



Satellite Applications

Current and Future developments: Strategies for a National Space Sector - Industrial Strategy, Innovation and Space

Space Policy and Law course 2018

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October 2018

We work with
Innovate UK

CATAPULT

Topics for Discussion

1. Industrial Strategy and Innovation
2. The UK Approach
3. Catapults
4. The Space Context
5. The Satellite Applications Catapult
6. The Space Growth Partnership

Section 1



Industrial Strategy and Innovation

Industrial Strategy - context

“Industrial strategy” is a term that generally refers to any attempt by government to apply a coherent and consistent set of policies that are designed to improve the performance of the economy.



Industrial Strategy - context

These policies are frequently directed at the **manufacturing sector**, but can also address the performance of other sectors, including **services**.



They attempt to **correct imbalances** in the economy's performance and involve the assumption by government of a prominent role in facilitating economic change.

Industrial Strategy - context

Sometimes the means deployed are very direct (often called "**interventionist**"), but attempts to restructure an economy can be undertaken using a **laissez-faire**, free-market approach.



Industrial Strategy – UK history (1 of 2)

Interventionism, during post-war economic consensus, through to 1970's Labour government:

Tony Benn made interventions in loss-making companies (Triumph motorcycles, British Steel, ...).

Strategy later derided as “*picking winners*”.

1980's - 2000's – Conservative (Thatcher) and Labour (Blair): prefer **laissez-faire**, free-market liberalism and the industrial strategy phrase becomes unfashionable, but Michael Heseltine “No Stone Unturned” and Peter Mandelson respectively recognise the issue.



Industrial Strategy – UK history (2 of 2)

2010-2015 Coalition: Financial crash (2008) led to George Osborne's "**March of the Makers**"; Vince Cable: introduced 11 "**industrial partnerships**", including automotive, offshore wind, life sciences and aerospace.

And David Willetts had "**8 great technologies**", including **satellites** and big data.

2015 – Conservative government: Sajid Javid preferred an "**industrial approach**" to an explicit strategy.

2016 Post-Brexit – Teresa May: creation of BEIS under Greg Clark: "**explicit recognition that the government should deliberately take a strategic approach to business and the economy**".



Section 2



The Current UK Approach to Innovation

Recent Industrial Strategy – UK context and focus on competitiveness

Government recognises that UK must be able to compete in the growth industries of the future to deliver jobs and prosperity – 5 themes:

- **Skills** – giving business a voice
- **Financing investments** – long-term finance, national investment bank
- **Innovation**, commercialising technologies and other science research from our universities
- Strategic **partnerships** and supporting small and medium-sized businesses
- **Procurement** – developing UK supply chains; simpler public sector procurement

UK Prime Minister at CBI Annual Conference 2016



[Industrial Strategy is about] *“creating the conditions where winners can emerge and grow. It is about backing those winners all the way to encourage them to invest in the long-term future of Britain. And about delivering jobs and economic growth to every community and corner of the country.”*

*“A new Industrial Strategy Challenge Fund will direct some of that investment to scientific **research and the development of a number of priority technologies** in particular, helping to address Britain’s historic weakness on commercialisation and turning our world-leading research into long-term success.”*

The Ten Pillars of the UK Industrial Strategy

1. Investing in **science, research and innovation**
2. Developing **skills**
3. Upgrading **infrastructure**
4. **Supporting businesses** to start and grow
5. Improving **procurement**
6. Encouraging **trade and inward investment**
7. Delivering affordable **energy and clean growth**
8. Cultivating **world-leading sectors**
9. Driving **growth across the whole country**
10. **Creating the right institutions** to bring together sectors and places



Innovate UK – the UK's innovation agency

Work with people, companies and partner organisations to find and drive the **science and technology innovations** that will grow the UK economy - delivering productivity, new jobs and exports.

The aim at Innovate UK is to **keep the UK globally competitive** in the race for future prosperity.

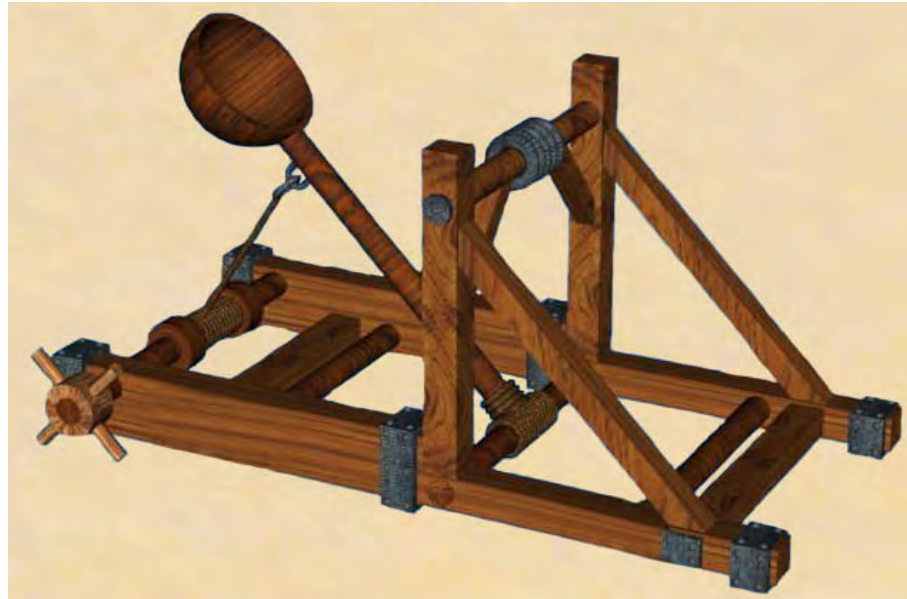


The 5-point plan

- 1** Working with the research community and across Government to turn scientific excellence into economic impact
- 2** Accelerating UK economic growth, nurturing small, high-growth companies, with strong productivity and export success
- 3** Building on innovation excellence throughout the UK, investing locally in areas of strength
- 4** Developing Catapults within a national innovation network
- 5** Evolving our funding models; helping public funding go further

Catapult Open

Section 3



Catapults...

What is a Catapult centre?

- Established following a review by **Hermann Hauser** in 2010
- **Business-focused, technology and innovation centre** that makes world-leading technical capability available to businesses to solve their technical challenges.
- Provides:
 - Access to world-leading **technology & expertise**
 - Reach into the knowledge base for **world-class science**
 - Capability to undertake **collaborative R&D** projects with business
 - Capability to undertake **contract research** for business
 - Create a **critical mass** of activity
 - **Skills development** at all levels

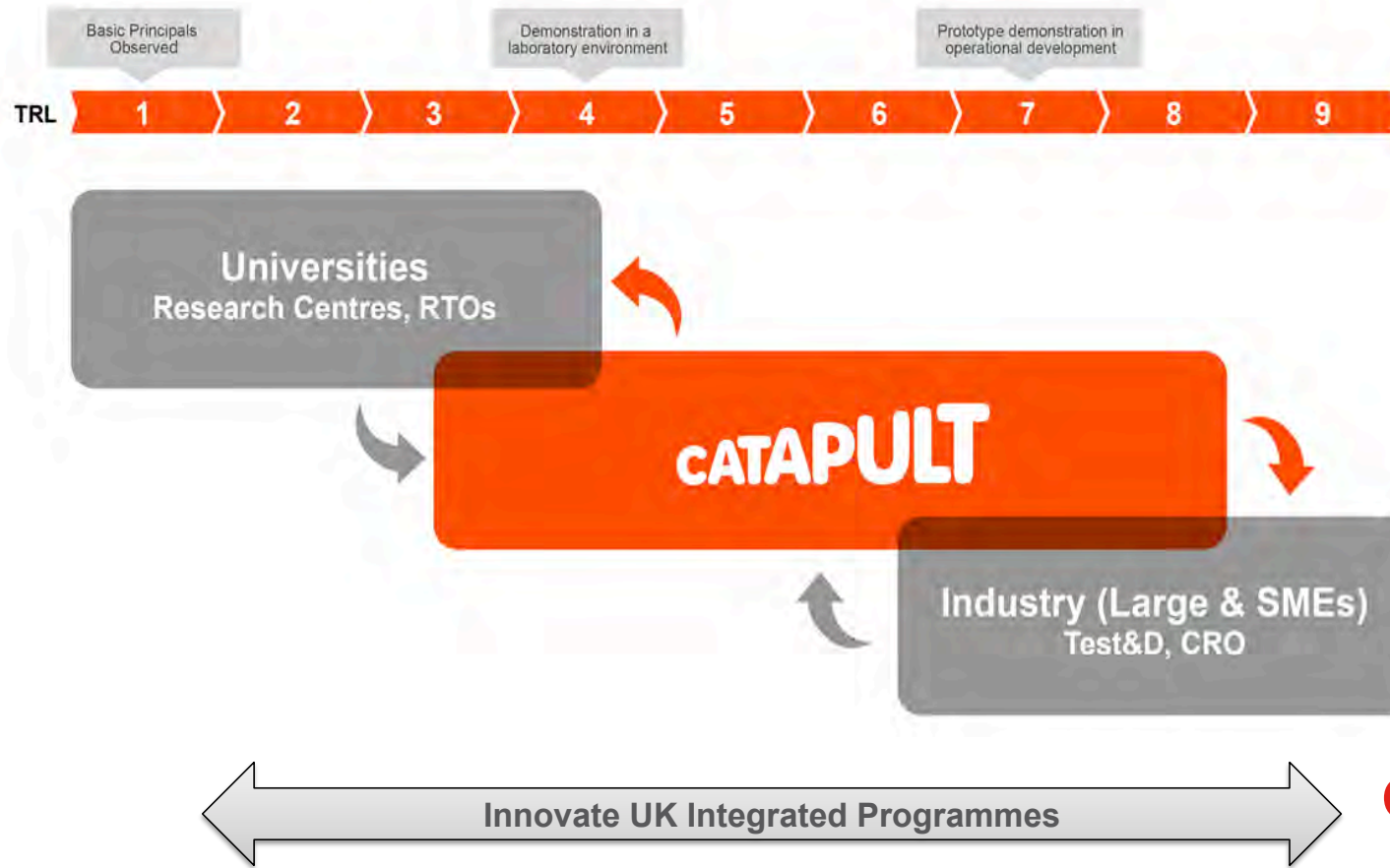
Catapults: Closing the gap between concept and commercialisation

