Technology Strategy Board: Satellite Applications Catapult

Appleton Space Conference

Paul Febvre
6th December 2012

Catapult is a Technology Strategy Board programme

CATAPULT Satellite Applications

Satellite Applications Catapult Presentation Overview

Technology Strategy Board Aims and Innovation Toolsets

Satellite Applications Catapult Strategy and Approach

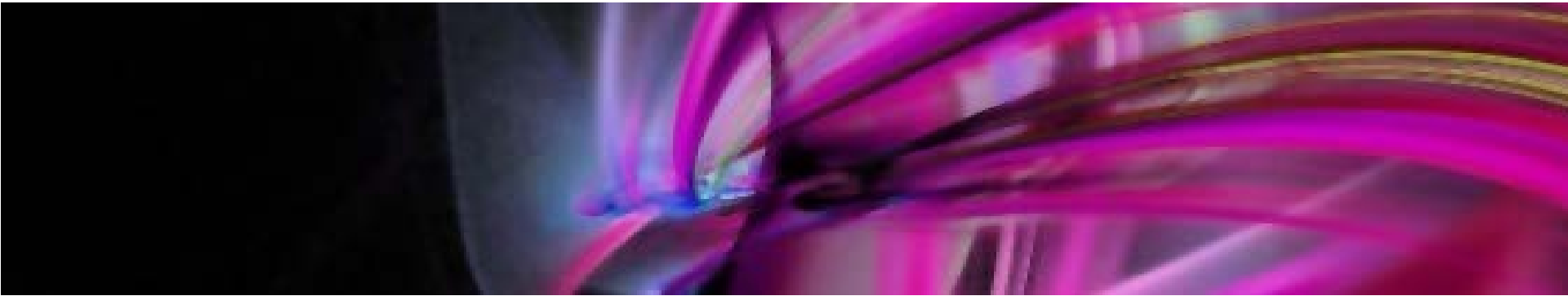
Satellite Applications Catapult Activities and Timeline

CATAPULT Satellite Applications

Driving Innovation

The Technology Strategy Board

December 2012



TSB strategic focus

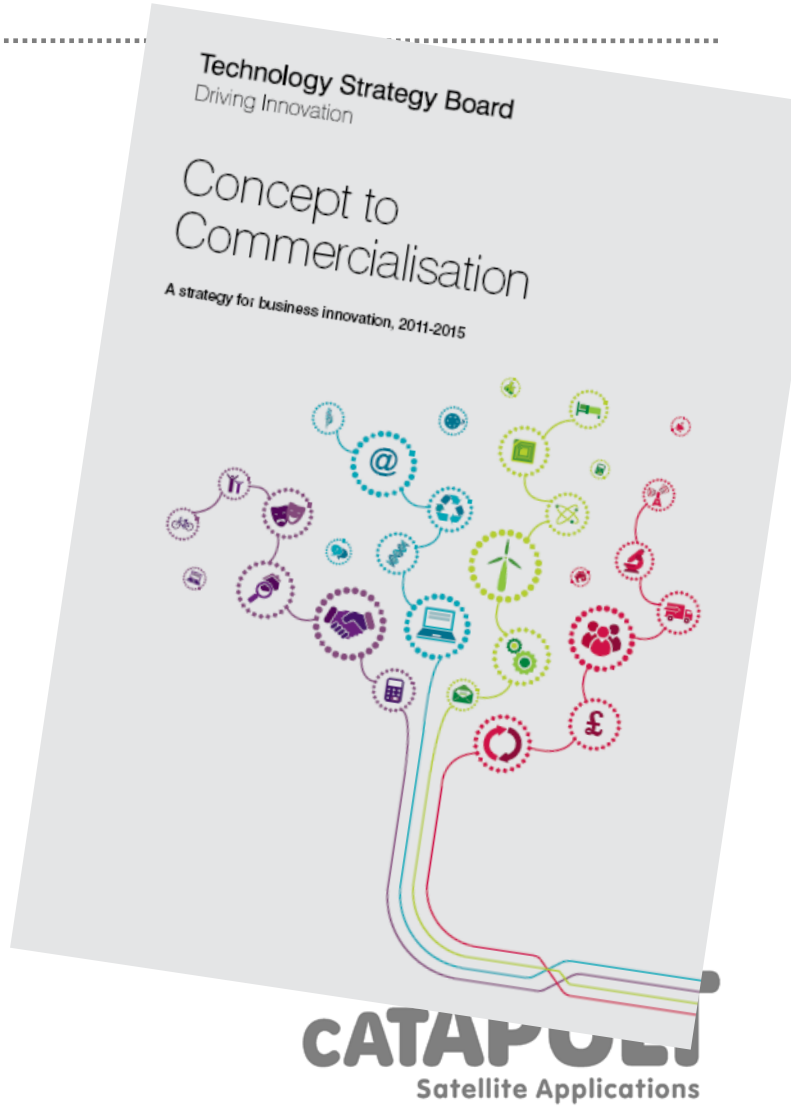
Accelerating the journey between concept and commercialisation

Investing in priority areas based on potential

Connecting the innovation landscape

Turning government action into business opportunity

Continuously improving our capability



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The Toolset

Range of Tools with different objectives / characteristics

Smart

SBRI Government challenges. Ideas from business. Innovative solutions.

Collaborative R&D

_connect

Knowledge Transfer Partnerships

eurostars™

Knowledge Transfer Networks

CLEAN AND COOL MISSION 2012
24 - 31 March

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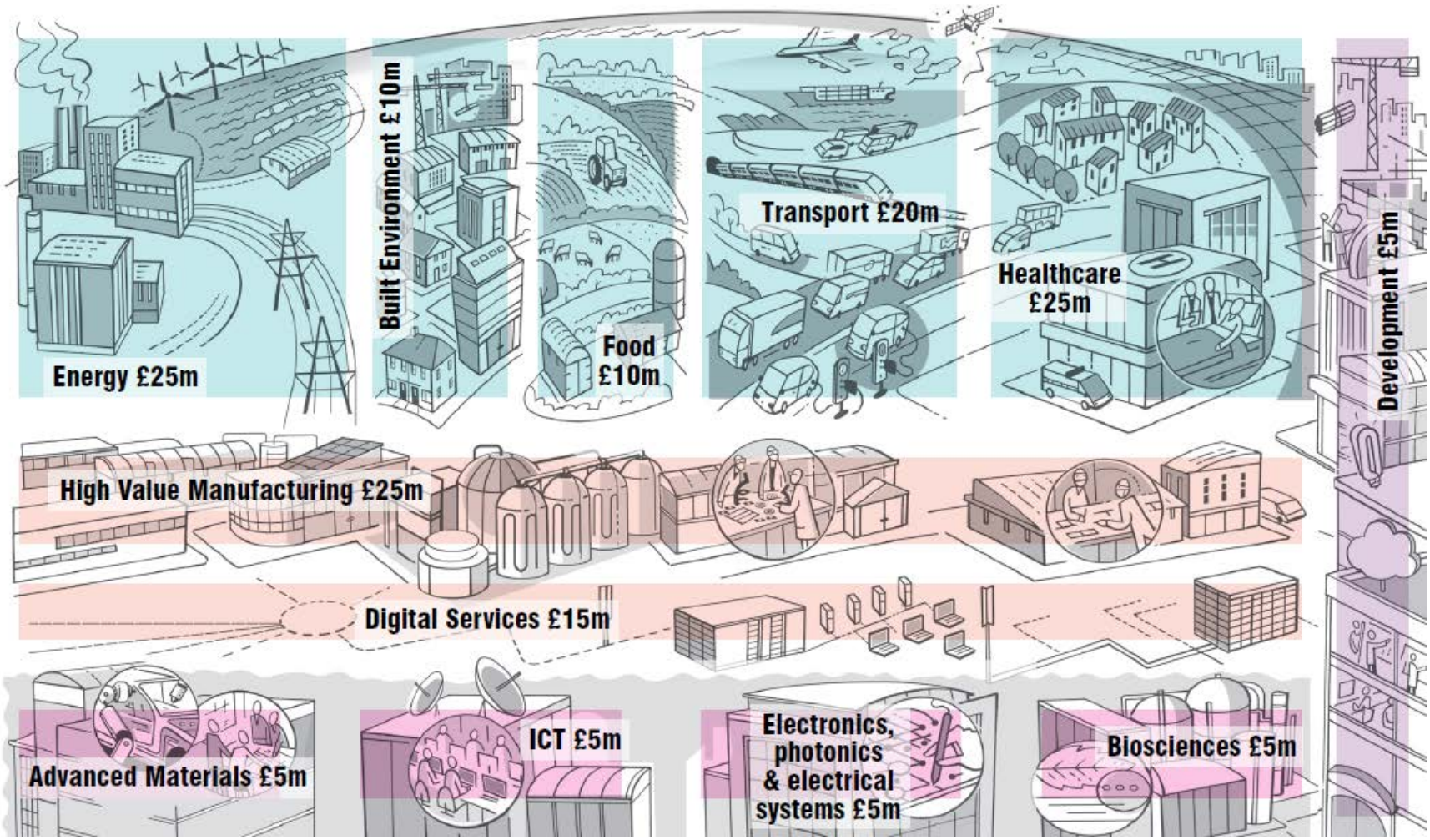
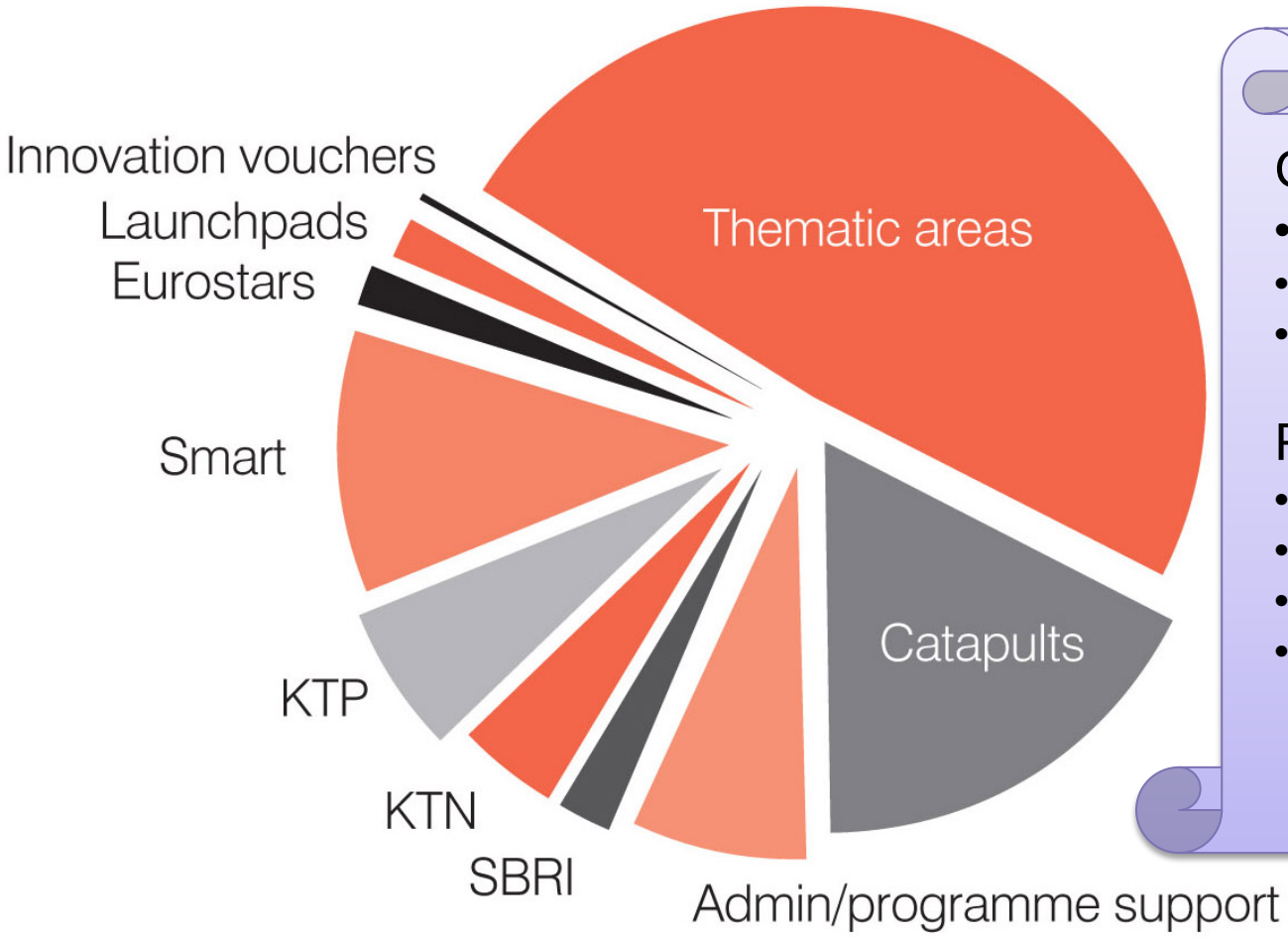
Launchpad

Thematic Programmes



Budget Distribution between Tools



Challenge Driven

- Thematic Programme
- SBRI
- Catapult (TIC)

