

The Emirati space programme will no doubt occupy global headlines later this year, when it launches its Mars probe, Hope. The initiative's ultimate goal is not so much the exploration of the Red Planet as the development of a diversified, knowledge- and innovation-based economy back home on Earth. By developing its space sector, the UAE aims to leverage a recent convergence between greater demand for space-based technologies and a dramatic fall in the price – and size – of satellites. But the industry is not without its challenges: its ability to act as a multiplier for domestic development in emerging economies is unproven, and concerns mount over the environmental impact of nano-satellites.

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When the Emirates' first astronaut, Hazza Ali Almansoori, returned to Earth last October after a successful eight-day mission on the International Space Station, he found a country firmly in the grip of space fever. Indeed, within the first few hours of applications opening for a second UAE astronaut, 1,000 Emiratis had applied.

But while the subject is inspiring enthusiastic discussions throughout the country, interest is just as driven by hard-headed economics as by glamour. With the country set on diversifying its economy via its Vision 2030 programme – and seeing [knowledge and innovation](#) as key routes to doing this – a successful space industry promises a range of knock-on effects, in sectors ranging from education to engineering.

At the same time, the UAE is seeking to gain a slice of a growing global space sector.

The Space Foundation, a non-profit space sector advocacy group, estimates that governments and companies worldwide spent a total of \$414.75bn on satellite-based entertainment, weather forecasting and other services in 2018 alone.<sup>[1]</sup> Meanwhile, Morgan Stanley estimates revenue from the global space sector could amount to \$1trn by 2040.<sup>[2]</sup>

Policies aimed at establishing the UAE as both the leading Arab nation in space and as a go-to destination for international private sector space investors are thus key parts of the country's recently released National Space Strategy 2030. This includes goals ranging from the creation of a legal framework for asteroid mining to incentivising partnerships with international outfits like Virgin

Galactic.

## Cosmic thinking

Since the UAE began its venture into space more than a decade ago – its first satellite was launched in 2009 – the space programme has accelerated and become more integrated. Dubai began it all, setting up the Emirates Institution for Advanced Science and Technology (EIAST) in 2006. With help from South Korea’s Satrec Initiative, EIAST put together the 200-kg DubaiSat-1 satellite, launched on a South Korean rocket in 2009.

Then, in 2011 the Franco-Italian Thales Alenia Space and Airbus-parented EADS Astrium worked with the Al Yah Satellite Communications Company (YahSat) and its lab at Abu Dhabi’s Khalifa University, to launch YahSat-1 on a France-based multinational Arianespace rocket. Now, YahSat has five satellites in orbit, while EIAST’s DubaiSat-1 was joined by DubaiSat-2 in 2013, Nayif-1 in 2017 and KhalifaSat in 2018. The sector has also expanded at an R&D level: the National Space Science and Technology Centre (NSSTC) was set up in Al Ain in 2016, followed by the YahSat Space Laboratory in 2017, while EIAST has evolved into the Mohammed bin Rashid Space Centre. Space science masters’ degree programmes have also begun at Khalifa University, UAE University, the American University of Sharjah and New York University Abu Dhabi.

Administratively, all these initiatives have also been coordinated by the UAE Space Agency (UAESA), set up in Abu Dhabi in 2014, with this responsible for the National Space Strategy. The space programme also benefits from some strong links with established space agencies, such as NASA, the UK Space Agency and the National Centre for Space Studies in France. Global high-tech aerospace manufacturers, such as Boeing and Northrop Grumman, have also partnered on space projects with UAESA.

## Lifting off

Each new satellite launch has benefitted from two major trends in the global space sector: shrinking sizes, which lead to falling costs, and a huge growth in demand for satellite-based ICT services. Digitisation and miniaturisation have sparked the development of smaller, lighter “CubeSat” or “nanosat” satellites, such as the Nayif-1, which do not require heavy-lift rockets to launch. The cost of

building and placing a nanosat in orbit averages around €500,000, while a conventional satellite might cost up to €500m.[3] Cubesats and nonsats are also capable of being combined into clusters. These small devices have enabled many non-traditional countries to join the space race. Indeed, some 13 nations have launched their own space agencies in just the last decade.[4]

The proliferation of nano-satellites has not been without its critics. Elon Musk's SpaceX now plans to launch some 12,000 StarLink, broadband internet mini-satellites by the mid-2020s.[5] This has led to complaints from astronomers, worried about the impact of so many objects on the observable night sky.[6]

There are also concerns over the proliferation of space junk. Many nano-satellites - including the UAE's - are in deteriorating low Earth orbits, and thus will burn up in the atmosphere after a few years. But it may well be that future satellite launches will have to incorporate some system to help pay for their future removal. However, such laws have yet to be written, let alone internationally agreed and enforced.

## Realising the benefits

The UAE's strategy is not just about launching its own space agency, but a whole space industry. This ambition derives from the evidence that space programmes in developed markets are widely recognised as adding value to a range of sectors. This includes upstream developments, like satellite and space exploration, to downstream advancements in engineering and medicine, which can use the R&D from upstream for their own advancement.

A joint European Commission-PwC study in 2016, for example, concluded that the €7.4bn invested by the European Space Agency (ESA) in its Copernicus Earth observation satellite programme would result in a cumulative economic value of €13.5bn in 2008-20.[7] Yet space programmes in emerging markets are still very new, and so the jury is still out on what their economic benefit might be. European countries, for example, have existing aerospace industries and high-tech, high-value-added manufacturers already in place to take on-board any downstream spin-offs from ESA programmes. In the UAE, graduates in - and ideas from - space engineering have far more limited local options.

Nonetheless, these are early days. Meanwhile, one way the industry can benefit the country is by attracting foreign space companies - and investment and knowledge - a goal included in the national

space strategy.

A recent example of this is Virgin Galactic, which signed a memorandum of understanding with the UAESA and Virgin's The Spaceship Company in March 2019 to explore the operation of a space tourism business from Al Ain. The city not only has the NSSTC, but also an under-used 4,000-metre runway at its international airport, which Virgin Galactica may use as the departure point for space tourists. This will require the establishment of a local spaceship maintenance, repair and overhaul business and a micro-gravity research centre nearby.

In addition, the UAE recently announced that it is developing a law on asteroid mining, under which space mining companies would retain full ownership of the resources – such as minerals and rare earths – they recovered.[8] Indeed, one of the strategy's main goals is ensuring “a supporting legislative framework and infrastructure to match future developments in the sector,” with more legislation therefore likely. Providing these physical and legal platforms for business is likely to attract companies to the UAE as its budding space sector clears their path to take-off.

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