Satellite Applications

Satellite Applications Catapult Nanosat Weekend Public Slides

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10 December 2015

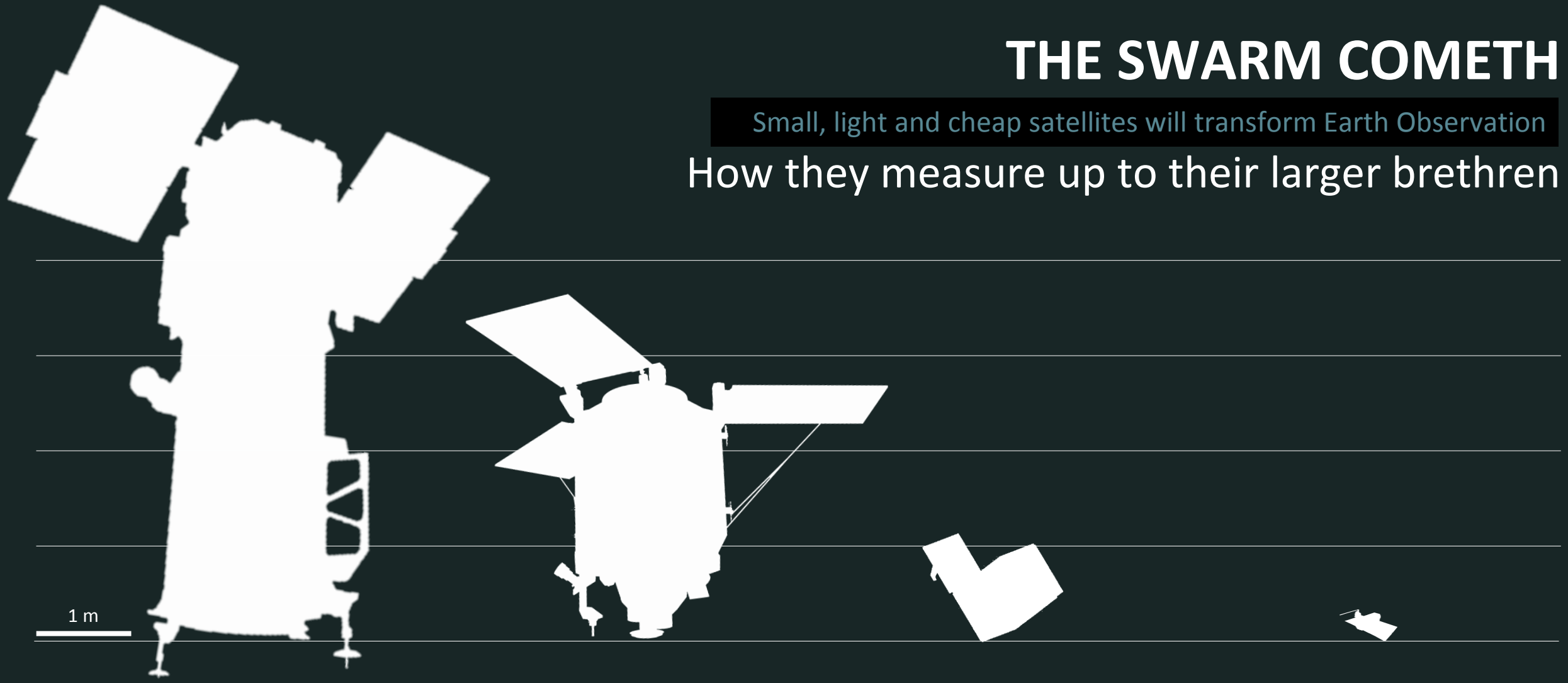
We work with Innovate UK

CATAPULT

THE SWARM COMETH

Small, light and cheap satellites will transform Earth Observation

How they measure up to their larger brethren



	WorldView-3	Pleiades-1A	Skysat	Dove
Operator:	DigitalGlobe	CNES/Airbus D&S	Skybox Imaging	Planet Labs
Constellation:	N/A	2	24[υ]	100[υ]
Weight:	2,800 Kg	940 Kg	120 Kg	5 Kg
Instruments:	Multiple spectral bands	Multiple spectral bands	Optical and near infrared spectral bands	Optical and near infrared spectral bands
Spatial resolution:	0.3-3m[ɣ]	0.5-2 m[ɣ]	~1 m (+1080p HD Video)	3-5 m

