1. Summary

AAC's analysis shows that 25 medium and large launches is the ideal number of launches to use in the upcoming Environmental Assessment (EA) project based on similar businesses, launch vehicle industry trends, and project longevity. The number of launches is realistic based on-site capabilities and is suitable to assure customers there are enough for their campaign, to support multiple customers, commercial and military should there be a sudden uptick, and sustain operations for many years before needing to seek another EA related to number and size of launch vehicles.

2. Analysis

This section covers the sources of the data and choice of data.

2.1 Alaska Aerospace Corporation (AAC) and the Virginia Commercial Space Flight Authority (VCSFA)

Alaska Aerospace and the VCSFA are similar in terms of annual operations and target markets, so will be the comparison focus for this analysis. The Mid-Atlantic Regional Spaceport (MARS) is in Virginia and operated by the Virginia Commercial Space Flight Authority.

MARS is approved to launch 18 times per year, with the highest number of launches historically occurring being 4 per year. PSCA is approved for 9 launches and has historically achieved 3 launches per year.

In 2017 VCSFA released a Strategic Plan including a conservative launch forecast. AAC released a Master Plan in 2021 with low, medium, and high range forecasts. Both low forecasts are compared in the images below, followed by VCSFA and AAC actual launch data.

Figure 1. Conservative Forecast for MARS Launches 2017-2022

Category	*2017*	*2018*	*2019*	*2020*	*2021*	*2022*
NGSO Medium	2-3	2-4	2-4	3-4	3-4	3-4
NGSO Small	-	1-2	1-2	1-2	1-2	1-2
Total	2-3	3-6	3-6	4-6	4-6	4-6

Figure 2: Conservative Forecast for PSCA Launches 2020-2030

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Government	1	1	1	0	0	1	0	0	1	0	1
Commercial Solid	0	0	0	1	1	1	1	2	2	2	2
Commercial Liquid	2	3	5	6	9	10	12	12	12	12	12
Total	**3**	**4**	**6**	**7**	**10**	**12**	**13**	**14**	**15**	**14**	**15**

Table 1: MARS Actual Launch Data

Year	2017	2018	2019	2020	2021	2022	2023
Total	1	2	2	3	3	2	4

2023: 3 launches, 1 suborbital – HASTE, All Rocket Lab in the last two years

Table 2: PSCA Actual Launch Data

Year	2020	2021	2022	2023
Total	2	3	1	1

VCSFA provides a range prediction of anticipated number of launches in a gradual annual increase over the next five years, from 2-3 to 4-6 annual launches. AAC predicted 3 launches increasing up to 15 by the end of the decade. Compared to the historical data, PSCA had 2 launches in 2020 and 1 in 2023 with 7 being originally predicted. VCSFA was fairly accurate with their prediction which indicates they are a good model of potential expectations. In early 2024, VCSFA announced plans to increase approved launch numbers to 55 per year including launches and sounding rockets.

2.2 Launch Vehicle Operator Analysis

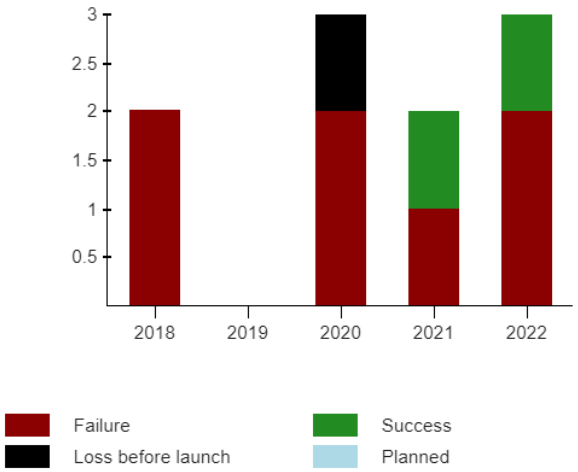
This section will analyze the launch vehicle operator timelines from start to launch from customer companies to leaders of the industry, to determine a reasonable forecast of annual launches per launch vehicle operator. These companies were chosen as representative companies with at least 5 years of historical launch data. AAC reviewed the companies Astra, Rocket Lab, Blue Origin, and SpaceX.

