

IAC-25-D2.1.7

## Small Launchers - 2025 Survey and Competitive Landscape

Erik Kulu

NewSpace Index, Nanosats Database, Factories in Space  
erik.kulu@newspace.im

### Abstract

The small launch industry has seen more pivots and continued execution challenges since the previous study in 2023. Many firms continue to announce larger rockets, while others are falling dormant. In 2025, the first two orbital launches by companies outside the United States were attempted by Isar Aerospace in Europe and Gilmour Space in Australia. Several others are expected before the end of the year but may not happen as announced. Relativity Space, once claiming Terran-1 as the “most pre-sold rocket in history before launch,” raised over \$1.3 billion but cancelled after a partial failure in 2023, following 7–8 years of development. Astra went public in 2021 at about \$2.1B valuation but was privatized in 2024 for about \$10M. ABL raised over \$500M, suffered a failed maiden launch in 2023, and pivoted to missiles in 2024. In contrast, Rocket Lab has passed 70 Electron launches and reached gross profit in launch, meaning revenue per flight now exceeds cost. Firefly has flown six Alpha missions and became publicly listed in 2025.

NewSpace Index ([www.newspace.im](http://www.newspace.im)) has been tracking small launch vehicles since 2016 and includes 216 entries, up from 203 in the previous survey. The public directory focuses on new private rockets that were, are or will be available on the worldwide commercial launch market. A small launcher is defined as capable of launching up to a 1500 kg payload to a 700 km SSO orbit.

The first half of this paper provides an updated statistical overview of small launch vehicles. Development status, payload capacity, first launch years, development delays, launch costs, geographical distribution, propellant types, reusability plans, and funding will be reported where available. Only 1 known small launcher company was founded in 2024 and at least 64 launch companies have received >\$1M in funding.

The second part discusses small launcher trends and the evolving competitive landscape. Statements about there is no market in dedicated small launch are imprecise but it is far from the billion-dollar forecast in many reports. As the sector matures, the next years will show who can demonstrate both technical execution and commercial viability. Alongside small launchers, larger rockets and emerging space tugs will increase access to orbit, often underselling to attract customers and generate revenue.

Other key questions remain: when will the first (partially) reusable small launcher appear, and how will lower-cost alternatives change demand compared to Electron’s relatively high price of \$7.5M per flight?

**Keywords:** launchers, rockets, small launchers, small lift launch vehicles, dedicated launchers

### 1. INTRODUCTION

This survey gives an overview of the current state of the small launch industry and discusses changes during the 2 years since the previous study by the author. For a more complete picture, please also see the papers from IAC 2021<sup>1</sup> and 2023.<sup>2</sup> The focus of this paper is on recent developments and changes, rather than providing a comprehensive historical account of the small launcher sector.

NewSpace Index ([www.newspace.im](http://www.newspace.im)) has tracked small launch vehicles since 2016.<sup>3</sup> There are 216 entries as of August 2025, which makes it one of the largest public databases. There were about 30 launchers listed in 2016, 60 by the end of 2017, 180 in the 2021 and 203 in the previous 2023 study.

A short history of small launchers was covered in the 2021 study.<sup>1</sup> The 2021 and 2023 papers also include more complete literature reviews.<sup>1,2</sup>

Over the past two years, optimism around small launch has been further tempered by reality. Launch failures, delays, and financial pressures have affected many companies, while high-profile entrants such as ABL have exited the launcher sector altogether.

The first orbital launch attempts by Isar Aerospace in Europe and Gilmour Space in Australia in 2025 were important milestones. However, these are only initial steps. Long-term success will depend on reaching orbit, scaling production, and demonstrating sustainable economics, challenges that are expected to take many years to resolve.

## 2. LITERATURE REVIEW

Recent academic literature on small launch vehicles seems to be relatively limited. Nevertheless, several studies since 2023 have addressed market dynamics, cost performance, propulsion options, and sustainability. Gunter's Space Page<sup>4</sup> (Gunter D. Krebs), Jonathan's Space Report<sup>5</sup> (Jonathan McDowell) and Space Launch Report<sup>6</sup> (Ed Kyle) have continued keeping lists of launches and launch vehicles. Regular surveys of the small launcher sector were presented by C. Niederstrasser, but no updates since 2022 have been found.<sup>7</sup> P. Lionnet has continued to write about launch vehicles and their economics.<sup>8,9</sup> Further analyses have been published outside the academic literature, including articles by Chris Larmour (former CEO of Orbex),<sup>10,11</sup> and for example by John Holst<sup>12</sup> and Peter Hague.<sup>13</sup>

**Market outlook and business challenges.** Novaspaces forecasts nearly 14000 smallsats (<500 kg) launching between 2024–2033.<sup>14</sup> Other analyses highlight ongoing uncertainty in small launch demand. Bhalodia (2024) describes the rapid growth of the segment as a speculative bubble, warning that rideshare missions are strong competition.<sup>15</sup> Meshko (2024) examines how companies have adapted strategies to changing technological and financial conditions, while a 2025 programmatic analysis stresses that new entrants continue to face high technical and organisational risks.<sup>16,17</sup> Motta (2024) questions if there is sufficient market demand for many micro-launchers to achieve sustainability.<sup>18</sup> In the NewSpace Index's Gartner Hype Cycle illustration, clearly near the trough of disillusionment.<sup>19</sup>

**Vehicle design and cost performance.** Cost efficiency remains a central concern. González-González et al. (2025) argues that many advertised prices for payloads < 400 kg are unrealistic, and suggest a more target of about \$15,000 per kg to LEO.<sup>20</sup> Related discussions of pricing, such as Autry (2024), claim competitive cost-per-kilogram advantages for new vehicles under development.<sup>21</sup> A recent NASA cost study found that U.S. government launch costs increased by an average of 2.8% annually between 1996 and 2024, with no evidence of a downward shift even after new commercial providers.<sup>22</sup>

**Sustainability and technologies.** Hybrid rockets have received renewed attention for small launchers. Wei et al. (2024) review advances in hybrid propulsion, including new fuel grain formulations, that address regression rate limitations and instabilities.<sup>23</sup> Casalino et al. (2022) analyze hybrid rockets with both ground-based and air-launch concepts, finding performance trade-offs depending on

mission profile.<sup>24</sup> Musso et al. (2024) propose a multidisciplinary optimization framework that includes life-cycle assessment into design, aiming to reduce the environmental footprint of reusable microsatellite launchers.<sup>25</sup> Dietlein (2024) complements this with a system study of recovery methods for reusable first stages in future European launchers.<sup>26</sup>

**Launch strategies and access to orbit.** Comparative studies investigate alternative launch architectures. Barato et al. (2024) examine strategies for small satellites to access defined low Earth orbits, highlighting the influence of launcher availability and rideshare constraints.<sup>27</sup> Maquera-Ortega (2024) presents conceptual designs for dedicated smallsat launchers aimed at improving responsiveness and affordability for the expanding small satellite market.<sup>28</sup> Tinoco et al. (2025) proposed a framework for evaluating readiness levels of new spaceports,<sup>29</sup> which could also be used to assess the readiness of small launch vehicles.

**Policy and security aspects.** Beyond economics and technology, several studies examine the security implications of the growing number of small launcher programs. Brockmann and Héau (2024) highlight how the expansion of NewSpace industry capabilities can blur the line between civilian and missile technologies.<sup>30</sup> A related SIPRI study maps the spread of NewSpace companies developing or testing missile-related technology and finds that at least eight countries outside the Missile Technology Control Regime now host active micro-launcher projects.<sup>31</sup> These works argue that small and micro launchers may present new missile proliferation risks, or at minimum complicate export control.<sup>32,33</sup>

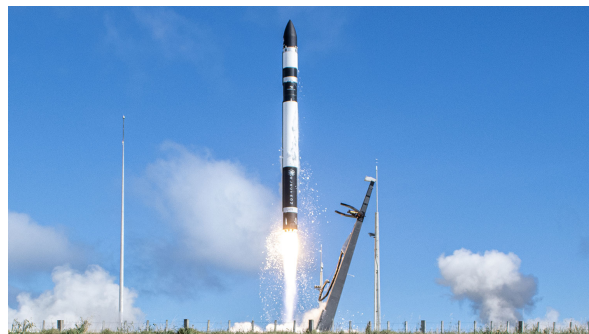


Figure 1: Rocket Lab Electron launches TROPICS mission from Cape Canaveral, May 2023 (NASA)

In summary, recent work touches on business viability, design optimization, sustainability, and alternative launch strategies for small launch vehicles. A broader view of developments is drawn from industry sources, summarized in the next section.

### 3. DEVELOPMENTS SINCE 2023

This section provides a broad overview of major developments in small launch vehicles since mid-2023, drawing mainly from industry reports, news, and blogs. Global orbital launches have continued to rise, yet almost all of the increase has been driven by SpaceX as per Figure 2. China has shown gradual growth too, while launch activity in the rest of the world has remained stable or slightly declined.

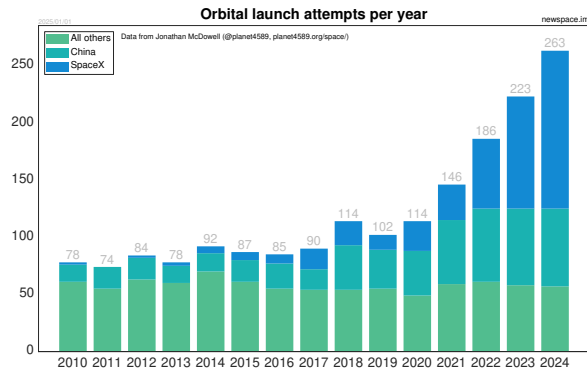


Figure 2: Yearly Rocket Launches

Satellite deployments show a slightly different pattern as seen on Figure 3. After rapid expansion, the yearly number of spacecraft launched has baselined at around 2800–2900 in 2023 and 2024. Starlink remains very dominant, but their newer satellite generations are larger and launched fewer at a time. Recently, China has started deploying their large constellations, and Amazon’s Kuiper began launches too. However, if Starlink, OneWeb, Kuiper and Chinese deployments are excluded, global growth in satellite launches has been relatively small.

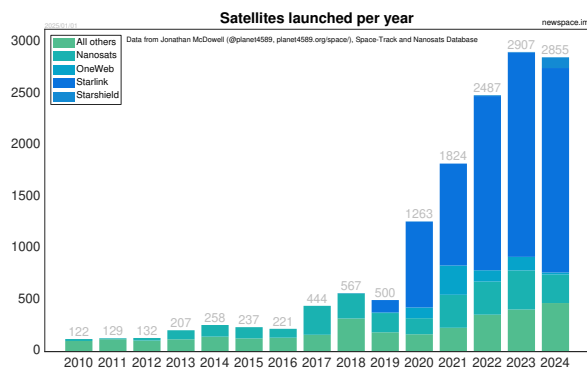


Figure 3: Yearly Satellite Launches

In a 2025 keynote, Peter Beck stated that “small launch is well and truly being solved,” citing Electron’s track record.<sup>34</sup> Electron nearly reached orbit on its first attempt in 2017. Peter Beck remarked in 2025 that “you’re not going to hear some rubbish

about clearing the pad being a success” when asked about Neutron’s first flight.<sup>35</sup>

Venture capitalist Steve Jurvetson predicted in 2023 that “over 100” small launch companies could go bankrupt within 2 years, warning of an investor “hangover” across the broader space economy.<sup>36</sup>

**Europe** In Europe, PLD Space conducted the suborbital flight of *Miura-1* in October 2023, reaching 46 km altitude.<sup>37</sup> However, the company claimed it was “the first private European rocket to reach space”<sup>37</sup> and “the first rocket created by a private company in Europe”.<sup>38</sup> The altitude remained below the Kármán line of 100 km and such inaccurate claims are already spreading.<sup>39</sup> Prior private European flights include for example Skyrora’s *Skylark Micro* to 26.9 km in 2020,<sup>40</sup> and Copenhagen Sub-orbitals’ *Nexø II* in 2018.<sup>41</sup> PLD Space raised more than €170 M by late 2024 including €40.5 M from Spain’s aerospace program and loans over €40 M.<sup>42</sup>

In March 2025, Isar Aerospace launched its *Spectrum* from Andøya, Norway, but the maiden flight lasted about 30 seconds.<sup>43</sup> Isar Aerospace extended its Series C by €65 M in June 2024, bringing the round above €220 M.<sup>44</sup> By 2025, it had secured more than \$420 M<sup>43</sup> including €150 M in June 2025.<sup>45</sup>

Rocket Factory Augsburg suffered a first-stage engine explosion during a hot-fire at SaxaVord in December 2023.<sup>46</sup> In 2024, HyImpulse conducted a successful suborbital launch of its *SR75* hybrid rocket.<sup>47</sup> In Poland, the ILR-33 Amber 2K became the first national rocket to reach space in 2024.<sup>48</sup> Skyrora is preparing its first UK suborbital launch of *Skylark L* from SaxaVord in 2025, following earlier testing in Iceland.<sup>49</sup>

Germany committed an additional €95 M to Isar, RFA, and HyImpulse in December 2024.<sup>50</sup> ESA awarded €44.2 M in Boost! contracts in 2024 to Isar, RFA, HyImpulse, and Orbex.<sup>51</sup>

Among larger rockets, RFA and PLD have presented their plans.<sup>52, 53</sup> The Exploration Company is developing a reusable *Helix* engine and were selected by ESA for funding in 2024.<sup>54</sup>

The European Space Agency in 2024 announced the *European Launcher Challenge*, offering up to €169 M to support new small launchers.<sup>55</sup> RFA, Orbex, Isar, PLD Space, and Maiaspace were selected for the first round.<sup>55</sup>

**Asia-Pacific** In Australia, Gilmour Space attempted first orbital launch with its hybrid-fueled *Eris* on July 30, 2025. The vehicle lifted off but lost thrust after 14 seconds.<sup>56, 57</sup>

In Japan, Space One attempted two orbital launches of its small solid *Kairos* in 2024, both of which failed shortly after liftoff.<sup>58</sup> Honda in Japan performed a vertical landing test in 2025.<sup>59</sup>

In South Korea, Innospace went public in July 2024 with an expected valuation near \$294M, raising funds for its *Hanbit-Nano* launcher family. However, its share price has declined after the IPO.<sup>60,61</sup>

**China** CAS Space extended its run of successes with *Lijian-1 (Kinetica-1)*, including a November 2024 flight that carried 15 satellites with its first international payload for Oman.<sup>62</sup> However, a December 2024 launch ended in failure.<sup>63</sup>

iSpace returned to orbit with a successful *Hyperbola-1* launch in July 2025 after setbacks.<sup>64</sup>

LandSpace had already demonstrated methalox to orbit with *Zhuque-2* in July 2023,<sup>2</sup> but a later flight of the *Zhuque-2E* failed in 2025.<sup>65</sup> The company received \$123M in December 2024 in state funding for a reusable variant.<sup>66</sup>

CAS Space and LandSpace also advanced plans for public listings in 2025.<sup>67</sup>

**United States** Rocket Lab is increasing cadence, with 16 launches in 2024 reaching 58 total missions by year end, and reached 70 flights in August 2025, including two within 48 hours.<sup>62</sup> Electron's launch services are financially breakeven (gross profit) since 2023, revenue per launch exceeds costs.<sup>68</sup>

Firefly Aerospace has launched six *Alpha* rockets, with 4 experiencing anomalies or partial failures.<sup>69</sup> Firefly Aerospace raised \$175M in late 2024<sup>70</sup> and completed an IPO in August 2025, raising \$868M at a valuation of \$6.3B.<sup>71</sup>

Astra was taken private in 2024 at a valuation near \$12M.<sup>72</sup> ABL Space had raised about \$461M but pivoted to missile programs in late 2024 after one orbital launch attempt failure in 2023 and losing the second rocket during preflight testing.<sup>73</sup>

In August 2025, a new U.S. executive order was issued to accelerate licensing, spaceport construction, and emerging on-orbit activities.<sup>74</sup>

## 4. METHODOLOGY

This section describes the survey criteria, which has resulted in the 216 entries, and provides explanation about some of the classifications used to categorize and compare the small launch vehicles.

This study builds on the NewSpace Index database of small launch vehicles and follows a similar methodology to the author's previous surveys.

Using the following criteria, the survey compiled data on each launcher's status, technical parameters, launch history, and funding. Public sources, company statements, and industry news up to August 2025 were used to update the dataset. The statistical results presented here reflect the information available (and vetted by the author to best abilities) as of August 31, 2025.