Responsive

- Smart(Grant for R&D)
- Eurostar
- KTP
- KTN

Catapult – operational status

2011

- **High Value Manufacturing**

2012/13

- **Cell Therapy**
- **Satellite Applications**
- **Offshore Renewable Energy**
- **Connected Digital Economy**
- **Transport Systems**
- **Future Cities**

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UK Space Innovation and Growth Strategy

- Global market forecast to be worth £400 billion by 2030
- Strategy to capture 10% of market and create over 100,000 jobs in the UK
- ‘applications and services using Space data will be one of the most important elements for delivering growth’

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Satellite Applications Catapult centre will Provide End-to-End Capability

Upstream ⟷ *Downstream*

Capturing new data ⟷ In orbit demonstration ⟷ Data management and integration ⟷ Connecting with new markets

Satellite technology | **Satellite Operations** | **Data Downlink & Processing** | **Data Exploitation & Application**

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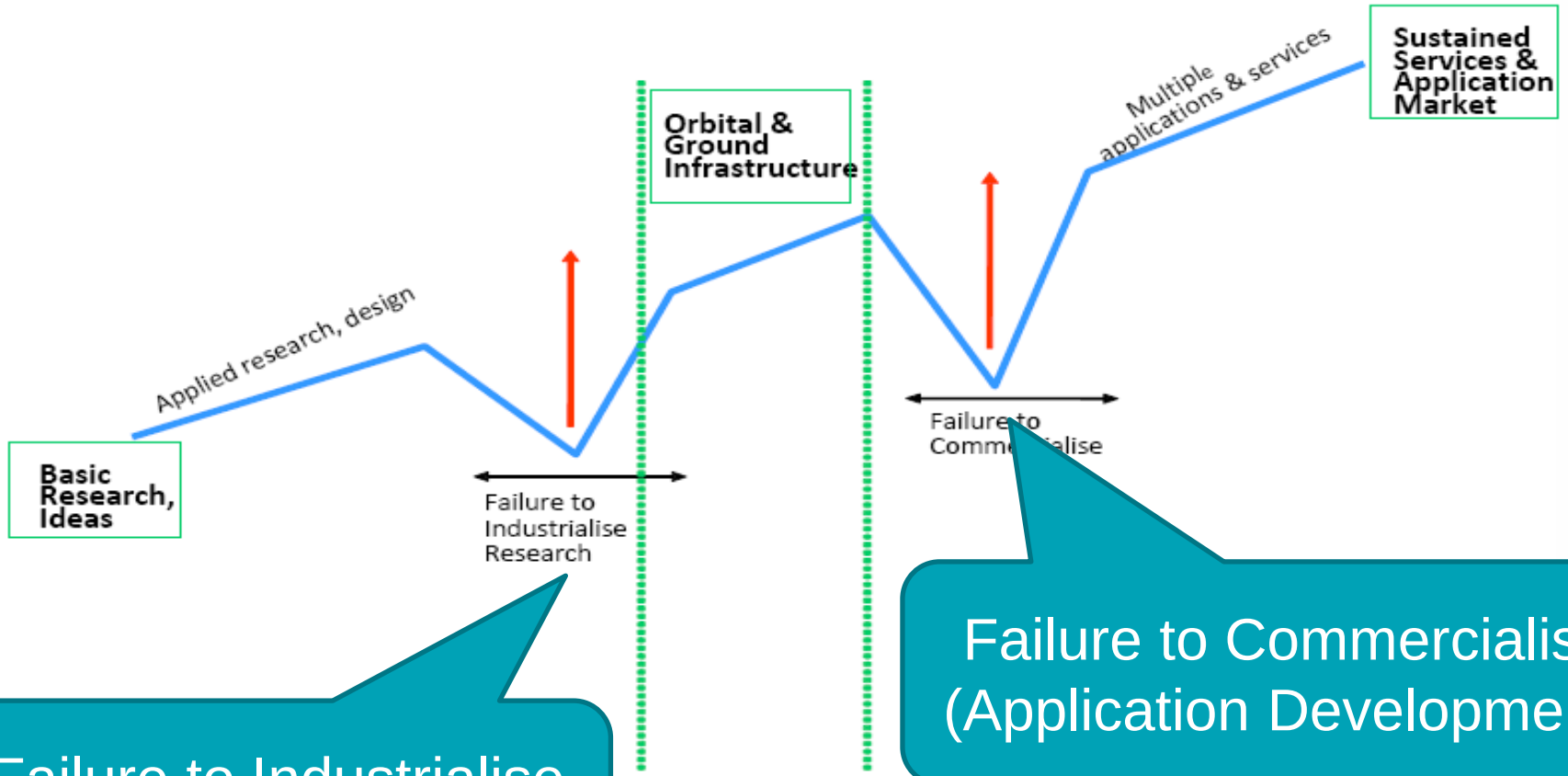
Challenges for Satellite Applications



Failure to Industrialise (Technology Research)

Failure to Commercialise (Application Development)

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The starting point: Consultation Process - Initial Expressions of Interest from the UK Space Community

	Satcoms	EO	GNSS
Distance learning and telemedicine	2	2	1
E-commerce, incl. home and remote working	4	0	0
Entertainment	1	1	0
Location-based consumer services	0	0	1
Traffic management, incl. fleet management	6	12	10
Natural resources management, incl. energy, farming, food and fisheries	5	21	11
Urban planning	2	6	2
Disaster prevention and management	3	11	1
Meteorology and climate change	1	17	3
Security	3	7	3
Financial services and insurance	0	2	2

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The Mission for Catapult

Innovate

- Idea creation
- Cross-fertilisation
- Investigation & Analysis
- Business Modelling

Industrialise & Commercialise

- Market Focus →
- Technology Research →
- Products & Services
- **Applications**

Growth

- Deployment
- Sustainability
- Export Potential
- UK Jobs & GDP enhancement

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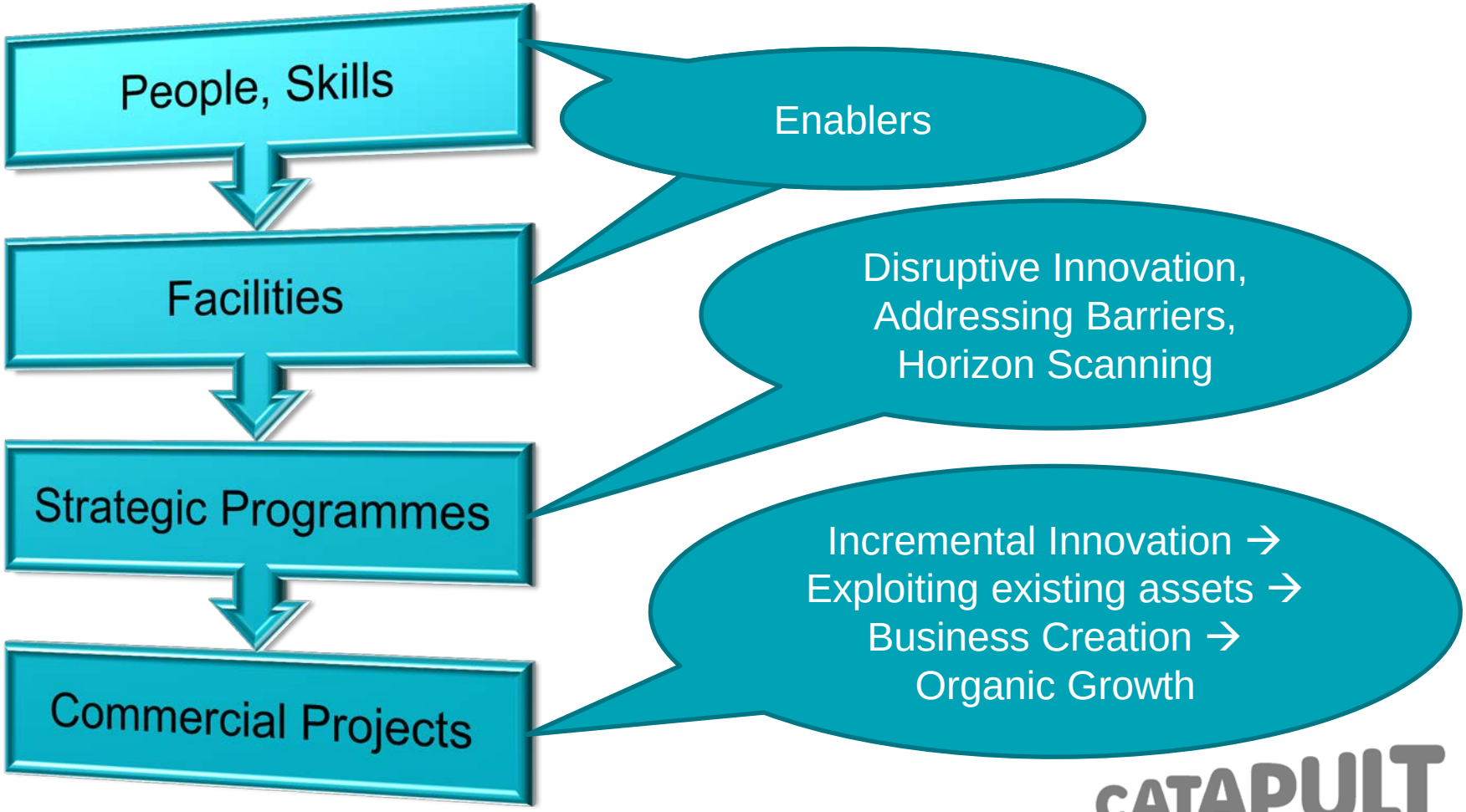
Catapult Operations



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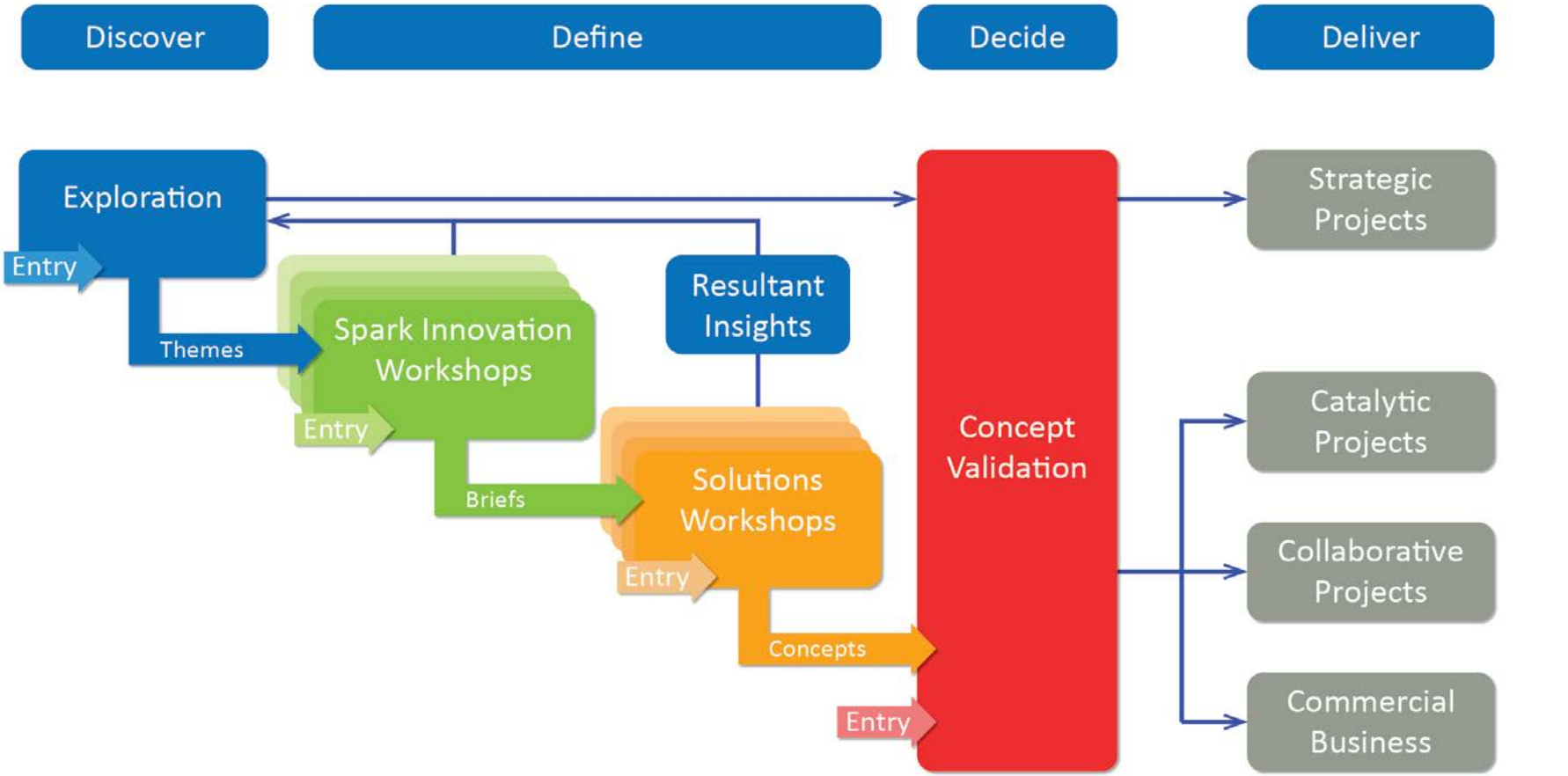
From Consultation to Project Delivery



