Europe's Galileo signals used for ocean remote sensing in space

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Surrey Satellite Technology Ltd and the University of Surrey have succeeded in detecting a weakly reflected Galileo signal off the ocean surface using the GPS Reflectometry Experiment on one of SSTL's small satellites, UK-DMC. The reflection was received off the North coast of Australia on 4th November 2007, and the shape of the reflection gives an indication of the ocean roughness, and hence the weather at that place and time (where the wind speed was around 22 km/h, or 14 mph).

The GPS Reflectometry Experiment was carried into space on the British remote sensing satellite UK-DMC launched in 2003. The experiment was a pioneering demonstration that GPS reflections could be used as a means to determining the roughness of the ocean, using a method called 'bistatic radar' or 'forward scatterometry'. Unlike other radar remote sensing techniques, no transmitter is required as GPS satellites are already broadcasting predictable signals to the Earth 24 hours a day. A satellite dedicated to GPS reflectometry would only therefore need to carry a modified GPS receiver and an antenna, which could potentially be accommodated on a tiny 10 kg satellite platform at a low cost.

GIOVE-A, the first Galileo demonstration satellite, also coincidentally built by SSTL was commissioned by the European Space Agency and has been transmitting prototype Galileo signals since its launch in December 2005. While the orbiting experiment on UK-DMC is not optimised for Galileo signals, enough of the reflected signal energy was received to allow the detection and plotting of the weak signal from a

short 20 second data collection by a PhD student at the University of Surrey, Philip Jales.

Dr Martin Unwin, head of the GNSS/GPS team in SSTL, commented: "This is an important achievement in the field of remote sensing, and shows the potential offered by Galileo for scientific purposes. Signals from Galileo in conjunction with those from GPS, and the Russian and Chinese systems, Glonass and Compass, can all be used as part of a new tool for ocean sensing. A constellation of small satellites could be deployed at a low cost to take measurements over the oceans where there are large gaps in forecast knowledge at present.

More navigation satellites mean more measurements, and some the future high bandwidth signals transmitted by Galileo in particular will enable higher resolution measurements of special interest to scientists, for example, in resolving wave heights. An improved measurement system in space such as this could be used to warn mariners of storms, and as an input towards global climate change models, and potentially even to detect Tsunamis."

The UK-DMC Reflectometry Experiment has also previously been used to detect GPS signals reflected off ice and, surprisingly, off dry land. The value of these measurements has yet to be fully explored, but they may be used as inputs for climate modelling.

A future revision of the experiment, the ‘GNSS Reflectometry Instrument’ is now being designed at Surrey with a view to a flight on a future satellite mission. It is being designed specifically to receive Galileo signals as well as those from GPS, with the intention of real time processing. "The sooner Galileo is up and transmitting the better," said Dr Unwin.

Source: University of Surrey