SFN Investors' Briefing
3 July 2015
Introduction:
Richard Peckham
Business Development Director
Airbus
Welcome:
Stuart Martin
CEO
Satellite Applications Catapult
Introduction to the UK Space Industry and Opportunities

Antonia Jenkinson
CFO and COO
Satellite Applications Catapult
Satellites: Eight Great Technologies and UKEF

Sophie Boldon
Innovation Gateway, UKTI
and
Peter Maplestone
Senior Underwriter
UK Export Finance
Space in the UK,

The commercial benefits of innovating in the UK
Innovation is GREAT

The UK is one of the world’s top locations for commercial research and innovation

• 2nd out of 143 countries assessed in the World Innovation Index (2014)
• 4 of the World’s Top 10 Universities
• 4th internationally for business-university collaboration (2014)
• Sustains the most ‘impactful research base in the world’ (Elsevier 2013)
• 15.9% of the world's most highly-cited research articles
• One in five people work in science-based roles - 5.8 million people
• Supportive tax system favours company R&D and innovation
• Easiest major economy in Europe to do business in (World Bank 2014)
The 8 GREAT Technologies

- **Space**
- Big Data
- Robotics and Autonomous Systems
- Synthetic Biology
- Regenerative Medicine
- Agri-Tech
- Advanced Materials and Nanotechnology
- Energy & its storage

8 GREAT Technologies Infographic
The UK “Space Sector”

- Contributes £11.3 billion to the economy
- Direct employment 35,000
- Estimated jobs supported by space 101,000
- Three quarters of staff are graduates
- 85% commercial business
- Upstream industry is three times more R&D intensive than the normal UK average
- UK space sector average growth rate 7.5% pa
- Estimated UK share of the global market 7%
- Targeting a £40B turnover in 2030
Investing in Space technologies

The UK government is very supportive of the Space Industry. Recent examples:

- £130m for development of telecommunications (ARTES)
- £48m to support ExoMars programme
- £2m Innovate UK/UKSA for spacecraft propulsion
- £32m UKSA International Space Partnership Programme

And launched this week:
Space for Smarter Government SBRI
(deadline 16 September 2015)
UK Trade & Investment

We work with:

- UK based businesses to ensure their success in international markets through exports.

- Overseas companies to look at the UK as the best place to invest, set up or expand their business.

UKTI at a glance

- 107 Markets throughout the world in which UKTI operates
- 1,265 Staff based overseas
- 515 Staff based in our London and Glasgow headquarters
- 400 International Trade Advisers and support staff based in the regions
- 40 Offices located throughout England
UKTI and Space

We work closely with the UK Space Agency to build the UK’s space offering to assist growth by:

- Showcasing the UK’s offer on space to international audiences.
- Assist overseas companies with ambitions to expand into the UK or Europe, to match them with suitable areas, universities, companies, skillsets, investment.
- Link UK projects requiring investment to develop with overseas investors
- Assist companies in the UK wanting to export.
Exporting

• **International Trade Advisers** - International trade advisers work with businesses in the English Regions to offer advice and guidance to help them export.  
  [www.ukti.gov.uk/tradeadvisers](http://www.ukti.gov.uk/tradeadvisers)

• **First Time Exporters Programme** – training and advice for companies selling overseas for the first time.  

• **Business Opportunities** - A service offering businesses new international sales leads identified by UKTI people.  
  [www.businessopportunities.ukti.gov.uk](http://www.businessopportunities.ukti.gov.uk)
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Success Stories
Chair – Barry Jennings – Bird & Bird
Mike Lawton – Oxford Space Systems
Nick Howland – Printech Circuit Laboratories
Charles Hannaford – O3b Networks
Maurizio Vanotti – SSTL
Success Stories

Mike Lawton
Oxford Space Systems
Oxford Space Systems is an award-winning space technology business that is pioneering the development of deployable space structures that are lighter, less complex and lower cost than those in current commercial demand.

© Oxford Space Systems
There are currently 2,300+ registered satellites orbiting Earth.

This is forecast to treble in the next 5 years.
Airbus to build giant satellite network

By Jonathan Amos
BBC Science Correspondent, at the Paris Airshow

15 June 2015 | Science & Environment

OneWeb aims to broaden internet access across the world
Launch is expensive: £30,000+/ kg

Two biggest factors: size & weight
To maximize efficiency, **critical components** are designed to **deploy** in orbit.
Changing Times: Old Space & New Space
AstroTube™

AstroTube™ Max video:
http://youtu.be/sKG0n_5Qoj0

AstroTube™ video:
https://youtu.be/ORc6DqYUytg
Deployable Parabolic Antennas
Success Stories
Nick Howland
Printech Circuit Laboratories
Printech Circuit Laboratories Ltd.