The vision: a **network** of world-leading centres:

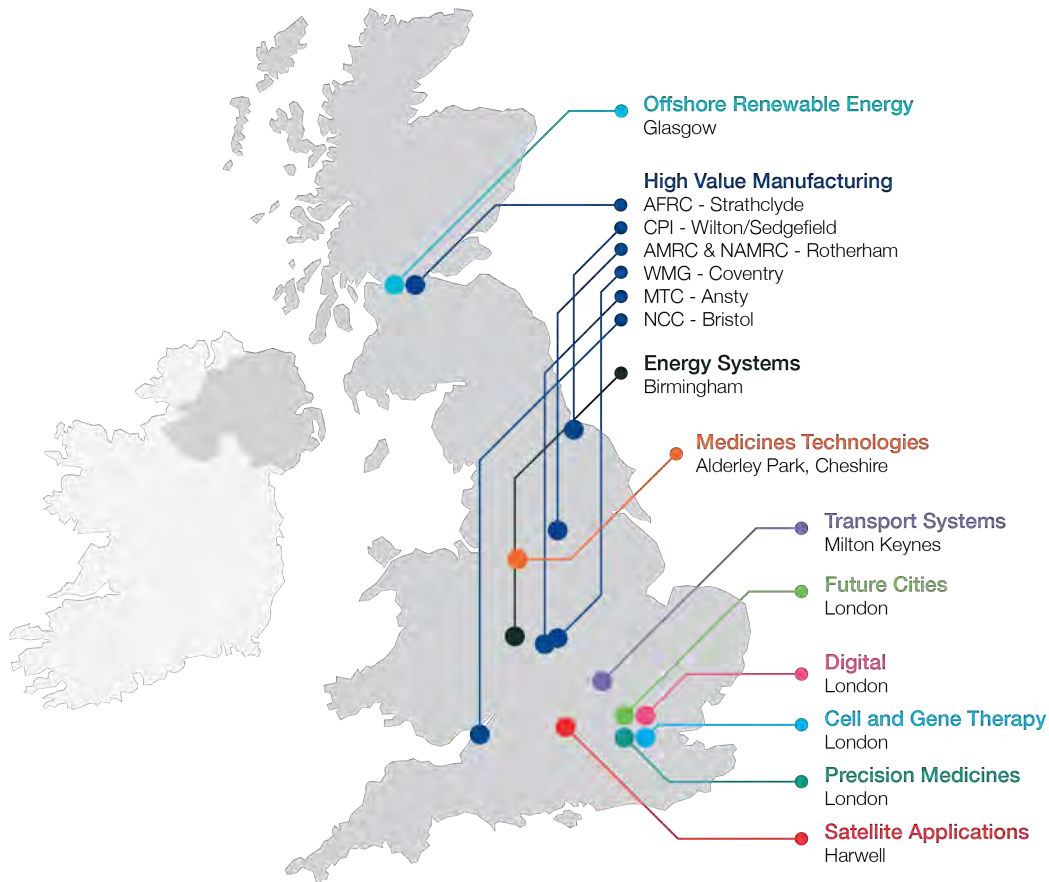
- Bringing **research and business** together
- Accelerating **commercialisation**
- **Investing for the long term**



Catapults – a new force for innovation & growth



Catapults – the network



11
Catapults

2013
First Catapults
launched

>£1.6bn
Private & public sector
investment

CATAPULT
Satellite Applications

Catapults: Activities

Helping businesses
to **identify, adopt
and exploit**
innovative
technologies

Core Projects

- Key challenges and barriers
- A unique technical capability
- Industry & research advisory groups
- Demonstration projects
- Disseminate to industry

Industry R&D

- Access to unique facilities & expertise
- Develop & demonstrate at scale
- Reduce risk of implementation
- Direct contracts for projects
- Easy access for SMEs

Collaborative R&D

- Innovation in collaborations
- Bring together customers, SMEs & blue-chip companies
- Technical & management resource
- Partners in Projects (IUK & EU)
- Expertise at unlocking funding

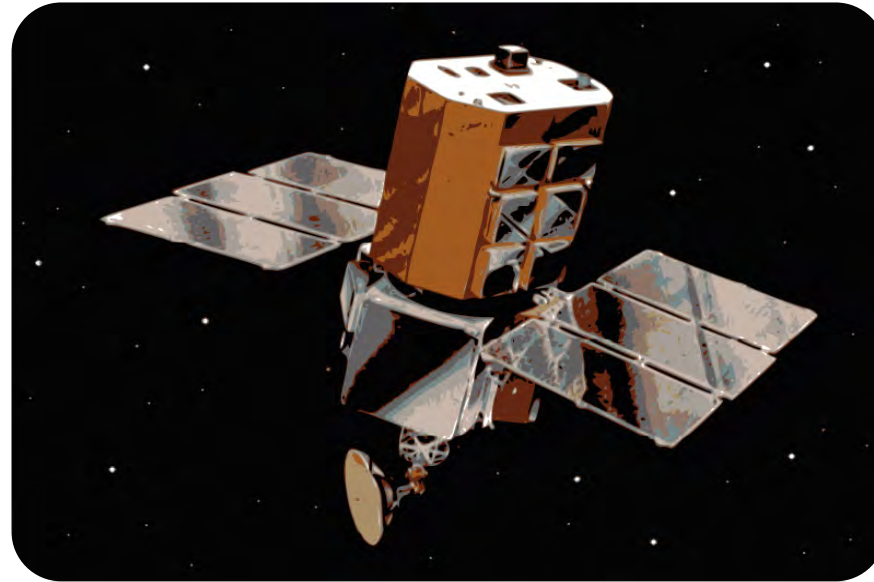
The role of Catapults in the current environment

Catapults are a very good fit with an Industrial Strategy setting ...

We have:

- a **Sectoral** approach
- Primary focus on “**Innovation**”
- Secondary objectives in **Regional Development** and **Skills**
- Significant interests in **Business Finance** solutions

Section 4



The Space Context

Space and the UK's Industrial Strategy

HM Government



Space Growth Partnership

The 10 pillars

- | | | | |
|---|---|---|--|
|  | Investing in science, research & innovation |  | Developing skills |
|  | Upgrading infrastructure |  | Supporting businesses to start and grow |
|  | Improving procurement |  | Encouraging trade & inward investment |
|  | Delivering affordable energy & clean growth |  | Cultivating world-leading sectors |
|  | Driving growth across the whole country |  | Creating the right institutions to bring together sectors & places |

UK Space Industry targets £40 billion revenue by 2030

“...substantive support for an elite group of Technology and Innovation Centres.”

Dr. Herman Hauser, 2010

“Catapult centres act as a neutral convener, the place where collaboration across TRLs can take place effortlessly.”