### 4.1 Survey Criteria

- **Small launcher** - up to 1500 kg to 700 km Sun-Synchronous Orbit (SSO). In literature, micro-launchers have been defined as <500 kg and small launchers as 501 kg - 2000 kg.<sup>75-77</sup> NASA has also used <2000 kg for the small launch vehicle class.<sup>78</sup>
- **Commercial and civilian** - It is preferred that rockets must be or are planned to be available in the commercial market or they have launched such missions. These criteria exclude small launchers from e.g., Israel (Shavit), Iran (Safir) and North Korea (Unha).
- **Performance to SSO orbit** - Different entities publish varying payload performance values for the rockets. In this case, payload to 500 km SSO is preferred. Thus, some values might look smaller when compared to other sources. When matching official values have not been found, then no effort has been made to re-calculate payload masses. In other words, performances are not strictly comparable, because the orbits can be different.
- **Orbital class** - Must be capable of putting a payload into orbit. Suborbital launch vehicles have not been included in this survey.
- **First launches after 1990** - This limit exists to include commercial Pegasus and Athena launchers, while excluding early and often non-commercial rocket families such as Scout (USA), Thor-Delta (USA), Diamant (France), Long March 1 (China), M or Mu (Japan), Kosmos-3M (Russia) and others.
- **Single entry per organisation preferred** - Many organisations are developing multiple launchers as presented on their websites. In most cases, only the first-to-fly or the most prominent launch vehicle has been included. Next ones are added when the initial vehicle becomes operational or is retired or cancelled. This avoids multiple conceptual rockets from the same entity in case all of them have a low probability of making to an orbital launch.

## 4.2 Status Classification

Each launcher in the survey is assigned a development status, based on available public information, and in some cases by the lack of it.

- **Retired** - Launchers that were operational, but have since been officially discontinued, or no further launches have been announced, or many years have passed since last news.
- **Operational** - Launches to orbit have been performed (successfully or not) and the next launches will likely have useful payloads and high likelihood of achieving orbital velocity. Including unsuccessful orbital launches here avoids having a separate category for them.
- **Development** - Suitable indicators are two or more from: the company and project is visibly active, the year for the first launch has been announced, relevant updates on social media channels and in the news, team size is increasing, private funding has been announced and/or governmental projects awarded.
- **Concept** - Alternatively, idea or study stage. Possible indicators are: study project and not yet approved for hardware development, lack of proof about sustained technical development, active development is unlikely based on funding level, types of updates on social media and via news media, team very small and not increasing and have alternative jobs based on LinkedIn. In other words, creating a website with some renders and specifications (in the best case) does not equal a new launcher in development. This status may be the most debatable and it still leaves a possibility that active development will start in the future.
- **Dormant** - The first step towards Cancelled. Possible indicators are offline website, lack of recent (1+ year) posts on social media channels, very small team or a single person according to LinkedIn, no announced funding. Some could be in stealth mode and future will tell.
- **Cancelled** - Indicates a small launcher, which project has been announced to have been stopped, or which website has been offline for years, or no indication of the launcher on the organisation website anymore when it used to be there before, or company bankrupt.

## 4.3 Limitations

This study has limitations that should be acknowledged. First, the data on small launch vehicles is constantly evolving. New announcements, delays, and failures can quickly change the status or outlook for a given project. Negative news or developments are rarely announced. The numbers presented (e.g., counts of operational vehicles, funding amounts) are based on the best available information as of August 31, 2025, but may quickly become outdated as companies progress or shut down.

Secondly, there is an inherent selection bias in the sources. Much of the data comes from company press releases or news reports. Firms may inflate or obscure figures for marketing purposes.

Third, the quoted price and performance figures should be treated cautiously. For several rockets, the publicly available values are years old and may not reflect redesigns or recent changes. While these numbers have been retained for consistency, they may not represent current capabilities and offerings.

Another limitation concerns categorization. The boundary between “Development” and “Concept,” or labeling a project as “Dormant,” involves subjective judgment. Different analysts might classify borderline cases differently. In this study, classifications were aligned with earlier surveys, generally giving the benefit of the doubt to many projects with some recent activity.

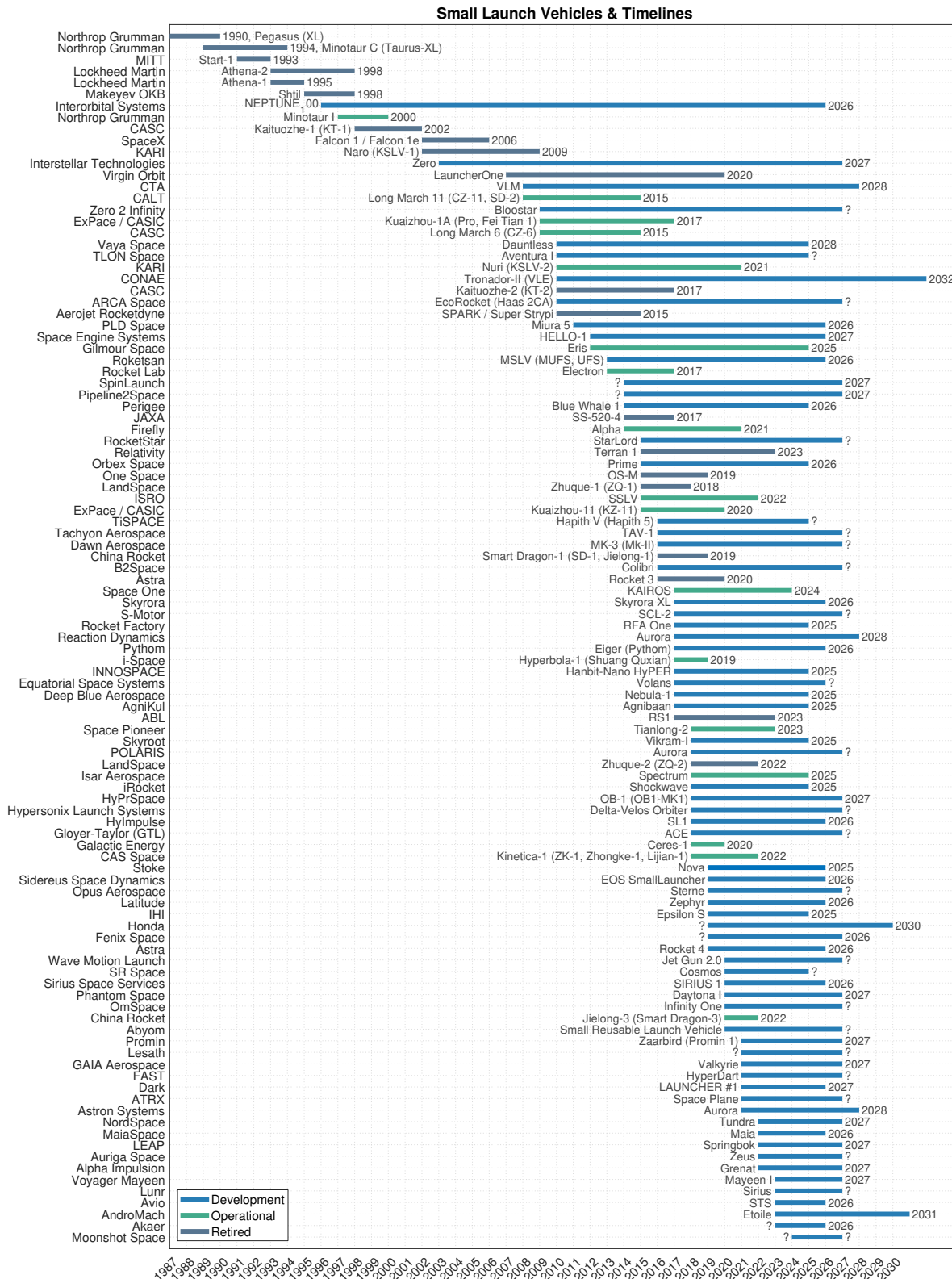
Market sizing for dedicated small launch is also not straightforward. No independent quantitative forecast was produced. Instead, reports and observed activity were synthesized. Forecasts vary widely, and many past estimates from the growth-hype period have proven inaccurate in hindsight.

Finally, this study does not cover suborbital launchers or space tourism vehicles, which form a different market (e.g., Blue Origin’s *New Shepard*). Larger vehicles above about 1500 kg to SSO are also excluded, which places rockets such as Rocket Lab’s *Neutron* outside scope.

In summary, the results should be taken as a snapshot with approximate figures. The overall trends are clear, but individual data points (such as costs or performance metrics) may have uncertainty. Ongoing research and updates are necessary to keep track of this industry.

## 5. SURVEY RESULTS

Figure 4 lists 105 of 216 surveyed small launchers, leaving out Cancelled, Dormant and Concept statuses for better readability. The full list and all figures will be available online at the NewSpace Index.<sup>3</sup>



## 6. STATISTICAL OVERVIEW

This section covers the statistical overview of the 216 entries in this 2025 small launchers survey. The focus is on changes and updates compared to earlier surveys, rather than restatement of most data.

### 6.1 Development Status

Figure 5 summarizes the current status of 216 small launch vehicles. 13 entries have been added in the last 2 years. Several of them are second rockets from the same organisations, some were already dormant or cancelled by the time of entry, while others are newly founded or discovered startups.

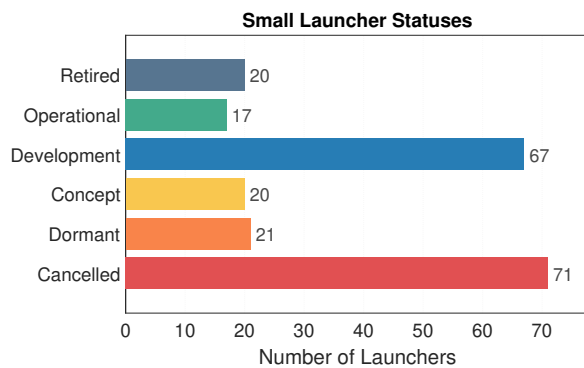


Figure 5: Current Status of Small Launchers

The number of retired small launchers has increased to 20 (~9%), up from 13 in 2023. This includes vehicles that performed at least one orbital launch attempt before cancellation. Notable additions since the last survey are ABL's RS1, MITT's Start-1, Northrop Grumman's Pegasus, Zhuque-2 (Zhuque-2E is too large) and OneSpace's OS-M (only 1 failed launch in 2019). Official announcement for Pegasus has not been found but assuming retired due to last launch in 2021. In some cases, companies have pivoted to other products, such as ABL moving towards missile development.

Operational launchers are 17 (8%), slightly lower than 2 years ago. This includes vehicles such as Rocket Lab's Electron, Firefly Alpha, China's Long March 6, Ceres-1, and Kuaizhou-1A, as well as India's SSLV and South Korea's Nuri. Several new entrants have joined since 2023, including Space One's KAIROS, Isar's Spectrum and Gilmour's Eris. However, a number of operational rockets have flown rarely, in some cases with more than a year since the last mission, and may be retired in practice.

Projects in active development now number 67 (31%), down from 88 in 2023. This is due to some advancing to operational status and others shifting back to concept, dormant or cancelled status. About

half of the development projects advertise a maiden launch date, though delays remain very common. Stoke Space has been moved into Pivot/Cancelled, because the current performance of 3000 kg of Nova is out-of-scope in the context of this database. The company itself is active and seemingly doing well.<sup>79</sup>

Concept-stage projects are at 20 (9%), up from 19 in the last survey. These are typically early paper projects or initiatives without confirmed funding. Some have been moved from Development to Concept as no progress has been observed while some were moved to Cancelled. The true number of dormant projects is likely even higher, since some "development" projects may actually be inactive.

Cancelled projects have increased sharply to 71 (33%), from 20 in 2023. This is due to some recent failures or pivots and many older long-silent projects were confidently deemed to be no longer active.

In total, half (52%) of all identified small launch projects are no longer actively developing hardware (retired, dormant, or cancelled). Only about one-third remain in active development, and <10% are considered operational. Only about 16% have ever had an orbital launch attempt (operational or retired). Most operational vehicles are from China. This illustrates consolidation compared to the peak optimism of the late 2010s and early 2020s. Further consolidation is extremely likely.

### 6.2 Yearly Launches

Figure 6 plots the orbital flight attempts of small launch vehicles since 2000. Activity was sporadic in the early 2000s, with only a few attempts per year, but began to increase after 2017. Electron accounts for the largest share of recent launches with 16 in 2024, while Ceres-1 and Kuaizhou-1A contribute notable share of the Chinese activity. High failure rates remain even as annual attempts have increased, but more often from maiden flights of new launchers.

