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Evaluating Over-Supply in the Launch Vertical and How this May Affect Investor Confidence in the Overall Space Sector

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Abstract

The launch vertical is oversupplied. There are over 125 launch companies worldwide, most of which are not yet operational. However, even with generous projections of the growth in the market for launch services in the coming years, there will be room in the market for fewer than eight new entrants. The purpose of this paper is to evaluate projected supply and demand within the increasingly crowded space launch vertical, and to discuss how this may affect the allotment and potential impact of future investor capital in the space sector overall. The authors collected and analysed publicly available data on 125+ commercial launch ventures globally and used this data to create the most comprehensive database on the launch industry currently available for public use (for reference, the database can be found: https://spacefund.com/launch-database/). This data was then analysed and compared to secondary research on the demand for orbital launch services.

The results of this analysis show that the supply of orbital launch is on pace to significantly exceed forecasted demand. It is the conclusion of this paper that the majority of these start up launch companies will not succeed as there will not be enough demand to support more than a few new entrants, especially with the currently operational private companies such as SpaceX and Rocket Lab having a substantial lead in time, capital, management, customer base, and industry credibility. It is predicted that the failure of so many of these new launch companies will have a significant effect on investor confidence in the overall space sector, which may reduce the amount of investment capital available for other types of space companies.

Keywords: Launch, Investment, Supply, Demand, Constellation, Oversupply

1. Introduction

Over 125 announced launch companies are being tracked by the authors of this paper, of which at least 40 have received private funding (nearly $5B in total, almost $4B of which has gone to SpaceX and nearly $300M to Rocket Lab). About 30 of these 125 companies are currently flight testing or operational, 20 of which are focused on orbital launch capabilities. However, market forecasts indicate the need for fewer than eight new private launch companies world-wide over the coming decade. So, even those companies with a good head start may not find the customers they will need to keep their capital-intensive businesses afloat.

Many such launch companies cite the upcoming wave of new constellations, a projected 10,000+ satellites that will launch in the coming decade, as their total addressable market. However, according to NewSpace Index [1], only 54% of those constellations (57 of 105) have secured any funding, and only a handful have raised enough capital to actually deploy their full constellation. Additionally, 4,425 of those satellites are SpaceX's Starlink constellation, and 3,236 are Blue Origin / Amazon's Kuiper constellation. In both cases, these companies will launch all of their own satellites, on their own launch vehicles, meaning the actual addressable constellation market for other private launch companies may be less than 2,000 satellites in the coming decade. Constellations typically have multiple satellites in the same orbital plane, so they can share a dedicated launch of up to 80 satellites at a time (depending on the size of the satellites and the rocket). Simple math shows that even if all these constellations succeed, only an additional 25 launches may be needed over the next decade to meet the constellation demand. For reference, there will be almost 100 launches in 2019 alone, so 25 additional launches in 10 years will have very little effect on the total demand for launch services. Obviously, there will be a need for bespoke launches, including custom orbits, timing and other considerations. Also, some of these constellations will have satellites that are too large for such a ride share, as well as other factors that will affect the actual demand for launch.

In order to further understand what the actual demand for launch will be, the authors of this paper decided to do a much more rigorous analysis of the supply and demand in this market to determine how many new entrants might be successful. The authors analysed both historical data as well as market predictions to determine the projected supply and demand in the orbital launch market through 2025. The results of these projections clearly show that there will not be enough demand to support the majority of these launch companies.

2. Methods

The following steps were taken to produce the three main sections of orbital launch market analysis presented in this paper beyond those that have been published previously.

2.1 Orbital Launch Forecasting Using Time Series Analysis

Time-series of historical (actual) orbital launch data at various grains were generated by scraping data from the orbital launch logs found on the Space Launch Report [2] website from the year 2004 to 2019. This data, supplemented with data from the SpaceFund launch database [3], was compiled into a table with the following parameters: `launch date`, `launch vehicle`, `launch vehicle class`, `launch operator name`, `operator type`, `payload mass`, and `intended altitude`. Once loaded, the data was used to count the number of launches by year, broken out by operator type (Public Sector, Private Sector) and launch vehicle class (as defined in Table 1).

