SMALL SATELLITE MARKET INTELLIGENCE REPORT

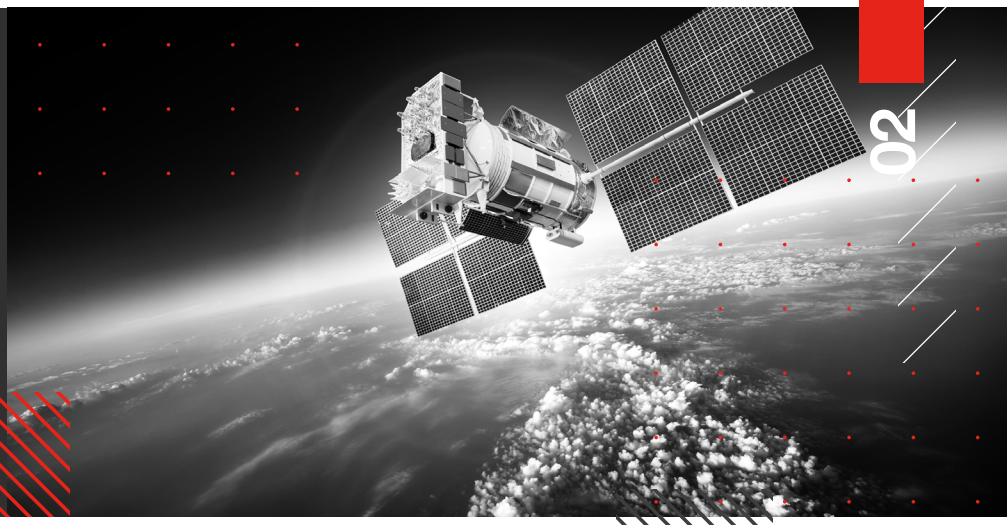
Q1 2021

This issue of the Satellite Applications Catapult's quarterly Small Satellite Market Intelligence report provides an update of the small satellites launched in Q1 2021 (1st January to 31st March 2021). This edition also includes a short article on the rising popularity of special purpose acquisition companies (SPACs) within the space industry.

SMALL SAT MARKET INTELLIGENCE

CATAPULT Satellite Applications

SMALL SATELLITES LAUNCHED IN Q1 2021

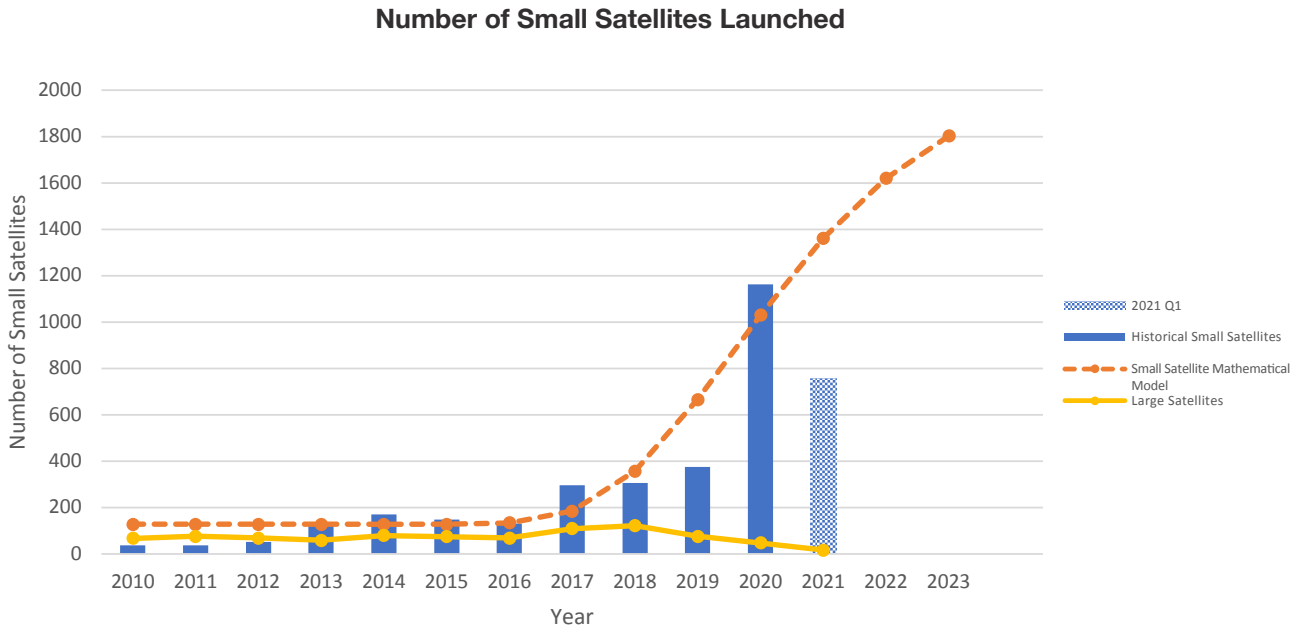


OVERVIEW

The first quarter of this year has seen a record number of small satellites launched into orbit. The Q1 total of 757 over double the number of small satellites launched in the entirety of 2019 and is nearly two thirds of the 2020 total 1163. It would be fair to assume, based on this rate, that 2021 will see another record-breaking year for small satellite launches.

