



Space data exploitation and expected business opportunities in the future

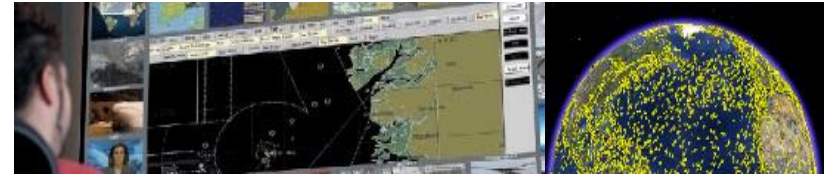
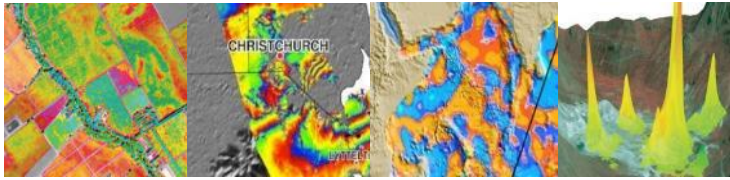
Dr Richard Hilton

CEO GlobalTrust, Satellite Applications Catapult Alumni

Opportunities



The Opportunity for the Space Sector



Earth Observation – monitoring

Communications – connecting

Navigation – locating



Applications

INTEGRATION FOR A CONNECTED AND INFORMATION CENTRIC WORLD



Key Insights

Macro Trends Across Sectors



Connected Future and Autonomy

Trends: Mobility is driving demand to close connectivity gaps while increasing demand for higher, seamless connectivity as users roam between motorways, rail, home, and work. Cellular bandwidth and Wi-Fi hot spots are unlikely to bridge demand both geographically and for the capacity required, particularly in rural areas and for high bandwidth applications such as streaming that roam between environments. The need for connectivity is driven by: (1) real-time redundancy for architecture; (2) demand for high speed data; (3) external connectivity for safety and other applications; (4) autonomous driving quality and safety; (5) reduced components with an increasing number of components reduced, and managed via cloud; (6) efficient communication and data transfer that requires mass-distribution.

Sub-trends: Less human capital needing to be deployed, leading to enhanced productivity;

Relevance for satellite services: seamless ubiquitous connectivity beyond line-of-sight/out of reach of terrestrial alternatives, reliability/security of service



IoT and Digitalisation

Trends: Digitalisation to reduce maintenance costs, enhance efficiency, deploying predictive maintenance analytics but in a more limited manner at present. Some energy providers already reporting almost 40% improvements in service reliability utilising improved analytics. Digital technology is being employed including *analytics*: obtaining sensory data through low-cost sensors in equipment; and including machine-to-machine; geological modelling; predictive maintenance. *Human-machine interaction*: sensors are used to transmit key data to managers on performance and safety. *AI*: The use of tele-remote and assisted-control equipment is becoming common, and deployment of fully autonomous equipment is occurring in haulage, drilling, and mining processes.

Sub-trends: Reducing human capital in remote monitoring and “ground truthing” of assets; increased safety for workers in remote (dangerous) environments

Relevance for satellite services: requires connectivity in remote areas (satcomms), digital grid key enabled by remote connectivity. Satellites can be utilised to push software updates and alerts to mass-devices/vehicles expediently, efficiently and cost-effectively



Big Data Analytics

Trends: Exponential growth in data from sensors leading to increased need for analytics to derive insights and value from underlying data. The Digital Grid of the future, for example, includes an increasing proportion of renewable and distributed energy resources, with this increasing the demand for accurate, real-time analytics and big data. Industrial process automation technologies are being implemented to transform daily operations, optimise returns on mining assets with big data analytics expected to drive demand for increased bandwidth and connectivity in all locations.

