SMALL SATELLITE MARKET INTELLIGENCE REPORT

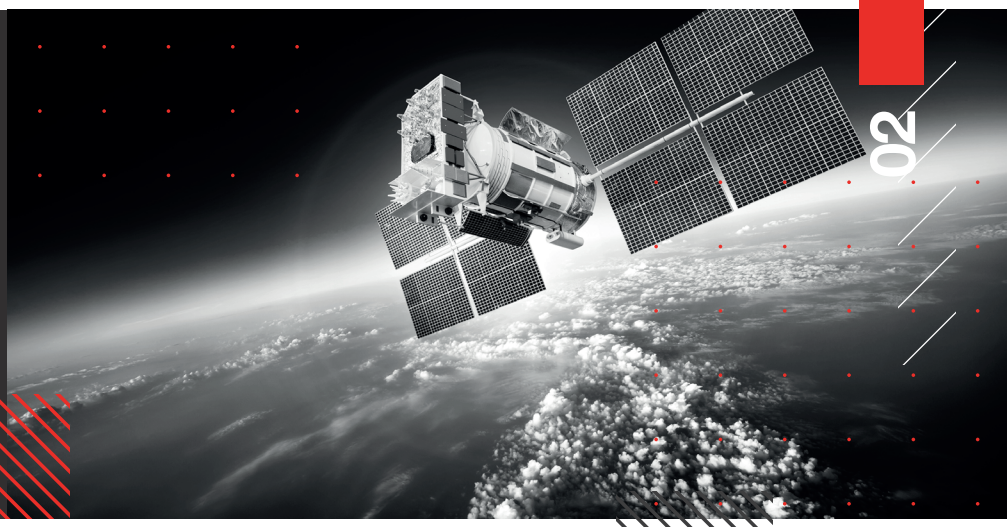
Q3 2018

This issue of the Satellite Applications Catapult's quarterly Small Satellite Market Intelligence report provides an update of the small satellites launched in Q3 2018 (1st July to 30th September 2018). This edition also includes a closer look at national strategies for encouraging growth in the NewSpace industry.

SMALL SAT MARKET INTELLIGENCE

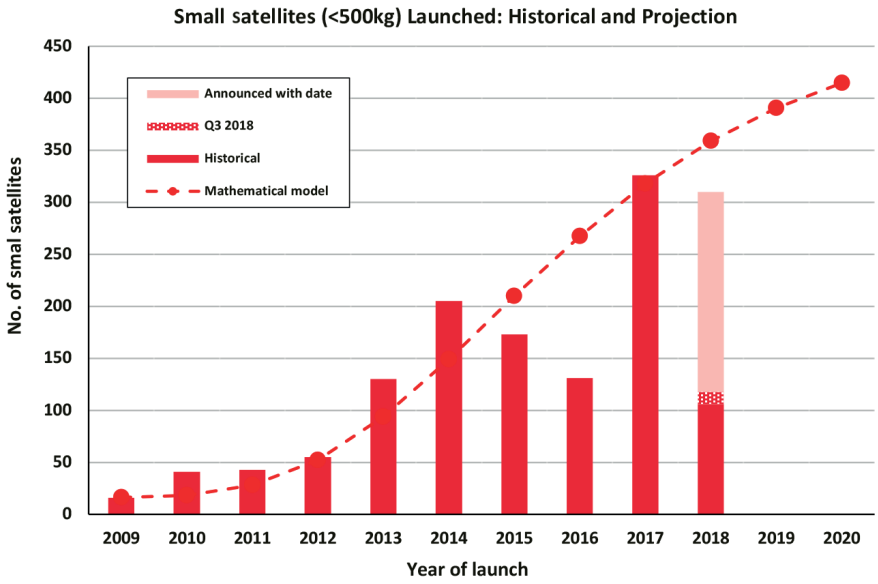
CATAPULT Satellite Applications

SMALL SATELLITES LAUNCHED IN Q3 2018



OVERVIEW

The downturn in small satellites put into orbit continued into Q3 with just 12 satellites launched over 5 launches, following the 41 in Q2. This is the lowest quantity since Q1 2013, which also saw a dozen launched. Large numbers of satellites scheduled for launch in Q4 should offset this downturn before the end of the year.



Note: The mathematical model line in the graph above (simulating an accelerating market uptake followed by a levelling off) provides a general trend and not a prediction per year.

