SMALL SATELLITE MARKET INTELLIGENCE

Q1 & Q2 2017

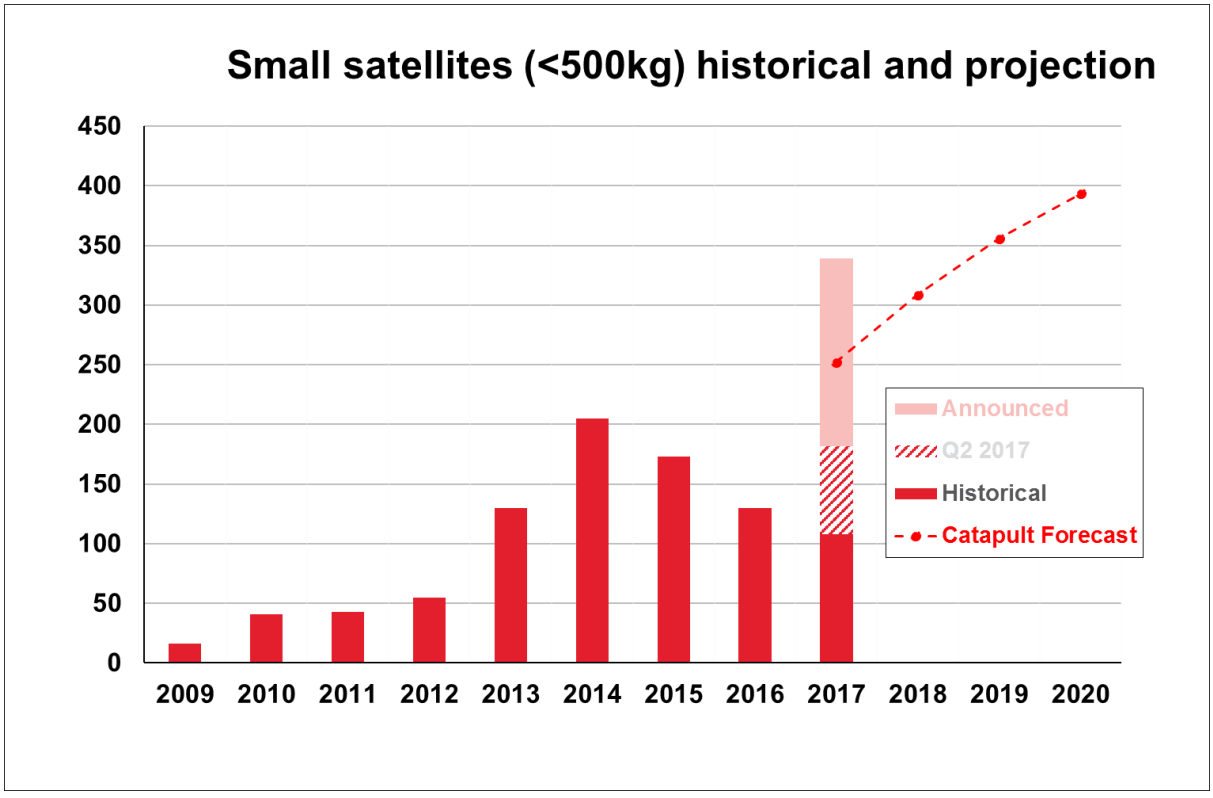
This first release of the Small Satellite Market Intelligence report provides the baseline context of the small satellites market over the past 7 years through to the end of June 2017. Subsequent releases will provide regular updates to these metrics as well as adding further areas of analysis, along a quarterly timescale. This release also includes news highlights from Q1 & Q2 in the area of dedicated Small Launch Vehicles, a key enabler of future growth of the small satellite market.