Relevance for satellite services: demand for increased bandwidth, growth in geospatial data

Key Insights

Satellite Services Opportunities: General Themes and Key Sector Highlights

Universal Themes

Sustainability

- Critical issue across majority of sectors
- Opportunity to cement roles for satellite data and technology in best practice methodologies in globally significant industries
- Impacting investment practices, operating models, risk assessment, and regulatory compliance
- Financials, Basic Resources, Energy, Industrials, Utilities

Digitalisation

- Universal focus on industrial process automation
- IoT at the centre of many initiatives
- Autonomy, sensor and EO technologies all being looked to for productivity gains
- Oil & Gas, Basic Resources, Industrial Goods & Services, Utilities, Consumer Services, Financials

Niche Themes

Recreational GNSS & Location Based Services

- High growth, mass retail market
- Connected vehicles, recreational marine, LBS smartphone apps,
- Consumer Goods, Software, Travel & Leisure, Automobiles & Parts

Fleet Management & Asset Tracking

- Subcategory of digitalisation
- Recurring feature of both process optimization and operational risk management
- Industrial Transportation, Aerospace, Oil & Gas, Utilities, Travel & Leisure

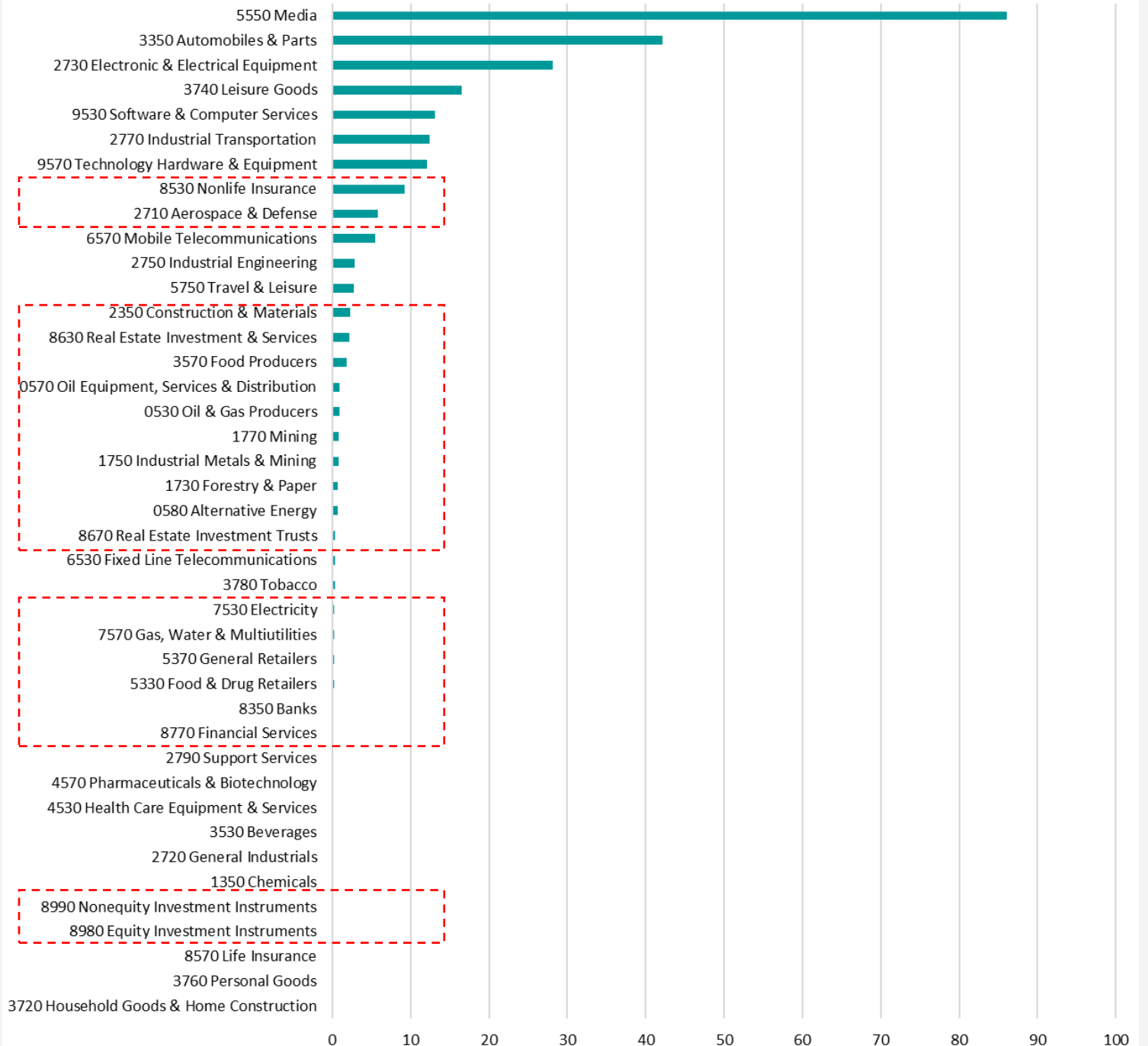
Customer / Passenger Connectivity

