Las Vegas. Photo courtesy of Earth-i ● ● ●

Q&A

Observing the Earth

Earth-i is one of Europe's most prominent NewSpace companies supplying high resolution image data and analytics services to clients across the globe. The company's vision is to provide Earth Observation based analytics and insights to unlock answers to the most challenging questions - and drive decisions about how we manage our world. Richard Blain, CEO at Earth-i, discusses EO applications in a NewSpace era.

Question: Can you provide an overview of Earth-i's current capabilities and expertise?

Richard Blain: Earth-i is a NewSpace company at the forefront of the commercialisation of space. We provide an end-to-end service that encompasses data acquisition and processing, and the advanced analytics that deliver meaningful and actionable insights to our clients in government and industry.

The company was set up in 2015 as a leading distributer of very high-resolution data from the DMC3 Constellation. Since then, we've added several other constellations to our portfolio of Earth observation satellites, including KompSat and SuperView, to deliver very high and ultra-high resolution optical and radar data from space.

We work with a wide range of customers worldwide to acquire, process and analyse the image data from these satellites, applying advanced algorithms, machine learning (ML) and artificial intelligence (AI) to derive the critical insights and solutions that enable better policy and decision making.
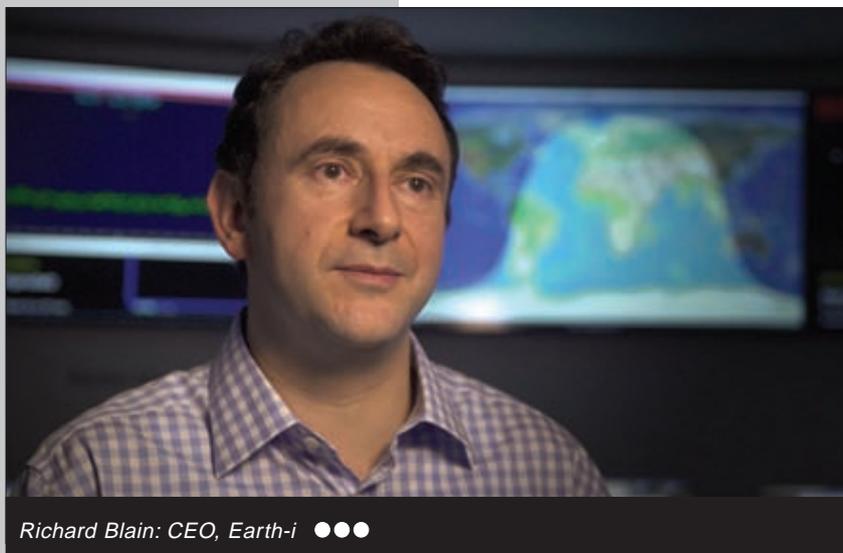
From 2020, we will deploy the first batch of satellites of our own constellation called Vivid-i – the first commercial constellation to provide still imagery and full-colour HD video imagery. This steady stream of high spatial and temporal image data will power even more powerful insights into the impact of human life on planet Earth.

Question: Earth-i has long-standing plans to deploy its own constellation of small Earth observation satellites, starting in 2020. What can you tell us about this constellation, plans for launch, and how the imagery will be used?

Richard Blain: The view we take is that to fulfil the needs of our clients, it's vitally important we have our own source of high-quality data. That doesn't mean we won't continue 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.

January 2018 saw the successful launch of our VividX2 satellite, a service demonstrator for our constellation, Vivid-i. This new constellation will be the first of its kind to provide full-colour HD video; and the first European-owned constellation able to provide both video and still images.

