

Breaching the bottleneck

UK-based Orbex was founded in 2015 to develop one of the world's most advanced, low-carbon, high-performance micro-launch vehicles, in order to provide access to polar and sun-synchronous low Earth orbits (LEO) from Europe. Having already received funding from two of Europe's largest venture capital funds (Sunstone Technology Ventures and the High-Tech Gründerfonds), as well as the UK Space Agency, the European Space Agency (ESA) and the European Commission Horizon 2020 programme, Orbex is well on its way to changing the face of the launch sector. Chris Larmour, CEO at Orbex, answers questions on the latest developments in the NewSpace sector, and Orbex's place within the rapidly-changing marketplace.



Chris Larmour

Image: Orbex

Question: Orbex is a pretty new company in space sector terms; can you give us an overview of the company's foundation development, and raison d'être?

Chris Larmour: Orbex is a private European spaceflight company headquartered in the UK, with subsidiaries and production facilities in the UK, Denmark and Germany. We founded the company in 2015 with the objective of developing orbital launch vehicles to launch small satellites into low Earth orbit (LEO). We are one of the few private spaceflight companies to have staff with credible, practical experience in the development of micro-launch vehicles and rocket engines.

We have people with very strong spaceflight backgrounds, including NASA, ESA, Ariane 5 and Ariane 6, as well as a group who have built five suborbital rockets. We also are fortunate to have the former Director General of the European Space Agency on our Advisory Board, plus a wealth of other experience and skills within the business.

Prior to 2018, we deliberately kept quiet about our work so that we could focus on delivering tangible progress, only sharing our development with a select group of people. In the Summer of 2018, we announced at Farnborough that we had been selected by the UK Space Agency to launch orbital vehicles from the newly-announced UK Vertical Launch spaceport in Sutherland in the Scottish Highlands, as part of the main consortium. And alongside that, we announced the results of our first major funding round.

Since Farnborough, we have been surprised by the enormous interest that has been sparked. We are in a unique position because we will have a European launcher launching into orbit from a site in continental Europe, and that's a first.

Question: Let's talk about your launch vehicle plans. What's the overall vision, and what can you tell us

about the design and technology, and progress to date?

Chris Larmour: We are working towards a launch in 2021, however this industry is notorious for getting the timings wrong, so we treat that date with caution. The 2021 timeframe is for the launch in Sutherland, but we are also working with other launch sites in Europe.

With our orbital launch vehicle, Prime, we went back to the drawing board to address a key problem with micro launchers. Micro launchers have always suffered from a fundamental mass challenge. There's a square-cube law that applies to rockets, which says that the bigger you get, the more efficient they become volumetrically, because, very simply, you get more volume enclosed by the metal or carbon fibre on the outside. Conversely, the smaller the vehicle, the heavier and less efficient the vehicle becomes comparatively.

We thought about how to solve this problem by re-architecting the vehicle and decided to use propane as the fuel. Propane has some unique properties that allow us to build a vehicle that is about 30 percent lower mass than anyone else in this category, which makes Orbex less costly while offering higher performance. We're also able to use bio-propane, which is chemically equivalent, but is also a clean, renewable fuel that helps makes our Prime launchers up to 30 percent lighter and 20 percent more efficient than any other vehicle in the small launcher category, packing more power per cubic litre than many heavy launchers. It also cuts carbon emissions by 90 percent compared to old-fashioned hydrocarbon fuels.

Another problem we tried to solve is that people are rightly worried about the orbital debris or space junk. We certainly didn't want our launcher to be dropping litter in space. So, we deliberately set out to architect the vehicle so it would not leave any debris on orbit. We deliberately designed features into the Stage 2 to de-orbit very rapidly, so it burns up on re-entry. We created

a new zero-shock staging system, which leaves zero orbital debris. It also features a novel reusability concept, with a new low mass recovery and re-flight system, which is now patent-pending.

From the outside, it may look like a normal rocket, but on the inside, there is a lot of innovation in areas that are subtle but add a lot of value in the ability for the rocket to lift at the right performance level.

Question: The UK is a booming region as far as the space sector goes, with great plans for the NewSpace era of the future. What's your assessment of the potential, and Orbex's place within it?

