

Satellite Applications

Earth Observation Showcase

Emerging Applications Powered by Innovative Technologies

Routes to Market

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Thursday 26th October 2017

Innovate UK
Technology Strategy Board

CATAPULT

Agenda



Routes to Market Report
07 - Satellite Technologies for
Carbon Monitoring Services

- Routes to Market Reports
- General Report Findings
- EO Opportunities
- 12 EO Reports – 24 Opportunities

Rationale for 35 Reports

1. To understand the potential market for Space services (EO/Comms/GNSS)
2. Rapidly compare a range of markets – targets for deeper dive
3. To stimulate the development of new space derived opportunities
4. To provide independent, evidence based market intelligence
5. Build on previous reports by enhancing stakeholder information, market dynamics and quantifying opportunities



Refresh and Enhance - Routes to Market Reports for the UK Space Industry

- Innovate UK funded
- 35 wide ranging topics
- Brief & Concise to identify opportunities
- 20 Consultants – market specialists
- 63 opportunities – now being prioritised
 - Value
 - Technical difficulty
 - Timeliness
 - Fit to UK industry
- Common opportunities across topics

- Agritech and Food Supply
- Carbon Monitoring & Modelling Services
- Climate Risk Services
- Energy Infrastructure Monitoring
- Environmental Monitoring Services
- Gaming & Augmented Reality
- Insurance Services
- Maritime Surveillance
- Persistent Surveillance
- Rail Traffic Management
- Road Traffic Management
- Weather Services

- Air Traffic Management
- Disaster Response
- Future Cities
- Galileo PRS
- Indoor Navigation
- Internet of Things Using Satcom
- Location Based Services

- Broadband to Aircraft
- Broadband to Ships
- Broadband to Trains
- Broadband to Vehicles
- Fixed Satellite Broadband
- High Altitude Platforms Comms
- Polar Region Comms
- Secure Satcom
- Seamless Personal Comms
- Unmanned Aircraft Systems Comms

- LEO & MEO Integrated Constellations
- Space Launch
- Space Surveillance And Tracking
- Space Tourism
- Space Traffic Management
- Space Weather

Themes Across Most Topics

Clients want 'end to end' solution

Ease of access to data sources or service

Value added insights

Understanding of client's business by vendor

Used by non-specialists - lack in-house skills

Themes Across Most Topics

**Data Granularity; Geographic Coverage
Timeliness; Cost of Ownership**

align with changing business needs (driven by customer's customer)

Themes Across Most Topics

Business Case Help

Client's often have little space expertise

Themes Across Most Topics

Shared Services to Reduce Costs

even with competitors, if not core business

Themes Across Most Topics

Link to Other Corporate Initiatives

IoT, Big Data Analytics, Connectivity, Social Media

EO Reports and Opportunities - 1


TOPIC	OPPORTUNITIES	OPPORTUNITIY DESCRIPTION	MARKET 2020 (£m)	MARKET 2030 (£m)
Road Traffic Management	Integrated Emissions and Traffic Monitoring for International Markets	Integrating space and terrestrial sensors with localised databases (CO2, NOX, Noise, Temp. Humidity) visualisation with planning tools. Used to baseline and then monitoring impact of interventions (vehicle bans etc). Provide as a services to prioritise Road Authority resources	£100	£163
Road Traffic Management	Widescale Road Infrastructure Monitoring in Remote Locations	Use of current and archive EO and terrestrial sensor data to assess road infrastructure assets and detect change, especially to support future semi-autonomous vehicles. Support condition based monitoring of assets	£300	£488
Energy Infrastructure Monitoring	Satellite remote sensing of coastal power station infrastructure	Environmental performance monitoring & reporting of the size, shape, temperature and movement of the cooling outflow from the power station (both absolutes and changes) enables calibration of mathematical models for assessing the environmental impact of the station	£184	£361
Energy Infrastructure Monitoring	Monitoring international gas pipeline network	Remote monitoring of pipeline routes using high quality images and other sensors (e.g. to detect if the pipeline has moved, water levels, local hotspots, vandalism, 3rd party works etc.) that provide a 'heart beat' to indicate that all is well. Reporting by exception	TBD	TBD
Energy Infrastructure Monitoring	Asset management of overhead lines	Overhead line assessment re vegetation, integrated with weather conditions providing regular survey and other	TBD	TBD
Carbon Monitoring Services	Terrestrial carbon stocks and flows monitoring (MRV related revenue)	Regular, robust Monitoring, Verification & Reporting (MVR) of greenhouse gas emissions, through direct satellite derived measurement (comply with UNFCCC AFOLU commitments). particularly concerned with land use and related emissions, for external validation of country claims, and for various voluntary (i.e. not mandated by countries) efforts to monitor and reduce emissions. Distinguish 1) Natural or 2) Anthropogenic	£280	£720
Carbon Monitoring Services	Land-use based carbon offset projects	independent verification of carbon sequestration rates, typically every 5 years. Satellite data to provide information for the quantification of biomass i.e. carbon sequestration rates for afforestation, reforestation, IFM (Improved Forest Management) and also baseline information for REDD+ projects.	TBD	TBD
Environmental Monitoring Services	Wide area flood monitoring services and risk modelling	Flood Risk Management - Pre-event hazard mapping & risk assessment service. Affordable high resolution EO data processed for use by catastrophic risk models. Including fusion with soil moisture data, land cover classification and near realtime exposure analysis especially for poorly covered regions	TBD	TBD

