

Space for Smarter Government: Environmental Monitoring

Workshop Report

21st March 2014

Satellite Applications Catapult, Harwell

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1. Introduction

1.1 Space for Smarter Government Programme

The public sector is a user of data and information acquired through space, such as for communications, navigation information, and earth observation images and data. The rapidly increasing quantity and types of data, information and images being created and delivered through programmes such as Copernicus and Galileo have the potential to enable new applications to help manage the challenges faced by central and local government, and other public bodies.

The Space for Smarter Government Programme (SSGP), run by UK Space Agency and the Satellite Applications Catapult aims to inspire and enable Government to make a step change in the use of space for smarter, more efficient operations and to use the UK Government as an anchor tenant to drive growth through export of UK space products and services.

1.2 Environmental Monitoring Workshop

The Space for Smarter Government: Environmental Monitoring workshop was developed for both the Forum for Earth Observation Applications community and the UK Environmental Observation Framework (UKEOF) Management Group organisations, as well as others within public sector organisations, who either already or could potentially use space products and services to enhance their environmental monitoring programmes.

The aims of the workshop were:

- To provide the opportunity to discuss how environmental monitoring can be enhanced using space products and services
- To demonstrate how government programmes (particularly SSGP), new data streams and funding mechanisms can help organisations to take action

2. Summary of the day

The workshop was held on 21st March 2014 at the Satellite Applications Catapult in Harwell. The event was well attended, with 65 participants from across government, industry, and SMEs and large companies representing the space sector. The full agenda and list of attendees can be seen in Annex 1 and Annex 2. All presentations can be found on the [UKEOF website](#).

The workshop began by considering the challenges faced by the environmental monitoring community. This was followed by a series of presentations from across the community, detailing what is already being done with data and information from space. In the afternoon, information was presented about what space products are available for use. Eurisy, a non-profit association of European space agencies that creates networks between space and society, presented solutions that have been implemented in Europe. Finally, there were three breakout sessions aimed at considering various opportunities and finding out what is needed by the environmental monitoring community from space. The outcomes of these discussions are provided in Section 3, together with some suggested next steps, in Section 4, to take forwards the issues raised during the day.

3. Breakout Sessions

3.1 Environmental Policy and Monitoring Requirements

Aim: To start discussions for the preparation of a Road Map for Defra to use for space 2015-2020.

Three specific areas for discussion were identified. A number of issues were raised out of these discussions that were split into two main focal areas: product requirements and process requirements. The issues raised are listed below with process requirements highlighted in italics.

1. What are our current needs
 - a. High resolution imagery of topography that is multi-temporal (to show seasonal changes).
This can be an operational service or reporting service.
 - b. Land-cover maps
 - c. In-field crop monitoring
 - d. Global food and water security
 - e. Ability to track animals to provide situational awareness and track vectors to assess disease risk
 - f. *Joined up community, aggregating user needs*
 - g. *Clarity on roles and responsibilities across Whitehall and Government agencies to assure short, medium and long-term monitoring*
 - h. *Different departments and agencies work together*
 - i. *Further understanding of what our needs are/what we want to share*
 - j. *A system of cost sharing.*

2. What are our future needs?
 - a. Monitor most individual species
 - b. See everything, everywhere all of the time
 - c. Ability to track soil function using a variety of measurements ie. nutrient status, how much GHG is being stored, how much water is stored
 - d. Real-time alerts to provide knowledge of tipping points in ecosystems to manage and mitigate unexpected change, ie. drought, pest infiltration, slow chronic changes which increase sensitivities to acute events
 - e. Systematic data integration technologies
 - f. Much more frequent imagery to provide dynamic change mapping
 - g. Data hub/cube
 - h. Currently unforeseen, new services
 - i. Services to sell overseas
 - j. *Linking increased data techniques through to models*
 - k. *Further education on what space can offer*
 - l. *Further clarification on data storage and access*
 - m. *Easier tasking*
 - n. *Automated but trusted pre-process with good Q&A (removal of human processor saves time and money).*

3. What is space unable to help us with?
 - a. Monitor most individual species
 - b. See everything, everywhere all of the time
 - c. Slot in easily to existing operational systems
 - d. Provide continuous service (except Copernicus)
 - e. Only provides proxies for sub-surface information
 - f. Never 100% imaging time per orbit
 - g. Global coverage not in equal detail /amounts
 - h. Zoom function (using the satellite but this can be achieved using a visualisation tool)
 - i. Services unaffected by weather (ie satellite TV and communications poor in bad weather)
 - j. GPS coverage affected by forest canopy
 - k. High resolution surface temperature
 - l. Unable to detect many chemicals.