Chris Larmour: The space sector in the UK is a hidden jewel, it's worth £14-16 billion today. The UK is very strong in other parts of the value chain, but does not have a launch capability. This is the gap in the supply chain that our solution will close. Our vision is to help create an end-to-end solution where the UK builds satellites, builds rockets and launches them from the UK, creating a complete joined-up value chain. This will become a virtuous circle, a complete ecosystem which will bring technology and business benefits not just to the UK, but to the whole European satellite industry. We see Orbex as being a central, enabling player in making this happen.

Question: In July 2018, Orbex secured UK£30 million in public and private funding for the development of orbital space launch systems. What can you tell us about this achievement, and how will the funds help Orbex move forward?

Chris Larmour: Yes, we secured £30 million (\$40 million) as a mix of public and private funding for the continued development of our orbital launch systems. This came from two of Europe's largest venture capital funds

(Sunstone Technology Ventures and High-Tech Gründerfonds) as well as private investors, the UK Space Agency, the European Space Agency and the European Commission Horizon 2020 programme, as well as a strategic investment from Elecnor Deimos. The fact that we were able to attract this degree of support from experienced partners across the industry is a validation of the uniqueness of the vision, the sophistication of the rocket design and the potential for the business. Externally, being a well-funded company in this sector has benefits too, as people recognise that you're a serious player.

Question: In the same month, Elecnor Deimos acquired a stake in Orbex and made the company its preferred supplier of all launch services required to place Elecnor Deimos satellites into orbit. Can you give us a little more detail of the deal, and Elecnor Deimos' plans for the satellite sector?

Chris Larmour: Under the terms of the agreement, Orbex will become the preferred supplier of all launch services required to place Elecnor Deimos satellites into orbit. So far, we are planning 20 launches for the company, which is a very significant volume for a micro launcher.

The other side of the deal is that Elecnor Deimos became the preferred supplier of various critical launch systems required to develop and operate the Orbex launcher system, including the Guidance, Navigation and Control (GNC) system.

The partnership with Elecnor Deimos is significant for us on a number of levels as it demonstrates that as well as technological maturity, we have achieved a milestone in business maturity to become the preferred launch partner for an organisation as significant as Elecnor



Deimos. It also helps us maintain our accelerated pace of development, as we are able to incorporate tried-and-tested critical launch systems from Elecnor Deimos ranging from navigation to ground and mission control systems.

I can't speak on behalf of Elecnor Deimos but their CEO, Miguel Belló Mora was publicly quoted as saying: "The huge potential of Orbex quickly became clear to Elecnor Deimos, which is why we became both an investor in the company as well as a strategic partner. By using a number of our advanced navigation and mission support systems, Orbex is leaping ahead in its ability to safely and efficiently execute small satellite launches in the near future. This in turn helps Elecnor Deimos as it gives us access to innovative and efficient launch vehicles, which will be launching from several sites within Europe."

Question: We hear that Orbex is also building a launch vehicle factory and Spaceflight Mission Control facility in Scotland. Can you provide an outline of your plans?

Chris Larmour: We have already purchased a second production facility close to the launch site, the first one being our existing 2000m² factory. The second site will become our main production and integration facility for final assembly. We needed a site which addressed two key elements.

Firstly, it needed to be relatively close to the launch site in Sutherland. Secondly, it needed to have reliable infrastructure fundamentals like good road access as well as proximity to airports and engineering talent.

We think we've got the right balance with the site we've acquired, and we'll be unveiling more about that