SMALL SATELLITES FACTS AND FORECASTS

OVERVIEW

The 182 small satellites (<500kg wet mass) launched in 2017 have already surpassed the total number for the whole year of 2016. This is primarily due to the world record of 104 satellites launched in Feb, 15th to SSO orbit by the Indian Polar Satellite Launch Vehicle (PSLV-XL). Public announcements indicate as many as 300 small satellites could be launched in 2017, but launch vehicle delays suggest a lower number is more likely, as per Catapult's estimation.

The current forecast from the Catapult's model for the period 2017-2020 is approximately 1,300 small satellites.



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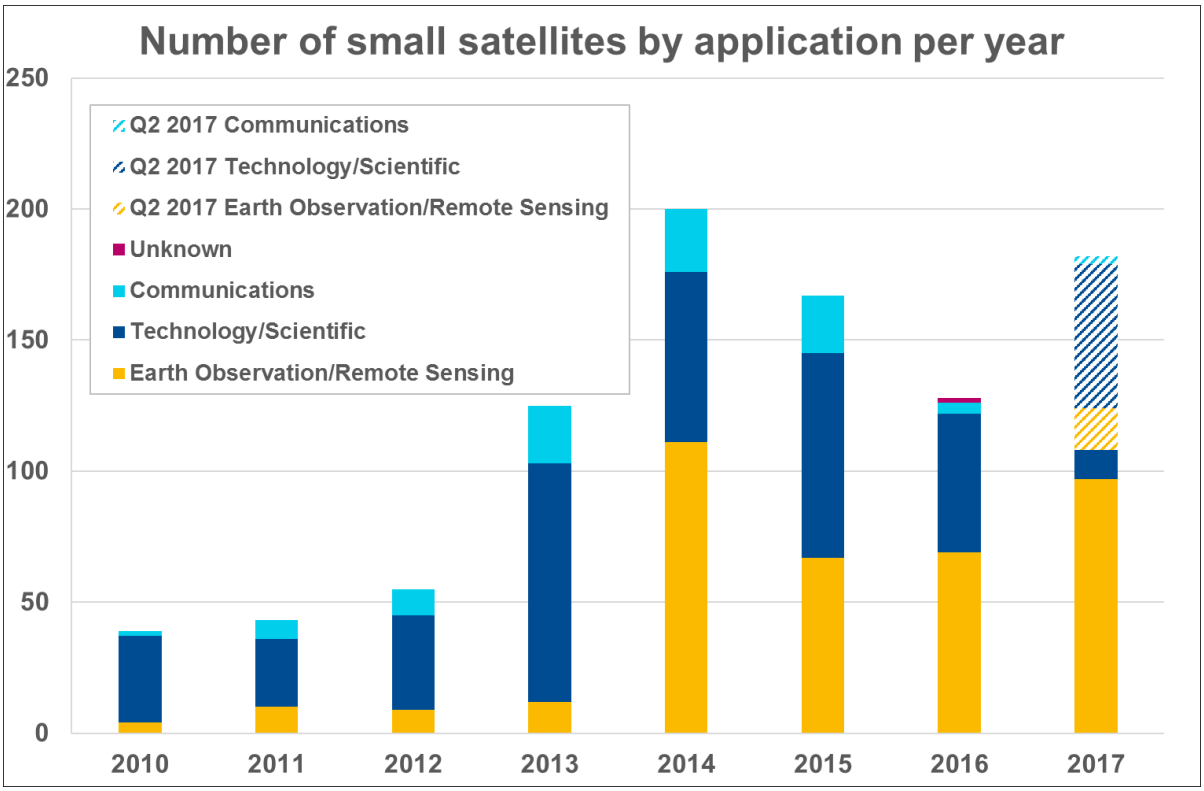
APPLICATION

Around 62% of the total number of small satellites launched in 2017 have Earth Observation/Remote Sensing as a primary application, mainly driven by Planet and Spire satellites; while the remaining 38% are focused on technology or scientific applications. 75% of the small satellites launched in Q2 2017 are classified as either technology or scientific, partly due to the 28 QB-50 CubeSat aiming at investigating the properties of the middle and lower thermosphere. Q2 2017 also saw the first commercial communication 3U CubeSat 'Diamonds' from Sky and Space Global.