In summary, the general consensus on the use of Earth Observations was positive. More information is required on the data and services provided by Copernicus. Additionally, there is a need to improve processes to make use and sharing of data more streamlined and user friendly.

3.2 Mapping, visualising and integrating data sets

Aim: To discuss common capabilities, issues and plans

Two presentations were delivered, followed by discussion as detailed below:

1. Visualisation Wall – Presentation by Stephen Spittle
 - a. A demonstration of the Visualisation Wall at The Satellite Applications Catapult was given, including examples of how the wall is being used. For instance, it has been used by Torness Powerstation in Scotland to help monitor jellyfish blooms, to find a way to prevent them from clogging the intake filters.
 - b. The benefits of the wall were presented including the ability to split the screens, or view imagery and mapping as one across the screens. This allows for a team of people to observe the wall and enables easier understanding of change over time.
 - c. The screen complements a large computing power that sits behind the wall and is able to undertake powerful data analysis.
 - d. There are innovation vouchers available from TSB for organisations to use the visualisation wall or other facilities.
 - e. It was agreed that the Civil Contingencies Committee should be informed about the visualisation wall for potential future use.
2. Copernicus Land Mapping Service – Presentation by Geoff Smith Specto Natura Ltd
 - a. Examples of different layers were given, for instance the imperviousness, forest and waterbodies layers. Benefits from these were demonstrated, such as detecting changes in urban development from the imperviousness layer.
 - b. It was recommended that the land services should be considered as a support layer for most applications and will be complimentary to other mapping.
 - c. Details about the Sentinel satellites were given; Sentinel-1 is about to be launched.

- d. Beth Greenaway invited discussion. There was agreement that these were useful support tools, although some of the more useful hi-res layers had been removed from the service, thus devaluing them in the biodiversity arena.
- e. It was noted that data sources needed combining with other data such as aerial and LiDAR, in order to obtain the required level of information.
- f. There was agreement that many users want the same baseline information / data/ images and therefore there could be benefits to the core mapping information being compiled centrally in a hub, where data storage is fast and access is easy for both commercial and public sector users.
- g. Many of the group just wanted access to the data from the Sentinels and to know how to access this rather than any of the derived products from the services.
- h. There was discussion around the Copernicus Network Groups which Defra run to gather user requirements for Copernicus. To find out information about these, it was recommended to speak to Geoff Smith or Zofia Stott to be added to the mailing list.

3.3 Monitoring with a new generation of sensors

Aim: To give the environmental monitoring community a chance to discuss the abilities of the new technologies.

Two presentations were given, followed by discussion as detailed below.

1. New Technologies and tools from SatComms – Presentation by Keiran Arnold, Satellite Applications Catapult
 - a. Kieran spoke about the Internet of Things, remote connectivity via satellite and machine to machine (M2M) and its applications were discussed.
 - b. Kieran outlined that the majority of these terminals were on the L-band or UHF-network frequencies.
 - c. The cost of the smaller modules varies depending on the frequency used, some UHF modules were as cheap as £200 whereas smaller modules for L-band start at £1000. These prices will only decrease as the market and demand increase but they will always be behind the mass market of personal mobile phone sensors.
2. Satellite Remote Sensing technologies and tools for Position Navigation and Timing (PNT) – Presentation by Alex Efimov, ESP KTN
 - a. Alex introduced the Knowledge Transfer Network (KTN) and their work.
 - b. Remote sensing principles and LIDAR were mentioned.
 - c. NovaSAR-S and Sentinel-1 were discussed including the applications of these satellites.
 - d. A comparison was presented between GNSS, GPS, GLONASS and other Position, Navigation and Timing (PNT) systems available.
 - e. Alex then led a discussion on levels of accuracy provided by each of the PNT systems and raised the question as to how accurate the environmental monitoring community need their data to be, in terms of positioning and real time data.
 - f. Reliability issues were outlined as were the possible mitigations after with general feeling that satellite systems are highly reliable.
 - g. Alex concluded his presentations with a look at how the data could be used for spatial analysis and actionable information and a look to future opportunities for sensing and PNT innovation.

