CASE STUDY

OXFORD SPACE SYSTEMS

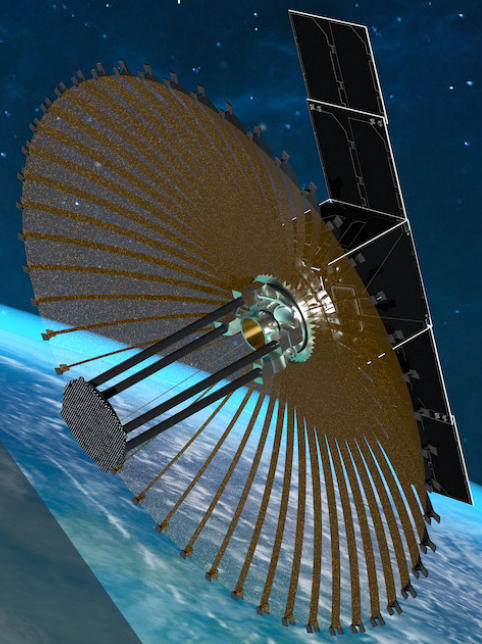


Image: soundmotive.tv

LIGHTWEIGHT, FOLDING ANTENNAS FOR SPACE. DESIGNED BY OXFORD SPACE SYSTEMS WITH A PRODUCTION BOOST FROM PROGRESSIVE ADVANCED MATERIALS

Oxford Space Systems, based in Harwell, UK, design and develop antennas for satellites launched into earth's orbit.

As the global demands on satellites increase, deployable antennas play a crucial role in delivering efficient cost effective services from smaller satellites. Satellite antennas requiring ever larger surface areas have design requirements governed by achieving minimal mass, compact stowage coupled with reliable and innovative deployment methods.

Through rigorous research and development, Oxford Space Systems' vision is to become the global leader of deployable antennas for Space - improving performance, maximising stowage efficiency and minimising mass. Origami inspired engineering by Oxford Space Systems resulted in a concept to achieve this goal. The task was to produce this agile antenna through engineering proprietary materials in innovative ways, to develop antenna solutions at a comparatively low cost and fast pace.

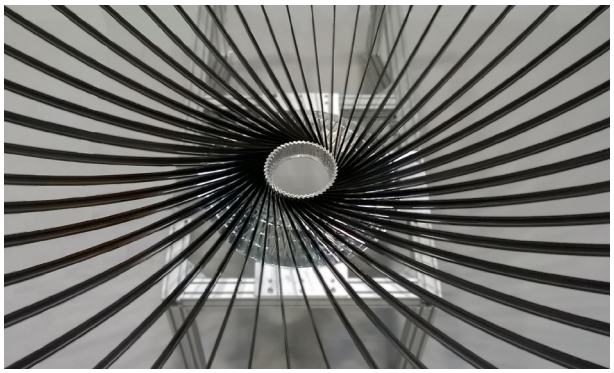
The Oxford Space Systems Wrapped-Rib antenna is a deployable Cassegrain, centre fed antenna that aims to be the go-to antenna for low Earth orbit (LEO), X-band synthetic aperture radar (SAR) applications. The Wrapped-Rib is scalable from 2.7m to 5m diameter and utilises a metal-mesh reflector surface. The antenna includes a central hub, carbon-fibre based lenticular "ribs" to support the reflector surface, and a deployable composite secondary reflector and mast.

Requirement

Having designed an innovative new antenna system, Oxford Space Systems needed a supplier partner willing and capable of developing new machining methods for crucial aspects of construction which would enable the antenna's metal mesh reflector surface to deploy as a perfect parabola. The kind of expertise in precision machining and finishing that Progressive Advanced Materials is known for.

The antenna module contained flexible rib sections constructed from a fine skin of carbon fibre and Kevlar, which require an incredibly high tolerance of machining to attach each rib to the antenna's surface mesh. At the time of approach, the project was still in R&D stage while Oxford Space Systems were establishing if the specific attachment process could be achieved.

It was essential to machine the lightweight and flexible ribs in their natural state, maintaining the integrity of each piece throughout the production process.



A conceptual idea was presented to us, with no obvious production process available to achieve the incredibly high tolerances required for the finished piece. Working collaboratively with Oxford Space Systems, we were confident in our ability to find a way to deliver the perfect result.

Aden Harvey,
CAM Engineer
Progressive Advanced Machining

Click here to watch an animation of the antenna deploying on the Oxford Space Systems website.

The challenge was to develop a method of fixing each irregular shaped part for machining, without exerting force on the part itself. As a company with decades of experience in precision engineering across a number of demanding sectors, including motorsports, aerospace and defence, our team were excited by the challenge.

We need reliable suppliers who will deliver what they promise.

Accurate machining of our large flexible ribs is not easy and Progressive have the right equipment to do this demanding job.

Richard Page,
Senior Mechanical Design Engineer,
Oxford Space Systems

Process

Working in partnership with the team at Oxford Space Systems, this was a collaboration to establish a production process that could be used to deliver the antenna at a manageable cost for production.

One of the key specialisms of our business is the ability to design and create tooling solutions for this kind of problem. Our experienced team has overcome many similar challenges over the years and we began our research before trialling a number of methods, ultimately leading to the perfect solution for fixturing, tooling and rigorous inspection of the parts.

Result

The willingness of Oxford Space Systems and Progressive Advanced Materials to test, troubleshoot and collaborate fully, made the most of our team's comprehensive ability to offer an end-to-end solution - from concept and consultation to design and delivery of each machined part. Our comprehensive manufacturing and inspection facilities ensure that the team's high levels of expertise are matched in production.