Continuing with the trend of recent years, SpaceX accounted for the majority of launches this quarter (65%). Q1, they sent 490 satellites of their Starlink constellation into space, bringing their total number of Starlink satellites launched to 1445. At the beginning of the year, SpaceX also broke the record for the most spacecraft launched once, after carrying 143 satellites into orbit with the first mission of their Smallsat Rideshare program.

The beginning of Q1 saw the maiden flight of Virgin Orbit's LauncherOne, their 2-stage expendable rocket, which released from its carrier aircraft before successfully delivering 10 small satellites into orbit. OneWeb also continued their launch operations this quarter, with 36 of their constellation being launched by a Soyuz rocket at the end March.

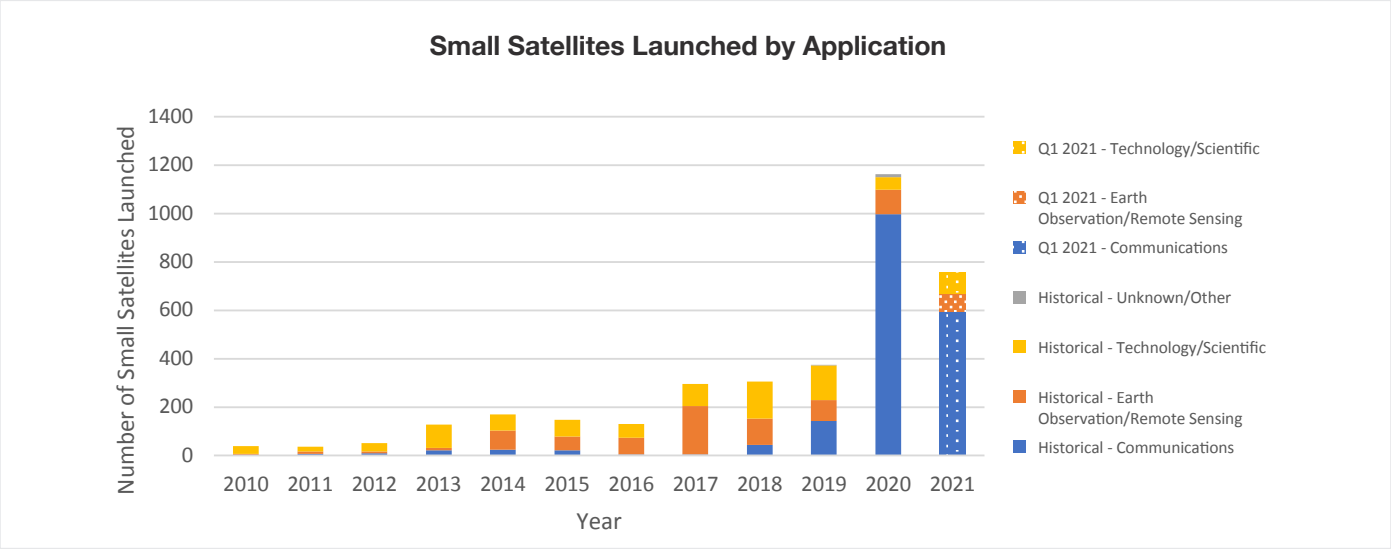


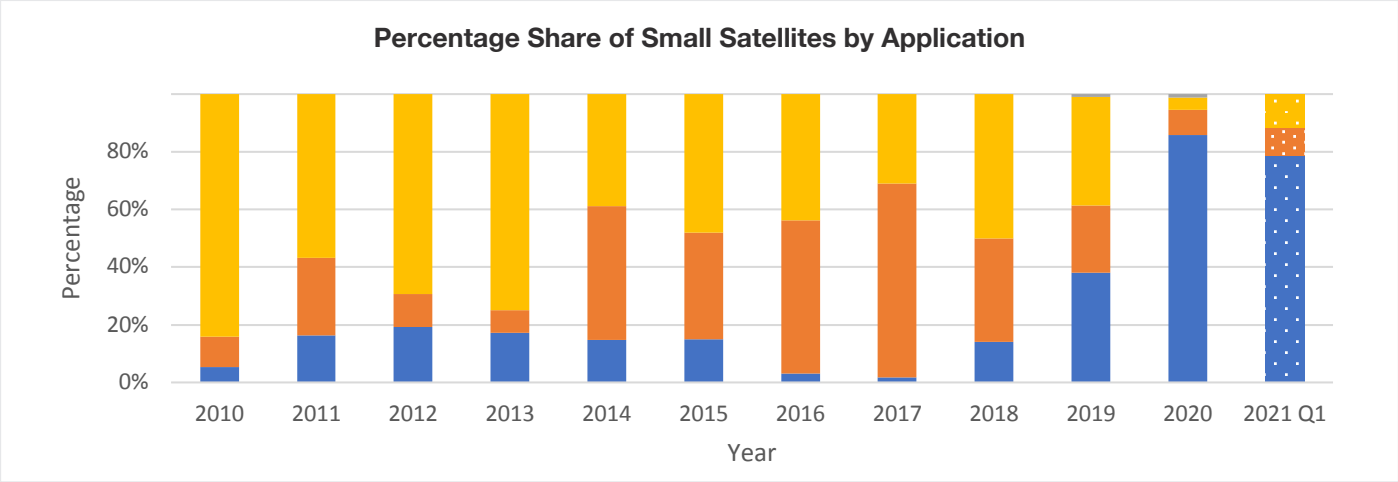
Note: The mathematical model line in the graph above (simulating an accelerating small satellite market