3. Discussion - How could the environmental monitoring programmes be transformed with the use of these tools?
- a. Position and Timing could be used as verification of monitoring records. It could also provide a unique identifier for cataloguing and database purposes.
 - b. Positioning capabilities could be utilised for monitoring adherence to legislation e.g. if integrated into fertilizer spraying mechanisms from tractors.
 - c. GNSS would provide ease of access for reporting and recording issues particularly when citizen science projects were initiated e.g. reporting oil spills or potholes or other road issues.
 - d. The Internet of Things was discussed in regards to its uses for environmental sensing and the significant impact it could have in rural areas.
 - e. The discussion then turned to the limitations and/or difficulties:
 - There is currently no single repository for data aggregation of the information currently available. There would be benefits to creating a central repository that could store adjusted/collated data as well as the original data.
 - There is little consistency in how this data is recorded and tagged for database purposes – an agreed format would be highly desirable.
 - UAVs were discussed as a great potential for environmental monitoring but the group realised that legislation would need to be significantly altered to allow this expansion.
 - f. It was agreed that departments and bodies should consider taking a more collaborative approach to requirements at the point of tendering for space data so that multiple organisations can be served and costs proportionally distributed.
 - g. Further discussion is also required as to whether this data should be made available to the public or not, taking into consideration the benefits it may have to citizen science, with individuals able to collect and review the data.

4. Conclusions and Next Steps

This workshop was very positive and allowed open discussion between organisations who would not routinely meet. It was recognised that this is the start of the discussions and the next steps have been identified to build on the success of the workshop and to move the environmental monitoring community towards enhanced use of space products and services.

- a. The Satellite Applications Catapult should disseminate information to the community about how they can access data from the Copernicus Sentinels. There is a general lack of awareness among organisations.
- b. Breakout A provided a forum to begin discussions on creating a roadmap for Defra (network) use of Space 2015-2020. This will now be continued by Defra and SSGP over the next few months. Once created, the roadmap can also provide a framework for strategic discussions with the wider community, beyond the Defra network, about space requirements and will therefore be shared more widely with the UKEOF community in the autumn.
- c. Organisations are currently lacking a central hub where raw, processed and collaborated data can be easily compiled, tagged and accessed. A key action from this workshop is for the SSGP team to work with the Satellite Application Catapult and wider industry to develop the scope and remit for this concept.
- d. It was recognised that there is a benefit to sharing best practice around using space products and services and SSGP will continue to work with the FEOA community, the Defra Copernicus groups and UKEOF to encourage organisations to share their strategies for using Satellite Data.

- e. There are many examples of use of space in the UK but few are showcased on the Eurisy website. Both public and private sector are encouraged to consider the solutions outlined by Eurisy and if their own success stories could be shared more broadly to promote uptake and use.
- f. Space for Smarter Government Programme to discuss possibilities of legislation change over UAVs.

Annex 1: Workshop Agenda

Space for Smarter Government Programme
Environmental Monitoring Workshop
Friday 21st March 2014
09:30 – 16:00

Workshop Agenda

09:30 Registration and coffee

Welcome and Introductions

10.00 Welcome - *Doug Wilson EA , Chair UK Environmental Observation Framework*

10.00 Aims of the day and introduction to SSGP – *Beth Greenaway, UK Space Agency*

10.10 The facilities of Harwell – *Nick Veck, Satellite Applications Catapult*

10.15 Environmental monitoring challenges – *Helen Beadman, UK Environmental Observation Framework*

What is the community already doing with space? Chair Doug Wilson

10.30 A review of 20 years of remote sensing in Natural England – what next?
- *David Askew, Natural England*

Questions

10.50 Exploring new methods for monitoring peat extent and condition in Wales - *Professor Bridget Emmett, Welsh Environmental Research Hub Steering Board*