Table 1: Launch Vehicle Classifications

Launch Class	Payload Capacity to Low Earth Orbit
Small	< 2,000 kg
Medium	2,000 to 20,000 kg
Heavy	20,000 to 50,000 kg
Super Heavy	> 50,000 kg

These counts yielded eight time-series (four launch classifications by two operator types) of yearly launches for the 16 years of historical data. To generate the forecasted launch counts, a low-order polynomial trend line was fitted to each historical time-series and extrapolated out through the year 2025. This forecast data was then aggregated across each dimension to be used in the following sections, and to visualize the authors' predictions on orbital launch growth over the coming years.

2.2 Estimating Payload Capacity Oversupply

Various assumptions and extremes were applied to the historical data and launch forecast data, broken out by launch vehicle class, to generate a model that illustrates a large delta between orbital launch payload capacity (supply) and demand from 2004 to 2025. The first major assumption was that all launches in the historical and forecasted data have an intended altitude of low Earth orbit. The second major assumption was that all vehicles/ launches within each launch class have the same standard payload capacity. As such, a fixed payload capacity (kg) value was assigned to each launch class, using conservative and/or extreme minimum values within the respective payload ranges found in Table 1. These conservative values were chosen to yield a minimum total payload capacity, which is much lower than actual, thus effectively underestimating supply (capacity). These assigned payload constants are shown by launch class in Table 2.

Table 2: Assumed Payload Capacities by Class

Launch Class	Assumed Fixed Payload Capacity
Small	600 kg
Medium	5,000 kg
Heavy	20,000 kg
Super Heavy	50,000 kg

With these constants, the historical and forecasted counts of launches per year by launch class were then multiplied to the respective payload capacity values, then summed over all four classes each year to yield a total yearly payload capacity (supply) estimate for 2004-2025. The next major assumption was that payload demand by launch class can be categorized as the average of all payloads delivered to low Earth orbit by class from the historical data. These averages were calculated, and the values shown in Table 3 were assigned to each class. (Note: the exception here was the Super Heavy launch class, which assumed the minimum value from the range in Table 1 due to lack of historical data).

Table 3: Average Payload Delivered by Class

Launch Class	Average Payload Delivered
Small	600 kg
Medium	4,830 kg
Heavy	10,100 kg
Super Heavy	50,000 kg

To generate demand data for 2004-2019, these average-payload-delivered values were multiplied by the historical launch count data, by class, by year. To generate demand data from 2020-2025, an external market forecast was applied to the historical demand data. The last major assumption was that the

SpaceWorks 2019 forecast [4] data (extrapolated through 2025) is an accurate measure of future growth within the Small launch class, and that this aggressive growth rate is also an accurate measure for the other three launch classes (which is assumed to be an overestimate of future growth within at least three of the four classes, if not all four). To calculate the projected demand data through 2025, the year over year growth factors were multiplied to the prior year's payload delivered value by class, by year, starting with 2020. Demand calculations were then summed across all launch classes to provide a total yearly payload demand estimate, by year. The yearly difference (kg) between estimated supply and estimated demand was calculated by subtracting the total yearly payload delivered from the total yearly payload capacity. Percent difference was also calculated using this yearly difference as a percent of the yearly available payload capacity. These results were used to illustrate the oversupply at hand even under extreme assumptions that overestimate demand and underestimate supply.

2.3 Orbital Launch Company Counts

The historical orbital launch data defined in Section 2.1 was used to count the number of unique organizations operating orbital launches per year from 2004-2019, by operator type. These results were joined with the historical time-series of launch counts by operator type, and the quotient of launch count over unique organizations was taken to produce the average number of launches conducted by each distinct organization per year. Two scenarios were then applied to predict a range for the number of launch companies needed to service the private sector. In the first scenario, it was assumed that the rate of launches per company through 2025 would be a constant value equal to that of 2018: 5.4 launches per company. For the second scenario, it was assumed that the rate each year through 2025 would equal the maximum value from recent data, which occurred in 2014: 7.8 launches per company. In each scenario, the launch forecast data for the private sector was divided by the respective constants to yield estimated unique companies per year through 2025, thus establishing a range of private companies for the next six years. This projection data was then compared to counts of existing, operational private launch companies to provide context for growth within the sector.