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 757 small satellites launched this quarter, around 79% (597) fall under the communications application category. SpaceX's Starlink satellites accounted for approximately 82% of communications satellites launched, having sent 490 into orbit this quarter. The next largest company within this category was Swarm Technologies (48) who continued the launch of their picosatellite Internet of Things (IoT) constellation. They were followed by OneWeb, who had 36 satellites delivered successfully to orbit, bringing their total number of satellites launched to 146 out of a planned 650 satellite constellation. The rest of the figures were made up of 9 other entities, whose number of satellites launched were in the single digits.

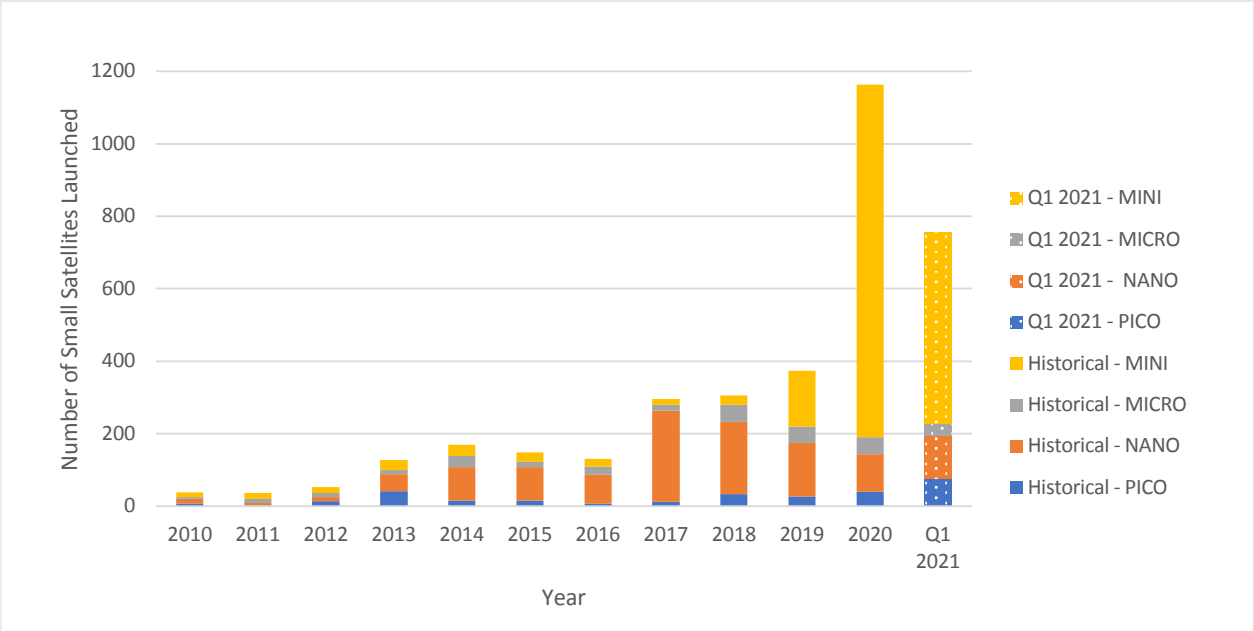
Planet Labs claim just over half of the Earth Observation/Remote Sensing small satellites in Q1, accounting for 48 of the 73 launched. Spire added 8 new satellites to their Lemur constellation which now consists of 126 of the in-house manufactured spacecraft. AxelSpace sent their first 4 micro-satellites into orbit as part of their GRUS constellation, while HawkEye 360 made use of SpaceX's rideshare program to launch the first of seven 3 Hawk satellite clusters as part of their constellation. Capella Space and Finnish microsatellite manufacturer ICEYE each sent 2 satellites into orbit to add to their constellations. Meanwhile BlackSky Global, iQPS, R2 Space and GHGSat Inc added 1 satellite a piece to their relatively small satellite constellations. The Korean Aerospace Research Institute (KARI) and The Emirates Institution for Advanced Science and Technology (EIAST) also contributed one satellite each to the statistics as part of Earth observation missions.

There were 87 small satellites launched in the Technology/Scientific category within the first quarter. These were spread across 59 different entities that launched between 1 and 4 satellites each. Of these 59 entities, there were 12 commercial companies. These included Astroscale, with the launch of the debris removal ELSA-d mission, Russian company SPUTNIX who launched a high-resolution telescope camera, and Japanese startup Warpspace, whose WARP 01 mission objective was to demonstrate a number of new satellite technology components. Universities and other academic organisations made up the bulk of these entities, accounting for 39 of the 59 total. The remainder of the entities in this category were government organisations. These 87 satellites launched are the largest number of Technology/Scientific satellites launched in one quarter.

