

# Upstream Space: A Galaxy of Capability

A Science and Innovation Audit Report sponsored by the Department  
for Business, Energy & Industrial Strategy

## **Annex C: Full Analysis of Small Satellite Markets:**

**Minisatellites**  
**Microsatellites**  
**Nanosatellites**  
**Picosatellites & Femtosatellites**

## **Small Satellites**

Small satellites are classified as possessing below 500kg of wet mass. Within this mass range, there are three distinct subcategories, each with their own unique characteristics, advantages and applications.

**Minisatellites: 100kg – 500kg**

**Microsatellites: 10kg – 100kg**

**Nanosatellites: 1kg – 10kg**

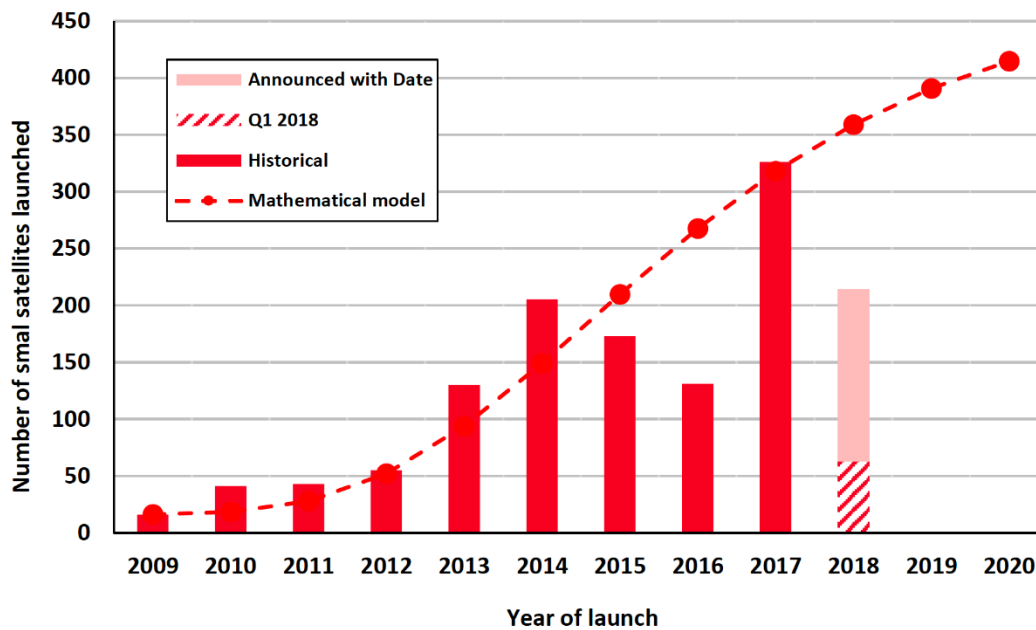
There are two further categories, *Picosatellites* (0.1kg – 1kg) and *Femtosatellites* (10g – 100g). The markets for these types of satellites are small and still rather embryonic, but we do give some consideration to them below, as there are signs that it may become another growth market.

The small satellite market continues to grow healthily. Presently, small satellites are used for a variety of applications: weather monitoring, surveillance, EO, navigation, communication, meteorology, and more.

In the future, small satellites look to be the preferred vehicle of choice for nations seeking to develop their own Global Navigation Satellite System (GNSS), and offer new telecommunications services, such as connection to the Internet of Things. The built-in redundancy of constellations also makes them an attractive proposition for operators.

In Q1 of 2018, 63 satellites were launched, which is more than the whole of 2012, and while the actual (projected) figure in 2018 lies below the growth curve formulated by the mathematical model, announcements of further launches and confirmations of uncertain launches and manifests will take the 2018 total above the current projection.