Dr. Herman Hauser, 2014

2010



2015



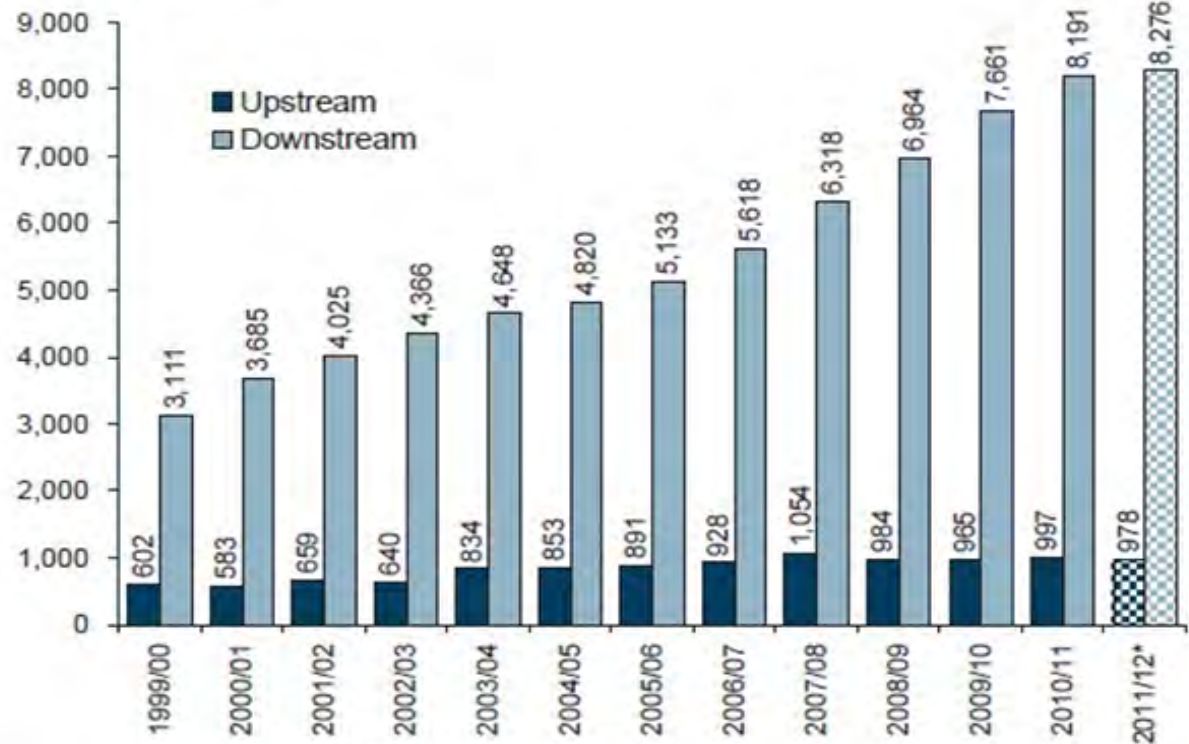
2014

Choice of Technology Areas

Broad criteria:

- Potential global markets worth £ billions
- UK has world-leading research capability
- UK business has ability to exploit the technology
- Centres enable UK to attract and anchor knowledge intensive activities of globally mobile companies
- Closely aligned with national strategic technology objectives

Real Space Turnover,
£m 2010/11 prices



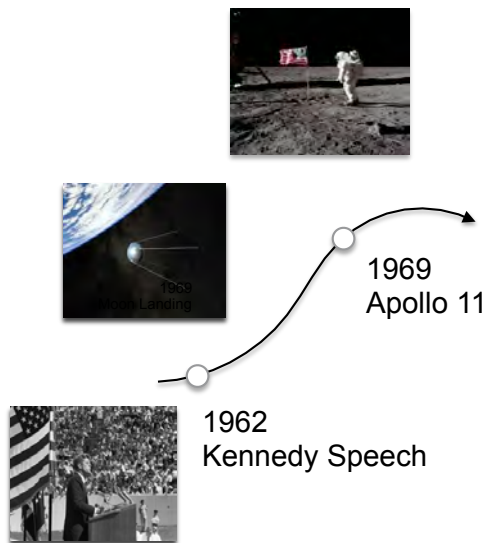
Source : Oxford Economics

Satellite Applications: Three Waves of Innovation

The Dark Age

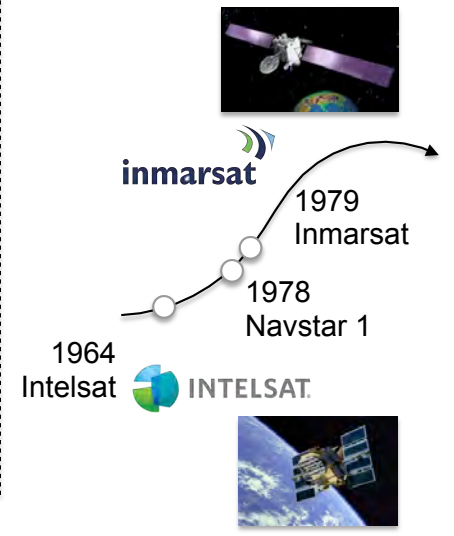
First Space Age

Prestige → Science



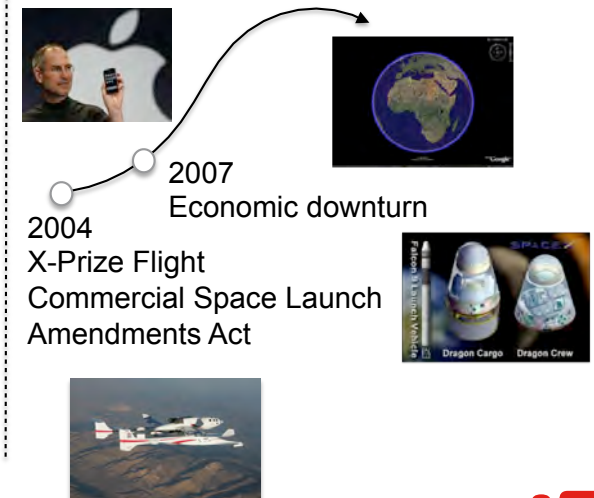
Second Space Age

Institutional → Commercial



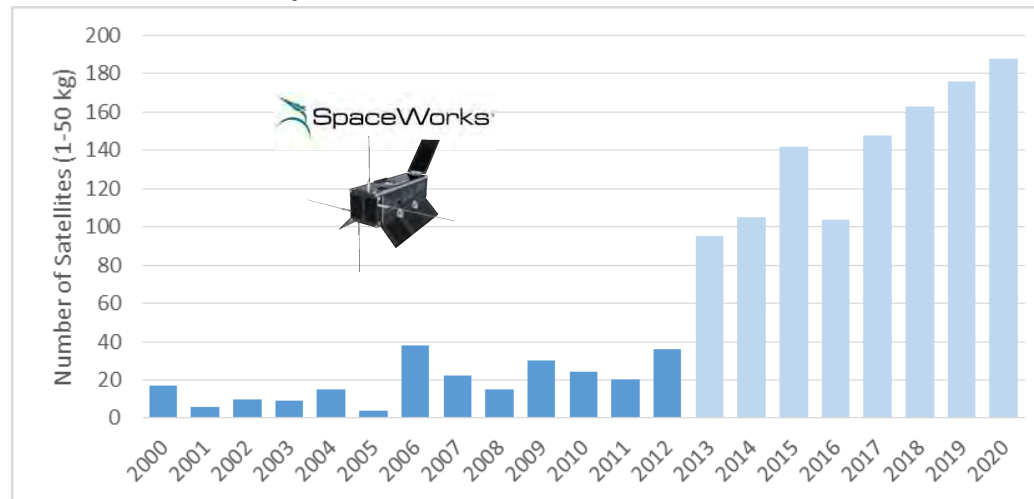
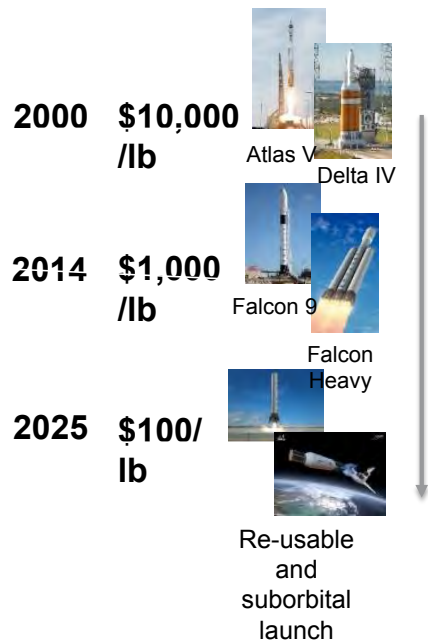
Third Space Age

Disruption → Mass Market



Upstream market trends

Reduced launch costs, miniaturisation of technology, and standardisation are bringing the space sector within the reach of start-ups.



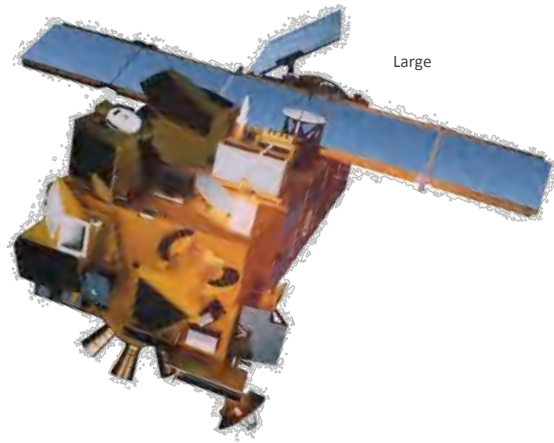
SpaceWorks forecasting 1000+ nanosatellites to be launched between 2014-2020; More than 4x 2000-2012

NewSpace Global analysts have heard from reliable sources that Google will launch constellation of 160 satellites in near-future (up to 1600); other industry players will follow...