2.2.1 Astra

As a past customer of AAC, Astra is ideal to analyze in past performance. This analysis ignores launch failures and counts them as launch attempts.

Astra had a fairly flat growth averaging about two launches a year for the years it was operating at AAC's launch site. Astra has had a short lifespan, but did manage to try two launches in their first year which is greater than all the other companies analyzed.

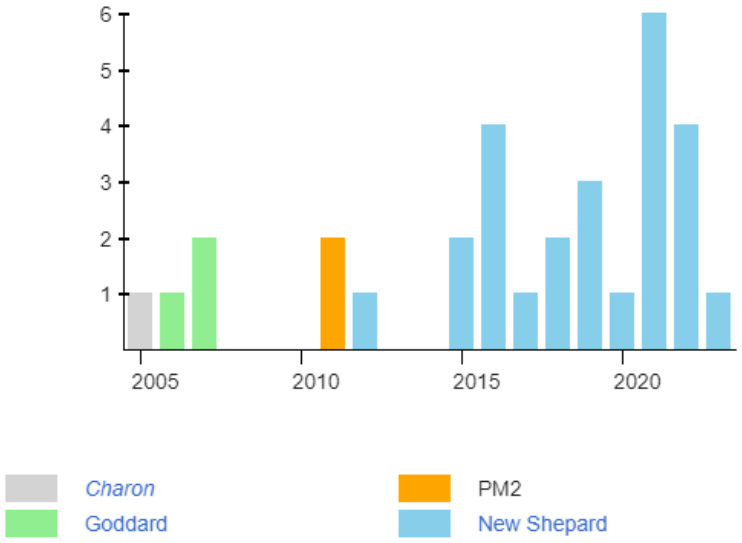
Figure 3: Astra Launch History



2.2.2 Blue Origin

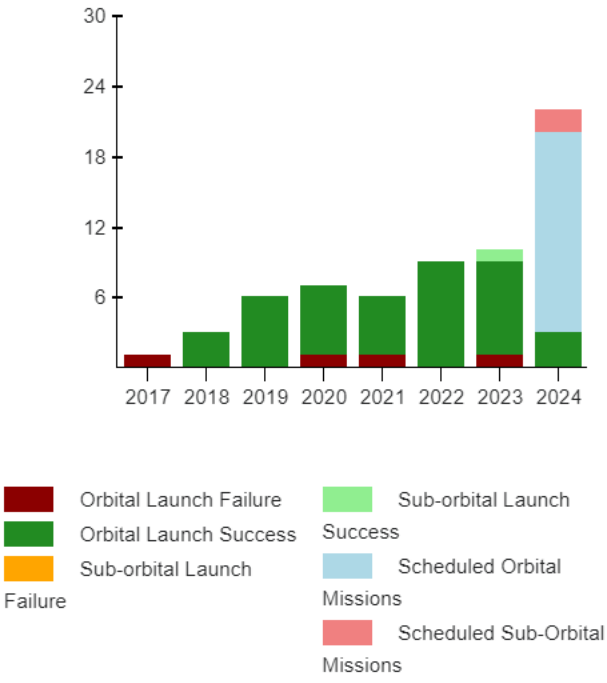
Blue Origin had a slow growth with most of the consistent business taking off around 2015. However, even though the growth was initially slow, it seems that industry wide launches greatly increased around 2016, as a similar historical trend is seen with SpaceX. Positive growth is measured after this time with the other companies examined, likely due to historical industry success supporting increased competition, increased skilled labor, and increase in demand for proven reliable space access.

