



OXFORD SPACE SYSTEMS

Space 101: Intellectual Property

Mike Lawton



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Who we are

- Founded in September 2013; **over-subscribed** Series A and interim rounds completed
- OSS team is a diverse mix of **industry experts** and highly talented graduates
- An **award-winning** space technology business **pioneering** the development of a new generation of **deployable space antennas and structures**
- Using origami & proprietary materials, OSS' structures are **lighter, less complex** and **lower cost** than those in current commercial demand
- **Significant** intellectual property developed / under development
- **Industry record**: shortest product development time to orbit (AstroTube™ boom)



- **Best UK Start Up 2015**
- **Grand Prix Winner 2015**



**Best Investment In A High
Growth Manufacturing
Business 2015**

Where we are....

Harwell Campus Quick Facts

- £2Bn+ infrastructure
- 5,500+ people
- 200+ organisations
- 70 Space companies
- 710 acres

European Space Agency
(ESTEC)

Focus Areas

- Space & Satellite Applications
- Life Sciences & Healthcare
- Big Data & Supercomputing
- Energy & Environment
- Advanced Engineering & Materials

Oxford Space
Systems

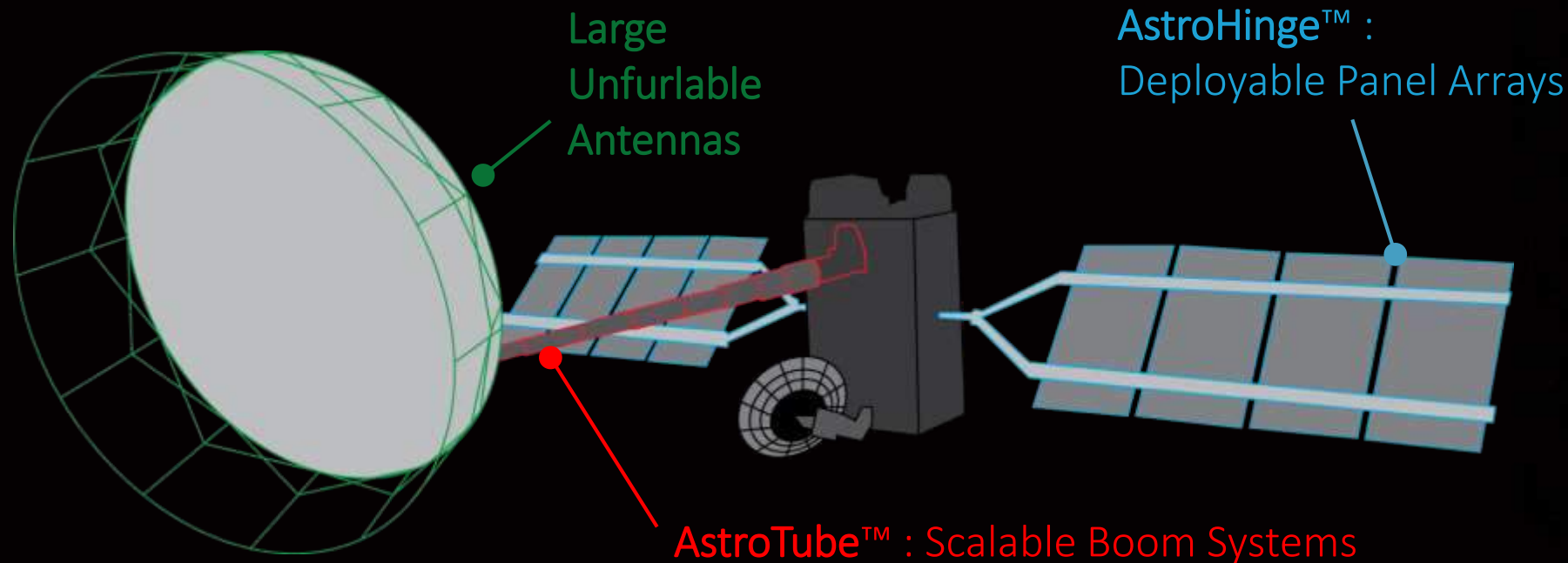
Beachhead offices for:

- Airbus Defence & Space
- Lockheed Martin Space Systems
- SSTL
- MDA

RAL Space / National
Space Test Facility
(vibration, thermal
vacuum, clean rooms, lab
space etc)



Products and IP under development



By using flight qualified proprietary materials OSS products are:

- ✓ Lighter
- ✓ Lower cost
- ✓ Less complex
- ✓ More stowage efficient

...than those in current commercial demand.