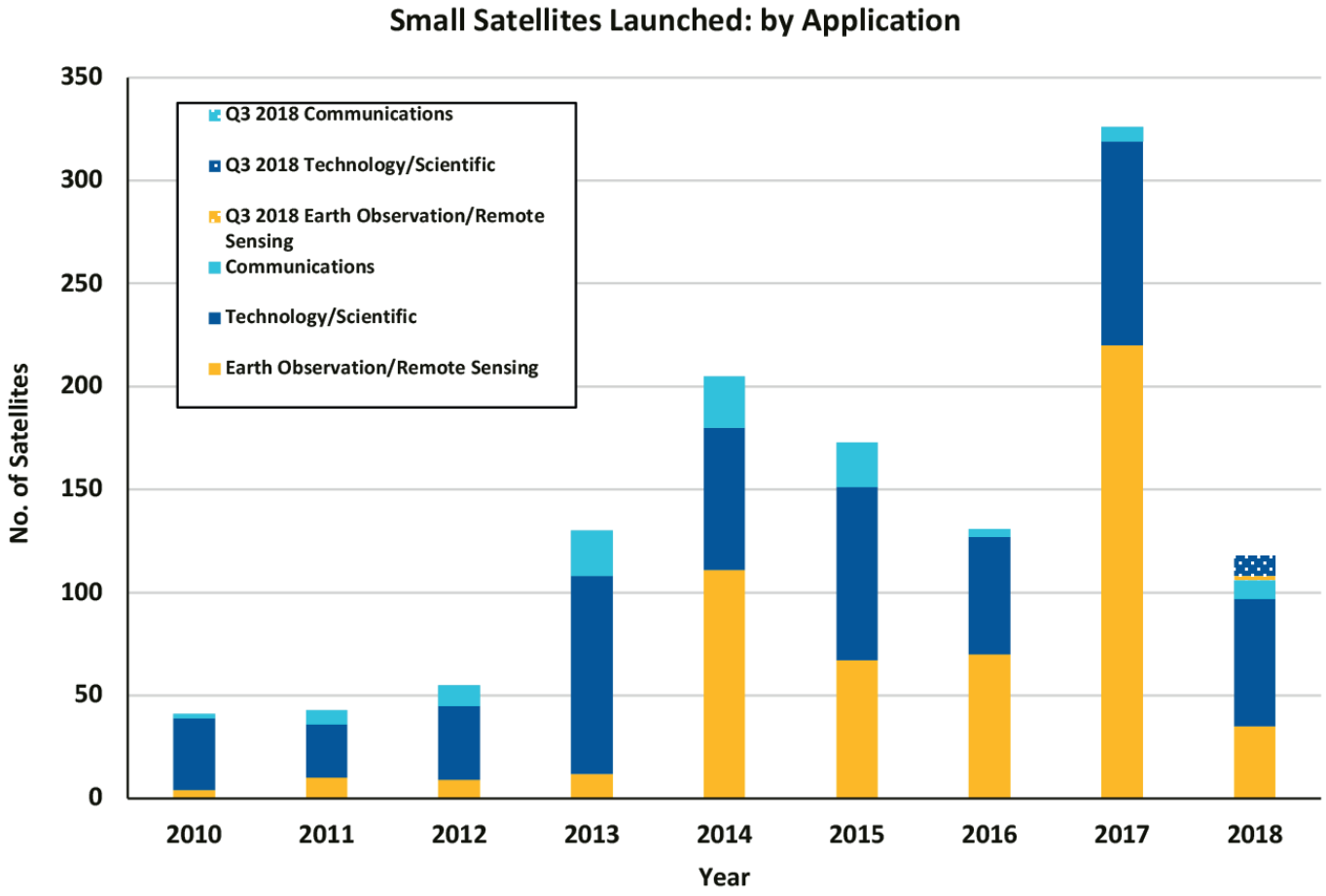
The decline in small satellites launched so far in 2018 looks, at first glance, like part of a larger trend. However, it has both real-world and analytical causes.

The real-world reasons include launch delays, such as the RocketLab Electron postponement, which has meant few small satellite specific launches has occurred. Furthermore, no high quantity launches, such as the 103 satellite PSLV launch in 2017, has occured.

In addition, no constellation operators has individually launched high quantities of satellites. The small satellite launch market is still tightly coupled to the manifest of Planet and Spire. As more constellation begin to launch, including OneWeb, now delayed to early 2019, this dependency should decrease.

The analytical cause is the sampling frequency of this report. Launch frequency is random and without clear periodic fluctuations. High quantity launches (6 launches with 14+ satellites), including large numbers of Planet Doves are scheduled for Q4. Whilst this will roughly double the number of satellites for 2018, 2018 will not match 2017's record of over 300 satellites, highlighting 2017 as a particularly high volume year.