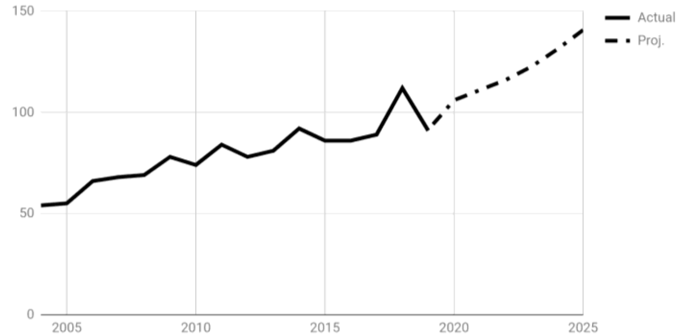
3. Results

The results of these analyses show steady growth in the number of orbital launches; however, they also show that there will be an average of 30% oversupply when compared to market demand. Additionally, there will be room in the industry for only a handful of additional private companies.

3.1 Orbital Launch Forecasts

The results of this analysis show a significant dip in the number of launches for 2019, and then slow, but steady growth in the coming years. While there will be less than 100 launches in 2019, the authors predict up to 140+ launches per year by 2025.

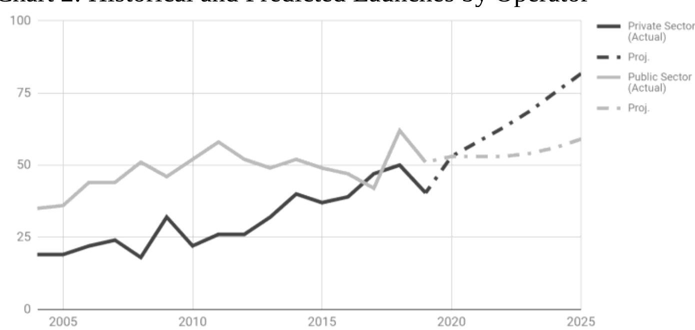
Chart 1: Historical and Projected Orbital Launches



(Full size chart available in Appendix)

The authors also predict that most of this growth will be in private sector launches, not government or state-owned launches.

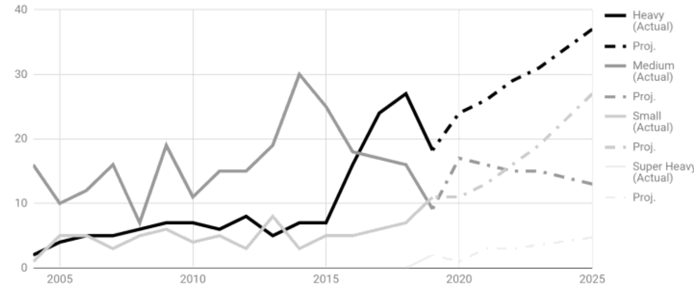
Chart 2: Historical and Predicted Launches by Operator



(Full size chart available in Appendix)

Within the private sector, the majority of the growth is projected to be from the small and heavy launch categories, with medium class launches remaining fairly steady over time and super heavy launches growing slowly from zero.

Chart 3: Historical and Predicted Launches by Class



(Full size chart available in Appendix)

3.2 Payload Capacity Oversupply

When compared to the projected demand for launch (measured in kilograms), there is a significant disparity with supply outpacing demand by an average of over 30%, both historically and within projections through 2025.

Table 4: Historical and Predicted Supply, Demand, and Overcapacity in the Launch Industry

Year	TOTAL Supply (kg)	TOTAL Demand (kg)	Delta (kg)	Delta (% capacity)
2004	398000	292370	105630	26.54%
2005	406600	282360	124240	30.56%
2006	496000	350260	145740	29.38%
2007	525400	369420	155980	29.69%
2008	596600	392140	204460	34.27%
2009	667200	441920	225280	33.76%
2010	664800	439520	225280	33.89%
2011	654800	466740	188060	28.72%
2012	635400	438800	196600	30.94%
2013	577200	419520	157680	27.32%
2014	678600	517350	161250	23.76%
2015	610400	451530	158870	26.03%
2016	671000	463990	207010	30.85%
2017	831600	536170	295430	35.53%
2018	924600	626110	298490	32.28%
2019	725600	447565	278035	38.32%
2020	893800	569609	324191	36.27%
2021	1025600	668163	357437	34.85%
2022	1073600	763377	310223	28.90%
2023	1181000	856919	324081	27.44%
2024	1299600	962386	337214	25.95%
2025	1488200	1071555	416645	28.00%

Historically, the majority of these launches have been carried out by government operators or public-private partnerships. However, the number of private company launches has grown in recent years, and it is expected to continue to grow in the coming years.

