Centre for EO Instrumentation & Space Technology

CEOI-ST Industry Consultation Workshop

Summary Report

"Remote Sensing, GIS, and Unmanned Aerial Vehicles Sector",

26th of March 2014

MRC Offices, London

Identifying the instrumentation and data needs for future applications in the Remote Sensing, and GIS sectors is essential to enable timely development of the next generation of earth observation / remote sensing instruments. In addition, the miniaturisation of remote sensing instruments is converging with the increasing payload capabilities of the rapidly emerging commercial UAV market, enabling the emergence of new applications and services.

The round-table consultation brought together industry representatives from all three sectors to discuss and provide input on market trends, challenges and opportunities that will inform CEOI-ST's strategy for the next generation of earth observation / remote sensing instruments. Based on the interests of the participants, three topic areas were identified for discussion:

- Earth Observation Instruments
- Instrumentation for Unmanned aerial vehicles
- Remote sensing data – sources, provenance, characterisation (e.g. meta-data), and quality

A range of conclusions were reached during the discussions. In earth observation, a major challenge for commercial applications is temporal resolution; spatial resolution is generally sufficient for current and potential applications. Substantial improvements in temporal coverage will enable a wide range of new applications, including "persistent" monitoring.

Nanosats are one route to addressing this issue through the reduced cost of deployment. Their ability to provide continuity through rapid replacement of failed satellites and the deployment of more constellations can give commercial companies security of service through continuity and redundancy. However, the size, weight, cost, and power needs of EO instruments need to be reduced substantially, whilst delivering adequate performance, if this is to become a reality.

There is a big need to identify and educate major markets in the benefits space can bring. Some suitable markets that are or could be using EO data are oil & gas, mining, insurance, and satellite hydrography. There is a significant interest in how data from the Copernicus satellites will be validated as this will affect the ability of the data to be used in applications.

Commercial thermal imaging may be the next big opportunity in EO. DMC revolutionised optical imaging, while NovaSAR is revolutionising radar. Not included in the Copernicus constellation, missions providing reliable, long-term thermal imaging may open up significant new markets.

There are also major future opportunities for hyper-spectral imaging, especially with high spatial resolution. However, there are a number of barriers at the moment. Temporal resolution is insufficient, and data interpretation is sufficiently complex to be a major barrier to adoption. Currently, hyper-spectral imaging is more of a research tool due to calibration issues.

What are the business models that will work for EO? Viable service chains often need multiple actors; end users don't wish to take on acquisition, just use the knowledge for exploitation.

The use of UAVs and the number of applications have started to grow rapidly over the past year, as has interest in their wider exploitation. The main emerging applications are imaging and survey using video cameras, still cameras, and a limited amount of Lidar. Hyper-spectral

imaging is just starting to be evaluated. The main markets for these UAV applications are engineering, surveying, media, utilities, oil & gas, and property.

UAVs and earth observation satellites have vastly different spatial and temporal coverage, and UAVs, with a current operating range of up to 5km, can only fill part of the gaps caused by the orbit and swath width limitations of many satellites. Initiatives are underway to increase the operating range of UAVs, which will strengthen the synergy between the two platforms resulting in better solutions for a wide range of current and emerging applications. Emerging market opportunities for these combined services include insurance, agriculture, oil & gas, mining, support for data services such as mobile and fixed telcos, and maritime.

This combined approach could be a "game-changer" but there are a range of challenges that need to be addressed if UAVs are to achieve this. They include:

- Major reductions are required in the weight, size, cost, and power consumption of remote sensing instruments, while maintaining performance that is fit-for-purpose. The regulatory limit for UAVs (airframe / fuel / payload) is 40 Kg with airworthiness certificates, and 20 kg without. Wide spread deployment of remote sensing instruments on UAVs is dependent on overcoming these constraints.
- A better understanding of the current and future applications to enable optimum data types and datasets to be identified and new techniques for combining them effectively to be developed. Meta data from these sensors is also a key issue in order to enable the outputs to be incorporated into different applications.

In the data arena, a translational tool is needed that enables users to find sensors with right spatial and meta-data attributes. At the moment finding the right data is a black art. (This service is being developed by an SME based at Harwell).

There are a number of significant challenges in the use of remote sensing data, including standardisation of meta-data; gaps in data sets; inter-operability of data; data management; data fusion and synthesis from different data sets. The final issue identified is the QA of data, which is a growing problem as data volumes get larger.

To support commercial deployment of earth observation instruments on small-sats, cubesats, nanosats, and UAVs, and enable utilisation of the data from them in products and services, the CEOI-ST strategy will continue to address the issues of size, weight, cost, power consumption, calibration and ground-truth referencing of instruments. Additional issues of ITAR free remote sensing systems; data formats, quality, and meta-data; techniques for the synthesis, analysis and interpretation of hyperspectral imaging data are outside of the scope of the CEOI-ST programme and need to be highlighted to Government and relevant other bodies.

The inputs and conclusions of the workshop, as summarised in this report, will provide an important input into the strategy for the CEOI-ST programme.

Further information about this technology and others funded by the CEOI-ST can be found at www.ceoi.ac.uk. You can also contact the CEOI-ST Director, Professor Mick Johnson: Tel: +44 (0)1438 774421 or email: mick.johnson@astrium.eads.net.