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

Small Satellites Launched by Mass Category



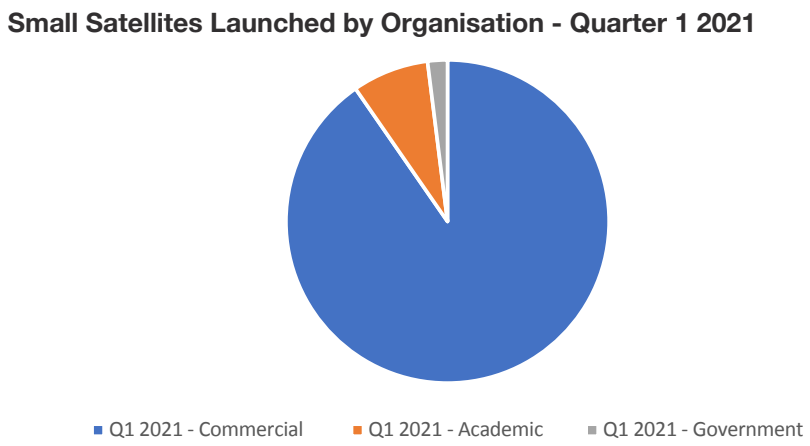
Mini-satellites continued to dominate the small satellite market this quarter, with 528 out of 757 satellites launched falling into this category. Two companies accounted for 99% of the mini-satellites launched in Q1 – SpaceX with 490 and OneWeb with 36. The two remaining satellites were Astroscale's ELSA-d chaser satellite and the Korean Aerospace Research Institute's Earth observation CAS500 satellite.

Nano-satellites were the next most popular choice this quarter, with 120 nano-satellites launched. Planet Labs accounted for 40% of these satellites, adding 48 Dove satellites to their constellation. Nanosatellites also appeared to be the popular choice for academic institutions with 34 of the 58 academic satellites launched falling within this mass category. This sentiment is echoed by government entities, as 9 of their 15 satellites launched in Q1 belonged to the nano-satellite category.

Following along with recent trends, Swarm Technologies captured a majority of the pico-satellite market share (63%) after adding another 48 0.25U SpaceBEE satellites to their IoT constellation deployed in 2 batches – one in January and one in February. This now takes their constellation total to 93 pico-satellites of a planned 150, which is hoped to be completed by the end of 2021. Pico-satellites made up the other 24 satellites launched this quarter by academic institutes and was also the second most popular choice for government entities, accounting for 3 of the 15 launched.

Micro-satellites were the least popular choice this quarter, with 32 micro-satellites sent into orbit. Kepler contributed to a quarter of these, while the rest were spread among 12 other entities.