Figure 4: Blue Origin Launch History



2.2.3 Rocket Lab

Figure 5: Rocket Lab Launch History

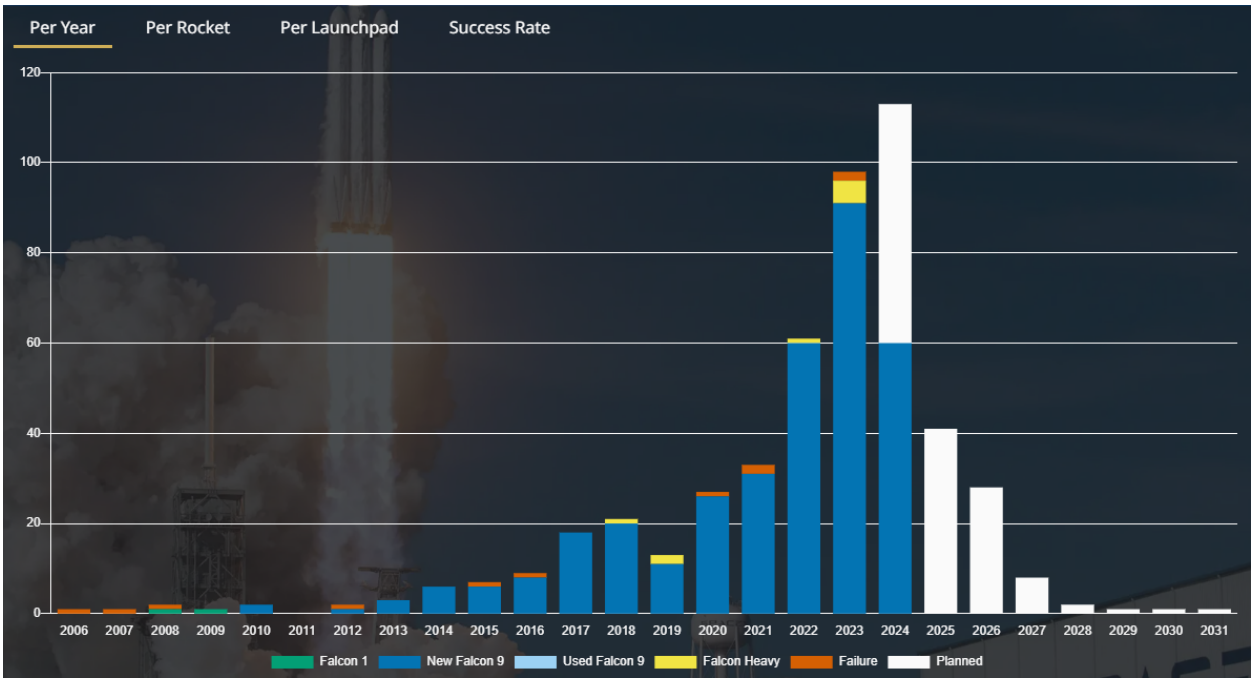


Rocket Lab has had a gradual and consistent growth in the last 7 years, increasing from 1 launch in 2017 to 10 last year in 2023. Rocket Lab was started after the 2015-2017 point where overall industry launches increased which may be why they have had much greater success at annual launch increases from the initial launch, than the companies that had started launching almost a decade prior. Greater competition and more industry knowledge may have contributed to their success, and this may continue to be a trend with future new launch companies.

2.2.4 SpaceX Launch History

SpaceX is the current industry leader in launches per year and has had an exponential like growth curve since their first launch attempt in 2006, going from 1 in 2006 to 98 last year. During the first decade, there was little to no growth, however between 2016 and 2017 the number of launches doubled and has been greatly growing since. SpaceX and Blue Origin had many years of longevity that seems to have contributed to their dramatic increases in this time frame and the benefit that later incorporated companies have enjoyed.