AstroTube™ Boom for SmallSat Applications

Two industry records set:

- ✓ World's longest retractable cubesat boom
- ✓ From new material concept to flight in <30 months

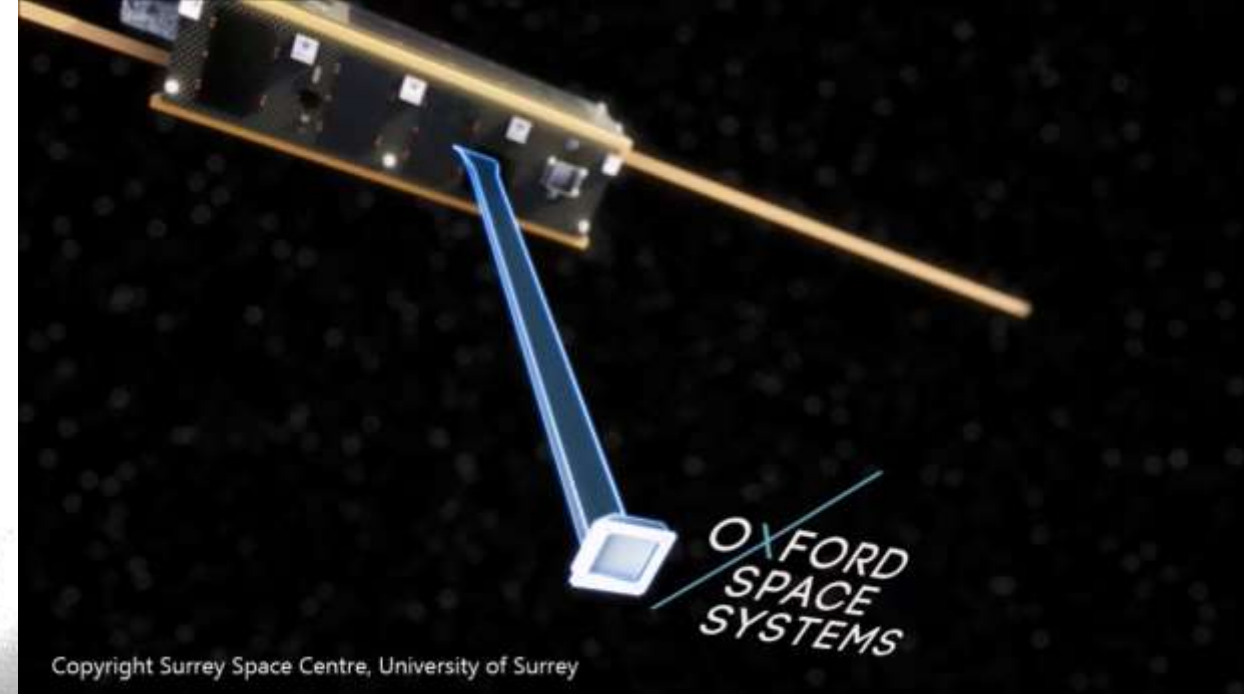


Alsats-1N

Launch: **26 September 2016**

Launcher: PSLV (India)

First Full Image from AlSat-N1



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Successful Deployment of Oxford Space Systems AstroTube™ Boom

Proprietary composite designer software toolkit

Enter name: Kevlar PW

Define		Calculate	
Long. modulus	Transv. modulus	Long. modulus	Transv. modulus
21.3 GPa	21.3 GPa	24.3 GPa	24.3 GPa
Shear modulus	Poisson's ratio	Shear modulus	Poisson's ratio
3.0 GPa	0.08	2.4 GPa	0.08
Ply thickness	Density	Ply thickness	Density
0.125 mm	1.30 g/cm ³	0.125 mm	1.30 g/cm³