- Continuous connectivity set to become expected as standard
- Connectivity creates platform for customer and environment-specific services
- Travel & Tourism, Recreational Services, Airlines, Software

Global Addressable Market for Satellite Services by Sector

Geospatial Intelligence (GI) & Ubiquitous Communications (UC) - £bn

Red boxes expected to be high growth markets for GI



Delivery



Technology Evolution

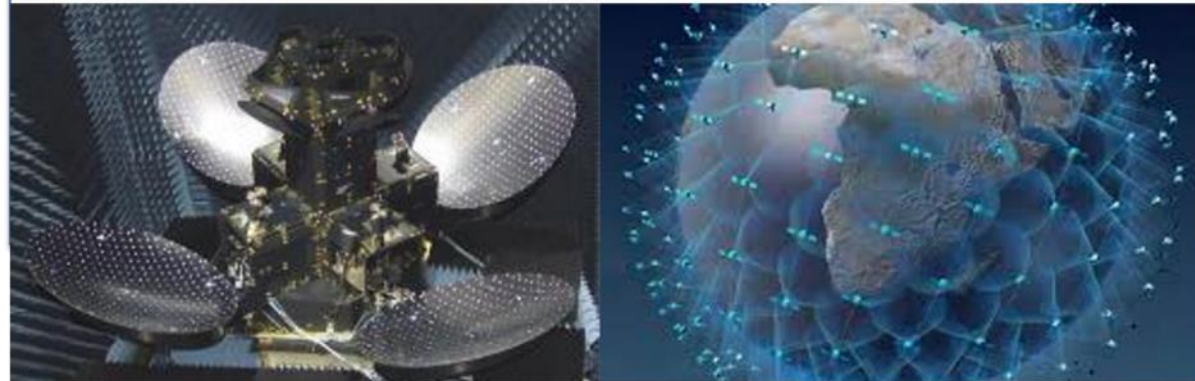
Wireless Communications

Advanced Satellite Constellations

- Platforms & Payloads
- Device Technology
- Ground Segment Operations
- Novel Mission Concepts

Mobile Connectivity and Positioning Systems

- Advanced antenna systems
- 5G Hybrid Networks
- Semiconductors & Devices
- Novel PNT Concepts
- Hybrid Devices (IoT)
- Cyber Security



Digital Intelligence

Robotics and Autonomous Systems

- Artificial Intelligence
- Autonomous systems
- Novel sensors and data processing architectures
- Multi Platform Operations (UAVs & HAPS)

Smart Geospatial Systems

- Computing architectures
- Geo-Visualisation
- Geospatial Media
- Edge & Fog Computing
- Democratisation of data
- Data refinement

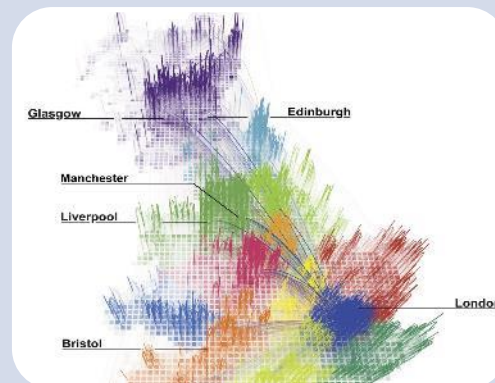


Key Developments



Multi Platform Data Analytics

The collection, integration, fusion and analysis of geospatial data from many different sources (HAPS,UAVs, Satellite, IoT, Crowdsorce)