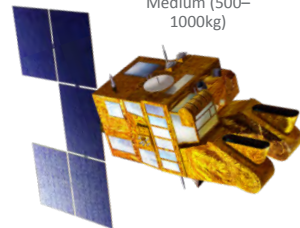
*We are just now beginning to see the **disruptive role** that entrepreneurs will play in this sector.*

*Higher risk appetite resulting in **unprecedented space data & applications.***

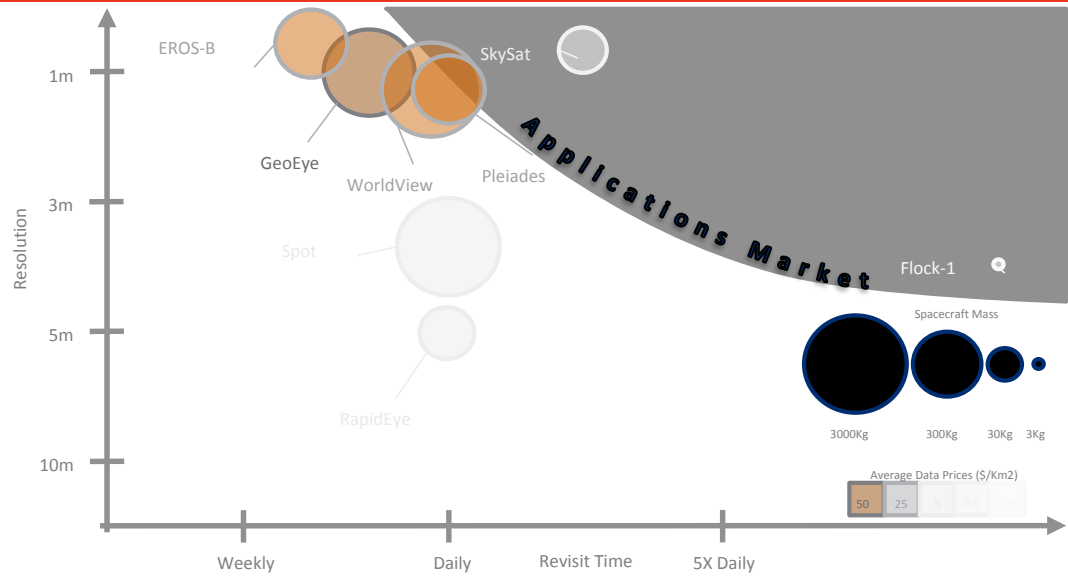
Trends in Earth Observation from space



European Space Agency
Envisat / 8000Kg
ERS Programme



SPOT 6 / 700Kg
SPOT Series



Surrey Satellite Technology Ltd.
SSTL 300 S1 / 300Kg
DMC-3 Constellation

Micro (10-100 kg)



Surrey Satellite Technology Ltd.
SSTL 100 / 100Kg
DMC-2G Constellation

Nano (1-10 kg)



Planet Labs Inc.
CubeSat 3U / 3Kg
Flock-1 Constellation

Pico (<1 kg)



PocketSpacecraft.com
TF SLR Scout / 1g
Mission to the Moon

Earth Observation market analysis

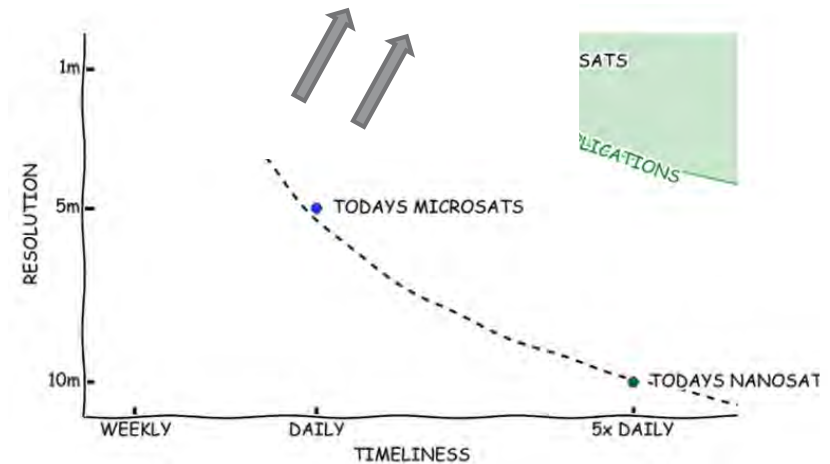


Market

- Optical at up to 50cm image resolution
- Pricing targeted at high-end users
- Fragmented value-adding sector
- **Lack of timeliness and access to data**

Trends

- Smaller, more responsive constellations
- Push toward mass-market offerings
- Real time, continuous data



Opportunities

- Smaller, low-cost constellations
- Persistent HD video from space
- Ground stations to support data downlink
- Integration with information technology
- Consolidation of value-adding sector

Communications market analysis



Market

- Mature, commercial, dominated by broadcast
- Strengths in remote areas, resilience
- **Expensive** vs. terrestrial solutions

Trends

- Larger, more capable satellites working w/ smaller, low-cost constellations
- Machine to machine comms (M2M)
- Integration with terrestrial services, 5G

Opportunities

- Developing nations without infrastructure
- HD penetration in developed markets
- M2M and terrestrial integration

Navigation market analysis



Market

- Successful mass-market platform adoption through mobile phones
- **Most signals are free**

Trends

- Improved redundancy
- Premium services with higher resiliency and accuracy
- Improved trust, accuracy, resilience and integration with complementary solutions

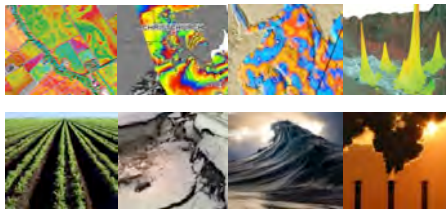
Opportunities

- Autonomous vehicles
- Security and accreditation

Satellite Enabled Services

Earth Observation

Satellite Infrastructure



Capabilities

- Earth imagery (different bands for different purposes)
- Ground movement information
- Wave height & sea state
- Environmental monitoring
- Meteorological information



Businesses impacted

- Agronomy, Logistics, Insurance, Commodities traders, Oil & Gas, Manufacturers, Government agencies

Communications



- Aim for ubiquitous connectivity (OneWeb, Internet.org, Virgin)
- Ka band achieving 50Mbps downstream data speeds
- Enabling growth in eHealth, eLearning and FinTech provision



- Emergency services, NGOs, Government agencies, Media, Oil & Gas, Tourism logistics

Navigation



- European Galileo constellation will see 10cm position accuracy
- Enabling development and deployment of autonomous vehicles
- Optimising global supply chains



- Logistics (Planes, Trains & Automobiles), Shipping, Security providers, Agronomy, Regulatory bodies

Space Industry Vision for 2030

Autonomous Planet

Self driving cars,
ships, planes....

Connected Planet

Truly ubiquitous
communications
integrating satellites

2030

Sustainable Planet

Precious earth
resources continuously
observed and
managed

Self-aware Planet

Global near real-time
images & earth data
for applications &
services

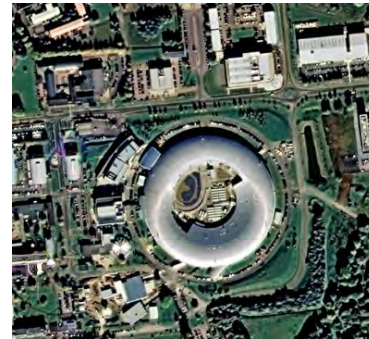
Changing Paradigm...