Fibre: Kevlar Resin: Epoxy
Type: PLAIN Resin wt.: 60.0% Fibre volume: 36.1%

Enter name: Zylon HM

Define		Calculate	
Long. modulus	Transv. modulus	Long. modulus	Transv. modulus
30.0 GPa	30.0 GPa	118.5 GPa	6.0 GPa
Shear modulus	Poisson's ratio	Shear modulus	Poisson's ratio
5.0 GPa	0.12	3.4 GPa	0.33
Ply thickness	Density	Ply thickness	Density
0.120 mm	1.80 g/cm ³	0.120 mm	1.33 g/cm³

Fibre: Zylon HM Resin: Epoxy
Type: UD Resin wt.: 45.0% Fibre volume: 30.9%

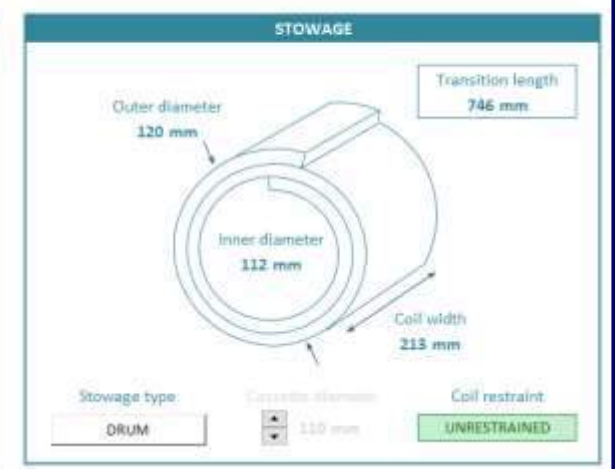
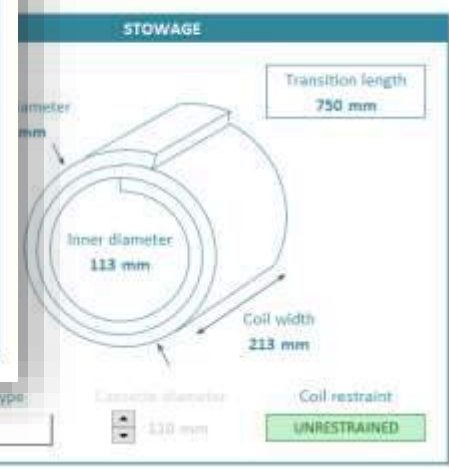
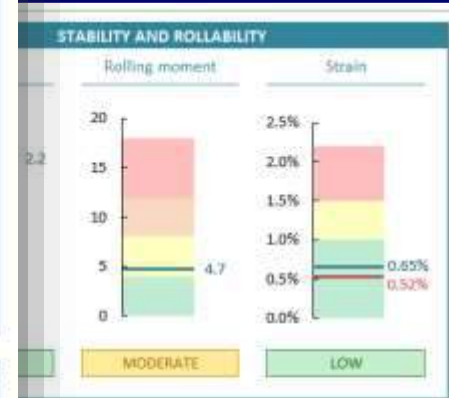
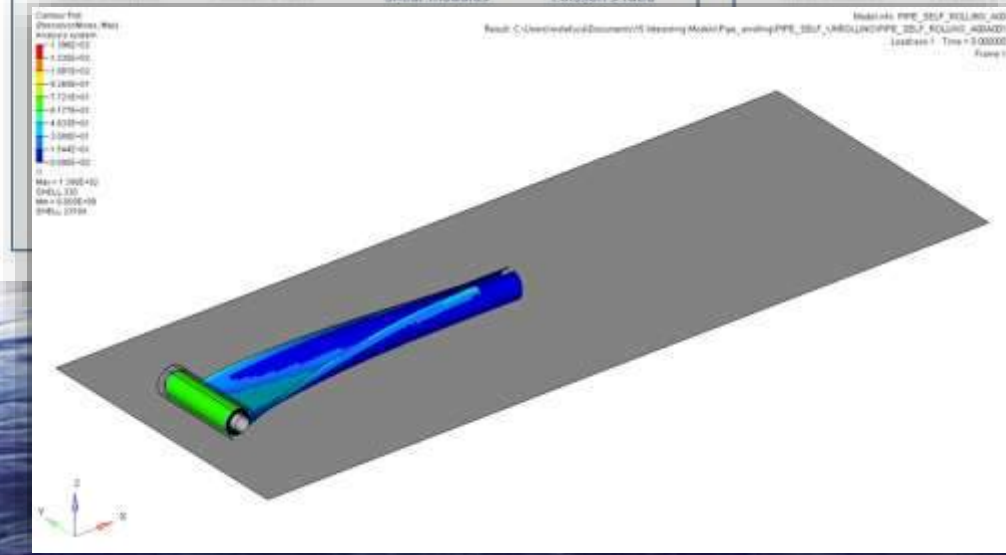
Enter name: Glass PW