APPLICATIONS



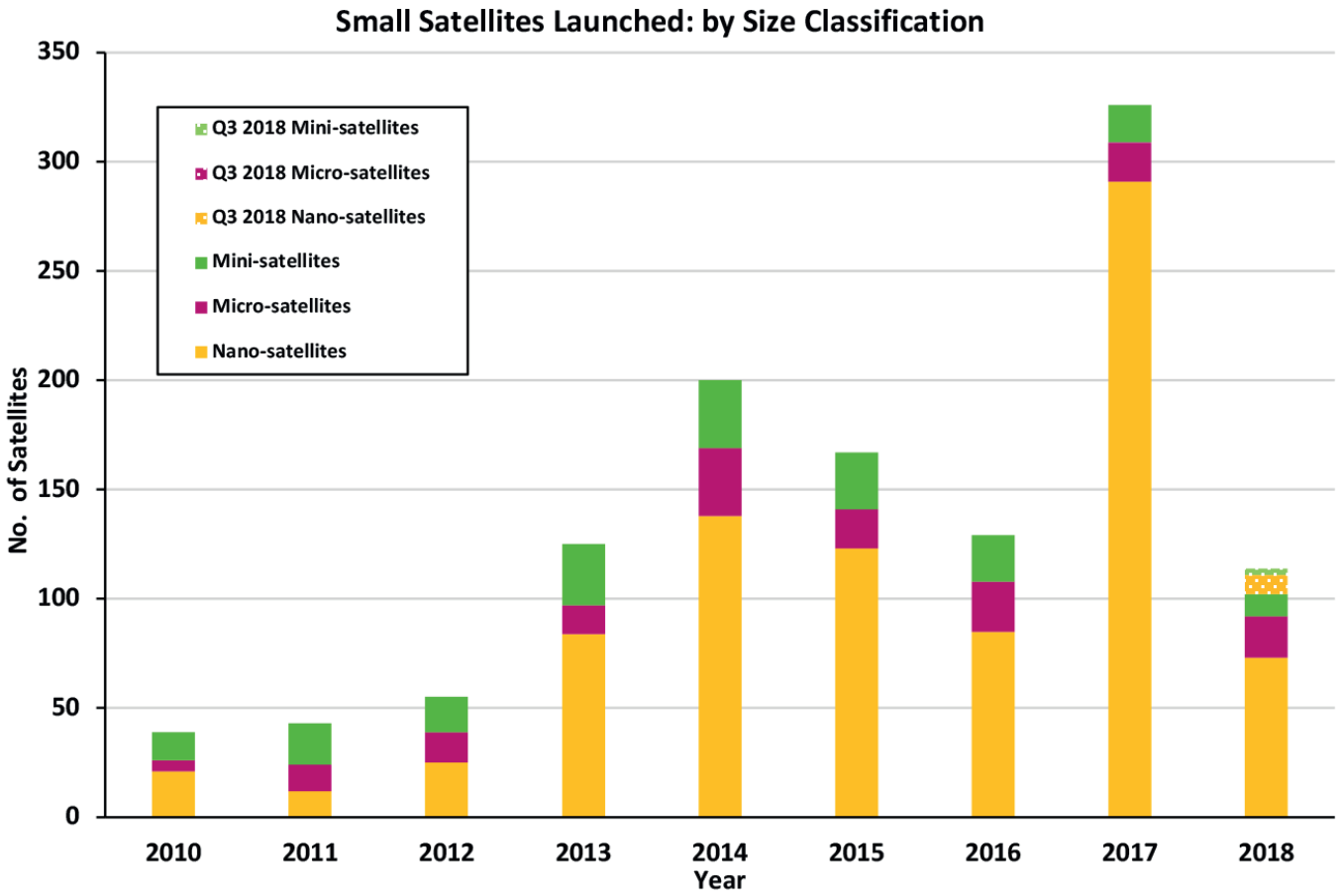
Applications are defined by the primary objective of the mission as categorised below:

- Communications: the objective of the mission is to transmit or receive signals to/from a user terminal or gateway;
- Technology/ Scientific: the objective of the mission is to gather knowledge to better understand physical phenomena or to test the functionality of the payload or equipment;
- Earth observation/ Remote sensing: the objective of the mission is to provide imagery or data relating to the Earth or its atmosphere.

Of the 12 satellites launched, only one was categorised as 'Commercial': DMC 3 (TripleSat), an Earth Observation satellite. The rest were all either technology demonstration or educational satellites operated by government agencies or educational institutions.