3.3 Orbital Launch Company Counts

Projections for the number of orbital launch companies needed to meet the forecasted number of launches show that there will only be room in the orbital launch market for between one and eight additional companies by 2025, assuming that the currently operating launch companies do not increase their capacity or flight rates.

Table 5: Historical and Projected Total Number of Private Orbital Launch Companies

Year	Companies	Projected Lower Bound	Projected Upper Bound
2004	4	-	-
2005	7	-	-
2006	9	-	-
2007	6	-	-
2008	4	-	-
2009	6	-	-
2010	6	-	-
2011	4	-	-
2012	5	-	-
2013	7	-	-
2014	5	-	-
2015	5	-	-
2016	6	-	-
2017	7	-	-
2018	9	-	-
2019	7	-	-
2020		7	10
2021		7	11
2022		8	12
2023		9	13
2024		10	14
2025		10	15

4. Discussion

The results of this analysis clearly show that, even with generous overestimates of demand and underestimates of supply, there will be room in the market for eight or fewer additional orbital launch companies by 2025. The authors certainly hope that continued reduction in launch prices will create additional demand for launch services, and there is a possibility that entirely new may markets develop, such as point to point travel on Earth. There is also the possibility that government customers could increase their demand for launch in the coming years with initiative's like the US Space Force, and many other world governments starting space programs. However, current data suggests that there will not be nearly enough demand to support the number of launch companies that are currently in development.

Regardless of the technology type, the 'secret sauce,' or the market niche, a large portion of the participants in this ecosystem will literally never get off the ground. Others may become operational, but not be able to sell enough launches to keep afloat. While to the outside observer they will fail for a wide range of reasons, their underlying fragility is simple - there are too many rockets and not enough demand. 40+ launch companies have received private investment of some sort, and with room in the market for less than 10 new entrants, it is highly likely that more than 30 venture- or angel- backed launch companies will fail, in most cases resulting in a complete loss to their investors.

As such, it is the conclusion of the authors that the opportunity for high-volume investment in this sector has passed. Investment in launch at this stage, especially in newer, less-established companies developing technologies touted as "cheaper, better, faster" versions of systems already much further along in their development paths, will carry a high risk of complete loss. Those that do succeed from a technical perspective may not capture enough market share to provide desired investment returns.

The authors believe the overall glamor of spaceflight systems as the icon of space exploration is working its magic on investors, and that this romance may be overcoming logic in many cases. There has been significant over-investment in this vertical, with no signs of slowing. Recently, Relativity Space announced a $140M Series C funding round [5], just weeks after the announcement of Vector Launch, a VC-backed company that raised over $100M in funding, closed its doors [6]. Investor capital seems to be flowing into the vertical, without concern for market size or industry viability. This is highly concerning to the authors as significant capital will be lost because of this investment behaviour. As more companies fail, or just fail to get off the ground, it is expected that investor confidence will begin to wane. However, that will be too late for the investors who are being reckless now.

It is also the concern of the authors that this significant loss of capital in the launch vertical will make investors wary of supporting other verticals of the space sector, drastically reducing the capital available to create more demand for launch companies and grow the in-space business ecosystem.

Investors interested in supporting the space economy should consider directing their investment towards other verticals within the space ecosystem, many of which stand to benefit from both the availability and frequency of transport to space. The coming extreme competition in the launch market will continue to reduce prices and increase access, helping new business models become possible. It is these new companies and new ways of doing business in space that offer the most attractive investment opportunities at this time. Investors will increase their odds of profitability by focusing more on the practical outcomes of the launch race, rather than trying to find a unicorn in such a crowded field.

