



# Start-up Space

Update on Investment  
in Commercial Space  
Ventures

2023



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## Executive Summary

Start-up space ventures attracted approximately \$8 billion in total financing in 2022. This investment was in the form of 154 deals, involving more than 400 investors, in 123 companies based in 20+ countries. For eight of these companies, 2022 saw their first publicly announced funding. The average deal size in 2022 was \$53 million, and seven deals were over \$100M. The biggest deals in 2022 were driven by SpaceX, accounting for \$2.2 billion out of \$8.2 billion. Later-stage start-ups received the largest investments in total magnitude, and series D rounds made up a more significant proportion of investment deals compared to 2021 levels. Space investment activity in 2022 occurred in the context of a global economic downturn which saw reduced venture funding across all industries.

Four key insights shaped the start-up space environment in 2022.

### **1** Venture investment in space decreased from 2021, reflecting the broader investment environment.

Monetary policy tightening affected global venture capital investment across all industries, which fell from a record high of \$681 billion in 2021 to \$445 billion in 2022. Total investment in space startups declined 46% from \$15 billion in 2021 to \$8 billion in 2022, with venture capital as the investment type showing the largest decline.

### **2** 2022 start-up space investment levels are below the record-shattering levels seen in 2021 but remain strong compared to previous years.

Start-up space investment was 6% higher than in 2020. The five-year average annual investment level as of the end of 2022 was \$8.2 billion, an increase from the 2021 five-year average figure of \$7.1 billion. There was an 82% increase in start-up space venture investment from 2020 to 2021. When compared to pre-2021 levels, start-up space investment remains significant.

### **3 Debt financing and acquisitions increased due to a few significant investments.**

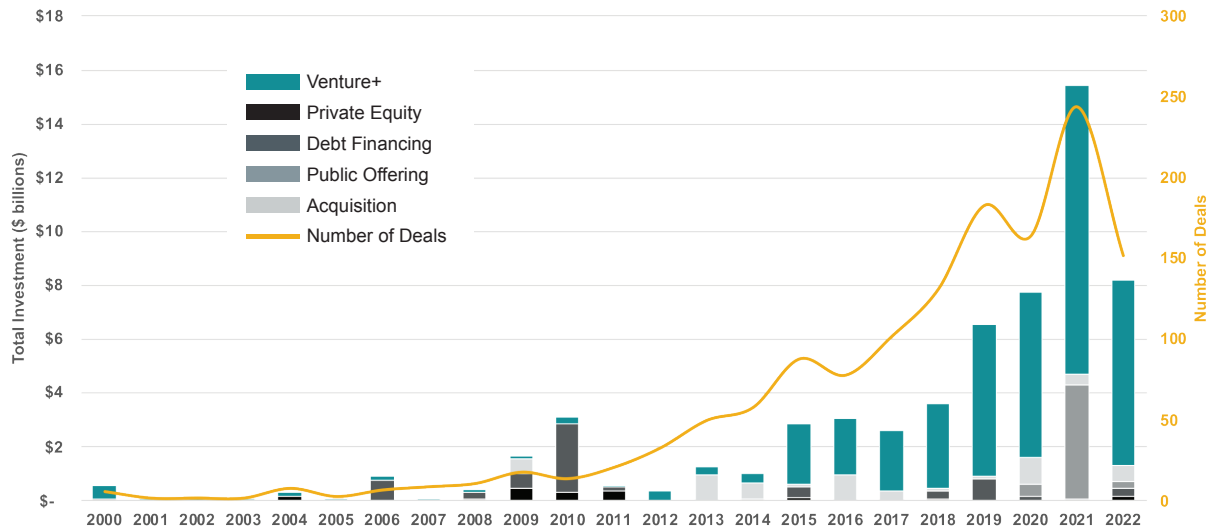
While venture capital investment and public offering activity declined in 2022, other types of investment continue to see consistent or even increased activity. Debt financing increased from \$11 million to \$312 million in 2022. Six acquisitions accounted for \$588 million in value, a \$228 million increase from 2021. In 2022, Terran Orbital received the two largest debt financing deals, raising a combined \$275 million. AE Industrial Partners' majority stake investment in York Space Systems was the largest recorded deal in total magnitude for space acquisitions in 2022. This activity matched trends in the broader space industry, with several prominent M&A deals announced in 2022 which fall outside the category of start-up space ventures, such as Advent International's acquisition of Maxar (\$6.4 billion), L3Harris's acquisition of Aerojet Rocketdyne (\$4.7 billion), and a merger between ViaSat and Inmarsat (\$7.3 billion).

### **4 Public offering activity declined in 2022 after emerging as a major source of start-up space funding in 2021.**

In 2022, 3 space companies went public via special purpose acquisition company (SPAC), raising over \$250 million (a decline of 94%). In 2022, SPAC investment dropped across all industries, including start-up space. 2021 saw a peak in space SPACs; public offering investment rose 823% in 2021 to account for 28% of total start-up space investment. This was primarily enabled by using SPACs as an alternative to traditional IPOs, as 12 start-up space companies went public through SPACs in 2021 and only 2 companies went public via IPO. The decline in public offering revenue accounts for a large portion of the overall investment drop from 2021 to 2022; when public offerings are excluded, the decrease in start-up space investment is 29%. The decline in SPAC activity was driven by the significant reduction in investor appetite for SPACs in all sectors, including space.

The availability of investment capital, business case outcomes for large LEO constellations, and government support of commercial space activities, particularly in national security, will shape the start-up space ecosystem in the next few years. In addition, consolidation is a growing trend; at the halfway mark, 2023 has seen important developments, such as potential M&A activity around ULA, the ongoing OneWeb/ Eutelsat merger, Viasat’s acquisition of Inmarsat, the completion of L3Harris acquisition of Aerojet Rocketdyne, and BAE Systems’ acquisition of Ball Aerospace. As space-industry specific factors can affect investment activities, broader factors such as global events and economic conditions may also shape the availability of investments as well.

**Figure 1. \$8 billion invested in 2022 across 154 deals.**



## Introduction

The *Start-Up Space* report series examines space investment in the 21<sup>st</sup> century and analyzes investment trends, focusing on new companies attracting private financing.

Start-up space ventures are defined as space companies that began as angel and venture capital-backed start-ups. This definition differentiates start-up space ventures from aerospace and defense government contractors and large, publicly traded space enterprises. *Start-Up Space* seeks to provide insight into the dynamics of the growing space industry and the investment driving it.

The report tracks seed, venture, and private equity investment in space start-ups as they grow and mature from 2000 through the end of 2022. The report includes debt financing for these companies where applicable to provide a complete picture of the capital available to them. The report also highlights start-up space M&A, SPAC, and IPO activity.

## Purpose and Background

BryceTech conducted the Start-Up Space study and produced this report, *Start-Up Space 2023*, the eighth in this series.

This report informs investors, the aerospace industry, and the public about activity in this emerging space ecosystem. It reflects BryceTech's ongoing commitment to providing the space community with rigorous analyses of industry dynamics to support sound decision-making in industry, government, and academia.

## Methodology

Our dataset includes a combination of (a) publicly reported investment transactions in start-up space companies as they mature, with details on investment level and investors where reported; (b) additional companies for which little or no transaction data was reported, but which we have identified as start-up space ventures; and (c) qualitative data about investment trends and investor motivations. Bryce conducts ongoing interviews, surveys, and conversations throughout the global investment ecosystem, including at



critical nodes such as Silicon Valley/San Francisco, Southern California, Washington, D.C., Seattle, New York, Florida's Space Coast, Houston, Austin, Beijing, Hong Kong, London, Luxembourg, Paris, Singapore, Sydney, and the United Arab Emirates.

## Definition of Start-Up Space Venture

Our definition of a space company is a business entity that provides space products or services, specifically one that:

- Manufactures satellites, launch vehicles, or other space-based systems
- Manufactures satellite ground equipment
- Provides services that rely on these systems, such as satellite TV, radio, broadband, remote sensing, or in-space servicing, assembly, and manufacturing services
- Provides analytic services based on data collected extensively from space-based systems, either alone or in combination with terrestrial systems

Our criterion for a start-up venture is a space firm that has received and reported seed funding or venture capital. This report defines these firms as start-up space ventures, including all development stages.

## Data Set

We include in our data set all firms that meet the start-up venture criteria at any time from 2000–2022. Analysis of investment magnitude (i.e., value), investors, and transactions throughout this report is based on data available as of January 31, 2023, covering transactions through December 31, 2022.

**Types of Investor** – This analysis considers six categories of investors to aid in understanding trends in investment and investor motivation: angel investors, venture capital (VC) firms, private equity (PE) firms, banks (typically not strictly investors, but an essential source of capital), corporations (as strategic partners and/or internal investors, or through corporate venture funds), and public markets. This typology conceptually groups some investor types that could be treated separately but share characteristics, such as sovereign wealth funds (included in the venture capital category) and hedge funds (included in the venture capital firm category). While investor categories continue to shift and evolve, the typology here provides a useful (and generally accepted) broad description of groups of investors and their typical investment behaviors.

**Types of Investment** – Our data set includes five key types of investment (venture, private equity, acquisition, debt financing, and initial public offering) in the firms that fall within the definition of a start-up space venture. A firm that receives venture funding and

then receives significant investment from a private equity group would be considered a start-up space venture by our definition, and the investments of both the venture firm and the private equity group would be included. On the other hand, a long-standing aerospace firm that recapitalizes and receives an investment from the same private equity group would not be considered a start-up, and the private equity investment would not be included in this analysis. The focus of this analysis is ‘new’ start-up space ventures and the capital they are attracting.

Note that the seed category (included in venture) includes funding from prizes (such as business plan competitions or XPRIZE), foundations, and crowdfunding campaigns, as well as seed funding from angels and “space billionaire” super-angels.

Seed rounds are often treated separately from venture capital rounds. Still, the distinction is somewhat arbitrary, especially in the capital-intensive space sector where “seed” rounds can be in the tens of millions of dollars. As such, they have been combined with the rest of the venture deals.

We include debt financing for start-up space ventures to provide a complete picture of the capital available to the management team at these companies.

The data set includes only publicly reported transactions; it does not include proprietary investment information. In some cases, transaction value, funding round, or investors are undisclosed. Depending on available information, these are either estimated or excluded.

The data set generally excludes government funding, except for specific grants that mirror seed or venture funding (i.e., not contract awards), such as those provided by the Grand Duchy of Luxembourg. A few quasi-government corporations are included (e.g., Midland Development Corporation and The Valencian Institute of Finance), where they provide seed or venture investments with economic development objectives. Bryce also includes funding from publicly funded venture capital firms, such as the Central Intelligence Agency’s In-Q-Tel.

**Sources** – Data sources on companies and investments include BryceTech databases; company and investor press releases; annual reports, investor materials, and SEC filings; financial newsletters and databases, such as Crunchbase, PitchBook, Owler, and CB Insights; data provided by NewSpace Hub; news articles from major media outlets, investment publications, trade press, and business journals; and ongoing engagement with industry subject matter experts. Where possible, we confirmed the details of each investment using multiple sources. For third-party sources’ records of investment deals that have not been verified by either a primary or secondary source, we exclude the investment deal from the report. We further validate our data with venture capitalists, private equity investors, investment bankers, industry experts, and management teams at space companies and through targeted interviews.