Space and the SME experience
‘Are you experienced?’
Established in 1980
Privately owned business based in Essex
30 people, currently recruiting
Annual T/O around £2.8m
Originally established to make circuits for defence/aerospace
Business now ‘specialist projects’

‘Odd circuits built by odd people!’
Space experience.
2000-2001 Inmarsat 4
Space experience.
2000-2001 Inmarsat 4

**Lessons learned**

- How many meetings need to be held?
- Who actually owns the IP?
- The space experience needs to be exploited
- The designs change on each satellite
Space experience 2.
E2V Flexible Circuitry
Space experience 2.
E2V Flexible Circuitry PCL Investment
Space experience 2.
E2V Flexible Circuitry
More lessons learned
10 years in development/build and test
Investment in infrastructure attracted more business and demonstrated commitment
Know your costs and more importantly your value!
Use our knowledge as leverage

Ongoing business contributing to profits
New and current space projects

5 layer Nomex/Kevlar/Polyimide paraboloid shaped polariser for Estec/ESA
New and current space projects
New and current space projects

Large flight antenna 2.2 x 2 m built from 60 mm Kevlar core with 2 multilayer feed circuits 1.2 x 0.45 m with customer feed pins and end launchers.
New and current space projects

Small directional patch antenna 90 x 90 mm for use in CubeSat. Full series of different frequencies from 401 MHz to 2.2 GHz.
Success Stories
Charles Hannaford
O3b Networks
O3b – A Success Story

Charles Hannaford
To..

2008

Download
Hard Drive
Classroom
Laptop

2015

Stream
Cloud
Online, Massive Open
Online Course (MOOC)
Smart Phone
Applications - central today ...... but non-existent when O3b started life

- YouTube: 2005
- Twitter: 2008
- Spotify: 2008
- Dropbox: 2008
- Facebook: 2008
- App Store: 2008
- HTML5: 2008
- Email: 2009
- WhatsApp: 2009
- Pinterest: 2010
- Instagram: 2010
- Quora: 2013
- Skype: 2013
The Connected Life by 2020

2011

- 9 billion Total connected devices
- 6 billion Mobile connected devices

2020

- 24 billion Total connected devices
- 12 billion Mobile connected devices

Revenue opportunity for mobile network operators in 2020

$1.2 Trillion

7x Increase on 2011 expected revenues

Revenue opportunity for connected devices in vertical sectors

- Automotive $202bn
- Health $69bn
- Consumer Electronics $445bn
- Utilities $36bn
- Latin America $92bn
- Asia Pacific $447bn
- Europe $305bn
- Middle East and Africa $87bn

Source: GSMA
“The Internet has become the world’s information exchange and everyone should have the opportunity to participate.”

Greg Wyler, Founder
The O3b Constellation
O3b in Numbers

- Fiber in the sky
- Cheap capacity
- Launch & Service
- Enabler
- Today

- 22 Gbps of contracted capacity
- 12 satellites launched
- $1.5bn of financing completed
- 7 offices worldwide
- 175 people

- Number 1 operator in the Pacific – outsold fiber and satellite
- 26 customers in service
- 8 MNOs have been enabled to launch 3G/4G mobile services
What our customers are saying about O3b

### O3b delivering Fiber speed, satellite reach

- “The reality after implementation matches the theory of what we hoped to achieve with O3b for our WiMAX network in Juba.”
  - RCS

- “O3b, our satellite communications partner, calls it ‘fiber speed with satellite reach,’ and this is exactly the result we are seeing,”
  - Royal Caribbean

- “The low latency O3b satellite constellation provides a similar service as we’d receive from an undersea cable, but at a fraction of the investment.”
  - Norfolk Telecom

### O3b as a strategic enabler

- “Like everyone, our customers want fast response times and fast download speeds, and with our O3b link we have gone from a basic low speed infrastructure to a state-of-technology performance comparable to internet in Sydney or Singapore”
  - Digicel PNG

- “We are very pleased to have gone live on the O3b network, which will allow us to launch 3G services”
  - Palau National Communications Company

- “Our corporate customers demand high levels of performance and resilience and our unique hybrid O3b and fibre network will differentiate our service.”
  - Gulfsat

- “In our technology road map we do not include geostationary satellite beyond 2017 and expect to move fully to MEO or other technologies in that timeframe”
  - Shell

- “Our 3G network now achieves up to 21 Mbps to a single customer, something that wasn’t possible before we had O3b”
  - Timor Telecom
3b Networks
Fiber Speed. Satellite Reach.
Success Stories
Maurizio Vanotti
SSTL
A very British success
The early days
Disaster Monitoring Constellation

9 satellites launched providing emergency Earth imaging for disaster relief under the International Charter for Space and Major Disasters.