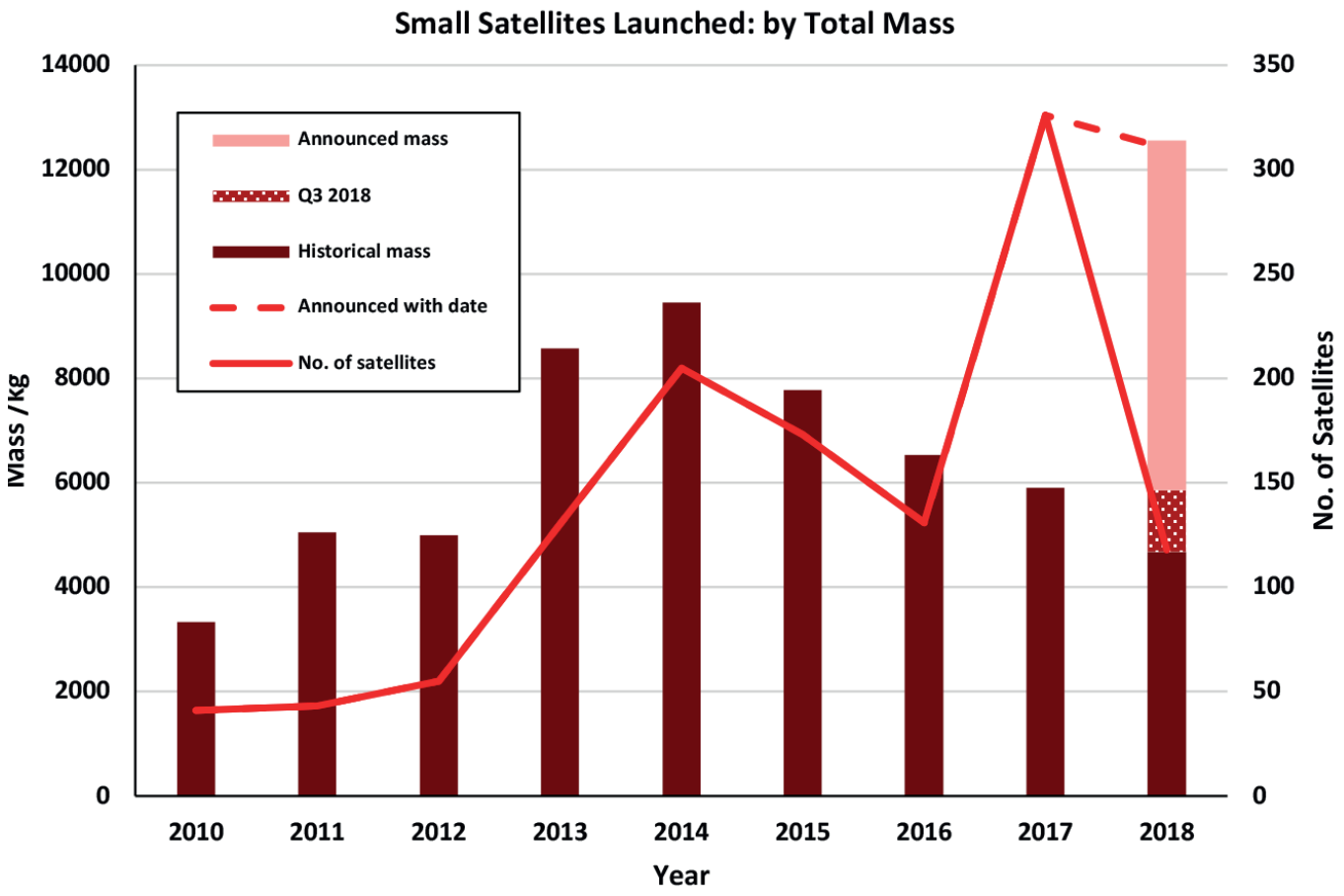
SIZE AND MASS

Satellite classification	Satellite subclassification	Associated wet mass range
Small Satellite < 500 kg	Mini-satellite	100 kg - 500 kg
	Micro-satellite	10 kg – 100 kg
	Nano-satellite	1 kg – 10 kg
	Pico-satellite	0.1 kg – 1 kg