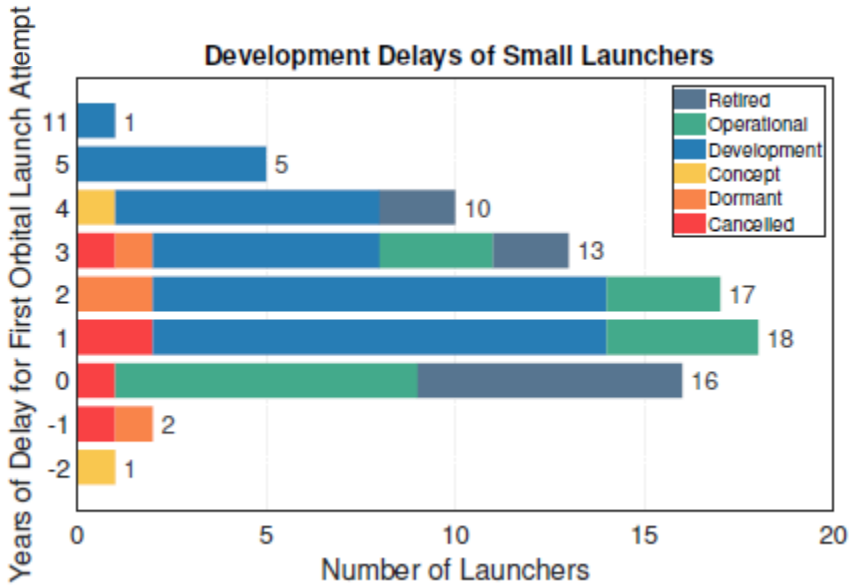
Figure 6: SpaceX Launch History



2.3 Growth and Delay Analysis

Figure 7 is a graph analyzing all small launch operators worldwide, charting years of developmental delay from first announced launch date. Looking at only the operational companies, about half will meet predicted timelines and half will be 1-3 years delayed. On average, half of all companies will be delayed about one year before launching for the first time.

Figure 7: Development Delay of Small Launchers



The graphs titled Figures 8 and 9 are line graphs depicting the four representative launch vehicle operators discussed previously, showing number of launches on the y-axis and the number of years following the first launch attempt on the x-axis. By graphing the launch data in this way, the trend of average launch growth per year since first launch can be estimated. Removing the calendar year allows for comparing increase in performance from the companies start and shows an average trend of expected increase in the first few years.

Rocket Lab is an outlier having been incorporated years after Blue Origin and SpaceX but still enjoying immediate levels of success. Astra arguably also had some level of benefit having been incorporated much later, as Astra started off and maintained a level of launches that the older two companies did not see until they hit almost 10 years past first launch.

With such a small data pool of companies and short collection times the results are heavily skewed by Rocket Lab in the middle years and SpaceX in the later years. However, with the early years there are some consistent averages for the first 5 years. AAC has previously captured launch companies in the early years who may follow similar early growth levels. Using this estimate can help determine how many annual launches AAC might need in the next 5-10 years.

Although companies may have similar early years growth after the first launch, there is a 50% chance that the trends in Figures 8 and 9 were predated by 1-3 years of delays from first announced launch, as supported by the data in Figure 7. This gives additional room for forecast flexibility as future companies pledged launches to PSCA have a high likelihood of being 1-3 years behind.

