New 'pollution radar' developed to provide unprecedented picture of urban smog

March 9 2009

(PhysOrg.com) -- Scientists and industrialists have invented a sophisticated new air quality measuring device that can act as a pollution radar over cities.

A team from the Surrey Satellite Technology Ltd, the University of Leicester and EADS Astrium are behind the technology that can be placed on satellites to provide unprecedented detail of gases in the atmosphere.

The researchers are also developing ground-based instruments this year, which will be able to create 3D maps of atmospheric gases.

The technologies have emerged from the UK's Centre for Earth Observation Instrumentation (CEOI) which is actively engaged in the development of novel Earth observation instrumentation and acts as a catalyst for the development of technologies for environmental monitoring from space. It is jointly supported via the Natural Environment Research Council (NERC) and Department of Innovation, Universities and Skills (DIUS).

Professor Paul Monks from the University of Leicester is one of the project leaders of the Compact Air Quality Spectrometer (CompAQS), a CEOI project to develop a compact imaging spectrometer operating in the ultra violet and visible (UV/VIS) part of the spectrum, with a number of potential applications on satellite platforms. The technology developed is now being adapted, through the NERC knowledge

exchange funding into the CityScan project, to enable the quality of the air to be easily and continuously monitored across physically large urban and industrial spaces.

He said: "The instrument has been developed for potential deployment as a small satellite payload and provides the performance of current, comparable instruments, which are significantly larger in size. Its compact size, achieved through the use of a novel optical design, means that the costs of manufacture, platform development and launch can be minimised

"There is now overwhelming consensus that poor air quality impacts on human health. The World Health Organization has estimated that 2.4 million people die each year from causes directly attributable to air pollution, with 1.5 million of these attributable to indoor air pollution. Population exposure to increased levels of gases and particulates requires action by public authorities at the national, regional and international levels.

"Measurements of atmospheric composition and quality are important to both the long term monitoring and control of human and naturally occurring emissions and the shorter term effects on human health. There is an increasing need for data to be collected, on a long term basis, in more detail, over larger areas and with higher levels of consistency with the CEOI playing a key role in meeting this challenge."

During 2009 two new CompAQS instruments are being constructed and configured for use as a ground-based Differential Optical Absorption Spectroscopy (DOAS) system by the University of Leicester, in collaboration with partners at Surrey Satellite Technology Ltd. These instruments will operate in the visible wavelength region to enable virtually real-time, 3D maps of atmospheric gases such as nitrogen dioxide to be constructed with five-minute time resolution. This is

achieved by the simultaneous analysis of scattered solar UV/Visible radiation from multiple instruments and multi viewing geometries, giving an unprecedented level of information on the dynamics and composition of the urban environment.

The CityScan instrument will have significant advantages over currently available air quality monitors providing a continuous monitoring technique for an entire urban area. Each system is envisaged to provide coverage of areas of some 25 km2 and to undertake real-time monitoring of nitrogen dioxide and aerosol at a spatial resolution of 50m. Effectively, acting like a pollution radar.

CityScan will enable the collection of unique air quality monitoring datasets with the potential to open up new areas in emission monitoring, pollution measurement and air quality control. Such measurements need high performance spectrometer and detector systems, sharing a number of key development demands with satellite instrumentation. This technology is therefore a natural spin-out avenue for space-borne spectrometer developments, with advances made in CityScan being fed back to the UK space industry via the project partners.

Source: University of Leicester