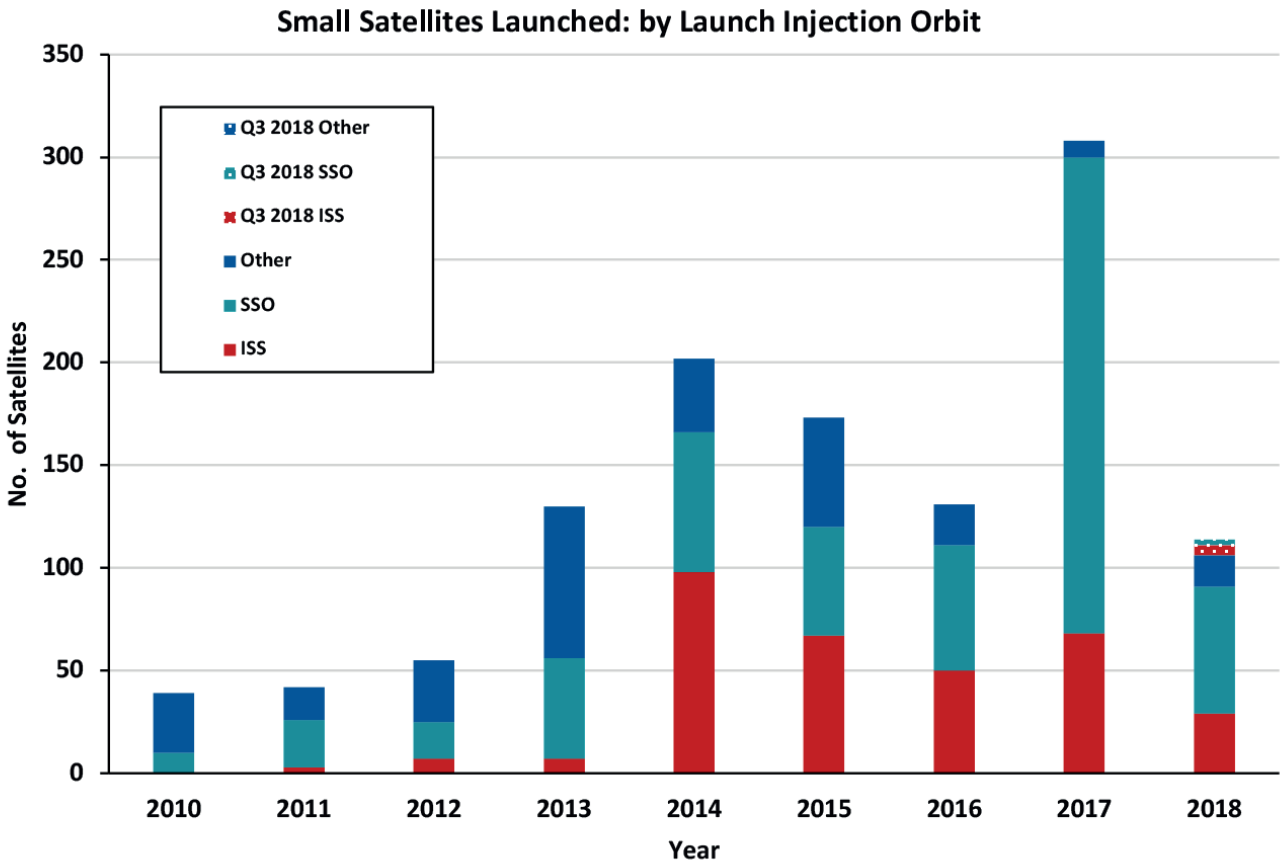
Whilst we should be careful not to identify trends based on so few satellites, the size and mass of the satellites this quarter show a divide in small satellite design. Whilst three of the twelve satellites had masses greater than 100 kg (two of which greater than 400 kg), the other nine were CubeSats under 10 kg. No micro-satellites or picosatellites were launched this quarter, meaning that those three minisatellites account for 98% of the total mass in this period and 20% of the total mass launched this year.