Data Interaction

The process of visualizing information to ease of interpretation of the underlying data



Unlocking geospatial information

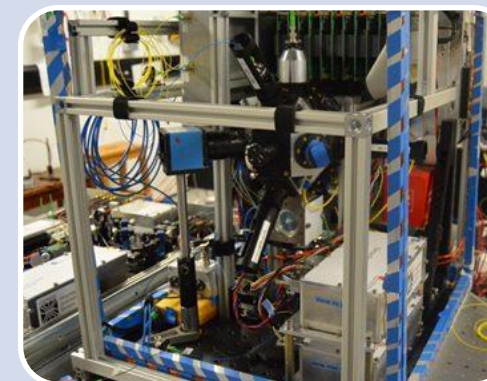
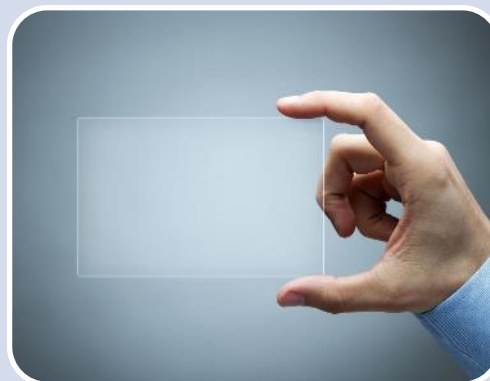
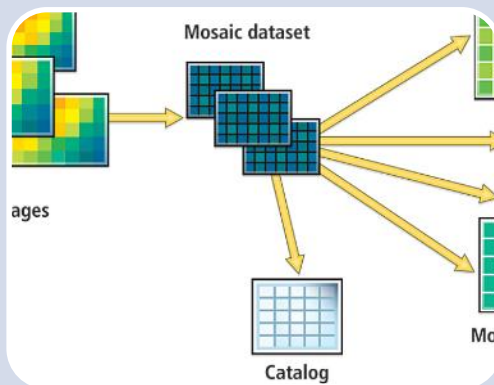
Moving away from point and click analysis to automated processing



Processing Time

Driving down the time from analysis to result through distributed computing and new architectures

Key Developments



On Demand Analytics

Geospatial is moving to the mass market and as such everyone expects information at a touch of a finger. This will be made possible through distributed computing and large cloud infrastructures

Data Transparency

The inherent ability to trust information will be key. The ability to have complete transparency and trust in the underlying datasets and associated analytics will become increasingly important, technologies such as distributed ledgers could have a large role to play.

Trust In Data

Subtly different to data transparency, this is about ensuring the right level encryption and role permissions have been granted

New Global Insights

Advancements in sensors will enable use to view the world in different ways, providing new opportunities for novel services

Key Developments



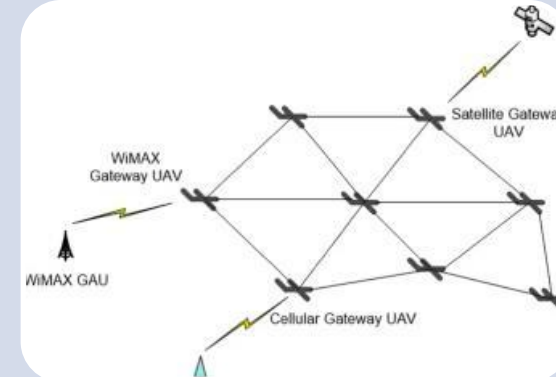
Onboard/ Edge computing

Satellites, HAPS, Drones, IOT etc. all downlink and transfer large quantities of data. It gets to a point where it is more efficient and timely to process the data on the platform at the edge of a network and just send the information back.