Figure 8: Launch Historical Data

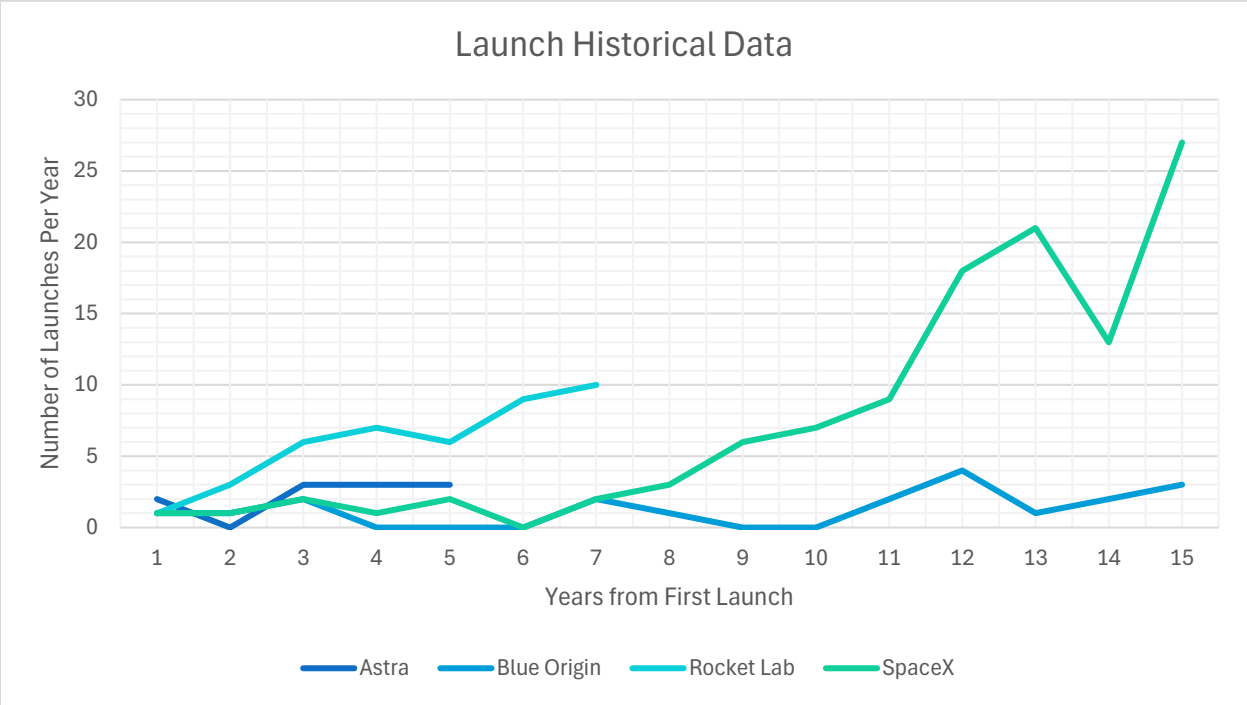


Figure 9: Launch Historical Data with Average Plotted

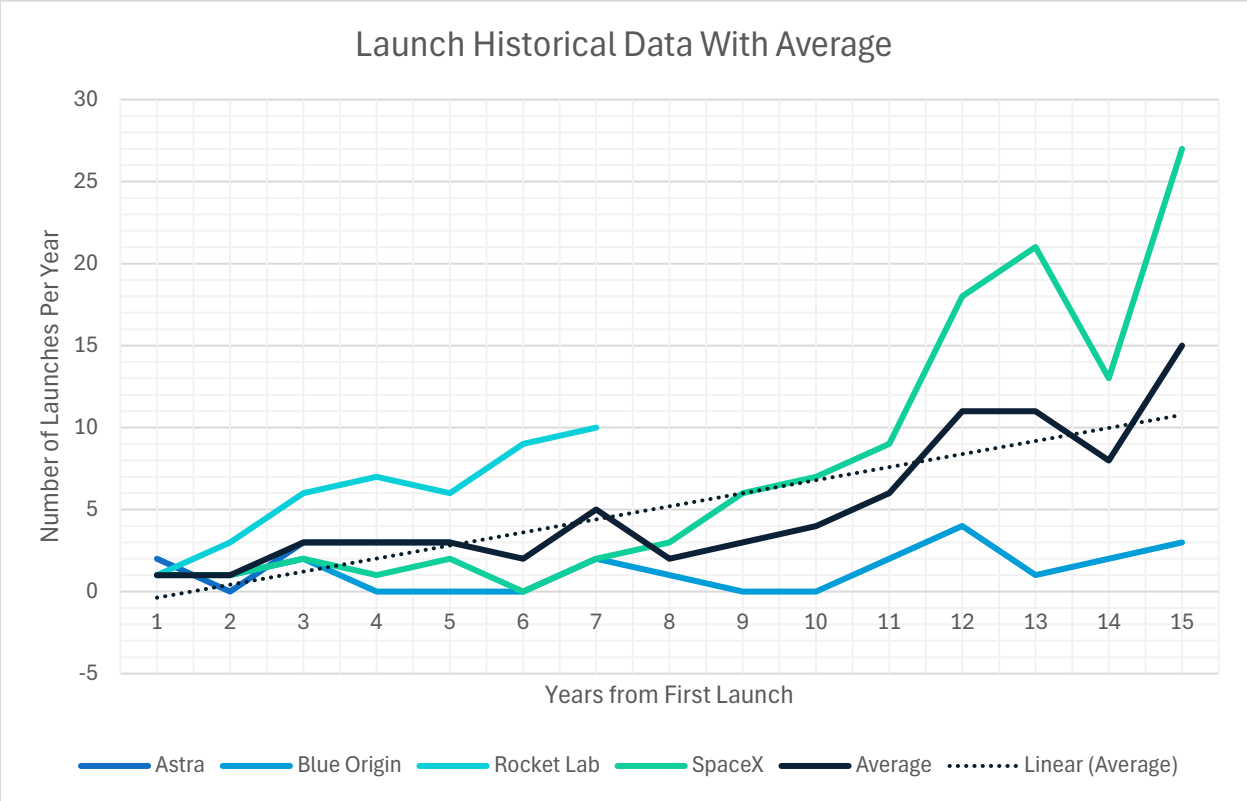
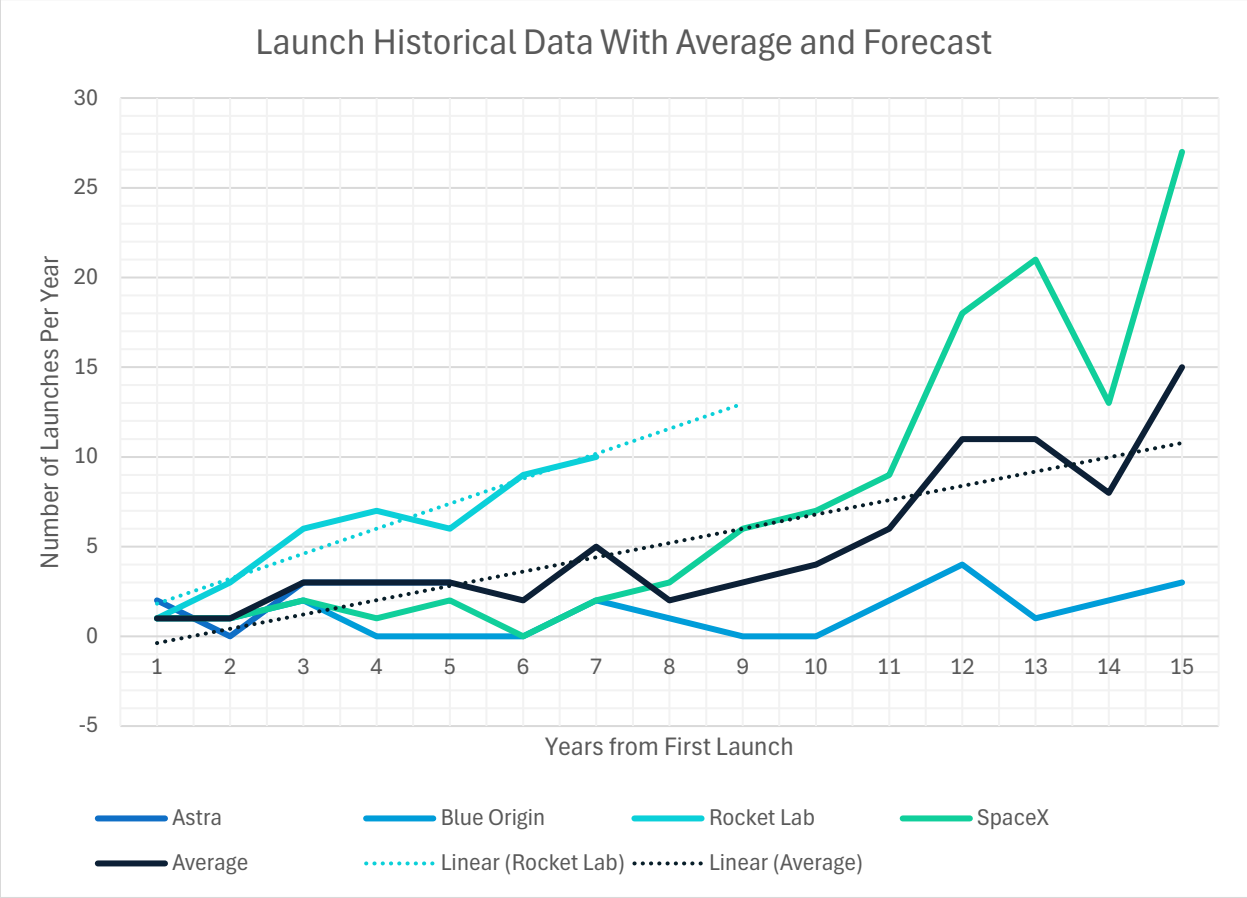


Figure 10 shows the average launch history compared to Rocket Lab's average and forecasted launch numbers. The average launch company reach 5 launches a year around 8 years in and Rocket Lab is averaging an increase of 3 launches every 2 years. Since it could be theorized that new launch companies are starting with an added benefit from the previous investments of older launch companies, a good estimate would be between the previous two averages, around 5 launches in 5 years.