SIZE AND MASS

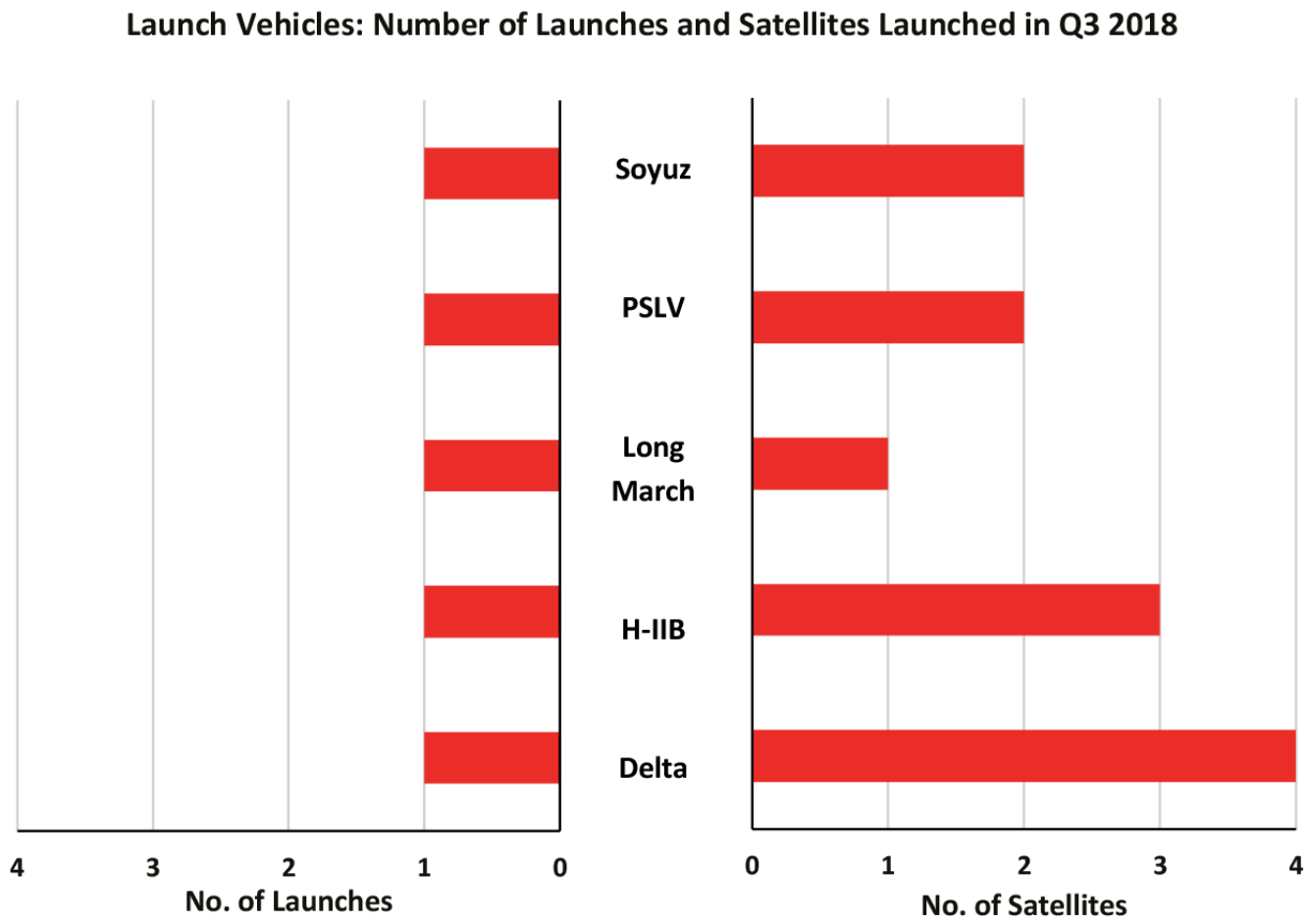


This brings the total mass launched this year so far to just below the total reached in 2017, despite the fewer satellites. This is mostly due to the high number of Planet and Spire satellites launched last year skewing 2017 to high volume, low mass satellite launches.

The Q4 launch of Virginia Space ThinSats, a set of 12 educational picosatellites, will greatly increase the number of picosatellites launched and continue the trend to lower mass satellites. This is expected to eventually level out as picosatellites are currently limited in their capabilities; presently they are mostly for educational purposes.



The three mini satellites were launched into Sun Synchronous Orbit; two on a PSLV and one on a Long March. A Delta rideshare carried four CubeSats to a polar orbit and all others went to the ISS via a Soyuz and a H-2B.



The world of small launch also had a quiet quarter, with RocketLab's Electron launch further delayed due to continued issues with the motor controller. Q4 should see some activity in the industry as the Electron is due to launch in November and private Chinese companies OneSpace and LandSpace race to be the first to orbit.

Virgin Orbit's LauncherOne and Vector Space's Vector-R have not provided firm launch dates but are aiming to launch in November. SpaceX's Falcon Heavy should conduct its first commercial launch, carrying 29 small satellites.

There were no rocket failures this quarter.

NATIONAL STRATEGIES AND POLICIES FOR GROWTH IN THE NEWSPACE INDUSTRY

Whilst space used to be the domain of governments, militaries and large multinationals, increasingly entrepreneurs are seeing opportunities value chain and create further growth by entering new markets. These ventures have been increasingly backed by private capital, fuelled by the constellations of space data. As private investment in the space industry has increased[1], governments see the potential gains of encouraging this commercial innovation to happen in their own countries, using a range of incentives to entice start-ups and scale ups to set up locally.

Here we look at of three important components of an overall national space strategy:

1. Policy and regulation: the sets of principles and associated legal mechanisms to guide decision-making of the entities operating within a nation.

2. Funding: space is a capital-intensive industry and finance is key to success is necessary to attempt any satellite mission.

3. Launch capability: accessing space is difficult. Currently, only around 11 countries have the capability of building and launching a rocket from their land[2]. Mastering the capability of deploying a satellite in orbit is a differentiator and important to a nation's autonomy.

There are many more aspects that a government can consider, however we have focussed on these three as they have seen significant developments over the last few years, boosting growth in the NewSpace industry. The following should be read not as an exhaustive list of developments, but a selection of initiatives pursued by various nations.

