

CASE STUDY

The Company Name: **Oxford Space Systems**

Managing Director: **Mike Lawton**

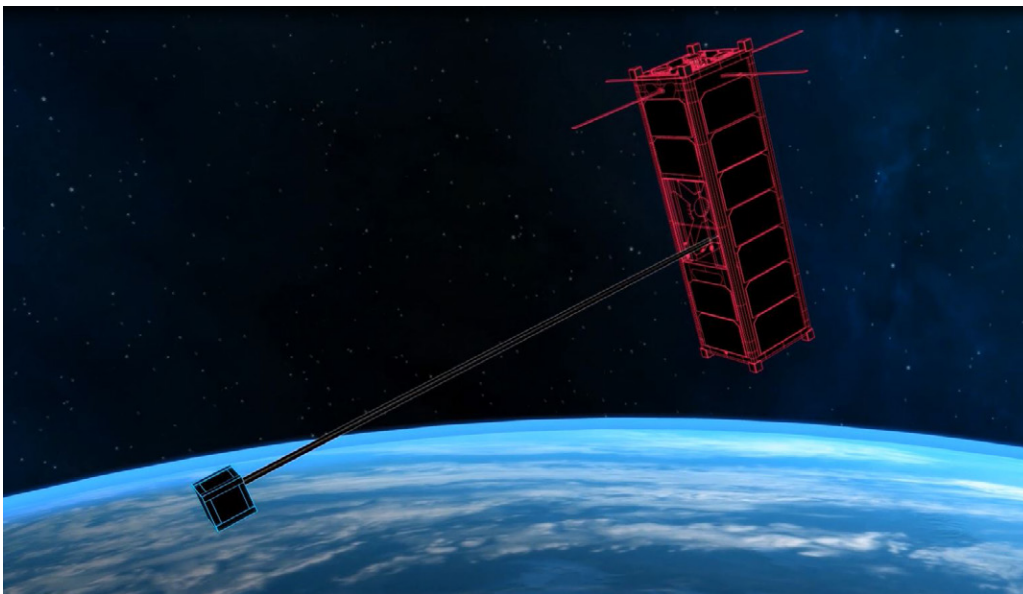
No. of Employees: **13**

Launched: **September 2013**

Location: **Harwell, Oxfordshire**

Sector: **Space Hardware**

Website : **www.oxfordspacesystems.com**



range of telescopic boom systems, large deployable antennas and deployable panel designs.

- Combining traditional and new, proprietary materials, such as flexible composites, to reduce stowage volume, complexity and cost.

Booms, antennas and panels are essential elements of most satellites but they add complexity and weight, and take up precious space on a launcher, with inevitable

OVERVIEW

Oxford Space Systems (OSS) is bringing to market a new generation of deployable structures for Space that are lighter, less complex and lower cost than those in current commercial demand. Part of a new wave of small, agile businesses transforming the Space sector, it is unusual in its focus on satellite hardware – historically an expensive sector for small firms to break into. OSS is attracting interest from leading satellite manufacturers in Europe, the US and Asia because of its use of innovative materials and agile approach to product development.

- Challenging traditional design concepts of deployable structures for Space by developing a novel

implications for cost. At Oxford Space Systems, innovator Mike Lawton, together with an industry experienced team including Professor Zhong You, an expert in origami and structural engineering at Oxford University's Department of Engineering, are successfully tackling these challenges following their initial success in developing a novel, compact unfolding parabolic antenna.

Their focus on new designs and materials for deployable structures was validated when OSS won £100,000 in matched funding for further research and development in the Harwell Space Launchpad competition in 2013. This, in turn, triggered seed investment from venture capital fund Longwall Ventures, allowing Lawton to strengthen



the fledgling OSS team by bringing in a number of sector recognised experts and highly talented graduates. This included world-renowned space mechanisms engineering consultant, Martin Humphries.

REPLACING BOOM MECHANICS WITH MEMORY

Current boom structures – extendable articulated arms that unfold from satellites to position large parabolic antennas, panels or payloads – are complex and heavy, with many moving parts. They also need their own dedicated power system. In contrast, one of OSS's innovative designs relies on the 'memory' properties of its own proprietary composite material which unfurls to assume a rigid final shape, just like a plant leaf on a stem. This reduces complexity and, compellingly, weight and cost.

