VIDEO FROM SPACE

The Earth-i team in the clean room

EARTH-I IS DEVELOPING A NEW SATELLITE CONSTELLATION DESIGNED TO PROVIDE CLIENTS WITH FULL-COLOUR VIDEO CAPABILITY FROM SPACE. **RICHARD HOLLINGHAM** DISCOVERS WHAT IT INTENDS TO OFFER

In a busy clean room at manufacturer SSTL, the company's latest earth observation (EO) satellite is being boxed-up ready for shipping. We watch as the engineers carefully align plastic panels designed to protect the fragile spacecraft during its journey to India for launch.

Weighing-in at less than 100kg and only around the size of a small domestic fridge, VividX2 is not much to look at. But although it resembles a box covered in solar cells, it has impressive capabilities and the potential to offer a wide range of new data products to clients around the world.

At the heart of this prototype satellite is a high definition (HD) camera. As well as being able to capture high-resolution images, the camera will be capable of filming around two minutes of HD video at a time.

VividX2 has been developed in partnership with Earth-i, a provider of satellite imagery and analytical services for a wide-range of big budget and high-profile customers. It's the technology demonstrator for Earth-i's Vivid-i Constellation, the first European-owned constellation to provide both video and still images – and the first in the world to provide full-colour video.

The satellite is the latest incarnation of SSTL's EO satellite platform and has evolved – with greatly enhanced optics – from the Carbonite-1 satellite, which launched in 2015 and is still operational. In November, Earth-i signed a contract with SSTL for it to provide the first five satellites in its fleet. Based on VividX2, these will be launched in 2019, with further batches of five commissioned over the coming years.

"The vision for Earth-i is to be one of the world's leading providers of earth observation-derived data," CEO Richard Blain explains. "We'll achieve this by providing our own data sources as well as integrating third-party data sources to create what we refer to as planetary big data."

Earth-i currently supplies very high-resolution image data services from SSTL's DMC3/TripleSat Constellation and the KOMPSAT series of satellites to clients across the globe. But having its own constellation represents a step-change for the company. "The view we take is that to fulfil the needs of our clients, it's vitally important we have our own source of data," says Blain. "That doesn't mean we won't be using third-party sources of data but, by having our own assured supply of very high-resolution earth observation data, we can provide levels of assurance in terms of answers to our clients that are valuable to them."

Moving targets

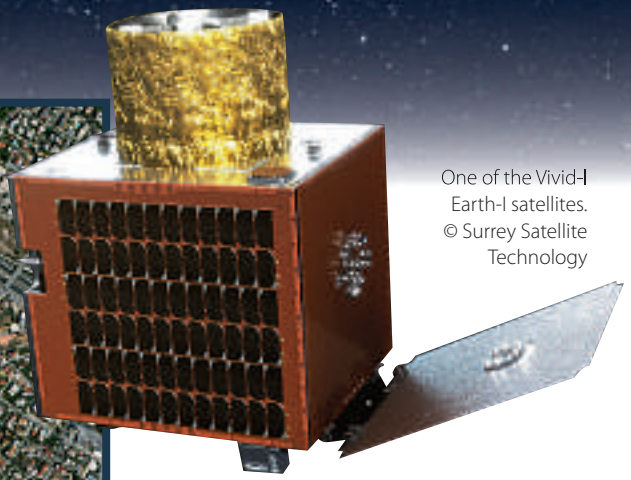
So, what will Earth-i offer that other EO companies around the world can't? One recent estimate by Euroconsult suggests the EO market will grow to US$8.5 billion in the next decade. It has already changed significantly. Once the bulk of EO data came from large government-owned satellites but a growing number of companies around the world are using commercial satellites and looking to develop or exploit constellations. However, only a few are developing their own constellations of dozens of satellites.

Multiple satellites provide the opportunity for frequent revisits of the same site to track change over time. They also provide a global picture, unobtainable with drones.

The Olympic Stadium in Athens. An example of sub-1m imagery from the DMC3 constellation currently used by Earth-i. © 21AT, Earth-i

An image of the offices of the British Geological Survey in Nottingham, UK. An example of sub-1m imagery from the DMC3 constellation currently used by Earth-i. © 21AT, Earth-i

The Gold Coast Convention and Exhibition Centre in Brisbane, Australia. In 2016, Earth-i was appointed by the State Government of Queensland to provide very high-resolution satellite imagery of the entire state. © 21AT, Earth-i



One of the Vivid-I Earth-I satellites. © Surrey Satellite Technology

They might be used to monitor a natural resource at multiple locations around the world or – at the other end of the scale – the cars in a particular supermarket car park.