Table 1: Small Satellites launched, historical and projected.<sup>1</sup>



The growth shows no sign of stopping. Over the next ten years, 3,600 small satellites are expected to be launched<sup>2</sup> by a variety of different countries. In terms of value, the global small satellite market accounted for \$2.53billion in 2016 and is projected to reach \$10.1billion by 2021, at a CAGR of 31.9%.<sup>3</sup>

With respect to the subsectors of the small satellite market, the payloads market represents the greatest value and potential for growth. In 2016 the payloads subsystems market was valued at \$615.9million, and is expected to grow at the highest CAGR of all subsystem markets, to wit 34.6% between the years 2017-2021, which will result in it having a 27% share of the entire market. The second highest contributor to the small satellite market will be the On-Board Computer (OBC) market. The UK possesses world-leading players in both of these subsystem markets, as well as the other subsystem markets of propulsion, structures, attitude control systems, ground segmentation, and power.

There is also evidence that some large geostationary satellite manufacturers are looking to enter the small satellite market. **Airbus DS** are partnering with UK-US startup **OneWeb** with the aim of launching 900 micro-satellites into orbit to provide global broadband internet coverage, for even the most remote and poverty-stricken regions of the globe, which looks to be a shrewd strategic decision, given the potential slowdown in the geostationary satcomms market.

<sup>1</sup> Table courtesy of Satellite Applications Catapult, Small Satellite Market Intelligence, Q1 2018.

<sup>2</sup> Source: *Global Small Satellites Market Analysis and Forecast*, 2017, BIS Research

<sup>3</sup> Source: *Global Small Satellites Market Analysis and Forecast*, 2017, BIS Research

Table 2: Projected value of small satellite subsystem markets in \$millions<sup>4</sup>

By Subsystem	2016	2017	2018	2019	2020	2021	CAGR % (2016-2021)
Payload	615.9	617.1	1,528.0	1,881.9	2,239.3	2,725.7	34.6
Structure	230.1	228.9	563.8	691.8	821.3	998.8	34.1
Telecommunication	251.3	246.2	597.1	721.4	843.4	1,009.9	32.1
On-Board Computer	515.7	503.2	1,215.3	1,462.2	1,702.2	2,029.9	31.5
Power System	336.2	320.7	757.2	890.6	1,013.6	1,181.6	28.6
Attitude Control System	290.7	287.0	701.0	853.2	1,004.7	1,211.9	33.0
Propulsion System	288.2	270.9	630.3	730.6	819.3	941.2	26.7
Total	2,528.1	2,474.1	5,992.6	7,231.7	8,443.8	10,098.8	31.9