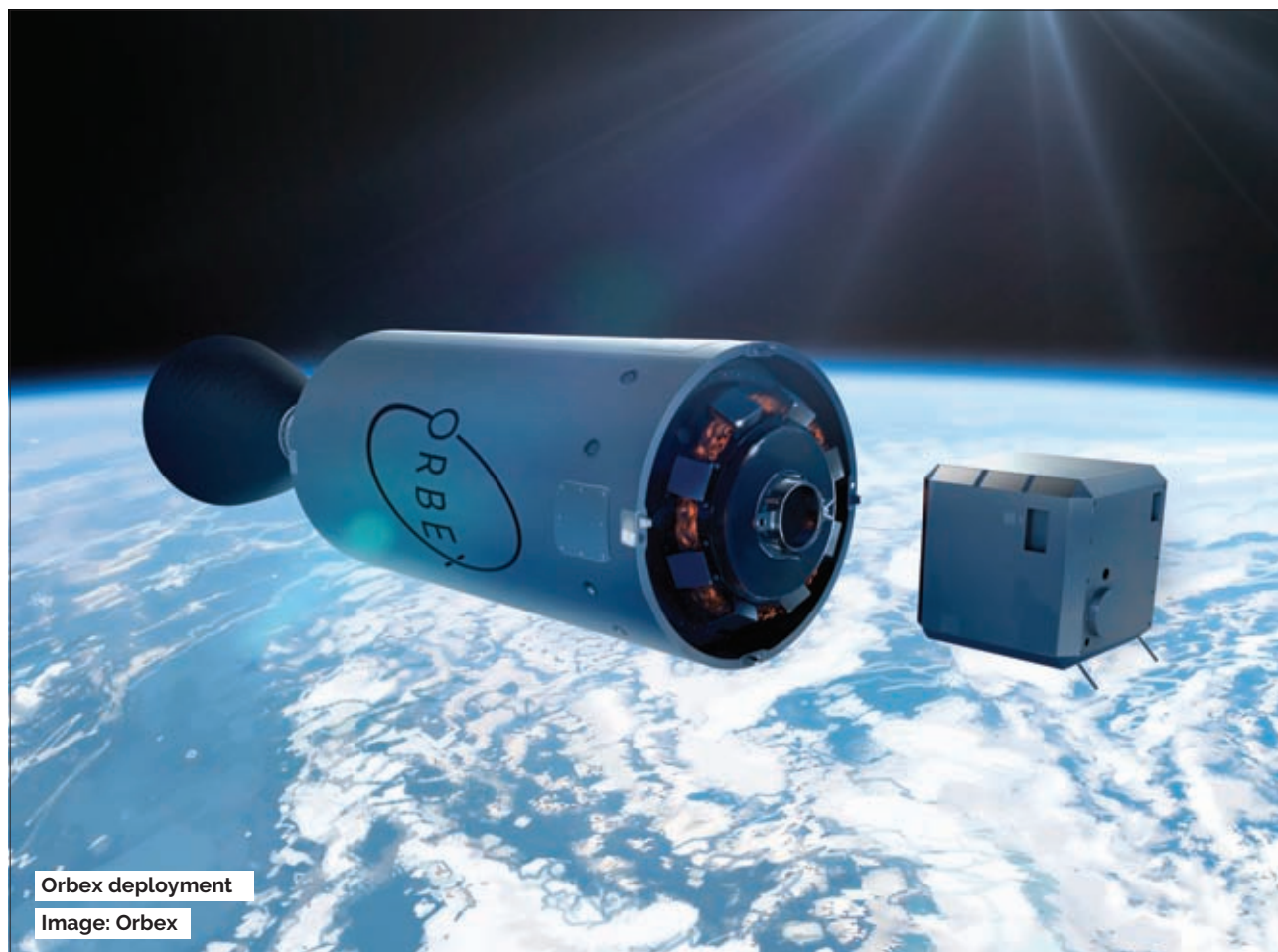
new facility quite soon.

Question: What are your expectations for the rest of 2019 and beyond?

Chris Larmour: The big picture is that the smallsat launch market is projected to grow strongly to around US\$60 billion between 2018-2030, with a strong shift towards more international satellite operators. Each satellite has a life expectancy of 3-5 years, creating a strong ongoing demand for upgrade and replenishment, and an ongoing need for our services.

For Orbex, 2019 is going to be another interesting year. There is a lot on the horizon, most of which I can't divulge at the moment. But you can expect to see more evidence of technology innovation and maturity, as well as major news regarding our progress as a business. From here, step by step, we will be doing everything we can to become the natural choice for companies looking to launch small satellites in Europe.

There is a quiet revolution taking place, thanks to small satellites. Smallsats are now able to perform a huge range of tasks at very low cost, making them a smart choice for satellite operators both commercially and logistically, and you can see that many satellite firms are looking closely at this new opportunity. But there is currently a huge bottleneck in getting smallsats delivered into orbit, which means that satellite operators face quite severe financial challenges. With Orbex, international smallsat operators will have access to a new class of launch service which was designed exclusively to serve their needs. We intend to relieve that smallsat bottleneck so that satellite operators have a reliable, long-term solution for orbital access. ■



Orbex deployment

Image: Orbex