POLICY AND REGULATION

Arguably the easiest way to signal your country is open for space development is to create regulations that allow space sector growth. These can target various sectors from enabling supply to building demand and streamlining access to space.

Supply – enabling companies to operate

In 2017, Luxembourg became the second country after the USA to pass national legislation allowing the commercialisation of resources mined from space. The 'Law on the Exploration and Use of Space' has, along with a space mining specific fund, encouraged futuristic space mining companies Planetary Resources and Deep Space Industries to open offices in the country.

The UK's Space Industry Act 2018 aims to boost the UK's presence in the commercial space sector by facilitating the development of horizontal and vertical launch capabilities. It outlines the licences and liability insurances required to operate launch facilities for sub orbital and orbital flight. This has enabled the recent announcements of investment in spaceports in Scotland and Cornwall, which could be operational within a few years. This primary legislation is to be supplemented with more specific statutory instruments in 2019.

[1] Space investment quarterly – Q3 2018, Space Angels Network
[2] USA, Russia, France, Japan, China, India, Israel, Ukraine, Iran, North Korea and New Zealand

Demand – creating opportunities for the commercial sector

Historically, Japan's space industry, as much of their economy, has been dominated by large corporations such as Mitsubishi. They have had a lack of demand for space hardware from military applications due to national laws enacted in 1969 that restrict the military use of space, including high resolution Earth imagery. In 2008 the Basic Space Law reduced the 'non-military' ban to 'non-aggressive'; this was enacted as part of the Basic plan on Space Policy. The Basic Space Plan strategizes the next decade of Japan's growth, including development of new communication and navigation satellites and encouraging the development of an environment favourable to entrepreneurship[3].

Even just a line in an official document can signal a clear intent. Whilst the Chinese economic system is obscured behind a complex network of state and private acronyms, some clarity is found in their five-year plans, which detail areas for development over that time frame. Whilst we are currently in the 13th plan (2016-2020), it is telling that space gained its own white paper, supplementing the plan, in 2000. The most recent white paper (2016) specifically mentions commercial activities and encouraging enterprise. In 2014, China announced that private companies would be able to participate more in developing space infrastructure, building satellites and launchers[4]. By the end of the year we are expecting to see the results of this: LandSpace's first orbital launch, soon followed by OneSpace and a small handful of other companies. This rapid development has been mostly fuelled by private investment.

Balancing commercial opportunities with security

Just as legislations can encourage development, they can also hamper it. The strict US export rules under the International Trafficking in Arms Regulations (ITAR) mean the flow of products are stunted by national security concerns. This grew to affect the space industry after a failed Chinese launch of an American satellite in 1996. Since then, non-US space companies have marketed their products as ITAR-free and sold to areas that US companies are not able to. This has impacted US companies, and in October this year the regulations were clarified, removing satellite and spacecraft thrusters from ITAR. Whilst the regulations are controversial, the economic impairment is generally dhaving cash availability.

FUNDING

The space industry has previously been the domain of large companies funded by government agency contracts, often linked to military capabilities. In the NewSpace industry, enterprises are commonly funded by venture capital, and so in the last few years governments have set up VC-style funds to develop local companies.

Earlier this year the Japanese government announced a ¥100bn (£680m) fund over five years specifically for start-ups. Companies with a promising idea will be given up to ¥10m (£68k) to develop it, after which they will have access to the full fund if the development is successful. The New Energy and Industrial Technology Development Organisation (NEDO), who fund and coordinate much of Japan's R&D, are overseeing the programme in collaboration with the state-owned Development Bank of Japan. Furthermore, they have launched a web-based platform 'S-Matching' that matches space entrepreneurs and ideas with potential investors[5].

In the UK the £70m Seraphim Space Fund, managed by Seraphim Capital, was launched in 2017. It is an Enterprise Capital Fund, combining public and industry money with technical support by ESA, the British Business bank and the Satellite Applications Catapult. In addition to this, Enterprise Investment Schemes (EIS) incentivise private investment in riskier ventures by offering various tax reliefs to investors. Oxford Space Systems recently saw an investment of £2.1m through an EIS-based fund.

[3] http://www8.cao.go.jp/space/plan/plan-eng.pdf
[4] http://www.gov.cn/zhengce/content/2014-11/26/content_9260.htm, section 7
[5] https://s-matching.jp/

In September this year, France's CNES set up a similar €80-100m venture fund named 'CosmiCapital' that focuses specifically on space and space applications. It is funded by CNES and industry and managed by venture capital firm CapDecisif, aiming to help 4-5 start-ups each year. It will begin investing in early 2019.