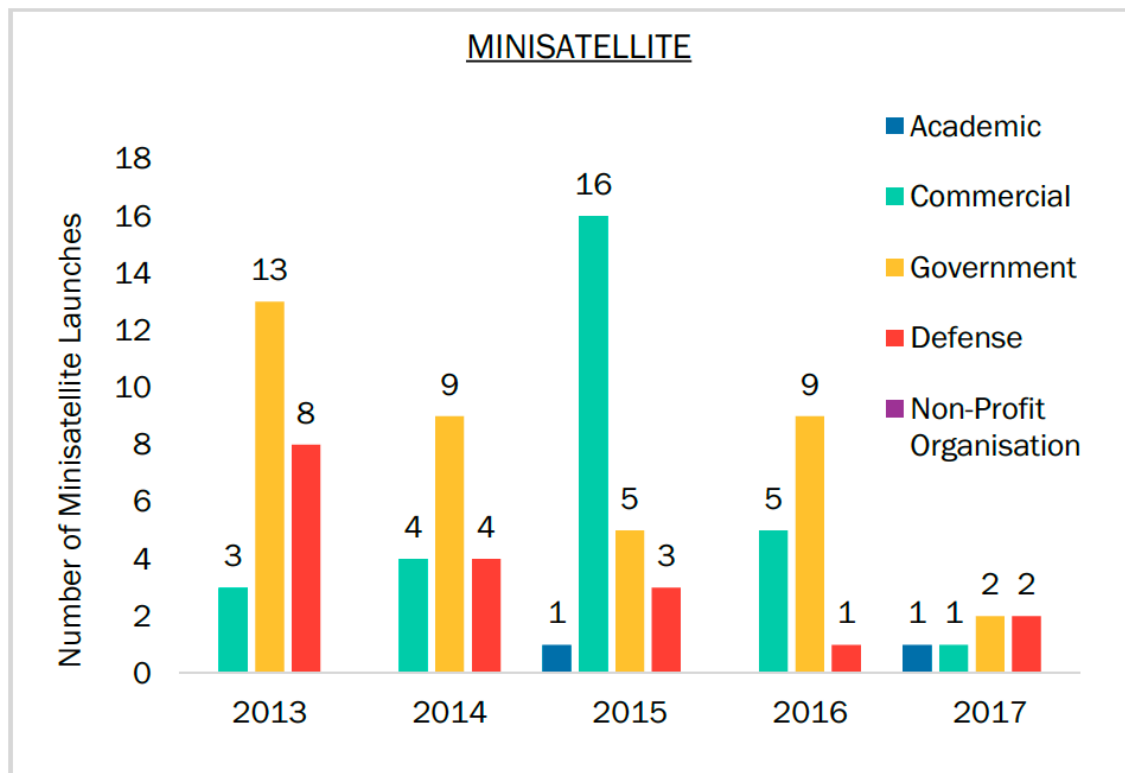
## Minisatellites

Minisatellites constituted 55.5% of the overall global small satellite market share, which translates as \$1.4billion, in 2016, as they have high manufacturing costs compared with micro and nanosatellites.

Minisatellites remain popular among public sector and Government agencies, with ROSCOSMOS, the **Italian Defense Ministry**, **Israel Aerospace Industries Ltd**, the **National Space Organization (NSPO)**, and the **United States Air Force (USAF)** among others, launching minisatellites in 2017 for various applications.

<sup>4</sup> Source: *Global Small Satellites Market Analysis and Forecast*, 2017, BIS Research

Table 3: Minisatellite market trends 2013 - 2017

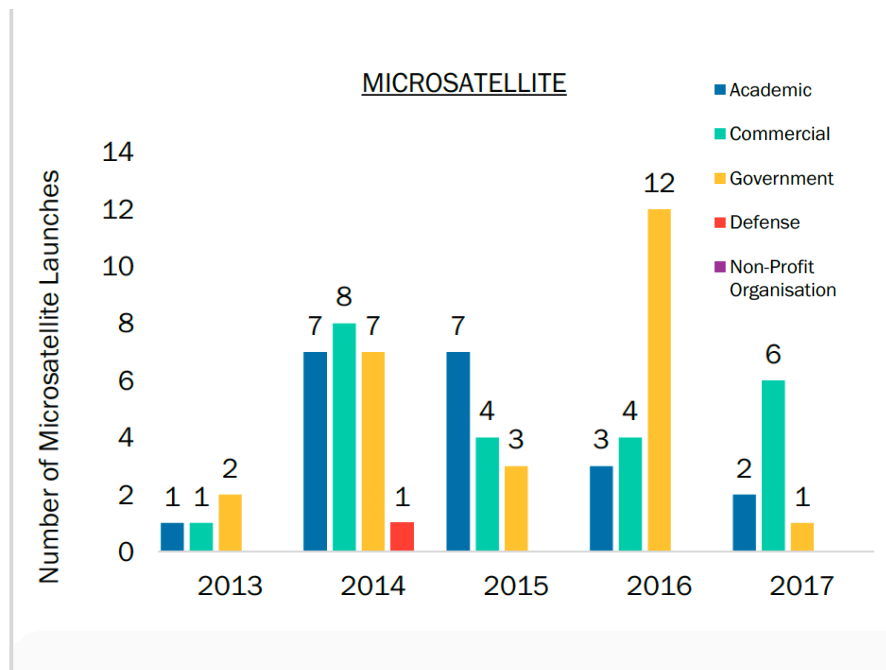


### Microsatellites

Microsatellites possess a wet (including fuel) mass range of 10kg – 100kg. The following figure shows the market values and CAGR of the microsatellite market. The microsatellite market was valued at \$992.5 million in 2016 and is expected to reach \$4,984.8 million in 2021 at a CAGR of 38.1% during the period, 2016-2021. The market value dropped in 2017, as the number of nanosatellite launches increased, in line with the growth trend of that market.