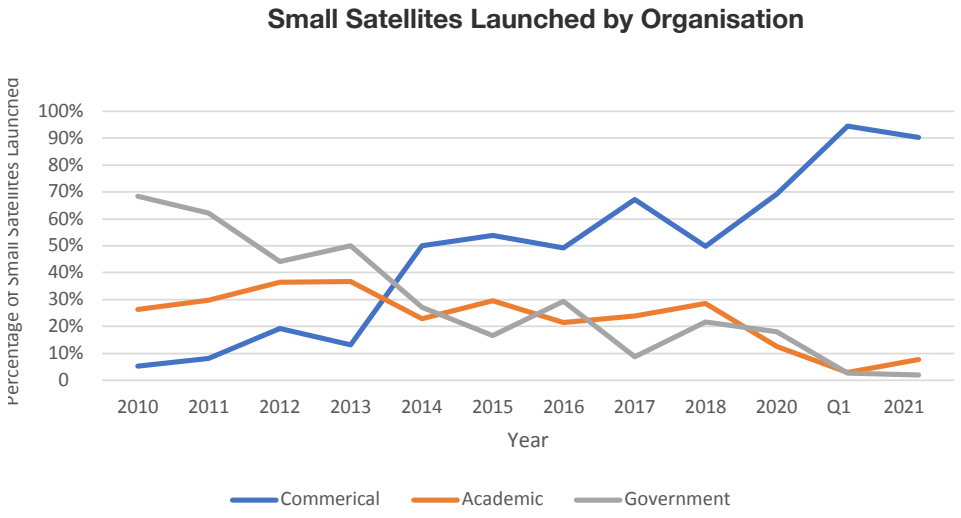
ORGANISATION



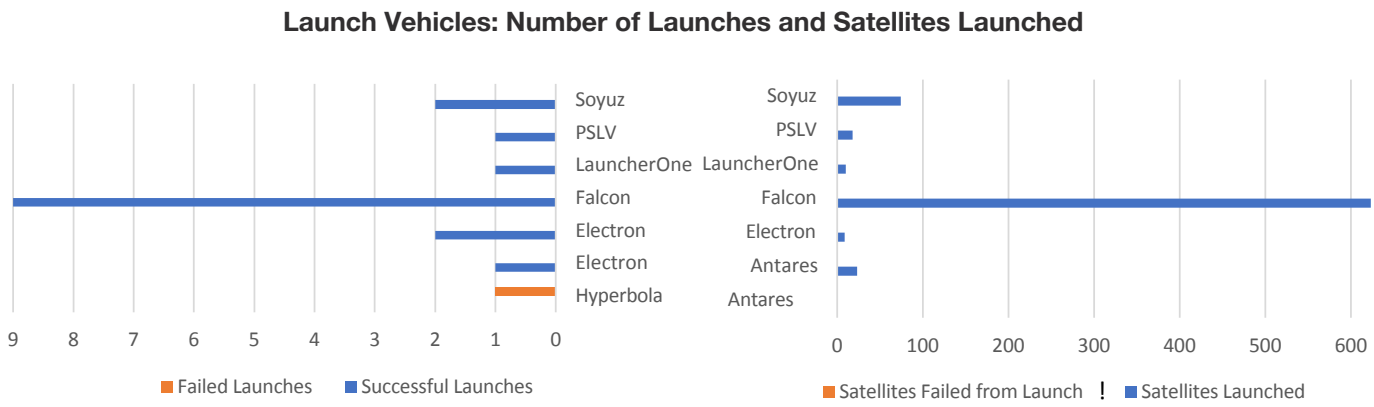
The dominance of commercial companies in the New Space era shows no sign of letting up, as they contributed to 90% (684) of small satellites launched this quarter, compared to 8% (58) and 2% (15) by academic and government entities, respectively. Four companies contributed to 90% of these commercial small satellite statistics: SpaceX with 490, Planet Labs with 48, Swarm Technologies with 48 and OneWeb with 36. Interestingly, even if we remove these four companies from the equation, commercial satellites companies would still have proved to have been the most active type of entity, with 62 small satellites launched.

The 58 small satellites launched by academic entities this quarter far surpasses the figure for academic satellites launched in the entirety of 2020 (34). This could be attributed to the fact that the COVID-19 pandemic hindered much of the academic activity last year. However, it is still of note that this figure of 58 is already two thirds of the way to breaking the record number of 87 academic small satellites launched in 2018, with another 9 months of the year left to go.

The figure for government launches this quarter (15) also signals a healthy improvement on last year's total (30), which is again a sign of recovery due to the easing of COVID-19 restrictions. However, the 2018 record of 66 government launched small satellites does not seem to be in danger just yet, if the current rate continues. This further highlights the evolving role of governments in the New Space era.

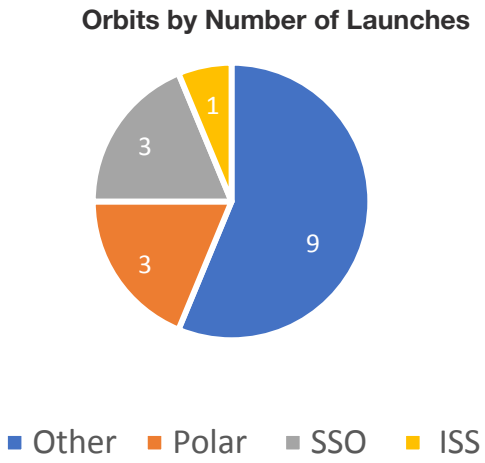


LAUNCH



There were 17 small satellites launched in the first quarter of 2021, including one failed launch. SpaceX's Falcon-9 launch vehicle continued its high launch cadence and dominated the competition both in terms of the number of launches and number of small satellites launched. These 9 launches see SpaceX over halfway towards breaking their record for the total number of small satellite launches in one year (16), while their 623 small satellites launched this quarter puts them in a good position to beat their 2020 record of 845 small satellites.

This quarter saw Virgin Orbit begin operations of their LauncherOne rocket, having been in development since 2007. The rocket was carried to the upper atmosphere on Cosmic Girl, a modified Boeing 747-400, before being released over the Pacific Ocean. LauncherOne delivered a payload of 10 non-commercial small satellites into orbit. Virgin Orbit is expected to continue this launch service throughout the year.