Define		Calculate	
Long. modulus	Transv. modulus	Long. modulus	Transv. modulus
55.0 GPa	33.0 GPa	21.8 GPa	21.8 GPa
Shear modulus	Poisson's ratio	Shear modulus	Poisson's ratio

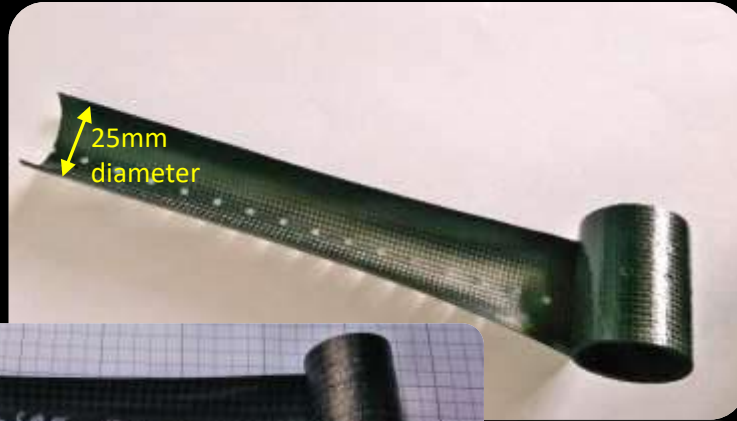
Enter name: Carbon HM

Define		Calculate	
Long. modulus	Transv. modulus	Long. modulus	Transv. modulus
130.0 GPa	130.0 GPa	185.1 GPa	5.5 GPa
Shear modulus	Poisson's ratio	Shear modulus	Poisson's ratio
3.1 GPa	0.30	3.1 GPa	0.30
Ply thickness	Density	Ply thickness	Density
0.120 mm	1.47 g/cm³		