(11.00 GIS at Kew - *Katherine Willis, Kew – unable to attend*)

11.10 Satellite Data Activities in Scotland - *Susan Stevens, SEPA*

11.20 Defra projects exploring the use of Space - *Jonathon Hicks, Defra*

11.30 EO for UK Habitat Mapping - *Paul Robinson, JNCC*

11.40 Novel techniques for processing images - *Dan Morton, CEH*

11.50 Applications of Space in the Met Office - *Ali Price, Met Office*

12.00 Smarter marine monitoring: assessing UK water quality from space - *Rodney Foster, CEFAS*

What's new from Space? Chair Beth Greenaway

12.15 What can the space sector offer? - *Jimmy Slaughter, SSGP*

12:40 The Disaster Charter - *Alice Bunn*

12:45 **Lunch and networking**

13:30 **Inspiring solutions from across Europe** – *Colin Hicks, Eurisy*

Questions

Breakout Sessions

14.00 Introductions to the breakouts – Are there common requirements , solutions, projects, actions?

A. Environmental policy and monitoring requirements- opportunities from space

B. Mapping, visualising and integrating data sets

C. Monitoring with a new generation of sensors- what is the role of space

Conclusions and next steps

15.15 Feedback of 3 key outcomes from breakout groups

15.25 Reflections of the day and next steps – SSGP, UKEOF

15.30 Refreshments and networking.

16:00 Close

Annex 2: Workshop Attendees

<u>Name</u>	<u>Organisation</u>
David Allen	Natural Resources Wales
Samuel Almond	CGI
Farhana Amin	Defra
Helen Beadman	UK Environmental Observation Framework
Elizabeth Bohm	The Royal Society
Philip Briscoe	Rezatec
Alan Brown	NRW
Paul Brown	Fera
Alice Bunn	UKSA
Richard Campbell	Serco
Debbie Clifford	National Centre for Earth Observation
Jacque Conway	Airbus geo-intelligence
Simon Crutchley	English Heritage
Mike Cutter	SSTL
Ian Davidson	Defra
Gareth Davies	Serco
Philip Davies	Deimos UK
Ian Downey	ESA
Alex Efimov	ESP KTN
Bridget Emmett	Centre for Ecology and Hydrology
Grazia Maria Fiore	Eurisy
Peter Fletcher	Airbus Defence and Space
Rodney Forster	CEFAS
Teresa Gonzalez rico	Future cities catapult
Eva Greco	Satellite Applications Catapult
Beth Greenaway	UK Space Agency
Tom Gunner	UKspace
Crispin Hambidge	Environment Agency
Jonathan Hicks	Defra
Colin Hicks	Eurisy
Claire Horton	Welsh Government
Sophie Isaacs	UK Environmental Observation Framework
Tim Just	Technology Strategy Board
Carol Kelly	Satellite Applications Catapult
Deirdre Kelly	Magellium Ltd
Steve Keyworth	Environment Systems
John Kupiec	Environment Agency
Michael Lawrence	Magellium Ltd
Iain le Duc	self-employed
Daniel Morton	CEH
Jaqueline Parker	Team Projects
Derek Pedley	ESKTN
Ali Price	Met Office
Jose J. Ramos	Deimos UK
Tobias Reinicke	Magellium

Andrew Richman	Environment Agency
Paul Robinson	JNCC
Douglas Scott	Welsh Government
Elizabeth Seaman	UK Space Agency
Andrea Sharpe	NERC
Andy Shaw	Terreflexion Consulting Limited
James Slaughter	Satellite Applications Catapult
Geoff Smith	Specto Natura Ltd.
Mike Stephenson	British Geological Survey
Susan Stevens	Scottish Environment Protection Agency
Vladimir Stoiljkovic	Satellite Applications Catapult
Zofia Stott	Assimila Limited
Richard Turner	RTC Ltd
Tim Vallings	Rezatec
John Vesey	Satellite Applications Catapult
Fausto Vieira	ESA
Rich Walmsley	Environment Agency
Lawrence Way	JNCC
Doug Wilson	Environment Agency
Mike Wooding	Remote Sensing Applications Consultants Ltd