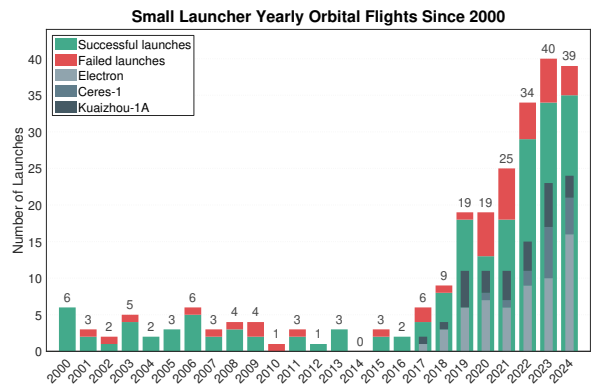


Figure 6: Yearly Orbital Launches of Small Rockets



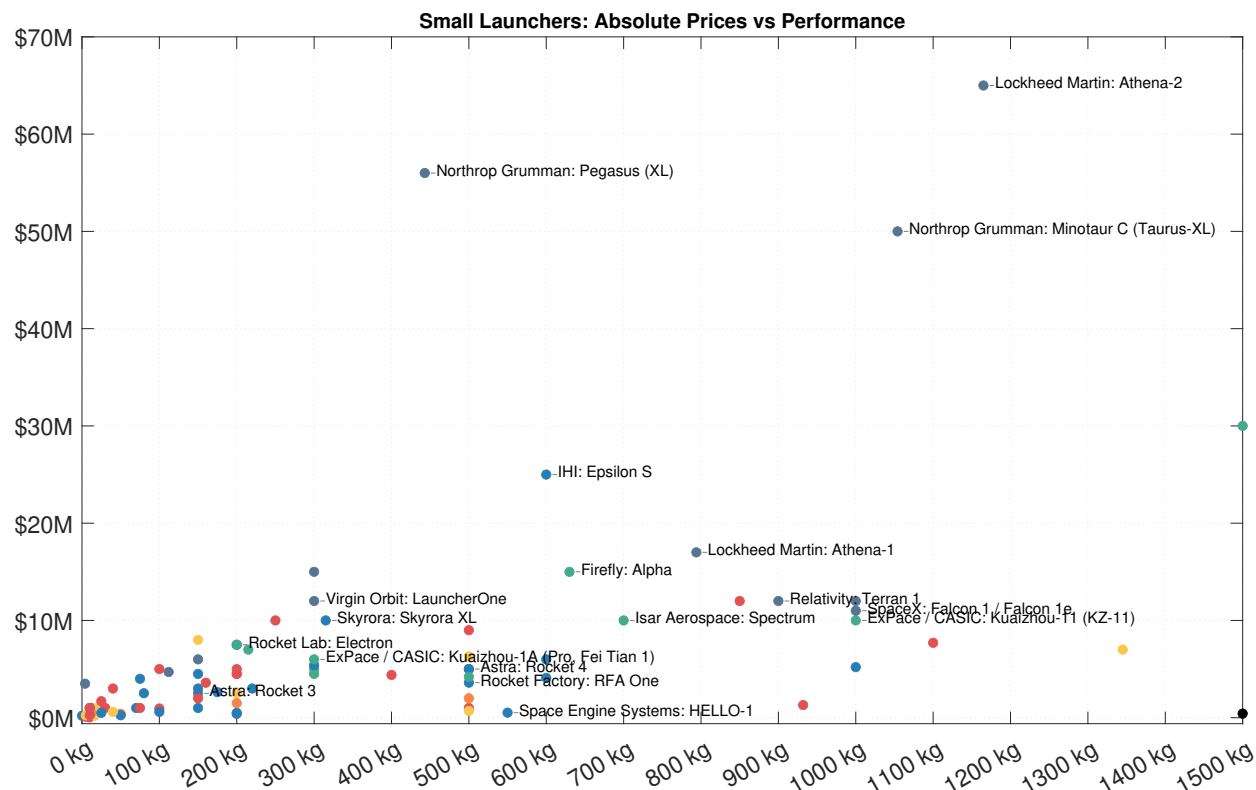


Figure 10: Absolute Costs per Kilogram vs Performance of Small Launchers

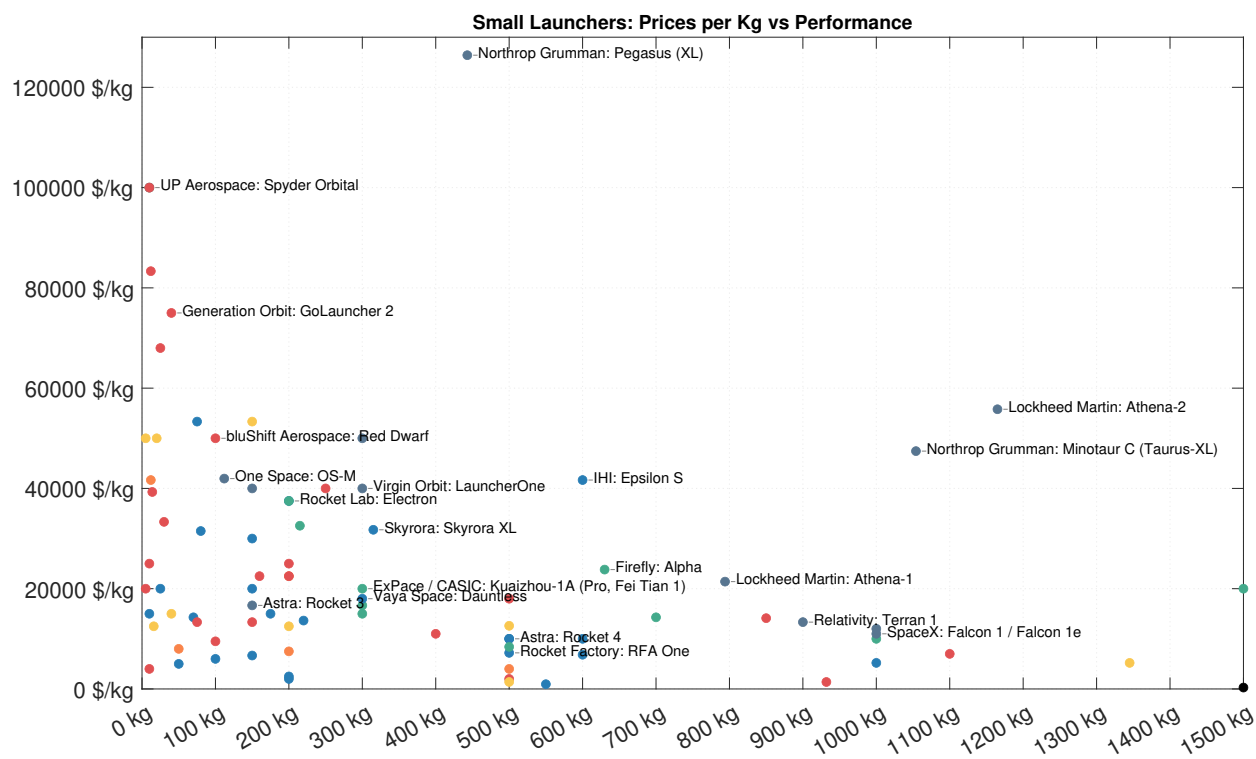


Figure 11: Costs per Kilogram vs Performance of Small Launchers

## 6.6 Prices per Kilogram

Figure 12 illustrates the dedicated launch prices per kilogram. Since 2023, almost no new information has been found on per-kilogram costs. The only solid benchmarks remain Rocket Lab’s *Electron*, at about \$37–40k/kg based on a \$7.5–8 M price for a 200 kg payload, and Firefly’s *Alpha*, at roughly \$19k/kg based on a \$12 M price for 630 kg.

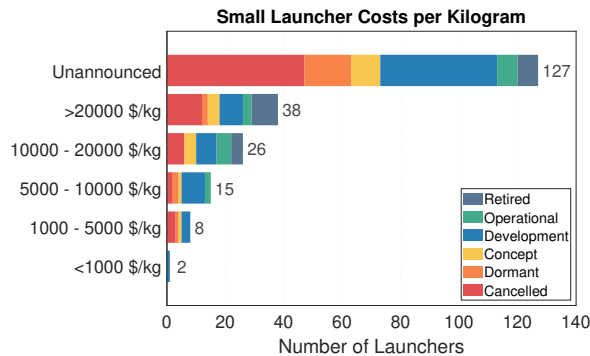


Figure 12: Kilogram Prices of Small Launchers

For comparison with all rockets, P. Lionnet and N. Sahli write that the actual price paid by the customer varies between 8-15k\$/kg and upwards to 70-100 k\$/kg, with an average price for the past 20 years of 15-20k\$/kg for launches to LEO and 25-30k\$/kg for launches to GEO and similar.<sup>8</sup>

## 6.7 Absolute Costs vs Performance

Figure 10 plots the absolute prices of the rockets in relation to their payload capabilities in kilograms. No significant changes have been observed since the last survey, and most vehicles still lack confirmed pricing. A more detailed discussion of this figure can be found in the 2023 survey.<sup>2</sup>

## 6.8 Costs per Kilogram vs Performance

Figure 11 shows the cost per kilogram of small launchers relative to their payload capacities. Some values may seem higher, because payloads to SSO orbits are preferred where available. Since 2023, similarly almost no new data has become available.

The robust benchmarks remain Rocket Lab’s *Electron* at about \$37,500/kg and Firefly’s *Alpha* at about \$19,000/kg. Rocket Factory Augsburg has previously quoted a low figure of around \$3,000/kg, but this is based on a 2021 estimate and its economic sustainability is uncertain. As before, dollars per kilogram provides only an approximate comparison due to factors such as adapters, volume limits, and common underutilization of payload capacity.<sup>87,88</sup>

## 6.9 First Launches

Figure 13 shows the first orbital launch attempts by years as they happened, or the upcoming maiden launches by the latest public announcements.

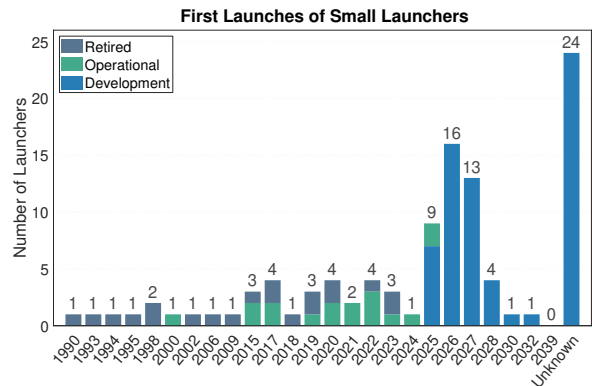


Figure 13: First Launch Years of Small Launchers

In the 2023 figure, maiden flights for 16 launchers were scheduled for 2023, 32 for 2024 and 8 for 2025. When looking back to what happened, then in the year 2023 only 3 small launchers made first orbital launch attempts. They were Tianlong-2 from Space Pioneer, ABL’s RS1 and Relativity’s Terran 1. The latter two have been retired.

In 2024, first orbital launch attempt was by Space One’s KAIROS.

In 2025, first orbital launch attempts have been made by Isar’s Spectrum and Gilmour’s Eris.

As of August 2025, maiden flights for 7 more small launchers are scheduled for 2025. They include for example RFA’s One, IHI Aerospace’s Epsilon-S and AgniKul’s AgniBaan. Most of the 7 are unlikely to happen based on historical trends.

There are 16 maiden flights currently known to be scheduled for 2026 and 13 for 2027.

It is worth noting that first-launch failure rates are high. Roughly half of maiden flights of new rockets fail.<sup>89</sup> The small launcher sector has conformed to this trend. Some exceptions exist, Tianlong-2 in 2023 succeeded on first try and Ceres-1 in 2020. This means that many “operational” vehicles actually prove themselves after a second or third flight.

## 6.10 Founded

Founding years of small launcher organisations are shown in Figure 14. For older organisations, the establishment year is not always the start of their launcher projects, but for newer startups in the last two decades this correlation is usually strong.

The founding of new small lift launch vehicle companies peaked around 2016–2020, but has not

yet fully collapsed. The number for 2024–2025 will likely rise in the future as additional projects are discovered. The peak years also contain the largest share of dormant and canceled projects, about half.

New companies founded in 2023 include Voyager Mayeen, AndroMach, Lunr and Black Aerospace. Moonshot Space was founded in 2024.

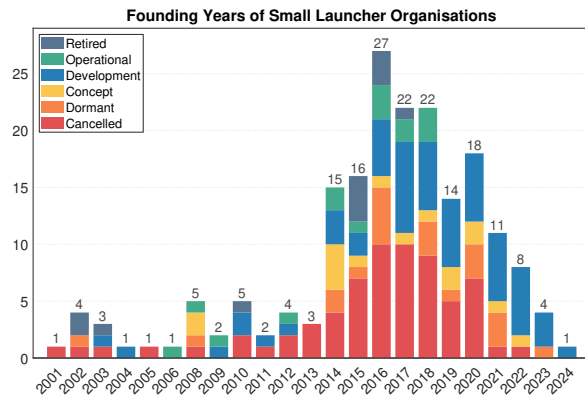


Figure 14: Small Launchers by Organisations Founding Years

### 6.11 Launch Types

Launch methods or types have been categorized in Figure 15. Launching from land is the most popular choice followed by a plane and a balloon.

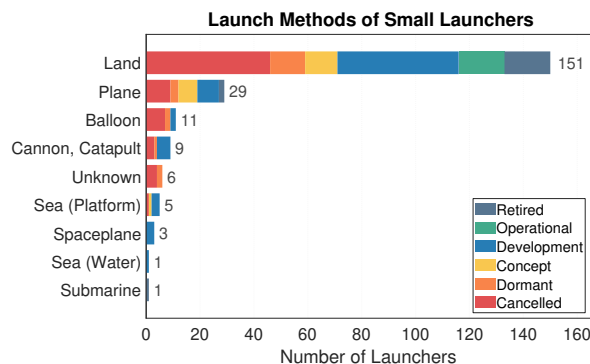


Figure 15: Launch Types of Small Launchers

Since 2023, some diversification has continued. China's *Ceres-1* has been launched from a sea platform several times,<sup>90</sup> in addition to land sites, joining Orienspace's much larger *Gravity-1* as an example of barge-based commercial operations.<sup>91</sup>

In the United States, SpinLaunch seems to be focusing more on the Meridian constellation and recently raised \$30M.<sup>92</sup> A newer entrant, Auriga Space, has raised \$12.2M to pursue an electromagnetic launch track.<sup>93</sup> Dark is developing an air-launched spacecraft to defend satellites and remove debris.<sup>94</sup> Apart from these, no major changes have been observed.

### 6.12 Development Times

Small launcher development times in years are presented on Figure 16. The starting point is the founding year of the organisation or an announced start of the project. End point is the first orbital launch attempt or the currently announced future goal, independent of the launcher making it to orbit.

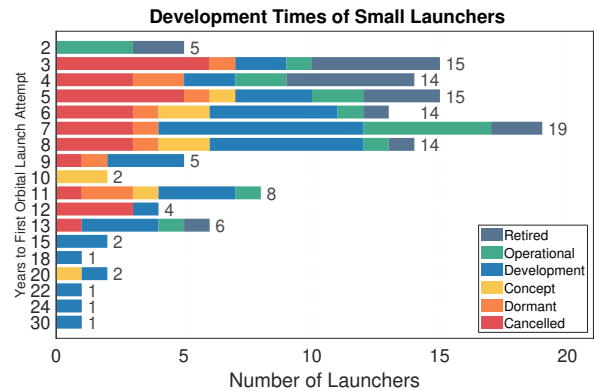


Figure 16: Small Launchers Development Periods

The chart shows that it is possible to develop an orbital-class rocket in 3-5 years. SpaceX's Falcon 1 took 4 years until the first launch attempt in 2006 and 6 years until the 4th launch in 2008. Astra needed 4 years, but Ventions heritage likely helped. Firefly's Alpha took 7 years, but that included a bankruptcy period. The active development of Electron started in 2013, also needing about 4 years.<sup>95</sup> Chinese rocket startups have been relatively quick.

Isar Aerospace was founded in 2018 requiring about 7 years to the first launch. Gilmour Space was founded in 2012 and needed about 13 years to perform maiden flight.

Many rocket companies like to compare their first orbital launches with Falcon 1 and Electron, because those maiden launches also failed. However, one should also look at the development times and budgets, flight time and altitude, and months-years to the second launch. As know-how becomes more widespread in the world, building a rocket should become cheaper and faster, in theory.

### 6.13 Development Delays

Development delays in years are on Figure 17. Originally announced launch years have been compared with the latest announcements or performed launches. A 2 to 3 year delay is common. Small rockets from China have a better track record. Large amount of launchers are unknown, because the flight date goals have not been announced or not updated when the previous date(s) passed.

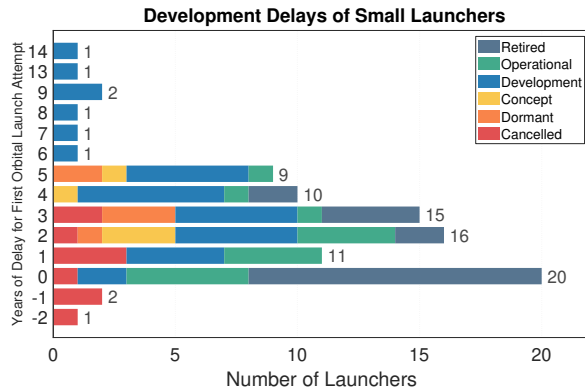


Figure 17: Small Launchers Development Delays

Among the recent maiden flights, KAIROS originally planned to launch in 2022, Spectrum in 2021 and Eris in 2020. Thus, several European examples have seen or are pushing to 4-5 years of delays. A longer list of examples is in the previous study.

Many companies are assumed to set aggressive launch dates to attract funding or publicity, only to quietly push them out multiple times. By the 2-year mark, some are on their third or fourth promised date. A 4-5 year delay is no longer unusual either. The related internal management and execution mindset would be worth an independent study.

#### 6.14 Launch Frequency

Planned launch frequencies or cadences of small launch vehicles are shown in Figure 18.

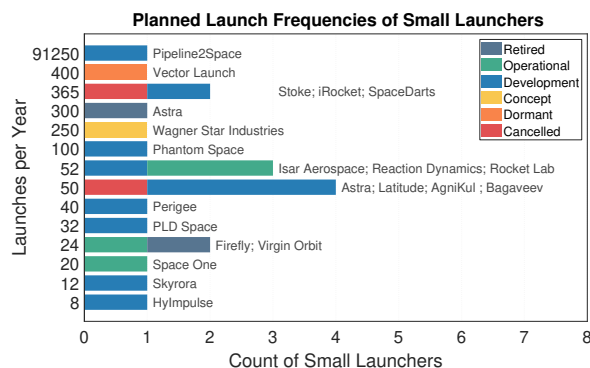


Figure 18: Small Launchers Planned Frequencies

While several vehicles have recently become operational, none have reached their announced annual cadences. In most cases, actual launch rates remain limited by vehicle readiness or by the ability of customers to provide payloads. Earlier surveys provided a more detailed literature review.

Rocket Lab continues to be the clear leader, conducting 16 missions in 2024 and 11 by August 2025.<sup>80</sup> They are on track for 20+ missions in 2025 and

have proved capability to conduct weekly launches.<sup>68</sup> Rocket Lab has noted that production capacity is not the limiting factor, but rather customer readiness.<sup>96</sup> Most other providers remain focused on achieving first orbit or repeatable flights.

PLD Space is targeting a production rate of 32 Miura 5 launchers annually by 2030.<sup>97</sup>

Firefly said in July 2024 that that it planned to perform as many as four Alpha launches in 2024 and up to six in 2025.<sup>98</sup> However, there was only one launch in 2024 and, so far, one in 2025.

Proposals for rapid-response launch services are common, but actual demand is likely to remain a niche compared to regular (commercial) missions.<sup>99</sup>

#### 6.15 Funding

Funding amounts for small launcher organisations have been grouped on Figure 19. For commercial organisations that have two or more entries, only one of the entries has the complete funding amount to avoid duplication. Many rocket projects inside larger organisations must have received significant funding, but those amounts usually have not been publicized, and are marked "Yes, amount unknown".