The HD camera fitted to the Earth-i satellites will be able to provide images of better than 1m-resolution for any location on Earth. Unlike other EO constellations, however, Earth-i will be able to show objects moving at these locations, such as vehicles, vessels and aircraft, with footage available for analysis within minutes of being captured.

SSTL, a subsidiary of Airbus, specialises in building small, low cost satellites. The fact that it can now build these to include video cameras represents a significant technological advance. The more satellites that join the constellation, the more capable it will be, ultimately able to capture bursts of video across the day.

Time resolution

"It's all about time resolution," says SSTL's chief technology officer Luis Gomes, who has been overseeing the development of the new satellites. "If you want to do surveillance of, for instance, changes in a refugee camp, you want daily imaging and a daily video but more videos if possible. The numbers of spacecraft equate to the opportunities to image."

Blain adds: "With a constellation of satellites, we look at the high temporal resolution of multiple revisits per day and we look at ultra-high temporal resolution where we've got video taking 25-30 frames per second. In terms of revisits, we're revisiting every fraction of a second and we're creating a whole new type of information from space that isn't available today. That will drive an amazing array of new and interesting applications."

It's easy to take the growing capabilities of space technology for granted but, to consider the challenge of making this work, just think of the basic physics. Satellites orbit the Earth at approximately 7km/s, passing over a particular target on the ground at around the same rate.

"You have to be able to point to a particular location," says Gomes. "As the spacecraft is travelling in its orbit, it has to rotate to keep looking at the target and that gives you a few minutes of video."

THE INTENTION IS TO DELIVER IMAGES OR VIDEO TO THE CUSTOMER WITHIN HALF AN HOUR OF THEIR BEING OBTAINED

As each satellite passes over the horizon, the next can target the same location. "With more satellites, you can pick up from the one that has just gone out of range," says Gomes. "That's one of the reasons why you want a constellation of these spacecraft."

Developing the ground infrastructure is also important for Earth-i. The company is aiming to task satellites within hours – if not minutes – of client requests. The goal is to provide them with the data they actually want, rather than the data that's available.

This rapid tasking will be controlled from Earth-i's own state-of-the-art operations centre where it will be overseen by General Manager, Adrian Norris. "We will be masters of what we're collecting," he says, "and be able to instruct the satellites to get exactly what we need and to be responsible for the process from end to end."

"Clients will tell us what they want – either through an online interface or even by calling us – then the constellation management systems will work out the optimal way to acquire images or video clips of that area," says Norris. "We'll send commands to the constellation, telling satellites when to switch-on and where to point, until all the area the customer has asked for has been imaged successfully."

As well as rapid tasking, the intention is to deliver images or video to the customer within half an hour of their being obtained. But only in limited applications is a raw image, or even video, of any great use on its own. The key to Earth-i's future success is to extract useful information, data and insights from that imagery. The intention is to provide an end-to-end service, from client request through satellite capture to useful end product, all in a timely, accurate and assured manner.

"Customers in both the public and private sectors are looking for the answers," says Earth-i commercial director Paul Majmader. "They're looking at using new information sources that weren't previously available to answer the questions that are facing their businesses and their own customer base."

SSTL has optimised the design of the camera on the new satellites to meet those demands. "These customers are interested in globally dispersed, high-value areas of interest and require frequent high-resolution still and video imaging in the visible spectrum, in all lighting conditions," says Majmader. "We're already meeting the needs of customers requiring wide-area multi-spectral imaging using the SSTL-built DMC3-TripleSat constellation and through distribution agreements with other satellite operators."

He adds. "It doesn't really matter where the data comes from. What matters is that we provide the services that add value to what our clients are doing."

Ready for lift-off

VividX2 is due for launch this month and represents a proving moment for the technology and capabilities that underpin the business model of Earth-i.

"We set out with a very clear plan for how we'd grow the business," says Blain. "We provide planetary big data and, particularly with the new types of data becoming available, beyond the still images that are traditionally derived from Earth observation satellites, this is a very exciting time to be engaged in this industry."

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