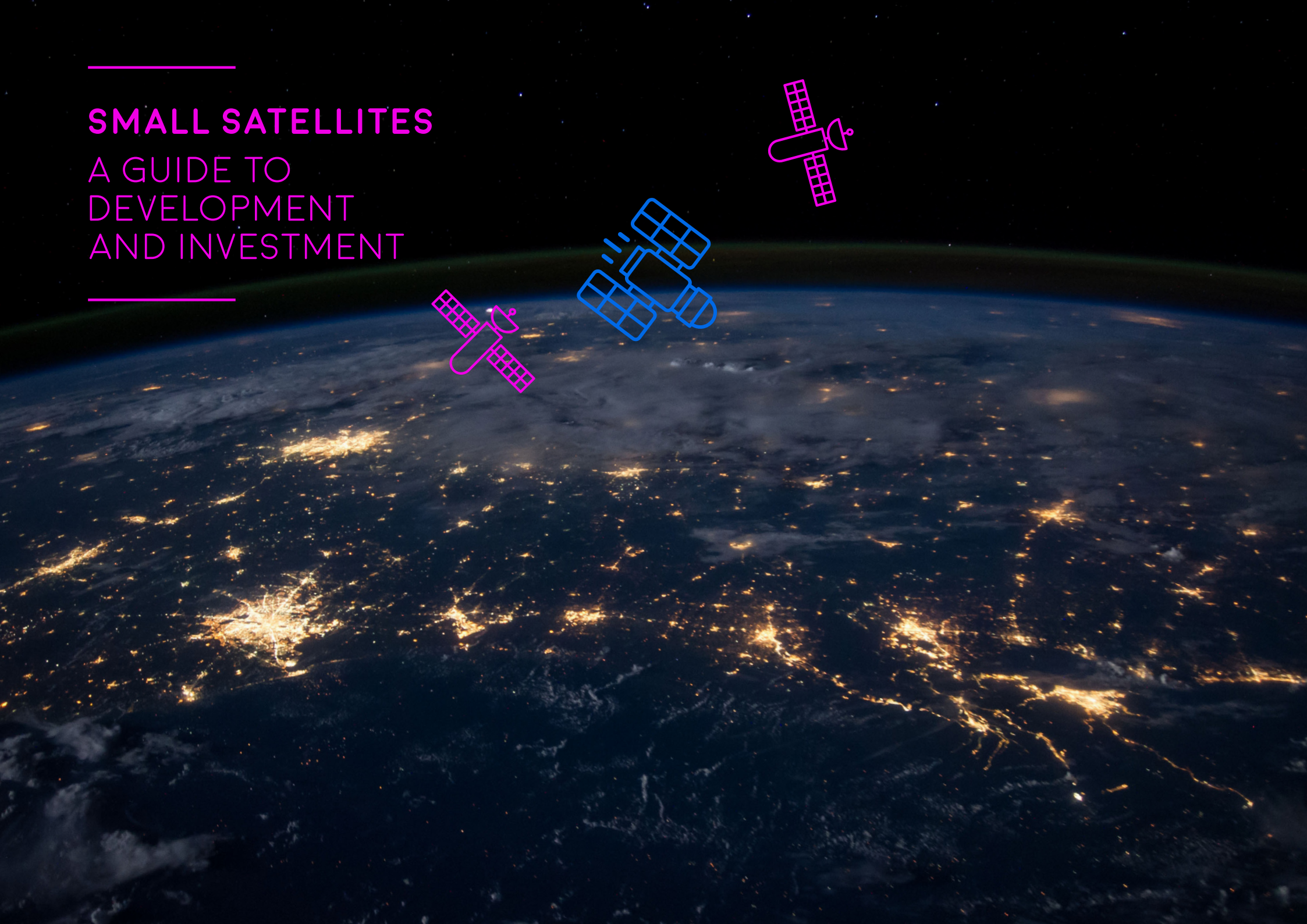
SMALL SATELLITES

A GUIDE TO DEVELOPMENT AND INVESTMENT



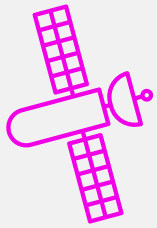
Global investment in the small satellite (smallsat) market has boomed over the last five years, with 2017 seeing the launch of more than 300 nanosatellites, a year-on-year increase of 205%.[1] While the launching of small satellites has traditionally been linked with military or civil missions, 50% of those launched since 2013 have been for distinctly commercial purposes, a proportion that is expected to grow to 75% by 2022.[2]