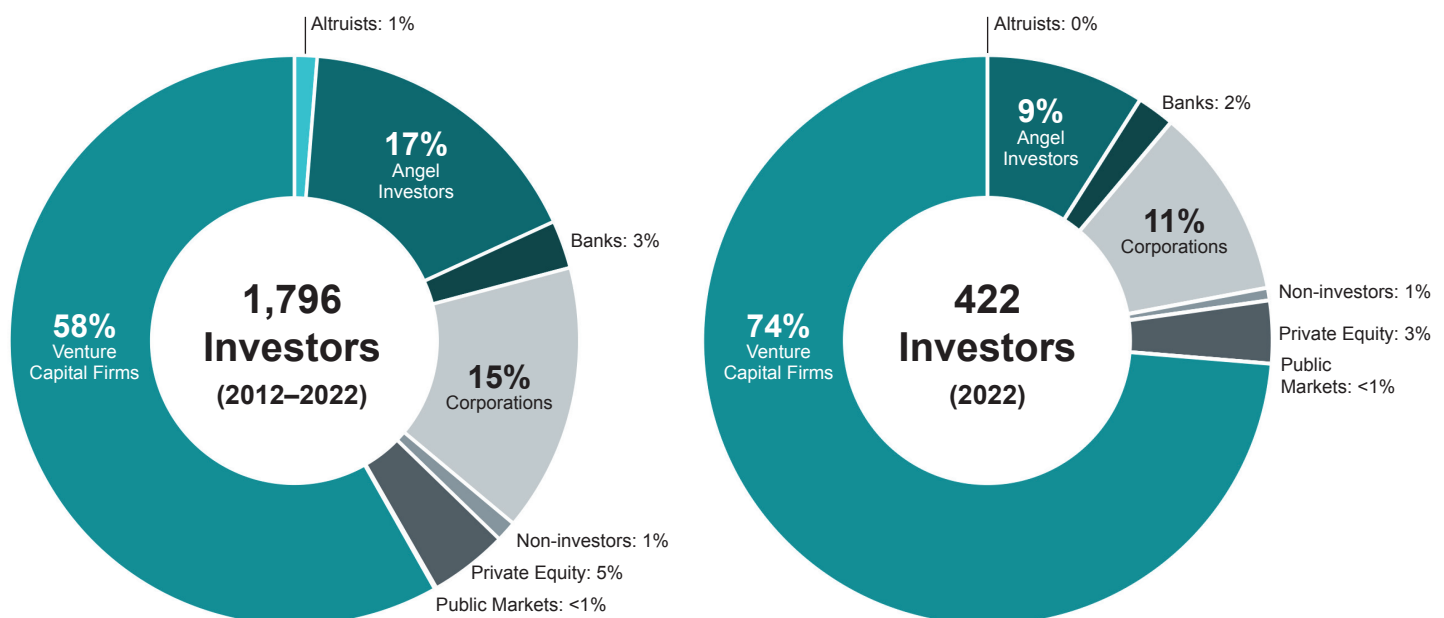


## Space Investors by the Numbers

### Overall

In 2022, 422 investors participated in funding deals for 123 start-up space companies, a total of 154 deals. The number of unique investors in 2022 fell 30% from 2021 but remained 10% above 2020. As shown in Figure 2, venture capital firms account for nearly three-quarters of investors in 2022 and, along with corporations and angel investors, make up over 90% of investors. Since 2000, over 1,875 investors have participated in 1,389 deals. Private equity firms and banks continue to have a small but consistent role in the start-up space investment landscape. Even during monetary tightening, start-up space attracted new interest, as shown in Figure 3. More than half of investors in 2022 were first-time investors in the start-up space, including 157 venture capital firms, 26 angel investors, and 26 corporations. The percentage of first-time investors in 2022 (52%) was lower than the 2021 percentage of first-time investors (63%).

**Figure 2. 422 investors invested in 123 start-up space companies in 2022.**



**Figure 3: 221 of 422 investors in 2022 were first-time start-up space investors.**

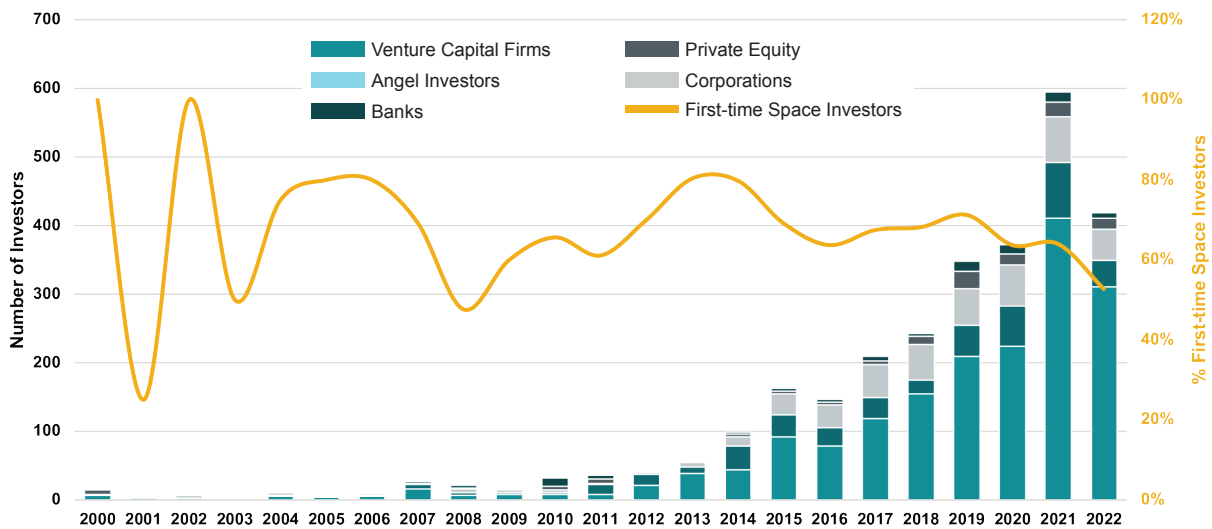
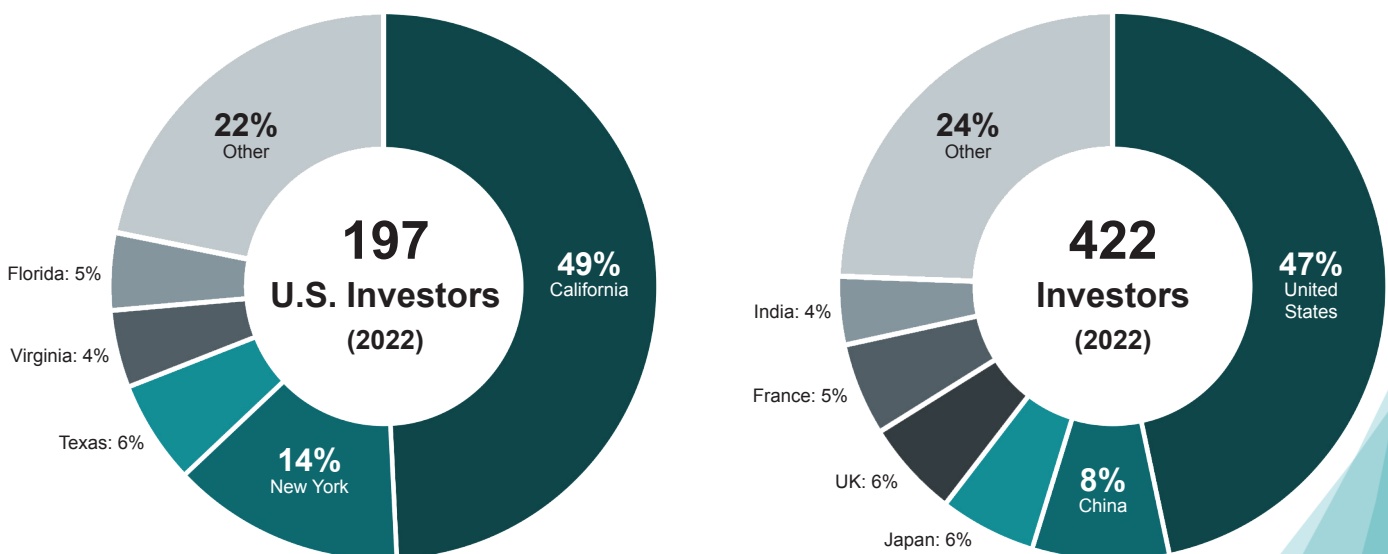


Figure 4 shows the geographic distribution of start-up space investors. In 2022, 225 investors were based outside the United States (53%), compared to 197 in the United States (47%). Considering all 1,875 investors since 2000, about 43% of investors in start-up space companies were from the United States, followed by China (12%), Japan (7%), and the United Kingdom (7%). California and New York were home to the highest number of start-up space investors within the United States; they represent, 21% and 8% of the global total, respectively. Investors outside the United States outnumbering investors from the United States is a relatively recent development that started in 2018. Participation from international investors has been increasing since 2018, primarily in China, Japan, and the United Kingdom. Particularly in 2015, start-up space investments significantly increased, 63% of investors were based in the United States, and the share fell to 47% in 2022.

**Figure 4: California, China, Japan, and the UK account for 48% of investors since 2000.**



We analyze each investor type in the next section, assessing (1) role as a funding source, (2) general objectives in investing, and (3) participation in the start-up space ecosystem. For illustrative purposes, examples of select space deals are also provided.

## Investors by Type

### Angel Investors

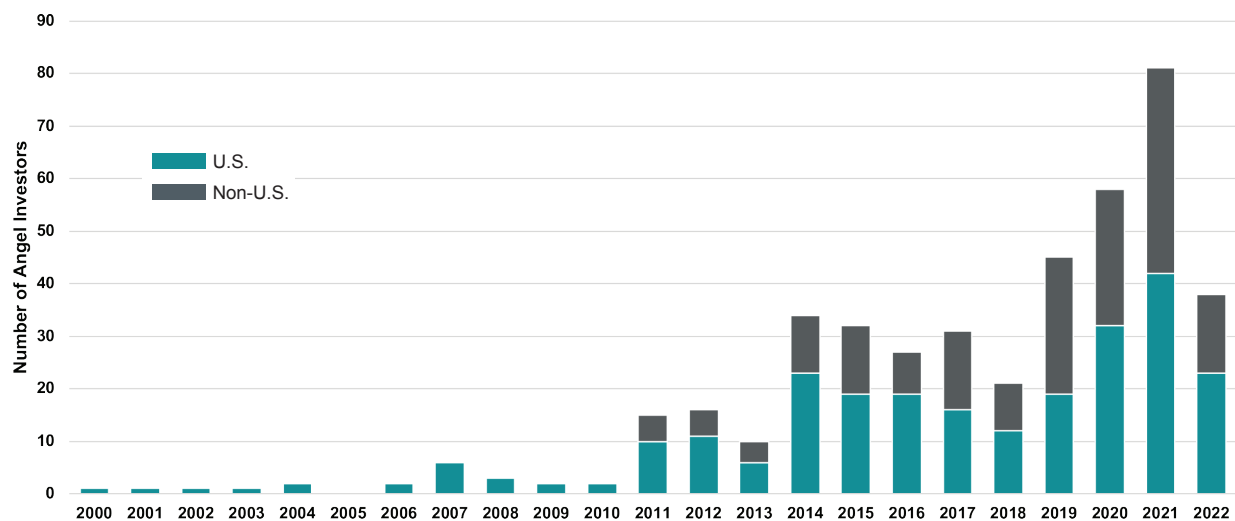
Typically, angel investors are individuals or families (including family offices) that have accumulated a high level of wealth and seek potentially high returns by investing in ventures during the early stages. By getting in on the ground floor, an angel investor can realize an attractive potential return, as the early investment will secure a significant foothold in the company. Angel investors typically seek to realize their return (i.e., exit) about 5 to 7 years from the investment date. Angels may expect an equity stake in the company as high as 30% to 40% in return for their investment; however, their equity stakes are often much lower, especially after subsequent, larger investors join the capital structure. In recent years, angels have also participated in syndicates, pooling investments with other angels and venture capital firms to provide more funding to start-ups. We include incubators and accelerators in this investor group because they provide equity, mentoring, and networking at a start-up's pre-seed or seed stage.

The most prominent angel investors are “space billionaires.” These billionaires have accrued their wealth through other successful businesses or investments and have either founded a space company or invested their own money in a space company. Several high-profile billionaires such as Elon Musk, Jeff Bezos, and Richard Branson are space investors. Well-known billionaires like Bill Gates, Mark Zuckerberg, and the late Paul Allen have been affiliated with space ventures. While angel investment typically ranges from \$50,000 to a few million dollars, the investment level by space billionaires far exceeds typical angel levels, often hundreds of millions of dollars to over \$1 billion per funding event.

Angel activity in 2022 saw a decrease from 2021. Thirty-eight angel investors funded start-up space ventures in 2022, with 61% based in the United States. Since 2000, 320 unique angel investors have invested in start-up space companies; most (56%) have been US-based.

