reporting software can be set up to provide management alerts when a logistics object moves into or out of pre-determined geographical areas, for example when it leaves a factory or supply partner’s storage area – or even when it leaves a country or continent.
Team work

OECON is working on developing the positioning systems, communication methods, hardware, software and systems for GALAPAGOS, while Dynatronics from Switzerland is contributing their expertise in near field communication methods and ad-hoc networks components – in particular for hardware development of the various modules.

Poland’s Poznan University of Technology is researching scientific aspects of the future integration of the system with Galileo, ad-hoc communications networking, antenna technology simulation of the ad-hoc network, and working on GSM algorithms.

TeleConsult Austria is developing the service centre, server reporting software, geodata generation and system design.

Finally, Tele+ Italia from Italy is working on project information dissemination, the business model and a market potential business plan for future exploitation.

A very important associated partner is Volkswagen Logistics, who are helping to test the system in ‘real world’ situations.

“Volkswagen run a complex logistics operation and they are helping to refine project definitions and give feedback on the client experience and what the user really needs to know form the system,” says Brandes. “This helps take the project development very close to market.”

Galileo Application Days in Brussels

At Galileo Application Days in Brussels GALAPAGOS demonstrated various components of the system and the application server. “The main focus was on the kind of reports and analysis that the system can produce,” says Brandes. “This showed users the benefits they can get out of the system.”

The demonstration featured real-time monitoring of individual containers and the ‘master/ slave’ function in the ad-hoc networking application.

Galileo Application Days, held on 3-5 March, kicked off this year’s European Satellite Navigation Competition (ESNC). The event was hosted by the European Commission and organised by the European GNSS Supervisory Authority (GSA) and the Application Centre
Optimising logistics with a seamless solution

for Satellite Navigation in Oberpfaffenhofen, the managing organisation for ESNC. It was sponsored by the European Space Agency’s Technology Transfer Programme.

The European Geostationary Navigation Overlay Service (EGNOS), Europe’s first venture into satellite navigation, improves the accuracy of the open public service offered by the USA’s Global Positioning System (GPS). EDAS disseminates EGNOS data in real time without relying on the signals from the three EGNOS’ satellites. EDAS is the single point of access for the data collected and generated by the EGNOS infrastructure. Galileo, a global navigation satellite system being developed by the EU, is scheduled to be operational by 2014.

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