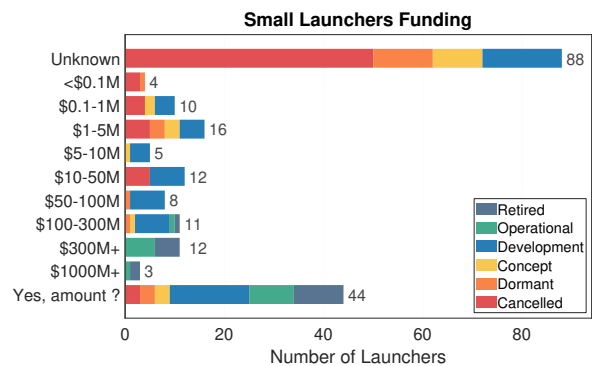


Figure 19: Small Launchers Funding Amounts

At least 85 organisations have received more than \$1 million in funding for small launchers, including approximately 20 from the "Yes, amount ?" category, which are operational or retired.

At least 50 have received more than \$50 million, which is near the lower limit to get to orbit at this time. Galactic Energy performed the first orbital launch attempt after having raised about \$73M and is currently the lowest known commercial example. Gilmour Space attempted orbital launch after raising about \$140M.<sup>100,101</sup> Among the operational launchers or close to it, almost all have raised over \$100 million, some (large) multiples of that.

For comparison, Falcon 1 development costs were about \$90M, which would be approximately \$150M after adjusting for inflation.<sup>102,103</sup> Gwynne Shotwell

wrote in a 2011 Feb article: *"The cost of developing Falcon 9 and Dragon was ~\$600M, including the demo flights. Total company expenditures since being founded in 2002 are <\$800M, which includes all development costs for the Falcon 1, Falcon 9 and Dragon, as well as building launch sites at Vandenberg, Cape Canaveral and Kwajalein. That \$800M also includes 5 flights of Falcon 1 in addition to the 2 flights of Falcon 9 and 1 flight of Dragon. Falcon 9 was developed from a blank sheet to first launch in 4 years and 7 months for just over \$300M."*<sup>104</sup>

Between September 2023 and August 2025, several notable funding rounds were recorded. In India, Agnikul raised \$26.7M in October 2023 to prepare for commercial launches.<sup>105</sup> In December 2023, Orbex and HyImpulse together received £6.7M from the UK Space Agency.<sup>106</sup> Galactic Energy closed \$154M across Series C and C+ rounds in 2023.

In 2024, Gilmour Space raised \$55M, MaiaSpace received €125M investment, Space Pioneer raised \$207M, Orienspace \$83.5M, and Landspace >\$123M. Latitude raised \$30 million in a Series B round.<sup>107</sup> Firefly Aerospace closed a \$175M Series D in November 2024.<sup>70</sup> Public funding remained important in Europe: ESA awarded €44.2M through Boost! contract extensions to Isar, RFA, Orbex, and HyImpulse,<sup>51</sup> and Germany later committed an additional €95M to Isar, RFA, and HyImpulse in December 2024.<sup>50</sup> ATEL Ventures also invested \$20M in Isar in 2024.<sup>108</sup> In South Korea, Innospace went public in July 2024 with valuation near \$294M.<sup>60,61</sup>

In June 2025, Isar Aerospace secured \$172 million<sup>109</sup> and Pitchbook estimates \$655M total raised.<sup>110</sup> Excluding inflation, this is starting to reach SpaceX level in 2011 and Astra, Virgin Orbit and Relativity were past it during their pivots-cancellations.

In August 2025, Firefly Aerospace completed an IPO, raising about \$868M.<sup>71</sup> Japan's Interstellar Technologies secured \$62M in a Series F round in July 2025.<sup>111</sup> Chinese companies CAS Space and Landspace announced plans for IPOs.<sup>67</sup> These rounds were accompanied by many smaller investments across many early stage firms. Astra raised about \$80M after returning to private ownership.<sup>112</sup> iRocket announced an IPO deal in 2025 but the SPAC is reported to have \$1.6M left, for a deal valued at \$400M.<sup>113</sup> Gilmour is planning an IPO within 3 years.<sup>101</sup>

In 2025, ESA preselected five challengers for the European Launcher Challenge: Isar Aerospace, MaiaSpace, Orbex, PLD Space, and Rocket Factory Augsburg (RFA). ESA will conduct a dialogue phase with Member States, after which the second stage of the tender will open and contracts will be signed with the preselected challengers.<sup>55,114</sup> The national

countries will have to contribute the funding.<sup>115</sup>

Overall, fundraising remains a decisive factor separating serious contenders from those unlikely to reach orbit. Nearly all companies that have reached operational status or are close to it have raised at least \$100M, often substantially more. The post-SpaceX generation has not yet demonstrated a significant reduction in development costs.

Cumulatively, very approximately over \$7–8 billion has been invested into small launch worldwide since 2002, yet only Rocket Lab has reached early profitability and most will never earn that investment back. This total funding amount is challenging to estimate, because some of the company funding has been diverted to larger launchers and a lot of government-backed or large-company projects are not well known.

### 6.16 Launcher Stages

The number of rocket stages is categorized on Figure 20. Where available, the criteria has been the count of stages required to reach a circular polar orbit. 4 stages is typical with solid rockets and most of them are operational in the US and China. Many new launchers have 2 stages, but some require an additional third stage to circularize orbit. Rocket Lab is considered here to have 3 rocket stages, because circularizing orbit requires the Kick Stage. There are now eight 1-stage SSTO launchers in development, an increase from 4. Sidereus Space Dynamics's EOS is one of the examples.<sup>116</sup>

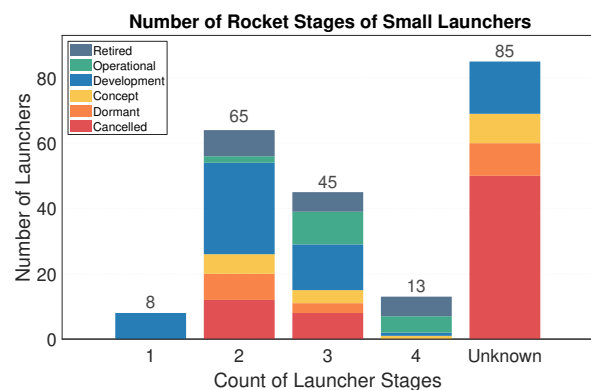


Figure 20: Small Launchers Stages

### 6.17 Propellant Types

Propellant or more accurately fuel types are shown on Figure 21. The criteria is defined by the propellant of the first and the largest stage or for the majority of the launcher stages. Methane has grown the most since 2023, from 8 to 13.

Gilmour Space's Eris uses a hybrid engine with a 3D-printed solid fuel grain and a Hydrogen Peroxide liquid oxidizer. A successful orbital launch would also be the first for a hybrid rocket design.<sup>117</sup>

Space One's KAIROS uses solid fuel for the first 3 stages.<sup>118</sup> Isar Aerospace's Spectrum uses propane.<sup>119</sup>

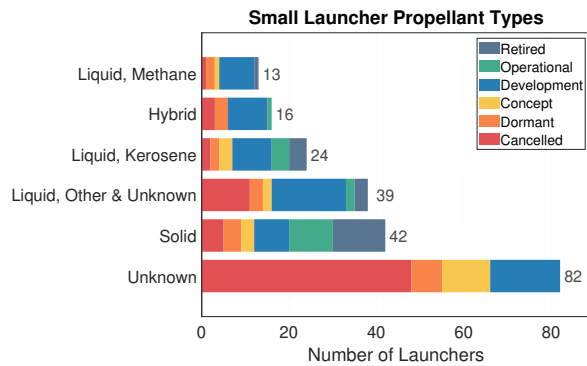


Figure 21: Small Launchers Propellant Types

There does not yet seem to exist a clear advantage between the launch costs and propellant types, and related economics would have to be proven.

### 6.18 Reusability

Figure 22 depicts the reusability status of small launchers. Partial reusability and full reusability has not been differentiated at this time.

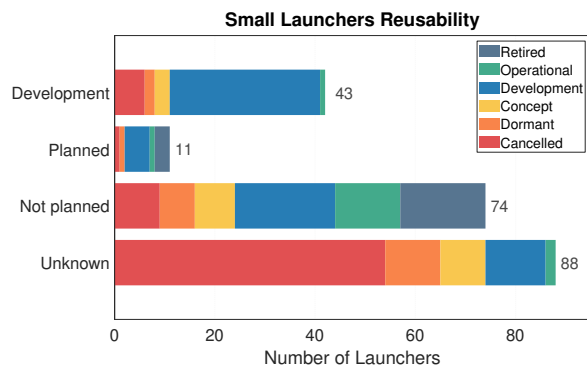


Figure 22: Small Launchers Reusability

In August 2025, a single Falcon 9 first stage has now been launched and landed 30 times.<sup>7</sup> While most small launchers are not planned to be reusable.

Rocket Lab talked about reflying Electron booster in 2024 but it has not happened as of August 2025.<sup>120</sup> Soon after that in 2024, Peter Beck said that Electron reuse is not that important to the business margins and that the team is focused on Neutron.<sup>121</sup>

Astron Systems is planning a fully reusable small launcher with 360 kg payload to LEO.<sup>122</sup>

None of the currently operational small launchers seem to have clear reusability developments or plans.

### 6.19 Geographical Distribution

Figure 23 shows the headquarters locations of small launcher organisations. When a company has a presence in multiple countries, only the legal headquarters is counted. Launch sites may be elsewhere.

The distribution is highly concentrated. The United States hosts 84 organisations, followed by China (21), the United Kingdom (16), India (11), France (9), Canada (9), Italy (7), Japan (7), Germany (6), Australia (6), Spain (5), Russia (5), and South Korea (4). Many other countries have one to three organisations each, for a total of 216 entries.

Illustrative examples include Orbex and Skyrora in the United Kingdom; RFA, HyImpulse, and Isar Aerospace in Germany; Latitude, MaiaSpace, and Sirius Space in France; Skyroot Aerospace and Agnikul Cosmos in India; Avio and Sidereus in Italy; Gilmour Space in Australia; and IHI Aerospace, Interstellar, Honda, and Space One in Japan.

## 7. MARKET ANALYSIS

This section presents an overview of market context, competition, and revenues of small launchers.

This was a significantly longer section in the 2021 and 2023 surveys but most of the content about launch market size estimations and forecasts has not been repeated. Majority of the statements still stand.

### 7.1 Market Overview

Compared to most new emerging space industries, space launch is an existing market, and it is straightforward to add up the yearly commercial and institutional revenues.

A number of market studies have been published but less in the last 2 years. Market forecasts should be treated cautiously, as past predictions have often proven inaccurate. Pierre Lionnet observed that "forecasting the launch market is a perilous exercise with a long history of failed projections".<sup>9</sup> The following examples highlight some recent analyses.

The global small launch vehicle market was valued at USD 1.55 billion in 2023 and is projected to grow to USD 4.29 billion by 2032, corresponding to a CAGR of 11.1%.<sup>123</sup>

Forecasts estimate that nearly 14000 small satellites <500 kg will be launched worldwide between 2024 and 2033, averaging close to 500 per month.<sup>14</sup>

Reports note that demand for satellites continues to rise but at a moderate rate rather than the exponential growth once projected.<sup>124</sup> Many small launch companies continue to struggle to compete with the low-cost rideshare services of larger rockets,

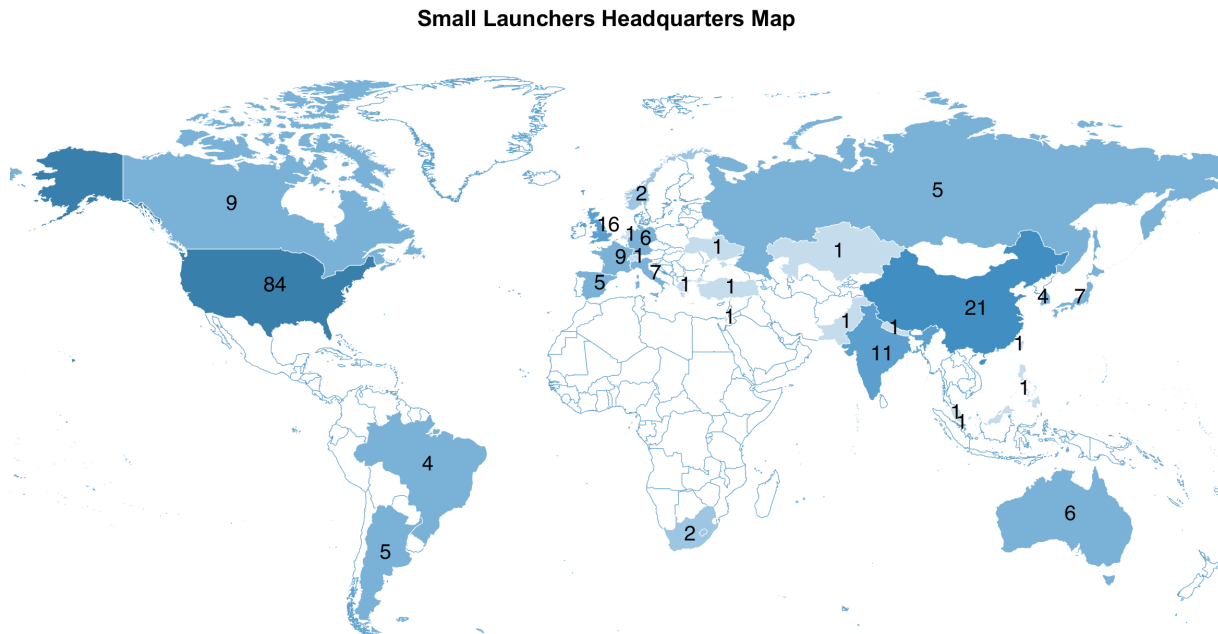


Figure 23: Headquarters Locations of Small Launcher organisations

particularly SpaceX's Transporter.<sup>125</sup> As a result, some analysts warn of consolidation and "bloodletting" among new entrants.<sup>36, 126</sup>

While the number of all global spacelaunches has increased overall, the growth has been concentrated in SpaceX and China, while activity in Europe, Russia, and India has decreased. SpaceX's rideshare program launched about ~800 payloads within 3 years, many of which had appeared in the backlogs of small launch providers.<sup>127</sup>

Lionnet has also stressed that launch demand cannot be generated independently of satellite production, and that customers must demonstrate both payload readiness and financing before launch opportunities can be secured.<sup>128</sup> Lionnet further stressed that achieving low launch cost, demonstrated most effectively by Falcon 9, continues to set the reference point for the industry.<sup>9</sup> He also described the small launch vehicle sector as "still a nascent market, with limited revenue opportunities and intense competition for a relatively fixed customer base".<sup>129</sup>

## 7.2 Competitive Advantages

Small launcher developers have continued to highlight a variety of potential advantages, including additive manufacturing, engine efficiency, propellant selection, alternative launch methods, and reusability. However, no single technology has proved to have a decisive advantage yet. For most companies,

the main challenges remain in execution: getting to the pad, achieving orbit, scaling manufacturing, and then addressing unit economics. These challenges are primarily managerial, industrial and financial, rather than the result of a particular design choice.

Responsive launch is expected to remain a limited niche within the broader small satellite launch market, even after military-supported demonstrations such as Victus Nox.<sup>99</sup>

## 7.3 Wider Market Competition

Small launchers continue to face competition from alternative access to orbit, including rideshare services on larger rockets, orbital transfer vehicles (space tugs), and occasional deployment from space stations. In the 2021 survey, this was also a longer chapter, but there have been few changes.

SpaceX rideshare remains by far the most widely used option, with prices increasing by about \$500 per kilogram annually. The 50 kg option is now \$325,000 with additional mass at \$6,500 per kg.<sup>130, 131</sup>

D-Orbit has continued flying one to four tugs per year. However, for now space tugs are often used for late payload additions rather than as primary transport to unique orbits. Russia and China largely serve domestic satellites. Deployment from crewed space stations is less common as of 2025.

## 7.4 Revenues

SPAC-era revenue predictions were optimistic and have not materialized. In this section, only launch service revenues are presented where available.

For reminder, Astra projected in February 2021 that it would make \$619 million from 165 launches in 2024 and \$1.125 billion from 300 launches in 2025.<sup>132</sup> Virgin Orbit forecast \$766 million in 2024, \$1.24 billion in 2025, and \$1.63 billion in 2026 from launch services.<sup>133</sup> These projections have not been achieved and most of the potentially corresponding satellites have not yet flown on other launch vehicles either.