Data Accessibility

There are hundreds of different types of geospatial data from an infinite number of sources. This vast quantity of information makes the process of accessing the data almost impossible. There will be a need to create common licenses, standards etc. with the ability to search using natural language.

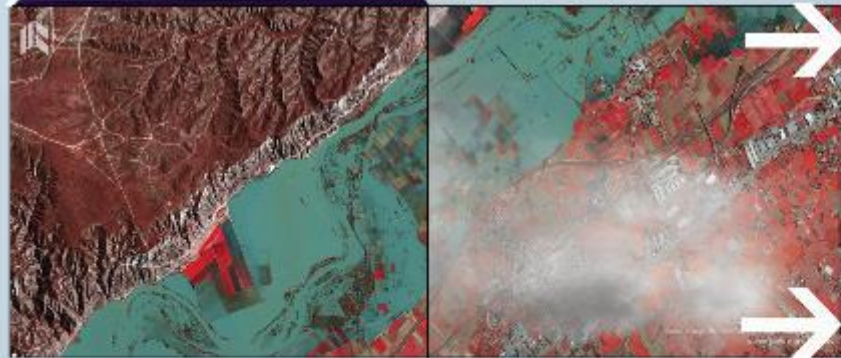
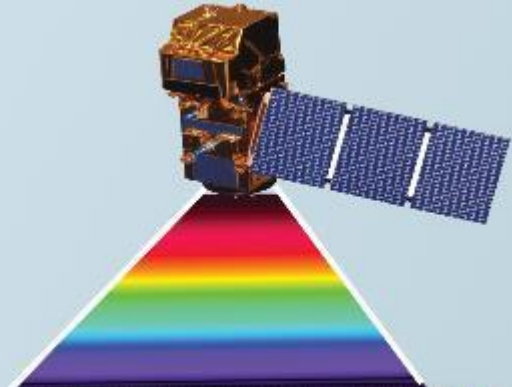


Command and Control

As the number of satellites, uavs and other sensory systems increase it becomes impractical to control each platform individually. AI analytics will be needed to control clusters of sensors.

Example: ARD / Datacubes

Scales of **Impact**

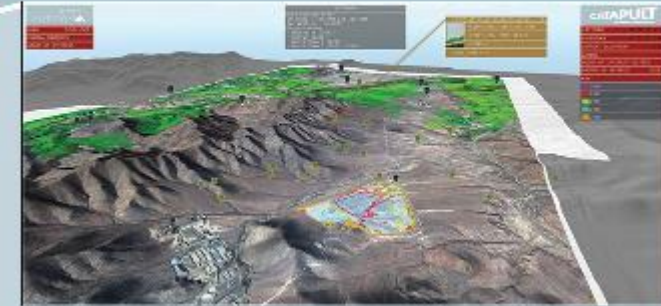


ANALYSIS READY DATA

TEMPORAL



SPATIAL



Geospatial Ecosystem

- Smart Analytics
- Scalable Infrastructure
- Multi Platform data inputs
- Intuitive Visualisation

The Approach

Key Building Blocks & Approach



Catapult Open

OUR STRATEGIC VISION

ENERGISING THE MARKET

Through our market programmes we unlock latent customer demand, open new markets, and drive exports by raising awareness, changing preconceptions and showcasing the power of space derived services.

EMPOWERING TECHNOLOGY

Through our technology programme we help companies advance their products to be closer to market programme opportunities by identifying the barriers to entry such as regulation, incumbents, or simple accessibility.

ENABLING BUSINESS

We connect business of all sizes with the resources and facilities they need to launch and grow, opening new routes to market and attracting inward investment. We provide targeted business support, user-centred design expertise and signposting to finance.