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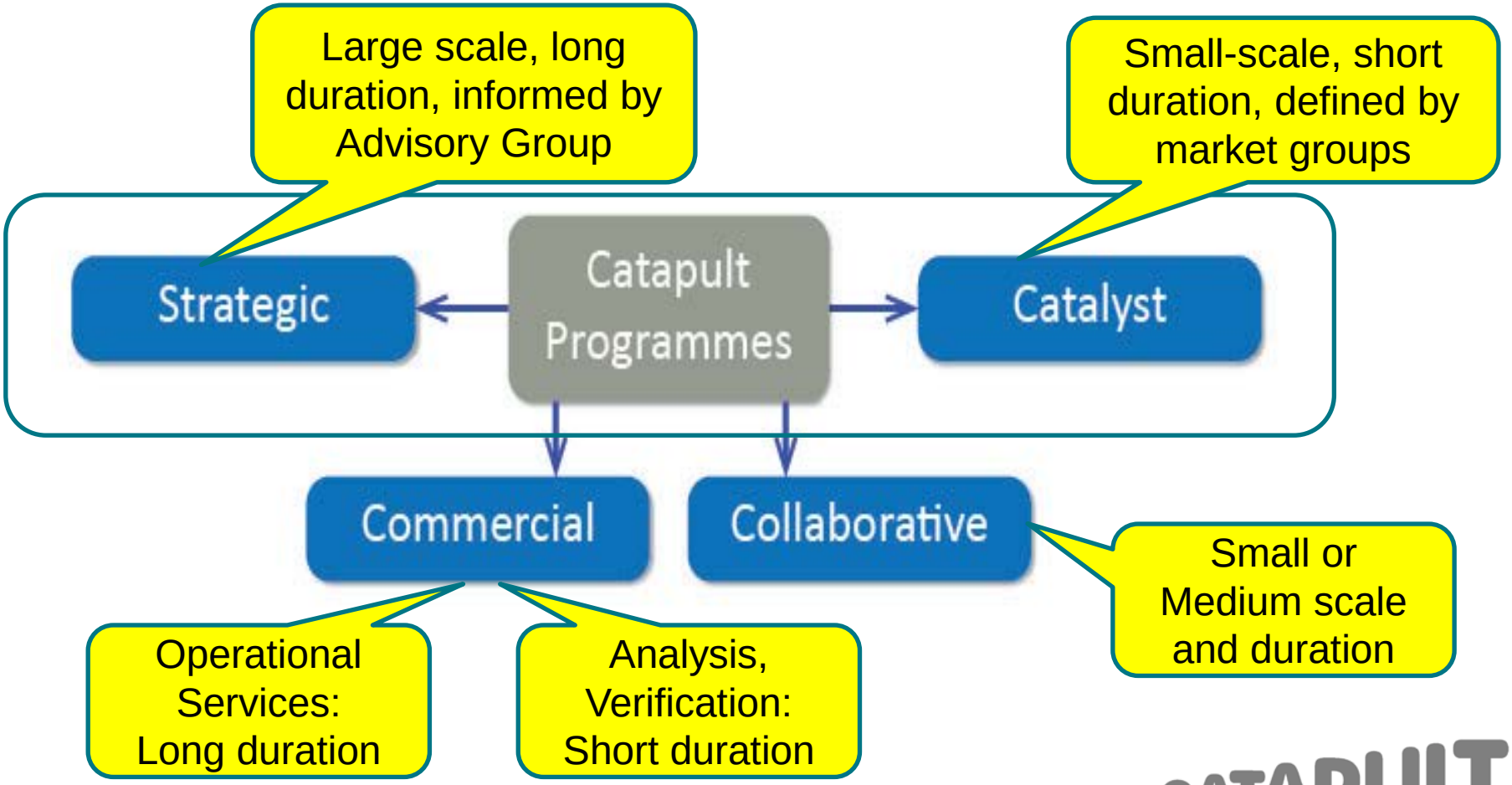
Satellite Applications Catapult Projects



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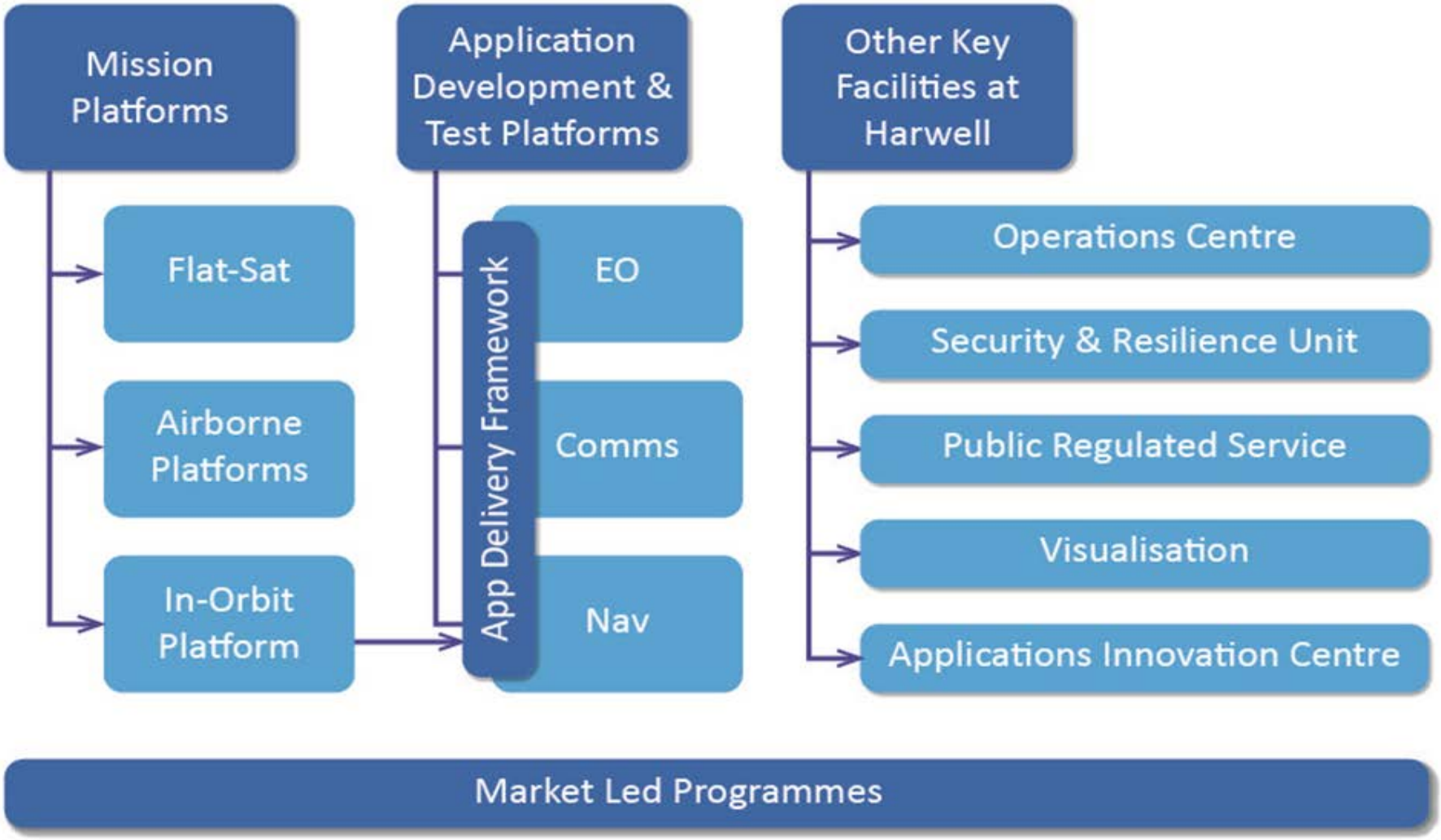
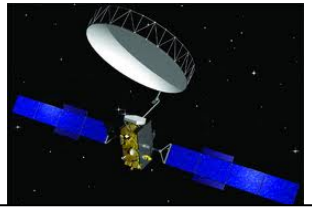
Satellite Applications Catapult Facilities

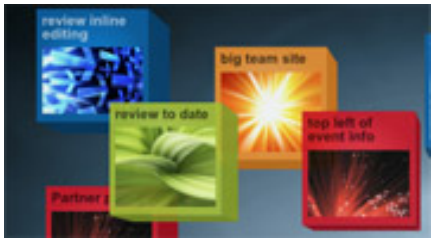


Supporting SMEs: Application Development Facilities

Application Hosting Facility



Satellite App Service Provider

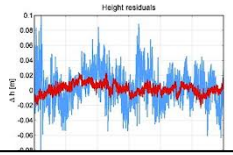


On-line Show-casing

Application Developer Environment

Physical Show-casing

EO Data Facility



GNSS Resilience Test Facility

Communications App Test Facility

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Example Scenario: Mission Platforms

Project Storyboard: Comms Application

COMMS App Development Facility
User Story - The Ambulance that is always on call

An SME in the health sector attended a workshop run by the Satellite Applications Catapult and realised that they could use satellite technology to help ambulances stay in better contact with controllers. They approached the Catapult, seeking help with the development process.

The Catapult offered signposting to the team, introducing them to Product Design Solutions (PDS), a consultancy.

PDS wrote a design specification in tandem with experts at the Catapult.

They helped with business modelling and prototyping and raised funds for a trial.

PDS and their new partners built an application around their service at the Satellite Applications Centre.

They were provided access to real satellite equipment during the trial process.

The service was trialled, and proven, with the St. John's Ambulance. The Catapult then provided guidance on commercialisation.

The Catapult helped the team write funding proposals to get the project moving.

A manufacturer was interested in trialling the service in a national health organisation.

They set up a large scale trial with the NHS to further develop and refine the system.

The trials yielded a range of useful products and services with great export potential.

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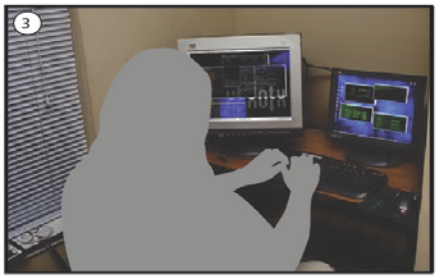
Project Storyboard: EO Data Application

Communal Earth Observation Data
User Story - Radiac the Lone Hacker/Developer

The Satellite Applications Catapult decided to make its data freely available to encourage enquiring minds to experiment.

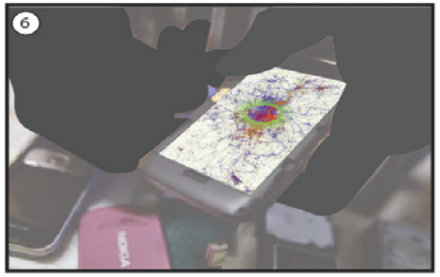
Radiac (Simone to her mother) loved to write code that could manipulate data in interesting, previously untried ways.



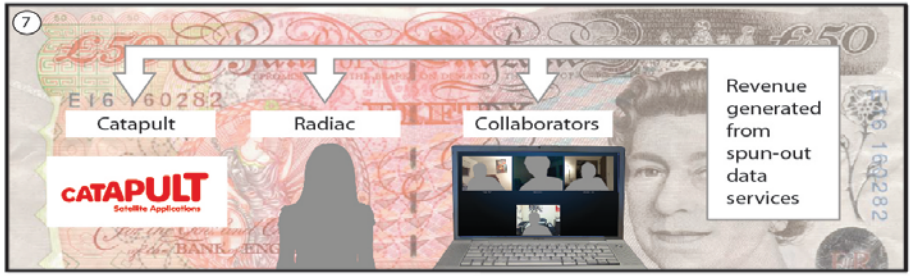
She was attracted to the Catapult by its vast datasets and accessibility via virtual machines (VMs) as she lived on the Shetland Isles.

Her VM gave her remote access to data, processing power, tech support, and an extensive library of tools built both by the Catapult and previous users. Building on the work of others accelerated her experiments. She was also able to discuss her work with other members of the community.

These discussions, hosted on Catapult forums, attracted collaborators with whom Radiac began to develop new applications.



The Catapult provided access to VCs and these new services were spun out as businesses, which began to produce revenue.



Each step of the value-adding chain was tracked, as all the development work was hosted on the Catapult's closed cloud network. In this way money flowed back up the value chain to the Catapult as well as the business founders.

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Catapult Engagement: Delivering the Vision

Space Industry

Other Industries

UK Space Agency

Other Government

TSB

ESA ARTES

EU FP7, H2020

UK National Programmes

Non-EU

US, China, Korea...