**Rocket Lab** Rocket Lab's estimated launch revenues from 2021 March were: \$49M in 2021; \$115M in 2022; \$141M in 2023; \$232M in 2024; \$399M in 2025; \$658M in 2026; \$915M in 2027.<sup>134</sup>

In reality, Rocket Lab reported launch service revenues of \$39M in 2021; \$60.7M in 2022; \$71.9M in 2023; \$125.4M in 2024, about half but closest.<sup>135</sup>

Including the suborbital HASTE missions, seven launches were done in 2020, 6 in 2021, 9 in 2022, 10 in 2023, 16 in 2024 and 12 in 2025 as of August.<sup>80</sup>

Since about 2023 Q2, the cost of launch revenue is lower than revenue (gross profit).<sup>136</sup> In the 6 months ended June 30, 2025, Rocket Lab's revenue per launch was \$7.5 million. Cost per launch for the 6 months ended June 30, 2025 was \$5.3 million.<sup>83</sup>

## 7.5 Backlogs

Several small launch companies that once announced significant backlogs, in some cases exceeding \$100 million, have since retired their vehicles (e.g., Rocket 3, Terran 1, RS1) or gone bankrupt (Virgin). In some cases, workforce and resources have been redirected toward larger next-generation rockets. While this can sometimes be justified, continued manufacturing and operations also provide opportunities for iteration, learning, and early revenue. Historical experience shows that scaling to higher launch cadences consistently requires years, even when customer demand is present.

ABL also reported a backlog of 75 launches for its RS1 vehicle in 2021, though most of these were associated with Lockheed Martin, a major investor.<sup>137</sup> Amazon initially booked ABL for the first Kuiper satellite launches in 2021, but by October 2022 these missions were reassigned to ULA.<sup>138,139</sup>

Several new announcements have been made since 2023. Latitude signed a multi-launch contract with Atmos Space Cargo in 2024.<sup>140</sup> Latitude announced that they have 26 pre-booked launches as of summer

2025 and that they can be profitable with less than 10 launches.<sup>141,142</sup>

Firefly announced an agreement with Lockheed Martin for up to 25 Alpha launches through 2029.<sup>143</sup>

Rocket Lab continued to expand its manifest, including a contract with Synspec for 10 Electron launches,<sup>144</sup> although in 2024 it reported that customer delays reduced the realized cadence from a planned 22 missions to about 17.<sup>96,145</sup> Peter Beck does not see a retirement of Electron as of 2024.<sup>146</sup>

Vaya Space announced a multi-launch agreement for up to 250 satellites of Space Telecommunications Inc.'s constellation starting in 2027.<sup>147</sup> iRocket disclosed a \$640M multi-year agreement in 2025.<sup>148</sup>

In August 2025, ESA signed the first launch service contracts under the Flight Ticket Initiative with Avio for free flights of Vega-C and with Isar Aerospace for two flights.<sup>149</sup>

Interstellar Technologies announced agreements with five organisations to launch payloads on the first flight of its ZERO rocket in 2027.<sup>150</sup>

However, industry views on the value of backlogs remain divided. Rocket Lab executives have characterized unflown contracts as of limited value, while Relativity Space has defended backlogs as a path toward product-market fit.<sup>151</sup>

In some cases it is uncertain whether customers have secured sufficient funding at the time of signing (often not), and the extent of actual financial commitment in these contracts is not always disclosed.

**Rocket Lab** As of 2025 June 30, the launch backlog is \$409.6 million.<sup>83</sup> About half of that is expected to be recognized within 12 month.<sup>152</sup> This would come to about 30 Electron launches but some Neutron activities may already be included also.

## 7.6 Valuations

Among the key examples highlighted two years ago, Astra has since returned to private ownership, Virgin Orbit has ceased operations, Firefly is now public with activities extending beyond small launch, Relativity Space has pivoted to larger vehicles, and ABL has shifted its focus away from orbital launch.

Global equity markets are trading near all-time highs, with the S&P 500 and Nasdaq both reaching record closing levels in August 2025. This also places many publicly listed space companies at relatively high valuations.<sup>153</sup> Analysts have raised concerns that these indices may have limited further upside, and that current overvaluation could extend to space-related stocks, many of which now trade at comparatively high multiples.<sup>154,155</sup>

Isar Aerospace is now valued at >\$1.2 billion.<sup>156</sup>

**Rocket Lab** Rocket Lab went public in August 2021 at \$4.8 billion valuation.<sup>157</sup>

As of 2025 August 24, Rocket Lab stock is ~\$44.3, giving a market cap of ~\$21.4 billion. A year ago, in August 2024, the stock price was approximately \$6, and even smaller before.

**Firefly** Firefly completed an IPO, raising about \$868 M<sup>71</sup> and shares started trading on 2025 August 7. The shares initially opened at ~\$70 and closed at ~\$60.<sup>158</sup> As of August 24, the share price is ~\$46, giving a market cap of \$6.76 billion.<sup>159</sup> However, Firefly is also working on a larger launcher and successfully landed on the Moon in March 2025.<sup>160</sup>

**Innospace** Innospace went public in 2024, but its share price has declined after the IPO.<sup>61</sup>

As of 2025 August 24, the stock price is ~\$6.8 and the valuation is about \$81 million.<sup>161</sup>

## 7.7 Spaceports

Launch site costs could be significant compared to small launch prices. Astra reported that launching from Cape Canaveral costs about \$1.5 million per mission, whereas private spaceports can be about one-third of that.<sup>162</sup> Peter Beck noted that private launch sites can be cheaper still.<sup>163</sup>

Potential bottlenecks have been noted at Cape Canaveral<sup>164</sup> and certain other heritage spaceports, including in China, but these constraints are not driven by small launchers, and no such limitations are currently evident in Europe.

The Spaceport Company is developing mobile sea-based launch platforms. The company has also performed initial demonstrations of offshore launch and recovery operations in the United States.<sup>165</sup> In 2024, it received a \$2.5 million contract from the U.S. Defense Innovation Unit.<sup>166</sup>

Several new spaceports are in development. In Europe, Orbex has decided to pause construction of its own spaceport at Sutherland and announced that its first Prime launches will instead take place from SaxaVord Spaceport.<sup>167</sup> Elara Aerospace plans launches from Sardinia.<sup>168</sup> Italy is reopening the Broglio offshore platform in Kenya.<sup>169</sup> Sweden's Esrange is expanding, with the Swedish military as an anchor customer.<sup>170</sup> Germany committed €2M for offshore infrastructure in the North Sea.<sup>171</sup> ESA and France signed agreements extending the use of the Guiana Space Centre to 2035.<sup>172</sup>

The chairman of the UK Space Agency said the development of spaceports in northern Europe has become a competition for first-mover advantage and market share and that "it's a close race."<sup>173</sup>

In North America, Maritime Launch Services is building Spaceport Nova Scotia, supported by provincial tax credits and federal financing,<sup>174,175</sup> and has partnered with Reaction Dynamics for initial sub-orbital launches.<sup>176</sup> Yuma, Arizona has been short-listed for a federally funded spaceport project.<sup>177</sup> Rocket Lab selected Bollinger Shipyards to support modification of Neutron ocean landing platform.<sup>178</sup>

In Asia-Pacific, Firefly has discussed and studies launching from Japan,<sup>179,180</sup> and Virgin Orbit previously planned flights from Oita Airport. China is expanding its commercial spaceport to support increased launch demand.<sup>181</sup> The Dongfang Aerospace Port is the first multi-functional ship for space launch and recovery in China.<sup>182</sup> Australia continues development of launch pads through Southern Launch.

A framework for evaluating readiness levels of new spaceports has been proposed,<sup>29</sup> which could be used to evaluate small launch vehicle readiness.

In many cases, shipping satellites remains cheaper than building a dedicated local pad, until launch rates become high enough that pad access itself is the limiting factor. Relativity estimates that transporting a first stage to Florida and returning it by barge cost up to \$3.45 million.<sup>183</sup> Multiple pads also introduce some duplication of personnel and infrastructure as well as new integration challenges. Thus, having a single pad can improve utilization of ground segment hardware and provide more operational experience, likely reducing scrubs. A local pad may only make sense for geopolitical and ITAR reasons if governments are willing to cover the extra costs.

In summary, many more spaceports may be developed than there are sustainable small launch companies to use them.

## 7.8 Future Plans & Alternative Revenues

Most launcher organisations continue looking beyond expendable small rockets toward reusability, larger vehicles, and diversified revenue streams. Several have initiated spacecraft and constellation projects (e.g., SpinLaunch's Meridian Space<sup>92</sup>), though only a few have advanced beyond early stages.

Space tugs are often mentioned as a complementary business due to their overlap with upper stages, but few have flown. Some firms also market spacecraft subsystems and components, again led by Rocket Lab, while newer actors such as NordSpace have also positioned themselves as end-to-end providers.

Hypersonic testbeds continue to being pursued as an additional source of revenue and technology development. Many kinetic launch concepts are focused on this area. Rocket Lab has flown multiple HASTE hypersonic research missions for government customers. In Europe, ESA and the UK have initiated the INVICTUS program, a reusable hypersonic test platform to provide flight access for high-speed propulsion and materials research.<sup>184</sup> INVICTUS has similarities to the Skylon spaceplane.

Hanwha Aerospace signed a technology transfer agreement with the state-funded Korea Aerospace Research Institute (KARI) for the KSLV-II (Korea Space Launcher Vehicle-II) launcher, also known as Nuri.<sup>185</sup> This is similar to how ISRO developed the Small Satellite Launch Vehicle (SSLV), which is now being commercialized.<sup>186</sup>

At the same time, some investors have started to question the merits of vertical integration by launcher companies, noting that attempts to control rockets, spacecraft, and subsystems in-house may increase costs and risk than improve competitiveness.<sup>187</sup>

#### 7.8.1 Reusability

Several small launcher developers have added reusability plans in recent years, and for newly announced rockets, reusability is now almost always part of the baseline design.

Rocket Lab initially discussed reflighting Electron boosters in 2024 but no such flight has occurred as of August 2025.<sup>120</sup> Later in 2024, Peter Beck stated that Electron reuse was not considered critical for business margins and that company efforts were shifting toward the development of Neutron.<sup>121</sup>

Stoke explained motivation behind reusability.<sup>188</sup>

Dassault Aviation unveiled VORTEX reusable spaceplane and Phase 2 VORTEX-S (Smart Free Flyer) may constitute as a small launcher.<sup>189</sup>

#### 7.8.2 Larger Rockets

The development of larger launch vehicles by companies that began with small rockets has intensified compared to the 2021 and 2023 surveys.

In Europe, Orbex announced in Dec 2024 that it will begin development of a medium-sized vehicle.<sup>190</sup> PLD Space presented plans for larger rockets and crewed spacecraft.<sup>53</sup> ESA has continued heavy-lift studies, publishing a call for a 60-ton class rocket in late 2024, releasing earlier findings, and awarding €230M to ArianeGroup for the Themis reusable demonstrator.<sup>191–193</sup> Rocket Factory Augsburg (RFA) and other European companies have also announced medium-class launch vehicle projects.

The Exploration Company has tested a pre-burner for a high-thrust rocket engine<sup>194</sup> and may enter the launch vehicle sector in the future.

Northrop Grumman invested \$50 million in Firefly in May 2025 to advance medium-class launcher Eclipse, with first launch expected in early 2026.<sup>195</sup>

In China, several commercial organisations are developing large reusable rockets, with first flights targeted for 2025–2026<sup>196,197</sup> and have further plans for even more launch vehicles.<sup>198</sup>

Blue Origin's New Glenn launched for the first time in early 2025 and reached orbit, but the first stage was lost before landing attempt.<sup>199</sup> Second mission planned to carry NASA's Mars probes in September 2025.<sup>200,201</sup> United Launch Alliance may be sold soon.<sup>202</sup>

#### 7.8.3 Satellite & Constellation Programs

Multiple small launch providers are working on in-house spacecraft development programs. Rocket Lab has launched many in-house developed spacecraft.<sup>203</sup> Gilmour Space's first satellite launched in June 2025.<sup>204</sup> SpinLaunch is now more focused on the Meridian Space broadband constellation.<sup>92</sup> NordSpace is co-developing a custom satellite bus.<sup>205</sup>

## 8. CONCLUSIONS

Statistical overview of 216 small launch vehicles with payloads up to 1500 kg has been presented. The database grew from 203 in 2023 to 216 in 2025. No major breakthroughs have been noted. For a more complete overview, it is recommended to view the 2021 and 2023 surveys<sup>1,2</sup> because many facts, discussions and findings have not been repeated.

The fortunes of small launch providers are mixed and often negative. While Electron passed 70 launches, Kuiazhou-1A passed 33 and Ceres-1 passed 20, most commercial rockets have struggled to get to the launchpad at all and then to orbit afterwards.

Technical execution remains very challenging. Even reaching orbit once is a crucial proving point. It demonstrates a company's technical capability and can unlock new funding or government support.

More consolidation, pivots, and exits in the coming years is very likely. The landscape by the late 2020s will likely be defined by only a handful of winners from the current crowded field.

Competition from rideshare services on large rockets and space tugs keeps intensifying. SpaceX's Transporter and Bandwagon missions continue to offer relatively low prices per kilogram to orbit, drawing many small satellite customers.

Many compare their maiden launches with Falcon 1 and Electron, which first orbital launches also failed. However, one should also look at the development times and budgets, flight time, and months to the second launch. Most recent rockets tend to be more expensive with slower timelines. As know-how becomes more widespread, building a launcher should become cheaper and faster, in theory.

Cumulatively, very approximately over \$7–8 billion has been invested into small launch vehicles worldwide since 2000. However, only Rocket Lab has reached early profitability and most will never earn their investment back.

In a 2025 keynote, Peter Beck stated that “small launch is well and truly being solved,” citing Electron’s track record.<sup>34</sup>

- Years 2023-2025 saw notable :
  - first launches (e.g. Isar’s Spectrum, Gilmour’s Eris, Space One’s KAIROS);
  - pivots (e.g. ABL RS1);
  - continued delays for maiden launches.
  - Rocket Lab seems to be profitable in recurring launch services (gross profit).
- 20 (9%) of 216 small launchers are retired, 17 (8%) are operational, 67 (31%) are in development, and 112 (52%) have either concept, dormant or cancelled status.
- Among funding:
  - At least 85 organisations have raised more than \$1 million.
  - At least 50 have received >\$50 million.
  - Almost all vehicles that reached orbit needed over \$100 million.
- Timelines remain long. Isar’s first orbital attempt came after about 7 years and Gilmour’s after about 13 years. Time from first flight to second flight often exceeds one year.
- Spaceport options keep expanding, but most will likely not find recurring usage.
- Venture formation slowed in 2024 and 2025.
- Execution seems to be the main constraint, not a single technology choice. Funding and teams matter, lower dollars and staff per launch.
- Backlogs often do not convert to launches.
- None of the operational small launchers offer dedicated mission prices of less than \$4 million.
- Rocket Lab’s Electron cadence and demand as per backlog are growing.
- Reusability work on Electron was paused to focus on Neutron.

From the market analysis side, revenues, backlogs and valuations were updated, and many claims were discussed in a wider context.

- Small launch excitement continues to cool with both launcher and constellation delays.
- Rocket Lab’s launches are waiting behind customer readiness, related to market demand.
- Many more small launch organisations have started developing larger rockets, but also satellite platforms and various other revenue sources.
- Launch market elasticity is difficult to forecast. Currently the gap between the \$1.3M SpaceX 200 kg rideshare and \$7.5M Electron launch is likely large for most space startups.

Future work could involve:

- Tracking the conversion rate of backlogs.
- Measuring learning and the time from first flight to second flight.
- Researching management and execution.

The aim is to keep repeating this written study every two years, but the online database and figures will continue to be updated multiple times per year.

As of 2025, the race is still on, but the finish line for many others will be coming into sight. With many bankruptcies, cancellations and pivots, who can take the lead from Rocket Lab in offering more affordable small satellite launches?