EO Reports and Opportunities - 2

TOPIC	OPPORTUNITIES	OPPORTUNITY DESCRIPTION	MARKET 2020 (£m)	MARKET 2030 (£m)
Environmental Monitoring Services	Wide area flood forecasting	Flood Risk Management - Forecast & post event loss estimation generating peak flood data over wide areas calibrated with industry standard risk models especially for urban and forested areas (potentially feeding flood early warning system)	TBD	TBD
Environmental Monitoring Services	Large scale habitat survey data service	Habitat Assessment for wide area surveys, protected species surveys using indicator data and species identification for Invasive Non-Native Species or crops (including disease identification)	TBD	TBD
Environmental Monitoring Services	Catchment area monitoring of land and watercourse pollution	Rural Diffuse Pollution monitoring service over wide catchment areas to target areas of further investigation, available to regional stakeholders	TBD	TBD
Persistent Surveillance	Small satellite constellation providing persistent remote sensing	A constellation of small satellites to give near realtime monitoring and warning to combat events such as illegal logging, forest fires (eg tropical orbiting SAR satellites integrated with existing optical platforms) with potential for dual use defence and humanitarian applications	£345	£1,991
Gaming, Augmented Reality	Mixed Reality Enabled 3D Real World Monitoring	MR device manufacturer purchases a database of landscapes, buildings and other permanent structure coordinates in 3D enabling them to pinpoint their users' locations within a 3D environment outside	£7	£20
Gaming, Augmented Reality	Mixed Reality services based on video data from space and airborne platforms	MR device manufacturer customers would purchase a live stream of temporary or moving object coordinates in 3D enabling them to pinpoint their users' locations within a richer 3D environment outside. This stream will enable a range of benefits, in addition to "Real World Monitoring" opportunity	£9	£100
Rail Traffic Management	Satellite Integrated Track Management Services	EO and GNSS for infrastructure and land monitoring; EO to detect potential hazards, together with smart sensors, and satellite comms. Improvements in data-handling combined with improved analysis and data-sharing. Targets in the first instance are private rail eg mining in South America; or freight lines in Australia	£50	£100
Future Cities	Integrated Urban Planning	Urban land use planning including urban agriculture, water use, change detection	£30m	£100m
Future Cities	Healthy Cities	Integrate urban heat maps, air quality and optimised traffic routing to support healthy cities initiatives. Connectivity for wellbeing and health monitoring in the community	£100m	£300m

EO Reports and Opportunities - 3

TOPIC	OPPORTUNITIES	OPPORTUNITY DESCRIPTION	MARKET 2020 (£m)	MARKET 2030 (£m)
Insurance Services	Shared Risk & Exposure Data Platform	Development of a platform giving access to standardised base-line EO imagery with centralised access to associated information products tailored for the insurance industry. Datasets to be included: Optical Imagery; Radar Imagery (SAR); Satellite-Derived bathymetry and insurance specific information products	£33	£140
Climate Risk Services	Climate Services for Agriculture	Agricultural yield forecasting with long time series climate data fused current crop and environment parameters to produce reliable yield information for policy makers and agronomists	TBD	£540
Climate Risk Services	Climate Enabled index insurance	Climate data to inform parametric insurance models. Currently for crop and livestock in developing countries, to be repurposed for Western insurance markets	TBD	£1,800
Climate Risk Services	Climate Data Records for Seasonal Forecasting	Opportunity for near real time seasonal forecasting for institutional clients using high quality data for ocean, landsurface and cryospheric parameters. Clients would be weather centres, environmental organisations, government and major agricultural organisations.	TBD	TBD
Weather Services	Fuse satellite data and multi sensor terrestrial information (local forecasts)	combination of terrestrial sensor data with (localised) weather forecasts. For example, data from water sensors monitoring reservoir and borehole depth or water levels in pipes can be combined with rainfall predictions for the reservoir catchment area for more effective demand management and flood prevention.	£230	£500
Maritime Surveillance	Marine Environmental Observation Services	Combined information services for monitoring maritime activity and environment change for clients operating in the marine sector (Aquaculture, Offshore Renewables, Oil and Gas, coastal development and asset owners, as well as insurance companies)	TBD	TBD
Maritime Surveillance	Space Derived Hydrography & Bathymetry Services	Provision of wide area, cost effective services to provide initial survey data prior to potential detailed survey. Market need for improvement in space-based bathymetry using SAR and LiDAR, Enabling Marine Autonomy through command and control connection with unmanned vessels.	£15	£25