Space Industry

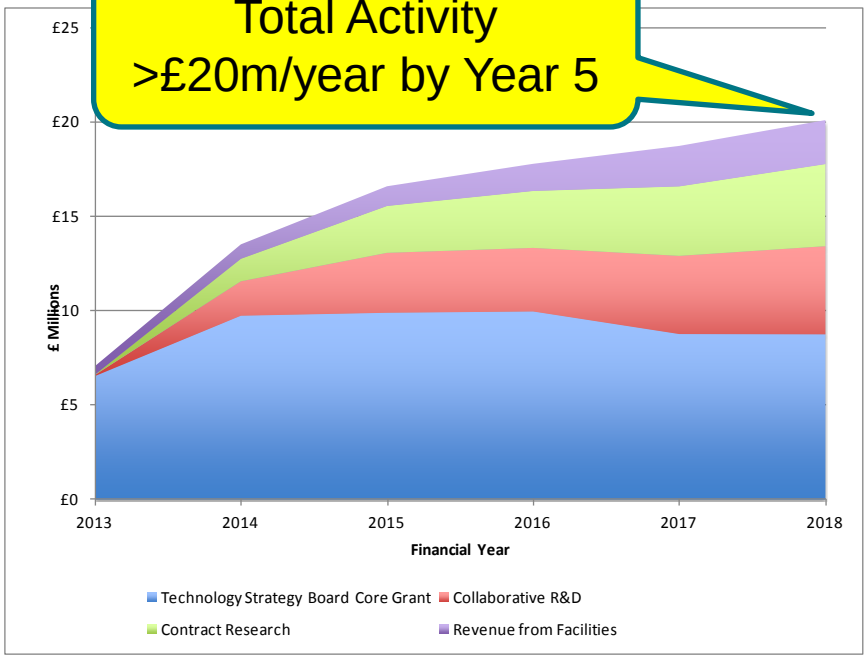
Academia + Research Institutes

Non-space Industry + SMEs

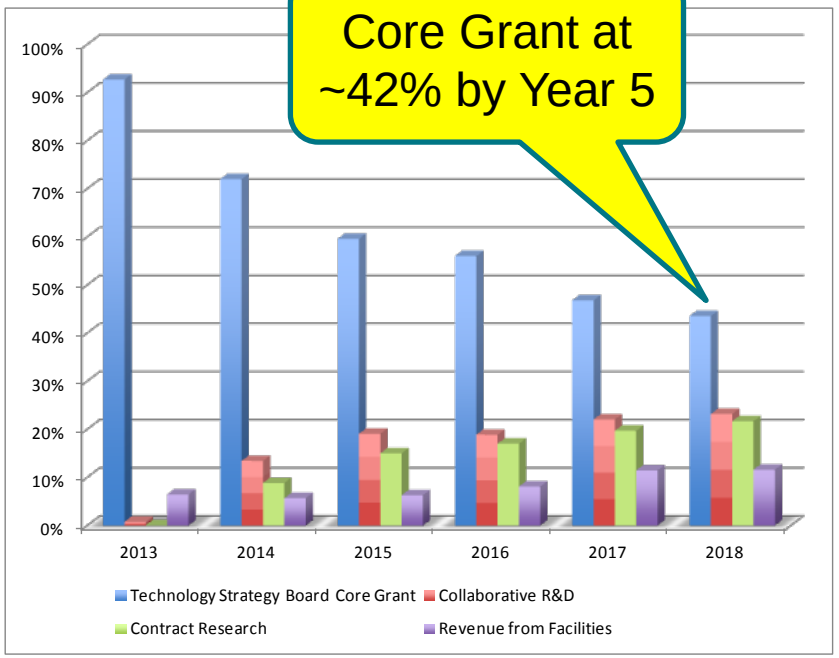
Other Catapults

Catapult 5-Year Financial Projection

Total Activity
>£20m/year by Year 5



Core Grant at
~42% by Year 5



Cumulative Activity
£51m by 2018

Cumulative Activity
£19m by 2018

Satellite Applications Catapult

Application Development Programmes

Applied Research

Facilities & Services

Cumulative Activity
£37m by 2018

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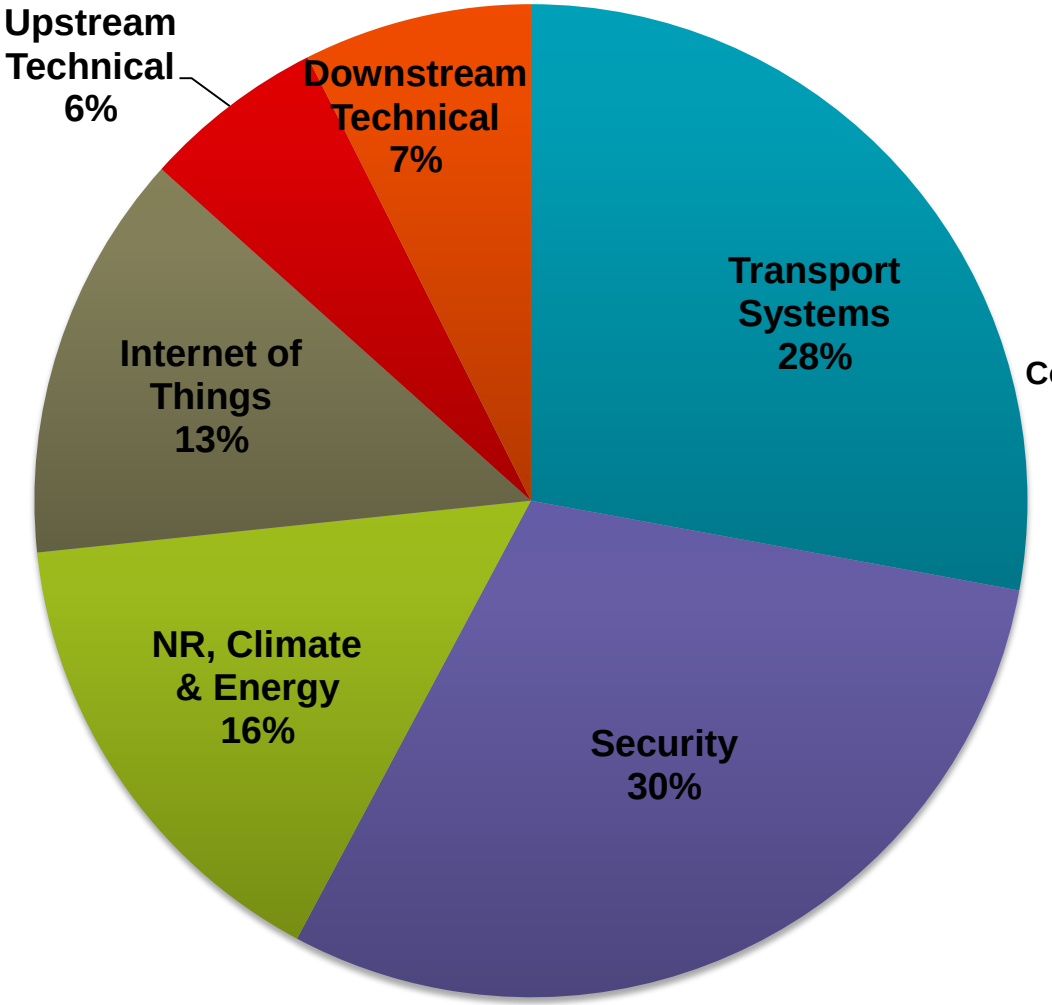
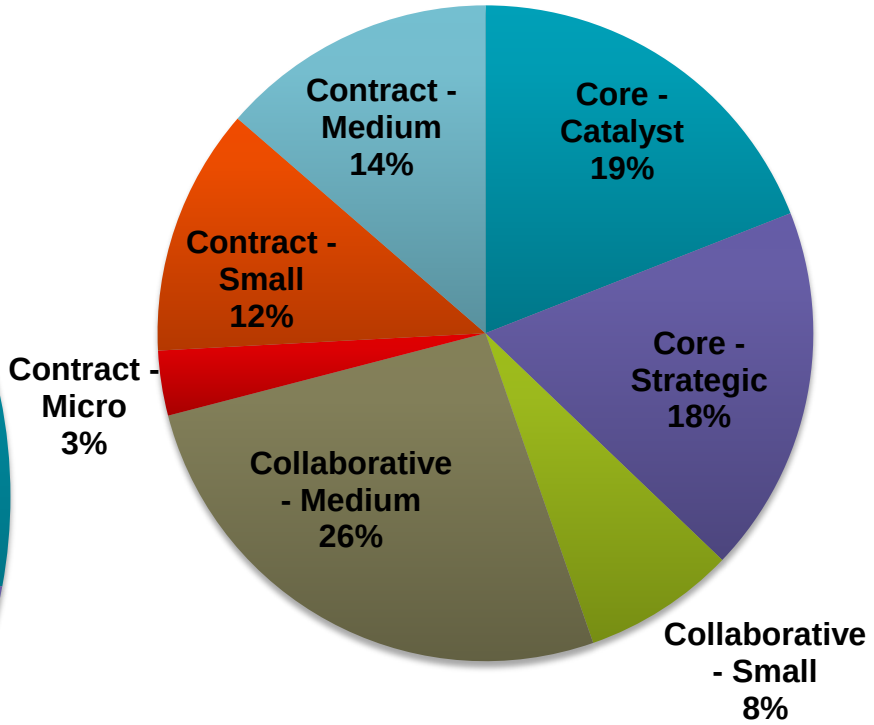
Indicative spend profile by Project type: (Total ~175 projects) by Year 5





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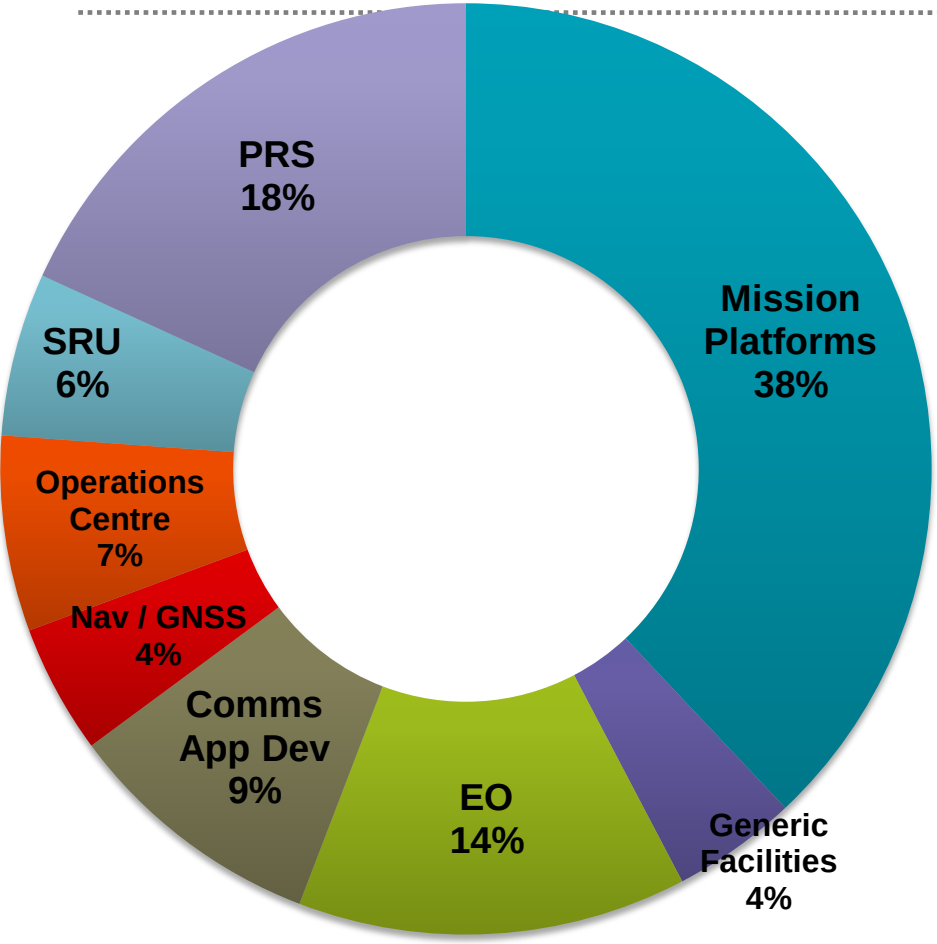
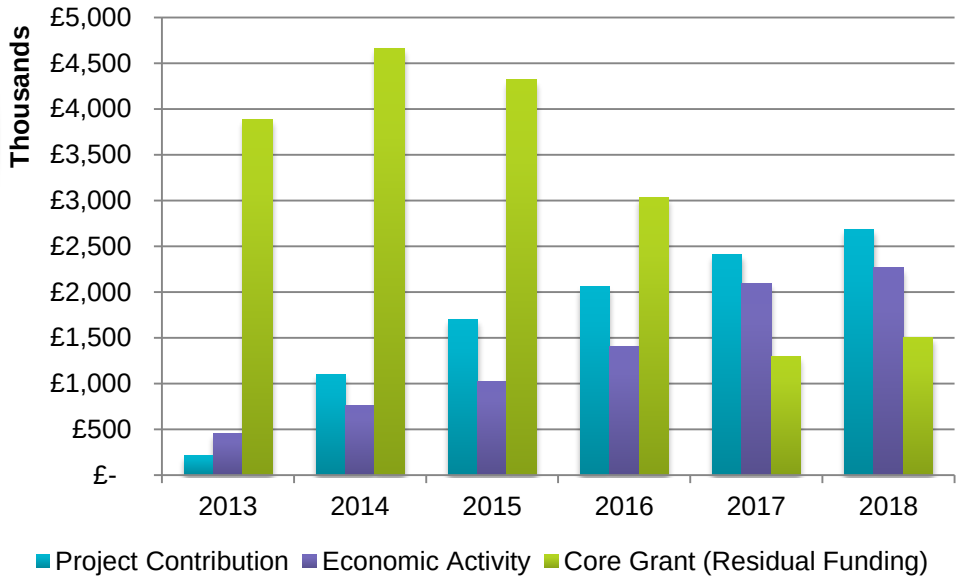
Indicative spend on Facilities: cumulative over 5 years