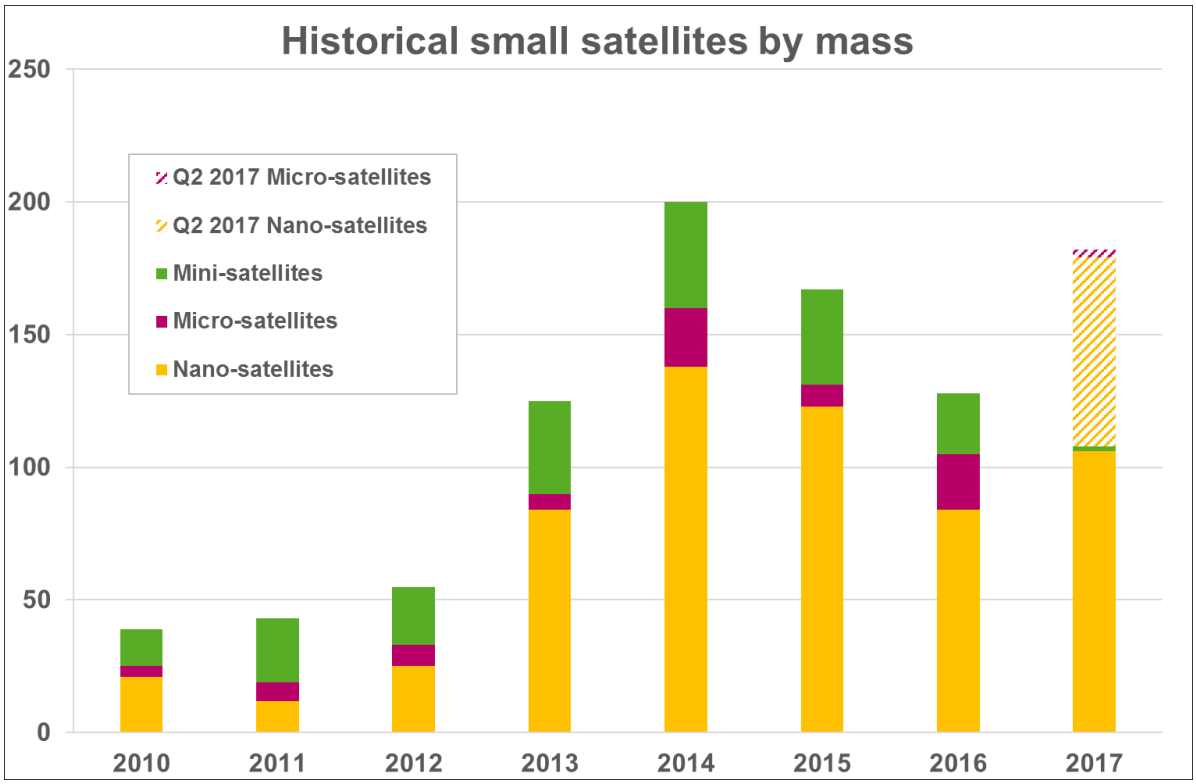
Applications are defined by the primary objective of the mission with the following groupings:

- 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 a 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.

SIZE OF SATELLITES:

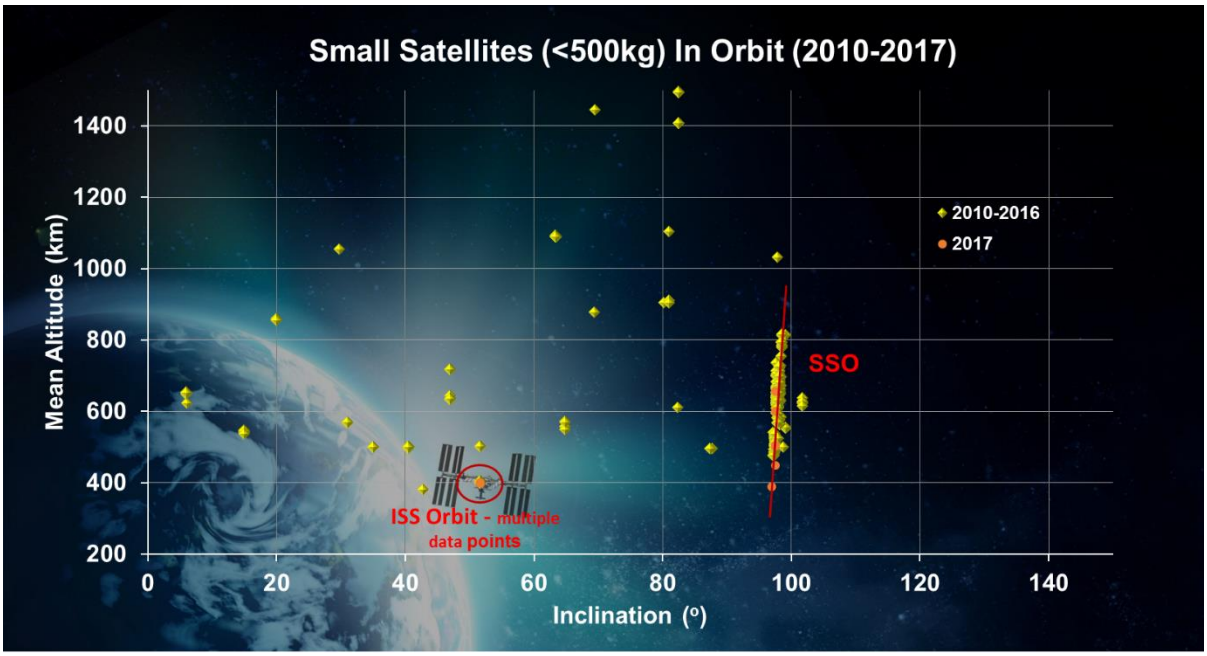
In the past, the small satellite launches were dominated by nanosatellites (a mass of 1-10kg), a trend which continues in Q1 and Q2 2017, primarily due to Flock and Lemur batches from Planet and Spire respectively, and the QB-50 CubeSat for Q2 2017. Small satellite numbers are still dominated by the nanosatellites class due to the majority of CubeSats falling into the mass bracket.

Satellite classification	**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*



ORBIT:

Approximately 45% of the small satellites launched since 2010 were placed into SSO/Polar orbit, while 30% were deployed from the ISS. So far in 2017, SSO seems to be massively favourable over any other orbit; utilised by 70% of the satellites launched, which is solely due to the PSLV-XL in Q1 this year. The appetite for the SSO is driven by the need from Planet to reach higher latitudes than the ISS inclination as well as benefiting from constant lighting conditions. The graph below shows the injection mean altitude and inclination of small satellites as per launch information. However, it is worth pointing out that this tracks orbits achieved by small satellites, rather than orbits demanded by small satellite operators. Due to the current need to access space through rideshare opportunities rather than dedicated launch, these details may not equate to each other.



Q2 2017 SMALL LAUNCH VEHICLE DEVELOPMENTS

A small launch vehicle is defined as a launch vehicle that can lift no more than 500kg to Low Earth Orbit (LEO). Small launch vehicles are important to address the growing demand for a dedicated launcher for access to space for small satellites. Whilst there are launch vehicles which regularly launch multitudes of small satellites to orbit (e.g. notably ISRO's PSLV), this analysis will only focus on launch vehicles with a payload capability below 500kg to LEO. So far, the only operational small launch vehicle is the Pegasus XL from Orbital ATK, however the Satellite Applications Catapult market intelligence team is aware of more than 50 small launch vehicles under development. Whilst many of these are too immature to warrant mentioning, some key developments in the landscape of small launch vehicles for Q1 and Q2 2017 are below.