In 2022, 51% of angel investors were based in California, followed by 12% in New York and 6% in Washington. The remaining 31% were from 23 other states. Outside of the United States, 24% of non-U.S.-based angels are based in India, 14% in Japan, and 14% in the UK. The remaining non-U.S. angels are from 21 other countries.

**Figure 5: 38 angel investors reported investing in start-up space ventures in 2022.**



## Venture Capital Firms

Venture capital firms are groups of investors providing capital to early-stage start-up companies with high growth potential. These firms accept significant risk in exchange for potentially high returns, leading to a high failure rate of firms funded by these investments. A 2012 research study by Shikhar Ghosh, senior lecturer at Harvard Business School, finds that “about three-quarters of venture-backed firms in the United States don’t return investors’ capital.” VC funding has traditionally come in stages (or rounds), generally designated series A, series B, series C, etc. The form of investment is equity; specifically, the instrument is usually preferred stock. Consequently, the VC firm has an equity ownership stake in the company but at a higher priority (or preference) than investors at common equity (e.g., founders, employees, and angels) and a lower priority than any company debt holders. The preferred shares are usually convertible to common stock in an initial public offering (IPO; see “Public Markets”) or sale of the company, which are the typical instances of a VC’s exit.

Several space-oriented VC funds have emerged from this class of investors. Examples include Space Angels (operating a venture capital fund, Space Capital, focused on early-stage companies), London-based Seraphim (offering several platforms including the Seraphim Space Fund, the first publicly-listed space fund, focused on early-stage space investments), Starburst Aerospace (a space-oriented VC firm and accelerator for start-ups), and SpaceFund (with a blockchain-oriented method of soliciting investor capital for start-up space companies). Other notable VC firms include HorizonX (AE Industrial Partners and Boeing) and Founder’s Fund.

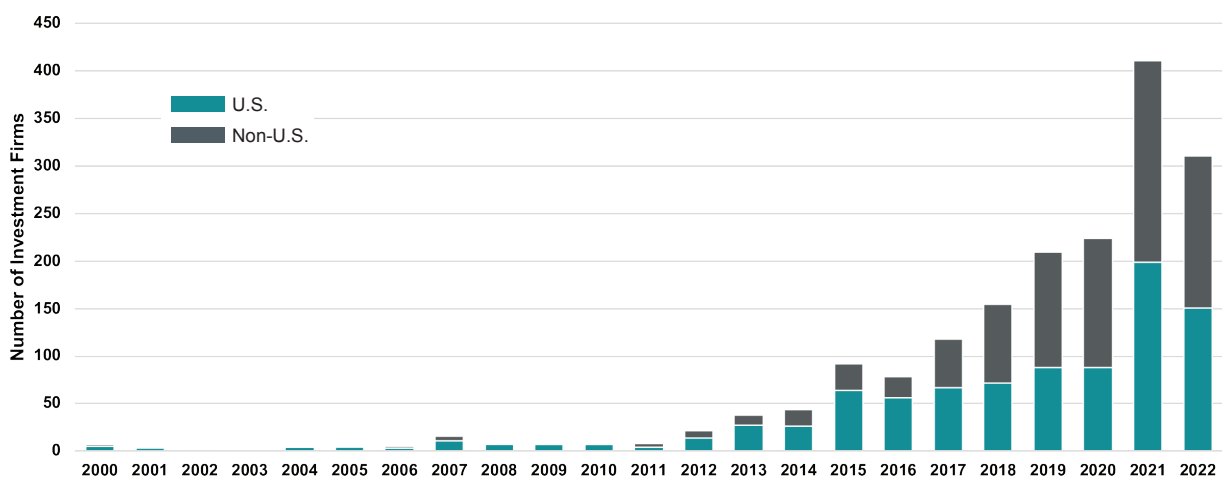
Additionally, while hybrid or specialized capital providers are well established in the broader investment landscape, dedicated space and deep tech firms, such as Overlap Holdings, are now emerging. Companies have also successfully sourced debt venture

funding from firms, such as Trinity Capital (to Space Perspective) and Triple Point Capital (to Astranis).

The number of VC firms investing in start-up space companies decreased to 311 in 2022 from 410 firms in 2021. (See Figure 6). Of those 311 firms, 154 (49%) had previously reported investment in start-up space companies, while 51% (157) are first-time investors in start-up space companies.

Since 2000, 1,045 unique VC firms have invested in space start-ups, 51% of which are headquartered in the United States. In 2022, of the U.S. firms based on investments, 51% were based in California and 13% in New York. Massachusetts and Texas lead the remaining states hosting U.S.-based VCs investing in space. Outside of the United States, VCs investing in start-up space ventures have headquarters in 50 countries, led by China hosting 19% of the non-U.S. total, the United Kingdom with 9%, and Japan with 10%. In 2022, countries such as Germany, France, Australia, India, Singapore, Canada, Spain, and Israel are also each home to ten or more VCs investing in space companies.

**Figure 6: 311 VC firms invested in start-up space ventures in 2022.**

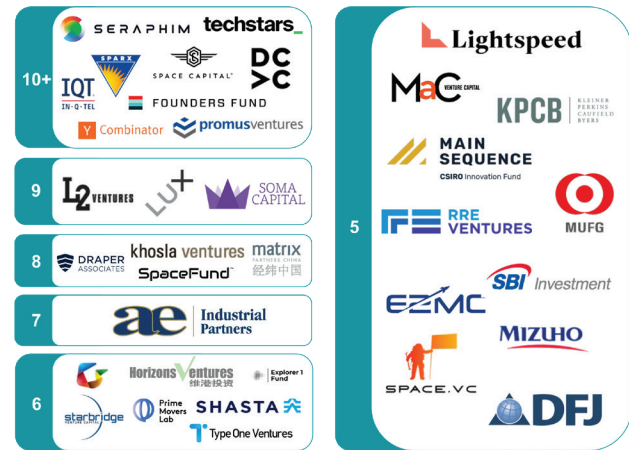


### Most Active Space VCs

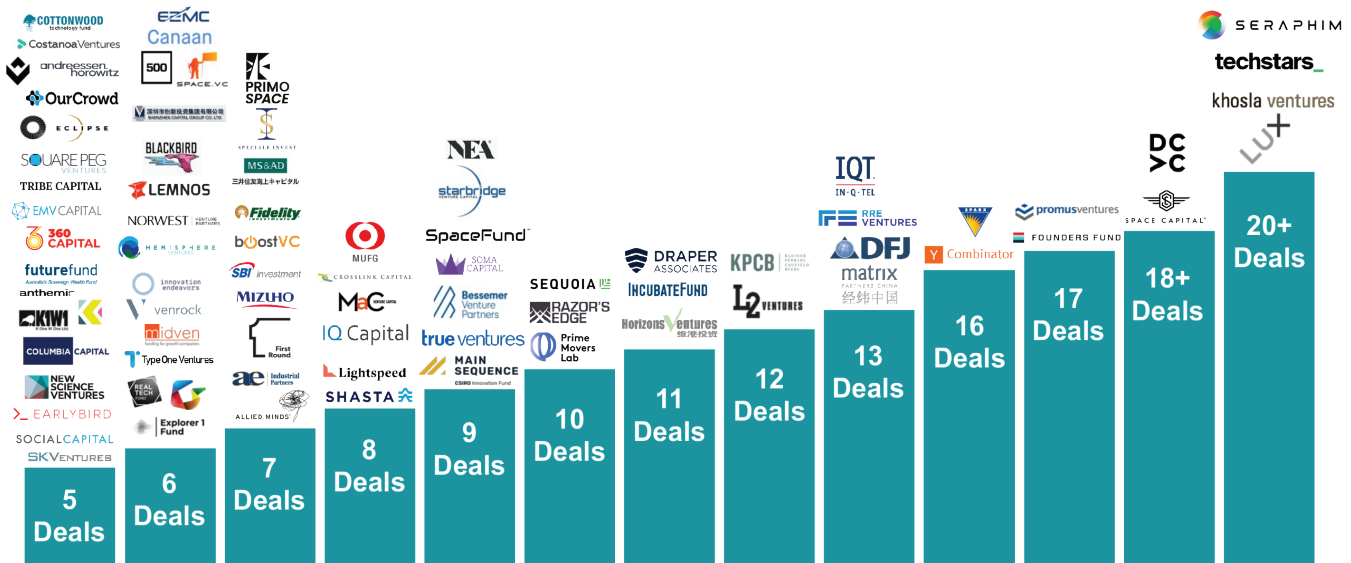
Between 2000 and 2022, 35 venture capital firms invested in five or more start-up space companies. VCs investing in ten or more startups include Founders Fund, Y Combinator, In-Q-Tel, DCVC, SPARX, Promus Ventures, Space Capital, TechStars, and Seraphim. Liquid2 Ventures, Lux Capital, and SOMA Capital invested in nine; Draper Associates, Khosla Ventures, Matrix Partners China, and Spacefund invested in eight; AE Industrial Partners invested in seven; Explorer 1, Gaingels, Horizons Ventures, Prime Movers lab, Shasta Ventures, Starbridge Venture Capital, and Type One Ventures invested in six; and 11 other companies invested in five start-up space companies. In addition, 72 venture capital firms invested in three or four start-up space companies.

Since 2000, 80 VCs participated in at least five start-up space deals, which may include more than one investment in a single company. Seraphim led this group, participating over 70 start-up space deals since 2000. It is followed by TechStars (24), Lux Capital (21), Khosla Ventures (20), Space Capital (19), Data Collective (18), Founders Fund (17), Promus Ventures (17), Sparx (16), Y Combinator (16), Matrix Partners China (13), In-Q-Tel (13), Liquid 2 Ventures (12), Draper Associate (11), Horizons Ventures (11), Sequoia Capital (10), Bessemer (9), SpaceFund (9), Starbridge Venture Capital (9). (See Figure 8).

**Figure 7: VCs investing in five or more different companies since 2000.**



**Figure 8: Four VCs have participated in over 20 space startups deals since 2000.**



## Private Equity Firms

PE firms manage capital on behalf of limited partner investors. PE funds primarily consist of capital commitments made by institutional investors, such as sovereign wealth funds, pension funds, and family offices. The largest PE firms invest over \$100 million, usually in companies that are ideal candidates for debt restructuring or leveraged buyouts. They traditionally invest in cash-producing companies, a key difference from venture capital investment. PE firms also look for companies that can be classified as “distressed assets” that is, the company is facing challenges that an infusion of capital and operational changes can overcome. Given their use of leverage to finance acquisitions, traditional PE firms generally seek companies with stable cash flows. Thus, PE activity has generally



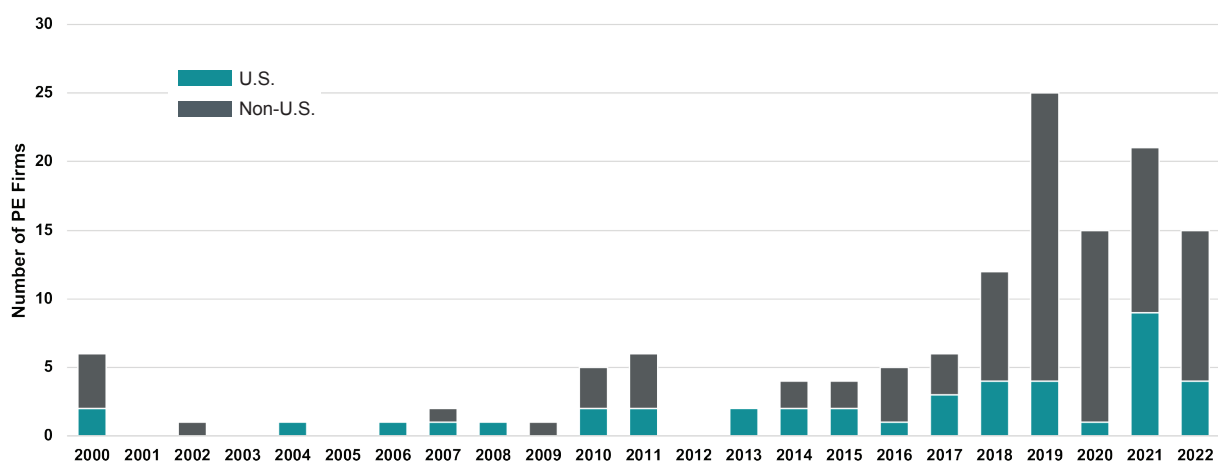
been limited in the start-up space ecosystem to areas such as to the telecommunications industry or government contracting.