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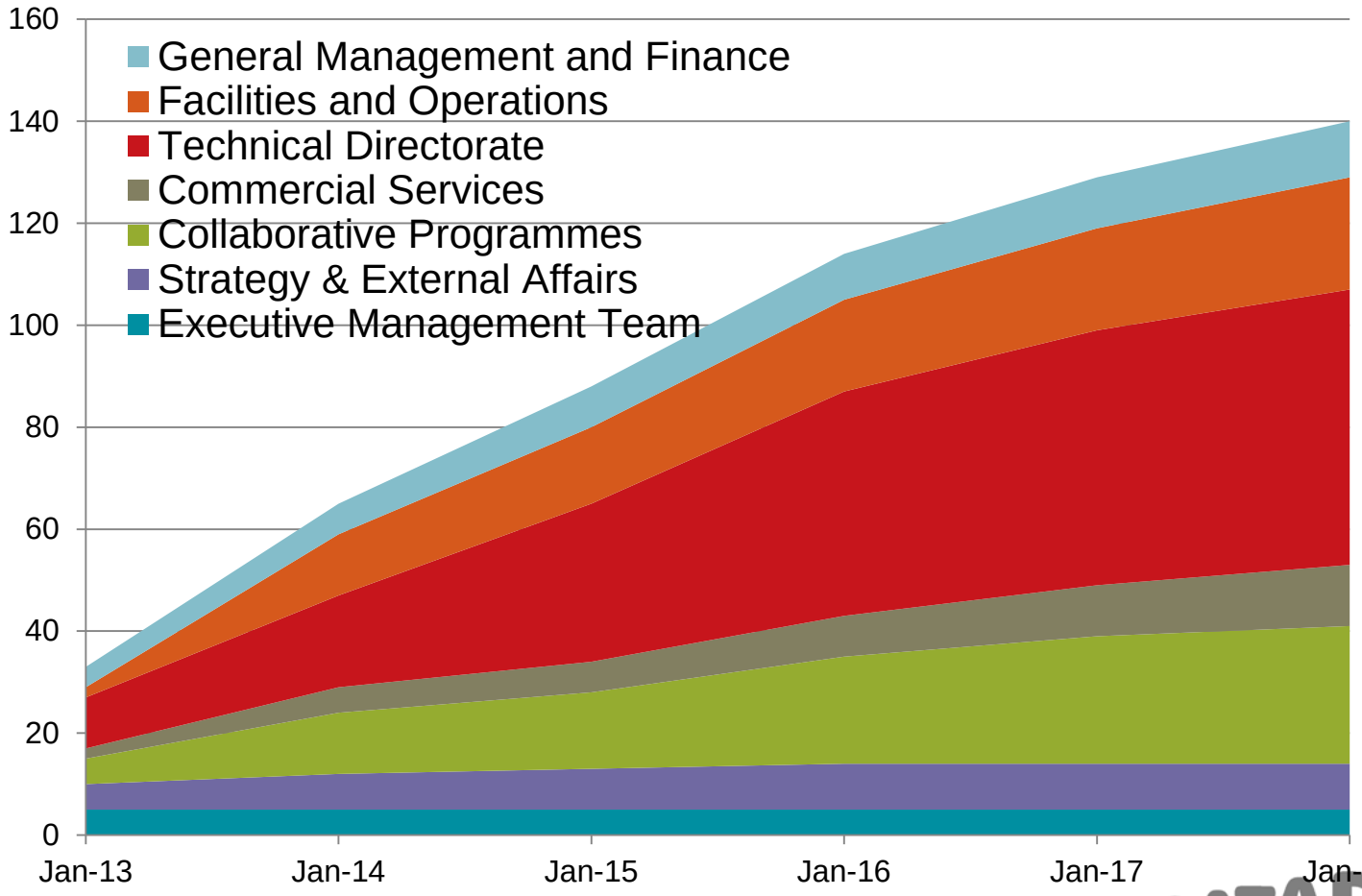
Indicative Staffing Profile over 5 yrs



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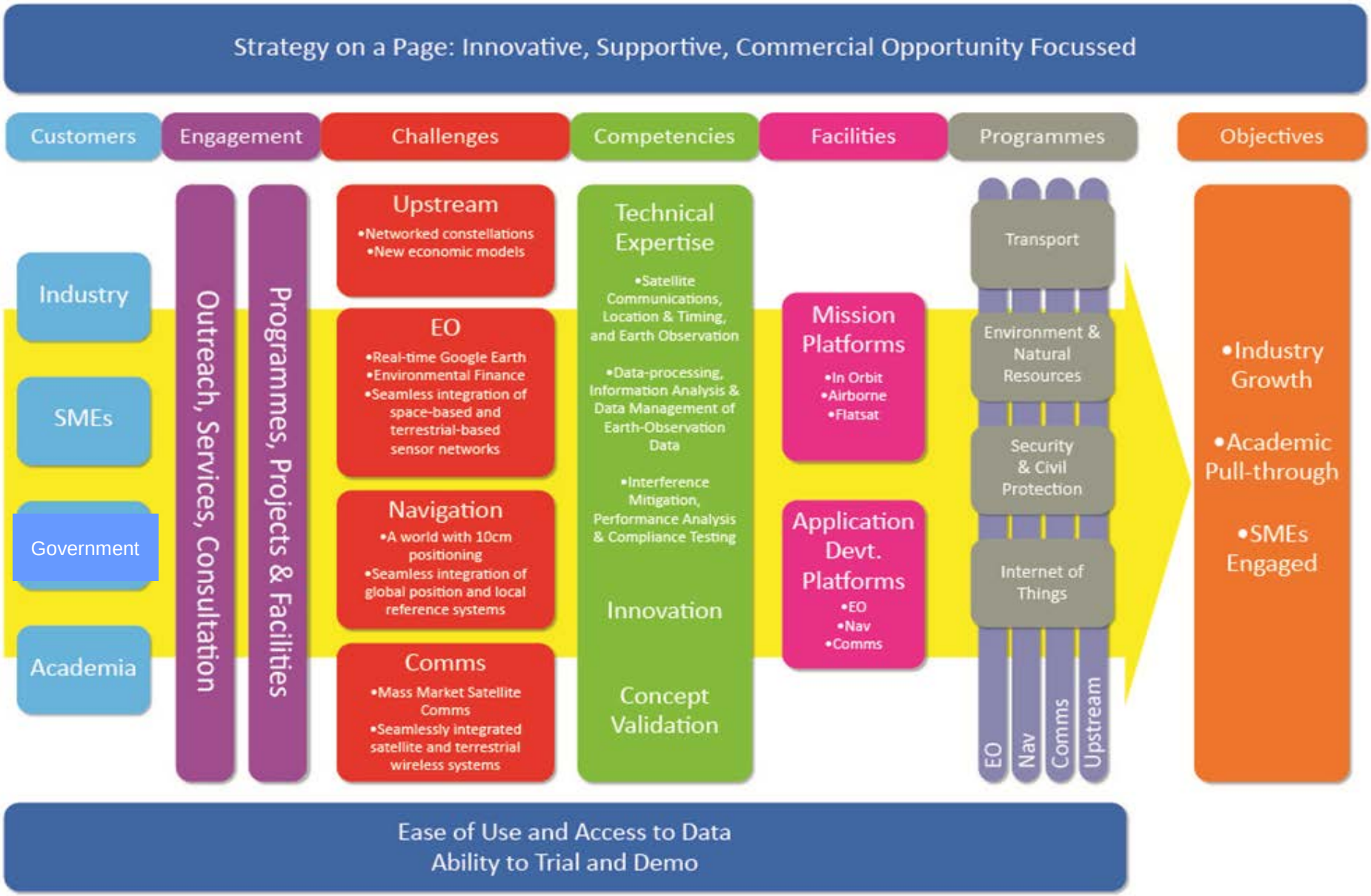
Satellite Applications Catapult Strategy



Satellite Applications Catapult: The Journey

Phase 1: TSB-led: Establishing the Vision

→Phase 2: Consortium-led: Defining the Mission

→Phase 3: Transition: Catapult Initiation

→Phase 4: Catapult Operation

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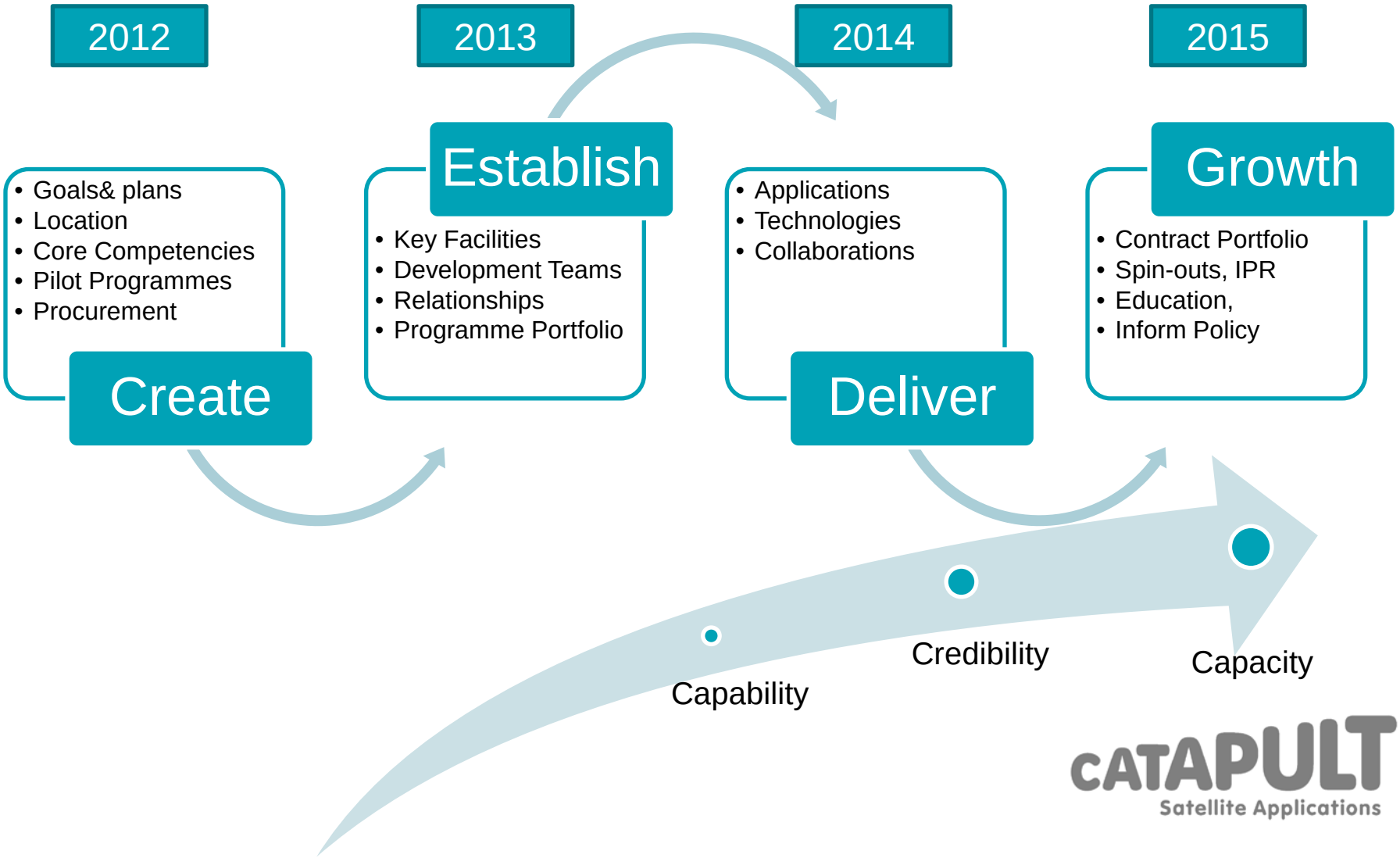
Catapult Strategic Timeline



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Satellite Applications Catapult: Conclusion

- Catapults have long term UK government support for commercialisation of innovation
- Catapults are independently governed and managed organisations
- Catapults have a strong mandate for providing support and value to SMEs in the UK
- The Satellite Application Catapult will operate within a network of Catapults to build the awareness and commercial value of space
- The Satellite Applications Catapult is now starting to employ staff and will become fully operational in April 2013

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Where are the challenges and opportunities for growth?