Microsatellites offer a compromise between the constellation-oriented nanosatellites, and standalone platforms offered by minisatellites and larger platforms. Microsatellites offer sufficient flexibility to be used alone or in distributed systems, for remote sensing, telecommunication, and space science.

Table 4: Microsatellite trends 2013 - 2017



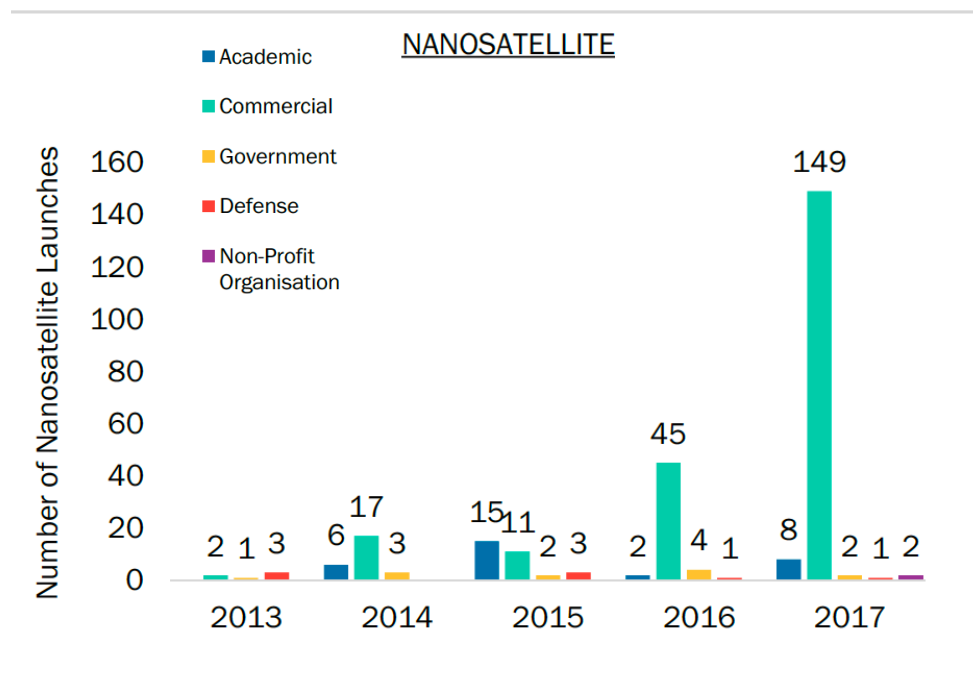
### Nano Satellites

Nano-satellites in particular are conducive to supporting the creation of services providing near-real-time information, which is more closely aligned with commercial operational needs in a variety of sectors. Because of their small mass and low-costs associated with launch and manufacture, it's no surprise that in the years from 2010 to 2017, nanosatellites have dominated the small satellite market. In that period, nanosatellites represent 70.31% of all small satellites launched.

Furthermore, the nanosatellite market looks set to witness the highest growth rate of all. In 2016 the nanosatellite market was valued at \$127.2million, and this is set to grow to \$768.6million in 2021. This growth of 43.3% CAGR, means that nanosatellites would take a 7.6% share of the global market by this time.

The reasons for this huge growth is that nanosatellites give companies a much easier, lower cost ability to access space. Companies can 3D-print certain components, and there is the increasing capability of miniature electronic technology, which has coincided with – and contributed towards – the growing demand for constellation-based services. Nanosatellites will make the sector more affordable for new entrants into the sector, both upstream and downstream, and so represents a huge opportunity for both investors and developers.

Table 5: Nanosatellite trends 2013 - 2017



However, there have been several 'blockers' associated with this trend, including:

- Regulations
- Business models for provision of downlink services for Earth Observation satellites
- Time taken to task satellites using conventional operational concepts

This means that although the UK has innovative satellite manufacturers able to deliver small satellites at very low cost, it is lagging behind the rest of the world in responding to the opportunities offered by nano-satellites. Consequently, using these satellite constellations to provide professional commercial operational services is still generally too costly.<sup>5</sup>