## REFERENCES

- [1] Erik Kulu. Small Launchers - 2021 Industry Survey and Market Analysis. In *72nd International Astronautical Congress (IAC 2021)*, Dubai, United Arab Emirates, October 2021. [https://www.newspace.im/assets/Small-Launchers-2021\\_Erik-Kulu\\_IAC2021.pdf](https://www.newspace.im/assets/Small-Launchers-2021_Erik-Kulu_IAC2021.pdf).
- [2] Erik Kulu. Small Launchers - 2023 Industry Survey and Market Analysis. In *72nd International Astronautical Congress (IAC 2021)*, Dubai, United Arab Emirates, October 2023. [https://www.newspace.im/assets/Small-Launchers-2023\\_Erik-Kulu\\_IAC2023.pdf](https://www.newspace.im/assets/Small-Launchers-2023_Erik-Kulu_IAC2023.pdf).
- [3] Erik Kulu. NewSpace Index - Small Satellite Launchers (www.newspace.im). <https://www.newspace.im/launchers>, 2025.
- [4] Gunter Dirk Krebs. Gunter’s Space Page. <https://space.skyrocket.de/>, 2021.
- [5] Jonathan McDowell. Jonathan’s Space Report. <http://www.planet4589.org/>, 2021.
- [6] Ed Kyle. Space Launch Report. <http://www.spacelaunchreport.com/index.html>, 2021.
- [7] Carlos Niederstrasser. A Small Launch per Month? - 2022 Edition of the Annual Industry Survey. In *36th Annual AIAA/USU Conference on Small Satellites*, December 2022. <https://digitalcommons.usu.edu/smallsat/2022/all2022/122/>.
- [8] Pierre Lionnet and Nédhir Sahli. Space Launch Services Prices. <https://www.linkedin.com/pulse/space->

- [0] launch-services-prices-pierre-lionnet- bvhbe/?trackingId=XQP4rrfuKRIBVWBarKacpw%3D%3D, April 2025.
- [9] Pierre Lionnet. SpaceX and the categorical imperative to achieve low launch cost. <https://spacenews.com/spacex-and-the-categorical-imperative-to-achieve-low-launch-cost/>, June 2024.
- [10] Chris Larmour. How long does it take Americans to build an orbital space rocket? [https://www.linkedin.com/feed/update/urn:li:activity:7205463176186966017/?updateEntityUrn=urn%3Aali%3Afs\\_updatev2%3A%2Bburn%3Ali%3AActivity%3A7205463176186966017%2CEFEED\\_DETAIL%2CEMPTY%2CDEFAULT%2Cfalse%29](https://www.linkedin.com/feed/update/urn:li:activity:7205463176186966017/?updateEntityUrn=urn%3Aali%3Afs_updatev2%3A%2Bburn%3Ali%3AActivity%3A7205463176186966017%2CEFEED_DETAIL%2CEMPTY%2CDEFAULT%2Cfalse%29), 2024.
- [11] Chris Larmour. What does a space rocket cost? [https://www.linkedin.com/feed/update/urn:li:activity:7218185797525508096/?updateEntityUrn=urn%3Aali%3Afs\\_updatev2%3A%2Bburn%3Ali%3AActivity%3A7218185797525508096%2CEFEED\\_DETAIL%2CEMPTY%2CDEFAULT%2Cfalse%29](https://www.linkedin.com/feed/update/urn:li:activity:7218185797525508096/?updateEntityUrn=urn%3Aali%3Afs_updatev2%3A%2Bburn%3Ali%3AActivity%3A7218185797525508096%2CEFEED_DETAIL%2CEMPTY%2CDEFAULT%2Cfalse%29), 2024.
- [12] John Holst. Revisiting Rocket Lab and Neutron. [https://illdefinedspace.substack.com/p/revisiting-rocket-lab-and-neutron?utm\\_campaign=post&triedRedirect=true](https://illdefinedspace.substack.com/p/revisiting-rocket-lab-and-neutron?utm_campaign=post&triedRedirect=true), June 2024.
- [13] Peter Hague. Mass Value Report for July 2025. <https://planetocracy.org/p/mass-value-report-for-july-2025>.
- [14] Prospects for the Small Satellite Market. <https://nova.space/press-release/smallsat-market-maintains-momentum-despite-starlink-and-starshield-disruption-increasingly-fueled-by-government-demand/>, December 2024.
- [15] D.R. Bhalodia. *New Space Revolution: Prospective Launchers for Small Satellites, Challenges for the Micro Launch Industry and Its Implications for Small-Sat Manufacturers | TU Delft Repository*. PhD thesis, TU Delft, 2024. <https://resolver.tudelft.nl/uuid:aa4503c7-a34a-45fc-a8d0-36263588504b>.
- [16] Nataliaia Meshko and Serhii Kaznachei. Evolution of Company Strategies in Response to Dynamic Changes in the Global Rocket Market. *European Journal of Management Issues*, 32:75–85, April 2024. <https://mi-dnu.dp.ua/index.php/MI/article/view/491>.
- [17] Mennattallah M. Hussein, Daiki Terakado, and Olivier L. de Weck. Comprehensive study of the international space launch industry: Programmatic analysis and technical failures. *Acta Astronautica*, 234:676–689, September 2025. <https://www.sciencedirect.com/science/article/abs/pii/S0094576525001717>.
- [18] Felipe Motta, José Bezerra Pessoa Filho, and Alison de Oliveira Moraes. Is there a market for micro-launch vehicles? *Space Policy*, 70:101629, November 2024. <https://www.sciencedirect.com/science/article/pii/S0265964624000201>.
- [19] Erik Kulu. From Hype and Bubbles to Sustainable Industries in NewSpace - Cases in Launch, Constellations, In-Space Transportation, Space Sustainability & More. In *76th International Astronautical Congress (IAC 2025)*, Sydney, Australia, October 2025.
- [20] Rubén González-González, Andrés García-Pérez, and Gustavo Alonso Rodrigo. Small Launchers Design and Cost Balance Improvements. *Engineering Proceedings*, 2025. <https://www.mdpi.com/2673-4591/90/1/98>.
- [21] Greg Autry. Small Rockets / Big Future: Room At The Bottom Of The Launch Market. <https://www.forsite.com/sites/gregautry/2024/06/15/small-rockets--big-future-room-at-the-bottom-of-the-launch-market/>, June 2024.
- [22] Matt Swayne. Study Finds NASA Launch Costs Are Rising, Defying Market Assumptions. <https://spaceinsider.tech/2025/04/14/study-finds-nasa-launch-costs-are-rising-defying-market-assumptions/>, April 2025.
- [23] Shih-Sin Wei, Meng-Che Li, Alfred Lai, Tzu-Hao Chou, and Jong-Shinn Wu. A Review of Recent Developments in Hybrid Rocket Propulsion and Its Applications. *Aerospace*, 11(9):739, September 2024. <https://www.mdpi.com/2226-4310/11/9/739>.
- [24] Lorenzo Casalino, Filippo Massenì, and Dario Pastrone. Optimal Design of Hybrid Rocket Small Satellite Launchers: Ground Versus Airborne Launch. *Journal of Spacecraft and Rockets*, 59(6):2084–2093, November 2022. <https://arc.aiaa.org/doi/10.2514/1.A35428>.
- [25] Girolamo Musso, Ana Figueiras, Hélène Goubel, Afonso Gonçalves, Iara Laura Costa, Bruna Ferreira, Lara Azeitona, Simão Barata, Alain Souza, Frederico Afonso, Inês Ribeiro, and Fernando Lau. A Multidisciplinary Optimization Framework for Ecodesign of Reusable Microsatellite Launchers. *Aerospace*, 11(2):126, January 2024. <https://www.mdpi.com/2226-4310/11/2/126>.
- [26] Ingrid Dietlein, Leonid Bussler, Sven Stappert, Jascha Wilken, and Martin Sippel. Overview of system study on recovery methods for reusable first stages of future European launchers. July 2024.
- [27] Francesco Barato, Elena Toson, Fabiana Milza, and Daniele Pavarin. Investigation of different strategies for access to space of small satellites on a defined LEO orbit. *Acta Astronautica*, 222:11–28, September 2024. <https://www.sciencedirect.com/science/article/pii/S0094576524002996>.
- [28] Seline Maciel Maquera Ortega, Rivaldo Carlos Duran Aquino, Romildo Genaro Silva Cuadros, Honorio Apaza Alanoca, Natalia Indira Vargas-Cuentas, and Avid Roman-Gonzalez. Unlocking Space: Designing a Dedicated Launcher for Small Satellite Missions. In *IAF Space Transportation Solutions and Innovations Symposium*, pages 899–903, Milan, Italy, 2024. International Astronautical Federation (IAF). <http://www.proceedings.com/078373-0093.html>.
- [29] Janet K. Tinoco, Patrick W. McCarthy, and Ryan Babb. Building a 21st century spaceport: Development and application of the spacecraft readiness level scale. *Acta Astronautica*, 235:288–301, October 2025. <https://www.sciencedirect.com/science/article/pii/S0094576525003261>.
- [30] Kolja Brockmann and Lauriane Héau. The Expansion of the NewSpace Industry and Missile Technology Proliferation Risks. Technical report, Stockholm International Peace Research Institute, October 2024. <https://www.sipri.org/publications/2024/policy-reports/expansion-newspace-industry-and-missile-technology-proliferation-risks>.
- [31] Kolja Brockmann and Lauriane Héau. Mapping the Spread of NewSpace Companies Developing, Testing, Producing or Marketing Missile-related Technology: A Pilot Study. Technical report, Stockholm International Peace Research Institute, October 2024. <https://www.sipri.org/publications/2024/sipri-fact-sheets/mapping-spread-newsace-companies-developing-testing-producing-or-marketing-missile-related>.

- [32] Small and micro launchers in the NewSpace era: New missile proliferation risks or more of the same? | SIPRI. <https://www.sipri.org/commentary/topical-background/2023/small-and-micro-launchers-newspace-era-new-missile-proliferation-risks-or-more-same>, December 2023.
- [33] Kolja Brockmann and Nivedita Raju. NewSpace and the Commercialization of the Space Industry: Challenges for the Missile Technology Control Regime. October 2022. <https://www.sipri.org/publications/2022/policy-reports/newspace-and-commercialization-space-industry-challenges-missile-technology-control-regime>.
- [34] Jeff Foust. Rocket Lab launches fourth set of Kinéis satellites. <https://spacenews.com/rocket-lab-launches-fourth-set-of-kineis-satellites/>, February 2025.
- [35] Andrew [Cosmic\_Andrew1]. Peter Beck on earnings call... [https://x.com/Cosmic\\_Andrew1/status/1953573305526452463](https://x.com/Cosmic_Andrew1/status/1953573305526452463), August 2025.
- [36] Jeff Foust [Jeff.Foust]. Steve Jurvetson, the VC, predicts in a talk... [https://x.com/jeff\\_foust/status/1714339641166381470](https://x.com/jeff_foust/status/1714339641166381470), October 2023.
- [37] Miura 1 rocket | PLD Space. <https://www.pldspace.com/en/miura-1.html>.
- [38] PLD Space successfully completes first private space rocket launch in Europe. <https://www.pldspace.com/en/news/pld-space-successfully-completes-first-private-space-rocket-launch-in-europe.html>, October 2023.
- [39] Kate Eliason. Rockets, Re-use and Return-to-Earth: Novel Approaches to Orbital Access. <https://www.kratospace.com/constellations/articles/rockets-re-use-and-return-to-earth-novel-approaches-to-orbital-access>, August 2025.
- [40] Jonathan O'Callaghan. Skyrora Rocket Launch From Iceland Reaches Three Times The Height Of Mount Everest. <https://www.forbes.com/sites/jonathanocallaghan/2020/08/18/skyrora-reaches-three-times-the-height-of-mount-everest-with-rocket-launch-from-iceland/>, August 2020.
- [41] Copenhagen Suborbitals. The full story of the Nexø II mission August 2018. <https://www.youtube.com/watch?v=BVwTU7FXmGE>, September 2018.
- [42] Satellite Evolution Group. 2024: The year in which PLD Space has become a global space launcher industry leader. <https://www.satelliteevolution.com/post/2024-the-year-in-which-pld-space-has-become-a-global-space-launcher-industry-leader>, December 2024.
- [43] Oliver Holmes. First orbital rocket launched from mainland Europe crashes after takeoff. *The Guardian*, March 2025. <https://www.theguardian.com/science/2025/mar/30/first-orbital-rocket-launched-europe-crashes-launch-spectrum>.
- [44] Leveraging commercial technologies for sovereignty: Isar Aerospace extends Series C to over EUR 220m with strong commitment from NATO Innovation Fund. <https://isaraerospace.com/press/isar-aerospace-extends-series-c-to-over-eur-220m-with-strong-commitment-from-nato-innovation-fund>, June 2025.
- [45] Isar Aerospace signs agreement with Eldridge Industries for EUR 150m financing. <https://isaraerospace.com/press/isar-aerospace-signs-agreement-with-eldridge-industries-for-eur-150m-financing>, June 2025.
- [46] Associated Press. Rocket engine explodes during test launch from new spaceport in Scotland. *AP News*, December 2023. <https://apnews.com/article/rocket-explodes-shetland-uk-scotland-rfa-a8b31577fec88a430d5f46e302dad7ab>.
- [47] James Hydzik. HyImpulse Has Successfully Launched Its SR75 Rocket. <https://orbitaltoday.com/2024/05/02/hyimpulse-launch-set-for-may-3/>, May 2024.
- [48] Andrew Parsonson. ILR-33 Amber 2K Makes History as Poland's First Rocket to Reach Space. <https://europeanspaceflight.com/ilr-33-amber-2k-makes-history-as-polands-first-rocket-to-reach-space/>, July 2024.
- [49] Ivan Yatskov. Skyrora Targets Spring 2025 for Launch Despite Regulatory Roadblocks. <https://orbitaltoday.com/2024/10/23/skyrora-targets-spring-2025-for-launch-despite-regulatory-roadblocks/>, October 2024.
- [50] Andrew Parsonson. Germany Commits €95M More to Isar, RFA, and HyImpulse. <https://europeanspaceflight.com/germany-commits-e95m-more-to-isar-rfa-and-hyimpulse/>, 2024.
- [51] Andrew Parsonson. ESA Awards €44.2M in Funding to Four European Rocket Builders. <https://europeanspaceflight.com/esa-awards-e44-2m-in-funding-to-four-european-rocket-builders/>, November 2024.
- [52] Andrew Parsonson [AndrewParsonson]. It has also revealed that Argo will be launched aboard a "future RFA heavy lift launch system" ... <https://x.com/AndrewParsonson/status/1767177901164650698>, March 2024.
- [53] Jeff Foust. PLD Space unveils plans for larger launch vehicles and crewed spacecraft. <https://spacenews.com/pld-space-unveils-plans-for-larger-launch-vehicles-and-crewed-spacecraft/>, October 2024.
- [54] Andrew Parsonson. ESA Selects Four Companies to Develop Reusable Rocket Technology. <https://europeanspaceflight.com/esa-selects-four-companies-to-develop-reusable-rocket-technology/>, October 2024.
- [55] European Launcher Challenge: Preselected challengers unveiled. [https://www.esa.int/Enabling\\_Support/Space\\_Transportation/European\\_Launcher\\_Challenge\\_preselected\\_challengers\\_unveiled](https://www.esa.int/Enabling_Support/Space_Transportation/European_Launcher_Challenge_preselected_challengers_unveiled), July 2025.
- [56] MISSION: ERIS TESTFLIGHT 1. <https://www.gspace.com/missions>, July 2025.
- [57] Adam Thorn. Clearing launch tower was 'major milestone', hails Gilmour. <https://www.spaceconnectonline.com.au/launch/6621-clearing-launch-tower-was-major-milestone-hails-gilmour>, July 2025.
- [58] Jeff Foust. Second Kairos launch fails. <https://spacenews.com/second-kairos-launch-fails/>, December 2024.
- [59] Honda Conducts Successful Launch and Landing Test of Experimental Reusable Rocket | Honda Global Corporate Website. [https://global.honda/en/topics/2025/c\\_2025-06-17ceng.html](https://global.honda/en/topics/2025/c_2025-06-17ceng.html), June 2025.
- [60] K. E. D. Global. Spaceflight venture Innospace eyes July Kosdaq IPO. <https://www.kedglobal.com/ipos/newsView/ked202406180005>, June 2025.