Telecoms as an example

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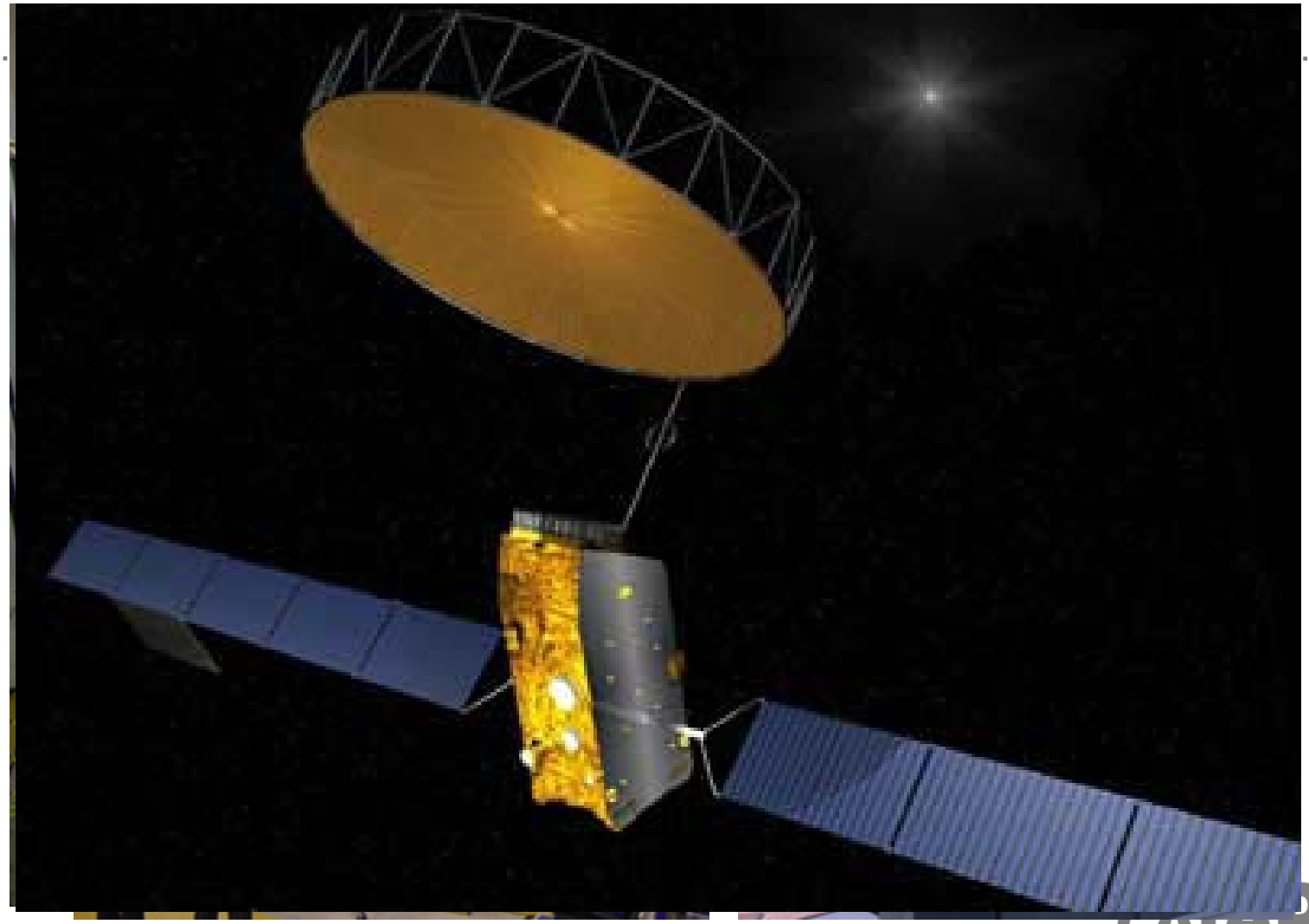
Inmarsat-4 satellites



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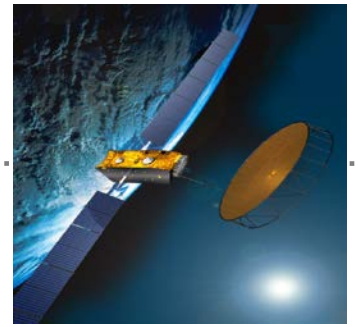
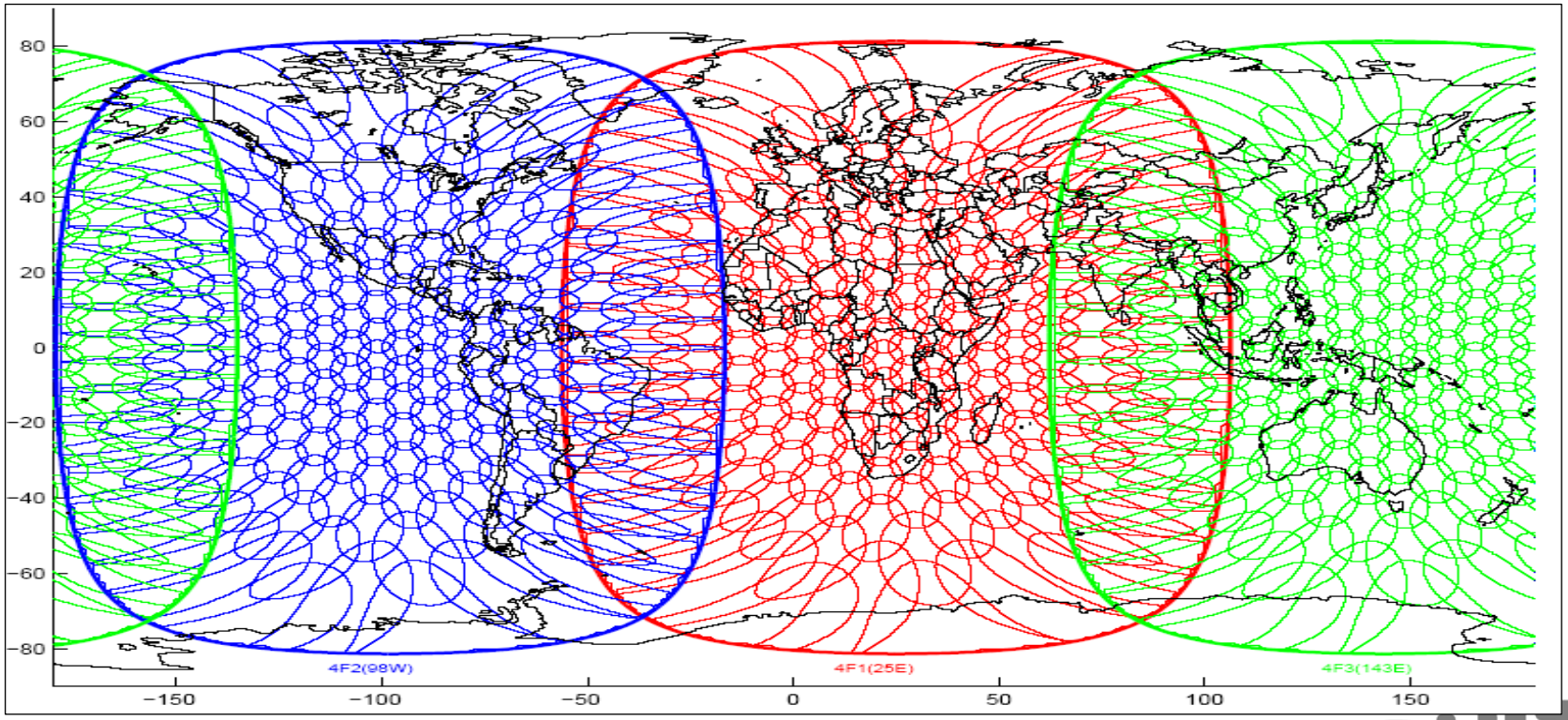
I-4/BGAN Worldwide Coverage



F3 Launch
18 Aug 2008
98°W

F2 Launch
08 Nov 2005
25°E

F1 Launch
11 March 2005
143.5°E



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Inmarsat Alphasat

Alphabus is sized for 12-18 kW payload d.c. power

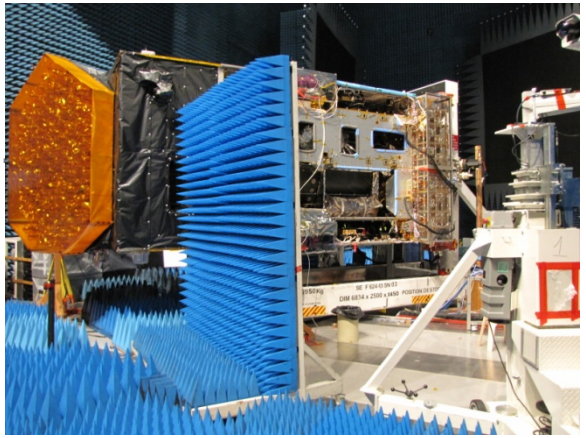
- 12 KW used for Alphasat I-XL

15 year design lifetime

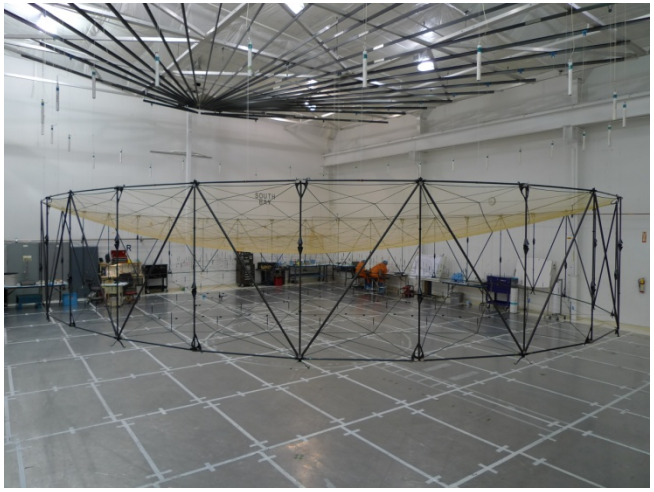
- Chemical + plasma propulsion

Spacecraft Thermal Vacuum Test - Q4 2012 – Q1 2013

All systems are go for a launch in Q2 2013



Alphasat 11 m Reflector



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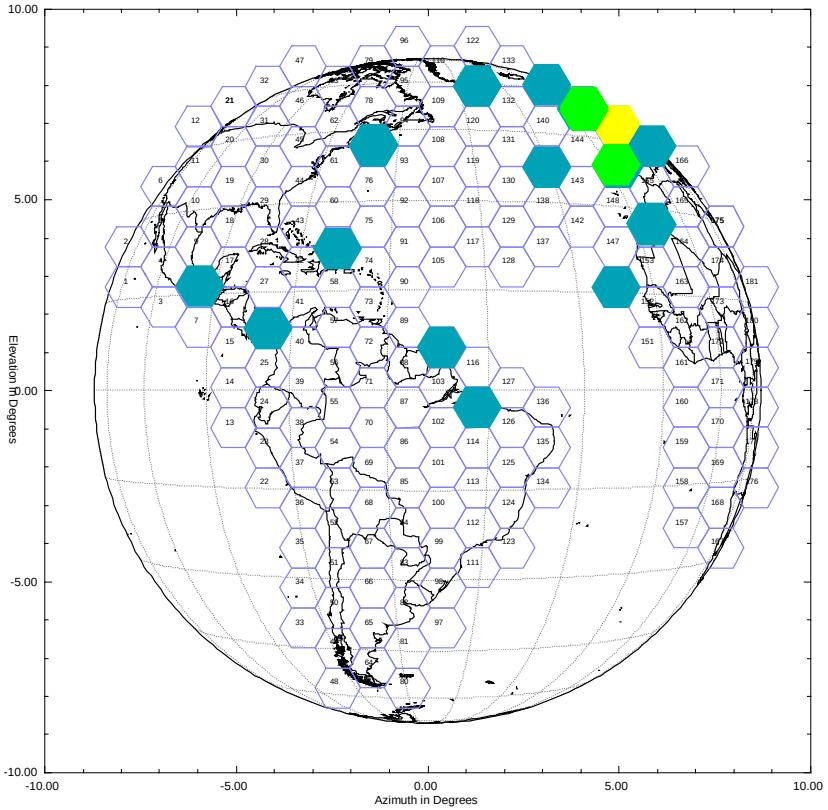
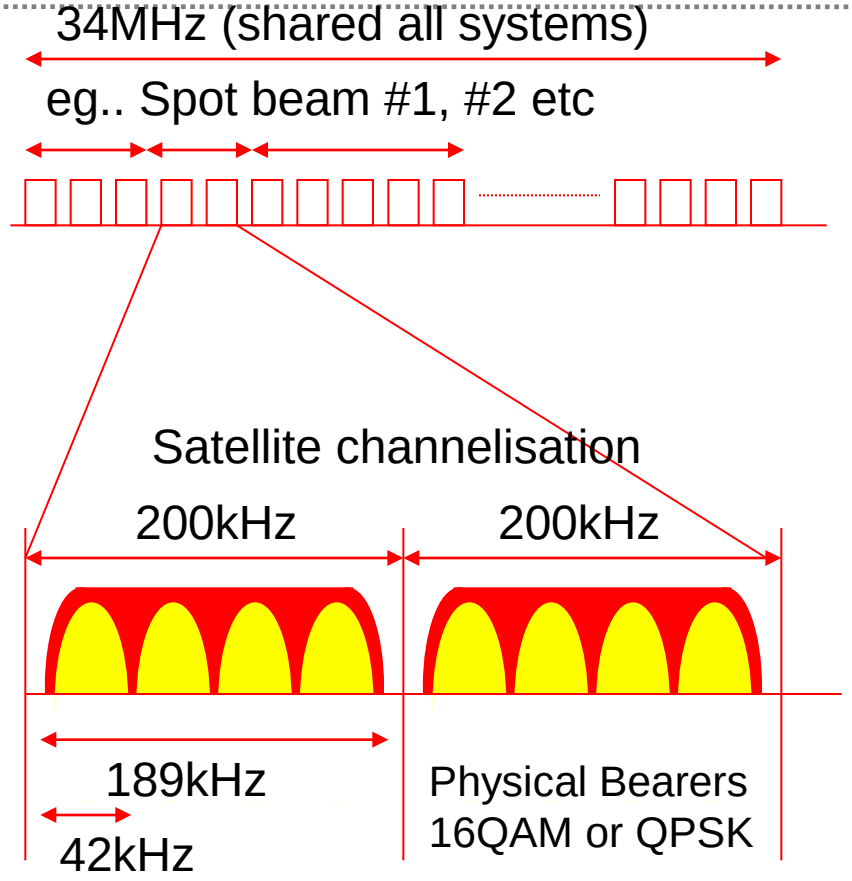
The BGAN System – Utilising the Inmarsat-4 Spot Beams