In recent years, many PE managers have been making equity investments at earlier stages of companies' maturity— on a minority basis and with longer expected exit time horizons. These early-stage companies have also been targeted by PE firms who look to acquire groups of similar companies whose capabilities could be beneficial for all businesses under the PE firm's umbrella. This process is commonly referred to as a "roll-up", and examples can be observed in AE Industrial Partners' merger of Adcole Space and Deep Space Systems to create Redwire Space and subsequent acquisitions of Made in Space, Roccoor, LoadPath, Oakman Aerospace, and Deployable Space Systems prior to their SPAC merger in 2021.

Fifteen PE firms invested in start-up space in 2022, down from 21 in 2021. Eight of these 15 PE firms had previously reported investment in start-up space companies, while seven were new entrants to the start-up space ecosystem. The number of PE firms investing in space start-ups has varied over the years, as shown in Figure 9. Since 2000, 133 unique PE firms have invested in start-up space companies.

About 30% of PE firms are headquartered within the United States. Based on the number of investments in 2022, New York PE firms account for 37% of the U.S. total, followed by California (23%) and Massachusetts (10%). Non-U.S. PE firms are headquartered in 16 countries. 32% of non-U.S. PE firms are based in China, with an additional 17% in the United Kingdom. France, Australia, Canada, Israel, and Japan are each home to four or more PE firms with start-up space investments.

**Figure 9: The number of PE firms investing in space start-ups has varied since 2000.**



## Corporations

Corporations invest internally in R&D, manufacturing, operations, processes, and many other areas to enhance capabilities to create or strengthen existing expertise or advantage. Some large companies invest through a corporate venture fund or acquire firms to bolster their competitiveness. When a corporation provides funding for a venture, it is usually in the form of straight equity or sometimes in the form of debt, often with the option to convert the instrument into the equity of the investee company.

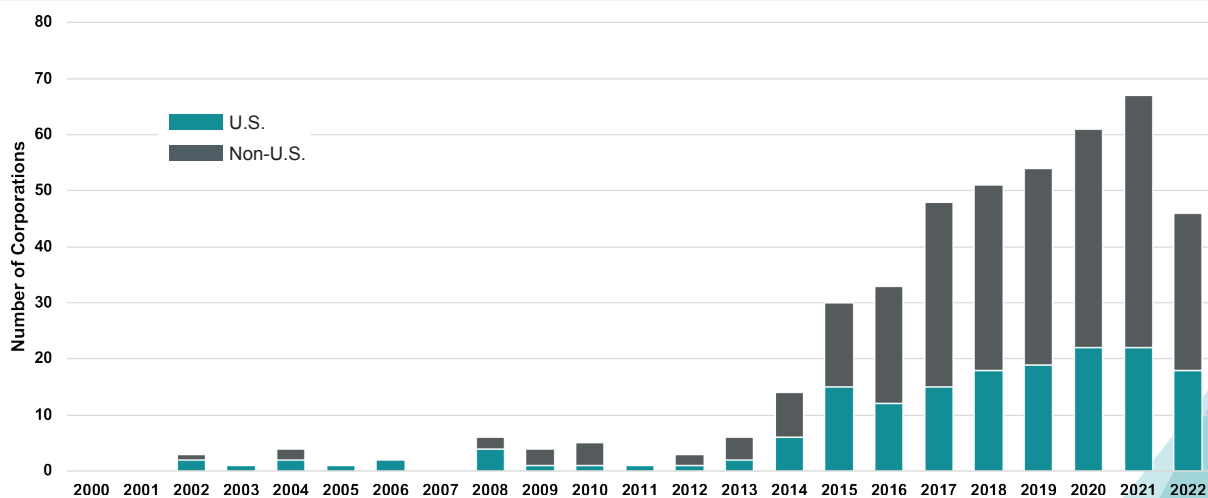
The most active corporate investors in the start-up space ecosystem since 2000 were Airbus (26 deals via Airbus and Airbus Group), Lockheed Martin (17 deals), Boeing (14 deals), and Google (13). Softbank Group focuses on investment management and has participated in 9 deals since 2017. In 2022, Softbank participated in Satellogic's private investment in public equity (PIPE) deal. Softbank also has repeatedly invested in OneWeb, having participated in 4 deals between 2016-2019 for debt financing and undisclosed rounds.

Not all corporate investments and acquisitions satisfy the definition of a start-up space deal; for example, deals between companies that have not received seed or venture investment are not 'start-up space' companies by the definition used here. Examples include Advent International's acquisition of Maxar Technologies and L3Harris' acquisition of Aerojet Rocketdyne for \$4.7 billion.

We include space-focused holding company Voyager Space Holdings in the corporations category. Voyager has said it aims to facilitate synergies between its portfolio of space companies by providing shared resources and capital.

As shown in Figure 10, the number of corporations investing in start-up space ventures fell by 31% from 2021 (67) to 2022 (46). Since 2000, 285 corporations have reported

**Figure 10: 285 corporations have reported investing in start-up space companies since 2000.**



investing in start-up space companies. Participation from corporations was lower in the first fifteen years of the study period, increasing significantly in recent years. Of corporations investing in start-up space ventures, 34% are headquartered in the United States, about 30% of which are based in California (10% of the global total). The remaining U.S. portion of the global total is distributed across the United States, with New York, Texas, Virginia, and Colorado leading. Non-U.S. corporate investors comprise 66% of the global total; 18% are based in Japan, 9% in China, and 5% in the United Kingdom. Others include France, Spain, and Canada, each home to at least ten corporations investing in start-up space companies.

## Banks

Banks have historically played a limited role in financing start-up ventures. Bank investment in start-up companies can come in several forms, including traditional lending, convertible notes, and traditional equity. Traditional lending provides loans to start-ups which is often critical in developing the capital-intensive systems and technologies associated with the space and satellite industry without diluting their equity, which may be important as they look to raise later funds through traditional venture capital investment.

Convertible notes allow banks to lend money to start-ups initially through debt, with this stake possibly becoming wholly or partly equity at a future point determined by the involved parties or if certain conditions are met. Equity investors provide a substantial “cushion” (e.g., 30% of the total capital expense or CapEx required for a certain program, such as the deployment of a satellite or satellites), and the remainder of CapEx (or other types of programmatic expenditure) is financed by debt, meaning that the initial instrument is in the form of debt. At certain trigger points, debt can be converted, in whole or in part, into an equity stake in the financed company.

Commercial banks based in the United States, such as Wachovia, Wells Fargo, and Citibank, and non-U.S.-based banks, such as Deutsche Bank, BNP Paribas, and ABN AMRO, in Europe, have provided debt financing at a magnitude of \$100 million to \$1 billion (sometimes exceeding \$1 billion) per funding event. Most financed companies, such as GEO satellite operators, have stable cash flows and large satellite CapEx requirements. In addition, government-backed banks (i.e., export credit agencies), such as the U.S. Export-Import (Ex-Im) Bank and COFACE of France, have provided debt funding (or guaranteed third-party debt funding) for several satellite systems.

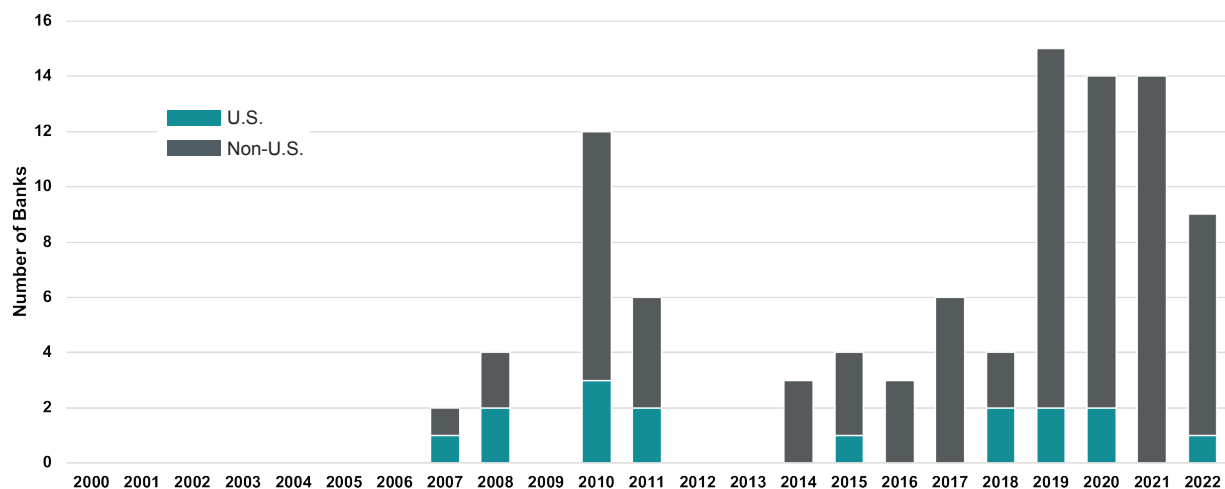
The type of banks investing in startup space venture vary from government-backed development banks which make investments into businesses developing new technologies, to traditional commercial ones who are providing a service as they would to any other business who is looking to take a loan.

Additionally, some banks also operate investment arms through which they make direct equity investments in start-ups, usually in the early phase of a company’s growth. Since financial transactions are largely governed by current banking regulations, banks in the United States, Europe, and globally significant banks cannot invest from their own balance sheet. Banks therefore tend to invest through their asset management arm or through creating venture capital funds to facilitate these private transactions. It is important to note that while these regulations generally apply to major banks, there may be exceptions for smaller institutions or specific cases where certain investments are permitted. Overall, the regulatory environment surrounding bank equity investments is designed to safeguard financial stability and mitigate potential risks associated with these activities.

In the start-up space ecosystem, the most active banks since 2000 are the Scottish Investment Bank (10 deals), the Business Development Bank of Canada (6 deals), HSBC Holdings (6 deals), and the European Investment Bank (4 deals).

As shown in Figure 11, the number of banks that invested in start-up space ventures in 2022 (9) is lower than the levels of bank participation observed in 2021. Of the nine banks that invested in 2022, four previously reported investments in start-up space companies, while five were new entrants to the start-up space ecosystem. Since 2000, 62 unique banks have invested in space start-ups. 18% of those banks are headquartered within the United States, with New York accounting for 36% of the U.S. total. Non-U.S. banks are primarily based in Japan (24% of non- U.S. total) and the United Kingdom (10%), with France, China, and Germany each home to four or more banks with start-up space investments. In 2022, 90% of deals with banks participating were venture capital deals, totaling \$390M.

**Figure 11: Nine banks invested in start-up space companies in 2022.**



## Special Topic: Silicon Valley Bank

Silicon Valley Bank's (SVB) closure in March 2023 was one of the biggest failures by a U.S. bank since the 2008 global financial crisis. The SVB failure and subsequent response by regulators were relevant to the start-up ecosystem, though it does not appear space start-ups were disproportionately affected. At least one media outlet (CNBC) reported in the aftermath that space companies ultimately had "much lower [exposure] than originally feared," particularly compared to other industries.<sup>1</sup>

Companies in the space industry that disclosed bank holdings with SVB include Rocket Lab, Astra, Redwire, and Planet Labs. VCs such as Founders Fund also had portfolios at SVB, and the bank itself had a venture unit with investments in Sequoia Capital and Andreessen Horowitz, both of which have invested in space ventures. In 2022, SVB participated in Space Perspective's \$17M debt financing round, further highlighting SVB's involvement in the start-up space ecosystem.