### Picosatellites and Femtosatellites

The very low-cost picosatellites (0.1kg – 1kg in wet mass) are a growing source of benefit to academics and conductors of scientific and space exploration research. The picosatellite in 2016 was estimated to be \$4.2million, but is expected to reach \$19.9million by 2021, at a CAGR of 36.5%.<sup>6</sup>

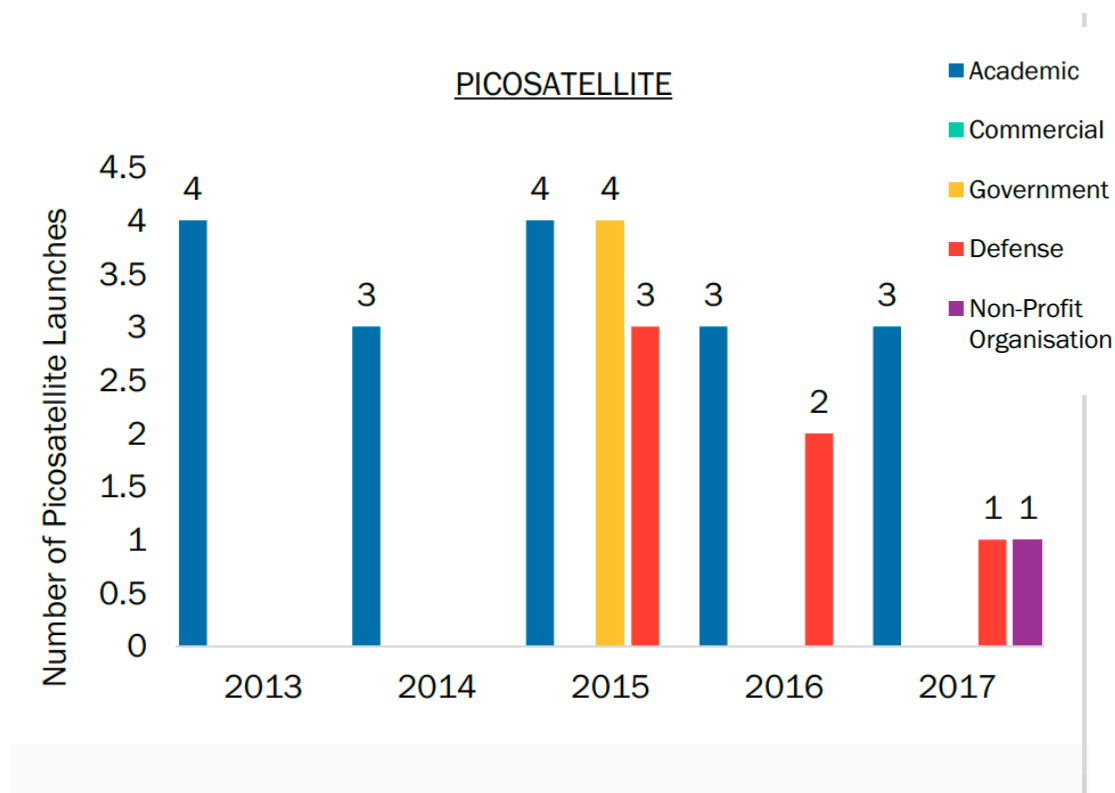
The academic sector is expected to remain the primary customers, though if launch services open up to greater numbers of picosatellites, more commercial customers may turn to picosatellites for constellation purposes.

<sup>5</sup> <https://sa.catapult.org.uk/services/missions-platforms/>

<sup>6</sup> *Global Small Satellite Market – Analysis & Forecast, BIS Research, 2017*

The femtosatellite (10g – 100g) market is rather embryonic at present. In 2017 it was valued at roughly \$100K, while moderate growth should see that rise to \$200K by 2021.<sup>7</sup> Currently the only players with any reasonable investment in the femtosatellite market are NASA and Asteroid Initiatives LLC (also based in the United States), but the UK is showing significant intent in this arena too, with **Alba Orbital** in Glasgow building and launching some of the world's most advanced picosatellites.

Table 6: Picosatellite trends 2013 - 2017



<sup>7</sup> Global Small Satellite Market – Analysis & Forecast, BIS Research, 2017