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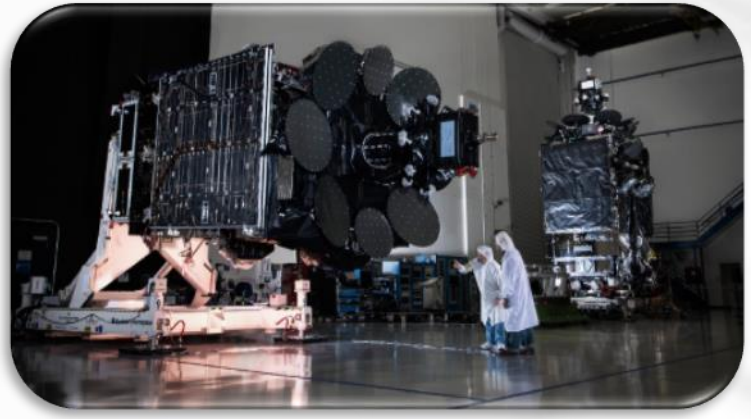
[ɣ] Depending on spectral mode

[υ] When fully operational

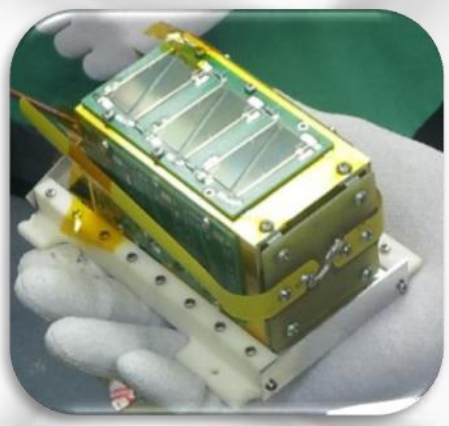
Why (and what are) PocketQubes?

Commercial Satellite

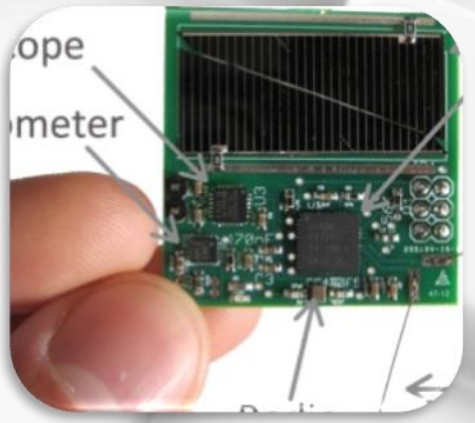


Cubesat

PocketQube



PCBsat



Complexity

Complexity

Cost

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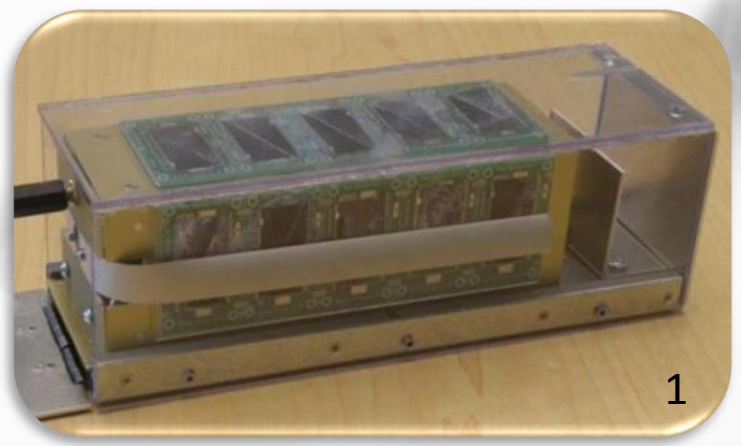
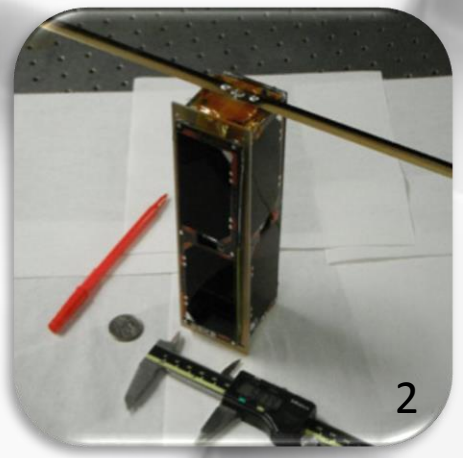
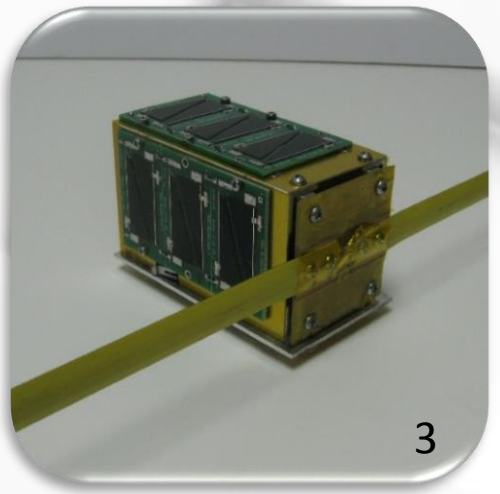
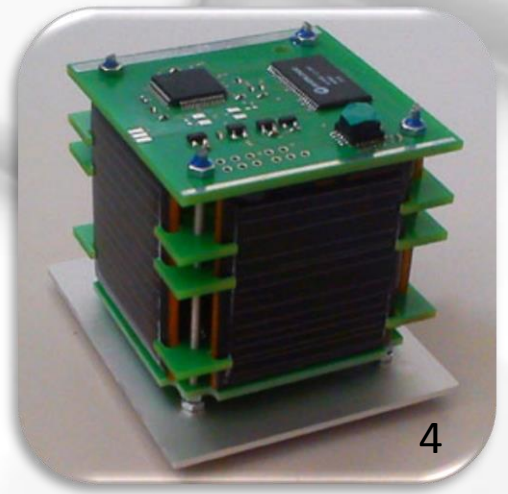
Flight heritage