For maximum flexibility, a variable number of sub-bands can be transmitted in each spot-beam

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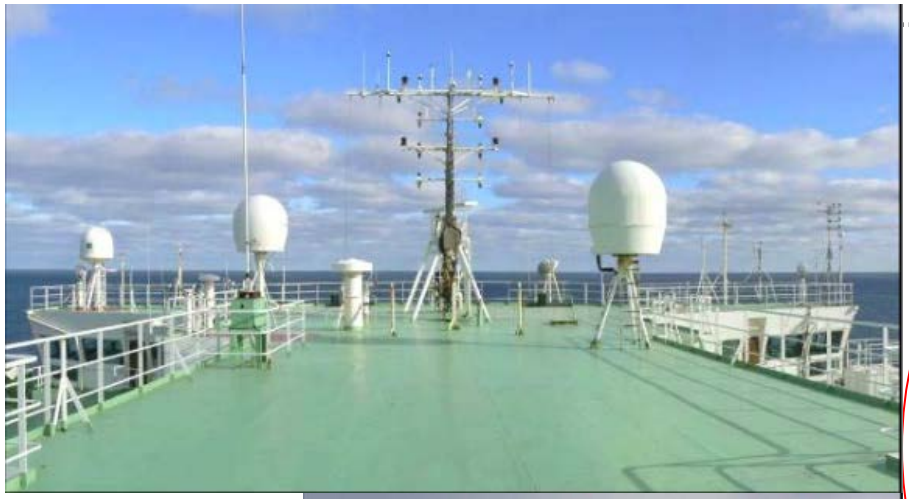
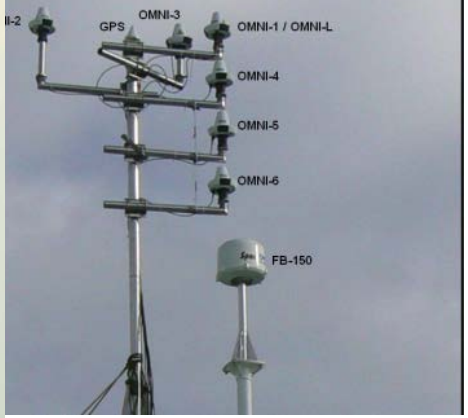
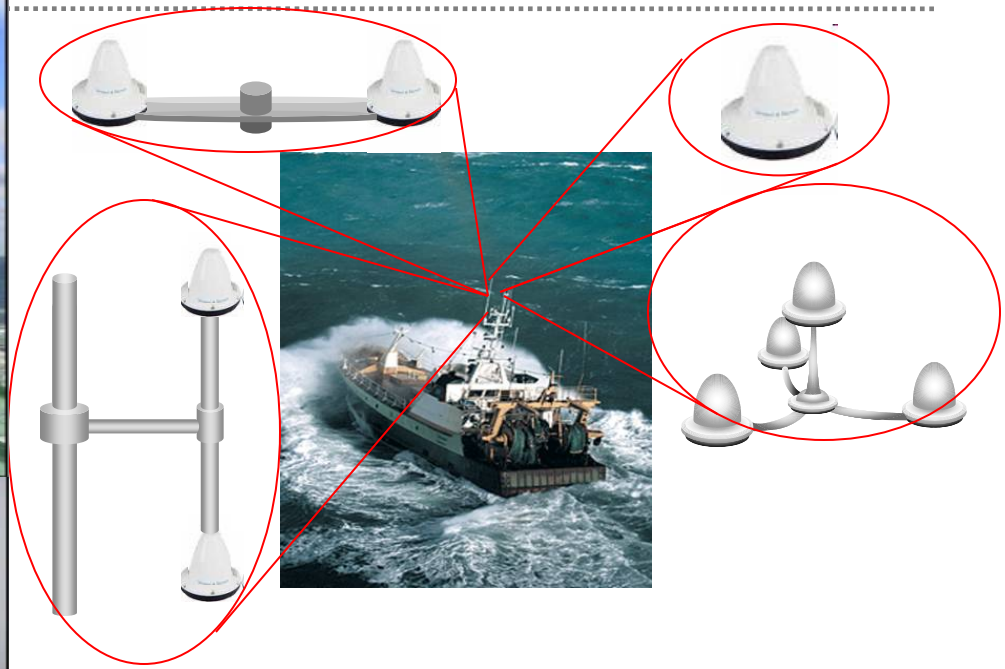
Exploiting 4G tech. for enhanced resilience (diversity + interference cancellation)







Maritime variants

Next generation maritime safety services will require high availability and high performance in extreme conditions. Exploits spatial and polarisation diversity.

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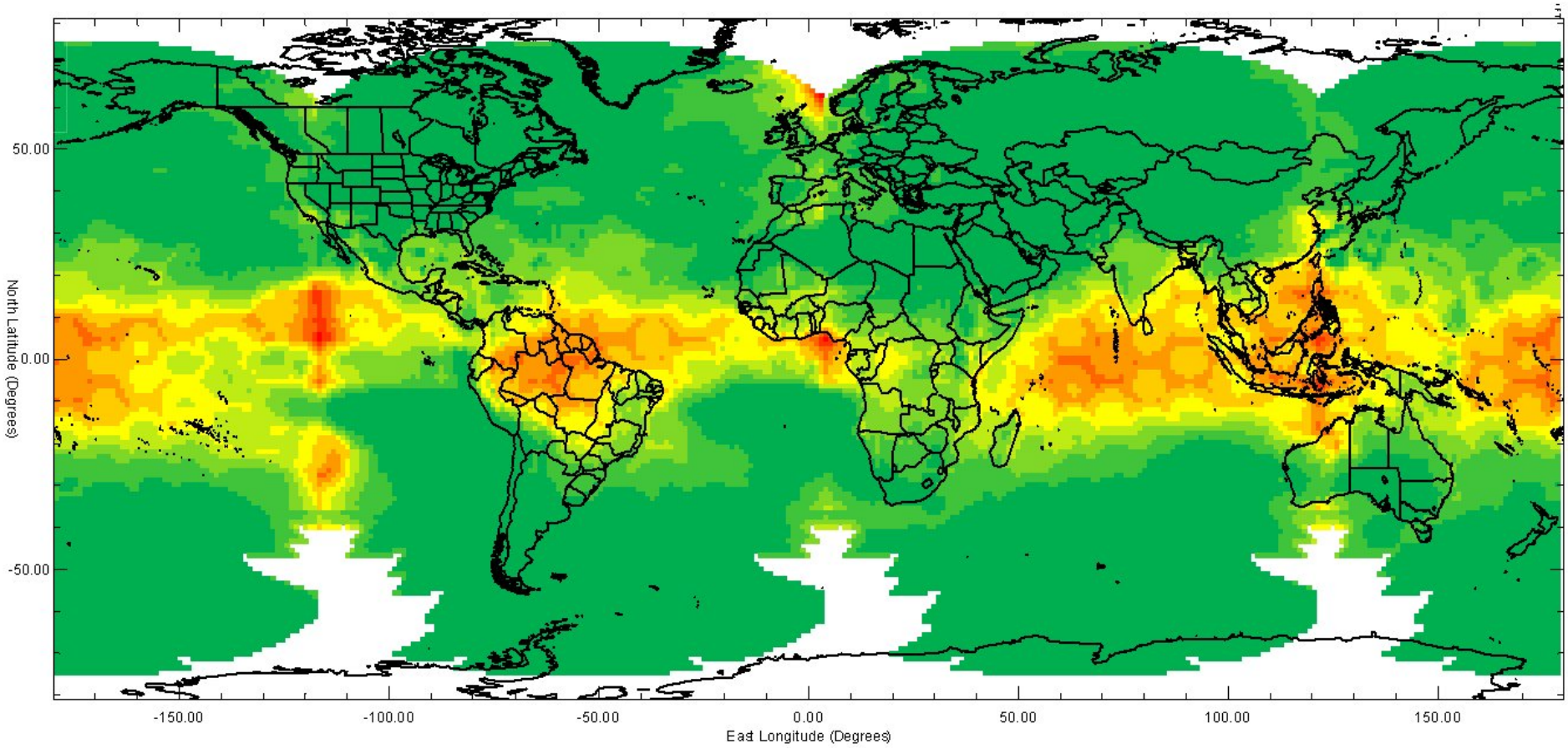
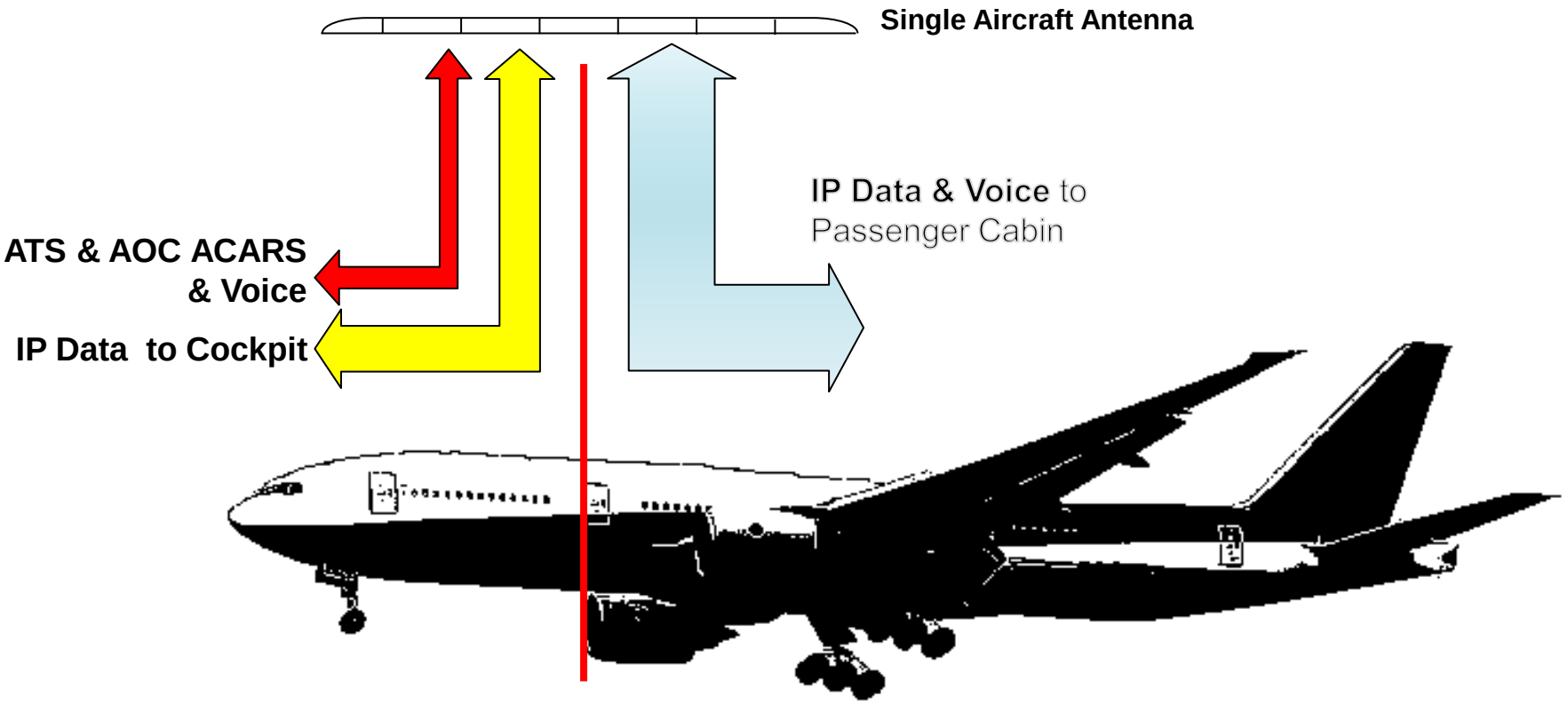
Service dependability for Ka Band