Traditional Space



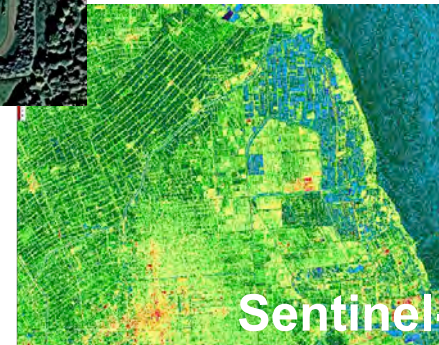
NewSpace



£££'s



Free



Sentinel-1

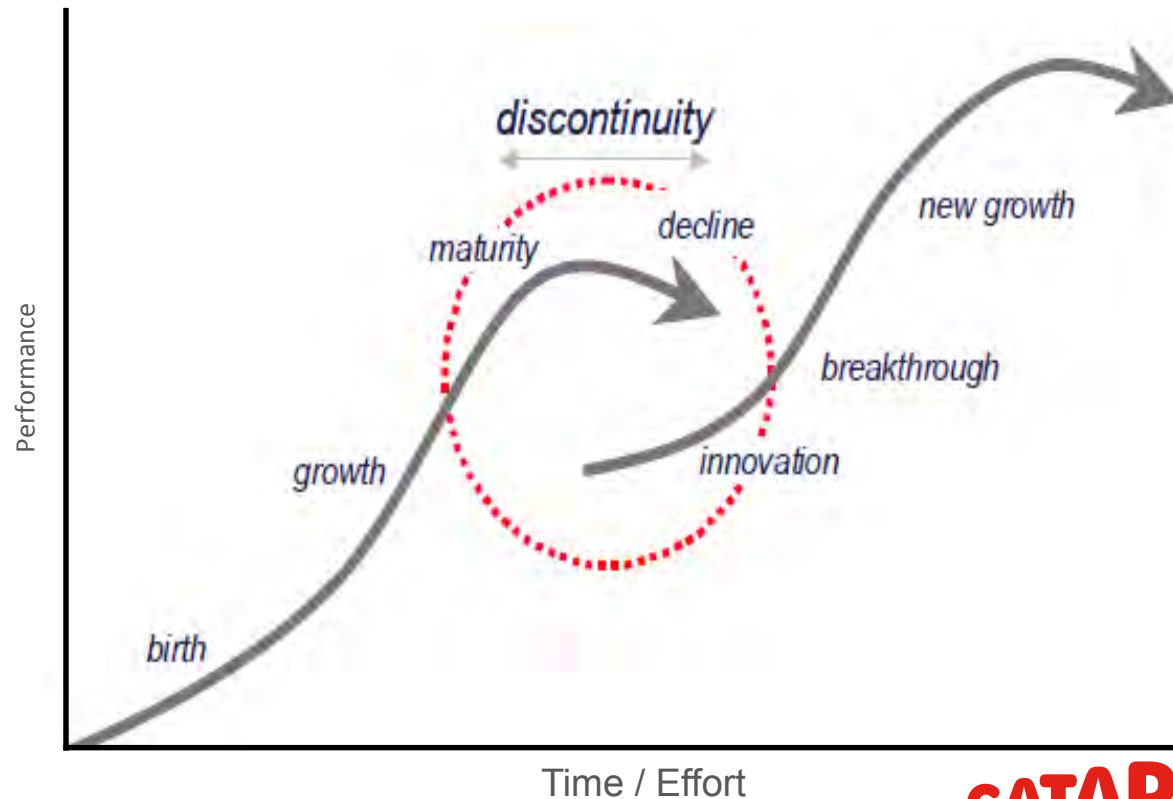
Point of Discontinuity...

Incumbent Space

- Mature/declining market
- Established players, limited competition
- Low-risk appetite, limited innovation
- Primarily government funded/contracted
- High capability, high cost
- Custom product, limited reach

New Space

- Increased innovation through higher risk tolerance
- New entrants & business models, increased competition
- Commercial solutions, focused on cost-reduction
- Low-cost, data on demand; targeting new customers



Catapult Open

Section 5

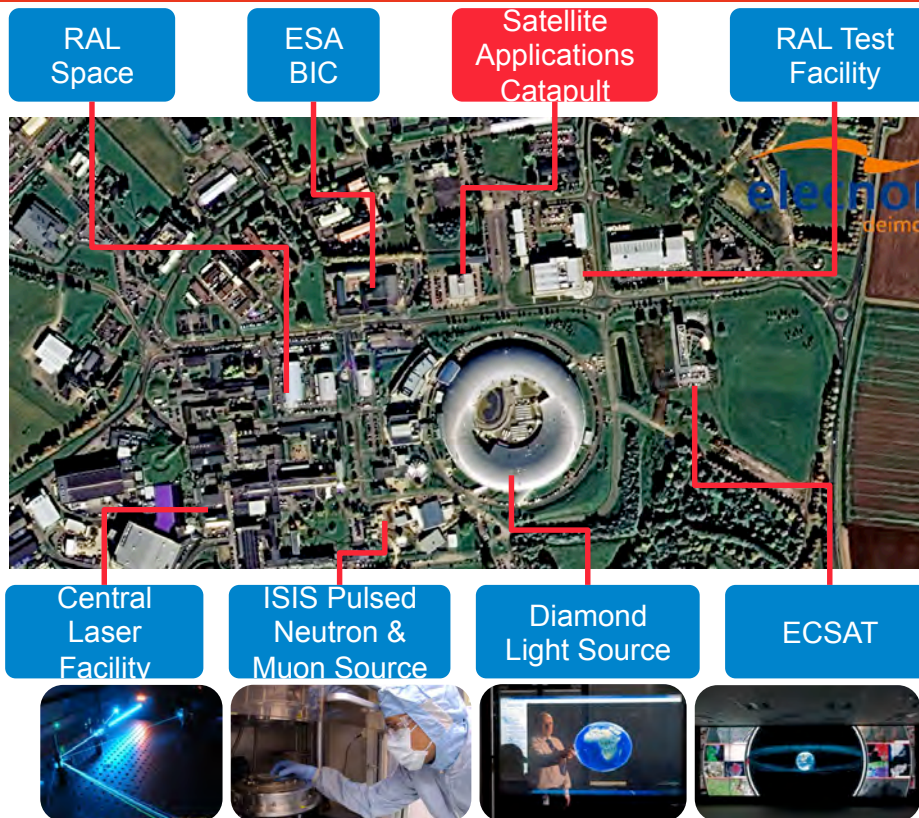


The Satellite Applications Catapult

CATAPULT
Satellite Applications

Harwell, Oxford Campus: Creation of a Space Cluster

Multi-sector, multi-disciplinary co-location promotes interaction and innovative thinking



Enabling Innovation



2016-17 Focus Areas



UN Sustainable Development Goals



From Consultation to Project Delivery...