1. T-LogoQube (Eagle1)
2. QubeScout S1
3. $50SAT
4. Wren









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A growing PocketQube community

ArduOrbiter

DIYSATELLITE
Do It Your Satellite for ALL!

albaorbital

ROUTE TO SPACE

OZQUBE-1
AUSTRALIA

EARS
POCKET
QUBE

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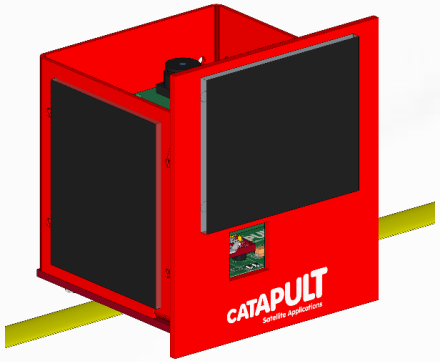
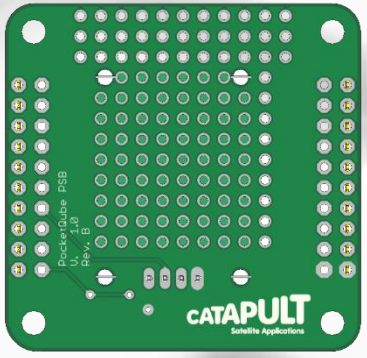
What is the Catapult PocketQube kit?

A SATELLITE PLATFORM



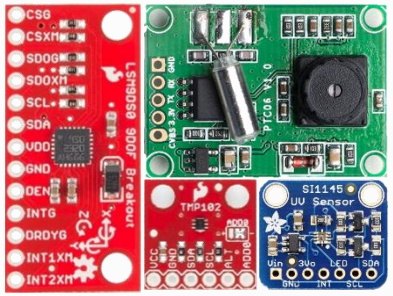
- All the components that make up the basis for every satellite
- Fly your satellite and broadcast the data to the ground via UHF radio

A PAYLOAD DEVELOPMENT KIT



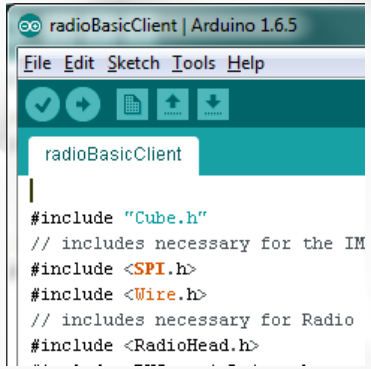
- A third-party camera integrated as a demonstration payload
- Design your own experiments using the Proto-Sense Board to prototype your own hardware

A SUITE OF SENSORS



- A suite of sensors to learn about the fundamentals of satellite design and operation
- Use the inertial measurement unit, temperature or light sensors to monitor the satellite and send data to the ground.

