

[News story: Status update for record breaking UK-Algeria CubeSat mission AlSat Nano](#)

Launched on September 26 2016 the UK Space Agency funded nanosatellite, delivered in collaboration with the Algerian Space Agency, met its core mission objectives back in February and is on track to complete even more advanced objectives within its first year of operations.

Status summary:

- Stable, healthy spacecraft platform
- All subsystems functional – over 15,000 ground to space commands successfully sent
- Strong communications link – over 1000 files downloaded so far
- Low spin rate
- Longest uptime: 27.4 days
- On board Attitude Determination Control System verified and activated
- Regular datasets returned for Thin Film Solar Cell payload
- Multiple image capture and download for all three C3D2 payload cameras – 105 image files downloaded in total so far, including 16 full size images
- AstroTube Boom payload deployed and stowed multiple times, incl. full 1.5 metre length, captured with dedicated C3D2 camera

World Firsts and World Records

AlSat Nano has provided Oxford Space Systems with the first flight of its innovative flexible carbon fibre composite boom payload, the AstroTube Boom, which is believed to have set a world first as the longest ever retractable CubeSat boom in orbit at 1.5 metres. Oxford Space Systems also believe they have set the space industry's fastest full cycle hardware development; material design to in orbit demonstration in under 30 months.

This has been enabled by AlSat Nano's rapid development programme, just 18 months between spacecraft design and flight readiness. This has allowed industrial and academic mission partners to stay ahead of the curve in the increasingly competitive global nanosatellite market.

The Thin Film Solar Cell test payload, led by Swansea University, is the first solar cell deposited directly onto cover glass to be deployed in space and successfully return data. The ultra-thin (just 1/10th of a millimetre thick) cover glass, developed by industrial partners Qioptiq Ltd, allows for extremely high power to weight ratio which is crucial for saving costs in spaceflight. Flight data returned so far show extremely promising performance, and with proven materials heritage there are now clear routes to secure further funding and eventually commercialise the payload.

Mission impact

The flight opportunity is providing major benefits to those involved already. Below is a snap shot of some of the highlights captured so far by mission partners, which they view as directly attributable to their role in AlSat Nano:

Additional contracts and competitiveness

- Surrey Space Centre's (University of Surrey) role as mission prime has led to successful bids in a range of technology development and international collaboration projects. Knowledge and experience from leading the mission has fed directly in to other ongoing projects
- Oxford Space Systems negotiating approx. £5.6 million export contracts across US, Europe and Israel, plus further enquiries from NASA and Asia, for derivatives of its AstroTube Boom payload and antenna systems based on its proprietary flexible composites
- Open University's industrial partners XCAM Ltd are bidding/negotiating contracts worth approx. £1.1 million following on from its payload role, and Teledyne e2v Ltd, which provided the sensor hardware, are using C3D2 heritage as inputs in to bids worth £2 million+
- Surrey Space Centre industrial partner SSTL secured €12 million contract with Algerian Space Agency

Increased Knowledge and Experience

AlSat Nano was delivered to Algerian Space Agency as its first nanosatellite mission. The programme has seen direct involvement from Algerian staff and students throughout its development:

- The UK Space Agency sponsored five Algerian post graduate students to study at Surrey Space Centre and gain invaluable experience by taking on roles to help develop the AlSat Nano platform
- Surrey Space Centre also provided training and consultation to Algerian Space Agency engineers and spacecraft operators, to help build its new ground station facility in Oran, which is being used to operate AlSat Nano
- The flight data returned from the satellite is feeding directly into the Algerian students' academic courses. These contain specific modules to study how small satellite technology can be applied to address real world problems. The qualifications and real life mission experience will build long term technological capability in the country's developing space sector

New partnerships and collaborations

- Surrey Space Centre and Oxford Space Systems have now teamed up for the RemoveDebris mission, due for launch in late 2017
- Surrey Space Centre and University of Swansea are working on further Thin Film Solar Cell development * AlSat Nano has facilitated Algerian interaction with a wide range of UK academic and industrial mission partners, acting as a firm basis for potential future collaborations