### Investment Banks

Investment banks are often-visible actors in complex investment transactions typically involving private equity, corporations, and/or public markets. They often act as brokers arranging and facilitating these transactions rather than as the principal lenders or investors. Investment banks play various roles, including advising on capital raising approaches and more strategic transactions such as mergers and acquisitions and underwriting a capital raising event (e.g., an IPO). They often focus on large transactions (typically in the multi-hundred-million-dollar to over \$1 billion range). Large space/satellite communications companies work with investment banks as financial advisors. These institutions will usually take the role of "lead managers" of a financing transaction, often with several fulfilling that position. An example is Bank of America's lending relationship with SpaceX. They arranged a loan worth \$750 million for SpaceX in 2018.<sup>2</sup> Mid-size banks may focus on smaller deals or new companies, such as Cannacord acting as capital market advisors to the Intuitive Machines' SPAC deal.

### Public Markets

Toward the later stages of a company's funding trajectory, there can be an initial public offering (IPO) or public sale of the company's equity (common stock). The IPO enables additional capital to supplement prior funding rounds and provide previous investors an exit mechanism for their investments (i.e., sell their equity shares in the public marketplace). In a customary process for an IPO, an issuer selects an underwriter that helps with regulatory issues, marketing, pricing, and post-deal price stabilization. In return, the issuer pays an underwriting fee and agrees to a lockup that prevents certain shareholders from selling for a specified time.

### SPACs

In recent years, alternatives to the traditional IPO process have been more common, including a direct listing or sale to a special purpose acquisition company (SPAC). A direct

listing allows shareholders to sell existing shares in exchange for whatever the market is willing to pay, but no new shares are issued. Alternatively, a SPAC can act as a shell company that goes public to use the proceeds to acquire a private company, in effect making it publicly listed. SPAC deals typically involve negotiation only between the SPAC sponsor and the target. As a result, the transaction is perceived to be more straightforward and transparent for a private company seeking to become publicly listed. In some cases, going public via SPAC enables the sponsor and target company to bypass the need for large due diligence and transaction costs commonly associated with traditional IPOs.

This report includes SPAC proceeds only once the business combination is approved and the acquired company starts to trade as a newly merged company (under the new ticker symbol). Since public shareholders can redeem their shares before merger completion, our dataset considers actual SPAC funding (e.g., net of redemptions) counted within the public offering investment category. Lastly, SPAC sponsors frequently invite private investment in public equity (PIPE) as a part of the business combination to provide an additional cash buffer in case of high redemptions. The report also includes PIPE investments within the public offering investment category.

While many established space companies and government contractors have long traded publicly (e.g., Boeing, Lockheed Martin, Northrop Grumman, L3 Harris), IPOs of space start-ups have historically been limited (e.g., UrtheCast in 2013, Kleos Space in 2018, Virgin Galactic in 2019).

Despite a record 12 start-up space IPOs that occurred in 2021, SPAC IPOs decreased in 2022. Three space SPACs were completed (Terran Orbital, SatixFy, and Satellogic), and two deals were canceled (D-Orbit and Tomorrow.io) by the end of 2022. Intuitive Machines announced going public via SPAC merger with Inflection Point in 2022 and completed its merger in 2023.

The decline in SPAC activity was driven by the significant reduction in investor appetite for SPAC deals in all sectors, including space. On the supply side, new proposed SEC regulations concerning the amount of disclosure and financial statements required for

**Figure 12: Three IPOs in 2022, compared to 12 in 2021.**





the completion of a SPAC merger to occur have restricted previously lenient conditions. These regulations will transform the process of de-SPAC transactions to be more like traditional IPOs, increasing liability for firms seeking a SPAC merger. While these rules are not yet in effect, their proposal has altered the approach many firms are taking to raising capital.

## Investor Types

Investors in start-up space ventures can be grouped into six categories, each with unique goals, strategies, and horizons.

The most common type of investor is the venture capital firm. Strategies of venture capital firms vary, and this is reflected in the values and types of their investments. Firms may make many small investments in a large number of companies or make a few, larger investments in a small number of companies. VC investors typically seek returns in excess of ~100x initial investment but recognize that the likelihood of an investment achieving this result is very small. Angel investors share many commonalities with venture capital firms but often act as an individual investor or a group of individuals.

Private equity investors differ in that they tend to be more selective in which firms they acquire or invest in, as they look for firms which are actively generating revenue but need additional capital or management to achieve their full potential. PE firms will also seek to acquire a group of small, similar companies that could benefit from sharing assets and merging. Different from venture capital and angel investors, PE firms will often use a combination of debt and equity to make their investments, which allows them to leverage the cashflow that many of the companies they invest in have.

Corporations will invest in start-up companies for a multitude of reasons, including to acquire a specific technology or even to disrupt or control potential competition. Consequently, some start-ups have been hesitant to accept investment from these firms. This also means that the timeline for exits can be much shorter than for other investments.

Banks are a small portion of the investors in space start-ups but can be important to firms who have had trouble raising investment from other investors. Banks can make traditional investments through venture capital arms, provide loan services, or provide convertible debt to start-ups.

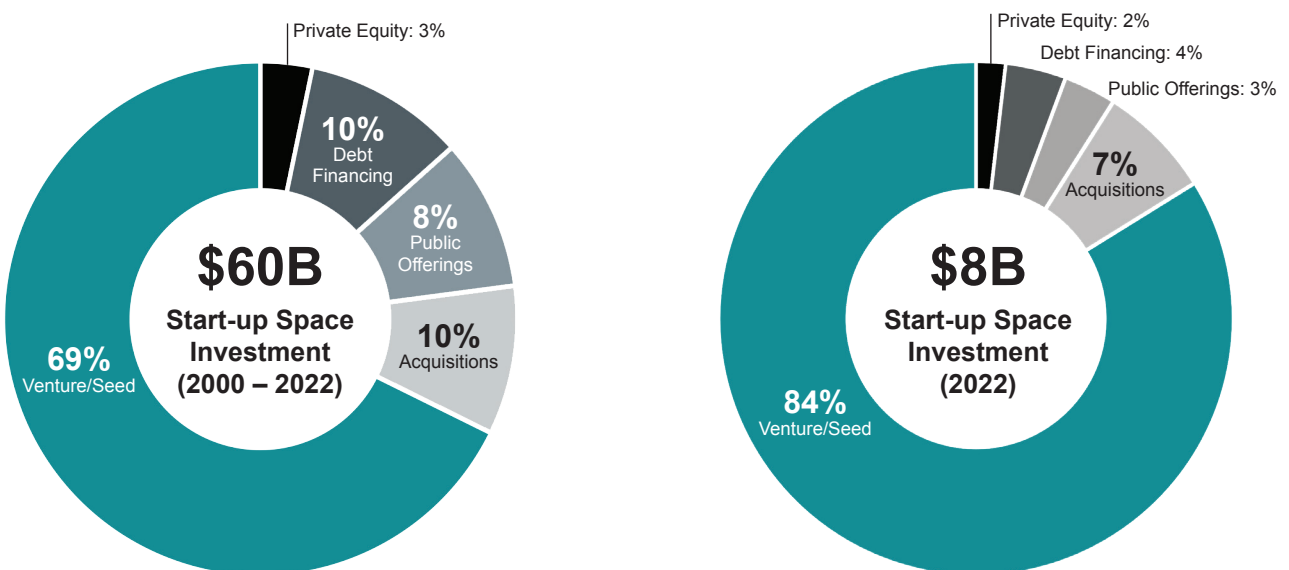
## Space Investment by the Numbers

### Overall

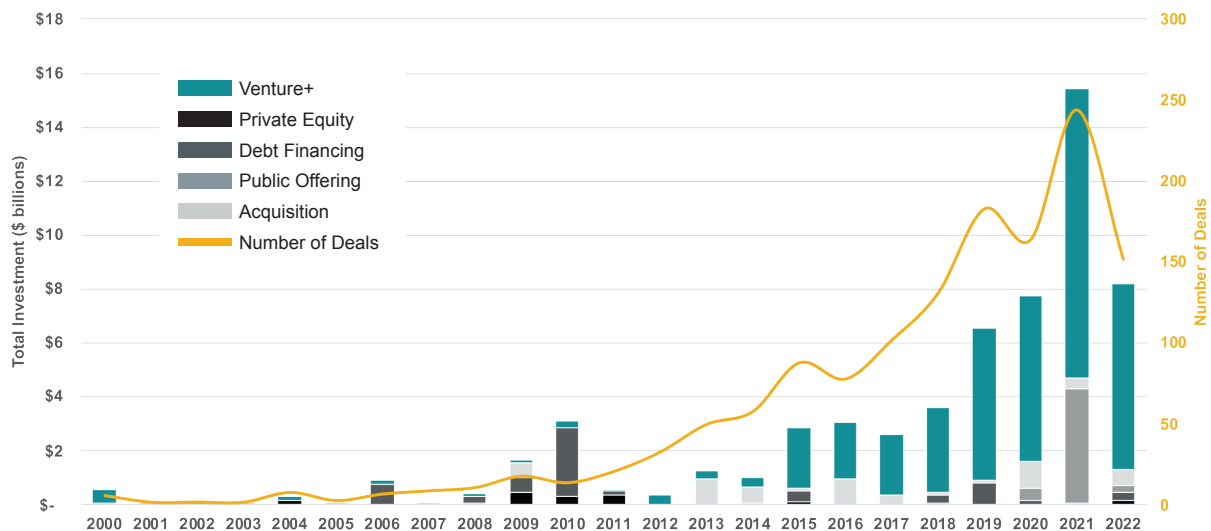
In 2022, we identified 154 start-up space deals, a drop from 241 in 2021, with U.S. deals (75) making up 48%, slightly less than non-U.S. deals (79). Total investment in space start-ups was \$8 billion in 2022. Investment in U.S. start-ups was \$6.6 billion (73% of total investment), compared to \$2.3 billion (27%) non-U.S start-ups. Most U.S. recipients were based in California (46% of U.S. total), Washington (21%), and Colorado (9%). Most non-U.S. recipients were based in China (20% of the non-U.S. total), the United Kingdom (18%), and Israel (12%).

Eleven companies have raised over \$1 billion across all investment types since 2000, including SpaceX, Blue Origin, OneWeb, O3b Networks, Virgin Galactic, LightSquared, Wild Blue, and the Climate Corporation. In 2021, three new companies reached the \$1 billion funding mark: Sierra Space, Relativity Space, and Rocket Lab. In 2022, no additional start-up space companies reached this mark. While some companies in this group remain active,

**Figure 13: Venture capital accounts for over three-quarters of start-up space investment in 2022.**



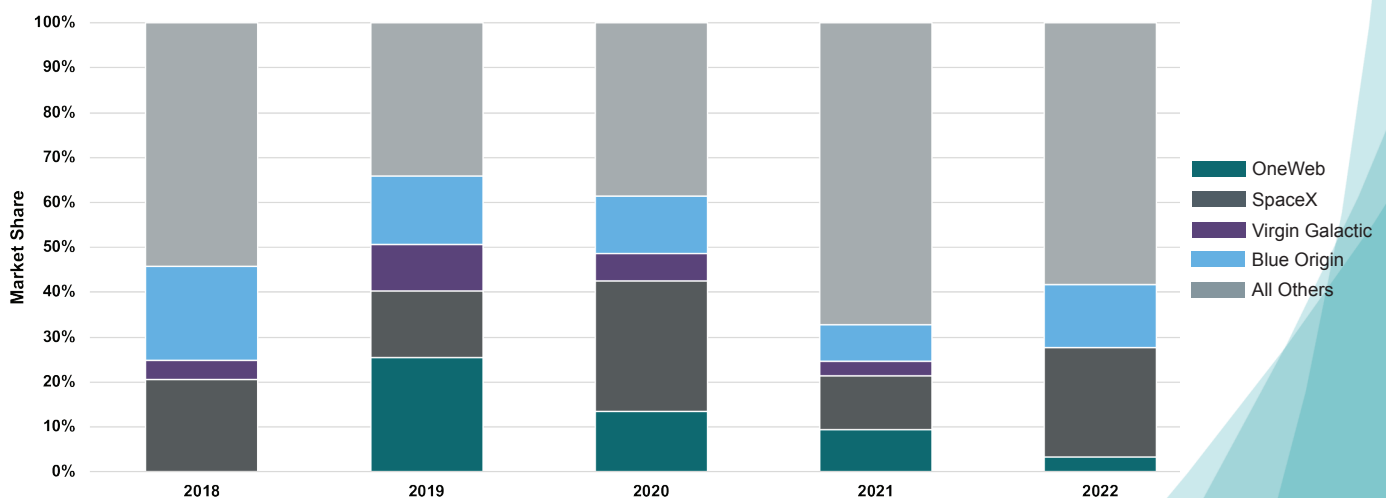
**Figure 14: Over \$8 billion invested in 2022 across 154 deals.**



others, such as O3b Networks, LightSquared, and WildBlue, have changed status; O3b Networks became a subsidiary of SES S.A. in 2016, LightSquared filed for Chapter 11 in 2016 and re-emerged as Ligado Networks, and WildBlue was acquired by Viasat in 2009.