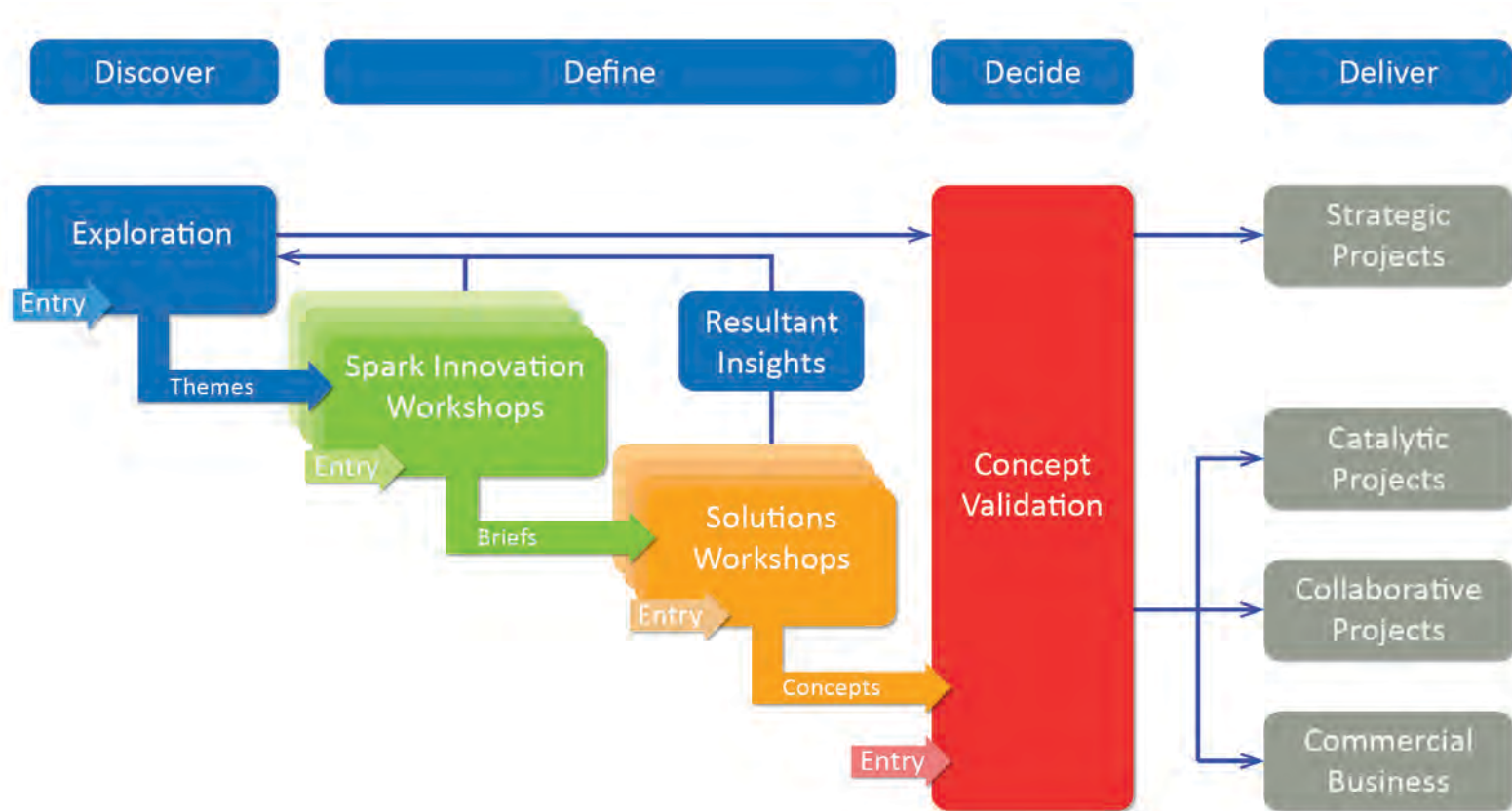


Image Copyright © Satellite Application Catapult Ltd, 2013
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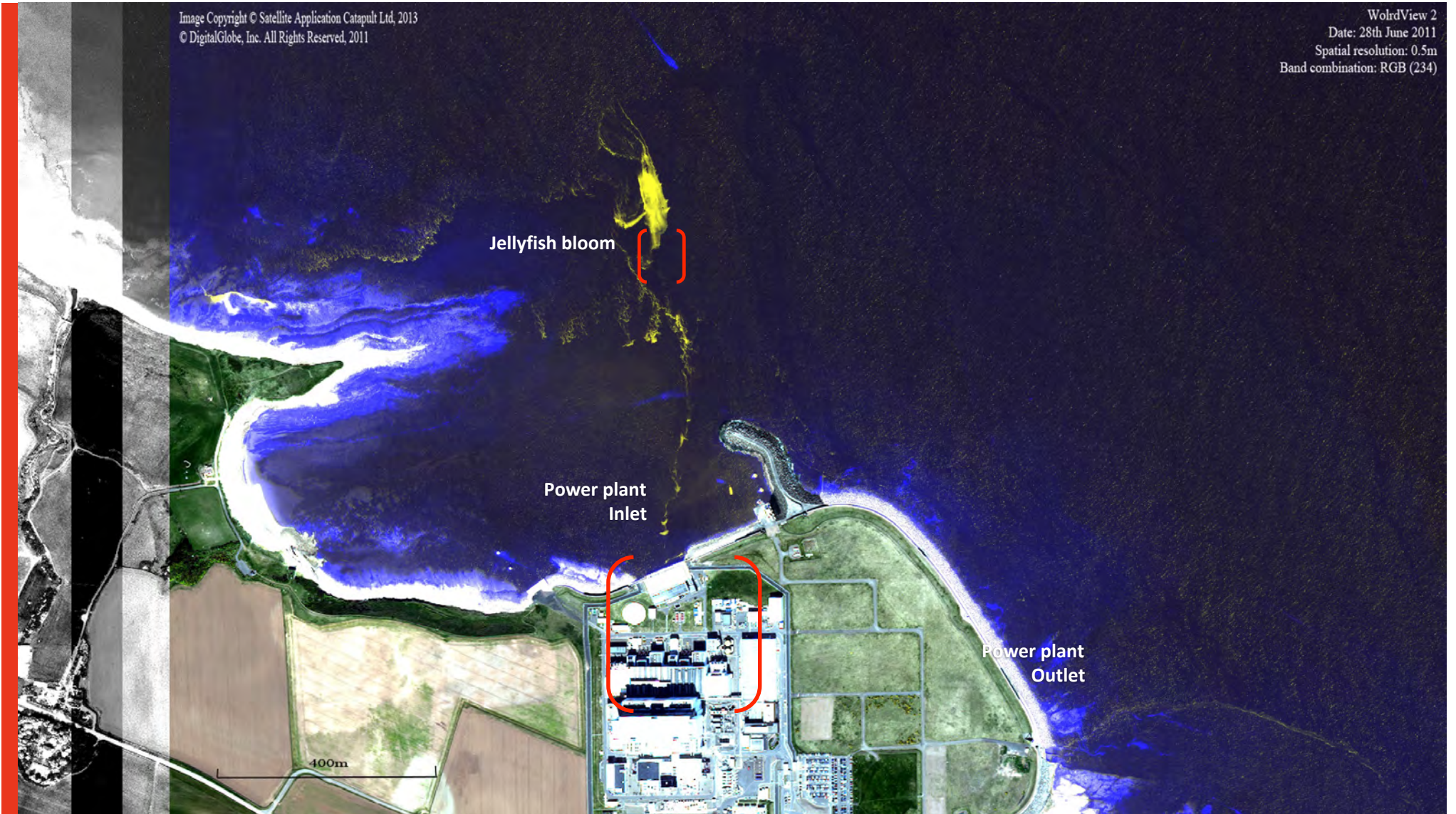
WorldView 2
Date: 28th June 2011
Spatial resolution: 0.5m
Band combination: RGB (234)

Jellyfish bloom

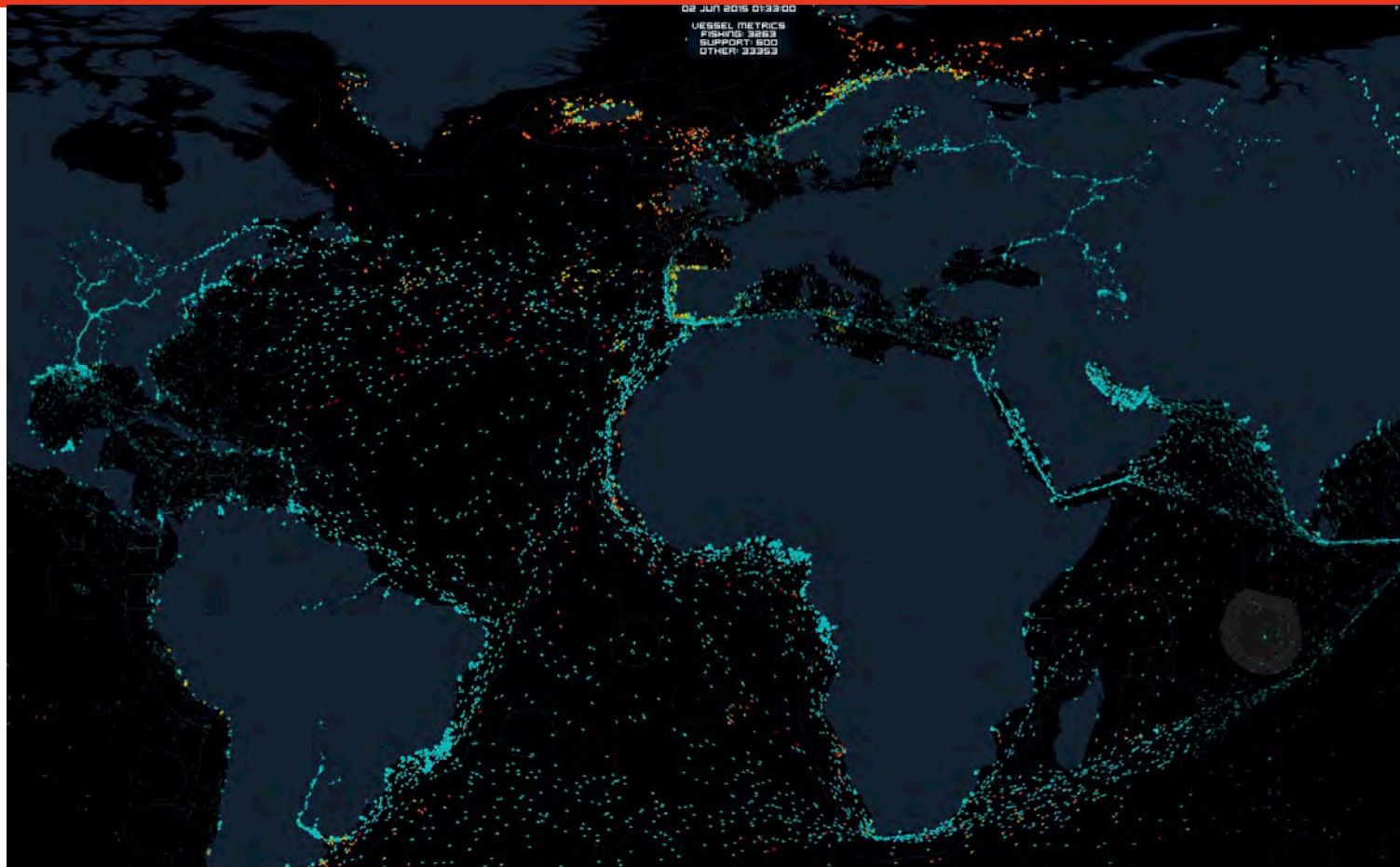
Power plant
Inlet

Power plant
Outlet

400m



Maritime Surveillance

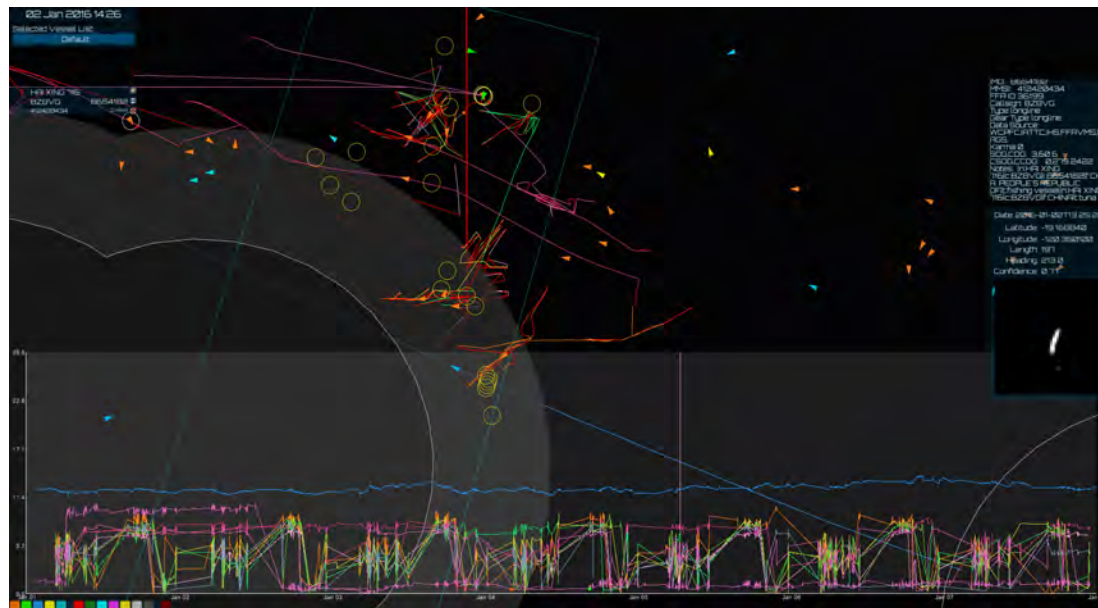


Blue Economy: Example: Eyes on the Sea

- Expert Fisheries and Enforcement Analysts
- + Productivity Enhancing Technology
- = Analytical Support and Capacity Building