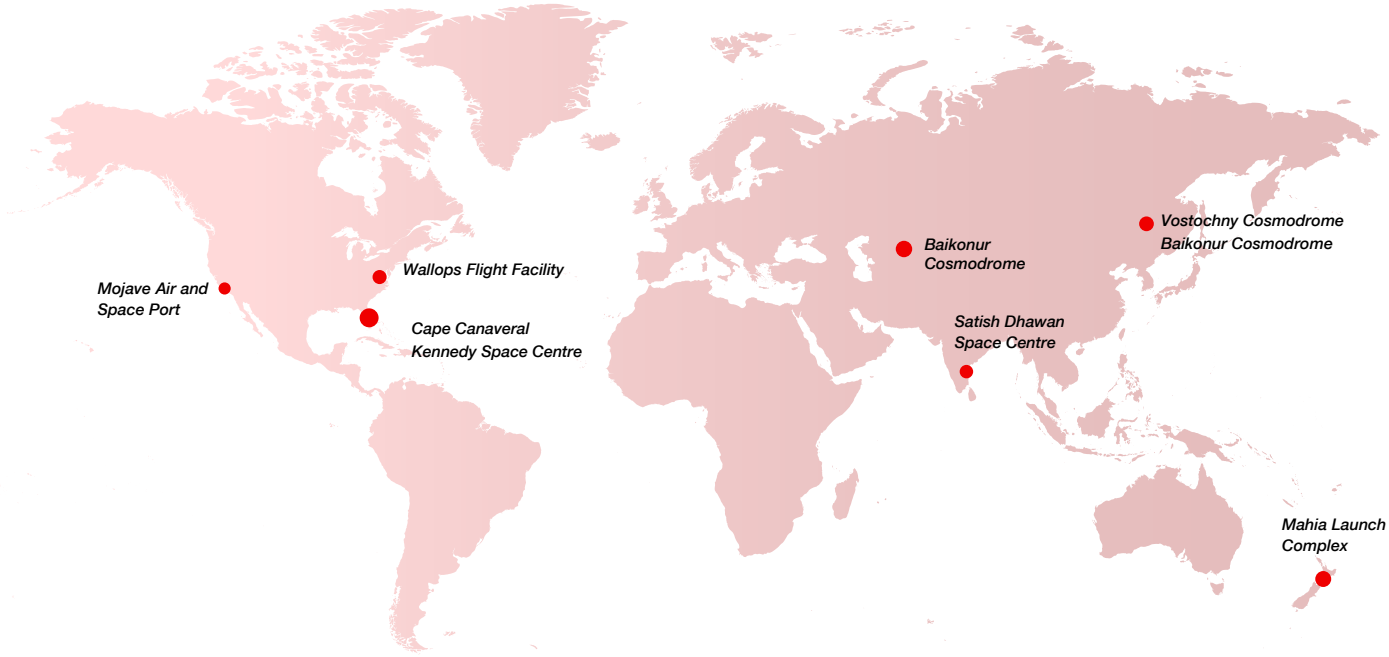


Rocket Lab had 2 launches this quarter using their Electron rocket, as they continue to make their mark on the global launch market. Their most recent launch included one of Rocket Lab's Photon satellites, the second to reach orbit. The satellite will conduct a risk reduction mission. The year has already been an exciting one for Rocket Lab, having announced a public listing through a special purpose acquisition company. Rocket Lab is hoping to use the capital raised to accelerate plans for a medium-class launch vehicle called Neutron. This will be a definite "watch this space" year for the company.

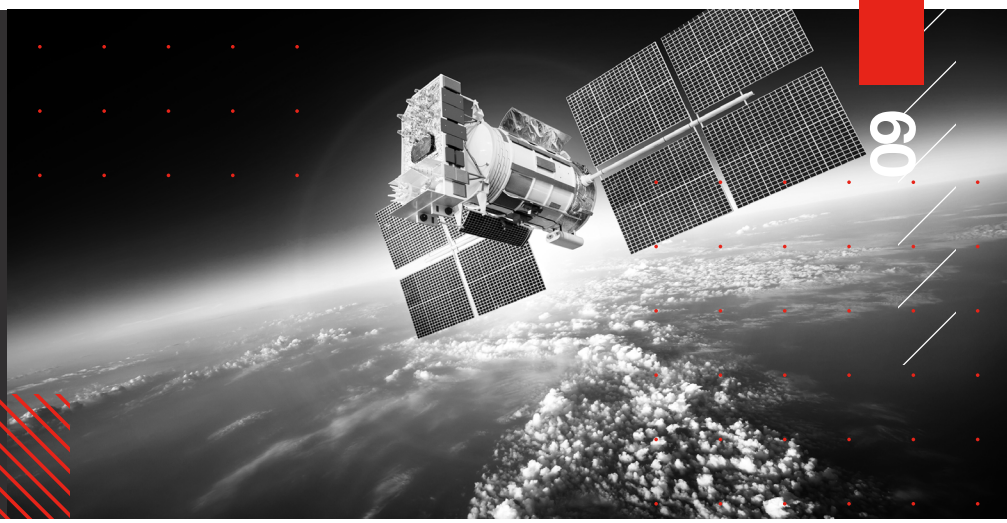
The one launch failure this quarter came from Chinese company iSpace's Hyperbola rocket, who stated that falling foam insulation was the cause of the loss of the launch vehicle. The payloads lost were not announced but were understood to be a number of small satellites.

Of the 9 launches to other LEO orbits, 7 of these were by the Falcon 9 rocket, with the Electron and LauncherOne the other 2 within this category. The Falcon 9 and Electron also delivered payloads to polar orbit this quarter, with one launch each in this category, and the Soyuz had one polar launch. The 3 SSO launches were by the Falcon 9, Soyuz and PSLV rockets. While the single ISS launch was successfully completed by the Antares launch vehicle.

The image below gives a visual representation of the locations of the sites from which the launch vehicles lifted off. Cape Canaveral Air Force Station in Florida claimed the most launches with 5, while the Kennedy Space Centre, also located in Florida, came in second with 4 launches this quarter. All 9 were SpaceX Falcon 9 launches. Rocket Lab's launch site of choice was Mahia Launch Complex in New Zealand, with both Electron launches lifting off there this quarter. The Soyuz rocket's 2 launches were at separate sites, with one lifting off from the Baikonur Cosmodrome in Kazakhstan and one from the Vostochny Cosmodrome in Russia. Virgin Orbit's LauncherOne completed its successful maiden launch from Mojave Air and Space Port in California, while the Antares and PSLV lifted off from Wallops Flight Facility in Virginia and the Satish Dhawan Space Centre in India respectively.