Fibre: Carbon HM M50 Resin: Epoxy
Type: UD Resin wt.: 45.0% Fibre volume: 45.9%



Proprietary flexible composite hybrid lay-ups

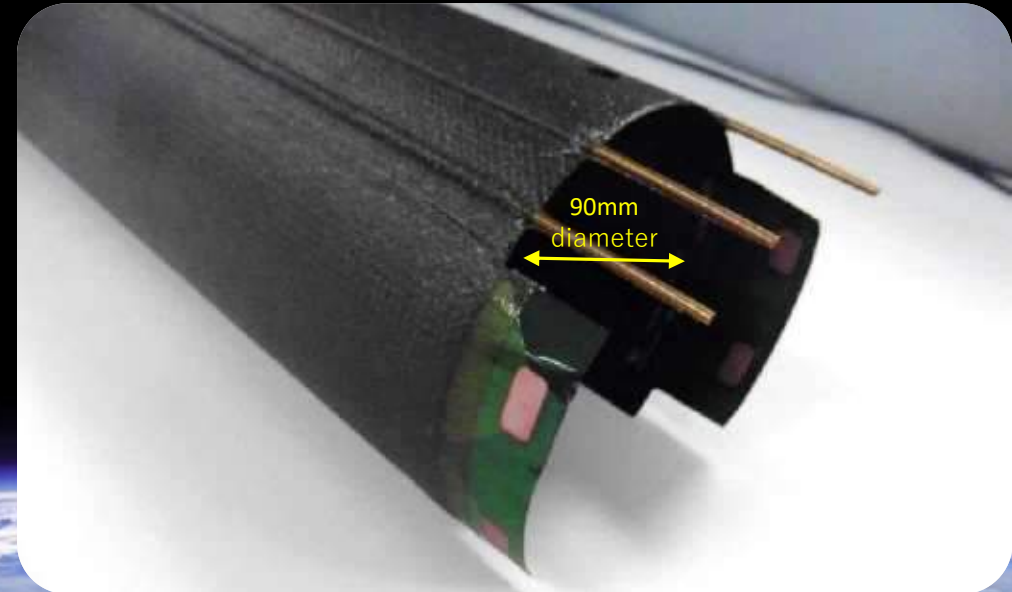


Composite materials selected:

- › Low out-gassing
- › Good radiation tolerance
- › High specific stiffness
- › Highly tuneable kinematics
- › Base materials have good flight heritage

Ability to embed structures:

- › Low cost antenna booms
- › Multifunctional boom systems
- › Xenon gas feed integration (for EP)
- › Embedded high voltage (4.5kV) PCBs



Do investors really care about intellectual property?

- **YES!**

- Potential investors need to know where an invention or innovation fits in the marketplace with reference to existing and potential competitors
- They want to know if the innovation offers a dramatic and sustained advantage: is there compelling evidence to warrant building a business based on the IP?
- Potential investors seek to evaluate both the strength of the innovation and the ability of the entrepreneur to drive commercialisation
- IP owned by the business and its ability to generate more are of critical importance – it's the 'currency' by which an investor judges the value of an investment
- The IP portfolio of the company drives exit value

Q. What's the best form of IP in a tech start-up?

➤ Patents or Know-How?

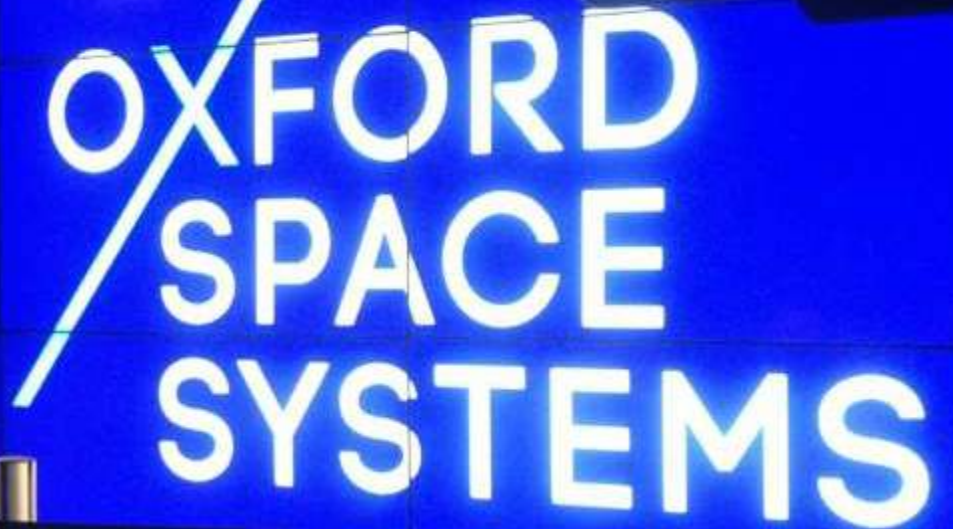
- ❑ Patents are only as good as your ability to defend them
- ❑ Investors do not want to spend their investment on litigation!
- ❑ Over-filing of patent claims sets up a 'bow-wave' of costs – can kill cash flow
- ❑ Know-How is only any good if you can achieve “protection via complexity” e.g. a 'Coke formula' approach

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The logo for Oxford Space Systems is displayed on a large blue wall. It features the words "OXFORD", "SPACE", and "SYSTEMS" stacked vertically in a bold, white, sans-serif font. A white diagonal line crosses the text from the top-left to the bottom-right, passing through the letter 'O' in "OXFORD" and the letter 'S' in "SYSTEMS".

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