Vivid-i will be a major leap forward for the Earth observation industry, significantly increasing the ability of companies and institutions to monitor, track and analyze activities, patterns of life and changes at any location on Earth. It will provide a number of

Richard Blain: CEO, Earth-i ● ● ●
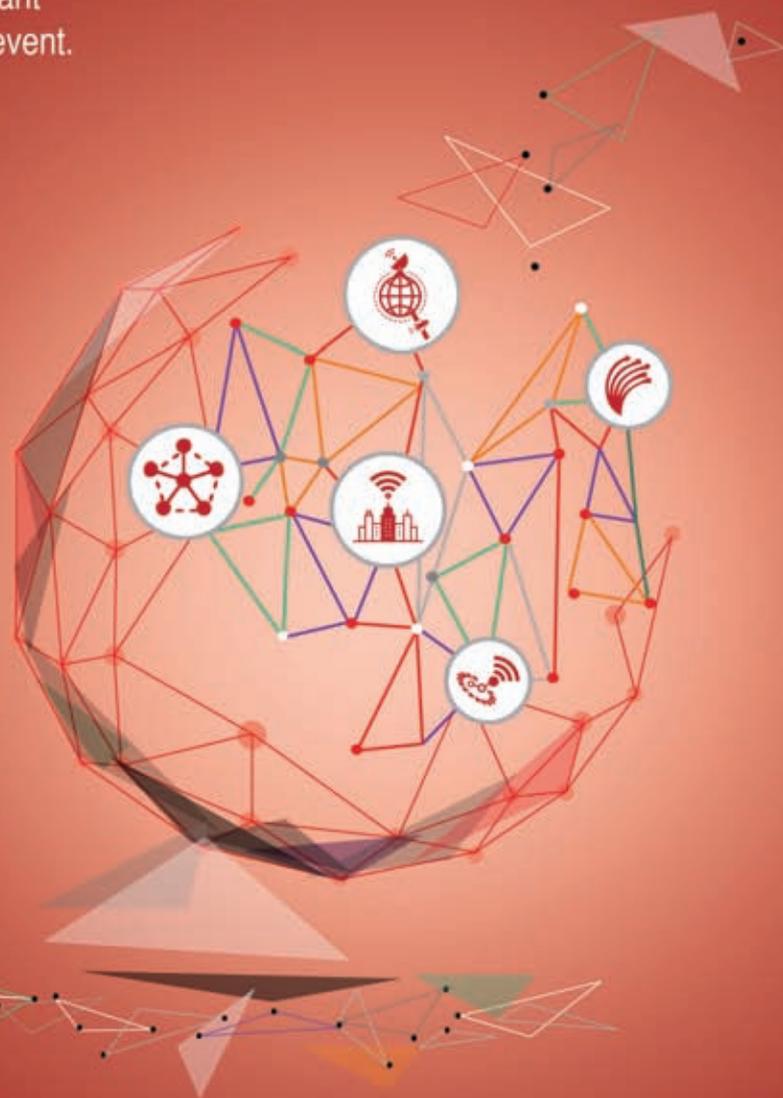
innovative capabilities, including:

- The provision of high-frame rate images with resolutions better than one metre for any location on Earth.
- The ability to film moving objects such as vehicles, vessels and aircraft in Ultra High Definition colour video.
- Revisiting the same location multiple times per day with agile satellites that can be pointed to image specific areas of interest.
- Rapid tasking of satellites to take images or video, and fast data download within minutes of acquisition.

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, from disaster response to infrastructure monitoring.

Earth-i will initially launch 15 satellites in batches of five in three different polar orbits. Once the constellation is complete, we will be able to visit any location on Earth at three different times of the day, every day. Further batches of five satellites can then be added according to customer demand.

Question: Earth-i delivered its first full-colour video of Earth from space back in April 2018. What are the challenges in delivering full-colour video from space?
Richard Blain: Capturing video from space isn't easy, otherwise many other companies would probably already be doing it. It is difficult, it is challenging, and I think sometimes we have to pinch ourselves a bit that we are doing something that is truly ground-breaking.