In Luxembourg, in addition to the space resources law, a €200m fund was set up specifically for space mining companies. Furthermore, a €100m fund was created for more general space technology companies. Launched in September 2018 concurrently with their 'commercially oriented' space agency, the fund is managed by the state-owned bank Société Nationale de Crédit et d'Investissement. Luxembourg has had some success with this approach: currently it is home to offices of at least 20 space companies, including current and future constellations such as Spire, Kleos Space, OQ Technology, and Aistech Space.

Growth of private equity funds and mechanisms to scale these initial investments, including IPOs and other exit strategies for initial investors, is key for the future success of the sector.

LAUNCH CAPABILITY

Beyond favourable regulations and financial incentives, it can help to have a specific value proposition, especially if resources are limited. Many countries have been attracted to the idea of having a launch capability. A launch vehicle and spaceport are the gateway to space and is crucial for a nation's autonomy; but it is also difficult. Historically, only 14 nations have launched a rocket from their land and as of now only around 11 countries have the capability of both building and launching a rocket from their territory.

The growth in small satellites and constellations has created a new market for small launchers, able to launch frequently and into specific orbits. Small launchers provide a cheaper alternative to large national launch programmes and can be funded for less than $100m; still a significant cost for any start-up. Whilst the rocket technology is almost ready, in many areas the supporting infrastructure is still in need of development.

In the UK, horizontal and vertical launch facilities are being developed; Sutherland Spaceport recently received £3m to start putting concrete in the ground, aiming for launches in the early 2020s. At the other end of the country Virgin Orbit recently signed a memorandum of understanding with Spaceport Cornwall to launch from the peninsula. Obstacles remain, including more detailed regulatory and insurance frameworks that allow these lower cost launchers to operate smoothly. The UK has several domestic vertical launchers in development, including Skyrora and Orbex, and Orbital Access and Reaction Engines are developing technologies required for spaceplanes.

In July, Australia created its space agency, the last OECD country to do so. Australia is looking to regain its launch capability with potential sites in the remote Arnhem Land (Equatorial Launch Australia) and the more populated Queensland (Australia Space Launch) regions. These could be launch sites for rocket companies such as Gilmour Space, who are developing a small hybrid fuel rocket.

Much of mainland Europe's launch capability is limited by geography, with France launching from French Guiana, where there is more open water to overfly. That has not stopped Spanish companies is looking at developing small launch capabilities. PLD Space have made the case for launch from the Spanish Canary Islands off the coast of Africa, but alternatives such as air-launch and balloon launch technologies are being developed by Celestia Aerospace and Zero2Infinity and respectively. In Italy, Virgin Galactic has signed various memorandums of understanding with Italian companies and the space agency to take off from southern Italy, launching over the Mediterranean Sea.

Japan already has launch sites and rockets, including the Mitsubishi Heavy Industries H-II. Upstart Interstellar Technologies are creating a smaller option and operate from their new test centre in Hokkaido, though following their recent launch failure (see Q2 2018 report) it may be a while before this is fully operational.

There is a limit to the number of small launchers that will be commercially viable; not all will succeed. Furthermore, it may not be essential for a country to have launch capabilities. Whilst it grants access to the short list of countries that can launch into orbit, the global launch industry is about 10% of the wider space industry. For countries such as the UK, a launch capability feeds into the wider ecosystem of satellite manufacturers, operators and downstream applications, but a customer is unlikely to prioritise launch location over price, regulatory ease and responsiveness. As spaceports pop up across the globe, regulation is likely to be the limiting factor, enabling companies to launch easily, or if not, enabling them to move to another country that can.

A NEW SPACE RACE?

As NewSpace continues to mature, governments are establishing mechanisms to attract this wave of innovation and future commercial growth. An increasing number of countries are seizing the opportunity of easier access to space and are implementing strategies to be the go-to nations for NewSpace companies and research. The development of favourable regulations and funding mechanisms has boomed in the last year and is likely to continue, especially in the rising small launch industry. There is no single solution or ideal space ecosystem, with countries limited by geography, funding or expertise, but creating a diverse space market that can foster innovation from academia to operation is essential for the long-term development of a national space industry, and governmental strategies are essential to this.

Q3 2018

Disclaimer: whilst every effort has been made to provide accurate and up to date information, we recognise that this might not always be the case. If any reader would like to contribute edits or suggestions to our reports, kindly email the team and we will make the amendments.

Contact

The Small Satellite Market Intelligence report is designed as a free data source to share information that is easy to access and use. We welcome feedback on other data points that would be of value to include. You can contact us at:

E: MarketIntelligence@sa.catapult.org.uk
T: +44 (0) 1235 567999
W: sa.catapult.org.uk/small-sats-market-intel

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