A SOFTWARE DEVELOPMENT LIBRARY



- That you can use to develop your own mission concepts with the kit

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Space Applications

Technology Strategy Board
Driving Innovation

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EXCITING TIMES

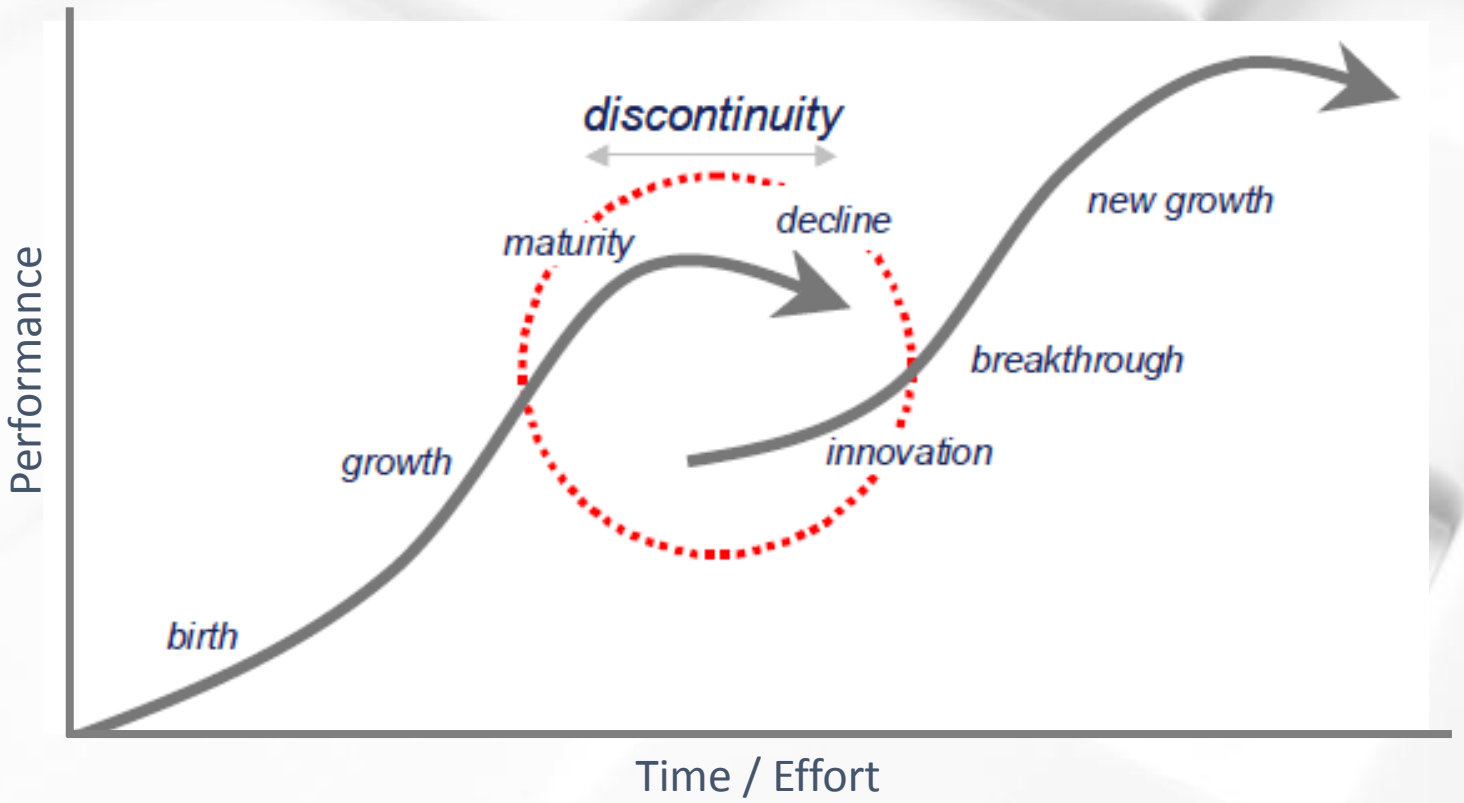
Characteristics

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



Why be Excited?