Figure 10: Launch Historical Data with Average and Forecast Plotted



3. Rocket Size

AAC is focusing the environmental assessment on large and medium-lift vehicles so all smaller vehicles will be covered by the environmental assessment.

Based on the past experience with previous commercial launch companies that have had multiple launches at PSCA, launch vehicles are getting larger. This can be seen through the iterations of Astra's rocket 3 and 4, and ABL's RS1. Demand is fueling growth of vehicle size from small to medium.

PSCA is already approved to launch nine rockets, with three being medium-lift sized and six being small-lift vehicles. Most of the small launches PSCA has hosted in the last five years have been less than 30 m tall and 900 kg to LEO. In letters of intent received, customer shared forecast plans, and verbal discussions, the size of rockets coming to PSCA will increase. Discussions have put upcoming rockets sizes into the medium large to large weight class vehicle range.

The vehicle size that AAC should apply for should be bigger than current discussed rockets to cover the launches that are most likely to occur at PSCA, medium and large.

4. MACH TB Program

The Multi-Service Advanced Capability Hypersonic Test Bed (MACH-TB) program is meant to increase the speed of testing for commercially available hypersonic systems. The program also called for the creation of an experimental glide body (EGB) that will allow the team to gather data on and validate performance of hypersonic glide body components.

This program is working towards increasing launch cadences and is expecting to support dozens of launches. To support any program such as this, PSCA needs to be able to dedicate a certain number of launches to the programs. Between 6-12 launches could be added to the launch total by a program like this alone.

5. Recommended Plan

Examining the data above, a plan similar to VCSFA seems to be a good course of action. VCSFA estimated a low growth forecast and is permitted to launch 18 times a year but is now increasing the approved number. 25 launches annually is a good estimate as it allows AAC to support multiple customers for multiple years before deconfliction would need to occur.

This number allows for launches to be assigned to multiple newer companies and still have additional launches for more mature campaigns. Assuming it takes about 5 years to achieve 5 launches annually, and all will take place at PSCA, this would allow for 3-5 new companies and 1-2 mature campaigns to be supported for 5 years. This would allow for approximately 15 launches for multiple small programs and 10 launches for a mature campaign, or any other combination as needed.

AAC should easily be able to pledge enough launches to both small and large customers. With 1-3 years pre-first launch delays as a buffer and average total growth per customer of 5 launches per five years, there will be enough time to reevaluate AAC's launch need after hitting between 20-25 launches annually.

The average growth of these launch vehicle companies is generally steady but historical data has shown a few points with massive growth. With a 25 launch capability, AAC assures companies that their campaigns can be supported regardless of ambitious customer annual launch estimations. If AAC did have a customer with a sudden increase in launches, AAC will be able to support with enough warning to start another EA should we need an increase. Additionally, due to the time and effort that the EA process requires, this number should cover AAC for the foreseeable future and leave time to get another increase should sudden demand occur.

Sources:

Figure 1: Forecast for MARS Launches 2017-2022: VA Space Strategic Plan PDF, pg 16

Figure 2: Forecast for PSCA Launches 2020-2023: AAC Master Plan PDF, pg 3-23

Table 1: MARS Actual Launch Data: Self-Generated

Table 2: PSCA Actual Launch Data: Self-Generated

Figure 3: Astra Launch History: Wikipedia
https://en.wikipedia.org/wiki/List_of_Astra_rocket_launches

Figure 4: Blue Origin Launch History: Wikipedia https://en.wikipedia.org/wiki/Blue_Origin

Figure 5: Rocket Lab Launch History: Wikipedia
https://en.wikipedia.org/wiki/List_of_Electron_launches

Figure 6: SpaceX Launch History: https://www.spacexstats.xyz/#upcoming-next

Figure 7: Development Delay of Small Launchers: IAC Small Launchers Paper 2023 PDF pg 10

Figure 8: Launch Historical Data: Self-Generated

Figure 9: Launch Historical Data with Average Plotted: Self-Generated

Figure 10: Launch Historical Data with Average and Forecast Plotted: Self-Generated

https://www.prnewswire.com/news-releases/leidos-mach-tb-program-successfully-completes-1st-test-launch-301853772.html