Market Briefing:	Insurance	Consultant Name:	Satellite Applications Catapult
Opportunity Title:	Shared Risk & Exposure Data Platform	Market Size (Medium)	TAM = ~\$290M (by 2020) + added value SME services
Opportunity Provide the insurance industry with: <ul style="list-style-type: none"> • Data for pre competitive risk analysis • Centralized access to multiple EO image types • Wider coverage and price optimization • Information products tailored to specific insurance use Used for applications such as: <ul style="list-style-type: none"> • Calculating urban flood extent • Understanding Large Scale Coastal Infrastructure Development Risk • Calculating Location and number of infrastructure assets • Modelling and Predicting Forest fire risk 			
Approach <ul style="list-style-type: none"> • Develop a platform containing optical, SAR and satellite-derived bathymetry data aggregated from commercial and public providers. • Include value-added datasets such as: <ul style="list-style-type: none"> - Weather (rain, hail & frost), - Environmental (temperature, air moisture, pollution) - Population data. • Engage VAS providers (UK SMEs, enviro consultancies etc) develop specialised products within the platform 		Blockers <ul style="list-style-type: none"> • High level of capital investment required. • Difficulty uniting the insurance industry to understand standard needs and requirements. • Data ownership, formats and use of algorithms Enablers <ul style="list-style-type: none"> • Development by a neutral body representing both the space sector and the insurance sector. 	

Drivers of EO Markets - Frameworks Already Exist



Drivers of EO Markets - Frameworks Already Exist

UN Development illustrate the breadth of uses for EO

Plenty of potential opportunities but ..

- Whatever the technology service must designed around customer needs
- Information must be delivered at the right price
- Fit with existing business processes
- Innovation can be in the business model (as opposed to technical breakthrough)
- Understand the needs of stakeholders along the supply chain
- Traditional Linear Supply Chains being disrupted – now webs of partners
- Solutions will be a fusion of EO and other services – partnering may be essential



Sources of Inspiration – New Markets – Old Problems

International engineering and business consultants have excellent free, “Thought Leadership” resources to guide EO Market

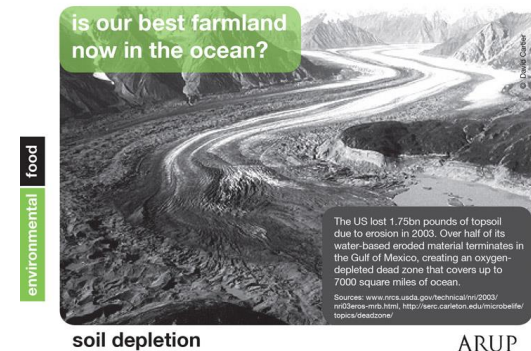
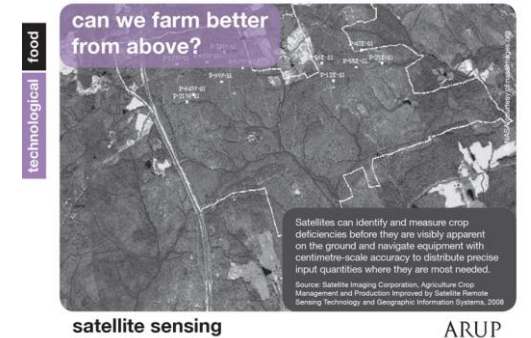
1. Identify global trends
 2. Easy to assimilate reports
- Arup “Foresight”
 - Bain & Co – “Insights & Macro Trends”
 - Atkins Global – “Angles”
 - BCG
 - Roland Berger – “Insights”
 - and many more



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