The main reason for this growing interest in the global smallsat market is the increasing scale of business opportunities created by the affordability and scalability of smallsat technologies. Huge multinational companies, such as Google, Facebook and Amazon are already exploring the commercial utility of smallsat investment, forging the path for a growth industry which will quickly draw in other players of varying sizes and backgrounds.[3]

[1] Alen, How to Do Business in Space, 05/10/2018

[2] ibid

[3] IEEE Xplore, Modern Small Satellites: Changing the Economics of Space, 3/03/2018



THE DEVELOPMENT OF THE CUBESAT

First proposed in the 1990s, the basic CubeSat design is a 10-centimetre (4-inch) cube with a mass of less than 1.33 kilograms. These miniaturised satellites have several significant advantages over traditional satellite technology. [4] Firstly, because of their much smaller size, the fuel cost of launching them into space is significantly reduced. Furthermore, because they take up comparatively little space they can also be launched in clusters or piggybacked on the launch of larger satellites.

Take the first CubeSat launch as a demonstrative example of its commercial viability. Russia's Plesetsk launch site saw six smallsats launched into orbit for the cost of just $40,000. By comparison, the development and launch of just one standard satellite can cost anywhere between $10 million and $400 million, depending on the vehicle used. [5]

THE OTHER MAIN BENEFIT OF CUBESATS IS THAT THEY USE ALREADY COMMERCIALISED TECHNOLOGIES. SAVING THE USER FROM HAVING TO DEVELOP THEIR OWN.

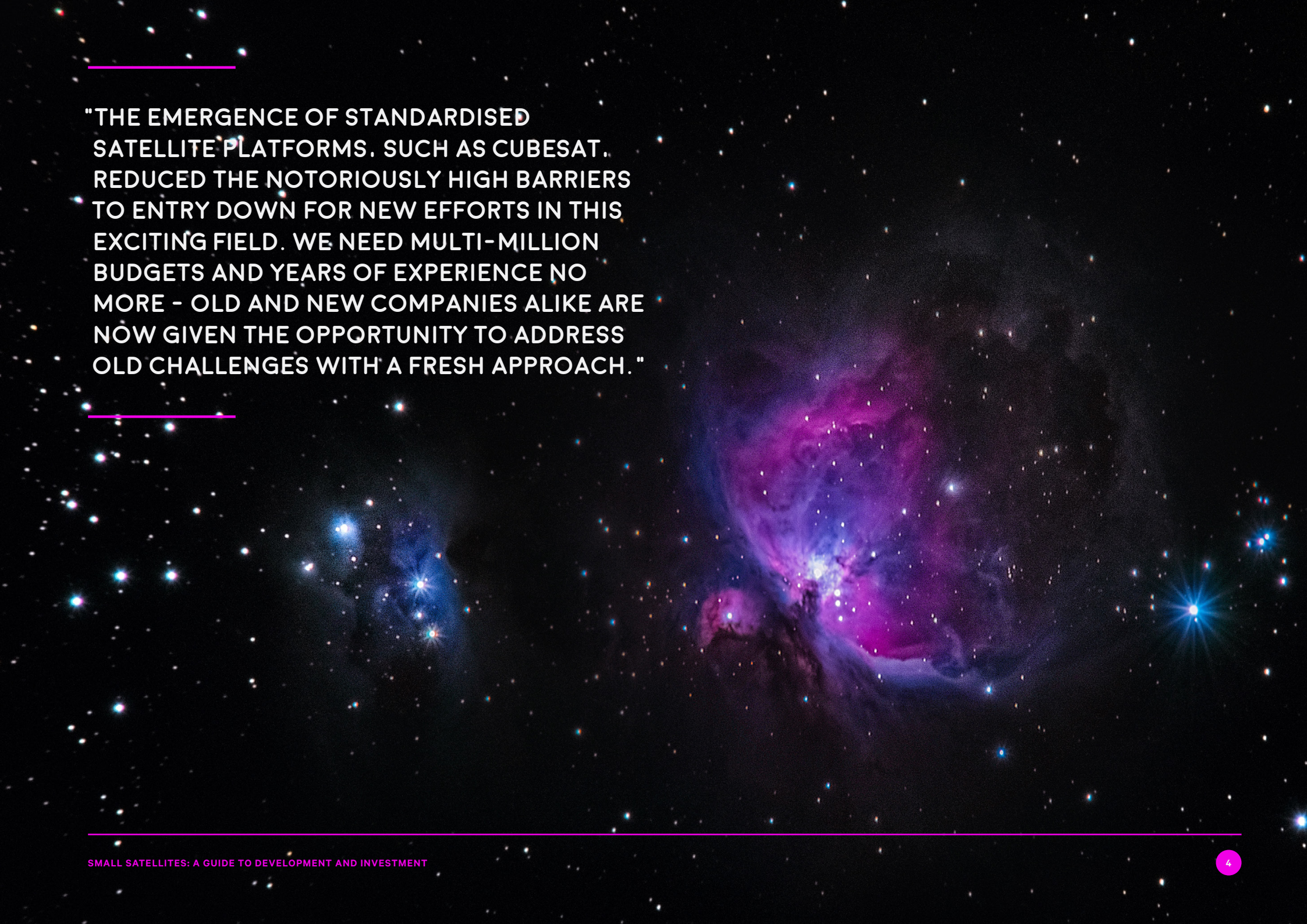
They utilise off-the-shelf circuitry in the familiar form of microprocessors and modem ports coupled with microchip sets from mobile phones, standard Global Positioning System (GPS) units and widely available digital cameras. [6] This has resulted in companies like Berlin Space Technologies and OneWeb being able to provide CubeSat models for between $250,00 to $500,000, a far more cost-effective proposition than the tens of millions of dollars usually associated with satellite development.