The Rise of SPACs



Introduction

At the beginning of the space age, the development of space technology was driven by the race for technical dominance between the USA and USSR. It got off to a rapid start, sending satellites into space and humanity to the moon within 15 years. However, the post-Apollo mismatch between ambitions and resources saw public space budgets decrease due to the high cost and long timeframes associated with funding space missions. Space remained a playground for big government projects, handing out contracts to large commercial entities, with huge barriers to entry for start-up space companies. The environment for private investment in these start-up space technologies appeared akin to the vacuum in which they operated – void and no sign of life.

However, not everyone shared so bleak an outlook, with individuals and companies keeping faith in the potential of this new economic frontier. Private endeavours towards commercial spaceflight in the '90s, such as Kristler Aerospace, Beal Aerospace, Mircorp and the XPRIZE Foundation helped to prove the effectiveness of tactical sponsorship and shed some light on the possibilities of non-governmental space operations. These efforts resulted in a build-up of momentum for commercial opportunities within the space sector, and unlocked new avenues for investment, ushering in the New Space Era at the beginning of the 21st century. A refreshed outlook on the private investment environment in the space sector is now being recognised, with a record $8.9 billion invested in 2020, despite the COVID-19 pandemic1. Where before it was compared to the vacuum of our cosmos, it is now more aptly likened to some of the universe's other characteristics – expanding and full of opportunities.

Raising Money in the New Space Era

Today, there are more ways of raising capital than ever before. However, this does not mean that it is straightforward. With the variety of business models and commercial offerings, there is no "one size fits all" when it comes to accessing funding. New Space business leaders must take on this burden of choice when deciding the best avenue to travel in order to achieve growth sustainably From business angels to venture capitalists, corporations, or the public markets, the financing solutions are abundant.

There has been a particular increase in activity regarding space companies within the public markets as of late. The first space-focused Exchange Traded Fund (ETF), Procure Space, was launched in 2019, while the recent announcement of a new space ETF by ARK CEO Cathie Wood saw space stocks surge purely on speculation. We are now starting to see space companies take advantage of this bullish sentiment towards the industry, riding the wave of the current route to market in vogue – the Special Purpose Acquisition Company or SPAC.

Special Purpose Acquisition Companies (SPACs)

What is a SPAC?
There has been a vast rise in interest over the last 2 years in what are known as Special Purpose Acquisition Companies, or SPACs. SPACs, also known as "blank check" companies, have been around for decades and were historically seen as a last resort approach to take a company public. However, due to a number of recent factors including low interest rates, volatile equity markets and an increasing number of SPAC expertise, it is becoming a more legitimate method of listing a company on the markets.

[1] CNBC (2021) 'Investment in space companies put at record $8.9 billion in 2020 despite Covid'

SPACs are essentially shell companies with no commercial operations and are created with the sole purpose of raising money through an Initial Public Offering (IPO) to acquire a privately held company. This is done by selling common stock, before any acquisition has taken place, meaning that investors may not have any knowledge on how their capital will be used. The capital raised is then held in a trust until either one of two things happens. Either the founders of the SPAC, also known as sponsors, identify a company of interest, which will then be taken public through acquisition using the funds raised by the SPAC's IPO; or, if the founders fail to acquire a company within a deadline (typically two years), the SPAC is liquidated, and investors will get their money back.

Benefits and Drawbacks

SPAC mergers offer several advantages to private companies that are looking to go public compared to the traditional IPO. Should a company decide to go down the IPO route, it becomes subject to regulatory and investor scrutiny of its audited financial statements. The company must also hire an investment bank to underwrite the IPO, which can take six to nine months to complete. This involves roadshows and pitch meetings between company executives and potential investors to build up interest and demand for their shares.

SPAC deals bypass this roadshow process as the capital has already been raised, prior to the merger, allowing the acquired company to go public in a much shorter time. As well as this, because the deal is technically an acquisition, securities regulators afford them a few luxuries not available to typical IPO companies. These include the ability to forecast revenues in investor pitches and publicly hype their stock, which allows SPACs to shift focus away from current business performance results. This lack of scrutiny compared to IPOs has led to some investors feeling wary towards investing in companies listed through SPACs.

Nevertheless, this has done little to affect the recent momentum, and we are now seeing a rapid increase in SPAC transactions. In 2019, there were 87 SPAC deals, with an average value of about $390 million. In 2020, there were 163, with an average of $965 million. Within the first quarter of 2021, there have been 73 SPAC transactions already, with an average value of over $2.3 billion2. When comparing 2021's $166 billion in deals to the overall Mergers and Acquisitions (M&A) deal volume, SPAC activity represents about 30% of volumes today3. This trend does not show any sign of slowing down either, with about 400 SPACs on the search for target companies.

The SPAC(e) Environment

You Can't Spell Space Without SPAC

Traditionally the space industry has been public market shy, so why are SPACs driving New Space companies to the markets? It is straightforward to see how the acquired space companies will benefit from a SPAC deal, by enjoying the aforementioned advantages (faster route to market, less scrutiny etc.). However, the question remains as to what makes the companies of the New Space era suitable targets for a SPAC?

Space is "new" – due to their innovative nature, New Space start-up companies' business models are often unproven, and carry a higher risk than similar sized companies in other industries. Space is competitive – companies go head-to-head with other space start-ups, billionaire space enthusiasts, and the legacy giants of the defence industry. Space is also expensive – New Space companies are capital intensive, and their burn rate is higher than almost any other industry. Paradoxically, it is these features that can make space companies an attractive candidate for a SPAC merger.