Catapult

OUR STRATEGIC VISION ENERGISE

INTELLIGENT TRANSPORT

Transport is key for the future of connectivity through connected vehicles and is high value for positioning and location-based services

SUSTAINABLE LIVING

Sustainable living poses challenges at scale and provides strong use cases for both geospatial innovation and connectivity in areas not often addressed by existing industry, but which will drive significant economic value by 2030

BLUE ECONOMY

Blue economy is an excellent first adopter market for space as there are usually few alternatives to satellite solutions of an area that covers 2/3 of the globe

GOVERNMENT SERVICES

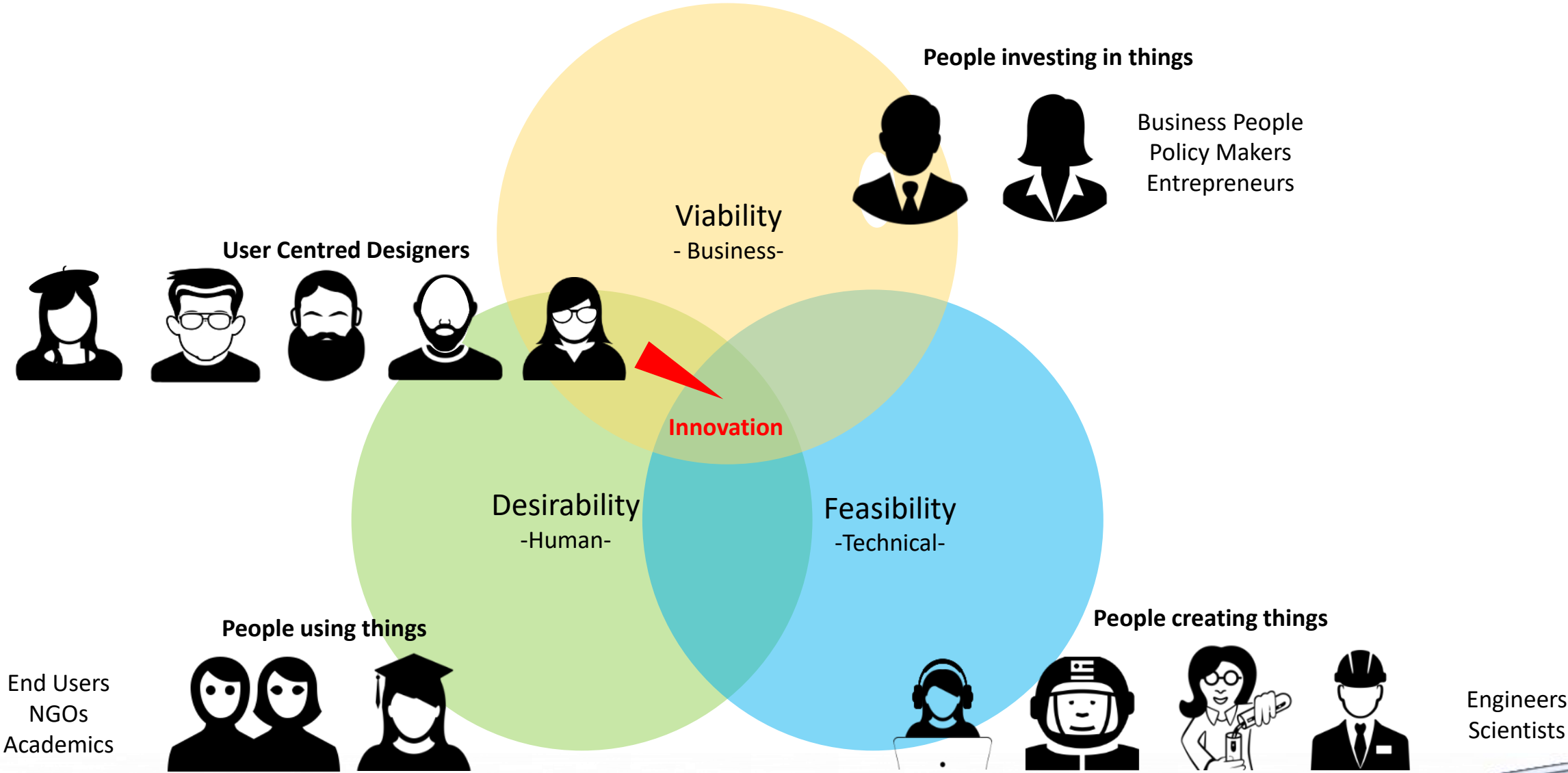
Government services has key early use cases for both ubiquitous connectivity (emergency services and health) and geospatial systems (across local government)



"We offer unique state-of-the-art and professional facilities designed specifically to help grow the space sector."