Accessible to start-up and growth capital

Accessible to new entrants

Reduced risk

Learning by doing

Rapid technological improvements

New operating concepts

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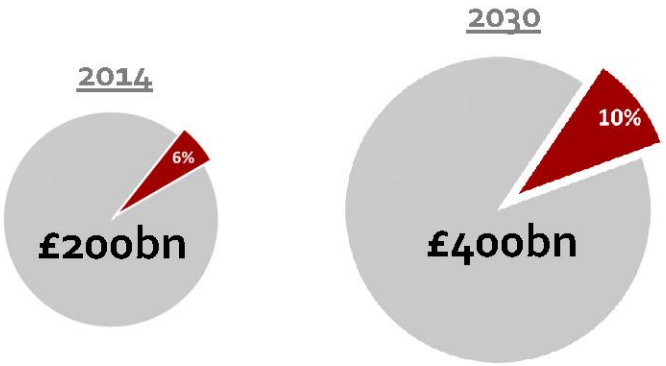
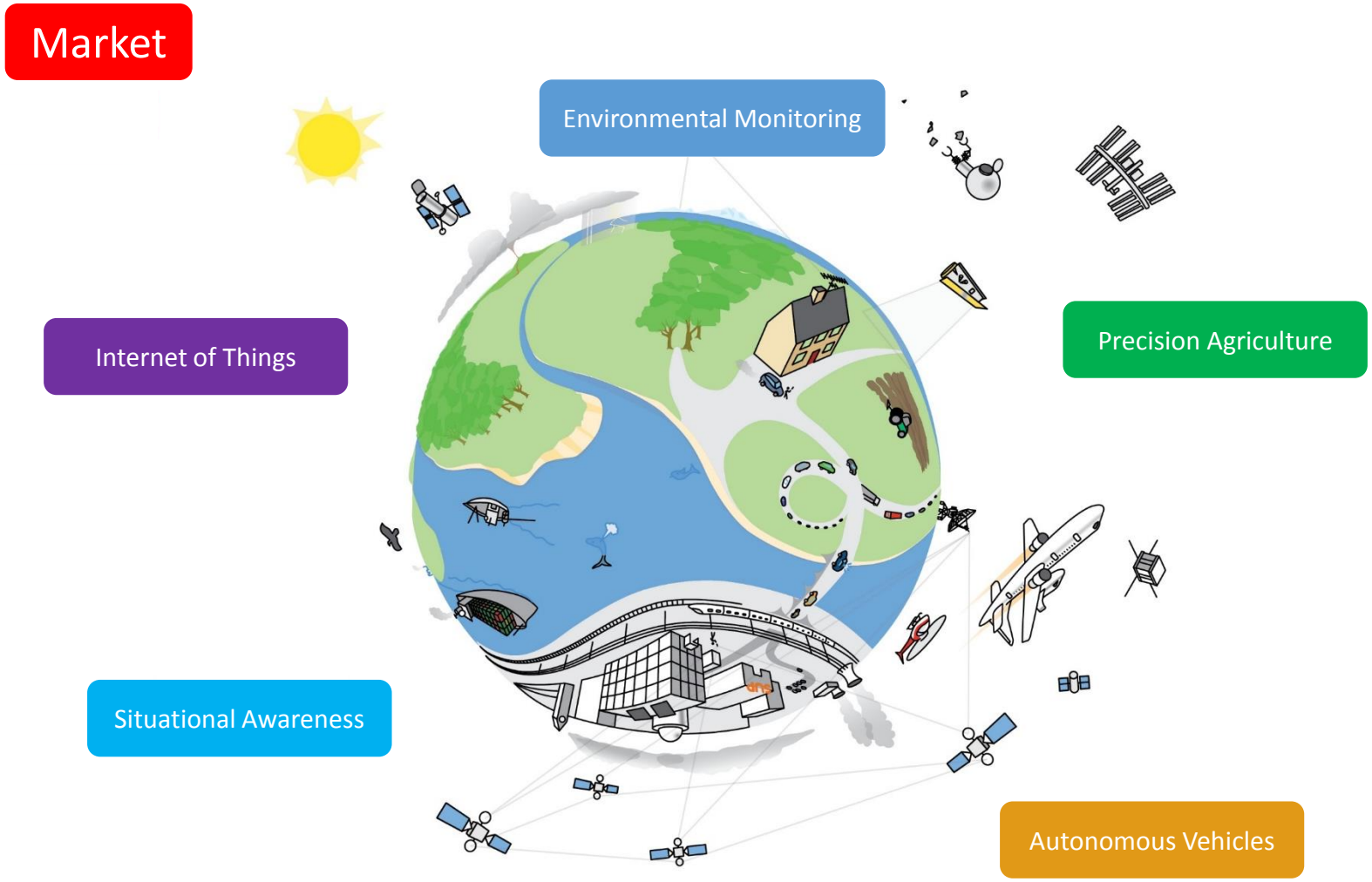
THE MARKET

Space is a **large and growing global market**. The UK is at the forefront of this trend and leading the World in low-cost operations and other enabling innovations.