[2] *Quartz (2021) – 'How the rocket business launched a wave of blank check acquisitions'*
[3] *Bloomberg (2021) – 'Blank-Check Mergers Grabbing Ever-Bigger Slice of M&A Market'*

We have recently witnessed a shift in investment away from value and towards growth opportunities, with today's investors having an unusual craving for risky bets. This allows companies with innovative and disruptive technologies, even early in their lifecycle and who are normally considered too high risk, a better chance of raising capital. Space companies are exciting, and with few publicly traded companies, they offer investors a relatively unusual investment opportunity. The accelerated route to market offered by SPACs enables these companies to strike while the iron is hot and ride on the coat tails of this market momentum.

The increasingly competitive nature of the space industry is also doing well to establish space companies as legitimate investment opportunities. Competition rewards the most optimal solution, stimulating innovation and promoting better, faster, or cheaper services. The floodgate of capital investment that a SPAC merger can open allows companies a faster track to growth, enabling them to pursue commercial options that will differentiate themselves from the rest of the competitive market.

SPACs will also look to acquire target companies who have the ability to deploy the large amount of funds raised in a relatively short time period, seeking a visible and near immediate impact. This complements the capital-intensive nature of New Space companies, who can hopefully use this injection of cash to produce the returns expected.

Space Companies Acquired by SPACs

To date, there have been eight SPAC deals announced to bring space companies public, with a cumulative value of over $10 billion. Table 1 below displays the details of the companies within the space industry that either underwent or are undergoing a SPAC acquisition. In addition to the companies below, it was announced in March of this year that Virgin Orbit is also searching for a SPAC to merge with[4].

Company	Announced	Offering	SPAC	Ticker Symbol	Valuation*	Merger Closed?
Virgin Galactic	2019	Space tourism	Social Capital Hedosophia	SPCE	$1.4 billion	Yes
Momentus	2020	In-space transportation and infrastructure	Stable Road Capital	MNTS	$1.2 billion	No
AST SpaceMobile	2020	Space-based cellular broadband	New Providence	ASTS	$1.8 billion	Yes
Astra	2021	Launch services	Holicity	ASTR	$2.1 billion	No
Rocket Lab	2021	Launch services	Vector Acquisition Corporation	RKLB	$4.1 billion	No
BlackSky	2021	Satellite imagery as a service	Osprey Technology	BKSY	$1.5 billion	No
Spire	2021	Space-to-cloud data and analytics	NavSight	SPIR	$1.2 billion	No
Redwire	2021	Space infrastructure technology	Genesis Park Acquisition Corp	GNPK	$170 million	No

**Valuation at time of acquisition announcement.*

[4] *Bloomberg (2021) – 'Richard Branson Targets New Space SPAC to Take Virgin Orbit Public'*

Not All Smooth Sailing

Despite the apparent benefits of SPACs in terms of offering a “simple” route to market, not all of these deals have gone as smoothly as initially hoped. Space companies operate in a highly regulated environment, and while many regulated companies find success in the public markets, the process can take time and experience more turbulence than desired.

Following their announcement of intentions to become a publicly traded company via SPAC in 2020, the Momentus CEO and founder resigned in early 2021 after an investigation into his access to restricted space technology interfered with the attempt to go public. The resignation came in response to US government national security and foreign ownership concerns surrounding the company.

Issues with government contracts may also upset the process for potential SPAC target companies. Some of the government contracting programs are not readily adaptable to the company going public in a short time period. Companies who work with classified or sensitive technologies will have to be re-vetted by the government before they can go public, while some contracts are awarded under small company qualification programmes that may not be appropriate when a company becomes publicly traded.

As well as this, there have been concerns about valuations. Rocket Lab has a $4.1 billion valuation, at 5.4 times the 2025 expected revenue of $749 million. Spire has a $1.2 billion valuation, at 5.4 times their 2023 expected revenue of $227 million, and AST SpaceMobile has a $1.8 billion valuation at 1.8 times their 2024 expected EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) of $1 billion5. The revenues that the companies will have to generate to meet these valuations have prompted some comments of a potential bubble, as well as the danger of damaging shareholder value if milestones are missed.

CONCLUSION

It is too early to predict the success of these SPACs and any others that may follow. Achieving a public listing is not the finish line, and the companies will have to take key steps to realize the levels of growth expected, in a sustainable way. Some of these will fail to reach metaphorical (or sometimes literal) orbit, while others will go interstellar. Such is the nature of the markets. However, what is clear is that investors are hungry for new and exciting opportunities to make returns on their investments. As long as there is an appetite, there will be no shortage of companies attempting to satiate it.

Will an explosion in public market interest, along with the continued declining launch costs and advances in technology, unlock the widely touted trillion-dollar space industry? Or is this the beginning of a dot-com-like bubble? Either way, it feels like the start of a defining period for New Space, and when the dust settles, the new titans of the space industry will be revealed.

[8] *https://www.theverge.com/2020/8/30/21407389/spacex-falcon-9-rocket-launch-polar-orbit-cape-canaveral-florida*
[9] *https://www.rocketlabusa.com/about-us/updates/rocket-lab-debuts-fully-autonomous-flight-termination-system/*

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:

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