Figure 15 depicts the concentration of start-up space investment by company over the last five years. SpaceX, Blue Origin, OneWeb, and Virgin Galactic were the top 4 recipients of investments between 2018 and 2022. The concentration of investments in SpaceX, Blue Origin, OneWeb, and Virgin Galactic peaked in 2019, at 66% of total investment. In 2020 and 2021, early-stage companies gained a larger share of start-up space investments; total investment in SpaceX, Blue Origin, OneWeb, and Virgin Galactic made up 33% of total 2021 investments. In 2022, SpaceX, Blue Origin, and OneWeb accounted for 42% of total investment. SpaceX received the most funding in 2022, with an estimated \$2.2 billion raised.

**Figure 15: Concentration of start-up space investment (2018-2022) in recipients with >\$1 billion.**

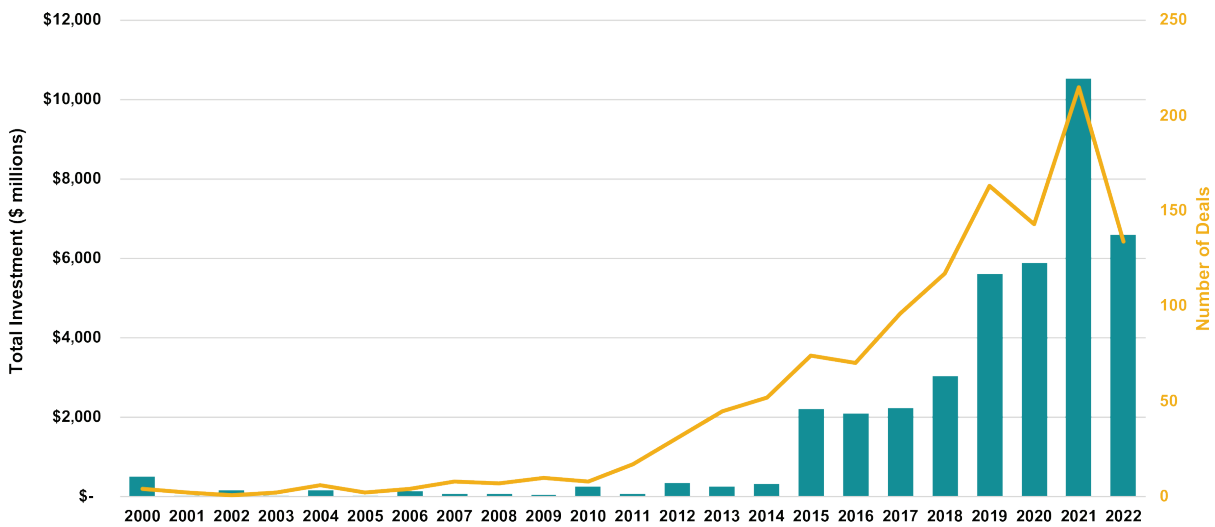


## Investment by Type

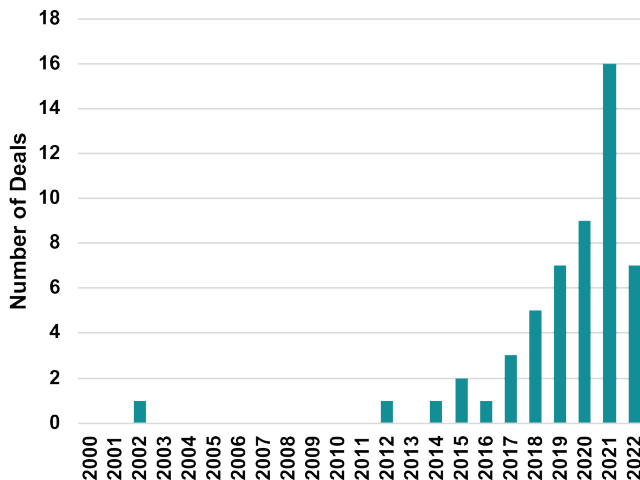
### Venture Capital

In 2022, the start-up space ecosystem saw a decline in venture funding (see Figure 16). Compared to 2021, VC investment declined 44%, from \$11 billion to \$7 billion, while the total number of VC deals declined 33%, from 215 to 137. Since 2000, VC investment in start-up space companies has totaled \$40 billion, with 79% in the last five years. As shown in Figure 17, 2022 saw seven deals over \$100M. As shown in Figure 18, the five-year rolling average has continued to grow, despite the decline compared to 2021.

**Figure 16: A total of \$6.5 billion of venture capital funding in 2022.**



**Figure 17. Seven VC deals over \$100 million.**



**Figure 18. 5-year rolling average increased from 2021.**

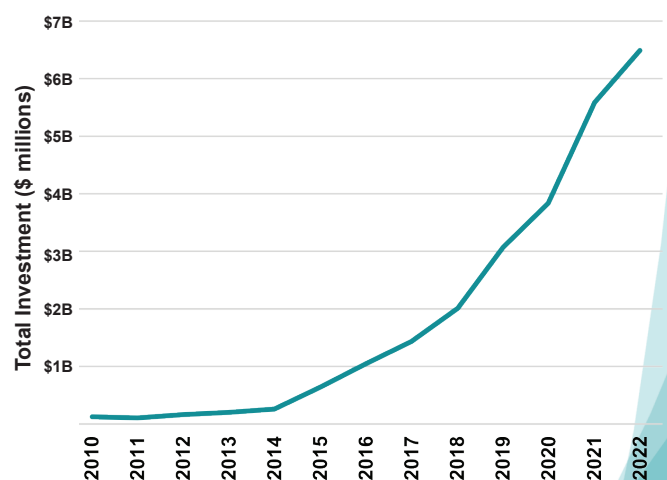
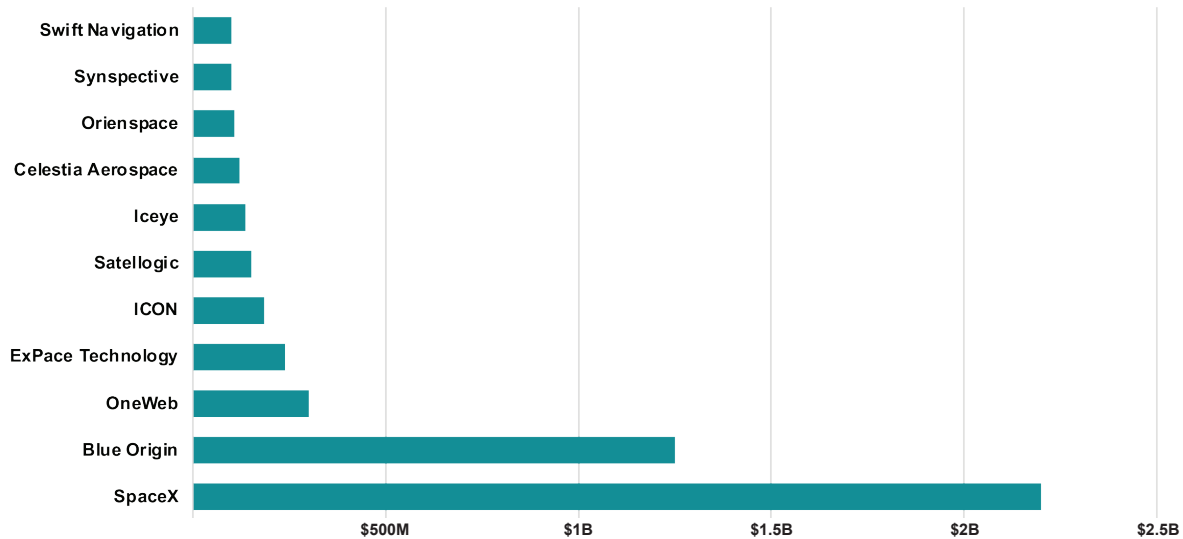


Figure 19 shows the top ten recipients of venture funding in 2022. SpaceX received an estimated \$2.2 billion in VC investment in 2022, the most of any space company. OneWeb received \$300 million from Hanwha Systems in 2021, and the transaction was completed in the first half of 2022. Series B companies, ExPace Technology and ICON

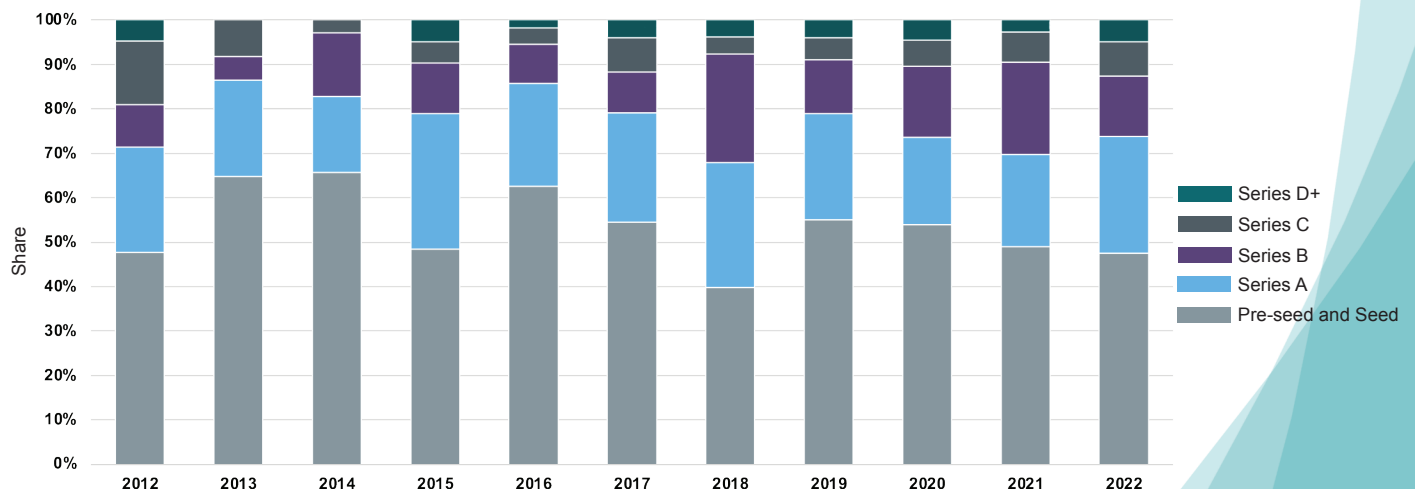
Technologies raised \$237 million and \$185 million, respectively. For their Series D, ICEYE and Swift Navigation raised \$136 million and \$100 million, respectively, in 2022. Satellogic raised \$150 million from Liberty Strategic Capital to help close a delayed SPAC merger as a PIPE deal.

**Figure 19: SpaceX received the most VC funding of any start-up space company in 2022.**



In 2022, of 137 announced space VC deals, 110 specified rounds (e.g., series B, series C), while 26 deals were undisclosed. Since 2012, most investments have been in seed and series A rounds. Figure 20 shows that while the seed category still represents the highest proportion of investment deals in 2022, investment in seed rounds declined slightly compared to previous years, from 63 to 47 deals. In 2022, the proportions of investments for series A and series D rounds are larger than the proportions in 2020 and 2021.