Planned Global Interventions
2016/17



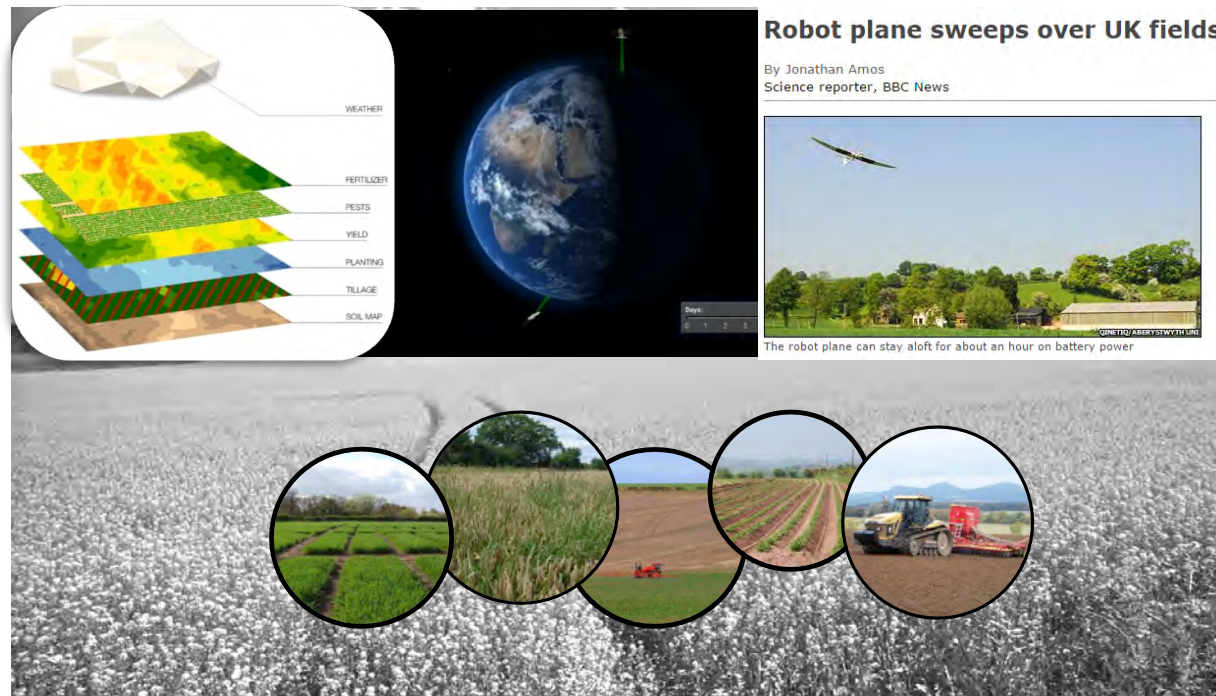
<https://www.youtube.com/watch?v=Mz9xysVlrUU>

Sustainable Living: Satellites & UAVs in Agriculture

Increase
productivity
and
sustainability

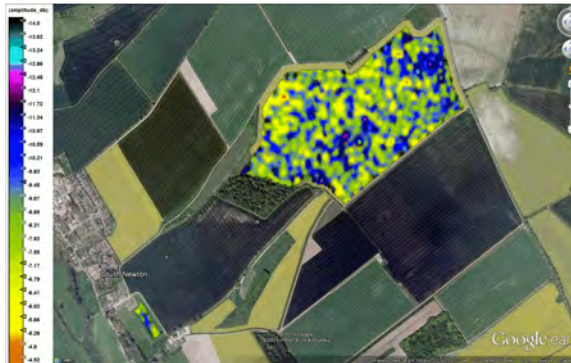


Reduce risk of
crop failure
Early
identification of
disease vectors
Observing local
weather effects



Agriculture services: Sentinel-1 Exploitation

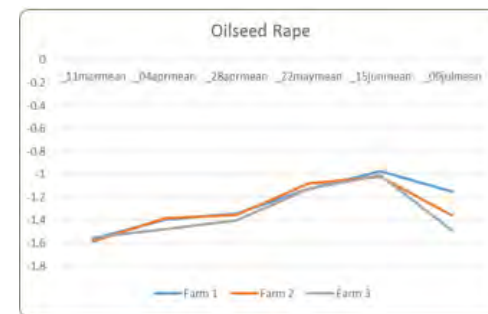
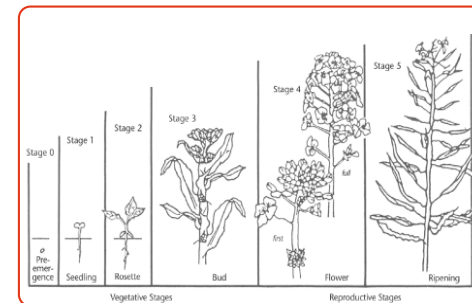
Crop management with SAR data



AgSpace develop agronomy tools which include the processing and delivery of satellite data.

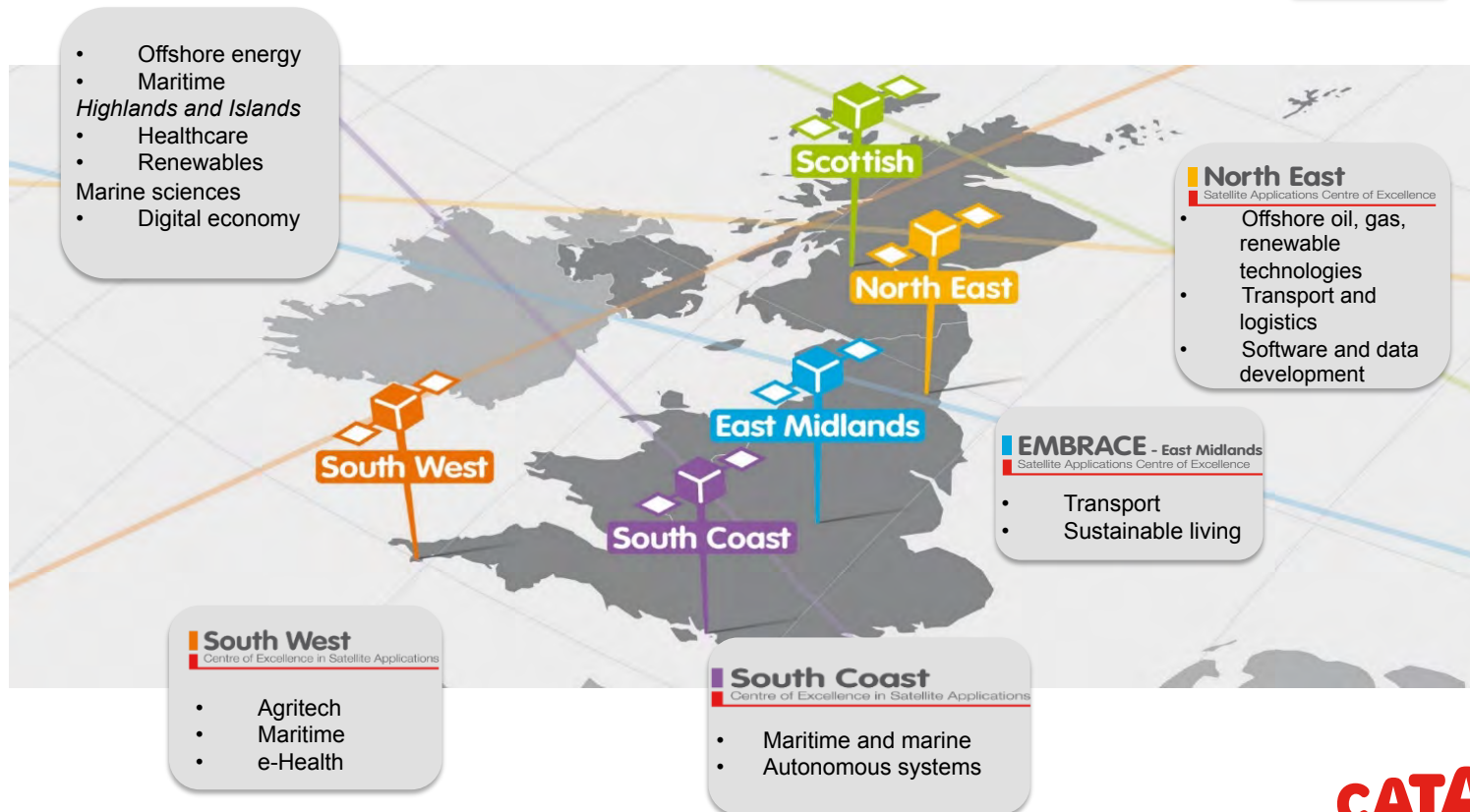
The Catapult is working to help enhance their offering by considering the use of SAR data for crop management, focused on the forthcoming Sentinel-1 mission.