Just considering the physics involved is mind-boggling. VividX2 orbits the Earth at around 7km/s while the planet is rotating 500km below. The satellite needs to constantly adjust its position to stay focussed on the same area to record HD video and transmit it back to mission control over a two-minute period. However, we've got a very precise attitude control system – unusual in a satellite this size – that lets the camera stare very precisely at a target on the ground as it's flying over. This means we've been able to acquire

very stable video sequences of quite precise target areas of interest.

As well as the satellites themselves, Earth-i is also partnering with companies like KSAT to provide ground stations to download our data, and we will be building a new operations centre. The aim is to make the whole system as client-focussed as possible, delivering images of anywhere on Earth on-demand and within minutes of being taken.

Question: Planetary Big Data is becoming increasingly important the world over. What's your assessment of the market potential, and future applications?
Richard Blain: Earth observation data is becoming a major driver in the so-called 'Fourth Industrial Revolution' – the era of Big Data analytics. Given that everything happens somewhere, location data is the foundation on which many Big Data solutions are being built to drive better decision-making and policy thinking the world over.

We can integrate many, and diverse, data sources with satellite image and video data, from social media analytics to climate data, traffic and trade data, and the plethora of public datasets available on economic and human activities. But the mix of data utilised to create an insightful solution really depends on the customer question –

what kind of third-party data is most helpful in deriving the insights that answers a specific question for our customers?

Utilising ML and AI is fast becoming a critical part of the solution given the potentially enormous size and complexity of the Big Data cloud we have access to. In addition to our own satellite datasets and fast-growing base of free Earth observation data provided by Europe's Copernicus programme and the US Landsat satellites, ML and AI helps us to analyse these Gigabytes (and sometimes Petabytes!) of data within a tight timeframe and using algorithms to organize and analyse the complex datasets to an extent that is not possible by conventional methods. We can train the software with customer specific interests and target the desired insights very specifically to clients needs.

Digital elevation models are often required in analysing the context of the observed landscape/targets in any earth observation data sets. A fly-through is a virtual pathway through a landscape or built-up area where the elevation information is created from a digital elevation model and the colour of the landscape taken from a satellite image. Moving through this digital landscape and seeing colour and elevation in context will help with better, more accurate decision-making and

Earth-i team in the clean room. Photo courtesy of Earth-i ●●●

planning for applications as diverse as urban management, to security planning to disaster response.

Taking motion video from space actually means very high frame-rate acquisition: Multiple images of the same locations from multiple angles as the satellite passes over the target whilst 'staring' at it. From these video sequences we can create our own very detailed digital elevation models (DEM) from the large amount of data, and from the many stereo image pairs (an image of the same feature captured from two different angles) we can collect. This allows us to calculate and model the elevations, depressions and contours within the landscape and height and shape of objects and features - a bit like humans see in 3D by having two images - left and right eye and looking at the objects from two angles.

Question: In July 2018, an Earth-i led consortium has received a grant from the Centre for Earth Observation Instrumentation (CEOI), funded by the UK Space Agency. What can you tell us about the technologies you plan to develop with the grant?
Richard Blain: This £2.7 million grant will enable us to implement our ACCORD product in Kenya and Rwanda, helping smallholder farmers address the challenges of climate change.

Coffee is the second most traded commodity globally and vitally important to many economies in the developing world. ACCORD was specifically developed to help smallholder coffee farmers in Africa improve crop quality and yield and drive up their incomes as a consequence. It combines satellite imagery with our partner WeatherSafe's local climate forecasting platform to provide alerts of changes in the weather that might then increase the danger of disease or pest occurring in the coffee trees. The alerts are sent directly to local agronomists and farmers via a mobile app.

This information helps farmers to identify the optimal time to apply agricultural inputs (for example, fertiliser, mulch, fungicides or pesticides) based on highly localised climate forecasts. Such timely information can make a critical difference to crop success given the

new levels of unpredictability in the local climate, and the potential impact of a range of consequences such as weather damage, pests, diseases, nutrient depletion or other factors which reduce coffee quality and quantity.