**Figure 20: Investments for seed and pre-seed rounds make up the largest proportion of investments across all years.**

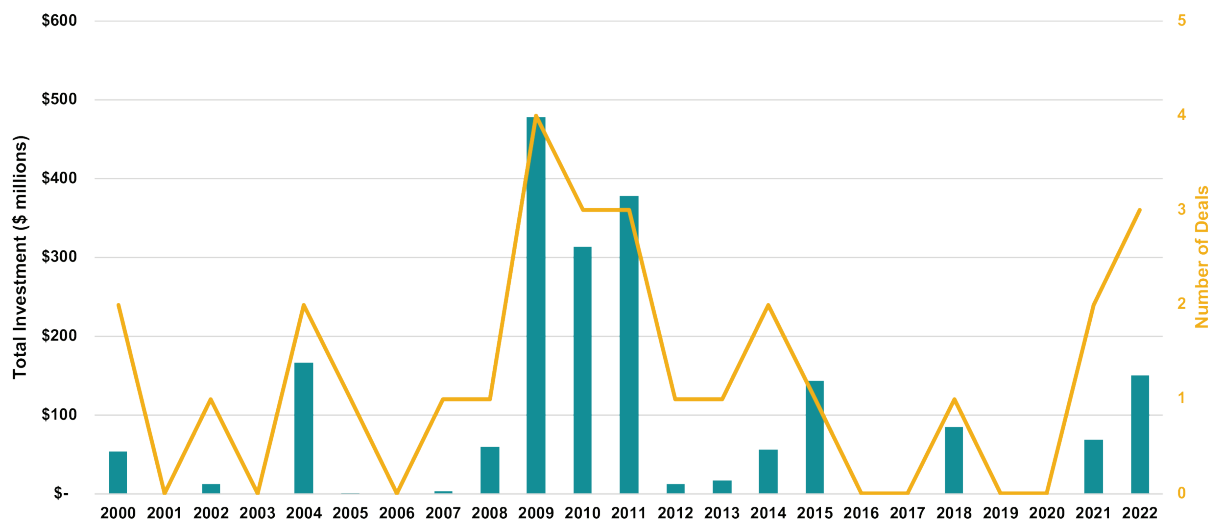


## Private Equity

PE investment in space start-ups has totaled \$2 billion since 2000. Historically, this investment has been limited to the telecommunications industry or government contracting. In recent years, one notable PE deal of magnitude, \$60 million, was invested in Omnispace by a group including Fortress Investment Group, Columbia Capital, Greenspring Associates, TDF Ventures, and Telcom Ventures.

The year 2021 marked the first time since 2018 that publicly disclosed PE funding was invested in a start-up space venture. In this context, PE funding represents minority-stake investments in start-up space companies (e.g., the PE firm does not take control of the recipient company). We include majority-stake investments, which are more typical in the PE ecosystem, within the acquisition section. In 2022, 3 PE deals occurred (at \$151 million), compared to 2 PE deals (\$69 million) in 2021. The largest deals were PIPE deals (private investment in public equity) in Satellogic (\$100 million) from Liberty Strategic Capital and Terran Orbital (\$50 million) from AE Industrial Partners, Beach Point Capital Management, and Lockheed Martin. Another notable deal was eSAT Global, an acquisition for a minority stake from Yahsat; however, financial details were undisclosed.

**Figure 21: 3 PE deals in 2022, disclosed deals total \$151 million.**



## Mergers & Acquisitions

Merger and acquisition (M&A) deals declined in number but increased in value in 2022 compared to 2021. Six start-up space acquisitions occurred in 2022 totaling \$588 million, compared to 13 (the most in any year) in 2021, totaling \$360 million (see Figure 22). The average value of M&A deals in 2022 was larger than in 2021 (\$98 million compared to \$28 million).

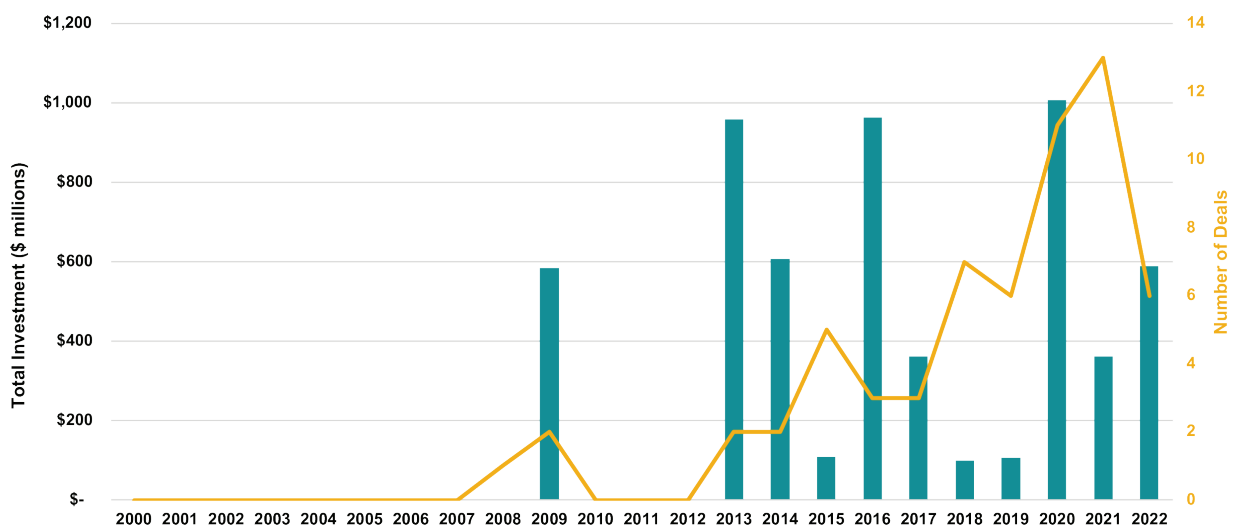


In 2021 SPAC-acquired companies, such as Rocket Lab and Planet Labs, used the funding to pursue additional acquisitions to either vertically integrate or improve near-term revenues. In 2022, acquisitions were primarily made by larger companies such as Raytheon Technologies. Since 2000, acquisitions of start-up space ventures total \$5.7 billion across 61 deals.

AE Industrial Partners' acquisition of a majority stake in York Space Systems was the largest M&A deal in 2022, estimated at \$573 million. Other notable deals in 2022 include Raytheon Technologies' acquisition of Northern Space and Security for an undisclosed amount; E-Space's effort to acquire the largest stand-alone radio frequency modules developer, CommAgility, for \$14.5 million; and the French company Grasp's acquisition of AirPhoton to create Grasp Global, an EU and U.S. Earth observation company working on its CubeSat constellation.

Several major space M&A deals occurred outside the defined start-up space ecosystem; neither the acquiring nor the acquired company had a publicly reported seed or VC investment prior to the acquisition. In 2022, notable non-start-up space deals included Maxar Technologies' acquisition by PE firm Advent International in a \$6.4 billion deal and Aerojet Rocketdyne's acquisition by L3Harris, for \$4.7 billion. Additionally, several large M&A activities in the space industry were announced in 2023, such as financial investor KKR's plan to take German company OHB private by buying a minority stake in the company and the potential sale of ULA.

**Figure 22: Start-up space acquisitions have declined in frequency compared to 2021.**

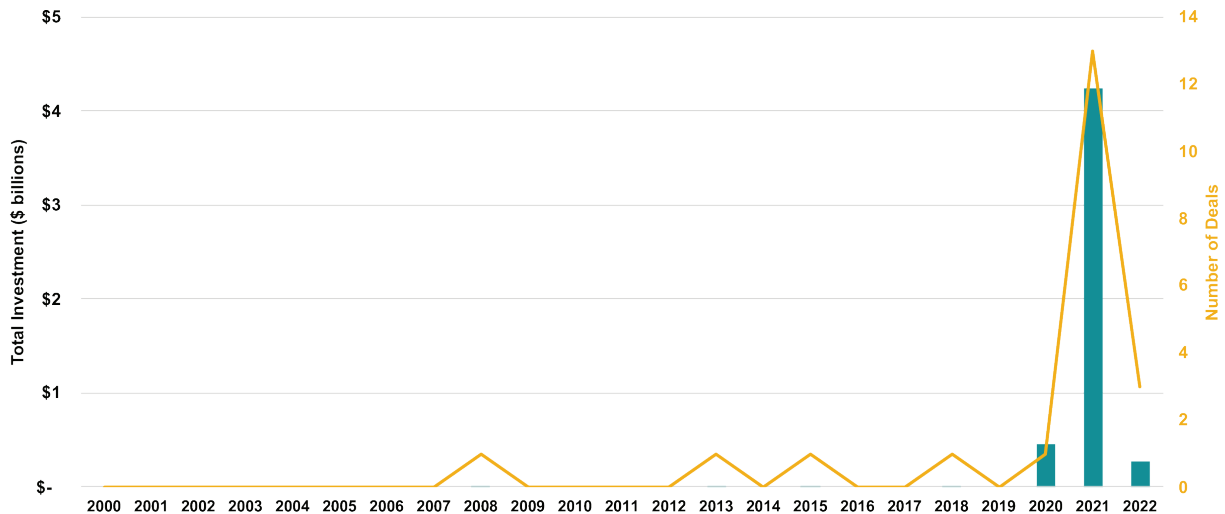


## Public Offering

In 2022, less start-up funding emerged as public market capital. Space start-ups raised \$271 million in 2022, compared to \$4 billion in public market capital in 2021. In 2022, Terran Orbital, SatixFy, and Satellogic went public via a special purpose acquisition company

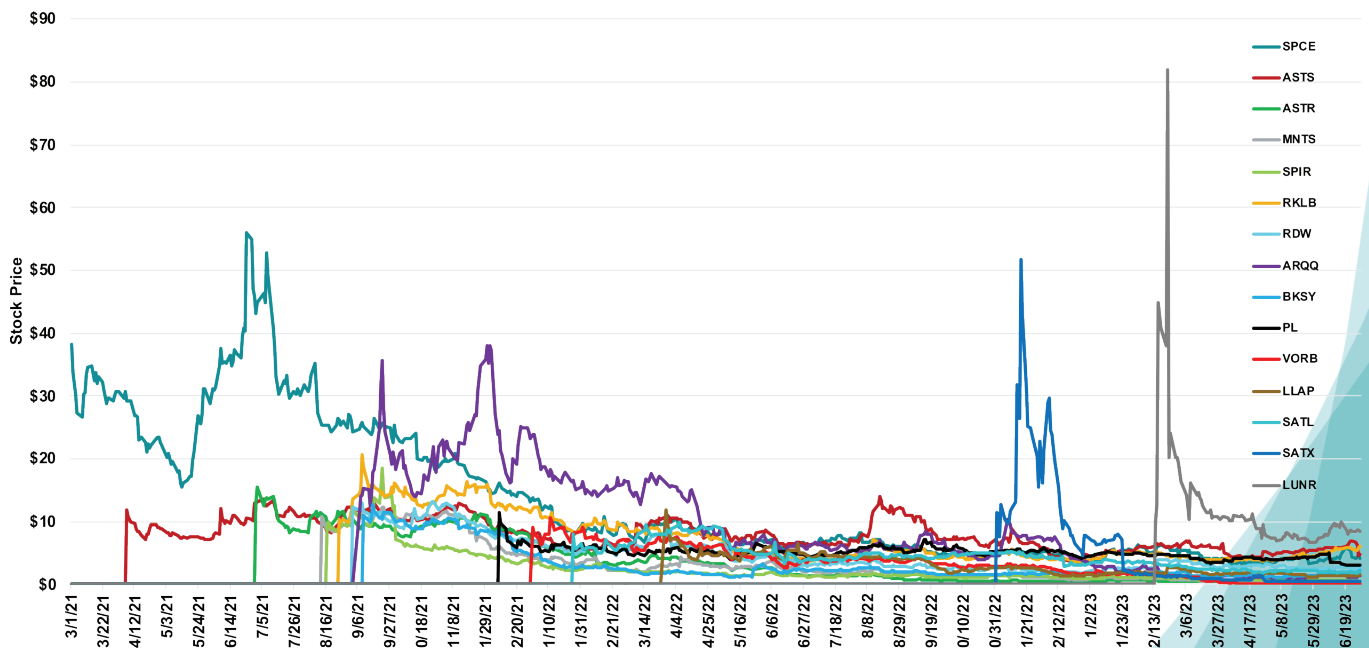
(SPAC). Two additional space start-ups, Tomorrow.io and D-Orbit, announced SPAC deals in 2021 that were later cancelled. Tomorrow.io's proposed deal was terminated (the company cited market conditions as the reason for termination). A space logistics company, D-Orbit, canceled its SPAC merger plan with Breeze Holdings Acquisition, citing financial market changes.<sup>3</sup> Figure 23 highlights SPAC funding raised by space start-ups in 2022 and shows the 3 SPAC deals, compared to 13 completed space SPACs in 2021.