INCREASING PRIVATE INVESTMENT

Nearly **$500 million** raised by early-stage space companies in 2014 alone

Crowd

NanoSatisfi – Affordable Access to Space™
FFO
MARS ONE
Copenhagen Suborbitals
PLANETARY RESOURCES
KickSat
LIFTPORT
BAGAVEEV
Google Lunar X Prize – Lunar Lion – Official Team
GOLDEN SPIKE
LUNAR MISSION ONE
OUTERNET
WAYPOINT 2 SPACE
HERMES

Angels

PLANETARY RESOURCES
SCALED COMPOSITES
moon express – the moon is me
Orbital
LaserMotive
ASTROBOTIC
SPACEX
XCOR AEROSPACE
zero G – the weightless experience
Graduate Aerospace Engineers
BAGAVEE
SPACE adventures
Orbital Outfitters
ROCKETPLANE
Masten
ALTIUS SPACE MACHINES
DSI – DEEP SPACE INDUSTRIES
ANSIBLE – Space Communications Systems
ROCKET RACING LEAGUE
STRATOLAUNCH SYSTEMS – A PAUL G. ALLEN PROJECT
CSI
KYMETA – CONNECTED. ANYWHERE.
NANORACKS
FIREFLY SPACE SYSTEMS
BIGELOW
WORLD VIEW®

Venture Capital

SPACEX
XCOR AEROSPACE
PLANET LABS
Virgin Galactic
NANORACKS
ZERO2INFINITY
CLYDE SPACE
Oxford Space Systems
O3b Networks
DAURIA AEROSPACE
Effective Space solutions
Skybox Imaging
ROCKET LAB LTD

Private Equity

Intelsat
Teledesic
O3b Networks
ORBCOMM
URTHECAST – THE EARTH VIDEO CAMERA
KISTLER aerospace corporation

Public Offering

URTHECAST – THE EARTH VIDEO CAMERA
DigitalGlobe
Intelsat
SPACEHAB – WE MEAN BUSINESS IN SPACE™
Orbital
ORBCOMM
iridium

Acquisition

THE CLIMATE CORPORATION
SURREY – SATELLITE TECHNOLOGY LTD
SPACE EXPEDITION CORPORATION – SXC
Skybox Imaging
ODYSSEY MOON
SCALED COMPOSITES
TSC – THE SPACESHIP COMPANY

$10Bn of private investment expected into the space sector in 2015

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CITY SOLUTIONS

CARBON MONITORING

NATURAL DISASTER RESPONSE

MARITIME MONITORING

AGRICULTURE

FINANCIAL TRADING

LOW LATENCY COMMUNICATIONS

M2M APPLICATIONS

ROBOTIC OPERATIONS

FINANCIAL SERVICES

SECURITY

REAL TIME FREQUENT REVISIT

LOW LATENCY RESPONSIVE

ACCURATE RESILIENT

INSURANCE MODELLING

OIL STORAGE MONITORING

MINING MONITORING

ENERGY INFRASTRUCTURE MONITORING

TRANSPORT MONITORING

CONNECTED VEHICLE

BROADCAST

CONNECTING THE UNCONNECTED

AUTONOMOUS VEHICLES

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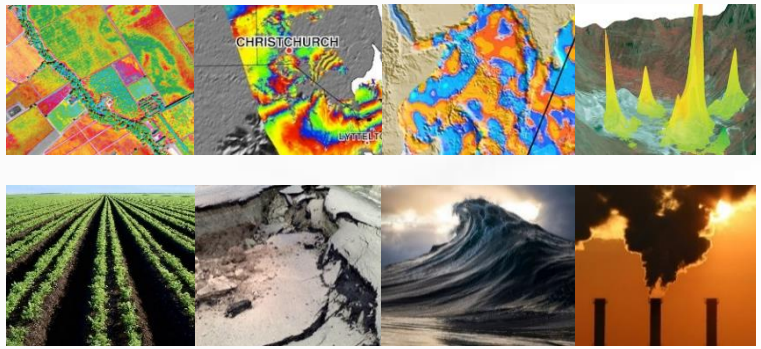
SATELLITE ENABLED SERVICES