NEWS HIGHLIGHTS

JUNE 2017

29TH **- Vector Space Systems** announces $21m Series A funding led by Sequoia Capital, with participation from Shasta Ventures and Lightspeed.

Source: PR Newswire – "Vector Partners with Sequoia and Secures $21M in Series A Funding" Read more

MAY 2017

30TH **- Stratolaunch** have taken their enormous carrier aircraft out of the hanger for the first time. With a wingspan of just under 120m, the Stratolaunch carrier aircraft is the world's largest aircraft measured by wingspan. The vehicle will offer a new capability in air-launch through being able to carry up to 3 rockets at a time to launch small satellites. First launch demonstration is set for 2019.

Source: Press Release – "Stratolaunch Aircraft Makes First Rollout To Begin Fueling Tests" Read more

25TH **- Rocket Lab** conducted their first orbital launch attempt from the first private orbital launch site in the world (Rocket Lab Launch Complex 1, Mahia Peninsula, New Zealand). Whilst the rocket failed to reach orbit, reaching space with the first flight of Electron still "delighted" the team. Future test flights are planned throughout the year.

Sources: NASA Spaceflight – "Rocket Lab's Electron conducts inaugural flight from New Zealand" Read more and Press Release – "Rocket Lab successfully makes it to space" Read more

3RD **- Vector Space Systems** conducted a suborbital test flight using a sub-scale version of its Vector-R rocket, with just one engine firing (the final launch vehicle will be a three-engine variant).

Source: NASA Spaceflight – "Vector Space completes first test flight, aims for small sat market expansion" Read more

APRIL 2017

28TH - Call for proposals closed on 28th April for dual spaceport-launch vehicle bids to the **UK Space Agency's Satellite Launch Programme** £10m grant funding opportunity Read more

6TH **- Vector Space Systems** aborted a sub-orbital test flight of their *Vector-R* small launch vehicle on April 6th. Whilst a full-scale Vector-R is planned to have three engines, this test article only has one.

Source: @vestorspacesys Read more

4TH **- Rocket Lab** placed their *Electron* rocket vertical on the pad, and undertook pad tests for the first launch planned "in coming months".

Source: @RocketLabUSA Read more

MARCH 2017

22ND **- Rocket Lab** raised a further $75m in funding bringing their total amount raised to $148m and their total valuation to over $1bn.

Source: Press Release – "Rocket Lab Raises $75 Million in Funding for Production of Electron Rocket" Read more

13TH **- Zero2infinity**, a Spanish start-up offering balloon-assisted launch services, ignited a small engine on their *Bloostar* launcher. Whilst not a test of the actual methalox engines to be used by the vehicle, the development is Zero2inifity's first ignition from a balloon.

Source: Press Release – "Zero 2 Infinity Successfully Launches its First Rocket from the Edge of Space" Read more

2ND **- Virgin Galactic** have spun out the operations of *LauncherOne*, the small satellite launch vehicle, and all small satellite launch services of the Virgin Group into a separate company, **Virgin Orbit**. This allows Virgin Galactic to focus on sub-orbital tourism, and will lead to Virgin Orbit pushing ahead with development of LauncherOne.

Source: Press Release – "Virgin Galactic Announces New Commercial Space Company "Virgin Orbit," Featuring LauncherOne Small Satellite Launch Service. Dan Hart, Former Boeing Executive, Appointed President Of Virgin Orbit" Read more

JANUARY 2017

14TH - The **Japanese Space Agency (JAXA)** had a test flight of their *SS-520-4* sounding rocket, modified to launch a single CubeSat to LEO, which failed before second stage ignition.

Source: Press Release – "SS-520 No. 4 Launch Results" – Read more

9TH - Spanish small launch vehicle manufacturer **PLD Space** announced that it had raised $7.1m; notably, the lead investment was by GMV of Spain, a ground station and data processing space company.

Source: Space News – “Spain’s GMV takes a stake in PLD Space’s reusable rocket quest” Read more

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:

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