**Figure 23: Start-up space public offerings have declined in frequency compared to 2021.**



The stock prices of start-up space SPAC companies are shown in Figure 24. When a SPAC begins trading publicly, the initial price is typically \$10 per share. As of June 30, 2023, publicly traded space SPAC companies were priced under \$10 per share. On average, in 2022, space SPAC stocks decreased 74% compared to their \$10 per share issue price.

**Figure 24: Publicly traded space SPAC stock prices.**

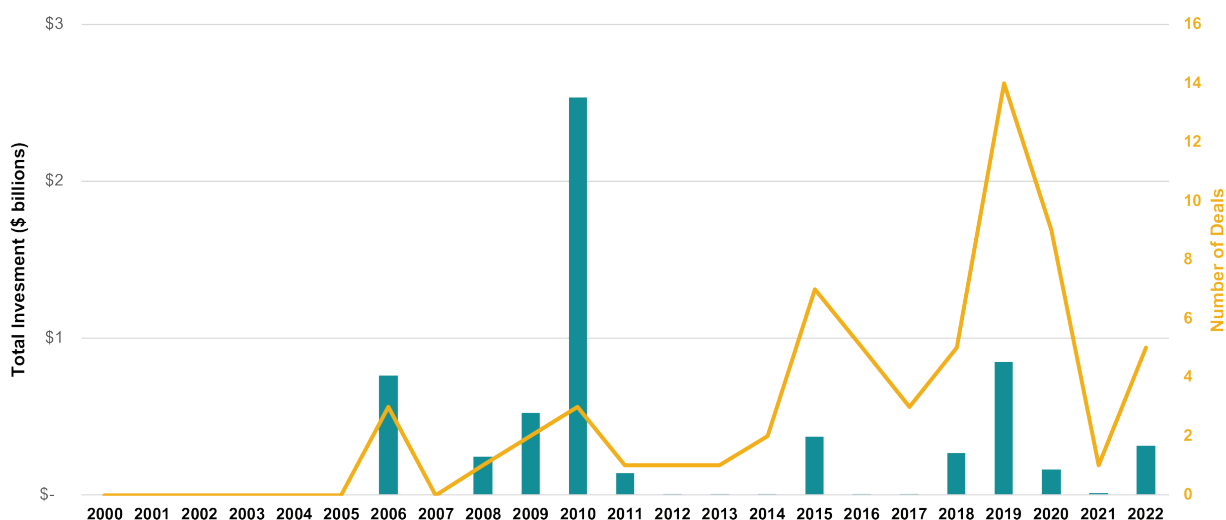


## Debt Financing

Debt financing initially grew between 2006 and 2010 with Protostar, WildBlue, O3b, and Ligado Networks receiving the most financing. In 2015 there was an increase in debt financing deals primarily for O3b, Planet, and UrtheCast. 2019 and 2020 recorded record numbers of debt financing deals, with 14 in 2019 and 9 in 2020. Notable recipients of these deals were ICEYE, OneWeb, Astranis, and BlackSky. This was followed by just 1 deal reported in 2021, the lowest since 2013. Debt financing deals saw a moderate recovery in 2022, returning to levels in line with 2018.

Five debt financing rounds occurred in 2022, with a total of \$312 million in funds (see Figure 25). Since 2000, debt financing for start-up space ventures has totaled \$6.2 billion. In 2022, Terran Orbital received \$175 million from investors, including Beach Point Capital, Lockheed Martin, and Francisco Partners. In October 2022, Lockheed Martin provided an additional \$100 million in debt financing to Terran Orbital. Virgin Orbit received \$20 million from Virgin Group in November 2022 as a financial stopgap, and Space Perspective received \$17 million in venture debt financing. Slingshot Aerospace also received an undisclosed amount from Horizon Technology Finance.

**Figure 25: Five debt financing rounds occurred in 2022 for roughly \$300 million/ Investment in start-up space companies.**



## Start-Up Exits

Successful exit refers to when an investor sells its equity in a portfolio company; the two most popular exit strategies are M&A and IPO. Additional strategies for a successful exit include SPACs or the venture fund selling via a trade sale or to a private equity buyer. In the space industry, some private equity firms combine (roll up) subsystem suppliers to create an integrated business or smaller firms can be merged into vertically integrated

businesses.<sup>4</sup> Examples of a successful exit through a private equity roll-up include Trive Capital combining Aerospace Engineering Corporation with AMRO Fabricating to form Karman Missile & Space Systems.

Unsuccessful exits refer to companies facing significant obstacles that lead to the company halting its operations. In this instance, companies can have multiple strategies to exit, such as filing for bankruptcy. In the U.S., when a case is filed under a reorganizational bankruptcy (Chapter 11), the debtors remain in possession and may continue to operate the company's business and propose a plan of reorganization. Alternatively, in a liquidation bankruptcy (Chapter 7), the bankruptcy trustee sells the debtor's nonexempt assets and uses the proceeds to pay creditors.

In 2022, Masten Space Systems filed for Chapter 11 bankruptcy and was acquired by Astrobotic Technology. Masten Space Systems had a stalking horse agreement submitted by Astrobotic, in which Astrobotic would provide Masten with debtor-in-possession financing as the company winds down its operations.

## Conclusion

2022 saw a decline in overall start-up space investment compared to 2021, reflecting global investment trends. Nevertheless, investment activity in 2022 was relatively robust compared to previous years.

Since 2012, most investments, in terms of number of deals, have been in early-stage VC funding for seed and series A rounds. While early-stage investment continued to drive the largest proportion of VC deals in 2022, there was a slight shift in investment toward later rounds as the proportion of series D deals increased. The year also saw a decline in SPAC activity and an uptake in acquisitions and debt financing, reflecting wider space industry investment trends. Since 2000, 35 venture capital firms have invested in five or more start-up space companies, showing continuous long-term interest in start-up space companies.

Since 2000, the United States has remained the country with the most investors, followed by China, Japan, and the United Kingdom. However, the start-up space sector continues to attract a large range of investors, with more non-U.S., non-space-focused firms and first-time investors entering the investment ecosystem. In 2022, half of investors were based outside of the U.S., and more than half were first-time start-up space investors, reflecting international interest in start-up space investments and the diversification of investors over time.

## Start-up Space: What's Next?

The availability of investment capital, business case maturation of large LEO constellations, and decisions surrounding government procurement of commercial services will shape the start-up space ecosystem in the near-term.

### Investment Capital, Broader Economy, and Challenges

While space industry-specific factors will affect the availability of investment capital, the largest determinant will likely be the macroeconomic environment. Energy shocks, persistent inflation and resulting high interest rates are constraining the availability of capital. VC and PE fund managers may adopt new priorities as they confront growing scarcity in available capital, resulting in a decline in deals and potential exits for start-ups. 2023 has already seen the high-profile bankruptcy of Virgin Orbit as it was unable to meet its fund-raising goals; capital constraints may contribute to the failure of other startups as well.

### Large LEO Constellations

Large low Earth orbit constellations of smallsats have transformed the orbital environment; the 7,316 active satellites at the end of 2022 outnumbered satellites five years earlier 7-fold. LEO constellations have driven increased launch rates and resulted in new manufacturing capabilities and supply chain shifts.

After initial service in 2021, SpaceX offered the Starlink Business service tier, with claimed download speeds up to 350 Mbps, and Starlink for recreational vehicles (RVs). Starlink also began service in countries such as the Philippines, Luxembourg, and Japan and targeted different markets, such as the passenger shipping industry and private charter aviation (on JSX). In December 2022, the FCC authorized SpaceX to launch its Gen2 constellation.

In 2021, OneWeb raised \$300 million in strategic investments from Hanwha Systems' defense division for an 8.8% stake, and the deal was completed with regulatory approval in 2022. The investment would further Hanwha System's plan to have a

LEO constellation of 2,000 satellites by 2030.<sup>5</sup> Later, in December 2022, OneWeb confirmed the deployment of 40 satellites launched with SpaceX, bringing the size of the OneWeb constellation to 502 satellites.<sup>6</sup> In early 2023, OneWeb confirmed the deployment of additional satellites, bringing the total number of operational satellites in the constellation to over 600.<sup>7</sup>

In 2022, E-Space raised \$50 million in investment from Prime Movers Lab for its planned network of 100,000 satellites. With this capital, E-Space also acquired RF modules developer CommAgility for \$14.5 million. E-Space aims to provide “low-cost ultra-safe system design” demonstrating that minimizing and even reducing space debris is achievable.”<sup>8</sup>

In 2023, Terran Orbital received a \$2.4 billion contract from Rivada to build and deploy 300 LEO satellites for Rivada’s constellation.<sup>9</sup> Amazon also has received approval from the FCC to deploy a constellation of 3,236 satellites as part of Project Kuiper in 2023.<sup>10</sup>

As these systems deploy and begin serving customers, a key question for the space ecosystem is that of their business success and the resultant impact on future architectures, launch demand, and satellite industry financial health.

## Government Procurement for Services

Increasing government procurement of commercial space services such as communications, launch, LEO destinations, and satellite imagery seeks to meet mission and policy objectives such as lower costs, economic growth, innovation, and strengthening emerging space markets. Future levels of government support will have a direct impact on start-up space as governments are increasingly important customers for commercial space ventures and anticipated government use of commercial systems is attractive to investors.

The 2022 war in Ukraine highlighted on the global stage the role the commercial space industry could play in modern conflict. Earth-imaging companies such as Planet and Maxar provided images documenting events on the ground leading up to and during the war.<sup>11</sup> Finnish start-up ICEYE provided Ukraine with dedicated capacity from its synthetic aperture radar satellites, thanks in part to charitable fundraising efforts.<sup>12</sup> SpaceX also provided Ukraine access to its Starlink constellation to support critical communications for civilians and government entities.

As the war continues and countries around the world recognize the value of commercial space capabilities to national security, more governments may signal demand for commercial remote sensing, communications, and other capabilities, leading to new investments that accelerate or spur commercial offerings.



## Points of Contact

This report was written and produced by BryceTech, which conducted the study on which it is based.

- Brian Dunn, Start-Up Space Project Lead, [brian.dunn@brycotech.com](mailto:brian.dunn@brycotech.com)
- Hanh Nguyen Le, Space Market Analyst, [hanh.nguyen-le@brycotech.com](mailto:hanh.nguyen-le@brycotech.com)
- Carissa Bryce Christensen, CEO, [carissa.christensen@brycotech.com](mailto:carissa.christensen@brycotech.com)
- Ryan Puleo, Space Investment Analyst, [ryan.puleo@brycotech.com](mailto:ryan.puleo@brycotech.com)
- Carie Mullins, Director of Analytics and Intellectual Property, [carie.mullins@brycotech.com](mailto:carie.mullins@brycotech.com)
- Simon Potter, UK Managing Director, [simon.potter@brycotech.com](mailto:simon.potter@brycotech.com)

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## About BryceTech

BryceTech is an analytic consulting firm serving government and commercial clients. Bryce provides unique, integrated insight into on the space economy. We understand the interplay of national security, civil, and commercial space. Many authoritative data sets characterising the space industry and sub-segments were originated by Bryce analysts. Bryce's expertise includes analysis of the space industry, finance and market analytics, technology readiness, cyber security, policy and economics, and strategy.

Find out more at: [brycetek.com](https://brycetek.com)

## Endnotes

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1737 N. King Street, Suite 601  
Alexandria, VA 22314  
[info@brycetek.com](mailto:info@brycetek.com)



[brycetek.com](http://brycetek.com)



703.647.8078