Monitoring crop growth with SAR data

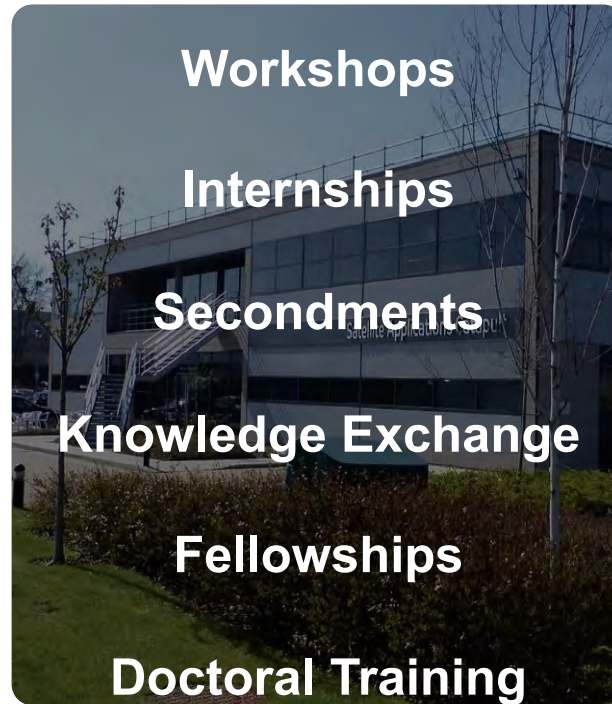


Our Regional Centres of Excellence network

In partnership with



Knowledge Exchange: Bringing people & ideas together



Skills

"The firm I worked for is now supporting me through my MSc in Applied GIS and Remote Sensing.

I'd like to take this opportunity to say thank you for planning the internship scheme;

I wouldn't be where I am now if it wasn't for SpIN."

STEM Engagement

- Engaging and Inspiring Young People
- Focused Events
- Engagement with Catapult STEM Ambassadors



Internships: Space Placements in Industry

- Funding available for businesses to host
- 1/3 receive job offers 6 months before graduating



PHD Sponsorship

- "Forest carbon maps with a view to building a Global Biomass Information System"
- "Improving flood predictions using data assimilation"
- Personal movement profiles for more sustainable buildings



Business Support

Startup Support

- Idea Validation
- Business Mentoring
- Workshop & Events
- Building a Team
- Sign-posting
- Space Business Portal
- Access to Funding & Investor Readiness
- Spin out Factory
- Competitions



Finance & Access to Funding

- Connections & Networking
 - Connections with Industry & Universities
 - Networking Events

*further detail in business support brochure

Innovation & Growth Services (for larger businesses)

- Stimulating New Ideas
 - Idea Generation
 - Concept Evaluation and Evolution
- Releasing your Innovation
 - Innovation Training
 - Innovation Match-Making – the Engage service
- Preparing you for Growth
 - Acceleration to Market
 - Commercialising your IP
 - Engaging Communities
 - Leadership Development

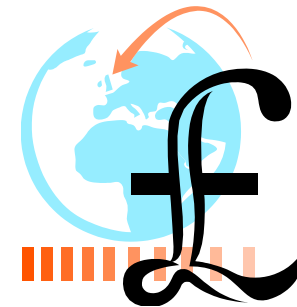
Catapult Role in International Context

Create jobs and revenue for the
UK

*“Catapult is differentiated in the international arena by our **not for profit, government backed status**, by being a **portal to any satellite capability** and by building **collaborative demonstrators** to open routes to market.”*

Support Inward Investment to drive UK growth, through innovation

1. Encourage overseas companies to invest in space R&D and manufacturing in the UK to develop new products or services generating UK revenue & jobs.
2. Where there is no existing UK capability, encourage international satellite and related service companies to move existing or start new operations here.
3. Encourage international companies to increase current investment in UK space related business.



Section 6



The Space Growth Partnership

Evolution of the Space Growth Partnership

**2010:
IGS Phase 1**

Establishes Space as a major growth opportunity for the UK

**2013:
IGS Phase 2**

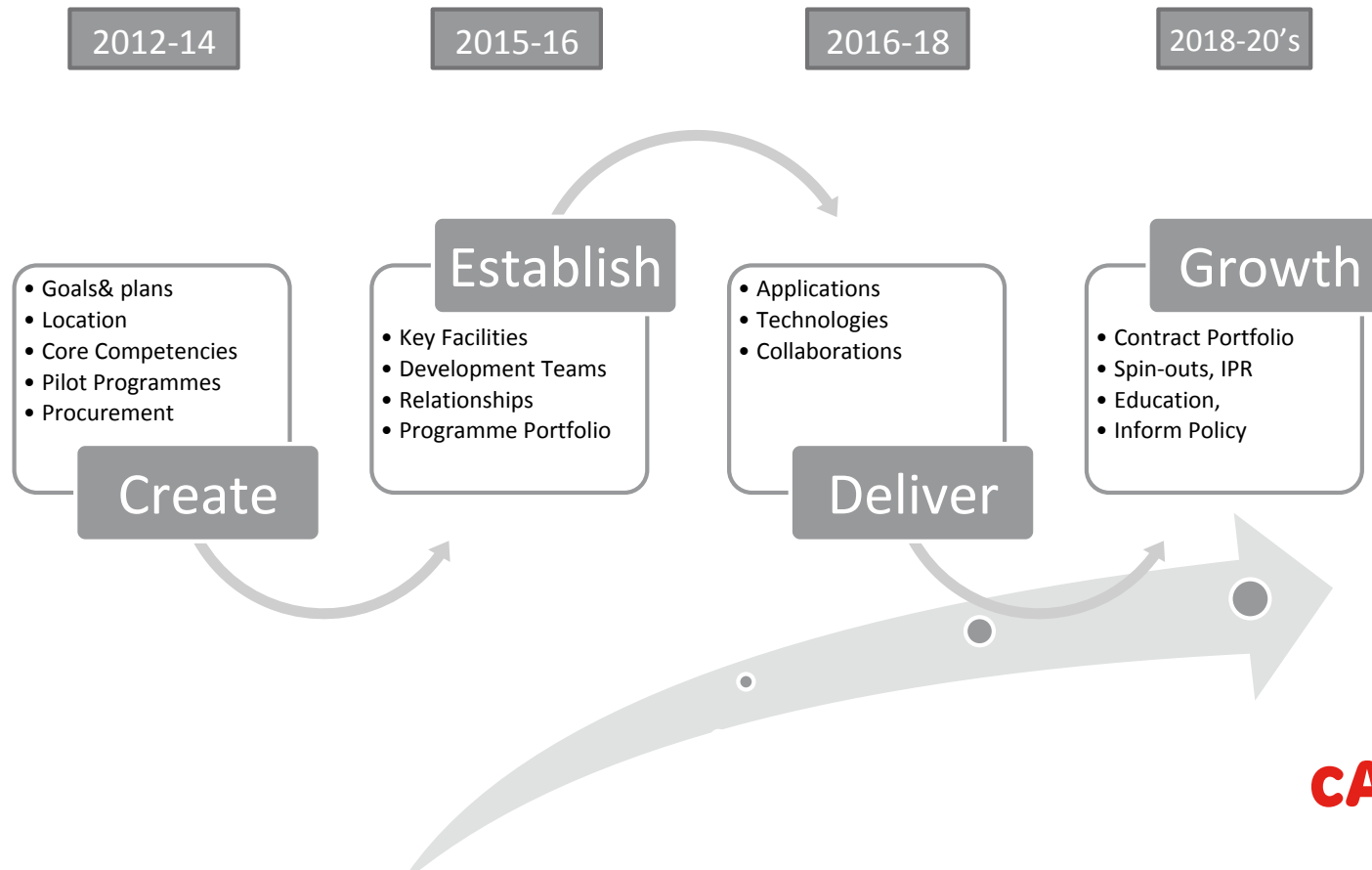
Re-stack and focus on key growth markets

SGP

A strategic partnership to face a rapidly changing environment



The journey so far...



Catapult Open

Satellite Applications

Thank you...
...and time for lunch!

Innovate UK
Technology Strategy Board

CATAPULT