Earth Observation

Satellite Infrastructure



Capabilities

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

Communications

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

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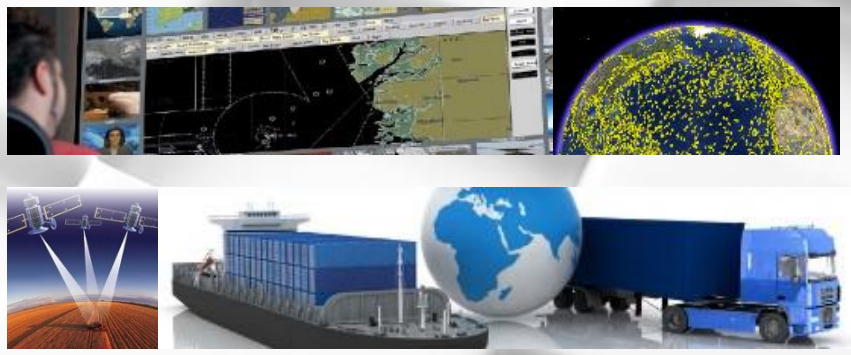
Navigation



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

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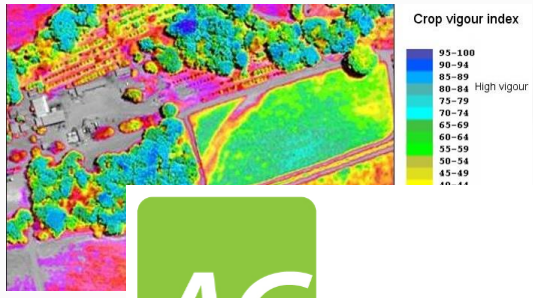
INCREASING DEMAND

Demand for downstream applications/services

AgSpace



- Providing precision agronomy software to farmers
- 3000+ farmers signed up to platform
- Working with Syngenta among other large agronomy businesses

Terrascope/FATMAP

- Provides 'real-life terrain intelligence' to skiers using satellite imagery and GPS
- Successfully seed funded
- 10k users since Feb 2015 launch

Geospatial Insight

- Provides 'information edge' to clients through unlocking space data
- Working with commodity traders and insurers
- Partnerships with data providers such as Kongsberg Satellite Services

Oxford Space Systems

- Upstream development of deployable systems (panels, booms and large antennas)
- AtroTube Boom selected to fly in Q2, 2016
- Partnerships with Airbus, RAL Space, Thales and more

OPPORTUNITIES

Competitive Advantage

Improved operational efficiency and consequent competitive advantage

Replace human element of intelligence gathering with regular satellite imagery

Communicate more efficiently via satellite networks

React faster with better situational awareness

Emerging Companies

GEOSPATIAL INSIGHT LTD

OUTERNET

AG Space

OXFORD SPACE SYSTEMS

WeatherSafe

CubeSatShop.com

MARS SPACE LTD
SPACE AND PLASMA TECHNOLOGIES

STERLING GEO
ENGINEERING GEOGRAPHY

GEOCENTO
earth imaging

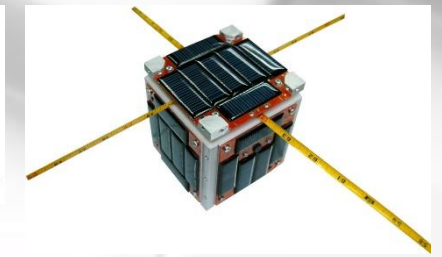
PROTEUS

COM DEV

Polar View
Earth Observation for Polar Monitoring

rezatec analyzing earth data

Emerging Technologies



Your backup generator for the Internet.