- [61] Jeff Foust. Innospace shares tumble in stock market debut. <https://spacenews.com/innospace-shares-tumble-in-stock-market-debut/>, July 2024.
- [62] Steve Kuhr. State of launch 2025. <https://www.payloadspace.com/launch-space/state-of-launch-2025>, 2025.
- [63] Andrew Jones. China suffers commercial rocket failure but sets record for annual launches. <https://spacenews.com/china-suffers-commercial-rocket-failure-but-sets-record-for-annual-launches/>, December 2024.
- [64] Andrew Jones. China's iSpace returns to flight with successful orbital solid rocket launch - SpaceNews. *SpaceNews*, July 2025. <https://spacenews.com/chinas-ispacere-returns-to-flight-with-successful-orbital-solid-rocket-launch/>.
- [65] Andrew Jones. Chinese launch startup Landpace suffers Zhuque-2 failure. <https://spacenews.com/chinese-launch-startup-landpace-suffers-zhuque-2-failure/>, August 2025.
- [66] Andrew Jones. China's Landpace secures state-backed funding for reusable rockets. <https://spacenews.com/chinas-landpace-secures-state-backed-funding-for-reusable-rockets/>, December 2024.
- [67] Andrew Jones. Chinese launch startups CAS Space, Landpace advance plans for IPOs. <https://spacenews.com/chinese-launch-startups-cas-space-landpace-advance-plans-for-ipos/>, August 2025.
- [68] Rocket Lab. Q2 2025 Investor Update. <https://investors.rocketlabcorp.com/static-files/815a4786-20f5-4f20-be8a-2bbfc8d75449>, August 2025.
- [69] Firefly Alpha. *Wikipedia*, August 2025. [https://en.wikipedia.org/w/index.php?title=Firefly\\_Alpha&oldid=1304471308](https://en.wikipedia.org/w/index.php?title=Firefly_Alpha&oldid=1304471308).
- [70] Risa Schnautz. Firefly Aerospace Closes \$175 Million Series D Capital Raise. <https://fireflyspace.com/news/firefly-aerospace-closes-oversubscribed-175-million-series-d-capital-raise-with-new-lead-investor/>, November 2024.
- [71] Pritam Biswas, Arasu Kannagi Basil, and Arasu Kannagi Basil. Firefly raises \$868 million in upsized US IPO as it sets sights on a positive liftoff. *Reuters*, August 2025. <https://www.reuters.com/business/aerospace-defense/firefly-raises-868-million-up-sized-us-ipo-it-sets-sights-positive-liftoff-2025-08-06/>.
- [72] Jeff Foust. Astra completes deal to go private. <https://spacenews.com/astra-completes-deal-to-go-private/>, July 2024.
- [73] Aria Alamalhodaie. After raising nearly half a billion dollars, ABL Space pivots from launch vehicles to missiles. <https://techcrunch.com/2024/11/15/after-raising-nearly-half-a-billion-dollars-abl-space-pivots-from-launch-vehicles-to-missiles/>, November 2024.
- [74] Josh Dinner. Trump signs executive order to boost commercial space and shift NASA's balance of power. <https://www.space.com/space-exploration/trump-signs-executive-order-to-boost-commercial-space-and-shift-nasas-balance-of-power>, August 2025.
- [75] Timo Wekerle, José Bezerra Pessoa Filho, Luís Eduardo Vergueiro Loures da Costa, and Luís Gonzaga Trabasso. Status and Trends of Smallsats and their Launch Vehicles — An Up-to-date Review. *Journal of Aerospace Technology and Management*, August 2017. <http://www.jatm.com.br/ojs/index.php/jatm/article/view/853>.
- [76] Walter Peeters and Llyod Damp. Launching Smallsats: The Example of Southern Launch. December 2020. <https://www.liebertpub.com/doi/full/10.1089/space.2020.0034>.
- [77] Main trends and challenges in the space sector. Technical report, PwC, June 2019. <https://www.pwc.fr/fr/assets/files/pdf/2019/06/fr-pwc-main-trends-and-challenges-in-the-space-sector.pdf>.
- [78] Paul K. McConnaughey et al. DRAFT Launch Propulsion Systems Roadmap. Technical report, National Aeronautics and Space Administration, November 2010. [https://www.nasa.gov/pdf/500393main\\_TA01-LaunchPropulsion-DRAFT-Nov2010-A.pdf](https://www.nasa.gov/pdf/500393main_TA01-LaunchPropulsion-DRAFT-Nov2010-A.pdf).
- [79] Nova. <https://www.stokesspace.com/nova/>.
- [80] List of Electron launches. *Wikipedia*, August 2025. [https://en.wikipedia.org/w/index.php?title=List\\_of\\_Electron\\_launches&oldid=1306666273](https://en.wikipedia.org/w/index.php?title=List_of_Electron_launches&oldid=1306666273).
- [81] Douglas Gorman. Interstellar Books Customers for its First ZERO Launch. <https://payloadspace.com/interstellar-books-customers-for-its-first-zero-launch/>, August 2025.
- [82] Andrew Parsonson. HyImpulse Updates SL1 Design with Performance Boost. <https://europeanspaceflight.com/hyimpulse-updates-sl1-design-with-performance-boost/>, April 2024.
- [83] Rocket Lab Corporation | 0001628280-25-038936 | 10-Q. <https://investors.rocketlabcorp.com/sec-filings/sec-filing/10-q/0001628280-25-038936>, August 2025.
- [84] Eric Berger. Rocket Lab will directly challenge SpaceX with its proposed Neutron launcher. *Ars Technica*, March 2021. <https://arstechnica.com/science/2021/03/with-the-neutron-boost-rocket-lab-shows-its-not-afraid-of-taking-on-spacex/>.
- [85] Firefly Aerospace. Firefly Alpha. <https://firefly.com/launch-alpha/>, 2021.
- [86] German Microlauncher start-up Rocket Factory announces unrivalled low price of EUR 3 million per rocket launch. February 2021. <https://www.globenewswire.com/en/news-release/2021/02/12/2175120/0/en/German-Microlauncher-start-up-Rocket-Factory-announces-unrivalled-low-price-of-EUR-3-million-per-rocket-launch.html>.
- [87] Elizabeth Driscoll. Why "Dollars Per Kilogram" Is A Poor Way To Estimate Launch Costs. <https://spaceflight.com/why-dollars-per-kilogram-is-a-poor-way-to-estimate-launch-costs/>, May 2021.
- [88] Pierre Lionnet. Interested in some Rocket Lab Electron launch data? <https://twitter.com/LionnetPierre/status/1689676846965694475>, August 2023.
- [89] David Todd. ISAR Spectrum maiden failure: Spectacular but not surprising. <https://www.seradata.com/isar-spectrum-maiden-failure-spectacular-but-not-surprising/>, March 2025.
- [90] Ceres-1. *Wikipedia*, August 2025. <https://en.wikipedia.org/w/index.php?title=Ceres-1&oldid=1306504913>.

- [91] Andrew Jones. Orienspace breaks Chinese commercial launch records with Gravity-1 solid rocket. <https://spacenews.com/orienspace-breaks-chinese-commercial-launch-records-with-gravity-1-solid-rocket/>, January 2024.
- [92] Douglas Gorman. What SpinLaunch Is Doing With Its \$30M Series C. <https://payloadspace.com/what-spinlaunch-is-doing-with-its-30m-series-c/>, August 2025.
- [93] Aria Alamalhodaiei. Auriga Space raises \$6M to shoot rockets off an electromagnetic launch track. <https://techcrunch.com/2025/07/15/auriga-space-raises-6m-to-shoot-rockets-off-an-electromagnetic-launch-track/>, July 2025.
- [94] Sandra Erwin. French startup developing space weapon to defend satellites and clean orbital debris. <https://www.dark-space.co/post/spacenews-french-startup-developing-space-weapon-to-defend-satellites-and-clean-orbital-debris>, April 2025.
- [95] Ashlee Vance. *When the Heavens Went on Sale: The Misfits and Geniuses Who Put Space within Reach*. HarperCollins Publishers, New York, NY, 2023.
- [96] Jeff Foust. Rocket Lab launches Capella Space SAR satellite. <https://spacenews.com/rocket-lab-launches-capella-space-sar-satellite/>, August 2024.
- [97] Douglas Gorman. PLD's Industrial Strategy Targets 32 Rockets a Year by 2030. <https://payloadspace.com/plds-industrial-strategy-targets-32-rockets-a-year-by-2030/>, July 2025.
- [98] Jeff Foust. Firefly Aerospace launches NASA-sponsored cubesats. <https://spacenews.com/firefly-aerospace-launches-nasa-sponsored-cubesats/>, July 2024.
- [99] Sandra Erwin. Guetlein calls for a change in culture in 'responsive space'. <https://spacenews.com/guetlein-calls-for-a-change-in-culture-in-responsive-space/>, January 2024.
- [100] Gilmour Space Technologies - Crunchbase Company Profile & Funding. <https://www.crunchbase.com/organization/gilmour-space-technologies>.
- [101] Tess Bennett. Australian space firm eyeing an IPO - but needs to reach orbit first. <https://www.afr.com/technology/australian-space-firm-eyeing-an-ipo-but-needs-to-reach-orbit-first-20250813-p5mmr4>, August 2025.
- [102] NASA. Commercial Market Assessment for Crew and Cargo Systems. [https://web.archive.org/web/20141207085554/http://www.nasa.gov/sites/default/files/files/Section403\(b\)CommercialMarketAssessmentReportFinal.pdf](https://web.archive.org/web/20141207085554/http://www.nasa.gov/sites/default/files/files/Section403(b)CommercialMarketAssessmentReportFinal.pdf), April 2011.
- [103] Jack Kuhr. Rocket Development Costs by Vehicle: Payload Research - Payload. <https://payloadspace.com/rocket-development-costs-by-vehicle-payload-research/>, August 2024.
- [104] Gwynne Shotwell. Letter: Old Model Doesn't Apply To SpaceX's Expenditures. <https://spacenews.com/letter-old-model-doesnt-apply-spacexs-expenditures/>, February 2011.
- [105] Jagmeet Singh. India's Agnikul gets \$26.7M to prepare for commercial space launches. <https://techcrunch.com/2023/10/16/agnikul-funding-india-space-tech-startup/>, October 2023.
- [106] Andrew Parsonson. HyImpulse and Orbex Received £6.7M in UK Space Agency Funding. <https://europeanspaceflight.com/hyimpulse-and-orbex-received-6-7m-in-uk-space-agency-funding/>, December 2023.
- [107] Aria Alamalhodaiei. French small launch startup Latitude closes \$30M Series B. <https://techcrunch.com/2024/01/23/french-small-launch-startup-latitude-closes-30m-series-b/>, January 2024.
- [108] Alyssa Lafleur. ATEL Ventures Invests \$20M in Isar Aerospace to Boost Satellite Launch Capabilities. <https://spaceinsider.tech/2024/06/04/atel-ventures-invests-20m-in-isar-aerospace-to-boost-satellite-launch-capabilities/>, June 2024.
- [109] German space startup Isar Aerospace secures 150 million euro fund. *Reuters*, June 2025. <https://www.reuters.com/business/aerospace-defense/german-space-startup-isar-aerospace-secures-150-million-euro-fund-2025-06-25/>.
- [110] Isar Aerospace 2025 Company Profile: Valuation, Funding & Investors | PitchBook. <https://pitchbook.com/profiles/company/233505-46>.
- [111] Andrew Jones. Japan's Interstellar secures \$62 million in Series F funding. <https://spacenews.com/japans-interstellar-secures-62-million-in-series-f-funding/>, July 2025.
- [112] Ashlee Vance. Astra Raises \$80m and Plots Comeback for the Ages. <https://www.corememory.com/p/astra-space-raises-80m-and-plots>, April 2025.
- [113] Aria Alamalhodaiei. A troubled SPAC plans to buy iRocket for \$400M but it already returned most of its cash. <https://techcrunch.com/2025/07/23/a-troubled-spac-plans-to-buy-irocket-for-400m-but-it-already-returned-most-of-its-cash/>, July 2025.
- [114] Jeff Foust. The long recovery from a launcher crisis. <https://www.thespacereview.com/article/5018/1>, July 2025.
- [115] Chris Larmour. What does the European Launcher Challenge pre-selection mean for those not selected? [https://www.linkedin.com/feed/update/urn:li:activity:7350079508185518081/?updateEntityUrn=urn%3Ali%3Afs\\_updateV2%3A%28urn%3Ali%3Aactivity%3A7350079508185518081%2CFEED\\_DETAIL%2CEMPTY%2CDEFAULT%2Cfalse%29](https://www.linkedin.com/feed/update/urn:li:activity:7350079508185518081/?updateEntityUrn=urn%3Ali%3Afs_updateV2%3A%28urn%3Ali%3Aactivity%3A7350079508185518081%2CFEED_DETAIL%2CEMPTY%2CDEFAULT%2Cfalse%29), August 2025.
- [116] Andrew Parsonson. Sidereus Space Dynamics Nears Completion of EOS Test Stand. <https://europeanspaceflight.com/sidereus-space-dynamics-nears-completion-of-eos-test-stand/>, July 2025.
- [117] Martin Smith. Gilmour Space's Eris rocket fails initial test flight from Australia. <https://www.nasaspaceflight.com/2025/07/eris-testflight1/>, July 2025.
- [118] Launch Your Space Business | SPACE ONE | Launch VehicleE. [https://www.space-one.co.jp/vehicle/index\\_e.html](https://www.space-one.co.jp/vehicle/index_e.html).
- [119] Spectrum. <https://isaraerospace.com/spectrum>.
- [120] Meredith Garofalo. Rocket Lab gearing up to refly Electron booster for 1st time. <https://www.space.com/rocket-lab-recovered-electron-production-line-reflight>, April 2024.
- [121] Tim Fernholz. Nifty Fifty: How Rocket Lab's Electron Set A New Speed Record.

- <https://payloadspace.com/nifty-fifty-how-rocket-labs-electron-set-a-new-speed-record/>, June 2024.
- [122] Astron Systems. Aurora. <https://astronsystems.com/aurora.jsp>.
- [123] Fortune Business Insights. Small Launch Vehicle Market Size, Share | Global Report [2032]. <https://www.fortunebusinessinsights.com/small-launch-vehicle-slv-market-108232>, August 2025.
- [124] Sandra Erwin. Industry report: Demand for satellites is rising but not skyrocketing. <https://spacenews.com/industry-report-demand-for-satellites-is-rising-but-not-skyrocketing/>, December 2023.
- [125] Jeff Foust. Small launch companies struggle to compete with SpaceX rideshare missions. <https://spacenews.com/small-launch-companies-struggle-to-complete-with-spacex-rideshare-missions/>, October 2023.
- [126] Jeff Foust. Small launch industry warns of “bloodletting”. *SpaceNews*, February 2023. <https://spacenews.com/small-launch-industry-warns-of-bloodletting/>.
- [127] Eric Ralph [@13ericralph31]. SpaceX’s Rideshare Program has now launched roughly 800 payloads in less than three years! <https://x.com/13ericralph31/status/1723486650519732648>, November 2023.
- [128] Pierre Lionnet [@LionnetPierre]. @towellnapkin @Peter\_J\_Beck Beyond Starlink and Kuiper there’s not much demand happening... <https://x.com/LionnetPierre/status/1790048085659312340>, May 2024.
- [129] Pierre Lionnet [@LionnetPierre]. So what is the limit to grow your launch business? ... <https://x.com/LionnetPierre/status/1846593510633308184>, October 2024.
- [130] Jeff Foust. SpaceX to offer mid-inclination small-sat rideshare launches. *SpaceNews*, August 2023. <https://spacenews.com/spacex-to-offer-mid-inclination-small-sat-rideshare-launches/>.
- [131] SpaceX Rideshare. <http://www.spacex.com>.
- [132] Astra-Holcity Investor Presentation. <https://astra.com/wp-content/uploads/2021/02/Astra-Investor-Presentation.pdf>, February 2021.
- [133] Virgin Orbit Investor Presentation. [https://www.sec.gov/Archives/edgar/data/0001843388/000121390021044175/ea146262ex99-2\\_nextgenacq2.htm](https://www.sec.gov/Archives/edgar/data/0001843388/000121390021044175/ea146262ex99-2_nextgenacq2.htm), August 2021.
- [134] Rocket Lab Investor Presentation. <https://www.rocketlabusa.com/assets/Rocket-Lab-Investor-Presentation.pdf>, March 2021.
- [135] Quarterly Results | Rocket Lab Corporation. <https://investors.rocketlabcorp.com/financial-information/quarterly-results>.
- [136] Rocket Lab USA, Inc. Form 10-Q - For the quarterly period ended June 30, 2023. <https://d18rn0p25nwr6d.cloudfront.net/CIK-0001819994/5b4c56bf-7152-4c40-a021-9949df78f84e.pdf>.
- [137] Jeff Foust. Lockheed Martin makes block buy of launches from ABL Space Systems. *SpaceNews*, April 2021. <https://spacenews.com/lockheed-martin-makes-block-buy-of-launches-from-abl-space-systems/>.
- [138] Alan Boyle. Amazon schedules first Kuiper satellite launches for 2022 using ABL’s RS1 rocket. *GeekWire*, November 2021. <https://www.geekwire.com/2021/amazon-schedules-first-kuiper-satellite-launches-2022-using-abls-rs1-rocket/>.
- [139] Alan Boyle. Plans for launch of prototype satellites for Amazon’s Project Kuiper revised ... again. *GeekWire*, August 2023. <https://www.geekwire.com/2023/amazon-project-kuiper-atlas-ula/>.
- [140] Jeff Foust. Latitude signs multi-launch contract with Atmos Space Cargo. <https://spacenews.com/latitude-signs-multi-launch-contract-with-atmos-space-cargo/>, November 2024.
- [141] Latitude. Upcoming New Business Announcements. <https://www.linkedin.com/feed/update/urn:li:activity:7340264427440537600/>, July 2025.
- [142] Jeff Foust. Latitude announces new factory and contracts for Zephyr small launcher. <https://spacenews.com/latitude-announces-new-factory-and-contracts-for-zephyr-small-launcher/>, July 2025.
- [143] Risa Schnautz. Firefly Aerospace Announces Multi-Launch Agreement with Lockheed Martin for 25 Alpha Launches. <https://fireflyspace.com/news/firefly-aerospace-announces-multi-launch-agreement-with-lockheed-martin-for-25-alpha-launches/>, June 2024.
- [144] Jeff Foust. Synspec orders 10 Rocket Lab Electron launches. <https://spacenews.com/synspec-orders-10-rocket-lab-electron-launches/>, June 2024.
- [145] Peter B. de Selding. Rocket Lab will launch 20% less often than planned in 2024 because of customer delays. Effect on cash position? De minimis. <https://www.spaceintelreport.com/rocket-lab-will-launch-20-less-often-than-planned-in-2024-because-of-customer-delays-effect-on-cash-position-de-minimis/>, August 2024.
- [146] Eric Berger. Sir Peter Beck unplugged: “Transporter can do it for free for all we care”. <https://arstechnica.com/space/2024/06/sir-peter-beck-unplugged-transporter-can-do-it-for-free-for-all-we-care/>, June 2024.
- [147] Vaya Space. Vaya Space Announces Multi-Launch Contract for Space Telecommunications, Inc.’s Satellite Constellation. <https://spacenews.com/vaya-space-announces-multi-launch-contract-for-space-telecommunications-inc-s-satellite-constellation/>, December 2024.
- [148] Innovative Rocket Technologies Inc. iRocket Announces \$640 Million Multi-Year Launch Agreement with SpaceBelt KSA to Deliver Secure and Autonomous Satellite Infrastructure for Saudi Arabia and Beyond. <https://www.globenewswire.com/news-release/2025/08/04/3126486/0/en/iRocket-Announces-640-Million-Multi-Year-Launch-Agreement-with-SpaceBelt-KSA-to-Deliver-Secure-and-Autonomous-Satellite-Infrastructure-for-Saudi-Arabia-and-Beyond.html>, August 2025.
- [149] Flight Ticket Initiative: First five missions secured with Avio and Isar Aerospace. [https://www.esa.int/Enabling\\_Support/Space\\_Transportation/Boost/Flight\\_Ticket\\_Initiative\\_first\\_five\\_missions\\_secured\\_with\\_Avio\\_and\\_Isar\\_Aerospace](https://www.esa.int/Enabling_Support/Space_Transportation/Boost/Flight_Ticket_Initiative_first_five_missions_secured_with_Avio_and_Isar_Aerospace), July 2025.
- [150] Douglas Gorman. Interstellar Books Customers for its First ZERO Launch. <https://payloadspace.com/interstellar-books-customers-for-its-first-zero-launch/>, August 2025.