References

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Appendix: Full Size Charts

Chart 1: Historical and Projected Orbital Launches

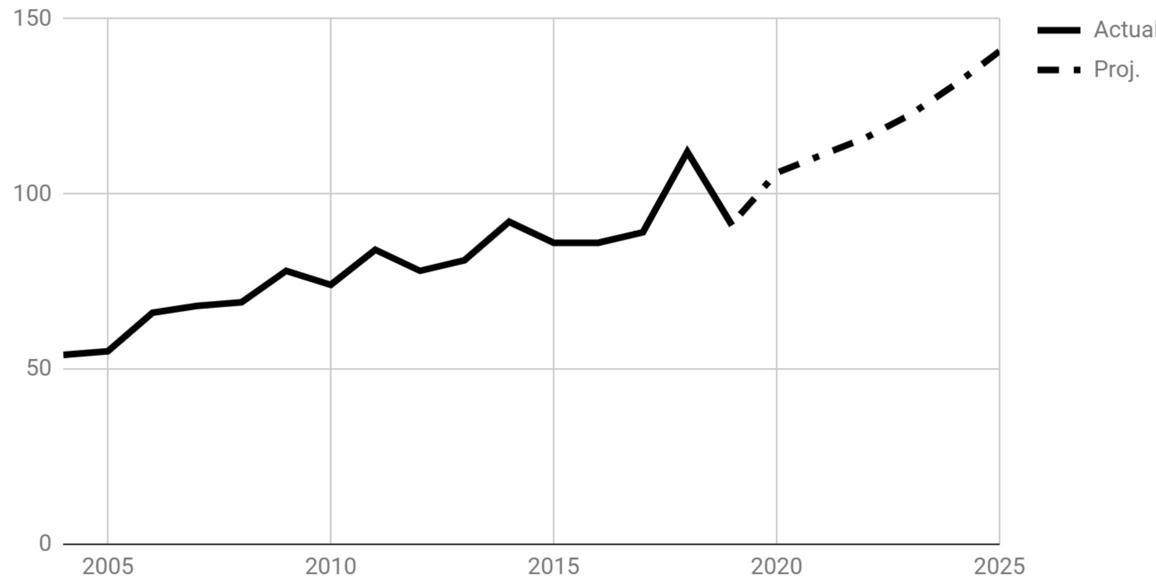

Chart 2: Historical and Predicted Launches by Operator

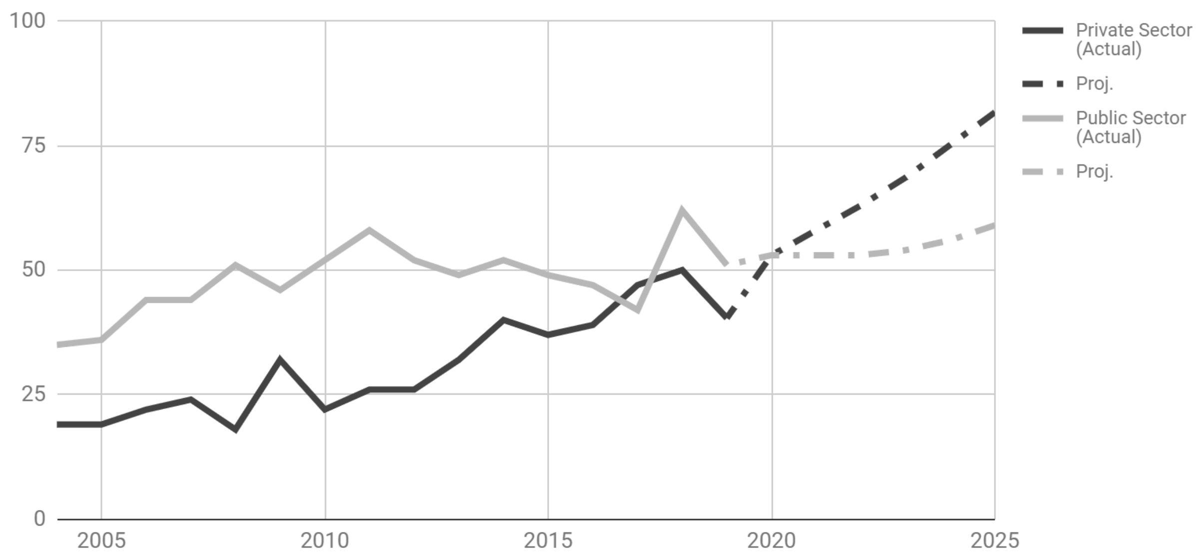

Chart 3: Historical and Predicted Launches by Class