WiFi INFLIGHT

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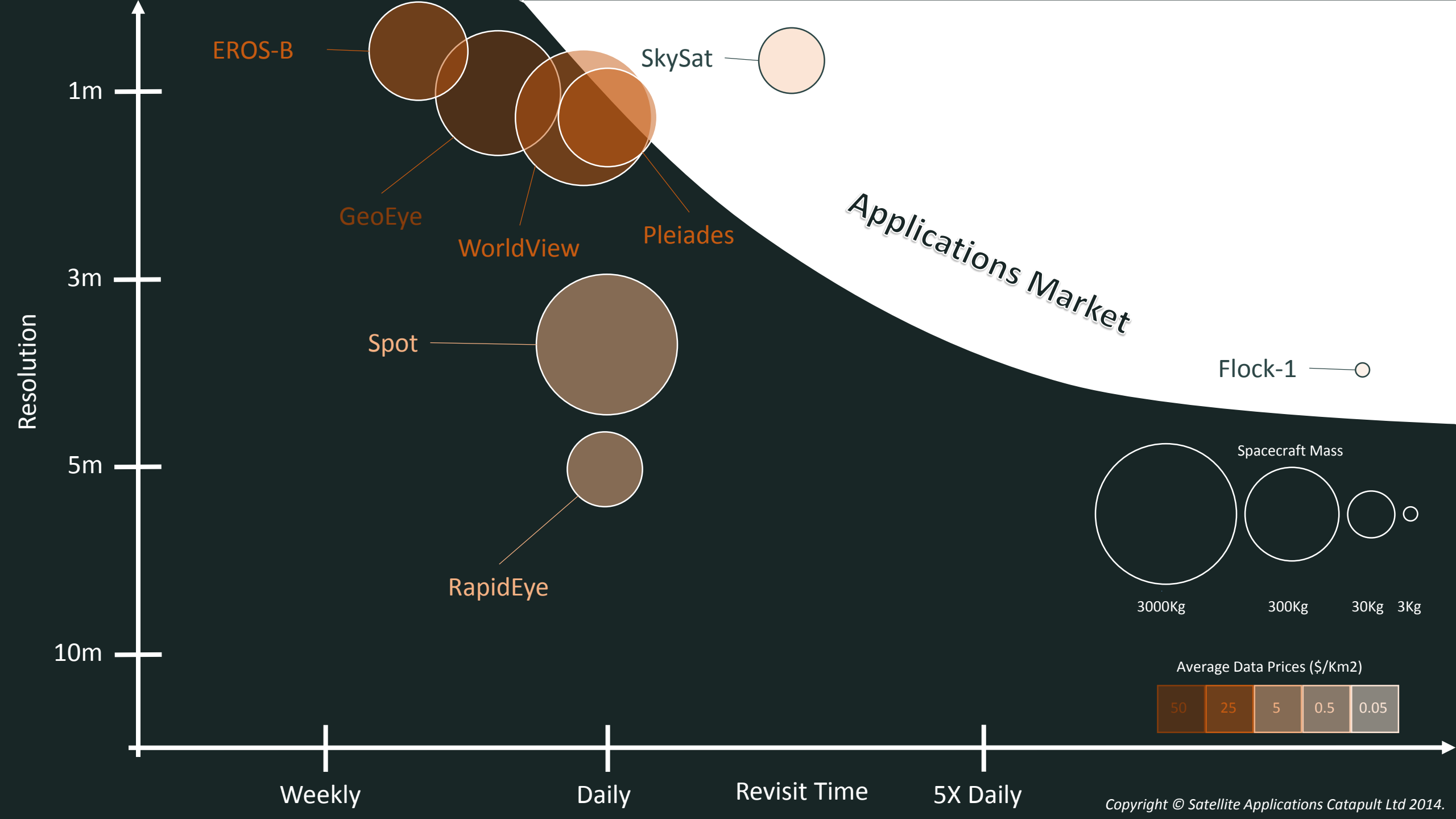

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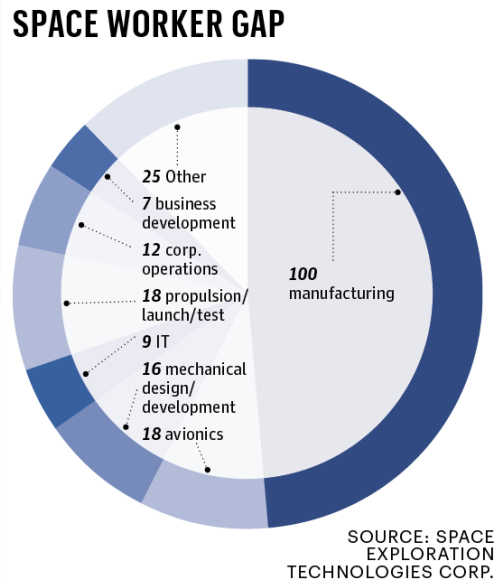
HOW YOU CAN GET INVOLVED

Join an exciting business.



Start your own space business.

Technology Strategy Board
Driving Innovation

Launchpad

Innovation Vouchers

Making it easier to startup and grow new businesses.

Join an innovation hub.

DELTA-V
AUSTRALIA'S SPACE STARTUP ACCELERATOR

SVSC

SURREY SPACE INCUBATOR
UNIVERSITY OF SURREY

Space Tango

LEMNOS Labs