- OPERATIONS CENTRE
- COMMS LAB
- COSPACE
- FAR-FIELD RANGE
- CEMS
- DEMO ROOM
- 3D HD DUAL PROJECTION
- SPARK CENTRE
- VIDEO WALL
- DISC





The Team

Recruitment

- A wide variety of skills are needed, not just EO experts e.g. business experts, industrial designers, mathematicians, environmental scientists, marketeers, IT experts, sector experts etc
- Even EO people come from different perspectives e.g. geographers vs physicists vs data scientists etc

Partnerships

- No need to recruit for every skillset. Partner intelligently for greatest impact

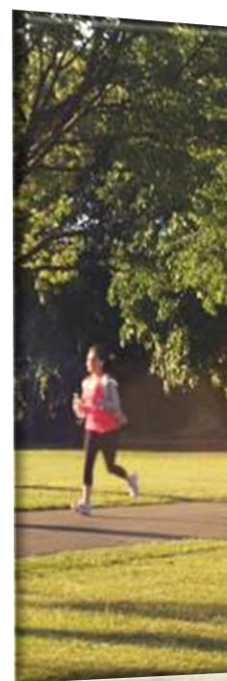
Remember that this is a business first and an interesting technology second. Build up the right skills on that basis



Examples



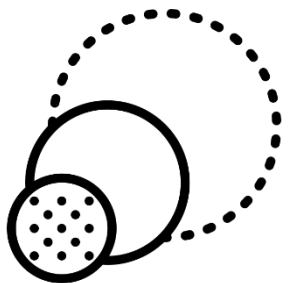
An Overview of Satellites Applications



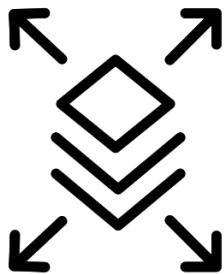
Environmental Monitoring | Forestry | Disaster Management | Maritime | Agriculture | Health | Extractive Industries | Transport
| Climate | Meteorology | Civil Protection | Sustainable Development | Energy | Finance | Insurance

EASOS

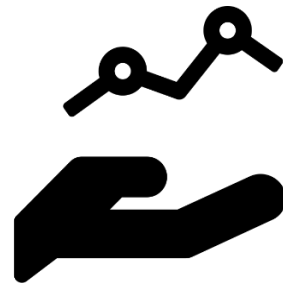
UK Space Agency funded programme developed by a UK Consortium organised and run by the Satellite Applications Catapult. EASOS is a powerful geospatial platform for running operation service across many application areas.



Scalable



Flexible



Valuable

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EASOS
EARTH AND SEA
OBSERVATION SYSTEM

SAVING LIVES
PRESERVING NATURE
ENABLING GOVERNMENT



EASOS: LIVE SERVICES

Harnessing the power of **geospatial** and **earth observation** data, **EASOS** is a world-leading management information and decision support **platform** that helps to **monitor** and **manage** government and business challenges

EASOS Live Applications:



Marine Watch: Reduce marine oil pollution



Forest Watch: Reduce the social, environmental, and economic impact of illegal logging



Flood Watch: Reduce the human and economic cost of flood events



MARINE WATCH

2,497 Potential slicks identified

419,496 Potential slick movements modelled

50,000,000 Vessel positions analysed and visualised



FOREST WATCH

11 Days Annual average between alerts of new activity

1,000+ Optical/radar images automatically processed for change

42,500 Hectares monitored for deforestation activity



FLOOD WATCH

4 Times every day 7-day flood forecast produced

847 River/Rain gauges accessed every 30 mins

595,380 Infrastructure assets integrated and monitored for flood impact

GlobalTrust

CATAPULT
Satellite Applications