- XCAM Ltd are now working with 6 other industrial-academic partners for Innovate UK funded cold atom CubeSat mission CASPA
- Oxford Space Systems have partnered with Sen to provide camera deployment boom for high-resolution video from orbit
- Surrey Space Centre is working with the Algerian Space Agency on a large scope follow up proposal with the objectives of setting up a local education and research centre, built using Surrey Space Centre as a blueprint, and deploying a CubeSat constellation for monitoring atmospheric pollution

Job Creation and Value

- As the first in orbit flight demonstration for Oxford Space Systems, AlSat Nano has helped grow the SME company's staff size by approximately 50% and achieved significant global profile raising. The successful mission role has provided excellent credibility when talking with potential domestic and overseas customers, and proven very valuable in investment negotiations with the venture capital community
- Within Surrey Space Centre (University of Surrey), the AlSat Nano programme has led to the creation of 5 jobs, two of which are permanent positions, while the others are on renewable contracts to be funded by further missions

Internal investment

- Surrey Space Centre internal investment of approx. £125,000 to upgrade environmental test facilities, which will now be available to commercial customers
- The Open University has invested approx. £35,000 in a UHF/VHF Ground Station for the OpenSTEMLab to enable practical satellite communications activities for distance learning students and enable new research opportunities
- XCAM Ltd internal investment of approx. £20,000 in thermal cycling test chamber

Scientific papers and publications

14 science and technology papers and articles by academic mission partners (Open University, Surrey Space Centre and Swansea University), published or shortly to be published, with more planned in the future as further data is returned from the satellite.

Technological Advances

- The AlSat Nano flight opportunity has driven the AstroTube Boom payload through the full scale of technology maturity, from initial concept to flight proven; permitting the on orbit verification of deployment mechanism, control electronics and kinetic verification of proprietary composite material
- Surrey Space Centre's new transceiver antennae design has advanced from prototype to flight proven having been deployed successfully and spent over 9 months so far transmitting and receiving data

- Open University's C3D2 camera suite payload is a fully flight proven instrument having captured and returned well over 100 images so far
- Thin Film Solar Cell has demonstrated its prototype's core materials ability to survive in space and be measured remotely, paving the way for development of a fully power generating model
- Flight and mission control software developed by Surrey Space Centre for AlSat Nano is acting as the baseline for further upcoming missions

C3D2 Images

The Open University's C3D2 (Compact CMOS Camera Demonstrator 2) payload has been busy snapping since November. Its suite of three cameras has captured a range of different continents and islands, interesting geographical features and weather systems. C3D2 is acting as a pilot remote experiment through the University's OpenSTEM labs and will open up a new experience for Open University distance learning students who will be able to interact with a live space instrument. The Oxford Space Systems AstroTube Boom payload can be seen in the foreground of several of the images, with one of the cameras positioned specifically to image the deployment in stages, offering great publicity for the product on its first flight.

Below is a selection of our favourite images captured since launch.

Taken in February 2017, this wintry scene was captured over the Sea of Okhotsk, just north of Japan, and shows mountains with snow, frozen sea, and ice sheets which have broken away. Image credit: AlSat Nano mission, Open University

This image was captured in January 2017 over New Caledonia in the South Pacific. The main island is to the right of the image with low level cloud cutting across it and bright sunlight reflecting off the surrounding ocean. Atoll lagoons can be seen at the bottom right of the image and the Vanuatu island chain to the upper left. Ground resolution at the bottom of the image is approximately 380m per pixel. Image credit: AlSat Nano mission, Open University

Taken in May 2017, this image shows a large weather system over Alaska and the Bering Sea

AlSat Nano's first full size colour image, taken in December 2016 above the Arkhangelsk Oblast region on the North West coast of Russia. It was captured under twilight conditions at dawn, showing the coastline to the top, and a brief winter sunrise over the arctic region with a deep red-brown hue. Through the cloud cover there is evidence of hills and snow on mountains, and mist in the river valleys.

You can find out more mission background here: bit.ly/2d4w9Uk