Agriculture is just one of a multitude of sectors where our imagery – and the insights drawn from those images – is improving lives on Earth.

Question: This isn't the first move Earth-i has made towards developing new technologies in partnership with other companies; there's also the project with commodities broker and research house Marex Spectron, to develop and distribute a range of unique analytical tools. What can you tell us about this project, and progress made to date?
Richard Blain: Earth-i's SAVANT is an information product for commodity traders, developed in collaboration with our partners at Marex Spectron. Very high-resolution satellite data mapping key copper mines around the world is acquired on a regular basis. Using advanced 3D modelling, volumetric analysis and mine activity monitoring, the algorithms unique to SAVANT produce regularly updated indices about the levels of production at each mine.

The results are correlated with other sources of production data to create an accurate measure of outputs and activity ahead of published production data. The goal is to provide traders with timely information and insights to inform critical trading decisions. It's a good

example of how the fusion of advanced image analytics with other data sources, can deliver new insights to help businesses improve decision-making in critical supply chains or strategic locations, anywhere on Earth.

The prototype product is live and in end-user testing phase with our partners Marex Spectron, and a group of other interested companies in the sector.

Question: Where do you think Earth-i will be this time next year?
Richard Blain: We are now in countdown to the launch of our first batch of the constellation in early 2020. In the meantime, we continue to develop our analytics and insights capabilities and services, targeting a range of different market sectors, or responding to market demand for Earth observation-based big data analytics and information solutions.

As we can literally monitor or investigate any location on Earth on a daily basis, the possibilities are limitless. The challenge is to focus our energies and development on the sectors where Earth observation-based analytics and insights can truly unlock real value for our customers. With the growing recognition of the value of insights from data from space, there is no shortage of interested parties.

We're a well-funded, capable and confident business pioneering new technologies and solutions. The future is extremely bright as we cement our position at the forefront of the commercialization of space.
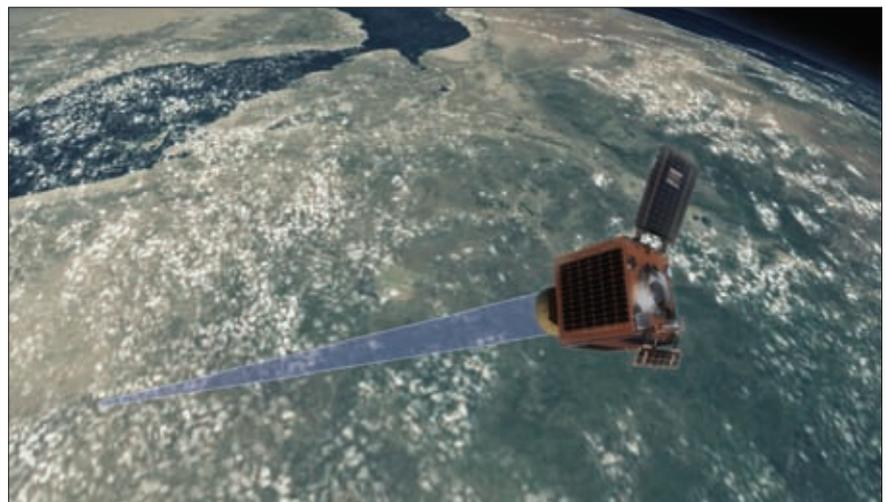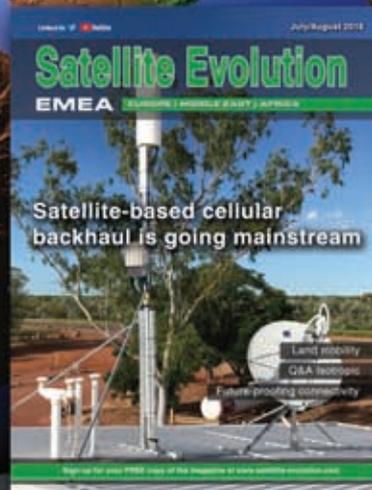

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