### Operational satellites

<table>
<thead>
<tr>
<th>Country Operator</th>
<th>Designation</th>
<th>Type</th>
<th>Imager</th>
<th>Launch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria NASRDA</td>
<td>Nigeriasat-NX</td>
<td>SSTL-100i</td>
<td>22m MS</td>
<td>2011</td>
</tr>
<tr>
<td>Nigeria NASRDA</td>
<td>Nigeriasat-2</td>
<td>SSTL-300</td>
<td>2.5m Pan, 5m MS, 32m MS</td>
<td>2011</td>
</tr>
<tr>
<td>UK DMCii</td>
<td>UK-DMC2</td>
<td>SSTL-100i</td>
<td>22m MS</td>
<td>2008</td>
</tr>
<tr>
<td>Spain Deimos</td>
<td>Deimos-1</td>
<td>SSTL-100i</td>
<td>22m MS</td>
<td>2008</td>
</tr>
<tr>
<td>China BLMIT</td>
<td>Beijing-1</td>
<td>SSTL-150i</td>
<td>32m MS, 4m Pan</td>
<td>2005</td>
</tr>
</tbody>
</table>

### Retired satellites

<table>
<thead>
<tr>
<th>Country Operator</th>
<th>Designation</th>
<th>Type</th>
<th>Imager</th>
<th>Launch</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK SSTL</td>
<td>UK-DNC</td>
<td>SSTL-100i</td>
<td>32m MS</td>
<td>2003</td>
</tr>
<tr>
<td>Nigeria NASRDA</td>
<td>Nigeriasat-1</td>
<td>SSTL-100i</td>
<td>32m MS</td>
<td>2003</td>
</tr>
<tr>
<td>Turkey BILTEN</td>
<td>Bilset-1</td>
<td>SSTL-150i</td>
<td>26m MS, 12m Pan</td>
<td>2003</td>
</tr>
<tr>
<td>Algeria ASAL</td>
<td>Alsat-1</td>
<td>SSTL-100i</td>
<td>32m MS</td>
<td>2002</td>
</tr>
</tbody>
</table>
RapidEye constellation

5 satellites constellation.
First small satellite constellation for commercial Earth Observation.
Snow-ball effect (& ROI)

£7M Gov investment

£9M Industry investment

£245M TOT Customer investment
VNIIEEM constellation

8 avionics suites of equipment for the Russian KANOPUS-type satellite platform

Avionics integration at SSTL

Kanopus satellites ready for launch
GIOVE-A

27 month programme launched on Dec 27th 2005
10 year anniversary in 2015
5 times the expected lifetime
Growing up

SSTL is an “Autonomous Entity” within Airbus Defence & Space
DMC-3 constellation

3 satellites with daily revisit time.
Formosat-7 constellation

6+6 satellites for the joint civil programme between NSPO and the National Oceanic and Atmospheric Administration (NOAA) in the US.

The new constellation is intended to comprise 12 spacecraft.
Galileo Full Operational Constellation

22 Navigation payloads selected by ESA for Europe's satellite navigation system
GMP-T Quantum Mission
Know-how Transfer and Training (KHTT)

18 SSTL international programmes completed

6 Space Agencies formed

3 Spin-out companies

Hands on training

Academic training - Underpinned by the University of Surrey
Q&A
Chair – Barry Jennings – Bird & Bird
Mike Lawton – Oxford Space Systems
Nick Howland – Printech Circuit Laboratories
Charles Hannaford – O3b Networks
Maurizio Vanotti – SSTL
Why Space? – Comments from Investors

Chair – Nick Flitterman, Portland Advisers
Mark Boggett, Seraphim
Richard Brook, E-Synergy
Simon Acland, Imprimatur Capital
Philip Grose, Castle Hill Asset Management
Stephen Ainsworth, Barclays
Why Space? – Comments from Investors

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Philip Grose, Castle Hill Asset Management
Stephen Ainsworth, Barclays
Final Remarks
Joanne Wheeler
Partner
Bird & Bird
Co-Chair SFN
Final Remarks

SFN Update

- Aims to support the growth of the UK space industry at all levels
- Facilitate and attract investment
- Identify regulatory barriers and other impediments to growth
- Promote business opportunities between companies
SFN Update

Attracting investment
- In last 3 months – approached by 3 new companies (1 start up, 2 with existing revenue streams)

Identify regulatory barriers
- Reform of Outer Space Act to cap unlimited indemnity to put UK companies on a level playing field – received Royal Assent on 26 March 2015
SFN – Success Through Collaboration

What's next?
- Elevator Pitch Event
- "Back on Board" project
- Regulatory Seminars (collaboration with ECSL/ESA)
  - Licensing
  - WRC-15 – what it means for the industry
Thank You!