LIFT-OFF FOR CARBONITE-2

In a world-first for Britain's space sector, the CARBONITE-2 smallsat mission is delivering full-motion colour video imagery to the Royal Air Force for the first time. It also heralds the first commercial, European-owned satellite constellation able to provide both video and still images

Built by Surrey Satellite Technology Ltd (SSTL) in Guildford and launched in January of this year atop a PSLV launch vehicle from the Satash Dhawan Space Centre in India, CARBONITE-2 is a technology demonstration mission that is already delivering 4k UHD video and 1.5m still imagery from its 505km sun-synchronous orbit.

Travelling at a speed of 7km a second, the 100kg spacecraft is roughly the size of a household washing machine and carries an off-the-shelf telescope and HD video camera, both of which have been adapted for a space environment and integrated into a custom-built framework. The imaging system is designed to deliver high-resolution images and colour HD video clips of up to two minutes at a time with a swath width of 5km.

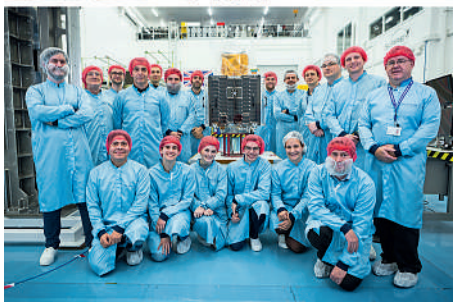
The satellite is a successor to CARBONITE-1 that was launched in 2015 and achieved full mission success by demonstrating the concept of a low-cost COTS video-from-orbit solution.

Built and launched into a 650km orbit in under eight months, it also demonstrated the use of very fast, low cost techniques to design and build satellites for "super constellations." The satellite features an 0.25-meter telescope for video and still image acquisition at a ground resolution of 1.5m. CARBONITE-2 flies enhanced avionics to provide increased data storage, faster data downlink, improved pointing accuracy, and a full colour HD video camera.

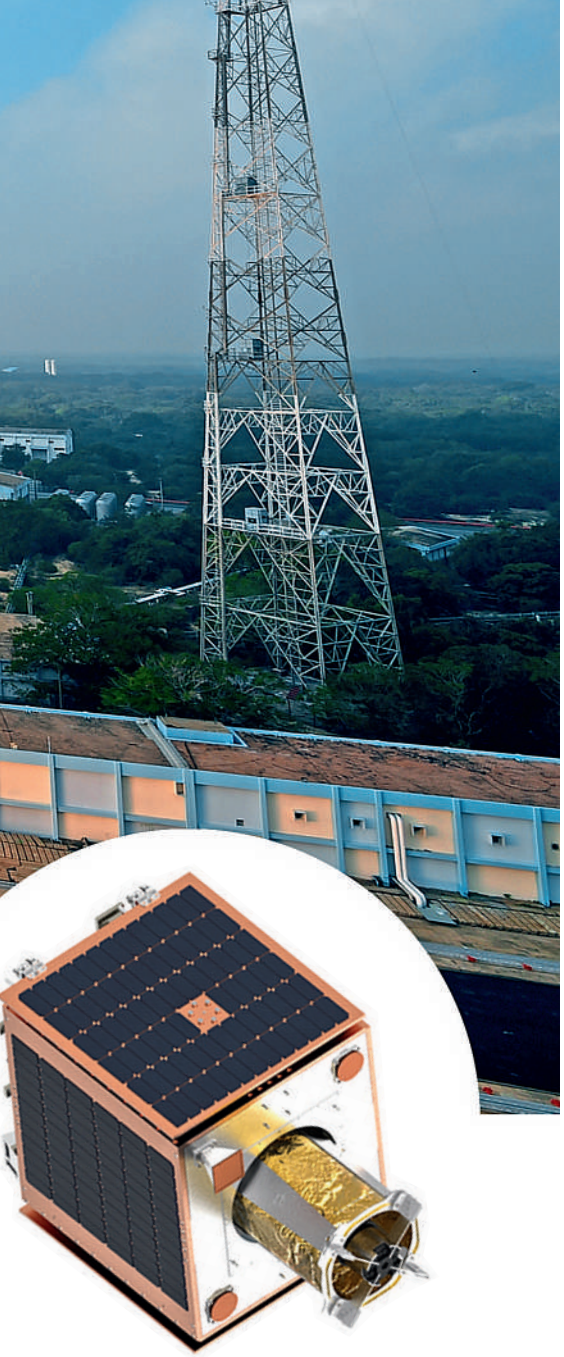
Into the cockpit

As part of the latest mission, the RAF worked with the Ministry of Defence's Chief Scientific Advisor, the Defence Science and Technology Laboratory and UK industry on a programme that could eventually see such satellites beaming video directly into the cockpit of fighter jets. This would improve the situational awareness of pilots by giving them the very best imagery and information anywhere on Earth in real-time.