- [151] Aria Alamalhodaie. Relativity Space CEO: Building a backlog isn't 'worthless,' it's the path to product-market fit. <https://techcrunch.com/2023/11/29/relativity-space-ceo-building-a-backlog-isnt-worthless-its-the-path-to-product-market-fit/>, November 2023.
- [152] Presentations | Rocket Lab. <https://investors.rocketlabcorp.com/static-files/815a4786-20f5-4f20-be8a-2bbfc8d75449>, August 2025.
- [153] Reuters. S&P 500 eases with Eli Lilly; Nasdaq manages record closing high. *Reuters*, August 2025. <https://www.reuters.com/business/sp-500-eases-with-eli-lilly-nasdaq-manages-record-closing-high-2025-08-07/>.
- [154] Lewis Krauskopf. Rated global stock market valuations are near the upper bound and may be overly optimistic. *Reuters*, July 2025. <https://www.reuters.com/business/rising-valuations-cloudy-earnings-view-confronts-us-stocks-after-tariff-rebound-2025-05-07/>.
- [155] Bank of America strategist Michael Hartnett. BofA warns S&P 500 price-to-book ratio has reached a record high, exceeding the dot-com era. *Business Insider*, August 2025. <https://www.businessinsider.com/stock-market-bubble-ai-sp500-price-to-book-valuations-bofa-2025-8>.
- [156] Saskia Doll. Isar Aerospace becomes a unicorn. <https://www.munich-startup.de/en/110643/isar-aerospace-unicorn/>, June 2025.
- [157] Michael Sheetz. Rocket Lab begins trading on the Nasdaq, with SPAC merger growing its cash pile. *CNBC*, August 2021. <https://www.cnbc.com/2021/08/25/rocket-lab-begins-trading-on-nasdaq-as-rklb-after-spac-merger.html>.
- [158] Brian Sozzi · Executive Editor Updated 2 min read. Firefly stock loses altitude after sizzling stock market debut. <https://finance.yahoo.com/news/firefly-stock-loses-altitude-after-sizzling-stock-market-debut-091428468.html>, August 2025.
- [159] Firefly Aerospace Inc (FLY) Stock price and news. <https://www.google.com/finance/quote/FLY:NASDAQ>.
- [160] Blue Ghost Begins Surface Operations, Captures Descent Video, Sunrise - NASA. <https://www.nasa.gov/blogs/missions/2025/03/04/blue-ghost-begins-surface-operations-captures-descent-video-sunrise/>, March 2025.
- [161] INNOSPACE (462350.KQ) Stock Price. <https://finance.yahoo.com/quote/462350.KQ/>.
- [162] Irene Klotz. [https://twitter.com/Free\\_Space/status/1494437279355576320](https://twitter.com/Free_Space/status/1494437279355576320), February 2022.
- [163] Peter Beck. [https://twitter.com/Peter\\_J\\_Beck/status/1494496870772588547](https://twitter.com/Peter_J_Beck/status/1494496870772588547), February 2022.
- [164] SpaceDotBiz. The Looming Spaceport Bottleneck. <https://newsletter.spacedotbiz.com/p/spaceport-bottleneck>, August 2023.
- [165] Jeff Foust. The Spaceport Company demonstrates offshore launch operations. <https://spacenews.com/the-spaceport-company-demonstrates-offshore-launch-operations/>, May 2023.
- [166] Sandra Erwin. Sea-based launch startup scores \$2.5 million Pentagon contract. <https://spacenews.com/sea-based-launch-startup-scores-2-5-million-pentagon-contract/>, 2024.
- [167] Peter A. Walker. Orbex to switch launch operations to SaxaVord Spaceport. <https://www.insider.co.uk/news/orbex-switch-launch-operations-saxavord-34244504>, December 2024.
- [168] Oxjno Sviluppo and Marco Liberati. Space: Elara Aerospace and OLM to launch satellites from Sardinia; tests of the new "Starlight" rocket soon. <https://ageei.eu/spazio-elara-aerospace-e-olm-per-il-lancio-di-satelliti-dalla-sardegna-a-breve-le-prove-del-nuovo-razzo-starlight/>, May 2025.
- [169] Andrew Parsonson. Italy to Reopen Kenya-Based Offshore Launch Facility. <https://europeanspaceflight.com/italy-to-reopen-kenya-based-offshore-launch-facility/>, November 2024.
- [170] Andrew Parsonson. Swedish Military to Serve as Anchor Customer for Esrange Space Center? <https://europeanspaceflight.com/swedish-military-to-serve-as-anchor-customer-for-esrange-space-center/>, January 2025.
- [171] Andrew Parsonson. Germany Commits €2M to Fund Offshore Launch Infrastructure. <https://europeanspaceflight.com/germany-commits-2m-euros-to-fund-offshore-launch-infrastructure/>, September 2023.
- [172] ESA - European Space Agency. New agreements for next decade of launches at Europe's Spaceport in French Guiana. [https://www.esa.int/Enabling\\_Support/Space\\_Transportation/Europe\\_s\\_Spaceport/New\\_agreements\\_for\\_next\\_decade\\_of\\_launches\\_at\\_Europe\\_s\\_Spaceport\\_in\\_French\\_Guiana](https://www.esa.int/Enabling_Support/Space_Transportation/Europe_s_Spaceport/New_agreements_for_next_decade_of_launches_at_Europe_s_Spaceport_in_French_Guiana), July 2025.
- [173] Sandra Erwin. Ursa Major closes \$138 million Series D and D-1 financings. <https://spacenews.com/ursa-major-closes-138-million-series-d-and-d-1-financings/>, November 2023.
- [174] Province of Nova Scotia Invests in Maritime Launch Services Driving Space Sector Innovation in Canada. *Business Wire*, September 2023. <https://www.businesswire.com/news/home/20230908517581/en/Province-of-Nova-Scotia-Invests-in-Maritime-Launch-Services-Driving-Space-Sector-Innovation-in-Canada>.
- [175] Matt Swayne. Maritime Launch Receives Conditional Term Sheet For \$12.9 Million From Canadian Government. <https://spaceinsider.tech/2024/05/14/maritime-launch-receives-conditional-term-sheet-for-12-9-million-from-canadian-government/>, May 2024.
- [176] Eric Berger. Rocket Report: Bloomberg calls for SLS cancellation; SpaceX hits century mark. <https://arstechnica.com/space/2024/10/rocket-report-bloomberg-calls-for-sls-cancellation-spacex-hits-century-mark/>, October 2024.
- [177] Kirsten Dorman. Yuma is a finalist for \$160 million to establish spaceport in Arizona. <https://www.kjzz.org/science/2024-12-04/yuma-is-a-finalist-for-160-million-to-establish-spaceport-in-arizona>, December 2024.
- [178] Rocket Lab Selects Bollinger Shipyards to Support Modification of Neutron Landing Platform. <https://rocketlabcorp.com/updates/rocket-lab-selects-bollinger-shipyards-to-support-modification-of-neutron-landing-platform/>, 2025.
- [179] Kantaro Komiya. Firefly Aerospace eyes Alpha rocket launch in Japan for Asia market | Reuters. August 2025. <https://www.reuters.com/business/aerospace->

- defense/firefly-aerospace-eyes-japan-rocket-launches-asia-market-2025-08-18/.
- [180] SPACE COTAN Signs MOU with Firefly Aerospace for Feasibility Study to Launch Alpha Rocket from HOSPO. <https://hokkaidospaceport.com/en/news/1929, August 2025>.
- [181] Andrew Jones. China to expand commercial spaceport to support upcoming launch surge. <https://spacenews.com/china-to-expand-commercial-spaceport-to-support-upcoming-launch-surge/>, May 2024.
- [182] CNSA Watcher - Archives. Discover China's Dongfang Aerospace Port: Revolutionary Ship for Space Launch and Recovery. <https://www.youtube.com/watch?v=EBcOCT8vXtU>, May 2025.
- [183] Eric Berger. Relativity Space has gone from printing money and rockets to doing what, exactly? <https://arstechnica.com/space/2024/09/relativity-space-has-gone-from-printing-money-and-rockets-to-doing-what-exactly/>, 2024.
- [184] INVICTUS – Europe's new hypersonic test platform. [https://www.esa.int/Enabling\\_Support/Space\\_Engineering\\_Technology/Shaping\\_the\\_Future/INVICTUS\\_Europe\\_s\\_new\\_hypersonic\\_test\\_platform](https://www.esa.int/Enabling_Support/Space_Engineering_Technology/Shaping_the_Future/INVICTUS_Europe_s_new_hypersonic_test_platform), July 2025.
- [185] Defence Review Asia. Hanwha Acquires KSLV-II Rocket Technology. <https://defencereviewasia.com/hanwha-aerospace-kslv-ii-tech-transfer-kari/>, July 2025.
- [186] Ajey Lele. Commercializing India's SSLV rocket. <https://www.thespacereview.com/article/5008/1>, June 2025.
- [187] Jason Rainbow. Space investors question the merits of vertical integration. <https://spacenews.com/space-investors-question-the-merits-of-vertical-integration/>, April 2024.
- [188] Andy Lapsa. The future of spaceflight, and why we built Stoke. <https://www.stokesspace.com/the-future-of-spaceflight-and-why-we-built-stoke/>, June 2025.
- [189] David Szondy. France's VORTEX spaceplane to land like a jet, operate like a shuttle. <https://newatlas.com/space/frances-vortex-spaceplane-to-land-like-a-jet-operate-like-a-shuttle/>, June 2025.
- [190] Orbex. Orbital Launch Services for Small Satellites. <https://orbex.space/news/orbex-to-begin-development-of-medium-sized-launch-vehicle-and-switch-launch-operations-to-saxavord-spaceport>, December 2024.
- [191] Andrew Parsonson. Third Time's the Charm? ESA Once Again Publishes 60T Rocket Study Call. <https://europeanspaceflight.com/third-times-the-charm-esa-once-again-publishes-60t-rocket-study-call/>, December 2024.
- [192] Andrew Parsonson. ESA Releases Findings of Super Heavy-Lift Rocket Studies. <https://europeanspaceflight.com/esa-releases-findings-of-super-heavy-lift-rocket-studies/>, November 2024.
- [193] Andrew Parsonson. ESA Awards Another €230M to ArianeGroup for Themis Demonstrator. <https://europeanspaceflight.com/esa-award-another-e230m-to-arianegroup-for-themis-demonstrator/>, November 2024.
- [194] Andrew Parsonson. The Exploration Company Tests Pre-Burner for High-Thrust Rocket Engine. <https://europeanspaceflight.com/the-exploration-company-tests-pre-burner-for-high-thrust-rocket-engine/>, February 2025.
- [195] Risa Schnautz. Northrop Grumman Invests \$50 Million in Firefly Aerospace to Advance Medium Launch Vehicle Named Eclipse™. <https://fireflyspace.com/news/northrop-grumman-invests-50-million-in-firefly-aerospace-to-advance-medium-launch-vehicle-named-eclipse/>, May 2025.
- [196] Andrew Jones. China to debut large reusable rockets in 2025 and 2026. <https://spacenews.com/china-to-debut-large-reusable-rockets-in-2025-and-2026/>, March 2024.
- [197] Andrew Jones. Chinese launch startup Cosmoleap secures funding for rocket featuring chopstick recovery system. <https://spacenews.com/chinese-launch-startup-cosmoleap-secures-funding-for-rocket-featuring-chopstick-recovery-system/>, 2024.
- [198] Andrew Jones. New rocket plans continue to emerge to support China's growing space ambitions. <https://spacenews.com/new-rocket-plans-continue-to-emerge-to-support-chinas-growing-space-ambitions/>, August 2025.
- [199] Jeff Foust. New Glenn reaches orbit on first launch. <https://spacenews.com/new-glenn-reaches-orbit-on-first-launch/>, January 2025.
- [200] Josh Dinner. Blue Origin's 2nd New Glenn rocket launch will fly twin NASA Mars probes to space on Sep. 29. <https://www.space.com/space-exploration/launches-spacecraft/blue-origin-sets-launch-date-nasa-escapade-mars-probes-2nd-new-glenn-rocket-liftoff>, August 2025.
- [201] Eric Johnson, Loren Grush, and Rainier Harris. Bezos' Blue Origin Suffers Fiery Setback Building New Rocket. *Bloomberg.com*, August 2024. <https://www.bloomberg.com/news/articles/2024-08-21/jeff-bezos-blue-origin-suffers-new-glenn-rocket-mishaps>.
- [202] Alyssa Lafleur. Boeing and Lockheed Martin in Discussion to Sell ULA to Sierra Space. <https://spaceinsider.tech/2024/08/19/boeing-and-lockheed-martin-in-discussion-to-sell-ula-to-sierra-space/>, August 2024.
- [203] Rocket Lab Delivers Second Spacecraft, Completes Third for Varda Space Industries. <https://rocketlabcorp.com/updates/rocket-lab-delivers-second-spacecraft-completes-third-for-warda-space-industries/>, December 2024.
- [204] Gilmour Space achieves milestone with Australian satellite now in-orbit – SatNews. <https://news.satnews.com/2025/09/02/gilmour-space-achieves-milestone-with-australian-satellite-now-in-orbit/>, September 2025.
- [205] NordSpace - Satellites and Spacecraft. <https://www.nordspace.com/satellites>.