In the words of Simon Gwozd, CEO of Equatorial Space Industries, a Singaporean company specialising in smallsat launches: “The emergence of standardised satellite platforms, such as CubeSat, reduced the notoriously high barriers to entry down for new efforts in this exciting field. We need multi-million budgets and years of experience no more - old and new companies alike are now given the opportunity to address old challenges with a fresh approach.”

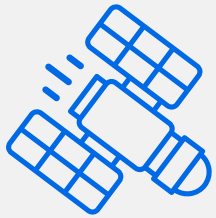
[4] Space, CubeSats: Tiny Payloads, Huge Benefits for Space Research, 19/06/2018

[5] Globalcom, The cost of Building and Launching a Satellite, 05/10/2018

[6] Space, CubeSats: Tiny Payloads, Huge Benefits for Space Research, 19/06/2018



"THE EMERGENCE OF STANDARDISED SATELLITE PLATFORMS, SUCH AS CUBESAT, REDUCED THE NOTORIOUSLY HIGH BARRIERS TO ENTRY DOWN FOR NEW EFFORTS IN THIS EXCITING FIELD. WE NEED MULTI-MILLION BUDGETS AND YEARS OF EXPERIENCE NO MORE - OLD AND NEW COMPANIES ALIKE ARE NOW GIVEN THE OPPORTUNITY TO ADDRESS OLD CHALLENGES WITH A FRESH APPROACH."



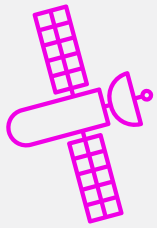
SMALLSATS AND 'NEW SPACE'

New Space is a term often used to refer to the renewed interest in the commercialisation of space seen since the early 2000s. Traditional space exploration, or Old Space, was largely dominated by government and the military, with the stated aims of discovery, exploration, science and security. By comparison, New Space investors and developers seek to use disruptive technologies, such as smallsats, to lower the cost of participation in the space industry and promote a vibrant space economy with heavy investment from the private sector.[7]

Gwozd continues:

"SMALLSATS ARE DISPLACING BOTH GROUND-BASED SYSTEMS. AND TRADITIONAL SATELLITES IN THE WAY WE COLLECT AND TRANSFER DATA. THE TECTONIC SHIFTS APPROACHING OUR TELECOMMUNICATIONS AND EARTH IMAGING SECTORS WILL DRIVE BILLIONS OF DOLLARS OF REVENUES INTO THE INDUSTRY VERTICALS RANGING FROM LAUNCHING TO DATA PROCESSING. THE NEW SPACE RACE IS ON!"