99.0 **99.3** **99.6** **99.9**

Percentage service availability

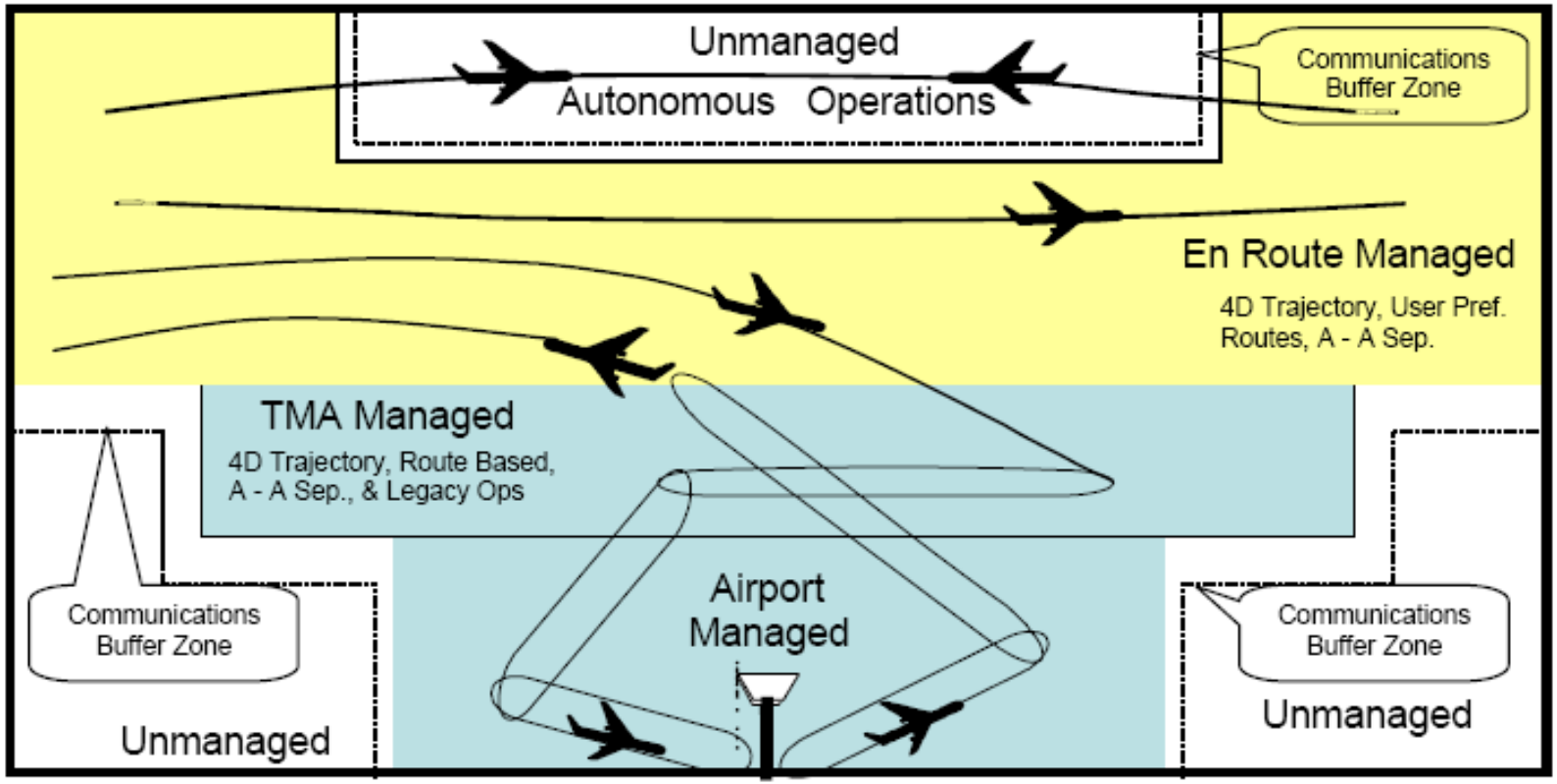
Segregation of Safety and Passenger Services



e.g. clearance and info. services using RCP240 ACARS & Multiblock AOC messaging

e.g. weather graphics, engine health monitoring, flight planning info.

An safety-service example application: Continental Air-Traffic Management



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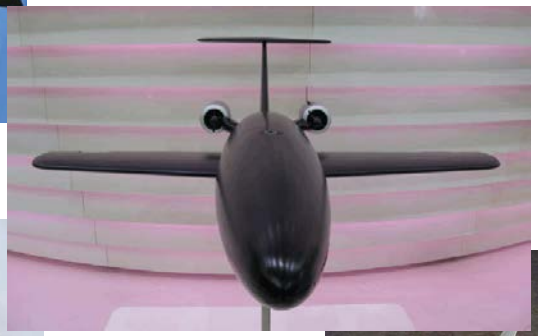
UAVs in civilian airspace...

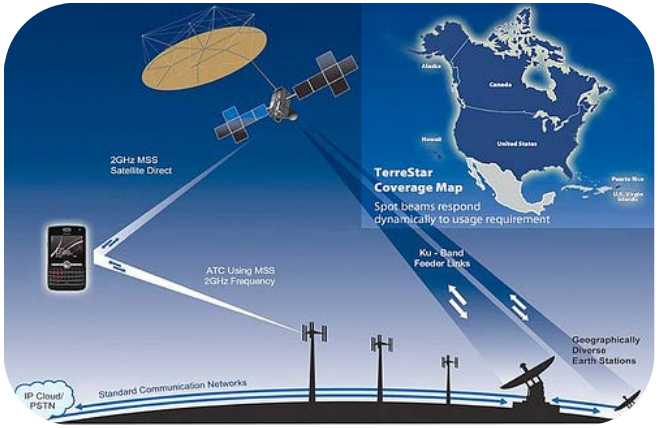


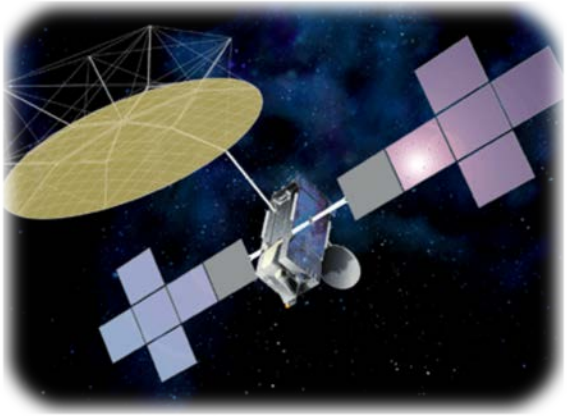
Satellite Applications

GEO Satellites for Ancillary Terrestrial Component operation

Terrestar

- 18m S-band reflector
- ~500 beams

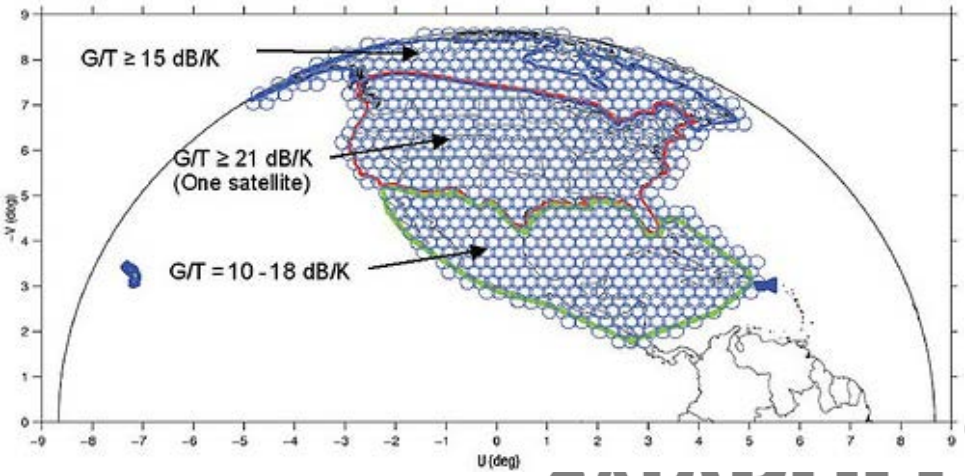




Courtesy of Electrobit (Finland)

Light-Squared

- 22m L-band reflector
- ~500 beams



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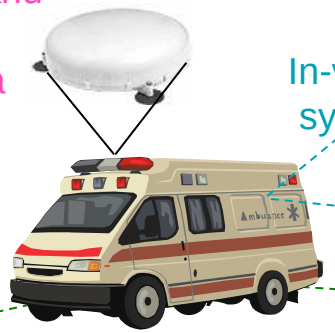
Satellite Security and Safety service communications evolution...

Ku-band Satellite antenna

Rapid-deployment command vehicles

Ka or S-band Satellite antenna



In-vehicle systems

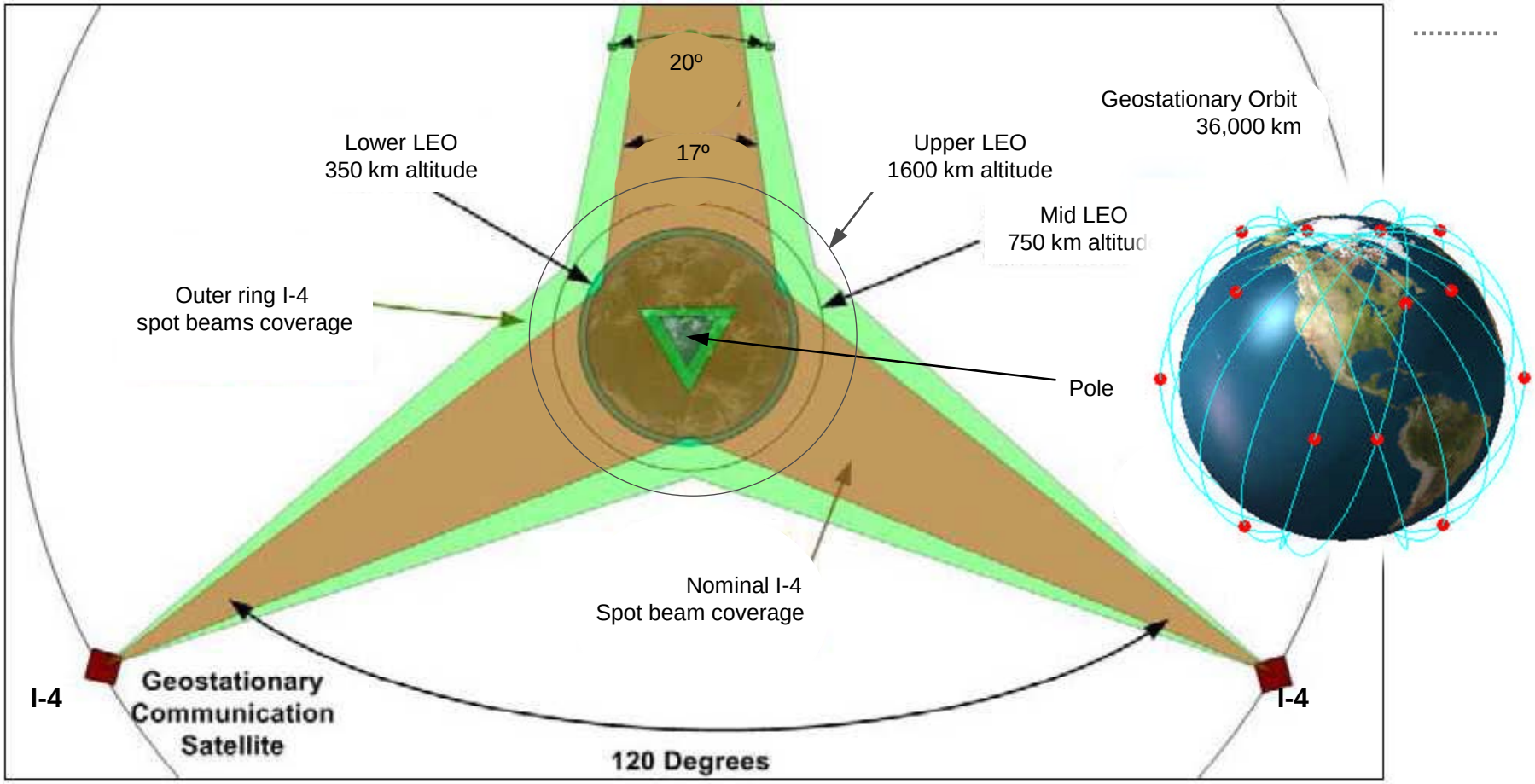
Local wireless (802.11, 802.15, 802.22 etc)

Possible TETRA relay

Communications-on-the-move

CATAPULT Satellite Applications

Inmarsat SB-SAT Data Relay Concept



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Conclusion

- There are many opportunities for satellite communications to grow
- For telecommunications to scale, many more technological and business innovations developed
- The real opportunities become evident when links between comms, navigation and earth observation are exploited
- Catapult must connect the opportunities with the capabilities
- Catapult must connect emerging science and technologies innovations with business needs
- The UK, and Harwell especially is well placed to deliver on the growth agenda.

Thank-you

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