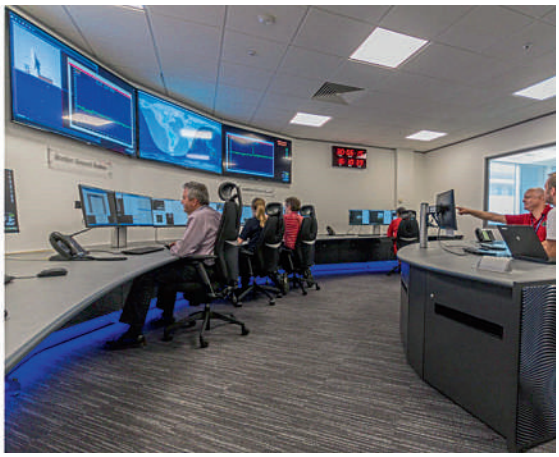
For Defence Minister Guto Bebb, the success of the mission shows that Britain is looking far beyond the skies when it comes



CARBONITE-2 being made flight-ready by SSTL engineers at the company's 40,000 sq. ft. technical facility in Guildford, Surrey. Photos: SSTL/Beaucroft Photography



CARBONITE-2 (inset) lifts off from the Dhawan Space Centre. Background Image: Indian Space Research Organisation. Inset image: SSTL / Earth-i



Chief of the Air Staff, Air Chief Marshal Sir Stephen Hillier, pictured with SSTL founder and Executive Chairman Professor Sir Martin Sweeting at SSTL's Spacecraft Operations Centre in Guildford as the CARBONITE-2 launch takes place. Photos: Crown copyright / SSTL

to defending the country. "We live in an increasingly dangerous world and satellite technology like this give our Armed Forces the extra advantage of quick video surveillance to keep us safe from a range of future threats, whether that's an airborne terror attack or a troop of tanks closing in on a foreign border. Investing millions into Britain's most innovative companies is helping us propel the UK forward in the space domain."

Crucial role

CARBONITE-2 will play a crucial role in the MoD's understanding of the potential for and shaping of the RAF's vision of an international constellation for the future. This could unlock new opportunities using a range of sensors and ground stations, e.g. to support emerging crises and combat intensifying threats, thereby giving the UK the opportunity to lead an area in which several close allies having already shown interest.

The MoD invested £4.5m into the programme just eight months ago and, according to its Chief Scientific Advisor, Professor Hugh Durrant-Whyte, is an excellent example of defence science and technology working with industry and the Royal Air Force to quickly deliver affordable and pioneering space technology for our Armed Forces.

Commercial constellation

A key industry partner in the venture is Earth-I of Guildford and for which CARBONITE-2 (designated VividX2 by the company) is a pre-production prototype for Vivid-i, its intended constellation of 15 such satellites. Planned for launch in batches of five from next year, it will be the first constellation of its kind to deliver full-colour video; and the first European-owned constellation able to provide both video and still images in near real-time with a high revisit rate.

Under a contract announced in November 2017, SSTL will supply Earth-i with CARBONITE-2 data for proving tasking, data downlinks to ground stations, image quality and the complex motion control systems that enable the spacecraft to capture video from space. Earth-I has appointed Norway's KSAT (Kongsberg Satellite Services) to provide ground network services; and commissioned software from Swedish photogrammetry and imagery specialist, Spacemetric, to manage, catalogue and geometrically correct images and video from the prototype satellite.

It is envisaged that footage will be available for analysis within minutes of being captured and will improve decision-making and response times in a wide variety of scenarios, from change detection to object identification, and from disaster response to infrastructure monitoring.

Commenting on the successful launch of CARBONITE-2, Richard Blain, CEO of Earth-i, said, "It's the culmination of much hard work by the teams at Earth-i and SSTL. We are now researching and testing the technology and data services for the Vivid-i Constellation using the still and video imagery from this prototype – and showing our customers what will be possible in the future from new capabilities such as colour video from space."

Richard Blain, CEO of Earth-I, pictured with SSTL Managing Director Sarah Parker at the signing of the order for the first batch of five satellites for its Vivid-I constellation. Photo: Earth-i