[7] Wanderingalpha, New Space and Old Space,05/10/2017



FUNDING. INVESTMENT AND OPPORTUNITY

The largest driver, and the area of most significant opportunity, in the smallsat market is the provision of Low Earth Orbit (LEO) services, such as imaging or connectivity. Smallsat clusters are capable of providing cost-effective, high-capacity, low-latency broadband services worldwide.

Thanks to the growing scale and prominence of bandwidth-intensive industries such as autonomous vehicles, smart cities and the Internet of Things (IoT), the demand for high-speed internet connectivity is expected to grow at a compound annual growth rate of 29%. This is especially true of regions that traditionally lack high-quality broadband, such as rural parts of the US and high-latitude regions such as Norway, Alaska and Russia.[8]

Some recent smallsat industry developments:

- Sky and Space Global (SAS) is aiming to provide low-cost, space-based mobile phone services by launching a constellation of 200 shoebox-sized satellites weighing just 10kg each. The total constellation cost was just $150m and when it goes live in 2020, SAS will offer competitively priced text, voice and data transfer services to a market of up to three billion people across the Earth's equatorial regions.[9]

- Smallsat developer GomSpace recently announced a $1.6 million deal with the Spanish data company Aistech for the assembly and launch of 10 small satellites. This deal is part of a larger effort by Aistech to launch a smallsat constellation of over 300 satellites to provide global air traffic and internet-of-things services for asset tracking and monitoring.[10] Because of the reduced development timeframe and lower costs of smallsat usage, Aistech expects to have the constellation in service by 2022.

[8] IDA, Global Trends in Small Satellites, 01/07/2017

[9] BBC, The low-cost mini satellites bringing mobile to the world, 23/02/2018

[10] Spacenews, Surge of new space companies has impressed even veteran industry observers, 07/03/2018

FUNDING. INVESTMENT AND OPPORTUNITY (CONTINUED)

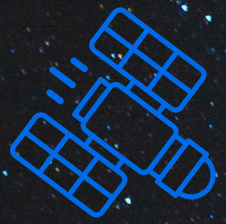
- Satellite imagery from smallsats is another growth market, with its revenue increasing by 49% annually and predicted revenues of up to $8.8 billion by 2030. Market recognition of the importance of smallsat imagery can be seen in the recent acquisition of Skybox Imaging by Google for an estimated $500 million.[11]

- The growth in demand for both smallsat-based broadband and imaging has resulted in a flood on investment from the private sector with an estimated $1–2 billion a year in early-stage investment from venture capital (VC) firms and angel investors.[12] Outside the private sector, more than 80 countries are expected to invest up to $80 billion annually in space technologies and capabilities over the next decade, making the overall investment landscape extremely promising.[13]

[11] ibid

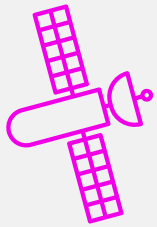
[12] ibid

[13] IDA, Global Trends in Small Satellites, 01/07/2017



A NEW SPACE AGE

Recent steps forward in satellite miniaturisation and cost-effective construction have led to a dramatic increase in both the investment in and commercial use of smallsats constellations. With a rising global demand for low-cost high-coverage broadband and satellite imagery, smallsat investors and developers are poised to take advantage of the lucrative market opportunities offered by this disruptive technology.



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https://spacenews.com/surge-of-new-space-companies-has-impressed-even-veteran-industry-observers/

The small satellites segment of the space industry has witnessed tremendous growth rates in recent years. With faster deployment times and reduced investments costs, small satellites are increasingly gaining an edge over large satellites for applications that do not require high-end satellite capabilities such as big data monetisation, earth imaging and asset tracking. Join us at our inaugural Smallsat Development and Commercialisation Asia Summit 2018 this December as we bring you an A-Z guide on ensuring smallsat project success covering the key aspects of making a business case, securing funding, feasible commercial applications, critical launch infrastructure, operating models and many more.

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