OSS's innovation was to orientate space grade carbon fibre weave – which is usually deployed for its rigidity and strength – in a novel way and combine this with resins tolerant to the space environment. The result is a strong, lightweight, 'shape memory' material that unfurls from a rolled-up state in a controlled manner to its planned functioning flight configuration. This is the basis of the AstroTube™ boom for microsat and cubesat applications. "We have designed this technology to deploy a wide range of instruments from satellites," explains Mike. "It is scalable up to 4m and very adjustable." OSS is on course to set two industry records in July 2016 with the first flight of an AstrTube boom on the UK Space Agency's AISat-N1 3U cubesat.

"To our knowledge", explains Lawton, "this will be the world's longest retractable cubesat boom and we would have gone from concept to flight in around 30 months – a record for the space industry"

OSS has also designed a telescopic boom – the AstroTube Max – that is scalable up to 10m for mid to high mass payload deployments. It recently finished successful qualification of a 2.5m long boom in record time under the Harwell Launchpad initiative and is now working with a number of satellite builders to explore specific commercial exploitation opportunities.

NOVEL DEPLOYABLE ANTENNAS

Deployable or unfurlable antennas are another focus for OSS. Satellites use antennas for capturing and relaying signals, such as satellite TV. They are critical for communication satellites and increasingly required for Earth Observation and data relay satellites – essentially forming an 'Internet in Space'.

To address challenges with large deployable antennas (LDAs) that are caused by high levels of vibration during take-off and extreme temperature gradients when on orbit, OSS has developed an entirely new solution. "We're not forced to evolve legacy designs, building upon those that have gone before like competitors," explains Mike. "OSS brings fresh thinking, new materials and an ability for fast-paced development."



The team has an ESA commended 4m diameter prototype which is scalable up to 12m and is developing a novel shape memory surface to act as the reflector surface. This further reduces the complexity of the antenna as well permitting operation at the higher frequencies demanded by telecomms operators. The antenna and its surface can connect to an OSS boom system enabling the company to offer a complete LDA assembly.

The OSS team is also exploring applying origami techniques to deployable systems for solar panel structures – the power source for all satellites – applying the same design philosophy evident in its booms and antenna technology: simplify and reduce mass to increase reliability and utility while cutting costs and production lead-times.

THE FUTURE

OSS is now expanding its team in order to develop its product portfolio, and raised £1.3 million in an over-subscribed funding round led by existing seed investor Longwall Ventures.

The company is working under contract with LuxSpace on deployable antenna designs for global ship tracking and with Airbus Defence & Space on novel deployable panel concepts. It has received an order for its cubesat boom technology from Kazakhstan and is advanced stages of negotiations with Singaporean and USA based companies for variants of its boom technology. Mike has a clear vision for developing the company. “

“We offer a way of outsourcing innovation, working with conventional and next generation materials, with the aim of lowering the cost and reducing lead times of Space

hardware. With our culture of minimising bureaucracy and relatively low overheads, we’re in a strong position to move boldly and be first to market – and crucially we’re in the right support environment at Harwell to achieve our ambition.”

ASHBY HOUSE SUPPORT

The Ashby House team have has been involved with Mike and the OSS team since its inception and this relationship was enhanced by OSS’s Launchpad win in 2013. Commenting on Launchpad, which is run by Innovate UK and the Science & Technology Facilities Council, Lawton says: “Launchpad is designed to support projects considered too risky to take forward without initial funding or those breaking into new areas of research, so it was perfect for us. We gained investment and it also led to a new relationship with the Catapult, helping to expand our network and raise our profile.”

The following spring, OSS participated in an Investor Readiness Programme run by Ashby House ion behalf of Innovate UK, focusing in particular, on being able to provide potential investors with a clear and coherent picture of the business and the investment opportunity. “The Ashby House team were experienced, knowledgeable and helpful, and brought original thinking which led to a quality output that I was able to use with potential investors,” notes Lawton.

OSS have taken advantage of several of the programmes run by Ashby House for the European Space Agency’s Business Incubation Centre at Harwell (ESA BIC Harwell). For example in 2015, OSS staff attended sales training provided by Ashby House on behalf of the ESA BIC Harwell. “Thanks to the support of the ESA BIC, Ashby House have provided ongoing business support in a number of key areas and have introduced us to both potential investors and business partners,” says Lawton.

“There’s a buzz of innovation at Harwell and being here gives us a level of gravitas within the Space industry, together with access to contacts and invaluable resources like Ashby House’s business support programme. It’s hard to think of a more perfect innovation environment in the UK, or indeed Europe, right now for our business to succeed.”